Detail Design Report

Solid Waste Operations Complex W-113
Specifications

Prepared for

Westinghouse Hanford Company

Prepared by

Raytheon Engineers & Constructors  BNFL Inc

September 1995
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EARTHWORK

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section includes furnishing of labor, supervision, equipment, tools, materials and all other items necessary to satisfactorily perform the earthwork operations as per this specification, Contract Drawings, codes, standards, data or other documentation attached, referenced or furnished.

1.02 RELATED SECTIONS: NOT USED

1.03 REFERENCES


ASTM D 1556-90 Density and Unit Weight of Soil in Place by the Sand-Cone Method.

ASTM D 1557-91 Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lb/ft³ (2700 kN-m/m³)).

ASTM D 2922-91 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).

B. Washington State

WSDOT-M41-10 State of Washington Standards Specifications for Road and Bridge Construction.

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS: NOT USED

1.06 DELIVERY, STORAGE & HANDLING: NOT USED

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

B. The existing soils within the project site consist of silty sand with gravel and cobbles with approximately 30 to 40 percent of the total soil volume being gravel and cobbles. The geotechnical report entitled "Geotechnical Engineering Services Trans-Uranic Waste Burial Trench 4C-4 200 West Area, Hanford Site" dated July 1994 Prepared by Shannon & Wilson, Inc. for Kaiser Engineers Hanford Company, Richland, Washington is available in the Buyer’s offices for review by the Seller.

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Rev 0
1. It is expressly understood that the Buyer will not be responsible for interpretations or conclusions drawn therefrom by the Seller.

C. Protection: Protect and maintain utilities that are to remain.

1. Bench Marks and Monuments: Carefully maintain and protect bench marks, monuments and other reference points; if disturbed or destroyed, replace as directed by the Buyer.

2. Safeguards: Erect and maintain such safeguards, as required by construction operations, codes or existing conditions, for the safety of persons or property and to protect same from damage, injury or loss.

3. Drainage: Provide for diversion of surface drainage during the period of site grading work.
   a. Keep excavation areas free from water during entire process of work, regardless of cause, source or nature of the water.

4. Existing Utilities: Determine locations, service type and material of existing underground utilities in the areas of work.
   a. If utilities are to remain in place, provide adequate means of protection during excavation operations.
   b. Notify Buyer at least 3 weeks before the start of excavation to allow time for scheduling and locating underground utilities either shown or not shown on the Contract Drawings.
   c. If uncharted or incorrectly charted piping or other utilities are encountered during excavation, protect facilities until it has been determined whether facilities are active or inactive.
      1) Consult Buyer immediately for directions as to procedure.
   d. Cooperate with Buyer, in keeping services and facilities in operation.
   e. Repair damaged utilities to the satisfaction of the Buyer.
   f. Do not interrupt existing utilities serving facilities occupied and used by the Buyer or others, except when permitted in writing by the Buyer, and then only after acceptable temporary utility services have been provided.
g. Demolish and completely remove from the Project site existing underground utilities indicated to be removed.

1) Coordinate with Buyer for shut-off of services if lines are active.

D. Dust Control: Control the spread of air-borne dust originating as a result of earthwork operations in accordance with WSDOT M41-10, 2-07.1-3.

E. Materials Found: In the event that items with archaeological or historical value are discovered, immediately notify the Buyer and await further instructions before proceeding with the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. Satisfactory Soil Materials: All materials used as embankment shall be suitable for the use intended, shall meet the specified requirements and shall be used only with the Buyer’s approval.

1. Material for building fill shall be a well graded soil having a maximum particle size of 2 inches. Materials obtained from the Trench excavation can be used as fill for the Trench Enclosure Building Foundation.

2. Bedding material shall consist of sand or silty sand having 100 percent particles passing the 3/8 inch sieve.

3. Backfill material shall be suitable material selected from excavation or trenching. The material shall not contain highly plastic clays, shall be free of organic material and be readily compactible.

B. Utility Identification Tape: For each utility use the industry standard color or the Hanford facility standard color if different than the industry standards. Tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film.

1. Tape shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil.

2. The lamination bond shall be strong enough that the layers cannot be separated by hand.

3. Tape shall be 6" wide, a minimum of 4.5 mils thick with a minimum tensile strength of 60 pounds in the machine direction and 58 pounds in the transverse direction per 3
inch wide strip.

4. Tape shall be imprinted with a continuous warning message normally repeated every 16 to 36 inches.

5. Tape shall be inductively locatable and conductively traceable using a standard pipe and cable locating device.

6. The warning message on tape shall be "Utility Service Identification" (i.e., water line, and similar wording) "Buried Below".

2.03 EQUIPMENT

A. All equipment utilized on the project shall be of such condition, capacity, and quality so as to perform the work satisfactorily in a reliable manner throughout the duration of the work.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL: NOT USED

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Excavation

1. Excavation Classifications:

   a. Excavation will not be classified and all material shown to be removed shall be excavated regardless of the nature of the material.

   b. Unauthorized Excavation: Consists of removal of materials beyond indicated subgrade elevations or side dimensions without being directed by the Buyer.

      1) Backfill and compact unauthorized excavations as specified for authorized excavations unless otherwise approved.

2. Excavation: Excavate according to grades and elevations indicated on the Contract Drawings. For excavation of soils above buried waste drums see paragraph 3.02.I.

   a. If any local soft spots are encountered at depth of bottom of footings, perform over-excavation to firm bearing soil as approved by the Buyer.

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1) Backfill over-excavation with specified material.

b. Excavation shall include all materials encountered regardless of the nature thereof, as required to achieve the grades and elevations indicated on the Contract Drawings.

c. Utilize excavated material to make fill.

1) Place materials in approved locations.

3. Stability Of Excavation: Excavation slopes shall be 1.5 horizontal to 1.0 vertical.

4. Dewatering: Prevent surface water and subsurface or ground water from flowing into the excavations and flooding the Project site and surrounding area.

a. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey the water away from excavations.

b. Convey water removed from excavations and storm water to existing drainage paths.

c. Do not use trench excavations as temporary drainage ditches.

5. Material Storage: Excavated materials classified as satisfactory embankment material shall be stockpiled in the existing spoils pile located south of Trench 4C-T07 or on Trench 4C-T00. Materials which are not satisfactory for embankment shall be disposed of where directed by the buyer.

a. Place, grade and shape stockpiles for proper drainage.

b. Locate and retain excavated materials away from edges of excavation.

c. Dispose of excess soil material and waste materials as directed.

6. Seasonal Limits: Do not deposit, spread or compact embankment material while it is frozen or thawing, or during unfavorable weather conditions.

a. When the work in process is interrupted by heavy rain, embankment operations shall not be resumed until the moisture content and density of the previously placed embankment are as specified.
7. Notification For Inspection Of Excavation: Upon completion of excavation work, and prior to commencing with any work thereon, immediately notify the Buyer in order that soil bearing capacities can be observed.

B. Embankment

1. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of embankment materials.

2. When the existing ground surface has a density less than that specified for the particular area classification, scarify, moisture condition, and compact to the required depth and percentage of maximum density.

3. Soil On Which Embankment Is To Be Placed: Compact as follows:
   a. Proof-roll with a heavy plate-compactor using a minimum of 4 slow passes of the compactor.
   b. Remove any soft soils encountered during proof-rolling and replace with satisfactory fill. Soft soil shall be defined as that soil which, in the opinion of the Buyer, weaves or heaves considerably during proof-rolling operations.

4. Moisture Control: Where the subgrade or layer of soil material requires moisture conditioning before compaction, uniformly apply water to the surface of subgrade, or layer of soil material.
   a. Prevent free water appearing on the surface during or subsequent to compaction operations.
   b. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
   c. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry.
   d. Assist drying by deicing, harrowing or pulverizing, until the moisture content is reduced to a satisfactory value.

5. Placing and Compaction Of Embankment Materials: Place in
layers not more than 12 inches in loose depth.
   a. Before compaction, moisten or aerate each layer as necessary.
   b. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.
   c. Compact all areas to receive surfacing.
   d. Prepare subgrade for driveway access to buildings.

   1) Surface Tolerance: Plus 0 to minus 0.05 feet in 10 feet.
   2) Compact top 6 inches to 95 percent maximum density.

C. Building Fill

1. Installation: Bring building area to proper grade.
   a. Material: Building fill material used shall be as specified under Article 2.02 of this Section.
   b. Compaction: Shall be a minimum of 95 percent of the maximum density.
   c. Lifts: Shall be not greater than 12 inches when loose.

D. Trenching

1. Excavate for trenches to depth indicated or required and to establish indicated invert elevations.
   a. Maintain uniform width required for particular item to be installed, including width to provide sufficient working room.
   b. Provide 6 to 9 inches clearance on both sides of pipe or buried conduit.
   c. Outside building, excavate trenches for water piping so top of piping is not less than 42 inches below finished grade.
   d. Accurately grade bottom of trench to provide uniform bearing and support for the lower quadrant of the pipe, for each section of the pipe along its entire length. Where trench bottom is rocky or consists of 1/2 inch or larger rocks, the trench shall be overexcavated and a 4 inch layer of bedding material placed to support pipe.
e. When bedding requirements are determined, either acceptable existing native material or bedding material will be tested in accordance with ASTM D1556 or ASTM D2922 to insure a minimum of 90% of maximum density, as determined by ASTM D1557, has been achieved in the trench bottom.

f. Where soil conditions permit, trench walls to be vertical from trench bottom to 12 inches above top of pipe. Slope trench walls higher than 4 feet above trench bottom 1.5 horizontal to 1 vertical or as required to meet applicable safety codes.

E. Backfilling

1. Maintain all timber sheeting below a plane one foot above the centerline of pipe in place in order not to disturb pipe grading.
   a. Before backfilling, remove all other sheeting, bracing and shoring.

2. Before backfilling around utilities and/or structures, remove and clear away forms, trash and debris.
   a. Place selected excavated material in 12 inch maximum layers, loose depth, and moisten each layer if necessary and compact with mechanical or hand tampers.

3. Backfill For Trench: Do not backfill until all tests and inspections as specified hereinafter covering the installation of the various utilities have been performed and approved.
   a. Backfill around and to one foot above pipe with bedding material and tamp thoroughly and carefully by hand.
   b. Backfill remainder of trench with selected backfill material in 12 inch maximum loose lifts, unless otherwise specified.
   c. Backfill material shall be free of organic material and shall be readily compactable.
   d. Backfill so that no settling will occur.
   e. Install electronically detectable plastic utility identification tape above all buried utility services. Locate 1 foot below finished grade elevation.
4. Backfill for Structures: Backfill excavations as promptly as the work permits, but not until completion of the following:
   a. Acceptance by Buyer of construction below finished grade.
   b. Inspection, testing, approval and recording locations of underground utilities.
   d. Removal of shoring and bracing, and filling of voids with satisfactory materials.
   e. Removal of trash and debris.
   f. Do not place fill or backfill against concrete structures or foundations less than 14 days after completion of structure or wall unless written permission is obtained from the Buyer.

5. Backfill: Place in lifts not to exceed 12 inches when loose.
   a. Compact each lift to a minimum of 90 percent of maximum density when not under structures or paved areas. When under structures, prepare the footing subgrade by excavating to the bottom of the footing with a smooth blade bucket and compacting with at least four slow passes of a heavy plate compactor. Compact trench backfill at road crossings to 95% of maximum density.
   b. Allowable Moisture Content Deviation: Use moisture content which is suitable for producing the required compaction.
   c. Backfill shall be free of organic material and shall be readily compactable.
   d. Do not place backfill material on surfaces that are muddy, frozen or contain frost or ice.
   e. Place backfill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.
   f. The west end of Trench 4C-T01 shall be backfilled with suitable material obtained from material excavated from Trench 4C-T04. Trench 4C-T01 backfill shall be compacted to 95% maximum density.
F. Grading

1. Uniformly grade areas within the limits of grading under site grading work, including adjacent transition areas.

   a. Smooth finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

2. Grading Outside Building Lines: Grade areas outside building lines to drain away from structures and to prevent ponding of water.

   a. Irregular Surface Changes: Finish surfaces free from irregular surface changes as follows:

      1) Pavement Areas: Shape the surface of areas under pavement to line, grade and cross-section, with the finished surface not more than 1/2-inch above or below, the required subgrade elevation.

3. Final grading of all work shall result in uniform, smoothly graded finished surface, free from irregular surface changes, leaving no depressed areas where water will accumulate or puddle.

4. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, re-shape, and compact to the required density prior to further construction.

5. Use hand tamping for recompaction over underground utilities.

G. Cleaning

1. At all times keep the premises free from accumulations of waste materials or rubbish caused by employees or work.

2. At completion of the work, remove all rubbish and excess excavated material from the work areas.

H. Maintenance

1. Protection Of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris.

2. Repair and re-establish grades in settled, eroded, and rutted areas to the specified tolerances.
I. Soil Overburden Removal

1. General

a. The soil overburden covering the top and sides of the waste modules shall be removed to line and grade by the method shown on the contract drawings and described herein. The equipment used to remove the overburden shall not come into contact with or in any other way damage the waste modules (or containers within the module) buried within the trench. The waste modules are made up of 19 (nineteen) modules numbered from east to west. Modules 12 (twelve), 13 (Thirteen), 14 (Fourteen), 15 (Fifteen) and 16 (Sixteen) contain waste boxes on the upper tier of the module. Modules 11 (eleven) and 9 (nine) contain 110 gallon drums. All other waste modules consist of 55 gallon drums. As a result of the inconsistency in size of the boxes, they may locally protrude above or drop below the level of the top tier of drums. The waste containers are overlaid with marine plywood sheets and tarpaulin covers. The existing topography of the soil together with the positioning of the waste within the trench is shown on the contract drawings.

b. If at any time during excavation the seller discovers any discoloration of the soil or any other anomaly in the expected soil characteristics, the seller shall stop work and inform the buyer immediately.

c. The top corners of each of the drum modules are currently marked by stakes, these stakes locate the module corners to within approximately 12 inches.

2. Soil Overburden Removal from Directly above the Modules

a. The method of removing the overburden shall be as follows:

1) Manually dig exploratory hole locations to a depth of approximately 24 inches below the top of the soil overburden. The positioning of the exploratory hole locations shall be as directed by the Buyer. The Buyer will specifically direct the Seller to dig exploratory holes over known positions of boxes within the waste modules that contain boxes. The purpose of the exploratory holes is to determine if waste modules are present in the soil, in order to allow the soil to be removed using mechanical excavating equipment without damaging the waste containers.
2) No more than 6 exploratory holes shall be required for modules containing boxes and 110 gallon drums per layer of soil to be removed using mechanical excavating equipment. No more than 4 exploratory holes shall be required for modules which consist only of 55 gallon drums per layer of soil to be removed using mechanical excavating equipment.

3) The seller shall demonstrate to the Buyer that none of the exploratory holes have uncovered the waste module and obtain approval of the Buyer to proceed with excavation of the overburden.

4) After digging the exploratory holes and obtaining approval to proceed, the following depths of soil shall be removed using mechanical excavating equipment:

   a) Waste modules which contain 55 and 110 gallon drums only, remove approximately 12 inches of soil overburden. The maximum soil removal shall not exceed 15 inches per layer of soil removed.

   b) Waste modules which contain boxes, remove approximately 9 inches of soil overburden. The maximum soil removal shall not exceed 12 inches per layer of soil removed.

The excavating equipment shall not drive directly over the buried waste modules at any time during excavation. Excavation shall be carried out by dragging a smooth-bladed excavating bucket (or equivalent) horizontally across the module to remove the layer of soil. The excavating bucket shall not vertically impact the soil over any of the modules in the trench.

5) After the Seller has excavated the 12 inch layer of soil using the excavating equipment, the buyer will monitor and confirm the surface of the soil is not contaminated. Surface soil monitoring will take no more than 15 minutes for each 12 inch layer of soil removed, for each of the modules. The seller will not be able to excavate deeper at that location, until monitoring is complete and the Buyer has given approval to proceed.

6) On completion of the soil surface monitoring, the seller shall repeat the manual exploratory hole digging and mechanical excavation sequence, until the exploratory holes uncover a waste module(s). If the exploratory holes uncovers a module between 12 and 24 inches below the surface of the soil, then following approval of the buyer, the soil overburden shall be removed to within approximately 12 inches of the module using the excavating equipment. The mechanical excavator shall not remove soil within 9 inches of the module. If the exploratory holes uncover a module less than 12 inches
below the surface of the soil, then no further soil removal shall take place at that module using the mechanical excavator.

7) When the overburden has been removed to within approximately 12 inches of the top of the module, the seller shall manually dig further exploratory holes to locate the north and south edges of the modules. The edges shall be considered as located when the exploratory holes expose at least 12 inches of the vertical side of the module. The edges of each module shall be positively located in three positions, once at the east end, once at the west end and once in the middle of each module. The adjacent corners between pairs of modules can be considered a common location point for the corner of two modules. When the edges of the waste modules have been located, stake markers shall be placed in the ground along the line of the edges of the waste modules. The stake markers shall be no more than 20 feet apart and extend at least 36 inches above the ground.

8) After the soil overburden has been removed to within 9 to 12 inches from the top of the module, and the edges of the module have been marked by stake, any existing exploratory or other holes shall be back filled.

3. Soil Removal at the Sides of the Module

a. Following removal of the overburden directly above the waste modules, the sides of the trench modules shall be excavated to the final profile shown on the contract drawings. Soil removal at the sides of the waste modules can proceed on a continuous bases after the soil has been removed from over the waste modules or after the soil has been removed from over all the waste modules.

4. Soil Removal from the Asphalt ramp

a. The seller shall excavate the soil which covers the asphalt ramp at the west end of the trench to the line and grade shown on the contract drawings. The seller is responsible for repair of any damage to the asphalt ramp as a result of excavation. Excavation of the soil covering the ramp can be carried out before, in parallel or after removal of the soil over or at the sides of the waste modules.

5. Removal of Rocks and Debris

a. After the soil overburden has been removed from the top and sides of the waste modules, and the ramp on the contract drawings, the Seller shall manually remove all rocks and debris greater than 3 inches in any dimension that are visible on the finished profile.
3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Compaction Tests: Compaction shall be controlled using ASTM D1557. Maximum density and in-place density test will be performed as required by the Buyer.

1. In-place density tests will be conducted in accordance with ASTM D1556 and D2922 by the Buyer on in situ soils, using nuclear density gage, during excavations. Results of these test shall be used for testing compaction of backfill.

2. Before placement of any embankment/fill/backfill material, demonstrate to the Buyer by physical test at site, that procedure proposed for installation and compaction of soils will provide degree of compaction specified. Prepare "Soil Compaction Procedure," Form KEH-0382, in accordance with printed instructions.

3. Location Of Tests: Will be determined by the Buyer.

4. Quality Control Tests: If tests indicate results below specified densities, provide additional compaction and retesting at no change in Contract amount.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
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SECTION 02511

BASE COURSE

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section includes furnishing of labor, supervision, equipment, tools, materials and all other items necessary to satisfactorily construct the aggregate surfacing and base course as shown on the Contract Drawings.

1.02 RELATED SECTIONS

A. Section 02200 Earthwork

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T96-87 Resistance to Abrasion of Small Size Coarse Aggregate by Use of Los Angeles Machine.

B. American Society for Testing and Materials (ASTM)

ASTM D1557-91 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³ (2700 kN-m/m³))

ASTM D1556-90 Density and Unit Weight of Soil In-Place by the Sand-Cone Method.

ASTM D2922-91 Density of Soil and Soil-Aggregate in Place By Nuclear Methods (Shallow Depth).

C. Washington State

WSDOT-M41-10 State of Washington Standard Specifications for Road and Bridge Construction.

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The Seller shall submit the following for Buyer’s record and information.
1. Letter of Conformance of specification compliance for base course.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

B. Stockpile to prevent excessive segregation or contamination with other materials or other sizes of aggregates.

C. Use only one source of supply for each aggregate.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

B. Soil on which Base Course is to be Placed: Prior to placing base course perform the following work:

1. Remove any soft soils encountered by proof rolling and replace with fill.

   a. Soft soil shall be defined as that soil which, in the opinion of the Buyer, weaves or heaves considerably during proof rolling operations.

C. Protection: Protect and maintain all utilities that are to remain on the property.

1. Bench Marks and Monuments: Carefully maintain and protect all bench marks, monuments and other reference points.

   a. If disturbed or destroyed, replace as directed by the Buyer.

D. Dust Control: Control the spread of air-borne dust originating as a result of this operation, in accordance with WSDOT-M41-10, Section 1-07.5(4).

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. Aggregate Material:

1. Base Course: Shall meet the requirements of WSDOT-M41-10, Section 9-03.9(3) and AASHTO T96.
2.03 EQUIPMENT

A. All equipment utilized on the project shall be of such condition, capacity, and quality so as to perform the work satisfactorily in a reliable manner throughout the duration of the work.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Placing and Spreading: Place all base course material on approved prepared surface and compact in layers to required thickness.

1. Deliver to subgrade as uniform mixture at or near optimum moisture content.

2. Deposit and spread material in a uniform layer and without segregation of size to such loose depth that when compacted, the layer shall have a thickness not less than 3 inches nor more than 6 inches and the required density shall be obtained for the full depth of the layer.

3. Spread from dump boards, spreader boxes, or approved mechanical equipment, or from moving vehicles equipped to distribute the material in a uniform layer.

4. Alternately shape and compact by blading and rolling to form uniformly mixed compacted layer.

5. Material may be watered during the mixing to maintain optimum moisture content.

B. Rolling Base Course: Immediately following final base course spreading and smoothing, roll all material placed with a pneumatic tire or other approved roller.

