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PACKAGE 1D

M&O Civilian Radioactive Waste Management System
MANAGEMENT & OPERATING CONTRACTOR

REFERENCE SPECIFICATIONS

VOLUME 1 OF 2

90% DESIGN REVIEW

JULY 11, 1994

9408020210 940725
NMSS SUBJ
102.8 CF

REFERENCE DOCUMENT - UNCONTROLLED

40

WBS: 1.2.6
QA: QA

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 12/17/93

Civilian Radioactive Waste Management System
Management and Operating Contractor

FIRST SUBMITTAL

Specification Section 01300

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SUBMITTALS

CI.16.0000

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6

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Page: 2 of:

Title of Design Specification SUBMITTALS

Document Identifier: BAB000000-01717-6300-01300 Revision Number 01

This specification covers QA Classification Q *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

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Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	James W. Tajala	*Date*	11.22.93
Reviewed by	Bernette J. Herold	*Date*	11/23/93
Reviewed by	Donald Vanica	*Date*	11-22-93
Reviewed by	William J. Rae	*Date*	11/22/93
Reviewed by	Gerald W. Keifer	*Date*	11/22/93
Verified by	Robert A. Schmidt	*Date*	11/22/93
Approved by	Jerry J. Nort	*Date*	11/23/93
QA Approval	Robert Justice	*Date*	11-24-93

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

WBS: _____

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Complete only applicable items.

Revision No.	*Pages Revised and Description*
01	Revised QA Classification

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

The work specified in this Specification Section includes the submittals of shop drawings, product data, samples, manufacturers' instructions, manufacturers' certificates, and all other submittals required by the technical specification sections in Construction Specifications Institute Divisions 2 through 16.

1.02 RELATED SECTIONS

A. Section 01400 Contractor Quality Control/Quality Assurance

B. Section 01600 Material and Equipment

1.03 REFERENCES

Yucca Mountain Site Characterization Project (YMP) Documents:

YMP Administrative Procedures (AP) Manual, latest revision

1.04 SUBMITTALS

A. Submittals specified in the technical Specification Sections shall be submitted by the Buyer to the Architect/Engineer (A/E) for review. All submittals resulting from "Issued for Construction" Drawings or Specifications shall be made in accordance with the appropriate procedure. Submittals shall be processed according to approved procedures for incorporation into the "As Built" records.

B. Submittals of shop drawings, product data, and manufacturer's instructions shall be made in accordance with Part 4 of the individual specification sections.

C. Provide manufacturer's warranties that are standard for the products being supplied.

D. Submit "As-Built" drawings when required by the individual specification section.

PART 2 PRODUCTS

2.01 SHOP DRAWINGS

A. Drawings shall be legible and shall clearly depict the intent.

B. Drawings shall include, as applicable, wiring diagrams, plans, elevations, sections of equipment, and any other items that must be shown to assure a coordinated installation.

C. Indicate adequate clearances for operation, maintenance, and replacement of operating equipment and devices.

D. Submit one transparent and five opaque reproductions of each sheet.

E. Reproduce and distribute to the applicable subcontractors and suppliers after review by the A/E.

F. Provide space for both the Buyer and A/E to place their review stamps.

2.02 PRODUCT DATA

A. Mark each copy to identify applicable products, models, options, and other data.

B. Manufacturer's data shall indicate overall dimensions, weights, construction details, certifications, and all other information necessary for the evaluation of the materials and/or equipment.

C. All equipment and materials shall conform to the standards and requirements as specified in each individual Specification Section.

D. Submit the number of copies required by Buyer, plus five copies which will be retained by the A/E.

2.03 MANUFACTURER'S INSTRUCTIONS

Submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for product data.

2.04 SAMPLES

A. Submit full range of manufacturer's standard colors, textures, and patterns for A/E selection. Submit samples for selection of finishes as specified in the technical specification sections.

B. Submit samples, as specified in the individual specification sections, to illustrate functional characteristics of the product with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

C. Identify each sample by marking on the sample the pertinent drawing number, detail number, Specification Section as appropriate.

D. Submit one of each sample to be retained by the A/E.

REFERENCE DOCUMENT - UNCONTROLLED

2.06 CERTIFIED TEST REPORTS

A. Certified Test Reports are a written and signed document approved by a qualified party, that contains sufficient data and information to verify the actual properties of items and the actual results of all required tests.

B. Before delivery of materials and equipment, certified copies of test reports specified in the individual specification sections shall be submitted to the A/E for review.

2.07 FACTORY TESTS

A. Factory Tests are tests which are required to be performed by the factory on the actual material or equipment proposed for procurement, installation, and operation.

B. Test results shall be submitted in accordance with the specific requirements of the individual specification sections.

C. The Buyer shall arrange for access to manufacturer or testing laboratory facility and shall provide for the A/E or U.S. Department of Energy representatives to witness all Factory Tests when so requested.

2.08 OPERATION AND MAINTENANCE (O&M) MANUALS

A. Furnish an O&M manual(s) covering the stipulated systems and equipment.

B. Fourteen copies of the manual(s), bound in hardback binders or an approved equivalent, shall be provided to the A/E.

C. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining thirteen manuals in the time frame indicated in Part 4 of the individual specification sections.

D. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL

BUILDING NO. (or system I.D.)_____

TITLE OF SYSTEM_____

_____

SUPPLIER _____

DATE OF INSTALLATION _____

.09 FIELD SAMPLES

A. Provide field samples of finishes at the Project construction site as required by individual specification section.

1. Install sample complete and finished.

2. Acceptable samples in place may be retained in completed work.

PART 3 EXECUTION

(NOT USED)

PART 4 SUBMITTALS AND NOTIFICATION

(NOT USED)

END OF SPECIFICATION SECTION

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By [signature] Date 12/17/93

WBS: 1.2.6
QA: QA

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Management and Operating Contractor

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Specification Section 01400

FIRST SUBMITTAL

CONTRACTOR QUALITY CONTROL/QUALITY ASSURANCE

CI.16.0000

Document Identifier: BAB000000-01717-6300-01400
QA Classification: Q

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

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Title of Design Specification CONTRACTOR QUALITY CONTROL/QUALITY ASSURANCE

Document Identifier: BAB000000-01717-6300-01400 Revision Number 01

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Yes ☐ **No** ☑

If Yes, identify attachment(s):

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Verified by	Robert A Schmidt	*Date*	11/22/93
Approved by	Jerry J Nor	*Date*	11/23/93
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Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Page: 3 of:

Revision No.	*Pages Revised and Description*
01	Revised QA Classification

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 01400

CONTRACTOR QUALITY CONTROL/QUALITY ASSURANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

The work included in this Specification Section requires the Contractor to maintain a Quality Control (QC)/Quality Assurance (QA) Program, as approved by the U.S. Department of Energy (DOE).

1.02 RELATED SECTIONS

(NOT USED)

1.03 REFERENCES

Office of Civilian Radioactive Waste Management (OCRWM):

DOE/RW-0333P Quality Assurance Requirements Document

1.04 QUALITY ASSURANCE

A. QA Program Requirements

1. Items Important to Radiological Safety and Waste Isolation: For items of work classified as important to radiological safety and waste isolation, the Contractor and Supplier shall comply with their approved QA Program. The QA classification shall be determined from the Drawings and the Specification Sections.

2. Items Not Important to Radiological Safety and Waste Isolation: Items of work not important to radiological safety and waste isolation performed by the Supplier shall comply with the codes, standards, and regulations specified in the Drawings and Specification Sections.

B. Source Evaluation and Selection: The Contractor is responsible for the technical and QA program qualification of Suppliers. The Architect/Engineer (A/E) will provide technical assistance in the evaluation of Suppliers when requested by the Contractor. As an alternative to qualification, on a case by case basis and with prior written approval by the A/E, Contractor may establish a material dedication program in accordance with the requirements of DOE/RW-0333P.

C. Acceptance of the Product: The QA Articles of the technical Specification Sections identify the minimum requirements for the acceptance of items or activities identified in the Specification Sections or as indicated on the Drawings. Acceptance of these items or activities will be based on one or more of the following, as specified by the Contractor:

REFERENCE DOCUMENT - UNCONTROLLED

1. Source Verification: The acceptance of items or services shall be according to the Contractor's approved QA plans and procedures.

2. Receipt Verification: The acceptance of items shall be according to the Contractor's approved QA plans and procedures.

3. Field Verification: The acceptance of items or services shall be according to the Contractor's approved QA plans and procedures.

4. Other methods as required by the Specification Sections.

D. Deviations: The Supplier shall request approval of deviations to the requirements of Construction Specifications in writing to the Contractor. If approved by the Contractor and the A/E, the A/E will initiate a Field Change Request (FCR) in accordance with DOE Administrative Procedures.

E. Access for Audit, Surveillance, and Inspection: The Supplier shall provide access to supplier facilities and records for inspection, surveillance, and audit by the Contractor, the A/E, DOE, and DOE representatives.

F. All records generated as a result of Q Control requirements specified within these Specification Sections shall be QA Records, and shall be controlled as such.

PART 2 PRODUCTS

2.01 SUPPLIER QUALITY CONTROL

Refer to each individual specification section to identify required Supplier tests and inspections, and acceptance criteria for the materials or products.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

The Contractor shall perform first line QC inspections and verifications. Likewise, verification of Q Controls shall be the responsibility of the Contractor, and documentation of verification shall be QA Records. The A/E is responsible for Title III Engineering oversight of the Contractor's Program.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

Contractor shall transmit a copy of all submittals (reference Specification Section 01300) to the Las Vegas Local Records Center.

REFERENCE DOCUMENT - UNCONTROLLED

4.02 NOTIFICATION

This Article of the Specification Section identifies the points which require witnessing or inspection by the A/E, DOE, or DOE representatives. These points are identified as hold or witness points. The Contractor shall provide the A/E advance written notification of hold and witness points within the time frame specified on the A/E's Submittals and Notification Requirements sheet. The work shall not proceed beyond hold points without the written authorization of the A/E. The A/E may assign additional hold or witness points after the receipt and review of the Contractor's planning documents such as schedules.

24/127

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By [signature] Date 2/28/94

WBS: 1.2.6
QA: QA

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Management and Operating Contractor

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Specification Section 01500

TEMPORARY SURFACE CONSTRUCTION FACILITIES

FIRST SUBMITTAL

Document Identifier: BAB000000-01717-6300-01500 Rev. 00
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QA Classification: Q/MC

Revision No.	Date
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CRWMS/M&O

Certification of Specification

Complete only applicable items.

WBS: 1.2.6
QA: QA
Page: 2 of 10

TITLE OF SPECIFICATION	TEMPORARY SURFACE CONSTRUCTION FACILITIES
DOCUMENT IDENTIFIER	BAB000000-01717-6300-01500
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QA CLASSIFICATIONS	Q/MC

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Previous work impacted by this revision:

☐ Yes ☑ No

If yes, identify attachment(s):

QAP-3-1 Review Conducted? ☒ Yes ☐ No

Specification Preparer

Verifier Exemption Justification Attached? ☐ Yes ☒ Not Required

PREPARER	DATE 2/8/94	REVIEWER N/A	DATE N/A
CHECKER	DATE 2/8/94	REVIEWER N/A	DATE N/A
REVIEWER	DATE 2.8.94	REVIEWER N/A	DATE N/A
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QAP-3-8 0081 (10/30/93)

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CRWMS/M&O

Revision Description

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WBS: 1.2.6
QA: QA
Page: 3 Of: 10

Revision No.	Revised Pages	Description

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SECTION 01500

TEMPORARY SURFACE CONSTRUCTION FACILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements under this Specification Section apply to temporary construction facilities which are not part of the designed Exploratory Studies Facility structures, systems, and components (SSCs) within the Conceptual Controlled Area Boundary.

B. Temporary Construction Utilities: Electricity and communications, lighting, water service, and sanitary facilities.

C. Temporary Construction Controls: Fencing, drainage control, protection of the work, and safety and health standards.

D. Temporary Construction Facilities: Parking, offices, shops, storage areas, pads, non-permanent fluids and materials and other facilities deemed necessary for construction.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 02225 Water Use for Construction and Operations

C. Section 02270 Slope Protection and Erosion Control

1.03 REFERENCES

A. Code of Federal Regulations (CFR):

1. 29 CFR 1910-92 Occupational Safety and Health Standards

2. 29 CFR 1926-92 Safety and Health Regulations for Construction

B. National Fire Protection Association (NFPA):

NFPA 70-93 National Electrical Code

C. U. S. Department of Energy (DOE) Standards:

DOE/EV-0043-8/79 Standard on Fire Protection for Portable Structures

REFERENCE DOCUMENT - UNCONTROLLED

D. Yucca Mountain Site Characterization Project (YMP) Document:

YMP/90-37-7/92	Yucca Mountain Site Characterization Project Safety and Health Plan

1.04 QUALITY ASSURANCE

A. Quality assurance for Q Control items of this Specification Section shall be conducted in accordance with Specification Section 01400.

B. This Specification Section includes provisions applicable to items and activities that are both important to waste isolation (ITWI) and/or important to radiological safety (ITRS) and those that are not ITWI or ITRS. Those provisions applicable to items and activities ITWI and/or ITRS are identified as Q Controls and are denoted in this Specification Section by underlined text. All other provisions that are non-Q are called Management Control (MC).

1.05 TEMPORARY ELECTRICITY AND COMMUNICATIONS FOR CONSTRUCTION PURPOSES

A. Provide temporary electric feeder from designated electrical service as required for construction operations.

B. Submit a layout of proposed temporary construction electrical and communications requirements to the Architect/Engineer (A/E) for review prior to implementation. Layout shall define and locate items to be installed and shall indicate when these items will be removed.

C. Q Control: All electrical equipment and components creating an electromagnetic field of sufficient strength to affect site characterization testing instruments shall be posted with electromagnetic field warning signage on or near them as determined by the A/E.

D. Q Control: Any transformer or wet-cell electrical component required for temporary construction activities shall be set on a concrete pad foundation with a catch basin adequately sized to contain all fluids from rupture of equipment. This basin shall be inspected periodically by individuals responsible for removing accumulated water or debris and checking for fluid leaks. The cleanliness of the concrete basin shall be maintained throughout the construction of this project.

E. Q Control: Where grounding is required for temporary construction activities, any non-shrinking grounding enhancement material suitable for reducing soil resistivity using backfill must be submitted to the A/E for review. Use of any salt compounds as ground enhancement material is forbidden.

F. Provide main service disconnect and overcurrent protection in accordance with NFPA 70.

1.06 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain temporary lighting, as required, for construction operations.

REFERENCE DOCUMENT - UNCONTROLLED

B. Submit a layout of proposed temporary construction lighting to the A/E for review prior to implementation. Layout shall define and locate items to be installed and shall indicate when the items will be removed.

C. Maintain lighting and perform routine repairs.

1.07 TEMPORARY WATER SERVICE FOR CONSTRUCTION PURPOSES

A. Provide and maintain suitable quality temporary water service, as required, for construction operations.

B. Temporary water service shall be in accordance with Specification Sections 01600 and 02225. **Q Controls are present in these Specification Sections.**

C. Submit a layout of proposed temporary construction water service distribution system to the A/E for review prior to implementation. Layout shall define and locate items to be installed and shall indicate when these items will be removed.

1.08 TEMPORARY SANITARY FACILITIES

A. Provide and maintain adequate facilities and enclosures to support all personnel working at the site.

B. Submit a layout of proposed temporary sanitary facilities to the A/E for review prior to implementation. Layout shall define and locate items to be installed and shall indicate when these items will be removed.

C. Temporary sanitary facilities shall be in accordance with Specification Section 01600. **Q Controls are present in this Specification Section.**

1.09 TEMPORARY FENCING

A. Provide temporary fencing, as required, for construction operations.

B. Submit details and layout for proposed temporary fencing to the A/E for review prior to implementation. Layout shall define and locate items to be installed and shall indicate when these items will be removed.

C. Construction: Commercial grade chain link fence with direct buried or driven pipe posts.

1.10 DRAINAGE CONTROL DURING CONSTRUCTION

A. Q Control: Temporary construction facilities, materials, and/or equipment shall not block nor substantially alter the positive drainage flow away from the starter tunnel or create significant ponding on the pad. Excavations in the pad for the purpose of installing utilities or foundations will be pumped out when significant water accumulates in the excavation.

REFERENCE DOCUMENT - UNCONTROLLED

1.11 PROTECTION OF SITE AND INSTALLED WORK

A. Protect site and installed work and provide special protection where specified in individual Specification Sections.

B. Control activity in immediate work area to prevent damage.

C. Provide protection against spills conforming to Specification Section 01600. **Q Controls are present in this Specification Section.**

1.12 SAFETY AND HEALTH STANDARDS DURING CONSTRUCTION

A. All construction activities and their associated SSC's shall be installed, operated, and maintained in accordance with applicable requirements of 29 CFR's 1926, 1910 and YMP Safety and Health Plan YMP/90-32 for personnel safety. Installation, operations, and maintenance plans are not required.

1.13 PARKING OF TEMPORARY CONSTRUCTION VEHICLES

A. Measures shall be taken to control leakage of hydrocarbons (i.e., hydraulic fluid, fuels, oils, etc.) by construction vehicles in conformance with Specification Section 01600. **Q Controls are present in this Specification Section.**

1.14 TEMPORARY CONSTRUCTION OFFICES, SHOPS, STORAGE AREAS, AND PADS

A. Provide temporary construction offices, shops, and storage areas, pads, and other facilities as required for construction operations.

B. Submit a layout of proposed construction offices, shops, storage areas, pads, and other facilities to the A/E for review prior to implementation. Layout shall define and locate items to be installed and shall indicate when these items will be removed. Minor items (e.g. sawhorses, small equipment, etc.) which are in conformance with Article 1.15 of this Specification Section do not require submittal review.

C. Portable structures shall be in accordance with DOE/EV-0043.

D. Measures shall be taken to control leakage of hydrocarbons (i.e., hydraulic fluid, fuels, oils, etc.) associated with temporary construction offices, shops, storage areas, pads, and other facilities in conformance with Specification Section 01600. **Q Controls are present in this Specification Section.**

1.15 USE OF NON-PERMANENT FLUIDS AND MATERIALS DURING CONSTRUCTION

A. The fluids and materials listed below are approved for use to a maximum depth of ten feet below grade. Submit a list of proposed materials not listed prior to delivery to the site for A/E approval prior to utilization.

REFERENCE DOCUMENT - UNCONTROLLED

1. Fluids: propane, cylinders of gas, standards for calibration of instruments, diesel fuel, ethylene glycol (antifreeze), lubricants for machines, insulating oils, fuel oil, gasoline, hydraulic fluid, battery acid, cleaning solvents, port-a-potty fluids (e.g., potpourri), thread cutting oil, air compressor lubricating oil, tire ballast materials, silicone sealant, cable pull lubricant.

2. Materials: plastic, PVC, ABS plastic, rubber, solid metals, wood, concrete, iron, steel, aluminum, rubber, glass, sheet metal, graphite-based grounding material (GEM), copper wire or plates, explosives, asphalt, asphaltic concrete, concrete curing compound, soil containing Road Oyl, gravel for roads, weld rod (E70XX electrodes), glue (silicone), PVC cement, silicone caulking compound, concrete joint sealant (elastomeric), expansion joint material (particle board), insulation (extruded polystyrene), pipe thread compound (teflon), fire sealant, bentonite clay, liner glue (PVC).

B. Material Safety Data Sheets (MSDSs) shall be maintained in accordance with YMP/90-37.

C. Report Tracers, Fluids, and Materials (TFM) utilization as required in Specification Section 01600. **Q Controls are present in this Specification Section.**

1.16 REMOVAL OF FACILITIES

A. All temporary construction utilities, equipment, facilities, and materials shall be removed in accordance with this Specification Section.

B. All buried installations shall be removed in accordance with this Specification Section.

C. Cleanup as required and repair damage resulting from removal of temporary construction facilities.

PART 2 PRODUCTS

(NOT USED)

PART 3 EXECUTION

(NOT USED)

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet and Specification Section 01300.

B. Any revisions to original layout submittals required under this Specification Section shall be submitted to the A/E for review.

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C. Any deviations from the requirements of this Specification Section shall be submitted to the A/E for approval in accordance with approved project procedures.

D. Q Control: The A/E shall be notified prior to excavation of the North Portal Pad which exceeds 10 feet in depth for temporary construction purposes.

4.02 NOTIFICATION

(NOT USED)

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 01500

TITLE: Temporary Construction Facilities and Controls

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD	STATUS:	STATUS:	TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE	TIMING:	TIMING:	NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)	NOTIFICATION:	NOTIFICATION:
Elec/Comm Layout	1.05B		X										30									
Grounding Material	1.05K		X										30									
Lighting Layout	1.06B		X										30									
Water Service Layout	1.07C		X										30									
Sanitary Layout	1.08B		X										30									
Fencing Layout	1.09B		X										30									
Facilities Layout	1.14B		X										30									
Fluids and Materials	1.15A		X								30		30									

COMMENTS:

END OF SPECIFICATION SECTION

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Specification Section 01600

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MATERIAL AND EQUIPMENT

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

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Title of Design Specification MATERIAL AND EQUIPMENT

Document Identifier: BAB000000-01717-6300-01600 Revision Number 01

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Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	[signature]	*Date* 11.22.93
Reviewed by	[signature]	*Date* 11/22/93
Reviewed by	Donald Vanden	*Date* 11.22.93
Reviewed by	William J. Reed	*Date* 11/22/93
Reviewed by	[signature]	*Date* 11/22/93
Verified by	Charles R Garrett	*Date* 11/22/93
Approved by	[signature]	*Date* 11/23/93
QA Approval	[signature]	*Date* 11-24-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

Complete only applicable items.

WBS: 1.2

QA Class: Q

Revision No.	*Pages Revised and Description*
01	Revised QA Classification

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

The work covered in this Specification Section includes packing, shipping, delivery, receipt, handling, storage, and protection of materials, equipment, and other components required in the construction of the Yucca Mountain Site Characterization Project (YMP). Additional specific requirements may be stated in individual specification sections, as applicable.

1.02 RELATED SECTIONS

A. Section 01300 Submittals

B. Section 01400 Contractor Quality Control/Quality Assurance

1.03 REFERENCES

A. YMP Documents:

1. ~~YMP AP 6.13~~ YAP 30.10 — YMP Administrative Procedure, ~~Request For~~ Authorization for Use of Regulated Hazardous Substances and Materials

2. YMP/91-23 — Tracers, Fluids, Materials Management Plan, Revision 1, November 1992

B. Code of Federal Regulations (CFR):

29 CFR 1910.1200 — Hazard Communication, Dated July 1, 1990

1.04 QUALITY ASSURANCE

A. Quality assurance (QA) shall be in accordance with Specification Section 01400.

B. Receipt Verification: The acceptance of materials and equipment shall be as per the appropriate Specification Section and according to the Contractor's approved QA plans and procedures.

C. (ADD INFORMATION PER ATTACHED SHEET)

PART 2 PRODUCTS

2.01 GENERAL

The Contractor shall submit each construction material (including constituents and the specific use) for evaluation and approval in accordance with YMP/91-23.

REFERENCE DOCUMENT UNCONTROLLED

1.04 QUALITY ASSURANCE

C. Products covered by this Specification Section include provisions that are both important to w isolation (ITWI) and/or important to radiological safety (ITRS) and those that are not ITWI or ITRS. Those provisions that are ITWI and/or ITRS are identified as Q Controls and are denoted in this Specification Section with underlined text. All other provisions that are non-Q.

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REFERENCE DOCUMENT - UNCONTROLLED

2.02 IDENTIFICATION

A. Labels: All materials or equipment stored on the jobsite or stored off site for use in the construction shall be ~~appropriately~~ identified by purchase number.

B. Hazardous Materials: Prior to ~~purchase~~ RECEIPT and use of any hazardous materials, proper management of those materials must be assured through conformation with the ~~YAP-AP-6.13~~ YAP 30.10 process. Furthermore, any materials/chemicals that are classified as hazardous in accordance with 29 CFR 1910.1200 shall be accompanied by a proper Material Safety Data Sheet (MSDS) as required by 29 CFR 1910.1200 and maintained in a manner that employees have easy access to the MSDS.

PART 3 EXECUTION

3.01 SHIPPING AND HANDLING

A. Packaging

1. Package finished products in boxes or crates for protection during shipment, handling, and storage.

2. Protect sensitive products against exposure to elements and moisture.

3. Protect sensitive equipment and finishes against impact, abrasion, and other damage.

B. Delivery and Receiving

1. Arrange deliveries of products in accordance with construction schedule.

2. Allow time for inspection prior to installation.

3. Coordinate deliveries to avoid conflict with:

   a. Work and conditions at site

   b. Limitations on storage space

   c. Availability of personnel and handling equipment

   d. Government's use of premises.

4. Deliver products in undamaged, dry condition; in original unopened containers or packaging; and with identifying labels intact and legible.

5. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.

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REFERENCE DOCUMENT - UNCONTROLLED

6. Immediately upon delivery, inspect shipment to ensure:

   a. Product complies with requirements of Contract documents and approved submittals

   b. Quantities are correct

   c. Accessories and installation hardware are correct

   d. Containers and packages (where used) are intact

   e. Labels are legible

   f. Products are protected and undamaged

   g. MSDSs accompany all hazardous materials and chemicals that are identified as "Hazardous" in accordance with 29 CFR 1910.1200

C. Product handling

1. Provide equipment and personnel to handle products, including those provided by the Government by methods to prevent soiling and damage.

2. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

3. Handle product by methods to avoid bending or overstressing.

4. Lift large and heavy components only at designated lift points.

3.02 STORAGE AND PROTECTION

A. Storage

1. Store products immediately on delivery in accordance with manufacturer's instructions with seals and labels intact.

2. Store products. If instructions are lacking, follow alternative storage instructions in paragraph F.

3 ~~2~~. Protect until installed.

4 ~~3~~. Arrange storage in a manner to provide access for maintenance and inspection.

B. Enclosed Storage

1. Store products subject to damage by the elements in substantial weathertight enclosures.

2. Maintain temperature and humidity within ranges stated in manufacturers' instructions.

3. Provide humidity control and ventilation for sensitive products as required by manufacturers' instructions.

4. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

C. Exterior Storage

1. Provide substantial platforms, blocking, or skids, to support fabricated products above ground

   a. Slope ground to provide drainage

   b. Protect products from soiling and staining.

2. For products subject to discoloration or deterioration from exposure to the elements:

   a. Cover with impervious sheet material

   b. Provide ventilation to avoid condensation.

3. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.

4. Provide surface drainage to prevent water erosion and ponding.

5. Prevent mixing of refuse, chemically injurious materials, or liquids, if such mixing does occur and the chemically injurious materials are hazardous, then the total waste may be deemed hazardous with appropriate disposal requirements.

D. Maintenance of Storage

1. Periodically inspect stored products on a scheduled basis

2. Verify that storage facilities comply with manufacturers' product-storage requirements

3. Verify that manufacturer-required environmental conditions are maintained continually

4. Verify that surfaces of products exposed to the elements are not adversely affected

5. Verify that any weathering of finishes is acceptable under requirements of the Construction Documents.

E. Maintenance of Equipment Storage

1. For mechanical and electrical equipment in long-term storage, implement manufacturers' storage for each item. Notice of enclosed instructions shall be shown on exterior of package.

2. Service equipment on a regularly scheduled basis if required by manufacturer's instructions.

F. Alternative Storage Instructions (See attached pages)

REFERENCE DOCUMENT UNCONTROLLED

F. Alternative Storage Instructions

1. Mechanical Equipment
   A. Mechanical equipment with driving or driven parts which have unpainted metal surfaces susceptible to corrosion, shall be inspected externally and internally to the extent possible.
      1. If such surfaces have not been protected with corrosion inhibitive coatings or require touching-up, check the compatibility of materials to be used with those recommended by the manufacturer. Protect the surfaces by spraying or otherwise applying inhibitive coatings.
      2. Check lubricant load in equipment having casings, housings or reservoirs that have been shipped filled with inhibitive lubricants. Replenish with compatible fluid as required.
      3. Where possible, rotate shafts for uniform distribution of lubricants over gears, bearings, pistons and other moving contact type surfaces.
      4. *Warning*: Indiscriminate use of lubricants or rust inhibitors may damage certain materials of construction or provide contaminants detrimental to operation.
      5. Prominently tag all equipment having protective coatings or corrosion inhibitors that are not compatible with eventual operational lubricants and must be removed, flushed out, and replaced.

   B. Equipment with unpainted surfaces outside the category of driving or driven parts (such as piping connections, flange faces and surfaces prepared for field welding) shall be inspected and given corrosion inhibitive coatings as required. Protect all such surfaces against damage or abuse, by plugs, covers, blind flanges or other means which shall also serve to seal the internals of the equipment against intrusion of contaminants and moisture.

   C. Periodically inspect equipment stored outside to assure that physical or cosmetic damage is not incurred through inclement weather and unsecured tarpaulins.

   D. Store equipment on substantial bases in such a manner as to preclude warpage or misalignment.

2. Electrical Equipment

   A. Motors:
      1. Store open drip-proof motors indoors.
      2. Explosion proof and totally enclosed motors may be stored outdoors without protective covering. Connect space heaters furnished with motors to a continuous supply of power.
      3. Large motors in NEMA I and II frames may be stored outdoors if dust-free, protective covering is furnished with good ventilation.

REFERENCE DOCUMENT - UNCONTROLLED

4. Every two weeks during storage, turn all pump and motor shafts two turns plus 45 degrees. Do not use tools that will grip or mar the shafts.
5. Every two weeks during storage, oil lubricated bearings and gear cases shall be inspected for water and drained if required. Replace the plugs after draining.
6. Megger check all motors prior to operation. For 25 hp and larger, megger check every six weeks.
7. Touched-up exposed shafts with a rust inhibitor.
8. Motors with space heaters shall be energized immediately after motor is put in storage.
9. Provide an oil mist for bearing lubrication in hi- humidity salt water corrosive atmosphere.

B. Transformers:
1. Store transformers for indoor use in a dust-free area under a shed roof with tarpaulin siding.
2. Transformers for outdoor use may be stored outdoors.
3. During storage, oil shall be checked every six months for contamination and moisture.

C. Switchgear, Starters and Control Equipment:
1. Store indoor switchgear, starters and control equipment indoors in a dust-free, dry area where condensation of humidity will not occur. In an area subject to high relative humidity or large rapid changes of temperature, provide the equipment with heaters or connect furnished heaters to maintain the internal temperature 10°F higher than the minimum daily temperature Provide good ventilation to prevent mildew.
2. Weatherproof enclosures may be stored outdoors if heaters are connected to a continuous source of energy.
3. Store all equipment in an upright position.
4. Megger check insulating resistance every six months during storage for insulation deterioration and moisture condensation.

3. Instruments, Control Valves and Automatic Control Equipment

A. Store all instruments and electronic equipment indoors in a dry place.

B. Maintain temperature in instrument storage shelter at least 10°F above minimum daily temperature.

C. Potentiometer and electronic instruments shall not be exposed to temperatures below 32°F or above 125°F. In humid locations, shipping cases shall be opened to permit ventilation and prevent mildew on electrical insulation.

D. Prefabricated panelboards shall be left in wrappings or shipping cases until moved into control house.

E. Store automatic control valves indoors.

F. Large slide valves, motor operated valves and similar large items may be stored outdoors if suitably protected. Store on pallets or a well drained paved area.

4 Valves and Piping Connections

A. Store valves smaller than 6 inches indoors.

B. If larger valves are stored outside, store on pallets or paved area. Lay valves on their sides or with valve stems upright.

C. Inspect coatings of rust preventive materials every 2 weeks. Renew coating if necessary.

D. Remove flange covers. If not previously coated, clean and coat flange faces with a rust preventive.

E. All valves shall be seated.

F. Replace flange covers and renew covers in poor condition.

G. Plug or cap threaded end valves and pipe after rust preventive coating has been applied.

H. Check flanges and connections of shop fabricated pipe and valves upon arrival at jobsite.

3.03 (ADD INFORMATION PER ATTACHED SHEET) 94/190

3.03 INSTALLATION REQUIREMENTS

A. QA Controls shall apply:

The Contractor shall fulfill following procedural submittal requirements which ever are applicable.

1. The Contractor shall submit a procedure that addresses the reporting of all tracers, fluids, and materials consumed during construction and operation of this system. The submitted reporting procedure shall be in accordance with the current TFM Management Plan, and shall be turned over at completion.

2. The amount of hydrocarbons spilled and lost in the construction and operation of this system shall be minimized. The Contractor shall submit a procedure that addresses the reporting of any unrecovered spilled material during construction and operation of this system. The submitted reporting procedure shall be in accordance with the current TFM Management Plan, and shall be turned over at completion.

3. The Contractor shall perform a electro-magnetic field survey of areas surrounding all electrical equipment after it is installed and energized. The Contractor shall document the results to the A/E for review and determination of "EMF Interference" signs prior to testing being performed in the area.

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REFERENCE DOCUMENT - UNCONTROLLED

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. All submittals shall be in accordance with the requirements of the technical specification sections.

B. No Submittal and Notification Requirements sheet is used in this Specification Section.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, th
~~Buyer~~ CONTRACTOR shall notify the A/E in writing for review.

END OF SPECIFICATION SECTION

FCR 94/190 ATTACHMENT A PAGE ~~4~~ 6 GAP 4/19/94 OF ~~5~~ 6 GAP 4/19/94 GAP 4/19/94

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: ~~N/A~~
QA [illegible] 12/21/93

Civilian Radioactive Waste Management System
Management and Operating Contractor

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DOCUMENT AND RECORDS CENTER

Specification Section 02210

FIRST SUBMITTAL

SITE GRADING

Cl.16.0000

Document Identifier: BAB000000-01717-6300-02210 Rev. 00
QA Classification: MC

Revision No.	Date
00	~~12/21/93~~ ~~12/02/93~~ 12/02/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1

QA Class: +

Title of Design Specification SITE GRADING

Document Identifier: BAB000000-01717-6300-02210 Revision Number 00

This specification covers QA Classification MC *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	[signature]	*Date*	12/17/93
Reviewed by	Roy D. Clark	*Date*	12/17/93
Reviewed by	[signature]	*Date*	12-17-93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	[signature]	*Date*	12.21.93
Approved by	[signature]	*Date*	12/21/93
QA Approval	Fred Att	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

Complete only applicable items.

WBS: 1.2.6

QA Class: N/A

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 02210

SITE GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, and labor to perform Site Grading as specified herein and indicated on the Drawings.

B This work includes:

1. Clearing and grubbing, topsoil removal and stockpiling, and satisfactorily disposing of vegetation and debris from the construction site.

2. Excavation of soil, rock, or combinations thereof to grade the construction site to the lines and grades indicated on the Drawings.

3. Construction of embankments and fills as indicated on the Drawings. Fills are to be constructed from excavated materials or imported select materials, as indicated.

1.02 RELATED SECTIONS

Division 1 General Requirements

Section 02225 Water Use for Construction and Operations

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1.	ASTM D422-63	Standard Method for Particle-Size Analysis of Soils
2.	ASTM D1140-54	Standard Test Method for Amount of Material in Soils Finer Than the No. 200 (75μm) Sieve
3.	ASTM D1556-90	Standard Method of Test for Density of Soil in Place by the Sand-Cone Method
4.	ASTM D1557-91	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))
5.	ASTM D2922-81	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

REFERENCE DOCUMENT - UNCONTROLLED

6. ASTM D3017-88 — Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

7. ASTM D4318-84 — Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. Yucca Mountain Site Characterization Project (YMP) Document:

YMP/91-14 — Reclamation Implementation Plan, Dated November 1992

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. Work performed under this Specification Section is considered not important to waste isolation or radiological safety and health.

PART 2 PRODUCTS

2.01 TOPSOIL

The upper organic layer of the existing native site soils as identified in the Site-Specific Reclamation Stipulations determined by the Project and Operations Control Division (POCD) in accordance with the Yucca Mountain Project Reclamation Guidelines shall be classified as Topsoil.

2.02 EXCAVATION

All soil, rock, and combinations thereof removed from the cuts indicated on the Drawings shall be classified as excavation.

2.03 COMMON FILL

Embankment and fill constructed with the materials excavated from the cut areas shall be classified as common fill. Common fill shall not contain individual pieces of rock larger than 30 inches in the vertical dimension.

2.04 SELECT FILL

Select fill shall be placed where indicated on the Drawings. Select fill shall have the following physical properties:

REFERENCE DOCUMENT - UNCONTROLLED

GRAIN SIZE (When tested in accordance with ASTM D422 and D1140)

U.S. Standard Sieve Size	Percent Passing
6 inch	100
3 inch	90 - 100
1-1/2 inch	65 - 100
No. 4	50 - 100
No. 200	5 - 35

The plasticity index, when tested in accordance with ASTM D4318, shall not exceed 15.

2.05 BORROW

Borrow, as necessary to construct the fills to lines and grades indicated on the Drawings, shall meet the requirements for the fill it is to be used for.

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

A. Clear and grub all areas to be disturbed by new earthwork.

B. Stockpile topsoil and the associated organic matter at the location indicated on the Drawings for future reuse. Clearing, grubbing, topsoil removal, and stockpiling shall be in accordance with YMP/91-14.

3.02 EXCAVATION

Excavate areas to the lines and grades indicated on the Drawings.

3.03 COMMON FILL

A. Common fill shall be selectively placed in horizontal layers not exceeding 12 inches in thickness, except layers containing rock larger than 12 inches may be as thick as the vertical height of the largest stone in the layer, plus 6 inches. Fill materials shall be placed at the moisture content necessary to obtain the indicated density, but not exceeding optimum moisture plus 2 percentage points and compacted to not less than 90 percent of the maximum density as determined by ASTM D557, except for the upper 5 feet which shall be compacted to 95 percent of maximum density as determined by ASTM D1557. Fill layers containing more than 30 percent retained on the [illegible] inch sieve shall be considered too rocky to test for density. Those layers shall be compacted by [illegible] minimum of five complete passes with a vibratory sheepsfoot roller weighing at least 10 tons. or non-vibrating sheepsfoot roller weighing a minimum of 35 tons.

B. Fills constructed on slopes steeper than 20 percent slope shall be benched into the slope at each lift.

REFERENCE DOCUMENT - UNCONTROLLED

C. Optimum moisture and maximum density shall be determined in accordance with ASTM D1557. In-place density shall be determined in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017.

3.04 SELECT FILL

A. Construct areas using select fill, as specified in Article 2.04, where indicated on the Drawings. Select Fill shall be placed in lifts not exceeding 12 inches in depth at a moisture content not exceeding optimum moisture plus or minus 2 percentage points and compacted to not less than 95 percent of maximum density as determined by ASTM D1557.

B. Optimum moisture and maximum density shall be determined in accordance with ASTM D1557. In-place density shall be determined in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017.

C. Fill too rocky to test as defined in Paragraph 3.03A shall be compacted as defined in Paragraph 3.03A.

3.05 FIELD QUALITY CONTROL

A. Testing to verify compliance with these specifications shall be performed by the construction Contractor's selected testing laboratory as requested by their quality control organization . The results shall be provided to the Architect/Engineer (A/E). (WITNESS POINT)

B. Compliance tests shall be performed on constructed earthwork in place or on samples removed from the constructed work, as applicable.

C. Minimum number of tests to be performed shall be as follows:

1. Grain Size Analysis (ASTM D422 and D1140) and Plasticity Index (ASTM 4318), one test each for select fill from each source of fill material.

2. Moisture Density Relations (ASTM D1557), one test for each soil type encountered, but not less than one test for each 100.000 cubic yards of fill placed.

3. In-place Density Tests (ASTM D1556 or D2922 and D3017), one test per 1,000 square yards of constructed lift one foot thick.

4. No density tests shall be required on fill too rocky to test as defined in Paragraph 3.03A.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

REFERENCE DOCUMENT - UNCONTROLLED

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requireme the Contractor shall notify the A E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 02210

TITLE: Site Grading

Requirement	Paragraph	STATUS						TIMING											NOTIFICATION			
		INFORMATION	REVIEW	CERTIFICATION	RECORD			PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED	PRIOR TO FINAL ACCEPTANCE			WITNESS (DAYS)	HOLD (DAYS)		
Lab Test Results	3.05A		X													X			3			

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: ~~N/A~~
QA 12/21/93

Civilian Radioactive Waste Management System
Management and Operating Contractor

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Specification Section 02220

FIRST SUBMITTAL

EXCAVATION, TRENCHING, AND BACKFILL

CI.16.0000

Document Identifier: BAB000000-01717-6300-02220 Rev. 00
QA Classification: MC

Revision No.	Date
00	~~12/21/93~~ NC 12/21/93 ~~12/02/93~~ NC 12/21/93 12/02/93

REFERENCE DOCUMENT - UNCONTROLLED

NOTICE OF OPEN CHANGE DOCUMENTS			
THIS DOCUMENT IS IMPACTED BY THE LISTED CHANGE DOCUMENT AND CANNOT BE USED WITHOUT THEM			
CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS
FCR 94/134	[illegible]	3/18/94	OPEN
FCR 94/135	mw	3/21/94	~~[illegible]~~ OPEN 4/26/94
FCR 94/178	[illegible]	4/15/94	OPEN

NOTICE OF OPEN CHANGE DOCUMENTS			
THIS DOCUMENT IS IMPACTED BY THE LISTED CHANGE DOCUMENT AND CANNOT BE USED WITHOUT THEM			
CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS

SAB 000000-01717-6300-02220

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: ~~N/A~~ QA Qual 12/21/93

Title of Design Specification EXCAVATION, TRENCHING, AND BACKFILL

Document Identifier: BAB000000-01717-6300-02220 Revision Number 00

This specification covers QA Classification MC *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	[illegible]	*Date*	12/17/93
Reviewed by	Roy D. Clark	*Date*	12/17/93
Reviewed by	[illegible]	*Date*	12-17-93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	[illegible]	*Date*	12.21.93
Approved by	[illegible]	*Date*	12/21/93
QA Approval	Fred Atth	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

WBS: 1.2.6

QA Class: N/A

Page: 3 of:

Complete only applicable items.

Revision No.	*Pages Revised and Description*

QAP-3-8 QAP-3-11

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0062 (07/17/92)

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 02220

EXCAVATION, TRENCHING, AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all material, tools, equipment, and labor to perform the Excavation, Trenching, and Backfill, related to the surface facilities, as specified herein and as indicated on the Drawings.

B. This work includes excavation, trenching, and backfill for buildings, utilities, drainage structures and other related facilities not specifically covered elsewhere.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 02210 Site Grading

C. Section 02225 Water Use for Construction and Operations

D. Section 02665 Water Distribution and Subsurface Wastewater System

E. Section 02720 Storm Sewerage

F. Section 02730 Sanitary Sewer Collection System

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

	~~1. ASTM C33-92~~	~~Standard Specification for Concrete Aggregates~~
1. ~~2.~~	ASTM D422-63	Standard Method for Particle-Size Analysis of Soils
2. ~~3.~~	ASTM D1140-92	Standard Test Method for Amount of Material in Soils Finer Than the No. 200 (μ-Micrometer) Sieve
3. ~~4.~~	ASTM D1556-90	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
4. ~~5.~~	ASTM D1557-91	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf ft (2,700 kN-m m))

FCR # 94-178

Attachment A1
Page 1 of 3
FCR # 94/178

REFERENCE DOCUMENT - UNCONTROLLED

5. ~~6.~~	ASTM D2922-91	Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)
6. ~~7.~~	ASTM D3017-88	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
7. ~~8.~~	ASTM D4253-91	Standard Test Methods for Maximum Index Density of Soils Using a Vibratory Table
8. ~~9.~~	ASTM D4254-91	Standard Test Methods for Minimum Index Density of Soils and Calculation of Relative Density
9. ~~10.~~	ASTM D4318-84	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. Code of Federal Regulations (CFR):

29 CFR 1926	Occupational Safety and Health Administration (OSHA)

~~C. National Fire Protection Association (NFPA):~~

~~NFPA 22-93~~	~~Standard for Water Tanks for Private Fire Protection~~

FCR # 5-11-95

1.04 QUALITY ASSURANCE

A. Quality Assurance will be conducted in accordance with Specification Section 01400.

B. Work performed under this Specification Section is not considered important to waste isolation or radiological safety and health.

PART 2 PRODUCTS

2.01 STRUCTURAL EXCAVATION

The removal of soil, rock, and combinations thereof to accommodate construction of below-grade structures, shall be classified as Structural Excavation.

2.02 UTILITY EXCAVATION

Excavation to facilitate the construction of underground utilities shall be classified as Utility Excavation.

2.03 ROADWAY EXCAVATION

All excavation involved in grading and constructing the raodway and appurtenances, irrespective of the nature and type of material encounted shall be classifed as roadway excavation.

Attachment A1
Page 2 of 3
FCR # 5-11-95

REFERENCE DOCUMENT - UNCONTROLLED

2.04 SELECT BACKFILL

The backfill of Structural Excavations and Utility Excavations above the pipe or conduit zone shall be constructed with material having the following physical properties, except not more than 30 percent of select backfill shall be retained on the 3/4 inch sieve:

GRAIN SIZE (When tested in accordance with ASTM D422 and D1140)

U.S. Standard Sieve Size	Percent Passing
6 inch	100
3 inch	90 - 100
1-1/2 inch	65 - 100
No. 4	50 - 100
No. 200	5 - 35

The plasticity index, when tested in accordance with ASTM D4318, shall not exceed 15.

2.05 BORROW MATERIAL

Borrow material shall be as defined in Specification Section 02210.

2.06 PIPE BEDDING MATERIAL

The initial backfill and bedding around utility pipe, conduits, cables, or other like carriers, shall have the following physical properties:

GRAIN SIZE (When tested in accordance with ASTM D422 and D1140)

U.S. Standard Sieve Size	Percent Passing
1 inch	100
No. 4	60 - 100
No. 200	0 -16

The plasticity index of the pipe bedding material shall not exceed 6 when tested in accordance with ASTM D4318.

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

A. Clear and grub all areas which have not been previously cleared in site grading to be trenched or excavated. Remove trees, shrubs, stumps, root balls, and root systems to the full depth of the excavation.

REFERENCE DOCUMENT - UNCONTROLLED

ATTACHMENT A
Page 1 of 1

FCR # 94/134

carriers including direct burial power or signal cables. For pipes over 12 inches in diameter backfill shall be placed along both sides of the culvert equally in uniform layers not exceeding inches in-depth (loose measurements). For pipes less than 12 inches in diameter backfill shall be placed uniformly to 8 inches above the top of the pipe (loose measurement).

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E. Compaction of bedding material by ponding or jetting will not be permitted.

3.06 FIELD QUALITY CONTROL

A. Testing to verify compliance with this specification section will be performed by the construction Contractor's selected testing laboratory at the request of their quality control organization. Test results will be reported to the Architect/Engineer (A/E).

B. Compliance tests will be performed on constructed earthwork in place or on samples removed from the constructed work, as applicable.

C. Minimum number of tests to be performed shall be as follows:

1. Grain Size Analysis (ASTM D422 and D1140) and Plasticity Index (ASTM 4318), one test each for Select Fill and Pipe Bedding Material, but not less than one test per 10,000 cubic yards placed.

2. Moisture Density Relations (ASTM D1557), one test for each soil type encountered, but not less than one test per 25,000 cubic yards placed.

3. In-place Density Tests (ASTM D1556 or D2922 and D3017), one test per 1,000 square feet of constructed lift, ~~one foot thick.~~ Below the bottom of the pipe, the Pipe Bedding Material shall be tested for density every 100 linear feet of trench. ~~No density tests will be required for Pipe Bedding Material above the bottom of the pipe.~~ A nuclear density test every 100 ft or a Sand cone test every 500 feet is required for the pipe bedding material above the plane defined by the bottom of the pipe.

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FCR# 94/134

PART 4 SUBMITTALS AND NOTIFICATION

(NOT USED)

END OF SPECIFICATION SECTION

Attachment A1
Page 3 of 3
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B. The upper organic layer of the existing native site soils as identified in the Site-specific Reclamation Stipulations determined in accordance with the Yucca Mountain Site Characterization Project ~~Reclam~~ation Implementation Plan has been classified as Topsoil. Remove Topsoil and stockpile in designated Topsoil stockpile areas. If Topsoil is to be reused at the trench site, it can be stored temporarily on the side of the trench opposite the main spoil pile.

