



Westinghouse
Hanford Company P.O. Box 1970
Richland, Washington 99352

V-B714C2-003

REV 0

0023323

Hanford Operations and Engineering Contractor
for the U.S. Department of Energy
under Contract No. DE-AC06-87RL10930.

KEH B714C2

SPECIFICATION FOR

Construction of Vault Concrete Basin, Shell, and Leachate Sump
for Grouted Vault Pair (218-E-16)

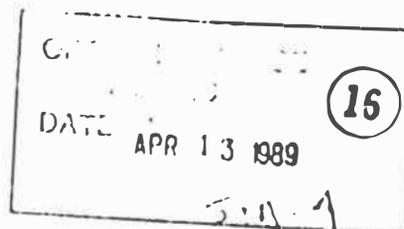
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Building: 218-E-16

Project: B-714

Impact Level: 2



Prepared By:

Kaiser Engineers Hanford Company

Approved By:

J.R. Briggs ; WHC

Date

4/10/89

B-714-C2

CONSTRUCTION SPECIFICATION FOR
VAULT CONCRETE BASIN, SHELL, AND LEACHATE SUMP
FOR
GROUTED WASTE DISPOSAL FACILITIES
GROUTED VAULT PAIR (21B-E-16)

Work Order ER9090

Prepared By:

KAISER ENGINEERS HANFORD COMPANY
Richland, Washington

For the US Department of Energy

Contract DE-AC06-87RL10900

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Released for Construction:

N/A
U. S. Department of Energy

Date

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The following is a summary of instructions to be used in preparing an Initial Release and Change Control Record (IRACCR) page and how appropriate Engineering Change Notice (ECN) and revisions are identified on the IRACCR.

NOTE: Prior to revision of an engineering document, all proposed changes shall have been approved by an ECN.

An IRACCR sheet shall include the following information.

Initial Release

- 1) The title of the engineering document.
- 2) The engineering document number.
- 3) The dated approval signature of Cognizant/Project Engineer
- 4) The dated approval signature of the Cognizant/Project Manager signifying the engineering document has met requirements for initial release
- 5) The Engineering Document Transmittal (EDT) number.

Change Control Record

- 6) The revision number of the change
- 7) A description of the change, including page changes, additions, and deletions where appropriate. List the ECN number(s) which have been incorporated
- 8) The authorizing signature of the Cognizant/Project Engineer signifying accurate editorial incorporation of the change
- 9) The dated signature of the Cognizant/Project Manager authorizing subsequent release of the revised engineering document

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TABLE OF CONTENTS

Total Pages

<u>DIVISION 1 - GENERAL REQUIREMENTS</u>		
Section 01010	Summary of Work	3
*Section 01019	Items Furnished for Construction	3
*Section 01027	Application for Payment	4
*Section 01040	Coordination	2
*Section 01043	Job Site Administration	3
Section 01050	Survey and Field Engineering	2
*Section 01065	Permits	2
*Section 01100	Special Project Procedures	2
*Section 01200	Project Meetings	2
Section 01300	Submittals	10
Section 01310	Progress Schedules	7
Section 01400	Quality Assurance	17
*Section 01500	Construction Facilities and Temporary Controls	5
*Section 01630	Product Option and Substitution	4
Section 01720	Project Record Documents	3
<u>DIVISION 2 - SITEWORK</u>		
Section 02145	Diffusion Barrier	8
Section 02200	Earthwork	5
Section 02512	Hot-Laid Asphaltic Concrete Pavement	3
Section 02752	Leachate Collection Sump Liner	8
Section 02753	Exterior Drainage Path	5
Section 02755	Waste Disposal Basin Liners	11
Section 02756	Leachate Collection System	6
<u>DIVISION 3 - CONCRETE</u>		
Section 03300	Cast-In-Place Concrete	6
Section 03301	Vault and Basin Cast In Place Concrete	30
Section 03419	Precast Prestressed Concrete Sections	6
<u>DIVISION 5 - METALS</u>		
Section 05500	Metal Fabrications	3
<u>DIVISION 9 - FINISHES</u>		
Section 09805	Special Protective Coating	4
Section 09885	Protective Coating for Concrete Vault Interior	5
<u>DIVISION 13 - SPECIAL CONSTRUCTIONS</u>		
Section 13440	Instrumentation	7
<u>DIVISION 15 - MECHANICAL</u>		
Section 15493	Chemical Process Piping Systems	23
<u>DIVISION 16 - ELECTRICAL</u>		
Section 16300	High Voltage Distribution (Above 600-Volt)	12
Section 16400	Service and Distribution (600-Volt and Below)	11
Section 16640	Cathodic Protection	14

*Denotes Sections that do not require Technical Design Control.

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 INTRODUCTION

1.1.1 Project B-714 for construction of grout disposal vaults is located near the 200-E Area in the Controlled Access Area of the Hanford Site, approximately 28 road miles north of Richland, Washington.

1.1.2 This Specification provides for construction of a pair of concrete vault structures shown on the Drawings.

1.2 STATEMENT OF WORK

1.2.1 Scope: Work consists of furnishing supervision, labor, equipment, materials, transportation and services for procurement, receiving, handling, storage, protection, fabrication, installation, inspection, and testing to provide 2 pair of concrete vault structures in accordance with these Contract Documents. Where vaults 104 and 105 are referred to as "Future" on the Drawings, include work as part of scope of Contract.

1.2.2 Work Included: Following itemization is intended to be broad in scope to identify major work elements and is not all inclusive.

1.2.2.1 Excavation.

1.2.2.2 Vault concrete basins and shells.

1.2.2.3 Leachate collection sumps.

1.2.2.4 Interior protective coating.

1.2.2.5 Exterior drainage path.

1.2.2.6 Vault hydrostatic and air leakage tests.

1.2.2.7 Diffusion barrier.

1.2.2.8 Liner for concrete basins.

1.2.2.9 Leachate collection detection and removal systems (LCDRS).

1.2.2.10 Precast prestressed concrete roof.

1.2.2.11 Site electrical and instrumentation, and conduit runs for vaults.

1.2.2.12 Transfer pit, excess water removal pits, and leachate collection pit.

1.2.2.13 Encased piping for each vault, and pipe runs for future vaults, including cathodic protection.

1.2.2.14 Shielding backfill/diffusion barrier and temporary protective geotextile.

1.2.2.15 Furnish pipe and concrete supports for tie-in at coordinate N40522/W45767.

1.2.2.16 Furnish and install pull wire from PP-10 to PP-11.

1.2.2.17 Furnish new cable, for installation by others, from PP-10 to PP-11.

1.2.2.18 Work included to connect Vaults 102 and 103 site to Vaults 104 and 105 site.

a. Route encased pipe from approximate coordinate N40450/W45768 to Vaults 104 and 105. Install encased pipe on coordinate N40265.5 from W45554 to W45450.

b. Construct electrical duct bank from Manhole 105A to coordinate W45430.

c. Provide cathodic protection on encased piping described in subparagraph 1.2.2.18a. Provide rectifier and circuit breaker for tie-in at Panel D-PB-01.

1.2.3 Work Not Included: Following work elements are part of Project but will be accomplished by others.

1.2.3.1 Pipe tie-in at coordinate N40522/W45767 including excavation and insulation.

1.2.3.2 Installation of new cable from PP-10 to PP-11.

1.2.3.3 Closure cover and site stabilization.

1.2.3.4 Ground water monitoring wells.

1.2.3.5 Run-on/run-off drainage control ditch.

1.2.3.6 Items shown on the Drawings to be done by others.

1.2.3.7 Excess water pit jumpers and water pump assemblies.

1.3 SEQUENCE OF WORK

1.3.1 Work shall be accomplished in following sequence to meet program commitments.

1.3.1.1 Complete Vault 102.

1.3.1.2 Complete Vault 103.

1.3.1.3 Complete Vaults 104 and 105.

1.3.2 Following items of work cannot be started without written authorization from KEH.

1.3.2.1 Start work on Vaults 104 and 105.

1.3.2.2 Diffusion barrier.

1.3.2.3 Vault and catch basin.

1.3.2.4 Leachate collection pipe.

1.3.2.5 HDPE flexible membrane liner.

1.3.2.6 Asphalt coating.

1.3.2.7 Exhauster riser.

1.4 DRAWINGS

1.4.1 Drawings for construction of Vaults 102 and 103 are listed on the Schedule of Drawings and include approximate location of Vaults 104 and 105.

1.4.2 Drawings for construction of Vaults 104 and 105 will be replications of Drawings for Vaults 102 and 103 and will be delivered before authorization to proceed with construction.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01019

ITEMS FURNISHED FOR CONSTRUCTION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Code of Federal Regulations (CFR)

Title 30 Mineral Resources

Sub Chapter N - Metal and Nonmetal Mine Safety and Health

30 CFR 56

Safety and Health Standards -
Surface Metal and Nonmetal Mines

1.2 SUBMITTALS: Not Used.

1.3 GENERAL

1.3.1 Material and equipment furnished or made available for incorporation into the Work are set forth in this Section. Other services and utilities provided are covered in other sections of this Specification.

1.3.2 Meet the provisions of Section 9 of the Contract General Conditions for items furnished for construction.

1.3.3 Provide KEH access to offsite premises where items furnished for construction are stored before incorporation into the Work.

1.4 GRAVEL AND SAND

1.4.1 Unmined natural deposits are available at no cost from sites designated by KEH within 6 miles of Project site. KEH makes no representation that unmined materials will meet physical properties required in this Specification.

1.4.2 If Contractor elects to utilize available gravel sites he shall furnish equipment and labor required to excavate, process, load, transport, and place gravel and sand.

1.4.3 Material shall be used only for the Work covered by this Specification and no gravel or sand, processed or unprocessed, or concrete manufactured therefrom shall be transported off the Hanford Site.

1.4.4 Access to gravel sites and travel between gravel and construction sites shall be on roads designated by KEH and use shall be in accordance with Section 01500.

1.4.5 Operations at gravel sites shall meet the following requirements.

1.4.5.1 Confine removal of overburden and top soil to areas designated by KEH. Stabilize blow sand areas after surface has been disturbed with ballast or other approved method to prevent wind erosion.

1.4.5.2 Make no excavation or bank cut within 100 feet of power lines, paved roads, railroads, security fences, or other permanent structures.

1.4.5.3 Excavating and processing shall be in accordance with 30 CFR 56. Correct operations identified by KEH to be hazardous to life or property.

1.4.5.4 Explosives are prohibited articles described in Section 56 of the Contract General Conditions and shall not be brought to the Hanford Site or proposed for use without written KEH approval.

1.4.5.5 Temporary structures are permitted at gravel site for offices, storage, or repair facilities necessary for gravel removal and processing operations. No facility for habitation will be permitted.

1.4.5.6 Use of gravel sites are nonexclusive. Others may also enter to excavate material required for other work.

1.4.5.7 Upon completion of operations clear gravel site of debris, temporary structures, and equipment. Grade excavated area, properly slope banks, and stabilize to prevent wind erosion. Conditions identified by KEH as not meeting these requirements shall be corrected before final acceptance of the Work.

1.4.5.8 Right to use gravel sites may be terminated by KEH for failure to meet the requirements set forth or for abandonment of operations under this Contract. Right to use gravel site will terminate without notice upon acceptance of Work under this Contract.

1.5 MATERIALS AND EQUIPMENT

1.5.1 Materials and equipment listed below will be furnished by KEH, for incorporation into the Work.

1.5.1.1 Structural backfill material for vaults.

1.5.1.2 2 inch stainless steel nozzles (PN 2 on reference Drawing H-2-90185), base metal P10H.

1.5.1.3 2 inch carbon steel kickplates (PN 4 on reference Drawing H-2-30600).

1.5.1.4 Hazardous waste disposal barrels.

1.5.2 Backfill material noted in subparagraph 1.5.1.1 is presently stockpiled at the Site approximately 1/2 mile from the Project. Materials noted in subparagraphs 1.5.1.2, 1.5.1.3, 1.5.1.4, and 1.5.1.5 will be delivered to the Site.

1.5.3 Furnish equipment and labor for hauling, handling, and installing backfill material.

1.5.4 Furnish other materials and equipment, shown on the Drawings or specified in the Specifications, required to complete the Work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01027

APPLICATION FOR PAYMENT

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 FORMAT

1.3.1 Complete Form KEH-1026.00, Progress Estimate Backup, sample appended. Contractor developed substitutes for form may be used only with prior approval of KEH.

1.3.2 Complete Form KEH-0959.00, Monthly Estimate of Work Complete, sample appended, or include following in letter requesting payments.

Subtotal Value of All Pay Items Completed to date (Include all modifications)		\$X,XXX.XX
Allowance for Material Stored on Site		
Previous Net Allowance	\$X,XXX.XX	
Minus Materials Placed	X,XXX.XX	
Plus Materials Stored	<u>X,XXX.XX</u>	
Net Allowance		<u>X,XXX.XX</u>
Subtotal Value Completed to Date		
Less Previous Payments	X,XXX.XX	
Less Other Charges from KEH	<u>X,XXX.XX</u>	
Subtotal Deductions		<u>X,XXX.XX</u>
Total payment Requested		<u>\$X,XXX.XX</u>
Less Retainage @ ____%		<u>(X,XXX.XX)</u>
Total payment Allowed		\$X,XXX.XX

1.4 APPLICATION PROCEDURE

1.4.1 Payments to Contractor set forth in Section 15 of Contract General Conditions are initiated by Contractor making application for payment as follows.

1.4.1.1 Begin application for payment by completing KEH furnished form referenced in Paragraph 1.3.1. Include, as minimum, breakdown of contract price for each item listed in Section 01310 and percent complete for each item.

1.4.1.2 Review backup sheets with KEH and adjust data.

1.4.1.3 Finalize application for payment by either completing Form KEH-0959.00 or initiating letter containing elements of Paragraph 1.3.2.

1.5 PAYMENT PROCEDURE

1.5.1 Upon receipt of application for payment, KEH will audit data and check for compliance with requirements of Section 01720. When satisfied that contract requirements are up-to-date, Form KEH-0959.00 will be prepared and signed by KEH.

1.5.2 Copy of signed Form showing amount of payment to be made will be furnished Contractor.

1.5.3 KEH will mail check to Contractor's designated address.

1.6 ADDITIONAL DATA REQUIRED

1.6.1 When processing applications for payment and preparing payment documents, KEH may require data to substantiate and justify amounts requested. Processing of payment documents may be delayed if data is not forwarded expeditiously to KEH.

1.6.2 Requests for payment for equipment or material which Contractor has received, but has not installed, shall be accompanied by invoice or other data to provide evidence that title to equipment or material is held by Contractor.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

**KAISER ENGINEERS
HANFORD**

MONTHLY ESTIMATE OF WORK COMPLETED

Contract or P.O. No.	Estimate No.	Date
----------------------	--------------	------

Name of Contractor

Address

Nature of Work

Initial Amount of Contract \$	Total Amount of Modifications to Date \$	Total Adjusted Contract Amount \$
----------------------------------	---	--------------------------------------

Description	Amount
-------------	--------

Estimated Work Completed to (Date)

Less: Previous Payments	\$	
Other Charges (Explain Below)	\$	

Total Deductions	(\$)
------------------	------	---

Adjusted Payment Requested	\$	
----------------------------	----	--

Less Retainage @ _____ %	\$	
--------------------------	----	--

Total Payment Allowed	\$	
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I certify that I have verified this periodical estimate dated _____ for \$ _____ and that to the best of my knowledge and belief it is a true and correct statement of work performed and that the contractor's statement of his account and amount due him is correct and just, and the quantities included in this estimate have been performed in full accordance with the terms and conditions of the corresponding construction documents.

FOR THE CONTRACTOR

KAISER ENGINEERS HANFORD COMPANY

By _____ By _____

END OF SECTION

SECTION 01040

COORDINATION

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 CONSTRUCTION ACTIVITIES

1.3.1 Coordinate construction activities to ensure efficient and orderly sequence of work, with provisions for accommodating items to be installed later.

1.3.2 As noted in Section 29 of the Contract General Conditions, other contracts may be under construction concurrently with the Work included in this Specification. Coordinate activities with other contractors for mutual benefit. Coordination meetings may be required in addition to progress meetings to keep parties informed of scheduled activities at interface points.

1.3.3 Following activities require interface with work by others.

1.3.3.1 Casing on existing monitoring well E-25-33 south of Vault 105 will be extended by KEH during backfill operations.

1.3.3.2 Install cover blocks for pits and drain seal assemblies for test fit to be witnessed by KEH. After demonstration of proper fit, remove cover blocks and plugs and store on dunnage or pallets at Project Site.

1.3.3.3 Excavation for additional vaults will be performed by others during 1990. Do not store equipment or facilities east of coordinate W45400 when excavation begins. Access to vault construction area may be rerouted accordingly.

1.4 CONNECTIONS TO EXISTING SYSTEMS

1.4.1 Advance notice of work that will affect existing systems shall be given to KEH. Careful planning and scheduling of work activities is required to coordinate operations of existing systems to keep disruptions at minimum.

1.4.2 As required in subsection 50.7 of Contract General Conditions connections to existing systems shall be scheduled well in advance for work to be done. KEH will coordinate schedule with Contractor and system operators.

1.4.3 Connections to existing systems shall be accomplished during system outage not to exceed 4 hours.

1.5 ACCESS TO WORK AFTER POSSESSION

1.5.1 As each vault is completed KEH will take possession and access will be restricted.

1.5.2 Access to warranty work set forth in Section 24 of Contract General Conditions or access to work after possession set forth in Section 20 of Contract General Conditions will be coordinated by KEH with other contractors, and users of facility. Notify KEH in advance of proposed work to minimize disruptions.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01043

JOB SITE ADMINISTRATION

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 WORKING HOURS

1.3.1 Working hours for this Contract are from 7:15 am to 3:45 pm Monday through Friday except holidays to avoid congestion at intersection of Route 4 and access road.

1.3.2 For other than normal working hours refer to Section 51 of the Contract General Conditions.

1.4 BADGE, DOSIMETER, AND ORIENTATION

1.4.1 Work being near the 200-E Area in the Controlled Access Area of the Hanford Site, the following are applicable.

1.4.1.1 Badge, dosimeter, and orientation requirements in accordance with Section 56 of Contract General Conditions.

1.4.1.2 Badges will not be provided until the Notice to Proceed letter has been signed and returned to KEH, supervisors have attended KEH safety training course, requirements of Section 55 of Contract General Conditions have been received by KEH, and Site Labor Conference and Preconstruction Meeting set forth in Section 01200 have been completed.

1.5 EVACUATION DRILLS

1.5.1 Personnel working on the Hanford Site are required to participate in emergency evacuation drills held approximately once each calendar quarter and lasting approximately 1 hour.

1.5.2 Maintain daily log or other suitable record of names of Contractor and subcontractor personnel working on the Hanford Site.

1.6 SECURITY

1.6.1 Policy and Procedures: Contractor employees are required to meet with security policy and procedures set forth in KEH-MA-6, Safeguards and Security Manual. Copies of manual will be provided to Contractor upon request after award of Contract.

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1.6.2 Security Escorts

1.6.2.1 Contractor personnel not having "5" or "3" security clearance, working within 200 East Limited Area require security escorts. Escorts are provided by KEH at no cost except as set forth in subparagraph 1.6.2.4.

1.6.2.2 Provide list of employees and vehicles to be used inside Limited Area and anticipated start and duration of utilization. Provide list 1 week before start of work for escort requirement determination. Provide weekly work schedules of employees, not later than Thursday of preceding week (minimum 24 hour notice required for changes), for KEH to provide sufficient escorts.

1.6.2.3 Escorts will be assigned from the KEH trailer located outside Limited Area near Access Gate No. 814. Personnel shall meet and transport assigned escorts from that location. Provide space within contractor vehicles to accommodate necessary personnel escorts. Minimum 1 escort is required in each vehicle.

1.6.2.4 Contractor may be charged for escorts when escorts have been requested and Contractor personnel do not show up at time and place specified. Charges will be made at rate of \$15.00 per hour for each escort for time lost waiting for Contractor personnel.

1.7 SAFETY REQUIREMENTS

1.7.1 Fire Safety

1.7.1.1 Contractor is required to address fire safety as part of construction safety plan required by Section 55 of Contract General Conditions. Incorporate following fire safety requirements into construction safety plan.

- a. Remove or shield combustible materials while welding or cutting.
- b. Maintain fire watch for period of 1/2 hour after cessation of welding, cutting, or grinding.
- c. Utilize portable shields wherever welding, cutting, or grinding.
- d. Have fully charged fire extinguishers available whenever welding, cutting, or grinding.
- e. Means to control ignition of brush fires.

1.7.1.2 See Section 01500 for off-road driving and grass fire prevention requirements.

1.7.2 Safety Apparel

1.7.2.1 Personnel shall wear appropriate footwear in construction areas. Tennis shoes, canvas type shoes, or open toe shoes do not meet this requirement.

1.7.2.2 Hardhats shall be worn at all times.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01050

SURVEY AND FIELD ENGINEERING

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 QUALITY CONTROL

1.3.1 Establishing alignment, location, and grades shall be the responsibility of a Land Surveyor registered in the state of Washington.

1.3.2 Deliver field notes, records, and documentation to KEH at 3 month intervals to review and verify procedures used and accuracy of work.

1.4 SURVEY DATA

1.4.1 Basic reference points with coordinate descriptions and bench marks with elevation identified, as shown on the Drawings, will be located by others.

1.4.2 Contractor shall be responsible for preservation of bench marks and reference points, including stakes or other markers established until removal is authorized by KEH.

1.5 PROCEDURES

1.5.1 Before initial layout, field verify horizontal and vertical data furnished. Report discrepancies to KEH before proceeding.

1.5.2 Establish adequate number of permanent reference points, to be used during construction, referenced to original control points. Record locations with horizontal and vertical data on project record documents.

1.5.3 Protect and preserve control and reference points until work is complete. Report loss or destruction of control points to KEH. Report relocation or change in data affecting reference points.

1.5.4 Periodically verify data for control and reference points, and construction stakes to maintain construction accuracy.

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PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

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SECTION 01065

PERMITS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 FEDERAL, STATE, AND MUNICIPAL LAWS, CODES, AND REGULATIONS

1.3.1 Permits or licenses to do business required by Federal, State, and Municipal laws, codes, and regulations are the responsibility of the Contractor as stated in Section 6 of Contract General Conditions.

1.4 HANFORD SITE PERMITS

1.4.1 General: Before certain types of work can be performed at Hanford, Contractor is required to have a permit. Permits are provided by KEH at no cost, however, Contractor shall furnish information required and notify KEH in advance of work which requires a permit. Contractor shall meet the requirements and restrictions set forth in each permit.

1.4.2 Excavation: Do not excavate without permit set forth in subsection 50.9 of Contract General Conditions. Post permit at Site.

1.4.3 Backfill Permit: Permit required for each element of fill and backfill and good for 5 days or duration of work element provided Work does not stop for 5 consecutive days. Complete permit form, furnished by KEH, and return to KEH for approval before starting work. Permit shall be kept at Site.

1.4.4 Welding and Cutting Permit: Welding or flame cutting requires a permit. Permit is good for duration of Contract. Provide process to be used 5 days before start of welding for KEH to furnish permit. Permit shall be kept at Site.

1.4.5 Radiation Work Permit (RWP): Permit required before entering area designed as radiation zone. Permit will be furnished by KEH and shall be posted outside zone for employee use.

1.4.6 Oversize Load Permits: In addition to a Washington State permit, obtain from KEH permits for each movement of each oversize vehicle or load within the Hanford Site. See Section 01500, subparagraph 1.6.4.3 for additional requirements.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

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SECTION 01100
SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications including documents referenced therein, form a part of this Section to extent designated herein.

1.1.1.1 Federal Standards (FED STD)

FED-STD-313B Including CHG NOT 1 and 2	Material Safety Data Sheets Preparation and Submission of
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1.1.1.2 Washington Industrial Safety and Health Act (WISHA)

Washington Administrative Code (WAC)

Title 296, Labor and Industries

Chapter 296-62 WAC	Occupational Health Standards-- Safety Standards for Carcinogens
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1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Air Quality Test Reports: Submit test reports showing air quality supplied by respirator compressor has been tested within last 6 months and meets Grade E requirements.

1.3 APPLICATION OF COATINGS

1.3.1 During application of coatings, provide respiratory protection in accordance with manufacturers recommendations on material safety data sheets for products being applied. Supplied-air respirators will be required during application of polyurethane insulation. Respirator protection shall be in accordance with WAC 296-62-071 and Contractor shall have minimal acceptable respirator program outlined in WAC 296-62-07109.

1.3.1.1 Contractor supplied air respirators require Grade E air quality, having following characteristics, for breathing air systems.

<u>Constituent</u>	<u>Limiting Characteristics</u>
Oxygen	*ATM/19.5 - 23.5%
Hydrocarbons (condensed)	5 mg/m ³
Carbon Monoxide	10 ppm
Carbon Dioxide	500 ppm

*Term ATM (atmospheric) denotes oxygen content normally present in atmospheric air. Numerical values denote oxygen limits for synthesized air.

1.3.1.2 Breathing air system shall be monitored for following conditions.

- a. Loss of power to compressor motor.
- b. Low pressure air receiver tank.
- c. Compressor overheating.
- d. Carbon monoxide levels in excess of requirements for Grade E

air.

1.3.1.3 Provide audible and visual alarms for conditions listed in subparagraph 1.3.1.2.

1.4 CONFINED SPACES

1.4.1 Vault interior is confined space after 4 sides have been erected.

1.4.2 Requirements of WAC 296-62-145 shall be met before entering or working in confined spaces.

1.5 HAZARDOUS MATERIAL REQUIREMENTS

1.5.1 Provide listing of hazardous products anticipated for construction. Provide material safety data sheets (MSDS) for each product listed.

1.5.2 Hazardous products, whether specified or recommended and voluntarily requisitioned by Contractor, shall be governed by requirements of FED-SID-313 and Section 111 of Contract General Conditions.

1.5.3 Discard hazardous construction waste such as cleaning solvents, waste oil, and antifreeze in disposal barrels provided by KEH. Identify, separate, and minimize hazardous waste. Disposal will be by KEH.

1.5.4 An area adjacent to Project site will be designated as washout area for concrete trucks. Remove hardened concrete periodically and at completion of work, and dispose of at central landfill.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 MEETING PROCEDURES

1.3.1 Representatives from KEH and Contractor, including major subcontractors, shall participate in project meetings.

1.3.2 Meeting times and locations shall be mutually agreed to by Contractor and KEH, and will be held at the Hanford Site in Richland, Washington. KEH will issue notices of meetings and prepare minutes. Meeting minutes will be distributed to project participants.

1.4 SITE LABOR CONFERENCE

1.4.1 Before starting construction onsite, Contractor and subcontractors shall attend informational conference on Hanford Site labor requirements applicable to Project. Contractor shall schedule conference with KEH and identify crafts for Project. KEH will attend and provide meeting notice to representatives from labor organizations whose members may be utilized in construction. Contractor shall conduct meeting and present proposed work plan and craft utilization. Contract General Conditions relating to labor will be reviewed.

1.5 PRECONSTRUCTION MEETING

1.5.1 Meeting will be scheduled by KEH before start of onsite work. Authorized representatives of Contractor and major subcontractors shall attend. KEH will advise others having interest in Project. Meeting will be chaired by KEH.

1.5.2 Following items, as minimum, will be incorporated into agenda for meeting.

1.5.2.1 Point of contact, key personnel (Operating Contractor, Safety, QA/QC, Acceptance Inspectors, etc) and contracts personnel.

1.5.2.2 Schedule requirements and restraints, submittals and work limitations.

1.5.2.3 Safety, construction progress meetings and frequency, and certified payrolls.

1.5.2.4 Report requirements and frequency.

1.5.2.5 Major material and equipment lists.

1.5.2.6 Vault liner preinstallation meeting required in Section 02755, subparagraph 1.3.4.1.

1.5.2.7 Other pertinent items.

1.6 CONSTRUCTION PROGRESS

1.6.1 Meetings, held weekly at time and location determined at preconstruction meeting, will be approximately 1 hour long.

1.6.2 KEH will chair meeting and request attendance of key personnel required. Authorized representative of Contractor and pertinent subcontractors shall attend.

1.6.3 Purpose of meetings is to monitor status and provide forum for exchange of pertinent Project information. Major topics may include, but not be limited to, following.

1.6.3.1 Schedule, cost and construction status.

1.6.3.2 Design and scope changes

1.6.3.3 Submittal status, key material and equipment delivery status.

1.6.3.4 Potential problem areas.

1.6.3.5 Action item status, goals for next meeting.

1.6.3.6 Other appropriate items.

1.6.4 Minutes will be issued by KEH as promptly as possible following meeting. Action items will be identified with assigned follow-up. Issues resolved will be reported in the minutes, as well as closed action items.

1.7 DAILY STATUS

1.7.1 Informal meetings will be held each work day, at time and place determined in the field, to review scheduled activities and hold or witness points.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not. Used

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION

1.1.1 This Section summarizes submittals required in Part 1 of each section of this Specification. It explains type of submittals required, and describes procedures for submittals and review.

1.1.2 Submittals required in Part 1 of each section are summarized in Schedule of Submittals. Each submittal is identified by Submittal Number, Reference Section, and Title. Submittals are required for either Review and Approval or Review for Record.

1.1.2.1 Submittals requiring Review and Approval are those which shall receive approval before procurement, fabrication, or construction is started.

1.1.2.2 Submittals requiring Review for Record are those which Contractor may proceed with procurement, fabrication, construction, or acceptance testing, but acceptance is contingent upon compliance with Drawings and Specifications.

1.1.3 Supplemental Submittals are initiated by Contractor in accordance with Section 01630 for consideration of substitute products or corrective procedures and require Review and Approval.

1.2 SUBMITTAL PROCEDURES

1.2.1 Transmit submittals for each vault to KEH by Data Transmittal form. Identify submittals by vault numbers.

1.2.2 Identify each submittal by Submittal Number, Reference Section, and Title noted in the Schedule of Submittals. Number of copies required for retention by KEH are shown in Schedule and include 2 copies to be returned to Contractor. Additional copies required for Contractor uses shall be added.

1.2.3 Review each submittal for completeness, compliance with Contract Documents, and proper identification before sending to KEH. Submittal data shall either be stamped showing review process has taken place or Data Transmittal form may be signed with statement of "Reviewed for Compliance." Submittals not stamped or signed to show review will be returned without consideration.

1.2.4 Submittals requiring Review and Approval will be stamped by KEH and marked "Approved", "Approved with Exception," or "Not Approved, Revise and Resubmit." Approval of submittals does not relieve Contractor of responsibility for errors which may be contained therein.

1.2.4.1 Approved submittals are identified by submittal stamp with "Approved" or "Approved with Exception" box checked. "Approved" signifies general concurrence to achieve conformance with design concept of Project and compliance with requirements of Contract Documents. "Approved with Exception" signifies general concurrence with noteworthy comments or clarifications. Approval of submittals does not relieve Contractor of responsibility for errors contained therein. Approval of specific item shall not be construed as approval of system or assembly of which item is a component.

1.2.4.2 A submittal which is not approved is identified as "Not Approved, Revise and Resubmit." Submittal is considered by KEH to be technically deficient or incomplete and therefore, unacceptable. Resubmittal is required, hence fabrication, procurement, or performance of procedures shall not proceed.

1.2.4.3 Upon receipt of deficient submittal data, Contractor shall make corrections noted on transmittal and resubmit data to KEH within 10 calendar days.

1.2.5 Materials and equipment fabricated or installed without required approved submittals, or which differ from approved Drawings or vendor data are subject to rejection and replacement at Contractor's expense.

1.2.6 Delays arising out of Contractor's failure to submit in timely manner required Drawings and other related data described in Contract Documents shall not constitute excusable delays for extensions, unless excusable under other provisions of Contract. Contractor shall allow 15 calendar days for KEH review and disposition of submittals, including shop drawings and vendor information, required to be furnished by Contractor. Time period will be measured from date of receipt of submittal in KEH's office to date of return mailing to Contractor.

1.2.7 Contractor is responsible for dimensions to be confirmed and correlated at worksite.

1.2.8 Submittals for Review and Record will be reviewed and filed. Incomplete or inaccurate data will be returned to Contractor marked "Resubmit" with appropriate comments, and items procured or work performed shall be corrected. Payment for equipment will not be made unless required Certified Vendor Information (CVI) has been furnished.

1.2.9 Supplemental Submittals shall contain sufficient data required in Section 01630 to show substantial compliance with Drawing and Specifications. Substitute product submittals shall contain as minimum, outline dimensions, operating clearances, and engineering data. Identify each submittal by Specification Section number and Paragraph number or referenced Drawing number and detail. Improperly identified or incomplete submittals will be returned without consideration.

1.2.10 Procedures for performing certain items of work are required to be submitted for Review and Approval before work is commenced. Those work

procedures which have been approved by KEH for work similar to that to be accomplished on Project may not need to be reapproved. Forward 1 copy of previously approved procedure to KEH by Data Transmittal form and identify by Submittal Number, Reference Section, Title, and either Contractor's procedure number or project number for which procedure was approved. Submittal will be reviewed by KEH and if acceptable retained for record. If previously approved procedure is not acceptable submittal will be returned with requirements for resubmittal.

1.3 SCHEDULE OF SUBMITTALS

Submittal Number	Submittal Title	Quantity	Review and Approval	Review For Record
CONTRACT GENERAL CONDITIONS				
55.2	Safety Program and Job Safety Analysis	5	5 days before start of work	
55.3	Industrial Injury/Illness Experience	5		5 days before start of work and each month
55.5.1	OSHA Form No. 200 Report	5		5th working day, each month
55.6	Equipment Certification	5		2 days before bringing equipment onsite
SPECIAL PROJECT PROCEDURES				
01100/1.2.1	Air Quality Test Reports	5	Before equipment use	
PROGRESS SCHEDULES				
01310/1.2.1	Progress Schedules	5	30 days after notice of award	
01310/1.2.2	CPM Project Schedule	5	30 days after notice of award	
01310/1.2.3	Initial Weekly Work Schedule	2	10 days after notice to proceed	

Submittal Number	Submittal Title	Quantity	Review and Approval	Review For Record
PROGRESS SCHEDULES (Continued)				
01310/1.2.4	Subsequent Weekly Work Schedules	2	By noon each Friday	
01310/1.2.5	Start-up Schedule	5	5 days after notice to proceed	
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS				
01500/1.2.1	Anchoring and Enclosure Methods	10	Before placing field office	
SUBMIT FOLLOWING FOR EACH VAULT				
DIFFUSION BARRIER				
02145/1.2.1	Laboratory Reports	10	Before delivery	
02145/1.2.2	Manufacturer's Data	10	Before mixing	
02145/1.2.3	Handling Procedure	10	Before delivery	
02145/1.2.4	Placing Procedure	10	Before delivery	
02145/1.2.5	Compacting Procedure	10	Before delivery	
02145/1.2.6	Geotextile Installation Procedure	10	Before installation	
EARTHWORK				
02200/1.2.1	Method to Prevent Damage During Excavation	10	Before excavation	
HOT-LAID ASPHALTIC CONCRETE PAVEMENT				
02512/1.2.1	Laboratory Reports	10	Before delivery	
02512/1.2.2	Handling and Placing Procedure	10	Before delivery	

Submittal Number	Submittal Title	Quantity	Review and Approval	Review For Record
LEACHATE COLLECTION SUMP LINER				
02752/1.2.1	Fabricator Drawings and Procedures	10	Before fabrication	
02752/1.2.2	Certified Material Test Reports (CMTR)	10	Before delivery	
02752/1.2.3	Filler Material Control Procedure	10	Before fabrication	
EXTERIOR DRAINAGE PATH				
02753/1.2.1	Fabricator Drawings	10	Before delivery	
02753/1.2.2	Installation Plan	10	Before installation	
02753/1.2.3	Manufacturer's Data	10	Before fabrication	
02753/1.2.4	Surface Acceptance	10	Before installation	
02753/1.2.5	Care and Repair Instructions	10		Before acceptance
WASTE DISPOSAL BASIN LINER				
02755/1.2.1	Installation Drawings	10	Before delivery	
02755/1.2.2	Installation Procedures	10	Before installation	
02755/1.2.3	Manufacturer's Data	10	Before fabrication	
02755/1.2.4	Samples	10		Upon completion of fabrication
02755/1.2.5	Certified Material Test Reports (CMTR)	10	Before delivery	
02755/1.2.6	Care and Repair Instructions	10		Before acceptance

Submittal Number	Submittal Title	Quantity	Review and Approval	Review For Record
WASTE DISPOSAL BASIN LINER (Continued)				
02755/1.2.7	Certificates of Experience	10	Before notice to proceed	
02755/1.2.8	Manufacturer's Quality Control Plan	10	5 days after notice of award	
02755/1.2.9	Certification	10		Before acceptance
02755/1.2.10	Surface Acceptance	10	Before installation	
LEACHATE COLLECTION SYSTEM				
02756/1.2.1	Fabricator Drawings	10	Before delivery	
02756/1.2.2	Installation Plan	10	Before installation	
02756/1.2.3	Manufacturer's Data	10	Before fabrication	
02756/1.2.4	Care and Repair Instructions	10		Before acceptance
02756/1.2.5	Certified Material Test Reports (CMTR)	10	Before delivery	
02756/1.2.6	Certificate of Conformance	10		At time of delivery
02756/1.2.7	Certificates of Experience	10	5 days after notice of award	
02756/1.2.8	Manufacturer's Quality Control Plan	10	5 days after notice of award	
CAST-IN-PLACE CONCRETE				
03300/1.2.1	Form Coating Materials	10	Before use	
03300/1.2.2	Certification of Ready Mixed Concrete Production Facilities	10	Before mixing	

Submittal Number	Submittal Title	Quantity	Review and Approval	Review For Record
03300/1.2.3	CAST-IN-PLACE CONCRETE (Continued) Certified Test Reports for Reinforcing Steel	10	Before delivery	
03300/1.2.4	Reinforcing Steel Fabricator Drawings	10	Before delivery	
03300/1.2.5	Block Diagram	10	Before installation of forms	
03300/1.2.6	Concrete Materials, Mix Design and Mix proportions	10	Before mixing	
03300/1.2.7	Cold Weather Concreting	10	Before placement	
03300/1.2.8	Curing Procedure	10	Before mixing	
03300/1.2.9	Certificate of Conformance	10		At time of delivery
03301/1.2.1	VAULT AND BASIN CAST-IN-PLACE CONCRETE Formwork	10	Before installation	
03301/1.2.2	Form Coating Materials	10	Before use	
03301/1.2.3	Certification of Ready Mixed Concrete Production Facilities	10	Before mixing	
03301/1.2.4	Laboratory Test Reports	10	Before delivery	
03301/1.2.5	Reinforcing Steel Fabricator Drawings	10	Before delivery	
03301/1.2.6	Manufacturer's Data	10	Before delivery	
03301/1.2.7	Certified Test Reports	10	Before delivery	

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Submittal Number	Submittal Title	Quantity	Review and Approval	Review For Record
VAULT AND BASIN CAST-IN-PLACE CONCRETE (Continued)				
03301/1.2.8	Schedule for Concrete Placement	10	Before installation of forms	
03301/1.2.9	Mix Design	10	Before mixing	
03301/1.2.10	Mix Certification	10	Before mixing	
03301/1.2.11	Control Procedures for Batching	10	Before mixing	
03301/1.2.12	Certificate of Conformance	10		At time of delivery
03301/1.2.13	Construction Joints	10	Before installation of forms	
03301/1.2.14	Weather Protection During Placement	10	Before placement	
03301/1.2.15	Curing and Protection	10	Before placement	
03301/1.2.16	Pump Concrete	10	10 days before placing concrete	
03301/1.2.17	Methods for Controlling Heat of Hydration and Thermal Gradients	10	Before placement	
03301/1.2.18	Air Leakage Test	10	Before test	
PRECAST PRESTRESSED CONCRETE SECTIONS				
03419/1.2.1	Fabricator Drawings	10	Before delivery	
03419/1.2.2	Records of Tests	10	Before mixing	
03419/1.2.3	Concrete Materials and Mix Design	10	Before mixing	

Submittal Number	Submittal Title	Quantity	Review and Approval	Review For Record
PRECAST PRESTRESSED CONCRETE SECTIONS (Continued)				
03419/1.2.4	Certification	10		At time of delivery
03419/1.2.5	Certification of Prestressed Concrete Production Facilities	10	Before fabrication	
03419/1.2.6	Manufacturer's Quality Assurance Plan	10	5 days after notice of award	
METAL FABRICATIONS				
05500/1.2.1	Fabricator Drawings	10	Before fabrication	
05500/1.2.2	Certified Material Test Reports (CMTR)	10	Before delivery	
SPECIAL PROTECTIVE COATING				
09805/1.2.1	List of Materials	10	Before delivery	
PROTECTIVE COATING FOR CONCRETE VAULT INTERIOR				
09885/1.2.1	List of Materials	10	Before delivery	
09885/1.2.2	Certified Material Test Reports (CMTR)	10	Before delivery	
09885/1.2.3	Samples	10	Concurrent with CMTR	
INSTRUMENTATION				
13440/1.2.1	Approval Data	10	Before delivery	
13440/1.2.2	Certified Vendor Information (CVI)	10		Before acceptance
CHEMICAL PROCESS PIPING SYSTEMS				
15493/1.2.1	Certified Material Test Reports (CMTR)	10	Before delivery	
15493/1.2.2	Certificate of Conformance	10		At time of delivery

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Submittal Number	Submittal Title	Quantity	Review and Approval	Review For Record
CHEMICAL PROCESS PIPING SYSTEMS (Continued)				
15493/1.2.3	Weld Identification Drawings	10	Before welding	
15493/1.2.4	Filler Material Control Procedure	10	Before fabrication	
15493/1.2.5	Welding Filler Metal	10	Before welding	
15493/1.2.6	Welding Procedures and Personnel	10	Before welding	
15493/1.2.7	NDE Personnel and Procedures	10	Before welding	
HIGH VOLTAGE DISTRIBUTION (ABOVE 600-VOLT)				
16300/1.2.1	Approval Data	10	Before delivery	
16300/1.2.2	Certification Vendor Information (CVI)	10		Before acceptance
CATHODIC PROTECTION				
16640/1.2.1	Approval Data	10	Before delivery	
16640/1.2.2	Certified Vendor Information (CVI)	10		Before acceptance
16640/1.2.3	Visual Examination Procedure	10	Before examination	
16640/1.2.4	Manufacturer's Instructions	10	Before installation	
PART 2 - <u>PRODUCTS</u>				
	Not Used			
PART 3 - <u>EXECUTION</u>				
	Not Used			

END OF SECTION

SECTION 01310

PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Progress Schedules: Submit schedule required in Article 1.3.