1. Correct any irregularities or depressions that develop under rolling by loosening the material at these places and adding or removing material and recompingating until the surface is smooth and uniform and to the desired grade.
2. At all places not accessible to the roller, tamp the material thoroughly with a mechanical tamper or hand tamper, the tamper faces of which shall not exceed 25 square inches in area.

3. Sprinkle material with water during rolling, tamping, and blading to maintain optimum moisture content.

C. Base Course Surface Smoothness Tolerances: Test the finish surface using a 10 foot straightedge applied parallel with and at right angles to the centerline.

1. Surface will not be acceptable if exceeding 3/8 inch of tolerance.

D. Base Course Compaction Requirements: 95 percent of maximum density as determined by ASTM D1557, Method D.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

1. Maximum densities will be determined in accordance with ASTM D 1557, Method D.

2. Quality control testing during construction will be performed by Buyer using in-place density test per ASTM D 1556 or ASTM D 2922.

3. Location of tests to be taken will be determined by the Buyer.

4. If quality control tests indicate results below specified densities, the Seller shall provide additional compaction and retesting at no cost to the Buyer.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
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SECTION 02513

ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section includes furnishing of labor, supervision, equipment, tools, materials and all other items necessary to satisfactorily construct the paved areas as shown on the Contract Drawings. Included in the work is the reconditioning of the base course surface prior to commencing paving operations.

1.02 RELATED SECTIONS

A. Section 02200  Earthwork
B. Section 02511  Aggregate Surfacing and Base Course

1.03 REFERENCES

A. State of Washington
   WSDOT-M41-10  State of Washington Standard Specifications for Road and Bridge Construction

B. American Association of State Highways and Transportation Officials (AASHTO)
   AASHTO T-165-86  Effect of Water on Cohesion of Compacted Bituminous Mixtures

C. American Society for Testing and Materials (ASTM)

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The Seller shall submit the following to the Buyer for information and record:

September 1995  02513 - 2  RAYTHEON PROJECT 9164.006
Rev 0
5. Certified Job Mix Formula Test Report for Leveling Course and Wearing Course.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. General: Use locally available materials and gradations which exhibit a satisfactory performance record for previous installations.

B. Base Course Aggregate: Meet requirements of Specification Section 02511.

C. Asphalt Concrete Paving Aggregate: Wearing Course - Class B as per WSDOT-M41-10, Section 9-03.8.

D. Mineral Filler: As per WSDOT-M41-10, Section 9-03.8(5).

E. Asphalt Cement: Grade AR-4000 W as per WSDOT-M41-10, Section 9-02.1(4).

F. Prime Coat: Provide cut-back asphalt type MC-250 as per WSDOT-M41-10, Section 9-02.1(2).

G. Tack Coat: Provide emulsified asphalt CRS-2 as per WSDOT-M41-10, Section 9-02.1(6).

H. Anti-Stripping Additive: As per WSDOT-M41-10, Section 9-02.4.

I. Asphalt-Aggregate Mixture
I. Asphalt-Aggregate Mixture

1. Provide plant-mixed, hot-laid asphalt-aggregate mixture of the same proportions and qualities of a mixture that has recently been utilized acceptably on a Washington state highway project. Design paving mixtures to have the properties set forth in WSDOT-M41-10, Section 9-03.8(2).

2. Provide certification of this fact.

2.03 EQUIPMENT

A. All equipment utilized on the project shall be of such condition, capacity and quality so as to perform the work satisfactorily in a reliable manner throughout the duration of the work.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Portions of the existing base course to be paved may require reconditioning. Reconditioning shall include furnishing, placing and compacting of new base course materials as required to bring the existing surface to the lines, grades and sections shown on the Contract Drawings. The Seller shall check all existing base course and add new material as necessary to recondition base course as specified herein.

B. Surface contamination shall be removed and wasted. Such removal shall be to a depth necessary to expose a surface comparable to that of newly placed base course. After surface cleanup, the existing surface shall be scarified to a depth of at least 3 inches, moistened and compacted as specified. New material shall be added, moistened and compacted as specified to bring the surface to required elevation and grade and to tolerance. All codes and standards, materials, construction equipment, construction methods, testing and acceptance utilized in reconditioning the existing base course shall be as set forth in Specification Section 02511.

C. Remove loose material from compacted base course surface immediately before applying prime coat.
D. Proof roll prepared base course surface to check for unstable areas and areas requiring additional compaction. Do not begin paving work until deficient areas have been corrected and are ready to receive paving.

E. Prime Coat: Apply prime coats when ambient temperature is above 50°F, and when temperature has not been below 35°F for 12 hours immediately prior to application.

1. Do not apply when base is wet or contains an excess of moisture.

2. Distribute at the rate of 0.3 gallons per square yard.

3. Paving operations shall not begin until prime coat is dry and volatiles have evaporated (approximately 24 hours after prime coat application).

F. Tack Coat: Apply tack coat when ambient temperature is above 50°F, and when temperature has not been below 35°F for 12 hours immediately prior to application.

1. Apply to contact surfaces of previously constructed asphalt pavement.

2. Distribute at rate of 0.05 to 0.15 gallon per square yard of surface.

3. Allow to dry until at proper condition to receive pavement.


3.02 ERECTION, INSTALLATION & APPLICATION

A. General: Place asphalt concrete mixture on prepared surface in accordance with WSDOT-M41-10; Section 5-04.3(9).

1. Install asphalt concrete paving when atmospheric temperature is above 40°F, and when underlying surface is dry.

2. Spread mixture at minimum temperature of 225°F.

3. Place inaccessible and small areas by hand.

4. Place each course to required grade, cross-section, and compacted thickness.
5. Compaction procedure shall be in accordance with WSDOT-M41-10, Section 5-04.3(10). Each course shall be compacted to 95 percent of the laboratory density using the design mixture.

B. Bituminous Paving Job-Mix Formula: When prepared and tested in accordance with the Marshall design method (ASTM D1559) with 50 blows each face of the specimens, the specimens shall have the following physical properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability, minimum, pounds</td>
<td>750 or higher</td>
</tr>
<tr>
<td>Flow, 1/100-inch units</td>
<td>8-18</td>
</tr>
<tr>
<td>Voids, total mix, percent</td>
<td>3-6</td>
</tr>
<tr>
<td>Voids filled with asphalt, percent</td>
<td>75-85</td>
</tr>
</tbody>
</table>

1. The composite bituminous paving mixture shall have an index of retained strength of not less than 75 as determined by AASHTO Test Method T165. If necessary, treatment of the aggregate with hydrated lime or an approved anti-stripping agent shall be performed.

2. Testing will be performed by the Buyer.

C. Job-Mix Formula: The Seller shall submit for approval, certified laboratory test results of the proposed job-mix formula.

1. The job-mix formula shall establish the definite percentage of each sieve fraction of aggregate, the percentage of bituminous cement, and the temperature of the completed mixture at the time it is discharged from the mixer. The material furnished shall conform to the approved job-mix formula with the following tolerances:

<table>
<thead>
<tr>
<th>Property</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passing No. 4 and larger sieves</td>
<td>7% plus or minus</td>
</tr>
<tr>
<td>Passing No. 8 through 100 sieves</td>
<td>4% plus or minus</td>
</tr>
<tr>
<td>Passing No. 200 sieve</td>
<td>2% plus or minus</td>
</tr>
<tr>
<td>Asphalt</td>
<td>0.4% plus or minus</td>
</tr>
<tr>
<td>Temperature of mixing</td>
<td>25°F plus or minus</td>
</tr>
</tbody>
</table>

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Surface and thickness tolerances.

1. General: The following criteria shall apply to this work and shall supersede section 5-04.3(13) of the WSDOT-M41-10. Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness.
a. Repair or remove and replace unacceptable paving as directed by the Buyer.

2. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:
   
a. Wearing Course: 1/4 inch, plus or minus.

3. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10 foot straightedge applied parallel with, and at right angles to centerline of paved area.

   a. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.

   1) Wearing Course Surface: 3/16 inch.

   2) Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template, 1/4 inch.

4. Make all paving uniform, smoothly graded with the finished surfaces free from irregular surface changes.

   a. Paved surfaces shall be properly graded leaving no depressed areas where water will accumulate or puddle.

5. Testing will be performed by the Buyer.

3.04 ADJUSTING AND CLEANING

A. Repair all damaged areas or defective areas that are part of this Project as directed by the Buyer.

   1. Perform repair in the manner and with the quantity and type of material designated by the Buyer.

   2. Repair holes from test specimens as a result of the Density Testing.

B. Patching: Remove and replace defective areas.

   1. Cut sides perpendicular and parallel to direction of traffic with edges vertical.

   2. Remove deficient areas for full depth of course.

   3. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.
4. Fill with fresh, hot asphalt concrete.

5. Compact by rolling to specified surface density and smoothness.

C. After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of Buyer.

D. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than six hours.

   1. Provide barricades and warning devices as required to protect pavement and the general public.

   2. Cover openings of structures in the area of paving until permanent coverings are placed.

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
## SECTION 02665
### WATER SYSTEMS

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<td>1.03 REFERENCES</td>
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<td>1.05 SUBMITTALS</td>
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<td>2.03 EQUIPMENT: NOT USED</td>
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<tr>
<td>2.04 COMPONENTS: NOT USED</td>
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<td>2.05 FABRICATION: NOT USED</td>
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<td>2.06 SHOP QUALITY CONTROL</td>
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<th>PART 3 EXECUTION</th>
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<td>3.01 PREPARATION: NOT USED</td>
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<tr>
<td>3.02 ERECTION, INSTALLATION &amp; APPLICATION</td>
<td>6</td>
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<tr>
<td>3.03 FIELD QUALITY CONTROL</td>
<td>8</td>
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<tr>
<td>3.04 ADJUSTING AND CLEANING</td>
<td>9</td>
</tr>
<tr>
<td>3.05 DEMONSTRATION: NOT USED</td>
<td>9</td>
</tr>
<tr>
<td>3.06 PROTECTION: NOT USED</td>
<td>9</td>
</tr>
</tbody>
</table>

### APPENDICES

APPENDIX A PIPING MATERIAL
SPECIFICATION "NK" and "NW"
SECTION 02665
WATER SYSTEMS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section covers the minimum requirements for furnishing materials, labor, equipment, tools, supervision and all other items necessary to satisfactorily construct the sanitary (potable) water supply, fire protection and utility water systems supply to the facility complete as shown on the Contract Drawings.

1.02 RELATED SECTIONS

A. Section 02200 Earthwork
B. Section 03300 Cast-In-Place Concrete

1.03 REFERENCES

A. American National Standards Institute/American Water Works Association (ANSI/AWWA):

3. A21.10/C110-93 Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch, (75 mm through 1200 mm) for Water and Other Liquids.

B. National Fire Protection Association (NFPA):
   1. NFPA No. 24-92 Installation of Private Fire Service Mains and their Appurtenances.

C. Factory Mutual Data Sheet
   1. FM 3-10 Fire Service Mains
   2. Factory Mutual Approval Guide

D. American National Standards Institute (ANSI):
   1. ANSI B 16.10-86 Face-To-Face and End-To-End Dimension of Valves.
   3. ANSI B 16.5-88 Pipe Flanges and Flanged Fittings.
   4. ANSI B 16.22-80 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
   5. ANSI B 1.20.1-88 Pipe Threads

E. Underwriter Laboratory, UL Fire Protection Equipment Directory.

F. American Society for Testing and Materials (ASTM)
   1. ASTM B88-92 Seamless Copper Water Tube
   2. ASTM B584-93B Copper Alloy Sand Castings for General Applications
   3. ASTM D2241-87 Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
   4. ASTM D1599-88 Test Method for Short-time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
   5. ASTM A 193-91a Alloy-Steel and Stainless Steel Bolting Materials for High-temperature Service
   6. ASTM A 194-91 Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
8. ASTM A 105-91 Forgings, Carbon Steel, for Piping Components
10. ASTM B61-90 Steam or Valve Bronze Castings
11. ASTM B62-90 Composition Bronze or Ounce Metal Castings
12. ASTM F477-93E1 Elastomeric Seals (gaskets for joining plastic pipe)

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittal than listed herein.

B. The Seller shall submit the following for review and approval by the Buyer:


2. Water Valves and Valve Boxes: Letter of Conformance, Manufacturer’s catalog data, and installation instructions.


7. Fire Hydrants: Letter of Conformance, Manufacturer’s catalog data and installation instructions.
8. Tapping Service Clamps and Valves: Letter of Conformance, Manufacturer's catalog data and installation instructions.


C. The Seller shall submit the following to the Buyer for review for records (for information and/or records):


1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. All pipe and piping components (e.g., valves, fittings, flanges, gaskets, bolts, etc.) for the water systems shown on the Contract Drawings shall conform to pipe Material Specification "NK" or "NW" in Appendix A. Pipe and piping components for the firewater system shall also conform to NFPA No. 24 and Factory Mutual Data Sheet 3-10.

B. Concrete: Shall be Class C complying with applicable portions of Section 03300 Cast-In-Place Concrete.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED
2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Refer to Section 02200 for trenching and backfilling.

B. Equipment

1. Use only equipment fully capable of performing operations required by the work in this Section.

2. Maintain equipment in satisfactory operating condition and provide sufficient quantity of equipment to maintain the scheduled progress of Work.

C. Work Layout

1. Locate and lay out utilities as shown on drawing H-2-823244.

2. Follow indicated locations and elevations as closely as possible, ground conditions permitting.

3. Field establish and maintain grades, lines and levels as required for the Work, and be responsible for the accuracy of same.

D. Water System Installation

1. Install water distribution system piping and specialties in locations and of sizes indicated on the Contract Drawings. Installation of the Fire Water System shall conform to NFPA 24 and FM 3-10.

   a. Install water distribution piping with a minimum of 42 inches of earth cover, from finished elevations shown on Contract Drawings.

2. Pipe and Accessories: Handle to ensure delivery to the Project site in sound, undamaged condition.

   a. Rope Or Canvas Slings: Use in loading, unloading and installing of water pipe.

   b. Use Of Chains Or Tongs: Will not be permitted.
c. Cutting Of Pipe: Perform in a neat manner with an approved type mechanical cutter without damage to pipe. Use wheel type cutters when practicable.

3. Before lowering into the trench, inspect all pipe sections for defects.
   a. Defective, damaged or unsound pipe will be rejected and shall be removed from the Project site.
   b. Deflections from a straight line or grade, as required by vertical or horizontal curves and offsets shall not exceed manufacturer’s recommendations.

4. Trench Bottom Support: When Trench has been excavated to required depth, as specified in Section 02200 3.02 D, the bottom will be evaluated to determine its suitability for pipe support by the Buyer.

5. Before joining, remove all lumps, blisters, oil and grease that will interfere with proper aligning from the ends of all pipes.

6. Protect open pipe ends whenever work is suspended during construction, to prevent foreign matter from entering and lodging in pipe.
   a. Use wood blocks or other method for protection.

7. Install valves in locations indicated on the Drawings.
   a. Set valves with the stem vertical.
   b. After valves have been installed and adjusted, test valves for operation under maximum operating pressure.
   c. Valves shall be watertight and operate easily.
   d. Anchor valves per pipe manufacturer’s recommendations.

8. Where connections are made between new work and existing mains, the connections shall be made using fittings to suit the actual conditions. Where connections are made under pressure, the connections shall be installed as approved by the Buyer. Thrust restraints must be installed in accordance with NFPA 24.

9. Securely block and anchor in place all size changes, changes of direction and elevation (e.g., tee connections, bends, etc.) and dead ends in accordance with the Contract Drawings.

10. Ductile iron fittings shall be encased in polyethylene in accordance with the procedures of AWWA C105.
E. Fire Hydrant Installation

1. Plumb the hydrants vertical.

2. Bury the base a sufficient depth so that the supply line has at least 3.5 feet of earth cover.

3. Install hydrant on concrete block as shown and pour concrete thrust block to anchor hydrant in place taking care not to block weep hole.

4. Install crushed rock around hydrant base as shown.

5. Traffic safety flange shall not be less than 2 inches and not more than 6 inches above final finish grade.

6. Install in accordance with manufacturer’s recommendations.

F. Pipe Guards

1. Posts shall be plumbed vertical.

2. Set posts in concrete footing and fill posts with concrete.

3. Paint post and install reflective adhesive sheeting strips as shown on the Contract Drawings.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Prior to concealing and covering work all piping systems shall be subject to a hydrostatic test.

C. Prior to testing piping systems, remove or otherwise protect from damage the components which are not designed to withstand the pressures used in testing piping.

D. Water Distribution System Test: After pipe is laid, the joints completed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping, or any valved section of piping, shall be subjected to hydrostatic pressure of 200 psig without pumping for at least two hours with no loss of pressure.

1. Conduct test in manner as approved, so that no pipe or joint will be left untested.

2. All visible leaks shall be repaired regardless of the amount of leakage.
3. Filling and flushing for hydrostatic testing shall be done through a temporary backflow preventer approved by the Washington State Department of Health.

3.04 ADJUSTING AND CLEANING

A. Flush water distribution systems in accordance with the procedures established by NFPA 24.

B. Filling and flushing for disinfecting shall be done through a temporary backflow preventer approved by the Washington State Department of Health.

C. Water Distribution Systems: Sterilize with approved chlorinating agent to provide a dosage of not less than 50 ppm after flushing. After a minimum contact period of 24 hours, system shall be flushed with clean water until residual chlorine is no greater than that of the water supply. All procedures shall comply with AWWA Specification C-651.

D. All backflow prevention assemblies shall be tested by a certified tester. Test reports shall be delivered to the Buyer and the administrative authority.

E. Maintain all areas in a neat and tidy condition.

F. At all times maintain the premises free from accumulations of waste materials or rubbish.

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
APPENDIX A

PIPING MATERIAL SPECIFICATION "NK" AND "NW"
## Specification "NK"

### Piping Material Specification

**Service:** Underground and Aboveground Utility Water Service

### Maximum Allowable Pressure and Temperature

<table>
<thead>
<tr>
<th>Temperature, °F:</th>
<th>140°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure, PSIG:</td>
<td>125</td>
</tr>
</tbody>
</table>

### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubing 1/4&quot; - 3&quot;</td>
<td>Seamless copper water tubing, hard drawn or soft drawn, Type L, ASTM B88.</td>
</tr>
<tr>
<td>Fittings 1/4&quot; - 3&quot;</td>
<td>Wrought copper or bronze solder-type, ANSI B16.22.</td>
</tr>
<tr>
<td>Soldering Material</td>
<td>Aboveground Service: 95-5 (tin-antimony) (lead-free) suitable for potable water.</td>
</tr>
<tr>
<td>Brazing Material</td>
<td>Buried Service: Silver brazing alloy (lead-free) suitable for potable water.</td>
</tr>
<tr>
<td>Curb Valves V002 3/4&quot; - 2&quot;</td>
<td>125# Class, cast bronze body and plug. Threaded inlet and outlet, Mueller Oriseal Mark II or approved equal.</td>
</tr>
<tr>
<td>Post Hydrants</td>
<td>Freeze-proof hydrant with lever handle, 1&quot; galvanized steel pipe casing, 3/4&quot; inlet, 3/4&quot; brass male hose thread cutlet, 1/8&quot; automatic drain opening, 42&quot; minimum depth of bury. Woodford Model Y34 or approved equal.</td>
</tr>
<tr>
<td>Backflow Preventers 2&quot; and Smaller</td>
<td>Angle pattern, reduced pressure type, bronze body, ASTM B584, threaded ends, rated to 175 psi water working pressure, with hydraulically dependent differential relief valve, vertical flow in, vertical flow out, complete with ball valves, Febco Model 825YA or approved equal.</td>
</tr>
<tr>
<td>Hose Reels</td>
<td>Spring-rewind industrial hose reel, ratchet assembly, 3/4&quot; hose capacity of 100 ft., McMaster-Carr No. 44835K54 or approved equal (hose not included).</td>
</tr>
<tr>
<td>Hoses</td>
<td>3/4&quot; ID general-purpose air and water hose, 100 ft. long, EPDM tube and cover, high tensile strength yarn braid, complete with long shank cast brass female coupling attached one end, McMaster-Carr No. 5304K44 (hose) with No. 5304K53 (coupling) or approved equal.</td>
</tr>
<tr>
<td>Spray Nozzles</td>
<td>Insulated low-pressure wash gun, bronze body, front trigger, 3/4&quot; ID hose barb coupling, 24 gpm at 100 psi, black cover, McMaster-Carr No. 3346K16 or approved equal.</td>
</tr>
</tbody>
</table>
Specification "NW"
Piping Material Specification


Maximum Allowable Pressure and Temperature
Temperature, °F: 100°
Pressure, PSIG: 175