3.02 STRUCTURAL EXCAVATION

Excavate areas to accommodate the construction of structures, including drainage structures, sufficiently to provide room for form work, shoring if required by 29 CFR 1926.650, and accessory construction.

3.03 UTILITY EXCAVATION

Excavate trenches to accommodate the construction of underground utilities, including conduits and direct burial cables, sufficiently to provide room for construction and shoring if required by 29 CFR 1926.650. The minimum width of the bottom of the trench shall be 2 feet plus the outside diameter of the pipe or conduit.

3.04 SELECT BACKFILL

In accordance with Section 02210, Article 3.04 A and

HAA 2/28/94

Construct Select Backfill using material as specified in Article ~~2.03~~ 2.04 above. All backfill of structural excavations and utility trenches above the pipe zone shall be Select Backfill. Select Backfill shall be placed with a moisture content of optimum, plus or minus 2 percentage points, and shall be compacted to not less than 95 percent of maximum density. Optimum moisture and maximum density shall be determined in accordance with ASTM D1557. In-place density shall be determined in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017.

3.05 PIPE BEDDING MATERIAL

A. Pipe Zone: The zone of the trench prism from 6 inches below the bottom of the pipe to 12 inches above the top of the pipe, shall be backfilled with Pipe Bedding Material as specified in Part 2. Article ~~2.04~~. 2.06.

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B. Bedding Material Beneath the Pipe: Pipe Bedding Material beneath the pipe shall be at least 6 inches thick. All backfill beneath the pipe shall be Pipe Bedding Material, in the event of over excavation of the trench.

C. Compaction Beneath the Pipe: Pipe Bedding Material beneath the pipe shall be compacted prior to laying the pipe. The compacted density shall be not less than 95 percent of ASTM D1557 maximum density if the Pipe Bedding Material has more than 5 percent passing the No. 200 sieve. Pipe Bedding Material with less than 5 percent passing the No. 200 sieve shall be compacted to not less than 75 percent relative density determined in accordance with ASTM D4253 and D4254.

D. Pipe Bedding material around and one foot above the top of the pipe or culvert shall be placed along both sides of the pipe or culvert equally in uniform layers not exceeding 8 inches in depth (loose measurements), wetted as required and thoroughly compacted to not less than 90 percent of maximum density per ASTM D1557. Reference to pipe in this Specification Section include other

REFERENCE DOCUMENT - UNCONTROLLED

WBS: 1.2.6
QA: QA

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

Civilian Radioactive Waste Management System
Management and Operating Contractor

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Specification Section 02225

FIRST SUBMITTAL

WATER USE FOR CONSTRUCTION AND OPERATIONS

Document Identifier: BAB000000-01717-6300-02225 Rev. 01
CI.16.0000
QA Classification: Q

Revision No.	Date
00	11/09/93
01	01/04/94

REFERENCE DOCUMENT - UNCONTROLLED

NOTICE OF OPEN CHANGE DOCUMENTS			
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FCR 94/191	Rg	4/22/94	open

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Title of Design Specification WATER USE FOR CONSTRUCTION AND OPERATIONS

Document Identifier: BAB000000-01717-6300-02225 Revision Number 01

This specification covers QA Classification ~~ME~~ QA FMO 1/4/93 *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	[signature]	*Date*	12/17/93
Reviewed by	Roy D. Clark	*Date*	12/17/93
Reviewed by	[signature]	*Date*	12-17-93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	[signature]	*Date*	1.4.94 ~~12-21-93~~
Approved by	[signature]	*Date*	~~12-21-93~~ 1/4/94
QA Approval	Fred Arth	*Date*	1-5-94 ~~12-21-93~~

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*
01	Page 4 Article 1.02 added "Division 1 General Requirements". Page 4 Paragraph 1.04B Change to "important to waste isolation and/or important to radiological safety". Page 4 Added Paragraph 1.04C "Chlorinated water shall not be used for construction purposes" Page 5 Paragraph 3.01D Changed to "Conceptural Control Area Boundary (CCAB)". Issued for Construction

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 02225

WATER USE FOR CONSTRUCTION AND OPERATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all material, tools, equipment, and labor necessary to haul, distribute, control, and document the use of water related to construction.

1.02 RELATED SECTIONS

Division 1 General Requirements

1.03 REFERENCES

A. American Water Works Association (AWWA):

ANSI/AWWA C700-90	Cold Water Meters-Displacement Type, Bronze Main Case, First Edition

B. Yucca Mountain Site Characterization Project (YMP) Documents:

1. YMP/91-23	Tracers, Fluids, Materials Management Plan, Revision 1, Dated November 1992
2. YMP-025-1-SP09	Section 15484, Chemical Tracer Injection System

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

~~B. Work performed under this Specification Section is considered important to waste isolation and/or important to radiological safety.~~ DMP 4/13/94

B. ~~C.~~ DMP 4/13/94 Chlorinated water shall not be used for construction purposes.

C. ~~D.~~ DMP 4/13/94 (ADD INFORMATION PER ATTACHED SHEET)

4 of 4

94/191 FCR

PART 2 PRODUCTS

2.01 MATERIALS

A. Construction water used at the site must come from a Yucca Mountain Site Characterization Project Office (YMPO) selected water source.

B. The Contractor is responsible for providing materials, equipment, and personnel required for acquiring the water and transporting it.

DMP 4/13/94

FCR 94/191 ATTACHMENT A 1 of 4

REFERENCE DOCUMENT - UNCONTROLLED

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PART 3 EXECUTION

3.01 GENERAL

A. Q Controls shall apply:

1. ~~X.~~ DHP 4/13/94 All water used for construction and dust control shall be me

2. ~~B.~~ DHP 4/13/94 The Contractor shall control and record the amount of water used for ... id location. Architect/Engineer (A/E) will be provided copies of these records weekly.

3. ~~C.~~ DHP 4/13/94 The Contractor may be required to add tracers to construction water in accordance with the tracer water injection system. Tracers shall not be added to construction water for surface use without an evaluation and A/E concurrence. DHP 4/13/94

4. ~~D.~~ The quantity of water used for construction, dust control, and other operations within the Conceptual Control Area Boundary (CCAB) shall be limited to 2 gallons per square yard per day average over a six month period. Outside the CCAB the amount of water used shall be limited to that required for sanitation, dust control, compaction of engineered fill material, and proper equipment operation.

5. ~~E.~~ DHP 4/13/94 Water trucks shall not be left standing where excessive dripping can cause puddling or deleterious effects to finished grades.

B. ~~F.~~ DHP 4/13/94 The Contractor shall conduct his operations in such a manner as to minimize the effects of erosion and air pollution due to his operations upon areas within the limits of the project, haul roads, material sites, disposal sites, and upon adjacent properties, streams and other bodies of water.

6. & 7. (SEE ATTACHED PAGES 3 OF 4) delete per Icicon EH Rev David Parker 4/22/94

~~G. & H. (SEE ATTACHED PAGES 3 OF 3)~~ 4 4/13/94 DHP 4/13/94

3.02 EQUIPMENT

A. Equipment used for the application of water shall have meters or water tubes installed or have the capability of being measured by dip-stick.

B. Meters, if used, shall comply with AWWA C700 Table 4 standards for accuracy.

C. Water tube or dip-stick measurements shall be recorded prior and subsequent to application.

D. Equipment used for the application of water shall be capable of providing a uniform application and be equipped with a positive means of shutoff.

E. Pumps, pipes, hoses, and nozzle equipment may be used to apply water in areas not readily accessible by water trucks.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

DHP 4/13/94

PER 94/1 REFERENCE DOCUMENT UNCONTROLLED

B. The Contractor shall submit to the A/E for review and approval a procedure describing the methodology used to control and record water usage applied as required. (HOLD POINT)

C. Submit procedure and usage records as indicated on the Submittal and Notification Requirements matrix in accordance with DOE YMP approved submittal procedures. No work will be performed until the procedure is approved.

4.02 NOTIFICATION

Should any change in the Specification Section be required to comply with these requirements, the Contractor shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

3.01 GENERAL

DHP 4/13/94

~~5~~. 6. The Contractor shall submit a procedure that addresses the weekly water use for this system during operation of ESF. This procedure shall address the reporting of the cumulative amount of water that has passed through each of the water meters. In the event that this weekly reporting shows a ~~combined~~ GHP 4/14/94 net water loss of 2000 gallons in a seven day period, in any meter, the procedure shall address the measures the Contractor shall follow to report this loss to the A/E immediately. The procedure shall address the requirement that if a meter shows a 2000 gallon loss then the water system shall be taken out of service until the leak is found and repaired or the cause is determined. This procedure shall also address the method used to visually inspect the waterline alignment for possible leaks and the immediate repair of the pipe where a leak is visually detected. This inspection and reporting shall be done on weekly basis. The submitted reporting procedure shall be in accordance with the current TFM Management Plan, and shall be turned over at completion.

DHP 4/13/94

~~6~~. 7. The Contractor shall submit a procedure that addresses the annual monitoring of the J-13 well water for Chlorine-36. This procedure shall be such that within 30 days of final completion and acceptance of this system by the owner, J-13 well shall be tested for the first time and tested annually thereafter. The submitted reporting procedure shall be in accordance with the current TFM Management Plan, and shall be turned over at completion.

94/191

DHP 4/13/94

REFERENCE DOCUMENT - UNCONTROLLED

ATTACHMENT

1.04 QUALITY ASSURANCE

~~D.~~ C. DHP 4/13/94 Products covered by this Specification Section include provisions that are both important to waste isolation (ITWI) and/or important to radiological safety (ITRS) and those that are not ITWI or ITRS. Those provisions that are ITWI and/or ITRS are identified as Q Controls and are denoted in this Specification Section with underlined text. All other provisions that are non-Q. 16/46

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 02225

TITLE: Water Use for Construction and Operations

Requirement	Paragraph	STATUS: INFORMATION	REVIEW	CERTIFICATION	RECORD			TIMING: PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED	PRIOR TO FINAL ACCEPTANCE	PRIOR TO COMMENCEMENT	WEEKLY REPORT	NOTIFICATION: WITNESS (DAYS)	HOLD (DAYS)		
Procedure	4.01B		X														X			3		
Water Use Record	3.01B				X													X				

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

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Specification Section 03300

FIRST SUBMITTAL

CAST-IN-PLACE CONCRETE-SURFACE
CI.16.0000

Document Identifier: BAB000000-01717-6300-03300 REV. 01
QA Classification: MC

Revision No.	Date
00	11/04/93
01	12/22/93

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fcR 94/178	[illegible]	4/15/94	OPEN
FCR 94/228	JF	5/31/94	OPEN

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Title of Design Specification CAST-IN-PLACE CONCRETE-SURFACE

Document Identifier: BAB000000-01717-6300-03300 Revision Number 01

This specification covers QA Classification MC *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Roy D. Clark	*Date*	12/22/93
Reviewed by	[illegible]	*Date*	12-22-93
Reviewed by	[illegible]	*Date*	12/22/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	Larry G. Engwall	*Date*	12-22-93
Approved by	[illegible] for P.A. Pimentel	*Date*	12/22/93
QA Approval	Fred Arth	*Date*	12-22-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

WBS: 1.2.6

QA Class: Q

Page: 3 of:

Complete only applicable items.

Revision No.	*Pages Revised and Description*
01	Pages 4 thru 15 Changed Specification Section to reflect title change and requirements for 2,000 and 4,000 psi compressive strength concrete and incorporated comments from the design verification.

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 03300

CAST-IN-PLACE CONCRETE-SURFACE

PART 1 GENERAL

1.01 WORK INCLUDED

The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary to set formwork, mix, transport, place, finish, and cure concrete for foundations, floor slabs, equipment bases, and other concrete as specified herein and indicated on Drawings. This does not include concrete related to nuclear safety, or underground.

1.02 RELATED WORK

Section 05120 Metal Fabrications

1.03 REFERENCES

A. American Concrete Institute (ACI):

1.	ACI 117-90	Standard Specification for Tolerances for Concrete Construction and Materials
2.	ACI 211.1-91	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3.	ACI 214-77	Recommended Practice for Evaluation of Strength Test Results of Concrete
4.	ACI 301-89	Specifications for Structural Concrete for Buildings
5.	ACI 302.1R-89	Guide for Concrete Floor and Slab Construction
6.	ACI 304R-89	Recommended Practice for Measuring, Mining, Transporting and Placing Concrete
7.	ACI 305R-91	Hot Weather Concreting
8.	ACI 306R-88	Cold Weather Concreting
9.	ACI 315-80	Details and Detailing of Concrete Reinforcement
10.	ACI 318/318R-92	Building Code Requirements for Reinforced Concrete

REFERENCE DOCUMENT - UNCONTROLLED

11. ACI 347R-88 Guide to Formwork for Concrete

12. ACI 347-89 Formwork for Concrete

B. American Society for Testing and Materials (ASTM):

1. ASTM A615/A615M-92b Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

2. ASTM C31-91 Making and Curing Concrete Test Specimens in the Field

3. ASTM C33-92a Standard Specification for Concrete Aggregates

4. ASTM C39-86 Standard test Method for Compressive Strength of Cylindrical Concrete Specimens

5. ASTM C94-92a Standard Specification for Ready-Mixed Concrete

6. ASTM C109-92 Standard Test Method for Compressive Strength of Cement Mortars

7. ASTM C138-92 Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete

8. ASTM C143-90a Standard Test Method for Slump of Hydraulic Cement Concrete

9. ASTM C150-92 Standard Specification for Portland Cement

10. ASTM C171-92 Standard Specification for Sheet Materials for Curing Concrete

11. ASTM C172-90 Standard Practice for Sampling Freshly Mixed Concrete

12. ASTM C173-78 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

13. ASTM C231-91b Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

14. ASTM C260-86 Standard Specification for Air Entraining Admixtures for Concrete

15. ASTM C309-91 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

16. ASTM C494-92 Standard Specification for Chemical Admixtures for Concrete

17. ASTM D75-E1-87 Standard Practice for Sampling Aggregates

REFERENCE DOCUMENT - UNCONTROLLED

1.04 QUALITY ASSURANCE (4,000 PSI MINIMUM COMPRESSIVE STRENGTH CONCRETE)

A. Quality Assurance will be conducted in accordance with Specification Section 01400.

B. Products covered by this Specification Section shall be considered not important to waste isolation or radiological safety.

C. Acceptance of Product

1. Receipt Verification

a. Dimensional and/or visual inspection of Portland cement, aggregates, admixtures, reinforcement and polyethylene sheeting.

b. Verification of material test reports and traceability for Portland cement, aggregates, admixtures, reinforcement, and liquid membrane curing compounds. (WITNESS POINT).

2. Field Verification

a. Visual inspection of surface preparation. (WITNESS POINT)

b. Visual and dimensional inspection of formwork, embeds, anchor, bolts, and reinforcement prior to concrete placement. (HOLD POINT)

c. Placement of concrete. (WITNESS POINT)

d. Visual and dimensional inspection of floor and slab construction and surface finishing. Verification of curing time, concrete protection during hot or cold weather, and visual inspection for damage after removal of forms and protection. (WITNESS POINT)

e. Verification of storage and identification of materials.

f. Verification of test results. (WITNESS POINT)

1.05 QUALITY ASSURANCE (2,000 PSI MINIMUM COMPRESSIVE STRENGTH CONCRETE)

A. Quality Assurance shall be conducted in accordance with Section 01400.

B. Products covered by this Section shall be considered not important to waste isolation or radiological safety.

C. Acceptance of Product

1. Receipt Verification

a. Dimensional and/or visual inspection of Portland cement, aggregates, admixtures, reinforcement, and polyethylene sheeting.

REFERENCE DOCUMENT - UNCONTROLLED

b. Verification of material test reports and traceability for Portland cement, aggregates, admixtures, reinforcement, and liquid membrane curing compounds. (WITNESS POIN

2. Field Verification

a. Visual inspection of surface preparation. (WITNESS POINT)

b. Visual and dimensional inspection of formwork, embeds, anchors, bolts, and reinforcement prior to concrete placement. (HOLD POINT)

c. Placement of concrete. (WITNESS POINT)

d. Visual and dimensional inspection of floor and slab construction and surface finishing. Verification of curing time, concrete protection during hot or cold weather, and visual inspection for damage after removal of forms and protection. (HOLD POINT)

e. Verification of storage and identification of materials.

f. Verification of test results. (WITNESS POINT)

3. Compressive Strength: The mix design and finished product shall be such as to develop strength as placed on the job as follows:

in 28 days: 2,000 psi minimum

4. Implementation: Architect/Engineer (A/E) shall inform the Contractor, in writing, of acceptance of mixes which meet the requirements.

PART 2 PRODUCTS

2.01 MATERIALS (4,000 PSI MINIMUM COMPRESSIVE STRENGTH CONCRETE)

A. Portland Cement

1. Cement used shall conform to the requirements of ASTM C150, Type II or Type V with the exception of sanitary sewer facilities which shall be limited to Type V cement. Cement shall be tested by the manufacturer, and cement mill test reports provided for each load of cement delivered. The mill reports shall show the chemical composition and physical properties and shall certify that the cement complies with ASTM C150.

REFERENCE DOCUMENT - UNCONTROLLED

2. The cement shall be delivered in bulk to elevated airtight, weatherproof storage bins. At the time of use, all cement shall be free flowing and free from lumps. Cement that has been in storage longer than six months shall be tested by standard mortar tests in accordance with ASTM C109, and shall not be used without review by the Architect/Engineer (A/E).

B. Aggregates: All aggregates shall conform to ASTM C33. Fine aggregate shall consist of clean, sharp, washed natural or washed crushed sand, well graded from coarse to fine as specified in the referenced Standard. Coarse aggregate shall consist of washed, crushed gravel or crushed stone, having hard, strong, durable pieces, free of deleterious substances and adherent coatings. Aggregate gradation shall conform to ASTM C33, Table 2, Size No. 67 (3/4-inch nominal size) for coarse aggregate, and ASTM C33, Paragraph 4.1 and 5.1 for fine aggregate. Aggregates shall be delivered for storage to a prepared hard, clear surface, in a manner that will preclude the inclusion of foreign material. Store fine and coarse aggregates in separate piles. Build stockpiles of coarse aggregate in horizontal layers not exceeding 4 feet in depth to minimize segregation. Remix coarse aggregates to conform to the grading requirements should it become segregated.

C. Water: Mixing water shall comply with requirements of ASTM C94.

D. Admixtures

1. Air-Entraining Admixtures (AEA): Air-entraining admixture shall conform to ASTM C260.

2. Water Reducing Admixtures (WRA): Water reducing admixtures shall conform to ASTM C494, Types A or D. Use of WRA Types A or D shall be determined in the field based on concrete placing temperature, ambient weather conditions, least dimension of member sizes, and type of placement. High Range Water Reducing Agents (HRWR) shall conform to the requirements of ASTM C494, Type F. HRWR, when required, shall be from the same manufacturer, and be compatible with, the Type A or Type D WRA in the mix.

3. Storage of Admixtures: Store and handle admixtures according to manufacturer's recommendations.

2.02 MATERIALS (2,000 PSI MINIMUM COMPRESSIVE STRENGTH CONCRETE)

A. Portland Cement

1. Cement used shall conform to the requirements of ASTM C150, Type II or Type V. Cement shall be tested by the manufacturer, and cement mill test reports provided for each load of cement delivered. The mill reports shall show the chemical composition and physical properties and shall certify that the cement complies with ASTM C150.

2. The cement shall be delivered in bulk to elevated airtight, weatherproof storage bins. At the time of use, all cement shall be free flowing and free from lumps. Cement that has been in storage longer than six months shall be tested by standard mortar tests in accordance with ASTM C109, and shall not be used without review by the A/E.

B. Aggregates: All aggregates shall conform with the gradations used in the concrete mix designs performed by the Raytheon Services Nevada, Materials Testing Laboratory on June 9, 1992.

REFERENCE DOCUMENT - UNCONTROLLED

C. Water: Mixing water shall comply with requirements of ASTM C94.

D. Admixtures

1. AEA: Air-entraining admixture shall conform to ASTM C260.

2. WRA: Water reducing admixtures shall conform to ASTM C494, Type A or D. Use of WRA Type A or D shall be determined in the field based on concrete placing temperature, ambient weather conditions, least dimension of member sizes, and type of placement. HRWR shall conform to the requirements of ASTM C494, Type F. HRWR, when required, shall be from the same manufacturer, and be compatible with, the Type A or Type D WRA in the mix.

3. Storage of Admixtures: Store and handle admixtures according to manufacturer's recommendations.

2.03 MIX DESIGN

Proportions for the design mix shall be selected in accordance with ACI 211.1 for normal weight concrete. All concrete shall contain 4-1/2 percent entrained air, plus or minus 1-1/2 percent. Each mix design ~~shall~~ may include a WRA complying with the requirements of ASTM C494, Type A or Type D at the dosage rate recommended by the manufacturer of the admixture. Type A or Type D WRA from the same manufacturer should be interchangeable in the mix. The type used will be based on ambient site conditions.

2.04 FORMS

A. General Requirements: Formwork design, tolerances and construction shall conform to ACI 301, Chapter 4 and ACI 347.

B. Form Materials: Forms shall be of wood, plywood, or steel. Use plywood forms for surfaces exposed to view in the finished structure, and requiring a smooth finish. Surfaces of steel forms shall be free from irregularities, dents, and sags.

2.05 REINFORCEMENT

All reinforcing bars No. 4 and greater shall be ASTM A615, Grade 60. No. 3 reinforcing bars used as ties or shrinkage reinforcement may be ASTM A615, Grade 40.

2.06 CURING MATERIALS

A. Polyethylene Sheeting shall conform to ASTM C171, be of natural color, and have a nominal thickness of 0.006 inches.

B. Liquid Membrane-Forming Compounds for Curing Concrete shall conform to ASTM C309, Class A, Type 1-D or Type 2.

FCR 94/228 Attachment A

PART 3 EXECUTION

3.01 SURFACE PREPARATION

Surfaces against or upon which concrete is to be placed shall be free from standing water, mud, debris, ice, snow and laitance immediately before placing concrete. In addition, all surfaces shall be free from oil, grease or any other substance which will prevent bond between the plastic and hardened concrete. Rock surfaces against which concrete is to be placed shall be free from objectionable coating and loose, semi-detached or unsound rock fragments.

3.02 FORMS

Forms for building construction shall comply with ACI 301, Chapter 4 and ACI 347, unless indicated otherwise on the Drawings. Finish of formed concrete surfaces shall be as indicated on the Drawings.

3.03 REINFORCEMENT

Concrete reinforcement shall be as indicated on the Drawings and the fabrication, installation, and placement of the reinforcing steel shall comply with Chapter 5 of ACI 301.

3.04 JOINTS AND EMBEDDED ITEMS

Construction joints shall be located and constructed as indicated on the Drawings and shall comply with Chapter 6 of ACI 301. Embedded items shall conform to Specification Section 05120.

3.05 FIELD QUALITY CONTROL

A. Inspection: Concrete shall not be placed in the formwork without notification of, and approval by, the A/E. Notification shall be given not later than 24 hours prior to scheduled placement. The A/E shall inspect formwork, reinforcement, and embedded items to insure compliance with the Drawings. (HOLD POINT)

B. Sampling and Testing

1. General: Sampling and testing of aggregates, water, and cement for mortar tests (reference Paragraph 2.01A.2), shall be performed by the construction contractor's selected testing laboratory working under the general surveillance of the construction contractor's organization. Final acceptance of test results shall be by the A/E. (WITNESS POINT)

2. Aggregates: Upon delivery of aggregates to the batch plant, fine and coarse aggregates shall be sampled in accordance with ASTM D75 and tested for compliance with ASTM C33 except aggregates for 2,000 psi concrete shall conform with Paragraph 2.02B. Aggregates shall be tested daily for moisture content and gradation prior to concrete production.

3. Concrete: Samples of fresh concrete shall be taken each day at the site of placement in accordance with ASTM C172. Each sample shall be tested for slump in accordance with ASTM C143, entrained air content and unit weight in accordance with ASTM C138, ASTM

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C173, or ASTM C231. A minimum of 3 specimens shall be molded for compressive strength tests to be conducted in accordance with ASTM C39. Two specimens shall be tested at 28 days and one shall be tested at 7 days. One sample shall be taken for each 50 cubic yards of each day's placement of each strength class of concrete.

3.06 PRODUCTION OF CONCRETE

A. Truck Mixing: Mix and deliver concrete in a truck mixer. Ready mixed concrete shall comply with the requirements of ASTM C94 and applicable requirements of Chapter 7 of ACI 301 except aggregates for 2,000 psi concrete shall conform with Paragraph 2.02B; the most restrictive requirements shall apply. Each batch of concrete delivered shall be accompanied by a batch ticket containing information required by ASTM C94.

B. Temperature Control

1. General: The minimum temperature of the concrete "as deposited" shall be in accordance with the following table:

Ambient Air Temperature	Concrete Temperature Sections < 12 in.	Concrete Temperature Sections > 12 in.
Above 30°F	60°F	50°F
0°F to 30°F	65°F	55°F
Below 0°F	70°F	60°F

"As deposited" concrete temperature shall not exceed 85 degrees F under any conditions.

2. Methods of Heating and Cooling: Any methods of heating or cooling of the concrete implemented by the Contractor in order to conform to the above concrete temperature requirements shall be submitted to the A/E for review at least 20 days in advance of anticipated conditions requiring their use. The Contractor shall provide in readiness on the site and maintain all equipment necessary for complying with these concrete temperature requirements.

3.07 CONVEYING AND PLACING CONCRETE

A. Concrete shall be conveyed and deposited as specified in ACI 301, Chapter 8.

B. Slump

1. Concrete not containing an HRWR shall be placed at a slump between 2-1/2 and 4 inches.

2. When placement conditions indicate high slump concrete would be advantageous, an HRWR complying with ASTM C494, Type F shall be used in addition to the Type A or Type WRA. When an HRWR is used, it shall be added to the ready mixed batch ~~at the site of~~ batching ~~placement~~ and the amount shown on the batch ticket. The proportioning for concrete containing HRWR shall be such that the concrete is delivered to the site of placement with a slump as specified in Paragraph 3.07B.1. After addition of the HRWR and 75 additional

revolutions of the mixer drum, the slump of the concrete shall be between 8 and 10 inches. The recommended maximum number of revolution is 300 but it can exceeded with A/E concurrence. Concrete containing HRWR shall be placed within 30 minutes (including mixing time) after the addition of the HRWR.

3.08 SURFACE FINISHES (EXCEPT FLOOR AND SLAB ON GRADE)

A. Repair of Surface Defects: Repair all surface defects including tie holes, minor honeycomb, and otherwise defective concrete as specified in Chapter 9 of ACI 301. Excessive honeycomb or embedded debris in concrete is not acceptable.

B. Finishing of Formed Surfaces: Formed surfaces shall be finished as specified in Chapter 10 of ACI 301. The type of finish required shall be as indicated on the Drawings.

3.09 FLOOR AND SLAB CONSTRUCTION

The construction of floors and slabs shall be in accordance with the requirements of Chapter 11 of ACI 301 and ACI 302.1R. Slab finish shall be as indicated on the Drawings.

3.10 CURING AND PROTECTION

~~A. General Requirements: Protect concrete adequately from injurious action by sun, rain, flowing water, frost, and mechanical injury, and do not allow to dry out from the time it is placed for a period of 7 days. Accomplish the curing by moist curing, by application of liquid membrane-forming compound, or covering with sheet polyethylene, as specified hereafter. The temperature of the air next to the concrete shall be maintained at not less than 50 degrees F for the full curing period.~~

~~B. Removal of formwork shall be in accordance with ACI 347.~~

~~C. Curing~~

AAP 2/23/94

~~1. After form removal, curing shall be continued on formed concrete members by the application of curing compound meeting the requirements of ASTM C309, Type 1-D. Correction of surface defects as specified above shall be accomplished prior to the application of the curing compound. The curing membrane shall be applied not later than the end of the work day the forms are removed.~~

~~2. Curing of slabs shall begin immediately after final finish. Slabs may be cured with membrane-forming curing compound or by covering securely with polyethylene sheet. Floor slabs that are to receive resilient flooring, tile grout beds or other bonded floor covering shall be cured with polyethylene rather than curing compound. Channel lining, curb and gutter, paving concrete and other similar site concrete shall be cured with Type 2 curing compound.~~

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3.10 CURING AND PROTECTION

A. General Requirements:

1. Protect concrete adequately from injurious action by sun, rain, flowing water, frost, and mechanical injury, and do not allow to dry out from the time it is placed for a period of 7 days.

2. For conditions where both of the following conditions exist, protection shall be provided in accordance with ACI 306, Cold Weather Concreting:

   a.) The average daily air temperature is less than 40°F (5°C) for more than three consecutive days and
   b.) The air temperature is not greater than 50°F (10°C) for more than one half of any 24 hour period.

3. For conditions where any of the following conditions tend to impair the quality of freshly mixed concrete, protection shall be provided in accordance with ACI 305, Hot Weather Concreting:

   a.) High ambient temperature
   b.) High concrete temperature
   c.) Low relative humidity
   d.) Solar radiation

B. Removal of formwork shall be in accordance with ACI 347.

C. Curing: All concrete shall be cured in accordance with ACI 308.

1. Whenever forms are used, curing shall be continued on the formed concrete surfaces after removal of forms by the application of an approved curing compound. Correction of surface defects as specified above shall be accomplished prior to the application of the curing compound. The curing membrane shall be applied not later than the end of the work day the forms are removed.

2. Curing of slabs shall begin immediately after final finish. Floor slabs that are to receive resilient flooring, tile grout beds or other bonded floor covering shall be cured with polyethylene rather than curing compound. Channel lining, curb and gutter, paving concrete and other similar site concrete shall be cured with Type 2 curing compound.

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PART 4 SUBMITTALS AND NOTIFICATIONS

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Reinforcing Steel Shop Drawings: Prepare shop drawings for reinforcing steel in accordance with ACI 315. Indicate bending and assembly diagrams, splicing and laps of bars, and dimensions and details of bar reinforcing. ~~(WITNESS POINT)~~

C. Mix Designs: Submit concrete mix designs for each cement type and for each concrete strength indicated on the Drawings. Mix designs shall be prepared in accordance with ACI 211.1, and meet the requirements of ACI 301, Chapter 3. The laboratory mix design report shall include, but not be limited to the following. ~~(WITNESS POINT)~~

FCR #94-178 FCR #

1. Confirmation of aggregate test data based on available test results determined within the past 6 months and the date tests were made.

2. Indicate proportions of aggregates, cement, water, and admixtures used in the laboratory trial mixes and present yield calculations.

3. Report 7 and 28 day compressive strength of test specimens made from the laboratory trial mix.

D. Certified Mill/Laboratory Test Reports: Submit certified copies of the results of tests performed on the following materials:

1. Cement (2.01 A.1)

2. Admixtures (2.01 D)

3. Reinforcement (2.04)

4. Liquid Membrane-Forming Curing Compound (2.05 B)

E. Placement Log: The Contractor shall prepare and submit documentation allowing traceability of concrete. This log shall, as a minimum, include:

1. Documentation relating placement location to time slip.

2. Time slip relating delivered concrete to batch ticket.

3. Batch ticket relating concrete to placement location.

4. Test results of field sampled concrete.

F. Contractor Procedures: The Contractor shall prepare and submit for A/E's approval procedures to be used for the following. ~~(WITNESS POINT)~~

FCR # 94-175

1. Detail procedures for cleaning surfaces prior to concrete placement. (3.01)

2. Detail methods of heating or cooling concrete. (3.06.B.2)

3. Detail methods for curing concrete. (3.10.A)

4.02 NOTIFICATIONS

Should any change in this Specification Section be required to comply with these requirements, the Contractor shall notify the A/E in writing for review.

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SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 03300

TITLE: Cast-In-Place Concrete

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1b		X										X						3			
Field Verification	1.04C.2b 1.05C2b		X										X							3		
Field Verification	1.04C.2a,c,f 1.05C.2a,c,d,f	X											X						3			
Mortar Tests	2.01A.2		X										X									
Inspection	3.05A		X		X								X							1		
Sampling & Testing	3.05B.1		X										X						3			
Reinforc. Shop Drwg.	4.01B		X							X			X						3			
Mix Designs	4.01C		X							X									3			
Cert. Mill Reports	4.01D		X										X									
Placement Log	4.01E		X													X						
Procedure	4.01F		X										X						3			

COMMENTS:

END OF SPECIFICATION SECTION

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DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

Civilian Radioactive Waste Management System
Management and Operating Contractor

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NO 102150
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JAN 07 1994

DOCUMENT AND RECORDS CENTER

Specification Section 04230

FIRST SUBMITTAL

REINFORCED UNIT MASONRY

Cl.16.3000

Document Identifier: BAB000000-01717-6300-04230 REV.00
QA Classification: MC

Revision No.	Date
00	12/22/93

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Page: 2 of:

Title of Design Specification REINFORCED UNIT MASONRY

Document Identifier: BAB000000-01717-6300-04230 Revision Number 00

This specification covers QA Classification MC *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Ray D. Clark	*Date*	12/22/93
Reviewed by	[illegible]	*Date*	12-22-93
Reviewed by	[illegible]	*Date*	12/22/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	Larry G. Engwall	*Date*	12/22/93
Approved by	[illegible] for P.A. Pimentel	*Date*	12/22/93
QA Approval	Fred Cutts	*Date*	12-22-93

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Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

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SECTION 04230

REINFORCED UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all materials, tools, equipment, and labor for the construction of concrete unit masonry including mortar, grout, reinforcing steel, and associated items and accessories.

1.02 RELATED SECTIONS

Division 1 General Requirements

1.03 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 531-79 — Building Code Requirements for Concrete Masonry Structures
2. ACI 531.1-76 — Specification for Concrete Masonry Construction

B. American Society for Testing and Materials (ASTM):

1. ASTM A153-82 — Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. ASTM C90B-92 — Standard Specification for Load-Bearing Concrete Masonry Units
3. ASTM C109-92 — Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
4. ASTM C140-91 — Standard Methods of Sampling and Testing Concrete Masonry Units
5. ASTM C144E1-91 — Standard Specification for Aggregate for Masonry Mortar
6. ASTM C150-92 — Standard Specification for Portland Cement
7. ASTM C207E1-91 — Standard Specification for Hydrated Lime for Masonry Purpc
8. ASTM C270A-92 — Standard Specification for Mortar for Unit Masonry
9. ASTM C404-92 — Standard Specification for Aggregates for Masonry Grout

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10. ASTM C426E1-70 — Standard Test Method for Drying Shrinkage of Concrete Block

11. ASTM C476-91 — Standard Specification for Grout for Masonry

12. ASTM C1006-84 — Standard Test Method for Splitting Tensile Strength of Masonry Units

13. ASTM C1019A-89 — Standard Method of Sampling and Testing Grout

14. ASTM D4317-88 — Standard Specification for Polyvinyl Acetate Based Emulsion Adhesives

C. Uniform Building Code (UBC):

Section 2407 — Masonry

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. Products covered by this Specification Section shall be commercial grade items and not important to waste isolation or radiological safety.

C. Acceptance of Product

1. Verification of material test reports. (WITNESS POINT)

2. Samples. (WITNESS POINT)

3. Inspection of block wall and reinforcing bars prior to grouting. (HOLD POINT)

D. Concrete unit masonry work shall conform to the requirements of ACI 531 and ACI 531.1.

E. Construction tolerances for concrete unit masonry shall conform to ACI 531.1 Section 2.1.6.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete Masonry Units (Concrete Block)

1. Concrete masonry units shall be of modular face dimensions and thicknesses as indicated. Furnish necessary shapes and sizes, bond-beam units, and corner units as required to satisfy conditions as indicated. Include half-size units where indicated or required.

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2. Concrete masonry units shall be hollow load-bearing units conforming to ASTM C90, No. 1 Normal Weight, Grade N, Type I - Moisture Controlled Units, with a minimum compress strength of 1500 psi and a minimum tensile strength of 150 psi. Units shall have a maxi m linear shrinkage of 0.06 percent, and shall meet water absorption requirements of ASTM C90.

3. Concrete masonry units shall be tan/beige-colored split faced fluted type blocks. Cinders or ingredients which might stain paint finishes shall not be permitted in the manufacture of concrete masonry units, unless noted on the Drawings.

B. Cement: ASTM C150 Type II Portland cement, low alkali.

C. Lime: ASTM C207, hydrated, Type S.

D. Mortar Sand: ASTM C144, natural sand, clean and graded.

E. Grout Aggregate: ASTM C404, clean and graded. Maximum coarse aggregate size shall be 3/8-inch.

F. Water: Fresh, clean, and free from amounts of mineral and organic substances that would adversely affect the mortar or grout.

G. Bonding Adhesive: Adhesive for bonding of mortar bed to concrete slabs shall be polyvinyl acetate emulsion conforming to ASTM D4317, factory prepared for permanently bonding mo bed to damp or dry concrete slab, and tinted to show by visual inspection where it has been applied. It shall dry to touch on concrete in less than one hour, remain flexible when dry, and develop a minimum bond strength of 150 pounds per square inch.

H. Control Joint Materials: Conform to requirements of ACI 531.1, Section 2.2.7.

I. Joint Reinforcement: Truss type galvanized steel wire (3/16-inch side rods and No. 9 gage cross ties) conforming to ACI 531.1, Section 3.2.2 and Section 3.2.6.5.

J. Reinforcing Steel: Provide reinforcing steel for grouted block masonry under this Specification Section in accordance with the requirements of Specification Section 03200 and ACI 531.1, Section 3.

K. Anchors and ties, where applicable, shall be as shown on the Drawings and, except as otherwise specified, shall be zinc-coated ferrous metal. Zinc coating of anchors and ties shall conform to ASTM A153, Class B-1, B-2, or B-3 as required.

2.02 MORTAR

A. Mortar for grouted unit masonry shall be cement-lime Type S mortar in accordance with ACI 531.1, Section 2.2.2, and shall have a minimum compressive strength at 28 days of 1500 psi

B. The use of admixtures shall not be permitted, except for color where specified.

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C. Mortar shall be job mixed and, in lieu of specific requirements specified herein, shall conform to ASTM C270, including measurement, mixing, proportioning, and water retention.

D. Accurately measure mortar ingredients and mix a minimum of five minutes after water has been added, in a mechanical batch mixer, using sufficient water to produce a workable and plastic consistency. Hand mixing shall be permitted for small quantities only.

E. Mortars that have stiffened shall be retempered by adding water as frequently as needed to restore the required consistency. No mortars shall be used beyond 2 1/2 hours after mixing.

F. Color of grout, if any, shall be specified by the Architect/Engineer (A/E).

2.03 GROUT

A. Grout shall be Coarse Grout, as defined in ASTM C476, with a minimum compressive strength at 28 days of 2000 psi, and shall be proportioned by volume per the limits set forth in ASTM C476, Table 1.

B. The use of admixtures shall not be permitted.

C. Accurately measure grout ingredients and mix a minimum of five minutes after water has been added, in a mechanical batch mixer, using sufficient water to produce a workable and plastic consistency. Hand mixing shall be permitted for small quantities only.

2.04 SURFACE SEALER

Use a clear, non-yellowing, mildew-resistant methylmethacrylate or isobutyl methacrylate water-repellent coating.

PART 3 EXECUTION

3.01 LAYING CONCRETE MASONRY UNITS

A. Installation Standards: Comply with applicable requirements of ACI 531.1.

B. General: Construct concrete unit masonry to dimensions indicated. Concrete masonry units shall be dry when laid. Avoid using less than half-size units in exposed locations. Do not expose cells on any surface. Concealed spaces not large enough for full or half-size units may be filled with concrete building brick or mortar.

C. Work Quality

1. Masonry work shall be performed by skilled and experienced masons. Erect walls plumb and true to line, with courses level and joints uniform in width using specified mortar. Vertical joints shall line up plumb in exposed walls.

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2. Concrete masonry units shall be sound and free of cracks and surface defects. Handle units carefully to avoid chipping and breaking. Do not substitute cut units where special shape are available.

3. Where steel beams or joists frame into masonry, fill spaces with mortar and finish off flush with masonry surface, neatly pointed around steel. Where pipes and ducts penetrate masonry, point neatly and accurately around pipes and ducts.

D. Cutting of Units: Cutting of units shall be kept to a minimum. Perform cutting accurately to accommodate items passing through or embedded in masonry to meet surfaces which masonry abuts, and to fit various conditions. Cutting of masonry units shall be performed with a power-driven masonry saw. Rub cuts smooth and even with carborundum or emery stone.

E. Bedding and Jointing

1. Use full mortar bed and coverage on horizontal and vertical face shells of hollow units. Webs shall also be bedded in mortar. Shove vertical joints tight.

2. Top surfaces of concrete foundations or other bed joints shall be clean concrete with aggregate exposed before start of laying. Tops of foundations shall be roughened and cleaned to remove laitance for exposing aggregates in the concrete. Where block is to be laid on slabs, bed joints shall be roughened and cleaned, and a bonding agent shall be applied before laying first course of block.

F. Joint Reinforcement: Provide reinforcement where indicated. Comply with ACI 531.1, Section 3.3.3.

G. Bond Pattern: Lay masonry units in stacking bond unless otherwise indicated.

H. Alignment of Vertical Cells: Masonry shall be built to preserve the unobstructed vertical continuity of the cells. The vertical alignment shall be sufficient to maintain a clear, unobstructed vertical flue, measuring not less than 3 inches in all directions for grouted masonry.

I. Cleanouts: Cleanout openings shall be provided at the bottoms of cells to be filled with grout. Mortar droppings shall be removed from cells, and cleanouts shall be sealed after inspection and before grout placement.

J. Pipe Chases: Chases and recesses for conduits, pipes, and ducts shall be formed as masonry work is constructed. Do not enclose conduit runs until complete and approved, or piping until it has been tested and approved. Make such chases and recesses plumb, with inside joints struck flush, and the interiors kept free of obstructions and cleaned out upon completion.

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K. Anchorage and Embedded Items

1. As the masonry work progresses, set accurately in place and bond into masonry bolts, straps, hangers, sleeves, anchors, inserts, frames for doors and windows, and any other anchorage items or attachments as indicated. Provide suitable recesses for cabinets, junction boxes, panels, and other items to be built into masonry. Consult with other trades in advance so their work can be accommodated at correct locations, as masonry work progresses, to avoid cutting and patching.

2. Cells containing anchorage or built-in items shall be grouted solid.

3. Where masonry is laid against concrete or metal, the joints between shall be filled with mortar as each course is laid.

L. Joint Finishing

1. Pack mortar tightly in joints and wipe wall faces clean as work progresses. Unless otherwise indicated, exposed joints shall be densely tooled concave and smooth with joint tool when mortar is thumbprint hard.

2. Joints in work concealed by other finishes shall be cut or struck off flush. Rake out joints around metal frames in openings 3/4-inch deep for sealant to be applied under Specification Section 07900, Joint Sealants.

3. Nominal joint size, both vertical and horizontal, shall be 3/8 inch.

M. Joining Work: Step back unfinished work for joining with new work. Toothing shall be resorted to only where unavoidable. Before starting or resuming work, remove loose mortar and foreign matter from work in place, and clean all surfaces of work to be joined.

N. Control Joints: Provide control joints where indicated. Comply with ACI 531.1, Section 2.3.8.

O. Precast Beams, Lintels, and Copings: Provide precast concrete units where indicated. Comply with ACI 531.1, Section 2.3.10.

3.02 REINFORCING STEEL

A. Provide reinforcing steel for grouted masonry as indicated. Comply with applicable requirements of ACI 531.1, Section 3.

B. Vertical reinforcing bars shall be placed prior to laying the wall and shall be held in place by standard reinforcing supports. Vertical bars shall be held in position at top and bottom and at intervals not exceeding 190 diameters of the reinforcement or 9 feet, whichever is less. Vertical reinforcing steel shall have a minimum clearance of 1 inch from the masonry.

C. When a foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six vertical. Dowels shall be grouted into a core in vertical alignment, even though it is an adjacent cell to the vertical wall reinforcing.

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D. Horizonal reinforcing bars shall be laid on the webs of the units in continuous masonry courses, consisting of bond-beam or channel units, or V-web units, and shall be solidly embedded in mortar and grout. Horizontal bars shall be tied to vertical bars as the block work progresses. Placing horizontal reinforcing bars in mortar joints shall not be permitted.

E. Reinforcing bars shall be straight except for bends around corners and where bends or hooks are indicated.

F. Reinforcing steel shall be lapped 30 bar diameters minimum where spliced, and shall be wire-tied together.

3.03 GROUTING

A. Grouting Requirements

1. Grouting shall be in accordance with ACI 531.1, Section 4.

2. Cells of concrete unit masonry shall be filled solid with grout where indicated. Cells containing reinforcement and anchorage or built-in items shall be filled solid with grout.

3. Spaces around metal frames and other built-in items shall be filled solid with grout or mortar.

4. Reinforcing steel shall be secured in place, inspected, and accepted before grouting starts.

5. Mortar droppings and projections shall be kept out of the grout space. Webs, wythes, and reinforcement shall be cleaned of mortar droppings before grout is placed.

6. Grout shall be rodded, puddled, or vibrated in place.

7. Cells shall be filled solid with grout, and pours shall be stopped 1-1/2 inches below the top of a course to form a key at pour joints.

8. Grouting of beams over openings shall be performed in one continuous operation. Tops of unfilled cell columns under a horizontal masonry beam shall be covered with metal lath, or special units shall be used to confine the grout fill to the beam section.

B. Grout Construction

1. Grout shall be placed by means of a grout pump capable of handling at least 12 cubic yards per hour of the specified grout mix, or by other accepted method approved by the A/E.

2. Grout may be placed by the low-lift method or the high-lift method. If grout is placed by the high-lift method, the work shall be performed under continuous inspection. Notify A/E 48 hours in advance of placing any grout.

3. Hollow unit masonry shall be allowed to set and cure a minimum of three days in hot weather or five days in cool or damp weather before grout may be placed.

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4. Grout shall be consolidated and reconsolidated at the time of placing with a smooth steel rod or a small internal vibrator.

C. Low-Lift Grouting: Low-lift grouting shall be in accordance with ACI 531.1, Section 4.3.2.

D. High-Lift Grouting: High-lift grouting shall be in accordance with ACI 531.1, Section 4.3.3.

3.04 REPAIRING AND POINTING

Upon completion of the work, carefully examine masonry surfaces and cut out and replace broken or defective units. Rake out defective mortar joints and repoint.

3.05 CLEANING

A. After erection and pointing, masonry shall be cleaned down with stiff brushes and water, followed by a thorough rinsing with clean water. All mortar deposits, stains, or other foreign matter shall be removed from masonry surfaces.

B. After masonry has been fully grouted, laitance and stains which have percolated through the blocks and mortar joints shall be hosed off with water under pressure.

C. The A/E may request certain masonry surfaces or areas to be cleaned with a commercial masonry cleaner manufactured for that purpose; in this case follow the instructions or recommendations of the manufacturer for cleaning method.

3.06 CURING

A. Masonry work and top of the grout pour shall be damp-cured for at least 7 days to prevent too rapid drying during hot or drying conditions.

B. Walls shall be kept moist or damp with water from a fogging nozzle, but shall not be wet to the point that free water drops from the surface.

3.07 SEALER APPLICATION

A. Preparation: Surfaces receiving sealer shall be thoroughly dry and free of all construction stains, surface dirt, and efflorescence.

B. Application: Apply sealer where concrete unit masonry is exposed to the weather in strict accordance with the manufacturer's instructions.

3.08 FIELD QUALITY CONTROL

A. Strength Tests: Conduct laboratory tests as follows: (WITNESS POINT)

1. Concrete Masonry Units: Concrete masonry units shall be tested in accordance with ASTM C140. Tensile strength tests shall be performed in accordance with ASTM C1006. Three units shall be tested for each 2,000 square feet of wall area.

