Dtx. (2)

JUL 20 1998

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 622267

S

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) TWRS Projects/SST Retrieval	4. Related EDT No.: n/a
5. Proj./Prog./Dept./Div.: W-320 TWRS/TCPN # D2991	6. Design Authority/ Design Agent/Cog. Engr.: JW Bailey, NHC	7. Purchase Order No.: n/a
8. Originator Remarks: For approval and release of a new supporting document. This document has been generated to ensure retrievability of the Project W-320 "Construction Specification W-320-C2".		9. Equip./Component No.: n/a
		10. System/Bldg./Facility: 241-C-106
11. Receiver Remarks: 11A. Design Baseline Document? [X] Yes [] No		12. Major Assm. Dwg. No.: n/a
		13. Permit/Permit Application No.: n/a
		14. Required Response Date:

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Desig-nator	(G) Reason for Trans-mittal	(H) Origi-nator Dispo-sition	(I) Receiv-er Dispo-sition
1	HNF-2533	-	0	Project W-320, 241-C-106 Sluicing, Construction Specification W-320-C2	NA			-

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 4. Review 2. Release 5. Post-Review 3. Information 6. Dist. (Receipt Acknow. Required)	1. Approved 4. Reviewed no/comment 2. Approved w/comment 5. Reviewed w/comment 3. Disapproved w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
2	1	Design Authority/ JW Bailey	JW Bailey	7/18/98	S2-48
	1	Design Agent	MC Davenport	7/18/98	
2	1	Cog.Eng. MC Davenport	MC Davenport	7/18/98	S2-48
2	1	Cog. Mgr. JW Bailey	JW Bailey	7/18/98	S2-48
		QA			
		Safety			
		Env.			

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN

18. M.C. Davenport — Signature of EDT Originator — Date 7/18/98

19. Authorized Representative for Receiving Organization — Date

20. J.W. Bailey — Design Authority/ Cognizant Manager — Date 7/18/98

21. DOE APPROVAL (if required) Ctrl. No.
[] Approved
[] Approved w/comments
[] Disapproved w/comments

BD-7400-172-1

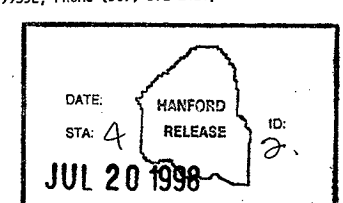
Project W-320, 241-C-106 Sluicing, Construction Specification W-320-C2

John W. Bailey
Numatec Hanford Co., Richland, WA 99352
U.S. Department of Energy Contract DE-AC09-96RL13200

EDT/ECN: 622267 UC: 506
Org Code: 8C452 Charge Code: D2991/HANA0600
B&R Code: EW3130010 Total Pages: 79

Key Words: W-320, Sluicing, Tank 241-C-106, Tank 241-AY-102, WRSS, Specifications, Construction.

Abstract: This supporting document has been prepared to make the construction specifications for Project W-320, readily available.



Release Stamp

Release Approval 7/20/98 Date

Approved for Public Release

DRE 6/25/98

ENGINEERING CHANGE NOTICE

1. ECN 649180
Proj. ECN W-320-806

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [ ] Direct Revision [X] Change ECN [ ] Temporary [ ] Standby [ ] Supersedure [ ] Cancel/Void [ ]	DL. Evans, FDNW, S2-47, 373-2688.	[ ] Yes [X] No	6/25/98
	6. Project Title/No./Work Order No. W320 Waste Retrieval for Tank 241-C-106 /W320 / Pkg 8	7. Bldg./Sys./Fac. No. Tanks 241-AY-102 & 241-C-106	8. Approval Designator SQ/SC
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) W-320-C2, Rev 0	10. Related ECN No(s). none	11. Related PO No. NA

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[ ] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	NA	NA Design Authority/Cog. Engineer Signature & Date	NA Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? [X] Yes [ ] No

GS

As-Built and General Revisions of the construction specification W-320-C2. Changes to include:

Section 01010

1.1.1 change "H-2-820722, Sh 3" to "H-2-818423"

1.3.1 change "H-2-820722, Sh 3" to "H-2-818423"

14a. Justification (mark one)

Criteria Change	[ ]	Design Improvement	[ ]	Environmental	[ ]	Facility Deactivation	[ ]
As-Found	[X]	Facilitate Const	[ ]	Const. Error/Omission	[ ]	Design Error/Omission	[ ]

14b. Justification Details

As-Built construction specification for project turnover.
No USQ required because categorical exclusion (TF-96-0690, Rev 2) applies.

No project calculations are affected by this work.
An independent review of this design change was performed by FDNW in accordance with HNF-PRO-445.

15. Distribution (include name, MSIN, and no. of copies)

CDC, S2-53, 1
TJ Kasnick, S2-47, 1

JW Bailey, S2-48, 1
RL Powers, S5-13, 1

Project Files, R1-29,

RELEASE STAMP

DATE: JUL 08 1998
STA: 4
HANFORD RELEASE
ID: 2

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): W-320-806

16. Design Verification Required	17. Cost Impact — ENGINEERING		17. Cost Impact — CONSTRUCTION		18. Schedule Impact (days)	
[x] Yes	Additional []	$ NA	Additional []	$ NA	Improvement []	NA
[] No	Savings []	$	Savings []	$	Delay []	

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]	None 6/29/98	[X]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

21. Approvals

	Signature	Date
Design Authority	[signature]	6/29/98
Cog. Eng.	[signature]	6/29/98
Cog. Mgr.	[signature]	6-29-98
QA	Keith Conrad	7-1-98
Safety	[signature]	7-1-98
Environ.		
Other	TWRS Project W-320 Cog Engr [signature]	07-08-98

	Signature	Date
Design Agent	Danny L. Evans	6/25/98
PE	[signature]	6-25-98
QA - NA		NA
Safety - NA		NA
Design - DL Evans	D. L. Evans	6/25/98
Environ. - NA		NA
Checker -	[signature]	6/25/98
Other -		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

DANNY LEE EVANS — STATE OF WASHINGTON — 28260 — REGISTERED PROFESSIONAL ENGINEER

[signature] 6/25/98

EXPIRES: 7/21/00

A-7900-013-3 (05/96) GEF096

AS-BUILT REV 1

TANK 241-C-106 SLUICING
Equipment Removal System

Original Issue: 10/12/94

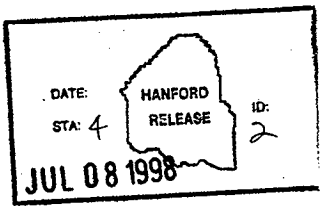
Prepared By

Fluor Daniel Northwest
Richland, Washington

For

Numatec Hanford Corporation

Contract 651005



Client Concurrence — 6/29/98 Date

Project Manager — 06-25-98 Date

Lead Engineer — 6/25/98 Date

Field Concurrence — 6/25/98 Date

Checked By — 6/25/98 Date

Prepared By — 6/25/98 Date

The ECNs affecting specification page attached.

ECNs affecting specification are as follows:

ECN-W-320-68
16400-4,5

ECN-W-320-69
5500-2,3,4
16400-5,12

ECN-W-320-70
5500-3,4,5
16300-4
16400-5,9

ECN-W-320-71
16400-13

ECN-W-320-77
2225-1,3

ECN W-320-93
16400-11

ECN W-320-548
16300-10

ECN W-320-597
16300-11
16400-13

ECN W-320-806
01010-1

CONSTRUCTION SPECIFICATION

EQUIPMENT REMOVAL SYSTEM

Work Order ER5735

Prepared By
ICF Kaiser Hanford Company
Richland, Washington

For the US Department of Energy
Contract DE-AC06-93RL12359

OFFICIAL RELEASE
BY WHC
DATE OCT. 12 1994
Sta #10

APPROVED

ICF Kaiser Hanford Company (ICF KH)

Danny L. Evans P.E. #28260 — Principal Lead Engineer — 9/29/94 Date

M. A. Fisher — Technical Documents — 9-28-94 Date

Safety — 9/30/94 Date

Robert K. Mahanna — Environmental Engineering — 9-29-94 Date

C. E. Watson — Quality Engineering — 9-30-94 Date

Construction — 9-30-94 Date

Project Management — 10/3/94 Date

Westinghouse Hanford Company (WHC)

Thomas A. May — Projects Department — 10/3/94 Date

CONTROLLED DOCUMENT
STATION NO. 4
DIST DATE JAN 2 1 1997
PROJ / WO W-320
NO PLE-1

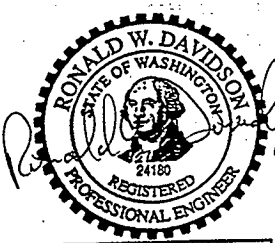
CONSTRUCTION SPECIFICATION

EQUIPMENT REMOVAL SYSTEM

Prepared by
ICF Kaiser Hanford Company
Richland, Washington

CERTIFICATION

I certify that the indicated sections of this Specification were prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Washington.

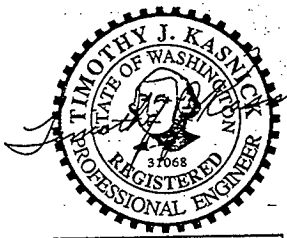


9/30/94

EXPIRES 03-03-94

Ronald W. Davidson, PE
Civil/Structural

Sections 02225, 02235
02831, 03300, 05500



9/30/94

EXPIRES 11 / 18 / 94

Timothy J. Kasnick, PE
Electrical

Sections 16300, 16400

TABLE OF CONTENTS

CALCULATIONS

W-320-C2

This listing provides traceability from project documents back to the supporting engineering analysis (see ENG-DPI-3) and is not part of the contract documents. Contract Placement shall remove this sheet prior to bid publication.

<Discipline>

[Listing shall be arranged by engineering discipline in the same order as listed on drawings.]

Calculation Number	Title	Section

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 INTRODUCTION

1.1.1 Project W-320, Equipment Removal Phase, is located as shown on Drawing H-2-~~820722, Sh 3~~ *818423*. ECN 806

1.1.2 This Specification is for fabrication and installation of equipment necessary to support the removal of existing equipment from Tanks C-106 and AY-102.

1.2 STATEMENT OF WORK

1.2.1 Scope: Work consists of furnishing labor, equipment, and materials to provide the means to remove existing equipment from waste storage tanks in accordance with the Contract Documents.

1.2.2 Work Included: The following itemization is intended to be broad in scope, and identify major work elements only.

1.2.2.1 General site preparation work, including laydown areas and road stabilization.

1.2.2.2 Preparation of site and installation of pads for electrical equipment.

1.2.2.3 Furnishing and installation of electrical distribution equipment.

1.2.2.4 Fabrication and installation of electrical equipment skids. Also, installation of power distribution panel on skid framework, and installation of skid in place.

1.2.2.5 Installation of spool pieces for sluice pit, pump pit, and heel pit.

1.2.3 Work Not Included: The following work elements are part of the Project, are covered by other documents noted, and will be done by others, concurrently with work included in the Contract Documents.

1.2.3.1 Fabrication of the high pressure pump trailer, the strong-back trailer, and the instrument trailer.

1.2.3.2 Fabrication and installation of construction support trailers.

1.2.3.3 Installation of the standby generator.

1.3 DRAWINGS

1.3.1 Drawings which show work required by the Contract Documents are listed on Drawing H-2-~~820722, Sh 3~~ *818423*. ECN 806

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 SITE-APPROVED ADMINISTRATIVE PROCEDURES

3.1.1 Site-approved administrative procedures, that meet the intent of this Specification, may be used. Site-approved procedures are not required to be submitted for project review and approval.

3.2 SITE-APPROVED WORK PROCEDURES

3.2.1 Site-approved work procedures, that meet or exceed manufacturer's installation instructions or construction requirements, may be used. Site-approved work procedures are not required to be submitted for project review and approval.

3.3 SITE-APPROVED PERSONNEL QUALIFICATIONS

3.3.1 Personnel qualified to site-approved procedures, that meet the intent of this Specification, may perform the work required. Site-approved personnel qualifications are not required to be submitted for project review and approval.

END OF SECTION

SECTION 01019

ITEMS FURNISHED FOR CONSTRUCTION

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 GENERAL

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

1.4 EQUIPMENT

1.4.1 Items listed below will be furnished by the Construction Engineer for incorporation into the Work.

1.4.1.1 C Farm Supply transformer, procured under PO WTG-VVV-412301.

1.4.1.2 AY Farm Supply transformers, procured under PO WDP-VVV-353654.

1.4.1.3 C Farm Supply watthour meter, meter cabinet and test switch, procured under PO WTG-VVV-412304.

1.4.1.4 C Farm Power Distribution Panel C-PDP-1 including current transformers for the C-Farm watthour meter, procured under W-320-P32.