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pipe</strong></td>
</tr>
<tr>
<td>4&quot; - 12&quot; Polyvinyl Chloride (PVC) with rubber gasketed push-on seal joints. AWWA C900, UL listed or FM approved for firewater service class 200, DR 14.</td>
</tr>
<tr>
<td>1½&quot; - 2&quot; Polyvinyl Chloride (PVC) with rubber gasketed push-on seal joints, ASTM D2241, Class 200, SDR-21.</td>
</tr>
<tr>
<td><strong>Fittings</strong></td>
</tr>
<tr>
<td>4&quot; - 12&quot; Ductile iron, Class 350, with mechanical joints to match pipe. ANSI/AWWA A21.10/C110 and ANSI/AWWA A21.11/C111, cement mortar lined in accordance with ANSI A21.4/AWWA C104 standard, sealed inside and coated outside, UL listed or FM approved for firewater service.</td>
</tr>
<tr>
<td>1½&quot; - 2&quot; Polyvinyl Chloride (PVC) ASTM D1599, gaskets conforming to ASTM F477.</td>
</tr>
<tr>
<td><strong>Bolting</strong></td>
</tr>
<tr>
<td>T-Head bolts and hexagon nuts conforming to ANSI/AWWA A21.11/C111 for use with mechanical joint retainer glands.</td>
</tr>
<tr>
<td>American standard stud bolts, ASTM A193, grade B7 with semi-finished heavy hex nuts ASTM A194, grade 2H, galvanized. (For flanged connections).</td>
</tr>
<tr>
<td><strong>Washers</strong></td>
</tr>
<tr>
<td>1/16&quot; thick flat steel washers, galvanized.</td>
</tr>
<tr>
<td><strong>Gaskets</strong></td>
</tr>
<tr>
<td>4&quot; - 12&quot; Synthetic rubber, conforming to ANSI/AWWA A21.11/C111 for use with push-on joints, retaining glands.</td>
</tr>
<tr>
<td>1/8&quot; red rubber, full face, ANSI Class 150, (for flanged connection).</td>
</tr>
<tr>
<td><strong>Valves, Gate</strong></td>
</tr>
<tr>
<td>V001 4&quot; - 12&quot; 175# iron body with lined interior (AWWA C509/C550), bolted, bronze mounted, rubber coated iron disc, non-rising stem, parallel seat, hub end.</td>
</tr>
<tr>
<td><strong>Curb Valves</strong></td>
</tr>
<tr>
<td>V002 1½&quot; - 2&quot; Cast bronze body and plug. Threaded inlet and outlet, Mueller Oriseal Mark II.</td>
</tr>
</tbody>
</table>
### Specification "NW"

Piping Material Specification

**Issued:**

**Revised:**

**Designation:** "NW"

**Service:** Underground Fire Water and Sanitary (Potable) Water.

<table>
<thead>
<tr>
<th>Branches</th>
<th>Description</th>
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<tbody>
<tr>
<td></td>
<td>Full or reducing, cement lined, ends to match piping system.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Service Clamps 3/4&quot; - 2&quot;</th>
<th>Bronze slip-hinge threaded, O-ring seal, Mueller Model H-13492 or approved equal.</th>
</tr>
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<tbody>
<tr>
<td>Valve Box</td>
<td>Adjustable, slip type, cast iron with deep seated lid marked WATER. Mueller or approved equal.</td>
</tr>
<tr>
<td>Fire Hydrant</td>
<td>175# UL/FM, AWWA C502 with interior lined in accordance with AWWA C550, Hanford facility standard thread, 5-1/4&quot; main valve opening, open clockwise, one 4-1/2&quot; pumper nozzle, two 2-1/2&quot; hose nozzles, dry barrel traffic type pattern, painted to match Hanford facility standards.</td>
</tr>
<tr>
<td>Indicator Post</td>
<td>UL/FM, with supervisory switch, adjustable type, with flange compatible with valve indicator post flange.</td>
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Valve Specification Sheet (NW)

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<tr>
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<tbody>
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<td><strong>Ends</strong></td>
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<tr>
<td><strong>Dimensional STD.</strong></td>
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<tr>
<td><strong>Bonnet Type</strong></td>
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<td><strong>Body/Bonnet Material</strong></td>
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<td><strong>Bolting</strong></td>
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<tr>
<td><strong>Stem</strong></td>
</tr>
<tr>
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02665 - A6
RAYTHEON PROJECT 9164.006
**SECTION 02730**

**SANITARY SEWERAGE**

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**APPENDICES**

**APPENDIX A PIPING MATERIAL SPECIFICATION**
SECTION 02730
SANITARY SEWERAGE

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section covers the minimum requirements for furnishing of labor, supervision, equipment, tools, materials and all other items necessary to satisfactorily construct the sanitary sewer system to the septic tank as shown on the Contract Drawings.

1.02 RELATED SECTIONS

A. Section 02200 Earthwork
B. Section 03300 Cast-In-Place Concrete

1.03 REFERENCES

A. Requirements of Regulatory Agencies: Comply with requirements of local regulatory agencies having jurisdiction.
B. ASTM A74-87 Service weight cast iron soil pipe and fittings.
D. ANSI A21.51-91 Ductile iron pipe - Centrifugally cast.

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The Seller shall submit the following for information and record to the Buyer:


2. Rubber Gaskets: Letter of Conformance and manufacturer’s product data and installation instructions.

C. Submit documents to certify suitability and specification compliance for materials furnished.
1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. All pipe and piping components for the sanitary building sewers shown on the contract drawings to the inlet of the septic tank shall conform to piping material specification "NT" in Appendix A.

B. All pipe and piping components from the outlet of the septic tank shall conform to Specification Section 02740.

C. Pipe Bedding Material: Refer to Specification Section 02200.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Excavating.

1. Refer to Specification Section 02200.

B. Backfilling.

1. Refer to Specification Section 02200.
C. Work Layout

1. Locate and lay out utility work as shown. Terminate site utilities above grade in building crawl space as shown.

2. Follow indicated locations and elevations as closely as possible, ground conditions permitting.

3. Field establish and maintain grades, lines and levels as required and be responsible for the accuracy of the same.

D. Sanitary Sewer Installation.

1. Installation: Install in strict accordance with the pipe material manufacturer's recommendations, and this specification.

2. Lines and Grades: Install to existing lines and grades.

3. Inspecting Pipe: Inspect each section of pipe before lowering pipe into trench. Reject and remove defective, damaged or unsound pipe from the Project site.

4. Trench Bottom Support: When trench has been excavated to required depth, as specified in section 02200, the bottom will be evaluated to determine its suitability for pipe support by the Buyer.

5. Water In Trenches: Do not allow water in trench while pipes are being laid or allow water to rise around the joint until joint material has set.

6. Pipe Laying: Lay pipe and embed it firmly at required line and grade.
   a. Lay piping true to line and grade with bells or groove end upgrade.
   b. Fit ends together, match so that sewer will have smooth and uniform invert throughout its length.

7. Clear Pipe Interior: As pipe laying progresses, clear pipe interior of dirt, joint compound or other superfluous materials.

8. During work stoppage period, provide effective plugs or covers for open ends of pipe to prevent foreign matter from entering.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.
B. Completely fill the system with water and let stand for 15 minutes. Visually inspect piping to ensure that it is watertight at all points.

C. After joints have been inspected and approved, backfill pipe to top of pipe as hereinbefore specified in Specification Section 02200.

D. Before remainder of trench is backfilled, the sewer main will be reviewed for displacement and alignment by the Buyer. Correct faults disclosed by review.

3.04 ADJUSTING AND CLEANING

A. At all times keep the premises free from accumulations of waste materials or rubbish caused by employees or work.

B. At completion of the Work, remove all rubbish and excess excavated material from the work area.

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
APPENDIX A

PIPING MATERIAL SPECIFICATION - "NT"
Piping Material Specification "NT"

Service:
Sanitary Building Sewers to Septic Tank

Maximum allowable pressure and temperature
Temperature, °F: 140
Pressure, PSIG: 5

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<tr>
<th>Description</th>
<th>Details</th>
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<tr>
<td>Pipe</td>
<td>Hub and spigot cast iron soil type, ASTM A74, service weight, five or ten foot lengths.</td>
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<tr>
<td>Fittings</td>
<td>Hub and spigot cast iron soil type, ASTM A74, service weight.</td>
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<td>Joints</td>
<td>Joints for hub and spigot piping shall be with neoprene gaskets, ASTM C 564.</td>
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<tr>
<td>Grade Clean-Outs</td>
<td>Cast iron soil type, ASTM A74, hub and spigot, service weight. Cast iron ferrule with plug. Coated cast iron access frame with anchor flanges and heavy duty cover set in 3'-0&quot; diameter, 8&quot; thick concrete pad flush with grade.</td>
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<tr>
<td>Pipe AT Water Line Crossing</td>
<td>Ductile iron pressure water pipe, thickness class .51, ANSI A21.51.</td>
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<tr>
<td>Joints Cast iron to ductile rion</td>
<td>FERNCO Model 1051-44 drain line couplings, ASTM C564.</td>
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SECTION 02740

SEPTIC SYSTEMS

PART 1  GENERAL

1.01 SECTION SCOPE

A. This Specification Section covers the minimum requirements for furnishing of labor, supervision, equipment, tools, materials and all other items necessary to satisfactorily install the septic system, including the septic tank, dosing pumps and pump chamber, liquid level controls, absorption bed field and all interconnecting piping.

1.02 RELATED SECTIONS

A. Section 02200  Earthwork
B. Section 02730  Sanitary Sewerage
C. Section 03300  Cast-In-Place Concrete
D. Section 16152  Electrical Specification for Packaged Mechanical Equipment

1.03 REFERENCES

A. Requirements Of Regulatory Agencies: Comply with requirements of Benton County Health Department.
F. ASTM C33-90 Concrete Aggregates

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.
B. The Seller shall submit the following for review and approval by the Buyer unless otherwise noted:

1. Perforated Pipe and Non-Perforated Pipe: Letter of Conformance for information and record.


3. Septic Tank: Manufacturer’s product data and installation instructions and shop drawings.

4. Manhole Covers: Manufacturer’s product data for information and record.

5. Manholes: Manufacturer’s product data and shop drawings for information and record.

6. Pumps: Manufacturer’s product data and installation instructions and shop drawings.

7. Pump Control Panel: Manufacturer’s product data, installation instructions and shop drawings.

8. Liquid Level Switches: Manufacturer’s product data, installation instructions and shop drawings.


10. Dose Counter: Manufacturer’s product data and installation instructions.

11. Carbon Filter: Manufacturer’s product data and installation instructions.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED
2.02 MATERIALS

A. Provide precast reinforced concrete septic tank, size and capacity as shown on Contract Drawings. Tank shall be on list of approved tanks by Benton-Franklin Health District.

B. Provide reinforced precast concrete pump chamber as shown on the Contract Drawings. Provide pump chamber vent with gooseneck and carbon filter.

C. Furnish all interconnecting piping and distribution pipe complete with bends, adapters, couplings, collars, pipe end caps and joint materials, as shown on the Contract Drawings and in accordance with Pipe Material Specification "NQ" in APPENDIX A.

D. Filter Material: Washed, drain rock, graded from 2-1/2 inches to 3/4 inch. ASTM C33 grading size number 2, 3, 4 or a mixture thereof is acceptable.

E. Filter Mat: Trevira Spunbond synthetic construction fabric or equal.

F. Provide manhole frames and covers, gas tight, cast iron, with the word "Sewer" cast on the cover, light duty, minimum weight 285 lbs. and conform to ASTM designation A-48, Neenah #R-6462-GL, built-up type for dosing chamber, Neenah #R-6461-GL slab type for septic tank, or equal.

G. Pumps: Provide duplex submersible sewage pumps complete with control panel, valves, piping, level controls and high water alarm. Pump level controls and high water alarm shall be sealed mercury float switches, Weil series 8230 (or equal). Pumps shall be located in the dosing chamber with level controls set to provide the required absorption field dosing volume. Each pump (sized for 100% of load) shall be rated at 100 GPM at 17.6 feet TDH, 3/4 H.P., 208 volt, 3 phase, 1150 RPM. Pumps shall have 3" discharge connections. Pumps shall be Weil Model 2501 or approved equal.

The exterior NEMA-4 duplex alternating control panel shall be Weil Model 8133 or equal with high water alarm package. The control panel shall be located on the east end of the general office building. A dry contact for high level alarm to Buyer’s Data Acquisition System (DAS) shall be provided rated for 0.5 amp at 120 V ac. The high level alarm shall also alarm on loss of power to panel.

H. Effluent Filter: Zabel Multi-Purpose Filter (or Equal).

I. Dose Counter: Orenco, Siphon Sitter I (or Equal).
J. Carbon Filter: Barneby & Sutcliffe Canister Adsorber (or Equal).

2.03 EQUIPMENT: NOT USED
2.04 COMPONENTS: NOT USED
2.05 FABRICATION: NOT USED
2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED
3.02 ERECTION, INSTALLATION & APPLICATION

A. Installation shall be made by a contractor certified as an installer by Benton-Franklin Health District.

B. Excavate areas to receive the septic tank, dosing chamber and absorption beds to insure complete excavation to elevations and slopes indicated.

C. Place filter material and compact to the required thickness. Lay drain pipe to grade solidly bedded in the filter material. Provide full bearing for each pipe section throughout its length, to true grades and alignment. All orifices shall be drilled clean and free of burrs and/or obstructions before placement. Install collars, couplings and fittings as required.

D. Prior to backfilling, a final inspection of the piping shall be completed with DOH present. The final inspection will include verifying pressure distribution of the drainfield. With the orifices pointed up, the dosing chamber shall be filled with water and the pumps activated. Verification shall be made that the squirt heights are uniform and that the network distribution meets pressure distribution guidelines. Remove all obstructions, replace damaged components and retest system until satisfactory. Following acceptance by DOH, the laterals shall be turned to their final position with perforations down and joints tightly closed in accordance with pipe manufacturer’s recommendations.

E. After drain lines have been installed in their final positions, place additional filter material around sides and top to compacted depth above top of pipe, as indicated.
F. Place filter mat and carefully backfill absorption beds taking care not to disturb piping or damage the installation.

G. Septic tank and dosing chamber shall be carefully placed with pipes connected at the proper locations and elevations. Septic tank and dosing chamber shall be leak tested following installation and shall be watertight. Backfill shall be carefully placed and compacted taking care not to disturb piping or damage the installation.

H. No backfilling of the system shall be performed until the Buyer has approved the installation of the sanitary system.

I. Do not permit construction equipment on backfilled trenches.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION

A. After completion of the septic system, the dosing pumps and related equipment shall be operated (with DOH and Buyer present) to verify the following:

1. The pump level controls are set to provide the proper dose volume.
2. The duplex pumps alternate as required.
3. The high water alarm is operational.
4. The reserve pump runs if the lead pump fails to run.
5. The pumps shut off at the proper liquid level.
6. The dose counter and display are operational.
7. The absorption field is capable of receiving the required volume of 1 dose plus 1 day reserve capacity.

3.06 PROTECTION: NOT USED
APPENDIX A

PIPING MATERIAL SPECIFICATION - "NQ"
Piping Material Specification "NQ"

Designation: "NQ"
Service: Septic System including absorption Field

Maximum allowable pressure and temperature
Temperature, °F: 140
Pressure, PSIG: 180

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<td>Pressure Pipe</td>
<td>Schedule 40 polyvinyl chloride (PVC). Pipe shall conform to ASTM D-1785. Pipe to be plain or belled end. Pipe perforations shall be as indicated on contract drawings.</td>
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<tr>
<td>Pressure Fittings</td>
<td>Schedule 40 polyvinyl chloride (PVC) socket type fittings conforming to ASTM D-2466.</td>
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<td>Joints</td>
<td>Polyvinyl chloride (PVC) solvent cement conforming to ASTM D-2564.</td>
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## CONCRETE FORMWORK

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SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SECTION SCOPE

A. This section establishes the requirements for all concrete formwork to be used for the project.

1.02 RELATED SECTIONS

A. Section 03200 - Concrete Reinforcement.
B. Section 03300 - Cast-In-Place Concrete.

1.03 REFERENCES

A. American Concrete Institute (ACI)
   ACI 301-89 Specifications for Structural Concrete for Buildings.
   ACI 347R-88 Recommended Practice for Concrete Formwork.
   ACI 117-81 Standard Tolerances for Concrete Construction & Materials

B. U.S. Product Standards
   PS 1-83 Construction and Industrial Plywood.

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS: NOT USED

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. General: Use of either wood or removable metal forms is
optional.

B. Wood Forms:

1. Unexposed Surfaces: Standard Grade or Better.

2. Exposed Surfaces: Use plywood complying with U.S. Product Standards PS 1, B-B Concrete Form Plywood, Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing the legible trademark of an approved inspection agency.

C. Removable Metal Forms: Surfaces equal to Douglas Fir, exterior type, concrete form plywood.

1. Rust-stained steel formwork is not acceptable.

2. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS

A. Form Ties: Shall be of the type leaving no metal within one inch of finished surface after removal of forms. Wire is not acceptable.

B. Form Coatings: Shall be a non-staining commercially manufactured form release agent free of oil, wax or lacquer and shall be compatible with the surface treatment and coating to be applied to the concrete.

2.05 FABRICATION

A. Design and fabricate forms per ACI 347R.

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare form surfaces in accordance with ACI 301, Section 4.4 using specified form coating materials, or as described in subparagraph 3.01 B.

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

A. Forms.

1. Form pieces shall be as large as possible resulting in the fewest amount of joints.

2. Arrange exposed joints symmetrically.

3. Reuse form material only if clean and undamaged.
   a. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable.

   b. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

4. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints.

5. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.

6. Design forms and falsework to include loadings and factors pertinent to safety of structure during construction.

7. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

8. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances specified in Section 3.03 D.

9. Retighten forms immediately after concrete placement as required to realign forms or eliminate mortar leaks.

10. Unless otherwise noted, the face of panel forms must be lined up with the face of adjacent panel forms leaving no offsets or fins.

11. Provide temporary openings in forms to permit inspection and clean-out.

12. Construct formwork to tolerances per ACI 117 Section 2.0.

B. Embedded Items

1. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete.
a. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

2. Installation Of Anchor Bolts: Unless indicated otherwise, anchor bolts shall be set perpendicular to the theoretical bearing surface.

a. Anchor bolts and foundation bolts must not vary from the dimensions shown on the erection drawings by more than the following:

1) 1/8 inch center to center of any two bolts within an anchor bolt group, where an anchor bolt group is defined as the set of anchor bolts which receive a single fabricated steel shipping piece.

2) 1/4 inch center to center of adjacent anchor bolt groups.

3) Maximum accumulation of 1/4 inch per hundred feet along the established column line of multiple anchor bolt groups, but not to exceed a total of one inch, where the established column line is the actual field line most representative of the centers of the as-built anchor bolt groups along a line of columns.

4) 1/4 inch from the center of any anchor bolt group to the established column line through that group.

5) The tolerances of subparagraphs 2., 3., and 4. apply to offset dimensions shown on the Drawings, measured parallel and perpendicular to the nearest established column line for individual columns shown on the Drawings to be offset from established column lines.

3. Edge Forms and Screed Strips For Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface.

a. Set forms and screeds for slabs to provide positive drainage of exterior slabs, and as indicated on Drawings.

C. Form Coatings:

1. Wood Forms: Coat with form coating before erecting and placing embedments and reinforcing. Coating shall not be allowed to come in contact with previously placed concrete against which fresh concrete will be placed.

2. Metal Forms: Treat surfaces as recommended by form manufacturer before placing reinforcing.
3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Form all concrete unless permitted otherwise.

C. All formwork shall be subject to review and approval of Buyer prior to use.

D. Form Removal

1. Minimum time before removal after placing concrete, unless permitted otherwise in writing by Buyer:
   a. Footings: 24 hours.
   b. Walls, grade beams, piers, piping thrust blocks and columns: 48 hours, 24 hours for metal-lined forms.

2. In any event, do not remove supporting forms and shoring until concrete has acquired strength to safely support own weight plus construction loads and wind loads.

3.04 ADJUSTING AND CLEANING

A. Thoroughly clean forms and adjacent surfaces to receive concrete.

   1. Remove chips, wood, sawdust, dirt and other debris before concrete is placed.

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
SECTION 03200
CONCRETE REINFORCEMENT

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SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION SCOPE: NOT USED

1.02 RELATED SECTIONS
   A. Section 03100 - Concrete Formwork.
   B. Section 03300 - Cast-In-Place Concrete.

1.03 REFERENCES
   A. American Concrete Institute (ACI)
      ACI SP-66 (88) ACI Detailing Manual
      ACI 301-89 Specification for Structural
      Concrete for Buildings
      ACI 318-89 Building Code Requirements for
      Reinforced Concrete
   B. Concrete Reinforcing Steel Institute (CRSI)
      MSP-1 (1980), with Manual of Standard Practice
      1983 supplement
   C. American Society for Testing and Materials (ASTM)
      ASTM A615-90 Deformed and Plain Billet-Steel Bars for
      Concrete Reinforcement
      ASTM A853-90 Steel Wire, Carbon, for General Use
      ASTM A82-90a Steel Wire, Plain, for Concrete
      Reinforcement

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS
   A. Refer to Division 1.0 for procedure including details
      regarding standard submittal schedule, distribution and number
      of copies required.
   B. Detailed Design Submittal: Following submittals shall be
      provided for review and approval by the Buyer unless otherwise
      noted.
      1. Shop Drawings: Submit shop drawings for fabrication and
         erection of items as follows:
a. Fabrication, bending and placement of concrete reinforcement.

b. Show bar schedules, bar spacing, diagrams of bent bars, arrangements and assemblies as required for fabrication and placement of concrete reinforcement.

c. Include special reinforcement required at openings through concrete structures.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

B. Deliver reinforcement to Project site bundled, tagged and marked.

C. Use metal tags indicating bar size, lengths, and other applicable information corresponding to markings shown on placement diagrams.

D. Store concrete reinforcement materials at the site designated by Buyer in a manner to prevent mechanical injury, accumulation of dirt, oil, paint or excessive rust.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. Reinforcing Steel: Shall conform with Standard Specifications for Deformed Billet Steel Concrete Reinforcement, ASTM A 615, including Supplemental Requirements S1.