1.2.2 CPM Project Schedule: Submit information required in Paragraph 1.4.2.

1.2.3 Initial Weekly Work Schedule: Submit schedule required in Article 1.5.

1.2.4 Subsequent Weekly Work Schedules: Submit schedules required in Article 1.5.

1.2.5 Start-Up Schedule: Submit schedule required in Article 1.6.

1.3 PROGRESS SCHEDULES

1.3.1 Schedule identified in Section 5 of Contract General Conditions shall be in accordance with following.

1.3.1.1 Prepare schedule, in form of horizontal bar chart of suitable scale, to show percentage of Work scheduled for completion at any time with separate bar for each activity. At end of each month or at end of other periods of time specified in Contract, Contractor shall prepare and submit 1 copy of chart showing actual progress at the end of period.

1.3.2 Provide subschedule to define critical portions of entire schedule.

1.3.3 Schedule shall include construction activities, progress milestones, and include, but not be limited to, following.

1.3.3.1 Phase I activities

a. Bonds and insurance.

b. Mobilization.

c. Submittals.

d. Furnish HDPE liners, geotextiles, and drainage nets for Vaults 102 and 103.

e. Furnish leachate collection sump liner and riser for Vaults 102 and 103.

- f. Foundation excavation for Vaults 102, 103, 104, and 105.
 - g. Furnish and place diffusion barrier and asphalt overlay under catch basin for Vaults 102, 103, 104, and 105.
 - h. Form, install reinforcing steel, and place concrete for leachate sump foundation for Vaults 102 and 103.
 - i. Place leachate sump and 4 inch catch basin drainage pipe and encase in concrete for Vaults 102 and 103.
 - j. Form, install reinforcing steel, and place concrete for catch basins for Vaults 102 and 103.
 - k. Install liner, geotextile, 4 inch perforated pipe, and gravel for Vaults 102 and 103.
- 1.3.3.2 Phase II activities
- a. Furnish HDPE liners, geotextiles, and drainage nets for Vaults 104 and 105.
 - b. Furnish leachate collection sump liner and riser for Vaults 104 and 105.
 - c. Form, install reinforcing steel, and place concrete for leachate sump foundation for Vaults 104 and 105.
 - d. Place leachate sump and 4 inch catch basin drainage pipe and encase in concrete for Vaults 104 and 105.
 - e. Form, install reinforcing steel, and place concrete for catch basins for Vaults 104 and 105.
 - f. Install liner, geotextile, 4 inch perforated pipe, and gravel for Vaults 104 and 105.
 - g. Form, install reinforcing steel, and place concrete for floors for Vaults 102, 103, 104, and 105.
 - h. Form, install reinforcing steel, and place concrete for walls for Vaults 102 and 103.
 - i. Furnish electrical and instrumentation materials required to complete Vaults 102 and 103. Include electrical distribution transformer at Vault 102 and cathodic protection materials for TGE and Vaults 101, 102, and 103.
 - j. Furnish precast prestressed concrete cover blocks for Vaults 102 and 103.

k. Furnish prefabricated pipe spools for piping to and over Vaults 102 and 103.

1.3.3.3 Phase III activities

a. Form, install reinforcing steel, and place concrete for walls for Vaults 104 and 105.

b. Apply asphalt coating to interior of Vaults 102, 103, 104, and 105.

c. Install exterior drainage path for Vaults 102, 103, 104, and 105.

d. Place diffusion barrier and backfill around Vault 102 and 1 side of Vault 103 to top of walls.

e. Place diffusion barrier and backfill around Vault 103 and 1 side of Vault 104 to top of walls.

f. Place diffusion barrier and backfill around Vault 104 and 1 side of Vault 105 to top of walls.

g. Set precast, prestressed concrete cover blocks for Vaults 102, 103, 104, and 105.

h. Form, install reinforcing steel, and place concrete for 4 excess water pits, vault pit, and leachate pit for Vaults 102, 103, 104, and 105.

i. Place concrete topping over cover blocks of Vaults 102, 103, 104, and 105.

j. Perform air leakage test on Vaults 102, 103, 104, and 105.

k. Install roof penetration risers for Vaults 102, 103, 104, and 105.

l. Furnish prefabricated pipe spools for piping to and over Vaults 104 and 105.

m. Place 3 feet of diffusion barrier and temporary protective geotextile over roof of Vaults 102, 103, 104, and 105.

n. Install encased grout feed and excess water pipe lines from tie-in point to vault pit for Vaults 102, 103, 104, and 105, including piping extension for future vaults.

o. Install encased excess water pipe over vault from vault pit to 4 excess water pits and leachate collection pit to excess water pit for Vaults 102, 103, 104, and 105.

p. Complete installation of cathodic protection for pipe at TGE and Vault 101.

q. Install cathodic protection for pipe to Vaults 102 and 104, including piping extension for future vaults.

r. Install power pole, transformers, and electrical service to Manhole 104.

s. Install electrical service and equipment to Manhole 102A and Vault 102. Include 225 kVA distribution transformer.

t. Install electrical service and equipment to Manhole 103A and Vault 103.

u. Install electrical service and equipment to Manhole 105A and Vault 105, and from Manhole 103A to Vault 104.

v. Install instrumentation for Vaults 102, 103, 104, and 105.

w. Apply special protective coatings and identification markings to Vaults 102, 103, 104, and 105.

x. Fabricate and install cast-in-place cover blocks, excess water pits, leachate collection pit, and vault pit for Vaults 102, 103, 104, and 105.

y. Fabricate and install drain seal assemblies, T-handle plugs, and guard rails for Vaults 102, 103, 104, and 105.

z. Deliver project record documents for Vaults 102, 103, 104, and 105.

1.3.3.4 Demobilize.

1.3.4 Schedule shall show, as minimum, accumulated percentage of completion of each activity and total percentage of work completed as of last work day of each month.

1.3.4.1 Develop an "S" curve from percentage of total work figures and superimpose on the schedule.

1.3.4.2 Show dollar value or percent of total next to each activity shown on schedule. Figures will be basis for determining progress payments described in Section 01027.

1.3.5 Activities identified in Paragraph 1.3.3 shall include other construction, procurement, testing, and documentation necessary to complete activity.

1.4 CPM PROJECT SCHEDULE

1.4.1 The CPM Project Schedule provided as attachment to Contract Documents is a preliminary schedule developed by KEH and does not include all procurement, fabrication, and construction activities necessary to complete the Work.

1.4.1.1 Basis for preliminary schedule is engineering estimates and sufficient concrete forms, equipment, and manpower to allow concurrent construction of vaults.

1.4.1.2 Some activities may be performed during inclement weather. Protect work and use construction techniques necessary to continue with construction.

1.4.1.3 Preliminary schedule allows 10 days of weather delays. If unusually severe weather delays work on activities, notify KEH immediately.

1.4.1.4 If allowance for unusually severe weather delays is exceeded, accelerate remaining activities required to complete Milestone 3 in time specified at no additional cost.

1.4.2 Submit following to assist in development of final CPM Project Schedule.

1.4.2.1 Estimated activity durations: Additional activity durations shall be in working days and in general, not exceed 20 days.

1.4.2.2 Identify work for each activity to be performed on single, double, or triple shift, and work to be done on 5, 6, or 7 day work week.

1.4.2.3 Identify illogical sequence and relationship of activities, including finish to-start and finish to finish relationships to be completed during performance of Work.

1.4.2.4 Identify manhours, crew sizes, and durations for activities on preliminary CPM Project Schedule and revised activities proposed by Contractor.

1.4.3 Upon KEH and Contractor concurrence to final CPM Project Schedule, KEH will issue 5 copies to Contractor for h.s. use. Contractor shall perform Work in accordance with CPM Project Schedule.

1.4.4 After approval of CPM Project Schedule, changes in method of operating and scheduling shall be given KEH in writing, stating reasons. Upon KEH approval of proposed changes, KEH will revise CPM Project Schedule and furnish Contractor with 5 copies.

1.4.5 Due to funding limitations, KEH will issue notices to proceed for specific phases of work identified in Paragraph 1.3.3. Each phase includes activities necessary to support the critical path. Certain activities, not on critical path but on preliminary CPM, are scheduled to start before release

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of phase in which located. Do not start activity until notice to proceed is issued.

1.5 WEEKLY WORK SCHEDULE

1.5.1 Prepare initial and subsequent detailed schedules of next week's work. Schedule shall include following as minimum.

1.5.1.1 Work description.

1.5.1.2 Location of work.

1.5.1.3 Work involving outages, overtime, weekends, etc.

1.6 START-UP SCHEDULE

1.6.1 Prepare schedule, in form of horizontal bar chart of suitable scale, to show activities conducted during first 60 calendar days after receipt of notice to proceed. Include procurement, submittals, and construction activities.

1.7 INTERFACE SCHEDULES

1.7.1 Prepare detailed interface schedules requested by KEH for complicated tasks that require detailed planning to assure timely completion or for detailed interface with other work.

1.8 REVISIONS TO SCHEDULES

1.8.1 Whenever KEH determines there are significant variances between actual and scheduled progress, endangering completion within Contract completion time, Contractor may be required to prepare and submit revised progress schedule and revised information for CPM Project Schedule.

1.8.2 Provide narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken, or proposed, and its effect, including effect of changes on schedules of separate contractors.

1.8.3 If Contractor fails to submit progress schedule specified in Paragraph 1.3.1 within prescribed time, or updated progress schedule and CPM information specified in Paragraph 1.8.1. within requested time, KEH may withhold approval of progress payments until time Contractor submits required progress schedule and CPM information.

1.9 CONSTRUCTION MILESTONES

1.9.1 Specific activities necessary to complete the Work on Vault 102 have been designated as milestones. Delays in completion of Vault 102 will impact testing and filling operations by others.

1.9.2 Milestones are identified as follows.

<u>Milestone Number</u>	<u>Description</u>	<u>Completion Period</u>
1	Complete concrete walls for Vaults 102 and 103	237 calendar days after notice to proceed with Phase I
2	Complete concrete cap over roof panel for Vault 102	369 calendar days after notice to proceed with Phase I
3	Complete construction, installation, punchlist items, and documentation for Vault 102	431 calendar days after notice to proceed with Phase I

1.9.3 Completion period for each milestone is based on release of phased funding within window described in the Agreement.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01400

QUALITY ASSURANCE

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 SPECIFIC CONTRACTOR QUALITY ASSURANCE PLAN (QAP) REQUIREMENTS

1.3.1 Have documented QAP in accordance with following criteria. If QAP is based on national standard, furnish matrix which cross-references plan with corresponding requirements listed below.

1.3.1.1 General: Elements of QAP include, but are not limited to, design, procurement, materials, fabrication, installation, inspection, testing, and following.

a. Provisions for special controls, processes, test equipment, tools, and skills to attain required quality, and description of methods to ensure quality is inherent in finished work.

b. Establish and maintain documented procedures and instructions defining inspection system to be used and records to be maintained.

c. Applicable subcontracted activities.

d. Planned contract activities whether performed on or off Hanford Site.

1.3.1.2 Authority and responsibility

a. Establish and document authority and responsibility of those in charge of quality assurance system. Persons performing quality functions shall have sufficient and well defined responsibility, authority, and organizational freedom to identify quality problems and to initiate, recommend, and provide solutions.

b. Address authority to stop work or to control further operations where conditions adverse to contract and quality requirements are identified and immediate corrective actions are required.

c. Organizational structure and responsibility shall be such that quality achievement is verified by persons or organizations not directly responsible for performing the work. Individuals or organizations responsible for establishing and executing QAP may delegate work to others but shall retain responsibility.

d. Employ dedicated, full-time quality assurance individual to be onsite whenever work is in progress.

1.3.1.3 Design control

- a. Define, control, and verify design activities by Contractor.
- b. Specify applicable design inputs on timely basis and translate into design documents.
- c. Identify and control design interfaces.
- d. Verify design adequacy by persons other than those designing item.
- e. Design changes shall be governed by control measures commensurate with those applied to original design.

1.3.1.4 Procurement control

a. Include or reference appropriate technical and quality requirements, including quality assurance records, in documents for procurement of items and services. Procurement documents shall require suppliers to have QAP consistent with applicable elements of this plan, provide for identification of test, inspection, and acceptance requirements of purchases for monitoring and evaluating supplier's performance, and include purchaser's requirements for reporting and approving disposition of nonconformances.

b. Provide for review of and changes to procurement documents to assure items or services meet specified requirements.

1.3.1.5 Document control: Provide procedures ensuring latest approved issue of Contract Documents are used for procurement, fabrication, assembly/installation, inspection, and testing.

1.3.1.6 Control of purchased items and services.

a. Selection of suppliers based on documented evaluation of capability to provide items or services in accordance with Contract requirements.

b. QAP shall provide for following.

1) Procurement source evaluation and selection based on supplier's technical and quality capabilities.

2) Supplier performance evaluations to include conducting of source inspections of work in progress to ensure compliance to purchase requirements.

1.3.1.7 Identification and control of items

a. Document receiving activities to ensure items meet purchase requirements, including identification and markings.

b. Items accepted at receipt inspection shall have identification maintained, segregation to prevent co-mingling of similar materials inspected to different technical requirements, and controls established to ensure only correct and acceptable items are available for fabrication and installation.

1.3.1.8 Control of processes: Control processes affecting quality of items or services. Perform special processes that control or verify quality, such as those used in heat treating, welding, nondestructive examination (NDE), and testing by qualified/certified personnel using approved procedures.

1.3.1.9 Inspection

a. Perform inspections specifically required by Contract Documents and sufficient additional inspections to ensure compliance with Contract requirements.

b. Document and review inspection for compliance with Contract Documents. Documented inspections shall report true physical/functional condition of inspected activity.

c. As minimum, prepare daily report and make available for review by KEH. Report shall provide sufficient detail to describe inspections and testing performed with applicable Contract requirements referenced and results and determination of inspections and tests shown.

d. Perform verification and inspection by qualified and certified persons other than those performing or directly supervising work being inspected.

e. Identify by written practice minimum requirements for qualification and certification of inspection and test personnel.

f. Persons designated as qualified and certified to perform inspections and tests shall be knowledgeable of QAP and appropriate Contract requirements.

g. Complete required examinations and inspections, and have documentation available for review before requesting overview inspection by KEH.

1.3.1.10 Test control: Ensure test procedures include and reference test objectives and provisions for ensuring prerequisites for each test have been met.

a. Test procedures shall identify applicable and adequate instrumentation is available and used, necessary monitoring is performed and suitable environmental conditions are maintained.

b. Instead of specially prepared written test procedures, appropriate sections of related documents such as ASTM methods, supplier manuals, and equipment maintenance instructions may be used.

1.3.1.11 Calibration of measurement and test equipment (M&TE)

a. Perform calibrations at specified intervals based upon type of equipment, required accuracy, and frequency of use.

b. Maintain records and mark equipment to show calibration status.

c. When M&TE is found to be out of calibration, specify means to identify its uses since last calibration and methods to reverify acceptability of items previously tested.

d. Standards used for M&TE calibration shall have accuracy verified directly by, or through precise comparison with legal standards traceable to the National Bureau of Standards or other recognized primary standards.

1.3.1.12 Handling, storing, and shipping: Handling, storing, cleaning, packing, shipping, and preserving items shall be controlled to prevent damage/loss and to minimize deterioration.

1.3.1.13 Inspection, test, and operation status

a. Identify status of inspection and test activities either on items or in documents traceable to items.

b. Specify authority for application and removal of tags, markings, labels, and stamps.

c. Document status of ongoing fabrication, installation, inspection, and testing and make available to KEH for review.

1.3.1.14 Control of nonconforming items

a. Provide for documenting and controlling nonconforming material, parts, components, or services. Address identification, documentation, segregation, review, recommended disposition types, and notification to affected organization.

b. Be responsible for prompt detection, identification, and documentation of nonconformances.

c. Require nonconformance dispositions of "use as is" or "repair" to have technical justifications delivered to KEH for approval before effecting disposition.

d. Deliver copies of nonconformance reports to KEH at time of initiation and closeout.

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e. Identify items or materials not meeting specified requirements and control to prevent inadvertent use, shipment, or intermingling with acceptable materials or items.

f. Reinspect or retest deficient items or materials to same criteria originally applied.

g. Take corrective action to prevent reoccurrence on materials or items manufactured or procured, and extend to performance of suppliers.

1.3.1.15 Quality assurance records: Define, implement, and enforce records system with written procedures, instructions, or other documentation. Records shall be legible, accurate, complete, and identifiable to appropriate item or activity and protected against damage, deterioration, or loss.

1.3.1.16 Audits

a. Verify adequacy of QAP procedures, controls, instructions, and directions by audit, using documentation and requirements applicable to areas being audited.

b. Perform audits by personnel not having direct line responsibility in areas being audited.

c. Audits shall include examination to verify quality operations and documentation are in agreement with established requirements, and to assess results of previously identified corrective actions.

d. Make documented results of audits available to KEH for review.

1.3.2 KEH may review/audit Contractor compliance with QAP and the Contract Documents.

1.4 INSPECTING AND TESTING

1.4.1 In accordance with Section 19 of Contract General Conditions, perform following.

1.4.1.1 Compaction demonstration tests required in Section 02145, subparagraph 3.3.1.1.

1.4.1.2 Compaction demonstration tests required in Section 02200, subparagraph 3.3.1.2a.

1.4.1.3 Weld examinations and documentation required in Section 02752, Paragraph 2.3.1.

1.4.1.4 Pipe coating examination required in Section 02752, subparagraph 3.1.5.3.

1.4.1.5 Hydrostatic test required in Section 02752, Paragraph 3.2.1.

- 1.4.1.6 NDE required in Section 02752, Paragraph 3.2.2.
- 1.4.1.7 Final examination and acceptance required in Section 02753, Paragraph 3.3.1.
- 1.4.1.8 Liner seam and repair nondestructive testing required in Section 02755, Paragraph 3.3.1.
- 1.4.1.9 Liner seam destructive testing required in Section 02755, Paragraph 3.3.2.
- 1.4.1.10 Documentation required in Section 02755, Paragraph 3.3.3.
- 1.4.1.11 Final examination and acceptance required in Section 02755, Paragraph 3.3.4.
- 1.4.1.12 Final examination and acceptance required in Section 02756, Paragraph 3.3.1.
- 1.4.1.13 Quarry aggregate testing required in Section 03301, Paragraph 1.3.5.
- 1.4.1.14 Aggregate testing required in Section 03301, subparagraphs 2.3.2.1 and 2.3.2.2.
- 1.4.1.15 Water testing required in Section 03301, subparagraph 2.3.2.3.
- 1.4.1.16 Cement testing required in Section 03301, subparagraph 2.3.2.4.
- 1.4.1.17 NDE required in Section 03301, Paragraph 3.2.4.
- 1.4.1.18 Visual weld examination required in Section 03301, Paragraph 3.3.3.
- 1.4.1.19 Vault hydrostatic and air leakage tests required in Section 03301, Paragraph 3.3.4.
- 1.4.1.20 Testing precast prestressed concrete sections required in Section 03419, Paragraphs 1.4.1 and 3.3.1.
- 1.4.1.21 Test cable assemblies required in Section 13440, Paragraph 3.2.1.
- 1.4.1.22 Survey piping systems required in Section 15493, subparagraph 3.1.2.6.
- 1.4.1.23 Perform holiday testing of coating materials required in Section 15493, subparagraph 3.1.6.4.
- 1.4.1.24 Perform NDE required in Section 15493, Paragraph 3.2.2.
- 1.4.1.25 Perform leak/pressure testing required in Section 15493, Paragraph 3.2.3.

1.4.1.26 Perform compressive strength of foam testing required in Section 15493, Paragraph 3.2.4.

1.4.1.27 Test equipment and wiring required in Section 16300, subparagraph 3.3.1.1.

1.4.1.28 Test equipment and wiring required in Section 16400, subparagraph 3.3.1.1.

1.4.1.29 Test wiring systems required in Section 16400, Paragraph 3.3.2.

1.4.1.30 Test sensing cable required in Section 16400, Paragraph 3.3.3.

1.4.1.31 Test mechanical integrity of conductors to pipe required in Section 16640, subparagraph 3.3.8.3

1.4.1.32 Test conductors for continuity required in Section 16640, subparagraph 3.4.1.1.

1.4.2 In accordance with Section 19 of Contract General Condition, KEH will perform following.

1.4.2.1 Sampling and testing required in Section 02145, Paragraph 3.5.2.

1.4.2.2 Soil compaction tests required in Section 02200, Paragraph 3.4.1.

1.4.2.3 Sampling and testing required in Section 02512, paragraph 3.2.1.

1.4.2.4 Concrete testing required in Section 03300, Paragraph 3.3.1.

1.4.2.5 Reinforcement acceptance examination required in Section 03301, Paragraph 1.4.2.

1.4.2.6 Concrete testing required in Section 03301, Paragraph 3.3.1.

1.4.2.7 Concrete plant coefficient of variation and standard deviation results required in Section 03301, Paragraph 3.3.2.

1.4.2.8 Coating inspections and tests required in Section 09805, Paragraph 3.4.1 and Section 09885, Paragraph 3.4.1.

1.4.2.9 Witness specific inspection and witness points.

1.4.2.10 Perform final acceptance inspection.

1.4.3 Specific Inspection and Witness Points

1.4.3.1 Adhere to inspection points required. Ensure personnel have completed inspections of and approved portions of work in accordance with Contract requirements before notifying KEH.

a. Specific inspection and witness points are defined as follows.

1) Construction inspection (H): Required for witnessing of specific construction features, before further construction is allowed to proceed.

2) Receiving (R): Special items of fabrication, equipment, or material scheduled to be delivered to Project site or other designated location which require inspection upon arrival. Notify KEH within 4 hours after arrival of item.

3) Witness (W): Selected for inspection at option of KEH. Work may proceed upon verbal release by KEH or upon expiration of 1 hour beyond scheduled time of witness.

b. H, R, and W points apply to both onsite and offsite work. Except where longer notification period is specified, notify KEH at least 4 working hours before each point for onsite work. For offsite work, notify KEH at least 3 working days before each required point.

1.4.3.2 H, R, and W points are listed in Article 1.7.

1.5 OPEN ITEM DEFICIENCY AND NONCONFORMANCE REPORTING

1.5.1 KEH utilizes open items deficiencies and nonconformance reports to document deviations from Contract requirements.

1.5.1.1 Open item deficiency: Documented on open items lists available from KEH on request. Can be corrected by Contractor without additional direction. Correction shall bring item into compliance with Contract requirements, using approved rework procedures or standards without violating application specifications, codes, or standards.

1.5.1.2 Nonconformance report: Documented on nonconformance report (NCR). NCR's document deviations from Contract requirements when characteristic, documentation, or procedure renders quality of item or activity unacceptable or indeterminate. Identified by blue NCR tag, or red construction hold tag. Hold tag prohibits movement, installation, processing or further fabrication of nonconforming items pending approval of NCR disposition. NCR tag identifies nonconformance but does not preclude movement, installation, processing, or further fabrication of item. No action shall be taken to correct or alter actual condition before receipt of approved disposition. Tags are not to be removed by anyone other than agency who applied tag.

1.5.2 Contractor shall ensure its organization is represented by individuals with sufficient authority to commit Contractor to corrective action requirements identified by KEH.

1.5.3 Open Item deficiencies and nonconformances reported during performance of Contract require resolution before completion and final payment.

1.6 WELDING AND NONDESTRUCTIVE TESTING (NDT) PROCEDURE AND PERSONNEL CERTIFICATION VERIFICATION

1.6.1 Perform welding and NDT activities by certified individuals using procedures in accordance with applicable Contract requirements.

1.6.2 Welding/NDT Procedure Review: Deliver welding procedure specifications with supporting documentation, including applicable procedure qualification records (PQRs) including laboratory test reports and NDT procedures for KEH review before start of activity and be available at Project site and place of fabrication for review.

1.6.3 Welder/NDT Personnel Certification Review

1.6.3.1 Deliver welder and NDT certifications for review before start of activity. Welder certifications shall include applicable documentation verifying maintenance of certification in accordance with applicable code. NDT certification shall include Contractor's written practice for qualification and certification of NDT personnel. Certifications shall be available at Project site and place of fabrication for review.

1.6.3.2 KEH reserves the right to revoke welder certifications or require recertification of welders who, in the opinion of KEH, are not producing acceptable welds.

1.6.3.3 Disqualification of welders or delays due to problems with welding/NDT procedures or personnel certifications will not be considered adequate reasons for adjusting Contract price or performance time.

1.6.4 Maintain welding/NDT records when required in Specification sections.

1.7 SCHEDULE OF HOLD, RECEIVING, AND WITNESS POINTS

Section Number	Subject	Type	Offsite	Onsite
DIFFUSION BARRIER				
02145/1	Initial crushing of gravel for diffusion barrier	H	X	
02145/2	Initial coating of gravel for diffusion barrier	H	X	
02145/3	Compaction demonstrations	H		X
02145/4	Backfill operations	H		X

Section Number	Subject	Type	Offsite	Onsite
EARTHWORK				
02200/1	Compaction procedure demonstrations	H		X
02200/2	Backfill operations	H		X
LEACHATE COLLECTION SUMP LINER				
02752/1	Initial welding	H	X	
02752/2	Initial dye penetrant examination for final cover pass of welds	W	X	
02752/3	Completed fabrication before release for shipping	H	X	
02752/4	Arrival of sump liner onsite for damage, seal openings, and storage on dunnage	R		X
02752/5	Arrival of steel riser pipe for damage	R		X
02752/6	Arrival of filler material for damage and proper storage	R		X
02752/7	Initial welding/bolting	H		X
02752/8	Initial root pass dye penetrant examination	W		X
02752/9	Initial final cover pass dye penetrant examination	W		X
02752/10	Hydrustatic testing inspections	H		X
02752/11	Holiday testing	W		X
02752/12	Initial installation of riser	H		X
02752/13	Final installation of riser	W		X

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Section Number	Subject	Type	Offsite	Onsite
LEACHATE COLLECTION SUMP LINER (Continued)				
02752/14	Acceptance/verification survey (location/plumb)	H		X
EXTERIOR DRAINAGE PATH				
02753/1	Arrival of material for damage and proper identification	R		X
02753/2	Installation of membranes	H		X
02753/3	Repair and replacement of membrane	H		X
02753/4	Acceptance/verification survey (slopes)	H		X
WASTE DISPOSAL BASIN LINERS				
02755/1	Raw material sampling and testing	H	X	
02755/2	Initial manufacturing of liner	H	X	
02755/3	Manufactured material sampling and laboratory testing	H	X	
02755/4	Visual examinations of manufactured liner	W	X	
02755/5	Initial crating of liner	H	X	
02755/6	Arrival of liner onsite for damage and proper identification	R		X
02755/7	Basin surface inspection before liner installation	H		X
02755/8	Liner surface inspection while unrolling	W		X
02755/9	Leachate collection pipe installation	W		X

Section Number	Subject	Type	Offsite	Onsite
WASTE DISPOSAL BASIN LINERS (Continued)				
02755/10	Initial joint preparation of liner before weld	H		X
02755/11	In-process installation of liner (overlapped)	W		X
02755/12	Initial welding (bonding) of FML liner	H		X
02755/13	In-process and final welding inspection	W		X
02755/14	Destructive testing of FML welded seams as required	H		X
02755/15	FML liner repairs	H		X
02755/16	Permanent anchoring of FML liner	W		X
02755/17	Vacuum testing of extrusion welds and repairs	H		X
LEACHATE COLLECTION SYSTEM				
02756/1	Arrival of gravel for proper sieve analysis and cleanliness	R		X
02756/2	Arrival of geotextile material onsite for damage and proper identification	R		X
02756/3	Arrival of leachate collection pipe onsite for proper size and type, and no damage	R		X
02756/4	Initial unrolling of geotextile for tear/damage	H		X
02756/5	Installation of geotextile	W		X
02756/6	Temporary anchoring	W		X
02756/7	Initial installation of perforated pipe	H		X

Section Number	Subject	Type	Offsite	Onsite
VAULT AND BASIN CAST-IN-PLACE CONCRETE (Continued)				
03301/10	Hydrostatic testing	H		X
03301/11	Acceptance/verification survey (forms/concrete elevation/slope)	H		X
PRECAST PRESTRESSED CONCRETE SECTIONS				
03419/1	Initial grout mixing before placement	H	X	
03419/2	Initial fabrication and installation of sections	H	X	
03419/3	Initial welding of reinforcing bars (splicing)	H	X	
03419/4	Initial concrete placement	H	X	
03419/5	Initial concrete curing	W	X	
03419/6	Arrival of precast sections at site for damage	R		X
03419/7	Initial lifting of sections	H		X
03419/8	Installations	W		X
METAL FABRICATIONS				
05500/1	Initial welding	W		X
05500/2	Metal fabrication installations	W		X
SPECIAL PROTECTIVE COATING				
09805/1	Receipt of coating material for proper type and damage	R		X
09805/2	Initial primer	H		X
09805/3	Initial coating application	H		X

Section Number	Subject	Type	Offsite	Onsite
PROTECTIVE COATING FOR CONCRETE VAULT INTERIOR				
09885/1	Receipt of coating material onsite for proper type and damage	R		X
09885/2	Storage and climatic condition for coating material	W		X
09885/3	Concrete surface curing before prime	W		X
09885/4	Initial priming	H		X
09885/5	Initial application of second coat	H		X
09885/6	Initial application of final coat	H		X
09885/7	Surface coating inspection including repairs	W		X
INSTRUMENTATION				
13440/1	Arrival of instrumentation assemblies at site	R		X
13440/2	Instrumentation installation	W		X
13440/3	Electrical testing	H		X
CHEMICAL PROCESS PIPING SYSTEMS				
15493/1	Initial welding	H	X	
15493/2	Initial nondestructive testing	H	X	
15493/3	Arrival of piping material at site	R		X
15493/4	Initial welding	H		X
15493/5	Fit-up inspection (tie-in welds)	H		X
15493/6	Root pass welding (tie-in welds)	H		X

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Section Number	Subject	Type	Offsite	Onsite
CHEMICAL PROCESS PIPING SYSTEMS (Continued)				
15493/7	Leak/pressure testing	H		X
15493/8	Holiday testing	W		X
15493/9	Polyurethane foam applications	W		X
15493/10	Initial nondestructive testing	H		X
HIGH VOLTAGE DISTRIBUTION (ABOVE 600-VOLT)				
16300/1	Arrival of cables for proper size and no damage	R		X
16300/2	Arrival of transformers and equipment for damage and labeling	R		X
16300/3	Testing (dc potential) on new cable upon arrival	H		X
16300/4	Electrical splicing, taping, and terminations	W		X
16300/5	Undreground installation of duct banks	W		X
16300/6	Electrical testing	H		X
16300/7	Acceptance test procedures (ATP's)	H		X
SERVICE AND DISTRIBUTION (600-VOLT AND BELOW)				
16400/1	Arrival of electrical equipment for correct type and no damage	R		X
16400/2	Splicing, taping, and terminations	W		X
16400/3	Electrical testing of cables and wires	H		X

Section Number	Subject	Type	Offsite	Onsite
SERVICE AND DISTRIBUTION (600-VOLT AND BELOW) (Continued)				
16400/4	Initial exothermic welding of ground grid	W		X
16400/5	Acceptance test procedures (ATP's), if required	H		X
CATHODIC PROTECTION				
16640/1	Arrival of equipment onsite for damage	R		X
16640/2	Initial exothermic welding	H		X
16640/3	Installation of equipment and enclosures	W		X
16640/4	Electrical testing	H		X
16640/5	Before closure of electrical enclosures	H		X
PART 2	- <u>PRODUCTS</u>			
	Not Used			
PART 3	- <u>EXECUTION</u>			
	Not Used			

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 National Fire Protection Association (NFPA)

NFPA 701-1977 Standard Methods of Fire Tests for Flame-Resistant Textiles and Films

1.1.1.2 Washington State Department of Transportation (W DOT)

M41-10 88 Standard Specifications for Road, Bridge, and Municipal Construction

1.2 SUBMITTALS: Refer to Section 01300 for procedures.

1.2.1 Anchoring and Enclosure Methods: Submit methods proposed for anchoring portable structures and enclosing underfloor area to meet the requirements of this Section.

1.3 CONSTRUCTION FACILITIES

1.3.1 First Aid: Facilities are available at Building 2719FA in the 200 East Area to provide first line medical attention.

1.3.2 Operation and Storage Areas: Confine onsite operations, including storage of materials, to laydown area designated by K&H.

1.3.3 Disposal Site for Waste: Dispose of construction material, broken asphalt, and broken concrete at Central landfill approximately 10 road miles from Project. Site is open only during regular working hours.

1.4 TEMPORARY UTILITIES

1.4.1 Water

1.4.1.1 Construction: Available from stand pipe located outside 200E perimeter fence adjacent to the Project site. Furnish hauling, dispensing, temporary piping and fittings approved by K&H for connection to water source. Remove temporary piping, hoses, fittings, and valves before final acceptance of the Work. Stand pipe valve is not freeze protected for cold weather use. Contractor shall provide protection when used in cold weather.

1.4.1.2 Drinking: Furnish adequate drinking water that meets health and safety requirements to employees.

1.4.1.3 Hydrostatic testing

- a. Available from transportable grout equipment (TGE) site located approximately 1/4 mile west of Project inside protected area.
- b. Furnish temporary piping and fittings approved by KEH for connection to water source.
- c. Install valve on pipe outside protected area at fence line.
- d. Piping for fill and disposal shall not leak.
- e. Contact KEH 24 hours in advance of need of water.
- f. Route pipe on west side of berm and not across existing vaults.
- g. Constantly monitor filling and disposal activities to prevent damage such as washouts or flooding.
- h. Volume of water at TGE is approximately 250 gpm at 125 psi.
- i. Piping across roadways shall permit unrestricted vehicle passage. Construct necessary ramps.
- j. Dispose of water into storm sewer located approximately 3/8 mile west of vaults inside protected area.
- k. Remove temporary piping, hoses, fittings, and valves before final acceptance of the Work.

1.4.2 Electrical Power: Temporary power 480V ac, 3 phase, will be made available at existing electrical Manhole 103 located near site. Furnish power lines or cable extensions, including load centers, transformers, protective equipment, disconnect switches, and fixtures for 240-120V ac power. Temporary power tie-in to point of supply will be provided by KEH. Notify KEH 48 hours in advance of need. Remove temporary installations upon completion of construction.

1.4.3 Telephone

1.4.3.1 Telephone system is operated by General Telephone Company of the Northwest, Inc (GTE). Upon written request, KEH will arrange for telephone service at field offices of Contractor and subcontractors, if facilities are available. KEH will charge Contractor for installation and services in accordance with charge assessed by GTE. Charges will be determined on basis of published tariffs. Information on tariffs may be obtained from DOE's Site Services Contractor, office of the Manager of the Plant Telephone and Radio, Telephone 376-6322.

1.4.3.2 Charges will be deducted from payments due Contractor. Contractor and subcontractors may use provided telephones for long distance calls necessary to the Work. Calls shall be made by valid credit card and cost not charged to Site Services Contractor or KEH.

1.4.4 Sanitary Facilities: Furnish and service chemical or other approved sanitary toilets for use of employees. Facilities shall meet the requirements of KEH which are available upon request.

1.5 ACCESS ROADS AND PARKING AREAS

1.5.1 Access to Project site will be by existing grout perimeter access road having no load restrictions located outside 200 East Area.

1.5.2 Parking: Available in vicinity of the Project outside the Limited Area.

1.5.3 Off-Road Driving: Keep off-road driving to minimum. Vehicles driving off-road or to remote locations, shall carry a minimum 10 pound ABC dry chemical portable fire extinguisher, communications equipment consisting of 2-way radio or mobil phone (CB type radios are not acceptable), and shovel. Report fires immediately to nearest Hanford Patrol, telephone 373-1780, and Hanford Fire Department, telephone 373-1311, or emergency number 811.

1.5.4 Access road to Project site is graveled for all weather use. Maintain road from pavement to Project site, including snow removal, grading, and necessary gravel for duration of Contract.

1.6 TEMPORARY CONTROLS

1.6.1 Provide plug or cap on roof penetrations and leachate riser when installation is not in progress to prevent entry of dirt and other foreign material. Cap ends if work is not to be performed on penetration within 4 hours, or, if due to environmental conditions, debris, or water can enter.

1.6.2 Dust Control: Maintain work areas to prevent hazard or nuisance to others. Accomplish dust control by sprinkling or other methods approved by KEH. Repeat sprinkling at necessary intervals to keep disturbed area damp at all times. Keep sufficient equipment on the Project job to accomplish dust control as work proceeds and whenever dust nuisance or hazard occurs. No separate or direct payment will be made for dust control and cost shall be considered incidental to and included in contract price.

1.6.3 Temporary enclosures: Plastic sheeting materials, minimum 14 mils thick, used to form enclosures shall have fire retardant properties meeting the requirements of NFPA 701 for small and large scale fire tests. Acceptable manufacturers Winman Corporation, St. Cloud, Minnesota; Lancs Industries, Kirkland, Washington; and Protective Plastics, Inc, Greer, South Carolina.

1.6.4 Traffic Control: Temporary traffic control and barricades in accordance with WSDOT M41-10, Section 1-07.23(3).

1.6.4.1 Provide 3 signs with directional arrows reading as follows.

- a. GROUT CONSTRUCTION SITE
- b. GROUT SITE - CONSTRUCTION ONLY
- c. GROUT SITE - VISITORS

1.6.4.2 Vehicle travel

a. Slow moving equipment and wide loads shall not travel on Hanford Site roads during heavy traffic periods between 6:30 and 8:00 a.m., and 3:30 and 5:30 p.m.

- b. Do not block existing roads with equipment or vehicles.
- c. Do not park on roadway shoulders.

1.6.4.3 Oversized vehicles and loads

a. Permits specified in Section 01065 are required for vehicles or loads exceeding following dimensions.

- 1) Width: 8'-6".
- 2) Height: 14 feet.
- 3) Length: Single unit, 40 feet.
Single trailing unit, 48 feet.

b. Additional requirements for vehicles and loads exceeding 8'-6" width.

1) Display oversize load sign on front of towing vehicle and rear of trailing unit.

- 2) Attach red flags to each corner.
- 3) Notify KEH 5 days before moving loads.

4) Travel between 9:00 a.m. and 2:30 p.m. unless special arrangements are made.

c. Escort vehicle requirements

1) Equip with oversize load signs and amber lights.

2) Vehicles or loads over 10 feet wide: Provide escort cars in front and rear on 2 lane highways.

3) Vehicles or loads over 14 feet wide: Provide escort car in rear on multiple lane highways.

4) Vehicles or loads over 20 feet wide: Provide escort cars in front and rear on multiple lane undivided highways.

d. Electrical escort requirements: KEH will provide qualified electrical escort when load reaches height of 14 feet or more from road surface, or when clearance of at least 6 feet cannot be maintained from overhead electrical or signal lines. Notify KEH 48 hours in advance of escort need.

1 7 FIELD OFFICE

1.7.1 Establish a field office equipped and staffed to conduct the Work. Keep copies of Drawings, Specifications, and other information pertinent to the Work at office. KEH shall have access to documents at all times. Telephone service will be made available at field office as set forth in Paragraph 1.4.3 providing service is available. Contractor may utilize existing telephones at buildings designated by KEH for local calls.

1.7.2 Anchor or tie down portable or relocatable structures, including trailers for field offices and storage, to prevent overturning or lateral movement in winds up to 70 mph, and enclose or skirt underfloor area with material that will not burn or support combustion to prevent accumulation of wind-blown debris and use of underfloor space for material storage. Complete anchoring and enclosing within 14 days of arrival onsite.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01630

PRODUCT OPTION AND SUBSTITUTION

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.3 GENERAL

1.3.1 Products include material, equipment and systems and shall meet the requirements of the Specifications and referenced standards.