1.4.1.5 AY Farm Power Distribution Panel AY-PDP-1, procured under W-320-P32.

1.4.2 Items noted in 1.4.1.1 through 1.4.1.3 are on hand and presently stored in Building 2101M in the 200 East Area approximately 2 miles from Project site. Notify the Construction Engineer 5 working days before need date to arrange for pick-up.

1.4.3 Items noted in 1.4.1.4 and 1.4.1.5 are on order with expected delivery on or before 10/28/94. Items will be delivered to Project site. Notify the Construction Engineer 5 working days before need date to arrange for delivery.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used (See the other sections requiring submittals)

1.3 SUBMITTAL CONDITIONS

1.3.1 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.

1.4 SUBMITTALS REQUIRED

1.4.1 Required submittals are defined in Part 1, Article 1.2 of the specification sections.

1.4.2 Submittals are divided into two types; those requiring approval, and those not requiring approval. Included in the former are submittals of architectural material samples, where the Construction Engineer reserves the right to make final selections.

1.4.3 Submittals are required no later than the times indicated. Those requiring approval must be approved before further submittal related procurement, fabrication, or construction is accomplished. This also applies for the Construction Engineer's selections made from samples submitted.

1.5 SUBMITTAL REVIEWS

1.5.1 Submittals requiring approval will be reviewed to verify completeness and conformance to requirements. Appropriate dispositions will be made as specified in 3.2.

1.5.2 Allow 21 calendar days for review and disposition of submittals. This time period will be measured from date of submittal receipt in the Construction Engineer's office to date of return mailing.

1.5.3 Submittals not requiring approval will be reviewed to verify completeness and adequacy for their intended purposes. If acceptable, these items are filed, and finally delivered to the Operating Contractor. Unacceptable items will be handled as specified in 3.2.1.3.

1.5.4 If a submittal not requiring approval has not been returned within the time period specified in 1.5.2, and the Construction Engineer has not been informed that additional review time is necessary, consider it accepted.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURE

3.1.1 Transmit submittals using "Data Transmittal/Review," Form KEH-1838.

3.1.2 Identify each submittal by Section/Paragraph Number and Submittal Title. The number of copies required includes 2 copies for return. If necessary, provide additional copies required for return.

3.1.2.1 Approval Data (for products): Mark each line item package with the specification section and paragraph numbers specifying the product.

3.1.2.2 Vendor Information (for products): Mark each line item package with the specification section and paragraph numbers specifying the product, and the item name, manufacturer's name, model or part number, and tag number (if specified).

3.1.2.3 Items that require approval: Submit 6 copies, including one reproducible.

3.1.2.4 Samples for selections: Submit as required by the Sections of this Specification.

3.1.2.5 Items that do not require approval: Submit 10 copies.

3.1.3 Review each submittal for completeness, compliance with Project Documents, and proper identification before sending to the Construction Engineer. Submittal data shall either be stamped, showing the review process has taken place, or the Data Transmittal form may be stamped "Reviewed for Compliance," and signed. Submittals not stamped or signed will be returned without consideration.

3.1.4 Procedures for performing certain types of work must be submitted for approval before work is commenced. Such procedures which have previously been approved, for work similar to that to be accomplished on this Project, may not need to be reapproved. Forward 1 copy of previously approved procedures to the Construction Engineer, by Data Transmittal form, and identify each by Section/Paragraph Number, Title, and either procedure number or project number for which the procedure was approved. Submittals will be reviewed by the Construction Engineer and, if acceptable, retained for record. If a previously approved procedure is not acceptable, the submittal will be returned, with requirements for resubmittal.

3.2 SUBMITTAL PROCESSING

3.2.1 Submittals requiring approval will be stamped by a representative of the Construction Engineer and marked "Approved", "Approved with Exception" or "Not Approved, Revise and Resubmit." Approval of submittals does not relieve the preparer of responsibility for errors contained therein.

3.2.1.1 Approved submittals are identified by the submittal stamp, with either the "Approved" or "Approved with Exception" box checked. "Approved"

signifies general concurrence of submittal conformance with Project design concepts and compliance with Project Document requirements. "Approved with Exception" signifies general concurrence, with noteworthy comments or clarifications. Approval of a specific item shall not be construed as approval of the system or assembly of which that item is a component.

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

3.2.1.3 Submittals not requiring approval that are found to be incomplete or inadequate will be returned marked "Resubmit." An explanation of the deficiencies will be included, for corrective action.

3.3 RESUBMITTAL

3.3.1 Upon receipt of deficient submittal data, make corrections noted on the transmittal, and resubmit data to the Construction Engineer.

END OF SECTION

SECTION 01405

PRODUCT QUALITY ASSURANCE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 Factory Mutual System (FM)

Approval Guide

1.1.1.2 Underwriters Laboratories (UL)

Electrical Appliance and
Utilization Equipment Directory

Electrical Construction
Materials Directory

1.2 SUBMITTALS: Not Used

1.3 ELECTRICAL/ELECTRONIC PRODUCT ACCEPTABILITY

1.3.1 Products shall be identified (listed) for their intended use in one of the following, and bear the organization's label. In the absence of a label, provide documentation that verifies product listing.

1.3.1.1 UL Electrical Construction Materials Directory.

1.3.1.2 UL Electrical Appliance and Utilization Equipment Directory.

1.3.1.3 FM Approval Guide.

1.3.2 When products with one of the above listings are not available, products tested and certified by another agency are acceptable, provided that the following conditions are satisfied.

1.3.2.1 The agency has been qualified for product testing in accordance with a national code or standard.

1.3.2.2 Product testing was accomplished in accordance with a national code or standard.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 EXCLUDING MISREPRESENTED PRODUCTS

3.1.1 Take measures to prevent incorporation of misrepresented (ie suspect/ counterfeit) products into the work.

3.1.2 Methods To Detect And Exclude Misrepresented Products

3.1.2.1 Obtain products from original manufacturers, their authorized distributors, or other established and reliable sources only.

3.1.2.2 During the initial stages of procurement, be suspicious of quoted prices significantly lower, or delivery times significantly shorter, than those of competitors. Such quotations may be an indication that misrepresented products are being offered.

3.1.2.3 Products received should be in boxes or containers bearing original manufacturer's labels, except for bulk or lot materials that are repackaged for shipment in quantities ordered.

3.1.2.4 Screen newly procured products and previously procured (ie, stock on hand) products that are scheduled to be incorporated into the work. Screening activities should, as a minimum, include the following:

a. Screening to identify product sources (manufacturer, authorized distributor, or other reliable source).

b. Screening for false marking as to class, type or grade.

c. Screening for false labeling indicating qualification or approval by nationally recognized agencies (eg, UL listed).

d. Screening for used products being represented as new.

e. Screening for falsified quality affecting documentation (eg, Certified Material Test Reports) being used as the basis for product acceptance.

3.1.3 Documentation: Invoices and shipping documentation should be addressed to ICF KH, and should indicate that products were procured from the original manufacturer, authorized distributors, or other established and reliable sources.

3.1.4 Upon detection of suspect products, document the findings, and deliver copies to the Construction Engineer.

3.1.5.1 Segregate suspect products and maintain control to prevent use in Project work. Obtain direction from the Construction Engineer for proper disposal of suspect products.

3.1.5.2 If procurement and screening activities result in partial but inconclusive evidence of suspect products, contact the Quality Control Inspector for additional direction and assistance.

END OF SECTION

SECTION 01415

SHOP AND WORKSITE QUALITY ASSURANCE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Society of Mechanical Engineers (ASME)

B&PVC	Boiler and Pressure Vessel Code, 1992 Edition
Section IX	Welding and Brazing Qualifications

1.1.1.2 American Society for Nondestructive Testing (ASNT)

SNT-TC-1A	Recommended Practice (Dec 1988 Edition)

1.1.1.3 American Welding Society (AWS)

D1.1-94	Structural Welding Code - Steel
D1.3-89	Structural Welding Code - Sheet Steel
D9.1-90	Sheet Metal Welding Code
QC1-88	Certification of Welding Inspectors

1.1.1.4 Environmental Protection Agency (EPA)

EPA/530-SW-86-031	Technical Guidance Document: Construction Quality Assurance for Hazardous Waste Land Disposal Facilities

1.2 SUBMITTALS: Not Used

1.3 QUALIFICATION/CERTIFICATION

1.3.1 Welding Processes - Structural Metal Work

1.3.1.1 Procedures for welding components shall have been qualified in accordance with the following.

a. For structural steel, in accordance with AWS D1.1.

b. For sheet steel (structural), in accordance with AWS D1.3.

c. For sheet metal (seal welding), in accordance with AWS D9.1.

1.3.1.2 Qualification in accordance with the ASME B&PVC Section IX may be substituted for the above requirements.

1.3.2 Welding Personnel - Structural Metal Work: Personnel performing welding shall have been qualified in accordance with the respective Codes of 1.3.1.

1.3.3 Welding Nondestructive Examination (NDE) Personnel

1.3.3.1 Visual weld examinations shall be performed, and appropriate documentation prepared by Certified Welding Inspectors (CWI) who have received certification in accordance with AWS QC1. Certified Associate Welding Inspectors (CAWI), certified in accordance with the above standard, may perform examinations when under immediate direction of CWIs.

1.3.3.2 Welding related examination documentation shall be signed or stamped by individuals performing examinations. Where CAWIs perform examinations, documentation shall be signed or stamped by both CAWIs and CWIs under whom examinations were performed.

1.3.3.3 Personnel performing other welding NDE shall be certified in accordance with the Contractor's written practice, which shall meet the requirements of ASNT SNT-TC-1A.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PROCESS CONTROL

3.1.1 Control fabrication, assembly, inspection, testing, and related activities, performed in shops and at the worksite, in accordance with the approved Supplier/Contractor Quality Assurance Plans. See Section 01010.

3.2 INSPECTING AND TESTING

3.2.1 The Construction Engineer's representative will perform the following:

3.2.1.1 Perform construction quality assurance (CQA) in accordance with EPA/530-SW-86-031.

3.2.1.2 Witness inspections at the specified points.

3.2.1.3 Perform final acceptance inspection.

3.2.2 Specified Inspection Points: Adhere to inspection points. Ensure that inspections of portions of the work, performed in accordance with Contract requirements, have been completed and approved before notifying the Construction Engineer.

3.2.2.1 Types of inspection points are the following:

a. Receiving (R): Required for inspection of special fabricated items, equipment, or material scheduled to be delivered to the worksite, or other designated location, which require inspection upon arrival and before installation. Notify the Construction Engineer within 4 hours after item arrival.

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

c. Witness (W): Required for inspection in addition to the above, selected at the option of the Construction Engineer. Work may proceed upon verbal release by the Construction Engineer, or upon expiration of 1 hour from the scheduled time of witnessing.

3.2.2.2 R, H, and W points apply to work both on and off the worksite. Except where a longer period is specified, notify the Construction Engineer at least 4 working hours before each point at the worksite. For work performed elsewhere, notify the Construction Engineer at least 3 working days before each required point.

3.2.2.3 An inspection plan listing the R, H, and W points shall be prepared and delivered to the Construction Engineer.

3.3 NONCONFORMANCE REPORTING

3.3.1 The Construction Engineer utilizes Nonconformance Reports (NCRs) to document deviations from Contract requirements.

3.3.1.1 Nonconformance reports: Nonconforming items are documented on nonconformance report (NCR) forms. NCR's document deviations from Project requirements when characteristics, documentation, or the procedure renders quality of an item or activity unacceptable, or indeterminate.

a. Nonconformances are identified by red construction hold tags, or blue NCR tags.

b. Hold tags prohibit movement, installation, processing, or further fabrication of nonconforming items pending approval of the NCR dispositions.

c. NCR tags identify nonconformances, but allow work to proceed, based upon approved NCR dispositions. No actions shall be taken to correct or alter actual conditions before receipt of approved dispositions.

d. Tags are not to be removed by anyone other than the agency that applied them.

3.3.2 Open items and nonconformances reported during performance of the work require resolution before Project completion.