   1. No. 4 and Larger: Grade 60.

   2. No. 3: Grade 40.

B. Steel Wire: Plain, cold-drawn complying with ASTM A 82.

C. Supports For Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.

   1. Wire Bar Type Supports: Comply with ASTM A 615.
a. Do not use wood, clay, concrete or fired brick or other unacceptable materials.

2. Slabs On Grade: Use supports with sand plates or horizontal runners where wetted base materials will not support chair legs.

D. Tie Wire: ASTM A 853, 0.062 inch minimum, annealed carbon steel.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION

A. General: Shop-fabricate reinforcing bars by bending cold to conform to required shapes and dimensions.

1. Fabrication tolerances shall be in accordance with ACI SP-66.

2. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

B. Tagging: Tag bars with metal tags in accordance with bar list.

C. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work:

1. Bar lengths, depths and bends exceeding specified fabrication tolerances.

2. Bends or kinks not indicated on Drawings or final shop drawings.

3. Bars with reduced cross-section due to excessive rusting or other cause.

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Installation: Comply with ACI 301 and ACI 318 standards, and Concrete Reinforcing Steel Institute MSP-1 recommended
practice for Placing Reinforcing Bars for details and methods of reinforcement placement and supports, and as herein specified.

1. Position, support and secure reinforcement against displacement by formwork, construction or concrete placement operations.

   a. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers.

   b. Place reinforcement to obtain at least the minimum coverages for concrete protection.

      1) Arrange, space and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations.

      2) Set wire ties so that ends are directed away from exposed concrete surfaces.

   c. Provide sufficient numbers of supports and of strength to carry reinforcement.

      1) Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support.

      2) Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

2. Splices: Provide standard reinforcement splices by lapping bar ends, placing bars in contact, and tightly wire tying.

   a. Comply with requirements of ACI 318 for minimum lap and as shown on the Drawings.

   b. Unless noted on the Drawings, all bars shall be lapped a minimum of 43 bar diameters for Grade 60, and 28 bar diameters for Grade 40 to develop the strength of the bars through bond.

      1) Splices shall be staggered in adjacent bars.

      2) Splices at points of maximum tensile stress shall be avoided wherever possible.

3. Welding: Welding of reinforcing will not be permitted.

4. Minimum clear distance between face of concrete and outside of bar shall be in accordance with ACI 318, Paragraph 7.7.
3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING

A. Adjusting: Reinforcing which is placed out of position or is moved out of position in excess of the specified tolerances shall be adjusted to conform with placing tolerance requirements of ACI 318.

B. Cleaning: Remove earth, loose rust and mill scale, ice and other materials deleterious to concrete bonding.

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
# SECTION 03300

CAST-IN-PLACE CONCRETE

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SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION SCOPE
A. This Section establishes the requirements for all concrete to be used for the project.

1.02 RELATED SECTIONS
A. Section 03100 Concrete Formwork
B. Section 03200 Concrete Reinforcement

1.03 REFERENCES
A. American Concrete Institute (ACI)
   1. ACI 301-89, Specifications for Structural Concrete for Buildings.
   2. ACI 304-89, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
   3. ACI 305R-89, Recommended Practice for Hot Weather Concreting.
   4. ACI 306.1-87, Recommended Practice for Cold Weather Concreting.
   5. ACI 318-89, Building Code Requirements for Reinforced Concrete.
B. American Society for Testing and Materials (ASTM)
   1. ASTM C 94-92, Ready-Mixed Concrete.
   2. ASTM C 260-86, Air-Entraining Admixtures for Concrete.
   3. ASTM C 33-90, Concrete Aggregates.
   5. ASTM C 309-91, Liquid Membrane-forming Compounds for Curing Concrete.
   6. ASTM C 494-92, Chemical Admixtures for Concrete.

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7. ASTM C 618-85, Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.


9. ASTM C 1107-91a, Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)

10. ASTM C 109-92, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens)

11. ASTM C 881-90, Epoxy-Resin-Base Bonding Systems for Concrete

12. ASTM C 143-90a, Test Method for Slump of Portland Cement Concrete

13. ASTM C 39-86, Compressive Strength of Cylindrical Concrete Specimens

14. ASTM C 172-90, Sampling Freshly Mixed Concrete

15. ASTM C 231-91b, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

16. ASTM C31-91, Standard Practice for Making and Curing Concrete Test Specimens in the Field

17. ASTM C 827-87, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

C. Note: Wherever the word, should or similar wording is used in the referenced ACI Standards, it shall be understood to read, shall or shall be, unless otherwise stated in the Specifications.

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required.

B. Detailed Design Submittal: Following submittals shall be provided for review and approval by the Buyer unless otherwise noted.
1. Design Mixes: Prepare and submit to the Buyer design mixes and test results for each type of concrete required before commencing with concrete work.

   a. Each Design Mix: Shall be proportioned by weight and include the following data:

      1) Identification of aggregate sources of supply.
      2) Test of aggregates for conformance to Specifications.
      3) Scale weight of each aggregate.
      4) Absorbed water in each aggregate.
      5) Brand, type, composition of cement.
      6) Brand, type, amount of each admixture.
      7) Amounts of water used.
      8) Proportions of each material per cubic yard.
      9) Measured slump.
     10) Measured air content.
     11) Compressive strength developed at 7 and 28 days.
     12) Identification of project, name of Seller and date.

   b. Placement location for each mix design.

   c. Proportioning: Shall conform to ACI 211.1.

2. Certifications: Submit the following for information and record:

   a. Letter of Conformance stating that ready mixed concrete production facilities conform to the requirements of ASTM C94.

   b. One copy of each delivery ticket shall be submitted to the Buyer by the Seller at time of delivery before each placement.

1.06 DELIVERY, STORAGE & HANDLING

A. Unless otherwise specified, concrete delivery, storage, and handling shall comply with the requirements of ASTM C94, Standard Specification for Ready-Mixed Concrete.
1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. Cement: Shall conform to the Standard Specifications for Portland Cement, ASTM C 150 and shall be Type II (low alkali). Cement which has become damp, lumpy, or partially hydrated shall not be used.

1. Type II cement shall contain less than 5 percent of tricalcium aluminate.

2. Use only one brand and color of each type of cement.

B. Aggregates: Shall conform to ASTM C 33.

1. Aggregates shall consist of natural sand and gravel, crushed rock or other chemically inert materials having clean uncoated grains of strong durable materials.


   b. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite or ochre which can cause stains on exposed concrete surfaces.

2. Combined Aggregate: The combined aggregate, coarse and fine, shall be of such composition of sizes that when separated on the No. 4 standard sieve the weight passing the sieve, fine aggregate, shall not be less than 30 percent nor greater than 50 percent of the total.

3. Supply Of Aggregates: Provide aggregates from one source of supply to ensure uniformity in color, size and shape.

4. Substitution: If the specified aggregate is not available, the Seller shall submit a substitution to Buyer for review. Concrete made from such aggregate shall be equal in strength and other characteristics to that specified originally.

C. Water: Shall be potable and clean, fresh, free from injurious amounts of oil, alkali, acid, salts, organic materials or other substances that may be deleterious to concrete or steel.

D. Admixtures: Admixtures to enhance durability and workability shall be as specified or permitted only with approval of Buyer.

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1. Admixtures containing chloride shall not be used.

   a. Use in accordance with manufacturer’s recommendations.
   b. Maintain air content when tested in accordance with ASTM C 231 as follows:

<table>
<thead>
<tr>
<th>Maximum Size Coarse Aggregate, Inches</th>
<th>Air Content, Percent By Volume</th>
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<tr>
<td>1-1/2, 2 or 2-1/2</td>
<td>5 percent plus or minus one percent</td>
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<tr>
<td>3/4 or 1</td>
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<td>3/8 or 1/2</td>
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3. Water Reducing Admixture: Concrete may contain a water reducing admixture conforming to ASTM C 494, Type A, used in the proportions recommended by the manufacturer.
   a. The use of any admixture conforming to ASTM C 494, Type F or G requires the approval of the Buyer.
   b. Water reducing admixture shall be introduced into the concrete in the water at the batch plant in strict accordance with material manufacturer’s instructions.
   c. Material manufacturer shall make available at no cost upon 72 hours notice the services of a qualified full-time field representative to assure proper use of the admixture.

4. Fly ash shall conform to ASTM C 618.

E. Membrane Curing:

1. Membrane forming curing compounds shall be in accordance with ASTM C 309.
   a. Promulsion 50 as manufactured by Protex Industries, Inc. (or approved equal) shall be used for exterior slabs-on-grade and sidewalks.

F. Nonshrink-Nonmetallic Grout: Five Star, premixed, ready to use grout as manufactured by Five Star Products, Inc., Fairfield, Ct. (or approved equal).

1. Grout: Shall be nonshrink in accordance with ASTM C 827 and ASTM C 1090 and shall meet requirements of ASTM C 1107, Grade C.

2. Other Acceptable Products: Subject to compliance with requirements, Crystex by L & M Construction Chemicals, Inc.; Euco-NS by Euclid Chemical Company; Masterflow 928 by Master Builders Company; Proflow 7000 by ProKrete Industries;
Sonogrun by Sonneborn-Contech; and Supreme Grout by Gifford-Hill and Company, Inc. are acceptable.

3. Perform all work in accordance with the instructions of ACI and the grout material manufacturer’s published specifications for mixing and placing.

4. Mixing Proportions: Water-grout ratios shall comply with grout material manufacturer’s recommendations.

5. Compressive Strength: Minimum 5000 psi in 28 days when tested according to ASTM C 109.

6. Refer to Drawings where nonshrink grout is required.

G. Bonding Compound: Polyvinyl acetate or acrylic base, non-rewetable type.

1. Acceptable Products: Subject to compliance with requirements, one of the following products, J-40 Bonding Agent by Dayton Superior Corporation; Weldcrete by Larsen Products; Everbond by L & M Construction Chemicals; EucoWeld by Euclid Chemical Company; Probond Vinyl by Protex Industries Incorporated; Sonocrete by Sonneborn-Contech; and Acrylic Bondcrete by The Burke Company are acceptable.

H. Epoxy Adhesive: Comply with ASTM C 881, two component material suitable for use on dry or damp surfaces.

1. Provide material "Type", "Grade", and "Class" to suit Project requirements.

2. Acceptable Products: Subject to compliance with requirements, one of the following products, Epoxite by A. C. Horn; Edoco 2118 Epoxy Adhesive by Edoco Technical Products; Probond 811 by ProKrete Industries; Sikadur Hi-Mod by Sika Chemical Corporation; Euco Epoxy 463 or 615 by Euclid Chemical Company; Patch and Bond Epoxy by The Burke Company; and Sure-Poxy by Kaufman Products Inc. are acceptable.

I. Concrete Splash Blocks: Size shall be 3 inches by 12 inches by 3 feet with (2) number 3 reinforcing bars full length.

2.03 EQUIPMENT

A. Concrete shall be mixed and transported with equipment conforming to ASTM C 94.

B. Grout and epoxy adhesives shall be mixed, transported, and placed using equipment recommended by the material manufacturer.

2.04 COMPONENTS: NOT USED

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2.05 FABRICATION

A. Class Of Concrete: The minimum strengths which concrete shall develop when tested according to ASTM Test C 39 are as follows:

1. Class C: Minimum strength shall be 3000 psi in 28 days.
   a. Class C concrete shall be used for building foundation walls, piers and footings, slabs-on-grade, and exterior equipment foundations unless specified otherwise.

2. Class D: Minimum strength shall be 2000 psi in 28 days.
   a. Use Class D concrete for electrical duct banks unless shown otherwise.

3. Mix Design: Shall be in accordance with ACI 304 and may be made either by actual test or by certified results of previous use of identical mix and materials.

B. Slump: Vary within specified range to suit specific concrete placement conditions.

1. Slumps for all types of construction except for electrical duct banks when tested in accordance with ASTM C 143 shall be 4 inches maximum and 2 inches minimum. Slump for electrical duct bank concrete shall be 6 inches maximum and 3 inches minimum.

C. Ready-mix concrete will be subject to the following requirements.

1. Plant: Plant shall be acceptable to the Buyer.

2. Water: Shall not be added to the mixer truck after initial introduction of mixing water except to bring concrete to specified slump, and the water-cement ratio established for the concrete is not exceeded.
   a. Turn drum additional 30 revolutions or more after adding water at mixing speed.

3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.
   a. When air temperature is between 85 degrees F. and 90 degrees F., reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F., reduce mixing and delivery time to 60 minutes.
b. When the specified delivery times cannot be achieved, the provisions set fourth in ASTM C 94 paragraph 11.7 shall apply.

D. Regular Grout

1. One part portland cement to three parts fine aggregate with sufficient water to maintain adequate workability.

2. Cure with wet burlap covering for seven days after placement or by other methods approved by Buyer.

3. Minimum Compressive Strength: 3000 psi in 28 days.

2.06 SHOP QUALITY CONTROL: NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Clean transporting equipment, reinforcing and embedded items before placing concrete.

1. Remove water and debris from places to be occupied by concrete.

B. Place no concrete until forms, reinforcing and embedded items, including building foundation anchor bolts, mechanical and electrical items have been observed by Buyer. Place no concrete over water covered, muddy or frozen soil.

C. All concrete, reinforcement, forms, fillers, and ground with which the concrete is to come in contact, shall be free from frost.

D. Obtain approval of required submittals prior to ordering concrete.

E. Obtain approval of formwork and reinforcement placement before batching concrete.

F. Obtain approval of "pour slip" before placing concrete. Pour slip shall include reference to specific portion of structure to be placed, maximum size of coarse aggregate, design compressive strength, admixtures, and slump.

3.02 ERECTION, INSTALLATION & APPLICATION

A. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of cold joints or planes of weakness within the section.
1. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.

2. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.

3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

4. Do not subject concrete to any procedure which will cause segregation.

5. Concrete shall not be allowed to harden between layers.

6. If a section cannot be placed continuously, provide construction joints as herein specified.

B. Prevent segregation during placing. Do not drop concrete more than 5 feet, unless otherwise approved by the Buyer.

C. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

D. Do not use concrete which becomes nonplastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials.

1. Do not use retempered concrete.

2. Remove rejected concrete from the Project site and dispose of in an acceptable location.

E. Concrete Conveying: Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

1. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end.

2. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit.

3. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

F. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
1. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

G. Consolidating Concrete

1. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Consolidate concrete placed against bulkheads of slabs on ground, as specified for formed concrete structures.

3. Consolidate concrete in the remainder of slabs in accordance with ACI 301 or other acceptable methods.

4. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

5. Vibration of forms and reinforcing will not be permitted, unless otherwise accepted by the Buyer.

6. Do not use vibrators to transport concrete inside of forms.

7. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine.

8. Insert vibrator through plastic surface into next lower layer of concrete about 6 inches.

   a. Do not insert vibrators into lower layers of concrete that have begun to set.

9. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

H. Bonding

1. Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent, and clean surfaces of laitance, coatings, loose particles and foreign matter.

   a. Roughen surfaces in a manner to expose bonded aggregate uniformly and to not leave laitance, loose particles of aggregate or damaged concrete at the surface.

   b. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:
1) At joints between footings and walls or columns and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

2. Bonding grout may be a commercial bonding agent.
   a. Apply to cleaned concrete surfaces in accordance with the printed instruction of the bonding material manufacturer.

3. Prepare for bonding of fresh concrete to fully cured hardened concrete or existing concrete by using an epoxy-resin adhesive binder, as follows:
   a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer’s printed instructions, including safety precautions.
   b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.
   c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16 inch thick.
   d. Place fresh concrete without removing the in-place grout coat when the epoxy-resin has cured as directed by the epoxy-resin manufacturer.

I. Cold Weather Concreting

1. During periods of cold weather, all concreting activities shall follow the recommended practices of ACI 306.1 and conform as herein specified.

2. Cold weather is defined as any period when for more than three successive days, the mean daily temperature is, or is forecast to be, below 40 degrees F. or when any unformed concrete surface less than 48 hours in age is, or is forecast to be, exposed to temperatures less than 32 degrees F.
a. Concrete Temperatures As Placed and Maintained For Curing Period:

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<thead>
<tr>
<th>Minimum Placement Dimension</th>
<th>Minimum Concrete Temperature As Mixed</th>
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<tr>
<td>12&quot; or Less</td>
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<tr>
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3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in writing by the Buyer.

4. Temperatures of forms, reinforcing, embedments or earth to be in contact with fresh concrete shall be at least 35 degrees F. but shall not exceed 60 degrees F.
   a. Heaters shall not be placed on uncured concrete.

5. Records of outside temperatures, weather conditions and concrete or form temperatures shall be maintained for the placements.

J. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete following the recommended practices of ACI 305R and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F.
   a. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cool reinforcing steel so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

4. Do not use retarding admixtures without the written acceptance of the Buyer.
5. Provide windbreaks and shading to prevent rapid setting and surface moisture evaporation.

K. Embedded Items

1. Secure embedded items in proper position before placing concrete.

L. Finishing

1. Flatwork: No coarse aggregate shall be at the surface. Surface depth of 1/8 inch to 1/4 inch shall consist of sand, cement and small aggregate.

   a. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drain.

   b. Sprinkling with water or dusting of surface with dry cement or sand during finishing processes is not permitted.

   c. Trowel Finish: Float surface to true, even plane.

      1) Steel trowel to smooth, uniform finish, free of defects; steel trowel second time to final burnish finish; use edger on exposed edges.

      2) Use on all slabs except on those areas specifically requiring a finish as listed below.

      3) Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straightedge.

   d. Broomed Or Belted Finish: Float surface to true, even plane.

      1) Steel trowel to smooth, uniform surface.

      2) Broom with fiber brush or drag burlap belt across surface in direction transverse to traffic flow.

      3) Use on exterior slabs and walkways.

   e. Float Finish: Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as herein specified and as shown on the Drawings or in schedules.

      1) After placing concrete slabs, do not work the surface further until ready for floating.
2) Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both.

3) Consolidate the surface with power-driven floats, or by hand floating if area is small or inaccessible to power units.

4) Check and level the surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straightedge placed on the surface at not less than two different angles.

5) Cut down high spots and fill all low spots.

6) Immediately after leveling, refloat the surface to a uniform smooth, granular texture.

2. Formed Surfaces: Remove fins, projections and loose material.

   a. Patch Honeycomb, Aggregate Pockets, Voids and Holes.

3. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces.

   a. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

4. Slab Surface Drainage Performance Test: In the presence of the Buyer, prior to requesting acceptance of the Work, the Seller shall water test concrete slabs for proper drainage.

   a. If there are areas that do not properly drain, and/or if there are areas which are depressed where water accumulates and puddles, the Seller shall properly correct such areas to the satisfaction of the Buyer, at no additional cost to the Buyer.

M. Concrete Curing

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

2. Curing shall be started as soon after placing and finishing as conditions permit and continued to the end of the curing period.

3. Curing of surfaces shall be accomplished by moist curing with forms in place or, if forms are removed prior to end of the curing period and for unformed surfaces, by the following, or combination, of methods.
a. Apply curing compound in accordance with manufacturer’s instructions and ensure the formation of a continuous, unbroken film.

   1) Curing compound shall not be used on surfaces where bonding preparation materials, concrete hardener, surface coating or painting is to be applied.

   2) Protect the final application of curing compound from traffic and other damage to the membrane for the curing period.

b. Moist curing with sheet materials shall be accomplished by completely covering the surfaces with sheet material using laps of at least 4 inches along edges and ends.

   1) Laps, edges and ends shall be sealed with pressure sensitive tape not less than 1 1/2 inches in width.

   2) Sheet materials shall be weighted to prevent displacement.

   3) Damage to the sheet materials such as tears or holes occurring during the curing period shall be immediately repaired.

c. Moist curing method using mats or burlap shall consist of covering formed or unformed surfaces with water saturated mats or two layers of burlap.

   1) Mats or burlap shall be kept continuously wet during the curing period.

   2) Unformed surfaces shall be kept moist or wet with fog spray between completion of finishing and start of moist curing.

4. The minimum curing period for concrete shall be as follows, except as modified under Article titled, Cold Weather Concreting.

   a. Concrete Temperature of 50 To 70 Degrees F: Minimum curing period shall be seven days.

   b. Concrete Temperature of 70 Degrees F Or Above: Minimum curing period shall be five days.

N. Concrete Surface Repairs

1. Condition Of Concrete At Time Of Repairs: The specified repair methods contemplate that the in-place concrete has attained a stabilized condition.
2. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms in accordance with ACI 301 Sections 9.1, 9.2 and 9.3.

a. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than one inch.

1) Make edges of cuts perpendicular to the concrete surface.

2) Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with approved bonding agent.

b. Exposed-To-View Surfaces: Blend white portland cement and standard portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete.

1) Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching.

2) Compact mortar in place and strike off slightly higher than the surrounding surface.

c. Fill holes extending through concrete.

3. Repair of Formed Surfaces:

a. Repair exposed to view formed concrete surfaces that contain defects which adversely affect the appearance of the finish.

1) Remove and replace concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the Buyer.

2) Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets and holes left by rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

b. Repair concealed formed concrete surfaces that contain defects that affect the durability of the concrete.

1) If defects cannot be repaired, remove and replace the concrete.
4. Repair Of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to the tolerances specified for each surface and finish.

   a. Repair finished unformed surfaces that contain defects which affect the durability of the concrete.

      1) Surface defects include crazing, cracks in excess of 0.01 inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycombs, rock pockets and other objectionable conditions.

   b. Correct high areas in unformed surfaces by grinding, after the concrete has cured at least 14 days.

   c. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete.

      1) Finish repaired areas to blend into adjacent concrete.