REFERENCE DOCUMENT - UNCONTROLLED

2. Mortar: Compressive strength tests shall be performed in accordance with ASTM C109. Three cubes shall be tested for each 2,000 square feet of wall area, one at seven days and at 28 days.

3. Grout: Compressive strength tests shall be performed in accordance with ASTM C1019. Three square prisms shall be tested for each 2,000 square feet, or fraction thereof, of wall area, one at seven days and two at 28 days.

B. Rejection of Masonry; Repair and Replacement: The A/E shall have authority to reject concrete masonry work which does not meet specification requirements, and to require repair or replacement as necessary to complete the work.

C. Acceptance of Structure: Acceptance of the completed concrete masonry work requires conformance with the dimensional tolerances, appearance, and strengths specified in this Specification Section and standards and specifications referenced herein.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. General: Refer to Specification Section 01300, Shop Drawings, Product Data, and Miscellaneous Submittals, for submittal requirements and procedures.

B. Shop Drawings: When not indicated on Contract Drawings in sufficient detail or definition, submit detailed drawings of unit masonry, showing type of mortar joints, bond pattern, reinforcing steel, connecting dowels, joint reinforcement, grouted cells, and control joints. (HOLD POINT)

C. Samples: Submit full-size sample of selected concrete block for acceptance. (WITNESS POINT)

D. Certificates: Submit certification stating that concrete masonry units meet all applicable standards and specifications and that masonry units conform to the special strength requirements of this Specification Section. Each certificate shall be signed by the masonry unit manufacturer, and shall contain the name of the manufacturer, the project location, and the quantity and dates of shipment of delivery to which the certificate applies.

E. Submit plan of procedure before starting construction when grouting is to be placed in temperatures lower than 40 degrees F.

F. Contractor shall submit test reports to the A/E.

4.02 NOTIFICATION

Should any changes in this Specification Section be required to comply with these requirements, the Contractor shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 04230

TITLE: Reinforced Unit Masonry

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Mfr Verification	1.04C.1																		3			
Samples	1.04C.2,4.01C		X								X								2			
Field Inspection	1.04C3																			3		
Lab	3.08A		X								X								3			
Field Inspection	3.08B														X							
Shop Drawings	4.01B		X										X							20		
Certificate	4.01D			X							X											
Procedure	4.01E														X							

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

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Specification Section 05120

FIRST SUBMITTAL

METAL FABRICATIONS
CI.16.3000

Document Identifier: BAB000000-01717-6300-05120 REV. 00
QA Classification: MC

Revision No.	Date
00	12/22/93

REFERENCE DOCUMENT - UNCONTROLLED

NOTICE OF OPEN CHANGE DOCUMENTS			
THIS DOCUMENT IS IMPACTED BY THE LISTED CHANGE DOCUMENT AND CANNOT BE USED WITHOUT THEM			
CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS
FCR 94/178	4/15/94	4/15/94	OPEN

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CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS

Civilian Radioactive Waste Management System

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Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6
QA Class: QA
Page: 2 of: 8

Title of Design Specification METAL FABRICATIONS

Document Identifier: BAB000000-01717-6300-05120 Revision Number 00

This specification covers QA Classification MC *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Roy D. Clark	*Date*	12/22/93
Reviewed by	[illegible]	*Date*	12-22-93
Reviewed by	[illegible]	*Date*	12/22/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	[illegible]	*Date*	12-22-93
Approved by	[illegible] for P.A. Pimentel	*Date*	12/22/93
QA Approval	Fred [illegible]	*Date*	12-22-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

WBS: 1.2.6

QA Class: Q

Page: 3 of:

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 05120

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDED

Work specified in this Specification Section includes furnishing, fabricating, and installing all miscellaneous metal items as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Section 03300 Cast-in-Place Concrete-Surface

B. Section 09900 Painting

1.03 REFERENCES

A. American Institute of Steel Construction, Inc. (AISC):

AISC MO16-89	Manual of Steel Construction Allowable Stress Design Ninth Edition

B. American Society for Testing and Materials (ASTM):

1.	ASTM A36/A36M-91	Standard Specification for Structural Steel
2.	ASTM A53-B90	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
3.	ASTM A307-A92	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
4.	ASTM A325-A92	Standard Specification for High-Strength Bolts for Structural Steel Joints
5.	ASTM A446/A446M-91	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
6.	ASTM A500-A90	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
7.	ASTM A501-89	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

REFERENCE DOCUMENT - UNCONTROLLED

8. ASTM A569/A569M-A91 Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality

C. American Welding Society, Inc. (AWS):

AWS D1.1-92 Structural Welding Code Steel Thirteenth Edition

D. Federal Specifications (FS):

FS TT-P-645B-90 Federal Specification, Primer, Paint, Zinc-Molybdate, Alkyd Type

E. National Association of Architectural Metal Manufacturers (NAAMM):

MGB 532-88 Heavy Duty Metal Bar Grating Manual

F. Steel Structures Painting Council (SSPC):

SSPC-82 Good Painting Practice, Volume 1, Second Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. Products covered by this Specification Section shall be considered not important to waste isol or radiological health and safety.

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of metal fabrications. (WITNESS POINT)

2. Field Verification: Dimensional/visual inspection of the installation of metal fabrications. (WITNESS POINT)

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials including steel shapes, steel plate, metal pipe, bolts, nuts, washers, welded metal, and other items to be used in the Project shall be of the type, grade, class, and size shown on the Drawings and shall meet the requirements of the applicable references.

B. Steel Shapes: ASTM A36/A36M

C. Steel tubing: ASTM A500 or A501

D. Sheet steel: ASTM A446, Grade B, with a class G90 coating

REFERENCE DOCUMENT - UNCONTROLLED

E. Plain bolts, nuts, and washers: ASTM A307, with ASTM A563 nut and ASTM F436 hardened steel washers

F. High strength bolts, nuts, and washers: ASTM A325 heavy hex head bolt with hardened washers and heavy hex nut according to AISC specifications for structural joints using ASTM A325 or A490 bolts.

G. Gratings: MBG 531, type as noted on the Drawings

H. Welding materials: AWS D1.1, type required for materials being welded

I. Floor plate: ASTM A569 or A36/A36M, carbon steel

J. Railings: Handrail to be fabricated of 1-1/2 inch diameter, Schedule 40 pipe conforming to ASTM A53 or as shown on the Drawings.

2.02 FABRICATION

A. Fabricate assemblies as indicated on the Drawings. Shop assemble sections in largest practical sizes for delivery and installation.

B. Make exposed handrail joints butt tight together, flush, and with a hairline joint. Grind exposed welds smooth and flush with adjacent surfaces.

C. Welding shall be in accordance with AWS D1.1 for structures under static loading. The fabricator shall submit for Architect/Engineer (A/E) review, procedures and welder's AWS qualification records.

D. Materials and parts necessary to complete each item, even though such work is not specified, shall be included.

2.03 FINISH

A. Prepare component surfaces in accordance with SSPC-SP6. Shop applied primer shall conform to FS TT-P-645B for non-galvanized steel.

B. Surfaces of items to be embedded in concrete shall not be painted, primered, or galvanized.

PART 3 EXECUTION

3.01 INSTALLATION

A. Clean and prime all bolt heads and nuts, field welds, and any abrasions to the shop coat, with the same primer as used for the shop coat.

B. Items to be embedded in concrete shall be located by template and securely held in place during concrete placement.

REFERENCE DOCUMENT - UNCONTROLLED

3.02 TOLERANCES

Erect work square, plumb, level, and accurately fitted and free from distortion or defects detrimental to appearance or performance, in accordance with tolerances as specified in AISC, Manual of Steel Construction, Code of Standard Practice, Section 7.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Submit Shop Drawings in accordance with Specification Section 01300. ~~(HOLD POINT)~~

C. Submit welders qualification and welding procedures.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Contractor shall notify the A/E in writing for review.

Attachment A3
Page 1 of 1

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 05120

TITLE: Metal Fabrication

Requirements	Paragraph	STATUS						TIMING											NOTIFICATION			
		INFORMATION	REVIEW	CERTIFICATION	RECORD			PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED	PRIOR TO FINAL ACCEPTANCE			WITNESS (DAYS)	HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X						3			
Field Verification	1.04C.2		X													X			3			
Shop Drawings	4.01B		X							X										3		
Welder's Qualifications	4.01C		X							X												

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

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Specification Section 15140

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SUPPORTS AND ANCHORS

CI.16.3000

Document Identifier: BABBA0000-01717-6300-15140 REV. 00
QA Classification: TBV-123

Revision No.	Date
00	12/09/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Title of Design Specification SUPPORTS AND ANCHORS

Document Identifier: BABBA0000-01717-6300-15140 Revision Number 00

This specification covers QA Classification TBV-123 *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	[signature]	*Date*	12/13/93
Reviewed by	[signature]	*Date*	12/14/93
Reviewed by	[signature]	*Date*	12/15/93
Reviewed by	[signature]	*Date*	12/16/93
Reviewed by	N/A	*Date*	
Verified by	[signature]	*Date*	12.21.93
Approved by	[signature]	*Date*	12/21/93
QA Approval	[signature]	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 15140

SUPPORTS AND ANCHORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary to install the Supports and Anchors as specified herein and indicated on the Drawings.

B. This work includes pipe hangers and supports, hanger rods, equipment bases, flashing, and sleeves.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 03300 Cast-In-Place Concrete

C. Section 15260 Mechanical Piping

D. Section 15310 Fire Protection Piping

E. Section 15410 Plumbing Piping

F. Section 15530 Refrigerant Piping and Specialties

G. Section 15890 Ductwork

1.03 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

1. ASHRAE Fundamentals Handbook 1989
2. ASHRAE HVAC Applications Handbook 1991
3. ASHRAE HVAC Systems and Equipment Handbook 1992
4. ASHRAE Refrigeration Handbook 1990

B. International Association of Plumbing and Materials Officials (IAPMO):

Uniform Plumbing Code 1991 Edition

REFERENCE DOCUMENT - UNCONTROLLED

C. Manufacturers Standardization Society of the Valves and Fittings Industry, Inc. (MSS):

1. MSS SP-58-88 Pipe Hangers and Supports - Materials, Design and Manufacture

2. MSS SP-69-91 Pipe Hangers and Supports - Selection and Application

D. National Fire Protection Association (NFPA):

NFPA 13-91 Standard for the Installation of Sprinkler Systems

E. Underwriters Laboratories, Inc. (UL):

UL 1479-83 UL Standard For Safety Fire Tests of Through-Penetration Firestops, First Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-123)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the support and anchor products. (WITNESS POINT)

2. Field Verification: Dimensional/visual inspection of the installed support and anchor products. (WITNESS POINT)

1.05 DELIVERY, STORAGE, AND HANDLING

Shall comply with Specification Section 01600.

PART 2 PRODUCTS

2.01 GENERAL

A. All hangers and supports shall be furnished by one manufacturer to the maximum extent possible.

B. Supports shall be dimensionally compatible with the outside diameter of the pipe and/or insulation.

C. Hangers on insulated systems shall incorporate protection saddles or shields. Saddles shall be clamped or welded to the pipe and shall project through the insulation to provide external attachment.

REFERENCE DOCUMENT - UNCONTROLLED

D. Cast iron soil pipe supports shall be supported in conformance with the UPC Section 316 and this Specification Section.

E. Steel and copper plumbing piping supports and installation shall be in conformance with MSS SP-58 and MSS SP-69 and this Specification Section. See Specification Section 15410 for plumbing piping materials.

F. Fire protection sprinkler piping hangers, supports, and installation shall be in conformance with NFPA 13 and the requirements of Specification Section 15310. Pipe hangers and supports to be used for fire sprinkler service shall be UL listed or FM approved.

2.02 PIPE HANGERS AND SUPPORTS

A. The material for supports shall be compatible with the characteristics of the piping material so that neither shall have a deteriorating action on the other.

B. Hanger and support components shall be based on the system temperature and insulation condition of the pipe in accordance with Table 1 of MSS SP-69.

1. Hangers for pipe sizes 1/2 inch to 1 1/2 inches: Adjustable steel band hanger, Type 7.

2. Hangers for pipe sizes 2 to 4 inches: Adjustable, steel clevis hanger, Type 1.

3. Wall support: Welded steel brackets, Type 31 or side beam steel brackets, Type 34.

4. Vertical support: Steel riser clamp, Type 8.

5. Floor support: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support, Type 38.

6. Copper pipe support: Adjustable steel swivel ring, copper plated, Type 10.

2.03 HANGER RODS

Steel hanger rods: Threaded both ends, threaded one end, or continuous threaded. Diameter as required in Paragraph 3.02 of this Specification Section.

2.04 INSERTS

A. Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, and lugs for attaching to forms.

B. Size inserts to suit threaded hanger rods.

2.05 FLASHING

A. Metal flashing: 22 gauge galvanized steel or 2 lb. per sq. ft. seamless sheet lead.

REFERENCE DOCUMENT - UNCONTROLLED

B. Flexible flashing: 47 mil thick sheet butyl; compatible with roofing.

C. Gaps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.06 SLEEVES

A. Sleeves for pipes passing through exterior walls and concrete slabs on grade: Form with iron pipe.

B. Sleeves for pipes through raised floors: Form with 18 gauge galvanized steel.

C. Sleeves for pipes passing through interior walls and partitions: Form with 24 gauge galvanized steel.

D. Sleeves for ductwork: Form with galvanized steel as required in Specification Section 15890.

PART 3 EXECUTION

3.01 INSERTS

Where concrete slabs form finished ceiling, provide inserts flush with slab surface.

3.02 PIPE HANGERS AND SUPPORTS

A. All hangers, supports, and braces shall be supported from building structural members only.

B. Support horizontal standard weight steel piping as follows:

PIPE SIZE	MAX. HANGER SPACING	ROD DIAMETER
1/2 to 1 1/4 inch	7'-0"	3/8"
1 1/2 inch	9'-0"	3/8"
2 inch	10'-0"	3/8"
2 1/2 inch	11'-0"	1/2"
3 inch	12'-0"	1/2"
4 inch	14'-0"	5/8"
6 inch	17'-0"	3/4"

C. Support horizontal copper tube as follows:

PIPE SIZE	MAX. HANGER SPACING	ROD DIAMETER
1/4 to 3/4 inch	5'-0"	3/8"
1 to 1-1/4 inch	6'-0"	3/8"
1-1/2 to 2 inch	8'-0"	3/8"
2-1/2 inch	9'-0"	1/2"
3 to 4 inch	10'-0"	1/2"

REFERENCE DOCUMENT - UNCONTROLLED

D. Provide protection shields for insulated pipe as follows:

PIPE SIZE	SHIELD LENGTH	GAUGE	SPACING
1/2 to 3-1/2 inch	12 inch	18	10 feet
4 inch	12 inch	16	10 feet
5 to 6 inch	18 inch	16	10 feet

E. Provide protection shields for insulated tubing as follows:

PIPE SIZE	SHIELD LENGTH	GAUGE	SPACING
1/4 to 1 inch	12 inch	18	5 feet
1-1/4 to 2-1/2 inch	12 inch	18	8 feet
3 to 3-1/2 inch	12 inch	18	10 feet
4 inch	12 inch	18	10 feet

F. Protection shield spans may be increased to hanger spacing when rigid insulation, such as foam glass or calcium silicate, is used in lieu of fiberglass insulation at pipe hanger locations. Reference Specification Section 15260 for Piping Insulation requirements.

G. Install hangers to provide a minimum 1 inch space between finished covering and adjacent work.

H. Place a hanger within 12 inches of each horizontal elbow, or where practical with Architect/Engineer concurrence.

I. Use hangers with a minimum 1/2 inch vertical adjustment.

J. Support horizontal cast iron pipe adjacent to each hub or joint, with 5 feet maximum spacing between hangers.

K. Support vertical piping at every other floor level. Support vertical cast iron pipe at each floor level at hub or joint.

L. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

M. Support riser piping independently of connected horizontal piping.

3.03 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases as shown on the Drawings, of concrete type specified in Specification Section 03300.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

REFERENCE DOCUMENT - UNCONTROLLED

3.04 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes shall project 3 inches minimum above finished roof surface, 6 inches minimum clear on sides. For pipes through outside walls, turn flanges back into wall and caulk, metal counterflash, and seal.

3.05 SLEEVES

A. Set sleeves in position in framework. Provide reinforcing around sleeves.

B. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves full depth and provide floor plate or escutcheon.

C. Clearance between sleeve and pipe/pipe covering shall be approximately 1/2 inch.

D. Install chrome plated steel escutcheons at exposed finished surfaces. Plates shall be sized to completely cover penetrations.

E. Where cutting of construction is necessary, the construction shall be repaired to match its original construction.

F. Pipes penetrating exterior walls shall be made weathertight and watertight using fiberglass or mineral wool packing and non-hardening plastic sealer.

G. Pipes penetrating fire-rated walls shall have sleeves filled with UL listed or FM approved firestopping material/assembly equal to the fire rating of the wall and installed strictly in accordance with the listed tested design.

3.06 PAINTING

All ferrous metal surfaces shall be painted in accordance with Specification Section 09900.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet and Specification Section 01300.

B. Manufacturer's data shall indicate overall dimensions, weights, metal gauges, materials, construction details, and all other information necessary for the evaluation of the following materials and/or equipment.

1. Pipe hangers and supports

REFERENCE DOCUMENT - UNCONTROLLED

2. Hanger rods

3. Inserts

4. Templates, anchor bolts, and accessories

5. Flashing

6. Sleeves

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Contractor shall notify the Architect/Engineer in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 15140

TITLE: Supports and Anchors

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X											X					3			
Field Verification	1.04C.2		X													X			3			
Mfr's Data	4.01B		X						30													

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

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Specification Section 15190

FIRST SUBMITTAL

MECHANICAL IDENTIFICATION

CI.16.3000

Document Identifier: BABBA0000-01717-6300-15190 REV. 00
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Revision No.	Date
00	12/09/93

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Title of Design Specification MECHANICAL IDENTIFICATION

Document Identifier: BABBA0000-01717-6300-15190 Revision Number 00

This specification covers QA Classification TBV-123 *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

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Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s): _____

Prepared by	Dallie Randolph	*Date*	12/13/93
Reviewed by	Clt L Meth	*Date*	12/14/93
Reviewed by	Norman E. Lemonnacca	*Date*	12/15/93
Reviewed by	David H. Gamm	*Date*	12/16/93
Reviewed by	N/A	*Date*	
Verified by	Russell E. Hye	*Date*	12.21.93
Approved by	[illegible]	*Date*	12/21/93
QA Approval	Fred Auth	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 15190

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary to install Mechanical Identification as specified herein and indicated on the Drawings.

B. This work includes pipe markers, valve tags, nameplates, safety warning signs, and tagging.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 15310 Fire Protection Piping

C. Section 15410 Plumbing Piping

D. Section 15890 Ductwork

1.03 REFERENCES

A. American National Standards Institute (ANSI):

ANSI A13.1-81	Scheme for the Identification of Piping Systems

B. Code of Federal Regulations

29 CFR 1910-1992	OSHA-Code of Federal Regulations

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-123)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Mechanical Identification products (WITNESS POINT)

REFERENCE DOCUMENT - UNCONTROLLED

2. Field Verification: Dimensional/visual inspection of Mechanical Identification products. (WITNESS POINT)

1.05 DELIVERY, STORAGE, AND HANDLING

Shall comply with Specification Section 01600.

PART 2 PRODUCTS

2.01 PIPE MARKERS

A. In conformance with ANSI A13.1, Table 2 and Table 3, each tape marker must show:

1. Approved color-coded background

2. Proper color of legend in relation to background color

3. Approved legend letter size

4. Approved marker length.

B. Direction of flow arrows are to be included on each marker, unless otherwise noted on the Drawings.

2.02 VALVE TAGS

A. Valve tags shall be brass, 1-1/2 inch diameter with 1/4 inch stamped black lettering.

B. Tags shall be securely fastened with meter seals, brass jack chains, or "S" hooks as required.

2.03 NAMEPLATES

A. Nameplates shall be laminated 1/16 inch plastic with beveled edges, black with white engraved 1/4 inch lettering and shall be permanently attached using rivets.

B. Nameplates shall identify equipment with the same notations used in the operating instructions.

2.04 SAFETY WARNING SIGNS AND TAGGING

A. Equipment shall be provided with safety warning signs and tags for personnel safety.

B. Safety warning and tags shall comply with OSHA, 29 CFR 1910.145.

REFERENCE DOCUMENT - UNCONTROLLED

PART 3 EXECUTION

3.01 PREPARATION

Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Piping Identification

1. All service piping accessible for maintenance operations shall be identified with identification markers.

2. Tape pipe markers shall be provided in the following locations:

   a. Adjacent to each valve and fitting

   b. At each branch and riser take-off

   c. At each side of pipe passage through walls, floors, or ceilings

   d. On all straight pipe runs, every 25 feet.

3. Tags shall be used on small diameter piping (under 3/4 inch diameter).

4. Install pipe markers in accordance with manufacturer's instructions.

B. Valve Identification

1. All valves shall be identified with the appropriate service (i.e., PLGB, F.P., C.W., etc.) and valve designation number with a brass valve tag.

2. Provide chart of all valves showing valve identification number, location, and purpose.

C. Equipment Identification

1. Identify air handler, fans, pumps, air compressors, filters, dryers, tanks, etc., with nameplates.

2. Nameplate shall bear the equipment name and numbers corresponding to the Drawings and operating instructions.

3. Small devices with insufficient surface area for nameplates shall be identified with metal tags.

D. Controls Identification

1. Identify control panels and major control components outside panels with nameplates.

2. Nameplate shall state control panel number and system controlled.

REFERENCE DOCUMENT - UNCONTROLLED

E. Ductwork

1. Identify ductwork with nameplates. Nameplate shall state air handling unit number and area served.

2. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet and Specification Section 01300.

B. Manufacturer's data shall indicate overall dimensions, weights, metal gauges, materials, construction details, and all other information necessary for the evaluation of the following materials and/or equipment.

1. Pipe markers

2. Valve tags

3. Nameplates.

C. A valve identification chart shall be provided.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Contractor shall notify the Architect/Engineer in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 15190

TITLE: Mechanical Identification

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD	STATUS:	STATUS:	TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE	TIMING:	TIMING:	NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)	NOTIFICATION:	NOTIFICATION:
Receipt Verification	1.04C.1		X										X						3			
Field Verification	1.04C.2		X													X			3			
Valve Ident. Chart	3.02B.2&			X												X						
	4.01C																					
Mfr's Data	4.01B		X						30													

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

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Civilian Radioactive Waste Management System
Management and Operating Contractor

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DOCUMENT AND RECORDS CENTER

Specification Section 15260

FIRST SUBMITTAL

PIPING INSULATION

CI.16.3000

Document Identifier: BABBA0000-01717-6300-15260 REV 00
QA Classification: TBV-123

Revision No.	Date
00	12/09/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6
QA Class: QA

Title of Design Specification PIPING INSULATION

Document Identifier: BABBA0000-01717-6300-15260 Revision Number 00

This specification covers QA Classification TBV-123 *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	[illegible]	*Date*	12/13/93
Reviewed by	[illegible]	*Date*	12/15/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	Russell E. Flye	*Date*	12-21-93
Approved by	[illegible]	*Date*	12/21/93
QA Approval	Fred Auth	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 15260

PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, and labor to install Piping Insulation as specified herein and indicated on the Drawings.

B. This work includes piping insulation materials, thickness for application, indoor and outdoor jacketing, and specialty fittings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 15140 Supports and Anchors

C. Section 15190 Mechanical Identification

D. Section 15410 Plumbing Piping

E. Section 15530 Refrigerant Piping and Specialties

1.03 REFERENCES

A. American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc. (ASHRAE):

1. ASHRAE 90.1-89 — Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

2. ASHRAE Fundamentals Handbook 1989

3. ASHRAE HVAC Applications Handbook 1991

4. ASHRAE HVAC Systems and Equipment Handbook 1992

5. ASHRAE Refrigeration Handbook 1990

B. American Society for Testing and Materials (ASTM):

1. ASTM C534-88 — Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

REFERENCE DOCUMENT - UNCONTROLLED

2. ASTM C547-77 — Standard Specification for Mineral Fiber Preformed Pipe Insulation

3. ASTM E84A-91 — Standard Test Method for Surface Burning Characteristics of Building Materials

C. Underwriters Laboratories, Inc. (UL):

UL 723-83 — UL Standard for Safety Test for Surface Burning Characteristics of Building Materials, Sixth Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-123)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the pipe insulation, fitting covers, and aluminum jacketing. (WITNESS POINT)

2. Field Verification: Dimensional/visual inspection of the installation of insulation and fitting covers and the application of aluminum jackets and vapor barrier protection. (WITNESS POINT)

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shall comply with Specification Section 01600.

B. All materials to be used shall be protected from the elements during storage. Reference Specification Section 01600.

C. Any insulation exposed to moisture prior to installation shall be rejected by the Architect/Engineer (A/E).

PART 2 PRODUCTS

2.01 MATERIALS

A. All insulation installed inside buildings shall be tested according to ASTM E84A and UL 723.

B. Materials shall have a flame-spread rating not greater than 25 and fuel-contributed and smoke-developed ratings not greater than 50.

C. Asbestos or asbestos-containing materials shall not be used.

REFERENCE DOCUMENT - UNCONTROLLED

2.02 PIPE INSULATION

A. Fiberglass pipe insulation shall meet ASTM C547.

B. Flexible closed-cell elastomeric thermal insulation shall meet ASTM C534.

C. The insulation shall have a thermal conductivity (K) within the allowable range of the ASHRAE 90.1 minimum thickness table.

D. Minimum pipe insulation thickness in inches shall be in accordance with Table 9-1 of ASHRAE 90.1.

1. Domestic hot water piping shall be insulated per the Service Hot Water Systems requirements.

2. Domestic cold water piping shall be insulated with a minimum 1/2 inch thick insulation with an all-service jacket to prevent condensation.

3. Heat pump refrigerant tubing shall be insulated with a minimum 1/2 inch thick closed-cell elastomeric insulation to prevent condensation.

E. Fiberglass pipe insulation shall be provided with an all-service jacket.

1. Jacket shall consist of a white-kraft paper bonded to aluminum foil and reinforced with glass fibers.

2. Jacket shall have a maximum water vapor permeance of 0.02 perm and a pressure sensitive tape lap sealing system.

F. For piping exposed to ambient temperatures, increase thickness by 0.5 inch.

G. Fittings, valves, and flanges shall be insulated with PVC fitting covers with fiberglass insulation inserts.

1. Fittings shall also meet the requirements of a flame-spread rating not greater than 25 and fuel-contributed and smoke-developed ratings not greater than 50.

2. On cold systems, apply a vapor barrier mastic around the edges of the adjoining pipe insulation and on the inside of the fitting cover overlap seam.

3. Covers shall be secured with pressure sensitive white tape along the circumferential edges. Tape shall consist of a flexible 10 mil polyvinyl chloride film coated with adhesive.

4. Tape shall extend over the adjacent pipe insulation and overlap itself at least 2 inches on the downward side.

REFERENCE DOCUMENT - UNCONTROLLED

5. In lieu of PVC fitting covers, fittings and valves may be insulated with fiberglass, molded fittings, or fabricated mitered segments of pipe insulation of the same thickness as the insulation of the adjoining pipe, then covered with a 1/4 inch thick layer weather protective coating and finished with presized glass cloth jacket saturated with lagging adhesive, followed with another weather protective coating layer.

H. All insulated pipes located outdoors shall have a 0.016-inch thick embossed aluminum jacket with a laminated moisture retarder.

1. Elbows and tees for metal jacketed systems shall be finished with matching metal fitting covers.

2. Other fittings in metal jacketed systems shall be finished with conventional weather resistant insulating materials with painted aluminum finish.

I. All pipe insulation shall be continuous through wall and ceiling openings and sleeves.

PART 3 EXECUTION

3.01 INSTALLATION

A. All necessary testing of piping shall be completed prior to installation of insulation.

B. Install all materials according to the recommendations of the manufacturer.

C. All insulation shall be installed over clean, dry surfaces.

3.02 APPLICATION

A. Aluminum jackets on piping shall have joints completely sealed along the longitudinal seam and shall be applied to shed water.

B. Protection shields shall be applied at all hangers and supports for insulated pipe in accordance with Specification Section 15140.

C. Butted ends of insulation must be vapor-barrier protected. Vapor barriers shall overlap a minimum of 2 inches at all seams and be sealed with an appropriate pressure sensitive tape or mastic.

PART 4 SUBMITTALS AND NOTIFICATION

01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet and Specification Section 01300.

REFERENCE DOCUMENT - UNCONTROLLED

B. Manufacturer's data shall indicate overall dimensions, weights, materials, construction details, and all other information necessary for the evaluation of the following materials and/or equipment:

1. Pipe insulation

2. Fitting covers

3. Aluminum jacketing.

C. Provide manufacturer's installation instructions for the following:

1. Pipe insulation

2. Fitting covers

3. Aluminum jacketing.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Contractor shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

MINIMUM PIPE INSULATION (IN.)

Fluid Design Operating Temperature Range, °F	Insulation Conductivity		Nominal Pipe Diameter (in.)					
	Conductivity Range Btu in./ (h ft² °F)	Mean Rating Temperature °F	Runouts* up to 2	1 and less	1-1 1/4 to 2	2-2 1/2 to 4	5 & 6	8 & up
Heating Systems (Steam, Steam Condensate, and Hot Water)								
Above 350	0.32-0.34	250	1.5	2.5	2.5	3.0	3.5	3.5
251-350	0.29-0.31	200	1.5	2.0	2.5	2.5	3.5	3.5
201-250	0.27-0.30	150	1.0	1.5	1.5	2.0	2.0	3.5
141-200	0.25-0.29	125	0.5	1.5	1.5	1.5	1.5	1.5
105-140	0.24-0.28	100	0.5	1.0	1.0	1.0	1.5	1.5
Domestic and Service Hot Water Systems**								
105 & Greater	0.24-0.28	100	0.5	1.0	1.0	1.5	1.5	1.5
Cooling Systems (Chilled Water, Brine, and Refrigerant)								
40-55	0.23-0.27	75	0.5	0.5	0.75	1.0	1.0	1.0
Below 40	0.23-0.27	75	1.0	1.0	1.5	1.5	1.5	1.5

* Runouts to individual terminal units not exceeding 12 ft. in length.
** Applies to recirculating sections of service or domestic hot water systems and first 8 ft. from storage tank for non-recirculating systems.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 15260

TITLE: Piping Insulation

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X						3			
Field Verification	1.04C.2		X												X				3			
Mfr's Data	4.01B		X						30		X											
Inst. Instr.	3.01, 4.01C		X								X											

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

Civilian Radioactive Waste Management System
Management and Operating Contractor

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Specification Section 15310

FIRST SUBMITTAL

FIRE PROTECTION PIPING

Document Identifier: BABBA0000-01717-6300-15310 Rev. 00
CI.16.3000
QA Classification: TBV-123

Revision No.	Date
00	01/04/94

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Design Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Page: 2 of:

Title of Design Specification FIRE PROTECTION PIPING

Document Identifier: BABBA0000-01717-6300-15310 Revision Number 00

This specification covers QA Classification TBV-123 *items. In accordance with established quality assurance procedures, signatures below certify that the above Design Specification was originated, verified, reviewed, and approved.*

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Hallie Kendall	*Date*	12/13/93
Reviewed by	CA Lilly	*Date*	12/14/93
Reviewed by	Norman S. Lucomanaca	*Date*	12/15/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	David H. Bannon	*Date*	~~12/16/93~~ 1/7/94 DH
Approved by	RCP	*Date*	~~12/21/93~~ 1/4/94 GR
QA Approval	Fred Curtis	*Date*	~~12-21-93~~ 1-5-94 FCA

QAP-3-11 *This form may be reproduced locally.* 0068 (07/17/92)

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 15310

FIRE PROTECTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, design, testing, and labor necessary to install Fire Protection Piping as specified herein and as indicated on the Drawings.

B. This work includes:

1. Fire protection piping above grade
2. Fire protection piping below grade
3. Pipe supports
4. Gate valves
5. Check valves
6. Globe valves
7. Gauges
8. Fire Department connections.

C. This work does not include the installation of fire protection piping below grade, buried within 5 feet of building.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 02225 Water Use for Construction and Operations

C. Section 02665 Water Distribution System

D. Section 07270 Firestopping

E. Section 09900 Painting

F. Section 15140 Supports and Anchors

REFERENCE DOCUMENT - UNCONTROLLED

G. Section 15190 Mechanical Identification

H. Section 15330 Wet-Pipe Sprinkler System

I. Section 15410 Plumbing Piping

J. Section 16721 Fire Alarm and Smoke Detector Systems

1.03 REFERENCES

A. American National Standards Institute (ANSI):

1.	ANSI B16.1-89	Cast Iron Pipe Flanges and Flanged Fittings
2.	ANSI B16.3-92	Malleable Iron Threaded Fittings
3.	ANSI B16.4-92	Gray Iron Threaded Fittings
4.	ANSI B16.9-93	Factory-Made Wrought Steel Buttwelding Fittings Includes Interpretations

B. American Society for Testing and Materials (ASTM):

1.	ASTM A53B-90	Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
2.	ASTM A307A-92	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

C. American Water Works Association (AWWA):

1.	AWWA C104/A21.40-90	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water, First Edition
2.	AWWA C110/A21.10-87	Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids
3.	AWWA C111/A21.11-90	Rubber-Gasket Joint for Ductile-Iron Pressure Pipe and Fittings
4.	AWWA C151/A21.51-91	Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids
5	AWWA C606-87	Grooved and Shouldered Joints

D. American Welding Society (AWS):

AWS D10.9-80	Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing

REFERENCE DOCUMENT - UNCONTROLLED

E. Factory Mutual Engineering and Research Corporation (FM):

FM Approval Guide-93	A Guide to Equipment, Materials and Services Approved by Factory Mutual Research for Property Conservation

F. National Fire Protection Association (NFPA):

1.	NFPA 13-91	Standard for the Installation of Sprinkler Systems
2.	NFPA 24-92	Standard for the Installation of Private Fire Service Mains and Their Appurtenances
3.	NFPA 1963	Standard for Screw Threads and Gaskets for Fire Hose Connections

G. Underwriters Laboratories, Inc. (UL):

UL-1993	Fire Protection Equipment Directory

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-123)

C. The Fire Sprinkler Contractor must be qualified and suitably licensed for the installation and design of fire protection systems.

D. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of pipe, fittings, unions, flanges, couplings, reducers, pipe supports, and valves. (WITNESS POINT)

2. Field Verification: Dimensional/visual inspection of the following:

a. Preparation of pipe. (WITNESS POINT)

b. Installation of pipe, valves, valve identification, drains, test valves, gauges, and Fire Department connection. (WITNESS POINT)

c. Cleaning and painting. (WITNESS POINT)

d. Final inspection. (WITNESS POINT)

1.05 DELIVERY, STORAGE, AND HANDLING

Shall comply with Specification Section 01600.

REFERENCE DOCUMENT - UNCONTROLLED

PART 2 PRODUCTS

2.01 GENERAL

A. Only UL listed or FM approved equipment will be approved for fire protection use.

B. Materials and equipment shall be new and current products of the respective manufacturers.

C. When two or more pieces of equipment that perform the same function are required, they shall be exact duplicates produced by one manufacturer.

D. All materials and equipment shall be approved for the intended purpose in conformance with current requirements of the applicable referenced NFPA standards.

E. Contractor shall submit proof that the items furnished under this Specification Section conform to such requirements.

F. Location of sprinkler piping shall be as determined by the Sprinkler Contractor.

G. Earthquake bracing shall be as required.

2.02 FIRE PROTECTION PIPING - ABOVE GRADE

A. Pipe: Steel Pipe: Schedule 40, black steel, ASTM A53B, seamless.

B. Fittings

1. Flanged fittings: Cast iron, ANSI B16.1.

2. Screwed fittings: Malleable iron, ANSI B16.3, 150 Class or Cast Iron, ANSI B16.4, Class 125.

3. Welded fittings: Factory made wrought steel buttwelding, ANSI B16.9.

C. Joint Materials: Teflon tape, pipe dope, or threaded joint compound.

D. Unions, Flanges, Couplings, Reducers, and Bushings

1. Unions

a. Two (2) inches or less malleable iron, 300 lb. bronze to iron ground joint.

b. Except where flexible joints are required, pipe unions and couplings may be used in lieu of flexible couplings.

c. Unions over 2 inches are prohibited.

REFERENCE DOCUMENT - UNCONTROLLED

2. Flanges: Class 125 forged steel slip-on flanges for ferrous piping. Bolts shall be ASTM A307A, Grade B, heavy hexagon head machine bolts with heavy hexagon nuts. Gaskets sh be full face, 1/8 inch thick, made of SBR or neoprene rubber.

3. Mechanical Grooved Couplings: Malleable iron houseing clamps to engage and lock, designed to permit some angular deflection, synthetic rubber gasket, steel bolts, nuts, and washers; galvanized coupling for galvanized pipe, conforming to AWWA C606. Listed flexible pipe coupling shall be installed in accordance with NFPA 13, Class 1 area for earthquake protection.

4. Reducers, Bushings

   a. A one piece concentric tapered reducing fitting shall be used wherever a change is made in the size of pipe.

   b. Bushings shall not be used.

2.03 PIPE SUPPORTS

Metal pipe supports, sway braces, hangers, clamps, and other accessories shall be UL listed or FM approved patterns and placed so as to conform with the design furnished, which is based on the seismic bracing requirements of NFPA 13, Seismic Zone 1 and UBC, Seismic Zone 4.

2.04 GATE VALVES

A. 2 inches and smaller: Class 125 bronze screwed gate valve, bronze body, integral seat, solid wedge disc, outside stem and yoke (OS and Y) screwed bonnet.

B. 2 1/2 inches and larger: Class 150 flanged gate valve, iron body, renewable bronze seat, cast iron bronze faced single disc, rising stem, OS and Y bolted bonnet.

C. Provide OS and Y block valves with tamper alarm switch.

D. Tamper alarm switches: Refer to Specification Section 16721.

2.05 CHECK VALVES

A. 2 inches and smaller: Class 125 bronze screwed swing check valve, bronze body and disc, integral disc and hinge, screwed cap.

B. 2 1/2 inches and larger: Class 150 flanged swing check valve, cast iron body, renewable bronze seat, bronze faced disc, bolted cap.

C. Mechanical grooved piping system: Silent operating, dual disc, spring loaded, check valve with single-piece body casting and downstream drain connection.

REFERENCE DOCUMENT - UNCONTROLLED

2.06 GLOBE VALVES

Class 125 bronze body, screwed, rising stem, screw-in bonnet, renewable disc.

2.07 GAUGES

A. Gauges measuring water pressure shall be minimum 2 1/2 inch dial.

B. Gauges shall read within midrange of scale at normal operating pressure.

C. Gauges shall be Class 1, Bourdon tube type, with rear safety blowout protection.

2.08 FIRE DEPARTMENT CONNECTIONS

A. A two-way standard Siamese Fire Department connection, 4 inch by 2 1/2 inch, shall be provided in accordance with the requirements of NFPA 13.

B. A single inlet Fire Department connection, 2 1/2 inch, may be used for building areas of less than 5000 square feet.

C. Hose threads shall be national standard fire hose coupling screw threads, complete with breakaway caps, and meet the requirements of NFPA 1963.

D. Drainage shall be provided by automatic drip connection arranged to drain to the outside.

PART 3 EXECUTION

3.01 PREPARATION OF PIPE

A. Ream pipe and tube ends to full inside diameter.

B. Remove burrs and bevel plain end ferrous pipe.

C. Remove scale and foreign material, inside and outside, before assembly.

3.02 INSTALLATION

A. Sprinkler system piping shall be installed in accordance with NFPA 13.

B. Underground piping shall be installed in accordance with NFPA 24.

C. Underground piping shall be installed by the Plumbing Contractor to interface as shown on the Drawings. All requirements of this Specification Section shall apply.

REFERENCE DOCUMENT - UNCONTROLLED

D. Piping

1. Screw joint steel piping up to and including 2 inch diameter. Weld piping 2 1/2 inch diameter and larger, including branch connection.

2. Mechanical grooved joints and tees may be used instead of threaded or welded joints.

3. All welding shall be done by a qualified welder in accordance with NFPA 13, 2.5.2.8.1. A welding procedure shall be prepared and qualified by the Contractor or fabricator before any welding is done. Welders and welding operators shall meet or exceed the requirements of AWS D10.9, Level AR-3.

4. Die cut screw joints with full cut standard taper pipe threads.

5. Coat threaded ends with teflon tape applied to male threads only.
6. In steel piping, main sized saddle branch connections or direct connection of branch lines to mains is permitted if the main is one pipe size larger than the branch for up to 6 inch mains and if main is two pipe sizes larger than branch for 8 inch and larger mains. Do not project branch pipes inside the main pipe.

7. Do not penetrate building structural members unless accepted in writing by the Architect/ Engineer (A/E).

8. Provide sleeves when penetrating footings, floors, and walls. 1 inch minimum clearance is required for pipe sizes 1 inch to 3 1/2 inches a 2 inch minimum clearance is required for pipe sizes 4 inches and larger.

9. Seal pipe and sleeve penetration to achieve fire resistance equivalent to fire separation required per Specification Section 07270.

E. Valves

1. Install valves with stems upright or horizontal, not inverted.

2. Provide gate valves for shut-off or isolating service.

3. Provide drain valves at main shut-off valves and at low points of piping apparatus.

4. Provide handwheels for gate and drain valves.

5. Provide valve connections to match pipe joints. Use valves matching the pipe size of installation.

F. Drains

1. All drains shall terminate with a 45-degree elbow on the exterior of the building except when otherwise shown on the Drawings.

REFERENCE DOCUMENT - UNCONTROLLED

2. Elbow shall discharge at a point one foot above grade.

3. Discharge of all drains shall be visible and, where directed to unpaved ground, shall discharge to concrete splash blocks on grade.

G. Valve Identification Signs

1. All control, drain, and test valves, and Fire Department connections shall be provided with identification signs in accordance with Specification Section 15190.

2. Signs shall be porcelainized metal, engraved laminated plastic, or an A/E accepted equal, and hung with chain or mounted with approved fasteners.

H. Inspector's Test Valve

1. An inspector's test valve shall be installed for sprinkler system.

2. The test valve shall be conveniently accessible and located near an exit so that point of discharge can be observed readily by the operator of the test valve.

3.03 FIELD QUALITY CONTROL

Hydrostatic Test and Flushing

1. Hydrostatic test and flushing shall conform to NFPA 13 for all indoor piping and NFPA 24 for all underground piping and shall be performed on all water lines for final acceptance. (WITNESS POINT)

   a. Fire protection system, including underground, shall be tested hydrostatically to not less than 200 psi not less than two hours, or for 50 psi above static working pressures in excess of 150 psi.

   b. All joints observed to leak shall be tightened, remade, or replaced as necessary.

   c. The A/E shall be given three working days advance notice of all hydrostatic tests.

2. Final Inspection

   a. When the Contractor is satisfied that the systems are in complete operating condition, the Contractor shall notify the A/E in writing for a final inspection and acceptance test. (WITNESS POINT)

   b. The A/E shall be given three working days advance notice of all inspection and acceptance points.

   c. Final inspection of all phases of the work shall be made by the A/E or authorized representative.

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d. The Contractor shall be present at this time to conduct any operating test of alarms, drains, or other system functions requested by the A/E.

e. Any faults or malfunctions in system, segment, or component operation discovered shall be corrected by, and at the expense of, the Contractor as directed by the A/E.

f. Successful completion of the final inspection and acceptance test, disinfection, cleaning and painting, and hydrostatic testing, as determined by the A/E, shall constitute evidence of satisfactory completion of the respective system, and the system shall be considered accepted.

g. The Contractor shall transmit to the A/E a fully executed certificate covering materials and tests, as stipulated in NFPA 13, Figure 8-1a.

3.04 CLEANING AND PAINTING

A. All exposed iron and steel parts shall be thoroughly cleaned by the Contractor of any visible corrosion, dirt, grease, or any material that will prevent the application or adhesion of prime coat.

B. Piping and other metal, except sprinkler heads, bronze or brass fittings, and moving parts, shall be given a prime coat of alkyd type paint. Primer may be shop-applied with field touchup to cover tool marks and scars. After the installation has passed a satisfactory hydrostatic test and has been accepted, all exposed piping shall be given one finish coat which shall be federal safety red in accordance with Specification Section 09900.

1. As an alternative, the Contractor may use shop paint (finish coat) as field touchup.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet and Specification Section 01300.

B. Welding Procedure.

C. Welder Qualifications.

D. Manufacturer's data shall indicate overall dimensions, weights, metal gauges, materials, construction details, pressure ratings, and all other information necessary for the evaluation of the following materials and/or equipment:

1. Pipe

2. Flanged, screwed, and welded fittings

3. Groove fittings and couplings

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4. Pipe hangers

5. Gate valves

6. Check valves

7. Globe valves

8. Gauges

9. Fire Department connections

E. Field Test: Hydrostatic test and flushing. (WITNESS POINT)

F. Operational Test: Inspection and acceptance. (WITNESS POINT)

4.02 NOTIFICATION

Should any change in this Specification Section be required for the Contractor to comply with these requirements, the Contractor shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 15310

TITLE: Fire Protection Piping

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04D.1		X											X					3			
Field Verification	1.04D.2		X													X						
Prep of Pipe	1.04D.2																		X			
Install of Pipe	1.04D.2																		3			
Cleaning & Painting	1.04D.2																		3			
Final Inspection	1.04D.2																		3			
Field Test	3.03A.1 &				X											X			3			
	4.01E																					
Oper. Test	3.03A.2 &				X											X			3			
	4.01F																					
Welding Procedure	4.01B		X																			
Welders Qualifications	4.01C		X																			
Mfr's Data	4.01D		X					30														

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

Date 4/13/94

WBS: 1.2.6
QA: QA

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Civilian Radioactive Waste Management System
Management and Operating Contractor

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Specification Section 15480

FIRST SUBMITTAL

COMPRESSED AIR SYSTEM

Document Identifier: BABBDA000-01717-6300-15480 Rev. 00
CI.16.2000
QA Classification: QA-NONE
This Specification Section includes QA Controls ☐ YES ☑ NO

Revision No.	Date
00	03/23/94

REFERENCE DOCUMENT - UNCONTROLLED

CRWMS/M&O

Certification of Specification

Complete only applicable items.

WBS: 1.2.6
QA: QA
Page: 2 Of:

TITLE OF SPECIFICATION
COMPRESSED AIR SYSTEM

DOCUMENT IDENTIFIER	REVISION NO.
BABBDA000-01717-6300-15480	00

QA CLASSIFICATIONS
QA-NONE

In accordance with established quality assurance procedures, signatures below certify that the above Specification was reviewed, verified and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted.

Previous work impacted by this revision:

☐ Yes ☑ No

If yes, identify attachment(s):

QAP-3-1 Review Conducted? ☐ Yes ☒ No

Russell E. Flye 3-23-94
Specification Preparer

Verifier Exemption Justification Attached?
☐ Yes ☐ Not Required

PREPARER Russell E. Flye	DATE 3-23-94	REVIEWER NA	DATE
CHECKER Chf L Yellen	DATE 3/23/94	REVIEWER NA	DATE
REVIEWER Donald F. Vanin	DATE 3-23-94	REVIEWER NA	DATE
REVIEWER NA	DATE	REVIEWER NA	DATE
REVIEWER NA	DATE	REVIEWER NA	DATE
REVIEWER NA	DATE	REVIEWER NA	DATE
VERIFIER N/A	DATE —	REVIEWER NA	DATE
QA CONCURRENCE Fred Auth	DATE 3-23-94	APPROVER [illegible]	DATE 3/23/94

QAP-3-8 0061 (10/30/93)

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	Revised Pages	Description

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 15480

COMPRESSED AIR SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for:

1. Refurbishing, modifying, inspecting, testing, and installing government furnished (GFE) air compressor units as specified herein and shown on the Drawings.

2. Design, fabrication, testing, and installation of compressed air system accessory components and piping as specified herein and shown on the Drawings.