3.4 QUALITY ASSURANCE PROGRAM DOCUMENTATION

3.4.1 Provide deliverable documents required by the Sections of this Specification.

3.4.2 See Section 01720 for document delivery requirements.

END OF SECTION

SECTION 01610

DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 SUMMARY

1.3.1 This section contains generally applicable requirements for delivery, inspection, marking, storage, and handling. Product unique requirements are contained in other sections.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 DELIVERY

3.1.1 Provide equipment and labor required for unloading, transporting, and handling delivered products.

3.2 RECEIVING INSPECTION

3.2.1 Arrange for immediate disposal and replacement of products found to be defective, damaged beyond repair, or in otherwise unacceptable condition.

3.2.2 Perform standard inspections, and additional inspections required by this specification.

3.2.3 Dry or clean products that have become wet or have accumulated foreign substances during shipment, but have not become damaged.

3.2.4 Perform additional identification marking of products when necessary to meet the requirements of this section, and other sections of this specification.

3.2.5 Inspect products and product marking and storage methods for compliance with specifications and the procedures required by this section, and other sections of this specification.

3.3 PRODUCT IDENTIFICATION AND SEGREGATION

3.3.1 Provide identification tags or markings for products of similar appearance, or intended for similar use, procured to different specifications, or from different manufacturers.

3.3.2 Include the following information, as applicable, on tags, with markings, and preexisting labels: Manufacturer's name, product brand name, specification number, and type, grade or class. Also include additional information required by other sections of this specification.

3.3.3 Segregate tagged or marked products, providing separate storage for each.

3.3.4 Preserve the identity of bulk and lot products (those consumed on an "as needed" basis during progress of the work) from the time of receipt at the worksite until use in construction.

3.3.4.1 Control the identification and storage of welding materials in accordance with a written filler metal control procedure, maintained at the worksite. The procedure shall specify methods for control by heat or lot number, from receipt of material through consumption during fabrication, and for disposal of contaminated and partially used material.

3.3.4.2 When pipe or tube is removed from storage and cut, clearly and permanently remark remaining pieces with either original markings or field code identification symbols, and return to storage.

3.3.4.3 Use permanent marking methods on pipe and tube, including pens with water insoluble, indelible ink, crayon, paint, or paint stick. Vibratory etching equipment may be used with the approval of the Construction Engineer. Marking with steel stamps is not acceptable.

3.4 STORAGE

3.4.1 Basic Storage

3.4.1.1 Store packaged products in their original, unbroken packages or containers, with seals and labels intact.

3.4.1.2 Store rolled products in an upright position.

3.4.1.3 Store products with finished surfaces in a manner to preclude surface damage by mechanical, atmospheric, or other effects.

3.4.1.4 Where contact between products could result in damage or rendering useless of one or both, store them far enough apart to prevent contact. If close proximity storage is necessary, provide a barrier between them.

3.4.1.5 Keep ports, nozzles, ends, and other openings on equipment, tanks, and lengths of pipe and tube capped or plugged during storage.

3.4.1.6 Follow manufacturer's recommendations for storage when such recommendations are given.

3.4.1.7 Remove, dispose of, and replace products with expired shelf-life dates.

3.4.2 Indoor Storage

3.4.2.1 Provide indoor storage for products that can be damaged by, or can deteriorate from, changes in temperature and relative humidity.

3.4.2.2 When required by other sections of this specification, or when recommended by product manufacturers, provide environmentally controlled storage. Maintain temperature 60 to 70°F, relative humidity below 55%, and provide ventilation.

3.4.3 Outdoor Storage

3.4.3.1 Provide skids, pallets, platforms, or other supports for products stored outdoors to prevent ground contact.

3.4.3.2 Provide sunshade protection for products that can be damaged by, or can deteriorate from, exposure to sunlight.

3.4.3.3 Provide weatherproof covers for products that can be damaged by, or can deteriorate from, the effects of contact with rain, snow, ice deposits, or blowing sand and debris.

3.4.3.4 Arrange stacks of stackable products so that condensation, which may accumulate during storage, will drain off.

3.5 HANDLING

3.5.1 Provide handling tools and equipment, and use methods designed to prevent occurrence of the following.

3.5.1.1 Impact, rubbing, or other contact damage to ends and surfaces of cylindrical (pipe and tube) type products, or to edges, corners, and surfaces of flat (panel and sheet) type products.

3.5.1.2 Twisting, racking, or other distortion of prefabricated structures and equipment assemblies.

3.5.1.3 Tearing or puncturing of wrappings or coverings, or breaking of seals on packages or cartons.

END OF SECTION

SECTION 01630

PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Substitution Approval Request(s): Before start of construction, submit request(s) as required by 1.3.4 and 1.3.5, prepared in accordance with 3.1.

1.2.3 Approval Not Required: None

1.3 SUBSTITUTIONS

1.3.1 Products include those items identified on the Drawings as well as in Part 2 of the Specification Sections.

1.3.2 Product options given in the Specification Sections represent functionally and physically equivalent items. In addition to generic type, materials, form and size, physical equivalence includes maintainability, reliability, and durability characteristics, as applicable for specific material or equipment items.

1.3.3 A substitute product may be used in place of a product or the product options identified in Specification Sections, without approval, if it is functionally and physically equivalent as defined above, and is not more hazardous.

1.3.4 Substitution of a product that is functionally but not physically equivalent, as defined above, or is more hazardous, requires submittal of a Substitution Approval Request.

1.3.5 Submittal of a Substitution Approval Request is also required when a product callout in the Specification Sections includes the phrase "or an approved substitute".

1.3.6 Total quantities of products required in specification sections shall be the same. Differences due to partial quantity substitutions are not acceptable.

1.3.7 Do not use materials and equipment removed from existing structure as substitutes for specified products, unless such use is required or allowed elsewhere in the Project Documents.

1.4 LIMITATIONS AND CONDITIONS

1.4.1 Substitutions will not be considered when indicated or implied on fabricator drawings, or product data submittals, without separate Substitution Approval Requests, when requested directly by subcontractors or suppliers, or when acceptance will require substantial revision of Project Documents.

1.4.2 Substitute products that require a substitution approval request shall not be ordered or installed before the request is approved.

1.4.3 Only one Substitution Approval Request for each product will be considered. When a substitution is not accepted, provide the specified product.

1.4.4 The Construction Engineer's representative will review and disposition requests for substitutions within 10 working days, unless evaluation requires extensive comparison or consultation.

1.4.5 The same submittals required for original products, by 1.2 of the Sections specifying them, are required for accepted substitute products.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 REQUEST PREPARATION

3.1.1 Submit a separate request for each substitution, using "Substitution Approval Request," Form KEH-1151.

3.1.2 Identify products 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.

3.1.3 To each Substitution Approval Request attach descriptive information for substitute and original products. The information shall consist of drawings, calculations, and data as appropriate to define operational and physical characteristics of products, and establish a basis for comparison.

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

3.1.5 Give quality and performance comparisons between proposed substitution and specified product.

3.1.6 Give cost data comparing proposed substitution with specified product, showing the Project Sum net change.

3.1.7 List availability of maintenance services and replacement materials.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 REFERENCES: Not Used

1.2 SUBMITTALS: Not Used

1.3 GENERAL

1.3.1 Hanford site work requires that certain documents, defined herein, be used to record the construction process, and administration of the Project. The Construction Engineer will assemble pertinent data for final disposition.

1.3.2 Some data required for project records shall be delivered to the Construction Engineer during the course of construction and contract administration, while other data shall be assembled after completion of construction for delivery to the Construction Engineer.

1.3.3 When information for project records is to be recorded on standard forms, copies of the forms will be supplied by the Construction Engineer. Samples of the appropriate required forms are included in the specification sections.

1.3.4 Project Record Documents, required by the Contract, shall be prepared, preserved, and delivered to the Construction Engineer. These deliverable documents are in addition to submittals required in Section 01300.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PROCEDURE

3.1.1 Identification and Marking: Mark documents that will become project records before use for construction. Upon completion, identify documents by title or number.

3.1.1.1 Notes or markings added by hand shall be legible, utilizing permanent nonsmearing marking media, such as ink or felt tip markers, in contrasting color.

3.1.1.2 Mark items to record actual construction, including changes to dimensions and details, manufacturer's name, catalog number, and substitute products.

3.1.2 Availability: Keep copies of project record documents in the field office, and make available to the Construction Engineer during progress of the Work.

3.1.3 Storage: Store one set in the field office, apart from documents used in construction, and maintain in clean, dry, and legible condition.

3.1.4 Delivery: Record delivery of documents by retaining copies of letters of transmittal itemizing delivered items, and reports delivered during the course of work. Retain until construction completion. An alternate means, acceptable to the Construction Engineer, may be used.

3.2 ACTIVITY AND ADMINISTRATIVE DOCUMENTS

3.2.1 Backfill Permit: Retain backfill permits approved for work required in Division 2.

3.2.2 Soil Compaction Procedure: Retain Forms KEH-0382 completed for work required in Division 2.

3.2.3 Pour Slips: After obtaining the Construction Engineer's approval of concrete pour slips required in Division 3, deliver copies to the Construction Engineer, and retain additional copies until Project closeout. After closeout deliver them to the Construction Engineer.

3.2.4 Trip Tickets: Deliver copies to the Construction Engineer with each truck load of concrete required in Division 3, and retain additional copies until Project closeout. After closeout deliver them to the Construction Engineer.

3.3 CONSTRUCTION, QUALITY ASSURANCE, AND SUPPORTING DOCUMENTS

3.3.1 Deliver in accordance with the following, when called for in specification sections.

3.3.2 Personnel Qualifications: Two copies of welder (bonder) qualifications, and NDE personnel qualifications, 5 days before start of fabrication. Maintain additional copies at the project site.

3.3.3 Procedures: Two copies of welding (bonding) and NDE procedures, 5 days before first use. Maintain additional copies at the project site.

3.3.4 Drawings: Three copies of weld (bond) identification drawings, 5 days before start of fabrication.

3.3.5 Expansion Anchor Inspection Results: One copy of inspection results within 5 days after completion.

3.3.6 NDE Records: One copy of weld (bond) NDE records within 5 days after NDE completion. These records may be either signed NDE record forms, or signed fabrication drawings with each weld (bond) bearing the inspector's stamp.

3.3.7 Material Properties Test Records: One copy of test results prior to delivery of material. These records are for acceptance tests of bulk materials and of lots or heats of preformed stock materials and parts.

3.3.8 Flushing Records: One copy of records verifying acceptable completion of flushing, before testing.

3.3.9 Leak/Pressure Testing Records: One copy of records verifying acceptable completion of leak and pressure testing, within 5 days after completion.

3.3.10 Disinfecting Records: One copy of records verifying acceptable completion of sanitary water line disinfecting, 5 days after completion.

3.3.11 Electrical Testing: One copy of records verifying acceptable completion of electrical insulation, continuity, and grounding tests, within 5 days after completion.

3.3.12 Operational Testing: One copy of records of component or subsystem operational testing, within 15 days before the start of acceptance testing.

3.3.13 Completed Acceptance Test Procedure (Test Results): One copy of Acceptance Test Procedure, with test results and other required information entered, within 5 days after completion.

3.3.14 Completed Certificate of Compliance: One copy of completed Certificate of Compliance, based on the above completed acceptance test procedure, along with that procedure.

3.4 PRODUCT SAMPLES AND MANUFACTURER'S INSTRUCTIONS

3.4.1 In addition to submittals required in Section 01300, and requirements of this Section, information received (from suppliers) that documents products used, and how they were installed, shall be delivered to the Construction Engineer as Project Records.

END OF SECTION

SECTION 02225

EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Society for Testing and Materials (ASTM)

D 653-90	Standard Terminology Relating to Soil, Rock, and Contained Fluids
D 1557-91	*Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft•lbf/ft^3 (2,700 kN•m/m^3))* ECN 077 ECN 077

1.1.1.2 Washington Administrative Code (WAC)

Title 296	Labor and Industries
Chapter 296-155	Safety Standards for Construction Work

1.1.1.3 Washington State Department of Transportation (WSDOT)

M 41-10-94	Road, Bridge, and Municipal Construction
M 41-01-93	Construction Manual

1.2 SUBMITTALS: Not Used

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Obtain specified soils from excavation or other locations designated by the Construction Engineer.

2.1.2 Fill or Backfill

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

2.1.2.2 Common: Well graded soil mixtures containing cobbles up to 8 inches in greatest dimension if uniformly distributed and not constituting more than 40% of volume of fill.

2.1.3 Bedding for Underground Pipe, Conduit, and Cable: Sand, as defined in ASTM D 653, or excavated sandy material having less than 20% gravel particles, with those particles having a maximum dimension of 1/2-inch.