      2) Proprietary patching compounds may be used as approved by the Buyer.

5. Repair defective areas, except random cracks and single holes not exceeding one inch diameter, by cutting out and replacing with fresh concrete.

   a. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4 inch clearance all around.

   b. Dampen concrete surfaces in contact with patching concrete and apply bonding compound.

   c. Mix patching concrete of the same materials to provide concrete of the same type or class as the original adjacent concrete.

   d. Place, compact and finish as required to blend with adjacent finished concrete.

   e. Cure in the same manner as adjacent concrete.

6. Repair isolated random cracks and single holes not over one inch in diameter by the dry-pack method.

   a. Groove the top of cracks and cut out holes to sound concrete and clean of dust, dirt and loose particles.
b. Dampen cleaned concrete surfaces and apply bonding compound.

c. Mix dry-pack, consisting of one part portland cement and 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

d. Compact dry-pack mixture in place and finish to match adjacent concrete.

e. Keep patched areas continuously moist for not less than 72 hours.

f. Use epoxy based mortar for structural repairs, where directed by Buyer.

7. Repair methods not specified above may be used, subject to the approval of the Buyer.

P. Construction Joints: Provide as shown on the drawings and in accordance with ACI 301 Section 6.1. For construction joints not shown on the drawings, obtain written approval from the Buyer.

3.03 FIELD QUALITY CONTROL

A. Sampling of fresh concrete will be performed in accordance with ASTM C172.

B. Concrete will be tested in accordance with ACI 301, Sections 16.3.4, 16.3.5, 16.3.6 and 16.3.8.

C. Concrete testing will be performed by the Buyer.

D. Concrete testing performed by the Buyer will be done in accordance with the following:

1. Making and Curing Concrete Test Specimens: ASTM C31

2. Compressive Strength: ASTM C39

3. Slump: ASTM C143

4. Sampling Fresh Concrete: ASTM C172

5. Air Content: ASTM C231

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED
3.06 PROTECTION

A. Protection Of Installed Finish Materials: Prior to installing and placing concrete that will be adjacent to installed finish materials, thoroughly and adequately cover all surfaces with a waterproof type membrane material that will not allow the concrete to come in contact with the installed finish materials.

   1. Membrane shall be securely held in place by means that will not damage the finish and appearance of installed finished work and finish materials.

   2. Remove protective membrane as soon as possible without damage to concrete and finish materials.

END OF SECTION
# SECTION 05100

## STRUCTURAL STEEL AND MISCCELLENOUS METALS

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SECTION 05100

STRUCTURAL STEEL AND MISCELLANEOUS METALS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Section establishes the minimum requirements for structural steel and miscellaneous metals for miscellaneous support framing.

1.02 RELATED SECTIONS

A. Section 03300 Cast-In-Place Concrete

1.03 REFERENCES

A. American Institute of Steel Construction (AISC).
   1. AISC, Code of Standard Practice for Steel Buildings and Bridges (September 1, 1986).
   2. AISC, Specification for Structural Steel Buildings, including the Commentary of the AISC Specification. (June 1, 1989)
   3. AISC, Specification for Structural Joints using ASTM A325 or A490 Bolts, and approved by the Research Council on Structural Connections of the Engineering Foundation. (November 13, 1985)

B. American Welding Society (AWS)
   2. AWS A5.1-91, Mild Steel Covered Arc-Welding Electrodes.
   3. AWS A5.5-81, Low-Alloy Steel Covered Arc-Welding Electrodes.

C. American Society for Testing and Materials (ASTM)
   ASTM A 36-91 Structural Steel
   ASTM A 325-90 High-Strength Bolts for Structural Steel Joints
   ASTM A 563-90 Carbon and Alloy Steel Nuts
   ASTM A 123-89a Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A 307-91  Carbon Steel Bolts and Studs Fasteners
ASTM A 53-90b  Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 500-90a  Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM F 436-90  Hardened steel washers
ASTM B695-91  Coatings of Zinc Mechanically Deposited on Iron and Steel

D. American National Standards Institute (ANSI)
ANSI B 18.22.1  1965 (R81) Plain Washers

E. Federal Specifications (FS)
FS FF-S-325-65  Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS-RR-G-661E-87  Grating, Metal, Bar Type

F. American Society for Non-destructive Testing (ASNT)
ASNT SNT-TC-1A  Personnel Qualifications and Certification in Non-destructive Testing

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Refer to Division 1 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required.

B. Detailed Design Submittal: Following submittals shall be provided for review and approval by the Buyer unless otherwise noted.

1. Shop Drawings: Submit shop drawings indicating erection details, including cuts, copes, connections, holes, threaded fasteners and welds.
   a. Indicate all welds, both shop and field, by AWS Welding Symbols.
   b. Identify each item with appropriate piece mark.

3. Expansion Bolts: Vendors catalog data.
4. Metal Grating: Vendors catalog data.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. Steel Shapes and Plates: ASTM A 36.

B. Square, Rectangular and Special Shapes: ASTM A 500, Grade B, cold formed structural quality carbon steel, welded or seamless.

C. Structural Steel Pipe: ASTM A 53, Type E or S, Grade B, hot formed structural quality carbon steel, welded or seamless.

D. High Strength Bolts, Nuts and Washers: ASTM A 325, Type 1 heavy, hexagonal heads (galvanized).
   2. Nuts: ASTM A 563, Grade DH (galvanized) for ASTM A 325 galvanized bolts.

   1. Plain Washers: ANSI B18.22.1, Type B (galvanized).
   2. Nuts: ASTM A 563, Grade DH heavy hex style (galvanized).

F. Expansion Bolts: FS FF-S-325, group II, type 4, class 1.
   1. Hilti Kwik-bolt II anchors by Hilti Inc. (or approved equal).
   2. Size and locations as indicated on Drawings.

G. All structural steel and miscellaneous metals shall be galvanized in accordance with ASTM A123 after fabrication.
H. All nuts, bolts and washers shall be zinc coated in accordance with ASTM B695, Type I.

I. Welding Electrodes: AWS A5.1 or A5.5 E70XX.

J. Metal Grating: Meeting the requirements of FS RR-G-661E, Type I, Class 1, Material S, hot-dip galvanized. Grating shall be plain surface type with end banding bars, size shown on the Drawings. Provide manufacturer’s standard clips for attachment to framing.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION

A. General: Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the final shop drawings.

   1. If structural steel details shown on design Drawings are not compatible with Seller’s erection procedures, submit proposed detail modifications for Buyer’s review.

B. Properly mark and match-mark materials for field assembly.

C. Where finishing is required, complete the assembly, including bolting and welding of units prior to commencing with finishing operations.

D. Shop Connections: Shall be welded to the greatest extent practicable and in accordance with AWS D1.1 and D1.4.

E. Shop Welding: Shall be performed only by welding operators who are certified by the American Welding Society to perform the type of work for this project.

   1. Welding procedure qualifications and welder qualifications shall be available for review by the buyer.

F. For field connections on main structural members use bearing type bolts with threads in shear planes, or slip-critical type. High strength bolting shall conform to ASTM A 325 and ASTM B 695.

   1. High strength bolts used in bearing connections may be tightened by the turn of the nut method.
2. Drift pins may be used to bring parts into alignment, but do not use in a manner which will distort or damage the structural steel.
   a. Do not use gas cutting to enlarge holes.
   b. Use electrical or pneumatic reamers which produce smooth round finished holes if enlargement of holes is necessary.

G. Field connections for secondary members, such as stairs and handrails, may be bearing-type connections made with common or regular bolts conforming to ASTM A 307.
   1. Tighten common or regular bolts to a snug-tight condition.
   2. Snug-tight shall be defined as the full effort of a man using an ordinary spud wrench.

H. Column Bases: Press flat and weld to columns.

I. All structural steel and miscellaneous metal fabrications shall be galvanized in accordance with ASTM A123 after fabrication.

J. Metal Grating: Floor grating shall be welded, open steel bar type with 1 1/4" x 3/16" bearing bars at 1 3/16" centers. Metal grating stair treads shall be the same as platform grating with checkered plate nosing. Grating shall be galvanized after fabrication.

K. Steel Diamond Tread Floor Plate: Galvanize after fabrication.
3.02 ERECTION, INSTALLATION & APPLICATION

A. Erect plumb and level; and maintain the structural steel in its proper position until permanently secured.

B. Use light drifting necessary to draw holes together.
   1. Drifting to match unfair holes is not allowed.

   2. Use twist drills or electrical or pneumatic reamers which produce smooth, round holes to enlarge holes to make connections.

C. Field Welding: Field welding shall be in accordance with AWS D1.1 and D1.4 as applicable and shall be performed only by welding operators who are certified by the American Welding Society to perform the type of work for this Project.

   1. Welding procedure qualifications and welder qualifications shall be available for review by the Buyer.

D. Grout bearing surfaces to provide full bearing area.

   1. For grout specification refer to Paragraph titled, Nonshrink - Nonmetallic Grout in Section 03300.

E. Column Bases and Bearing Plates: Align attached column bases and similar structural members with wedges or shims.


      a. Clean the bottom surface of base plates.

      b. Set base plates for structural members on wedges, or other adjustable devices.

      c. Tighten anchor bolts after supported members have been positioned and plumbed.

         1) Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.

      d. Pack grout solidly between bearing surfaces and base plates to ensure that no voids remain.

F. Anchor Bolts: Anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

G. Erection Tolerances: Erect individual pieces so that the deviation from plumb, level and alignment shall not exceed the requirements of the AISC code of standard practice for steel buildings and bridges.

H. Field Assembly: Accurately assemble structural steel frames to the lines and elevations indicated, within the specified erection tolerances.

1. Splice only where indicated and accepted on shop drawings.

2. Field Connections: High strength bolted construction shall be as specified under Article 2.05 title, Fabrication.

3. Tighten erection bolts used in welded construction and leave them in place.

4. Introduce temporary bracing wherever necessary to withstand loads to which the structure may be subjected, including wind, seismic, equipment and its operation.

I. Adequacy of Temporary Connections: As erection progresses, securely bolt or weld the Work to withstand all dead load, wind load and erection load stresses.

J. Comply with AISC Specifications for bearing, adequacy of temporary connections and alignment.

K. Do not enlarge holes which are too small in members by burning or by use of drift pins.

1. Ream holes that must be enlarged to admit bolts.

L. Securing to Other Work: Drill holes for expansion bolts and similar anchorages to the diameter and depth as recommended by the anchor manufacturer.

1. Deviations from approved shop or installation drawings shall be approved by the Buyer prior to their installation.

M. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in structural framing.

1. Cutting will be permitted only on secondary members which are not under stress, as approved by the Buyer.

2. Finish gas-cut section when permitted equal to sheared appearance.

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N. Field Touch-Up Painting: After erection of structural steel, touch-up damaged areas of galvanizing including bolt heads, nuts, field welds and abrasions with a zinc rich galvanizing repair paint.

3.03 FIELD QUALITY CONTROL

A. The Seller shall inspect high-strength bolted connections and welded connections.
   1. The Buyer may witness inspections.

B. Correct deficiencies in structural steel work which inspections have indicated.
   1. Additional inspection shall be conducted at Seller’s expense as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

C. Welding acceptance criteria shall be in accordance with AWS D1.1, paragraph 8.15.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

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| PART 3 EXECUTION: NOT USED                          |      |

Appendix

APPENDIX A - DATA SHEET
SECTION 14450
TRUCK MOUNTED VACUUM LOADER

PART 1  GENERAL

1.01  SECTION SCOPE

This procurement specification establishes the minimum requirements for the design, manufacture, testing, delivery and performance of one mobile, self propelled, vacuum soil removal system for use at the DOE's Hanford site on the Solid Waste Operations Complex (SWOC) W113 project.

1.02  RELATED SECTIONS

13121  Trench Enclosure Building
16152  Electrical Specification for Packaged Mechanical Equipment

1.03  REFERENCES


   1. Title 29 CFR  Occupational Safety and Health Administration (OSHA)
      Part 1910

C. American Nuclear Standards Institute
   2. ANSI N42.17B, 1989  Performance Specifications for Health Physics Instrumentation - Occupational Airborne Radioactivity Monitor Instrumentation

1.04  SYSTEM DESCRIPTION

A. The equipment supplied under this specification shall be capable of removing dry soil (predominantly sand and gravel) from above and around buried waste drums inside the W113 trench enclosure as shown on the contract drawings. The main items of equipment will be situated outside the enclosure on an unpaved access road running parallel to and adjacent to the north and south enclosure walls.

B. Flexible hoses shall be used to connect the extraction equipment to the trench, via a series of penetrations in the enclosure wall. The hose length should be kept to a minimum by re-positioning the vacuum equipment and re-routing the hose as convenient.

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C. The vacuum equipment shall be capable of removing 16 cubic yards of light, dry soil per hour, on a daily basis. The soil is to be loaded into a collection tank, integral with the vacuum equipment for temporary storage prior to disposal.

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure, including details of the standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals to those listed herein.

B. Detailed Design Submittals:

1. Descriptive Literature: The Seller shall supply general product information relevant to the equipment being supplied including descriptive literature and catalog cut sheets. This submittal shall be supplied for information and record and shall provide generic information regarding the Seller’s standard products which may differ in detail from, the items furnished under this specification.

2. Data Sheets: The Seller shall produce a sheet comparing the requirements of the Equipment Data Sheets located in Appendix A of this specification with relevant data applicable to the particular products being furnished by the Seller. This information shall be submitted to the Buyer for review and approval.

3. Drawings: Accurate drawings shall be provided for all items supplied under this specification, which show the following as appropriate:

   a. Equipment general arrangements.
   b. Equipment outline, overall dimensions and weight.
   c. Hose connections.
   d. Turning circles.
   e. Cab door openings and maintenance access panels.
   f. Electrical wiring diagrams
   g. Record sampler for air exhaust monitoring
   h. Detailed equipment drawings

This information shall be submitted to the Buyer for review and approval.

4. Test Reports: The Seller shall provide a list of all tests carried out on equipment components and assemblies supplied under this specification. In addition the Seller will supply certified documentation to verify the acceptability of the results of these tests and inspections. This information shall be submitted for review and approval.

5. Miscellaneous Submittals: The Seller shall provide complete information regarding the following, (these shall be submitted for information and record):
a. List of spare parts recommended to be held at the Buyers site, with unit pricing.

b. Operating Instructions: The Seller shall provide comprehensive operating instructions, specific to each major component supplied in compliance with this specification.

c. Maintenance Data: The Seller shall supply two complete sets of maintenance manuals for the vacuum and discharge equipment, and for the truck and chassis. These shall include a maintenance plan detailing cleaning lubrication and inspection requirements. Full instructions shall also be supplied, on equipment disassembly, replacement and repair. A complete list of parts shall be provided with the manufacturers part number.

d. Availability of Parts: The Seller shall provide a list of dealerships and suppliers of parts and service throughout the country, and the address of the nearest supplier to the project site.

e. Warranties: The Seller shall submit warranties and guarantees describing in detail which components and systems are covered by the guarantees, and the circumstances and extent of that coverage.

f. Safety: A description of the safety measures incorporated into the design to protect personnel during operation. Requirements for personal protective equipment will also be listed.

g. Supplies: Manufacturer’s data sheets and Material Safety Data Sheets (MSDS’s) in compliance with 29 CFR 1910.1200 (Hazard Communications), providing adequate information for the safe use, handling and storage of maintenance and operational supplies such as hydraulic fluids, fuels and lubricants.

h. Electrical and hydraulic system schematics.

6. Calculations

a. Reliability, Availability and Maintainability (RAM): A calculation of the predicted availability shall be included. Failure rate data shall be provided. Methods for improving the reliability and availability predictions (e.g. maintenance intervals, self checking, redundancy) shall be provided. This shall be submitted for Review and Approval.
1.06 DELIVERY STORAGE AND HANDLING

A. The Seller shall be responsible for ensuring delivery of all items covered in this specification to the Hanford site Richland, WA. The method of transportation may be truck, train or the Seller may drive or haul the equipment to site. Refer to Division 1 for standard conditions pertaining to delivery storage and handling.

B. The Seller shall notify the Buyer of shipment prior to dispatch from the Seller's works/dealership, and in any case not less than two days prior to the expected arrival of the shipment at the Buyer's site. The Seller shall be responsible for packing, labeling and loading the equipment to ensure that no damage or loss occurs in transit. Any such loss or damage shall be repaired or replaced at the Seller's expense.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable Site Conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

To provide references under the specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Vacuum Soil Removal Systems
   a. Federal Signal
   b. Vac Master
   c. Keith Huber

2. Record Sampler
   a. Graseby Anderson Division

2.02 MATERIALS

A. All materials and components furnished under this specification shall be new and of the manufacturer's standard quality. Equipment and components shall comply with 29 CFR Part 1910 as applicable.

B. All items liable to corrosion, and exposed surfaces shall have protective coatings applied. The outside of the equipment shall be painted with the manufacturer's standard paint.

C. The Seller is to avoid the use and installation of hazardous materials during construction. Any hazardous materials contained in the final products shall be notified to the Buyer prior to delivery at the site.
2.03 EQUIPMENT

A. General:

1. The equipment covered by this specification comprises one, truck mounted, vacuum soil removal system. The system shall discharge directly into a temporary storage tank of 16 cubic yards minimum working capacity. The excavation shall be performed inside a weather protected enclosure although the vacuum unit shall remain outside.

2. The existing soils within the project site consist of silty sand with gravel and cobbles with approximately 30 to 40 percent of the total soil volume being gravel and cobbles. The geotechnical report entitled "Geotechnical Engineering Services Trans-Uranic Waste Burial Trench 4C-4 200 West Area, Hanford Site" dated July 1994 Prepared by Shannon & Wilson, Inc. for Kaiser Engineers Hanford Company, Richland, Washington is available in the Buyer’s offices for review by the Seller.

3. The system shall be capable of removing soil, rocks and debris up to 3" maximum dimension at a rate of 16 cubic yards per hour via a 125 foot long hose, with a lift from the trench base at elevation 675' to the vacuum inlet of the trunk standing outside the trench enclosure at elevation 691 feet.

4. Equipment shall be sealed during operation to prevent dust leakage. A HEPA filter system and air sampler is to be installed in the air discharge line. A filter located on the truck is preferred, but if there is insufficient space, this may be supplied fitted to a trailer, provided the truck is capable of towing the trailer on public roads.

5. The equipment noise during operation shall not exceed 95 dBA at the control panel on the truck.

6. The debris tank shall conform with ASME Boiler and Pressure Vessel Code (Section VIII, Division I).

7. The equipment shall be designed to simplify the transportation and unloading of excavated soil.

8. The design shall include appropriate safety items (e.g., railings, platforms and locks) to ensure safe operation and maintenance of the vehicle and equipment.

B. Trucks:

1. The truck shall be a diesel powered, manual transmission type and shall be supplied with a cold-start package to ensure adequate overnight protection during periods of below zero temperatures. For site conditions see Division I.
2. The truck shall be supplied with all the manufacturers standard equipment and facilities including lights, seating and instrumentation normally supplied for road going vehicles. An audible warning shall be installed which sounds while the truck is reversing.

3. The truck shall be equipped with an alarm system similar to a standard automobile burglar alarm. On activation the alarm shall sound an audible alarm and isolate the vacuum system from the hose. The alarm shall operate a flashing warning light (this may be the truck headlights and turn signals). The alarm shall be activated by a "low-flow" signal from the exhaust record sampler.

4. The truck shall be supplied with at least one spare tire and wheel and with the necessary equipment to remove and replace a wheel in the event of a puncture. The tires shall be suitable for operation on unfinished, flat dirt roads.

5. The cab shall be equipped with a heater and air conditioning.

6. The fuel tank capacity shall be sufficient to permit continuous operation of the vacuum equipment for at least 8 hours.

7. The trucks electrical system shall be equipped with a 120 VAC 60 Hz inverter capable of supplying power to the record sampler (see section 2.04.D). The truck shall be equipped with a facility to permit grounding of the vehicle chassis and vacuum equipment during operation in order to prevent static build-up.

C. Sampler:

1. The system shall include a permanently installed record sampler consisting of an isokinetic sampling system which continuously samples the final extract to the environment (downstream of the HEPA filters). The system shall comprise a single shrouded probe, sample transport tubing, sample head suitable for holding a 47 mm diameter filter, air flow indicator with a low flow alarm, a constant positive displacement vacuum pump as specified in Section 2.04 (Components), paragraph D.

D. Hoses:

1. The Seller shall supply at least 200' of 6" diameter flexible hose with the vacuum truck. This hose shall be supplied in sections of not greater than 35' in length.
2. The individual hose sections supplied shall be robust enough to resist kinking and to prevent collapse under the full vacuum produced by the truck, but shall be light enough and flexible enough to be moved and connected up by a single operator.

3. The end connections of the hose sections shall be sealed to prevent leakage of air or soil. The interlocking hose sections shall be designed to permit quick disconnection and reconnection.

4. The hose sections supplied shall be robust enough for the duty outlined in Section 2.03A, paragraphs 1, 2 and 3 of this specification.

5. The operating or suction end of the hose shall be a short length of rigid steel pipe to prevent damage to the hose during soil removal. It shall be equipped with a metal grid or mesh covering to prevent the ingress of debris larger than 3 inches.

6. The suction end of the hose shall be equipped with steel handling attachments to permit both manhandling of the hose end during operation, or the attachment of slings suitable for connection to a crane hook.

7. The vacuum truck and hose system shall be provided with an emergency switch that can be triggered by either the operator at the remote end of the hose, or the crane operator if the crane is being used to manipulate the hose end. This emergency system shall remove the vacuum from the hose end without necessarily shutting down the vacuum truck.