B. The compressed air system shall provide compressed air at the Exploratory Studies Facility (ESF) for all surface and subsurface work activities during construction, operation, and site characterization testing. Also, emergency refuge supply air will be provided by the compressed air system. Equipment and work required to purify the compressed air for breathing quality air is not part of the scope of work under this Specification Section.

C. Compressed air shall be provided to a point-of-use chemical tracer injection system for usage in the test drilling at nominal pressure of 125 psig and with no particulate size larger than 3 microns. Additional filtration to less than 3 microns shall be provided at the point of use. Chemical tracer injection system scope of work is provided under Specification Section 15487. Work associated with the chemical tracer injection system is not part of the scope of work under this Specification Section.

D. The compressed air system shall be provided with 50 percent standby compressor capacity, and filtration units as shown on the Drawings.

E. The compressed air system design and installation shall provide access to all points, items, units and components that require testing, servicing, adjusting, removal, replacement, or repair.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 02225 Water Use for Construction and Operations

C. Section 15060 Mechanical Piping

D. Section 15190 Mechanical Identification

E. Section 15260 Piping Insulation

REFERENCE DOCUMENT - UNCONTROLLED

F. Section 15487 Chemical Tracer Injection System For Construction Compressed Air Usage

G. Section 16152 Electrical Requirements for Packaged Mechanical Equipment

1.03 REFERENCES

A. Refurbished equipment shall be brought into compliance with all applicable federal, state, and local codes and regulations.

B. All equipment specified herein shall be refurbished, installed, and tested in accordance with the standards and requirements of the following:

1. American Conference of Governmental Industrial Hygienists (ACGIH):

20th Edition	Industrial Ventilation Handbook

2. American Society of Mechanical Engineers/American National Standards Institute (ASME/ANSI):

a) ASME/ANSI B1.20.1-83	Pipe Threads, General Purpose (inch)
b) ASME/ANSI B16.5A-92	Pipe Flanges and Flanged Fittings
c) ASME/ANSI B19.3-91	Safety Standard for Compressors for Process Industries
d) ASME/ANSI B31.1-92	Power Piping
e) ASME/SEC VIII D1-92	Boiler and Pressure Vessel Code (BPVC), Rules for Construction of Pressure Vessels, Division 1

3. Code of Federal Regulations (CFR):

29 CFR 1910.95-92	Occupational Safety and Health Standards (OSHA)

4. National Electrical Manufacturers Association (NEMA):

a) NEMA MG 1-93	Motors and Generators
b) NEMA 250-85	Enclosures for Electrical Equipment (1000 volts maximum)

5. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

6. Uniform Building Code (UBC):

UBC-91	Uniform Building Code

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C. If there is a discrepancy between any of the requirements of this Specification Section and those stipulated in Paragraph 1.03B, the most stringent requirements shall apply. The Architect/Engineer (A/E) shall be apprised of all apparent discrepancies for resolution.

1.04 QUALITY ASSURANCE

A. Quality assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety. The minimization of the amount of hydrocarbons spilled during installation, testing, and operation will be provided by a separate design.

C. Tracers, fluids, and materials (TFM) used for construction and operations shall be controlled and monitored by an approved TFM plan in accordance with Specification Section 01600.

D. Water usage shall be controlled in accordance with Specification Section 02225.

E. Acceptance of Product

1. Receipt Verification: Visual inspection of the air compressor units, materials, and system accessory components. (WITNESS POINT)

2. Field Verification: Visual inspection of the installation and operational testing of the air compressor units, materials, and system accessory components. (WITNESS POINT)

PART 2 PRODUCTS

2.01 GENERAL

A. The compressor units and system accessory components shall be capable of continuous operation 24 hours/day at the designed rated capacities and pressures indicated on the Equipment Schedules shown on the Drawings.

B. The compressor unit and accessory manufacturer shall be Airnetics Engineering Co. (Contact: David Evans, (602) 273-1964); Inquipco (Contact: Richard Bosch, (702) 644-1700); or approved equal.

2.02 PACKAGED AIR COMPRESSOR UNITS

A. Refurbishing Requirements

1. Three packaged air compressor units are to be refurbished. Two units were originally manufactured in 1983 by Ingersoll-Rand Company in Davidson, North Carolina, and the other unit was originally manufactured in 1981 by Colt Industries, Quincy, Illinois. All components of the air compressor units shall be carefully inspected, tested for their intended operation, and repaired or replaced as necessary to provide the complete and workable air compressor units. After refurbishment, the air compressor units shall have a maintainable life of 15 years. Each

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compressor unit shall have a one (1) year written warranty starting from the date the unit is placed into service.

2. The rating of each existing air compressor is 1500 scfm at 125 psig for each unit. Each compressor is an electric motor driven, single stage oil injected (flooded) rotary screw type, complete with accessories, and is piped, wired, and baseplate mounted. Each compressor unit is totally self-contained. Electrical voltage rating is 4160 volts/3-phase/60 hertz. The maximum equipment envelope dimensions of the Ingersoll-Rand units are 156 inches in length x 84 inches in width x 108 inches in height, and for the Quincy unit, 180 inches in length x 72 inches in width x 149 inches in height.

3. Each unit shall be checked and serviced as necessary. All components such as inlet air filtration, compressor and motor assembly, pump pressurized coolant lubrication system, coolant separation system, discharge air after cooling system, motor starting control system including breaker and fuses, instrumentation, safety operating provisions, etc., shall be checked and serviced, refurbished, or replaced as necessary. Each compressor unit shall be recalibrated to deliver 1365 scfm at 150 psig. Each compressor unit shall be suitable for operation in a temperature range of -14 to 108 degrees F ambient.

B. Compressor Control Systems

1. General

a. Each compressor subsystem shall be provided with a local Manual Control Panel (MCP) that provides for independent compressor power, operation, and status monitoring. Each MCP shall be connected to a central Programmable Logic Controller (PLC), which shall be located in a shelter at the compressor equipment pa nd provide central manual and automatic operation of the compressors as specified herein and as shown in Figure 1. The PLC shall also be provided with the necessary hardware and software to communicate with an Ethernet Transmission Control Protocol/Internet Protocol (TCP/IP) network provided by others.

b. Each MCP shall operate in a local and remote mode of operation determined by a key-lock switch located at the panel. The panel shall be mounted in a NEMA 4 enclosure and shall include all the controls, indicators, power, and wiring required for independent operation of the complete air compressor and aftercooler package and as indicated on the Mechanical Compressed Air System Piping and Instrumentation Diagrams (P&IDs). The MCP can include the power control panel and components specified in Paragraph 2.03B.2.d. The local operation mode shall inhibit any remote operation of the associated air compressor but shall maintain remote monitoring of the analog and status instruments including the local/remote status of the compressor unit.

c. The MCP shall also provide central cable terminations for all instrument/control power, signal event, and control signals associated with each compressor unit. The terminations shall be provided on barrier strips which are convenient to eye-level servicing and without having to remove or displace other equipment in the local panel. Control and monitoring points shall be wired from each MCP to the central PLC per the Mechanical Compressed Air Systems P&IDs as specified herein. Spare cables will be included in the cable

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bundles between the MCP and the PLC and shall be provided with termination points at each end to meet the spare input/output (I/O) point capacity specified herein.

d. The PLC shall be provided as a central (supervisory) controller to operate all assigned future compressor units as specified. The PLC shall provide central signal conditioning, control, and data processing of the functions defined on the P&ID diagrams and as specified herein. The PLC shall be an Allen-Bradley PLC-5 midsize series or equivalent as a minimum and shall be provided with the hardware and software interface for real time operation with an Ethernet/TCP/IP network. The Ethernet network shall be provided by others.

e. The PLC shall be mounted in a NEMA 4 enclosure designed for wall mounting with all electrical connections provided to the unit with environmental connectors. Internal power, control, and signal wiring shall be properly shielded, isolated from each other, and terminated at barrier terminal strips. The cable terminations shall be convenient to eye-level servicing and without having to remove or displace other equipment in the enclosure. PLC enclosure equipment shall be of modular construction and easily serviceable and replaceable in the shortest possible time. The enclosure shall be provided with an electrical temperature controller to maintain the internal temperature within a range recommended by the PLC manufacturer and to maximize equipment lifetime. Access to the enclosure shall be for front access and servicing.

f. The following components shall be included in the PLC enclosure:

1) PLC processor and I/O components

2) Operator display and control panel

3) Electric temperature controller

4) Interface connectors to the field cables and power

5) Interface connector to an Ethernet fiber optic cable

6) Internal interface connector to support a field data terminal for programming the PLC

2. PLC Programmed Functions

a. The PLC shall be programmed to perform the following compressor control and data processing functions:

1) Compressor Operation Mode: Shall support operating mode selection, compression selection, compressor status, and start/stop commands in any of the following sub operating modes:

a) Manual Operation: Shall provide for selection and operation of any single compressor or group of compressors for independent operation. This mode backs up MCP operation at the PLC when in the remote position on the local/remote switch.

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b) Auto Operate: Shall automatically fail over to an available (assigned backup) compressor when any selected unit fails or goes off line. Compressor selection shall be from the same menu used for manual operation. The PLC program shall identify compressor units not available for automatic operation.

c) Compressor Management: Shall automatically select compressors with the least run-time hours once the number (quantity) of compressor units has been requested. Compressor management shall be selectable in the manual and auto modes. When in the Auto Operate mode, the program shall provide compressor fail-over to an assigned backup or to a compressor with the least run-time hours (as configured by the operator).

b. When switching from one mode of operation to another, the PLC program shall maintain the operation of compressors already running. The PLC shall issue warnings for any incompatibility between the operating compressors and the selected mode of operation and provide advisories for recommended actions. For example, if the only available backup compressor is down for servicing (MCP switch is in local), the PLC program shall advise the operator to operate in the manual mode, and operation in auto mode will be inhibited. When starting additional compressors or stopping operating units, the program shall also issue messages and advisories for any incompatibility with the operational mode such as the following:

1) No available backups - select manual mode

2) Select another backup - available back-ups are:

3) Re-select compressors - available compressors are:

4) Restart from the manual mode.

c. The PLC program shall provide manual and automatic start and stop options. Auto start shall automatically start each compressor in a controlled sequence. Each compressor operation shall be verified before subsequent units are started. Auto stop shall sequence the compressors off to minimize power transients.

1) Manual stops shall be issued to any single compressor unit unless in the auto mode.

2) In auto mode, the operator shall be prompted to reply if compressor operation is to continue. If yes, the program shall automatically start the backup compressor when the stop command is issued and ask that a new backup compressor be assigned. If no, the program shall transfer to the manual mode, where each compressor can be shut down individually.

d. Standby mode shall be initiated following power-up of the PLC and provide a menu of the following operations:

1) Select operation mode as described previously

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2) Select maintenance mode and PLC diagnostics: This mode shall provide for running PLC diagnostics with a field portable PC terminal connected to the PLC.

3) Select program mode: This mode shall provide for programming the PLC control logic, analog conversion, I/O configuration, alarm limits, and display assignments.

e. Special Data Processing: The PLC program shall maintain a permanent (non-volatile) record of the compressor run-time hours and displays the hours and compressor status adjacent to each compressor in the selection menu. The PLC shall provide for resetting the hours reading under password access. The PLC shall also maintain the averages of air flow, motor loading, temperatures, pressures, and analyzers for each compressor/aftercooler while running. A daily time-tagged activity log shall be maintained by the PLC for review at the PLC operator panel and for transfer to the host computer (Ethernet) on a daily or twice daily basis. Data trending shall also be provided for all parameters.

f. High-high, high, low, low-low, and rate of change alarm limits shall be settable for each analog measurement. Alarms shall be displayed at the PLC control and display panel and provided on the Ethernet. Alarms shall be provided with flashing indicators by the alarm value and an audible tone at the PLC. Alarm tones shall be cleared when acknowledged, but the alarm shall not clear until the data is back within operating range. All alarms shall be time-tagged for time of occurrence, acknowledgement, and when cleared. Operators shall be provided with the inputs to reset any compressor fault from the PLC and any terminal on the Ethernet.

3. Operational Requirements

a. Operator Panel: The operator panel shall be located internal to the PLC enclosure. The panel shall support a suite of operator selectable functions at the panel as follows:

1) Set Up: For initializing the PLC, selecting the modes of operation, and issuing primary commands to start and stop the compressor/aftercooler equipment as previously described.

2) Status Displays: For displaying primary compressor status/analog data. A set of displays shall provide the status and summary information of each compressor station, daily log of each compressor start/stop operations including the run-time hours, alarm log, average pressures, flow, and temperature. PLC OK/not OK status shall be indicated on the primary display.

b. Remote Operation: All compressor data and control functions shall be available at the PLC and for remote operation and control from any terminal or workstation on the Ethernet network. Compressor status shall be provided at the Ethernet in real time. Da data status shall be provided to the workstations on request or daily as configured. Access to the PLC shall be with password access.

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c. The control system shall be sized to handle up to six air compressor/aftercooler stations. Each station shall be provided with the instrumentation and controls as defined on the project P&IDs and herein. Additional compressors shall be automatically recognized, controlled, and monitored by the PLC system when connected.

d. The air compressor PLC shall include as a minimum signals to the central plant operator workstation consisting of:

1) Emergency stop switch indication

2) Motor overload relay tripped status indication

3) Motor bearing temperature switch status indication

4) Local/remote switch position status

5) Motor running status indication

6) Motor/fan vibration status.

e. Thirty percent I/O points shall be provided and wired in the PLC cabinet for the following I/O data types:

1) Discrete input

2) Discrete output

3) Analog input

4) Analog output

f. Provide for functional interlocks within the PLC logic to interface with other project systems such as the surface conveyor and Tunnel Boring Machine control system. Provide the following interlocks as a minimum with inhibits installed:

1) Discrete outputs from air compressor PLC:

a) Air compressors ready

b) Air compressors running

c) Spare.

2) Discrete inputs to air compressor PLC:

a) Air compressor start

b) Air compressor stop

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c) Spare.

C. Miscellaneous Requirements: Each compressor unit shall be provided with a 115 VAC automatic drain valve (ADV). The ADV shall have a timer with a water and dust resistant enclosure and built-in surge protection. The timer shall have a manual push-to-test button and LED indicators that verify valve operation by signaling "power on" and "drain open." Timer shall have a 0.5 to 45 minutes field adjustable dial. The ADV diaphragm shall be viton and the valve body shall have a full-port 7/16-inch drain orifice.

2.03 COMPRESSED AIR SYSTEM ACCESSORIES

A. General: Compressed air system accessories shall all be new, and shall be furnished and installed as specified herein and as shown on the Drawings. The system accessories shall include but not be limited to aftercoolers, receivers, coalescing filters, piping, and instrumentation. All components of the system shall be restrained to meet UBC Zone 4 seismic requirements and shall fully comply with NFPA requirements. The system accessory components shall be suitable for outdoor installation and operation.

B. Aftercooler/Air Receiver System

1. General Design

a. Each aftercooler, air receiver, and control panel shall be mounted on a common skid, pre-piped and pre-wired, such that the Contractor need only supply utilities and make tie-ins to form a complete modular system. Piping shall be in accordance with Article 2.05 of this Specification Section.

b. Each system shall have rated capacities and pressures as indicated on the Equipment Schedules shown on the Drawing. Total pressure drop through the system shall not exceed 3 psig.

c. Instrumentation to monitor airflow, temperature, and pressure and to control accessory functions shall be installed as shown on the Drawings.

d. The installation of each component shall allow provisions for service replacement of that particular component without the necessity of shutting down the whole system.

e. Modular system design shall meet UBC Zone 4 seismic requirements.

f. All outdoor motors rated above 10 horsepower shall be furnished with space heaters. Space heaters shall be of sufficient capacity to keep the motor windings and internal parts dry when the motors are not operating. Heaters shall be made from chrome steel or other non-corrosive material. Surface temperature of space heaters at rated voltage shall conform to maximum permitted by area classification but shall not exceed 200 degrees C. Space heaters shall be designed for operation at 120 VAC, single phase.

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2. Basic Design

a. Aftercooler

1) Aftercooler shall be an air cooled type capable of cooling compressed air discharge temperature to approximately 3 degrees F of the ambient air temperature.

2) Heat exchanger shall be constructed of coils of seamless copper tubes with aluminum fins. Provide flanges for air inlet and outlet connections.

3) Housing shall be rigid construction of 16 gage galvanized steel sheet minimum. Legs shall be of structural steel angle construction.

4) Propeller type fan with totally enclosed fan cooled (TEFC) motor. Fan guards shall meet OSHA safety regulations. Motor shall conform to NEMA MG-1 and shall be suitable for 460 volt/3-phase/60 hertz operation.

5) Units shall be rated for 200 psig at 400 degrees F.

6) Each aftercooler shall have the following features:

(a) Manual isolation valves at the inlet and outlet connections

(b) By-pass lines and valves to manually by-pass the aftercooler during extended winter operations as shown on the Drawings.

(c) A temperature switch to automatically shut down the aftercooler fan when the outside temperature drops to 40 degrees F and resume fan operation when the outside temperature reaches 60 degrees F.

(d) An automatic drain valve to open when compressed airflow is bypassed or when the compressor is off and the outside ambient temperature is below 40 degrees F.

(e) Control labels to show direction of operation using arrows and functional results (e.g., open, close). Rotary valve controls should open with a counterclockwise motion.

b. Moisture Separators

1) Each moisture separator shall be of centrifugal type, and shall be designed to remove/separate moisture from compressed air line by impingement with 99 percent efficiency.

2) The body shall be of cast construction, fitted with inlet/outlet heavy gauge steel flanged connections in a horizontal pipeline configuration. The centrifuge and anti-re-entrainment baffle shall be removable for inspection and cleaning. Moisture separator units shall be constructed in compliance with ASME Section VIII code "U" stamped. The unit shall be suitable for operation for up to 175 psig pressure.

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3) Each moisture separator shall be provided with a 115 VAC automatic drain valve as described in Paragraph 2.02C.

c. Compressed Air Receivers

1) Each receiver shall be a carbon steel horizontal tank rated at 175 psig, ASME Section VIII code "U" stamped, complete with pressure gauge, gauge cock, and pressure relief valve as shown on the Drawings. Inlet and outlet flange connections shall be provided.

2) Each receiver shall be provided with a 115 VAC automatic drain valve as described in Paragraph 2.02C.

3) The receiver size shall be as indicated on the Drawings.

d. Control Panel

1) A NEMA 4 control panel shall be mounted on the skid.

2) Panel shall contain a circuit breaker, motor starter, terminal strips, and transformer 460V-120V control voltage relays necessary to form a complete system as shown on the Drawings.

3) All controls shall be clearly labeled.

4) Enclosure shall be properly sealed against dust and moisture and shall be equipped with space heaters. Heating elements shall be metal-clad and shall be provided with thermal enclosures. Heating elements shall be designed for operation at 120 VAC, single phase.

C. Coalescing Filters Basic Design

1. Each multi-stage, coalescing compressed air filter shall be used to remove liquid water, solid particulate, liquid oil, and oil mists from the air. The filter shall have a theoretical filtration efficiency greater than 99.9999 (dry media @ ambient temperature) percent and be capable of removing particulate as small as 0.01 microns using DOP (dioctyl phthalate) penetration test to verify filter efficiency, as described in the ACGIH Industrial Ventilation Handbook.

2. Each filter shall use centrifugal separation and impingement to remove up to 99 + percent by weight of contaminants before the compressed air reaches the element, in order to prevent early clogging of the element, while limiting excessive pressure drop and to provide a long life between element replacements. Contaminants thus removed shall drain into an above-ground collection system and be disposed of in accordance with applicable EPA requireme

3. Filter elements shall consist of perforated support core and multiple layers of graded glass fiber coalescing medium which remove progressively smaller particles. Elements shall also include a drain layer that consists of a PVC coated polyurethane foam compatible with all

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PACKAGE 1D

M&O Civilian Radioactive Waste Management System
MANAGEMENT & OPERATING CONTRACTOR

REFERENCE SPECIFICATIONS

VOLUME 2 OF 2

90% DESIGN REVIEW

JULY 11, 1994

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WBS: 1.2.6
QA: QA

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 12/17/93

Civilian Radioactive Waste Management System
Management and Operating Contractor

Specification Section 16110

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01	10/29/93
02	11/19/93

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FCR 94/109	KW	2/24/94	OPEN
FR 94/196	PF	5/3/94	OPEN

NOTICE OF OPEN CHANGE DOCUMENTS			
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REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Title of Procurement Specification CONDUIT

Document Identifier: BAB000000-01717-6300-16110 Revision Number 02

QA Classifications: TBV-112

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ **No** ☑

If Yes, identify attachment(s):

Prepared by	Lizzie J. Fernandez	*Date*	11/23/93
Reviewed by	Lawrence R. Fan	*Date*	11/23/93
Reviewed by	Kenneth J. Herrell	*Date*	11/23/93
Reviewed by	Chris A. Sherrett	*Date*	11/23/93
Reviewed by	John H. Pye	*Date*	11/23/93
Verified by	Bharat G. Majmudar	*Date*	11/23/93
Approved by	Jerry J. Moy	*Date*	11/23/93
QA Approval	Robert Jackson	*Date*	11-24-93

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Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*
01	Page 4 Para 1.03B3 Change "NEMA TC 8-90 Extra Strength PVC Plastic Utilities Duct for Underground Installation" to "NEMA TC 6-90 PVC and ABS Plastic Utilities Duct for Underground Installation" Page 5 Para 2.01D Change "Schedule 40 or 80" to "DB 60" Page 6 Para 2.01H Add "60" between "DB" and "PVC" Page 6 Para 2.01N Change "TC 8" to "TC 6" Page 6 Para 2.02D Change "Schedule 40 to 60" to "DB 60" Page 6 Para 2.03D Change "TC 8" to "TC 6" Page 11 Para 3.05F3 Change "30 degrees or greater" to "greater than a 30 degree" Page 11 Para 3.05F4 Add "60" between "DB" and "PVC" Page 11 Para 3.05F4b Change "colored red" to "sprayed red on the top" Issued for Construction
02	Pages 1, 2, and 3 revised QA Classifications/Designator FROM TO QA Classification: MC TBV-112 QA: N/A QA QA Class: N/A QA Page 5 Para. 1.04B add QA Classification TBV-112

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16110

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all material, tools, equipment, and labor necessary for the supply and installation of Conduit as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements (Surface and Subsurface)

B. Section 02220 Trenching and Backfilling (Surface)

C. Section 03300 Cast-In-Place Concrete (Surface)

D. Division 16 Electrical (Surface and Subsurface)

1.03 REFERENCES

A. American National Standards Institute (ANSI):

1.	ANSI C80.1-90	Rigid Steel Conduit-Zinc Coated
2.	ANSI C80.3-91	Electrical Metallic Tubing-Zinc Coated

B. National Electrical Manufacturers Association (NEMA):

1.	NEMA FB 1-88	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
2.	NEMA RN 1-89	Polyvinyl-Chloride (PVC) Externally Coated Rigid Steel Galvanized Conduit and Intermediate Metal Conduit
3.	NEMA TC 6-90	PVC and ABS Plastic Utilities Duct for Underground Installation
4.	NEMA TC 9-90	Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation

C. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

REFERENCE DOCUMENT - UNCONTROLLED

D. Underwriters Laboratories, Inc. (UL):

1.	UL 1-85	Standard for Safety Flexible Metal Conduit
2.	UL 6-81	Standard for Safety Rigid Metal Conduit
3.	UL 360-86	Standard for Safety Liquid-Tight Flexible Steel Conduit
4.	UL 514B-89	Standard for Safety Fittings for Conduit and Outlet Boxes
5.	UL 651-89	Standard for Safety Schedule 40 and 80 Rigid PVC Conduit
6.	UL 797-83	Standard for Safety Electrical Metallic Tubing
7.	UL 1242-83	Standard for Safety Intermediate Metal Conduit

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-112)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Conduit products.

2. Field Verification: Dimensional/visual inspection of the installed Conduit products.

1.05 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling shall be conducted in accordance with Specification Section 01600.

PART 2 PRODUCTS

2.01 CONDUIT

A. Rigid Steel Galvanized Conduit (RSG): RSG shall comply with the requirements of ANSI C80.1.

B. PVC Externally Coated Rigid Steel Galvanized Conduit: Conduit shall conform to the requirements of NEMA RN 1.

C. Electrical Metallic Tubing (EMT): EMT shall be galvanized and comply with the requirements of ANSI C80.3 and UL 797.

D. Rigid Non-Metallic Conduit: Non-metallic conduit shall be DB 60 complying with the requirements of UL 651, rated for 90 degrees C wiring.

REFERENCE DOCUMENT - UNCONTROLLED

E. Flexible Metal Conduit: Flexible metal conduit shall be zinc-coated steel conforming to UL 1. Aluminum flexible conduit shall not be used.

F. Liquid-Tight Flexible Steel Conduit: Liquid-tight flexible conduit shall be flexible metal galvanized steel with a polyvinyl-chloride jacket. The entire assembly shall comply with the requirements of UL 360.

G. Intermediate Metal Conduit (IMC): IMC shall be zinc coated steel conforming to UL 1242.

H. Underground: Underground utilities duct shall be Type DB 60 PVC conforming to NEMA TC 6 or as indicated on the Drawings.

I. Minimum conduit size shall be 3/4 inch trade diameter above ground and 1 inch trade diameter in or under floor slabs unless otherwise noted on the Drawings.

2.02 FITTINGS

A. Fittings for metal conduits, electrical metallic tubing, or flexible metal conduit shall be cadmium or zinc coated and in compliance with UL 514B and NEMA FB 1.

B. Fittings for rigid metal conduit and IMC shall be threaded type. Split couplings are not acceptable.

C. Fittings for electrical metal tubing (EMT) shall be the compression type.

D. Fittings for DB 60 PVC conduit shall comply with UL 651.

E. Fittings for PVC utilities duct shall comply with NEMA TC 9.

F. USE OF CONDULETS SHALL BE PERMITTED WHEN CABLE BENDING RADIUS CRITERIA IS MET AND ALLOWED BY NATIONAL ELECTRICAL CODE. CAP 4/14/94 94/196

2.03 SELLER QUALITY CONTROL

A. The conduits shall comply with the referenced ANSI, NEMA, NFPA 70, and UL requirements pertaining to the materials, testing, and inspections.

B. Finished products shall be inspected by the seller before bundling for shipment. All material not meeting the requirements of this Specification Section is to be rejected.

C. Plastic ducts shall be inspected by the seller for compliance with dimensional and performance requirements of NEMA TC 6 and UL 651 and freedom from defects; e.g., visible cracks, holes, burns, foreign inclusions or other defects that could damage conductors or cables.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. All electrical installations shall be installed in a neat and workmanlike manner in accordance with this Specification Section, the Drawings, NFPA 70, and the manufacturer's written instructions.

REFERENCE DOCUMENT - UNCONTROLLED

B. The Buyer shall be responsible for coordinating conduit work to avoid interference between the trades.

C. Do not install conduit closer than 6 inches to any heat duct, hot water pipe, or other heated line.

D. The Buyer shall coordinate with other work such as mechanical, civil, structural, and electrical/instrumentation wire/cable, boxes, and panel work, as necessary to interface installation of electrical conduits and components.

3.02 APPLICATION

A. RGS conduit may be used in the following locations:

1. Above grade where exposed to mechanical damage

2. Below grade where maximum mechanical protection is required

3. Where underground runs emerge through floor slabs on grade

4. Where specifically required by NFPA 70

5. In concrete not containing additives that could cause corrosion or damage to the conduit (refer to Specification Section 03300).

B. Plastic coated rigid galvanized steel conduit may be used in the following locations:

1. In concrete containing additives that could cause corrosion or damage to the conduit

2. Below grade, direct buried

3. Below grade, concrete encased (where indicated)

4. All outdoor locations.

C. EMT may be used in the following locations:

1. Concealed locations in furred walls and ceilings, and in space above suspended ceilings

2. Exposed in unfinished areas where not exposed to mechanical damage.

D. Rigid non-metallic conduit may be used in the following locations:

1. Underground by direct burial

2. Underground with concrete encasement

3. Where underground runs emerge through floor slabs-on-grade for grounding systems and lightning protection circuits

REFERENCE DOCUMENT - UNCONTROLLED

4. Non-hazardous areas only where protected from physical damage.

E. Flexible metal conduit is to be used in dry locations for the connection of equipment subject to vibration or displacement.

F. Liquid-tight flexible metal conduit is to be used in wet or dry locations for the connection of equipment subject to vibration or displacement.

G. IMC may be used in the following locations:

1. Above grade

2. Below grade

3. Where underground runs emerge through floor slabs-on-grade

4. Where specifically allowed by NFPA 70

5. Embedded in concrete not containing additives that could cause corrosion or damage to the conduit.

H. Concealed fittings embedded in concrete, including all end bells, couplings, bends, etc., shall be specifically manufactured for use with the conduit installed.

3.03 CONCEALED CONDUIT INSTALLATION

A. All conduits installed shall be concealed in the building structure except that exposed conduits may be used in the following locations:

1. Motor and equipment connections

2. Electrical and mechanical equipment rooms and closets

3. Unfinished areas which may have painted walls and ceilings consisting of the basic building structure.

B. Concealed conduits shall be run parallel or perpendicular to the building lines and, where possible, with long sweep bends and offsets.

3.04 EXPOSED CONDUIT INSTALLATION

A. Route exposed conduits parallel or perpendicular to building lines with right-angle turns and symmetrical concentric bends.

B. Support: Exposed conduit shall have supports in accordance with NFPA 70.

1. Supports shall be wall brackets, ceiling trapeze hangers, clip-type fastening devices, or malleable iron straps. Plumber's perforated straps are not permitted as a means of support.

REFERENCE DOCUMENT - UNCONTROLLED

2. Secure supporting members by means of toggle bolts in hollow masonry; expansion bolts in solid masonry and concrete; machine screws, bolts, or welding on metal surfaces; and screw lag bolts, or through bolts on wood construction. In general, support of exposed conduit shall be with channels anchored to concrete building construction with 1/4 inch anchoring devices.

3. Support conduits and equipment independently. Do not support from water lines or other piping or from ductwork.

C. Penetrations

1. Wall penetrations shall be made perpendicular to the wall only.

2. Penetrations through fire rated walls shall be sleeved for the size of conduit. Seal opening around the conduit with UL listed fire stop material which is suitable for the use intended and maintains the fire rating of the wall.

3.05 ROUGH-IN WORK

A. Field Bends

1. Field bends made on RGS, IMC, EMT, or plastic coated RGS shall be made with an approved hickey or conduit bending machine. Crushed or deformed conduit shall not be used.

2. Field bends in non-metallic rigid conduit shall be made with the use of heat box, or use factory-fabricated elbows of radius indicated.

B. Conduit Sizes Not Indicated on the Drawings: Size conduits in accordance with NFPA 70 for the number and sizes of wires to be installed.

C. Liquid-tight flexible steel conduit shall be installed as follows:

1. Installation of liquid-tight flexible conduit shall be limited to short connections not exceeding 6 feet in length.

2. All liquid-tight flexible conduit shall be bonded with code gauge wire, No. 14 AWG minimum.

REFERENCE DOCUMENT - UNCONTROLLED

3. Conduit connections to motors and other equipment subject to vibration or movement shall be liquid-tight flexible steel conduit with suitable fittings. Each connection shall be of a minimum length as indicated in the table below:

Liquid-Tight Flexible Conduit Size (in.)	Approximate Inside Bend Diameter (in.)	Minimum Length (in.)
3/4	6	12
1	8	16
1-1/2	11	18
2	14	18
3	23	18

~~D. Underground Conduit Installation~~

~~1. Conduit in the ground shall be installed in compliance with the minimum cover requirement of Table 300-5 or Table 710-3(b) of NFPA 70.~~

~~2. Below grade conduits terminated under main service equipment, pad mounted transformers, and similar items on floor slabs or equipment bases shall extend a minimum of 2 inches above floor or base to prevent entry of water.~~

~~E. Conduit Expansion Joints: Provide conduit expansion joints with necessary bonding conductor at building expansion joints and where necessary to compensate for conduit or building thermal expansion and contraction. Expansion fittings shall be approved for the use intended and shall have a copper bonding jumper.~~

~~F. Buried Utility Duct Installation~~

~~1. Excavation for electrical ducts shall extend an adequate distance to provide sufficient space for construction operations and inspection of the work.~~

~~a. Excavation deeper than required shall be filled with soil compacted to the density requirement of backfill.~~

~~b. Excavation shall be timed to immediately precede the placing of conduits.~~

~~c. Before placing conduits, remove any rocks, debris, or other materials subject to corrosion, rot, or termite attack. Place a 3 inch layer of pipe bedding material conforming to Specification Section 02220 beneath the conduits.~~

~~2. Solvent weld all PVC conduit joints.~~

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(From BAB000000-01717-6300-16110)

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REFERENCE DOCUMENT - UNCONTROLLED

D. Underground Direct Buried Conduit Installation

1. Conduit in the ground shall be installed in compliance with the minimum cover requirement of Table 300-5 or Table 710-3(b) of NFPA 70.

2. Below grade conduits terminated under main service equipment, pad-mounted transformers and similar items on floor slabs or equipment bases shall extend a minimum of 2 inches above floor or base to prevent entry of water.

3. Excavation deeper than required shall be filled with soil compacted to the density requirement of backfill.

4. Excavation shall be timed to immediately precede the placing of conduits.

5. Before placing conduits, remove any rocks, debris, or other materials subject to corrosion, rot, or termite attack. Place a 3 inch layer of pipe bedding material conforming to Specification section 02220 beneath the conduits.

6. Backfill shall be in accordance with Specification Section 02220.

7. Install an underground tape warning system approximately one foot below finished grade in the trench above all underground conduits.

   a. Tape shall be polyethylene, minimum 6 inches wide, color-coded orange for communications and red for electric conduit, with printing to identify the type of lines below.

8. Rigid metallic conduit shall be in accordance with Paragraph 3.02.B.

E. Conduit Expansion Joints: Provide conduit expansion joints with necessary bonding conductor at building expansion joints and where necessary to compensate for conduit or building thermal expansion and contraction. Expansion fittings shall be approved for the use intended and shall have a copper bonding jumper.

F. For Buried Utility Concrete Encased Duct Installation Refer to Specification Section 16112.

1. Solvent weld all PVC conduit joints.

2. When a change of direction of greater than a 30 degree angle with an inside radius of 5 feet or less is made in an underground duct, the PVC conduit shall be replaced with rigid metallic conduit at that point. Rigid metallic conduit shall be in accordance with Paragraph 3.02B.

REFERENCE DOCUMENT - UNCONTROLLED

~~3. When a change of direction of greater than a 30 degree angle with an inside radius of 5 feet or less is made in an underground duct, the PVC conduit shall be replaced with rigid metallic conduit at that point. Rigid metallic conduit shall be in accordance with Paragraph 3.02B.~~

~~4. All Type DB-60 PVC underground conduit shall be encased in concrete.~~

~~a. Place concrete, taking care not to displace or damage PVC conduits.~~

~~b. Concrete shall be sprayed red on the top for all electrical duct banks.~~

~~c. Concrete shall extend at least 3 inches beyond the edges of the outermost conduit in a duct bank and 3 inches over the top of the conduits.~~

~~5. Backfill shall be in accordance with Specification Section 02220.~~

~~6. Install an underground tape warning system approximately one foot below finished grade in the trench above all underground conduits.~~

~~a. Tape shall be polyethylene, minimum 6 inches wide, color coded orange for communications and red for electric conduit, with printing to identify the type of lines below.~~

~~b. For PVC conduit use polyethylene tape with a metallic core.~~

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G. Termination: Conduits that enter outlet boxes or cabinets shall be firmly fastened with double lock nut and insulated bushings.

H. Conduit Identification

1. At the load end of each conduit, tag the conduit indicating voltage level, number, and source (MCC, panel, etc.) of the circuit in the conduit.

2. Conduits containing emergency circuits shall be identified with blue tape adhered to the outside of the conduit with the words "EMERGENCY" in black every 10 feet along the length of the conduit.

I. Empty Conduit Systems

1. Provide a pulling string such as installed by a jetline gun in all empty conduit runs.

2. Identify conduit use and opposite end termination point with suitable tag attached to line at each end and held in position with plastic penny and plastic bushing.

3. Plug or seal empty conduit from underground duct banks to prevent drainage or gas from entering any manhole or building.

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Attachment 1, Page 2 of 3
(From REFERENCE DOCUMENT 16UA)

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J. Wiring

1. Clean conduits prior to pulling wire by pulling a swab through the conduit.

2. Wire pulling lubricant, where needed, shall be non-corrosive, non-combustible, completely safe for use on all insulations and UL listed. Unapproved materials containing oil or water shall not be used.

3.06 FIELD QUALITY CONTROL

The Buyer shall perform field inspection while work is in progress and final inspection to assure compliance with the technical and quality requirements of the Specification Sections and the Drawings.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the Buyer for the Architect/Engineer (A/E) prior to final acceptance.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16110

TITLE: Conduit

Requirements	Paragraph	STATUS						TIMING											NOTIFICATION			
		INFORMATION	REVIEW	CERTIFICATION	RECORD			PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED	PRIOR TO FINAL ACCEPTANCE			WITNESS (DAYS)	HOLD (DAYS)		
Receipt Verification	1.04C.1		X							X												
Field Verification	1.04C.2		X													X						
Field Inspection	4.01B	X													X							

COMMENTS:

END OF SPECIFICATION SECTION

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By [illegible] Date 1/5/94

WBS: 1.2.6
QA: QA

Civilian Radioactive Waste Management System
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FIRST SUBMITTAL

Specification Section 16112

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UNDERGROUND DUCTS AND MANHOLES

CI.16.2000

Document Identifier: BABBDA000-01717-6300-16112 REV 00
QA Classification: TBV-153

Revision No.	Date
00	~~12/20/93~~ 12/21/93 BA
	12/20/93

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NOTICE OF OPEN CHANGE DOCUMENTS			
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CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS
FCR 94/098	SRB	2/25/94	OPEN
FCR 94/123	mw	3/8/94	OPEN
FCR 94/139	mw	3/16/94	OPEN
FCR 94/163	[illegible]	4/4/94	OPEN
FCR 94/197	YK	5/3/94	OPEN

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Title of Procurement Specification UNDERGROUND DUCTS AND MANHOLES

Document Identifier: BABBDA000-01717-6300-16112 Revision Number 00

QA Classifications: TBV-153

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s): _____

Prepared by	Bharat H. Majmudar	*Date*	12/20/93
Reviewed by	Judith Shane	*Date*	12/20/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	Leslie J. Fernandez	*Date*	12/21/93
Approved by	[illegible]	*Date*	12/21/93
QA Approval	N/A Fred Ott	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

WBS: 1.2.6

QA Class: C

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16112

UNDERGROUND DUCTS AND MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all material, tools, equipment, and labor necessary for the installation of the Underground Ducts and Manholes as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 02220 Excavation, Trenching and Backfilling

C. Section 03300 Cast-In-Place Concrete

D. Section 16050 Basic Electrical Materials and Methods

E. Section 16110 Conduit

1.03 REFERENCES

A. American National Standards Institute (ANSI):

ANSI C2-93 National Electrical Safety Code

B. American Society for Testing and Materials (ASTM):

1. ASTM A48-92 Standard Specification for Gray Iron Castings
2. ASTM C33-92 Standard Specification for Concrete Aggregates
3. ASTM C144E1-91 Standard Specification for Aggregate for Masonry Mortar
4. ASTM C150-92 Standard Specification for Portland Concrete
5. ASTM C478BE1-90 Standard Specification for Precast Reinforced Concrete Manhole Sections
6. ASTM C857-87 Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
7. ASTM F512-89 Standard Specification for Smooth-Wall Poly Vinyl Chloride (PVC) Conduit and Fittings for Underground Installation

REFERENCE DOCUMENT - UNCONTROLLED

C. National Electrical Manufacturers Association (NEMA):

1. NEMA RN 1-89 Poly Vinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

2. NEMA TC 6-90 PVC and ABS Plastic Utilities Duct for Underground Installation

3. NEMA TC 9-90 Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation

4. NEMA TC 10-90 PVC and ABS Plastic Communications Duct and Fittings for Underground Installation

E. National Fire Protection Association (NFPA):

NFPA 70-93 National Electrical Code

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-153)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Underground Ducts and Manholes equipment and components.

2. Field Verification: Dimensional/visual inspection of the installed Underground Ducts and Manholes. (HOLD POINT)

PART 2 PRODUCTS

2.01 ELECTRICAL UNDERGROUND DUCT

A. The electrical underground ducts shall be type DB 60 PVC or PVC coated rigid steel galvanized (RSG) conduit, rated for use with 90 degrees C conductors and encased in concrete sprayed red on the top for electrical duct bank and sprayed orange on the top for communication ductbank.

B. The electrical ducts and fittings shall comply with ASTM F512, NEMA TC 6, NEMA TC 9, NEMA TC 10, and NEMA RN 1.

C. The electrical underground duct spacers, fittings, accessories, rebars, and sizes shall be as indicated on the Drawings.

REFERENCE DOCUMENT - UNCONTROLLED

1. Electrical duct bank spacers shall be non-metallic with capability of interlocking spacers in both the horizontal and vertical planes. Spacers will accommodate a minimum spacing of 3 inches between conduits.

2. Non-metallic spacers shall be used with maximum outside dimension and comply with ASTM F512.

D. The electrical underground duct bank concrete shall comply with the requirements ~~of Specification Section 03300.~~ as indicated in the notes of drawing BABBD0000-01717-2100-20028.

E. For the PVC type DB-60 and the PVC coated rigid galvanized steel conduits with fittings refer to Specification Section 16110.

2.02 MANHOLES

A. Precast Concrete Manholes

1. Manholes shall conform to the requirements of ASTM C478.

2. All concrete shall conform to ASTM C150, Type II.

3. Joint sealant between manhole sections and between the base and the first section shall be a premolded bitumastic material expressly manufactured for that purpose.

4. Grout for jointing the sections shall be composed of Portland Cement conforming to ASTM C150 and sand meeting the requirements of ASTM C144.

5. Manhole bases may be either cast-in-place or precast. If cast-in-place, the concrete shall conform to Specification Section 03300.

6. Manholes shall have embedded horizontal inserts for cable support.

7. Manhole shapes, inside dimensions, necking and shaft sections, windows for duct entry, and inserts for cable racks, and cable rack location shall be as indicated on the Drawings.

8. The manholes shall be complete with drain sump, pulling irons, two knock-outs for ground rods, and galvanized steel ladder with "J" hook top for hanging purposes as indicated on the Drawings.

9. The manholes shall be complete with a 30 inch diameter cast iron cover suitable for heavy duty traffic, top precast concrete grade ring, 36 inch diameter opening, 12 inches high with a notch to receive a 3/4 inch diameter galvanized steel step unless otherwise indicated on the Drawings.

10. Sump pits shall be installed in all manholes.

11. All manholes shall be designed for heavy traffic designation A-16 (HS20-44) per ASTM C857.87.

REFERENCE DOCUMENT - UNCONTROLLED

B. Manhole Accessories: The manhole covers, frames, and sump covers shall comply with ASTM A48, Class 30B gray cast iron, machine finished with flat bearing surfaces.

2.03 SUPPLIER QUALITY CONTROL

The electrical underground ducts and manholes shall comply with the requirements pertaining to the materials, testing and inspections of the codes and standards referenced in Article 1.03 of this Specification Section.

PART 3 EXECUTION

3.01 INSTALLATION

A. All Underground Ducts and Manholes shall be installed in a neat and workmanlike manner in accordance with this Specification Section, the Drawings, ANSI C2, NFPA 70, and the manufacturer's written instructions.

B. The Buyer shall be responsible for coordinating the installation of the Underground Ducts and Manholes to avoid interference between the trades.

C. Install the electrical underground duct banks with a minimum grade of 4 inches per 100 feet or as indicated on the Drawings.

D. The electrical underground duct shall terminate in end bells at the pullbox or manhole entries as indicated on the Drawings.

E. When a change of direction greater than a 30 degree angle is made in an underground duct, the PVC conduit shall be replaced with rigid metallic conduit and required fittings at that point (refer to Specification Section 16110).

F. For the installation of the PVC Type DB-60 and PVC coated rigid galvanized steel conduits and fittings refer to Specification Section 16110.

G. Duct spacer shall be interlocked horizontally and/or vertically consistent with the Supplier's installation instructions for maximum vertical shear plane. Minimum of three spacers shall be installed in each 20 foot length section.

H. Underground Duct Banks

1. Excavation for electrical ducts shall extend an adequate distance to provide sufficient space for construction operations and inspection of the work.

2. Excavation deeper than required shall be filled with soil compacted to the density requirement of backfill refer to Specification Section 02220. In confined areas around manholes, place minus 3/4" concrete aggregate around the base of the manholes up to the elevation where compaction and testing of select backfill can be accomplished without interference from the sides of the trench.

HAA 2/23/94

FCR # 94/123

3. When placing concrete encasement, encase from one end of the duct section toward the other end, to allow the free end to move. Never encase from the ends of the section toward the center.

4. A minimum of 3 inches of concrete shall be provided covering the bottom, tops and side of the electrical duct banks.

3.02 PRECAST CONCRETE MANHOLES

A. Precast concrete manholes shall be installed and sealed in accordance with the manufacturer's written instruction.

B. Install all manholes plumb.

C. Set the top of each manhole cover to the finished elevation as indicated on the Drawings.

D. Use precast neck and shaft sections to bring the manhole entrance to proper elevation.

3.03 MANHOLE ACCESSORIES

A. Install ground rods with the top protruding 4 inches above the manhole floor. Bond all non-current carrying metallic parts for the manhole to the ground rod with number ~~6~~ #4/0 AWG bare copper, stranded wire. Connection shall be by exothermic weld. 94/163

B. The manhole exterior surfaces, joints and interruptions shall be waterproofed after the concrete has cured. ~~28 days minimum (refer to Specification Section 03300).~~ Concrete curing shall be in accordance with the recommendations of the manufacturer of the waterproofing material which is used. CAP 3/8/94 94/139

C. Attach cable racks to inserts after the manhole installation is completed as indicated on the Drawings and in the manufacturer's written instructions.

3.04 IDENTIFICATION

A. ~~All underground~~ Electrical duct banks shall be encased in concrete ~~colored red~~ sprayed red on the top. Communication duct banks shall be encased in concrete sprayed orange on the top. REH 1/25/94

B. Install an underground tape warning system ~~approximately one foot below finished grade in the trench above~~ as shown on the drawing for all electrical underground duct banks. The tape shall be polyethylene minimum 6 inches wide, color-coded red for all electrical ducts, with printing to identify the type of lines below. 94/139

C. The manhole cover shall be lettered with "ELECTRICAL" centered along the diameter of the cover. The circumference of the cover shall be lettered "CONFINED SPACE CONTACT THE FIELD OPERATIONS CENTER (FOC)".

FCR 94/163
Attachment 1, Page 1 of 1

3.05 FIELD QUALITY CONTROL

The Buyer shall perform field inspection while work is in progress to ensure compliance with the technical and quality requirements of the Specification Section and the Drawings.