2.1.4 Stabilization: Crushed rock, with a maximum fragment size of 3/4-inch for staging and laydown areas.

2.1.5 Plastic Sheet Marker: 6-inch wide nondetectable tape imprinted with a warning, such as "CAUTION - BURIED INSTALLATION BELOW", at intervals of 4 feet maximum; Reef Industries "Terra Tape."

PART 3 - EXECUTION

3.1 EXCAVATION

3.1.1 Obtain an excavation permit before performing excavation. Excavation permits will be provided by the Operating Contractor.

3.1.2 If cultural properties (eg bones, artifacts) are encountered during excavation, stop work. The Hanford Cultural Resources Laboratory will assess the significance of the find.

3.1.3 Locate and expose underground utilities by hand tools. Use of heavy equipment and machinery requires approval by the Construction Engineer.

3.1.4 Where 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 prevent interrupting service to existing buildings.

3.1.5 Make excavations to line and grade shown on the Drawings and wide enough to make connections. Excavate with near vertical sides from bottom of trench up to 1 foot above pipe, conduit, and cable. Excavate trench deep enough to permit placement of compacted bedding, 4 inches minimum thickness, beneath pipe, conduit, and cable except where excavation is in undisturbed sand which will serve as bedding or where lines are to be encased in concrete. Pare holes in trench bottoms for pipe couplings so pipe will bear full length of barrel or section.

3.1.6 Install shoring to hold materials and surcharge pressure for full depth of trench.

3.1.7 Keep trenches free of standing water when laying is in progress.

3.1.8 If over-excavation occurs, correct by placement of structural backfill.

3.1.9 In Situ Soils

3.1.9.1 Salvage in-situ stabilization material and reuse for backfilling and compacting. Do not use or reuse contaminated material. Contact the Construction Engineer for backfill material, if required.

3.1.9.2 Conduct in-place density tests on in-situ soils, using nuclear density gage, during excavation. Results of tests will be used for testing compaction of backfill.

3.1.9.3 Excavated material containing concentrations of radioactive materials that can be detected by portable survey instruments normally used for performing radiation surveys is considered contaminated, and shall be

sampled and analyzed for content. Contact the Construction Engineer for disposal.

3.1.10 Where stabilization is required, finish subgrade 3 inches below elevations shown on the Drawings.

3.2 PLACEMENT

3.2.1 Fill and Backfill

3.2.1.1 General:

a. Backfill Permit: Obtain signatures required on the backfill permit for each element to be filled or backfilled. Work not started within 5 calendar days from the time a permit is approved shall not be started until a new permit has been approved. A continuing job that has not had backfill installed within the past 5 calendar days will require a new backfill permit.

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

c. Use only select materials for fill or backfill. Keep materials free of frozen particles, lumps, 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.

3.2.1.2 Compaction:

a. Before placement of fill or backfill, demonstrate by physical test at the worksite, that proposed layer depths and the procedure for compaction of soils will provide compaction specified. Prepare "Soil Compaction Procedure," Form KEH-0382, in accordance with the instructions.

b. Place backfill in accordance with WSDOT M 41-10, Section 2-03.3(14)C and approved procedure as follows.

1) Use Method C under pipelines.

2) Use Method B within 5 feet of buildings, fences, other structures, or poles supporting electric lines or pipes.

c. Compaction control tests will be in accordance with WSDOT M 41-10,Section 2-03.3(14)D *or ASTM D1557*. ECN 077

3.2.1.3 Common:

a. Place fill or backfill in layers not more than 12 inches thick, loose measurement.

b. Compact each layer, full width, by at least 1 pass of vibratory or rammer type compactor, pneumatic-tired roller, loaded scraper wheel, grader wheel, or power roller.

c. Mound over top layer of backfill to depth of 1 inch for each 12 inches of trench depth to maximum mound height of 6 inches.

3.2.1.4 Underground piping, conduit, and cable trenches:

a. Bedding placed beneath pipe, conduit, and cable in trenches shall be material specified in 2.1.3.

b. Place and compact bedding in trench prepared as specified in 3.1.5 before laying pipe, conduit, and cable. Compact bedding as specified for structural backfill.

c. Place backfill over joints in underground pipes only after pressure testing of line has been completed.

d. Backfill under conduit and haunches of pipe, around sides, and up to 1 foot above top of pipe, conduit, and cable using bedding material. Place and compact material same as specified for structural backfill. Compact with care, to avoid misalignment of pipe and provide uniform bearing along barrel of pipe.

e. Backfill trenches from elevation 1 foot above top of pipe, conduit, and cable as follows.

1) Use structural fill or backfill in locations specified in 3.2.1.2.

2) Use common fill or backfill as specified in 3.2.1.3 for other locations.

f. Do not allow heavy construction equipment to pass over buried lines until at least 2 feet of backfill has been placed over the line or until bridging has been placed across trenching and approved by the Construction Engineer.

3.2.1.5 In situ soils:

a. Compact backfill by depositing soils in 8 inch layers and compacting to density equal to in-situ density determined by tests made during excavation. Maintain uniformity of compaction throughout backfill.

b. Do not use soils containing rocks larger than 3 inches in greatest dimension for compacted backfill.

3.2.2 Plastic Sheet Marker: Place continuously and directly over buried utility lines, 1 foot below finish grade. Place markers over each outside line of multiple lines, if spacing permits. Place intermediate markers spaced 4 feet maximum.

3.2.3 Finish Grading and Stabilization

3.2.3.1 Rake areas disturbed by work, remove surface stones larger than 6 inches, and dispose of excess material and debris at an area designated by ICF KH.

3.2.3.2 Stabilize areas disturbed by work with a 3-inch course of gravel specified in 2.1.4. Finish stabilization course to elevations shown on the Drawings.

3.3 FIELD QUALITY CONTROL

3.3.1 Soil Compaction Tests: Sampling and testing of compacted fill and backfill will be performed. Frequency of testing shall be in accordance with WSDOT M 41-01, Page 9-52 or as directed by the Construction Engineer to assure uniform compaction.

END OF SECTION

SECTION 02235

ROAD SUBGRADE AND GRANULAR BASE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 Washington State Department of Transportation (WSDOT)

M 41-10-94	Road, Bridge, and Municipal Construction
M 41-01-93	Construction Manual

1.2 SUBMITTALS: Not Used

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Subgrade Fill and Backfill

2.1.1.1 Obtain specified soils as directed by the Construction Engineer.

2.1.1.2 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% of volume of fill.

2.1.2 Granular Base

2.1.2.1 Base course: WSDOT M 41-10, Section 9-03.9(3), Base Course Classification.

2.1.2.2 Leveling course: WSDOT M 41-10, Section 9-03.9(3), Top Course Classification.

PART 3 - EXECUTION

3.1 EXCAVATION

3.1.1 Before performing excavation, obtain an excavation permit.

3.1.2 If cultural properties (eg bones, artifacts) are encountered during excavation, stop work and notify the Construction Engineer. The Hanford Cultural Resources Laboratory will assess the significance of the find.

3.1.3 If over-excavation occurs, correct by placement of backfill.

3.2 PLACEMENT

3.2.1 Subgrade Filling and Backfilling

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

3.2.1.2 Use only specified materials for fill or backfill. Keep materials free of frozen particles, lumps, organic matter and trash.

3.2.1.3 Do not place fill or backfill on frozen ground.

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

3.2.2 Fill or Backfill

3.2.2.1 Before placement of fill or backfill, demonstrate by physical test at the worksite, that proposed layer depths and the procedure for compaction of soils will provide the compaction specified. Prepare "Soil Compaction Procedure," Form KEH-0382, in accordance with the instructions.

3.2.2.2 Place backfill under roads in accordance with WSDOT M41-10, Section 2-03.3(14)C, Method B and approved procedure.

3.2.3 Granular Base

3.2.3.1 Before placement of granular fill, demonstrate by physical test at the worksite, that proposed layer depths and the procedure for compaction of soils will provide compaction specified. Prepare "Soil Compaction Procedure," Form KEH-0382, in accordance with the instructions.

3.2.3.2 Construction Requirements: Construction shall be in accordance with following sections of WSDOT M 41-10.

a. Subgrade: Section 2-06.3.

b. Equipment: Section 4-04.3(1).

c. Mixing: Section 4-04.3(3).

d. Placing and spreading: Section 4-04.3(4).

e. Miscellaneous requirements: Section 4-04.3(7).

f. Weather limitations: Section 4-04.3(8).

g. Hauling: Section 4-04.3(9).

3.2.3.3 Shaping and Compacting:

a. Final shaping before compacting shall be accomplished using approved equipment.

b. Compaction control tests will be in accordance with WSDOT M 41-10, Section 2-03.3(14)D.

3.2.4 Finish Grading and Stabilization: Rake area disturbed by work, remove surface stones larger than 6 inches and dispose of excess material and debris at area designated by the Construction Engineer.

3.3 FIELD QUALITY CONTROL

3.3.1 Sampling and testing of compacted fill and backfill will be performed. Frequency of testing shall be in accordance WSDOT M 41-01, Page 9-52 or as directed by the Construction Engineer to assure uniform compaction.

END OF SECTION

SECTION 02831

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Society for Testing and Materials (ASTM)

A 90-81 (1991)	Test Method for Weight of Coating on Zinc-Coated Galvanized) Iron or Steel Articles

1.1.1.2 Federal Specifications (FS)

RR-F-191K	Fencing, Wire And Post, Metal(And Gates, Chain-Link Fence Fabric, And Accessories) (General Specification)
RR-F-191/1D	Fencing, Wire And Post, Metal (Chain-Link Fence Fabric) (Detailed Specification)
RR-F-191/2D	Fencing, Wire And Post, Metal (Chain-Link Fence Gates) (Detailed Specification)
RR-F-191/3D	Fencing, Wire And Post, Metal (Chain-Link Fence Posts, Top Rails And Braces) (Detailed Specification)
RR-F-191/4D	Fencing, Wire And Post, Metal (Chain-Link Fence Accessories) (Detailed Specification)

1.2 SUBMITTALS: Not Used

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 See Section 01610 for general requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Fence Fabric: FS RR-F-191/1, Type I, 2 inch mesh, 11 gage, 84 inch height, top and bottom selvages twisted and barbed.

2.1.2 Posts, Top Rails and Braces: FS RR-F-191/3, Class 1, Grade A or B, of following sizes.

2.1.2.1 Line posts: SP3.

2.1.2.2 Terminal posts and posts set at break in grade: SP4.

2.1.2.3 Gate posts: In accordance with following chart.

Gate Opening		Post Size
Single Swing	Double Swing	
Up to 6 feet	Up to 12 feet	SP4
6 to 13 feet	12 to 26 feet	SP5
13 to 18 feet	26 to 36 feet	SP6
Over 18 feet	Over 36 feet	SP7

2.1.2.4 Top rails: SP1.

2.1.2.5 Braces: Diagonal truss and horizontal brace, hot-dip galvanized steel rods 3/8-inch diameter with turnbuckle.

2.1.2.6 Where posts other than Class 1 are used, they shall be Class 3, Class 4 or Class 6, and of equal strength and stiffness as posts specified in 2.1.2.

2.1.3 Accessories: FS RR-F-191/4.

2.1.3.1 Wire ties and clips: Zinc-coated steel

2.1.3.2 Tension wire: No. 7 gauge zinc-coated steel per FS RR-F-191/4.

2.1.3.3 Miscellaneous accessories: Miscellaneous fittings including bolts, nuts and washers shall be malleable iron, cast iron, or steel, and be hot-dip galvanized.

2.1.4 Gates

2.1.4.1 Gate frames: Constructed from FS RR-F-191/3, Class 1, Grade A or B, Size SP2, steel pipe. Open ends shall be fitted with pipe plugs. Corner fittings, if used, shall be malleable iron. If gate frames are welded construction, hot-dip galvanize after construction. Rigidly brace frames to prevent sagging, buckling, and weaving. Gate frames shall conform to the requirements of FS RR-F-191/2.

2.1.4.2 End members of gate frames: FS RR-F-191/4, extending 12 inches above top of fabric and fitted with ball top or similar fitting to shed water.

2.1.4.3 Fabric: Same as specified for fence.

2.1.4.4 Accessories: FS RR-F-191/4, zinc-coated steel.

a. Hinges: Heavy pattern with large bearing surfaces for clamping in position. Hinges shall allow gate to swing 180 degrees, and be capable of being opened and closed easily by one person.

b. Latches: Plunger bar type to engage center stop and arranged for padlocking.

c. Center stops: Device, set in concrete, to engage plunger bar.

d. Keepers: Set in concrete to secure free end of gate when in full open position.