8. The Seller shall supply a simple support if necessary to prevent undue bending of the hose or undue stress on the trench enclosure wall at the point where the hose penetrates the wall. Refer to contract drawings H-2-823258 and H-2-823262.

E. RAM Requirements:

1. The Lift Truck (including all associated equipment) shall have an operational availability of 99.7% or greater. The 99.7% minimum operational availability requirement includes all unplanned periods of downtime when the unit is not operational. Scheduled maintenance and diagnostic checks are excluded from the downtime figure. Operational availability is defined as:

\[
Ao = \frac{MTBM}{MTBM + MTTM}
\]

Where:

\(Ao = \text{Operational availability}\)

\(MTBM = \text{Mean-time-between-maintenance (unplanned)}\)
MTTM = Mean-time-to-maintain clock hours to restore to full operations (assuming no administrative delays)

The Seller shall provide an estimate of MTBM and MTTM and provide the basis to substantiate the estimate (including actual data from testing and maintenance records).

2. Target values for MTBM and MTTM should be:
   a. MTBM: Not less than 2000 hours.
   b. MTTM: Not more than 3.0 hours.

2.04 COMPONENTS

A. Controls and Instrumentation: The vacuum loader shall have its controls conveniently located for operational access. Instrumentation shall include indication of the vacuum created and remaining capacity of the soil collection tank. All controls and instrumentation shall be reachable and accessible to operators wearing cold weather clothing, hearing and respiratory protection.

B. Collection Tank: Emptying of the soil collection tank should not exceed 10 minutes following arrival at the disposal site. The tank shall be provided with a sealable closure that may be opened for access/dumping.

C. Filters: The vacuum system shall include adequate filtering to ensure dust free operation and include the following features:
   1. The filter system shall be designed to permit rapid cleanout/changing of filter elements.
   2. The Seller shall include a HEPA filtration capability connected to the air discharge line from the vacuum equipment. This HEPA filter shall be sized to handle the maximum air discharge volume from the truck.
   3. The outlet from the HEPA filter unit shall be a straight duct one foot diameter by seven feet long. Provision shall be made for the placement of the sample probe into the duct, two feet downstream of the start of the straight section.

D. Record Sampler: One truck mounted isokinetic sampling system comprising the following items and meeting the following requirements:
   1. One single shrouded sample probe meeting ANSI 13.1.
   2. One sample head suitable, tag reference RE-11-105, for holding a 47 mm diameter filter (without cartridge) e.g. SAIC Model LB-5211 or equivalent.
   3. One pump consisting of a constant positive displacement vacuum pump and operating on 120 VAC power.
4. The pump shall consist of the Eberline model RAP-1/5 or similar.

5. The pump shall incorporate an airflow regulator to maintain a constant pressure drop and be locally adjustable.

6. One direct indicating sample flow meter, tag reference FISL-11-105, complete with low flow switch e.g. Brooks models 1350 & 7949 or equivalent. On zero or low-flow, the flow meter shall send an appropriate signal to set-off the truck alarm system (Section 2.03.B.3).

7. Recommendations from ANSI N13.1 shall be used for installation of the probe, interconnecting pipework and the sample head.

8. The duct must be characterized using a velocity traverse (EPA Method 2 or equivalent) and the probe shall be permanently located in the flow stream where representative particle concentrations are expected.

9. The sample head shall be positioned as close as reasonably practical to the sample probe such that it samples a representative sample without undue deposition.

10. Power will be supplied to the sample pump by an inverter connected into the truck’s electrical system (see Section 2.03.A.7). The inverter shall be equipped with a receptacle as required by the sample pump.

2.05 FABRICATION

A. Assembly: With the exception of the equipment hoses, the vacuum loader shall be delivered to the Buyer's site fully assembled and operable.

B. Identification: Clearly marked nameplates of corrosion resistant metal shall be permanently attached to a prominent position on major items of equipment such as the vehicle chassis, collection tank, dust separator, blower, filters, etc. Name plates shall include the following information as appropriate:

   1. Manufacturers name
   2. Model number
   3. Serial number
   4. Contract number and date (month and year)
   5. Date of manufacture (month and year)
   6. ASME code stamps, as applicable

C. Identification - Instrumentation: The record sampler components shall also have nameplates fixed to the same requirements as above. Additionally they shall bear the instrument tag number set out in Section 2.04.D.
2.06 SHOP QUALITY CONTROL

A. General Conditions: Refer to Division 1.0 for standard shop quality requirements.

B. Shop Functional Tests: In addition to the standard quality control inspections, the Seller shall perform a complete functional test on the equipment. The test shall demonstrate that the vacuum removal system operates satisfactorily at the capacity and duty set out in this specification, and that all systems and indicators function properly. As a minimum the tests shall include:

1. Two complete fill ups with dry sand and 3" rocks to demonstrate the equipment meets the requirements of Section 2.03A.

2. Two complete dumps of the waste collection tank.

3. Vacuum test of all hoses to demonstrate they do not collapse under full vacuum.

4. Demonstration of noise levels during vacuuming.

5. Filter test.

C. Notification: The Seller shall notify the Buyer 2 weeks prior to the scheduled test and allow the Buyer's representative to witness the functional tests described above.

PART 3 EXECUTION: NOT USED

END OF SECTION
APPENDIX A

EQUIPMENT DATA SHEETS

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| DESIGN BASIS MANUFACTURER: | FEDERAL SIGNAL (GUZZLER)/KEITH HUBER |

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## APPENDICES

APPENDIX A DATA SHEETS
SECTION 14452

LIFT TRUCK (ELECTRIC)

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification establishes the minimum requirements for the manufacture, supply and delivery of one electrically powered lift truck, equipped with a drum handling adapter, battery charger and its support equipment, for use at the DOE’s Hanford site on the Solid Waste Operations Complex (SWOC) W113 project.

1.02 RELATED SECTIONS

16152 Electrical Specification for Packaged Mechanical Equipment.

1.03 REFERENCES

A. Applicable Codes and Standards: Codes, specifications and standards referred to by number or title, shall form a part of this specification to the extent required by the references hereto.

B. American National Standard Institute (ANSI):

1. ANSI-B56.1-93 Low Lift and High Lift Trucks
2. ANSI/UL-583-91 Safety Standard for Electric-Battery Powered Industrial Trucks

C. National Fire Protection Association (NFPA):

1. NFPA-79-94 Electrical Standard for Industrial Machinery
2. NFPA-505-92 Fire Safety Standard for Powered Industrial Trucks


1. Title 29 CFR Part 1910.178 Occupational Safety and Health Administration (OSHA) (Powered Industrial Trucks)
2. Part 1910.1200 Hazard Communications
3. Title 49 CFR Part 178 DOT 17 H Galvanized Steel Drums
1.04 SYSTEM DESCRIPTION

A. The lift truck described in this specification shall be capable of operation inside the trench enclosure of the SWOC, W113 project as shown on the contract drawings. The truck shall be 12,000 lbs. rated and will be primarily used for moving 1,000 lb., 85 gallon overpack drums containing 55 gallon waste drums. The truck and drum grab is also required to be capable of handling the following:

1. Individual 55 gallon drums (not overpacked)
2. Individual L-10 drums (two 55 gallon drums welded end-to-end)
3. Individual Waste boxes weighing up to 8,000 lbs. on a 36" load center.

Note: For container dimensions, see Appendix A. 55 and 85 gallon drums to be handled will conform to DOT 17 H, as published in 49 CFR Part 178.

B. The truck will be supplied equipped with a drum grab capable of handling the individual drums and overpacks described above without causing damage or permanent distortion. This shall be fully connected up and ready for operation. A single drum grab which can be easily adjusted to accommodate both 55 and 85 gallon containers is preferred, but two individual grabs are acceptable. If two grabs are supplied, the one for handling 85 gallon overpacks shall be fitted prior to delivery. The truck shall also be supplied with a separate set of standard 6' forks for box handling.

C. The truck will normally operate inside the trench enclosure on a smooth asphalt surface but should be capable of negotiating isolated steps or obstacles in the surface of up to ¼" in height across the full width of the roadway. These steps could occur on a 13% incline, along which the truck is required to transport containers. The truck is only required to transport the containers up and down the incline, not across it. The environment outside the enclosure is normally similar to desert conditions. The truck should be capable of
operating outside for periods of up to 1 hour per week and, operating safely in moderate rainfall.

D. The trench enclosure will be an unheated structure and the lift truck shall be capable of operating in an extreme temperature range. For site conditions see Division 1.0.

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details of the standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals to those listed herein.

B. Detailed Design Submittals for Approval:

1. Data Sheets: The Seller shall complete an information sheet covering all the areas noted in the equipment data sheets located in Appendix A of this specification. This information shall be specific to the particular products being furnished and shall be submitted to the Buyer for review and approval.

2. Drawings: Accurate drawings shall be submitted to the Buyer for approval. These shall cover all items supplied under this specification, which show the following as a minimum.
   a. Equipment general arrangements.
   b. Equipment outline, overall dimensions and weight.
   c. Limits of travel for drum grab(s).
   d. Turning circles.
   e. Cab door openings and maintenance access panels.
   f. Electrical and hydraulic wiring schematics and interface drawings.

3. Test Procedures: The Seller shall submit, for approval the functional test procedure outlining the activities necessary to demonstrate the requirements in Section 2.06.B.

4. Test Reports: The Seller shall provide a list of all tests carried out on equipment components and assemblies supplied under this specification. In addition the Seller will supply certified documentation to verify the acceptability of the results of these tests and inspections. This information shall be submitted for review and approval.
5. Calculations

a. Reliability, Availability and Maintainability (RAM): A calculation of the predicted availability shall be included. Failure rate data shall be provided. Methods for improving the reliability and availability predictions (e.g. maintenance intervals, self checking, redundancy) shall be provided. This shall be submitted for Review and Approval.

C. Detailed Design Submittals for Information:

1. Descriptive Literature: The Seller shall supply general product information relevant to the equipment being supplied, including descriptive literature, and catalog cut sheets. This submittal shall be supplied for information and records, and shall provide generic information regarding the Seller's standard products which may differ in detail from the items furnished under this specification.

2. Miscellaneous Submittals: The Seller shall provide the following for information:

a. Parts List: List of spare parts recommended to be held at the Buyer's site, with unit prices.

b. Operating Instructions: The Seller shall provide two sets of comprehensive operating instructions, specific to each major component supplied in compliance with this specification.

c. Maintenance Data: The Seller shall supply two complete sets of maintenance manuals for the truck, drum grab and battery charger. These shall include a comprehensive maintenance schedule detailing cleaning, lubrication and inspection requirements, full instructions on equipment disassembly, replacement and repair. A complete list of parts with the manufacturers part number shall be included.

d. Availability of Parts: The Seller shall provide a list of dealerships and suppliers of parts and service throughout the country and the address of the nearest supplier to the project site.

e. Warranties: The Seller shall submit warranties and guarantees describing in detail which components and systems are covered by the guarantees and the circumstances and extent of that coverage.

f. Material Safety Data Sheets (MSDS): The Seller shall provide MSDS in accordance with 29 CFR 1910.1200 (Hazard Notification) as applicable.
1.06 DELIVERY, STORAGE AND HANDLING

A. The Seller shall be responsible for ensuring delivery of all the items covered by this specification to the Hanford site, Richland, WA. The method of transport shall be either truck or train. Refer to Division 1 for standard conditions pertaining to delivery, storage and handling.

B. The Seller shall notify the Buyer of shipment prior to dispatch from the Seller's works/dealership, and in any case, not less than two days prior to the expected arrival of the shipment at the Buyer's site. The Seller shall be responsible for packing, labeling, and loading the equipment to ensure that no damage or loss occurs in transit. Any such loss or damage shall be repaired or replaced at the Seller's expense.

C. The Seller shall supply instructions for off loading equipment at the Buyer's site.

1.07 SITE CONDITIONS:

A. Refer to Division 1 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under the specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Lift Trucks
   a. Clark
   b. Hyster
   c. Yale

2. Drum Grabs
   a. Cascade
   b. Wesco
   c. Hobbs

2.02 MATERIALS

A. All materials and components furnished under this specification shall be new and of the manufacturer's standard quality.

B. All items liable to corrosion and exposed surfaces shall have protective coatings applied. The outside of the truck shall be finish painted with the manufacturer's standard paint.
C. The Seller should avoid the use and installation of hazardous materials during construction. Any hazardous materials contained in the final products shall be notified to the Buyer prior to delivery at the site and should be accompanied by an appropriate Materials Safety Data Sheet (see Section 1.04.C.2.f).

D. Hydraulic fluids used in the lift truck and associated equipment shall be "Less Flammable" types as approved by Factory Mutual Research Corporation Section 6, Flammable Liquid Equipment, and shall be recommended by the manufacturer for the conditions of service.

2.03 EQUIPMENT

A. General:

1. The equipment covered by this specification comprises one four wheel, rider type lift truck complying with ANSI B56.1-93 and ANSI UL 583-91. The lift truck shall be equipped with drum grab equipment capable of handling both 85 gallon and 55 gallon drums. The truck shall be "E" designated as defined by NFPA 505. The truck shall operate in an "unclassified" environment as defined in Title 29 CFR, Part 1910.178 and WAC 296-24-230.

2. The truck shall be supplied with a battery, battery charger, standard 6' forks and any special tools particular to the equipment being supplied. This includes special tools, connectors and operational data. The equipment shall perform to, and conform with, the equipment data sheet in Appendix A.

3. The truck shall normally be operated intermittently throughout an 8 hour workday and should be capable of moving 2 boxes and 18 overpacks per day on an asphalt surface and up a 96' long incline of 13%. The average round trip distance for each overpack transfer is approximately 500 feet.

4. During periods of extreme cold temperatures (see Data Sheets in Appendix A) the truck shall be capable of constant operation of all its facilities for a minimum of 2 hours.

5. The truck, and drum grab capable of handling 85 gallon overpacks, shall be supplied fully assembled serviced and ready for operation, the forks and separate 55 gallon drum grab (if required) being supplied separately.

6. The truck shall have locking doors and a lockable on/off switch.
7. The truck shall have a suitable on-board storage area for one set of operating instructions as per section 1.05.c.2.

B. Lifting Equipment

1. The gripping mechanism shall be designed such that it can pick and carry maximum weight (1,000 lb.) lidless 85 gallon overpacks without causing damage to, or permanent distortion of the containers.

2. When the truck is fitted with standard 6' forks, it shall be capable of lifting a box weighing up to 8,000 lbs.

3. Any hydraulic connections between the drum grab and the lift truck shall be made using "quick-disconnect" couplings. The grab shall be designed to be readily removable such that the truck can be converted to standard fork attachments for box handling. The distance between the forks shall be adjustable to accommodate the box sizes specified in the data sheets (Appendix A).

C. Mast

1. The mast shall be a high visibility type with forward and backward tilt capability as detailed in the data sheets (Appendix A), and shall have sufficient sections or stages to enable the truck to pick drums and overpacks from ground level, and to pick a drum/overpack at a height of 12 feet (base of drum to ground).

2. With the load and mast in the lowered position, the lift truck shall not require more than 10 feet overhead clearance.

D. Carriage

1. The Carriage shall have powered shifting capability, during operation, to move to either side by a minimum of 4".

E. Steering

1. The lift truck shall be equipped with power steering.

F. Cab

1. The truck shall be supplied and equipped; with a fully enclosed heated and ventilated cab with safety glass front window and other windows as necessary to afford the operator clear, all-round vision. The cab shall accommodate all truck and attachment operating controls.
G. Battery Charger

1. The battery charging equipment shall be delivered with the truck and shall be 480 volt, 3 phase input 48 volt DC output. The charger shall be capable of re-charging a completely exhausted battery in no more than 8 hours. Charging of the truck shall be possible without requiring removal of the batteries.

2. The charger shall be fully automatic, compatible with the batteries supplied and have automatic start/stop. In addition, the charger shall include the following features:
   a. Quick connect couplings between truck and charger and a minimum of 25' leads.
   b. Automatic AC line compensation.
   c. Automatic overload protection (current limiting).
   d. Automatic DC voltage regulation.
   e. AC input 3-pole circuit breaker.
   f. DC output 2-pole circuit breaker.
   g. Reverse polarity protection.
   h. Automatic surge suppressors.
   i. UL listed.
   j. DC ammeter and equalize switch on outside panels.
   k. NEMA 12 enclosure with incoming AC external power disconnect. The disconnect switch shall be heavy duty, HP rated and non-fused.
   l. Suitable for free standing on rough surface or dirt.
   m. Maintenance on/off switch triggered when any access panel is opened.
   n. Indicator lights showing "on" "Fault" "Equalize" "80% Charged" "Battery Ready" lights clearly visible.
H. RAM Requirements:

1. The Lift Truck (including all associated equipment) shall have an operational availability of 99.7% or greater. The 99.7% minimum operational availability requirement includes all unplanned periods of downtime when the unit is not operational. Scheduled maintenance and diagnostic checks are excluded from the downtime figure. Operational availability is defined as:

\[
Ao = \frac{MTBM}{MTBM + MTTM}
\]

Where:

Ao = Operational availability
MTBM = Mean-time-between-maintenance (unplanned)
MTTM = Mean-time-to-maintain clock hours to restore to full operations (assuming no administrative delays)

The Seller shall provide an estimate of MTBM and MTTM and provide the basis to substantiate the estimate (including actual data from testing and maintenance records).

2. Target values for MTBM and MTTM should be:
   a. MTBM: Not less than 2000 hours.
   b. MTTM: Not more than 3.0 hours.

2.04 COMPONENTS

A. Hydraulic Systems: All system components shall be compatible with the "less flammable" hydraulic fluid specified in Section 2.02D. System capacity shall be sufficient to provide power for all lifting, tilting drum clamping and fork movement operations.

B. Batteries: The lift truck batteries shall be supplied by the Seller with the truck. They shall be the largest batteries capable of accommodation within the standard truck body and shall comply with the minimum weight requirements of the lift truck manufacturer. Batteries shall be 48 volt and selected to comply with the performance requirement specified in the data sheets (Appendix A).

D. Controls and Instruments: All controls used during normal truck operation shall be conveniently located within the cab. This includes the drum grab operating controls. Similarly all instruments used during normal operation shall be clearly visible to an operator in the driver's seat. As a minimum instruments shall consist of an hour meter and a battery charge indicator.

2.05 FABRICATION

A. Assembly: The lift truck is to be fully assembled when delivered to the Buyers facility. The truck shall be supplied with all facilities for handling 85 gallon overpacks connected up and ready to operate. The forks will be supplied as a separate unit complete and ready for attachment to the carriage. Lifting features will be attached at the Seller's facility and clearly labeled.

B. Identification: Clearly marked nameplates of corrosion resistant metal shall be permanently attached to a prominent position on the lift truck and shall show the manufacturer's name.

The following information shall also be included:

1. Model number
2. Serial number
3. Contract number and date (month and year)
4. Date of manufacture (month and year)
5. Capacity/Rating (include attachments)

2.06 SHOP QUALITY CONTROL

A. Standard Requirements

1. Refer to Division 1.0 for standard shop quality requirements.

B. Shop Functional Tests:

1. In addition to the Seller's standard tests and quality control activities, the Seller shall perform a complete functional test on each truck. The test shall demonstrate that the truck operates satisfactorily at its rated capacity and that all systems and indicators function properly. The Seller shall carry out tests that clearly demonstrate that the truck can lift, maneuver and negotiate a 13½ incline while carrying the following containers.
a. 55 gallon drum weighing at least 1,000 lbs.
b. 85 gallon overpack containing a 55 gallon drum weighing 1,000 lbs.
c. L-10 drum weighing 1,000 lbs.
d. 7' x 6' x 6' box weighing at least 8,000 lbs.

The test shall demonstrate the operation of the drum handling equipment for loads a, b and c and changeover procedure to conventional forks for load d. The test shall demonstrate that the containers are not damaged during handling. The Seller shall provide the test loads.

2. The Seller shall notify the Buyer 2 weeks prior to the scheduled test and allow the Buyers representative to witness the load maneuvering and function tests described above.

PART 3 EXECUTION NOT USED

END OF SECTION
## APPENDIX A

**EQUIPMENT DATA SHEETS**

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>ITEM NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drum/Box Handling Fork Lift Truck</td>
<td>W113-FT-02-101</td>
</tr>
</tbody>
</table>

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14452-A1  RAYTHEON PROJECT 9164.006
## Conditions of Service

**Application:** Transfer Retrieved 55 gal. drums as is, or overpacked in 85 gallon lidsless drums to HGS/NDE/NDA. Transport Retrieved boxes.

**Unit Load Description:** Retrieved 55 and 85 gal. drums (1,000 lbs.), Retrieved boxes (up to 8,000 lbs.)

**Location:** Inside Trench Enclosure - Limited Outside Operation

**Unit Load Weight:**
- 1,000 lbs (Drums)
- 8,000 lbs (Boxes)

**Maximum Ground Slope:** 13% (86 ft long)

**Rated Capacity:** 8,000 lbs at 48" load center

**Battery Recharge:** 8 hrs.

**Ambient Temperature Range:** Refer to Division 1

### Construction

**Unit Weight Shipping:** 14,000 lbs (approx)

**Unit Weight Operating:** 22,000 lbs (approx)

**Steering:** Power

**Truck Type:** Electric (battery powered)

**Brakes:** Servo Assisted

**Operators Compartment:** Heated vented cab

**Battery:** Manufacturer to specify, 1200 AH min.

**Tires:** Manufacturer to specify

**Travel Speed (W/O Load):** 5/6 mph

**Lift Speed (W/O Load):** 27/57 ft/min

**Drum Clamp:** Hydraulic, Removable

**Maximum Allowable Turning Radius:** 100 inches

### Notes:

1. L10 containers are two 55 gallon drums welded together end-to-end.
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PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification establishes the minimum requirements for the manufacture, supply and delivery of one 4,000 lb. capacity, diesel powered lift truck, equipped with a drum handling adapter and supplied with a separate set of standard forks, for use at the DOE’s Hanford site on the Solid Waste Operations Complex (SWOC) W113 project.