FCR # 94/098
Attachment "C", Page 1 of 1

FCR 94/139
Attachment 1, Page 1 of 1

REFERENCE DOCUMENT - UNCONTROLLED

PART 4 SUBMITTAL AND NOTIFICATION

01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the Buyer for Architect/Engineer (A/E) review. ~~(WITNESS POINT)~~ GAP 4/22/94

C. Manufacturer's data, shop drawings, and test reports shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

FCR# 94/197 ATTACHMENT 3, PAGE 1 OF 2

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16112

TITLE: Underground Ducts and Manholes

Requirement	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD	TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE	NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)
Receipt Verification	1.04C.1		X								X					
Field Verification	1.04C.2		X											X		3
Field Inspection	4.01B	X											X			3
Field Tests	4.01B		X											X	~~14~~	4
Mfr.'s Data	4.01C		X				30									
Shop Drawings	4.01C		X				30									
Test Reports	4.01C			X										X		

COMMENTS:

END OF SPECIFICATION SECTION

FCR# 94/197 ATTACHMENT 3, PAGE 2 OF 2

REFERENCE DOCUMENT - UNCONTROLLED

WBS: 1.2.6
QA: QA

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By [illegible] Date 12/17/92

Civilian Radioactive Waste Management System
Management and Operating Contractor

RECEIVED

FEB 3 1994

DOCUMENT AND RECORDS CENTER

Specification Section 16122

FIRST SUBMITTAL

600 V POWER AND CONTROL CABLE

CI.16.0000

Document Identifier: BAB000000-01717-6300-16122
QA Classification: TBV-112

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NO. 102150
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Revision No.	Date
00	09/21/93
01	10/20/93
02	10/29/93
03	11/19/93

REFERENCE DOCUMENT - UNCONTROLLED

NOTICE OF OPEN CHANGE DOCUMENTS			
THIS DOCUMENT IS IMPACTED BY THE LISTED CHANGE DOCUMENT AND CANNOT BE USED WITHOUT THEM			
CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS
FCR94/197	dl	5/3/94	OPEN

NOTICE OF OPEN CHANGE DOCUMENTS			
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CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS

BAB000000-01717-6300-16122

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Title of Procurement Specification 600 V POWER AND CONTROL CABLE

Document Identifier: BAB000000-01717-6300-16122 Revision Number 03

QA Classifications: TBV-112

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s): _____

Prepared by	Lessie J. Fernandez	*Date*	11/23/93
Reviewed by	Donald Varner	*Date*	11-23-93
Reviewed by	Kenneth J. Herold	*Date*	11/23/93
Reviewed by	Robert A. Schmidt	*Date*	11/23/93
Reviewed by	John H. Pye	*Date*	11/23/93
Verified by	Bharat G. Majmudar	*Date*	11/23/93
Approved by	Jerry T. Mott	*Date*	11/23/93
QA Approval	Robert Gantner	*Date*	11-24-93

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Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*
01	Page 4 Para. 1.03B change "30 CFR 56 and 57" to "30 CFR 57-92"
02	Issued for Construction
03	Pages 1, 2, and 3 revised QA Classifications/Designator FROM TO QA Classification: MC TBV-112 QA: N/A QA QA Class: N/A QA Page 5 Para. 1.04B add QA Classification TBV-112

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16122

600 V POWER AND CONTROL CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for the installation of the 600 V Power and Control Cable as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

Division 1 General Requirements

Division 16 Electrical

1.03 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronics Engineers, Inc. (ANSI/IEEE):

ANSI/IEEE 141-86	Recommended Practice for Electric Power Distribution for Industrial Plants

B. American Society for Testing and Materials (ASTM):

1. ASTM B1-90	Standard Specification for Hard-Drawn Copper Wire
2. ASTM B3-90	Standard Specification for Soft or Annealed Copper Wire
3. ASTM B8-90	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Code of Federal Regulations (CFR):

30 CFR 57-92	Safety and Health Standards for Underground Metal and Nonmetal Mines

D. National Electrical Manufacturers Association (NEMA):

1. NEMA WC 7-88	Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
2. NEMA WC 8-88	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

REFERENCE DOCUMENT - UNCONTROLLED

E. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

F. Underwriters Laboratories, Inc. (UL):

1.	UL 44-91	Standard for Rubber-Insulated Wires and Cables, Twelfth Edition
2.	UL 83-91	Standard for Thermoplastic-Insulated Wires and Cables, Ninth Edition
3.	UL 854-91	Standard for Service-Entrance Cables, Eighth Edition
4.	UL 493-88	Standards for Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables, Seventh Edition
5.	UL 1581-91	Reference Standard for Electrical Wires, Cables, and Flexible Cords, First Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-112)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the 600 V Power and Control Cable.

2. Field Verification: Dimensional/visual inspection of the installed 600 V Power and Control Cable.

1.05 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling shall be in accordance with Specification Section 01600.

PART 2 PRODUCTS

2.01 MATERIALS

A. The 600 V Power and Control Cables shall, as a minimum, meet the requirements of ASTM, NFPA 70, NEMA, and UL standards as referenced.

REFERENCE DOCUMENT - UNCONTROLLED

B. 600 V Power and Control Cable, Surface

1. Single-Conductor, Power, Control, and Lighting

   a. Single-conductor, power, control, and lighting wire and cable shall be 600 V, for use in wet and dry locations as indicated on the Drawings.

   b. Wire and cable as a minimum shall be rated for 75 degrees C for dry and wet locations.

   c. Conductors for power and lighting branch circuits shall be not smaller than No. 12 AWG. No. 10 and No. 12 AWG conductors for power and lighting branch circuits shall be solid. No. 8 AWG conductors and larger shall be stranded. Power and lighting conductors shall be 600 volts type THW, XHHW, or THWN.

   d. Conductors rated at 90 degrees C in accordance with NFPA 70 shall be RHH, THW, or THHN. Conductors in higher temperature areas shall be type FEP or TFE as indicated on the Drawings.

   e. All motor leads and control leads shall be stranded.

   f. The control circuits shall be copper 14 AWG minimum, stranded, THW or THHN insulation.

2. Direct-burial conductors shall be type UF complying with UL 493.

3. Bonding and grounding conductors shall be solid, bare copper for size No. 8 AWG and smaller complying with ASTM B1. Bonding and grounding conductors No. 6 AWG and larger shall be Class B, stranded copper complying with ASTM B8.

4. Conductors for interior electrical systems shall be copper.

5. Multi-Conductor Power Cable

   a. Multi-conductor power cable shall be rated 600 V for use in wet and dry locations as indicated on the Drawings. Minimum size of conductors shall be No. 12 AWG.

   b. The cables shall consist of three or four conductors with full-size bare copper ground built into the cable.

   c. The conductors shall be Class B copper, stranded, in accordance with ASTM B8 in all sizes as indicated on the Drawings.

   d. Insulation shall be in accordance with NEMA WC 7 or NEMA WC 8.

   e. The overall jacket shall be heavy-duty hypalon or neoprene having high resistance to tearing, punctures, moisture, ozone, oil, and chemicals.

REFERENCE DOCUMENT - UNCONTROLLED

C. 600 V Power and Lighting Cable, Subsurface

1. The power and lighting cable shall be multi-conductor, rated 600 V, Type TC with THHN conductors, sunlight-resistant, low smoke emission, and capable of continuous operation at 90 degrees C for dry locations and 75 degrees C for wet locations as indicated on the Drawings. Minimum size of conductor shall be No. 12 AWG.

2. The power conductors shall be cabled round with grounding conductors.

D. 600 V Control Cable, Subsurface

1. The control cable shall be multi-conductor, rated 600 V, sunlight-resistant, low smoke emission, Type RHH, THW, or THHN, cable tray rated, capable of continuous operation at a conductor temperature of 90 degrees C for dry locations and 75 degrees C for wet locations.

2. The cable shall be a minimum size of No. 14 AWG stranded.

2.02 REMOTE CONTROL AND SIGNAL CABLE

A. The conductor shall be Class B, soft or annealed concentric copper complying with ASTM B3 and ASTM B8.

B. All remote control and signal cable shall comply with NFPA 70.

C. Control cable for Class 1 remote control and signal circuits shall be copper conductor, 600 V insulation. Conductor sizes and types shall be as indicated on the Drawings but not smaller than No. 18 AWG.

D. Control cable for Class 2 or Class 3 remote control and signal circuits shall be copper conductor. 300 V insulation, rated 60 degrees C, individual conductors twisted together, shielded, and PVC jacketed.

E. Plenum cable for Class 2 or Class 3 remote control and signal circuits shall be copper conductor. 300 V insulation, rated 125 degrees C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket. Cable shall be UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.03 IDENTIFICATION AND MARKING

All wire and cable shall bear the UL label and marking as required by NFPA 70.

2.04 SUPPLIER QUALITY CONTROL

The Supplier shall comply with UL 1581 and UL 44 for Rubber-Insulated Wires and Cables, UL 83 for Thermoplastic-Insulated Wires and Cables, and UL 854 for Service-Entrance Cable pertaining to the materials, construction, and performance test requirements for the 600 V Power and Control Cables.

PART 3 EXECUTION

3.01 INSTALLATION

A. The 600 V Power and Control Cable installed shall comply with referenced ASTM, NEMA, UL, NFPA 70, and 30 CFR 56 and 57 (for cables installed in the subsurface) standards, the Drawings, this Specification Section, and the manufacturer's written instructions.

B. Install a bare or green insulated copper grounding conductor, No. 12 AWG minimum, with each electrical circuit, sized in accordance with NFPA 70 requirements or as indicated on the Drawings.

C. Bending radius of insulated wire or cable shall be not less that the minimum recommended by the manufacturer. Maximum pull tension of wire or cable shall not exceed the manufacturer's recommended values.

D. Care shall be exercised while installing wire in conduits so as not to damage the conductor insulation. Pulling compounds may be used in pulling conductors and shall be used if wire is pulled by mechanical means (refer to Specification Section 16110).

E. Portal entry 600 V Power and Control Cable shall be installed in such a manner as to preclude kinking, excess tension, and crushing of the insulation.

F. Splicing of wire: If splicing is necessary, it shall be done in an accessible pull, junction, or outlet box.

1. Splices shall provide a firm mechanical and electrical connection.

2. Insulation value of splice shall equal that of the conductor insulation.

3. Conductor shall be inserted full depth into pressure-type lug or wrapped two-thirds to three-quarters around the binding screw for breakers and other equipment supplied with terminals.

   a. Wire nuts shall be used as taps to lighting fixtures.

   b. Termination or splice device shall be approved by the manufacturer for use with the conductor material to be installed.

4. No splicing of the 600 V Power or Control Cables shall be allowed without written acceptance from the Buyer.

G. Splices and Connection to Devices: A minimum of 8 inches of conductor shall be left in boxes.

H. Direct burial cables connected to above-ground junction or terminating boxes shall be encased in rigid steel conduit from the elevation of the cable to the box.

REFERENCE DOCUMENT - UNCONTROLLED

3.02 IDENTIFICATION

A. Color Coding: Grounded conductors and grounding conductors shall be color coded in accorda with NFPA 70.

1. Phase conductors for 3 phase feeders and motor branch circuits shall be color coded as follows:

   a. 120/208, 240 Volt:
      1) Phase A: Black
      2) Phase B: Red
      3) Phase C: Blue
      4) Neutral: White
      5) Ground: Green

   b. 277/480 Volt:
      1) Phase A: Brown
      2) Phase B: Orange
      3) Phase C: Yellow
      4) Neutral: Gray
      5) Ground: Green

2. Where insulation pigmentation or coding is not available for large conductor sizes, use a colored plastic tape and wrap in a spiral half-lap manner to identify the exposed conductor

3. Conductors for 120/240 V single phase feeders and branch circuits shall be as follows:

   a. Phase 1: Black
   b. Phase 2: Red
   c. Neutral: White
   d. Ground: Green

4. Control and power multi-conductor cable shall comply with NEMA WC 7, Appendix K, Table K-2.

3.03 FIELD QUALITY CONTROL

A. The Contractor shall perform field inspection while work is in progress and a final inspection to assure compliance with the technical and quality requirements of this Specification Section and other applicable documents.

B. Field Testing: All power and control cables shall be tested in accordance with applicable testi requirements contained in referenced codes and standards or defined in this Specification Section.

REFERENCE DOCUMENT - UNCONTROLLED

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. All records of the following shall be submitted to the Buyer for Architect/Engineer (A/E) review.

1. Shop and field tests ~~(WITNESS POINT)~~ GAP 4/22/94

2. Shop and field inspection

3. Cable data sheets

4. Manufacturer's catalog cut sheets.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

FCR# 94/197 ATTACHMENT 1, PAGE 1 OF 2

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16122		STATUS						TIMING											NOTIFICATIO	
TITLE: 600 V Power and Control Cable		INFORMATION	REVIEW	CERTIFICATION	RECORD			PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED	PRIOR TO FINAL ACCEPTANCE			WITNESS (DAYS)	HOLD (DAYS)
Requirements	Paragraph																			
Receipt Verification	1.04C.1		X										X							
Field Verification	1.04C.2		X													X				
Field Tests	4.01B.1		X													X			** Bryan 9/14/94	
Shop Tests	4.01B.1			X							X									
Field Inspection	4.01B.2	X												X						
Shop Inspection	4.01B.2	X								X										
Cable Data Sheets	4.01B.3				X			30												
Mfr.'s Catalog Cuts	4.01B.4		X						30											

COMMENTS:

END OF SPECIFICATION SECTION

FCR # 94/197 ATTACHMENT 1, PAGE 2 OF 2

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

Civilian Radioactive Waste Management System
Management and Operating Contractor

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FIRST SUBMITTAL

Specification Section 16130

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PULL AND JUNCTION BOXES

Document Identifier: BAB000000-01717-6300-16130 Rev. 00
CI.16.0000
QA Classification: TBV-125

Revision No.	Date
00	01/04/94

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class:

Page: 2 of:

Title of Procurement Specification PULL AND JUNCTION BOXES

Document Identifier: BAB000000-01717-6300-16130 Revision Number 00

QA Classifications: TBV-125

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Bharat H. Majmudar	*Date* 12/16/93
Reviewed by	Yuri A. Shiraev	*Date* 12/16/93
Reviewed by	N/A	*Date*
Reviewed by	N/A	*Date*
Reviewed by	N/A	*Date* 1/4/94 LF 1/4/94
Verified by	Luis J. Fernandez	*Date* ~~12/16/93~~ LF 12/21/93
Approved by	[illegible]	*Date* ~~12/21/93~~ 1/4/94 RP
QA Approval	Fred Arth	*Date* ~~12-21-93~~ 1-5-94

QAP-3-8 *This form may be reproduced locally.* 0061 (07/17/92)

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16130

PULL AND JUNCTION BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for the installation of the Pull and Junction Boxes as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 16050 Basic Electrical Materials and Methods

C. Section 16110 Conduit

D. Section 16122 600 V Power and Control Cable

E. Section 16190 Supporting Devices

F. Section 16195 Electrical Identification

1.03 REFERENCES

A. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

B. Underwriters Laboratories, Inc. (UL):

UL 50-92	Standard for Safety Cabinets and Boxes, Ninth Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. Products covered by this Specification Section shall be considered not important to radiological waste isolation or radiological safety. (TBV-125)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Pull and Junction Boxes.

REFERENCE DOCUMENT - UNCONTROLLED

2. Field Verification: Dimensional/visual inspection of the installed Pull and Junction Boxes.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Pull and Junction Boxes as a minimum shall meet the requirements of UL 50 and NFPA 70.

B. Pull or Junction Boxes for dry interior locations shall be cast metal boxes or sheet steel boxes with phosphatized surfaces and gray enamel finish inside and outside.

1. Sheet steel boxes for outdoor locations and continuously damp indoor locations shall have a hot-dip galvanized finish, gasketed cover, and welded seams.

2. Physical size of all sheet metal pull boxes shall be as required by NFPA 70 for the number and size of conduits permitted, unless specified larger on the Drawings.

3. Sheet metal Pull Boxes shall have metal gages as defined in UL 50.

C. Junction or Pull Box covers shall be secured to the box by screws, bolts, or the equivalent in lieu of hinges.

PART 3 EXECUTION

3.01 INSTALLATION

A. All Pull and Junction Boxes shall be purchased and installed in accordance with NFPA 70, UL 50, this Specification Section, the Drawings and the manufacturer's written instructions.

B. Install connectors, fittings, and boxes in such a manner that shall seal out foreign matter.

C. Furnish and install Pull Boxes:

1. For conduit runs of more than 100 feet or with more than three right-angle bends where indicated on Drawings.

2. Mounting of enclosures and boxes for electrical apparatus shall be set true and plumb and shall be secured rigidly to building, structural steel, rock surface, masonry walls, or floors by approved attachment methods (refer to Specification Section 16190). The supporting devices shall be independent of the conduits entering or leaving the boxes or enclosures. Mounting heights from finished floor to centerline of electrical apparatus shall be as indicated on the Drawings.

3. Provide Pull or Junction Boxes in the wiring and raceway systems wherever required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures as indicated on the Drawings.

REFERENCE DOCUMENT - UNCONTROLLED

D. Junction or Pull Boxes shall be provided with means for connection of an equipment grounding conductor.

1. If an equipment grounding terminal or terminal assembly is intended for field installation, the Junction or Pull Box in which the termination or assembly is intended to be used shall be marked to indicate:

   a. The catalog or type number of the terminal or assembly intended to be used therein; and

   b. Proper installation instructions and information stating the wire size of terminals available.

2. The marking required by item 3.01 D.1.b may be provided on or in the individual shipping package or carton of the terminal or terminal assembly instead of on the box.

3. Cast metal Junction or Pull Boxes need not be provided with means for connection of an equipment grounding conductor when shown on the Drawings as not required.

3.02 FIELD QUALITY CONTROL

The Buyer shall perform field inspection while work is in progress and a final inspection to ensure compliance with the technical and quality requirements of the Specification Sections and the Drawings.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the Buyer for Architect/Engineer (A/E) review.

C. Manufacturer's data, shop drawings, and test reports shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in the Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16130

TITLE: Pull and Junction Boxes

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.2		X													X						
Field Inspection	4.01B	X													X							
Mfr.'s Data	4.01C		X						30													
Shop Drawings	4.01C				X				30													
Test Reports	4.01C		X													X						

COMMENTS:

END OF SPECIFICATION SECTION

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

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Specification Section 16131

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OUTLET BOXES

Document Identifier: BAB000000-01717-6300-16131 Rev. 00
CI.16.0000
QA Classification: TBV-125

Revision No.	Date
00	01/04/94

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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Page: 2 of:

Title of Procurement Specification OUTLET BOXES

Document Identifier: BAB000000-01717-6300-16131 Revision Number 00

QA Classifications: TBV-125

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Bharat H. Mahimadar	*Date*	12/16/93
Reviewed by	Yuri A. Shiner	*Date*	12/16/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	1/4/94 LF 1/4/94
Verified by	Sam J. Fernandez	*Date*	12/16/93 12/21/93 LF
Approved by	[illegible]	*Date*	12/21/93 1/4/94 RLP
QA Approval	~~AA~~ 1-6-94 Fred Aitt ~~AA~~ 1-6-94	*Date*	~~12-21-93~~ 1-5-94 FCA

CAP-3-8 *This form may be reproduced locally.* 0081 (07/17/92)

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16131

OUTLET BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for the installation of the Outlet Boxes as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 16050 Basic Electrical Materials and Methods

C. Section 16122 600 V Power and Control Cable

D. Section 16195 Electrical Identification

1.03 REFERENCES

A. National Electrical Manufacturers Association (NEMA):

NEMA OS 1-89	Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

B. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

C. Underwriters Laboratories, Inc. (UL):

UL 514A-91	Standard for Safety Metallic Outlet Boxes, Seventh Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. Products covered by this Specification Section shall be considered not important to radiological waste isolation or radiological safety. (TBV-125)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Outlet Boxes.

REFERENCE DOCUMENT - UNCONTROLLED

2. Field Verification: Dimensional/visual inspection of the installed Outlet Boxes.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Outlet Boxes and miscellaneous hardware shall, as a minimum, meet the requirements of NEMA OS 1, NFPA 70, and UL 514A. All items shall be new.

B. Outlet Boxes for flush wall-mounted devices shall be standard galvanized steel type at least 2 1/8 inches deep, single or gang style with appropriate cover, of the size to accommodate the device indicated on the Drawings.

C. Outlet Boxes for surface mounted devices shall be a minimum of 4 inches square sheet steel or a cast box, single or gang style, and equipped with an appropriate sheet metal cover.

D. Outlet Boxes for receptacles for continually damp indoor locations, and all outdoor locations, shall be cast boxes with a cast cover equipped with a neoprene gasketed spring door.

E. Boxes for other than lighting fixture outlets shall not be less than 4 inches square, except that 4 inch by 2 inch boxes may be used where only one raceway enters the outlet. Telephone outlets shall be a minimum of 4 inches square by 1 1/2 inches deep.

F. All surfaces of a ferrous metal box and all attached ferrous metal parts of a box including screws, ferrous metal box cover, and ferrous flush device cover plate shall be protected against corrosion with a zinc or cadmium coating on the interior and exterior surfaces (except tapped holes, the area under the heads of screws securing the sides of a gangable device box, pierced holes and cut edges formed from zinc-coated stock, and bar hangers made of steel bar stock).

2.02 SELLER QUALITY CONTROL

The Seller shall comply with UL 514A requirements pertaining to the construction, tests, assembly, and marking of Outlet Boxes.

PART 3 EXECUTION

3.01 INSTALLATION

A. All boxes and miscellaneous hardware shall be installed in accordance with NFPA 70, this Specification Section, the Drawings, and the manufacturer's written instructions.

B. Boxes shall be provided in accordance with NFPA 70 in the wiring and raceway systems wherever required for pulling wires, making connections, and mounting of devices or fixtures.

REFERENCE DOCUMENT - UNCONTROLLED

C. Mounting of enclosures and boxes for electrical apparatus shall be set true and plumb and shall be secured rigidly to the building structural steel, masonry walls, or floors by approved attachment methods. Mounting heights from finished floor to centerline of electrical apparatus shall be as indicated on the Drawings.

D. Provision for supporting a device within the Outlet Box shall be independent of the means used to support the box.

3.02 IDENTIFICATION

Identification marking shall be in accordance with Specification Section 16195.

3.03 FIELD QUALITY CONTROL

The Buyer shall perform field inspection while work is in progress and a final inspection to ensure compliance with the technical and quality requirements of the Specification Section and Drawings.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections performed and shall be provided to the Buyer for Architect/Engineer (A/E) review.

C. Manufacturer's data shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in the Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16131

TITLE: Outlet Boxes

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD	STATUS:	STATUS:	TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE	TIMING:	TIMING:	NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)	NOTIFICATION:	NOTIFICATION:
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.2		X													X						
Field Inspection	4.01B	X													X							
Mfr.'s Data	4.01C		X					30														

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

WBS: 1.2.6
QA: QA

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 12/17/93

Civilian Radioactive Waste Management System
Management and Operating Contractor

RECEIVED

FEB 3 1994

DOCUMENT AND RECORDS CENTER

Specification Section 16141

FIRST SUBMITTAL

WIRING DEVICES

CI.16.0000

Document Identifier: BAB000000-01717-6300-16141
QA Classification: TBV-112

FIELD CONTROLLED COPY
NO. 102150
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Revision No.	Date
00	09/21/93
01	10/29/93
02	11/19/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Title of Procurement Specification WIRING DEVICES

Document Identifier: BAB000000-01717-6300-16141 Revision Number 02

QA Classifications: TBV-112

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Leslie J. Fernandez	*Date*	11/23/93
Reviewed by	Donald Vanica	*Date*	11-23-93
Reviewed by	Kenneth J. Herold	*Date*	11/23/93
Reviewed by	Robert A. Schmidt	*Date*	11/23/93
Reviewed by	John H. Pop	*Date*	11/23/93
Verified by	Bharat H. Majmudar	*Date*	11/23/93
Approved by	Jerry F. Kim	*Date*	11/23/93
QA Approval	Robert Jenkins	*Date*	11-24-93

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*
01	Issued for Construction
02	Pages 1, 2, and 3 revised QA Classifications/Designator FROM TO QA Classification: MC TBV-112 QA: N/A QA QA Class: N/A QA Page 4 Para. 1.02 add Division 1 Page 5 Para. 1.04B add QA Classification TBV-112

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16141

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for the installation of the Wiring Devices as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 16050 Basic Electrical Materials and Methods

C. Section 16122 600 V Power and Control Cable

D. Section 16130 Pull and Junction Boxes

E. Section 16131 Outlet Boxes

F. Section 16195 Electrical Identification

1.03 REFERENCES

A. Federal Specifications (FS):

FS W-S-896E-88	Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification)

B. National Electrical Manufacturers Association (NEMA):

1. NEMA ICS 4-83	Terminal Blocks for Industrial Use
2. NEMA WD 1-83	General Requirements for Wiring Devices

C. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

D. Underwriters Laboratories, Inc. (UL):

UL 20-86	General-Use Snap Switches

REFERENCE DOCUMENT - UNCONTROLLED

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-112)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the wiring devices.

2. Field Verification: Dimensional/visual inspection of the installed wiring devices.

1.05 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling shall be in accordance with Specification Section 01600.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials, equipment, and devices shall, as a minimum, meet the requirements of NEMA WD 1, UL 20, and NFPA 70. All items shall be new.

B. Switches: Toggle switches for lighting circuits shall be single-pole and double-pole, single-throw or three-way, 120-277 VAC, UL listed with grounding means and in accordance with FS W-S-896E.

C. Receptacles

1. Convenience or ground fault receptacles for 120 volt, single-phase wall outlets shall be general grade, two-pole, three-wire, grounding type, 125 volts AC or DC, UL listed, NEMA Configuration 5-20R.

2. Receptacle strips shall be located as indicated on the Drawings and shall be of NEMA Configuration 5-20R, three-wire, single circuit, 6 inch spacing, 48 inch length, UL listed.

3. Dedicated receptacle load shall be as indicated on the Drawings.

4. Receptacles and cover plates powered from emergency power panels shall be red.

5. All isolated ground outlets shall be orange.

D. Cover plates for surface-mounted devices in unfinished areas shall be galvanized steel.

E. Cover plates for wiring devices in outdoor, subsurface areas, and indoor damp locations shall be of cast material and equipped with a neoprene gasketed spring door.

F. Cover plates for flush-mounted devices in finished areas shall be ivory colored plastic in general occupancies.

G. Device plates for telephone and intercommunication outlets shall have a 3/8 inch bushed opening in center.

H. Terminal Blocks and Accessories

1. Terminal blocks and accessories shall be UL listed and comply with the requirements of NEMA ICS 4 and as indicated on the Drawings.

2. Terminal blocks shall be suitable for copper conductor connections.

3. The terminal block connecting capacity, including the type and number of conductors, shall be as indicated on the Drawings.

2.02 SELLER QUALITY CONTROL

The wiring devices shall comply with the requirements of the referenced NEMA and UL standards pertaining to the materials, testing, and inspections.

PART 3 EXECUTION

3.01 INSTALLATION

A. The electrical installation shall be in accordance with NFPA 70, this Specification Section, the Drawings, and the manufacturer's written instructions.

B. Receptacle strips, switches, and receptacles shall be plumb and centered with regard to drywall and similar conditions.

3.02 IDENTIFICATION

Identify and mark all device plates with the panel and circuit number as specified in Specification Section 16195.

3.03 FIELD QUALITY CONTROL

Prior to final inspection, replace all cracked, chipped, or burned devices or cover plates or damaged devices.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the Buyer for the Architect/Engineer (A/E) prior to final acceptance.

C. Manufacturer's data, shop drawings, and test reports shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16141		STATUS						TIMING											NOTIFICATION			
TITLE: Wiring Devices		INFORMATION	REVIEW	CERTIFICATION	RECORD			PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED	PRIOR TO FINAL ACCEPTANCE			WITNESS (DAYS)	HOLD (DAYS)		
Requirements	Paragraph																					
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.2		X													X						
Field Inspection	4.01B	X													X							
Mfr's Data	4.01C		X						30													
Shop Drawings	4.01C		X						30													
Test Reports	4.01C				X											X						

COMMENTS:

END OF SPECIFICATION SECTION

WBS: 1.2.6
QA: QA

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 12/17/93

Civilian Radioactive Waste Management System
Management and Operating Contractor

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Specification Section 16152

FIRST SUBMITTAL

PACKAGED MECHANICAL EQUIPMENT

CI.16.0000

Document Identifier: BAB000000-01717-6300-16152
QA Classification: TBV-112

FIELD CONTROLLED COPY
NO. 102150
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Revision No.	Date
00	09/08/93
01	10/29/93
02	11/19/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Title of Procurement Specification PACKAGED MECHANICAL EQUIPMENT

Document Identifier: BAB000000-01717-6300-16152 Revision Number 02

QA Classifications: TBV-112

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s): _____

Prepared by	Louis J. Fernandez	*Date*	11/23/93
Reviewed by	Donald Vanica	*Date*	11-23-93
Reviewed by	[illegible]	*Date*	11/23/93
Reviewed by	Robert A. Schmidt	*Date*	11/23/93
Reviewed by	John H. Pye	*Date*	11/23/93
Verified by	Gordon Eberhard	*Date*	11/23/93
Approved by	[illegible]	*Date*	11/23/93
QA Approval	[illegible]	*Date*	11-24-93

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*
01	Issued for Construction
02	Pages 1, 2, and 3 revised QA Classifications/Designator FROM TO QA Classification: MC TBV-112 QA: N/A QA QA Class: N/A QA Page 4 Para 1.02 delete Sections 16050 and 16195 Page 6 Para. 1.04B add QA Classification TBV-112 Page 10 Add Para. 2.02F6 Page 11 Para. 2.02H3 Add "All panel door(s) shall be hinged and self-supporting in the open positions." Page 16 Para. 2.0201 Add "Emergency and warning nameplates shall be mounted to the equipment which presents the hazard and shall be conspicuously displayed."

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16152

PACKAGED MECHANICAL EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes the furnishing of all materials, tools, and labor necessary to install Packaged Mechanical Equipment as specified herein and indicated on the Drawings.

B. The work included in this Specification Section describes basic electrical requirements, materials. and work to be performed in the electrical design and construction/fabrication of Packaged Mechanical Equipment. This Specification Section is specifically applicable to Division 15. This Specification Section applies to all Specification Sections of all Divisions unless specified otherwise in the individual Specification Section.

C. It shall be the responsibility of the Seller to select the proper combination of components and to assemble them into coordinated units which shall withstand the environments and operating requirements stipulated in Division 1. Equipment to be supplied shall be standard design of the manufacturer. All units supplied under the same item shall be identical and interchangeable.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

1.03 REFERENCES

A. All equipment shall comply with all applicable federal, state, and local codes and regulations.

B. All equipment specified herein shall be designed, manufactured, and tested in accordance with the applicable standards and requirements of the following:

1. American National Standards Institute (ANSI):

   a. ANSI C2-93 — National Electrical Safety Code

   b. ANSI C80.1-90 — Rigid Steel Conduit - Zinc Coated

   c. ANSI C80.5-90 — Rigid Aluminum Conduit

2. American Society for Testing and Materials (ASTM):

   a. ASTM B1-90 — Standard Specification for Hard-Drawn Copper Wire

   b. ASTM B2-88 — Standard Specification for Medium-Hard-Drawn Copper Wire

c. ASTM B3-90 — Standard Specification for Soft or Annealed Copper Wire

d. ASTM B8-90 — Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

e. ASTM B193-87 — Standard Test Method for Resistivity of Electrical Conductor Materials

f. ASTM D469-89 — Standard Specification for Natural Rubber Heat-Resisting Insulation for Wire and Cable, 75 Degrees C Operation

g. ASTM D2633-82 — Standard Methods of Testing Thermoplastic Insulations and Jackets for Wire and Cable

h. ASTM D3032-91 — Standard Test Methods for Hookup Wire Insulation

3. American Welding Society (AWS):

AWS QC3-89 — Standard for AWS Certified Welders

4. Factory Mutual Engineering and Research Corporation (FM):

FM Approval Guide-93 — A Guide to Equipment, Materials and Services Approved by Factory Mutual Research for Property Conservation

5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

IEEE 100-92 — Standard Dictionary of Electrical and Electronics Terms, Fourth Edition

6. Instrument Society of America (ISA):

ISA RP60.8-78 — Electrical Guide for Control Centers, Recommended Practice

7. National Electrical Manufacturers Association (NEMA):

a. NEMA 250-85 — Enclosures for Electrical Equipment (1000 Volts Maximum)

b. NEMA AB1-86 — Molded Case Circuit Breakers and Molded Case Switches

c. NEMA AB3-84 — Molded Case Circuit Breakers and Their Application

d. NEMA EW5-87 — Guidelines for the Preparation of the Material Safety Data Sheets for Welding Consumables and Related Products

e. NEMA FB1-88 — Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

f.	NEMA ICS1-88	General Standards for Industrial Control and System
g.	NEMA ICS2-88	Industrial Control Devices, Controllers and Assemblies
h.	NEMA ICS4-83	Terminal Blocks for Industrial Use
i.	NEMA ICS6-88	Enclosures for Industrial Control and Systems
j.	NEMA 0S1-89	Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
k.	NEMA KS1-90	Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
l.	NEMA PB2.2-88	Application Guide for Ground Fault Protective Devices for Equipment
m.	NEMA WC55-86	Instrumentation Cables and Thermocouple Wire (ICEA No. S-82-552)
n.	NEMA WD1-83	General Requirements for Wiring Devices

8. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

C. References listed in each Specification Section of each Division to which this Specification Section applies shall be included.

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to safety or waste isolation. (TBV-112)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Packaged Mechanical Equipment components shall be conducted.

2. Field Verification: Dimensional/visual inspection of the installation and operational testin the Packaged Mechanical Equipment components shall be conducted. (HOLD POINT)

PART 2 PRODUCTS

2.01 DESIGN AND CONSTRUCTION

A. All electrical equipment shall be new and complete. The electrical equipment shall be designed, constructed, installed, and tested in accordance with reference standards in Paragraph 1.03B. All equipment shall be guaranteed to be free of defects in materials and workmanship.

B. All electrical material and equipment shall be listed or labeled by Underwriters Laboratories, Inc. (UL), FM, or equivalent testing laboratory for the service in which it is used, and shall bear their label or listing. Material and equipment not available with such label or listing shall be built in accordance with the latest published standards of UL, FM, or equivalent testing laboratory.

C. The manufacturer shall provide a complete material list for all electrical equipment and materials for Architect/Engineer (A/E) review.

D. All packaged equipment shall operate successfully at its design load horsepower at the ambient temperature and altitude specified in Division 1.

E. All packaged equipment shall be designed and constructed to withstand the environmental conditions specified in Division 1.

2.02 FABRICATION

A. Equipment

1. Seller shall furnish, prepare, and prewire all components necessary for the complete and proper operation of the packaged equipment.

2. Motor starters, disconnect switches, and contactors shall be furnished for mechanical equipment packages except for 120 VAC usage, as specifically requested in the Mechanical Specification Sections or Attachments.

3. All devices requiring external connections shall be routed to terminals in a junction box or control panel. Separate terminal boxes shall be provided for:

   a. 120 VAC power and control circuits.

   b. Thermocouple circuits, which shall be wired to a separate thermocouple terminal box. Shields shall be wired to separate terminal points.

   c. DC analog, AC analog, RTDs, digital signal, or measuring circuits may occupy the same instrumentation terminal box, but shall be terminated on separate terminal blocks. Shields shall be wired to separate terminal points.

REFERENCE DOCUMENT - UNCONTROLLED

B. Power Supplies and Voltages

1. Nominal ratings of power supplies available to supply the packaged equipment are as follo

   a. 208Y/120 VAC, 3-phase, 60 Hz

   b. 480 V, 3-phase, 60 Hz.

2. Incoming power to main control panel shall terminate at a properly rated main breaker providing both overload and short circuit protection as required per NFPA 70 Article 240.

3. When power is required for movable equipment, it shall be supplied through reels, trolleys, or plugs furnished by the Seller.

4. Equipment shall be designed for a short circuit current of 42,000 amperes rms symmetrical at 480 VAC unless indicated otherwise on the Drawings or Attachments. All circuit breakers applied at 480 VAC shall be rated to interrupt 42,000 amperes RMS symmetrical as a minimum, unless indicated otherwise on the Drawings or Attachments.

5. The Seller shall supply the necessary transformers, associated switching, and protection equipment for voltages other than those listed in Paragraph 2.02B.1.

6. Control circuits shall be 120 VAC, 60 Hz, grounded neutral unless specified otherwise.

7. If voltages other than 120 VAC are required for control devices or instruments, the Seller shall furnish the necessary transformers or devices to produce such voltages.

8. The voltage to ground on any instrument device for control and/or indication shall not exceed 120 VAC. Normal instrument power shall be 120 VAC, 60 Hz, single-phase.

C. Motors

1. In general, motors furnished with packaged equipment shall be high power factor and high efficiency, designed for full-voltage, across-the-line starting.

2. Fractional horsepower motor loads less than 1/2 HP may be rated 115/230 VAC, unless noted otherwise on the Drawings or Attachments. The Seller shall provide all necessary control, protective, and switching equipment for these motors.

D. Motor Starters

1. Motor starters for all motors in packaged mechanical equipment shall be combination moto starters furnished by the Contractor, unless noted otherwise on the Drawings or Attachmen

REFERENCE DOCUMENT - UNCONTROLLED

2. When the Seller provides motor starters, the following requirements apply:

   a. Starters shall be magnetic, combination type, with motor circuit protector, full-voltage, across-the-line starting duty, rated to interrupt 42,000 amperes available short circuit amperes (minimum), RMS symmetrical at 480 VAC. Individually enclosed non-combination starters shall not be used.

   b. Starters shall have 120 VAC, single-phase, 60 Hz control transformers. Control transformers shall be fused in accordance with NFPA 70 Article 430-72(c).

   c. Control circuits having a control power transformer shall be wired such that one leg of the secondary transformer is grounded, and no contacts other than the overload contacts shall be wired between the starter coil(s) and the ground leg. The ungrounded leg of the secondary transformer shall be properly fused.

   d. Control power transformers shall have 50 VA extra capacity above the minimum required size.

   e. Magnetic contactors, where used, shall be applied in combination with properly rated thermal-magnetic type circuit breakers to protect the associated cables and loads.

E. Control Equipment and Devices

1. Indicating lights shall be of the transformer type with 6 volts AC incandescent lamps. Indicating lights shall be of the push-to-test type unless the Seller has included a lamp test circuit.

2. Pushbuttons and selector switches for indoor installations shall be heavy-duty, dust and oil-tight construction mounted in NEMA type 12 enclosures in accordance with NEMA 250.

3. Pushbuttons and selector switches for outdoor installation shall be heavy-duty, dust and oil-tight construction mounted in NEMA type 4 enclosures.

4. Device mounting requirements for devices requiring operation by an operator shall be semiflush mounted on doors or panels for dead front operation.

5. Control relays shall be rated 600 VAC. Relay coils shall be 120 VAC, 60 Hz. or 125 VDC (when DC is specified on the Attachments or Drawings). Contacts shall be rated 10 amps minimum continuous at rated contact voltage. When acceptable to the A/E, a 5 A rating may be acceptable.

6. In addition to contacts required by the system, relays shall have two spare convertible contacts for the A/E's exclusive use.

7. Controls shall be mounted on supports (racks) that will not transmit vibration to the control device. In general, these supports shall not be mounted on the machinery or attached to its base.

REFERENCE DOCUMENT - UNCONTROLLED

8. Control devices shall be heavy duty industrial type.

F. Enclosures and Miscellaneous Material

1. Enclosures shall be constructed of adequate gauge to assure rigidity and durability and shall be steel, aluminum, or stainless steel. Enclosures shall meet the requirements defined by NEMA 250 and NEMA ICS 6.

2. All miscellaneous material such as channel, angle, strut, hanger rods, clamps, angle clips, etc., shall be fiberglass-reinforced polyester or steel.

3. All attachment hardware such as bolts, nuts, screws, washers, etc., shall be stainless steel or cadmium plated steel.

4. All junction boxes, terminal boxes, enclosures for relays, and enclosures for controls shall be properly sealed against the entrance of dust and moisture and shall be equipped with breathers and drains. Space heaters shall be installed where required.

5. Enclosures for electrical equipment shall be suitable for the environment in which they will be located as stated in Division 1, and shall be as follows:

a. Indoor Unclassified Locations	NEMA Type 12
b. Outdoor Unclassified Locations	NEMA Type 4
c. Indoor/Outdoor Corrosive Areas	NEMA Type 4X

6. All exposed corners and edges shall be rounded to prevent personnel injury during installation, deinstallation, and maintenance.

G. Heating Elements

1. Heating elements shall be metal-clad and shall be provided with thermal enclosures to prevent exposure of live parts.

2. Heating elements to 1800 watt rating shall be rated for 120 VAC, single-phase operation. Higher wattage heaters shall be suitable for 208 or 480 VAC, three-phase operation as indicated on the Drawings.

H. Control Panel

1. Where a control panel is furnished by the Seller, the panel shall be a complete control syst and sized for ease of maintainability, and cabinet fans and vents shall be used to dissipate day heat generated by its components. Instrumentation and controls piped and wired to heaters and terminal blocks shall be included. Piping shall be separated from electrical by a physic barrier.

2. Pushbuttons and indicating lights shall be furnished and wired on control panel(s) for start-up of all motors associated with driven equipment.

3. All doors shall be pan type construction. Doors shall be fully gasketed to keep the panels free of dust. All panel door(s) shall be hinged and self-supporting in the open positions.

4. Free-standing upright control panels shall be provided with an internal light and a 120 VAC duplex polarized receptacle wired to a junction box or terminal block to be fed from an external power source as indicated on the Drawings. Safety ground shall be installed to meet the requirements of NFPA 70 Article 250 and NEMA PB2.2.

I. Wire and Cable Types

1. All wire and cable shall meet the applicable requirements of NFPA 70.

2. Wire and cable as a minimum shall be rated 90 degrees C (194 degrees F) for dry and 75 degrees C (167 degrees F) for wet for locations as indicated on the Drawings.

3. All power, motor, and control leads shall be stranded.

4. Cable conductors for power service 0-600 volts shall be black, type THHN, No. 12 AWG minimum, rated for 600 VAC, 3 wire plus equipment grounding conductor.

5. Conductors for 120 VAC motor control circuits, interlocks, etc., shall be 600 VAC, type THHN, No. 14 AWG minimum.

6. Conductors for lighting service 0-600 volts shall be type THHN, No. 12 AWG minimum.

7. Electronic instrument wire shall be a twisted pair, or triad, not smaller than No. 16 AWG 7-strand copper conductor with No. 18 AWG 7/S tinned copper drain wire, 90 degrees C, PVC primary insulation, aluminum 100 percent shield, 80 degrees C jacket.

8. Individual pair thermocouple extension wire shall be a twisted pair No. 16 solid alloy conductor, 105 degrees C primary insulation, aluminum 100 percent overall shield, 80 degrees C jacket. The extension wire shall be of material compatible with the thermocouple and color coded per NEMA WC55.

9. Control panel wiring (internal) shall meet the applicable requirements for switchboard wire, type SIS insulation. Minimum wire size shall be No. 14 AWG, unless specified otherwise on the Drawings.

J. Circuit/Wire Identification

1. Each circuit and wire shall be identified at each end and in all junction, terminal, and pull boxes with the proper identifying number. Identifying labels shall be firmly attached to the cable, wire, or wires and shall be of a permanent nonweathering type.

2. An individual wire shall have the same assigned number at each end and at each location where it is terminated.

3. Wire Color Coding

   a. Single Phase, AC

Line	- Black
Neutral	- White

   b. DC Circuits (Power and Control)

Positive Leads and Buses	- Red
Negative Leads and Buses	- Black

   c. Thermocouple Wiring - Per NEMA WC55

   d. Insulated Grounding Conductors - Green

   e. Combination Starter Terminal No.

Hot - 1	- Black
Ground - X2	- White
Coil-Hot - 3	- Red
Coil - Neutral (6)	- Orange

   f. Annunciation (AC or DC)

Signal	- Orange
Common	- Black

4. Where it is necessary to terminate 120 VAC (nominal) or higher voltage circuits in control panels, terminal boxes, or other enclosures containing lower voltage conductors, the higher voltage conductors shall be isolated with an insulating cover or barrier and identified with a label showing the voltage and the service.

K. Terminal Box and Control Panel Wiring Details

1. All control wiring external to enclosures shall be terminated within the enclosures using insulated spade lugs on devices with screw-type terminals. Terminals shall be sized to the current carrying requirements of the conductor. Splicing any circuits is not permitted.

2. Wire and cable shall be neatly dressed with nylon ties and shall be free from nicks or cuts in the copper conductor. Plastic wire duct may be used as an alternative to nylon ties. Self-adhesive "stick-on wire" tie bases are not acceptable.

3. All wiring shall be suitably sized for the service intended and each end of each conductor shall be permanently tagged in accordance with the schematic and wiring diagrams with plastic, printed wire markers.

4. A maximum of two conductors per terminal shall be permitted. This includes all internal panel wiring plus terminal allowance for all external wiring normally required.

5. A minimum of 25 percent spare terminals shall be provided in all terminal boxes and control panels.

6. Terminal and junction boxes shall be sized per NFPA 70, Article 370 for the maximum number of terminations in the box (including the 25 percent spares mentioned above) and based on two No. 14 AWG wires per terminal.

7. Control panel wiring shall be done in a neat and professional manner and shall be laced and/or secured in wireways. Wiring shall be collected and gathered wherever possible; however, control and power wiring shall not be intermixed.

8. All thermocouple extension wiring connections to terminal blocks shall be made without lugs. Thermocouple terminal blocks shall be specifically designed for the thermocouple-type wire. Thermocouple wires shall be twisted together or welded on the hot end only. No other contacts between the bare wire shall be made.

9. Wiring shall be long enough inside junction boxes to allow for relocation to other terminals without splices.

L. Miscellaneous Wiring Details

1. Wire nuts shall not be used. Splices in junction boxes or at lighting fixtures shall be made with self-insulated, crimp-type connectors. These connections shall be waterproofed with rubber tape and vinyl plastic electrical tape to prevent the entrance of moisture into the connector.

2. Splices or taps shall be avoided in power or control wiring. In general, wire or cable shall be installed in a single continuous length from termination point to termination point. Wire shall not be spliced in conduit under any conditions.

3. All splices and terminations of thermocouple wiring shall be made with terminal blocks specifically designed for the particular type of thermocouple wire. Individual pair shields shall be kept isolated and continuous at all points except that the shield of each pair shall be bonded to the thermocouple well.

4. When dressing individual shielded multipair or triad cable at termination points, tape shall be installed on stripped pairs or triads to prevent unraveling of wrapped coverings.

5. Shielded wires shall contain no splices between terminating points.

6. Special care shall be exercised to isolate all shields from ground except at the common grounding point and to keep positive and negative signal leads close together and twisted. Shields shall be wired to separate terminal points.

7. Instrument wiring shall be in separate conduits from power wiring.

8. No open wiring or exposed live parts shall be allowed. All live parts or equipment subject to arcing shall be guarded by a grounded metal enclosure.

9. All devices requiring periodic operator adjustment, (e.g., timers, overloads, resets), shall be accessible without a need to open/enter areas containing exposed live parts.

10. Relays, fuses, or other devices shall not be installed in wire raceways, junction boxes, pull boxes, or other enclosures intended for routing and/or connecting wires.

11. All wiring connections to screw-type terminal blocks shall be made using insulated spade lugs.

12. Control circuits for motors shall contain only those components necessary for control of the individual motor. A motor-driven service and its spare shall not have contacts of one relay in both circuits. A single contact of a relay or sequence timer shall not be used to control more than one motor.

M. Conduit Systems

1. The Packaged Mechanical Equipment Manufacturer shall furnish and install the complete conduit system required for the equipment package. The conduit system shall include, but not be limited to: conduit, conduit fittings, condulets, pull boxes, junction and terminal boxes, braces, hangers, brackets, supports, cover plates, drains, bonding jumpers, and miscellaneous hardware.

2. All electrical circuits shall be installed in rigid or intermediate metal conduit, threaded or nonthreaded, and shall bear the label of a UL listed manufacturer. All conduit shall be level, plumb and installed in a neat and workmanlike manner. Conduit shall be installed either parallel with or perpendicular to structural members and grouped wherever possible. Conduit shall be supported at spacings not to exceed the following:

Conduit Size	Maximum Support Spacing
3/4" - 1"	5'-0"
1-1/2"	7'-0"
2"	8'-0"
3" and above	10'-0"

3. Conduits of multiple duct systems shall have a minimum separation of 2 inches for conduit to 2-inch nominal size, and a minimum separation of 3 inches for 3-inch and larger size conduit.

4. Conduit and pull fittings shall not be located in inaccessible places where difficulty would be experienced in wire pulling. Conduit and conduit fittings shall not be welded to any pipe or structure. Conduit shall not be installed within 6 inches of insulated above-ground hot lines. A line shall be considered "hot" when operating at a temperature of 195 degrees F or higher.