2.1.5 Coating

2.1.5.1 Fence and gate parts shall have zinc coating of uniform thickness, weighing at least 1.2 oz/ft^2 of surface, as determined by ASTM A 90. Apply coating to parts after fabrication.

2.2 MIXES

2.2.1 Concrete: Minimum compressive strength of 2000 lb/in^2 at 28 days.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Install fence true to line and grade in locations shown on the Drawings and in accordance with this Section.

3.1.2 Setting Posts

3.1.2.1 Set posts in concrete, plumb and true to line. Space line posts evenly, 10 feet maximum, between end and gate posts.

3.1.2.2 Set gate posts at exact spacing required for proper operation of gates. Gate sizes are nominal and shall be located as shown on the Drawings and installed in accordance with the manufactures instructions.

3.1.2.3 Holes for setting line posts shall be 8 inches to 12 inches in diameter and 3 feet deep. Holes for setting gate and end posts shall be 10 inches to 17 inches in diameter and 3'-6" deep. Set post ends 6 inches above bottom of hole.

3.1.2.4 Firmly support posts to prevent movement or deflection until concrete has set 24 hours minimum.

3.1.3 Bracing Posts: Horizontally brace gate, corner and terminal posts with steel pipe using brace attachments, and diagonally brace from the base of gate, corner, and terminal posts to the midheight of adjacent line posts using steel rods with truss attachments.

3.1.4 Tension Wires: Install top and bottom tension wires to stabilize wire fabric.

3.1.4.1 Install top tension wire through 1/4 inch holes drilled in each post, except gate posts drilled 3 inches below the top in each post.

3.1.4.2 Install bottom tension wires through 1/4 inch holes in each post, except gate posts, 4 inches above finish grade.

3.1.5 Attaching and Stretching Fabric

3.1.5.1 Thread tension bars through end loops of each section of fabric and tie to end, corner, and gate posts with tension bands spaced not more than 15 inches on centers.

3.1.5.2 Fasten fabric to posts with ties spaced not more than 14 inches on centers. Topmost tie shall be as near top of fabric as possible; lowest tie as near bottom of fabric as possible.

3.1.5.3 Tie fabric to top and bottom tension wires with wire clips or ties spaced 24 inches maximum on centers.

3.1.5.4 Stretch fence fabric taut.

3.1.5.5 Dress barbed ends of barbed top fabric approximately 2 to 3 inches above top tension wire. Straighten each barb as needed to present unbroken line above and below tension wire.

3.1.5.6 Bottom of fabric shall extend to within 2 inches of finish grade.

3.1.6 Installation of Gates

3.1.6.1 Install gates in good alignment for proper swing and latch. Adjust hinges so gates swing outward at 180 degrees or more. Install hinges to obtain a 2-inch maximum clearance from finished grade to bottom of gate.

3.1.6.2 Install fabric on gate frames with tension bars and bands spaced 15 inches on centers, vertically and horizontally.

3.1.8 Bolt Heads: Locate bolt heads on outside of fence.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Concrete Institute (ACI)

117-90	Tolerances for Concrete Construction and Materials
301-89	Structural Concrete for Buildings
306.1-90	Cold Weather Concreting
318-89 (R 1992)	Building Code Requirements for Reinforced Concrete
SP-66-88	ACI Detailing Manual

1.1.1.2 American Society for Testing and Materials (ASTM)

A 615-92b	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A 853-91	Steel Wire, Carbon, for General Use
C 33-92a	Concrete Aggregates
C 94-92a	Ready-Mixed Concrete
C 150-92	Portland Cement
C 260-86	Air-Entraining Admixtures for Concrete
C 1107-91a	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
D 994-71 (R 1982)	Preformed Expansion Joint Filler for Concrete (Bituminous Type)

1.1.1.3 Federal Specifications (FS)

SS-S-1996 REINST	Sealer, Water and Weather Resistant for Asphalt, Concrete, and Masonry Surfaces

TT-S-00230C Including AMD 2	Sealing Compound: Elastomeric Type, Single Component (For Caulking, Sealing and Glazing in Buildings and Other Structures)

1.1.1.4 National Ready Mixed Concrete Association (NRMCA)

Certificate of Conformance for Concrete Production Facilities	Certification of Ready Mixed Concrete Production Facilities January 1, 1984 (Fourth Revision)

1.1.1.5 Washington State Department of Transportation (WSDOT)

M 41-10-94	Road, Bridge, and Municipal Construction

1.2 SUBMITTALS: Not Used

1.3 QUALITY ASSURANCE

1.3.1 Misrepresented Products: See Section 01405 for required measures to prevent the use of misrepresented products.

1.3.2 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to Construction Document Control in accordance with Section 01720.

Document	Paragraph
Pour Slip and Trip Tickets	3.2.2.1
Materials Test Results	3.4.1

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 See Section 01610 for general requirements.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 Concrete: ACME preapproved mix design No. 6452.

2.2.2 Measuring, Mixing, and Delivery: In accordance with ASTM C 94.

2.2.3 Reinforcing Steel

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

2.2.3.2 Tie wire: ASTM A 853 carbon steel, 0.062-inch (16-gage) minimum, annealed.

2.2.4 Joint Materials

2.2.4.1 Epoxy resin: In accordance with WSDOT M 41-10, Section 9-26, Type II, Grade 2, Class B or C; QCM Company EAS8 Class A, Adhesive Engineering "Concresive 1001 LPL," or Protex Industries "Probond 822."

2.2.4.2 Expansion joint filler: ASTM D 994.

2.2.4.3 Sealant: FS TT-S-00230, Type II.

2.2.5 Nonshrink Grout: ASTM C 1107; Sika Corporation "Sika Grout 212," or Master Builders "Masterflow 713."

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

2.2.7 Form Coating Materials: Symons Corporation "Magic Kote," AC Horn Incorporated "Form Shield," or Burke Company "Burke Release No. 1."

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 117, Section 4.

3.1.1.2 Prepare form surfaces in accordance with ACI 301, Section 4.4 using specified form coating materials, or as described below.

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. 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 to dimensions shown on the Drawings, within tolerances shown in ACI 301, Section 5.6.

3.2.1.2 Tag in accordance with the bar list.

3.2.1.3 Place as shown on the Drawings, within tolerances specified in ACI 117, Section 2.2.

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 the concrete protection dimension equal to the minimum given in ACI 301, Section 5.7, except where shown otherwise on the Drawings.

3.2.2 Concrete

3.2.2.1 Before placing:

a. Approve the "Pour Slip," including identification of sections of structure to be placed, maximum size of coarse aggregate, and design strength.

b. For each truck load, collect the "Trip Ticket." "Trip Tickets" shall contain information listed in ASTM C 94, Paragraphs 16.1.1 through 16.1.10, and the water/cement ratio.

3.2.2.2 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, reinforcement, or embedded items.

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

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

3.2.2.5 Weather conditions: Protect concrete during placement in accordance with ACI 301, Sections 7.6 and 8.4. Cold weather concreting procedure shall be in accordance with ACI 306.1.

3.2.2.6 Construction joints: Make in accordance with ACI 301, Section 6.1, and as detailed on the Drawings. Coat joints with epoxy resin, where shown on the Drawings, in accordance with manufacturer's recommendations.

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

3.2.2.8 Expansion joints: Make in accordance with ACI 301, Section 6.2 and details on the Drawings.

3.2.2.9 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.

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

3.2.2.11 Cure concrete in accordance with ACI 301, Section 12.2.

3.2.3 Form Removal and Concrete Repair

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 the Construction Engineer.

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

3.2.3.4 Repair surface defects in accordance with ACI 301, Sections 9.1, 9.2 and 9.3. Cure concrete repairs the 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 the following ACI 301 sections.

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 the following ACI 301 sections.

a.	Interior floors	Section 11.7.3
b.	Exterior equipment slabs	Section 11.7.3
c.	Exterior slabs subject to foot traffic	Section 11.7.4

3.2.5 Sealant

3.2.5.1 Perform sealing using specified materials and proper tools in accordance with the manufacturer's recommendations.

3.2.5.2 Do not apply exterior sealing material when ambient temperature is below 40 F or above 100 F.

3.2.5.3 Apply materials with guns having proper size nozzles. Use sufficient pressure to fill spaces and voids. Where use of gun is impractical, approved hand tools may be used.

3.3 CURING

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

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

3.4 FIELD QUALITY CONTROL

3.4.1 Concrete Testing: Sample and test concrete to ACI 301, Sections 16.3.4, 16.3.5, 16.3.6 and 16.3.8.

3.5 PROTECTION

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

3.5.2 Protect concrete from mechanical damage in accordance with ACI 301, Section 12.4.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American Institute of Steel Construction (AISC)

ASD	Allowable Stress Design (Manual of Steel Construction) 9th Edition
S335-June 1, 1989	Structural Steel Buildings - Allowable Stress Design and Plastic Design

1.1.1.2 American Society for Testing and Materials (ASTM)

A 36-91	Structural Steel
A 307-92a	Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
A 563-92a	Carbon and Alloy Steel Nuts
A 786-89	Rolled Steel Floor Plates
F 436-92	Hardened Steel Washers

1.1.1.3 American Welding Society (AWS)

A5.8-92	Filler Metals for Brazing and Braze Welding
D1.1-92	Structural Welding Code - Steel
D1.3-89	Structural Welding Code - Sheet Steel

1.1.1.4 Steel Structures Painting Council (SSPC)

SP 2-82	Hand Tool Cleaning
SP 3-82	Power Tool Cleaning
SP 5-85	White Metal Blast Cleaning

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

~~1.2.2.1 Drawings: For metal fabrications not shown on manufacturer's data sheets: Before fabrication, submit fabrication drawings and bill of materials. Include plans, elevations, details, sections, and connections. Show thickness, type, grade, class of metal, fasteners, anchorage, and accessory items where applicable.~~ ECN 069 ECN 069

1.2.2.~~2~~1 Manufacturer's data: Before delivery, submit copies of manufacturer's specifications, dimensioned diagrams, anchor details, and installation instructions for manufactured items. ECN 069

1.2.3 Approval Not Required: None

1.3 QUALITY ASSURANCE

1.3.1 Misrepresented Products: See Section 01405 for required measures to prevent the use of misrepresented products.

1.3.2 Qualifications: See Section 01415 for qualification of fabrication processes, personnel performing fabrication, and personnel performing visual and other nondestructive examination.

1.3.3 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to Construction Document Control in accordance with Section 01720.

Document	Paragraph
Expansion Anchor Inspection Results	3.5.1

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 See Section 01610 for general requirements.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 Rolled Steel Shapes and Plates: ASTM A 36.

2.2.2 Fasteners: Fasteners shall have a class 2 fit.

2.2.2.1 Bolts: ASTM A 307, Type 1, 1/2-inch diameter, plain (uncoated).

2.2.2.2 Nuts: ASTM A 563, Grade C, plain, heavy hex.

2.2.2.3 Washers: ASTM F 436, type 1, circular.

2.2.2.4 Expansion anchors: Hilti Fastening Systems "Kwik-Bolt II," or ITW-Ramset "Trubolt Wedge Anchor."

2.2.3 Welding Electrodes: E70XX.

2.2.4 Floor Plate: ASTM A 786, using ASTM A 36 material, diamond tread.

2.2.5 Zinc-rich coating: Southern Coating Incorporated "Galvicon", or ZRC Products Company "ZRC".

2.2.6 Supports: Interchangeable channels, channel spring nuts, and bolts; Unistrut Corporation "Unistrut."

2.2.6.1 Channels: Sized as specified on the Drawings.

2.2.6.2 Channel spring nuts: Manufacturer's standard.

2.2.6.3 Bolts (for use with channel spring nuts): Manufacturer's standard.

2.2.6.4 Support Clamps (for rigid steel conduit): Manufacturer's standard.

2.3 FABRICATION

2.3.1 General

2.3.1.1 Verify measurements and take field measurements necessary before fabrication. Provide miscellaneous bolts and anchors, supports, braces, and connections necessary for completion of metal fabrications. Cut, reinforce, drill, and tap metal fabrications shown to receive finish hardware and similar items. Weld or bolt connections as shown on the Drawings.

2.3.1.2 Workmanship: Form metal fabrications to shape and size, with sharp lines, angles, and true curves. Drilling and punching shall produce clean, true lines and surfaces. Execute and finish work in accordance with fabrication drawings.