1.02 RELATED SECTIONS: NOT USED

1.03 REFERENCES

A. Applicable Codes and Standards: Codes, specifications and standards referred to by number or title, shall form a part of this specification to the extent required by the references hereto.

B. American National Standard Institute (ANSI):
   1. ANSI-B56.1-93 Low Lift and High Lift Trucks

C. National Fire Protection Association (NFPA):
   1. NFPA-505-92 Fire Safety Standard for Powered Industrial Trucks

   1. Title 29 CFR Part 1910.178 Occupational Safety and Health Administration (OSHA) (Powered Industrial Trucks)
   2. Part 1910.1200 Hazard Communications
   3. Title 49 CFR Part 178 DOT 17H Galvanized Steel Drums

E. Underwriter’s Laboratories (UL)
   1. UL 558 (formerly B56.4) Industrial Trucks, Internal Combustion Engine Powered - Standard for Safety

September 1995
Rev 0
F. Washington Administrative Code:

1. WAC 296-24-230 Powered Industrial Trucks

1.04 SYSTEM DESCRIPTION

A. The lift truck described in this specification shall be capable of operation outside the trench enclosure of the SWOC, W113 project as shown on the contract drawings. The truck will be primarily used for moving both lidded and unlidded, individual, 85 gallon overpack drums containing 1,000 lb., 55 gallon waste drums.

Note: For container dimensions, see Appendix A.

55 and 85 gallon drums shall conform to DOT 17H as published in 49 CFR Part 178.

B. The truck will be supplied with a drum grab capable of handling the individual drums and overpacks described above without causing damage or permanent distortion. This shall be fully connected up and ready for operation. A single drum grab which can be easily adjusted to accommodate both 55 and 85 gallon containers is preferred, but two individual grabs are acceptable. If two grabs are supplied, the one for handling 85 gallon overpacks shall be fitted and operational prior to delivery. A set of standard forks shall be supplied with, but not fitted to, the truck.

C. The truck will normally operate outside the trench enclosure on a smooth asphalt surface but should be capable of operating on flat dirt and negotiating isolated steps or obstacles of up to 2" in height across the full width of the roadway. The truck shall be capable of picking and moving 1,000 lb. drums, on a 13% incline. The environment outside the enclosure is normally similar to desert conditions. The truck should be capable of operating outside in moderate rainfall.

D. The lift truck shall be capable of operating in an extreme temperature range and shall be supplied equipped with a cold start package to ensure adequate overnight protection during periods of below zero temperatures. For site conditions see Division 1.0.

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details of the standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals to those listed herein.
B. Detailed Design Submittals for Approval:

1. Data Sheets: The Seller shall complete an information sheet covering all the areas noted in the equipment data sheets located in Appendix A of this specification. This information shall be specific to the particular products being furnished and shall be submitted to the Buyer for review and approval.

2. Drawings: Accurate drawings shall be submitted to the Buyer for approval. These shall cover all items supplied under this specification, which show the following as a minimum.
   
   a. Equipment general arrangements.
   b. Equipment outline, overall dimensions and weight.
   c. Limits of travel for drum grab(s).
   d. Turning circles.
   e. Cab door openings and maintenance access panels.
   f. Electrical wiring diagrams, hydraulic schematics and interface drawings.

3. Test Procedures: The Seller shall submit for approval the functional test procedure outlining the activities necessary to demonstrate the requirements specified in Section 2.06.B.

4. Test Reports: The Seller shall provide a list of all tests carried out on equipment components and assemblies supplied under this specification. In addition the Seller will supply certified documentation to verify the acceptability of the results of these tests and inspections. This information shall be submitted for review and approval.

5. Calculations
   
   a. Reliability, Availability and Maintainability (RAM): A calculation of the predicted availability shall be included. Failure rate data shall be provided. Methods for improving the reliability and availability predictions (e.g. maintenance intervals, self checking, redundancy) shall be provided. This shall be submitted for Review and Approval.
C. Detailed Design Submittals for Information:

1. Descriptive Literature: The Seller shall supply general product information relevant to the equipment being supplied, including descriptive literature, and catalog cut sheets. This submittal shall be supplied for information and records, and shall provide generic information regarding the Seller's standard products which may differ in detail from the items furnished under this specification.

2. Miscellaneous Submittals: The Seller shall provide the following for information:

   a. List of spare parts recommended to be held at the Buyers site, with unit prices.

   b. Operating Instructions: The Seller shall provide two sets of comprehensive operating instructions, specific to each major component supplied in compliance with this specification.

   c. Maintenance Data: The Seller shall supply two complete sets of maintenance manuals for the truck and drum grab. These shall include a comprehensive maintenance schedule detailing cleaning, lubrication and inspection requirements, full instructions on equipment disassembly, replacement and repair. A complete list of parts with the manufacturers part number shall be included.

   d. Availability of Parts: The Seller shall provide a list of dealerships and suppliers of parts and service throughout the country and the address of the nearest supplier to the project site.

   e. Warranties: The Seller shall submit warranties and guarantees describing in detail which components and systems are covered by the guarantees and the circumstances and extent of that coverage.

   f. Material Safety Data Sheets (MSDS): The Seller shall provide MSDS in accordance with 29 CFR 1910.1200 (Hazard Notification) as applicable.

1.06 DELIVERY, STORAGE AND HANDLING

A. The Seller shall be responsible for ensuring delivery of all the items covered by this specification to the Hanford site, Richland, WA. The method of transport shall be either truck or train. Refer to Division 1 for standard conditions pertaining to delivery storage and handling.
B. The Seller shall notify the Buyer of shipment prior to dispatch from the Seller’s works/dealership, and in any case, not less than two days prior to the expected arrival of the shipment at the Buyer’s site. The Seller shall be responsible for packing, labeling, and loading the equipment to ensure that no damage or loss occurs in transit. Any such loss or damage shall be repaired or replaced at the Seller’s expense.

C. The Seller shall supply instructions for off loading equipment at the Buyer’s site.

D. The truck shall be delivered to the Buyer’s site fully assembled, serviced and ready for operation.

1.07 SITE CONDITIONS:

A. Refer to Division 1 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under the specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Lift Trucks
   a. Clark
   b. Hyster
   c. Yale

2. Drum Grabes
   a. Cascade
   b. Wesco
   c. Hobbs

2.02 MATERIALS

A. All materials and components furnished under this specification shall be new and of the manufacturer’s standard quality.

B. All items liable to corrosion and exposed surfaces shall have protective coatings applied suitable for full-time outside operation. The outside of the truck shall be finish painted with the manufacturer’s standard paint.
C. The Seller should avoid the use and installation of hazardous materials during construction. Any hazardous materials contained in the final products shall be notified to the Buyer prior to delivery at the site.

D. Hydraulic fluids used in the lift truck and associated equipment shall be "Less Flammable" types as approved by Factory Mutual Research Corporation, and shall be recommended by the manufacturer for the conditions of service.

2.03 EQUIPMENT

A. General:

1. The equipment covered by this specification comprises one diesel engine powered, four wheel, rider type pneumatic tired, lift truck complying with ANSI B56.1-93. The lift truck shall be equipped with drum grab equipment capable of handling both 85 gallon and 55 gallon drums. The truck shall also comply with UL558 and be D designated as defined by NFPA 505. The operating environment for this truck shall be "unclassified" as defined in Title 29 CFR, Part 1910.178 and WAC 296-24-230.

2. The truck shall be supplied with any special support equipment and tools particular to the truck and its accessories. This includes special tools, connectors and operational data. The equipment shall perform to, and conform with, the equipment data sheet in Appendix A.

3. The truck shall normally be operated intermittently throughout an 8 hour workday and should be capable of moving 18 overpacks per day on an asphalt surface and along a 96' long incline of 13%. The average round trip distance for each overpack transfer is approximately 500 feet.

4. During periods of extreme cold temperatures (see Data Sheets in Appendix A) the truck shall be capable of constant operation of all its facilities for a minimum of 8 hours.

5. The truck, and drum grab capable of handling 85 gallon overpacks, shall be supplied fully assembled with the forks, and a 55 gallon drum grab (if required) being supplied separately.

6. The truck shall have locking doors and a lockable on/off switch.
7. The truck shall have a suitable on-board storage area for one set of operating instructions as per section 1.05.C.2.

B. Lifting Equipment

1. The gripping mechanism shall be designed such that it can pick and carry maximum weight (1,000 lb.) lidless 85 gallon overpacks containing a 55 gallon drum, without causing damage to, or permanent distortion of, the containers.

2. Any hydraulic connections between the drum grab and the lift truck shall be made using "quick-disconnect" couplings. The grab shall be designed to be readily removable.

C. Mast

1. The mast shall be a high visibility type with forward and backward tilt capability as detailed in the data sheets (Appendix A), and shall have sufficient sections or stages to enable the truck to pick drums and overpacks from ground level, and to pick a drum/overpack at a height of 12 feet (base of drum to ground).

2. With the load in the lowered position, the lift truck shall not require more than 10 feet overhead clearance.

D. Carriage

1. The Carriage shall have powered shifting capability, during operation, to move to either side by a minimum of 4".

E. Steering

1. The lift truck shall be equipped with power steering.

F. Cab

1. The truck shall be supplied and equipped; with a fully enclosed heated and ventilated cab with safety glass front window with a windshield wiper, and other windows as necessary to afford the operator clear, all-round vision. The cab shall accommodate all truck and attachment operating controls.
G. RAM Requirements:

1. The Lift Truck (including all associated equipment) shall have an operational availability of 99.7% or greater. The 99.7% minimum operational availability requirement includes all unplanned periods of downtime when the unit is not operational. Scheduled maintenance and diagnostic checks are excluded from the downtime figure. Operational availability is defined as:

\[
Ao = \frac{MTBM}{MTBM+MTTM}
\]

Where:

Ao = Operational availability
MTBM = Mean-time-between-maintenance (unplanned)
MTTM = Mean-time-to-maintain clock hours to restore to full operations (assuming no administrative delays)

The Seller shall provide an estimate of MTBM and MTTM and provide the basis to substantiate the estimate (including actual data from testing and maintenance records).

2. Target values for MTBM and MTTM should be:
   a. MTBM: Not less than 2000 hours.
   b. MTTM: Not more than 3.0 hours.

2.04 COMPONENTS

A. Hydraulic Systems: System capacity shall be sufficient to provide power for all lifting, tilting and drum clamping operations.

B. Controls and Instruments: All controls used during normal truck operation shall be conveniently located within the cab. This includes the drum grab operating controls. Similarly all instruments used during normal operation shall be clearly visible to an operator in the drivers seat. As a minimum instruments shall consist of an hour meter, fuel gauge and oil pressure warning indicator.

2.05 FABRICATION

A. Assembly: The lift truck is to be fully assembled when delivered to the Buyer's facility. The truck shall be supplied with all facilities for handling 85 gallon overpacks connected up and ready to operate. Lifting features will be attached at the Seller’s facility and clearly labeled.

B. Identification: Clearly marked nameplates of corrosion resistant metal shall be permanently attached to a prominent location.
position on the lift truck and shall show the manufacturer’s name.

The following information shall also be included:

1. Model number
2. Serial number
3. Contract number and date (month and year)
4. Date of manufacture (month and year)
5. Capacity/Rating (include attachments)

2.06 **SHOP QUALITY CONTROL**

A. **Standard Requirements**

   1. Refer to Division 1.0 for standard shop quality requirements.

B. **Shop Functional Tests:**

   1. In addition to the Seller’s standard tests and quality control activities, the Seller shall perform a complete functional test on each truck. The test shall demonstrate that the truck operates satisfactorily at its rated capacity and that all systems and indicators function properly. The Seller shall carry out tests that clearly demonstrate that the truck can lift, maneuver and negotiate a 13% incline while carrying the following containers.

      a. 55 gallon drum weighing at least 1,000 lbs.

      b. 85 gallon overpack containing a 55 gallon drum weighing 1,000 lbs.

      The test shall demonstrate the operation of the drum handling equipment for loads a and b. The tests shall demonstrate that the containers are not damaged during handling. The Seller shall provide the test loads.

   2. The Seller shall notify the Buyer 2 weeks prior to the scheduled test and allow the Buyer’s representative to witness the load maneuvering and function tests described above.

**PART 3 EXECUTION NOT USED**

**END OF SECTION**
### APPENDIX A

#### EQUIPMENT DATA SHEETS

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<th>ITEM NUMBER</th>
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<tr>
<td>Fork Lift Truck</td>
<td>W113-FT-02-102</td>
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<tr>
<td>UNIT LOAD SIZE:</td>
<td>LOCATION:</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------</td>
</tr>
<tr>
<td>(55 gal. Drums) 23(^\circ) Dia. x 34(^\circ) H</td>
<td>Outside Trench Enclosure</td>
</tr>
<tr>
<td>(86 gal. Drums) 28(^\circ) Dia. x 39(^\circ) H</td>
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<table>
<thead>
<tr>
<th>UNIT LOAD WEIGHT:</th>
<th>DUTY:</th>
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<tbody>
<tr>
<td>1,000 lbs (Drums)</td>
<td>Intermittent operation throughout a 8 hr. work shift.</td>
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<tr>
<th>MAXIMUM GROUND SLOPE:</th>
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<td>13(^\circ) (96 ft long)</td>
<td>1000 lbs at 24(^\circ) load center</td>
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<td>UNIT WEIGHT SHIPPING:</td>
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<td>TIRES:</td>
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<td>MAST TYPE:</td>
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<td>GROUND CLEARANCE:</td>
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<tr>
<td>MAXIMUM ALLOWABLE TURNING RADIUS:</td>
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<th>NOTES:</th>
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<tr>
<td>Side shift: 4(^\circ) (minimum)</td>
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<tr>
<td>Steering: Power</td>
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<td>Brakes: Servo Assisted</td>
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<td>Travel speed (W/O LOAD): 5/6 mph</td>
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<tr>
<td>Lift speed (W/O LOAD): 27/57 ft/min</td>
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<tr>
<td>Drum clamp: Hydraulic, Removable</td>
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<tr>
<td>Maximum height not to be exceeded: 10' (load fully lowered)</td>
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</table>
DIMENSIONS: ARE IN INCHES

A: 64" MAX  C: 4" MAX  E: 98" MAX  G: 40" MAX  J: 9.5" MAX  L: 120" MAX  N: 8' MIN
B: 39" MAX  D: 87" MAX  F: 48" MIN  H: 15" MIN  K: 108"  M: 8' MIN  P:
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- 1.02 RELATED SECTIONS ........................................ 2
- 1.03 REFERENCES ............................................. 2
- 1.04 SYSTEM DESCRIPTION .................................... 3
- 1.05 SUBMITTALS ............................................... 4
- 1.06 DELIVERY, STORAGE & HANDLING ....................... 6
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APPENDIX A DATA SHEETS

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SECTION 14550
POWERED ROLLER CONVEYORS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the minimum requirements for the design, fabrication, installation and testing of powered roller conveyors and all associated appurtenances, as delineated in this section and in the contract drawings for Project W113.

B. The Seller shall be responsible for strict compliance with this Specification Section, and its references for all components of the powered roller conveyors.

1.02 RELATED SECTIONS

A. Section 16151 NEMA Frame Electric Motors
B. Section 16152 Electric Specification For Packaged Mechanical Equipment

1.03 REFERENCES

A. Applicable Codes and Standards: Codes, specifications and standards referred to by number or title, shall form a part of this specification to the extent required by the references hereto.

B. Anti-Friction Bearing Manufacturers Association (AFBMA):
   1. AFBMA STD-9-90 Load Ratings and Fatigue Life For Ball Bearings

C. American Gear Manufacturers Association (AGMA):
   1. AGMA 6001-C-88 Design and Selection of Components for Enclosed Gear Drives
   2. AGMA 6010-E-88 Standard for Spur, Helical, Herringbone and Bevel Enclosed Gears
   3. AGMA 6019-E-89 Gearmotors Using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears
D. American Institute of Steel Construction (AISC):
   1. AISC M016-89 Manual of Steel Construction

E. American National Standards Institute (ANSI):
   2. B29.15-87 Heavy Duty Roller Type Conveyor Chains and Sprocket Teeth
   3. B29.17M-88 Hinge Type Flat Top Conveyor Chains and Sprocket Teeth
   4. B29.22M-87 Drop Forged Rivetless Chains. Sprocket Teeth Drive Chain/Drive Dogs
   5. B29.25M-87 Open Barrel Steel Pintle Type Conveyor Chains. Attachments and Sprockets

F. American Welding Society (AWS):
   1. AWS D1.1-90 Structural Welding Code-Steel

G. Conveyor Equipment Manufacturers Association (CEMA):
   1. CEMA STD 404-85 Chain Driven Roller Conveyors (Package Conveyor Series)

H. United States Code of Federal Regulations (CFR), 1990:
   1. 29 CFR 1910 Occupational Safety and Health Standards (OSHA)

I. International Council of Building Officials
   1. UBC-94 Uniform Building Code

1.04 SYSTEM DESCRIPTION

A. System shall consist of two straight and one curved conveyor sections joined together as an integrated unit.

B. Configuration is shown on the Data Sheets in Appendix A.
1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The following submittals, required by this section, shall be provided for review and approval.

1. Data Sheets: Seller specific information shall be filled in appropriately on the Equipment Data Sheets supplied as part of this Section in Appendix A. The Seller shall also provide completed electrical and instrument data sheets.

2. Drawings:
   a. Equipment outline (general arrangement) drawings showing dimensions, required clearances, weight, mounting details, location and description of mechanical and electrical interfaces, and the location of instrumentation.
   b. Electrical wiring diagrams, connection diagrams, and schematics with electrical characteristics and connection requirements.

3. Test & Inspection Reports:
   a. See section 16151, NEMA Frame Electric Motors for motor report requirements.
   b. Reports shall include standard tests required by ANSI B20.1A.

4. Test Procedures:
   a. The Seller shall furnish a comprehensive test procedure document that details how each equipment item will be shop and field demonstration tested. The testing shall demonstrate compliance with this Specification Section.

5. Calculations:
   a. Reliability, Availability and Maintainability (RAM): A calculation of the predicted availability shall be included. Failure rate data shall be provided. Methods for improving the reliability and availability predictions (e.g. maintenance intervals, self checking, redundancy) shall be provided. See 2.03.I for further RAM information.
   b. Seismic calculations: Calculations in accordance with UBC seismic requirements.
C. The following information shall be submitted for information and record:

1. Descriptive Literature: Descriptive literature shall include catalog cut-sheets showing general product information.

2. Recommended spare parts list with unit pricing.

3. Installation, Operation & maintenance manual including the following:
   a. Manuals shall include operating parameters, preventive maintenance plans, recommended operating and maintenance procedures and complete lists of spare parts for all components.
   b. Operation Data: Submit Seller’s instructions, start-up data and trouble-shooting check lists.
   c. Maintenance Data: Submit Seller’s literature, cleaning and oiling procedures, replacement parts lists, and repair data.
   d. Availability of parts and service: Provide address of nearest factory from which replacement parts will be available for all major equipment supplied. Provide address of supplier’s nearest service facility to the project site.

4. Motor nameplate data.

5. Bill of materials.

6. Erection Instructions: The Seller furnished erection instructions shall include the following:
   a. A sequence of installation with all installation requirements defined for each piece shown on the shipping list.
   b. Field erection drawings that define the pieces that are to be field assembled. Details shall include locations of lifting lugs, spreader bar requirements, weights of each lift, and details of each field connection. Each loose piece to be assembled shall have a unique mark number called out in the field erection drawings and on the shipping list.
c. Each major shipping item shall have a separate shipping assembly drawing showing overall dimension, weight, lifting lug details, and recommended rigging for unloading and erection.

7. Material Safety Data Sheets (MSDS)
   a. Seller shall provide Material Safety Data Sheets in accordance with 29CFR 1910.1200, as applicable.

1.06 DELIVERY, STORAGE & HANDLING
   A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS
   A. Refer to Division 1.0 for applicable Site Conditions

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. To provide procurement references under this specification, and subject to compliance with the requirements herein, the following list of manufacturers is identified. Procurement need not be limited to these listed manufacturers, subject to Buyer’s approval.
      1. Hytrol Conveyors
      2. Interlake Material Handling Division
      3. Roach Conveyors

2.02 MATERIALS
   A. General:
      1. All castings and forgings shall be free from scale and mismatching. No process such as peening, plugging or filling with solder or paste shall be used for reclaiming any defective part.
      2. All material specifications shall be a U.S. specification (ASTM, UNS, SAE, etc.).
      3. Greases and oils shall be of U.S. manufacture.
B. All materials and components furnished under this specification shall be new and of the manufacturer's standard quality. Any damage occurring during manufacture will be replaced or repaired at the Sellers expense.

C. The Seller should avoid the use and installation of hazardous materials during construction. Any hazardous materials contained in the final products shall be notified to the Buyer prior to delivery at the site, as indicated in 1.05.C.7.