5. Conduit sizes shall be 3/4 inch, 1 inch, 1-1/2 inches, 2 inches, 3 inches, 4 inches, 5 inches or 6 inches. Conduit fittings, unless otherwise noted, shall be compatible with conduit with covers and solid neoprene gaskets. Sizing of condulet bodies and boxes to accommodate splices shall be per NFPA 70. The 480 VAC conduit system shall be sized for THHN 90 degrees C rated wire and cable. Conduit sizes of 1/2 inch or 1-1/4 inch shall not be used.

6. Conduit used for instrumentation wiring between instrumentation and junction box shall be 3/4 inch minimum size. An exception would be when a 1/2 inch NPT instrument conduit connection is required, then 1/2 inch NPT is acceptable.

7. All conduit shall be terminated in threaded hubs or insulated bushings designed to prevent damage to wire during pulling operation.

8. Conduit entrance into boxes shall be made with threaded terminal adapters with "O" ring seal and nonmetallic bushing.

9. All conduit bends shall be made with an approved conduit bending machine. The use of a pipe tool, vise, or heat for bending shall not be permitted.

10. Radius of conduit bends shall be not less than specified in NFPA 70 or the minimum conductor bending radius, whichever is greater.

11. Flexible nonmetallic conduit shall be employed at all apparatus or devices subject to vibration. movement for belt adjustments, operational inspection, and maintenance facility. Flexible connections shall be liquid-tight flexible conduit.

12. Flexible conduit connections to motors with belt drives shall be long enough and installed in such a manner as to facilitate belt tightening or replacement without distorting the flexible conduit.

13. Liquid-tight flexible nonmetallic conduit shall be terminated at both ends using insulated, threaded, watertight connectors.

14. Conduit shall be installed in such a manner as to prevent the collection of trapped condensation, and all runs of conduit shall be arranged so as to be free of traps whenever possible.

15. Power wiring shall not be mixed with control, instrument, or alarm wiring. Power circuits shall be run in separate conduits, and terminations shall be made in separate junction and terminal boxes.

16. Small single conductor wires or small OD single or multiple pair shielded wires shall not be run in the same conduit with larger OD multiconductor cable.

17. The maximum number of single-conductor wires in service per conduit shall be limited to 15 in 1 inch including 3 spare wires, and limited to 25 in 1-1/2 inch including 5 spare wires.

18. Conduits or wireways containing thermocouple lead wires shall not contain any other wiring.

N. Grounding and Bonding

1. Electrical circuits, exposed noncurrent carrying metal parts of electrical equipment and metal structures shall be grounded in accordance with NFPA 70.

2. All grounding cables and wires shall be insulated to prevent corrosion. Green insulated wire shall be used only for the grounding conductor, and for no other purpose.

3. A ground wire sized in accordance with NFPA 70 shall be installed in the conduit to all motors.

4. Equipment frames shall be bounded and grounded per NEC 250 G.

5. The skid-mounted packaged systems shall include threaded stud connectors at each end of the skid, diagonally opposite each other, sized appropriately to accept and connect No. 2/0 AWG stranded copper ground taps or indicated on the drawings.

6. Electrical equipment rated 600 VAC or less which is solidly mounted on a metallic switchr will be considered adequately grounded providing the switchrack is solidly grounded.

7. A copper ground bus with the necessary mechanical lugs must be provided in all control and panel enclosures. This bus shall be grounded to the skid steel.

8. The cases of all instruments, relays, and meters in a control panel shall be grounded effectively to the panel frame.

O. Nameplates - Equipment and Device Identification

1. Seller shall provide for each item of electrical equipment and each control station, a firmly attached nameplate consisting of a three-ply laminated phenolic plate engraved to show the equipment device number, function, and service. Nameplates for equipment shall be black-and-white and engraved through the black lamination. Lettering shall be 3/16 inch minimum size. Edges of all nameplates shall be beveled at 45 degrees. Nameplates for emergency equipment or for warning shall be red-white-red, engraved through the red lamination. Emergency and warning nameplates shall be mounted to the equipment which presents the hazard and shall be conspicuously displayed.

2. Nameplates shall be attached with 1/4 inch stainless steel screws.

2.03 SUPPLIER QUALITY CONTROL

A. Testing and Inspection

1. Electrical equipment furnished shall be assembled, wired, and tested at the factory. Factory tests shall include, but not be limited to, complete functional test of all components. The manufacturer shall submit the standard factory tests for review by the A/E.

2. The Seller shall perform continuity tests on all electrical circuits to verify that all devices are installed and connected in accordance with the Drawings and this Specification Section.

PART 3 EXECUTION

3.01 GENERAL

A. Packaged Mechanical Equipment shipped separately shall be set in place and connected by the Contractor.

B. Refer to Specification Section 16050 for electrical field requirements.

3.02 INSTALLATION

A. Each equipment package furnished shall be a complete assembly. Installation of the packaged equipment shall only require setting in place, coupling to the driven equipment, and making power and control cable connections.

B. When packaged equipment is factory assembled and coupled to the driven equipment, installation of each unit assembly shall require only setting in place and making power and control cable connections.

C. Wire and cable shall be installed continuous from point to point without splices, except for connections at junction boxes with terminal blocks per applicable Seller/Manufacturer's drawings reviewed by the A/E.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the A/E prior to final review.

C. Drawing Requirements

1. Drawings shall be provided for the Specification Section as specified in this Specification Section and related Division 15 Specification Sections. Drawings shall be completely dimensioned and include cross-references. These drawings shall include, but are not limited to, the following:

   a. Plans and elevations including projected floor space requirements

   b. Location of all accessories

   c. Size, type, quantities, and installation details for the equipment package

   d. Sectional views as required.

2. Elementary Diagrams

   a. Elementary (schematic) wiring diagrams shall be furnished for each different control scheme.

   b. Each elementary diagram shall show all related control devices and device contacts.

   c. Each elementary diagram shall show all device and wire numbers, and terminal block numbers.

3. Connection Diagrams

   a. . All interconnecting wiring and connection diagrams shall be shown in detail.

   b. Identification of all terminal blocks and all connections, including A/E connections, shall be shown in detail.

D. Catalog Information: The Seller shall supply catalog information for the equipment being supplied prior to material shipment. This information shall include all components for all Original Equipment Manufacturer (OEM) equipment supplied. The actual manufacturer's catalog numbers shall be provided if different from Seller's part numbers.

E. Recommended Spare Parts List

1. The Seller shall submit a complete equipment parts list, which shall cross-reference all the Seller assigned part numbers to the original manufacturer's part numbers. The Seller shall make a notation of quantities of these items recommended or required for continuous operation during one normal overhaul cycle.

2. The parts list shall include cross-sectional or assembly-type drawings, part numbers, mater and estimated delivery lead time. Part numbers shall identify each part for interchangeability purposes. The parts list shall be provided to the A/E upon the Seller's receipt of approved drawings. The parts list shall also contain the individual prices.

REFERENCE DOCUMENT - UNCONTROLLED

F. Special Tools and Test Equipment: A separate list and pricing shall be provided for any special tools and test equipment that may be needed for maintenance.

G. Certified Test Reports: Before delivery of materials and equipment, certified copies of all test reports specified in the Specification Package shall be submitted for A/E review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Contractor shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16152

TITLE: Packaged Mechanical Equipment

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X																			
Field Verification	1.04C.2		X																	3		
Material List	2.01C		X							X												
Factory Tests	2.03A.1		X								X											
Mfr's Data	4.01		X						30													
Shop Drawings	4.01C		X						30													
Test Reports	4.01G			X							X											
Field Inspections	4.01B	X													X							
Field Tests	4.01B		X													X						

COMMENTS:

END OF SPECIFICATION SECTION

WBS: 1.2.6
QA: QA

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/13/94

Civilian Radioactive Waste Management System
Management and Operating Contractor

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FEB 3 1994

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FIRST SUBMITTAL

Specification Section 16195

ELECTRICAL IDENTIFICATION

CI.16.0000

Document Identifier: BAB000000-01717-6300-16195
QA Classification: TBV-112

FIELD CONTROLLED COPY
NO. 102150
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Revision No.	Date
00	09/21/93
01	10/29/93
02	11/19/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: C

Page: 2 of:

Title of Procurement Specification ELECTRICAL IDENTIFICATION

Document Identifier: BAB000000-01717-6300-16195 Revision Number 02

QA Classifications: TBV-112

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Lesli J. Fernandez	*Date*	11/23/93
Reviewed by	Dmitri Vanin	*Date*	11-23-93
Reviewed by	Kenneth J. Herold	*Date*	11/23/93
Reviewed by	Robert A. Blomquist	*Date*	11/23/93
Reviewed by	John H. Rye	*Date*	11/23/93
Verified by	Bharat G. Majmudar	*Date*	11/23/93
Approved by	[illegible]	*Date*	11/23/93
QA Approval	[illegible]	*Date*	11-24-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Revision No.	*Pages Revised and Description*
01	Issued for Construction
02	Pages 1, 2, and 3 revised QA Classifications/Designator FROM TO QA Classification: MC TBV-112 QA: N/A QA QA Class: N/A QA Page 4 Para. 1.04B add QA Classification TBV-112

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes the furnishing of all materials, tools, equipment, and labor necessary for the Electrical Identification of electrical equipment and accessories as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Division 16 Electrical

1.03 REFERENCES

A. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-112)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Electrical Identification products.

2. Field Verification: Dimensional/visual inspection of the installed Electrical Identification products.

PART 2 PRODUCTS

2.01 MATERIALS

A. Nameplates shall consist of three-layer laminated plastic with engraved black capital letters on a white background, with minimum letter height as indicated below:

1. Panelboards shall be 1/4 inch, identifying equipment designation and 1/8 inch letters, identifying voltage rating and source.

REFERENCE DOCUMENT - UNCONTROLLED

2. Individual circuit breakers, switches, and motor starters in panelboards, switchboards, and motor centers shall be 1/8 inch, identifying the circuit, load served, and location.

3. Transformers: 1/4 inch, identifying equipment designation; 1/8 inch, identifying primary and secondary voltages, primary source, kVA rating, and secondary load and location.

B. Tape labels shall consist of embossed adhesive tape with a minimum 1/8 inch high white capital letters on black background.

C. Wire and Cable Markers shall be:

1. Self-adhesive strip tape designed for wrapping on the conductor insulation. The markers may be either self-laminating vinyl or cloth, or pressure-sensitive paper for temporary marking.

2. Sleeve wire markers shall be split sleeve or tubing type.

PART 3 EXECUTION

3.01 PREPARATION

All surfaces shall be degreased and cleaned to receive nameplates and tape.

3.02 INSTALLATION

A. All identification of electrical equipment and accessories shall be installed in accordance with NFPA 70, this Specification Section, the Drawings, and the manufacturer's written instructions.

B. Nameplates shall be fastened with self-tapping No. 6 screws 1/4 inch long or fastened with epoxy.

C. Nameplates shall be tagged as indicated on the Drawings and shall be provided for the following:

1. All control and power devices mounted inside the control panels or on the cover of the control panels. The nameplates are to be mounted adjacent to, not on the device. All devices mounted on the cover of a control panel shall have nameplates for the front and rear of the panel.

2. Motor starters, pushbuttons, pilot lights, safety switches, instruments, thermostats, and all control, instrumentation, and power devices.

3. Power and lighting panels.

D. Install all nameplates and tape labels parallel to equipment lines.

E. Embossed tape shall be used for identification of wall switches, receptacles, and control device stations.

REFERENCE DOCUMENT - UNCONTROLLED

3.03 IDENTIFICATION

Wire identification shall be in accordance with Specification Section 16122.

3.04 FIELD QUALITY CONTROL

The Buyer shall perform field inspection while work is in progress and a final inspection to ensure compliance with the technical and quality requirements of this Specification Section and the Drawings.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the Buyer for Architect/Engineer (A/E) review.

C. Manufacturer's data shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16195

TITLE: Electrical Identification

Requirements	Paragraph	STATUS						TIMING											NOTIFICATION			
		INFORMATION	REVIEW	CERTIFICATION	RECORD			PRIOR TO TESTING	DAYS AFTER AWARD	PRIOR TO FABRICATION	PRIOR TO SHIPMENT	WITH SHIPMENT	PRIOR TO INSTALLATION	DAILY REPORT	AS DIRECTED	PRIOR TO FINAL ACCEPTANCE			WITNESS (DAYS)	HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.2		X													X						
Field Inspection	4.01B	X													X							
Mfr's Data	4.01C		X						30													

COMMENTS:

END OF SPECIFICATION SECTION

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

Civilian Radioactive Waste Management System
Management and Operating Contractor

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FIRST SUBMITTAL

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Specification Section 16405

NEMA FRAME INDUCTION MOTORS (SMALL)

Cl.16.2000

0 BKM 12/16/93

Document Identifier: BAB000000-01717-6300-16405 REV 00
QA Classification: TBV-125

Revision No.	Date
00	~~12/06/93~~ RH 12/21/93
	12/06/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Title of Procurement Specification NEMA FRAME INDUCTION MOTORS (SMALL)

Document Identifier: BAB000000-01717-6300-16405 Revision Number 00

QA Classifications: TBV-125

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Bharat H. Karmudar	*Date*	12/16/93
Reviewed by	Yuri A. Shane	*Date*	12/16/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	Leon J. Fernandez	*Date*	12/21/93 12/21/93 LF
Approved by	[illegible]	*Date*	12/21/93
QA Approval	Fred Ott	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16405

NEMA FRAME INDUCTION MOTORS (SMALL)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for the installation of the Motors as specified herein and indicated on the Drawings.

B. The work under this Specification Section includes the furnishing, inspection, and testing of alternating current Induction Motors 250 horsepower and below.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 16050 Basic Electrical Materials and Methods

C. Section 16110 Conduit

D. Section 16112 Underground Ducts and Manholes

E. Section 16123 600 V Instruction Cable

F. Section 16130 Pull and Junction Boxes

G. Section 16131 Outlet Boxes

H. Section 16141 Wiring Devices

I. Section 16190 Supporting Devices

J. Section 16195 Electrical Identification

K. Section 16450 Grounding

1.03 REFERENCES

A. American National Standards Institute (ANSI):

ANSI C50.41-82	Polyphase Induction Motors for Power Generating Stations

REFERENCE DOCUMENT - UNCONTROLLED

B. American National Standards Institute/Institute of Electrical and Electronics Engineers, Inc. (ANSI/IEEE):

ANSI/IEEE 112-91	Standard Test Procedure for Polyphase Induction Motors and Generators

C. Anti-Friction Bearing Manufacturers Association (AFBMA):

1.	AFBMA 1-90	Terminology for Anti-Friction Ball and Roller Bearings and Parts
2.	AFBMA 9-90	Load Ratings and Fatigue Life for Ball Bearings
3.	AFBMA 10-89	Metal Balls
4.	AFBMA 11-90	Load Ratings and Fatigue Life for Roller Bearings

D. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

IEEE 85-73	Test Procedure for Airborne Sound Measurements of Rotating Electric Machinery

E. National Electrical Manufacturers Association (NEMA):

1.	NEMA MG 1-87	Motors and Generators
2.	NEMA MG 10-83	Energy Management Guide for Selection and Use of Polyphase Motors
3.	NEMA MG 11-77	Energy Management Guide for Selection and Use of Single-Phase Motors
4.	NEMA MG 13-84	Frame Assignments for Alternating Current Integral-Horsepower Induction Motors

F. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

G. Underwriters Laboratories, Inc. (UL):

UL 1004-89	Standard for Safety Electric Motors Fourth Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. Products covered by this Specification Section shall be considered not important to waste isolation or radiological safety. (TBV-125)

REFERENCE DOCUMENT - UNCONTROLLED

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the NEMA Frame Induction Motor (Small) shall be conducted. (HOLD POINT)

2. Field Verification: Dimensional/visual inspection of the installed NEMA Frame Induction Motor (Small) shall be conducted. (HOLD POINT)

PART 2 PRODUCTS

2.01 DESIGN REQUIREMENTS

A. General

1. Vendor shall complete items as required in Attachment A. Data shall be subject to review by the Architect/Engineer (A/E).

2. Each motor shall be a complete assembly. Installation of each motor shall require setting in place, alignment, coupling, and making power and control cable connections at the job site.

3. Motors factory assembled and coupled to the driven equipment will require only setting in place and making power and control cable connections at the job site.

4. Minimum life of the motor shall be 15 years.

B. Service Conditions: All motors shall operate successfully at their design load horsepower under the environmental conditions specified in Division 1.

C. Ratings

1. Horsepower: The nameplate continuous horsepower rating shall be equal to or greater than the horsepower required by the driven equipment when the driven equipment is operating at the design load conditions specified in Division 15.

2. Service Factor: Unless specified otherwise in Attachment A, all motors shall have service factors of 1.0.

3. Torque and WK^2 (Inertia, lb-ft2)

a. All motors shall have characteristics suitable for the torque and WK^2 characteristics of the driven equipment when the driven equipment is operating as specified in Attachment A.

b. Unless specified otherwise in Attachment A or if another design is required by the driven equipment load characteristics, all induction motors shall have a torque characteristic similar to NEMA Design B. Other NEMA Design torque characteristics for special applications shall be reviewed by the A/E.

REFERENCE DOCUMENT - UNCONTROLLED

4. Temperature Rise

   a. Motor temperature rise for any class of insulation shall not exceed that specified in referenced NEMA Standards for Class B insulation. In addition, the hot-spot temperature (service ambient plus rise at nameplate horsepower plus hot-spot allowance) shall not exceed 130 degrees C for Class B, 155 degrees C for Class F, or 180 degrees C for Class H insulation.

   b. If the service conditions specified in Attachment A are not standard in accordance with NEMA MG 1 (40 degrees C ambient temperature and not over 4500 feet elevation), the temperature rise of motors having Class B insulation shall be adjusted in accordance with NEMA MG 1 so that the total hot-spot temperature will not exceed 130 degrees C at rated horsepower, except as specified in Paragraph 2.01C.4.c below.

   c. If the motor nameplate horsepower exceeds the driven equipment brake horsepower requirement by the percentage specified in Attachment A, no adjustment shall be required and a standard motor will be accepted.

5. Voltage and Frequency

   a. Motors shall be rated as indicated on the Drawings. Permissible voltage and frequency variations shall be in accordance with NEMA MG 1 and ANSI C50.41.

   b. Motors shall be capable of producing satisfactory operation of their driven equipment during short-time (up to one minute) dips to 75 percent of rated voltage.

6. Starting

   a. All motors shall be designed for full voltage starting. Full voltage starting equipment shall be furnished by the Buyer, unless specified otherwise in this Specification Section. If the driven equipment is designed to use reduced voltage starting, or if variable speed and/or torque control is required, the driven equipment manufacturer shall furnish suitable starting and control equipment in accordance with this Specification Section and Attachment A.

   b. Motor starters and control equipment, if supplied, shall be suitable for the type of service being designed. All starting equipment shall be fully described in the Seller's Proposal, complete with manufacturer's catalog data and descriptive bulletins.

   c. Motor starting current shall not exceed 6.5 times rated full load current. Motors shall be capable of withstanding the number of starts imposed by the driven equipment without appreciable loss of service life.

   d. Motors shall be capable of starting and accelerating their driven equipment to full speed at a starting voltage shown on the Drawings. The temperature rise during a restart following continuous full-load operation shall not produce injurious heating.

REFERENCE DOCUMENT - UNCONTROLLED

7. Enclosures

   a. The types of enclosures required for the motors to be furnished are specified on Attachment A.

   b. TEFC or explosion-proof motors, when specified on the Drawings, shall be rated for mill and chemical processing applications, with epoxy-coated windings and cast iron frame, end plates, and conduit box. The fan shall be a corrosion-resistant type. The motor shall have stainless steel hardware, corrosion-resistant shaft, and breather drains. Fan guards and screens over air passages shall be stainless steel, monel, slotted cast iron, or bronze. Explosion proof-motors shall have fans constructed from nonsparking material.

   c. Motors subject to high humidity, alkali or acid vapor shall have epoxy-encapsulated windings, stainless steel hardware, running shaft seals, and cast iron terminal boxes. These motors shall be designated "Severe Duty" on the Drawings.

   d. Drip-proof motors shall have a cast iron frame with integral cast base, cast iron end plates, cast iron conduit box rotatable through 90 degree increments, and high pressure ventilation.

8. Insulation

   a. The insulation of all motors shall meet or exceed NEMA requirements for Class B insulation.

   b. Motors with weatherproof enclosures or motors for outdoor application shall have sealed or encapsulated insulation systems produced by a vacuum pressure impregnation process.

   c. TEFC and explosion-proof motors shall have Class F insulation systems, but with a temperature rise rating not exceeding that for Class B.

   d. Open drip-proof motors for indoor application shall have epoxy encapsulated, Class B or Class F insulation.

9. Bearings

   a. General

      1) All motors with antifriction bearings shall be furnished with grease fittings for bearing lubrication and drain plugs for draining excess grease, except as specified in Paragraph 2.01C.9.a.2.

      2) Fractional horsepower motors may be furnished with prelubricated sealed ball bearings or oil lubricated sleeve bearings if greaseable ball bearings are not available. All sleeve bearings shall have provisions for oiling.

REFERENCE DOCUMENT - UNCONTROLLED

3) Motors for outdoor installation shall be furnished with special bearing seals to prevent leakage of lubricant or entrance of foreign matter along the shaft or through the bearings.

4) The type of bearing lubricant shall be selected according to the environmental conditions presented in Division 1.

5) All motors with antifriction bearings shall have the AFBMA antifriction rating and number stamped on the motor nameplate.

6) Provision shall be made for collection of spilled and excess lubricants without contamination of the external facility.

b. Horizontal Motor Bearings

1) All horizontal motors shall be furnished with either antifriction or sleeve bearings in accordance with the manufacturer's standard practice for the particular frame size and application.

2) Antifriction bearings shall be in accordance with AFBMA 1, AFBMA 9, and AFBMA 10 for ball bearings and AFBMA 1, AFBMA 10, and AFBMA 11 for roller bearings.

3) Antifriction bearings in direct-coupled motors shall have a minimum L-10 rating life of 60,000 hours and a median life (L-50) of 300,000 hours as rated by AFBMA 1 and AFBMA 9.

4) Antifriction bearings in belt or chain drive motors shall be evaluated based on AFBMA 10 rating life.

5) If available, split-sleeve bearings shall be furnished in lieu of antifriction bearings. Sleeve bearings shall be split, oil ring-lubricated, with split end bells. Motors with oil ring-lubricated bearings shall have a glass-sight oil-level gage for instant visual checking of oil level marked to indicate normal oil level. If available, motors with oil ring-lubricated bearings shall have a transparent window for oil ring inspection.

c. Vertical Motor Bearings

1) All vertical motors shall be furnished with antifriction thrust bearings which meet the requirements of AFBMA 1, AFBMA 9, and AFBMA 10 for ball bearings or AFBMA 1, AFBMA 10, and AFBMA 11 for roller bearings. Bearings shall be of a grade that will provide a minimum L-10 rating life of 35,000 hours and a median life (L-50) of 175,000 hours as rated by AFBMA 1, AFBMA 9, or AFBMA 11.

2) Thrust bearings or guide bearings in vertical motors may be oil lubricated, if required. Sight-glass oil gauges marked to indicate normal oil level shall be furnished.

3) The oil reservoir shall be deep enough to act as a settling chamber. The drain plug shall be accessible from outside the motor.

REFERENCE DOCUMENT - UNCONTROLLED

10. Vibration: The motors shall operate without exceeding the applicable vibration allowances provided by NEMA MG 1.

11. Terminal Boxes

a. All motor lead terminal boxes. except as specified in Paragraph 2.01C.11.d below, shall have, as a minimum, the inside dimensions shown in the following table or shall be the manufacturer's nearest standard size:

Motor Horsepower	Height, Inches	Width, Inches	Depth, Inches
0 thru 3	Manufacturer's Standard		
5 thru 25	8	6	6
30 thru 50	9	7	7
60 thru 75	12	8	8
100 thru 125	12	10	10
150 thru 200	14	12	12

b. All terminal boxes shall have a bolt-type copper ground connector, sized as follows and brazed, welded, or bolted inside the box:

Motor Horsepower	Size, AWG
0 thru 10	12
15 thru 20	10
25 thru 50	8
60 thru 75	6
100 thru 250	2

c. Separate terminal boxes or approved condulets or fittings shall be furnished for terminating all wiring (e.g., heater, thermocouple, thermostat) as required in Attachment A. When space allows, wiring shall be terminated with ring-type connectors on washer-head screw terminal blocks.

d. Motors Rated 2300 Volts or Higher: Terminal boxes shall have the following minimum internal dimensions for the type cable specified:

Shielded and Unshielded Cable

18 inches high
12 inches wide
10 inches deep

e. Where possible, the terminal boxes shall be designed for installation in any position 90 degree steps from the bottom entry vertical position.

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12. Bracing: Motors shall be braced for an occasional full voltage bus transfer within an interruption time not exceeding 6 cycles.

13. Noise: Motors shall operate with an equivalent A-weighted sound level not to exceed the table in MG 1, unless otherwise approved. Noise shall be determined by test in accordance with IEEE 85.

14. Painting: All motors shall be primer painted and finish painted in accordance with manufacturer's standards. Preferred color is light gray.

15. Accessories

    a. All motors rated above 10 horsepower which are to be located outdoors and have totally enclosed or weather-protected enclosures shall be furnished with space heaters. All indoor totally enclosed motors rated above 100 horsepower which are intended for spare or intermittent duty shall be furnished with space heaters. Space heaters shall be of sufficient capacity to keep the motor windings and internal parts dry when the motors are not operating. Heaters shall be made from chrome steel or other noncorrosive material. Surface temperature of space heaters at rated voltage shall conform to maximum permitted by area classification but shall not exceed 200 degrees C.

    b. All space heaters shall be designed for operation at 120 VAC, single phase.

    c. All weather-protected motors shall be furnished with filters and guard screens. Filters shall be arranged to be readily removable for cleaning and replacement while the motor is in service. Guard screens shall be of stainless steel or an approved corrosion-resistant material.

    d. Motors specified on Attachment A for outdoor installation shall be conditioned for outdoor use with special attention to corrosion-resistant finish of the metal parts and special bearing seals.

    e. All totally enclosed and explosion-proof motors shall be furnished with a stainless steel automatic drain-breather at the low point of the motor.

    f. All motors shall be provided with suitable lifting devices or attachments for motor installation and removal.

    g. When required by Attachment A, stator thermocouples or RTDs, stator thermostatic type protection, and/or bearing thermocouples or thermostats shall be furnished. All thermostatic-type sensing elements shall have normally closed circuit configurations.

    h. When required by Attachment A, soleplates or baseplates shall be furnished with the motors.

    i. Vertical motors with enclosed housings shall have drip shields over the air circulation fan.

REFERENCE DOCUMENT - UNCONTROLLED

j. The bottom ventilating opening provided in the enclosure of vertical motors shall be guarded by baffles or by location to prevent the direct entrance of liquids that might released by a pump seal failure.

16. Nameplate

a. Nameplate data shall be furnished in accordance with NEMA MG 1 except that temperature rise by resistance at service conditions, and the service conditions (ambient temperature and elevation), shall be shown on the nameplate.

b. Direction of rotation shall be permanently marked on the motor if the motor is suitable for only one direction of rotation.

17. Loss Evaluation: Sellers shall supply high efficiency, high power factor motors since total motor full load losses will be evaluated on all integral horsepower motors.

18. Direction of Rotation: All motors shall have their leads tagged to indicate direction of rotation when a specified power connection or phase sequence is applied.

19. All induction motors 25 horsepower and above shall be high efficiency type, and motors 50 horsepower and larger shall be furnished with power factor correction capacitors or variable frequency drives as indicated on the Drawings.

a. Capacitors shall be sized to correct motor power factor to approximately 95 percent.

b. If a motor is controlled by means other than a non-reversing starter, full voltage and across the line, the capacitor shall be located upstream of the motor controller.

2.02 SELLER QUALITY CONTROL

The Seller shall comply with NEMA MG 1 and UL 1004 requirements pertaining to the construction, test, assembly, packaging, and inspection of NEMA Frame Induction Motors (Small).

2.03 SUPPLEMENTS

The following supplements is part of this Specification Section: Attachment A, Ratings and Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Motors shall be set in place under other Divisions of the Specification Package.

B. Motors shall be connected under the work of Division 16.

REFERENCE DOCUMENT - UNCONTROLLED

3.02 IDENTIFICATION

A. Identify and mark motor lead terminal boxes with information relevant to the motor in accordance with Specification Section 16195, including but not limited to:

1. Motor driven load
2. Circuit number
3. Motor Control Center or panel and device number.

3.03 FIELD QUALITY CONTROL

A. The Buyer shall perform field inspections while work is in progress and a final inspection to ensure compliance with the technical and quality requirements of this Specification Section and the Drawings.

B. Induction motors shall be given the manufacturer's standard and other tests to determine that they are free of mechanical and electrical defects. As a minimum, these tests shall include: (WITNESS POINT)

1. Determination of locked-rotor current
2. Measurement of no-load running current
3. Measurement of winding resistance
4. High-potential test
5. Bearing inspection
6. Measurement of air gap
7. Measurement of no-load running vibration.

C. For induction motors for which no electrical duplicate unit has previously been built, tested, and certified, quotations shall include the cost for conducting the following additional tests:

1. Full-load heat run
2. Percent slip
3. Determination of starting characteristics, including starting torque and locked-rotor current.

REFERENCE DOCUMENT - UNCONTROLLED

PART 4 SUBMITTALS AND NOTIFICATION

.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and shall be provided to the A/E prior to final acceptance.

C. Manufacturer's data per Attachment A, shop drawings, and test reports shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

ATTACHMENT A
NEMA FRAME INDUCTION MOTORS (SMALL)
RATINGS AND REQUIREMENTS

I. NEMA FRAME MOTORS (SMALL)

A.	Nameplate Horsepower	_____
B.	Phase	_____
C.	Synchronous Speed (RPM)	_____
D.	% Slip	_____
E.	Volts	_____
F.	Frequency (Hz)	_____
G.	Multispeed; single winding, two winding, variable torque, constant torque	_____
H.	Area Classification; Class, Group, Division	N/A
I.	Enclosure; Open-Drip Proof, TENV; Forced Ventilated, TEFC, Weather Protected, Mill and Chemical Resistant, Explosion Proof with "T" Code Marking, Dust-IGN Proof, or Other (state)	_____
J.	Starting Conditions; Loaded, Unloaded, Full Voltage, Reduced Voltage (min. Starting Voltage % of Rated)	_____
	Starting Current (x • flc)	x -
K.	Insulation; Encapsulated, VP, Manufacturer's Standard	_____
L.	Rotation Facing End Opp. Drive, Clockwise, Counterclockwise	_____
M.	Bearings; Antifriction, Split Sleeve, Grease Lube, Oil Lube	_____
N.	Mounting; Horizontal, Vertical Solid Shaft, Vertical Hollow Shaft	_____

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O. Drive System: Direct Coupled, Gear Unit, V Belts, Chain. Half Coupling Pressed on by Motor Supplier, Sheave Pressed on by Motor Supplier _____

P. Service Factor _____

Q. Accessory Equipment

1. Baseplate, Soleplate by: _____
2. Coupling, Furn. by: _____
3. Space Heater Volts, Phase, kW _____
4. Air Filters, Guard Screens _____
5. Stator Winding Temperature Detectors; 120 Ohm Rated, 2 per phase wired to J.B., Thermostat, 1 per Motor wired to J.B. _____
6. Drain/Breather _____
7. Bearing Temperature Detectors; 120 Ohm Rated, 1 per bearing wired to J.B., Thermocouple, 1 per bearing wired to J.B. _____
8. Bearing Oil Sump Heaters _____
9. Bearing Vibration Detectors _____
10. Surge Capacitor Mounted in Terminal Box _____
11. Motor Controller by Motor Supplier _____
12. Terminal Box; Sized For Motor Leads Only, Oversized for Motor Leads with Stress Cones _____
13. Ground Lug Mounted Inside, Size AWG _____

REFERENCE DOCUMENT - UNCONTROLLED

II. CRITERIA FOR EVALUATION

A. Motor losses (efficiency) shall be evaluated as described in Paragraphs 2.01C.17 and 2.01C.19.

B. Testing shall be conducted as required in Article 3.03.

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SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16405

TITLE: NEMA Frame Induction Motors (Small)

Requirement	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X							3		
Field Verification	1.04C.2		X													X				3		
Torque Charac.	2.01C3.b		X							X												
Field Tests	3.03B		X													X			14			
Field Inspection	4.01B	X													X							
Mfr's Data	4.01C		X						30													
Shop Drawings	4.01C		X						30													
Test Reports	4.01C		X													X						

COMMENTS:

END OF SPECIFICATION SECTION

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date _____

WBS: 1.2.6
QA: QA

Civilian Radioactive Waste Management System
Management and Operating Contractor

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Specification Section 16450

FIRST SUBMITTAL

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GROUNDING

CI.16.0000

Document Identifier: BAB000000-01717-6300-16450
QA Classification: ~~TBV-112~~ Q REH 2/21/94

Revision No.	Date
00	09/21/93
01	10/29/93
02	11/19/93

Attachment 1 FCR # 94-176 page 1 of 6

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NOTICE OF OPEN CHANGE DOCUMENTS			
THIS DOCUMENT IS IMPACTED BY THE LISTED CHANGE DOCUMENT AND CANNOT BE USED WITHOUT THEM			
CHANGE DOCUMENT NUMBER	POSTED BY	DATE	STATUS
FCR 94/176	[illegible]	4/14/94	open
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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: QA

Title of Procurement Specification GROUNDING

Document Identifier: BAB000000-01717-6300-16450 Revision Number 02

QA Classifications: TBV-112

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s): _____

Prepared by	Leslie J. Fernandez	*Date*	11/23/93
Reviewed by	Daniel Vance	*Date*	11-23-93
Reviewed by	Kenneth J. Herolie	*Date*	11/23/93
Reviewed by	Robert A. Sherwood	*Date*	11/23/93
Reviewed by	John H. Cyr	*Date*	11/23/93
Verified by	Bharat G. Majmudar	*Date*	11/23/93
Approved by	[illegible]	*Date*	11/23/93
QA Approval	[illegible]	*Date*	11-24-93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Revision Description

WBS: _____

QA Class: _____

Complete only applicable items.

Revision No.	*Pages Revised and Description*
01	Issued for Construction
02	Pages 1, 2, and 3 revised QA Classifications/Designator FROM TO QA Classification: MC TBV-112 QA: N/A QA QA Class: N/A QA Page 6 Para. 1.04B add QA Classification TBV-112

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16450

GROUNDING

PART I GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for the installation of Grounding Systems for Electrical Power Distribution as specified herein and indicated on the Drawings.

B. The work in this Specification Section also includes measurement, testing, and inspecting of completed grounding systems specified herein and indicated on the Drawings.

C. Grounding systems specified herein shall be provided for, but not limited to, the following applications.

1. Standby Generators
2. Substations
   a. Grounding grid/equipment grounding
   b. Transformer neutral impedance grounding
3. Power Line Grounding
   a. Transmission Line
   b. Distribution
      1) Overhead
      2) Underground
4. Subsurface Grounding
5. Premises Grounding
   a. Commercial
   b. Industrial
6. Computer Room/Control Room

1.02 RELATED SECTIONS

A. Section 03300 Cast-in-Place Concrete

B. Division 16 Electrical

1.03 REFERENCES

A. American National Standards Institute (ANSI):

1.	ANSI C2-93	National Electrical Safety Code
2.	ANSI C29.8-85	Wet-Process Porcelain Insulators-Apparatus, Lap, and Pin Type
3.	ANSI C135.30-88	Galvanized Ferrous Ground Rods for Overhead or Underground Line Construction

B. American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE):

1.	ANSI/IEEE C62.92-87	Guide for the Application of Neutral Grounding in Electrical Utility Systems Part I - Introduction
2.	ANSI/IEEE C62.92-89	Guide for the Application of Neutral Grounding in Electrical Utility Systems Part II - Grounding of Synchronous Generator Systems

C. American Society for Testing and Materials (ASTM):

1.	ASTM B1-90	Standard Specification for Hard-Drawn Copper Wire
2.	ASTM B2-88	Standard Specification for Medium Hard-Drawn Copper Wire
3.	ASTM B3-90	Standard Specification for Soft-Drawn or Annealed Copper Wire
4.	ASTM B8-90	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

D. Federal Information Processing Standards Publication (FIPS PUB):

FIPS PUB 94-83	Guideline for Electrical Power for ADP Installations

E. Institute of Electrical and Electronics Engineers (IEEE):

1.	IEEE 32-72	Standard Requirements, Terminology, and Test Procedure for Neutral Grounding Devices
2.	IEEE 80-86	Guide for Safety in AC Substation Grounding

3. IEEE 81-83 — Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

4. IEEE 142-91 — Recommended Practice for Grounding of Industrial and Commercial Power Systems

5. IEEE 446-87 — Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications

6. IEEE 665-87 — Guide for Generator Station Grounding

7. IEEE 751-91 — Trial-Use Design Guide for Wood Transmission Structures

8. IEEE 837-89 — Standard for Qualifying Permanent Connections Used in Substation Grounding

F. National Fire Protection Association (NFPA):

NFPA 70-93 — National Electrical Code

G. Underwriters Laboratories, Inc. (UL):

UL 467-84 — Standard for Grounding and Bonding Equipment

H. United States Department of the Interior/Bureau of Mines Information Circular (USDI/BMIC):

1. USDI/BMIC 8767-78 — Guide for the Construction of Driven-Rod Ground Beds

2. USDI/BMIC 8835-80 — Guide to Substation Grounding and Bonding for Mine Power Systems

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-112) 9/1/96

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Grounding conductors and cable reels.

2. Field Verification: Dimensional/visual inspection of installed ground electrode, exothermal welds and connections, and Grounding systems prior to burial in earth or otherwise concealing.

B. Products covered by this Specification Section include provisions that are both important to waste isolation (ITWI) and/or important to radiological safety (ITRS) and those that are not ITWI or ITRS. Those provisions that are ITWI and/or ITRS are identified as Q Controls and are denoted in this Specification Section with underlined text. All other provisions that are non-Q are called Management Controls. 9/1/96

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ATTACHMENT 1, PAGE 1 OF 2

PART 2 PRODUCTS

2.01 DESIGN REQUIREMENTS

A. General: Conductors, connectors, ground rods, neutral grounding devices, and materials described herein shall be suitable for use in the permanent construction of ground grids for substations and generating stations, safety ground beds, equipment grounding, building grounding, and signal reference grids for computer rooms.

B. Service Conditions: All equipment and material described herein shall be suitable for use under the environmental conditions specified in Division 1.

2.02 MATERIAL

A. Conductors

1. Down leads and bonding shall be soft-drawn copper, solid or stranded as indicated on the Drawings, and in accordance with ASTM B3 and ASTM B8.

2. Copper conductors used in the construction of ground grids, other ground electrodes, and circuit ground conductors shall be in accordance with ASTM B1, ASTM B2, ASTM B3, and ASTM B8, and as indicated on the Drawings.

B. Signal Reference Grid (SRG) Conductors

1. SRG conductors shall consist of 1.5 inch to 2.0 inch wide, flat medium-hard copper strip, minimum 26 gauge thick.

2. Manufactured signal reference grid shall consist of a 1.5 inch to 2.0 inch wide, flat, medium-hard copper strip, 26 gauge thick minimum on maximum 2 foot centers. All crossovers shall be joined by welding or brazing. The grid shall be furnished as indicated on the Drawings in sections not to exceed 10 feet wide by 100 feet long.

C. Connections

1. Connections used in construction of ground electrodes shall be of the exothermal type.

2. Mechanical (non-exothermic) connections used in bonding, and equipment grounding connections shall be suitable for the use intended and shall be accessible for periodic inspections.

3. Connections shall be in accordance with UL 467 and as indicated on the Drawings.

D. Ground Rods: Ground rods shall be copper or copper-clad steel, 3/4 inch in diameter (minimum) and 10 feet in length (minimum).

4. Pressure type connectors shall be in accordance with IEEE-837.
Exothermal type connectors shall be in accordance with IEEE-80.

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E. Soil Treatment

1. Non-shrinking grounding enhancement material suitable for reducing soil resistivity using backfill must be reviewed by the Architect/Engineer (A/E). ~~Use of any salt compounds~~ as ~~ground enhancement material is forbidden.~~

2. Q Controls shall apply: The use of salt-grounding solution is prohibited. 94/176

3. Concrete used to embed electrode conductors is an acceptable material for reducing soil resistivity.

4. Materials used in the treatment of soil shall conform to IEEE 80, IEEE 142, and Specification Section 03300.

F. Neutral Grounding Devices

1. Environmental conditions governing the construction of neutral grounding devices shall be as specified in Paragraph 2.01B.

2. This Specification Section shall be limited to resistance (high and low) neutral grounding devices.

3. The basis for rating the devices shall be: current, voltage, frequency, basic impulse level (BIL), insulation class, circuit voltage of the system, service (indoor or outdoor), and time.

4. Grounding devices shall be insulated as indicated on the Drawings per ANSI C29.8 and manufacturer's written instructions.

5. Neutral grounding devices shall conform to the requirements of IEEE 32.

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment and materials shall be installed in a neat and workmanlike manner in accordance with this Specification Section, the Drawings, and the manufacturer's written instructions. 94/176

B. Standby Generator

1. The grounding system for the standby generator shall be based upon ground fault currents at the generator location. The ground fault current shall be separated into generator and transmission and distribution contributions with the grid layout based upon the larger of the two per IEEE 665.

2. The resistivity of the soil at the generator location shall be measured using approved methods and devices in accordance with IEEE 81. Provide chemical treatment to reduce resistivity as indicated on the Drawings.

B. Q Controls Shall Apply: The use of salt grounding solution is prohibited 94/176

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3. The ground grid design shall be based upon local soil resistivity conditions and available ground fault current levels, and shall be in accordance with IEEE 80.

4. The acceptable range for resistance of the ground grid shall be 1 to 5 ohms depending on local conditions per IEEE 80.

5. Bonding and grounding of the generator frame, auxiliary equipment, and system shall be as indicated on the Drawings, in accordance with the manufacturer's written instructions, and in accordance with IEEE 665. Neutral grounding shall be in accordance with ANSI/IEEE C62.92.

6. Ground grid conductors shall be copper. All grid connections below grade shall be made using an exothermal welding process. All conductor crossings shall be bonded using an exothermal welding process. Connections to ground rods shall be made using exothermal welds. Exothermic welding is the preferred method of bonding. Other methods of bonding shall be used where it is not feasible to use exothermal welds as indicated on the Drawings.

7. The use of copper-clad steel conductors in the construction of the ground system shall be allowed only in areas of probable theft, and demonstration of equivalence to a copper conductor system with calculations, and acceptable measured resistance values.

D. Power Line Grounding

1. Grounding for overhead power line construction shall be in accordance with ANSI C2 and Specification Section 16371.

2. Underground Power Line Grounding

   a. Bond tape shields, concentric neutrals, and drain wires shall be in accordance with manufacturer's written instructions and as indicated on the Drawings.

   b. Provide a ground wire, bare or insulated, size as indicated on the Drawings, to run direct buried in conduit with the phase conductors.

   c. Provide bonding to ground electrode for circuit ground wires, cable shields and concentric neutrals at both ends of underground circuit, including riser poles, substations, and pad-mounted equipment, as indicated on the Drawings.

   d. Bond metal conduits to ground as indicated on the Drawings with connecting devices in accordance with UL 467.

   e. Provide a 4/0 AWG grounding conductor embedded in the concrete encasement of all duct banks, extending cable beyond duct bank termination for connection to premises or equipment grounding.

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REFERENCE DOCUMENT - UNCONTROLLED

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D. Subsurface Grounding

E. 2/21/94

1. Substations supplying underground tunnels shall also be grounded in accordance with USDI/BMIC 8767 and USDI/BMIC 8835.

2. Substations serving power for underground tunnel construction shall have the neutrals grounded as prescribed in USDI/BMIC 8835, and as indicated on the Drawings.

3. Safety ground beds for underground tunnel constructions shall be constructed as indicated on the Drawings, and shall have a measured maximum resistance of less than 5 ohms in accordance with USDI/BMIC 8767.

4. Provide a bare ground wire for cable trays, size as indicated on the Drawings.

5. Provide bonding to subsurface safety grounding wires for ground wires, cable shields, conveyor system, ventilation system, electrical equipment, subsurface unit substations, rail system, and communication/data systems as indicated on the Drawings.

6. Provide two 4/0 AWG grounding conductors, one on either side of the tunnel surface as indicated on the Drawings.

7. Provide a bare copper or green-insulated copper ground conductor in feeder and branch circuits. Bond to metallic conduits, boxes, exposed non-current carrying metal parts of electrical equipment, and receptacle ground conductors.

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E. Premises Grounding

F. 2/21/94

1. Include commercial-type buildings and industrial-type buildings in premises grounding and bonding requirements.

2. Provide a building ground electrode at the service entrance in accordance with NFPA 70 and IEEE 142.

3. Ground the service neutral to the building ground electrode. Bond metallic cold water piping and building steel (reinforcing bars, etc.) to the building ground electrode as indicated on the Drawings.

4. Ground each separately-derived neutral to the nearest effectively grounded electrode as indicated on the Drawings in accordance with NFPA 70 and IEEE 142.

5. Provide a minimum number 6 AWG bare copper ground wire for telephone and communication backboards, installed in conduit and bonded to the building ground electrode as indicated on the Drawings.

6. Provide a bare copper or green-insulated copper ground conductor in feeder and branch circuits. Bond to metallic conduits, boxes, exposed non-current carrying metal parts of electrical equipment, and receptacle ground connectors.

7. Provide isolated grounding systems as indicated on the Drawings in accordance with NFPA 70.

   a. The isolated ground conductor shall be insulated, and identified to differentiate it from insulated green circuit ground wire. The isolated ground shall not be tied to the ground bus in subpanels, but shall run uninterrupted to the building ground electrode.

   b. Provide orange color or otherwise identified isolated ground receptacles for use on isolated grounded systems. Bond other components such as conduits and boxes to the circuit ground conductor.

6. ~~E.~~ Computer Room/Control Room Grounding

1. Computer rooms and control rooms, in addition to grounding required by NFPA 70, shall be grounded as indicated on the Drawings and in accordance with FIPS PUB 94.

2. Distribution panels and power distribution shall be mounted directly to building steel or shall be connected to it by a short grounding conductor as practical (with 2 feet a preferred maximum), equal to the "green wire ground," but not less than number 4 AWG. The ground wire inside any panel or enclosure supplying AC power to the computer shall be bonded to its enclosure.

3. Signal Reference Grid (SRG): The preferred method of constructing a SRG is forming a grid consisting of 1.5 to 2.0 inch, 26 gauge (minimum) flat copper strips on maximum 2 foot centers. Connect crossovers using an exothermic weld process, or provide a manufactured SRG.

4. Bond all equipment to the SRG using a flat, tinned, copper braided strap, 2 feet maximum. Connections to the SRG shall be exothermal weld.

5. Bond every fourth to sixth raised floor pedestal to the SRG using a number 6 AWG seven-strand copper conductor. Connections shall be made using an exothermal weld.

6. Bond all columns, conduits, water pipes, ducts, etc., entering the computer room to the SRG (at each end of the room if these are horizontal) using a seven-strand number 6 AWG copper conductor and exothermal welded connections. If exothermal welding is not practical, connect in accordance with UL 467.

7. The bolted stringer type of access floor specified in Specification Section 10270 as indicated on the Drawings may be used as a SRG subject to:

   a. Distribution panels shall be in accordance with Paragraph 3.01F.2.

   b. Equipment connection to the SRG shall be in accordance with Paragraph 3.01F.4.

   c. Every other pedestal for the access floor shall be bonded to the SRG using a number 6 AWG, seven-strand copper conductor 2 feet long maximum.

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ATTACHMENT 1, PAGE 2 OF 2

d. Bonding other non-current carrying metal equipment shall be in accordance with Paragraph 3.01F.6.