2.3.1.3 Jointing and intersections: Accurately made, tightly fitted, and in true planes with adequate fastenings.

2.3.1.4 Perform welding of steel connections in accordance with AWS D1.1.

2.3.2 Visually inspect welds unless otherwise required by the Drawings. Lifting attachment welds shall be 100% visually inspected and 100% magnetic particle ~~or liquid penetrant~~ inspected ~~before and after~~ ECN 069
~~load testing. *Test loads shall be 150% of the total estimated weight.*~~ ECN 070

2.3.3 Shop Painting

2.3.3.1 After fabrication, paint exposed carbon steel surfaces unless otherwise specified, as follows:

a. Surface preparation shall be in accordance with SSPC SP 2, 3, and 5, or in accordance with coating manufacturer's recommendations.

b. Apply two coats of Amerlock No. 400, ~~gray~~ *beige*, in accordance with manufacturer's instructions. ECN 069

c. Apply one finish coat of Amercoat 450 HS, 2 to 3 mils thick, in accordance with manufacturer's instructions.

d. In lieu of B and C above, paint fabrications made from the Drawings with Benjamin-Moore Ironclad high-gloss enamel in accordance with manufacturer's instructions. ECN 069/070

e. Do not paint threaded surfaces before assembly.

f. Do not paint nameplates. ECN 069/070

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Examine areas where metal fabrications are to be installed and notify the Construction Engineer in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

3.2.1 Prepare setting drawings, diagrams, templates, and instructions for installation of anchorages, such as concrete inserts. Coordinate with the Construction Engineer for delivery of items to Site.

3.3 INSTALLATION

3.3.1 Tolerances: Installation tolerances shall be as provided in accordance with AISC ASD.

3.3.2 Steel Erection

3.3.2.1 Erect steel in accordance with AISC S335, except that welding shall be in accordance with this section.

3.3.2.2 Install metal fabrications plumb and level, or as shown on the Drawings.

3.3.2.3 Make field connections as neatly as possible with joints flush and smooth. Grind smooth exposed field welds and polish before field painting. Repair welds in galvanized work with 2 coats of zinc-rich coating.

~~3.3.2.4 Torque bolts used with channel spring nuts in support channels and clamps as follows.~~

~~Bolt size, inches~~	~~Torque, ft lb~~
~~1/4~~	~~6 — 9~~
~~5/16~~	~~11 — 17~~
~~3/8~~	~~19 — 30~~
~~1/2~~	~~50 — 75~~

ECN 070 ECN 070

3.3.3 Install expansion anchors in accordance with the manufacturer's recommendations.

3.3.4 Welding shall be performed in accordance with AWS D1.1.

3.4 APPLICATION

3.4.1 After installation has been approved, clean and paint connections with primer. Touch-up shop prime coat wherever damaged. Repair breaks in galvanized coatings with zinc-rich coating.

3.5 FIELD QUALITY CONTROL

3.5.1 Expansion Anchor Installations: Inspect and document results on "Expansion Anchor Installation Report," Form KEH-1910.

END OF SECTION

SECTION 16300

MEDIUM VOLTAGE DISTRIBUTION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

C2-1993	National Electrical Safety Code
C80.1-1990	Rigid Steel Conduit--Zinc Coated

1.1.1.2 Factory Mutual (FM)

Approval Guide	1993 Edition

1.1.1.3 Federal Specifications (FS)

W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
TT-S-00230C AMD 2	Sealing Compound: Elastomeric Type, Single Component (For Caulking, Sealing And Glazing in Buildings And Other Structures)

1.1.1.4 Institute of Electrical and Electronics Engineers (IEEE)

C57.12.00-1987	General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers
C62.1-1989	Gapped Silicon-Carbide Surge Arrestors for AC Power Circuits

1.1.1.5 National Electrical Manufacturers Association (NEMA)

FB 1-1988	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
ICS 6-1988 Rev 1	Enclosures for Industrial Controls and Systems
RN 1-1989	Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

1.1.1.6 National Fire Protection Association (NFPA)

70 (1993)	National Electrical Code

1.1.1.7 Underwriters Laboratories (UL)

Electrical Application and Utilization Equipment Directory	1993
Electrical Construction Materials Directory	1993
Fire Resistance Directory	1993 (Vol I & II)

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Approval Data: Before delivery, submit information listed in the Approval Data List in this Section.

1.2.3 Approval Not Required

1.2.3.1 Vendor information: Before installation, submit information listed in the Vendor Information List in this Section.

1.3 QUALITY ASSURANCE

1.3.1 Electrical/Electronic Product Acceptability: See Section 01405 for required use of products listed and labeled by national testing and evaluation agencies.

1.3.2 Misrepresented Products: See Section 01405 for required measures to prevent the use of misrepresented products.

1.3.3 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to Construction Document Control in accordance with Section 01720.

Document	Paragraph
Electrical Test Results	3.3.1

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 See Section 01610 for general requirements.

1.4.2 Cable Inspection: Upon delivery to the worksite, inspect cable and reels for shipping damage such as the following:

1.4.2.1 Marks caused by improper lifting equipment or techniques.

1.4.2.2 Breaks or cuts in outer covering.

1.4.2.3 Damaged jacket or insulation.

1.4.2.4 Reel damage from mishandling.

1.4.2.5 Damaged or missing high voltage cable end seals.

1.4.3 Cable Testing: Upon delivery to the worksite, perform dc overpotential tests on new cable. The specifics of how to perform the tests will be provided by the Construction Engineer.

1.4.4 Cable Reel Storage

1.4.4.1 Store reels with flanges resting on hard surface or pallet to prevent sinking into the ground.

1.4.4.2 Reel flanges shall not touch cable on other reels.

1.4.4.3 Do not store reels on sides. Store with reel axis horizontal.

1.4.4.4 Cap or tape cable ends to prevent entrance of moisture.

1.4.5 Cable Reel Handling

1.4.5.1 Slings and forklifts shall not contact cable or protective covering.

1.4.5.2 Use spreader bars when lifting reels with bar and sling.

1.4.5.3 Do not drop reels.

1.5 FURNISHED EQUIPMENT

1.5.1 The following items will be furnished for installation under this Section. Upon request, one copy of approved vendor data submittals will also be furnished. See Section 01019.

1.5.1.1 C-Farm supply transformer.

1.5.1.2 AY-Farm supply transformers.

1.5.1.3 C-Farm supply watthour meter, meter cabinet and test switch.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 Solderless Connectors and Terminal Lugs: Pressure type, rated for use with copper or aluminum conductors.

2.2.2 Solderless Terminals for Insulated Aerial Conductors: Circumferential compression type; Burndy Corporation HYLUG Type YA for copper conductors and Type YA-A for aluminum conductors.

2.2.3 Conduit, Fittings, and Boxes

2.2.3.1 Conduit: ANSI C80.1 and FS W-C-1094, Type II PVC (Schedule 40).

2.2.3.2 PVC coating on rigid steel conduit: NEMA RN 1, Type A-40, factory applied.

2.2.3.3 Fittings for rigid steel conduit: NEMA FB 1.

2.2.3.4 Use "Myers" type watertight fittings, or sealing type locknuts, for conduit entries into sides or tops of NEMA ICS 6 Type 3 or 3R enclosures.

2.2.4 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 maximum.

2.2.4.1 Conductor: Copper, annealed, Class B concentric stranding.

2.2.4.2 Conductor shield: Extruded semi-conducting thermosetting compound, 15-mils thick, minimum.

2.2.4.3 Insulation: Ethylene-propylene-rubber, 220-mils thick, minimum.

2.2.4.4 Insulation shield: Minimum 30-mil extruded nonmetallic covering over insulation with minimum 5-mil nonmagnetic metal component directly over or embedded in covering.

2.2.4.5 Jacket: ~~Black polyethylene, 80 mils average minimum thickness.~~ ECN 070
Any material except polythylene. ECN 070

2.2.4.6 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.

2.2.5 Wiremarkers: Imprinted tubular plastic.

2.2.6 Wire Pulling Compound: Electro Compound Company "Y-er Eas", or American Polywater Corporation "Polywater."

2.2.7 Tape

2.2.7.1 Plastic insulating tape: 3M Company "Scotch No. 33+."

2.2.7.2 Conduit protection tape: 3M Company "Scotchrap No. 50."

2.2.7.3 Silicon rubber termination tape: 3M Company "Scotch No. 70."

2.2.8 Insulating Putty: 3M Company "Scotchfil," General Electric Company No. 8389, or Kearney Company "Airseal."

2.2.9 Penetration Sealants: FS TT-S-00230, Type II, Class A, 1-component polyurethane, nonsag type light-colored.

2.2.10 Tie Wires: Length, material type, size, and installation method as recommended by the line conductor manufacturer.

2.2.11 Equipment Nameplates: Laminated plastic, 1/16 inch thick with white surface and black core. Edges beveled and smooth. Engraved nomenclature sharp and clear, sized to meet legend requirements.

2.3 EQUIPMENT

2.3.1 Electrical equipment shall be PCB free, and shall include Material Safety Data Sheets for hazardous materials of construction.

2.3.2 Equipment Enclosures: NEMA ICS 6 Type 3; if Type 3 is not commercially available, use Type 3R.

2.3.3 Potential (voltage) transformer: 288/120 V with one primary fuse, GE JVP-1 or an approved substitute.

2.3.4 AY-Farm Supply Watthour Meter: Socket type, 2 stator, Class 200, 240 V ac, for 3-phase 4-wire 480/277Y V service, complete with M-90 demand register and pulse generator, R/P = 1/12, General Electric type VM-65-S or an approved substitute. Meter socket, Circle AW Catalog No. U-267.

2.3.5 C-Farm Lightning Arresters: Pole mounted, distributed valve type, rated at 18 kV (15.3 MCOV), Josyln 8134C0018J001 or an approved substitute.

2.3.6 Lightning Arrestors for Transformer at C Farm: Metal oxide, elbow shaped, with metal oxide varistor, rated at 18 kV (15.3 MCOV), in premolded insulating elbow designed for use with the RTE 200 A 8.3/14.4 kV loadbreak bushings that are on the transformer.

2.3.7 C-Farm Cutouts: 100 A, extra heavy duty, 15 kV with 12T fuse.

2.3.8 Loadbreak Elbow Connector: Complete with inserts, to mate with RTE 200 A 8.3/14.4 kV loadbreak bushing wells and parking stand, that are on the padmount transformer for terminating No. 2 AWG copper cable with 15 kV EPR insulation.

2.3.9 Vault: Concrete, Utility Vault Company 644-LA. Vault cover: Utility Vault Company 44-332P. Padmount for Transformer: Utility Vault Company Padmount 66-4015.

2.3.10 AY-Farm Fuse Link: 8T.

2.3.11 Duct Bank Spacers: Compatible with PVC Schedule 40 conduit size specified on the Drawings, interlocking, that provide 3-inch spacing between conduits, and preferably made by the conduit manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Field Measurements: Scale dimensions on the Drawings show desired and approximate locations of equipment. Actual locations, distances, and levels shall be governed by field conditions.

3.1.2 Watthour Meters: Before installation, have meters calibrated by a representative of the Construction Engineer.

3.2 INSTALLATION

3.2.1 General

3.2.1.1 Perform work in accordance with NFPA 70 and ANSI C2.

3.2.1.2 Install products as shown on the Drawings and as specified.

a. Identify electrical equipment with nameplates engraved with designation and function shown on the Drawings.

b. Attach nameplates on or near equipment with 4-40 by 3/8 inch, binding head, self-tapping machine screws, or pull stem rivets.

3.2.1.3 Use appropriate calibrated special tools when installing devices for which special installation tools are recommended by manufacturers.

3.2.1.4 Duct bank excavation and backfill shall be as specified in Section 02225.

3.2.2 Ground Systems: Use stranded copper conductors for ground conductors installed in earth or concrete. Make joints connecting copper and galvanized steel above grade and in dry location. Connections may be made with ground rod clamps or exothermic welds.

3.2.3 Conduits

3.2.3.1 Use galvanized rigid steel unless specified otherwise on the Drawings.

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 concealed conduits as directly as possible and with bend radii as long as possible.

3.2.3.4 Make elbows, offsets, and bends uniform and symmetrical. Bend conduit with approved bending devices.

3.2.3.5 Cut conduit ends 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.

3.2.3.6 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.