1.3.2 Material and workmanship shall meet requirements of Section 13 of the Contract General Conditions.

1.3.3 Components required to be supplied in quantity within Specification sections shall be the same and be interchangeable.

1.3.4 Do not use materials and equipment removed from existing structure, except as specifically required, or allowed, by Contract Documents.

1.4 PROCEDURES

1.4.1 Submittal of Substitution Approval Request Form 1151.00, sample appended, not required when product is specified by reference standards or by description and proposed product meets the standards.

1.4.2 Submittal of Form 1151.00 required when product is specified by naming models of 1 or more manufacturers and product not named.

1.4.3 Limitations on Substitutions

1.4.3.1 Substitutions will not be considered when indicated or implied on fabricator drawings or product data submittals without separate formal request, when requested directly by subcontractor or supplier, or when acceptance will require substantial revision of Contract Documents.

1.4.3.2 Substitute products shall not be ordered or installed without written acceptance.

1.4.3.3 Only 1 request for substitution for each product will be considered. When substitution is not accepted, provide specified product.

1.4.3.4 KEH will determine acceptability of substitutions based on technical requirements and cost related to substitution incurred by KEH.

1.4.4 Requests for Substitutions

1.4.4.1 Submit separate request for each substitution using Form KEH 1151.00. Document request with complete data substantiating compliance of proposed substitution with requirements of Contract Documents.

1.4.4.2 Identify product by Specification Section and Article or Paragraph numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.

1.4.4.3 Attach as minimum product data specified in Section 13 of the Contract General Conditions.

1.4.4.4 Give itemized comparison of proposed substitution with specified product, listing variations, and reference to Specification Section and Article or Paragraph numbers.

1.4.4.5 Give quality and performance comparison between proposed substitution and specified product.

1.4.4.6 List availability of maintenance services and replacement materials.

1.4.4.7 State effect of substitution on construction schedule, and changes required in other work or products. If substituted product requires or necessitates revisions to structures, foundations, footings, services, systems, piping, electrical, etc, cost of engineering and construction shall be borne by Contractor. Contractor shall submit for approval drawings, calculations, and vendor data which clearly show revisions to accommodate substitution.

1.4.5 Contractor Representation

1.4.5.1 Request for substitution constitutes representation that Contractor has investigated proposed product and has determined it is equal to or superior to specified product.

1.4.5.2 Contractor shall provide same warranty for substitution as for specified product.

1.4.5.3 Contractor shall coordinate installation of accepted substitute, making changes required for work to be completed.

1.4.5.4 Contractor waives claims for additional costs related to substitution which may later become apparent.

1.4.5.5 Contractor waives claim for additional performance time resulting from product substitution.

1.4.6 Submittal

1.4.6.1 Submit 10 copies of request for substitution.

1.4.6.2 KEH will review Contractor's request for substitutions with reasonable promptness.

1.4.6.3 For accepted products, submit fabricator drawings, product data, and samples required in Section 01300.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

11'03"142"

From (Contractor) _____ Contract No. _____

Project _____

Description of Proposed Substitution _____

We hereby submit for consideration the following product instead of specified item for above project:

Specification No. _____ Section _____

Drawing No. _____ Section or Zone _____

Specified Item _____

Proposed Substitution _____

Attach complete technical data, including laboratory tests and samples, as applicable.

Provide detailed comparison of the significant qualities (system performance, interface requirements, size weight, durability, performance and similar characteristics, and including visual effect where applicable) for the proposed substitution of comparison with the original requirements.

Describe other changes to drawings and specifications required by proposal as outlined below and attach additional information as necessary.

Complete Each Item

A Changes to drawing dimensions _____

B Effect of substitution on other systems _____

C Outline differences between proposed substitution and specified item _____

D Manufacturer's guarantees of proposed and specified items are
_____ Same _____ Different (explain on attachment)

Undersigned attests function, and quality equal or equivalent or superior to specified item and has reviewed General Conditions paragraph GC 13 for assignment of responsibility if the substitution is approved.

Authorized by _____		Signature _____	
Address _____		Date _____	
		Phone _____	

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 RECORD REQUIREMENTS

1.3.1 The nature of work at the Hanford Site requires certain documents, defined herein, be held to record construction process and administration of the Contract. KEH will assemble pertinent data for final disposition. Contractor shall prepare, preserve, and deliver project record documents to KEH required by this Contract. Documents are in addition to submittals required in Section 01300.

1.3.2 Mark project record documents to identify copies for record and to prevent use for construction. Keep record copies of construction documents in field office and make available to KEH during the progress of the Work.

1.3.3 Data required during course of construction shall be delivered to KEH and copies retained to be assembled after completion of construction of each vault structure.

1.3.4 Vault record documents, noted in Paragraph 1.3.6, shall be organized by Specification section, folded to 8 1/2 by 11 inch size, boxed, and delivered 10 days after completion of each vault. List documents included and missing in letter of transmittal.

1.4 PROJECT RECORD DOCUMENTS

1.4.1 General: Documents required for project records are itemized herein. Identify complete documents by Title or Number and segregated by each vault. Notes or markings added by hand shall be legible utilizing permanent nonsmearing marking media, such as ink or felt tip markers, in contrasting color.

1.4.2 Contract Documents: Keep 1 set in field office, apart from documents used in construction, and maintain in clean, dry, and legible condition. Legibly mark items to record actual construction, including changes to dimensions and details, manufacturer's name, catalog number, and substitute products.

1.4.3 Certified Payrolls: Each week deliver certified payrolls, required by Section 108 of the Contract General Conditions, to KEH. Progress payments will not be processed unless certified payrolls for work period have been received by KEH.

1.4.4 Daily Force and Equipment Report: Before noon each day, furnish KEH 1 copy of detailed daily force report covering labor and supervision of Contractor and each lower tier contractor for previous day. Report shall include general description of work performed and list major items of equipment onsite.

1.4.5 Weekly Manpower Report: Complete weekly manpower reports daily and submit weekly, before 10:00 a.m. on Monday for previous week, during performance period of the Contract. Forms will be furnished by KEH.

1.4.6 Vault Record Documents

1.4.6.1 Survey notes: Deliver notes, specified in Section 01050, to KEH.

1.4.6.2 Quality record: Deliver documents generated in accordance with Quality Assurance Plan required in Section 01400.

1.4.6.3 Soil compaction procedure: Retain Form KEH-302 completed for work required in Sections 02145 and 02200.

1.4.6.4 Backfill permit: Retain backfill permits approved for work required in Section 02200.

1.4.6.5 Soil tests: If Contractor elects to test any soil or to have independent test performed, copies of tests shall be given to KEH.

1.4.6.6 Water disposal procedure: Deliver approved procedure for disposal of water used for testing and flushing required in Section 02752, subparagraph 3.2.1.1 and Section 15493, subparagraphs 3.1.5.2a and 3.2.3.2a.

1.4.6.7 Leak/pressure testing: Provide documentation that testing required in Sections 02752 and 15493 were accomplished.

1.4.6.8 NDE documentation: Provide records of NDE required by Section 02752 subparagraph 2.3.1.4, and Section 15493 subparagraph 3.2.2.8.

1.4.6.9 Manufacturers certificate: Deliver certificate required in Section 02756, Paragraph 1.3.2.

1.4.6.10 Record drawings: Deliver Drawings required in Section 02756, Paragraph 3.3.1.

1.4.6.11 Wild identification: Deliver map required in Section 03301, subparagraph 3.2.1.5.

1.4.6.12 Pour slips: After obtaining KEH approval of concrete pour slip required in Sections 03300 and 03301, give copy to KEH.

1.4.6.13 Trip tickets: Deliver to KEH with each truck load of concrete required in Sections 03300 and 03301 and retain Contractor copy until Contract closeout.

1.4.6.14 Concrete tests: If Contractor elects to test concrete or to have independent tests performed, copies of tests shall be given to KEH.

1.4.6.15 Weld examination documentation: Provide records of visual examination required in Section 03301, Paragraph 3.3.3.

1.4.6.16 Documentation: Provide documentation required in Section 03301, Paragraph 3.3.5.

1.4.6.17 Test results: Deliver test results required in Section 13440, Paragraph 3.2.1; Section 15493, Paragraph 3.2.4; Section 16300, Paragraph 3.3.1; and Section 16640, Paragraph 3.4.1.

1.4.6.18 Test results and tabulations: Deliver test results and tabulations required in Section 16400, Article 3.3.

1.4.6.19 Product samples and manufacturer's instructions: In addition to submittal required in Section 01300 and requirements of this Section, information received by Contractor from suppliers that can document products used and how they were installed shall be forwarded to KEH for Project Records.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 02145

DIFFUSION BARRIER

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Society for Testing and Materials (ASTM)

C 294-86	Standard Descriptive Nomenclature for Constituents of Natural Mineral Aggregates
C 295-85	Standard Practice for Petrographic Examination of Aggregates for Concrete
D 1117-80	Standard Methods of Testing Nonwoven Fabrics
D 1682-64 (1975)	Standard Test Methods for Breaking Load and Elongation of Textile Fabrics
D 1777-64 (1975)	Standard Method for Measuring Thickness for Textile Materials
D 3776-85	Standard Test Methods for Mass Per Unit Area (Weight) of Woven fabric
D 3787-80a	Standard Test Method for Bursting Strength of Knitted Goods-- Constant Rate-of-Travel (CRT) Ball Burst Test
D 4491-85	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
E 11-87	Standard Specification for Wire Cloth Sieves for Testing Purposes

1.1.1.2 Washington State Department of Transportation (WSDOT)

M41-10-88

Standard Specification for
Road, Bridge, and Municipal
Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Laboratory Reports: Submit reports from independent laboratory showing following.

1.2.1.1 Proposed aggregate source will produce gravel classified as igneous or metamorphic rock in accordance with ASTM C 294. Examine aggregate in accordance with ASTM C 295.

1.2.1.2 Aggregate meets the requirements of Paragraph 2.1.1.

1.2.1.3 Liquid asphalt meets the requirements of MC-250 in accordance with WSDOT M41-10, Section 9-02.1(2).

1.2.2 Manufacturer's Data: Provide data defining physical properties of geotextile filtration and reinforcing fabrics to be supplied. As minimum, properties shall meet requirements of specified ASTM standards listed in Paragraph 2.1.3.

1.2.3 Handling Procedure: Submit proposed procedure that defines methods used for delivery, storage, and handling to ensure requirements of Paragraphs 1.3.1 and 3.3.1 are met. Include method for keeping coated gravel free of dirt or foreign material.

1.2.4 Placing Procedure: Submit proposed procedure that defines methods used during placing and spreading to ensure requirements of Paragraph 3.3.1 are met. Include method for keeping coated gravel free of dirt or foreign material, and type and size of equipment used.

1.2.5 Compacting Procedures: Submit proposed procedures for compacting, including type and size of equipment. Include 3 separate procedures for placement under concrete basin, adjacent to vault walls, and over vault roof.

1.2.6 Geotextile Installation Procedure: Submit proposed procedure for installation of geotextile as shown on the Drawings. Include placement and removal techniques of temporary protective geotextile to minimize contamination of coated gravel.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Diffusion Barrier

1.3.1.1 Construct stockpiles in accordance with WSDOT M41-10, Section 3-02.2(6).

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1.3.1.2 Place stockpiles of coated gravel on asphalt or concrete surface, free of dirt and debris.

1.3.1.3 Cover stockpiles with suitable covers or tarps approved by KEH when not in use, at end of each shift, or when average wind speed at Hanford weather station exceeds 25 mph or peak gusts exceed 40 mph.

1.3.1.4 Remove coated gravel from stockpiles in accordance with WSDOT M41-10, Section 3-02.2(7).

1.3.1.5 Hauling equipment shall meet the requirements of WSDOT M41-10, Section 5-04.3(2) with additional requirement that coated gravel shall be covered during transportation.

1.3.2 Geotextile: Handle and store in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Aggregate: Composed of crushed stone or gravel aggregates classified in ASTM C 294 as either igneous or metamorphic rocks, and meeting following requirements.

2.1.1.1 Aggregate production: In accordance with WSDOT M41-10, Section 3-01.

2.1.1.2 Grading and quality

a. Amounts finer than each laboratory sieve (square-openings), weight percent.

<u>Nominal Square Opening Sieve Size</u>	<u>Percent</u>
1 in.	100
3/4 in.	50 to 100
1/2 in.	10 to 55
3/8 in.	0 to 15
No. 4	0 to 5
No. 200	0 to 1

b. Deleterious materials: Particles of specific gravity less than 1.95, maximum 1 percent by weight.

c. Limits for fractured faces by percent weight: Minimum of 2 fractured faces on 75 percent and least 1 fractured face of 90 percent of material retained on 3/8 inch and above sieves, as determined by WSDOT Test Method No. 103.

2.1.2 Asphalt: Meeting the requirements of WSDOT M41-10, Section 9-02.1(2) for MC-250 liquid asphalt.

2.1.3 Nonwoven Geotextile: Long-chain synthetic polymer with stabilizers and inhibitors added to base plastic to make filaments resistant to deterioration due to ultraviolet and heat exposure. Geotextile shall meet following requirements.

<u>Property</u>	<u>Test Method</u>	<u>Values</u>
Fabric Weight (oz/sq yd)	ASTM D 3776	10
Thickness (mil)	ASTM D 1777	100
Grab Tensile Strength (lbs, min)	ASTM D 1682	300
Grab Elongation (% , min)	ASTM D 1682	30 in any principal direction
Coefficient of Water Permeability (cm/sec)	ASTM D 4491	0.5
Puncture Strength (lbs, min)	ASTM D 3787	100
Tear Strength (lbs, min trapezoidal)	ASTM D 1117	100 in any principal direction
Equivalent Opening Size (EOS), US Sieve	----	70-100 in accordance with ASTM E 11
Minimum Width (ft)	----	12

2.2 MIXES

2.2.1 Proportions

2.2.1.1 Size, grade, and quantity of materials, when proportioned and mixed shall produce mixture meeting following requirements.

a. Percentage of asphalt: Range from 1.5 to 2.5 percent by weight of total asphalt mixture.

2.2.2 Mixing

a. Asphalt mixing plants: Meet the requirements of WSDOT M41-10, Section 5-04.3(1).

b. Remove aggregates from stockpiles in manner to ensure minimum segregation when being moved to plant for processing into final mixture.

c. Heat aggregates to minimum 150 and maximum 200 F.

d. Heat asphalt to minimum 175 and maximum 225 F. Heat in manner to avoid local overheating and provide continuous supply of material to mixer.

e. Wet mixing time: Sufficient to produce 95 percent coated particles as determined by WSDOT Test Method No. 714.

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Geotextile

3.1.1.1 Before work is started inspect sheet rolls for damage from transit and storage. If damaged set aside and do not use.

3.1.1.2 During unrolling of material, visually examine surfaces. Do not use material showing defects or damage. Cut out and replace or patch defective or damaged areas.

3.2 PREPARATION

3.2.1 Subgrade: Prepare subgrade in accordance with Section 02200, Paragraph 3.2.6, within 3 weeks before placing diffusion barrier.

3.3 INSTALLATION

3.3.1 Diffusion Barrier

3.3.1.1 Before placement demonstrate to KEH, by trial placement at site, procedure proposed for placing and compacting diffusion barrier. Prepare "Soil Compaction Procedure" Form KEH-382, sample appended, in accordance with printed instructions, for following areas. Forms will be furnished by KEH.

- a. Under concrete.
- b. Adjacent to vault/basin walls.
- c. On top of vault roof.
- d. Other areas requiring hand tampers or small compaction

equipment.

3.3.1.2 Keep surrounding area free of dust by watering during placing operation.

3.3.1.3 Stop placing and cover diffusion barrier gravel when average wind speed at Hanford weather station exceeds 25 MPH or peak gusts exceed 40 MPH.

3.3.1.4 Cover diffusion barrier at end of each shift, or when placement or compaction is not in progress.

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3.3.1.5 Clean equipment used for hauling, placing, spreading, or compacting of dirt or gravel before handling diffusion barrier material.

3.3.1.6 Conveyers or other equipment used for placement shall not produce segregation.

3.3.1.7 Maximum placement temperature of coated gravel: 150 F when placing against exterior drainage path.

3.3.1.8 Hauling equipment will not be allowed to be driven on diffusion barrier unless thoroughly cleaned.

3.3.1.9 Place coated gravel in layers not to exceed 6 inches loose measurement. Compact areas inaccessible to large compacting equipment by small mechanical compactors. Continue rolling or compacting until particle orientation and consolidation has stopped. KEH will determine type and number of passes required for particular compacting equipment used based on trial placement in subparagraph 3.3.1.1.

a. It is anticipated that desired compaction can be obtained with 6 passes of tandem wheel steel roller weighing at least 10 tons.

3.3.2 Geotextile

3.3.2.1 Lay to minimize tension, stress, folds, wrinkles, or creases, and to provide minimum 12 inch overlap for each joint.

3.3.2.2 Use bags of clean, washed gravel to secure material during installation. Do not use securing pins.

3.4 CONTAMINATED MATERIAL

3.4.1 Remove placed or stored material that has excess dirt or dust contamination, as determined by KEH.

3.5 FIELD QUALITY CONTROL

3.5.1 Verify placement and compaction of diffusion barrier and geotextile as specified in subparagraphs 3.3.1.1 and 3.3.1.9.

3.5.2 Sampling and testing of aggregate and coated gravel will be performed by KEH.

SOIL COMPACTION PROCEDURE

Project No.	Project Title	Date																																																																													
Contract No.	Procedure No.	Location of Demonstration																																																																													
REQUIREMENTS		EQUIPMENT DEMONSTRATED																																																																													
A	Applicable Spec./Dwg.	Type																																																																													
	Compaction Required %	Manufacturer																																																																													
	Maximum Lift Size	Model																																																																													
LABORATORY SOIL TEST RESULTS																																																																															
B	<input type="checkbox"/> Non-granular Materials (WSDOT Test Method No. 609)	<input type="checkbox"/> Granular Materials (WSDOT Test Method No. 606-A)																																																																													
COMPACTION DEMONSTRATION TEST RESULTS																																																																															
Formula for Percent Compaction: $\frac{\text{dry density}}{\text{max density}} \times 100 = \text{Percent Compaction}$																																																																															
C	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 10%;">No. of Passes</th> <th style="width: 10%;">Depth of Lift</th> <th style="width: 10%;">Percent Moisture</th> <th style="width: 10%;">Lbs/ft³ Dry</th> <th style="width: 10%;">Maximum Density</th> <th style="width: 10%;">Percent Compaction</th> <th style="width: 10%;">Accept</th> <th style="width: 10%;">Reject</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>							No. of Passes	Depth of Lift	Percent Moisture	Lbs/ft ³ Dry	Maximum Density	Percent Compaction	Accept	Reject																																																																
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Observations or Comments 																																																																															
TEST METHOD USED FOR DEMONSTRATION <input type="checkbox"/> Nuclear Gauge (ASTM D2922 & D3017) <input type="checkbox"/> Sand Cone (ASTM D1556) <input type="checkbox"/> Other _____ Apparatus No. _____																																																																															
D	Contractor Representative						Date																																																																								
	Government Representative						Date																																																																								

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INSTRUCTIONS

This Soil Compaction Procedure form, when approved by the Government Representative, constitutes an approved compaction procedure.

Section A is the responsibility of the Construction Contractor. It is to be completed at the time of backfill compaction demonstration and presented to the Government Representative.

Section B is completed by the Government Representative. Data entered is obtained from the agency that performs the laboratory testing.

Section C is completed by the Government Representative as the demonstration is performed. Using the applicable formula, the percent compaction achieved is determined and entered. Acceptance is based on the results as compared with the compaction percent required in Section A.

Section D is signed and dated by the Construction Contractor Representative acknowledging responsibility for this procedure and compliance thereto for applicable backfill operations. Section D is signed and dated by the Government Representative to signify approval.

END OF SECTION

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Washington State Department of Transportation (WSDOT)

M41-10-88

Standard Specifications for
Road, Bridge, and Municipal
Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Method to Prevent Damage During Excavation: Submit procedure proposed to prevent overstressing existing structures or interrupting service to existing facilities.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 General: Obtain select soils from excavation or other designated locations. Obtain on-site approval for soils.

2.1.2 Structural Fill or Backfill: Well graded soil mixtures which may contain cobbles up to 3 inches in greatest dimension if uniformly distributed and not constituting more than 20 percent of volume of fill.

2.1.3 Plastic Sheet Marker: 6 inch wide nondetectable tape similar to "Terra Tape" manufactured by Griffolyn Co, Inc. Tape shall be imprinted with warning such as "Caution Buried Installation Below" at intervals of not more than 4 feet. Color code in accordance with the American Public Works Association uniform color code.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Clearing and Grubbing: Clear debris and organic material from areas to be excavated and to be used for stockpile, and move to location designated by Operating Contractor.

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3.2 EXCAVATION

3.2.1 Before performing excavation, obtain excavation permit. Excavation permits will be furnished as set forth in Section 01065.

3.2.2 Locate and expose underground utilities by hand tools. Use of heavy equipment and machinery is subject to approval of KEH.

3.2.3 Shore excavations more than 4 feet deep and with sides sloped steeper than 1-1/2 horizontal to 1 vertical. Install shoring as excavation progresses and remove as backfilling is accomplished.

3.2.4 Store excavated material at stockpile area shown on the Drawings. Water stockpile to ensure dust control.

3.2.5 Wherever slopes of excavations will intersect existing underground lines or structures such as building foundations, underground piping, electrical ducts or direct buried electrical lines, install shoring or other means of support to prevent overstressing existing structure or underground lines or to prevent interrupting service to existing buildings.

3.2.6 Subgrade

3.2.6.1 Make excavations to depth shown on the Drawings. Make bottom of excavations, level, true, and free of loose material. Compact to 95 percent of maximum density before placing diffusion barrier.

3.2.6.2 If over-excavation occurs, correct by placement of backfill, compacted in accordance with subparagraph 3.3.1.2b.

3.2.6.3 Following excavation, moisten subgrade soil as required and proof roll with 2 passes of vibratory compaction equipment.

3.2.7 Existing Asphalt Pavement

3.2.7.1 Make vertical cut along rectangular lines of pavement to remain.

3.2.7.2 Remove and haul broken pavement to disposal site given in Section 01500.

3.3 INSTALLATION

3.3.1 Fill and Backfill

3.3.1.1 General

a. Backfill Permit: Do not start fill or backfill without approved permit as set forth in Section 01065.

b. Remove debris and organic matter from area to be filled or backfilled.

c. Use only select materials for fill or backfill. Keep materials free of frozen particles, lumps, cobbles larger than 3 inches, organic matter and trash.

d. Do not place fill or backfill on frozen ground.

e. Filling or backfilling by sluicing or flooding with water will not be permitted.

f. Bring fill or backfill up evenly on sides of walls, structures and utility lines to avoid unbalanced loading.

g. Do not place fill or backfill against concrete structure or foundation wall less than 14 days after completion of structure or wall unless written permission from KEH is obtained.

3.3.1.2 Structural

a. Before placement of fill or backfill, demonstrate, to KEH by physical test at Site, that procedure proposed for installation and compaction of soils will provide degree of compaction specified. Prepare "Soil Compaction Procedure" Form KEH-382, sample appended, in accordance with printed instructions. Forms will be furnished by KEH.

b. Place backfill in accordance with WSDOT M41-10, Section 2-03.3(14)C, Method C.

c. Compaction control tests will be in accordance with WSDOT M41-10, Section 2-03.3(14)D.

3.3.2 Plastic Sheet Marker: Place continuous over buried utility lines. Place marker tape directly over line and 1 foot below finish grade. Place marker over each outside pipe of multiple lines. Place intermediate markers at maximum of 4 feet apart.

3.4 FIELD QUALITY CONTROL

3.4.1 Soil Compaction Tests: Sampling and testing of compacted fill and backfill will be performed by KEH.

SOIL COMPACTION PROCEDURE

Project No.	Project Title	Date																																																																																													
Contract No.	Procedure No.	Location of Demonstration																																																																																													
REQUIREMENTS		EQUIPMENT DEMONSTRATED																																																																																													
A	Applicable Spec./Dwg	Type																																																																																													
	Compaction Required %	Manufacturer																																																																																													
	Maximum Lift Size	Model																																																																																													
LABORATORY SOIL TEST RESULTS																																																																																															
B	<input type="checkbox"/> Non-granular Materials (WSDOT Test Method No. 609)	<input type="checkbox"/> Granular Materials (WSDOT Test Method No. 606-A)																																																																																													
COMPACTION DEMONSTRATION TEST RESULTS																																																																																															
<p>Formula for Percent Compaction:</p> $\frac{\text{dry density}}{\text{max density}} \times 100 = \text{Percent Compaction}$																																																																																															
C	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">No. of PASSES</th> <th style="width: 10%;">Depth of Lift</th> <th style="width: 10%;">Percent Moisture</th> <th style="width: 10%;">Lbs/ft³ Dry</th> <th style="width: 10%;">Maximum Density</th> <th style="width: 10%;">Percent Compaction</th> <th style="width: 10%;">Accept</th> <th style="width: 10%;">Reject</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>							No. of PASSES	Depth of Lift	Percent Moisture	Lbs/ft ³ Dry	Maximum Density	Percent Compaction	Accept	Reject																																																																																
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<p>Observations or Comments</p> 																																																																																															
<p>TEST METHOD USED FOR DEMONSTRATION</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> Nuclear Gage (ASTM D2922 & D3017) </div> <div style="width: 30%;"> <input type="checkbox"/> Sand Cone (ASTM D1556) </div> <div style="width: 30%;"> <input type="checkbox"/> Other _____ </div> </div> <p style="text-align: right;">Apparatus No. _____</p>																																																																																															
D	Contractor Representative						D	316																																																																																							
	Government Representative						D	316																																																																																							

INSTRUCTIONS

This Soil Compaction Procedure form, when approved by the Government Representative, constitutes an approved compaction procedure.

Section A is the responsibility of the Construction Contractor. It is to be completed at the time of backfill compaction demonstration and presented to the Government Representative.

Section B is completed by the Government Representative. Data entered is obtained from the agency that performs the laboratory testing.

Section C is completed by the Government Representative as the demonstration is performed. Using the applicable formula, the percent compaction achieved is determined and entered. Acceptance is based on the results as compared with the compaction percent required in Section A.

Section D is signed and dated by the Construction Contractor Representative acknowledging responsibility for this procedure and compliance thereto for applicable backfill operations. Section D is signed and dated by the Government Representative to signify approval.

END OF SECTION

SECTION 02512

HOT-LAID ASPHALTIC CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Washington State Department of Transportation (WSDOT)
M41-10-88 Standard Specification for Road,
Bridge, and Municipal
Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Laboratory Reports: Submit laboratory reports for following.

1.2.1.1 Asphalt: Showing that asphalt used in mix meets the requirements of AR-4000W in accordance with WSDOT M41-10, Section 9-02.1(4).

1.2.1.2 Asphalt concrete mix: Showing compliance with WSDOT M41-10. Sections 9-03.8(2) and 9-03.8(6). Include Rice density as established by WSDOT Method 705.

1.2.2 Handling and Placing Procedures: Submit procedure that defines methods to keep diffusion barrier free of dirt or foreign material during asphalt concrete pavement placement.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Asphalt: Meeting the requirements of WSDOT M41-10, Section 9-02.1(4). Grade of paving asphalt for use in asphaltic concrete mixture shall be AR-4000W.

2.1.2 Aggregate: Class "B" meeting the requirements of WSDOT M41-10, Section 9-03.8(1), (2), and (3)B.

2.1.3 Blending Sand: Meeting the requirements of WSDOT M41-10, Section 9-03.8(4).

2.1.4 Mineral Filler: Meeting the requirements of WSDOT M41-10, Section 9-03.8(5).

2.2 MIXES

2.2.1 Proportioning of Asphalt Concrete Materials: Meeting the requirements of WSDOT M41-10, Section 9-03.8(6) Class "B" asphalt concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Construction: In accordance with following sections of WSDOT M41-10.

3.1.1.1 Asphalt mixing plants: Section 5-04.3(1).

3.1.1.2 Hauling equipment: Section 5-04.3(2).

3.1.1.3 Asphalt pavers: Section 5-04.3(3).

3.1.1.4 Rollers: Section 5-04.3(4).

3.1.1.5 Asphalt material heating: Section 5-04.3(6).

3.1.1.6 Aggregate preparation: Section 5-04.3(7).

3.1.1.7 Mixing: Section 5-04.3(8).

3.1.1.8 Spreading and finishing: Section 5-04.3(9).

3.1.1.9 Compaction: Section 5-04.3(10).

3.1.1.10 Diffusion barrier shall remain covered as specified in Section 02145, subparagraphs 3.3.1.2 and 3.3.1.4 before placing pavement.

3.1.1.11 Weather limitations: Do not place asphalt when surface temperature of diffusion barrier is less than 45 F, when average wind speed at Hanford weather station exceeds 25 mph, or peak gusts exceed 40 mph.

3.1.1.12 Keep surrounding area free of dust by watering during paving.

3.1.1.13 Stop placing and cover diffusion barrier when average wind speed at Hanford weather station exceeds 25 mph, or peak gusts exceed 40 mph.

3.1.1.14 Clean equipment used for conveying, placing, spreading, and compacting of dirt or gravel that may contaminate diffusion barrier during paving operation.

3.1.1.15 Hauling equipment will not be allowed to be driven on diffusion barrier.

3.1.2 Patching Existing Asphalt Pavement

3.1.2.1 Prepare subgrade in area to receive asphalt patching by compacting in accordance with Section 02200, subparagraph 3.3.1.2b.

3.1.2.2 Before patch is constructed, true-up pavement cut with straight edges and vertical faces.

3.1.2.3 Place asphalt concrete to thickness required to match compacted thickness of existing pavement or to minimum compacted thickness of 1-1/2 inches, whichever is greater. Place, level, and compact to comply with adjacent paved surface.

3.2 FIELD QUALITY CONTROL

3.2.1 Sampling and testing of asphalt concrete pavement will be performed by KEH.

END OF SECTION

SECTION 02752

LEACHATE COLLECTION SUMP LINER

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Society of Mechanical Engineers (ASME)

1986 Edition, w/Addenda
through Dec 1988

ASME Boiler and Pressure Vessel
Code

Section IX

Qualification Standard for
Welding and Brazing Procedures,
Welders, Brazers, and Welding
and Brazing Operators

1.1.1.2 American Society for Nondestructive Testing (ASNT)

Recommended Practice
No. SNT-TC-1A
(1984 Edition)

Personnel Qualification
and Certification in
Nondestructive Testing

1.1.1.3 American Society for Testing and Materials (ASTM)

A 36-87

Standard Specification for
Structural Steel

A 53-87b

Standard Specification for Pipe,
Steel, Black and Hot-Dipped,
Zinc-Coated Welded and Seamless

D 3350-84

Standard Specification for
Polyethylene Plastics Pipe and
Fittings Materials

1.1.1.4 American Welding Society (AWS)

AWS D1.1-88

Structural Welding Code-Steel

AWS D9.1-84

Specification for Welding of
Sheet Metal

AWS QC1-86

Standard for Qualification and
Certification of Welding
Inspectors

1.1.1.5 American Water Works Association (AWWA)

C203-86

AWWA Standard for Coal-Tar
Protective Coatings and Linings
for Steel Water Pipelines--Enamel
and Tape--Hot-Applied

1.1.1.6 Steel Structures Painting Council (SSPC)

SSPC-SP 3-82

No. 3 Power Tool Cleaning

SSPC-SP 6-85

No. 6 Commercial Blast Cleaning

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Fabricator Drawings and Procedures: Submit drawings and procedures for fabrication, erection and installation of sump liner, riser, and plastic pipe spools. Include plans, elevations, details, sections and connections. Submittal shall show thickness, type, grade, class of metal, and fasteners. Show anchorage and accessory items where applicable.

1.2.2 Certified Material Test Reports (CMTR): Submit legible reports, certified by responsible manufacturer, showing chemical analysis and physical properties of each heat steel plate, shapes, pipe and fittings, and filler material. Submit separate certified reports for each lot of steel furnished by each supplier.

1.2.3 Filler Material Control Procedure: Submit procedure for control of filler material. Specify methods of control, by heat or lot number, from receipt of material to consumption during fabrication, and control and disposal of contaminated and partially used material.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Welding Personnel and Procedures

1.3.1.1 Personnel and procedures for welding structural steel and steel pipe shall have been qualified in accordance with AWS D1.1 before welding. Qualification in accordance with ASME Section IX may be substituted for this requirement.

1.3.1.2 Personnel and procedures for welding sheet metal shall have been qualified in accordance with AWS D9.1 before welding. Qualification in accordance with ASME Section IX may be substituted for this requirement.

1.3.1.3 Personnel and procedures for welding steel pipe shall have been qualified in accordance with ASME Section IX before welding.

1.3.1.4 Deliver 2 copies of welding procedure specifications, procedure qualification records, and welder performance qualification test results to KEH 5 days before welding. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.3.2 Qualification of Nondestructive Examination (NDE) Personnel

1.3.2.1 Visual weld examinations and appropriate documentation shall be performed by Certified Welding Inspectors (CWI) who have received certification in accordance with AWS QC1. Certified Associate Welding Inspectors (CAWI), certified in accordance with above standard, may be used to perform examinations when under immediate direction of CWI. Welding related examination documentation shall be signed, or stamped by individual performing examination. Where CAWI's are used for examinations, documentation shall be signed, or bear CAWI's stamp in addition to CWI's under whom examinations were performed.

1.3.2.2 Personnel performing other NDE shall have been certified in accordance with Contractor's written practice, which shall meet the requirements of ASNT No. SNT-TC-1A, before performing NDE. Use Level II or III personnel to interpret test results.

1.3.2.3 Deliver 2 copies of personnel certifications, written NDE performance procedures, and Contractor's written practice to KEH 5 days before examining. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Welding Material

1.4.1.1 Store separately, welding materials of different material specifications.

1.4.1.2 Store and control filler material in accordance with approved procedure.

1.4.1.3 Preserve identity from time of receipt on site until use in facility construction.

1.4.2 Sump Liner: Upon receipt examine for damage, seal openings, and store on dunnage.

1.4.3 Steel Riser Pipe: Upon receipt examine for damage.

1.4.4 Polyethylene Plastic Pipe and Fittings: Upon receipt examine for damage.

1.4.5 Deliver materials to project at time convenient for installation and store off ground. If exposed to inclement weather, protect with paper, plastic, or other weatherproof covering.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Carbon Steel Plate and Shapes: ASTM A 36, except as specified on the Drawings.

2.1.2 Carbon Steel Pipe: ASTM A 53, Type S, Grade B.

2.1.3 Polyethylene Plastic Pipe and Fittings: ASTM D 3350, Class 355434C.

2.1.4 Exterior Protective Coating: Tapecoat Company "Tapecoat 20" and primer meeting the requirements of AWWA C203.

2.2 FABRICATION

2.2.1 Fabricate sump liner and pipe spools in accordance with the Drawings and approved submittals.

2.2.2 Weld plastic pipe by butt fusion method.

2.2.3 Weld Identification: Prepare weld identification drawings which show relative position of each pressure containing weld and each weld to pressure retaining components.

2.3 SOURCE QUALITY CONTROL

2.3.1 Weld Examinations

2.3.1.1 100 percent visual examination is required for fit-up, root and cover passes. Examine in welded condition. Acceptance criteria shall be in accordance with AWS D1.1, Paragraph 8.15.1.

2.3.1.2 Perform 100 percent liquid penetrant (dye penetrant) examination (PT) on root and cover passes in accordance with AWS D1.1, Paragraph 6.7.6 and Section 8.

2.3.1.3 Fabrication of sump liner is subject to examination by KEH.

2.3.1.4 NDE documentation.

a. Document examination of pressure welds and welds to pressure retaining components for pipes and liners on NDE/Weld Record Form KEH-433 furnished by KEH (sample appended).

1) See Form KEH-433 for instructions for recording weld identification drawings, weld numbers, welder identification, welding procedure specification numbers, visual examinations, nondestructive examinations, and for noting satisfactory completion of leak testing.

b. Documentation shall be kept current and is subject to review by KEH. Prepare and certify records as work progresses.

c. Required NDE/Weld examinations shall be completed and documented before start of leak testing.

d. NDE/Weld Record information and weld identification drawings may be incorporated on single format or traveler for specific work package.

e. Deliver completed NDE/Weld Record and record weld identification drawings to KEH within 7 working days after completion of system leak testing.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Place sump liner and assemble plastic pipe in accordance with approved submittals and the Drawings.

3.1.2 Assemble plastic to steel flange joints without gasket. Use steel backing rings on plastic flanges.

3.1.3 Before sump liner and pipe is encased in concrete, hydrostatically test liner and flanged connections in accordance with Paragraph 3.2.1.

3.1.4 After concrete encasement has cured install riser in accordance with the Drawings and approved submittals.

3.1.5 Exterior Protective Coating

3.1.5.1 Complete NDE and leak testing before application of exterior protective coating.

3.1.5.2 Protect short lengths of carbon steel pipe and fittings exposed to earth backfill with specified coating.

a. Clean carbon steel surfaces to white metal by sandblasting in accordance with SSPC-SP 6. Where blasting is impracticable, as determined by KEH, clean by power wire brushing in accordance with SSPC-SP 3.

b. Heat and apply specified tape in accordance with AWWA C203, Section 3, and manufacturer instructions.

3.1.5.3 After installation, examine carbon steel pipe having field applied exterior protective coating materials.

a. Use electrical holiday detector in accordance with AWWA C203, Section 2.14.12.

b. Repair damage to coating in accordance with AWWA C203, Section 2.14.12.

3.2 FIELD QUALITY CONTROL

3.2.1 Hydrostatic Testing

3.2.1.1 Prepare written procedure for disposal of water used for testing. Deliver to KEH for approval 10 days before testing.

3.2.1.2 Hydrostatically test sump liner and pipe flanged connections before placing concrete by applying internal pressure of 15 psig of water to entire length of plastic pipe and steel flange. Pump water out and dry liner after test. No visible standing water.

3.2.2 Perform NDE listed on back of attached NDE/Weld Record Form KEH-433 for welds.

NDE / WELD RECORD

1. Parent W.O. No.

2. Weld Identification Draw

DATE

4. WELD INFORMATION	5. VISUAL EXAMINATION			6. WELD PEN / MAG PART	7. RADIO. LEAK TEST	8. Other
	Fit up	Root Pass	Cover Pass			
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						

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INSTRUCTIONS FOR USE

The NDE WELD RECORD form shall be used to document the nondestructive examination testing of the piping systems listed below. Entries shall be made as work progresses, and records are subject to review by the Government's Representative at any time.

Complete the NDE WELD RECORD as follows (number in parenthesis corresponds to block number):

- (1) Enter Project Number.
- (2) Enter Weld Identification Drawing Numbers.
- (3) Enter name of Contractor.
- (4) Enter Weld information:
 - Weld Number
 - Welder Identification
- (5) through (9) Enter date of examination testing in upper half of block, initial or stamp lower half of block as each weld is examined and accepted in compliance with contract requirements.
 - Welding Procedure Specification
 - Weld Filler Material (Type)

NONDESTRUCTIVE EXAMINATION/TESTING REQUIREMENTS FOR PIPING SYSTEMS

NDE METHOD	PIPE CODES		Riser	Catch Basin	Liner	COMMENTS
	Pit	Drain	Drain			
VISUAL						*Visually examine butt fusion weld on polyethylene drain pipe. Allowable reduction of pipe thickness: 10 percent maximum. Maintain minimum wall thickness.
Root Pass	C			C		
Cover Pass	C		C*	C		
LIGHT PENETRANT						
Root Pass	C					
Cover Pass						
MAGNETIC PARTICLE						
Root Pass						
Cover Pass						
RADIOGRAPHIC						
Completed Weld						
LEAK PRESSURE						
Completed Weld			G	G		
OTHER						

Legend

- A. Requires witnessing concurrently by the Government Representative and acceptance prior to recording.
- B. Requires acceptance of radiographs and documentation by the Government Representative prior to recording.
- C. Circumferential and longitudinal butt welds.
- D. Full penetration welds on branch connections.
- E. Attachment welds to pipe.
- F. Tie-in circumferential and longitudinal butt welds that cannot be examined by leak/pressure test.
- G. Other: Welded and flanged connections.

21A02/50 SP

END OF SECTION

B-714-C2

SECTION 02753

EXTERIOR DRAINAGE PATH

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Society for Testing and Materials (ASTM)

D 638-87b Standard Test Method for Tensile Properties of Plastics

D 746-79 (1987) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

D 792-86 Standard Test Methods for Specific Gravity and Density of Plastics by Displacement

D 1004-66 (1981) Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting

D 1238-86 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

D 1505-85 Standard Test Method for Density of Plastics by the Density-Gradient Technique

D 1593-81 Standard Specification for Nonrigid Vinyl Chloride Plastic Sheeting

D 1623-76 (1983) Standard Test Method for Carbon Black in Olefin Plastics

D 3895-80 (1986) Standard Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis

1.1.1.2 National Sanitation Foundation (NSF)

NFS Standard 54-85 Flexible Membrane Liners

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Fabricator Drawings: Submit drawings showing details of factory and field joints.