3.02 FIELD QUALITY CONTROL

A. Test ground electrodes, ground grids, and safety ground beds in accordance with IEEE 81.

B. Test neutral grounding devices in accordance with IEEE 32.

~~C. Inspect the grounding installation for proper connection, prior to concealment and installation in accordance with IEEE 837.~~ GAP 5/9/94

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D. Field inspections shall be made by the Buyer while work is in progress to ensure compliance with technical and quality requirements of this Specification Section and the Drawings.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests, and shall be provided to the Buyer for the A/E prior to final acceptance.

C. Manufacturer's data, shop drawings, and test reports shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

C. Prior to concealment, inspect the grounding installation for proper installation and inspect the connections in accordance with the manufacturer's instructions. GAP 5/9/94

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REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16450

TITLE: Grounding

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.2		X													X						
Field Inspection	3.02, 4.01B	X													X							
Mfr's Data	4.01B		X																			
Shop Drawings	4.01C		X						30													
Test Reports	4.01C		X						30							X						

COMMENTS:

END OF SPECIFICATION SECTION

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

FIELD CONTROLLED COPY
10/2/50
NO _____
THIS IS A RED STAMP

Civilian Radioactive Waste Management System
Management and Operating Contractor

RECEIVED
JAN 07 1994
DOCUMENT AND RECORDS CENTER

Specification Section 16481

FIRST SUBMITTAL

LOW VOLTAGE MOTOR STARTERS

Cl.16.2000
0 12/16/93

Document Identifier: BAB000000-01717-6300-16481 REV.00
QA Classification: TBV-125

Revision No.	Date
00	~~12/03/93~~ 12/21/93
	12/03/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Title of Procurement Specification LOW VOLTAGE MOTOR STARTERS

Document Identifier: BAB000000-01717-6300-16481 Revision Number 0C

QA Classifications: TBV-125

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Bharat H. Majmudar	*Date*	12/3/93
Reviewed by	Yusuf Shaw	*Date*	12/16/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	Luis J. Fernandez	*Date*	12/16/93 21 12/21/93 LF
Approved by	[illegible]	*Date*	12/21/93
QA Approval	Fred Arth	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16481

LOW VOLTAGE MOTOR STARTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for the installation of the Low Voltage Motor Starters as specified herein and indicated on the Drawings.

B. The equipment furnished and delivered shall be of essentially standard design and quality meeting or exceeding the requirements of this Specification Section and Attachments.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 16050 Basic Electrical Materials and Methods

C. Section 16425 Low Voltage Switchgear

.03 REFERENCES

A. All equipment shall comply with all applicable federal, state, and local codes and regulations.

B. All equipment specified herein shall be designed, manufactured, and installed in accordance with the standards and requirements of the following:

1. American Society for Testing and Materials (ASTM):

a.	ASTM B3-90	Standard Specification for Soft or Annealed Copper Wire
b.	ASTM B8-90	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
c.	ASTM D2633-82	Standard Methods of Testing Thermoplastic Insulations and Jackets for Wire and Cable
d.	ASTM D3032-91	Standard Test Methods for Hookup Wire Insulation

REFERENCE DOCUMENT - UNCONTROLLED

2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

IEEE 32-72	Standard Requirements, Terminology, and Test Procedure for Neutral Grounding Devices

3. National Electrical Manufacturers Association (NEMA):

a.	NEMA 250-91	Enclosures for Electrical Equipment (1000 Volts Maximum), Revision 2, May 1988
b.	NEMA AB 1-86	Molded Case Circuit Breakers and Molded Case Switches
c.	NEMA AB 3-84	Molded Case Circuit Breakers and Their Application
d.	NEMA ICS 1-88	General Standards for Industrial Control and Systems
e.	NEMA ICS 2-88	Industrial Control Devices, Controllers and Assemblies
f.	NEMA ICS 2.2-83	Maintenance of Motor Controllers After a Fault Condition
g.	NEMA ICS 2.3-83	Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers
h.	NEMA ICS 6-88	Enclosures for Industrial Control and Systems
i.	NEMA KS 1-90	Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
j.	NEMA WC 5-73	Thermoplastic-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-61-402)

4. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

5. Underwriters Laboratories, Inc. (UL):

a.	UL 44-91	Standards for Safety Rubber-Insulated Wires and Cables, Thirteenth Edition
b.	UL 83-91	Standard for Safety Thermoplastic-Insulated Wires and Cables, Tenth Edition
c.	UL 94-91	Standard for Safety Tests for Flammability of Plastic Material for Parts in Devices and Appliances, Fourth Edition
d.	UL 98-87	Standard for Safety Enclosed and Dead-Front Switches, Eleventh Edition

REFERENCE DOCUMENT - UNCONTROLLED

e.	UL 198C-86	Standard for Safety High-Interrupting Capacity Fuses, Current Limiting Types, Fifth Edition
f.	UL 198E-88	Standard for Safety Class R Fuses, Fourth Edition
g.	UL 486E-88	Standard for Safety Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, Second Edition
h.	UL 489-91	Standard for Safety Molded-Case Circuit Breakers and Circuit-Breaker Enclosures, Eighth Edition
i.	UL 508-93	Standard for Safety Industrial Control Equipment, Sixteenth Edition
j.	UL 845-88	Standard for Safety Motor Control Centers, Third Edition
k.	UL 1059-93	Standard for Safety Terminal Blocks,Third Edition
l.	UL 1581-91	Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords, Second Edition

C. If there is an apparent discrepancy between any of the requirements of this Specification Section and those stipulated in Paragraph 1.03B, the most stringent requirements shall apply. The Architect/Engineer (A/E) shall be apprised of all apparent discrepancies for resolution.

..04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-125)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Low Voltage Motor Starters, materials, and equipment.

2. Field Verification: Dimensional/visual inspection of the installation and operational testing of the Low Voltage Motor Starters, materials, and equipment. (HOLD POINT)

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Seller or manufacturer instructions and recommendations for delivery, storage, an handling of material and equipment and Specification Section 01600.

REFERENCE DOCUMENT - UNCONTROLLED

PART 2 PRODUCTS

2.01 DESIGN

A. Enclosure

1. Each assembly shall consist of metal-enclosed, deadfront, vertical steel enclosures containing combination motor starters, combination lighting or heating controllers, feeder breakers, control equipment, and other devices as specified on the Drawings and Attachments.

2. The enclosure shall be constructed of No. 14 gauge minimum sheet steel. All doors shall be No. 14 gauge minimum sheet steel, with 1/2 inch flange mounted on pin hinges.

3. The size and type of enclosure shall be in accordance with NEMA 250.

4. The enclosure shall be suitable for back-to-wall mounting and shall have front-mounted equipment only, unless noted otherwise in the Attachments or Drawings.

5. All hinged front doors shall close on gaskets installed around the edge of the door or the structure. The assembly shall meet the requirements of NEMA Type 12 or as specified on the Attachments. Neoprene gaskets are preferred; the Seller shall identify the type of material the manufacturer proposes to use.

6. Motor Starter enclosures shall be UL listed and carry UL labels.

7. Each Motor Starter enclosure assembly shall be provided with all material required to facilitate handling.

8. The design and fabrication of the Motor Starter assemblies shall be in accordance with the standards referenced in Article 1.03. Testing shall be in accordance with Article 2.04.

B. Space Heaters

1. When specified on the Attachments, thermostat controlled electric space heaters shall be installed to prevent condensation of moisture in the equipment.

2. These heaters shall be operated at 120 VAC and sized to provide adequate heat at the operating voltage. However, insulation shall be adequate for at least 240 VAC operation.

3. All space heaters within each Motor Starter assembly shall be controlled only by a single circuit breaker located in one of the units in the assembly. The entire circuit shall be wired to an accessible terminal block with a single connection for the external power source provided by the Buyer.

4. Provisions shall be made for the Buyer to energize the space heaters of each shipping section during storage at the jobsite. The space heater electrical connection point shall be readily available without uncrating the equipment and clearly identified as to its location and the electrical service it requires.

REFERENCE DOCUMENT - UNCONTROLLED

C. Control Devices

1. All control devices such as pushbuttons, selector switches, and indicating lights shall be sin unit, heavy-duty oil-tight type.

   a. Contacts shall be of silver alloy, rated ten amperes continuous, six amperes make and six amperes break at 120 VAC.

   b. The voltage rating of the contact block assembly shall be 600 volts.

   c. Pushbutton color-coded inserts shall be removable and interchangeable with other color-coded inserts.

2. Ammeter and voltmeter selector switches shall be three-phase with on-off positions.

3. Open knife switches shall not be used.

4. Each motor controller shall have transformer type indicating lights. A red lens shall be provided for RUN light, blue lens for REVERSE light, yellow lens for AUXILIERY light, and a green lens for STOP light.

5. All indicating lights shall be push-to-test, heavy-duty oil-tight type with unshrouded color caps. Indicating lights shall be suitable for panel mounting and shall incorporate a transformer with a 6 to 8 volt lamp.

D. Arrangement

1. Motor Starter assemblies shall have all starters, contactors, and circuit breakers front mounted only.

2. The enclosure door shall be mechanically interlocked to prevent the door from being opened when the external disconnect operator is in the ON position, and also to prevent the external disconnect operator from being turned to the ON position when the door is open. A defeater means shall be furnished to permit trained personnel to bypass these mechanical interlocks.

3. With the door closed, circuit breaker operating handle positions shall indicate ON, TRIPPED, and OFF and shall have provisions for padlocking with at least one padlock in the ON position and three padlocks in the OFF position.

4. Auxiliary devices such as control transformers, relays, current transformers, and meters, as specified on the Attachments, shall all be installed in the same enclosure as the starter, even if a larger enclosure may be required. Using additional enclosures to consolidate these components is not acceptable. All components shall be mounted in the vertical position, unless otherwise specifically designed for another orientation on the Drawings and Attachments.

5. A ground lug shall be furnished in the enclosure. Provide neutral lug as indicated on the Drawings and Attachments.

REFERENCE DOCUMENT - UNCONTROLLED

6. Incoming and outgoing cables shall enter either from the top or bottom of the assembly as indicated on the Attachments.

E. Manual Motor Starters

1. Manual Motor Starters shall be in accordance with NEMA ICS 2 and as indicated on the Drawings.

   a. Fractional horsepower up to 1 horsepower may be of the toggle switch type.

   b. Integral horsepower up to 10 horsepower shall be of the pushbutton type.

2. Enclosure shall be surface mount, NEMA designation as indicated on the Drawings.

3. Manual Motor Starters shall be full-voltage, with overload protection selected for the full-load nameplate current and service duty of the motor to be controlled, with red pilot light, and shall be lockable in either the ON or OFF position; number of poles, single or three phase as indicated on the Drawings.

4. Manual Motor Starters shall also have, but not be limited to, as indicated on the Drawings:

   a. Provision for remote or automatic control hand-off-automatic (H-0-A) selector switch

   b. Provision for key operation

   c. Low voltage protection

   d. Reversing and two-speed feature

   e. Auxiliary contacts

   f. Remote emergency stop.

F. Combination Starters

1. Combination starters shall be 3-pole, 480 VAC, full voltage, across-the-line starting, magnetic contactor type, combination motor circuit protector (MCP) as shown on the Drawings and Attachments with individual control transformers and three thermal overload relays (including heater elements).

2. Combination motor starters and lighting/heating contactors for NEMA Sizes 1 through 6 shall be of the bolted-on type. Feeder circuit breakers shall be of the bolted-on type.

3. The minimum starter size shall be NEMA Size 1.

REFERENCE DOCUMENT - UNCONTROLLED

4. Contactor and relay coils shall be rated for 120 VAC, 60 Hz except when DC coils are specified on Attachments. If an external DC power supply is used, the Seller shall furnish an interlock system to trip the breaker to deenergize the compartment when the unit compartment door is opened for maintenance.

5. When specified in the Attachments, motor starters shall be equipped with an undervoltage, time-delay dropout circuit. Dropout time shall be adjustable from 0 to 5 seconds. The capability of removing or inserting this time delay feature shall be provided by installing jumpers on the terminal blocks. The circuit shall be designed so that the start-stop pushbutton stations with momentary closing and opening contacts may be used to manually control the motor. The contactor shall not reclose until 5 seconds after the voltage is restored to normal.

6. In addition to the starter holding contacts, two normally open (NO) and two normally closed (NC) spare auxiliary contacts, unless more are specified in the Attachments, shall be provided on each combination starter. When programmable logic controllers (PLCs) are specified for relay control, one normally open (NO) and one normally closed (NC) spare auxiliary contact shall be provided on each combination starter, unless more are specified in the Attachments. Contacts not used for starter control shall be wired to outgoing terminal blocks and marked as spares for A/E use.

7. Reversing and two-speed motor starters shall be electrically and mechanically interlocked to prevent the simultaneous energization of contactors.

8. One three phase thermal overload relay, and ambient temperature compensated, manual reset bimetallic type relays, adjustable between 85 and 115 percent of their nominal trip rating, shall be provided. Ambient temperature insensitive type thermal overload relays may be acceptable if authorized by the A/E.

9. Thermal overload relay heater elements shall be sized based upon motor full load current nameplate data. Overload relay heater elements for spare starters shall be sized based upon the maximum continuous current rating of the starter or as indicated on the Drawings and Attachments.

10. Overload relays shall have an external manual reset pushbutton.

11. Control power transformers (CPTs) shall be 480-120 VAC, single phase, 60 Hz with voltampere (VA) rating one size larger than normally supplied for each combination motor starter or contactor, and mounted in the same enclosure as the starter or contactor. The minimum CPT size shall be 130 VA. CPTs shall have both primary legs fused in accordance with NFPA 70. One secondary leg of the CPT shall be provided with a fuse and the other secondary leg grounded. Connections to both secondary legs shall be provided at the control terminal block.

G. Circuit Breakers

1. All circuit breakers shall be molded case type, 3-pole, 600 volt AC, 100 ampere minimum frame size. Shunt trips shall be furnished when indicated on the Drawings and Attachments. The circuit breaker interrupting rating shall be as shown on the Drawings and Attachments.

REFERENCE DOCUMENT - UNCONTROLLED

2. Motor circuit protectors for motor starters shall have adjustable, magnetic only trip units.

3. Circuit breakers for feeders shall have thermal-magnetic trip units.

4. Where indicated on the Drawings and Attachments, molded-case circuit breakers shall be equipped with integral current limiting type devices with an interrupting rating not less than the three-phase short circuit current available.

5. One (NO) and one (NC) spare auxiliary contact shall be provided in the motor starter and feeder enclosure equipped with ground fault protection. Contacts not used for starter or feeder control shall be wired to outgoing terminal blocks and marked as spares for A/E use.

H. Lighting and Heating Contactors: Lighting and heating contactors shall be similar to the combination motor starters except that no overload relays shall be provided, and the circuit breaker shall be of the thermal-magnetic type.

I. Motor Winding Heaters: When specified on the Attachments, the Motor Starter assembly shall contain solid state motor winding heater control circuitry, including a silicon-controlled rectifier (SCR) to apply a single phase voltage and any required protection components. This circuitry shall use the motor windings to carry a current of a magnitude capable of producing enough heat to maintain the temperature inside the motor above ambient. The motor winding heater shall be connected to the line side of the contactor through normally closed contacts and also connected to the load side of the contactors before the motor overloads. This circuitry shall be used on all process motors and all outside motors and other intermittent duty motors.

2.02 FABRICATION

A. General

1. Workmanship and materials used in the equipment specified herein shall be first class, the best of their respective kinds, and shall be in full accordance with the most modern electrical and mechanical engineering practices.

2. The Motor Starter assemblies will be supplied from a solidly grounded system, unless otherwise noted in the Attachments.

3. Equipment shall be new and free of defects in materials and workmanship.

4. All electrical materials and equipment shall be listed or labeled by Underwriters Laboratories, Inc. (UL), Factory Mutual (FM), or equivalent testing laboratory for the service in which used, and shall bear their label or listing.

5. Provide a complete list of all electrical equipment and materials.

   a. All electrical components of all equipment furnished shall be in accordance with the materials list.

REFERENCE DOCUMENT - UNCONTROLLED

b. Any deviations or substitutions from the materials list shall require written authorization from the A/E.

B. Wiring

1. Minimum wiring size for power circuits shall be No. 12 AWG. Minimum wiring size for control circuits shall be No. 14 AWG. All wiring shall be soft or annealed copper, in accordance with ASTM B3. Wires shall be stranded in accordance with ASTM B8, Class D stranding for wires that cross hinged joints, and Class C stranding or finer for all other wires.

2. Internal wiring of combination motor starters shall be in accordance with UL 44. Minimum conductor sizes for internal wiring and minimum cable lug sizes for copper conductors to the load side of the following size starters shall be as follows:

Starter Size	Wiring and Cable Lugs
1	No. 12 AWG
2	No. 10 AWG
3	No. 6 AWG
4	No. 2/0 AWG
5	No. 4/0 AWG
6	500 kcmil

3. All wiring shall be neatly bundled, secured, and protected against contact with any sharp metal edges. There shall be no spliced conductor or repaired insulation. Wires that cross hinged joints shall be properly installed and secured on both sides of the hinge with a flexible loop protected by an appropriate size of spiral wrapping. All wireways, troughs, and other areas where wiring is present shall have no sharp edges, burrs, or other protrusions that could damage the wire insulation. Where the fabrication of metal pieces leaves exposed edges, the manufacturer shall install non-metallic protection to prevent any possible damage to the insulation and any hazards to construction and maintenance personnel.

4. Maximum space for bending and making up the incoming feeder cables shall be provided in the Motor Starter enclosure.

5. The insulation of the wiring shall be for 600 VAC operation.

6. The type of wire and cable insulation to be used for control and power wiring for all equipment shall meet the requirements of UL 44 or UL 83. The wire shall be UL listed and comply with NFPA 70.

7. All wires shall be rated for 90 degrees C continuous conductor temperature. Wires shall not cross over or pass in front of any terminal block. All wire shall be capable of passing the ASTM Vertical Flame Tests per ASTM D2633 or ASTM D3032 as appropriate.

8. All wires originating from the same electrical node or point shall carry the same wire number. This wire number shall be unique for any given cubicle and in accordance with Article 2.

REFERENCE DOCUMENT - UNCONTROLLED

9. Internal wiring connections made with lugs shall be compression type. Lugs to be used shall be submitted to the Buyer for A/E review. Crimped lugs shall be installed using ratcheting type crimping tool of the same manufacturer as lugs and reviewed for use with the specific lugs.

10. The Motor Starter assemblies shall be completely front wired.

C. Finish and Painting

1. Each enclosure shall be cleaned, primed, and painted in accordance with manufacturer's standard practice, with a minimum of two coats of paint. Final exterior finish for indoor assemblies shall be the manufacturer's standard light grey. Interior removable bucket back pan metal components of Motor Starter assemblies shall be painted white for increased visibility.

2. The Seller shall supply paint, matching each color used, for field touch-up after installation of the equipment. One quart of each color used shall be supplied per order. All details for painting procedures shall be submitted to the Buyer for A/E review.

3. If the manufacturer's standard painting practice is to use an electrostatic power spray process with chromic seal and deionized rinse, only one coat is required.

2.03 IDENTIFICATION, MARKING, AND TRACEABILITY

A. Engraved nameplates made of 1/16-inch thick laminated black and white material, with 1/8-inch letters engraved through the white top lamination to the black interior, shall be furnished. The Seller shall submit a nameplate list to the Buyer for A/E review.

B. A door-mounted sign, laminated plastic with white letters on a red background, shall be provided on each Motor Starter assembly in which an external voltage source will be terminated. The sign shall read "CAUTION - This Unit Contains An External Voltage Source."

C. An engraved metal rating nameplate shall be permanently attached to the equipment with self tapping screws or captive fasteners. Rating nameplate shall indicate manufacturer's name, style, type model/catalog number, and equipment rating.

D. Each part of each piece of equipment requiring field assembly shall be durably marked with equipment number, title, and part number related to the installation requirements.

E. Identification of wiring shall be provided using manufacturer's standard identification system. The identification shall be by the application of heat-shrinkable, plastic sleeve markers accepted by the A/E in writing. The proposed wire identification system shall be included in the drawings to be submitted. Individual identification for each wire shall be included in wiring and schematic diagrams to be submitted. All wires shall be labeled at both ends and at any point between where the wires may terminate. The labels must be permanent and in accordance with wire identification shown on approved wiring and interconnection drawings. Wire numbers shall be typed or machine stamped on the plastic sleeve markers. Handwritten wire numbers are not acceptable.

REFERENCE DOCUMENT - UNCONTROLLED

F. An identification nameplate shall be attached to each Motor Starter assembly displaying identification shown on the Drawings and Attachments. Attachment shall be with nonferrous metal screws or fasteners. Use of adhesive for attaching the nameplates is not acceptable.

2.04 SELLER QUALITY CONTROL

A. The Buyer or authorized representative shall have access to the manufacturer's shop, shop procedures, schedules, testing, and inspection procedures and documents.

B. The Seller shall verify by test that the complete electrical system with its components complies with all its performance requirements. A detailed list of tests and testing procedures, including requirements in IEEE 32, shall be submitted to the Buyer for A/E review. Testing shall be witnessed by the Buyer and the A/E. The Buyer and A/E's test forms shall be used if indicated in the Attachments. The Seller shall use their standard test forms for all other tests. (WITNESS POINT)

C. The Seller shall perform the following tests as a minimum:

1. Each power and control conductor shall be checked for continuity.

2. Dielectric withstand voltage test of all power conductors and buses shall be performed between conductors and between conductors and ground.

3. All control conductors shall be checked for insulation resistance.

4. An operational test shall be performed with electrical components installed to ensure completeness, adequacy, and proper functioning and fitting of all equipment and components.

5. Equipment or components that can be damaged by tests shall be isolated during the tests.

6. Circuit breakers and motor circuit protectors shall be trip tested to verify that settings are in accordance with the manufacturer's requirements or data furnished with the purchase order.

7. All test results shall be recorded on the appropriate forms. Completed forms shall be signed and dated by the manufacturer and Buyer representatives, if present.

8. Certified test reports shall be supplied as applicable for the equipment purchased under this Specification Section.

9. The results of all factory tests, traceable to the items they represent, shall be documented and certified by the manufacturer as in compliance with the performance requirements. The original copy of each test result shall be submitted to the Buyer for A/E review prior to shipment.

10. Control conductors shall be tested with a 1000 volt DC megger for a period of one minute. A minimum reading of 1 kV + 1 megohms resistance is acceptable.

REFERENCE DOCUMENT - UNCONTROLLED

11. With all circuit breakers closed and associated devices isolated, a 1000 volt DC megger insulation test of the entire bus (horizontal and vertical), including the individual sections, shall be performed for a period of one minute. A minimum of one megohm for each 1000 volts of operating voltage with a minimum value of one megohm, preferably resistance corrected to 40 degrees Celsius shall be greater than or equal to 1.5 megohms.

12. Circuit breakers shall be tested in accordance with UL 489.

PART 3 EXECUTION

3.01 GENERAL

The Motor Starter specified in this Specification Section will be installed in designated buildings designed to accommodate the equipment.

3.02 PREPARATION

Preparation for installing the Motor Starter shall be in accordance with Division 1 requirements.

3.03 INSTALLATION

A. The Motor Starter shall be installed in the designated buildings in accordance with the Drawings and the manufacturer's installation instructions.

B. The Motor Starter shall be installed electrically in accordance with the Drawings, the Specification Package.

C. The Buyer shall solicit Seller field engineer(s) for technical direction for assembly, installation, and start-up to ensure the safe and successful operation of the equipment supplied when the Buyer does not have the technical expertise.

3.04 FIELD QUALITY CONTROL

A. Testing and Adjustment: The following requirements are supplementary to tests specified for individual equipment items or systems under the electrical Specification Sections of the Specification Package. All testing for the Motor Starter shall be scheduled by the Buyer and reviewed by the A/E.

1. The Buyer shall notify the A/E by letter at least two weeks in advance of testing.

2. Complete test and inspection records shall be made by the Buyer and incorporated into a report for each item of equipment tested.

   a. Record all readings taken.

   b. The Buyer shall submit copies to the A/E for review as specified in Part 4.

REFERENCE DOCUMENT - UNCONTROLLED

3. Furnish necessary calibrated meters, instruments, temporary wiring, and labor to perform all required tests and adjustments of equipment and wiring installed and connected in this wc including electrical equipment specified elsewhere in this Specification Section, to determi proper polarity, phasing, freedom from grounds and shorts, and operation of equipment.

4. All materials and installations shall be in strict accordance with the applicable requirements of NFPA 70, the Drawings, the Specification Section, and the manufacturer's written instructions.

5. Replace all defective items to provide a complete and operable system.

6. Demonstrate that all power and control operating devices/equipment function properly.

3.05 ADJUSTING AND CLEANING

A. Keep premises in a clean and orderly condition during construction.

B. All equipment nameplates shall be kept clean for easy reading.

C. Upon completion of work, clean all equipment and remove surplus material and rubbish relating to electrical work, leaving the work neat and clean.

3.06 ADDITIONAL REQUIRED DATA

A. The following Attachments shall be included as a part of this Specification Section:

Ratings and Requirements, Attachment A

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Drawing Requirements: Drawings shall be provided for the equipment as specified and ordered. These drawings shall include, but are not limited to, the following:

1. Outline and Arrangement Drawings, which shall be completely dimensioned and show:

a. Equipment arrangement

b. Dimensional plans and elevations, front view, and other elevation views if pertinent

c. Component locations and miscellaneous mechanical details

d. All conduit entrance sizes and locations (both top and bottom) for the A/E's connections

REFERENCE DOCUMENT - UNCONTROLLED

e. A/E's wiring (both power and control alarm) terminal locations, arrangement, and grounding connections

f. Required clearances, tolerances, and mounting methods, and recommended minimum bolt sizes

g. Weight of equipment, including individual weights of stationary units, and removable components

h. Incoming power cable terminator (lug) positions

i. Required clearances for opening doors and for removing withdrawable components.

2. Elementary Wiring Diagrams

a. Complete elementary (schematic) wiring diagrams showing all control devices and device contacts. All devices and contacts shall be labeled with their proper IEEE C37.2 device function number.

b. Terminals for all devices and all terminal blocks shall be numbered and shown on the elementary diagrams.

3. Connection Diagrams

a. Interconnecting wiring diagrams with clear identification of terminals including A/E connection points, and any A/E and Seller interconnections between panels, cabinets, or components.

b. Connection diagrams shall indicate all terminals and show the approximate physical location in the assembly.

C. Test Reports and Calculations: Certified test reports containing the results of all tests on each unit shall be provided to the Buyer for review by the A/E.

D. Catalog Information: The Seller shall supply catalog information for the equipment being supplied showing voltage, controller size, rating and size of switching and overcurrent protection devices, short circuit ratings, dimensions, and enclosure details. This information shall include all components for all original equipment manufacturer (OEM) equipment being supplied. The actual manufacturer's catalog numbers shall be provided if they differ from the Seller's part numbers.

E. Recommended Spare Parts List

1. The Seller shall submit a complete parts list for the equipment which shall cross-reference all the Seller or Subseller assigned part numbers to the original manufacturer's part number. The Seller shall make a notation of quantities of these items recommended or required by the Buyer for continuous operation during one normal overhaul cycle. This recommended spare parts list (RSPL) shall include items requiring replacement under the following conditions (which condition to be noted):

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a. Wear, corrosion, or erosion during normal operation

b. Failures which cause a shutdown of equipment

c. Damage or breakage during routine maintenance or inspection of equipment

d. Long lead time of operational insurance items

e. Time-compliance limits on time-in-service due to age-related deterioration.

NOTE: Shelf life shall also be stipulated for spare parts subject to age-related deterioration.

2. The parts list shall include cross-sectional or assembly-type drawings, part numbers, materials, and estimated delivery lead times. Part numbers shall identify each part for interchangeability purposes. The parts list and RSPL notations shall be provided to the Buyer promptly upon the Seller's receipt of approved drawings. The parts list shall contain prices for all RSPL components.

F. Special Tools and Test Equipment: A separate price shall be quoted for any special tools and test equipment that may be needed for maintenance.

G. Installation and Operating Instructions: A complete field test, maintenance, and service manual shall be furnished and shipped with the Motor Starter for the proper installation, operation, and maintenance of the equipment.

H. Operation and Maintenance Manuals: A materials list shall be furnished listing the quantity, type, rating, the Seller's (and the manufacturer's, if different) catalog number of all equipment in each unit.

I. Manufacturer Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

ATTACHMENT A
LOW VOLTAGE MOTOR STARTERS
RATINGS AND REQUIREMENTS
SUBSURFACE VENTILATION SYSTEM

I. Motor Starter for a TEAO 250HP Ventilation Fan Motor

II. Ratings and Requirements:

A. Rated Operating Voltage, Volts: 480

B. Starter Size: NEMA Size 6

C. Rated Frequency, Hertz: 60

D. Phase: 3

E. Enclosure NEMA: 12 Industrial Dust Tight

F. Combination Starter Type: Circuit Breaker

G. Combination Starters Interrupting Capacity: 50,000 RMS Symmetrical Amperes

H. Combination Starters Breaker Type: Thermal-magnetic

I. Incoming and Outgoing Lines: 2 - 3/c 500 kcmil, Copper, Top entry

J. Special Features

1. Indicator Lights:

   Green for Stop
   Red for Run
   Blue for Reverse
   Yellow for Overload Trip

2. Local/Off/Remote Switch with keylock

3. For Local Control operations:

   Red Pushbutton for Stop
   Green Pushbutton for Run
   Yellow Push Button for Reverse

4. Control circuitry for 120 VAC motor heater unit sized for ventilation fan motor.

REFERENCE DOCUMENT - UNCONTROLLED

5. Forward and Reverse remote auxiliary interlock contacts for the following:

   a. To remotely start, stop and reverse the ventilation fan.

   b. To prevent local operations without the go ahead form the ventilation supervisory control unit.

6. Solid State motor protection unit with the following (Westinghouse IQ-1000 II or approved equal):

   a. Phase current and ground fault current monitoring

   b. Motor bearing temperatures in degrees with resistive temperature detector leads.

   c. Motor protection feature:

      Locked rotor current: Device 51
      Ultimate trip current: Device 51
      Maximum allowable stall time
      Instantaneous overcurrent with programmable trip and start delay: Device 50
      Phase loss and phase unbalance trip and alarm: Device 46
      I^2T alarm level: Device 47
      Zero sequence ground fault trip: Device 50G/51G

   d. CTs and GFCTs to support the above functions.

7. Provide terminals for the Motor vibration monitor unit for the shut down of ventilation motor for excess vibrations.

8. Provide communication capability to Allen Bradley's PLC-5/20 Programmable Logic Controller.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16481

TITLE: Low Voltage Motor Starters

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.2		X													X				3		
Painting Procedures	2.02C									X												
Nameplate List	2.03A		X							X												
Ident. Marker	2.03E		X							X												
Factory Inspection	2.04		X										X									
Factory Test Proc.	2.04B		X						30										14			
Test Reports	2.04C &		X								X					X						
	4.01C																					
Field Testing Proc.	3.05A		X													X						
Id Testing	3.05A		X													X						
Factory Cert. Test	4.01		X								X											
Drawings	4.01B		X												X							
Catalog Information	4.01D				X											X						
Parts List	4.01E				X						X											
Equip. Quotes	4.01F															X						
OEM Manuals	4.01G															X						
Material List	4.01H															X						

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 1/5/94

WBS: 1.2.6
QA: QA

Civilian Radioactive Waste Management System
Management and Operating Contractor

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Specification Section 16501

FIRST SUBMITTAL

LAMPS

Cl.16.2000
12/16/93

Document Identifier: BAB000000-01717-6300-16501 Rev.00
QA Classification: TBV-125

Revision No.	Date
00	~~12/06/93~~ 12/21/93
	12/06/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class: Q

Title of Procurement Specification LAMPS

Document Identifier: BAB000000-01717-6300-16501 Revision Number 00

QA Classifications: TBV-125

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Bharat G. Majmundar	*Date*	12/16/93
Reviewed by	Yusuf D. Shaw	*Date*	12/16/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	Lewis J. Ferrara	*Date*	12/~~16~~ 21/93 12/21/93 LF
Approved by	[illegible]	*Date*	12/21/93
QA Approval	Fred Acte	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16501

LAMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes the furnishing of all materials, tools, equipment, and labor necessary for the installation of the Fluorescent, High Pressure Sodium, and Metal Halide Lamps as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 16050 Basic Electrical Materials and Methods

C. Section 16502 Fixture Accessories

D. Section 16510 Fluorescent Lights

E. Section 16512 High-Intensity Discharge Lights

1.03 REFERENCES

A. American National Standards Institute (ANSI):

1.	ANSI C78.1-91	Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
2.	ANSI C78.1350-90	Electric Lamps - 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
3.	ANSI C78.1351-89	Electric Lamps - 250-Watt, 100-Volt, S50 Single-Ended High-Pressure Sodium Lamp
4.	ANSI C78.1352-90	Electric Lamps - 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
5.	ANSI C78.1353-90	Electric Lamps - 70-Watt, 52-Volt, S62 Single-Ended High-Pressure Sodium Lamps
6.	ANSI C78.1354-90	Electric Lamps - 100-Watt, 55-Volt, S54 Single-Ended High-Pressure Sodium Lamps

REFERENCE DOCUMENT - UNCONTROLLED

7. ANSI C78.1377-90 — Electric Lamps - 175-Watt, M57 Single-Ended Metal Halide Lamps

8. ANSI C78.1378-90 — Electric Lamps - 250-Watt, M58 Single-Ended Metal Halide Lamps

9. ANSI C78.1375-90 — Electric Lamps - 400-Watt, M59 Single-Ended Metal Halide Lamps

B. National Fire Protection Association (NFPA):

NFPA 70-93 — National Electrical Codes

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. Products covered by this Specification Section shall be considered not important to radiological waste isolation or radiological safety. (TBV-125)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the lamps.

2. Field Verification: Dimensional/visual inspection of the installed lamps.

PART 2 PRODUCTS

2.01 MATERIALS

A. All lamps shall comply with referenced ANSI requirements and the Drawings.

B. Fluorescent lamps shall be standard cool white in color characteristics unless otherwise indicated on the Drawings and of the rapid start type complying with ANSI C78.1.

C. Metal-Halide HID lamps shall be phosphor coated or as indicated on the Drawings. The lamps shall comply with the following ANSI requirements:

1. 175-Watt, ANSI C78.1377.90

2. 250-Watt, ANSI C78.1378.90

3. 400-Watt, ANSI C78.1375.90

D. High-Pressure Sodium HID lamps shall be coated suited for all burning positions as indicated on the Drawings. The lamps shall comply with the following ANSI requirements:

REFERENCE DOCUMENT - UNCONTROLLED

1. 70-Watt, ANSI C78.1353.90
2. 100-Watt, ANSI C78.1354.90
3. 250-Watt, ANSI C78.1351.90
4. 400-Watt, ANSI C78.1350.90
5. 1000-Watt, ANSI C78.1352.90

PART 3 EXECUTION

3.01 INSTALLATION

A. All lamps shall be installed in accordance with the Specification Sections, the Drawings, the manufacturer's written instructions, and NFPA 70.

B. All lamps shall be installed in the intended lighting fixtures in accordance with the Specification Sections, the Drawings, and manufacturer's written instructions.

3.02 FIELD QUALITY CONTROL

A. Field Inspection: Inspection shall be performed while work is in progress and a final inspection to ensure compliance with the technical and quality requirements of the Specification Sections and the Drawings.

B. Field Testing: The Buyer shall perform an operating test to demonstrate conformance of the lamps in accordance with applicable testing requirements contained in referenced codes and standards or defined elsewhere in the Specification Sections.

3.03 ADJUSTMENTS

Failed, damaged, or discolored lamps shall be replaced at completion of work.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the Buyer for Architect/Engineer (A/E) prior to final acceptance.

C. Manufacturer's data, shop drawings, and test reports shall be provided to the Buyer for the A/E's review.

REFERENCE DOCUMENT - UNCONTROLLED

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16501

TITLE: Lamps

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04B.1		X										X									
Field Verification.	1.04B.2		X													X						
Field Inspection	4.01B	X													X							
Field Tests	4.01B		X													X						
Mfr's Data	4.01C		X						30													
Shop Drawings	4.01C		X						30													
Test Reports	4.01C				X											X						

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By [illegible] Date 1/5/94

WBS: 1.2.6
QA: QA

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Specification Section 16502

FIRST SUBMITTAL

FIXTURE ACCESSORIES

Document Identifier: BAB000000-01717-6300-16502 Rev. 00
CI.16.0000
QA Classification: TBV-125

Revision No.	Date
00	01/04/94

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1

QA Class:

Title of Procurement Specification FIXTURE ACCESSORIES

Document Identifier: BAB000000-01717-6300-16502 Revision Number 00

QA Classifications: TBV-125

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Bharat H. Majmudar	*Date*	12/16/93
Reviewed by	Yuri Shana	*Date*	12/16/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	1/4/94 LF 1/4/94
Verified by	Lucie L. Fernandes	*Date*	12/20/93 LF 12/21/93
Approved by	[illegible]	*Date*	~~12/20/93~~ 1/4/94
QA Approval	Fred Orth	*Date*	~~12/21/93~~ 1-5-94

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16502

FIXTURE ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes the furnishing of all materials, tools, equipment, and labor necessary for the installation of the Fixture Accessories as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 16050 Basic Electrical Materials and Methods

C. Section 16122 600 V Power and Control Cable

D. Section 16501 Lamps

E. Section 16510 Fluorescent Lights

1.03 REFERENCES

A. American National Standards Institute (ANSI):

1.	ANSI C82.1-85	Ballasts for Fluorescent Lamps - Specification
2.	ANSI C82.4-85	Ballasts for High-Intensity Discharge and Low-Pressure Sodium Lamps

B. American Society for Testing and Materials (ASTM):

1.	ASTM A153-82	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2.	ASTM A500-90a	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

C. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

REFERENCE DOCUMENT - UNCONTROLLED

D. Underwriters Laboratories, Inc. (UL):

1.	UL 810-81	Standard for Safety Capacitors, Fourth Edition
2.	UL 935-93	Standard for Safety Fluorescent-Lamp Ballasts, Seventh Edition
3.	UL 1029-86	Standard for Safety High-Intensity Discharge Lamp Ballasts, Fourth Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. Products covered by this Specification Section shall be considered not important to waste isolation or radiological safety. (TBV-125)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Fixture Accessories.

2. Field Verification: Dimensional/visual inspection of the installed Fixture Accessories.

PART 2 PRODUCTS

2.01 GENERAL

A. All Fixture Accessories, material and equipment shall, as a minimum, meet the requirements specified in this Specification Section.

B. All Fixture Accessories shall be UL listed.

2.02 MATERIALS AND EQUIPMENT

A. Ballasts

1. General

a. Fixtures requiring ballasts shall be provided with a ballast designed for the operation of lamps of the size intended for use with the fixture and shall be wired in accordance with the diagram of instructions on or with the ballast.

b. All ballasts shall be Certified Ballast Manufacturers Association (CBM) certified.

c. Provide low temperature ballasts, with reliable starting to -20 degrees F with exterior fixture.

REFERENCE DOCUMENT - UNCONTROLLED

2. Fluorescent Ballasts

   a. Fluorescent Ballasts shall comply with UL 935 and ANSI C82.1C.

   b. The ballast shall be high power factor type, Class "P," thermally protected type, sound rating "A."

   c. Energy-saving Ballasts shall be CBM certified, full light output type. The ballasts shall have an average input wattage of 86 or less when operating F40T12 lamps or as indicated on the Drawings.

3. High-Intensity Discharge (HID) Ballasts and Fixture

   a. The HID ballast requirement covers the use with metal-halide and high pressure sodium fixtures.

   b. The HID ballasts shall comply with the UL 1029 and ANSI C82.4 requirements. The ballasts shall be Constant Wattage Autotransformer (CWA) or regulator, high power factor type (unless otherwise indicated). The ballasts shall be designed to operate on the voltage system to which they are connected.

   c. The designated emergency fixture shall include Tungsten halogen lamp to provide minimum level of illumination during warmup or restrike period.

   d. HID Fixture Reflector

      1) Interior

         The reflector material shall be formed aluminum with a chemically bonded non-breakable glass coating providing corrosion resistance. Heat and shock resistant, ease of cleaning and as indicated on the Drawings.

      2) Exterior

         Reflector shall be an anodized aluminum hinge out of housing, leaving both hands free for maintenance. The lens frame assembly shall include capline stainless steel fasteners, full perimeter frame to housing extruded weatherproof neoprene gasket, and a tempered heat and impact resistant flat glass lens. Glass lens permanently sealed to the frame with silicone gasket.

B. Capacitors shall be non-PCB type. Capacitors in lighting fixtures shall conform to UL 810 for physical, thermal, voltage, and current-interrupting limitations established for these components.

C. Fixtures shall have diffusers and lenses of polycarbonate lexan with self-extinguishing Class A fire rating.

REFERENCE DOCUMENT - UNCONTROLLED

D. Automatic dusk-to-dawn control

1. Shall have a built-in photoelectric receptacle with photocell for individual Site and Flood light. The voltage shall be as indicated on the Drawings.

2. The photoelectric lighting control shall be outdoor type, variable voltage, 1000 watt, normally closed, single pole, single throw, on at 1 footcandle nominal and off at 3 footcandles average.

2.03 SELLER QUALITY CONTROL

The Seller shall comply with the referenced standards for the requirements pertaining to the construction, tests, assembly, packaging, and inspection of the Fixture Accessories.

PART 3 EXECUTION

3.01 INSTALLATION

All Fixture Accessories installed shall be installed in a neat and workmanlike manner and in accordance with the Specification Section, the Drawings, the manufacturer's written instructions, and NFPA 70.

3.02 FIELD INSPECTION AND TESTING

A. Field Inspection: Inspection shall be performed while work is in progress to ensure compliance with the technical and quality requirements of this Specification Section and the Drawings.

B. Field Testing: The Buyer shall perform an operating test to demonstrate conformance of the Fixture Accessories in accordance with applicable testing requirements contained in referenced codes and standards or defined elsewhere in the Specification Section.

3.03 FIELD QUALITY CONTROL

The Buyer shall perform field inspection while work is in progress and a final inspection to ensure compliance with the technical and quality requirements of the Specification Section and other applicable documents.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the Buyer for Architect/Engineer (A/E) prior to final acceptance.

REFERENCE DOCUMENT - UNCONTROLLED

C. Manufacturer's data, shop drawings, and test reports shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16502

TITLE: Fixture Accessories

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.1		X													X						
Field Inspection	4.01B	X													X							
Field Tests	4.01B		X													X						
Mfr's Data	4.01B		X						30													
Shop Drawings	4.01C		X						30													
Test Reports	4.01C				X											X						

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

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WBS: 1.2.6
QA: QA

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Management and Operating Contractor

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Specification Section 16512

FIRST SUBMITTAL

HIGH INTENSITY DISCHARGE LIGHTS

CI.16.2000
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12/16/93

Document Identifier: BABBDA000-01717-6300-16512 REV 00
QA Classification: TBV-125

Revision No.	Date
00	~~12/06/93~~ 12/21/93
	12/06/93

REFERENCE DOCUMENT - UNCONTROLLED

Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2.6

QA Class:

Page: 2 of:

Title of Procurement Specification HIGH INTENSITY DISCHARGE LIGHTS

Document Identifier: BABBDA000-01717-6300-16512 Revision Number 00

QA Classifications: TBV-125

In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

The "Prepared by" signature also certifies that a determination of potential impact to work performed in accordance with previous revisions was conducted for this revision.

Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Bhavi H Majmudar	*Date*	12/12/93
Reviewed by	[illegible]	*Date*	12/16/93
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Verified by	Luis J. Fernandez	*Date*	12/20/93 21 12/21/93 LF
Approved by	[illegible]	*Date*	12/21/93
QA Approval	Fred Auth	*Date*	12-21-93

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Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

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SECTION 16512

HIGH INTENSITY DISCHARGE LIGHTS

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes the furnishing of all materials, tools, equipment, and labor necessary for the installation of the High Intensity Discharge Lights as specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 16050 Basic Electrical Materials and Methods

C. Section 16190 Supporting Devices

D. Section 16501 Lamps

E. Section 16502 Fixture Accessories

1.03 REFERENCES

A. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

B. Underwriters Laboratories, Inc. (UL):

UL 1572-91	Standards for Safety High-Intensity Discharge Lighting Fixtures, Second Edition

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-125)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the High-Intensity Discharge Lights.

REFERENCE DOCUMENT - UNCONTROLLED

2. Field Verification: Dimensional/visual inspection of the installation and operational testing of the High-Intensity Discharge Lights. (HOLD POINT)

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT FOR SURFACE APPLICATIONS

A. All High Intensity Discharge Lights materials and equipment shall, as a minimum, meet the requirements of NFPA 70 and UL 1572.

B. These requirements cover the use of HID electric lighting fixtures in accordance with NFPA 70. Included are metal-halide and high-pressure sodium fixtures for interior and exterior lighting.

C. All materials used shall be UL listed.

D. For ballasts and accessories for the HID fixtures, refer to Specification Section 16502.

E. HID fixtures shall be completely wired with all splices and connections unless indicated otherwise on the Drawings or in the manufacturer's written instructions.

F. Enclosures: All splices, tapes, wires, transformers, ballasts, capacitors, current-carrying parts or devices with exposed live metal, and leads or terminals for field connection of supply wire shall be enclosed in material constructed of metal, glass, ceramic, or porcelain.

G. Electrical devices and insulated conductors shall have ratings at least equal to the voltage and current for the intended usage with the HID fixture.

H. Thermal insulation provided as part of a fixture shall be glass fiber, permanently and reliably secured in place. Holes through the insulation for passage of wire, mounting screws, stems, fixture studs, and the like shall not be larger than necessary, and all such holes shall be provided at the factory.

I. For Flood and Site Light reflectors and lighting standards requirements, refer to Specification Section 16502.

J. Flood and Site Lights shall be High Pressure Sodium fixtures for wet and dry locations complying with UL 1572 requirements and as indicated on the Drawings.

K. For the HID lamp requirements refer to Specification Section 16501.

2.02 IDENTIFICATION AND MARKING

Identification and marking on all HID fixtures shall conform to UL 1572.

REFERENCE DOCUMENT - UNCONTROLLED

2.03 SELLER QUALITY CONTROL

The Seller shall comply with UL 1572 requirements pertaining to the construction, tests, assembly, packaging, and inspection of the High Intensity Discharge Lighting Fixtures.

PART 3 EXECUTION

3.01 INSTALLATION

A. All installations shall be accomplished in a neat and workmanlike manner and in accordance with this Specification Section, the Drawings, the manufacturer's written instructions, UL 1572, and NFPA 70.

B. Power Supply Connections

1. Connections to a barrel circuit shall consist of pigtail leads or a terminal block with a pressure terminal connector or wire binding screw. Connections for pendant fixtures, the means may consist of a UL listed cord and attachment plug.

2. A field-wiring terminal shall be prevented from turning or shifting in position by means other than friction between surfaces.

3. Connections between the fixture conductors or terminals and the conductors of the power supply barrel circuit shall be readily accessible for inspection.

C. Surface Mounted Fixtures

1. HID fixtures weighing more than 50 pounds shall be provided with a means of support independent of the outlet box.

2. A surface mounted fixture shall be provided with a back enclosure for the area of a fixture outside a 15-inch diameter circle concentric with the outlet box.

3. A HID fixture shall be provided with means for mounting such as:

a. Keyhole slots or holes for mounting to an outlet box or mounting surface.

b. Holes for mounting to threaded studs.

c. Provision for suspension mounting by chain, cable, hook, or stem.

d. Provision for support by threaded conduit.

REFERENCE DOCUMENT - UNCONTROLLED

D. Fixtures Mounted on Lighting Standards

1. HID fixtures intended for mounting on lighting standards shall include provisions for physical support of the wiring in the standard, either in the fixture itself or, if the fixture is shipped with or marked for use with the fixture fitting (such as a standard lighting arm), in the fitting. A HID fixture need not be provided with strain relief if it is marked to prohibit its use.