3.2.3.7 Use pipe straps, one hole clamps equipped with clampbacks or Unistrut with clamps to secure conduits.

3.2.3.8 Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, antiseize, conductive thread lubricant and sealant.

3.2.3.9 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.

3.2.3.10 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 Nonaerial Type Conductors

3.2.4.1 Use paint or pressure-sensitive colored tape to identify conductors instead of colored insulation on No. 4 AWG and larger wire only. Maintain phase color coding. Clearly identify equipment grounding conductors throughout the system.

3.2.4.2 Use lubricant recommended by cable manufacturer, or wire pulling compound specified, when pulling wire and cable through conduit.

3.2.4.3 Do not install or handle wires with thermoplastic insulation or jacket when ambient temperature is 15°F or below.

3.2.5 Splices, Taps, and Cable Terminations

3.2.5.1 Make splices and taps with solderless connectors specified in 2.2.1. Use connectors in accordance with the manufacturer's instructions.

3.2.5.2 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.

3.2.5.3 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.

3.2.5.4 Follow manufacturer's instructions and directions for splices, stress cones, and cable terminations.

3.2.5.5 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 one half-lapped layer of silicon rubber termination tape over plastic insulating taping.

3.2.6 Aerial Conductors

3.2.6.1 Clearances shall be maintained for cables and conductors in accordance with the Drawings, and ANSI C2.

3.2.6.2 String conductors from rotating reels and do not drag along ground nor permit conductors to lie where they may be run over by vehicles. Pull conductors through stringing sheaves or stringing blocks hung on messenger cable, but do not pull around sharp corners. Inspect conductors as they leave reels and cut out weak or damaged sections and splice ends. Do not make splices in adjacent spans, dead end spans, or within 4 feet of support. Install conductors to proper stringing tensions in accordance with manufacturer's recommendations.

3.2.6.3 Make splices under tension mechanically and electrically secure by compression fittings. Do not use self-gripping or automatic tension splicing sleeves. Make taps between primary wires, jumpers, etc, with mechanical connectors. Use aluminum-to-copper split-bolt connectors for tapping aluminum service cables to copper transformer leads or copper secondary lines.

3.2.6.4 Install hot line stirrups on existing conductors where new feeder taps are made.

3.2.6.5 Sag conductors in accordance with ANSI C2 for medium loading districts and manufacturer's specification.

3.2.7 Aerial Equipment Grounding: Ground fused switches and lightning arresters in accordance with the Drawings. Bond together pole line hardware separated by less than 2 inches. Ground messenger cable of each aerial cable in accordance with the Drawings. Connect grounding conductor to messenger with split-bolt connector.

3.3 FIELD QUALITY CONTROL

3.3.1 Testing

3.3.1.1 Furnish equipment and instruments required to perform testing.

3.3.1.2 Use instruments which bear calibration stamps showing dates of calibration and expiration dates of stamps. Calibration and accuracy of instruments shall be certified by an independent testing laboratory having standards traceable to the National Institute of Standards and Technology.

3.3.1.3 Test the 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 the Construction Engineer before start of tests. Record the results.

3.3.2 Reconnect devices disconnected during testing.

3.3.3 Acceptance Testing: After installation, and prior to energizing, Perform dc overpotential (Hi-Pot) tests on cable to verify installation acceptability.

Project No. W-320-C2

Project Title Equipment Removal System

Specification Section 16300

APPROVAL DATA LIST
("X" Indicates Required Data)

1 EPN IDENTIFICATION	2 DESCRIPTION	3 REFERENCE DRAWING	4 SPECIFICATION PARAGRAPH	5 DATA: Dimensional Drawings	Equipment Weights	Specifications	Material Description	Performance Data	Circuit or Control Diagrams	Data Sheets	Illustrative Cuts	Installation Instructions	6 REMARKS
	Cable (15 kV)		2.2.4			X	X						
	Lightning Arrestors		2.3.5, 2.3.6			X				X	X		
	~~Loadbreak Elbows~~		~~2.3.8~~			~~X~~				~~X~~	~~X~~		ECN-548

Project No. W-320-C2

Project Title Equipment Removal System

Specification Section 16300

VENDOR INFORMATION LIST
("X" Indicates Required Data)

1	2	3	4	5 VENDOR INFORMATION (VI)												
									Instructions							
EPN IDENTIFICATION	DESCRIPTION	REFERENCE DRAWING	SPECIFICATION PARAGRAPH	Dimensional Drawings	Equipment Weights	Specifications	Certified Test Data	Circuit or Control Diagram	Installation	Operation	Maintenance	Spare Parts List	Data Sheets	Illustrative Cuts	
	Cable (15 kV)		2.2.4			X							X	X	
	Lightning Arresters		2.3.5, 2.3.6			X			X				X	X	ECN-597
	Loadbreak Elbows		2.3.8			X			X				X	X	ECN-597

END OF SECTION
16300 - 11

SECTION 16400

SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 REFERENCES

1.1.1 The following documents, including others referenced therein, form part of this Section to the extent designated herein.

1.1.1.1 American National Standards Institute (ANSI)

C57.12.01-84	Dry-Type Transformers
C80.1-1990	Rigid Steel Conduit--Zinc Coated

1.1.1.2 Factory Mutual (FM)

Approval Guide	1993 Edition

1.1.1.3 Federal Specifications (FS)

W-C-375B NOT 1	Circuit Breakers, Molded Case; Branch Circuit And Service
W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
W-F-406E	Fittings For Cable, Power, Electrical And Conduit, Metal, Flexible
TT-S-000230C AMD 2	Sealing Compound: Elastomeric Type, Single Component (For Caulking, Sealing, and Glazing in Buildings and other Structures)
WW-C-566C	Conduit, Metal, Flexible

1.1.1.4 National Electrical Manufacturers Association (NEMA)

FB 1-1988	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
ICS 6-1988 Rev 1	Enclosures for Industrial Controls and Systems
RN 1-1989	Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
ST 20-1986	Dry-Type Transformers for General Applications
WD 1-1983 (R 1989)	General Requirements for Wiring Devices

1.1.1.5	National Fire Protection Association (NFPA)	
	70 (1993)	National Electrical Code
1.1.1.6	Underwriters Laboratories (UL)	
	Electrical Appliance and Utilization Equipment Directory	1993
	Electrical Construction Materials Directory	1993
	486B-1990	Wire Connectors For Use With Aluminum Conductors

1.2 SUBMITTALS

1.2.1 See Section 01300 for submittal procedures.

1.2.2 Approval Required

1.2.2.1 Approval data: Before delivery, submit information listed in the Approval Data List in this Section.

1.2.3 Approval Not Required

1.2.3.1 Vendor information: Before installation, submit information listed in the Vendor Information List in this Section.

1.2.3.2 Time current curves: Before installation, submit time current curves for circuit breakers.

1.3 QUALITY ASSURANCE

1.3.1 Electrical/Electronic Product Acceptability: See Section 01405 for required use of products listed and labeled by national testing and evaluation agencies.

1.3.2 Misrepresented Products: See Section 01405 for required measures to prevent the use of misrepresented products.

1.3.3 Deliverable Documentation: The following documents and records, required by this Section, shall be delivered to Construction Document Control in accordance with Section 01720.

Document	Paragraph
Electrical Test Results	3.3.1

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 See Section 01610 for general requirements.

1.5 FURNISHED EQUIPMENT

1.5.1 The following items will be furnished for installation under this Section. Upon request, one copy of approved vendor data submittals will also be furnished. See Section 01019.

1.5.1.1 C-Farm power distribution panel.

1.5.1.2 AY-Farm power distribution panel.

PART 2 - PRODUCTS

2.1 SUBSTITUTES

2.1.1 See Section 01630 for substitution approvals.

2.2 MATERIALS

2.2.1 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.

2.2.1.1 For conductors No. 8 AWG and smaller:

a. Ideal Industries, Incorporated "Wire-Nuts."

b. Thomas and Betts Company "Sta-Kon."

c. 3M Company "Scotchlok."

2.2.1.2 For conductors No. 6 AWG and larger:

a. Burndy Engineering Company "Screw Pressure Connectors" or "Hydent."

b. Thomas and Betts Company "Lock-tite."

2.2.2 Conduit, Fittings, and Boxes

2.2.2.1 Conduit: ANSI C80.1, FS W-C-1094, Type II PVC (Schedule 40), and FS WW-C-566.

2.2.2.2 PVC coating on rigid steel conduit: NEMA RN 1, Type A-40, factory applied.

2.2.2.3 Flexible metal conduit shall have an integral ground conductor.

2.2.2.4 Fittings for rigid steel NEMA FB 1.

2.2.2.5 Fittings for flexible metal conduit: FS W-F-406, squeeze type.

2.2.2.6 Use "Myers" type watertight fittings, or sealing type locknuts, for conduit entries into sides or tops of NEMA ICS 6 Type 3 or 3R enclosures.

2.2.2.7 Receptacle wet location: Cast box Crouse Hinds FDCT2 or approved substitute.

2.2.2.8 Receptacle wet location cover: Crouse Hinds WLRD-5-15 or approved substitute.

2.2.3 Conductors: Stranded copper with type THWN/THHN or XHHW insulation, of type and AWG size specified on the Drawings.

2.2.4 Cables: 3 conductor stranded copper, XHHW insulated for 600 V, with grounding conductor, Type MC ~~(with galvanized steel armor)~~, jacketed, with 90°C dry/75°C wet rating, approved for direct burial installation. Cable shall have PVC jacket. ECN 068

2.2.5 Wiremarkers: Imprinted tubular plastic.

2.2.6 Wire Pulling Compound: Electro Compound Company "Y-er Eas," or American Polywater Corporation "Polywater."

2.2.7 Tape

2.2.7.1 Plastic insulating tape: 3M Company "Scotch No. 33+."

2.2.7.2 Conduit protection tape: 3M Company "Scotchrap No. 50."

2.2.8 Insulating Putty: 3M Company "Scotchfil," General Electric Company No. 8389, or Kearney Company "Airseal."

2.2.9 Duct Sealing Compound: Porcelain Products Company "Sealex."

2.2.10 Penetration Sealant: FS TT-S-00230, Type II, Class A, 1-component polyurethane, nonsag type, light-colored.

2.2.11 Supports

2.2.11.1 Individual conduit hangers: Factory made springable wrought steel clamps, or malleable iron split and hinged rings.

2.2.11.2 Lighting fixture supports: 1-1/2 inch channel; Unistrut or Kindorf.

2.2.11.3 Expansion Anchors: Hilti Fastening Systems "Kwik-Bolt II", or ITW-Ramset "Trubolt Wedge Anchor".

2.2.12 Type MC Cable Terminators: Type SPKSR O-Z Gedney Armored/Metal Clad Cable Terminations, with Gedney Dozseal 220 filling insulating compound to seal terminators, or approved substitutes. Select fitting size based on diameter over jacket.

2.2.13 Equipment Nameplates: Laminated plastic, 1/16 inch thick with white surface and black core. Edges beveled and smooth. Engraved nomenclature sharp and clear, sized to meet legend requirements.

2.3 EQUIPMENT

2.3.1 Electrical equipment shall be PCB free, and shall include Material Safety Data Sheets for hazardous materials of construction.

2.3.2 Equipment enclosures: NEMA ICS 6 Type 3; if Type 3 is not commercially available, use Type 3R.

2.3.3 Transformer/Breakers Skid and Transfer Switches/Breakers Skid

2.3.3.1 Free standing units designed for direct mounting on the ground or concrete pad, as shown on the Drawings. Provided with lifting eyes, grounding pads and nameplates. Skids shall withstand temperatures of -10 to 120°F, humidity of 20 to 100% and wind load of 20 lb/ft^2.

2.3.3.2 Skids shall consist of transformers, circuit breakers, wireways, support structures, etc as shown on the Drawings. See Section 05500 for structural fabrication. Electrical assembly shall be in accordance with this Section.

2.3.4 Transformer: Transformer/Breakers Skid transformer shall be a 2-winding general purpose dry-type, in an outdoor enclosure for floor mounting, with two 2-1/2% taps above and two 2-1/2% taps below nominal rated primary voltage. Minimum insulation system shall be rated 220°C with 150°C winding temperature rise above ambient temperature. Transformer shall conform with NEMA ST-20 and ANSI C57.12.01. The kVA rating, and the primary and secondary winding voltages are as shown on the Drawings. Transformer shall have lifting eyes.