1.2.2 Installation Plan: Submit procedures for installation of materials and components. Include list of equipment and amount of utilities required, proposed methods for laying materials and components, and method for holding material sections in place during installation.

1.2.2.1 Installer may submit alternate method of installation that provides complete coverage of vault exterior.

1.2.3 Manufacturer's Data: Provide data defining physical properties of drainage net and membrane to be supplied.

1.2.4 Surface Acceptance: Provide information required by Paragraph 3.1.2.

1.2.5 Care and Repair Instructions: Submit information concerning recommended care and repair procedures for membrane and components. Include recommended shoe types for construction personnel, tools for cleaning, and minimum and maximum temperatures at which cleaning, inspecting, and repair operations may be performed.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Pack fabricated pieces in containers to prevent damage during shipment. Pack containers for minimum handling at site and clearly mark with location of installation.

1.3.2 Storage

1.3.2.1 Unload and store with minimum of handling.

1.3.2.2 Do not store materials on ground.

1.3.2.3 Storage area shall protect materials from moisture, mud, soil, dust, and debris.

1.3.3 Handling

1.3.3.1 Handle materials to ensure sound, undamaged conditions.

1.3.3.2 During unrolling of material, visually examine sheet surface. Mark and repair faulty areas in accordance with approved instructions.

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1.4 PROJECT CONDITIONS

1.4.1 Environmental Requirements: Within limits given in NSF Standard 54, Appendix C while handling plastic sheeting material.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 HDPE Membrane

2.1.1.1 Fabricate from 60 mil HDPE sheeting meeting following requirements.

<u>Property</u>	<u>Test Method</u>	<u>Values</u>
Gage (mils, nominal)		60
Thickness (mils, minimum)	ASTM D 1593/ Para 9.1.3	54
Specific Gravity (min)	ASTM D 792	0.94
Minimum Tensile Properties (each direction)	ASTM D 638	
Tensile Strength Yield (lb/in. width)		120
Tensile Strength at Break (lb/in. width)		180
Elongation at Yield (percent)		10
Elongation at Break (percent)		500
Modulus of Elasticity (psi)		80,000
Tear Resistance (lb, minimum)	ASTM D 1004 Die C	30
Low Temperature (F)	ASTM D 746 Procedure B	-40

2.1.1.2 Thickness: 54 mils minimum at any point on membrane.

2.1.1.3 Fabricate liner from large pieces of sheeting to proper size and shape. Keep field joints to minimum in accordance with approved installation drawings. Preform corner pieces to proper size and shape at factory.

2.1.2 Drainage Net

2.1.2.1 Fabricate from HDPE strands. Arrange 2 sets of strands, spaced 1/2 inch center to center maximum, together to form "net" or "mesh" with minimum 2 strands per inch each direction. System shall meet the following requirements.

<u>Property</u>	<u>Test Method</u>	<u>Values</u>
Density (g/cm ³) (min)	ASTM D 1505	0.94
Crystallinity (%)	Differential Scanning Calorimeter	40-55
Carbon Black (%)	ASTM D 1603	1-3
Melt Flow Index (g/10 min.)	ASTM D 1238 (190 C, 2.16 KG) (190 C, 5.0 KG)	0.2-0.5 1.0-2.2
Thermal-Oxidative Stability, minutes DSC	ASTM D 3895 (160 C, 20 psi O ₂) (160 C, 800 psi O ₂)	20-175 6-36
Minimum Compressive Stress Imposed (psf)	----	7,000
Minimum Thickness (mm)	----	5

2.1.3 Geotextile: See Section 02756.

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Before work is started examine sheet rolls for damage from transit and storage. If damaged, set aside and do not use.

3.1.2 Before installation, provide written documentation to KEH that surfaces to receive materials have been examined and are acceptable for installation.

3.2 INSTALLATION

3.2.1 Climatic Conditions: Within limits given in NSF Standard 54, Appendix C while handling sheeting material.

3.2.2 Placing: Place fabricated pieces in position shown on approved installation drawings. Unroll, position, and smooth out folds and wrinkles. Allow sheets to relax before anchoring. Fasten material temporarily, in

accordance with installer's approved procedure, to prevent wind damage until material is secured.

3.2.3 Field Seams: Overlap membrane panels 6 inches, minimum, and fasten with batten plate.

3.2.4 Extrusion Weld Repair Work

3.2.4.1 Welding equipment shall be capable of continuously monitoring and controlling temperature in zone of contact so changes in environmental conditions will not effect integrity of weld.

3.2.4.2 Where "fish mouths" occur, repair area in accordance with Paragraph 3.2.5.

3.2.4.3 "Fish mouths" are not acceptable within seam area.

3.2.4.4 Replace or repair, in accordance with Paragraph 3.2.5, membrane area showing out of tolerance injury due to excessive scuffing, or puncture.

3.2.4.5 Welds, on completion of work, shall be tightly bonded.

3.2.5 Repairs

3.2.5.1 Make repairs to membrane by applying piece of sheeting, sufficient in size to extend approximately 3 to 6 inches beyond damaged area. Make patch round or oval.

3.2.5.2 Make repairs to geogrid and geotextile in accordance with manufacturer's recommended procedures.

3.3 FIELD QUALITY CONTROL

3.3.1 Final Examination and Acceptance

3.3.1.1 Verify no damage has occurred to geotextile or geomembrane.

3.3.1.2 Prepare record drawings showing field changes incorporated.

3.3.1.3 Deliver test documentation and record drawings to KEH.

END OF SECTION

SECTION 02755

WASTE DISPOSAL BASIN LINERS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Society for Testing and Materials (ASTM)

D 413-82 (1988)	Standard Test Methods for Rubber Property--Adhesion to Flexible Substrate
D 570-81	Standard Test Method for Water Absorption of Plastics
D 638-87b	Standard Test Method for Tensile Properties of Plastics
D 696-79	Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics
D 746-79 (1987)	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
D 751-79	Standard Methods of Testing Coated Fabrics
D 792-86	Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004-66 (1981)	Standard Test Method for Initial Tear Resistance of Plastic Film and Sheetinq
D 1203-86	Standard Test Methods for Volatile loss from Plastics Using Activated Carbon Methods
D 1204-84	Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheetinq or Film at Elevated Temperature

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|---|--|
| D 1238-86 | Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer |
| D 1593-81 | Standard Specification for Nonrigid Vinyl Chloride Plastic Sheeting |
| D 1603-76 (1983) | Standard Test Method for Carbon Black in Olefin Plastics |
| D 1693-70 (1980) | Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics |
| D 3083-76 (1983) | Standard Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining |
| D 3985-81 | Standard Test Method for Oxygen Gas Transmission Rate Through Plastic Film and Sheeting Using a Coulometric Sensor |
| E 96-80 | Standard Test Methods for Water Vapor Transmission of Materials |
| 1.1.1.2 | Environmental Protection Agency (EPA) |
| EPA/530-SW-86-031 | Technical Guidance Document Construction Quality Assurance for Hazardous Waste Land Disposal Facility |
| 1.1.1.3 | Federal Standards (FED STD) |
| FED-STD-101C, Including CHGS NOT 1, And 2 | Test Procedure For Packaging Materials |
| Method 2065.1 | Puncture Resistance And Elongation Test (1/8 Inch Radius Probe Method) |
| 1.1.1.4 | National Sanitation Foundation (NSF) |
| NSF Standard 54-85 | Flexible Membrane Liners |

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Installation Drawings: Submit drawings showing lining sheet layout with proposed size, number, position, sequence of placing, and location of field seams. Include details and methods for anchoring at perimeter, making field seams, and making anchors/seals to pipes and structures penetrating lining.

1.2.2 Installation Procedures: Submit procedures for installation and testing of liner and components. Include list of equipment and amount of utilities required, proposed methods for laying liner and components, and following.

1.2.2.1 Procedures for welding seams in accordance with manufacturer's recommendations and this Section.

1.2.2.2 Method for holding liner sections in place during installation.

1.2.2.3 Method for examining liner and components, and testing joints, seams, welds, and bolt tightening.

1.2.3 Manufacturer's Data

1.2.3.1 Resin: Provide data defining physical properties of high density polyethylene (HDPE) resin to be supplied. For each resin batch, test as shown in Table 02755-I. Complete testing and submit for review before using.

TABLE 02755-I

PHYSICAL PROPERTIES QUALITY CONTROL

<u>Property</u>	<u>Test Method</u>	<u>Values</u>
Specific Gravity (min)	ASTM D 792	0.94
Melt Flow Index (gr/10 mins, max)	ASTM D 1238, Condition E	0.3
Volatile Loss (max%)	ASTM D 1203, Method A	0.1

1.2.3.2 Liner: Provide data defining physical properties of high density polyethylene (HDPE) liner to be supplied. As minimum, properties shall meet the requirements of NSF Standard 54. Provide documentation of verification of physical properties of liner sheets. For each resin batch used, test using parameters defined in subparagraph 2.1.1.2 to document material properties. Complete testing and submit for review before fabrication. Submit additional copy of documentation with each panel.

1.2.4 Samples: Submit samples of lining material and field seams.

1.2.4.1 Lining material: Submit 8 inch by 10 inch samples from same batch of liner used for construction, and totaling approximately 20 sq ft.

1.2.4.2 Field seams: Submit numbered and dated samples, measuring 12 inches plus seam width in width and 18 inches in length, fabricated with materials specified for lining in accordance with approved procedures and this Section, and tested in accordance with Paragraph 1.3.5.

1.2.5 Certified Material Test Reports (CMTR): Submit materials test reports, for each item furnished by each supplier, certified by manufacturers of resins and liners, and stating that liner and extrudate are of 100 percent virgin materials. Reports shall identify items, show results of chemical analysis and physical tests and meet following requirements.

1.2.5.1 Raw materials: Table 02755-I.

1.2.5.2 Lining material: Subparagraph 2.1.1.2.

1.2.6 Care and Repair Instructions: Submit information concerning recommended care and repair procedures for liner and components. Include recommended shoe types for construction personnel, tools for cleaning and removing wind-blown sand and debris, and minimum and maximum temperatures at which cleaning, inspecting, and repair operations may be performed.

1.2.7 Certificates of Experience: Submit "Certificates of Experience" from manufacturer and installer showing qualification in accordance with Paragraphs 1.3.1 and 1.3.2. Installer shall provide list showing names, addresses, and telephone numbers for completed projects.

1.2.8 Manufacturer's Quality Control Plan: Submit quality control plan for Project. Plan shall address requirements of Paragraph 1.3.3.

1.2.9 Certification: Submit certificates of compliance in accordance with Paragraph 1.3.6.

1.2.10 Surface Acceptance: Provide information required in Paragraph 3.1.2.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Manufacturer: Manufacturer shall have successfully manufactured minimum 5,000,000 square feet of similar liner material for hydraulic lining installations, and be listed by NSF as meeting the requirements for manufacturing HDPE. Material supply shall also include projects for Resource Conservation and Recovery Act (RCRA) Landfills and Surface Impoundments.

1.3.1.1 Make arrangements with manufacturer for KEH visit to plant before manufacture of lining material to verify quality control program, and during manufacture of material for Project to observe manufacturing methods and obtain raw materials and products for independent testing.

1.3.2 Qualification of Installer: Provide evidence of successfully installing at least 10 projects, and at least 5,000,000 square feet of liner. Projects shall include RCRA Landfills and Surface Impoundments.

1.3.3 Manufacturer's Quality Control Plan: Quality control plan to be implemented for Project shall be in accordance with EPA/530-SW-86-031. Include name of polymer resin supplier, product identification, acceptance testing, fabrication and production testing, documentation of changes, retests, and acceptance.

1.3.4 Construction Quality Assurance

1.3.4.1 Preinstallation meeting: Manufacturer and Contractor shall attend meeting, initiated by KEH, before installation of lining to review and discuss training and qualification procedures for Contractor personnel, and demonstration of making field welded seams including peel and shear tests.

1.3.4.2 Manufacturer shall provide on-site technical supervision and assistance during installation of lining.

1.3.5 Qualification of Welds: Before welding liner, provide field weld samples using same equipment and procedure to be used for welding liner. Perform nondestructive testing in accordance with Paragraph 3.3.1. Perform destructive testing in accordance with Paragraph 3.3.2. Entire seam shall pass nondestructive tests, and 2 of 3 samples shall pass destructive tests, third sample shall attain at least 95 percent of required values.

1.3.6 Upon completion of work, and as condition of acceptance, deliver to KEH 2 copies of certificate signed by authorized agent of manufacturer of liner, and cosigned by installer, stating materials and methods used meet specified requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Pack fabricated pieces and roll, wrapped with sheet of same material in containers supported and padded to prevent damage during shipment. Pack containers for minimum handling at site and clearly mark with location of installation. Provide label for each roll and prefabricated piece showing results of tests in subparagraph 2.1.1.2 and stating name of manufacturer, product type, thickness, manufacturer's batch code, date of manufacture, physical dimensions, panel number or placement of prefabricated pieces according to Paragraph 1.2.1, and directions for unrolling membrane. Do not remove labels.

- 1.4.2 Examine lining materials delivered to Site for:
- 1.4.2.1 Puncture from nails or splinters.
 - 1.4.2.2 Tears from operation of equipment or inadequate packaging.
 - 1.4.2.3 Exposure to temperature extremes resulting in unusable material.
 - 1.4.2.4 Bonding together of adjacent membrane layers which may be caused by excessive heat.
 - 1.4.2.5 Crumpling or tearing from inadequate packaging support.
- 1.4.3 Unload and store with minimum of handling.
- 1.4.4 Store materials off ground on padded dunnage in secure area sheltered from mud, soil, dirt, debris, adverse weather, precipitation, ultraviolet light, heavy winds, and temperature extremes.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 High Density Polyethylene (HDPE) Liner: Add carbon black, antioxidants and heat stabilizers to resin for ultraviolet resistance and manufacturing purposes. Supply HDPE as single ply continuous sheet with no factory seams and in rolls with minimum 22 foot width. Maximize roll length to provide largest manageable sheet for fewest field seams.

2.1.1.1 Materials similar to those manufactured by Gundle Lining Systems Inc, Houston, Texas; or Poly-America Inc, Grand Prairie, Texas.

2.1.1.2 Lining material shall meet following minimum physical property values.

<u>Property</u>	<u>Test Method</u>	<u>Values</u>
Thickness (mils \pm 10 %)	ASTM D 1593	60
Specific Gravity (min)	ASTM D 792	0.94
Carbon Black Content (%)	ASTM D 1603	2 to 2-1/2
Melt Flow Index (g/10 min, maximum)	ASTM D 1238, Condition E	0.3
Tensile Properties (each direction)	ASTM D 638, Type IV Specimen, 2 ipm	
Tensile Strength at Yield (lb/in width, min)		120
Tensile Strength at Break (lb/in width, min)		180

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<u>Property</u>	<u>Test Method</u>	<u>Values</u>
Elongation at Yield (% , min)		10
Elongation at Break (% , min)		500
Modulus of Elasticity (lbs/sq in. , min)		80,000
Tear Resistance (lb, min)	ASTM D 1004, Die C	30
Puncture Resistance (lbs, min)	FED-STD-101, Method 2065.1	69
Low Temperature/Brittleness (F, max)	ASTM D 746, Procedurr B	-40
*Dimensional Stability (max % change each direction)	ASTM D 1204, 212 F 1 hr	±2
*Volatile Loss (max %)	ASTM D 1203, Method A	0.1
*Environmental Stress Crack (min hours)	ASTM D 1693, Condition C (100 C)	750
Water Absorption (max % weight change)	ASTM D 570	0.1
Coefficient of Linear Thermal Expansion (cm/cm C, max)	ASTM D 696	1.2 X 10-4
Hydrostatic Resistance (psi, min)	ASTM D 751, Method A-1	490
Moisture Vapor Transmission (g/m ² day, max)	ASTM E 96	0.03
Resistance to Soil Burial	ASTM D 3083, using ASTM D 638 Type IV specimen at 2 ipm	
Change in Tensile Strength at Break and Yield (%)		± 5
Change in Elongation at Break and Yield (%)		± 10

<u>Property</u>	<u>Test Method</u>	<u>Values</u>
Bonded Seam Strength, Field Tensile, min Peel Adhesion, min	ASTM D 638 ASTM D 413	90% of parent material film tear band
Oxidation Inductive Time (minutes, min at 130 C 800 psi O ₂)	ASTM D 3985	2000

*Format uses NSF 54 table for HDPE as guide. However, RCRA values for Volatile Loss, Dimensional Stability, and Environmental Stress Crack have been added.

2.1.1.3 Resin used for extrudate fusion welding shall be HDPE produced from and same as HDPE sheet resin. Physical properties shall be same as HDPE lining sheets.

2.1.1.4 Liner thickness shall be at least 54 mils at any point on liners.

2.1.1.5 Fabricate liner from large pieces of sheeting to proper size and shape to fit contours of basin. Prefabricate corner pieces in factory. Keep field joints to minimum and in accordance with approved installation drawings.

2.1.1.6 Liner material will be required for EPA's method 9090 testing. There shall be no changes in formulation of liner material once testing has begun.

2.2 SOURCE QUALITY CONTROL

2.2.1 Tests

2.2.1.1 Preparation: Obtain 1 sample from preformed products from each form in use each day. Cut sample in half. Keep 1/2 for testing and deliver remaining half to KEH for testing.

2.2.1.2 Testing: Test samples for thickness, tensile strength at yield, and tensile strength at break as specified in subparagraph 2.1.1.2 except values may be reduced by 10 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Before work is started examine sheet rolls for damage from transit. If damaged set aside. Those that cannot be repaired, shall be rejected.

3.1.2 Before installation of liner, ensure surface is free of soil rocks, standing water or other debris, and provide written documentation to KEH that surfaces to receive liner have been examined and found to be acceptable for installation.

3.1.3 During unrolling of material, visually examine sheet surface. Mark and repair faulty areas in accordance with approved procedure. Document repaired areas on installation drawings by showing location and identity of repair crew.

3.2 INSTALLATION

3.2.1 Climatic Conditions: Within limits given in NSF Standard 54, Appendix C while handling, repairing, or seaming plastic sheeting material. Maximum wind 15 mph and no precipitation or fog.

3.2.2 Placing: Place fabricated pieces in position shown on approved installation drawings. Verify preformed pieces fit snugly in position to prevent undue stress. Unroll, position, and smooth out folds and wrinkles. Allow sheets to relax before seaming. Anchor liner temporarily, in accordance with installer's approved procedure, to prevent wind damage until material is secured.

3.2.3 Field Seams: Do not make horizontal welds on vertical surfaces. Overlap panels 4 to 6 inches. Ensure liner surface is free of dirt, dust, moisture, and deleterious materials before seaming, and climatic conditions meet the requirements of Paragraph 3.2.1.

3.2.3.1 Do not place in areas where field vacuum box testing cannot be performed.

3.2.3.2 Extrusion welding: Weld sheeting together using extrudate with composition identical to sheeting material.

3.2.3.3 Fusion welding: Weld sheeting together by producing a double seam with an enclosed space.

3.2.3.4 Welding equipment shall be capable of continuously monitoring and controlling temperature in zone of contact so changes in environmental conditions will not effect integrity of weld.

3.2.3.5 Where "fish mouths" occur, repair area in accordance with Paragraph 3.2.4.

3.2.3.6 "Fish mouths" are not acceptable within seam area.

3.2.3.7 Traverse entire surface and examine for tears, punctures, and thin spots. Replace or repair, in accordance with Paragraph 3.2.4, liner area showing out of tolerance injury. Document repaired areas on installation drawings by showing location and repair crew identity.

3.2.3.8 Welds, on completion of work, shall be tightly bonded.

3.2.4 Damage Repairs: Make repairs to liner by applying piece of sheeting, sufficient in size to extend approximately 3 to 6 inches beyond damaged area. Make patch round or oval and install using same materials and procedures used in making field joints. Do not use cutting tools while

working on top of installed liner except when cutting destructive test samples.

3.2.4.1 Seam repairs: Repair seam areas represented by failed samples. Area to be repaired includes failed test location and extends in both directions to location where sample passed. To reduce extent of area to be repaired, additional samples may be taken 10 feet minimum from either side of failed test location. Document failed seams on installation drawings by showing location and seaming crew identity.

3.2.5 Vault Floor Covering: Cover portion of vault floors shown on the Drawings, coated with protective coating specified in Section 09885, with HDPE after hydrostatic testing specified in Section 03301.

3.3 FIELD QUALITY CONTROL

3.3.1 Nondestructive Testing

3.3.1.1 Test fusion welds in their entirety using air pressure test or vacuum box. Pressurize channels between seams to minimum 30 psi, indicated by calibrated gage or manometer inserted in channel. Maintain pressure for minimum 15 seconds.

3.3.1.2 Vacuum test for extrusion welded seams and repairs.

a. Equipment: Aluminum frame box with calibrated vacuum gage on frame, fitted with sponge gasket on bottom, sealed with transparent Plexiglas top, and connected to vacuum pump.

b. Test: Spread soap solution over seam, press box down over seam, and apply 10 inches Hg vacuum, plus or minus 2 inches, for minimum 15 seconds to each portion of seam. If defect is present, bubble will form and indicate area for repair. Test seams and repairs in their entirety.

3.3.1.3 KEH will observe testing and review results.

3.3.2 Destructive Testing

3.3.2.1 Preparation: Obtain samples of field seams at beginning and end of each work day, and at 1 or more intervals during day if seaming conditions have been altered.

a. Use 10 foot long test weld from each welding machine, and mark with date, ambient temperature, and machine number.

b. Take 2 foot long random weld samples from installed welded sheeting at rate of 1 sample for each seaming crew for each day.

c. Cut samples in 2 parts, keep 1/2 for testing and deliver remaining half to KEH.

3.3.2.2 Tests: Test samples for bonded seam strength in accordance with ASTM D 3083, and for peel adhesion in accordance with ASTM D 413.

3.3.3 Documentation

3.3.3.1 Document field seam test results by marking installation drawings with location of sample identification number and label sample with location, date, time, crew identity, and machine number.

3.3.3.2 Certify test results.

3.3.3.3 Deliver documentation to KEH within 7 working days.

3.3.4 Final Examination and Acceptance

3.3.4.1 Measure overlap of seams and verify no damage has occurred to liner.

3.3.4.2 Prepare record drawings showing field changes.

3.3.4.3 Deliver record drawings to KEH within 10 working days after completion of liner installation.

END OF SECTION

SECTION 02756

LEACHATE COLLECTION SYSTEM

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

ANSI B16.11-1980 American National Standard
Forged Steel Fittings, Socket-
Welding and Threaded

1.1.1.2 American Society for Testing and Materials (ASTM)

A 53-87b Standard Specification for
Pipe, Steel, Black and Hot-
Dipped, Zinc-Coated Welded and
Seamless

A 105-87a Standard Specification for
Forgings, Carbon Steel, for
Piping Components

A 194-87 Standard Specification for
Carbon and Alloy Steel Nuts for
Bolts for High-Pressure and
High-Temperature Service

D 1117-80 Standard Methods of Testing
Nonwoven Fabrics

D 1632-64 (1975) Standard Test Methods for
Breaking Load and Elongation of
Textile fabrics

D 177-64 (1975) Standard Method for Measuring
Thickness for Textile Materials

D 3776-85 Standard Test Methods for Mass
Per Unit Area (Weight) of Woven
Fabric

D 3787-80a Standard Test Method for Bursting
Strength of Knitted Goods--
Constant-Rate-of-Traversal (CRT)
Ball Burst Test

1.2.5 Certified Material Test Reports (CMTR): Submit materials test reports, certified by manufacturer of geotextile, which identify items and show results of chemical analyses and physical tests specified in ASTM standards.

1.2.6 Certificate of Conformance: Submit legible certificate from supplier stating that drainage gravel furnished meets the requirements of Paragraph 2.1.3.

1.2.7 Certificates of Experience: Submit "Certificates of Experience" from installer showing qualification in accordance with Paragraphs 1.3.1 and 1.3.2. Provide list showing names, addresses, and telephone numbers for completed projects.

1.2.8 Manufacturer's Quality Control Plan: Submit quality control plan for Project. Plan shall address requirements of Paragraph 1.3.3.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Installer: Licensed or approved by manufacturer of geotextiles. Provide evidence of successfully installing at least 10 projects, and at least 1,000,000 square feet of geotextiles. Projects shall also include Resource Conservation and Recovery Act (RCRA) Landfills and Surface Impoundments.

1.3.2 Upon completion of work, and as condition of acceptance, deliver to KFH 2 copies of certificate signed by authorized agent of manufacturer of geotextiles, and co-signed by installer, stating materials and methods used meet specified requirements.

1.3.3 Manufacturer's Quality Control Plan: Quality control plan to be implemented for Project shall be in accordance with EPA/530-SW-86-031.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

1.4.1.1 During shipment and storage, wrap geotextiles in heavy-duty protective covering to prevent damage.

1.4.1.2 Examine geotextile delivered to site for damage. If damaged, set aside and do not use. Do not remove material identification label.

1.4.2 Storage

1.4.2.1 Unload and store with minimum of handling.

1.4.2.2 Do not store materials on ground.

1.4.2.3 Storage area shall protect geotextile from mud, soil, dust, debris, ultraviolet light, heavy winds, temperature extremes, and precipitation.

1.4.2.4 Store geotextile materials indoors in original unopened packaging.

1.4.2.5 If temporarily outdoors, place on pallet and protect from direct rays of sun under light colored heat-reflective opaque cover in manner to provide free air flowing space between materials and cover.

1.4.2.6 Cover gravel to protect from blowing sand and debris.

1.4.3 Handling: Handle materials to ensure sound, undamaged condition.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Nonwoven Geotextile: Long-chain synthetic polymer composed of polypropylene and contain stabilizers and inhibitors added to base plastic to make filaments resistant to deterioration due to ultraviolet and heat exposure. Geotextile shall be composed of continuous geotextiles held together through needle-punching. Edges of fabric shall be sealed or otherwise finished to prevent outer material from pulling away from fabric, or ravelling. Geotextile shall meet following requirements.

<u>Property</u>	<u>Test Method</u>	<u>Values</u>
Fabric Weight (oz/sq yd)	ASTM D 3776	10
Thickness (mil)	ASTM D 1777	70
Grab Tensile Strength (lbs/min.)	ASTM D 1682	200
Grab Elongation (% min)	ASTM D 1682	30 in any principal direction
Coefficient of Water Permeability (cm/sec)	ASTM D 4491	0.2
Puncture Strength (lbs, min.)	ASTM D 3787	100
Tear Strength (lbs, min. trapezoidal)	ASTM D 1117	100 in any principal direction
Equivalent Opening Size (EOS), US Sieve	---	70-100 in accordance with ASTM E 11
Minimum Width (ft)	---	12

2.1.2 Carbon Steel Drainage System

2.1.2.1 Pipe: Meet the requirements of ASTM A 53, Type S. Perforate by drilling four 1/4 inch holes for each foot of length.

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2.1.2.2 Threaded fittings, including flanges: Meet the requirements of ASTM A 105 and ANSI B16.11. Stress relieve fitting welds and bends.

2.1.2.3 Hex nuts: Meet the requirements of ASTM A 194, Grade 2.

2.1.2.4 Gasket mating flange to liner: Full face teflon.

2.1.3 Drainage Gravel

2.1.3.1 Thoroughly washed and screened naturally occurring gravel, having following size distribution.

<u>Sieve Size</u>	<u>Percent Passing</u>
1 inch	100
3/4 inch	85-95
3/8 inch	45-55
#4	20-25
#8	0

2.1.3.2 Crushed or partially crushed gravel will not be acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Before work is started examine sheet rolls for damage from transit and storage. If damaged set aside and do not use.

3.1.2 During unrolling of material, visually examine surfaces. Do not use material showing defects, ribs, holes, flaws, deterioration, or other damage.

3.2 INSTALLATION

3.2.1 Climatic Conditions

3.2.1.1 Within limits given in NSF Standard 54, Appendix C while handling geotextile material.

3.2.1.2 Temperature: 40 to 104 F.

3.2.1.3 Winds: 15 mph, maximum.

3.2.2 Geotextiles

3.2.2.1 Place at locations shown on approved installation drawings.

3.2.2.2 Lay smooth and free of tension, stress, folds, wrinkles, or creases, and to provide minimum 12 inch overlap for each joint.

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- 3.2.2.3 Measure overlap joints and seams as single layer of cloth.
 - 3.2.2.4 Use bags of clean, washed gravel to secure material during installation. Do not use securing pins.
 - 3.2.2.5 Protect geotextile and gravel during construction from contamination.
 - 3.2.2.6 Remove contaminated geotextile and gravel and replace with new.
 - 3.2.3 Install leachate collection pipe as shown on the Drawings.
 - 3.2.3.1 Coat threads of pipe and fittings with coal tar enamel meeting the requirements of AWWA C203.
 - 3.2.3.2 Backfill with material specified in Paragraph 2.1.3, in 6 inch lifts, up to elevation shown on the Drawings. Each lift shall be compacted with 2 passes of hand operated impact tamper. Protect gravel from contamination during construction.
 - 3.2.4 Repairs: Make repairs to geotextile in accordance with manufacturer's recommended procedures.
 - 3.3 FIELD QUALITY CONTROL
 - 3.3.1 Final Examination and Acceptance: Measure proper overlap of seams and verify no damage has occurred to geotextile. Prepare record drawings showing where field changes have been incorporated. Deliver test documentation and record drawings to KEH.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Concrete Institute (ACI)

ACI 301-84 (Revised 1987) Specifications for Structural
Concrete for Buildings

ACI 306.1-87 Standard Specification for
Cold Weather Concreting

1.1.1.2 American Society for Testing and Materials (ASTM)

A 185-85 Standard Specification for
Steel Welded Wire Fabric, Plain,
for Concrete Reinforcement

A 615-87 Standard Specification for
Deformed and Plain Billet-Steel
Bars for Concrete Reinforcement

C 33-86 Standard Specification for
Concrete Aggregates

C 94-86b Standard Specification for
Ready-Mixed Concrete

C 150-86 Standard Specification for
Portland Cement

C 260-86 Standard Specification for
Air-Entraining Admixtures for
Concrete

1.1.1.3 National Ready Mixed Concrete Association (NRMCA)

January 1, 1976 Certification of Ready Mixed
(Third Revision) Concrete Production Facilities

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Form Coating Materials: Submit proposed form coating materials in accordance with ACI 301, Section 4.4.

1.2.2 Certification of Ready Mixed Concrete Production Facilities: Submit current legible copy of "Certificate of Conformance for Concrete Production Facilities" issued by and bearing the seal of the National Ready Mixed Concrete Association. Certificate shall contain signature and seal of registered Civil Engineer.

1.2.3 Certified Test Reports for Reinforcing Steel: Submit manufacturer's certified test reports showing chemical analysis and physical tests made on particular heat or heats of steel from which reinforcement was manufactured. Furnish separate certificates for each group of items furnished by each supplier.

1.2.4 Reinforcing Steel Fabricator Drawings: Submit complete reinforcing fabrication and placing drawings based on block diagram in accordance with ACI 301, Section 5.1, including splices not shown on the Drawings.

1.2.5 Block Diagram: Submit block diagram of scheduled concrete pours. Identify pours.

1.2.6 Concrete Materials, Mix Design and Mix Proportions: Submit concrete materials, mix design and mix proportions in accordance with ACI 301, Sections 3.8 and 16.7.3. Define each material to be used in concrete and state amount, by weight, to be utilized per cubic yard of plastic mix.

1.2.7 Cold Weather Concreting: Submit detailed procedure in accordance with ACI 306.1, Section 1.5.1.

1.2.8 Curing Procedure: Submit description of materials and methods of curing in accordance with ACI 301, Section 12.2.

1.2.9 Certificate of Conformance: Submit legible certificate, certified by manufacturer, that lifting inserts and plates meet the requirements of the Drawings. Include load capacity and factor of safety.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Concrete

2.1.1.1 Cement: ASTM C 150, Type II (low Alkali)

2.1.1.2 Aggregates: ASTM C 33, maximum size as follows.

a. 3/4 inch for duct banks.

b. 1-1/2 inch for all other.

2.1.1.3 Air-entraining admixture: Meeting the requirements of ASTM C 260; Sika Chemical Company "SIKA AFR"; Chem-Masters Corp "Adz-Air"; or Protex Industries "Protex".

2.1.1.4 Properties

- a. Minimum allowable compressive strength at 28 days.
 - 1) 3000 psi for duct banks.
 - 2) 4000 psi for all other.
- b. Slump: 4 inch maximum in accordance with ACI 301, Section 3.5.
- c. Air content: In accordance with ACI 301, Table 3.4.1.
- d. Proportions: In accordance with ACI 301, Sections 3.8 and 3.9.

2.1.1.5 Mixing: In accordance with ASTM C 94.

2.1.1.6 Delivery: In accordance with ASTM C 94.

2.1.2 Reinforcing Steel

2.1.2.1 Steel bars: ASTM A 615, deformed, Grade 60.

2.1.2.2 Welded wire fabric: ASTM A 185.

2.1.2.3 Tie wire: Black annealed steel, 16 gage minimum.

2.1.3 Nonshrink Grout

2.1.3.1 Nonmetallic type: "Five Star Grout" by US Grout Corp; "Por-Rok" Anchoring Cement by Hallemite; or "Masterflow 713" by Master Builders.

2.1.4 Forms: Wood, steel, plywood, or Masonite Corporation "Concrete Form Presdwood", as required for various specified finishes.

2.1.5 Lifting Inserts and Plates: Specified on the Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Form Construction

3.1.1.1 Install formwork in accordance with ACI 301, Section 4.2. Interior shape and rigidity shall be such that finished concrete will meet the requirements of the Drawings within tolerances specified in ACI 301, Table 4.3.1.

3.1.1.2 Prepare form surfaces in accordance with ACI 301, Section 4.4.

3.1.1.3 Forms for surfaces which will be permanently concealed from view may be saturated with water before placing concrete instead of other treatment, except in freezing weather forms shall be treated with oil or stearate.

3.1.1.4 Clean forms of foreign material before placing concrete.

3.2 INSTALLATION

3.2.1 Reinforcing Steel

3.2.1.1 Fabricate bars accurately to dimensions shown on Drawings, within tolerances shown in ACI 301, Section 5.4.

3.2.1.2 Tag in accordance with bar list.

3.2.1.3 Place as shown on approved submittals within tolerances specified in ACI 301, Sections 5.4 and 5.5.

3.2.1.4 Tie to prevent displacement during placement of concrete.

3.2.1.5 Do not force into concrete after initial set has started.

3.2.1.6 Place with dimension of concrete protection equal to minimum given in ACI 301, Section 5.5, except where shown otherwise on the Drawings.

3.2.1.7 Place welded wire fabric on chairs and lap two mesh at splices. Tie splices with wire.

3.2.2 Concrete

3.2.2.1 Before ordering, obtain approval of required submittals.

3.2.2.2 Before batching, obtain approval of formwork and reinforcement by KEH.

3.2.2.3 Before placing:

a. Obtain approval of "Pour Slip" by KEH. "Pour Slip" shall include appropriate reference to specific portion of structure to be placed, maximum size of coarse aggregate, design strength, admixture, and slump. "Pour Slip" forms can be obtained from KEH.

b. For each truck load, deliver "Trip Ticket" to KEH. "Trip Ticket" shall contain information listed in ASTM C 94, subparagraphs 16.1.1 through 16.1.10, and include water/cement ratio.

3.2.2.4 Place in accordance with ACI 301, Sections 8.1, 8.2, and 8.3. Do not drop (free fall) more than 5 feet. Insert vibrator, vertically if possible, into concrete and reach small distance into concrete in next lower layer. Do not insert vibrators into lower courses that have reached initial

set. Take care to avoid allowing head of vibrator to come in contact with forms or embedded items.

3.2.2.5 Temper only as permitted in ACI 301, Section 7.5.

3.2.2.6 Place nonshrink grout where shown on the Drawings and in accordance with manufacturer's recommendations.

3.2.2.7 Weather conditions: Protect concrete during placement in accordance with ACI 301, Section 8.4. Cold weather concreting shall be in accordance with approved procedure.

3.2.2.8 Construction joints: Make in accordance with ACI 301, Section 6.1, and as detailed on the Drawings.

3.2.2.9 Embedded items: Install in accordance with ACI 301, Sections 6.4 and 6.5.

3.2.2.10 Placing concrete against earth: Place on or against firm, damp surfaces free of frost, ice and free water. Do not place until required compaction has been obtained. Dampen earth surfaces to receive fresh concrete.

3.2.2.11 Consolidation: Consolidate concrete slabs in accordance with ACI 301, Section 11.6.

3.2.3 Concrete Repair and Form Removal

3.2.3.1 Form removal: Remove in accordance with ACI 301, Section 4.5.

3.2.3.2 Cut back form ties and examine concrete surfaces for defects. Repair only after permission for patching is given by KEH.

3.2.3.3 Place concrete repair mortar within 1 hour after mixing. Do not retemper mortar.

3.2.3.4 Surface defect repair: Repair in accordance with ACI 301, Sections 9.1, 9.2 and 9.3. Cure concrete repairs same as new concrete.

3.2.4 Concrete Finishes and Tolerances

3.2.4.1 Formed surfaces: Start finishing following concrete repair and complete within 96 hours after forms have been removed. Finish in accordance with sections of ACI 301 noted below.

- | | |
|---|----------------|
| a. Surfaces exposed to earth backfill | Section 10.2.1 |
| b. Interior surfaces | Section 10.2.2 |
| c. Exterior surfaces exposed to weather | Section 10.2.2 |

- d. Related unformed surfaces Section 10.5
- e. Surfaces to receive
 special protective coating Section 10.3.2

3.2.4.2 Unformed surfaces: Finish in accordance with sections of ACI 301 noted below:

- a. Interior floors Section 11.7.3
- b. Exterior equipment slabs Section 11.7.3

3.3 FIELD QUALITY CONTROL

3.3.1 Concrete Testing: Sampling and testing of concrete will be the responsibility of KEH. Concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6 and 16.3.8.

3.4 CURING AND PROTECTION

3.4.1 Curing

3.4.1.1 Cure concrete in accordance with ACI 301, Section 12.2. Clear curing compounds shall be tinted or applied surfaces marked to delineate extent of spraying.

3.4.1.2 Do not use curing compound on concrete surfaces to receive flooring or special protective coating.

3.4.2 Protection

3.4.2.1 Protect concrete during extreme weather conditions in accordance with ACI 301, Section 12.3.

3.4.2.2 Protect concrete from mechanical injury in accordance with ACI 301, Section 12.4.

END OF SECTION

SECTION 03301

VAULT AND BASIN CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Concrete Institute (ACI)

ACI 301-84 (Revised 1987)	Specifications for Structural Concrete for Buildings
ACI 306.1-87	Standard Specification for Cold Weather Concreting
ACI 315-80	Details and Detailing of Concrete Reinforcement
ACI 347-78 (Reapproved 1984)	Recommended Practice for Concrete Formwork
ACI 349-85	Code Requirements for Nuclear Safety Related Concrete Structures

1.1.1.2 American Society for Testing and Materials (ASTM)

A 108-81	Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
A 307-86a	Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
A 615-87	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C 31-88	Standard Practice for Making and Curing Concrete Test Specimens in the Field
C 33-86	Standard Specification for Concrete Aggregates

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C 39-86	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C 87-83	Standard Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
C 94-86b	Standard Specification for Ready- Mixed Concrete
C 125-88	Standard Terminology Relating to Concrete and Concrete Aggregates
C 138-81	Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C 143-78	Standard Test Method for Slump of Portland Cement Concrete
C 150-86	Standard Specification for Portland Cement
C 171 69 (1986)	Standard Specification for Sheet Materials for Curing Concrete
C 227-87	Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
C 233-87a	Standard Test Method for Air- Entraining Admixtures for Concrete
C 260-86	Standard Specification for Air- Entraining Admixtures for Concrete
C 289-87	Standard Test Method for Potential Reactivity of Aggregates (Chemical Method)
C 309-81	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
C 494-86	Standard Specification for Chemical Admixtures for Concrete

- C 618-87 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete
- C 932-80 (1985) Standard Specification for Surface Applied Bonding Agents for Exterior Plastering
- D 75-87 Standard Practice for Sampling Aggregates
- D 512-81 (1985) Standard Test Methods for Chloride Ion in Water
- D 516-82 Standard Test Methods for Test for Sulfate Ion in Water
- D 3370-82 Standard Practices for Sampling Water
- F 779-87 Standard Test Method for Determining Air Leakage Rate by Pressurization
- 1.1.1.3 American Welding Society (AWS)
- AWS D1.1-88 Structural Welding Code - Steel
- AWS D1.4-79 Structural Welding Code - Reinforcing Steel
- AWS QC1-86 Standard for Qualification and Certification of Welding Inspectors
- 1.1.1.4 National Ready Mixed Concrete Association (NRMCA)
- January 1, 1976 (Third Revision) Certification of Ready Mixed Concrete Production Facilities
- 1.1.1.5 Washington State Department of Transportation (WSDOT)
- M41-10-88 Standard Specifications for Road, Bridge, and Municipal Construction
- 1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.
- 1.2.1 Formwork: Submit fabrication drawings showing general arrangement of forms, sizes and grades of lumber, panels and related components. Include

placement rate of fresh concrete in walls based on ACI 347, Chapter 2. Show control joints and method of forming, locations of inserts, tees, sleeves, and other related items.