2. For HID lighting standards refer to Specification Section 16502.

E. Suspended Fixtures: Provide hangers capable of supporting twice the combined weight of the fixtures (refer to Specification Section 16190).

3.02 FIELD QUALITY CONTROL

A. Field Inspection: The Buyer shall perform field inspection while work is in progress and a final inspection to ensure compliance with the technical and quality requirements of the Specification Packages and Drawings.

B. Field Testing: The Buyer shall perform an operating test to demonstrate conformance of the HID fixtures in accordance with applicable testing requirements contained in referenced codes and standards or defined elsewhere in this Specification Section.

3.03 ADJUSTING AND CLEANING

A. Align fixtures, clean bases, diffusers, clean paint splatters, dirt and debris from fixture installed at completion of work.

B. Relamp fixtures which have failed or discolored lamps at completion of work.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections and tests performed and shall be provided to the Buyer for Architect/Engineer (A/E) prior to final acceptance.

C. Manufacturer's data, shop drawings, and test reports shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16512

TITLE: High Intensity Discharge Lights

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.2		X													X				3		
Field Inspections	4.01B	X													X							
Field Tests	4.01B		X													X						
Mfr's Data	4.01C		X						30													
Shop Drawings	4.01C		X						30													
Test Reports	4.01C				X											X						

COMMENTS:

END OF SPECIFICATION SECTION

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By [signature] Date 1/5/94

WBS: 1.2.6
QA: QA

Civilian Radioactive Waste Management System
Management and Operating Contractor

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JAN 07 1994

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Specification Section 16671

LIGHTNING PROTECTION SYSTEMS

CI.16.2000
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12/16/93

Document Identifier: BAB000000-01717-6300-16671 REV. 00
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Civilian Radioactive Waste Management System

Management & Operating Contractor

Certification of Procurement Specification

Complete only applicable items.

WBS: 1.2 6

QA Class:

Page: 2 of:

Title of Procurement Specification LIGHTING PROTECTION SYSTEMS

Document Identifier: BAB000000-01717-6300-16671 Revision Number 00

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In accordance with established quality assurance procedures, signatures below certify that the above Procurement Specification was originated, verified, reviewed, and approved.

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Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Bharat H. Majmudar	*Date*	12/16/93
Reviewed by	Yuri R. Shewce	*Date*	12/16/93
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Reviewed by	N/A	*Date*	
Verified by	Lois J. Fernandez	*Date*	12/20/93 12/21/93 LF
Approved by	[illegible]	*Date*	12/21/93
QA Approval	Fred Autt	*Date*	12-21-93

REFERENCE DOCUMENT - UNCONTROLLED

Revision Description

Complete only applicable items.

Revision No.	*Pages Revised and Description*

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SECTION 16671

LIGHTNING PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work in this Specification Section includes furnishing all materials, tools, equipment, and labor necessary for the installation of a Lightning Protection System for buildings, tunnels, power lines, substations, and other structures as specified herein and indicated on the Drawings.

B. Protection against overvoltages due to lightning shall include those due to other abnormalities in the power system which cause overvoltages such as, but not limited to, switching and power system short circuits.

C. Inspection and testing of the Lightning Protection System, as required for certification by a nationally recognized testing laboratory.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 02210 Site Grading

C. Section 02220 Excavation, Trenching and Backfill

D. Section 03300 Cast-In-Place Concrete

E. Section 13120 Pre-Engineered Structures

F. Section 16450 Grounding

1.03 REFERENCES

A. All equipment shall comply with all applicable federal, state, and local codes and regulations.

B. All equipment specified herein shall be designed, manufactured, and tested in accordance with the standards and requirements of the following:

1. American National Standards Institute (ANSI):

   a. ANSI C2-93 National Electrical Safety Code

   b. ANSI C92.1-82 Power Systems - Insulation Coordination

2. American National Standards Institute/Institute of Electrical and Electronics Engineers, Inc.

REFERENCE DOCUMENT - UNCONTROLLED

(ANSI/IEEE):

a. ANSI/IEEE C62.2-87 Guide for the Application of Gapped Silicon - Carbide Surge Arresters for Alternating Current Systems

b. ANSI/IEEE C62.11-87 Standard for Metal-Oxide Surge Arresters for AC Power Circuits

c. ANSI/IEEE C62.32-81 Standard Test Specifications for Low-Voltage Air Gap Surge-Protective Devices (Excluding Valve and Expulsion Devices)

3. American Society for Testing and Materials (ASTM):

a. ASTM A363-89 Standard Specification for Zinc-Coated (Galvanized) Steel Overhead Ground Wire Strand

b. ASTM B3-90 Standard Specification for Soft or Annealed Copper Wire

c. ASTM B8-90 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

d. ASTM B172-90 Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch Stranded Members, for Electrical Conductors

e. ASTM B174-90 Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors

f. ASTM B229-90 Standard Specification for Concentric-Lay-Stranded Copper and Copper-Clad Steel Composite Conductors

4. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

IEEE 751-91 Trial-Use Design Guide for Wood Transmission Structures (Private Organization Standards)

5. Lightning Protection Institute (LPI):

a. LPI 175-87 Lightning Protection Institute Standard of Practice

b. LPI 176-87 Material and Components Standard

6. National Electrical Manufacturers Association (NEMA):

NEMA LA 1-86 Surge Arresters

REFERENCE DOCUMENT - UNCONTROLLED

7. National Fire Protection Association (NFPA):

   a. NFPA 70-93 — National Electrical Code

   b. NFPA 780-92 — Lightning Protection Code

8. Underwriters Laboratories, Inc. (UL):

   a. UL 96-85 — Standard for Safety Lightning Protection Components

   b. UL 96A-82 — Standard for Safety Installation Requirements for Lightning Protection Systems, Ninth Edition

   c. UL 467-84 — Standard for Grounding and Bonding Equipment, Sixth Edition

9. United States Department of the Interior, Bureau of Mines Information Circular (BuMines IC):

   BuMines IC 8835-80 — Guide to Substation Grounding and Bonding for Mine Power Systems

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-125)

C. Acceptance of Product

   1. Receipt Verification: Dimensional/visual inspection of the Lightning Protection components including air terminals, conductors, cable reels, connection and holding devices.

   2. Field Verification: Dimensional/visual inspection of the installation and operational testing of the Lightning Protection components and grounding systems.

PART 2 PRODUCTS

2.01 DESIGN REQUIREMENTS

A. General

   1. Air terminals, conductors, connection and holding devices, ground rods, arresters, and materials described herein shall be suitable for use in the permanent construction of lightning and overvoltage protection systems for power lines, substations, tunnels, and buildings.

REFERENCE DOCUMENT - UNCONTROLLED

2. Service Conditions: All equipment and materials described herein shall be suitable for use under the environmental conditions specified on the drawings.

3. The design and construction of the Lightning Protection Systems shall be in accordance with the standards referenced in Article 1.03. Testing shall be in accordance with Article 3.02.

2.02 MATERIALS

A. General

1. Materials shall be classified as Class I or Class II as defined in NFPA 780.

2. The materials shall be resistant to corrosion or shall be protected against corrosion. No combination of materials shall be used that forms an electrolytic couple of such nature that in the presence of moisture corrosion is accelerated.

3. Components shall be made of copper, copper alloy or aluminum in accordance with UL 96.

4. Components shall be electrolytically compatible with the conductor and mounting surface. Aluminum components shall not be used on structures with copper roofing, siding, or other copper surfaces; copper components shall not be used on structures with aluminum roofing, siding or other aluminum surfaces in accordance with NFPA 780, LPI-175, and UL 96.

5. All components shall be new and free of defects.

6. Lightning protection components shall be marked for identification in accordance with UL 96.

B. Air Terminals

1. Air terminals shall be of one piece construction or have several separate parts including: point (tip portion), elevation conductor, base support, and cable connections.

2. Air terminals for Class I structures shall be solid or tubular. Dimensions for the air terminal, copper or copper alloy, shall be minimum 10 inches in length, 0.375 inch in diameter for solid terminals, and 0.625 inch in diameter with a minimum wall thickness of 0.033 inch for tubular. Aluminum air terminals shall be 0.5 inch in diameter for solid, and 0.625 inch with a minimum wall thickness of 0.064 inch for tubular, in accordance with NFPA 780, LPI-175, and UL 96.

3. Air terminals for Class II structures shall be solid copper or aluminum with minimum dimensions of 0.5 inch diameter for copper and 0.625 inch diameter for aluminum. The air terminals shall be a minimum of 10 inches in length. Class II air terminals shall be in accordance with NFPA 780, LPI-175, and UL 96.

REFERENCE DOCUMENT - UNCONTROLLED

C. Conductors

1. Conductor material shall be copper or aluminum of the following types; rope lay, smo twist, loose-weave cable, flexible and solid strip conductors, tubular, round, rectangular, square, or star-shaped rod in accordance with UL 96.

2. Conductors for Lightning Protection shall be stranded tightly enough to form a symmetrical cable and to remain in a fixed position when installed in accordance with UL 96.

3. Conductors shall be categorized as primary (main) or secondary conductors. The primary (main) conductors are those which connect air terminals at roof ridges, perimeters, center areas, and serve as downleads to ground from the roof system. Secondary conductors are those used to accomplish various bonding and other connections as specified in LPI-175.

4. Minimum Dimensions of Conductors

   a. Main conductors, Class I, the minimum size for each strand of copper conductor shall be not less than 17 AWG and a cross sectional area of 57,400 circular mils. Aluminum conductors shall have a minimum size for each strand not less than 14 AWG and a cross sectional area of 98,600 circular mils in accordance with UL 96 and NFPA 780.

   b. Secondary conductors, Class I, the minimum size for each strand of copper cond or shall be not less than 17 AWG and a cross sectional area of 26,240 circular mil solid strip not less than 16 AWG thick and 0.5 inch wide. For aluminum conductors, minimum size of each strand shall not be less than 14 AWG and a cross sectional area of 41,100 circular mils, solid strip not less than 14 AWG thick and 0.5 inch wide in accordance with UL 96 and NFPA 780.

   c. Main conductors, Class II, the minimum size for each strand of copper conductor shall be not less than 15 AWG and a cross sectional area of 115,000 circular mils. Aluminum conductors shall have a minimum size for each strand not less than 13 AWG and a cross sectional area of 192,000 circular mils in accordance with UL 96 and NFPA 780.

   d. Secondary conductors, Class II, the minimum size for each strand of copper conductor shall be not less than 17 AWG and a cross sectional area of 26,240 circular mils, solid strip not less than 16 AWG thick and 0.5 inch wide. For aluminum conductors, minimum size of each strand shall not be less than 14 AWG and a cross sectional area of 41,100 circular mils, solid strip not less than 14 AWG thick and 0.5 inch wide in accordance with UL 96 and NFPA 780.

   e. Overhead ground wires shall be extra high strength, galvanized steel wire in accordance with ASTM A363.

REFERENCE DOCUMENT - UNCONTROLLED

D. Connections

1. A connector fitting shall be a casting or shall be stamped from sheet stock. Copper or copper alloy fitting shall be on copper components. aluminum fittings shall be used on aluminum. Dimensions shall be used in accordance with UL 96 for Class I and Class II components.

2. Bimetallic fittings shall be used in making a transition from copper to aluminum or aluminum to copper. Bimetallic fittings shall be constructed in accordance with UL 96 for Class I and Class II components.

3. Water-pipe connectors, ground rod clamps, bonding plates, clips and fasteners shall, as a minimum, be in accordance with UL 96 for Class I and Class II components.

E. Ground Electrodes

1. Ground electrodes shall consist of copper plates, iron or steel plates, rods, pipes, or copper conductors as indicated on the Drawings and in accordance with UL 96 for Class I and Class II installations, and in accordance with UL 467.

2. Ground rods, when indicated on the Drawings, shall be in accordance with Specification Section 16450.

F. Arresters

1. Arresters for protection from lightning and overvoltages shall be metal-oxide type and shall be suitable for use at altitudes up to 12,000 feet, class and kV rating as indicated on the Drawings and in accordance with ANSI/IEEE C62.11.

2. Arresters for use on systems 600 volts and less shall conform to ANSI/IEEE C62.32 and as indicated on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment and materials shall be installed in a neat and workmanlike manner in accordance with this Specification Section, the Drawings, and the manufacturer's written instructions.

B. Zone of Protection: Each structure shall be analyzed to determine the zone of protection for the Lightning Protection installation in accordance with LPI-175 and NFPA 780.

REFERENCE DOCUMENT - UNCONTROLLED

C. Air Terminals

1. Air terminals shall have a height to extend above the structure to be protected not less than 10 inches nor more than 36 inches. Air terminals exceeding 24 inches shall be supported with a suitable brace located at a point not less than one-half the height of the air terminals in accordance with LPI-175, NFPA 780, and UL 96A.

2. Air terminals shall be located on the structure to be protected as required for Class I and Class II structures as indicated on the Drawings and in accordance with LPI-175, NFPA 780 and UL 96A.

D. Conductors

1. Connections to conductor from air terminals shall have a two-way path to ground. Air terminals may be "dead-ended" with only one path to ground to the main conductor on roofs below the main protected level provided the lower level roof conductor is not more than 16 feet from the air terminal to a main conductor in accordance with LPI-175, NFPA 780, and UL 96A.

2. No bend of a conductor shall form an included angle of less than 90 degrees, nor shall it have a radius of less than 8 inches. Conductors shall maintain a horizontal or downward coursing and shall not form "V" or "U" pockets by connection to a lower conductor or metal object upward to a higher main conductor, in accordance with LPI-175, NFPA 780, and UL 96A.

3. Primary and secondary conductors shall be supported, protected, and installed in accordance with LPI-175, NFPA 780, and UL 96A and as indicated on the Drawings.

4. Metal roofing and siding, eave troughs, downspouts or other such metal parts are not acceptable as substitute parts of the Lightning Protection system. The structural steel framework of a building or a steel water tank may be utilized as the main conductor of a Lightning Protection system if it is electrically continuous or is made so. Metal parts not allowed to be part of the Lightning Protection and building steel which is part of the Lightning Protection shall be bonded in accordance with LPI-175, NFPA 780, and UL 96A.

E. Arresters

1. The application of arresters for Lightning Protection shall be as indicated on the Drawings and in accordance with ANSI/IEEE C62.2, ANSI/IEEE C62.11, ANSI/IEEE C62.32, and NEMA LA 1.

2. Arresters shall be located within 100 feet of the tunnel portal, applied to all ungrounded conductors which enter the tunnel, and grounded locally as indicated on the Drawings and in accordance with BuMines IC 8835.

REFERENCE DOCUMENT - UNCONTROLLED

3. Arresters shall be applied to overhead power lines for protection of equipment such as overhead transformers, capacitors, and risers feeding underground medium-voltage distribution lines as indicated on the Drawings and in accordance with Specification Section 16371.

4. Low voltage arresters shall be installed as indicated on the Drawings in accordance with NFPA 70, NFPA 780, and ANSI/IEEE C62.32.

F. Overhead Ground Wires: Overhead ground wires shall be installed to provide a zone of protection for the phase conductors on transmission and distribution power lines as indicated on the Drawings and in accordance with NFPA 780. Extra-high strength (EHS) steel wire shall be used for the overhead ground wire, size as indicated on the Drawings. Connect to ground in accordance with Specification Section 16371.

G. Grounding for Lightning Protection:

1. Ground electrodes for structures covered by this Specification Section shall be constructed in accordance with Specification Section 16450. In addition, ground electrodes specifically for Lightning Protection shall be constructed as indicated on the Drawings in accordance with LPI-175, NFPA 780, and UL 96A.

2. Grounding specifically for the Lightning Protection system shall be bonded to the building ground electrode, substation grid as indicated on the Drawings and in accordance with LPI-175, NFPA 780, and UL 96A. Bonding Lightning Protection systems for tunnel application to ground electrodes shall be in accordance with BuMines IC 8835.

3.02 FIELD QUALITY CONTROL

A. Field inspections shall be made by the Buyer while work is in progress to ensure compliance with the technical and quality requirements of the Specification Section and the Drawings.

B. Structures which require certification by LPI or UL shall be inspected in accordance with LPI-175, LPI-176, and UL 96.

C. Connections to ground electrodes and Lightning Protection System shall be tested and inspected in accordance with Specification Section 16450.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Records shall be maintained for all inspections, tests, and certifications and shall be provided to the Buyer and Architect/Engineer (A/E) prior to final acceptance.

REFERENCE DOCUMENT - UNCONTROLLED

C. Manufacturer's data and test reports, and reports of any certifying agency, shall be provided to the Buyer for the A/E's review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16671

TITLE: Lightning Protection

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C1		X										X									
Field Verification	1.04C2		X													X						
Identification	2.02A6		X										X									
Field Inspections	3.02	X													X							
Records	4.01B																					
Mfr's Data	4.01C		X						30													
Shop Drawings	4.01C		X						30													
Test Reports	4.01C				X											X						

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

WBS: 1.2.6
QA: QA

DOE/YMP ACCEPTANCE FOR CONSTRUCTION

By _____ Date 12/17/93

Civilian Radioactive Waste Management System
Management and Operating Contractor

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FEB 3 1994

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FIRST SUBMITTAL

Specification Section 16050

BASIC ELECTRICAL MATERIALS AND METHODS

CI.16.0000

Document Identifier: BAB000000-01717-6300-16050
QA Classification: TBV-112

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Revision No.	Date
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Civilian Radioactive Waste Management System

Management & Operating Contractor

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Previous work is impacted by this revision:

Yes ☐ No ☑

If Yes, identify attachment(s):

Prepared by	Lisa J. Fernandez	*Date*	11/23/93
Reviewed by	Donald Vanica	*Date*	11-23-93
Reviewed by	Kenneth J. Herold	*Date*	11/23/93
Reviewed by	Robert A. Sharrett	*Date*	11/23/93
Reviewed by	John H. Fye	*Date*	11/23/93
Verified by	Bharat G. Majmudar	*Date*	11/23/93
Approved by	[illegible]	*Date*	11/23/93
QA Approval	[illegible]	*Date*	11-24-93

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Revision Description

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Revision No.	*Pages Revised and Description*
01	Issued for Construction
02	Pages 1, 2, and 3 revised QA Classifications/Designator FROM TO QA Classification: MC TBV-112 QA: N/A QA QA Class: N/A QA Page 5 Para. 1.04B add QA Classification TBV-112 Page 6 Para. 2.01C change "tested" to "listed" Page 6 Change Para. 2.01D to read: "All electrical equipment used to isolate power to machines and equipment requiring servicing and maintenance shall be equipped with means for Lockout/Tagout as required by 29 CFR 1910.147 and 29 CFR 1910.333. Such equipment shall include manually operated electric circuit breakers and power switches that can disconnect all ungrounded conductors and which no pole can be operated independently. Pushbuttons, selector switches, and other control circuit type devices are not considered energy isolating devices." Page 6 Para. 2.01E delete the last sentence Page 6 Para. 2.02A change "these items" to its associated equipment" Page 8 Delete Article 3.05 Concrete Work (Surface Construction)

REFERENCE DOCUMENT - UNCONTROLLED

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Specification Section includes Basic Electrical Materials and Methods requirements specifically applicable to Division 16 Specification Sections. This Specification Section applies to all Specifications Sections of Division 16 unless specified otherwise in the individual Specification Section.

1.02 RELATED SECTIONS

A. Division 1 General Requirements (Surface and Subsurface Construction)

B. Section 02220 Excavation, Trenching and Backfill (Surface Construction)

C. Section 03300 Cast-In-Place Concrete (Surface Construction)

D. Section 05120 Structural Steel and Miscellaneous Metal (Surface Construction)

E. Section 16450 Grounding (Surface and Subsurface Construction)

1.03 REFERENCES

A. American National Standards Institute (ANSI):

ANSI C2-93	National Electrical Safety Code

B. American Welding Society (AWS):

AWS QC 3-89	Standard for AWS Certified Welders

C. Code of Federal Regulations (CFR):

29 CFR 1910	Labor

D. National Fire Protection Association (NFPA):

NFPA 70-93	National Electrical Code

1.04 QUALITY ASSURANCE

A. Quality Assurance shall be conducted in accordance with Specification Section 01400.

REFERENCE DOCUMENT - UNCONTROLLED

B. The materials and activities described for this Specification Section are not important to radiological safety or waste isolation. (TBV-112)

C. Acceptance of Product

1. Receipt Verification: Dimensional/visual inspection of the Basic Electrical Materials and Methods as applicable to the specific Specification Section in Division 16.

2. Field Verification: Dimensional/visual inspection of the installed Basic Electrical Materials and Methods as applicable to the specific Specification Section in Division 16.

1.05 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling shall be conducted in accordance with Specification Section 01600.

1.06 PROJECT/SITE CONDITIONS

A. Drawings and Specification Sections at Project Site: A set of the most current Drawings and Specification Sections shall be kept on the Project site, along with accepted shop drawings with recorded changes. At contract close-out, deliver record documents to the Buyer for Architect/Engineer (A/E) actions.

1. Record location of all concealed or semi-concealed equipment, junction boxes, or other items that may require inspection, repair, or maintenance.

2. Record actual location and elevation of all buried raceways and equipment.

B. Coordination of Work: Buyer shall coordinate electrical work with all other work.

1. For equipment requiring manufacturer's printed installation instructions to aid in proper execution of the work, such instructions shall be submitted to the Buyer for the A/E's review and returned to the Buyer prior to the time of installation for use in supervising the work.

2. Coordinate progress of electrical work with all other work. Entire electrical installation shall be completed as indicated in the Specification Sections and the Drawings.

3. Where conflicts of work occur and departure from the indicated arrangement is necessary, the Buyer shall obtain documented acceptance from the A/E for proposed changes before proceeding with work.

4. Monitor the electrical work during progress of building-in to prevent misalignment or damage to electrical work and materials.

REFERENCE DOCUMENT - UNCONTROLLED

PART 2 PRODUCTS

2.01 MATERIALS

A. Unless otherwise noted, all electrical equipment and materials shall be new, free of defects, and identified as to suitability for a specific purpose, environment, or application. Equipment or material identification shall consist of an attached identifying label.

B. Manufacturer's name or trademark shall be placed on all equipment installed, along with other applicable markings such as voltage, current, wattage, or similar ratings.

C. Electrical materials and equipment shall be Underwriters Laboratories, Inc (UL) listed, with label attached, for the purpose intended, whenever such products are available. Where there are no UL listed products of the type, testing and certification by another nationally recognized testing agency may be acceptable.

D. All electrical equipment used to isolate power to machines and equipment requiring servicing and maintenance shall be equipped with means for Lockout/Tagout as required by 29 CFR 1910.147 and 29 CFR 1910.333. Such equipment shall include manually operated electric circuit breakers and power switches that can disconnect all ungrounded conductors and which no pole can be operated independently. Pushbuttons, selector switches, and other control circuit type devices are not considered energy isolating devices.

E. The design, fabrication and construction of the Equipment and Materials specified in this Specification Section shall be in accordance with the standards referenced in each Specification Section's Article 1.03.

2.02 SUBSTITUTIONS

A. Electrical work is specified as standard construction practice and its associated equipment shall be installed as specified.

B. Acceptable Equipment: Similar products specified by several manufacturer's names are for the convenience of the Buyer, and are intended to be Buyer's choice. Products specified without reference to a specific manufacturer may be of any manufacturer provided that such products shall have cast, stamped or indelibly marked on them the manufacturer's name or mark, as well as other applicable information as required.

C. It shall be the responsibility of the Buyer to ensure that Buyer's chosen products and alternate approved products comply with the Drawings and Specification Section as to space requirements, performance, capacities, configuration, and accessories and are standard materials of construction. Additionally, submit catalog cuts or manufacturer's data on Buyer chosen products.

REFERENCE DOCUMENT - UNCONTROLLED

PART 3 EXECUTION

3.01 GENERAL

A. Electrical Drawings are diagrammatic in nature and are not intended to show every bend, offset, fitting, or accessory that may be required for a complete installation.

1. Do not scale drawings for exact dimensions.

2. Data presented on the drawings are as accurate as can be determined, but field verification of all dimensions is required.

3. Drawings indicate required sizes, points of termination of raceways, and suggest proper routing.

4. Installation shall conform to structure, preserve clearances, avoid obstructions, maintain headroom, and keep openings and passageways clear.

5. Exact locations, distances, and levels shall be governed by field conditions.

B. If a conflict exists between the drawings and specifications contact the Buyer for clarification.

3.02 INSTALLATION

A. Work shall be executed by qualified electricians in conformity with the best accepted trade practice and with the proper tools of the trade.

B. The Buyer shall lay out the work and be responsible for lines, elevations, and measurements required for the installation of the work.

C. It is the intent that all work done under the work package shall be completed and electrically operational prior to acceptance.

D. Electrical clearance at all voltage classes shall be in accordance with the requirements of NFPA 70 and ANSI C2.

3.03 EXPANSION AND TOGGLE BOLTS

A. To attach material, fixture, or equipment to rock surface, masonry or concrete walls, ceiling, and floors, use properly sized bolts in accordance with manufacturer's recommendation or as indicated on the Drawings.

B. Where bolting is not practical, use adequately sized expansion anchors approved for the intended use.

C. Do not use wood plugs, plastic, or fiber expansion shields under any circumstances.

3.04 EQUIPMENT SUPPORTS, FOUNDATIONS AND STANDS

A. Provide supports, foundations, curbs, and stands for switchboards and other electrical equipment where they are not indicated on the Drawings but are necessary for proper installation.

B. Provide foundation bolts, sleeves, washers, nuts, and templates to locate position of bolts.

C. Make sleeves as shown on the Drawings.

D. Where equipment is to be floor mounted on stands or legs, construct floor stands with structural steel members or steel pipes and fittings in accordance with Division 5; brace and fasten with flanges bolted to floor.

3.05 SLEEVES OPENINGS AND LOCATIONS (SURFACE CONSTRUCTION)

Coordinate equipment and raceway to openings in walls, floors, and equipment pads, as shown on the Drawings.

3.06 CUTTING AND PATCHING (SURFACE CONSTRUCTION)

A. Perform all cutting and patching that may be necessary for the installation of the system specified, and make necessary repairs.

B. No cutting or structural work shall be done without written consent of the A/E.

C. All cutting and patching shall be done by mechanics skilled in the appropriate building trade.

D. Restore all surfaces to match adjacent surface.

3.07 MATERIALS PENETRATING WALLS, FLOORS, AND CEILINGS (SURFACE CONSTRUCTION)

A. Wherever piping, conduit, ducts, steel members, brackets, equipment, or any item or material penetrates or passes through a wall, ceiling or floor, the voids surrounding each item or material shall be completely filled with cement grout, plaster, or a fire-resistant material (as required).

1. Fill the full thickness of the wall, ceiling, or floor.

2. Where surfaces are exposed, finish to match adjacent finished surfaces.

3.08 WELDING (SURFACE CONSTRUCTION)

Welders: All welders shall be tested and certified in accordance with AWS QC 3.

REFERENCE DOCUMENT - UNCONTROLLED

3.09 MECHANICAL EQUIPMENT, WIRING, AND CONNECTIONS

A. Motors for mechanical equipment will be furnished and set in place under the work of Division 15. Electrical power wiring between the branch circuit protective device or the control device, whichever is the electrical power source, and via any disconnecting device and the final connection to the motor, shall be in accordance with the appropriate Specification Section in Division 16.

B. Packaged mechanical equipment with motors and control devices for starting and stopping the motors, internal power and control wiring installed at the factory or in the field, and a main power supply disconnecting device, if specified, will be furnished and set in place under the work of Division 15. The final electrical connection to the incoming line terminals of the packaged mechanical equipment shall be provided under the work of Division 16.

C. The Buyer shall obtain complete information required for wiring and connecting electrically operated equipment on Buyer furnished equipment.

D. Equipment which includes a number of correlated electrical devices mounted in a single enclosure or on a common base with the equipment shall be furnished completely wired as a unit with identified terminals in a common terminal box for connection of external wiring.

E. Electrical Drawings indicate branch circuit conductor sizing and overcurrent protective device ratings for the mechanical heating/ventilation/air-conditioning equipment specified or first-named on the Mechanical Drawings.

F. The Buyer shall verify from nameplate of mechanical equipment and from manufacturer's heater table for installed motor controllers that designed circuits are correct for "Minimum Circuit Ampacity," "Maximum Fuse Size," and "Maximum Overcurrent Device Ampere Rating" to ensure that all requirements of NFPA 70 are satisfied.

3.10 FIELD QUALITY CONTROL

A. Testing and Adjusting: The following requirements shall be supplementary to tests specified for individual equipment or systems under the Electrical Specification Sections of the Specifications.

1. All testing will be scheduled by the Buyer and reviewed by the A/E.

   a. The Buyer shall notify the A/E by letter at least two weeks in advance of any testing. (WITNESS POINT)

   b. A complete test and inspection record shall be made and incorporated into a report for each piece of equipment tested.

      1) Record all readings taken.

      2) The Buyer shall submit copies to the A/E for review as specified in Part 4 Submittals.

REFERENCE DOCUMENT - UNCONTROLLED

c. The necessary calibrated meters, instruments, temporary wiring, and labor will be furnished by the Buyer to perform all required tests and adjustments of equipment and wiring installed and connected in this work, including electrical equipment specified elsewhere in the Specification Section to determine proper polarity, phasing, freedom from grounds and shorts, and operation of equipment.

d. All materials and installations shall be in strict accordance with the applicable requirements of NFPA 70 and ANSI C2.

2. Wiring: Check system insulation and equipment grounds for proper value of resistance using Megger testers in accordance with manufacturer's standard instructions and procedures.

a. Overall resistance of ground system shall be in accordance with Specification Section 16450.

b. Grounding System: Inspect to ensure that all above-ground cables and connections are protected as shown on the Drawings.

c. Ground Resistance Tests: Make all test points accessible as required by the Buyer or required in the Specification Sections.

d. Correct or replace any nominal current-carrying circuit which is defective or grounded.

3. Lighting and Receptacles: Check all lighting fixtures for cracked lenses, noisy ballasts, pro color, failure to operate, and similar items, and check receptacles for proper ground, open circuits, reversed phase, and neutral connections. Replace all burned out lamps and ballasts.

4. Motors: Before startup, check motor nameplates for running amps, horsepower, speed, phase, and voltage.

a. Adjust and check overload elements in motor starters for suitability to motor characteristics. Replace any overload element improperly sized or rated.

b. Check all bearings, making sure they are properly lubricated. Check coupling alignment and shaft play.

c. Following established procedures, energize equipment after confirmation that the installation is satisfactory.

d. Check shaft rotation, shaft rpm, and bearing temperature, and check for excessive vibration to prevent housing or structural damage.

1) Take current readings at full load using a clamp-on ammeter.

2) If a meter reading is over the rated full load current, determine the reason for the discrepancy and take the necessary corrective action.

REFERENCE DOCUMENT - UNCONTROLLED

3) These final tests are to determine that the installation is correct. The tests are to be witnessed by the A/E.

5. Miscellaneous

a. Demonstrate that all illuminating and control devices function properly.

b. Replace all defective transformers, coils, and similar items.

c. Demonstrate that all power operating devices function properly.

d. Demonstrate that all switches, relays, remote control switches, and similar items function properly.

e. Demonstrate that all systems, including fire, paging, radio, control/signal, and similar items function properly.

3.11 ADJUSTING AND CLEANING

A. Keep premises in a clean and orderly condition during construction.

B. All nameplates of equipment shall be kept clean for easy reading.

C. Upon completion of work, clean all equipment, remove surplus material and rubbish relating to electrical work, and leave the work area neat and clean.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet.

B. Specific items requiring submittals shall be as specified in each individual Specification Section of Division 16. Partial submittals are not acceptable; such submittals will be returned without review.

C. Shop Drawings: Prepare and submit shop drawings to the Buyer for A/E review.

1. All shop drawings shall be thoroughly checked by the Buyer prior to submittal for review.

2. Review of shop drawings shall not relieve the Buyer of responsibility for quantity, proper construction, accuracy of measurements, or the necessity of furnishing the labor and materials required by the Drawings and Specification Sections, but which are not shown on the shop drawings.

REFERENCE DOCUMENT - UNCONTROLLED

3. Shop drawings shall show types, sizes, accessories, elevations, floor plans, sectional views, installation details, elementary diagrams, wiring and connection diagrams, adequate clearan for operation, and replacement of operating equipment devices. If any equipment is unacceptable, the drawings shall be revised to show acceptable equipment and resubmitted.

D. Operation and Maintenance Manuals

1. Submit a complete electrical wiring and connection diagram including wiring identification numbers for each item of equipment requiring electrical connections.

2. If the manufacturer of equipment does not supply an electrical elementary control diagram, the Buyer shall be responsible for providing the drawing.

3. Provide copy of guarantees and warranties, showing dates of expiration.

4. Provide copy of test readings and records.

5. After review by the A/E, resubmit corrected, bound copies, complete with the required information listed above.

6. Provide complete nomenclature listing for all replacement parts including part numbers.

E. Certified Test Reports: Before delivery of materials and equipment, certified copies of all test reports specified in the individual Specification Sections shall be submitted to the Buyer for review by the A/E.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Buyer shall notify the A/E in writing for review.

REFERENCE DOCUMENT - UNCONTROLLED

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 16050

TITLE: Basic Electrical Materials & Methods

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04C.1		X										X									
Field Verification	1.04C.2		X													X						
Field Tests	3.11A.1		X													X						
	3.11A.2.e		X										X									
Field Inspections	3.11A.1.a	X											X						14			
Field Test Reports	3.11A.1b.2		X													X						
Field Insp. Records	3.11A.1b.2		X													X						
Shop Drawings	4.01C		X							X												
O&M Manuals	4.01D		X									X										
Cert. Test Report	4.01E		X									X										

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED

synthetic compressor lubricants in common use. The drain layer shall drain coalesced oil mists and droplets to a second collection system with a second external drain connection.

4. Each filter shall have an initial (dry) pressure drop of 0.4 psi and wetted pressure drop with clean element shall be 2 psi differential, at 150 psig and rated flow. The average pressure drop over life of elements shall be approximately 3.5 psi when replaced at the recommended interval of 7.0 psi differential. The filter shall include differential pressure indicator to indicate the need for element replacement. The indicator shall be in the green zone when element is good and in the red zone when element needs to be replaced.

5. Each filter housing shall be constructed of carbon steel ASME code "U" stamped filter vessel. The element core shall withstand pressure surges up to 100 psi differential.

6. Each filter shall be provided with a 115 VAC automatic drain valve as described in Paragraph 2.02C. A cleanable Y-strainer shall be provided in line.

7. Removal, replacement, and inspection of filters shall not require the use of special tools or devices.

2.04 ELECTRICAL

Electrical requirements shall be in accordance with NFPA 70 and Specification Section 16152.

.05 COMPRESSED AIR PIPING, FITTINGS, AND VALVES

A. Piping, fitting, and valves shall be in accordance with Specification Section 15060.

B. All piping, fittings, and valves shall be heat traced and insulated as shown on the Drawings. Insulation shall be in accordance with Specification Section 15260.

2.06 IDENTIFICATION, MARKING, AND TRACEABILITY

In addition to the manufacturer's identification nameplate, each piece of equipment shall be provided with corrosion resistant metal tag identification in accordance with Specification Section 15190.

2.07 SUPPLIER QUALITY CONTROL

A. The Contractor shall arrange for the A/E or authorized representative to have access to the refurbishing procedures, schedules, inspection and testing procedures, and documents.

B. The Supplier shall verify by test that the complete mechanical, control, and electrical systems with their components comply with all their performance requirements. Detailed testing procedures shall be submitted for all tests to the A/E for review. Testing shall be witnessed by the A/E. The following test shall be performed as a minimum:

1. All compressors and accessory components shall be given the Supplier's standard shop tests.

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2. Hydrostatic test certificates are acceptable in lieu of witness testing of normally stocked components.

3. All compressors shall be subjected to a shop running test at rated speed to verify that all components meet the manufacturer's performance requirements. Proper operation of controls and instrumentation shall be verified. Such a test shall run for a total of four hours, one hour unloaded and three hours loaded.

4. Hydrostatic testing shall be performed on all pressure containing components and shall include rotor casing and oil piping.

5. A performance test of the unit shall be conducted. Inlet capacity, brake horsepower and discharge pressure shall be measured as a minimum for each operating condition and at no flow. Noise level shall not be greater than 85 dB per OSHA Code 29 CFR 1910.95.

PART 3 EXECUTION

3.01 GENERAL

The refurbished air compressor units and accessory components described in this Specification Section will be installed outdoors.

3.02 PREPARATION

Preparation for installing the compressed air system shall be in accordance with Division 1 requirements.

3.03 INSTALLATION

A. The air compressor units and accessory components shall be installed outdoors in accordance with the Drawings and the Supplier's installation procedures. Electrical installations shall be in accordance with Division 16 requirements.

B. The Contractor shall solicit Supplier's Service Engineer for technical direction of assembly, installation, and startup to ensure the safe and successful operation of the equipment supplied when the Contractor does not have the technical expertise.

C. Identification and marking shall be provided for piping and valves in accordance with Specification Section 15190.

D. Maintenance shall be performed to the extent practical, using standard tools, lubricants, cleaners, and test equipment. The use of special tools and the number of standard tools required shall be minimized by selection of common fasteners, clamps, adapters, and connectors.

REFERENCE DOCUMENT - UNCONTROLLED

3.04 FIELD QUALITY CONTROL

A. Testing and Adjustment: The following requirements are supplementary to tests specified for individual equipment or systems. All testing for the air compressor units and accessory components will be scheduled by the Contractor and reviewed by the A/E.

1. A/E shall be notified via construction schedule at least two weeks in advance of testing. This shall include a description of the test procedure. (WITNESS POINT)

2. Complete test and inspection records shall be made and incorporated into a report for each item of equipment tested. The following steps shall be followed:

   a. Record all readings taken.

   b. Submit copies to the Contractor for A/E's review.

3. All necessary meters, instruments, temporary wiring, and labor shall be provided to perform all required tests or to make adjustments of equipment and wiring installed and connected in this work, including electrical equipment specified elsewhere in this Specification Section, to determine proper operation of equipment.

4. All electrical materials and installations shall be in strict accordance with the applicable requirements of NFPA 70, the Drawings, and the Specification Package.

5. All defective items shall be replaced, at no cost to the Contractor, to provide a complete and operable system.

3.05 ADJUSTING AND CLEANING

A. Premises shall be kept in a clean and orderly condition during construction.

B. All equipment nameplates shall be kept clean for easy reading.

C. Upon completion of work, the equipment shall be cleaned, and surplus material and rubbish related to compressor installation work shall be removed, leaving the work neat and clean.

3.06 TRAINING

A. A description of each Operator Interface System training program, a course outline for each program type, and all course materials shall be submitted to the A/E for review at least six weeks prior to the start of training classes.

B. Operator Training Program

1. Formal training for four operators shall be provided at the project site. The training classes shall be conducted by experienced instructors using the actual TCP/IP equipment where possible and simulator equipment (provided by the instruction team) where necessary. Each

REFERENCE DOCUMENT - UNCONTROLLED

trainee shall receive a full set of all printed materials used in the classroom to be permanently retained by the trainee.

2. Operator training shall be oriented toward personnel having no previous experience with similar control systems or equipment. Training shall be tailored specifically to the functionality of the installed system and shall include, but not be limited to, the following:

   a. Overview of system hardware components

   b. Operating system use and LAN communications

   c. Equipment and process monitoring controls.

C. Technical Training Program

1. Formal training for four maintenance technicians shall be provided at the project site. The training classes shall be conducted by experienced instructors using the actual TCP/IP equipment where possible and simulator equipment (provided by the instruction team) where necessary. Each trainee shall receive a full set of all printed materials used in the classroom to be permanently retained by the trainee.

2. Technician training shall be oriented toward personnel having some previous experience with similar control systems or equipment. Training shall be tailored specifically to the functionality of the installed system and shall include, but not be limited to, the following:

   a. Hardware function and operation

   b. General control system maintenance

   c. Troubleshooting, configuration, and control loop tuning techniques.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with the attached Submittal and Notification Requirements sheet and Specification Section 01300.

B. Drawing Requirements: As-built drawings shall be provided for the equipment as specified and ordered. These drawings shall include, but are not limited to, the following:

1. Outline and Arrangement Drawings: These drawings shall be completely dimensioned and show the following:

   a. Equipment arrangement

   b. Dimensional plans and elevations, front view, and other pertinent elevation views

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c. Component locations and miscellaneous mechanical details

d. All required utilities connections for the Contractor and A/E's interface

e. Contractor and A/E's wiring (both power and control alarm) terminal block locations, arrangement, and grounding connections

f. Required clearances, tolerances, and mounting methods, including anchor bolt hole sizes and locations and recommended minimum bolt sizes

g. Equipment weights.

2. Elementary Wiring Diagrams: Complete as-built elementary (schematic) wiring diagrams showing all control devices and device contacts. All devices and contacts shall be labeled with their proper ANSI device function number.

3. Connection Diagrams

   a. As-built interconnecting wiring diagrams with clear identification of terminals and terminal blocks, including Contractor and A/E connection points, and any Contractor and Supplier interconnections between panels, cabinets, or components.

   b. Connection diagrams shall indicate all terminals and terminal blocks and show the approximate physical location in the assembly.

4. Instruments/Control Documents

   a. Logic diagrams

   b. Instrument data sheets

   c. Instrument list

   d. Instrument mounting details

   e. Piping and instrument diagrams

   f. PLC input/output listing

   g. Control cabinet/panel layout and general arrangement

   h. Four copies of PLC program on magnetic disk

   i. Hard copy of PLC program

5. Test Reports: Certified test reports containing the results of all tests on each unit shall be provided to the Contractor for the A/E's review.

REFERENCE DOCUMENT - UNCONTROLLED

6. Catalog Information: The Supplier shall supply catalog information for the equipment being supplied. This information will include all components for all original equipment manufacturer (OEM) equipment being supplied. The actual manufacturer's catalog numbers shall be provided if they differ from the Supplier's part numbers.

7. Recommended Spare Parts List

   a. The Supplier shall submit a complete list of recommended spare parts list (RSPL) for the refurbished equipment. The Supplier shall make a notation of quantities of these items recommended or required by the Contractor for continuous operation during one normal overhaul cycle. This RSPL shall be reviewed by the A/E and shall include items requiring replacement under the following conditions (which condition to be noted):

      1) Wear, corrosion, or erosion during normal operation

      2) Failures which cause a shutdown of equipment

      3) Damage or breakage during routine maintenance or inspections of equipment

      4) Long lead time or operational insurance items

      5) Time-compliance limits on time-in-service due to age-related deterioration.

      NOTE: Shelf life shall also be stipulated for spare parts subject to age-related deterioration.

   b. The parts list shall include cross-sectional or assembly-type drawings, part numbers, materials, and estimated delivery lead times. Part numbers shall identify each part for interchangeability purposes. The parts list and RSPL notations shall be provided to the Contractor promptly upon the Supplier's receipt of drawings. The parts list shall contain prices for all RSPL components.

8. Installation and Operating Instructions: Thirteen copies of complete field test, maintenance, and service manual with manufacturer's data sheets for all components shall be supplied with the refurbished equipment and submitted 30 days prior to shipment in accordance with Specification Section 01300.

C. Installation requirements are in accordance with Specification Section 01600.

D. Outline of the Supplier scope of work and delivery schedule for refurbished air compressor units and new equipment shall be submitted to the A/E for review.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Contractor shall notify the A/E in writing for review and authorization to proceed.

REFERENCE DOCUMENT - UNCONTROLLED

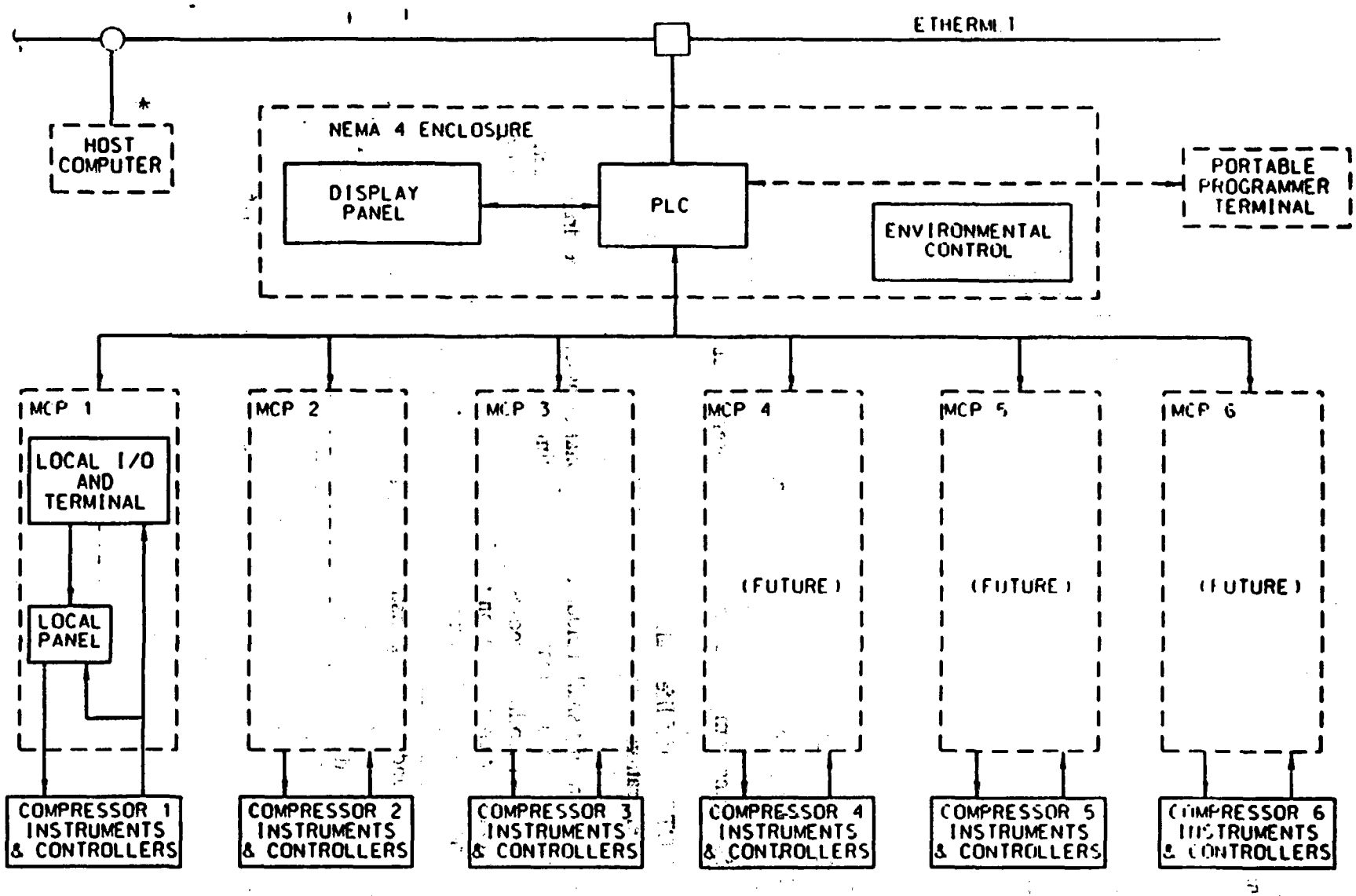

FIGURE 1

ESF AIR COMPRESSOR CONTROL SKETCH

* BY OTHERS

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 15480

TITLE: Compressed Air System

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD			TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE			NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)		
Receipt Verification	1.04E1		X										X						3			
Field Verification	1.04E2		X													X			3			
Field Testing Proc.	3.04A1		X					30														
Field Testing	3.04A1		X					X											14			
Training Mat'l	3.06	X													X							
Drawings	4.01B		X													30						
Test Reports	4.01B5		X													X						
Catalog Info	4.01B6				X				15													
Spare Parts List	4.01B7		X		X						30											
Ops Manual	4.01B8				X						30											
Schedule	4.01D		X						15													

COMMENTS:

END OF SPECIFICATION SECTION

REFERENCE DOCUMENT - UNCONTROLLED