2.3.5 ~~Power Distribution Blocks: 3I-pole block capable of connecting 4 350 Kcmil conductors each pole, Square D LBA365202 or an approved substitute.~~ ECN 068 | ECN 068

Power Distribution Blocks: For the Transfer Switch/Breakers Skid, use 1-pole blocks, Square D LBA165202 or an approved substitute. For the Transformer/Breakers Skid, use 1-pole blocks LBS163104 or an approved substitute. ECN 070 | ECN 070

2.3.6 Transfer Switches: Manual 3-pole, double throw, with ~~minimum interrupting duty of 10,000A symmetrical~~ grounding kit. Ampacity and voltage ratings as shown on the Drawings. ECN 069 ECN 069

2.3.7 Circuit Breakers: Thermal magnetic molded case bolt-on type. Minimum interrupting duty of 10,000A symmetrical. Ampacity and voltage ratings as shown on the Drawing. Breakers shall comply with W-C-375, as applicable.

2.3.8 Wireways: NEMA ICS 6 Type 3 (if Type 3 is not commercially available, use Type 3R), preferably hinged. Size to accommodate bending radius of the largest cables. (Minimum dimension is 8 times the cable bending radius.)

2.3.9 Fixture Types: Light fixture for AY-PDP-1 and C-PDP-1, Crouse Hinds V2759, or approved substitute, with light switch in weatherproof box, GFCI receptacle in weatherproof box and 3/4 inch rigid steel conduit.

2.3.10 Receptacles: GFCI duplex receptacle, 125 V ac, 20 A, Hubbell GF-5362-W or an approved substitute.

2.3.11 Toggle Switch: Crouse Hinds EDSC2129 or an approved substitute.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Field Measurements: Scale dimensions on Drawings show desired and approximate locations 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.

3.2.1.2 Fasten equipment to metal supports attached to structure, or to concrete surfaces.

a. Use clamping devices for attaching to structural steel, or, when clamping is impracticable, obtain permission from the Construction Engineer to weld, drill, or cut structural members for attachments.

b. Fasten equipment to concrete or masonry with expansion anchors.

c. Locate equipment, boxes, and conduit approximately where shown in relation to equipment served.

d. Do not install conduit raceways and boxes in positions that interfere with work done by other trades.

e. Identify components with nameplates bearing legends shown on the Drawings.

f. Attach nameplates on equipment with metal screws. Attach with designations and at locations shown on Drawings.

3.2.1.3 Use appropriate calibrated special tools when installing devices for which special installation tools are recommended by manufacturers.

3.2.2 Skids: Assemble skid wiring systems connecting electrical devices of the 2 skids, using stranded copper wire with 90°C, with cross-linked polyethylene (XLP) type insulation in wireway. Route cable from skid component to skid component in either wireway or in rigid galvanized conduit nipples with double locknuts and grounding bushing at each end. Use galvanized rigid conduit nipples to connect switches and breaker enclosures to the wireway.

3.2.3 Grounding Systems

3.2.3.1 Underground conductors, electrodes, and connections: Install in accordance with the Drawings. Make joints connecting copper and galvanized steel above grade and in dry locations. Connections may be made with ground rod clamps or exothermic welds.

3.2.3.3 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 NFPA 70.

3.2.3.4 Skid grounding: Metal noncurrent carrying parts of the skid shall be bonded to ground through grounding conductors. Grounding conductors shall be sized in accordance with the NEC. Grounding conductors shall be routed along the channel posts to the wireway. Grounding lugs located inside and outside the wireway will be held by a copper screw. Grounding terminals or lugs shall be provided for terminating the cable grounding conductors in the wireway and device enclosures. The grounding system shall be connected and bonded into a single low resistance path to ground.

3.2.3.5 Circuit breaker grounding: Enclosed feeder breakers for the 120/240 V ac construction trailers shall have neutral terminals bonded to the enclosure in addition to the grounding terminals.

3.2.4 Conduit

3.2.4.1 Use galvanized rigid steel unless specified otherwise on the Drawings.

3.2.4.2 Install concealed conduits as directly as possible and with bend radii as long as possible.

3.2.4.3 Permanently label conduits with numbers shown on the Drawings using Brady marking film at both ends. For 10 foot maximum length conduits, place one label at the center.

3.2.4.4 Make elbows, offsets, and bends uniform and symmetrical. Bend conduit with approved bending devices.

3.2.4.5 Cut conduit ends 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.

3.2.4.6 Use galvanized steel locknuts and insulated bushings for attachment to enclosures except threaded hubs or sealing type 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.

3.2.4.7 Use 1-hole clamps equipped with clampbacks, or Unistrut with clamps, to secure conduits.

3.2.4.8 Install conduits 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.

3.2.4.9 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 4 foot maximum lengths for other equipment, with approval of the Construction Engineer.

3.2.4.10 Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, antiseize, conductive thread lubricant and sealant.

3.2.4.11 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.

3.2.4.12 Install each power distribution panel on a skid as shown on Drawings. Install the receptacle, light fixture and toggle switch on power distribution panels as shown on Drawings. Each skid mounted power distribution panel shall be installed on the concrete pad designated by cutting holes by the bottom of the panel as required for conduit entry.

3.2.4.13 Wrap conduit passing from concrete to air or to direct earth burial with conduit protection tape from 3 inches in concrete to 12 inches minimum in earth, or 3 inches in air, unless conduit is PVC coated.

3.2.4.14 Encase conduit installed below concrete slabs with 3 inches minimum of concrete on all sides, or use PVC coated rigid steel.

3.2.4.15 Install PVC coated conduit in accordance with manufacturer's recommendations. Repair coating, damaged during handling or installation using PVC paint recommended by conduit manufacturer.

3.2.5 Metal Raceway Other Than Conduit: Install complete with necessary fittings, connectors and parts, in accordance the manufacturer's instructions.

3.2.6 Wireway Taps: Install taps using insulated gutter taps. Strip insulation only where necessary. Tape as required to maintain integrity of insulation.

3.2.7 Underground Duct Banks

3.2.7.1 Use rigid steel or PVC conduit in concrete-encased duct banks as shown on the Drawings.

3.2.7.2 Install underground ducts in accordance with the Drawings and route without drains where possible.

3.2.7.3 Where drains or risers are required, install in accordance with the Drawings. Seal conduit at both ends with duct sealing compound.

3.2.7.4 Form concrete encasements unless a written waiver is obtained from the Construction Engineer.

3.2.8 Boxes, Enclosures, and Wiring Devices

3.2.8.1 Install boxes firmly in position and plumb.

3.2.8.2 Install extension ring with blank cover on flush mounted junction boxes where box serves permanently installed equipment.

3.2.8.3 Flush mount junction boxes served by concealed conduit.

3.2.8.4 Install dust covers on junction, pull, and outlet boxes, and other types of wiring outlets at initial installation. Replace with permanent covers or devices after wires are installed.

3.2.9 Conductors

3.2.9.1 Do not bend cables installed in wireways to less than manufacturer's recommended minimum bending radii. 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.

3.2.9.2 Identify conductors, by wire numbers shown on the Drawings, with wiremarkers. Attach wiremarkers at termination points within 2 inches of wire terminations. Marker nomenclature shall be visible without moving wires or markers.

3.2.9.3 Paint or pressure-sensitive colored tape may be used for coding conductors instead of colored insulation on No. 8 AWG and larger wire for phase (ungrounded) conductors, and No. 4 AWG and larger wire for neutral (grounded) conductors and equipment grounding conductors only. Maintain phase color coding, in accordance with the following table, for branch and feeder circuits up to and including equipment connections.

Conductor Origin	Conductor	Insulation Color	
480Y/277 V, 3-phase systems, transformers, panels, switchboards, etc.	Phase A Phase B Phase C Neutral Equipment ground	Red ~~Orange~~ *Yellow* ~~Black~~ *Blue* White or Gray Green (or bare)	 ECN 070 ECN 070
120/240 V, single-phase transformers, panels, switchboards, etc.	Hot Number 1 Hot Number 2 Neutral Equipment ground	Black ~~Red~~ *Brown* White or Gray Green (or bare)	 ECN 070

3.2.9.4 Use lubricant recommended by the cable manufacturer, or wire pulling compound specified, when pulling wire and cable through conduit.

3.2.9.5 Do not install or handle wires with thermoplastic insulation or jacket when ambient temperature is 15°F or below.

3.2.9.6 Install and mark direct burial cable in accordance with the Drawings.

3.2.10 Splices, Taps, and Cable Terminations

3.2.10.1 Make splices and taps in building wire with solderless connectors specified in 2.2.1. Use connectors in accordance with the manufacturer's instructions.

3.2.10.2 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.

3.2.10.3 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.

3.2.11 Check bus phasing before making cable connections. Connect cable and bus conductors with phase sequence as follows when observed from front:

A Phase	-	Front	Left	Top
B Phase	-	Center	Center	Center
C Phase	-	Rear	Right	Bottom

3.3 FIELD QUALITY CONTROL

3.3.1 Testing

3.3.1.1 Furnish equipment and instruments required to perform testing.

3.3.1.2 Only instruments which bear calibration stamps showing dates of calibration and expiration dates of stamps shall be used. Calibration and accuracy of instruments shall be certified by an independent testing laboratory having standards traceable to the National Institute of Standards and Technology.

3.3.1.3 Skids: Electrical equipment on the skids shall be tested for proper phase connections, continuity, unintentional grounds, and for ground continuity to the metal framing of the skid. Phase-to-phase and phase-to-ground wiring systems insulation shall be tested with a megger. Minimum acceptable value is 200 megohms.

3.3.1.4 Wiring: Wiring shall be tested for proper phase connections, tested for continuity and unintentional grounds. Ground resistances between the ground pads and the device enclosures shall be measured.

3.3.1.5 Phase-to-phase and phase-to ground insulation resistance shall be tested with a megger. Minimum acceptable value is 200 megohms. Megger manufacturer's instruction booklet, furnished with the megger, shall be used in conducting the tests. Devices not capable of withstanding voltage or current of megger test, shall be disconnected. Voltage output of megger shall be 1000 V dc, nominal. Record the results.

3.3.1.6 *Transformer: Verify that secondary voltages are 120/240 V ±5%; choose tap setting as required.* ECN 093 ECN 093

3.3.1.7 Test the power input terminals on the Equipment Removal System trailers for unintentional grounds, and verify proper phase sequence and voltage at equipment served before attempts are made to operate equipment. Notify the Construction Engineer before start of tests. Record the results.

3.3.2 Reconnect devices disconnected during testing.

Project No. W-320-C2

Project Title Equipment Removal System

Specification Section 16400

APPROVAL DATA LIST
("X" Indicates Required Data)

1 EPN IDENTIFICATION	2 DESCRIPTION	3 REFERENCE DRAWING	4 SPECIFICATION PARAGRAPH	5 DATA									6 REMARKS
				Dimensional Drawings	Equipment Weights	Specifications	Material Description	Performance Data	Circuit or Control Diagrams	Data Sheets	Illustrative Cuts	Installation Instructions	
	Cable~~/Conductors~~		~~2.2.3,~~ 2.2.4			X				X	X		ECN 069
	Transformer		2.3.4		X	X					X		
	Transfer Switches		2.3.6	X	X	X				X	X		
	Circuit Breakers		2.3.7		X	X				X	X		Include curves

Project No. W-320-C2

Project Title Equipment Removal System

Specification Section 16400

VENDOR INFORMATION LIST
("X" Indicates Required Data)

1	2	3	4	5 VENDOR INFORMATION (VI)												
									Instructions							
EPN IDENTIFICATION	DESCRIPTION	REFERENCE DRAWING	SPECIFICATION PARAGRAPH	Dimensional Drawings	Equipment Weights	Specifications	Certified Test Data	Circuit or Control Diagram	Installation	Operation	Maintenance	Spare Parts List	Data Sheets	Illustrative Cuts	
	~~Cable/~~Conductors		2.2.3, ~~2.2.4~~										X		ECN-071
	Transformer		2.3.4	X	X	X			X	X	X	X	X	X	
	Transfer Switches		2.3.6	X	X	X			X		X		X	X	
	Circuit Breakers		2.3.7	X	X	X			X		X		X	X	Include curves
	Cable		*2.2.4*	*X*	*X*	*X*			*X*				*X*	*X*	ECN 071 ECN 597

END OF SECTION 16400 - 13

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	JW Bailey	Date 17 July 1998
Project Title/Work Order		EDT No. 622267
Project W-320, 241-C-106 Sluicing, Construction Specification, W-320-C2		ECN No. n/a

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
JW Bailey	S2-48				
W-320 Project Files	R1-29				