1.2.2 Form Coating Materials: Submit proposed form coating materials in accordance with Paragraph 3.1.2 and ACI 301, Section 4.4.

1.2.3 Certification of Ready Mixed Concrete Production Facilities: Submit current legible copy of "Certificate of Conformance for Concrete Production Facilities" issued by and bearing the seal of the National Ready Mixed Concrete Association. Certificate shall be dated within past 12 months of first concrete delivery.

1.2.4 Laboratory Test Reports: Submit certified copies of test reports showing following materials meet specified requirements.

1.2.4.1 Cement

1.2.4.2 Aggregates

1.2.4.3 Admixtures

a. Air-entraining: Tested in accordance with ASTM C 233.

b. Water reducing: Tested by combining with cement and aggregates to be used to produce specified concrete having desired properties with respect to time of set, water-reduction, slump, strength, shrinkage, and pumpability.

c. Set retarding: Tested by combining with cement and aggregates to be used to produce specified concrete having desired properties with respect to retardation, water content, slump and strength.

1.2.4.4 Reinforcement

1.2.4.5 Concrete curing material

1.2.4.6 Water

1.2.5 Reinforcing Steel Fabricator Drawings: Submit complete and checked reinforcing steel fabrication and installation drawings, based on schedule for concrete placement and showing bending diagrams, assembly diagrams, splicing and laps of rods, and shapes, dimensions and details of bar reinforcing and accessories. Prepare drawings in accordance with ACI 315, Chapter 2.

1.2.6 Manufacturer's Data: Submit manufacturer's catalog cuts of reinforcing steel mechanical couplers along with data on material and installation procedures. Include type and series identification of sleeve splice for size of bars to be spliced.

1.2.7 Certified Test Reports: Submit manufacturer's certified test reports showing chemical analysis and physical tests made on particular heat or heats of steel from which reinforcing steel mechanical couplers were manufactured. Submit separate certificates for each group of like items furnished by each supplier.

1.2.8 Schedule for Concrete Placement: Submit schedule delineating location, sequence of pouring and time lapse between supporting and supported elements. Provide block diagrams and pouring sequence for slabs and walls.

1.2.9 Mix Design: Submit mix design, in accordance with ACI 349, Paragraphs 4.2 and 4.3 based on aggregate data, gradation and specific gravity determined by laboratory within past 6 months, and specified requirements.

1.2.10 Mix Certification: Submit certification of concrete mix design, by approved independent engineering testing laboratory. Certification shall include but not be limited to following.

1.2.10.1 Confirmation of aggregate test data based on available test results determined within past 6 months and date tests were made.

1.2.10.2 Evaluation of mix design: Check calculations and report cement factor, concrete plant standard deviation used in design of mix, maximum water (gallons per sack of cement), percentage of fine aggregate to total aggregate by weight, weight in pounds of saturated surface-dry aggregates per sack of cement, percentage of admixtures and yield for 1 cubic yard of concrete.

1.2.11 Control Procedures for Batching: Submit detailed procedures for controlling following activities.

1.2.11.1 Handling and storage of cement, fly ash, aggregate, and admixtures.

1.2.11.2 Limiting moisture content of fine aggregate to 5 percent.

1.2.11.3 Batching operation to include sequencing of material.

1.2.11.4 Addition of chilled water or ice.

1.2.11.5 Prohibition of added water except to adjust slump at point of placement. Additional water may be added if slump of concrete is less than specified.

1.2.11.6 Regulation of mixing drum revolutions.

1.2.12 Certificate of Conformance. Submit legible certificate stating that concrete delivery equipment meets the requirements of subparagraphs 2.2.6.2a and 2.2.6.2b.

1.2.13 Construction Joints: Submit drawings showing location and treatment of construction joints in accordance with ACI 301, Section 6.1.

1.2.14 Weather Protection During Placement: Submit protection procedures meeting the requirements of subparagraph 3.2.9.5 and ACI 301, Section 8.4.

1.2.15 Curing and Protection: Submit description of materials and methods of curing in accordance with Article 3.4 and ACI 301, Section 12.2.

1.2.16 Pump Concrete: Submit description of concrete pump and form capacity in accordance with subparagraph 3.2.9.6.

1.2.17 Methods for Controlling Heat of Hydration and Thermal Gradients: Submit control procedures meeting the requirements of subparagraph 3.2.9.7.

1.2.18 Air Leakage Test: Submit description of major components to be used in testing as defined in ASTM E 779, Paragraph 6.2 and proposed method.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Welding Personnel and Procedures

1.3.1.1 Personnel and procedures for welding shall have been qualified in accordance with AWS D1.1 and AWS D1.4 before welding.

1.3.1.2 Deliver 2 copies of welding procedure specifications, procedure qualification records, and welder performance qualification test results to KEH 5 days before welding. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.3.2 Qualification of Nondestructive Examination (NDE) Personnel

1.3.2.1 Visual weld examinations and appropriate documentation shall be performed by Certified Welding Inspectors (CWI) who have received certification in accordance with AWS QC1. Welding related examination documentation shall be signed, or stamped, by individual performing examination.

1.3.2.2 Deliver 2 copies of NDE personnel qualifications to KEH 5 days before examining. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.3.3 Qualification of Splicers: Personnel splicing reinforcing bars by welding or mechanical splice shall be qualified before splicing in accordance with following requirements.

1.3.3.1 Prepare 2 qualification splices on largest bar size for each splice position using reinforcing bar identical to one used in structure.

1.3.3.2 Tensile test splices with results equal to 125 percent of specified yield strength.

1.3.3.3 Deliver 2 copies of splicer performance qualification test results to KEH 5 days before splicing. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.3.3.4 Requalification of personnel required if:

- a. Specific splice position has not been used for period of 3 months or more.
- b. Completed splices fail to pass visual examination or tensile tests.
- c. Consistent visual rejects occur.
- d. Requalification not required if based on single visual reject.
- e. Requalification procedures shall be identical to original qualification procedure.

1.3.4 Test Records: Institute and maintain for examination by KEH complete legible records of tests performed pursuant to design of concrete mixtures. Keep records in chronological order of initial and subsequent mixture designs, and correspondence related to design and testing, along with results of tests.

1.3.5 Quarry Aggregate Testing: Determine sieve analysis of separate sizes of coarse and fine aggregates sampled at quarry source and results combined in accordance with proportions of mix design. Keep records of tests. Combined aggregates proportioned at concrete plant using separate sizes of aggregates shall meet specified gradation. Gradation of separate individual sizes of coarse and fine aggregates shall meet specified requirements. In following table, letter "X" is gradation Contractor proposes to furnish for specific sieve sizes. In addition to grading, distribution of aggregates shall be as follows.

1.3.5.1 Fine aggregate

- a. Difference between total percentage passing No. 16 sieve and total percentage passing No. 30 sieve: Between 10 and 35.
- b. Difference between percent passing No. 30 and No. 50 sieves: Between 10 and 30.

1.3.5.2 Make additional sieve analysis and other aggregate tests in accordance with ASTM C 33 whenever sieve analysis fails to meet requirements, there is change of aggregate source, or consecutive concrete strength results fail to meet specified strengths.

FINE AGGREGATE GRADING

<u>Sieve Size</u>	PERCENT PASSING	
	<u>Individual Test Result</u>	<u>Moving Average of Five</u>
3/8 in.	100	100
No. 4	95-100	96-100
No. 8	80-100	81-99
No. 16	X ± 10	X ± 8
No. 30	X ± 9	X ± 7
No. 50	X ± 6	X ± 4
No. 100	2 - 10	3 - 9
No. 200	0 - 5	0 - 4

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Packing and Shipping to Site

1.4.1.1 Identification: Each bundle of reinforcing bars shall display metal tag identifying manufacturer and heat numbers from which product was made along with ASTM specification number and type to which product complies.

1.4.2 Acceptance at Site: Reinforcement will be receipt examined by KEH for compliance with material identification tag.

1.4.3 Storage and Protection at Plant

1.4.3.1 Cement: Store immediately upon receipt.

a. Bags

1) Store in suitable weatherproof structure, as air-tight as practicable, with floors elevated above ground sufficiently to prevent absorption of moisture.

2) Stack close together to reduce circulation of air, but not against outside walls, in manner to permit easy access for examination and identification of shipments.

b. Bulk cement: Transfer to elevated airtight and weatherproof bins.

c. At time of use cement shall be free-flowing, and free of lumps. Cement stored longer than 6 months shall be tested by standard mortar tests or other tests deemed necessary by KEH to determine suitability of use, and not used without approval of KEH.

d. Cement containers shall show production date of cement.

1.4.3.2 Aggregates

- a. Store on areas covered with tightly laid wood planks, sheet metal, or other hard and clean surface, and in manner to preclude inclusion of foreign material.
- b. Store aggregates of different sizes in separate piles.
- c. Build stock piles of coarse aggregate in horizontal layers not exceeding 4 feet in depth to minimize segregation.
- d. Should coarse aggregate become segregated, remix to meet grading requirements.
- e. Do not store fine aggregate from different sources of supply in same stockpile.

1.4.3.3 Admixtures

- a. Store in manner to prevent damage to containers.
- b. Air-entraining admixtures stored longer than 6 months, or subjected to freezing shall not be used until retest proves satisfactory.
- c. Production dates of admixtures shall be shown on containers.

1.4.4 Storage and Protection at Site: Store and protect reinforcement to avoid excessive rusting or coating with grease, oil, dirt, and other objectionable materials.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Reinforcing Steel

2.1.1.1 Steel bars: ASTM A 615, deformed, Grade 60.

2.1.1.2 Tie wire: Black annealed steel, 16 gage minimum.

2.1.1.3 Provide stirrups, hanger bars, wire ties, chairs, spacers, supports, and other devices shown on the Drawings or required in this Section.

2.1.1.4 Reinforcing steel mechanical couplers: Sleeves with ferrous filler material, or other types of couplers which can be used with specified reinforcing steel bars, and capable of 125 percent of yield strength of reinforcing steel.

2.1.2 Concrete: Meet construction requirements of ACI 349 and ACI 301. If conflicts between ACI 349 and ACI 301 occur, ACI 349 shall govern.

2.1.2.1 Cement: ASTM C 150, Type II. Cement content minimum required to attain specified properties.

2.1.2.2 Aggregates: ASTM C 33, maximum size 3/4 inch, free of chlorides, sulfates, and substances which may be deleteriously reactive with alkalis in cement in amount sufficient to cause excessive expansion of concrete.

a. Fine aggregates: Grade in accordance with ASTM C 33. Aggregates from different sources of supply shall not be used alternately in same structure.

1) Aggregate meeting grading requirements of WSDOT, Section 9-03.1(2)B, Class 1 may be used instead of ASTM C 33.

b. Coarse aggregate: Grade in accordance with ASTM C 33, size number 67.

2.1.2.3 Water: Water for mixing and curing, including free moisture and water in aggregates, shall be fresh, clean and potable. Turbidity of water shall not exceed 2,000 turbidity units expressed as JTU (Jackson Turbidity Units) or FTU (Formeson Turbidity Units).

2.1.2.4 Admixtures: Do not use admixtures containing chloride ions.

a. Air-entraining admixtures: Meeting the requirements of ASTM C 260.

b. Water-reducing admixture: Pozzolan meeting the requirements of ASTM C 618, Class N or F.

c. Set-retarding admixture: Meeting the requirements of ASTM C 494.

2.1.2.5 Properties

a. Minimum allowable compressive strength: 4000 psi at 28 days.

b. Slump: 2-4 inches, determined in accordance with ASTM C 143.

c. Air-entrained: 5 percent plus or minus 1 percent.

d. Water/cement ratio: 0.42 maximum.

2.1.2.6 Chloride contamination: Level of soluble chloride in fresh concrete mix from all sources shall not exceed 1000 ppm (0.1 percent) by weight of cement.

2.1.3 Waterstops: See Section 05500.

2.1.4 Concrete Curing Material

2.1.4.1 Waterproof paper: Regular, meeting the requirements of ASTM C 171.

2.1.4.2 Polyethylene film: Clear, meeting the requirements of ASTM C 171.

2.1.4.3 White-burlap-polyethylene sheet: Meeting the requirements of ASTM C 171.

2.1.4.4 Liquid membrane-forming compound: Meeting the requirements of ASTM C 309, Type 1, Class B.

2.1.5 Bonding Agent: Meeting the requirements of ASTM C 932.

2.1.6 Anchor Bolts: ASTM A 307.

2.1.7 Weld Anchors and Shear Connectors: ASTM A 108.

2.1.8 Formwork: Materials meeting the requirements of ACI 347, Chapter 4.

2.2 BATCHING AND MIXING

2.2.1 Equipment for weighing and measuring materials shall meet local and state requirements, and visually exhibit latest seals.

2.2.2 Batch concrete in plant approved by NRMCA and the Operating Contractor.

2.2.3 Aggregates

2.2.3.1 Fine aggregates: Do not mix fine aggregates from different sources of supply.

2.2.3.2 Coarse aggregates: Combine separate sizes of coarse aggregates with other sizes in proportions by weight to produce aggregate meeting grading specified.

2.2.4 Admixtures: When more than 1 admixture is use in mix, furnish satisfactory evidence that admixtures to be used are compatible in combination with cement and aggregates, and suitable at job temperatures.

2.2.4.1 Air-entraining admixtures: Add in solution in portion of mixing water by mechanical batcher ensuring uniform distribution of agent throughout batch.

2.2.4.2 Water-reducing admixture: Replace 15 percent of cement in concrete mix with Pozzolan. Accurate batching is required.

2.2.4.3 Set-retarding admixture: Use as necessary to meet specified water/cement ratio and delay set 2 to 3 hours.

2.2.5 Proportioning Concrete Materials: In accordance with ASTM C94.

2.2.6 Ready-Mixed Concrete: Equipment for ready-mixed concrete shall meet the requirements of ASTM C 94 as modified herein. Ready-mixed concrete may be used provided plant has sufficient capacity and transportation equipment to deliver concrete at rate desired, and meets the requirements specified for equipment, measurement of materials, and mixing, except as modified herein. Cement, aggregates, water and admixtures shall meet applicable requirements of this Section. Mix and deliver ready-mixed concrete by 1 of following methods.

2.2.6.1 Central-plant mixing: Utilize central-plant mixing specified in ASTM C 94, Paragraph 11.3. Mix concrete in stationary mixer at plant and transport to site in truck agitator or truck mixer operating at agitating speed. Begin mixing within 90 minutes after cement has been added to aggregates. When authorized in writing by Kell, approved nonagitation equipment may be used for transporting concrete. Time lapse between introduction of mixing water to cement and aggregates and placing of concrete in final position in forms, shall not exceed the following

a. For agitating equipment: 90 minutes when air temperature is less than 85 F, and 60 minutes when air temperature is equal to or greater than 85 F.

2.2.6.2 Truck-mixed concrete: Ready-mixed concrete may be batched from manually-operated batch plant and mixed and delivered in truck-mounted mixer units provided following additional requirements are adhered to.

a. Truck mixer units used meet the requirements of ASTM C 94. Demonstrate compliance by performing tests in accordance with ASTM C 94, Annex A1.

b. Establish maintenance inspection program to ensure mixer units are maintained in condition to perform in accordance with ASTM C 94. Maintenance inspection program shall address following as minimum.

- 1) Frequency of inspection.
- 2) Inspection criteria including requirements for water meters, counters, fin heights, and cleanliness.
- 3) Name of individual performing inspection.
- 4) Results of inspection.
- 5) Statement that units are satisfactory for use. Include equipment numbers.

c. To preclude weighing inaccuracies in batch constituents bring dial indicator on weigh scales to essentially motionless condition at each desired intermediate batch weight before addition of remainder of material or discharge of weigh hopper.

2.3 SOURCE QUALITY CONTROL

2.3.1 Sampling: Before delivery of concrete to site, sample fine and coarse aggregates in accordance with ASTM D 75. Each sample shall be in clean container, securely fastened to prevent loss of material, and tagged for identification with following information.

Contract No. _____

Sample No. _____ Quantity _____

Date of Sample _____

Sampler's Signature _____

Source _____

Intended Use _____

For Testing _____

2.3.1.1 Fine aggregates: Take two 50 pound samples for each 200 tons for sieve analysis of fine aggregate sand and specific gravity tests. Additional samples shall be taken when analyses show deficiencies, unacceptable variances, or deviations. Sampling may be reduced to 1 when test results show fine aggregates consistently meet specified requires. Take samples of sand when sand is moist.

2.3.1.2 Coarse aggregate: Take 50 pound or larger sample for each 400 tons, from conveyor belt. Bring plant up to full operation before taking samples. Take samples so uniform cross section, accurately representing materials on belt or in bins, is obtained. Additional sampling shall be made when analyses show deficiencies or unacceptable variances or deviations from specified requirements.

2.3.1.3 Obtain water samples in accordance with ASTM D 3370, Practice A.

2.3.2 Testing: Test and record results at least 10 days before using materials.

2.3.2.1 Aggregates: Make gradation tests on each sample taken at batch plant. Make other required aggregate tests on samples, and repeat whenever there is a change of source. Tests shall include analysis of each grade of material and analysis of combined material representing aggregate part of mix. Combined aggregates proportioned at plant using separate sizes of aggregates shall meet specified gradation.

2.3.2.2 Test for potential reactivity of aggregates in accordance with ASTM C 289. Test aggregates from newly-developed quarries in accordance with ASTM C 227.

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a. Fineness modulus of fine aggregate, defined in ASTM C 125, shall be at least 2.3 but not more than 3.1. Aggregate showing variation in fineness modulus more than plus or minus 0.2 of representative sample submitted will be rejected.

2.3.2.3 Water: Test at start of work, and change of source.

a. Determine extent of chloride and sulfate contamination of water in accordance with ASTM D 512 and ASTM D 516. Water shall contain no more than 250 ppm of chlorides as CL nor more than 250 ppm of sulfates as SO₄.

b. Mortar specimens made in accordance with ASTM C 87, when compared with similar mortar specimens made with water of known satisfactory quality and using same sand and cement, shall show no unsoundness or marked change in setting, and compressive strength of mortar specimens at 28 days shall be at least 95 percent of compressive strength of specimens made with water of known satisfactory quality.

2.3.2.4 Test cement in accordance with ASTM C 150.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Form Construction: Construct and install forms in accordance with approved submittals, set true to line and grade, and maintained to ensure completed work within specified tolerances and mortar-tight.

3.1.1.1 Arrange bolts and rods used for internal ties so when forms are removed, metal shall be at least 2 inches from surfaces.

a. Do not use bolts or rods that must be removed when forms are removed.

3.1.1.2 Provide forms with temporary and adequate clean-out openings at base of wall forms to permit examination and easy cleaning after reinforcement has been placed.

3.1.1.3 Where forms for continuous surfaces are placed in successive units, fit over completed surface to obtain accurate alignment and prevent leakage of mortar.

3.1.1.4 Construct panel forms to provide tight joints between panels. Form repair requires KEH approval before use.

3.1.1.5 Construct forms to be removed without damaging concrete.

3.1.2 Form Coating

3.1.2.1 Coat contact surfaces of forms with nonstaining mineral oil or form coating compound, or 2 coats of nitrocellulose lacquer.

3.1.2.2 When temperature is above 40 F, sheathing may be thoroughly wetted with clean water.

3.1.2.3 Remove excess coating by wiping with cloths.

3.1.2.4 Thoroughly clean contact surfaces of reused forms.

3.1.2.5 Apply additional coating to previously coated forms.

3.1.3 Form Insulation: See subparagraph 3.2.9.7.

3.1.4 Tolerances: In accordance with ACI 347, Paragraph 3.3.5.

3.2 INSTALLATION

3.2.1 Reinforcing Steel, General: Wash reinforcement that has been in contact with the ground with water before placing to remove potential chloride contamination.

3.2.1.1 Reinforcing shall be free of rust, scale, oil, grease, clay, coatings, or foreign substances that will reduce or destroy bond between steel and concrete.

3.2.1.2 Rusting will not be basis for rejection, provided it has not reduced effective cross sectional area of reinforcement to extent that strength is reduced beyond specified values.

3.2.1.3 Remove heavy, thick rust or loose, flaky rust by rubbing with burlap or other approved method, before placing.

3.2.2 Placing

3.2.2.1 Accurately and securely place reinforcing in accordance with approved submittals.

3.2.2.2 On ground, and where otherwise subject to corrosion, use concrete or other suitable noncorrodible material for supporting reinforcing.

3.2.2.3 Support and wire reinforcing together to prevent displacement by construction loads or placing of concrete.

3.2.2.4 Unless directed otherwise by KEH do not bend reinforcing after partial embedment in hardened concrete.

3.2.3 Splicing, General

3.2.3.1 Examine bar ends and splice sleeves before assembly for cleanliness and proper end preparation. Bars shall meet sleeve manufacturer's recommendations.

3.2.3.2 Preparation and testing of sister joints: Make sister joints, removable test splices, in place, adjacent to production joints and by same welder or splicer making production joint. Perform tests as follows.

a. For each bar direction taken separately (horizontal, vertical, or diagonal), provide sister joints in following number.

1) 1 for first 10 production splices of each type in each direction.

2) 1 for next 25 production splices of each type in each direction.

3) From then on, 1 for every 33 production splices of each type in each direction.

b. Test sister joints in tension to destruction.

1) Acceptable tensile strength of each sample: 125 percent of specified yield strength.

2) If tensile strength of test splice does not equal or exceed acceptable tensile strength, test 1 production splice on each side of failed test splice. If either production splice fails, remove splices made by welder or splicer making production splice. Additional tensile tests may be made on production splices to demonstrate acceptability of splices.

3.2.3.3 Splice reinforcement in accordance with ACI 349 and approved submittals, except as modified by this Section and the Drawings. Do not splice at points of maximum stress. Butt splicing may be used instead of lap splicing provided splice material, equal or greater in cross-section to spliced steel, has minimum 125 percent of yield strength. Lap splices shall be Class C unless otherwise noted or dimensioned on the Drawings.

3.2.3.4 Welded

a. Weld reinforcing bar splices with full penetration buttwelds, unless shown otherwise, in accordance with AWS D1.4.

b. Do not weld until welding documents have been approved.

c. KEH may examine welding processes.

d. Weld identification: Prepare and maintain map of welded splices. Deliver to KEH at completion of work.

1) Assign weld number, prefixed by letter 'W', to each weld as made. Show numbers on splice map.

2) Place identification symbol of welder making weld and weld number adjacent to each weld. Use marking crayon or paint.

3) Do not reuse weld numbers. If weld is completely replaced, assign new number.

3.2.3.5 Mechanical

a. Where bar cutting is required, cut by sawing, shearing, or flame cutting. If bars are sheared, straighten ends after shearing. If bars are flame cut, remove slag by chipping and wire brushing before splicing.

b. Splice bars in accordance with manufacturer's approved instructions. Make connections with manufacturer's standard hardware and equipment.

c. Splice identification: Prepare and maintain map of mechanical splices. Deliver to KEH at completion of work.

1) Assign splice number, prefixed by letter "C", to each splice as made. Show splice numbers on splice map.

2) Place identification symbol of splicer making splice and splice number adjacent to each splice. Use marking crayon or paint.

3) Do not reuse splice numbers. If splice is completely replaced, assign new number.

3.2.4 Nondestructive Examination

3.2.4.1 Welds: Perform 100 percent visual examination of welds in accordance with AWS D1.4. Document examination of cover pass on splice map.

3.2.4.2 Splice sleeves with filler metal

a. Examine connections visually after cooling for longitudinal centering of sleeve on spliced ends, allowable voids in filler metal, extent of leaking of filler metal, gas blowout, amount of packing, and slag at tap hole.

b. Bar end location markers and filler metal shall be visible at each bar end and at filler hole.

c. Subject each end to maximum allowable void criteria recommended by manufacturer.

d. Splices that fail to pass visual examination shall be discarded and replaced, and not used as tensile strength samples.

3.2.4.3 Splice sleeves without filler metal

a. Mark bars with suitable marker to show depth of insertion into splice. After completion, use mark to check actual depth of insertion for compliance with manufacturer's recommendations. Insertion depth shall not vary from manufacturer's recommendations by more than 1/4 bar diameter.

b. Check assembly and swaging pressure for compliance with installation procedure described in manufacturer's instructions. Certification of calibration of gages used for registering press pressures is required.

c. Check length of each coupler after swaging for compliance with manufacturer's minimum final length requirements.

d. Replace coupler splices, rejected for not meeting visual quality acceptance standards, with new splices using new couplers.

3.2.5 Moving Reinforcing

3.2.5.1 Placing, or moving reinforcing after placement, to positions other than shown or specified, requires approval of KEH.

3.2.5.2 Bars may be moved to avoid interference with other reinforcing steel, conduits, or embedded items, but shall not impair design strength of members.

3.2.6 Protect reinforcing with concrete as shown, and in accordance with ACI 349, Paragraph 7.7.

3.2.7 Tolerances: In accordance with ACI 349, Paragraph 7.5.

3.2.8 Embedded Items: Accurately position and support waterstops and embedded items against displacement. Temporarily fill voids in sleeves, inserts, and anchor slots with readily removable material to prevent entry of concrete.

3.2.8.1 Waterstops: Locate waterstops in construction joints as shown on the Drawings. Make joints at intersections and ends of pieces with complete penetration butt splice welds. Bending plates at corners is allowable, except minimum inside radius shall be 1 inch.

3.2.8.2 Other embedded items: Place sleeves, inserts, anchors, and embedded items required for adjoining work or its support before placing concrete.

3.2.8.3 Waterstops and other embedded items shall be free of mud, oil, or other material to facilitate bonding to concrete.

3.2.9 Conveying and Placing Concrete

3.2.9.1 Before placing, obtain following.

- a. Approval of required submittals.
- b. Approval of formwork and reinforcement by KEH.

c. Obtain approval of "Pour Slip" by KEH. "Pour Slip" shall include project name, location of pour, concrete strength, slump, places for signoff by contractors having embedded items, estimated and actual cubic yards of concrete, date and time of placing concrete, pour slip number and signoff by Contractor with date. Contractor's signature shall indicate embedments are in place and concrete may be placed. Deliver completed pour slips to KEH upon completion of pour.

d. For each truck load, deliver "Trip Ticket" to KEH. "Trip Ticket" shall contain information listed in ASTM C 94, subparagraph 16.1.1 through 16.1.10, and include water/cement ratio, water temperature at plant, mixer discharge time, and Contractor's signature.

3.2.9.2 Conveying

a. Convey concrete from mixer to forms as rapidly as practicable by methods which will not cause segregation or loss of ingredients or interruption of continuous pour.

b. Clean conveying equipment before each run.

c. Remove and dispose of concrete which has segregated in conveying as directed by KEH.

3.2.9.3 Placing

a. Place no concrete after initial set, or when weather conditions prevent proper placement and consolidation. Placement in uncovered areas during precipitation or in water will not be permitted.

b. Deposit as nearly as practicable in final position in forms.

c. Deposit concrete as soon as practicable after forms and reinforcement have been examined and approved.

d. Forms shall be clean of dirt, construction debris, water, snow, and ice.

e. Maximum free vertical drop of concrete shall not exceed 4-1/2 feet. Chuting will be permitted only where concrete is deposited into hopper before placing in forms.

f. Deposit concrete in horizontal layers 12 to 20 inches deep in manner to preclude formation of cold joints between successive layers. Deposit by method to avoid displacing reinforcement and segregating aggregate.

g. Use telescoping drop chute to place concrete in walls and when vertical lift of forms exceeds 4 feet.

h. Work concrete about reinforcement and embedded fixtures and into corners and angles of forms. Avoid overworking which may result in segregation.

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i. Remove water accumulation on surface of concrete during placing by absorption with porous materials that prevent removal of cement.

j. Pumping concrete through aluminum pipe will not be permitted.

k. Concrete that has partially hardened before placing or been contaminated or remixed after initial set shall not be used.

3.2.9.4 Vibration

a. Compact with high frequency, internal mechanical vibrating equipment supplemented by hand spading and tamping. Vibrators shall be designed to operate with vibratory element submerged in concrete, and have minimum frequency of 6,000 impulses per minute when submerged.

b. Avoid vibrating forms and reinforcement unless authorized by KEH.

c. Do not transport concrete in forms with vibrators.

d. Discontinue vibrating when concrete has been compacted and ceases to decrease in volume.

e. When concrete is placed in layers, vibrator shall penetrate previously placed layer, to prevent formation of cold joints.

3.2.9.5 Weather conditions

a. Placing concrete in cold weather: Place in accordance with ACI 306.1 except as modified herein. Concrete shall not be placed when atmospheric temperature is less than 40 F except when authorized by KEH. When freezing temperatures are likely to occur within 24 hours heat concrete materials so temperature of concrete when deposited will be between 40 and 50 F. Do not heat mixing water above 140 F. Remove lumps of frozen material and ice from aggregates before placing in mixer. Do not use calcium chloride in concrete as accelerator. Remove concrete damaged by freezing and replace with new concrete.

b. Placing concrete in hot weather: Reduce temperature of concrete being placed to prevent rapid drying. Temperature of concrete placed shall not exceed 70 F. Shade fresh concrete as soon as possible after placing. Start curing as soon as surface of fresh concrete is sufficiently hard to prevent damage.

c. Control concrete placement temperatures by 1 or combination of the following.

1) Shade aggregates from sun and keep stockpiles moist by sprinkling with water to keep temperature of aggregate at or below 60 F.

2) Avoiding use of hot cement.

3) Add sufficient crushed ice, made from water meeting the requirements of subparagraph 2.1.2.3 to concrete mix, replacing equivalent amount of mix water to maintain required water/cement ratio, to reduce temperature of concrete mix at time of mixing.

4) Insulating water supply lines and tanks.

5) Insulating mixer drums, or cooling them with sprays or wet burlap coverings.

6) Working only at night.

7) Adding retarder or water reducing retarder in mix, if approved by KEH.

3.2.9.6 Pump concrete

a. If pumping of concrete from mixer to forms is used, deliver following certification, information and data at least 10 days before placement of concrete.

1) Name, type and capacity of proposed pump

2) Statement from manufacturer that pump will pump specified class of concrete without changes to approved mix proportions and slump.

3) Certified statement that concrete forms to receive pumped concrete have been designed to withstand concrete pressure in its plastic condition as result of proposed vertical placement rate and expected ambient temperatures during pumping.

b. Pumping concrete from mixer to forms may be permitted only if approved standby method of concrete placement, such as standby pump, is available at Site.

3.2.9.7 Control of heat of hydration and thermal gradients

a. Insulate grout vault and concrete basin forms, except construction joints, with at least 1 inch of polyurethane foam, or cover pit or provide equivalent means of reducing thermal gradients. Leave insulated forms in place for at least 14 days after completion of pour. Instead of polyurethane foam insulation remaining in place for 14 days, curing blankets with R value of at least 6 may be used to cover exterior of wall forms before concrete placement completion. Wall form removal and curing compound application may be done the fifth day after pour. Reinstall curing blankets as soon as possible, but no later than 4 hours after form removal. Curing blankets may be removed for short periods of time not exceeding 4 hours as construction practices necessitate. Curing blankets may be removed 14 days after pour.

b. Cover unformed portions of slab receiving troweled finish with insulating blankets or equivalent, having R value of 5.8 or greater, morning after finishing. Insulation shall remain for curing period specified in Article 3.4 except for short periods not exceeding 4 hours as construction practices necessitate.

3.2.10 Construction Joints: Make and locate joints shown on the Drawings in accordance with approved submittal.

3.2.10.1 Reinforcement: Continue reinforcing steel across joints. Provide keys as shown. Provide longitudinal keys at least 1-1/2 inches deep in joints in walls.

3.2.10.2 Surface preparation: Clean surface of concrete at joints and remove laitance.

3.2.10.3 Bonding: Bond construction joints and joints between new and existing concrete by 1 of following methods.

a. Use specified bonding agent.

b. Roughen surface of concrete to expose aggregate uniformly and not leave laitance, loosened particles of aggregate, or damaged concrete at surface.

c. Concrete retardant to delay concrete curing on joint surfaces may be used with approval by KEH.

3.2.11 Form Removal

3.2.11.1 Remove forms in manner to prevent damage to concrete. Remove forms after minimum periods following placement of concrete specified below, with approval of KEH.

a. Insulated forms: 14 days.

b. Uninsulated forms with curing blankets: 5 days.

3.2.11.2 If average ambient temperatures during curing are below 50 F, minimum time for removal of forms and shore, shall be 50 percent greater than specified.

3.2.11.3 Protect concrete work from damage during construction.

3.2.11.4 Place no concrete for subsequent wall lifts until supporting members have reached at least 70 percent of design strength.

3.2.12 Concrete Repair: Repair surface defects including tie holes, minor honeycombing and otherwise defective concrete with cement mortar of same composition used in concrete. Patch as soon as forms are removed.

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3.2.12.1 Thoroughly clean and cut out areas to be patched to solid concrete to depth of at least 1 inch. Edges of cut shall be perpendicular to surface of concrete.

3.2.12.2 Saturate area to be patched and at least 6 inches adjacent thereto with water before placing mortar. Mix mortar 1 hour before placing and remix occasionally during period with trowel and without addition of water. Brush grout of cement and water mixed to consistency of paint onto surfaces to which mortar is to be bonded. Compact mortar into place and screed slightly higher than surrounding surface.

3.2.12.3 Finish patches on exposed surfaces to match adjoining surfaces, after they have set for an hour or more. Cure patches as specified for concrete.

3.2.12.4 Fill holes extending through concrete by plunger type gun or other suitable device from exterior face. Wipe excess mortar off exposed face with cloth.

3.2.12.5 Protect finished surfaces from stains and abrasions.

3.2.12.6 Concrete with excessive honeycombing which exposes reinforcing steel or other defects which affect structural strength of member, will be rejected or defects corrected as directed by KII.

3.2.13 Concrete finishing: finish formed surfaces as soon as practicable after form removal and repair of surface defects. Chamfer exposed joints, edges, and corners 3/4 inch minimum, unless specified otherwise.

3.2.13.1 Rough form finish, exterior walls of concrete basin and grout vault: No selected form facing materials are required for rough form finish surfaces. Patch tie holes and defects. Chip or rub off fins exceeding 1/8 inch in height. Otherwise, leave surfaces with texture imparted by forms.

3.2.13.2 Smooth rubbed finishes, interior walls of concrete basin: Remove forms and complete patching as soon after placement as possible without jeopardizing structure. Produce finish on newly hardened concrete no later than day following form removal. Wet and rub surfaces with carborundum brick or other abrasive until uniform texture is produced. Use no cement grout other than cement paste drawn from concrete itself by rubbing process.

3.2.14 Placing and Screeding Concrete Slabs: Place, consolidate, and strike-off concrete of slump within specified limits to bring top surface of slab to proper contour, grade and elevation. Operation may be followed by darbying or full floating of surface with wooden, aluminum or magnesium tools to correct unevenness. Complete striking off and darbying before bleed water appears on surface of freshly-placed concrete. Perform no further work until concrete has attained set sufficient for floating and to support weight of finisher and equipment. If bleed water has not disappeared by time floating is to start, drag excess water off surface with rubber hose. Do not use dry cement to absorb bleed water.

3.2.14.1 Provide floated finish for grout vault slabs. Perform floating by hand with wood or magnesium float, or with power-driven float of suitable type. During floating, check surface with 10 foot straight edge applied at 2 different angles minimum. Cut down high spots and fill low spots to produce surface true to plane within 1/2 inch in 10 feet. Refloat slab to uniform sandy texture.

3.2.14.2 Provide troweled finish for concrete basin slabs. First give slabs floated finish as specified. Upon attaining proper set, power trowel and then hand trowel surfaces. First troweling after floating shall produce smooth surface relatively free of defects but may still show some trowel marks. Do additional trowelings with raised edge by hand after surface has hardened sufficiently to provide consolidated surface. Finished surface shall be free of troweled marks, uniform in texture and be true to plane 1/4 inch in 10 feet when checked with 10 foot straight edge placed anywhere on slab in any direction.

3.3 FIELD QUALITY CONTROL

3.3.1 Concrete Testing: Sampling and testing of concrete will be the responsibility of KEH. Concrete will be tested to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6, and 16.3.8.

3.3.1.1 Strength tests: Specified strengths and design mix will be verified by testing standard cylinders of samples taken at Site. 6 test specimens for laboratory curing and 3 for field curing for each 150 cubic yards of concrete, minimum 1 set each day, will be made in accordance with ASTM C 31.

a. Tests: Specimens will be tested for compressive strength in accordance with ASTM C 39 at 7, 28, and 90 days from time of molding on laboratory cured cylinders. Strength test results will be average strengths of 3 test specimens at 28 days, except if 1 specimen in set of 3 shows evidence, other than low strength, of improper sampling, molding, handling, or curing, remaining 2 specimens will be considered strength test result.

b. Test results: Evaluation of 28 day test results will be made in accordance with ACI 349, Paragraph 4.7.2.3.

3.3.1.2 Tests for consistency: Slump will be measured in accordance with ASTM C 143. Samples will be taken for slump determination from concrete during placing in forms. Tests will be made as follows.

a. At beginning of concrete placement operation and at subsequent intervals to ensure specified requirements are met.

b. Whenever test cylinders are made.

3.3.1.3 Yield tests will be made in accordance with ASTM C 138 as follows.

a. Whenever yield of concrete mix is challenged by KEH.

- b. Twice a day on concrete.
- c. Whenever materials or mix proportions are changed.

3.3.1.4 Temperature tests will be made as follows.

- a. In hot or cold weather conditions at frequent intervals until satisfactory control is established.
- b. Whenever test cylinders are made.

3.3.1.5 Contractor-furnished mix design: If evaluation of 28 day test results show concrete strength is below specified limits and does not meet other requirements make necessary adjustments, as directed by KEH.

3.3.2 At completion of concrete work, plant's coefficient of variation and standard deviation results for each class of concrete placed will be determined by KEH.

3.3.3 Waterstop Field Joint: Perform 100 percent visual examination of fit-up, root, and cover passes of steel waterstop welds. Acceptance criteria for welds shall be in accordance with AWS D1.1, paragraph 8.15.1. Document examination of fitup and cover pass on NDE/Weld Record Form KEH-433, sample appended, furnished by KEH.

3.3.3.1 Complete and document required NDE/Weld examination, and deliver to KEH before concrete placement.

3.3.4 Vault Testing

3.3.4.1 Hydrostatic

a. Fill vault with 33 feet of water, after application of interior protective coating specified in Section 09885, and before installation of exterior drainage path specified in Section 02753. Protect interior coating with splash pad during filling operation.

b. Test for 48 hours after water reaches specified depth.

c. Monitor vault wall exterior and leachate collection sump liner for leakage throughout test. Mark visible leaks and damp spots on exterior wall for reference.

d. Water drops forming on exterior vault walls or visible leakage is unacceptable and vault shall be repaired.

e. Maximum leakage rate collected in leachate collection sump liner: 0.10 gallons per day.

f. If precipitation occurs during test period, restart test after exterior walls have dried and rainwater collected in concrete basin and leachate collection sump has been removed.

1) Contractor may provide method to prevent precipitation from entering concrete basin and wetting exterior walls.

g. Vault repair

- 1) Repair concrete as specified in Paragraph 3.2.12.
- 2) Repair interior protective coating in accordance with Section 09885.
- 3) Repeat vault hydrostatic testing.

h. Remove water from vault immediately after hydrostatic testing and dispose of in accordance with Section 01500.

3.3.4.2 Air leakage

a. Perform test in accordance with ASTM E 779 after installation of precast roof specific in Section 03419, concrete topping shown on the Drawings, and sealing vault penetrations.

b. Air in leakage rate: Determined at test pressure differences between 0.05 and 0.5 inch water gage vacuum.

c. Maximum air leakage rate: 3000 cfm at 0.5 inch water gage vacuum.

d. Vault and roof repair

1) Repair concrete and concrete roof topping as specified in Paragraph 3.2.12.

2) Repeat air leakage test.

e. Document test results in accordance with Paragraph 3.3.5 with following minimum information.

1) Vault number.

2) Items required in ASTM E 779, Paragraphs 10.1.2, 10.1.3, and 10.1.4.

3.3.5 Documentation

3.3.5.1 Document test results and examinations required in this Section.

3.3.5.2 Documentation shall be kept current and is subject to review by KEH. Prepare and certify records as work progresses.

3.3.5.3 Deliver documentation to KEH within 7 working days after completion of tests.

3.4 CURING AND PROTECTION

3.4.1 General

3.4.1.1 Protect concrete from injurious action by sun, rain, flowing water, frost, and mechanical injury. Do not allow to dry out from time placed until expiration of minimum curing periods specified.

3.4.1.2 Cure by moist curing, or application of liquid chemical or liquid membrane-forming compound. Continue curing following removal of forms.

3.4.1.3 Maintain temperature of air next to concrete at 40 F minimum for full curing periods. When concrete is authorized for placement in temperatures below 40 F, maintain air in contact with concrete at temperature of at least 50 F for 7 days after placing, or at 70 F minimum for 3 days after placing, and at 40 F minimum for remainder of specified curing periods.

3.4.1.4 Heating concrete in place shall be by venter heaters, steam coils under canvas covers, or other suitable means. Temperature within enclosures shall not exceed 100 F, and adequate moisture shall be applied to concrete surface during heating period to prevent it from drying out.

3.4.1.5 Rate of cooling after protection period shall be approximately 1 F per hour for first 24 hours and 2 F per hour thereafter.

3.4.1.6 Protect concrete against freezing for full curing period specified.

3.4.2 Moist Curing: Moist or wet curing with water or by complete coverage with waterproof membrane sheets shall be continuous for 7 days at 60 F and above, and for longer periods at lower temperatures.

3.4.2.1 Mats: Cover entire surface of concrete slabs with 2 thicknesses of wet burlap weighing at least 7 ounces per square yard dry weight, cotton mats, or other suitable material having high absorptive quality. Thoroughly wet material when applied and keep continuously wet during time remaining on slab. Make mats of clean material free of substances which will have deleterious effects on concrete, and at least as long as width of concrete under construction. During application, do not drag mats over finished concrete slabs or mats already placed, and place to provide complete coverage of surface with slight overlap over adjacent mats. Leave mats in place during curing period.

3.4.2.2 Impervious sheeting curing

a. Thoroughly wet entire exposed surface with fine water spray and cover with 1 of the following.

- 1) Waterproofed paper.
- 2) Polyethylene-bonded waterproof paper sheeting.

3) Polyethylene-coated burlap sheeting.

4) Polyethylene sheeting.

b. Lay sheets directly on concrete surface and overlap 12 inches when continuous sheet is not used. Curing medium shall be at least 18 inches wider than concrete surface to be cured, and be weighted down by placing bank of moist earth on edges just outside forms and over transverse laps to form closed joints. Repair or replace sheets if torn or otherwise damaged during curing. Curing medium shall remain on concrete surface for at least 7 days.

3.4.3 Liquid Membrane-Forming Compound Curing: Apply clear liquid compound, free of paraffin or petroleum, over concrete surface to restrict evaporation of mixing water. Cure for 7 days following placing of liquid membrane-forming compound.

3.4.3.1 Application of curing compound: Apply after surface loses water sheen and has dull appearance. Agitate curing compound by mechanical means during use and apply uniformly in 2 coat continuous operation by suitable power spraying equipment. Total coverage for 2 coats shall be between 150 and 200 square feet per gallon of undiluted compound. Compound shall form uniform, continuous, coherent film that will not check, crack, or peel and be free of pinholes or other imperfections. Apply additional coat of compound to areas where film is defective. Keep suitable covering, other than liquid curing compound, readily available for use to protect freshly placed concrete in event conditions occur which prevent correct application of compound at proper time. Respray concrete surfaces that are subject to heavy rainfall within 3 hours after curing compound has been applied as specified.

3.4.3.2 Protection of treated surfaces: Keep treated surfaces free from foot and vehicular traffic and other sources of abrasion for at least 72 hours. Maintain continuity of coating for entire curing period and repair damage.

3.4.3.3 Liquid chemical compound curing may be provided instead of liquid membrane-forming compound curing. Apply as specified for liquid membrane-forming compound curing except coverage and number of applications shall be in accordance with manufacturer's recommendations.

3.4.4 Additional Curing Periods: When 7 day compression test cylinders, representative of parts of structure already placed, indicate that 28 day strengths may be less than 90 percent of design strengths, give those parts of structure additional curing, as directed by KEH. Curing shall be as follows.

<u>Time (Min.)</u>	<u>Concrete Element</u>
14 days	Concrete basin slabs and walls.
14 days	Grout vault slabs and walls.
* 14 days	Construction joints (* or until adjacent concrete is placed).

3.5 CLEANING

3.5.1 Clean basin slabs with ordinary brooms or other suitable method. Keep clean and free of debris and dirt until concrete basin liner is in place.

3.5.2 Clean grout vault floor by sweeping with ordinary brooms or other suitable method.

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NDE/WELD RECORD

1. Project/W.O. No.

2. Weld Identification Dwgs.

3. Contractor

4. WELD INFORMATION	5. VISUAL EXAMINATION			6. LIQUID PEN. / MAG. PART.	7. RADIO. LEAK TEST	9. Other:
	Fr up	Root Pass	Cover Pass			
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						

END OF SECTION

SECTION 03419

PRECAST PRESTRESSED CONCRETE SECTIONS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Association of State Highway and Transportation Officials (AASHTO)

1983 Standard Specification for Highway Bridges, 13th Edition

1.1.1.2 American Concrete Institute (ACI)

ACI 318-83 (Revised 1986) Building Code Requirements for Reinforced Concrete

1.1.1.3 American Society for Testing and Materials (ASTM)

A 36 87 Standard Specification for Structural Steel

A 53-87b Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A 185-85 Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

A 416-87a Standard Specification for Uncoated Seven-Wire Stress-Relieved Strand for Prestressed Concrete

A 615-87 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

C 33-86 Standard Specification for Concrete Aggregates

C 150-86 Standard Specification for Portland Cement

C 260-86 Standard Specification for
Air-Entraining Admixtures for
Concrete

C 494-86 Standard Specification for
Chemical Admixtures for Concrete

1.1.1.4 American Welding Society (AWS)

AWS D1.1-88 Structural Welding Code-Steel

AWS D1.4-79 Structural Welding Code-
Reinforcing Steel

1.1.1.5 Federal Specifications (FS)

WW-U-531F Unions, Pipe, Steel Or Malleable
Iron; Threaded Connection, 150 lb
And 250 lb

1.1.1.6 Prestressed Concrete Institute (PCI)

MNI -116-85 Manual for Quality Control for
Plants and Production of Precast
Prestressed Concrete Products

1.1.1.7 Washington Industrial Safety and Health Act (WISHA)

Washington Administrative Code (WAC)

Title 296, Labor and Industries
Chapter 296-155 WAC, Safety Standards for Construction Work

Part F Material Handling, Storage, Use,
and Disposal

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Fabricator Drawings: Prepare and submit complete drawings and design calculations for prestressing and erection methods, materials and equipment. Drawings shall show plan, elevations and sections of units, and methods and sequence of stressing, including specifications and details of prestressing steel and anchoring devices, anchoring stresses, type of enclosure, arrangement of prestressing steel, erection procedures, location of lifting points for handling, method of transportation, details of lifting devices, and details of penetrations.

1.2.2 Records of Tests: Maintain and submit records of tests performed to determine properties of materials used in concrete.

1.2.3 Concrete Materials and Mix Design: Submit concrete materials and mix design established in accordance with ACI 318, Chapter 4. Define each material used in concrete and state amount, by weight, utilized per cubic yard of plastic mix.

1.2.4 Certification: Submit certification of proof-testing lifting devices in accordance with WISHA.

1.2.5 Certification of Prestressed Concrete Production Facilities: Submit current legible copy of certification by Prestressed Concrete Institute.

1.2.6 Manufacturer's Quality Assurance Plan: Submit quality assurance plan for Project that addresses requirements of Section 01400.

1.3 DESIGN REQUIREMENTS

1.3.1 Design sections in accordance with ACI 318.

1.3.2 Design Calculations: Prepared by registered engineer experienced in precast, prestressed concrete design. Calculations shall include estimated camber.

1.3.3 Loadings for Design.

1.3.3.1 Soil overburden: 500 psf.

1.3.3.2 Surcharge: 300 psf.

1.3.3.3 Dead loads including member weight and concrete topping varying in thickness from 2 inches at plank ends to 8 inches, at center of span.

1.3.3.4 Thermal loading: During operation, temperature gradient will exist between top and bottom of members as follows.

a. Bottom temperature: 105 F.

b. Top temperature: 70 F.

1.3.3.5 Other loads specified on the Drawings.

1.3.4 Sections shall be able to withstand torsional, impact and point loads generated by handling from place of casting to and including installation.

1.3.5 Design and fabricate lifting devices meeting the requirements of WISHA, of malleable steel formed so considerable deformation, easily discernable to eye, is required before failure.

1.4 QUALITY ASSURANCE

1.4.1 Testing

1.4.1.1 Fabrication of precast prestressed concrete sections shall include testing in accordance with PCI MNL-116, Section 6.1.

1.4.1.2 Inspection and test records shall be in accordance with PCI MNL-116, Section 1.2, 6.1, and 6.2. Deliver to KEH upon request.

1.4.2 Personnel and procedures for welding shall have been qualified in accordance with AWS D1.1 and D1.4 before welding.

1.4.3 Deliver 2 copies of welding procedure specifications, procedure qualification records, and welder information qualification test results to KEH 5 days before welding. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Deliver, store and handle members in accordance with PCI MNL-116, Sections 5.1.7 and 5.1.8.

1.5.2 Lift members only at lifting points shown on fabricator drawings, using approved lifting devices. Lifting devices shall have minimum safety factor of 5.

1.5.3 Support members during manufacture, stockpiling, transporting and installing only at support points shown on fabricator drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Each aggregate, cement, water and admixture shall be capable of producing consistent quality within quantity of materials required for project. Aggregates, cement and admixtures shall have been produced by same manufacturer and, when quantity required is less than one batch or mix, be from same batch or mix.

2.1.2 Aggregates: Meet the requirements of ASTM C 33.

2.1.3 Portland Cement: ASTM C 150, type or modified type compatible with aggregates, water and admixtures.

2.1.4 Water: Potable and free of foreign materials in amounts harmful to concrete and embedded steel.

2.1.5 Admixtures

2.1.5.1 Air-entraining agents: Meeting the requirements of ASTM C 260.

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2.1.5.2 Water reducing agents: Meeting the requirements of ASTM C 494, Type "A."

2.1.6 Stressing Steel: 7 wire stress-relieved steel strand units meeting the requirements of ASTM A 416, Grade 250 or 270.

2.1.7 Reinforcing Steel

2.1.7.1 Steel bars: ASTM A 615, deformed, Grade 60.

2.1.7.2 Welded wire fabric: ASTM A 185.

2.1.7.3 Tie wire: Black annealed steel, 16 gage minimum.

2.1.8 Anchors and Inserts

2.1.8.1 Anchors and inserts: Structural steel, ASTM A 36 with manufacturer's standard shop prime finish.

2.1.8.2 Pipe inserts: Carbon steel meeting the requirements of ASTM A 53. Malleable iron pipe caps, threaded, in accordance with FS WW-U-531.

2.1.9 Grout

2.1.9.1 Cement grout: Portland cement, sand and water sufficient for placement and hydration. Minimum strength, 3000 psi at 28 days.

2.1.9.2 Nonshrink grout: See Section 03300.

2.1.10 Elastomeric Bearing Pads: Meeting the requirements of AASHTO "Standard Specification for Highway Bridges," Division 1, Section 25.

2.2 MIXES

2.2.1 Design each concrete mixture using data obtained from tests in Article 1.4.

2.2.1.1 Minimum allowable compressive strength: 6000 psi at 28 days.

2.2.1.2 Minimum release strength: 4500 nsi.

2.2.2 Concrete may contain air-entraining agent.

2.2.3 Use of calcium chloride, chloride ions, or other salts will not be permitted.

PART 3 - EXECUTION

3.1 FARRICATION

3.1.1 Fabrication of sections shall be by PCI certified fabricator.

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3.1.2 Fabrication Procedures: In accordance with PCI MNL-116.

3.1.3 Fabrication Tolerances: Meet the requirements of PCI MNL-116.

3.1.4 Finishes

3.1.4.1 Finishes for completed units shall be in accordance with PCI MNL-116, Section 3.5.

3.1.4.2 Finishing of formed surfaces shall be from casting against approved, properly cleaned forms using industry practice in placing and curing.

3.1.4.3 Strands on end surfaces shall be recessed and ends of members shall receive sack finish.

3.2 INSTALLATION

3.2.1 Install members by competent erector. Lift members in accordance with Paragraph 1.5.2.

3.2.2 Align and level members as shown on approved fabricator drawings.

3.2.3 Variation between adjacent members shall be reasonably leveled out by jacking or other feasible method acceptable to KEH.

3.3 FIELD QUALITY CONTROL

3.3.1 Sampling and testing will be the responsibility of precast fabricator.

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Society of Mechanical Engineers (ASME)

1986 Edition, w/Addenda
through Dec 1988

ASME Boiler and Pressure Vessel
Code

Section IX

Qualification Standard for
Welding and Brazing Procedures,
Welders, Brazers, and Welding
and Brazing Operators

1.1.1.2 American Society for Testing and Materials (ASTM)

A 36-87

Standard Specification for
Structural Steel

A 106-87a

Standard Specification for
Seamless Carbon Steel Pipe for
High-Temperature Service

A 500-84

Standard Specification for
Cold-Formed Welded and Seamless
Carbon Steel Structural Tubing
in Rounds and Shapes

A 569-85

Standard Specification for
Steel, Carbon (0.15 Maximum,
Percent), Hot-Rolled Sheet and
Strip, Commercial Quality

1.1.1.3 American Welding Society (AWS)

AWS D1.1-88

Structural Welding Code - Steel

AWS D1.3-81

Structural Welding Code - Sheet
Steel

1.1.1.4 Steel Structures Painting Council (SSPC)

SSPC-SP 3-82

No. 3 Power Tool Cleaning

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Fabricator Drawings: Submit drawings and bill of materials for waterstops. Include plans, elevations, details, sections and connections. Show thickness, type, grade, class of metal, and accessory items where applicable.

1.2.2 Certified Material Test Reports (CMTR): Submit legible reports, certified by responsible manufacturer, showing chemical analysis and physical properties of material used for waterstops. Submit separate reports for each lot of steel furnished by each supplier.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Welding Personnel and Procedures

1.3.1.1 Personnel and procedures for welding structural steel shall have been qualified in accordance with AWS D1.1 before welding. Qualification in accordance with ASME Section IX may be substituted for this requirement.

1.3.1.2 Deliver 2 copies of welding procedure specifications, procedure qualification records, and welder performance qualification test results to KEH 5 days before welding. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Deliver metal fabrications to project at time convenient for installation. If exposed to inclement weather, protect fabrications with paper, plastic or other weatherproof covering and store off ground.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Waterstop: 6 inch wide by 1/4 thick continuous steel plate; ASTM A 36.

2.1.2 Rolled Steel Shapes and Plates: ASTM A 36.

2.1.3 Sheet Steel: ASTM A 569.

2.1.4 Steel Pipe: ASTM A 106, Grade B.

2.1.5 Steel Tubing: ASTM A 500, Grade B.

2.1.6 Weld Studs: Nelson Stud Welding Company Type H4L.

2.2 FABRICATION

2.2.1 General

2.2.1.1 Verify measurements and take field measurements necessary before fabrication. Provide miscellaneous supports and braces necessary for completion of metal fabrications.

2.2.1.2 Workmanship: Form metal fabrications to shape and size, with sharp lines, angles, and true curves.

2.2.1.3 Perform welding in accordance with AWS D1.1, Section 8, using E70XX electrodes and complete penetration welds.

2.2.1.4 Weld and examine sheet steel in accordance with AWS D1.3

2.2.2 Waterstop: Steel free of mud, oil, or other material to facilitate bonding to concrete.

2.2.2.1 Make splices by buttwelding ends of plates together.

2.2.2.2 Bending of plates at corners is allowable, except minimum inside radius shall be 1 inch.

2.2.3 Finishes

2.2.3.1 Do not coat members to be embedded in concrete, or surfaces and edges to be field welded.

2.2.3.2 Remove weld spatter, flux, slag, and other deleterious matter in accordance with SSPC-SP 3.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Install metal fabrications plumb, level or as shown on the Drawings.

3.1.2 Make field connections as neatly as possible with joints flush and smooth.

END OF SECTION

SECTION 09805
SPECIAL PROTECTIVE COATING

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 Steel Structures Painting Council (SSPC)

SSPC-SP 6-85

No. 5 White Metal Blast Cleaning

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 List of Materials: Submit complete list of materials, colors and location to be used, to substantiate compliance with the Drawings and this Section. List shall enumerate percentage of volatile and nonvolatile materials and percentage of component parts of each type of material.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Deliver materials to site in manufacturer's unopened containers with labels intact. Do not open containers or remove labels until after inspection and acceptance by KEH.

1.3.2 Store materials in accordance with manufacturer's recommendations and in well ventilated area not exposed to excessive heat, sparks, flame or direct rays of sun.

1.4 PROJECT CONDITIONS

1.4.1 Environment for Coating: Coat exterior surfaces only when ambient and surface temperatures are between 35 F and 120 F, and temperature is 5 F above dewpoint.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Coating materials are products of Protective Coatings Division of Ameron, Brea, California unless otherwise specified.

2.1.2 Filler: Nu-Klad 114.

2.1.3 Primers

2.1.3.1 Dimetcote Steel Primer 205.

- 2.1.3.2 Amercoat 71.
- 2.1.3.3 Amercoat 187.
- 2.1.4 Finish Coatings
 - 2.1.4.1 Amercoat 33.
 - 2.1.4.2 Amercoat 78HB.
 - 2.1.4.3 Amercoat 234.
- 2.1.5 Colors
 - 2.1.5.1 Finish coat: White.
 - 2.1.5.2 Symbols and flow diagrams: Black letters on yellow background, except as shown on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into acceptable condition through preparatory work included in Article 3.2.

3.1.2 Report in writing to KEH conditions that may potentially affect proper application of finish. Do not commence surface preparation or coating application until defects have been corrected and conditions are made suitable.

3.2 PREPARATION

3.2.1 General: Before application, sweep and dust space or area to receive coating.

3.2.2 Pre-Priming

3.2.2.1 Prepare ferrous metals in accordance with SSPC-SP 5, remove abrasive residue and dust, and prime within 4 hours after preparation.

3.2.2.2 Clean concrete surfaces of laitance, oil, stains dust and other foreign material.

a. Where laitance has not been removed, treat concrete with uniform application of 1 of following solutions.

- 1) 1 part 10 percent solution muriatic acid and 3 parts water.

2) 5 percent solution of trisodium phosphate.

b. When solution ceases to foam, rinse thoroughly with clean water and scrub with stiff bristle brush. Allow treated area to thoroughly dry. Scratches, cracks, holes and abrasions shall be cut back to proper key and filled with Nu-Klad 114.

c. Allow concrete to cure 30 days before coating is applied, except coating may be applied after concrete has cured 21 days if moisture content of concrete is less than 12 percent.

3.2.3 Post Priming

3.2.3.1 Feather abrasions, chips, skips and holidays occurring in prime coat by sanding and recoat with material and color to minimum dry film thickness specified.

3.2.3.2 Previously coated surfaces shall be recoated only after existing film is completely dry.

3.2.3.3 Protect coating from rain until dry to touch.

3.2.4 Protection

3.2.4.1 Provide and install drop cloths, shields and other protective devices required to protect surfaces adjacent to areas being coated. Keep spatter, smears, droppings and over-run of coating materials to minimum and remove as coating work progresses.

3.2.4.2 Remove and store electrical fixtures, outlets and switch plates, mechanical diffusers, escutcheons, surface hardware, fittings and fastenings before starting work. Clean and reinstall upon completion of work in each area. Use no solvent or abrasives to clean hardware that will remove lacquer finish normally used on some items.

3.3 APPLICATION

3.3.1 Apply coating materials in accordance with manufacturer's recommendations.

3.3.2 Apply with equipment recommended by manufacturer.

3.3.3 Identify each coat of opaque material by its relation to color of finish coat. Prime coat shall be darkest tint of specified color with each succeeding coat lighter, up to finish coat, which shall be color, tint and sheen specified. Tints of identical coats of identical color and material shall not vary.

3.4 FIELD QUALITY CONTROL

3.4.1 Inspection: KFH will perform tests to ascertain that coating materials have been applied in accordance with this Section.

3.5 CLEANING

3.5.1 Furnish and maintain at site, closed metal containers for disposal of waste materials. Place materials spotted or soaked with paint, oil or solvents in containers.

3.5.2 Brushes, rollers, spatulas and spray equipment shall be thoroughly cleaned after each use and shall contain no oils, thinners or other residue after such cleaning.

3.5.3 Remove empty cans from site at end of each shift.

3.5.4 At completion of coating work, remove materials, containers, rags, cloths, brushes, and other equipment from site. Clean up spills.

3.6 COATING SCHEDULE

		Minimum Wet Film Thickness and Percent- age of Film Forming <u>Solids per Volume</u>	Minimum Dry Film <u>Thickness</u>
3.6.1	Concrete and Masonry		
	Prime: Amercoat 187	4.5 mils & 22.0%	1.0 mil
	Second: Amercoat 33	6.4 mils & 23.46%	1.5 mils
	Finish: Amercoat 33	6.4 mils & 23.46%	1.5 mils
3.6.2	Ferrous Metals		
	Prime: Dimetcote Steel Primer 205	1.4 mils & 35%	0.50 mil
	Second: Amercoat 187	4.5 mils & 22.0%	1.0 mil
	Third: Amercoat 33	6.4 mils & 23.46%	1.5 mils
	Fourth: Amercoat 33	6.4 mils & 23.46%	1.5 mils
	OR		
	Third: Amercoat 234	10 mils & 25%	2.5 mils
	Fourth: Amercoat 234	10 mils & 25%	2.5 mils
3.6.3	Carbon Steel		
	Prime: Amercoat 71	4.3 mils & 47%	2.0 mils
	Second: Amercoat 78HB	20.5 mils & 78%	16.0 mils

END OF SECTION

SECTION 09885

PROTECTIVE COATING FOR CONCRETE VAULT INTERIOR

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 List of Materials: Submit complete list of materials. List shall enumerate percentage of volatile and nonvolatile materials and percentage of component parts of each type of material.

1.2.2 Certified Material Test Reports (CMTR): Submit materials test reports, certified by manufacturer of protective coating, which identify components and show chemical analysis and physical properties for each lot number used.

1.2.3 Samples: Submit 1 gallon sample of coating material to be used on Project, for independent testing and comparison with CMTRs.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Substrate Preparer: Provide evidence of previous successful concrete substrate preparation for coating applications.

1.3.2 Qualification of Applicator: Provide evidence of previous successful sprayed-on asphalt coating applications.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Deliver materials to site in manufacturer's unopened containers with labels intact. Do not open containers or remove labels until after inspection and acceptance by KEH.

1.4.2 Store materials in accordance with manufacturer's recommendations and in well ventilated area not exposed to excessive heat, sparks, flame or direct rays of sun.

1.5 PROJECT CONDITIONS

1.5.1 Environment for Coating

1.5.1.1 Preferred ambient and surface temperatures: 60 F or above and rising.

1.5.1.2 Minimum ambient and surface temperatures: 40 F and rising.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Coating materials are products of Protective Coatings Department of Lion Oil Company, El Dorado, Arkansas. No substitutes allowed.

2.1.1.1 Primer: Nokorode 705M thinned at ratio of 1 to 1 with naptha or mineral spirits.

2.1.1.2 Finish Coating: Nokorode 705M.

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Examine surfaces scheduled to receive coating for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into acceptable condition through preparatory work included in Article 3.2.

3.1.2 Report in writing to KEH conditions that may potentially affect proper application of finish. Do not commence surface preparation or coating application until defects have been corrected and conditions are made suitable.

3.2 PREPARATION

3.2.1 General

3.2.1.1 Allow concrete to cure 21 days minimum before preparing surface.

3.2.1.2 Before application, sweep and dust space or area to receive coating.

3.2.2 Pre-Priming

3.2.2.1 Clean concrete surfaces of laitance, oil, stains, dust and other foreign material.

3.2.2.2 Prepare concrete by removing surface until dry, clean, contaminant-free, sound, open pore, exposed-aggregate concrete is obtained by using 1 of the following methods. Remove spalled concrete.

- a. Scabbling machine: Hammer type.
- b. Steel shot, for horizontal surfaces only: Wheelabrator-Frye Blastrac type. Ensure no shot remains.
- c. Sandblasting.

d. Very high pressure water/sandblasting: Use clean, fresh water and dry blasting silica, maximum particle passing 16 mesh screen, at pressure sufficient to achieve specified surface.

e. Ultra high pressure waterblasting: Use clean fresh water at highest pressure necessary to achieve specified surface.

3.2.2.3 Remove dust and debris from concrete pores with clean, dry, oil-free compressed air or adequately powered, heavy duty industrial vacuum.

3.2.2.4 Thoroughly dry surface before applying primer.

3.2.3 Post Priming

3.2.3.1 Feather abrasions, chips, skips and holidays occurring in prime coat by sanding and recoat.

3.2.3.2 Previously coated surfaces shall be recoated only after existing film is completely dry.

3.2.3.3 Protect coating from rain until dry to touch.

3.2.4 Protection: Provide and install drop cloths, shields and other protective devices required to protect surfaces adjacent to areas being coated. Keep spatter, smears, droppings and over-run of coating materials to minimum and remove as coating work progresses.

3.3 APPLICATION

3.3.1 Do not apply materials when excessive wind, blowing dust, or rain is imminent.

3.3.2 Minimum Temperature of Coating Material: 70 F.

3.3.3 Spray apply coating materials in accordance with Article 3.6 and manufacturer's recommendations.

3.3.3.1 Apply second coat 5 to 60 minutes after primer.

3.3.3.2 Do not allow second coat to cure beyond elastomeric set before applying finish coat.

3.3.3.3 On vertical surfaces, apply finish coat perpendicular to second coat.

3.3.3.4 Allow finish coat to cure dry to touch before repairing.

3.3.3.5 Protect coated surfaces from dust and other foreign materials while curing.

3.3.3.6 Protect coating from sunlight until roof is installed.

3.3.4 Apply with equipment recommended by manufacturer.

3.3.5 Repair: Scratch area with wire brush before application of additional coats.

3.4 FIELD QUALITY CONTROL

3.4.1 Testing: After coating has cured, test for pinholes. Results shall be less than 1 pinhole per square yard.

3.4.2 Inspection: KEH will perform tests to ascertain that coating materials have been applied in accordance with this Section.

3.5 CLEANING

3.5.1 Furnish and maintain at site, closed metal containers for disposal of waste materials. Place materials spotted or soaked with paint, oil or solvents in containers.

3.5.2 Spray equipment shall be thoroughly cleaned after each use and shall contain no oils, thinners or other residue after such cleaning.

3.5.3 Remove empty cans from site at end of each shift.

3.5.4 At completion of coating work, remove materials, containers, rags, cloths, brushes, and other equipment from site. Clean up spills.

3.6 COATING SCHEDULE

		Approximate Rate	Min Wet Film Thickness	Min Dry Film Thickness
3.6.1	Concrete			
	a. Vertical surfaces			
	Prime: Nokorode 705M, thinned	0.5-0.75 gal/ 100 ft ²	Uniform Cover	
	Second: Nokorode 705M	2.0 gal/ 100 ft ²	30 mils	26 mils
	Finish: Nokorode 705M	2.0 gal/ 100 ft ²	30 mils	26 mils

<u>Approximate Rate</u>	<u>Min Wet Film Thickness</u>	<u>Min Dry Film Thickness</u>
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b. Horizontal surfaces

Prime: Nokorode 705M, thinned	0.5-0.75 gal/ 100 ft ²	Uniform Cover	
Finish: Nokorode 705M	4.0 gal/ 100 ft ²	60 mils	52 mils

END OF SECTION

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SECTION 13440

INSTRUMENTATION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

ANSI MC96.1-1982	American National Standards for Temperature Measurement Thermocouples
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1.1.1.2 National Electrical Manufacturers Association (NEMA)

Standards Publication/ No. ICS 6-1983 w/Rev through Nov 1986	Enclosures for Industrial Controls and Systems
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1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Approval Data: Submit information listed in Column 5 of Vendor Data List in this Section.

1.2.2 Certified Vendor Information (CVI): Submit information listed in Column 6 of Vendor Data List in this Section.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery field mounted equipment assemblies completely assembled, except as noted.

1.3.1.1 Thermocouple assemblies: Package with padding material and place inside pipe with cap on end. Junction box shall have door secured and be well padded, then wrapped with packaging tape. Assemblies shall then be secured to shipping pallets.

1.3.1.2 Level element assemblies: Well padded and placed in separate wooden boxes for shipment.

1.3.1.3 Cable assemblies: Individually tied and placed in padded wooden crate for shipment.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Electrical Connecting Cables: Assembled from cable and connectors specified on Data Sheet Y-101.

2.1.2 Other materials required to complete instrumentation installation are specified in Section 15493, Section 16400 and on the Drawings.

2.2 EQUIPMENT

2.2.1 Instruments: In accordance with data sheets in this Section.

2.2.1.1 Identification: Attach nameplates, in readily visible locations, with manufacturer's name, model number, name of item, and serial number.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Install instruments, materials, and equipment in accordance with the Drawings, manufacturers' instructions, and Section 16400.

3.2 FIELD QUALITY CONTROL

3.2.1 Test cable assemblies for continuity and unintentional grounds. Resistance shall not exceed 1 ohm on continuity checks. Deliver test results to KEH upon completion of tests.

LEVEL INSTRUMENTS, CAPACITANCE TYPE
LEACHATE SUMP 218-E-16-102 & 218-E-16-103

GENERAL

- | | |
|--------------------------|-----------------------------|
| 1. Tag Number | (See Note 1, Page 3 of 3) |
| 2. Service | Leachate solution |
| 3. Vessel Identification | Vault leachate sump |
| 4. Application | Sump level |
| 5. Function | Indicate and transmit level |

PROBE

- | | |
|------------------------|--|
| 6. Type | Flexible insulated cable attached to weatherproof probe head |
| 7. Orientation | Vertical |
| 8. Material | Heavy-duty stainless steel cable with polypropylene insulation |
| 9. Weight | Stainless steel, 2-1/2 inches diameter, 3 inches long |
| 10. Insertion Length | 56'-10-1/2" (including attached weight) |
| 11. Inactive Length | 40'-7-1/2" |
| 12. Active Length | 16 feet |
| 13. Signal Connection | Quick-disconnect connector |
| 14. Process Connection | 3 inch, 150 pound, RF, 304 SST flange |

TRANSMITTER

- | | |
|---------------------------|---|
| 15. Enclosure | NEMA 4 steel box, surface mount |
| 16. Power | 115V ac, 60 Hz |
| 17. Output | 4-20 mA dc |
| 18. Indicator | 3-1/2 Digit meter, mounted in transmitter |
| 19. Range | 0 - 16 feet |
| 20. Conduit Connection | 3/4 inch |
| 21. Probe Head Connection | Quick-disconnect connector |

LEVEL INSTRUMENTS, CAPACITANCE TYPE (Cont)

LEACHATE SUMP 218-E-16-102 & 218-E-16-103

ACCESSORIES

- | | | |
|-----|--------------------|---|
| 22. | Compensation Cable | 100 feet long with quick-disconnect connectors on both ends |
| 23. | Flanges | Probe head mounted on 3 inch, 150 pound, RF, 304 stainless steel flange |
| 24. | Power Supply | 24V dc, mounted in transmitter by manufacturer |
| 25. | Connectors | Quick-disconnect connector at both ends of compensation cable |

SERVICE

- | | | |
|-----|---------------------------|--|
| 26. | Fluid | Leachate solution (pH 12+) |
| 27. | Conductivity | 70+ Micromho/cm |
| 28. | Pressure | Atmosphere |
| 29. | Temperature (probe) | Maximum 200 F; normal 35-100 F |
| 30. | Temperature (transmitter) | -20 to 120 F |
| 31. | Suggested Manufacturer | Drexelbrook Engineering Co, Inc |
| 32. | Model Numbers | System, 508-25-8; quick-disconnect connectors on 100 foot general purpose cable, 380-100-12 with Drexelbrook Std environmental mental rated quick-disconnect connector set at transmitter - 1 connector or pigtail with "Liquid-Tite" strain relief at transmitter housing with quick-disconnect pair at sensing element; probe weight, 752-297-4; |

LEVEL INSTRUMENTS, CAPACITANCE TYPE (Cont)
LEACHATE SUMP 218-E-16-102 & 218-E-16-103

32. Model Numbers (Continued)

digital meter, 370-3000-1;
power supply, 401-13-21.
Instrumentation system shall
have minimum service life of
10 years under normal use and
maintenance.

NOTES: 1. Tag Numbers:

<u>Element</u>	<u>Transmitter</u>
LE-LS-102-1A	LIT-LS-102-1A
LE-LS-102-1B	LIT-LS-102-1B
LE-LS-103-1A	LIT-LS-103-1A
LE-LS-103-1B	LIT-LS-103-1B

THERMOCOUPLE ASSEMBLIES

VAULT LOCATED

1. Tag Numbers	(See Note 1)
2. Type	Type K, 16 point
3. Protection Tube	1 inch Schedule 40S 304 stainless steel pipe
4. Length	(See Note 2)
5. Thermocouple Spacing	(See Note 2)
6. Service	Grouted radioactive waste (pH 12+)
7. Temperature	35 to 200 F
8. Wire Size	Manufacturer's standard
9. Junction	Ungrounded
10. Insulation Material	Mineral Oxide
11. Test Resistance	100 Mohm minimum, TC to sheath and TC to TC
12. Accuracy	ANSI MC96.1
13. Lead Termination	Terminal strips in NEMA 4 junction box suitable for direct burial (See Note 2)
14. Conduit Connection	1-1/2 inches, bottom of junction box
15. Lag Extension	(See Note 2)
16. Special Feature	Protection tube to be factory sealed to junction box (See Note 2)
17. Suggested Manufacturer	Thermo-Couple Products Co, Inc. Sales Aid No. 126

NOTES: 1. Tag Numbers:	TE-102-1	TE-103-1
	TE-102-2	TE-103-2
	TE-102-3	TE-103-3
	TE-102-4	TE-103-4

2. See Drawings.

3. Instrumentation system shall have minimum service life of 10 years under normal use and maintenance.

SECTION 15493

CHEMICAL PROCESS PIPING SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Referenced Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

ANSI B16.9-1986	American National Standard Factory-Made Wrought Steel Buttwelding Fittings
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ANSI B31.3 - 1987 Edition, w/Addenda ANSI B31.3a and B31.3b	American National Standard Code for Pressure Piping--Chemical Plant and Petroleum Refinery Piping
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1.1.1.2 American Society of Mechanical Engineers (ASME)

1986 Edition, w/Addenda through Dec 1988	ASME Boiler and Pressure Vessel Code
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Section II	Material Specifications
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Section IX	Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
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1.1.1.3 American Society for Nondestructive Testing (ASNT)

Recommended Practice No. SNT-TC-1A (1984 Edition)	Personnel Qualification and Certification in Nondestructive Testing
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1.1.1.4 American Society for Testing and Materials (ASTM)

A 153-87a	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
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A 234-87	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moder- ate and Elevated Temperatures
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A 307-86a	Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
A 563-84	Standard Specification for Carbon and Alloy Steel Nuts
C 518-85	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
D 1621-73 (1979)	Standard Test Method for Compressive Properties of Rigid Cellular Plastics
D 1622-83	Standard Test Method for Apparent Density of Rigid Cellular Plastics
D 1623-78	Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
D 2842-69 (1975)	Standard Test Method for Water Absorption of Rigid Cellular Plastics
D 2856-87	Standard Test Method for Open Cell Content of Rigid Cellular Plastics by the Air Pycnometer
1.1.1.5	American Welding Society (AWS)
AWS QC1-86	Standard for Qualification and Certification of Welding Inspectors
1.1.1.6	American Water Works Association (AWWA)
C203-86	AWWA Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - -Hot-Applied
1.1.1.7	Pipe Fabrication Institute (PFI)
ES-24 (April 1985)	Pipe Bending Tolerances - -Minimum Bending Radii - -Minimum Tangents

1.1.1.8 Steel Structures Painting Council (SSPC)

SSPC-SP 3-82

No. 3 Power Tool Cleaning

SSPC-SP 6-85

No. 6 Commercial Blast Cleaning

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Certified Material Test Reports (CMTR): Submit legible reports, certified by responsible manufacturer of materials used in fabrication of pipe, fittings and flanges for pipe code and services noted below. Reports shall present results of chemical analysis and physical tests specified in ASTM Standards of production lots and heats of materials. Submit separate reports for following.

1.2.1.1 Pipe Code M-25: Service; Grout, and Excess Water.

1.2.1.2 Pipe Code M-26a: Service; Grout Encasement, Excess Water Encasement, and Encasement Drains.

1.2.2 Certificate of Conformance: Submit legible certificate stating that polyurethane insulation materials furnished meet requirements of Drawings and this Section. Include date of manufacture, shelf life of material, physical properties, and material safety data sheets.

1.2.3 Weld Identification Drawings: Submit isometric and spool drawings which show relative location of each weldment in piping systems.

1.2.4 Filler Material Control Procedure: Submit procedure for control of filler material. Specify methods of control, by heat or lot number, from receipt of material to consumption during fabrication, and control and disposal of contaminated and partially used material.

1.2.5 Welding Filler Metal: Submit certified material test reports giving results of tests in applicable material specifications in ASME Section II, Part C. If testing is not required by material specification, submit Certificate of Conformance to applicable material specification.

1.2.6 Welding Procedures and Personnel: Submit welding procedure specifications, procedure qualification records, and welder performance qualification test results meeting the requirements of Paragraph 1.3.1.

1.2.7 Nondestructive Examination (NDE) Personnel and Procedures: Submit personnel certifications and written NDE performance procedures meeting the requirements of Paragraph 1.3.2.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Welding Personnel and Procedures

1.3.1.1 Personnel and procedures for welding pressure retaining components along with attachments thereto shall have been qualified in accordance with ANSI B31.3 before welding.

1.3.1.2 Personnel and procedures for welding structural steel, nonpressure components, shall have been qualified in accordance with ASME Section IX before welding.

1.3.1.3 Deliver 2 copies of welding procedure specifications, procedure qualification records and welder performance qualification test results to KEH 5 days before welding. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.3.2 Qualification of Nondestructive Examination (NDE) Personnel

1.3.2.1 Visual weld examinations and appropriate documentation shall be performed by Certified Welding Inspectors (CWI) who have received certification in accordance with AWS QC1. Certified Associate Welding Inspectors (CAWI), certified in accordance with above standard, may perform examinations when under immediate direction of CWI. Welding related examination documentation shall be signed, or stamped by individual performing examination. Where CAWIs are used for examinations, documentation shall be signed, or bear CAWI's stamp in addition to CWIs under whom examinations were performed.

1.3.2.2 Personnel performing other NDE shall have been certified in accordance with Contractor's written practice, which shall meet the requirements of ASNT No. SNT-TC-1A, before performing NDE. Use Level II or III personnel to interpret test results.

1.3.2.3 Deliver 2 copies of personnel certifications, Contractor's written practice, and written NDE performance procedures to KEH 5 days before examining. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Pipe

1.4.1.1 Preserve identity of pipe and tube from time of receipt on site until installation is complete. Store pipe of different material specification and grade separately.

1.4.1.2 When pipe is removed from bundle and cut, return remaining piece to bundle or clearly and permanently mark. Do not remove manufacturer's identifying tags from bundles.

1.4.1.3 When material identifying mark is cut from length of pipe re-mark remaining section clearly and permanently. Use either original marking or field code identification symbol.

1.4.1.4 KEH may inspect materials for compliance with above storage and control procedures.

1.4.2 Welding Materials

1.4.2.1 Store separately, welding materials of different material specifications.

1.4.2.2 Store and control filler material in accordance with approved procedure.

1.4.2.3 Preserve identity from time of receipt on site until use in facility construction.

1.4.2.4 KEH may inspect materials for compliance with procedure specifications.

1.5 FURNISHED EQUIPMENT

1.5.1 Following items are furnished for Contractor installation. Upon request, KEH will furnish 1 copy of approved vendor submittal data. Submit equipment delivery requirements to KEH 10 days before need.

1.5.1.1 2 inch nozzles (PN 2).

1.5.1.2 2 inch kickplates (PN 4).

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Piping

2.1.1.1 Piping materials shall meet the requirements of attached pipe codes, and details on the Drawings.

2.1.1.2 Valves shall be as specified in pipe codes unless shown otherwise on the Drawings. Brand names and catalog numbers are shown only to illustrate type and class of valve required. Unless otherwise specified, valve packing shall be manufacturer's standard for intended service.

2.1.1.3 Integrally reinforced branch connections may be used on 2 inch and larger welded main lines instead of buttwelding tees noted in pipe codes. Material and weight shall correspond to pipe code for particular piping system.

2.1.1.4 Close or butt nipples are not permitted.

2.1.1.5 Attachments welded to pressure containment boundaries may be noncertified material, provided material bears type identifying mark, is suitable for welding, and compatible with material to which attached.

2.1.2 Pipe Joint Sealant for Threaded Joints: Chesterton "Goldend" No. 7298; Federal Process Company "JC-30"; Lake Chemical Co "Slic-tite" with teflon.

2.1.3 Protective Coating For Earth Backfill

2.1.3.1 Carbon steel piping: Factory applied exterior protective coating consisting of coal tar enamel, felt wrap and cover wrap of kraft paper in accordance with AWWA C203.

2.1.3.2 Carbon steel field joints, fittings, and short lengths of pipe: Tapecoat Company "Tapecoat 20" and primer meeting the requirements of AWWA C203.

2.1.4 Nonshrink Grout: See Section 03300.

2.1.5 Polyurethane Foam for Below Grade Piping: 2 component sprayed foam-in-place rigid product, similar to PSI-S200-25 system by Polythene Systems Inc, with the following physical properties.

2.1.5.1 Apparent overall density: 2.2 to 2.8 lb/cu ft when tested in accordance with ASTM D 1622.

2.1.5.2 Minimum compressive strength: 45 psi parallel to rise and 27 psi perpendicular to rise when tested in accordance with ASTM D 1621.

2.1.5.3 Minimum tensile strength: 60 psi when tested in accordance with ASTM D 1623.

2.1.5.4 Closed cells: 90 to 95 percent when tested in accordance with ASTM D 2856.

2.1.5.5 Maximum water absorption: 0.06 lb/cu ft of surface area in accordance with ASTM D 2842.

2.1.5.6 K factor: Approximately 0.15 Btu in./hr ft² at 75 F after aging 10 days at 140 F when tested in accordance with ASTM C 518.

2.1.6 Flexible Duct Liner: Similar to CA Schroeder Inc, Casco-Flex air duct CF-25.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Piping, General

3.1.1.1 Fabricate and install in accordance with ANSI B31.3, the Drawings, and this Section.

3.1.1.2 Cut pipe with cutters designed specifically for task.

3.1.1.3 Ream pipe to nominal inside diameter after cutting. Remove burrs from threads before assembly.

3.1.1.4 Bend pipe using methods and equipment which produce bends free of wrinkles, bulges, or kinks. When wall thickness, diameter, and bend radius indicate possibility of wall collapse during bending, fill pipe with clean silica sand or fusible material such as Cerro-bend, manufactured by Cerro Corp. Bend pipe in accordance with ANSI B31.3, and meet tolerances given in ANSI B31.3 and PFI ES-24.

3.1.1.5 Clean interior of 4 inch M-26a pipe and exterior of 2 inch M-25 pipe to remove dirt and oily residue, before fabrication, using steam/TURCO "PLAUDIT" mixture, 1 part Plaudit to each 40 parts water in concentrate tank. Flush with filtered water and dry with clean oil-free air or nitrogen. Check for grease removal by passing swab over cleaned surface. Repeat if grease or oil is detected. After cleaning wrap exterior surface with plastic wrap and cap pipe ends.

3.1.1.6 Keep piping systems clean. Once fabrication has started plug or cap ends of piping when installation is not in progress to prevent entry of dirt and other foreign material. Cap ends if work is not to be performed on pipe or spool within 4 hours, or, if due to environmental conditions, debris or water can enter pipe. Leave ends of spare lines capped or blind flanged when installation has been completed.

3.1.2 Underground Piping

3.1.2.1 Place piping supports on undisturbed soil, or backfill placed and compacted in accordance with Section 02200, Paragraph 3.1.1.2.

3.1.2.2 Application of heat to pipe for purposes of heat bending to meet Drawing installation tolerances will not be permitted.

3.1.2.3 Cold springing of pipe will not be permitted.

3.1.2.4 Protect outdoor welding operation from rain and wind by using barriers to protect welder and weld joint. KEH will determine if environmental conditions are such that barriers are required.

3.1.2.5 Complete piping welds before tie-in welds to valve pits, risers, or fixed items.

3.1.2.6 Survey piping systems for elevation and location before final tie-in welds to valve pits, risers, or fixed items. Placement of supports shall be complete and meet Specification and Drawing requirements before survey. Elevation and location shall be in accordance with the Drawings. After final tie-ins, survey piping system again for final acceptance.

3.1.3 Welding

3.1.3.1 Weld piping and attachments to pressure retaining components in accordance with ANSI B31.3.

3.1.3.2 See Section 05500 for carbon steel fabrications.

3.1.3.3 Use gas tungsten arc welding (GTAW) process for first 2 passes on pressure retaining components. Use either GTAW or shielded metal arc welding (SMAW) process for remaining passes. Welding process for nonpressure components is optional.

3.1.3.4 When welding pipe in contact with earth, ground welding machine to same pipe being welded in close proximity to weld being made, less than 100 feet.

a. Welding machine attachments to pipe system shall be secured to bare metal with pipe clamps that apply firm pressure. Clamps shall have current carrying capacity equal to or greater than output of welding machine. Clamps shall be installed so they cannot be accidentally dislodged.

3.1.3.5 Backing strips if used shall meet the requirements of ANSI B31.3, Paragraph 327.2.2, and be removed.

3.1.4 Weld Identification

3.1.4.1 Prepare weld identification drawings, isometric and spool, which show relative position of each pressure containing weld and each attachment weld to pressure retaining components.

3.1.4.2 Assign weld number to each pressure containing weld and each attachment weld to pressure retaining components as it is made. Record weld number on weld identification drawings as weld is made.

3.1.4.3 Place identification symbol of welder and weld number adjacent to each weld upon completion. Place identification symbol approximately every 3 feet on long weld seams or large weldments. Use crayon or paint. Vibratory etching equipment may be used with approval of K&H.

3.1.4.4 Do not reuse weld numbers. If weld is completely replaced, assign new number.

3.1.4.5 Show on weld identification drawings location and extent of materials requiring CMTR. Reference each item to its specific report.

3.1.4.6 Perform nondestructive weld examination in accordance with Paragraph 3.2.2.

3.1.5 Flushing: Flush piping noted below after installation.

3.1.5.1 Piping and services are as follows.

<u>Service</u>	:	<u>Pipe Code</u>	:	<u>Flushing Method</u>
Grout	:	M-25	:	Water
Excess Water	:	M-25	:	Water

3.1.5.2 Water flushing

a. Prepare written procedure for disposal of flushing water. Deliver to KEH for approval 10 days before flushing. Disposal of water near ground supported pipe supports will not be permitted.

b. After fabrication and NDE is completed and before leak testing completed system, or before connecting completed system into existing system, flush piping with water until effluent is clean and contains no visible particulate matter. Duration of flush shall be at least 1 minute. Use flushing pressure, not to exceed maximum operating pressure specified on pipe codes, sufficient to produce velocity of at least 5 feet per second in largest pipe section with pipe full. Water velocity shall be verified by suitable instrument at inlet of flushing water to determine velocity at largest pipe section. If leak testing is not performed within 4 hour period, or, if due to environmental conditions, debris may enter, seal flushed lines until leak testing is performed.

3.1.6 Exterior Protective Coating

3.1.6.1 Complete NDE and leak testing before application of exterior protective coating.

3.1.6.2 Coat grout encasement and excess water encasement pipes, including sections to be covered with polyurethane foam, with specified coating.

3.1.6.3 Protect short lengths of carbon steel pipe and fittings exposed to earth backfill with specified coating.

a. Clean carbon steel surfaces to white metal by sandblasting in accordance with SSPC-SP 6. Where blasting is impracticable, as determined by KEH, clean by power wire brushing in accordance with SSPC-SP 3.

b. Heat and apply specified tape in accordance with AWWA C203, Section 3, and manufacturer's instructions.

3.1.6.4 After installation, examine carbon steel pipe having factory applied exterior protective coating, and joints, fittings, and short lengths of pipe having field applied exterior protective coating materials.

a. Use electrical holiday detector in accordance with AWWA C203, Section 2.14.12.

b. Repair damage to coating in accordance with AWWA C203, Section 2.14.12.

3.1.7 Polyurethane Foam

3.1.7.1 Install in accordance with manufacturer's recommended procedure.

3.1.7.2 Side-wall retainer may be used to assure uniform width and height of sprayed foam. Obtain approval of retainer wall installation and materials from KEH.

3.1.7.3 Secure flexible duct to pipe in position shown on the Drawings.

3.1.7.4 Repair holes left by taking of test samples. Leave no holes open over night.

3.1.7.5 Verify compressive strength of foam in accordance with Paragraph 3.2.4.

3.2 FIELD QUALITY CONTROL

3.2.1 Notify KEH before performing following.

3.2.1.1 Flushing piping systems.

3.2.1.2 Testing piping exterior protective coatings.

3.2.1.3 Hydrostatic testing.

3.2.1.4 Final weld connections into valve pits, risers, tanks, and other fixed items.

3.2.1.5 Backfilling, or covering with concrete, pipe connections.

3.2.2 Nondestructive Weld Examination (NDE)

3.2.2.1 Equipment and materials used for NDE shall be available for review and approval by KEH before performing work.

3.2.2.2 KEH may witness NDE of welds. When KEH disagrees with performance of NDE or with Contractor's acceptance of examination results, decision of KEH will be final.

3.2.2.3 Perform NDE for pressure containing welds and attachment welds to pressure retaining components specified for each pipe code listed on back of attached NDE/Weld Record Form KEH-433.

3.2.2.4 Visual examination: Perform in accordance with ANSI B31.3 paragraph 344.2.

a. Verify following and consider as part of fit-up examination. Document on NDE/Weld Record under fit-up.

1) Longitudinal alignment of pipes being joined: Within 2 degrees measured from outside diameter of pipe.

2) No cold springing.

3) Pipe symmetrically located within encasement.

3.2.2.5 Liquid penetrant (dye penetrant) examination (PT): Perform in accordance with ANSI B31.3 paragraph 344.4.

3.2.2.6 Radiographic examination: Perform in accordance with ANSI B31.3 paragraph 344.5.

a. If Iridium 192 source is used, deliver verified radiographic examination procedures to KEH before use for production radiographs. Procedures shall be verified by demonstration that required radiographic sensitivity has been obtained for material to be radiographed. Procedure shall be proven satisfactory by actual demonstration of penetrometer resolution on minimum thickness of material to be radiographed. Use of Cobalt 60 will not be permitted.

b. Identify radiographic film with project or work order number assigned to work covered by this Section.

c. Prepare radiographic examination reports as follows: List each radiographic exposure location (0-1, 1-2, ...) individually on radiographic examination report. Indicate location acceptability or rejectability and note discontinuities whether rejectable or not. When report includes radiographs of welds which have been repaired, indicate which welds are repair welds and how many times each weld has been repaired.

d. If additional welding is performed on weld area which has already been examined radiographically, this area is repair area. Identify subsequent radiographs by "R-1, R-2", etc.

e. Deliver radiographs along with original of reports to KEH within 24 hours after radiographs are taken.

3.2.2.7 Tie in weld examination: Where leak testing of tie-in weld cannot be performed due to physical impossibility, or impracticality of pressure test application requires concurrence of KEH, perform additional NDE as follows.

<u>Service</u>	:	<u>Pipe Code</u>	:	<u>Additional NDE</u>
Grout (GR)	:	M-25	:	Liquid Penetrant
Excess Water (FW)	:	M-25	:	Liquid Penetrant

3.2.2.8 NDE documentation

a. Document examination of pressure welds and welds to pressure retaining components for piping systems on NDE/Weld Record Form KEH-433 furnished by KEH (sample appended).

1) See Form KEH-433 for instructions for recording weld identification drawings, weld numbers, welder identification, welding procedure specification numbers, visual examinations, nondestructive examinations, and for noting satisfactory completion of leak testing.

b. Documentation shall be kept current and is subject to review by KEH. Prepare and certify records as work progresses.

c. Required NDE/Weld examinations shall be completed and documented before start of leak testing.

d. NDE/Weld Record information and weld identification drawings defined in Paragraph 3.1.4 may be incorporated on single format or traveler for specific work package.

e. Deliver completed NDE/Weld Record and record weld identification drawings to KEH within 7 working days after completion of system leak testing.

3.2.3 Leak/Pressure Testing

3.2.3.1 General

a. Perform leak/pressure testing of pipe in accordance with ANSI B31.3 and this Section.

b. Document testing of each piping system on "Leak/Pressure Test Certification" Form KEH-1757 (sample appended). Forms will be furnished by KEH. Use 1 or more forms to describe and record each piping system. Under "Description" describe piping system in enough detail to be correlated to weld identification drawings, shop fabrication drawings, and Contract Drawings as applicable. For systems tested segmentally, indicate continuity in "Description" to ensure entire system has been tested.

c. Pipe joints, fittings and other potential leak sources to be tested shall be visible and accessible during tests.

d. Complete testing of piping before field application of foam or protective coating.

e. Install necessary restraining devices, before applying test pressure, to prevent distortion or displacement of piping.

f. Install 1 temporary relief valve during testing. Relief valve shall have discharge capacity of at least 125 percent of capacity of pressurizing device and be set to operate at not more than 110 percent of

test pressure. Tag each relief valve used to show serial number, calibration date, and pressure setting.

g. Isolate instruments and other items which could be damaged by test pressures.

h. Visually examine piping and tubing joints, fittings, and other potential leak sources, includes welds which attach wear plates, anchors, etc to piping systems, during testing. Repair leaks and reexamine.

i. Duration of tests shall be at least 10 minutes with no visible leaks or drop in test pressure, and for such additional time as may be necessary to conduct examination for leakage.

j. Test gages shall have been calibrated within 2 weeks before start of test. Use gages with dial-type face and range between 1.5 and 4 times test pressure.

3.2.3.2 Hydrostatic testing

a. Prepare written procedure for disposal of water used for testing. Deliver to KEH for approval 10 days before testing.

b. Perform tests on systems listed below.

<u>Service</u>	<u>:</u>	<u>Pipe Code</u>	<u>:</u>	<u>Test Pressure (psig)</u>
Grout	:	M-25	:	1,200
Excess Water	:	M-25	:	1,200
Excess Water	:	M-26a	:	90
Encasement and	:		:	
Encasement Drain	:		:	

c. Piping systems with removable jumper assemblies shall be tested without jumper in place.

d. Verify that air has been expelled from piping before applying hydrostatic pressure.

e. Coat piping joints, fittings and other potential leak sources, includes welds attaching wear plates, anchors, etc, to piping systems, with mixture of powdered blue chalk and either water or isopropyl alcohol, and allow to dry before filling piping with water and inspecting for leaks.

f. Remove water from lines immediately after hydrostatic testing is completed.

3.2.3.3 Pneumatic testing

a. Perform testing with oil-free air or nitrogen on piping systems listed below.

<u>Service</u>	<u>:</u>	<u>Piping Code</u>	<u>:</u>	<u>Test Pressure (psig)</u>
Grout Encasement and Encasement Drain	:	M-26a	:	90

b. Coat joints and other potential leak sources with bubble forming solution approved by KEH. Soaps and detergents designed specially for cleaning shall not be used. Apply internal gas pressure before solution contacts external surface. Remove solution at completion of testing.

3.2.4 Testing Polyurethane Foam

3.2.4.1 Perform compressive properties test in accordance with ASTM D 1621 and this Section.

3.2.4.2 Take separate test samples from production batch for each day and from each batch of foam sprayed. Take samples at time work is being performed.

3.2.4.3 Test 5 specimens, minimum, from test sample. Specimens shall be 2.7 inch diameter cylinders, 2 inches long, cored and cut with saw having at least 11 teeth per inch. Dimensional tolerance shall be plus or minus 1/16 inch.

3.2.4.4 Minimum compressive load of field test specimen for Tests No. 1 and 2 shall be:

<u>TEST</u>	<u>HOURS AFTER DEPOSITION OF INSULATION</u>	<u>FORCE (Pounds)*</u>
No. 1	Within 2-4 hours for ambient temperature above 50 F or Within 4-8 hours for ambient temperature equal to or less than 50 F	115 115
No. 2	Within 20-28 hours	150

*Minimum force required to reach 10 percent deformation. (0.2 inch for 2 inch high specimen when tested with Link-Belt 250 Compression Tester. Tester ram diameter: 2.625 inch).

3.2.4.5 Document force and deformation results of each test specimen on Form KEH 377.00, sample appended.

3.2.4.6 Complete compressive testing of specimens before backfilling.

3.2.4.7 Remove insulation which fails tests. Replace damaged parting agent and apply new insulation, then retest.

3.2.4.8 Deliver report of results to KEH upon completion of tests.

1170301551

PIPE CODE M-25

Service:	Max Operating Pressure:	Max Operating Temp:
Grout (GR)	800 psig	200 F
Excess Water (EW)	800 psig	200 F

-
- Size : 4" and smaller
-
- Pipe : Carbon steel, ASTM A 106, Grade B.
-
- Wall Thickness : Schedule 40, and 80*
-
- Fittings : Wrought carbon steel, buttwelding, in accordance with ANSI B16.9,
: ASTM A 234, Grade WPB. Schedule to match pipe.
-
- Valves : Shown on Drawings.
-

*2" excess water piping on top of vault: Schedule 40.
2" grout distribution, and excess water return pipes: Schedule 80.

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PIPE CODE M-26a

Service:	Max Operating Pressure:	Max Operating Temp:
Grout Encasement	60 psig	200 F
Excess Water Encasement	60 psig	200 F
Encasement Drains	60 psig	200 F

Size : All

Pipe Grade: Carbon Steel, ASTM A 106, Grade B.

Wall :
Thickness : Schedule 40

Fittings : Wrought carbon steel, ASTM A 234, Grade WPB, buttwelding in
: accordance with ANSI B16.9. Schedule to match pipe.

Bolting : Carbon steel, heavy hex head series bolts, ASTM A 307,
: Grade B and heavy hex nuts, ASTM A 563, Grade A.

Gaskets : Compressed synthetic fiber 1/16". Anchor Style #443. Use full
: face gasket with flat face flanges.

NDE / WELD RECORD

1. Project W O No.

2. Weld Identification Dwgs.

3 Contractor

4 WELD INFORMATION	5 VISUAL EXAMINATION			6 LIQUID PEN. / MAG. PART.	7 RADIO. LEAK TEST	9 Other:
	Fit-up	Root Pass	Cover Pass			
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						
Weld No.				Root Pass	Radiographic	
Welder Identification						
Welding Procedure Specification				Cover Pass	Leak Test	
Weld Filler Mat'l.						

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INSTRUCTIONS FOR USE

The NDE WELD RECORD form shall be used to document the nondestructive examination testing of the piping systems listed below. Entries shall be made as work progresses, and records are subject to review by the Government's Representative at any time.

- Complete the NDE WELD RECORD as follows (number in parenthesis corresponds to block number):
- (1) Enter Project Number.
 - (2) Enter Weld Identification: Drawing Numbers.
 - (3) Enter name of Contractor.
 - (4) Enter Weld Information:
 - Weld Number
 - Welder Identification
 - (5) through (9) Enter date of examination testing in upper half of block, initial or stamp lower half of block as each weld is examined and accepted in compliance with contract requirements.

NONDESTRUCTIVE EXAMINATION/TESTING REQUIREMENTS FOR PIPING SYSTEMS

NDE NOT METHOD	PIPE CODES								COMMENTS
	M-LS	M-LSa							
VISUAL									
Flare	C	C, D							
Root Pass	C	C, D							
Cover Pass	C, E, G	C, D, E, G							
LOD PENETRANT									
Root Pass									
Cover Pass	A, F	A, C, F							
MAGNETIC PARTICLE									
Root Pass									
Cover Pass									
RADIOGRAPHIC									
Completed Weld	B, C								
LEAK PRESSURE									
Completed Weld	A, C, E	A, C, D, E							
OTHER									

Legend

- A. Requires witnessing concurrently by the Government Representative and acceptance prior to recording.
- B. Requires acceptance of radiographs and documentation by the Government Representative prior to recording.
- C. Circumferential and longitudinal butt welds.
- D. Full penetration welds on branch connections.
- E. Attachment welds to pipe.
- F. Tie in circumferential and longitudinal butt welds that cannot be examined by leak pressure test.
- G. Other: KEH will inspect 10 percent of welds, minimum.

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B-714-C2

Project or W O No	Title	Dwg Reference	Test Procedure/Rev
Construction Spec /Rev	Code or Standard	Year	Addenda
		Class	Stamp Required <input type="checkbox"/> Yes <input type="checkbox"/> No

Description of System or Component(s) Test Boundaries

TEST PREPARATION

Notification Requirements <input type="checkbox"/> Quality Control <input type="checkbox"/> Acceptance Inspection <input type="checkbox"/> Safety Engineer <input type="checkbox"/> Client _____ <input type="checkbox"/> Authorized Inspector <input type="checkbox"/> _____	Valve Line-up Requirements (for permanent valves installed) Valve I.D. _____ <input type="checkbox"/> Open <input type="checkbox"/> Close Valve I.D. _____ <input type="checkbox"/> Open <input type="checkbox"/> Close
--	--

Required Test Medium Medium _____	Required Test Medium Temp. Temp _____	Flushing Requirements Flushing _____	<input type="checkbox"/> Blue Chalking Required <input type="checkbox"/> Soap Solution Required
Design System Pressure _____	Design Test Pressure _____	Specified Hold Time _____	Prepared By _____ Date _____

PRETEST CHECKLIST

Item or Requirement	Craft Supervision	Quality Control	
		Accept	Date
Valve line-up per design requirements (see above line up)			
Flushing of system and/or component completed per design requirements			
All lines or components not to be tested are properly isolated or disconnected			
Vents and openings checked, proper Pressure Relief Valve installed and discharge checked			
Test medium per design requirements; temperature equalized Medium _____ Medium Temp _____ (ASME only)			
Test gauge(s) correct range and currently calibrated			
SN _____ Range _____ Cal Due Date _____			
SN _____ Range _____ Cal Due Date _____			
SN _____ Range _____ Cal Due Date _____			
Pressure Relief Valve properly set and currently calibrated			
SN _____ PSI Set _____ Checked Date _____			
SN _____ PSI Set _____ Checked Date _____			
SN _____ PSI Set _____ Checked Date _____			

TEST PERFORMANCE

Item or Requirement	Quality Control		
	Accept	Date	
RDT/NE and Other if specified.			
50% Tp obtained and examination conducted = Tp _____			
Pressure increments at 0.10 Tp:			
= Tp _____			
Hydrostatic testing - areas to be inspected chalked prior to application of pressure.			
Hydrostatic testing - examination conducted while system/component pressurized.			
Specified Tp _____ PSI obtained at: _____ a.m. p.m.			
Pneumatic Testing - soap solution applied to areas to be tested and system/components examined while pressurized.			
Specified Tp _____ PSI obtained at _____ a.m. p.m.			
Pressure Test <input type="checkbox"/> Accepted <input type="checkbox"/> Rejected	Quality Control Signature	Stamp or PR No.	Date

INSPECTION VERIFICATION

Documentation properly prepared	<input type="checkbox"/> Yes <input type="checkbox"/> No	Actual Tp during final inspection _____ PSI	
All joints and welded attachments to pressure retaining components chalked/soaped as applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No		
All joints and welded attachments to pressure retaining components visually inspected for leakage.	<input type="checkbox"/> Yes <input type="checkbox"/> No	Specified hold time verified at _____ a.m. p.m.	
Pressure Test <input type="checkbox"/> Accepted <input type="checkbox"/> Rejected	Acceptance Inspection Signature	Stamp or PR No.	Date

OTHER

Comments

NCR No. (if applicable)	Client Representative	Date	
	Witness - ASME Authorized Inspector	Date	
<input type="checkbox"/> Document Reviewed <input type="checkbox"/> Drawings Highlighted	Construction Engineering	PR No.	Date

ACCEPTANCE INSPECTION REPORT

Project No

Inspection Plan No

Items Inspected

Acc

Rej

Other Documentation

Other Activities/General Comments

Date this Report

Reviewed by

Inspector's Signature

Employee No
KEH-

END OF SECTION

SECTION 16300
HIGH VOLTAGE DISTRIBUTION
(Above 600-Volt)

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American Association of State Highway and Transportation Officials (AASHTO)

1983 Standard Specifications for Highway Bridges, 13th Edition

1.1.1.2 American National Standards Institute (ANSI)

ANSI C2-1987 American National Standard National Electrical Safety Code, 1987 Edition

ANSI C57.12.00-1980 American National Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers

ANSI C57.12.70-1978 American National Standard Terminal Markings and Connections for Distribution and Power Transformers

ANSI C80.1-1983 American National Standard for Rigid Steel Conduit--Zinc Coated

ANSI 05.1-1979 American National Standard Specifications and Dimensions for Wood Poles

1.1.1.3 American Wood Preservers Association (AWPA)

C7-73 Western Red Cedar, Northern White Cedar and Alaska Yellow Cedar Poles - Preservative Treatment of Incised Pole Butts by the Thermal Process

P1-78 (Revised) Standard for Coal Tar Creosote for Land and Fresh Water Use

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	P8-87	Standard for Oil-Borne Preservatives
	P9-87	Standard for Solvents and Formulations for Organic Preservative Systems
1.1.1.4	Federal Specifications (FS)	
	W-C-1094A	Conduit and Conduit Fittings Plastic, Rigid
1.1.1.5	Institute of Electrical and Electronics Engineers (IEEE)	
	IEEE C62.1-1984	IEEE Standard for Surge Arresters for AC Power Circuits
1.1.1.6	National Electrical Manufacturers Association (NEMA)	
	Standards Publication/ No. FB 1-1983 w/Rev through Sep 1984	Fittings and Supports for Conduit and Cable Assemblies
	Standards Publication/ No. ICS 6-1983 w/Rev through Nov 1986	Enclosures for Industrial Controls and Systems
	Standards Publication/ No. RN 1-1980	Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
	Standards Publication/ No. WC 8-1976 (R 1982) w/Rev through Jan 1983	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
1.1.1.7	National Fire Protection Association (NFPA)	
	NFPA 70	National Electrical Code, 1987 Edition
1.1.1.8	Underwriters Laboratories, Inc (UL)	
	May 1988	Electrical Appliance and Utilization Equipment Directory
	May 1988	Electrical Construction Materials Directory

UL 1242-1985

Standard for Intermediate Metal
Conduit

1.1.1.9 Washington State Department of Transportation (WSDOT)

M41-10-88

Standard Specification for
Road, Bridge, and Munciple
Construction

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Approval Data: Submit information listed in Column 5 of Vendor Data List in this Section.

1.2.2 Certified Vendor Information (CVI): Submit information listed in Column 6 of Vendor Data List in this Section.

1.3 QUALITY ASSURANCE

1.3.1 Standards: Products shall be identified for intended purpose by Underwriters Laboratories, Inc (UL) in the Electrical Appliance and Utilization Equipment Directory or Electrical Construction Materials Directory, and bear listing mark of laboratory. In absence of mark, submit documentation of applicable listing. Listing and marking by UL is not required for products specified to meet the requirements of a national standard, or designated by manufacturer's part number on the Drawings or in this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

1.4.1.1 Cable: Upon delivery to site inspect cable and reels for shipping damage such as:

- a. Marks caused by improper lifting equipment or techniques.
- b. Breaks or cuts in outer covering.
- c. Damaged jacket or insulation.
- d. Reel damage from mishandling.

1.4.1.2 Test: Operating Contractor will perform dc overpotential test on new cable upon delivery to site. Acceptance criteria is given in subparagraph 3.3.2.1.

1.4.2 Storage

1.4.2.1 Cable

a. Store reels with flanges resting on hard surface or pallet to prevent sinking into ground.

c. PVC (Schedule 40)

FS W-C-1094, Type II

2.1.2.2 PVC coating on rigid steel conduit: Factory applied, and meet the requirements of NEMA RN 1, Type A-40.

2.1.2.3 Fittings for rigid steel conduit shall meet the requirements of NEMA FB 1.

2.1.2.4 Use "Myers" type watertight fittings or sealing type locknuts for conduit entries into sides or tops of NEMA Type 3, 3R, or 4 enclosures.

2.1.3 Cable: 15 kV single conductor meeting the requirements of NEMA WC 8 for both wet and dry conditions at normal operating temperature of 90 C max.

2.1.3.1 Conductor: Copper, annealed, Class B concentric stranding.

2.1.3.2 Conductor shield: Extruded semi-conducting thermosetting compound, 15 mils thick, minimum.

2.1.3.3 Insulation: Ethylene-propylene-rubber, 220 mils thick, minimum.

2.1.3.4 Insulation shield: Minimum 30 mil extruded nonmetallic covering over insulation with minimum 5 mil nonmagnetic metal component directly over or embedded in covering.

2.1.3.5 Jacket: Black polyethylene, 80 mils average minimum thickness.

2.1.3.6 Cable shall have continuous permanent printing on jacket showing manufacturer's name, trade name, type, size, rated voltage and footage markings. Cable reels shall be marked to show above information and length of each cable. Ends of cable shall have weatherproof seals and both ends exposed on reel, accessible for testing.

2.1.4 Wiremarkers: Imprinted tubular plastic.

2.1.5 Nameplates: Made from 1/16 inch laminated plastic stock with white surface and black core. Edges smooth, without burrs, and beveled 45 degrees. Letters sharp and clear.

2.1.6 Wire Pulling Compound: "Y-er Eas" manufactured by Electro Compound Co, or Polywater manufactured by American Polywater Corp.

2.1.7 Tape

2.1.7.1 Plastic insulating tape: Scotch No. 33+ manufactured by 3M Company.

2.1.7.2 Conduit protection tape: Scotchrap No. 50 manufactured by 3M Company.

2.1.7.3 Silicon rubber termination tape: Scotch No. 70 manufactured by 3M Company.

2.1.8 Insulating Putty: "Scotchfil" manufactured by 3M Company, GE No. 8389 manufactured by General Electric Co, or "Airseal" manufactured by Kearney Company.

2.1.9 Tie Wires: Length, material type and size, and installation method as recommended by line conductor manufacturer.

2.1.10 Connectors: For connecting copper conductors to aluminum conductors shall be manufactured for purpose and listed by UL.

2.1.11 Wood Poles: Meeting the requirements of ANSI O5.1 and be western red cedar cut from live timber. Poles shall be butt-treated by manufacturer in accordance with AWWA C7, using preservative meeting the requirements of AWWA P8 and P9, or P1. Each pole shall be given single top; cut at 30 degree angle with normal to axis of pole and at right angles to sweep. Gains shall be cut so roof will be at right angles to line and sweep of pole will be in line. Roofs and gains shall be brush treated by manufacturer with specified preservative. Each gain shall fit crossarm tightly. Bolt holes shall not be more than 1/16 inch oversize.

2.2 EQUIPMENT

2.2.1 Equipment enclosure shall meet the requirements of NEMA ICS 6-110 and be Type 3, 3R, or 4.

2.2.2 Outdoor Distribution Transformer: Meeting the requirements of ANSI C57.12.00 with kVA and voltage ratings shown on the Drawings. Transformer shall be oil filled, 55c rise, deadfront loop feed, self cooled 3 phase with 2 primary 1 piece integral bushings for each phase as shown on the Drawings and have two 2 1/2 percent above and below normal high-voltage taps. Identify high and low voltage bushings in accordance with ANSI C57.12.70.

2.2.2.1 Transformer shall be self-protecting with metal oxide varistor elbows, deadfront arrester, 15 kV class arrester elbow, gapless, solid state with metal oxide varistor permanently sealed into elbow shank. Primary fuses Bay-o-net fused with Kerney DEWL Cat. No. 124089 15, Kerney Back up Clf Cat. No. 150615 65 and secondary breaker shown on the Drawings.

2.2.2.2 Transformer shall be designed for pad mounting and include following.

a. Three 400 to 5A current transformers: General Electric Type JAB-0 Cat. No. 750X35G204 with socket type kilowatt hour demand meter for 277/480V ac, wye, 3 phase, 4 wire, 400A system, Westinghouse Type D4S-8M Class 10, 240V.

b. Maximum connected load: 225kVA.

c. Pulse generator

- 1) KWH/pulse: 0.25.
- 2) Pulse ratio: 125/144.

d. Sweepand type demand register with 30 minute demand interval.

e. Combination meter socket and test switch: Superior Cat. No.

W11511-MM.

2.2.3 Load break center module and load break elbows shown on the Drawings.

2.2.4 Overhead Lightning Arresters: Distribution valve type rated 15 kV, 95 BII, for use on 13.8 kV high impedance ground system, and meeting the requirements of IEEE C62.1. Porcelain bodies shall be wet porcelain with uniform color glaze. Galvanized cap and base hardware shall have bolted clamps for both line and ground connections. Mounting bolts shall be galvanized.

2.2.5 Manholes: Reinforced precast concrete utility vault with top, configuration shown on the Drawings, and meeting AASHTO, Section 1.2.5 (E), H-20 load criteria; Arco Concrete, Inc Cat. No. 6060-7 complete with manhole ring and cover meeting the requirements of WSDOT M41-10, Section 9-05.15(1).

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Field Measurements: Scale dimensions on the Drawings show desired and approximate location of equipment, actual locations, distances, and levels shall be governed by field conditions.

3.2 INSTALLATION

3.2.1 General

3.2.1.1 Perform work in accordance with NEPA 70 (NEC) and ANSI C2.

3.2.1.2 Install products as shown on the Drawings and specified.

a. Identify electrical equipment with nameplates engraved with designation and function shown on the Drawings.

b. Attach nameplates on or near equipment with clear RIV silicone sealant.

3.2.1.3 Use appropriate special calibrated tools when installing devices for which special installation tools are recommended by manufacturer.

3.2.2 Ground Systems: Use galvanized, stranded steel conductors for ground conductors installed in earth or concrete. Make joints connecting copper and galvanized steel conductors above grade and in dry location.

3.2.3 Conduits

3.2.3.1 Use rigid steel or intermediate metal conduit.

3.2.3.2 Use PVC coated rigid steel conduit in contact with earth. Install in accordance with manufacturer's recommendations. Repair coating, damaged during handling or installation using PVC paint recommended by conduit manufacturer.

3.2.3.3 Install #14 gage galvanized steel pull wire or 1/8 inch polyethylene rope in conduit installed and left empty for future use.

3.2.3.4 Permanently label or mark at both ends with conduit number shown on the Drawings.

3.2.3.5 Make elbows, offsets and bends uniform and symmetrical. Bend conduit with approved bending devices.

3.2.3.6 Cut square, ream and remove burrs. Conduit shall be clean, dry, and free of debris. Immediately after installation, plug or cap exposed ends with standard accessories until wires are installed.

3.2.3.7 Use galvanized steel locknuts and insulated bushings for attachment to enclosures except threaded hubs or sealing locknuts shall be used outdoors or where moisture is present. Threadless fittings will not be permitted for rigid conduit. Use Erickson type couplings where required. Do not use running threads.

3.2.3.8 Use pipe straps, 1 hole clamps equipped with clambacks or Unistrut with clamps to secure conduits.

3.2.3.9 Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, antiseize, conductive thread lubricant and sealant.

3.2.3.10 Install exposed conduit stubbing up through concrete slabs straight and plumb, lined up, and uniformly spaced. Install at sufficient depth below slab to eliminate part of bend above top of slab. Couple conduit flush with surface of slab. Verify stub-up locations with final equipment arrangements.

3.2.3.11 Wrap conduit, passing from concrete to air or to direct burial, with conduit protection tape 3 inches in concrete to at least 12 inches in earth or 3 inches in air, unless conduit is PVC coated.

3.2.4 Underground Duct Banks

3.2.4.1 Use PVC conduit in concrete encased duct banks.

3.2.4.2 Install underground ducts as shown on the Drawings.

3.2.4.3 Seal conduit at both ends with duct sealing compound.

3.2.4.4 Form concrete encasements unless written waiver is obtained from KEH.

3.2.5 Nonaerial Type Conductors

3.2.5.1 Use paint or pressure-sensitive colored tape to identify conductors instead of colored insulation on #4 AWG and larger wire only. Maintain phase color coding. Identify equipment grounding conductors clearly throughout system.

3.2.5.2 Use lubricant recommended by cable manufacturer, or wire pulling compound specified, to decrease friction when pulling wire and cable through conduit.

3.2.5.3 Do not install or handle wires with thermoplastic insulation or jacket when ambient temperature is 15 F or below.

3.2.6 Splices, Taps and Cable Terminations

3.2.6.1 Make splices and taps with solderless connectors described in Paragraph 2.1.1. Use connectors in accordance with manufacturer's instructions.

3.2.6.2 Use plastic insulating tape for uninsulated splices and taps to thickness at least equal to conductor insulation. Where bolted splice or connection presents irregular surface, apply insulating putty to joints before taping.

3.2.6.3 Use crimp-on type, ring or spade lugs with turned up legs for wire terminations of stranded conductors to binder screw or stud type terminals. Lugs shall have insulated sleeves.

3.2.6.4 Follow manufacturer's instructions and directions for splices, stress cones and cable terminations.

3.2.6.5 Wrap terminations for stranded insulated conductors on aerial equipment with 2 half-lapped layers of plastic insulating tape from 2 inches back on cable insulation to cover barrel of terminal. Taping shall effect moisture barrier so moisture cannot penetrate between conductor and insulation or interstices of stranded conductor. Overlay 1 half-lapped layer of silicon rubber termination tape over plastic insulating taping.

3.2.7 Setting Poles

3.2.7.1 Excavate holes large enough to admit tamping bar around pole at butt. Do not use explosives to excavate holes.

3.2.7.2 Use backfill materials which can be solidly compacted by hand tamping in 6 inch lifts. Compact surplus earth around pole in cone 1 foot high above grade. Add additional backfill where backfill has settled, and tamp before completion of work.

3.2.7.3 Set 30 foot poles 6 feet in earth and 50 foot poles 7 feet in earth. Measure depth from lowest side, on moderately sloping ground and from point 2'-6" from center of pole toward low side on steep slopes, cuts, embankments, or where soil is likely to be washed away from pole.

3.2.7.4 Set poles plumb and in line, except that corners and other strain points which are guyed shall have butts displaced to keep tops in line where feasible. At such locations, rake against strain shall be approximately 2 inches for each 10 feet of height.

3.3 FIELD QUALITY CONTROL

3.3.1 Testing, General

3.3.1.1 Test equipment and wiring for continuity and unintentional grounds, and verify proper phase sequence and voltage at equipment served before attempt is made to operate equipment. Notify KEH before start of tests. Correct items found, during testing or examination by KEH, to be at variance with the Drawings and this Section.

3.3.1.2 Furnish instruments, labor and equipment required to conduct the testing.

3.3.1.3 Use test instruments which bear valid calibration stamp showing date of calibration and expiration date of stamp. Calibration and accuracy of test instruments shall be certified by independent testing laboratory having standards traceable to the National Bureau of Standards.

3.3.1.4 In addition to testing specified to be performed by Contractor, installation will be subject to examination by KEH for conformance with design and applicable codes. Assist KEH as requested.

3.3.2 Acceptance Testing

3.3.2.1 Upon receipt of new cable, Operating Contractor will perform following tests.

<u>Test</u>	<u>Acceptance Criteria</u>
a. dc Test Overpotential (Hi-Pot) 5 kV shielded and nonshielded cable tested at 25 kV dc for 15 minutes. 15 kV dc shielded cable tested at 55 kV dc for 15 minutes.	Leakage current not to exceed 5 micro- amps.

3.3.2.2 After installation Operating Contractor will perform following tests to verify acceptability of installation.

<u>Test</u>	<u>Acceptance Criteria</u>
a. Transformer	
. Routine	ANSI C57.12.00
. Resistance Measurement	Not applicable, for base data
. Combustible Gas	Less than 0.5 percent
. Oil Neutralization Number	Less than 0.1 mg KOH/gram
. Oil Dielectric	18 kV or greater
. Oil Interfacial Tension	18 dynes/Cm or greater
. Askarel Content	1 PPM
. Oil Power Factor	1 percent
. Oil PCB Content	Less than 1 PPM
b. Cable	
. ac Power Factor (not to exceed rated voltage of cable).	Power factor not to exceed 2 percent.
. dc Overpotential (Hi Pot) 5 kV shielded and nonshielded cable tested at 25 kV dc for 15 minutes. 15 kV shielded cable tested at 55 kV dc for 15 minutes.	Leakage current not to exceed 5 micro-amps.
. Shield resistance test for shield-to-termination continuity between phases and between each phase and ground. Observe uniformity between resistance readings.	Resistance readings greater than 5 ohms are generally indication of discontinuity (or open circuit) and are not acceptable.

SECTION 16400

SERVICE AND DISTRIBUTION
(600-Volt and Below)

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

ANSI C80.1-1983 American National Standard for Rigid Steel Conduit--Zinc Coated

1.1.1.2 Federal Specifications (FS)

W-C-1094A Conduit And Conduit Fittings Plastic, Rigid

W-F-406D Fittings For Cable, Power, Electrical And Conduit, Metal, Flexible

TT-S-00230C,
Including AMD 2 Sealing Compound: Elastomeric Type, Single Component (For Calking, Sealing, And Glazing In Buildings And Other Structures)

WW-C-566C Conduit, Metal, Flexible

1.1.1.3 National Electrical Manufacturers Association (NEMA)

Standards Publication/
No. FB 1-1983 w/Rev through
Sep 1984 Fittings and Supports for Conduit and Cable Assemblies

Standards Publication/
No. ICS 6-1983 w/Rev through
Nov 1986 Enclosures for Industrial Controls and Systems

Standards Publication/
No. RN 1-1980 Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing

1.1.1.4 National Fire Protection Association (NFPA)

NFPA 70

National Electrical Code,
1987 Edition

1.1.1.5 Underwriters Laboratories, Inc (UL)

May 1988

Electrical Appliance and
Utilization Equipment Directory

May 1988

Electrical Construction Materials
Directory

UL 1242-1985

Standard for Intermediate Metal
Conduit

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.3 QUALITY ASSURANCE

1.3.1 Standards: Products shall be identified for intended purpose by Underwriters Laboratories, Inc (UL) in the Electrical Appliance and Utilization Equipment Directory or Electrical Construction Materials Directory, and bear listing mark of laboratory. In absence of mark, submit documentation of applicable listing. Listing and marking by UL is not required for products specified to meet the requirements of a national standard, or designated by manufacturer's part number on the Drawings or in this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Solderless Connectors and Terminal Lugs: Pressure type, rated for use with copper or aluminum conductors with insulating caps or covers rated for system utilization voltage. Connectors shall be types specified below.

2.1.1.1 For conductors #8 AWG and smaller.

- a. Ideal Industries, Inc "Wire-Nuts."
- b. Thomas and Betts Company "Sta-Kon."
- c. 3M Company "Scotchlok."

2.1.1.2 For conductors #6 AWG and larger.

- a. Burndy Engineering Company "Screw Pressure Connectors" or "Hydent."
- b. Thomas and Betts Company "Lock-tite."

2.1.2 Raceways, Fittings and Boxes

2.1.2.1 Conduit shall meet the requirements of appropriate standard as follows.

- | | | |
|----|--------------------|----------------------|
| a. | Rigid steel | ANSI C80.1 |
| b. | Intermediate metal | UL 1242 |
| c. | PVC (Schedule 40) | FS W-C-1094, Type II |
| d. | Flexible metal | FS WW-C-566 |

2.1.2.2 PVC coating on rigid steel conduit: Factory applied, and meeting the requirements of NEMA RN 1, Type A-40.

2.1.2.3 Conduit fittings for rigid steel and electrical metallic tubing shall meet the requirements of NEMA FB 1. Only compression type threadless fittings shall be used with FMI.

2.1.2.4 Fittings used with flexible metal conduit shall meet the requirements of FS W-F-406 and be squeeze type only. Flexible metal conduit shall have integral ground conductor.

2.1.2.5 Use "Myers" type watertight fittings or sealing locknuts manufactured by Midwest Electric Manufacturing Corp, for conduit entries into sides or tops of NEMA Type 3 or NEMA Type 3R enclosures.

2.1.3 Conductors: Stranded copper, type and AWG size specified on the Drawings.

2.1.3.1 Conductor insulation: Type THWN/THHN or XHHW.

2.1.4 Leak Sensing and Locating Cable: Raychem TraceTek Catalog No. TT300-MSL.

2.1.4.1 Modular jumper cable: With male connector on 1 end and female connector on other end; Raychem TraceTek Catalog No. TT300-MJC.

2.1.4.2 Modular end termination: Raychem TraceTek Catalog No. TT300-MET.

2.1.4.3 Jumper cable: 3 foot long with male connector on 1 end and female connector on other end; Raychem TraceTek Catalog No. TT300-RPT.

- a. Use for connecting sensing cables together, if required.

2.1.5 Wiremarkers: Imprinted tubular plastic.

2.1.6 Nameplates: Made from 1/16 inch laminated plastic stock with white surface and black core. Edges smooth, without burrs, and beveled 45 degrees. Letters sharp and clear.

2.1.7 Concrete and Masonry Anchors: Kwik-Bolt manufactured by Hilti Fastening Systems or Red Head Wedge Anchor manufactured by Phillips Drill Company.

2.1.8 Wire Pulling Compound: "Y-er Eas" manufactured by Electro Compound Company or Polywater manufactured by American Polywater Corp.

2.1.9 Tape

2.1.9.1 Plastic insulating tape: Scotch No. 33+ manufactured by 3M Company.

2.1.9.2 Conduit protection tape: Scotchrap No. 50 manufactured by 3M Company.

2.1.10 Insulating Putty: "Scotchfil" manufactured by 3M Company, GE No. 8389 manufactured by General Electric Co, or "Airseal" manufactured by Kearney Company.

2.1.11 Duct Sealing Compound: "Sealex" manufactured by Porcelain Products Co or "Kerite" manufactured by Kerite Co.

2.1.12 Nonshrink Grout: See Section 03300.

2.1.13 Hangers for Individual Conduits: Factory made springable wrought steel clamps or malleable iron, split and hinged rings. For suspended conduit, clamps or rings shall be bolted to, or interlocked with threaded suspension rod.

2.1.14 Sealant: Polysulfide meeting the requirements of FS TT-S-00230, Type II, Class B.

2.2 EQUIPMENT

2.2.1 Equipment enclosures shall meet the requirements of NEMA ICS 6-110 and be Type 3, 3R or 4.

2.2.2 Terminal Blocks

2.2.2.1 For #10 AWG conductors and smaller: Either 1-piece or factory assembled sectional double terminal, barrier type, with binder screw terminals. Terminal ampacities shall be equal to or greater than conductor ampacities; Marathon or Buchanan.

2.2.2.2 For #8 AWG conductors and larger: Either 1-piece or factory assembled sectional barrier type with box lug terminals having pressure plate between screw and conductor. Size terminals to accommodate conductors to be connected.

2.2.2.3 Furnish covers to cover live parts of terminations for circuits of more than 150 volts to ground. Provide with means for ready inspection and full width marking areas.

2.2.3 Annunciator: Similar to X12 Series manufactured by Ronan.

2.2.3.1 Weatherproof, in NEMA 4 enclosure, with 7 row high by 8 column wide plug-in light boxes. Input power 120V ac, 60 Hz.

2.2.3.2 Display shall have white translucent nameplates 3 inches by 2-3/4 inches nominal. Lamp boxes shall have 1 alarm point each with minimum 2 lamps for each alarm.

2.2.3.3 Solid state electronics with internal 24V dc power supply. Field contacts field selectable, NO or NC, for 24V dc.

2.2.3.4 Features

- a. Lock-in of momentary alarms.
- b. Auxiliary contacts.
- c. Ring-back circuit by alarm audible signal.
- d. Signal own failure.
- e. Lamp test.
- f. Flasher, common "acknowledge" pushbutton, and common "test" pushbutton located in cabinet.

2.2.3.5 Sequence of operation

<u>STAGE</u>	<u>VISUAL SIGNAL</u>	<u>AUDIBLE SIGNAL</u>
Normal	Off	Off
Alert, initial	Flashing	On
Acknowledge, initial	On steady	Off
Return to normal	Off	Off
Reset	Auto	Auto

2.2.3.6 Accessories: Horn, 120V ac, NEMA 4 rating, 24V dc power supply located in cabinet.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Field Measurements: Scale dimensions on Drawings show desired and approximate location of equipment, actual locations, distances, and levels shall be governed by field conditions.

3.2 INSTALLATION

3.2.1 General

3.2.1.1 Perform work in accordance with NFPA 70 (NEC).

3.2.1.2 Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

a. Use clamping devices for attaching to structural steel, or, when clamping is impracticable, obtain written authority from KEH to weld to, drill or cut structural members to provide attachment.

b. Fasten equipment to concrete or masonry with expansion anchors.

c. Attach to drywall by screws into studs, and to metal wall panels by weld studs, bolts or self-tapping metal screws.

d. Locate equipment, boxes and conduit approximately where shown in relation to equipment served.

e. Do not install conduit raceways and boxes in positions that interfere with work of other trades.

f. Identify components by nameplate engraved with designation and function shown on the Drawings.

g. Attach nameplates on or near equipment with clear RTV silicone sealant.

3.2.1.3 Use appropriate special calibrated tools when installing devices for which special installation tools are recommended by manufacturer.

3.2.2 Grounding Systems

3.2.2.1 Underground conductors, electrodes, and connections: Install in accordance with the Drawings. Make joints connecting copper and galvanized steel conductors above grade and in dry location.

3.2.2.2 System and equipment grounding: Solidly ground neutral conductor of 3-wire, single phase and 4-wire, 3 phase, wye-connected distribution systems. Ground equipment in accordance with the Drawings and the NEC.

3.2.3 Conduit

3.2.3.1 Use rigid steel or intermediate metal where subject to mechanical damage, installed in concrete floors and walls, installed exposed to weather, or installed 4 feet or less above floor.

3.2.3.2 Install #14 gage galvanized steel pull wire or 1/8 inch polyethylene rope in spare conduits.

3.2.3.3 Install concealed conduits as directly as possible and with bend radii as long as possible. Install exposed conduit parallel with or at right angles to building lines.

3.2.3.4 Permanently label each conduit, using black paint and stencil, at both ends, with number shown on the Drawings.

3.2.3.5 Make elbows, offsets and bends uniform and symmetrical. Bend conduit with approved bending devices.

3.2.3.6 Cut square, ream and remove burrs. Conduit shall be clean, dry, and free of debris. Immediately after installation, plug or cap exposed ends with standard accessories until wires are installed.

3.2.3.7 Use galvanized steel locknuts and insulated bushings for attachment to enclosures except threaded hubs or sealing type locknut shall be used outdoors or where moisture is present. Threadless fittings will not be permitted for rigid conduit. Use Erickson type couplings where required. Do not use running threads.

3.2.3.8 Use 1 hole clamps equipped with clambacks or Unistrut with clamps to secure conduits.

3.2.3.9 Install without moisture traps wherever possible. Where practicable, provide drain holes in pullboxes or fittings at low points in raceway systems and remove burrs from drilled holes.

3.2.3.10 Flexible conduit

a. Use to make connections to motors and other equipment subject to vibration. Use liquidtight flexible metal conduit where conduit and fittings are installed outdoors or exposed to moisture or chemical fumes indoors.

b. Use in lengths not exceeding 4 feet for other equipment, with approval of KEH.

c. Use for flush and recessed lighting fixtures in lengths at least 4 feet, but not exceeding 6 feet.

3.2.3.11 Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, antiseize, conductive thread lubricant and sealant.

3.2.3.12 Install exposed conduit stubbing up through floor slab straight and plumb, lined up, and uniformly spaced. Install at sufficient depth below slab to eliminate part of bend above top of slab. Cap or plug stub-up before placing concrete. Verify stub-up locations with final equipment arrangements.

3.2.3.13 Wrap conduit passing from concrete to air or to direct earth burial with conduit protection tape from 3 inches in concrete to at least 12 inches in earth, or 3 inches in air, unless conduit is PVC coated.

3.2.3.14 Where routing is parallel with hot water or steam pipes, maintain minimum 6 inch clearance from pipe covering. Where not run parallel with pipe it is acceptable to run closer than 6 inches, providing conduit does not touch pipe covering.

3.2.3.15 Encase conduit installed below grade with minimum 3 inches of concrete on all sides. Use PVC coated rigid steel where shown on the Drawings.

3.2.3.16 Install PVC coated conduit in accordance with manufacturer's recommendations. Repair coating, damaged during handling or installation using PVC paint recommended by conduit manufacturer.

3.2.3.17 Seal opening around conduit penetrating manhole walls with nonshrink grout.

3.2.4 Underground Duct Banks

3.2.4.1 Use either rigid steel or PVC conduit in concrete encased duct banks.

3.2.4.2 For single conduit runs, PVC coated rigid steel conduit may be used instead of concrete encased duct bank.

3.2.4.3 Install underground ducts in accordance with the Drawings and route without drains where possible.

3.2.4.4 Where drains or risers are required, install in accordance with the Drawings. Seal conduit at both ends with duct sealing compound.

3.2.4.5 Form concrete encasements unless written waiver is obtained from KEH.

3.2.5 Boxes, Enclosures and Wiring Devices

3.2.5.1 Install boxes firmly in position and plumb

3.2.5.2 Install extension ring with blank cover on flush mounted junction boxes where box serves permanently installed equipment.

3.2.5.3 Flush mount junction boxes served by concealed conduit.

3.2.5.4 Install dust covers on junction, pull, and outlet boxes, and other types of wiring outlets at initial installation. Do not remove dust covers until wires are installed and permanent cover or device is placed on box or outlet.

3.2.6 Conductors

3.2.6.1 Do not bend cables installed in wireways to less than manufacturer's recommended minimum bending radius. Bind power and control circuits separately with nylon cable ties, at 18 inch intervals. Lay cables in wireways in straight parallel lines, and avoid crossing.

3.2.6.2 Maximum pulling tension on conductors: Recommended by manufacturer.

3.2.6.3 Identify each conductor designator by wire number on the Drawings with wire marker. Attach wire marker at each termination point within 2 inches of wire termination. Marker nomenclature shall be visible without moving wire or marker.

3.2.6.4 Paint or pressure-sensitive colored tape may be used for coding conductors instead of colored insulation on #8 AWG and larger wire only. Maintain phase color coding, in accordance with the Drawings, for branch and feeder circuits up to and including equipment connections.

a. Use colored tape to properly code existing conductors whose color does not comply.

3.2.6.5 Use lubricant recommended by cable manufacturer, or wire pulling compound specified, to decrease friction when pulling wire and cable through conduit.

3.2.6.6 Do not install or handle wires with thermoplastic insulation or jacket when ambient temperature is 15 f or below.

3.2.6.7 Install and mark direct burial cable in accordance with the Drawings.

3.2.7 Splices, Taps and Cable Terminations

3.2.7.1 Make splices and taps in building wire with solderless connectors described in Paragraph 2.1.1. Use connectors in accordance with manufacturer's instructions.

3.2.7.2 Use plastic insulating tape for uninsulated splices and taps. Apply tape to thickness at least equal to conductor insulation. Where bolted splice or connection presents irregular surface, apply insulating putty to joints before taping.

3.2.7.3 Use crimp-on type ring or spade lugs with turned up legs for wire terminations of stranded conductors to binder screw or stud type terminals. Lugs shall have insulated sleeves.

3.2.8 Sensing Cable: Install in bottom of annulus between 2 inch inside and 4 inch outside pipes of grout transfer line as follows.

3.2.8.1 Install #14 gage galvanized steel pull wire from 1 termination access port to next at time of pipe fabrication and installation. Take care to ensure pull wire is installed in bottom segment of annulus and not burned-off or welded to pipe.

3.2.8.2 Pull in cable after completion of pipe installation.

3.2.8.3 Connect cables at each termination access port using connectors supplies as part of modular sensing cable.

3.2.8.4 Install specified modular end termination on end of cable at vault pit, and lay cable back in annulus.

3.2.8.5 Contact representative of TraceTek before installation of first sensing cable, and as needed for installation of remaining cables.

3.3 FIELD QUALITY CONTROL

3.3.1 Testing, General

3.3.1.1 Test equipment and wiring for continuity and unintentional grounds, and verify proper phase sequence and voltage at equipment served before attempt is made to operate equipment. Notify KEH before start of tests. Correct items found, during testing or examination by KEH, to be at variance with the Drawings and this Section.

3.3.1.2 Furnish instruments, labor and equipment required to conduct testing.

3.3.1.3 Use test instruments which bear valid calibration stamp showing date of calibration and expiration date of stamp. Calibration and accuracy of test instruments shall be certified by independent testing laboratory having standards traceable to the National Bureau of Standards.

3.3.1.4 In addition to testing specified to be performed by Contractor, installation will be subject to examination by KEH for conformance with design and applicable codes. Assist KEH as requested.

3.3.2 Wiring Systems

3.3.2.1 Megger conductors rated 600 volts and used for services, feeders or branch circuits over 150 volts to ground, phase-to-phase, and phase-to-ground. Minimum acceptable value of insulation resistance is 200 megohms. Megger manufacturer's instruction pamphlet, furnished with megger, shall provide instructions for conducting tests. Disconnect devices not capable of withstanding voltage or current of megger test, such as indicating instruments, relays and lamps, before test is made. Voltage output of megger shall be 1000V dc, nominal.

3.3.2.2 Test wiring operating less than 150 volts to ground for continuity and unintentional grounds. Resistance shall not exceed 1 ohm on continuity checks.

3.3.2.3 Contractor may elect to group and connect together conductors within raceway while performing megger test. Record readings which indicate less than minimum acceptable value. Repeat megger test after replacement of defective wiring.

3.3.2.4 Reconnect devices disconnected during testing.

3.3.3 Sensing Cable

3.3.3.1 Before installation: Connect portable test box to 1 end and modular end termination to other end of each sensing cable and verify there is no current leakage caused by dirt, grease, or moisture. If current leakage is detected, clean or replace cable.

3.3.3.2 During installation: Connect portable test box to 1 end and modular end termination to other end of sensing cable. Monitor cable for current leakage caused by dirt, grease, or moisture during pull. If current leakage is detected, pull cable out, clean pipe annulus, and clean or replace cable. Hand pull cable with 50 pounds maximum pull tension.

END OF SECTION

SECTION 16640
CATHODIC PROTECTION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 Reference Standards and Specifications: The following standards and specifications, including documents referenced therein, form part of this Section to extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

ANSI C39.1-1981	American National Standard Requirements for Electrical Analog Indicating Instruments
ANSI C80.1-1983	American National Standard for Rigid Steel Conduit--Zinc Coated

1.1.1.2 American Society for Testing and Materials (ASTM)

B 8-86	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
D 3487-82a	Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus

1.1.1.3 American Wood-Preservers Association (AWPA)

C1-87	All Timber Products-- Preservative Treatment by Pressure Processes
C2-87	Lumber, Timbers, Bridge Ties and Mine Ties--Preservative Treatment by Pressure Processes
P8-87	Standards for Oil-Borne Preservatives

1.1.1.4 National Association of Corrosion Engineers (NACE)

RP-01-69 (Rev 1983)	Recommended Practice - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
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1.1.1.5 National Electrical Manufacturers Association (NEMA)

Standards Publication/
No. 250-1985

Enclosures for Electrical
Equipment (1000 Volts Maximum)

Standards Publication/
No. RN 1-1980

Polyvinyl-Chloride Externally
Coated Galvanized Rigid Steel
Conduit and Electrical Metallic
Tubing

Standards Publication/
No. WC 5-1973 (R 1979) w/Rev
through Mar 1985

Thermoplastic-Insulated Wire
and Cable for the Transmission
and Distribution of Electrical
Energy

1.1.1.6 National Fire Protection Association (NFPA)

NFPA 70

National Electrical Code,
1987 Edition

1.1.1.7 Underwriters Laboratories, Inc (UL)

May 1988

Electrical Appliance and Utili-
zation Equipment Directory

May 1988

Electrical Construction
Materials Directory

1.2 SUBMITTALS: Refer to Section 01300 for submittal procedures.

1.2.1 Approval Data: Submit information listed in Column 5 of Vendor Data List in this Section.

1.2.2 Certified Vendor Information (CVI): Submit information listed in Column 6 of Vendor Data List in this Section.

1.2.3 Visual Examination Procedure: Submit examination procedure for attaching cables, wires, or leads to pipe wall by exothermic weld process.

1.2.4 Manufacturer's Instructions: Submit manufacturer's instructions for exothermic welding of conductors to horizontal and vertical pipe.

1.3 QUALITY ASSURANCE

1.3.1 Qualification and Demonstration of Exothermic Weld Process: Personnel shall be qualified in accordance with following requirements.

1.3.1.1 Prepare 2 exothermic weld connections, No. 4 or 6 AWG cable to pipe, for each weld position to be used.

1.3.1.2 Qualification tests shall meet the requirements of subparagraphs 3.3.8.3a and 3.3.8.3b.

1.3.1.3 Examine connection in accordance with manufacturer's recommended method.

1.3.1.4 KEH will witness performance qualification tests.

1.3.1.5 Deliver 2 copies of connection performance qualification test results to KEH 5 days before making exothermic weld connections. Maintain additional copies as specified in Section 01400, Paragraph 1.6.2.

1.3.2 Standards: Products shall be identified for intended purpose by Underwriters Laboratories, Inc (UL) in the Electrical Appliance and Utilization Equipment Directory or Electrical Construction Materials Directory, and bear listing mark of laboratory. In absence of mark, submit documentation of applicable listing. Listing and marking by UL is not required for products specified to meet the requirements of a national standard, or designated by manufacturer's part number on the Drawings or in this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Solderless Terminal Lugs: Pressure type, rated for use with copper conductors with insulating caps rated for system utilization voltage. Lugs shall be types specified below.

2.1.1.1 For conductors #8 AWG and smaller: Thomas and Betts Company "Sta-Kon."

2.1.1.2 For conductors #6 AWG and larger.

a. Burndy Engineering Company "Hydent."

b. Thomas and Betts Company "Lock-tite."

2.1.2 Compression Splice Connectors: Burndy Co "Crimpit," size shown on the Drawings.

2.1.3 Exothermic Fusion Weld Mold for Connection of Pipe Test Conductors, Jumpers, and Negative Return Cables to Steel or Cast Iron Pipe: Erico Products "Cadweld" size and part number shown on the Drawings.

2.1.3.1 Exothermic weld metal: Erico Products "Cadweld" shown on the Drawings.

2.1.4 Ground Clamp Connector: Bronze, Teledyne Penn-Union, Catalog No. GPL, size as required.

2.1.5 Conduit: Meet the requirements of ANSI C80.1 and be PVC coated in accordance with NEMA RN 1, Type A-40.

2.1.6 Conductors

2.1.6.1 Direct current (DC): High molecular weight low density polyethylene, Type "CP", meeting the requirements of ASTM B 8 and NEMA WC 5. Size specified on the Drawings.

2.1.6.2 Alternating current (AC): Stranded copper with 600 volt Type THHN/THWN insulation. Size specified on the Drawings.

2.1.7 Conductor Splice Kit: Scotchcast Brand, Catalog No. 82-B1 and 90-B1.

2.1.8 Tape

2.1.8.1 Plastic insulating: 3/4 inch wide, Scotch No. 88 manufactured by 3M Company.

2.1.8.2 Electrical splice insulating: Self-vulcanizing rubber, 3/4 inch wide.

2.1.8.3 Electrical color coding: 3/4 inch wide, Scotch No. 35 manufactured by 3M Company.

2.1.9 Plastic Sheet Marker: See Section 02200, yellow warning tape.

2.1.10 Wiremarkers: Imprinted tubular plastic.

2.1.11 Equipment Nameplates: Laminated plastic, 1/16 inch thick with white surface and black core. Edges beveled and smooth. Engraved nomenclature shall be sharp and clear.

2.1.12 Cable Marker: Field fabricate and paint as shown on the Drawings.

2.2 EQUIPMENT

2.2.1 Anodes: Durichlor 51, Type D, size 2 inch by 60 inch with 20 foot lead wire of No. 8 AWG stranded copper with high molecular weight, low density polyethylene (HMW PE) insulation, prepackaged in 8 inch by 96 inch steel canister with coke breeze backfill.

2.2.1.1 Cable to anode connection: Covered with epoxy cap in accordance with manufacturer's standards.

2.2.1.2 Canister: 30 gage galvanized stove pipe.

2.2.1.3 Coke breeze: Compacted to total weight of approximately 200 pounds per canister.

2.2.1.4 Electrical resistivity of coke breeze shall not exceed 50 ohm/cm³.

2.2.2 Anode Junction Box, and Test Station Enclosures: Quazite Corporation, Style "PG" service box, Model no. PG1324BA18 with locking steel cover, Part No. PG1324SA00 with logo engraved: "CATHODIC PROTECTION".

2.2.3 Anode Junction Box: Single hub, double box, slip fit for 3 inch rigid conduit, 8 standard terminals, each terminal 3/8 inch silicon bronze studs with nuts and washers; Gerome, Catalog No. 2007.

2.2.4 Test Station: Single hub, double box, slip fit for 3 inch rigid conduit, 8 standard terminals and 6 extra terminals, each terminal 3/8 inch silicon bronze with nuts and washers; Gerome, Catalog No. 2007.

2.2.5 Reference Electrode: Permanent horizontal copper-copper sulfate type, Harco Corp, Part No. IHRP-802, Matcor Part No. PRC-CU4, or Farwest Corrosion, Part No. FWCC-SP-150. Provide with 50 feet of #8 AWG MMW/PE insulated wire.

2.2.6 Rectifier

2.2.6.1 General requirements: Rectifier and associated equipment shall operate and deliver rated capacity, without exceeding temperature limitations specified, when operating in following environment.

a. Operating Environment

- 1) Location: Outdoors in direct sunlight.
- 2) Ambient temperature: Minimum minus 13 F, Maximum 113 F.
- 3) Relative humidity: Maximum 100 percent.
- 4) Dust: Exposure to dust particulate (sandstorm).
- 5) Precipitation: Driving rainstorm.
- 6) Snow: Accumulation of sleet or snow.

b. Design life: Minimum 10 years.

2.2.6.2 Design Requirements

a. Rating

- 1) AC line input voltage: 480V ac, minus 5 percent to plus 10 percent.
- 2) AC line frequency: 60 Hertz.
- 3) Number of phases: 3.
- 4) DC output voltage: 60 volts.

5) DC output current: 12 amps.

b. Oil-immersed type.

c. Suitable for mounting on concrete slab.

d. Transformer: Separate primary and secondary windings fully rated for maximum capacity. Electrostatic shield placed between primary and secondary windings and fully insulated from both windings. Arrange shield not to form complete closed loop and equip with lead wire connected to negative terminal.

e. Silicon stacks: Connected in full wave bridge circuit configuration, and coated with corrosion-resistant finish equivalent to NEMA Grade C.

f. Silicon diodes: Rated to provide margin for over-voltage surges and over-current surges, and protected by selenium surge-plates against over-voltage surges and by current-limiting devices against over-current surges. Heat sinks sized to keep diode junction and case temperatures below temperatures that could cause failure.

g. Efficiency filter: Incorporate in rectifier to increase efficiency of unit.

h. Enclosure: Meet the requirements of NEMA 250.

i. Current carrying pressure connections, such as terminal studs and current shunt connections, shall have thin layer of conductive grease applied to contact surfaces to prevent oxidation.

2.2.6.3 Construction requirements

a. Construct to permit transformer, stacks and other internal components to be immersed in oil. Inside of enclosure shall be accessible through cover mounted on top. Attach cover to cabinet by hinges and provide with quick-release clamps and padlock clasp or other means of locking cabinet. Provide stop to limit swing of lid when opened. Provide positive, oil-resistant, compressible sealing lid gasket. Cork and sponge materials are not acceptable. Gasket joints shall not have gaps.

b. Provide panel for mounting terminals, circuit breakers, shunts, etc. Board inside panel shall be micarta or similar insulating material, supported on 4 edges.

c. Enclosure and appurtenances: Approved for use in specified environmental conditions. Materials and methods used in construction and fabrication of rectifier shall be in accordance with NEMA requirements for specified service. Internal components and connections of rectifier shall be immersed under 3 inches of oil, minimum.

d. Enclosure shall be minimum 0.1196 inch steel provided with oil drain plug. Oil level shall be clearly marked.

e. Construct and protect enclosure so environmental conditions specified in subparagraph 2.2.6.1a will not affect rectifier rated performance.

f. Finish enclosure inside and outside with 1 coat of epoxy red oxide primer and 2 coats of gray baked enamel.

g. Provide engraved, manufacturer's standard nameplates on rectifier. Nameplate information shall include rating data specified in subparagraph 2.2.6.2a.

2.2.6.4 Instrumentation

a. Indicating instruments: Meet the requirements of ANSI C39.1.

b. Continuous reading, 3-1/2 inch flush mounted dc voltmeter, for measuring voltage output. Scale shall be linear and range from 0 to 125 percent of rated output voltage.

c. 3-1/2 inch flush mounted dc ammeter, connected across external shunt for reading total dc current output of rectifier. Meter circuit shall have disconnect switch which may be closed by operator when readings are being taken. Ammeter scale shall be linear and range from 0 to 125 percent of rated current output in amperes.

d. Shunt: 50 millivolt, 12 ampere mounted on front of instrument panelboard.

2.2.6.5 Voltage and current control: Output voltage manually controlled. Transformer taps shall have tap-changing devices for manual operation to permit at least 18 equal steps of adjustment.

2.2.6.6 Protection: Furnish with following protective devices and equipment.

a. AC thermal magnetic circuit breakers: Mounted within panel and provide short-circuit protection for rectifier.

b. DC fuse: Rated at 15 amperes, 125 volts, and installed in positive phase leg. Fuse shall be accessible from front of panel.

c. DC valve-type arrester: For 150 volt maximum line-to-ground fault voltage.

d. AC input surge (lightning) arresters.

e. Ground lug: Installed on cabinet so cabinet may be connected to grounding system. Size ground lug for No. 4 AWG copper ground cable.

2.2.6.7 Output terminals

a. 2 negative and 4 positive terminals mounted on front of panel and appropriately marked.

b. External shunts on output (positive and negative) circuits indicated above. Output shunts of same rating as ammeter external shunt.

2.2.6.8 Shop tests: Factory test and inspect to establish that design and construction are in accordance with this Section and applicable standards, and to determine that equipment is free from electrical and mechanical defects.

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Where existing pipes are exposed during excavation, and usage not known and cannot be verified, do not exothermically weld test conductors to pipe unless written permission is granted by KEH. Make connections using bronze ground clamp connector. Coat connection using same materials and installation methods as for exothermic weld.

3.2 PREPARATION

3.2.1 Field Measurements: Scale dimensions on the Drawings show desired and approximate location of equipment, actual locations, distances, and levels shall be governed by field conditions.

3.3 INSTALLATION

3.3.1 General

3.3.1.1 Perform work in accordance with NFPA 70 (NEC).

3.3.1.2 Cathodic protection systems: Meet the requirements of NACE RP-01-69.

3.3.1.3 Use appropriate special calibrated tools when installing devices for which special installation tools are recommended by manufacturer.

3.3.2 Anodes: Install vertically to depth shown on the Drawings.

3.3.2.1 Drill or auger hole to enable anode to be lowered into hole. Where casing is used to maintain open hole, remove after anode has been placed in hole.

3.3.2.2 Lower anode to bottom of hole by rope and center within hole. Do not use lead wire to lower anode into hole.

3.3.2.3 Backfill and compact in accordance with Section 02200.

3.3.2.4 If temporary casing was used, lower anode into position and slowly withdraw casing while backfilling.

3.3.2.5 Repair damaged anode lead wire insulation by encapsulation with epoxy resin using conductor splice kit.

3.3.2.6 Splice anode lead conductor to anode header cable as shown on the Drawings.

3.3.2.7 Insulate splice as shown on Drawings. Provide 18 inch slack cable on anode lead at splice location.

3.3.3 Anode Junction Box Enclosure: Install 2 inches above grade at location shown on the Drawings. Install nameplate on top of enclosure. Engrave nameplate, using 3/16 inch letters, ANODE JUNCTION BOX AJB (number shown on the Drawings). Fasten nameplate to enclosure by machine screws or rivets. Install steel cover on enclosure and lock.

3.3.4 Anode Junction Box: Install inside anode junction box enclosure and terminate anode header and loop cables on terminals as shown on the Drawings. Install equipment nameplate on cover of each junction box. Engrave nameplate, using 3/16 inch letters, ANODE JUNCTION BOX AJB (number shown on the Drawings). Fasten nameplate to box by machine screws or rivets. Form slack loop in anode header and loop cables, length shown on the Drawings, and place in bottom of enclosure.

3.3.4.1 Use 1/8 inch thick bus bar of bus grade copper, cut and drilled to fit, to connect terminal studs shown on the Drawings.

3.3.5 Test Station Enclosure: Install 2 inches above grade at location shown on the Drawings. Install nameplate, on top of enclosure. Engrave nameplate, using 3/16 inch letters, TEST STATION T (numbers shown on the Drawings). Fasten nameplate to enclosure by machine screws or rivets. Install steel cover on enclosure and lock.

3.3.6 Test Station: Install inside test station enclosure and terminate pipe and reference electrode test conductors on terminals shown on the Drawings. Install nameplate on cover of test station. Engrave nameplate, using 3/16 inch letters, TEST STATION T (number shown on the Drawings). Fasten nameplate to box by machine screws or rivets. Form slack loop in pipe test conductors, length shown on the Drawings, and place in bottom of enclosure.

3.3.7 Reference Electrode

3.3.7.1 Install at each test station enclosure location as shown on the Drawings.

3.3.7.2 Soak in water for minimum 3 hours, then lower into hole with ropes. Do not use lead to lower into hole.

3.3.7.3 Install package between 6 and 18 inches below outer surface of pipe. 1 electrode is required for 2 pipes or less. For configuration of 2 parallel pipes, install electrode in center of configuration, and not adjacent to or touching foreign pipelines. KEH will assist in positioning reference electrodes.

3.3.7.4 Bring lead wire to top of hole for termination in test station.

3.3.7.5 Repair damaged lead wire insulation using conductor splice kit.

3.3.7.6 Backfill trench in accordance with Section 02200.

3.3.8 Rectifier: Attach to concrete pad with anchor bolts as shown on the Drawings.

3.3.8.1 Terminate ac wiring on input circuit breaker in rectifier.

3.3.8.2 Fill rectifier to level shown on rectifier case, with transformer oil meeting the requirements of ASTM D 3487.

3.3.8.3 Pipe test conductors

a. Verify usage of each pipe to which pipe test conductors are to be connected. If pipes are coated, cut window in coating large enough to accommodate exothermic weld mold. Wire brush each pipe and file to bright metal surface, free of oil and dirt. Make exothermic weld of test conductor to pipe in accordance with approved manufacturer's instructions, size shown on the Drawings. Install weld mold as shown on the Drawings.

b. After weld is made, test integrity of connection by tapping side of weld material with hammer. If weld fails, make another weld at least 3 inches from previous attempt.

c. Coat exothermic weld as shown on the Drawings. If pipe is coated, overlap coating 2 inches beyond cut edge of coating around exothermic weld.

d. Conductor size and color code marking specified on the Drawings.

e. Repair damaged conductor insulation using conductor splice kit.

f. Make repairs of foam insulation on pipe with sprayed polyurethane, specified in Section 15493, applied in accordance with manufacturer's instructions.

g. Identify each conductor using specified wiremarker with typewritten pipe number to which conductor is connected. Label pipe test conductors connected to unidentifiable pipes with pipe size followed by words "UNKNOWN".

h. Use solderless terminal lugs for conductor terminations in test station.

i. Where required, place plastic sheet marker 1 foot below grade and over pipe test conductors in accordance with Section 02200.

j. Backfill in accordance with Section 02200.

3.3.8.4 Reference electrode conductor

a. Wrap lead wire in test station with green electrical color coding tape.

b. Identify conductor using specified wiremarker with typewritten reference electrode number shown on the Drawings.

c. Use solderless terminal lug for conductor termination in test station.

d. Terminate lead wire in test station as shown on the Drawings. After termination, place test station in flush-mounted enclosure. Form slack loop in lead wire, length shown on the Drawings, and place at bottom of enclosure.

e. Repair damaged conductor insulation using conductor splice kit.

3.3.8.5 Backfill in accordance with Section 02200.

3.3.9 Conductors

3.3.9.1 Anode header, anode loop, and negative return cables

a. Place on bedding in trenches prepared in accordance with the Drawings.

b. Where only 1 cable is being installed, center in trench. Where more than 1 cable is installed, minimum spacing between cables shall be 1 inch. Do not transpose cables in trench.

c. Loosely bundle anode header and loop cables together with electrical tape and center in trench. Provide 12 inch slack loop in header cable at anode lead splice locations. Provide 18 inch slack loop in anode lead cable at tap splice location.

d. Maintain identity of each cable. Where 2 or more cables are in same trench, maintain relative positions of cables, as shown on the Drawings, throughout entire run. Identify cables, using specified wiremarkers, at terminations and where in-line splice is necessary, before leaving unattended.

e. Terminate anode header and loop cables at rectifier positive output terminals and anode junction box. Terminate negative return cable at rectifier negative output terminal. Use solderless terminal lugs for conductor terminations. Identify cables using specified wiremarkers, typewritten.

f. Repair damaged cable insulation by using "Scotchcast" 90-B1 splice kits for No. 2 and No. 2/0 AWG cables and "Scotchcast" 82-B1 splice kits for No. 8 AWG anode lead cables.

g. Place minimum 3 inches of bedding material, as shown on the Drawings, over cables and compact in accordance with Section 02200.

h. Place 2 inch by 12 inch wood planks, treated in accordance with AWPA C1, C2, and PB, continuous over bedding for entire length of trench. Do not place planks over individual anode leads.

i. Place plastic sheet marker 1 foot below grade directly above wood planks in accordance with Section 02200. Do not place over anode leads.

j. Identify each cable end as required with 1 of following phrases, typewritten on specified wiremarker.

1) "Anode Header Cable - (+E), (+W), (+WE), (+SE)".

2) "Anode Loop Cable - (+WL), (+NEL), (+SEL)".

3) "Neg Return Cable - (-)".

k. Cover cable ends with plastic electrical tape until ready to be terminated at rectifier, or anode junction box.

1. Cable marker

1) Install directly over cables at locations shown on the Drawings.

2) Install 5 feet from end of cable run and on turns of cable runs. Arrow on marker shall be parallel to cable.

3) Do not place marker in traffic ways. Where cathodic protection cables cross roadways, crossing shall be as shown on Drawings.

3.3.9.2 Connection of negative return and jumper cables to pipe.

a. Connections shall not be made to pipe until pipe has been identified by KEH.

b. Prepare cable and make connections to pipe as shown on the Drawings.

c. If pipes are coated or covered by foam insulation, cut windows large enough to accommodate exothermic weld mold.

d. Connect each conductor section to pipe by exothermic weld process.

e. Insulate weld as shown on the Drawings. Insulate welds on coated pipe in same manner as bare pipe welds. Weld coating material shall overlap existing pipe coating 2 inches, minimum.

f. Make repairs of foam insulation with sprayed polyurethane insulation foam specified in Section 15493.

3.3.10 Conduit: Install PVC coated conduits in accordance with manufacturer's installation instructions and as shown on the Drawings. Cut conduit square, ream and deburr. Damage to PVC coated conduits shall be touched up with "Plastic-Bond" touch-up compound.

3.4 FIELD QUALITY CONTROL

3.4.1 Testing, General

3.4.1.1 Test conductors for continuity where practicable. Resistance values shall be less than 1 ohm. Notify KEH before start of tests. Correct items found during testing or examination to be at variance with the Drawings or Specifications.

3.4.1.2 Furnish instruments, labor and equipment required to conduct testing.

3.4.1.3 Use test instruments which bear valid calibration stamp showing date of calibration and expiration date of stamp. Calibration and accuracy of test instruments shall be certified by independent testing laboratory having standards traceable to the National Bureau of Standards.

3.4.1.4 In addition to testing specified to be performed by Contractor, installation will be subject to examination by KEH for conformance with design and applicable codes.

STA-4
APR 13 1989

16

ENGINEERING DATA TRANSMITTAL (EDT)
(USE BLACK INK OR TYPE)

Page 1 of 1

(1) EDT: 102088

(2) To: (Receiving Organization)
Distribution & 24320
Environmental Projects

(3) From: (Originating Organization)
Environmental Projects
24320

(4) Related EDT No:
101663/101290
101089/102073

(5) Proj/Prog/Dep/Div:
B-714 / WP / GROUT VAULTS

(6) Cogn/Proj Engr:
S R BRIGGS

(7) Purchase Order No:
NA

(8) Originator Remarks:
This specification if being released to initiate
Bid Package Preparation for Grout Vault Construction.

(9) Equip/Component No:
NA

(10) System/Blag/Facility:
218-E-16

(11) Receiver Remarks:
REFER TO INTERNAL MEMO 24320-89-021
FOR OPEN ITEMS.

(12) Major Assn Dwg No:
NA

(13) Required Release Date:

(14) DATA TRANSMITTED					(M)	(C)	(I)	(R)
(A) Item No.	(B) Document/Drawing No.	(C) Sht. No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Impact Level	Reason for Transmittal	Disposition	Receiver Disposition
1	V-B714C203 (B714C2)	-	0	Construction specification for Vault Concrete Basin, Shell, and Leachate Sump for Grouted Waste Disposal Facilities Grouted Vault Pile (218 E-16)	2	1&2	2	2

(15) KEY		
Impact Level (F) 1, 2, 3, or 4 see MRP 5.43 and EP 1.7	Reason for Transmittal (G) 1. Approval 4. Review 2. Release 5. Post Review 3. Information	Disposition (M & I) 1. Approved 4. Reviewed no comment 2. Approved w comment 5. Reviewed w comment 3. Disapproved w comment 6. Receipt acknowledged

(16) SIGNATURE DISTRIBUTION (See Impact Level for required signatures)					
Name	Signature	Date	Name	Signature	Date
182 III D. R. Lucas	<i>[Signature]</i>	4/10/89			
182 III D. R. Ellingson	<i>[Signature]</i>	4/10/89			
182 III J. R. McGee	<i>[Signature]</i>	4/10/89			
182 2/21 D. L. Wadrich	<i>[Signature]</i>	4/10/89			
182 2/11 S. R. Briggs	<i>[Signature]</i>	4/10/89			
182 III A. W. Lissila (DOE-RR)	<i>[Signature]</i>	4/10/89			
182 III R. T. Windward	<i>[Signature]</i>	4/10/89			

(17) Signature of Originator: <i>[Signature]</i> 4/10/89	(18) Authorized Representative Date for Receiving Organization: <i>[Signature]</i> 4/10/89	(19) Cognizant Project Engineer's Date: <i>[Signature]</i> 4/10/89	(20) DOE APPROVAL (If required) LTR No. NA Approved Approved w/comments Disapproved w/comments
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