D. Buyer reserves the right to approve manufacturer and model of components.

2.03 EQUIPMENT

A. General:

1. Live roller conveyors shall be in accordance with CEMA Standard No. 404 Chain Driven Live Roller Conveyors.

2. Moving parts of each roller conveyor section shall be readily accessible for inspection, lubrication and repair.

3. The noise emission shall not exceed 85 dBA when measured at a distance of 5 feet from the equipment, and at 1/2 of its vertical height. The noise measurement techniques, instrumentation and test conditions utilized to acquire sound level data shall comply with 29 CFR 1910.

4. The equipment shall be suitable for partial disassembly, relocation, and reassembly with minimal expenditure of time and effort. Field assembly should rely on bolted rather than welded connections to the maximum extent possible.

5. The conveyors shall be capable of handling 85 gallon drums weighing up to 1,000 pounds, as indicated on the data sheets in Appendix A.

6. Mechanical stops shall be provided as indicated on the Data Sheets in Appendix A. Impact against the stops shall not cause the drums to tip over.

7. Structural design shall be in accordance with the requirements in UBC Section 1632, with the following factors:

\[
I = 1.25 \\
Z = 0.2 \text{ (Zone 2B)} \\
R_w = 4
\]
B. Conveyor Supports:

1. The conveyor frame and support legs shall be fabricated from structural steel per AISC M016, and shall be hot dip galvanized.

2. The load shall be guided within the effective conveyor width by use of structural steel guide rails and/or use of rollers "set low" within the frame. Top of the guide member shall be a minimum of 1/2 inches above the top of roller elevation.

3. The support legs shall be designed to accommodate the elevation variations shown on the Data Sheet in Appendix A, with an additional ±3" adjustment capability in each leg beyond that needed to accommodate the elevation variations of the two setups shown on the Data Sheet. Two sets of interchangeable legs are acceptable.

4. Support legs on each conveyor section shall fully support that fully loaded section without support from adjoining sections.

C. Rollers:

1. Rollers shall be constructed from 11 gauge A36 carbon steel, per AISC M016.

2. Bearings shall be internally mounted within the roller tube or shall be flange mounted on the conveyor frame. Bearings shall be dust and rain tight, lubricated for life, anti-friction type, and shall conform to AFBMA STD. 9.

D. Chains:

1. The chains shall conform to the requirements for ANSI standard series or heavy series roller chain, B29.15, B29.17M, B29.22M and B29.25M. The chain shall include case hardened pins and bushings constructed from high quality alloy steel. Rollers and plates shall be subjected to shop peen or equivalent process to enhance fatigue strength.

2. The chain shall be preloaded to seat parts and to burnish wear surfaces. The chain shall be prelubricated in a bath or hot dip lubricant to provide initial lubrication and rust inhibitor.

3. All roller chains shall be a minimum chain size RC 60.

4. The roller to roller chain drive shall be completely housed in a rain tight steel enclosure.
E. Gear Drives

1. The gear drives furnished shall conform to AGMA 6001-C, 6010-E and 6019-E.

F. Sprockets:

1. The sprockets shall conform to ANSI standards.

2. The drive ratios shall not exceed 3 to 1. The driver sprocket shall have more than the minimum recommended number of teeth.

3. The driver sprocket shall have an odd number of teeth and the driven sprocket shall have an even number of teeth.

4. Sprockets shall have hardened teeth and "QD" type compression hubs with standard key sets. Where applicable, the driven sprocket shall have a shear pin or torque limiting hub.

G. Ratings:

1. The drive sizing shall be determined by using the manufacturer's selection method with a minimum service factor of 1.33 applied to the motor horsepower. A larger service factor shall be used if recommended by the manufacturer for the specific application.

H. Conveyor Guards:

1. The conveyor shall be equipped with shields, guards, and safety devices to prevent personal injury and promote safe operation of the machinery per 29 CFR 1910 requirements.

I. RAM Requirements:

1. The Powered Roller Conveyors (including the local controller and all associated equipment) shall have an operational availability of 99.9% or greater. The 99.9% minimum operational availability requirement includes all unplanned periods of downtime when the unit is not operational. Scheduled maintenance and diagnostic checks are excluded from the downtime figure. Operational availability is defined as:

   \[
   Ao = \frac{MTBM}{MTBM + MTTM}
   \]

   Where:

   \[
   Ao = \text{Operational availability}
   \]

   \[
   MTBM = \text{Mean-time-between-maintenance (unplanned)}
   \]
MTTM = Mean-time-to-maintain clock hours to restore to full operations (assuming no administrative delays)

The Seller shall provide an estimate of MTBM and MTTM and provide the basis to substantiate the estimate (including actual data from testing and maintenance records).

2. Target values for MTBM and MTTM should be:
   a. MTBM: Not less than 4,000 hours.
   b. MTTM: Not more than 4.0 hours.

2.04 COMPONENTS

A. Instruments:

1. General Requirements:

   a. All control systems shall be engineered and designed for safe failure positions in the event of a complete loss of electrical power.

   b. The Seller shall provide all instrumentation associated with the packaged equipment unit and shall provide junction boxes and/or local panels at the edge of the skid with terminal strips and wire markers identifying each point for termination. All terminations shall be brought to terminal strips including all spares.

   c. Switches for discrete signals shall have a minimum rating of 3 Amps at 120 VAC and 3 Amps at 28 VDC, resistive loads, with double Form C contacts.

   d. For purposes of identification, all instrument items shall have instrument information stamped on a stainless steel tag that is affixed to the body of the instrument or attached by stainless steel wire to the body of the instrument. Stainless steel tag shall be a minimum of 1.5" long x 0.5" wide. Seller shall use instrument tag numbers as specified on the Contract Drawings. Where Seller provides additional instruments than indicated on the Data Sheets in Appendix A, Buyer shall provide the additional tag numbers as required. Instrument tagging method shall conform with ISA S5.1-84.

   e. All shutdown sensors shall be dedicated devices.

   f. Electrical switches employing mercury ampules are not permitted.
g. At no time shall any voltage in excess of 40VDC or 120VAC, 60 Hz be allowed in any instrument/control systems panels, except as specifically approved by the Buyer.

h. Instrument systems requiring 120 VAC power for operation shall have individual over current protection.

i. Selection, routing, and installation of signal wiring, with respect to other electrical systems, shall be carefully considered to prevent introduction of spurious signals. Instrument signal wiring shall be isolated from electrical noise generating equipment, such as power transformers.

j. Where practicable, instruments shall be capable of being calibrated with standard tools and meters, such as, multimeter and milliamp signal generator. Unique tools and test equipment requirements shall be identified by the Seller.

k. The requirements of NFPA 70-90, National Electric Code, shall apply throughout the design of equipment instrumentation.

l. All power wires going out to field devices shall be individually fused. Terminal blocks in panels shall comply with ICS-4-83.

2. Conveyor Controls:

a. The conveyor shall be equipped with dual safety switches (hand ropes) for emergency stops, one for each side, wired into the motor controls. Pulling any switch shall stop all conveyors, if running.

b. The conveyor shall be equipped with a position sensor at the end of the conveyor utilizing a floating roller limit switch or equal.

   1) The position sensor shall be located per the Data Sheets in Appendix A.

   2) The position sensor’s location shall be field adjustable to satisfy operating parameters.

   3) Detection of a drum on the conveyor at the end of the conveyor assembly shall stop all the conveyors.

c. The conveyors shall come complete with all instruments and controls completely wired.
d. The conveyor shall have a local pushbutton station for conveyor control as shown on the Data Sheets in Appendix A. Control functions include forward and stop. In the forward mode the command shall seal in and the conveyors shall run until automatically stopped by the position sensor, or until manually stopped using the stop pushbutton. All conveyor sections shall operate simultaneously to move a drum from one end of the assembly to the other end.

e. A spare contact, closed when the conveyor is running forward, shall be wired to a junction box for future use.

B. Electrical:

1. Installation of control, instrument, and power wiring shall conform to Specification Section 16152, Electrical Specification for Packaged Mechanical Equipment.

2. All terminal boxes and junction boxes shall conform to requirements as called for in Specification Section 16152, Electrical Specification for Packaged Mechanical Equipment.

3. The drive motors shall be furnished in compliance with Specification Section 16151, NEMA Frame Electric Motors.

4. Characteristics of the electrical system shall be as indicated on the Data Sheets in Appendix A.

5. Power feed to the conveyors shall be at a single junction box as shown on the Data Sheets in Appendix A. Seller shall supply any transformers, if needed, for 120V controls.

6. Seller shall provide power and control quick disconnect fittings between conveyor sections.

C. Control Panel

1. The panel associated with the conveyors shall be designed and supplied by the Seller and conform to Section 16152. Layout drawings of the front of the panel and internal subpanels, along with electrical wiring drawings shall be submitted to Buyer for approval prior to fabrication. The panel location shall be as shown on the Data Sheets in Appendix A and shall be within the framework of the conveyor to protect from mechanical damage.

2. Human factors engineering practices in accordance with MIL-STD-1472D shall be used when designing man-machine interfaces.
3. All panel and console instruments, switches and similar devices shall have nameplates on front with item identification and service description. All instruments, switches, and similar devices in back of panels shall have permanent type labels with item identification.

4. Rear of panel wiring shall not interfere with spare space for possible future installation on the panels, or accessibility for maintenance.

5. Switches on the front of the panel shall be designed to prevent accidental operation.

6. Panel mounting shall be such that it shall be free of vibration.

7. Control panel shall be mounted below the top edge of the frame, approximately 5 feet above grade. It shall be recessed inside the frame envelope for protection against damage by moving heavy equipment around the conveyor.

8. Panels shall be rated NEMA 4.

2.05 FABRICATION

A. Welding:

1. All welds shall be in accordance with AWS D1.1 and shall be visually examined for defects.

B. Shop Assembly:

1. All equipment furnished shall be shop assembled to the maximum extent and shipped in the fewest number of sections. As applicable, all component parts of machinery or equipment shall have been formed, machined, welded, stress relieved, tested for defects, balanced, fitted and assembled in the Seller’s shop, then disassembled as necessary for shipment. Each loose piece to be assembled shall have a unique mark number called out in the field erection drawings and on the shipping list and shall be tagged with the mark number.

2. To the largest extent possible, all field assembled pieces shall have bolted connections to enable disassembly, relocation, and reassembly.

C. A nameplate of stainless steel shall be permanently attached to each roller conveyor section. In addition to the manufacturers name and address, the following information shall be included:

1. Tag number
2. Model number
3. Serial number
4. Date of manufacture – month and year
5. Contract number and date – month and year
6. Capacity

D. Painting:
1. The Seller's standard primer and finish coat shall be applied to each unit.

E. Instrument Accessibility

1. All instruments shall be located for maximum convenience of operation and serviceability of instruments. Any components shall be removable without the removal of another component.

F. Instrument Mounting

1. Instruments shall be mounted on supports (racks) that will not transmit vibration to the instrument.

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

B. A decision by the Buyer not to witness the shop tests, or to conduct shop inspections, shall in no way relieve the Seller from full responsibility for the completeness, quality and precision of the work, or the specified performance of the equipment.

C. The acceptance of shop inspection results and tests, shall not constitute a waiver of the necessity to meet the field performance requirements under specified operating conditions.

D. Shop Tests as a minimum shall include the following:

1. Functional testing of all mechanical equipment and the associated drive components under full load.

2. Functional testing of all electrical and control equipment including motors, limit switches, and rope switches.
E. Any replacements or repairs necessary for the equipment to pass the tests shall be at the Seller’s expense.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. General:

1. Install equipment and appurtenances in accordance with manufacturer’s recommendation and instructions and in compliance with requirements indicated on the Contract Drawings and specified herein.

2. Provide access space around the machine for service of equipment and components. Space shall not be less than minimum as recommended by the Seller. The maximum space is dictated by the Contract Drawings.

B. Foundations

1. Seller shall supply movable concrete foundation slabs as indicated in the contract drawings.

2. Seller shall supply fasteners to anchor the conveyors to the foundation slabs.

C. Installation

1. Seller shall install conveyors in the west wall of the trench enclosure as shown on the contract drawings.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0, for standard field quality control requirements.

3.04 ADJUSTING AND CLEANING

A. Alignment:

1. Following completion of the initial equipment setting, the equipment shall be checked for alignment with all interfaces and rotating components.

B. Lubrication:

1. Before operating equipment, all components requiring lubrication shall be lubricated in accordance with the
Sellers recommended lubrication instructions.

3.05 DEMONSTRATION

A. Division 1.0 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for the product(s) contained in this Specification Section.

B. All equipment shall be operationally checked in all specified operating modes, and under all conditions of service necessary to assure acceptable operation.

C. Testing:

1. Following installation of the equipment, tests shall be conducted to determine that the equipment meets specified performance requirements. All testing equipment and instruments and testing personnel shall be provided and all expense connected with such tests shall be incurred by the seller.

2. Field tests shall include but not be limited to the following:

   a. Motor no-load and full-load amperage checks.
   b. Equipment capabilities under actual operating conditions.
   c. Control circuitry and operation.
   d. Testing of switches and alarms.

3. Any repairs or replacements necessary for the equipment to pass the tests shall be at the Seller’s expense.

3.06 PROTECTION: NOT USED

END OF SECTION
## APPENDIX A
### EQUIPMENT DATA SHEETS

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<td>Waste Drum Conveyor</td>
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<td>W113-CV-02-103</td>
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September 1995
Rev 0

14550 - A1 RAYTHEON PROJECT 9164.006
**EQUIPMENT DATA SHEET**

**NAME:** WASTE DRUM CONVEYOR

**PROJECT:** SWOC MODULE W113

**CUSTOMER & LOCATION:** WHC HANFORD, WA

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<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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**RAYTHEON JOB NO.:** 9164.006

**SPEC. NO.:** 14560

**TAG NO.:** W113-CV-02-101

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<td>AVAILABLE POWER:</td>
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<tr>
<td>LOCATION:</td>
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<tr>
<td>DUTY:</td>
<td>20 DRUMS/8 HOUR SHIFT</td>
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**CONDITIONS OF SERVICE**

- **UNIT LOAD DESCRIPTION:** 85 GALLON DRUMS
- **UNIT LOAD SIZE:** 28" DIA. X 39" HIGH
- **UNIT LOAD WEIGHT:** 1,000 LBS
- **IMPACT LOADING:** MODERATE
- **NEC AREA CLASS:** UNCLASSIFIED
- **UBC SEISMIC ZONE:** 2B
- **SPEED:** 30 FPM
- **RATED CAPACITY:** 4 DRUMS, 4,000 LBS
- **AVAILABLE POWER:** 460V/3P/60 HZ
- **LOCATION:** OUTDOORS
- **DUTY:** 20 DRUMS/8 HOUR SHIFT

**CONSTRUCTION**

- **EQUIP. WEIGHT:** 1,000 LBS
- **FRAME MAT'L:** CARBON STEEL
- **DRIVE TYPE:** ROLLER TO ROLLER CHAIN
- **DRIVE MOTOR LOCATION:** UNDERSIDE
- **ROLLER MAT'L:** 11 GAGE CARBON STEEL
- **ROLLER SIZE:** 5LG X 5"DIA
- **ROLLER PITCH:**
- **ROLLER RETENTION:**
- **BEARING TYPE:**
- **CHAIN GUARD:**
- **CHAIN TYPE:**
- **CHAIN SIZE:**
- **NUMBER ROLLERS:**
- **DRIVE CAPACITY:**
- **MOTOR REDUCER CONN:**
- **REDUCER TYPE:**
- **CONTROL TYPE:** FORWARD/STOP
- **LOCATION:** ON CONVEYOR FRAME 101

**ELECTRICAL**

- **ELECTRICAL DESCRIPTION:** MOTORS WITH STARTERS
- **NEMA RATING:** 4
- **EQUIP. MOTOR HP/KVA NAMEPLATE:** 3.36 KVA (NOTE 1)(NOTE 2)
- **MOTOR HP:** % (NOTE 1)
- **EQUIP. MOTOR VOLTAGE:** 460 (NOTE 1)
- **VOLTAGE PHASE:** 3 (NOTE 1)
- **EQUIP. MOTOR RPM:** 3,600 (NOTE 1)

**NOTES:**

1. TO BE CONFIRMED BY VENDOR
2. INCLUDES KVA FOR SECTIONS 102 AND 103
### EQUIPMENT DATA SHEET

**NAME:** WASTE DRUM CONVEYOR  
**TAG NO:** W113-CV-02-102  
**PAGE:** 2 OF 5

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### CONDITIONS OF SERVICE

- **UNIT LOAD DESCRIPTION:** 85 GALLON DRUMS  
- **SPEED:** 30 FPM
- **UNIT LOAD SIZE:** 28" DIA. X 39" HIGH  
- **RATED CAPACITY:** 3 DRUMS, 3,000 LBS
- **UNIT LOAD WEIGHT:** 1,000 LBS  
- **AVAILABLE POWER:** 480V/3P/60 HZ
- **IMPACT LOADING:** MODERATE  
- **LOCATION:** OUTDOORS
- **NEC AREA CLASS:** UNCLASSIFIED  
- **DUTY:** 20 DRUMS/8 HOUR SHIFT
- **UBC SEISMIC ZONE:** 2B

### CONSTRUCTION

- **EQUIP. WEIGHT:** 1,000 LBS  
- **FRAME MAT'L:** CARBON STEEL
- **BARE ERECTED SIZE:** 6' X 6' X 6'-9" HIGH  
- **DRIVE TYPE:** ROLLER TO ROLLER CHAIN
- **DRIVE MOTOR LOCATION:** UNDERSIDE  
- **ROLLER MAT'L:** 11 GAGE CARBON STEEL (TAPERED)
- **ROLLER SIZE:** "LG X "DIA X "DIA
- **ROLLER PITCH:**
- **ROLLER RETENTION:**
- **BEARING TYPE:**
- **CHAIN GUARD:**
- **CHAIN TYPE:**
- **CHAIN SIZE:**
- **NUMBER ROLLERS:**
- **DRIVE:**
- **DRIVE CAPACITY:**
- **MOTOR REDUCER CONN:**
- **REDUCER TYPE:**

### CONTROL

- **TYPE:** FORWARD/STOP
- **LOCATION:** ON CONVEYOR FRAME 101

### ELECTRICAL

- **ELECTRICAL DESCRIPTION:** MOTORS WITH STARTERS  
- **NEMA RATING:** 4
- **EQUIP. MOTOR HP/KVA NAMEPLATE:** (NOTE 2)  
  - MOTOR HP: % (NOTE 1)
- **EQUIP. MOTOR VOLTAGE:** 460 (NOTE 1)
- **VOLTAGE PHASE:** 3 (NOTE 1)
- **EQUIP. MOTOR RPM:** 3600 (NOTE 1)

### NOTES:

1. TO BE CONFIRMED BY VENDOR  
2. KVA FOR THIS SECTION INCLUDED IN KVA FOR SECTION 101
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NOTES:

1. THIS INSTRUMENT IDENTIFICATION SYSTEM IS BASED ON
ISA STANDARD S5.1 AS MODIFIED PER PROJECT REQUIREMENT

2. TAGS SHALL BE FORMATTED AS "MODULE ID - ISA CODE - SYSTEM ID - LOOP NUMBER".
MODULE ID IS W113. THE SYSTEM ID'S ARE LISTED BELOW. IT SHALL
BE NOTED OUTSIDE THE BUBBLE FOR EACH TAG.
11 = MISCELLANEOUS RADIOLOGICAL INSTRUMENTS
12 = ISOKINETIC SAMPLING SYSTEM
13 = DATA MANAGEMENT SYSTEM
14 = DATA ACQUISITION SYSTEM
15 = BAR CODE READER SYSTEM
16 = CONVEYOR CONTROLS
17 = SEPTIC SYSTEM INSTRUMENTS

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SECTION 14552
MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section includes miscellaneous equipment for project W113 as indicated on the contract drawings and specified herein.

1.02 RELATED SECTIONS

A. Section 05100 Structural Steel and Miscellaneous Metals
B. Section 16152 Electrical Specification for Packaged Mechanical Equipment
C. Section 14640 Cranes Rotating Hooks and Drum Grapple

1.03 REFERENCES

A. Title 29 CFR part 1910 Occupational Safety and Health Administration

1.04 SYSTEM DESCRIPTION

A. Portable Vacuum Cleaner.

1. The seller shall provide portable vacuuming equipment to retrieve and collect miscellaneous debris such as wood chips/splinters, tarpaulin shreds, and small stones. (Equipment No. W113-X-02-102).

B. Vacuum Lifter

1. The seller shall provide vacuum lifting equipment for lifting 8'(L) x 4'(W) x ½" marine plywood sheets (Equipment No. W113-X-02-104). Refer to Section 14640 for details of the crane hook attachment for deployment of the vacuum lifter. Also refer to Section 16152 for electrical requirements.

C. Radiological Control (RC) Clearance Stands

1. The seller shall provide two mobile HPT clearance stands (one three foot high stand and one five foot high stand) which allow operators to survey drums positioned on elevated conveyors (Equipment Nos. W113-X-02-106 and W113-X-02-107). The clearance stands shall comply with Title 29 CFR 1910 OSHA.

D. Specific requirements of the equipment described is given on the data sheets located in Appendix A.
1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The following submittals shall be provided for review and approval by the Buyer:

1. Portable Vacuum Cleaner
   a. Vendor Data Sheets/Literature/Power Requirements
   b. Operating and Maintenance Manuals
   c. Equipment Warranty Data

2. Vacuum Lifting Equipment
   a. Vendor Data Sheets/Literature/Power Requirements
   b. General Arrangement Drawings
   c. Operating and Maintenance Manuals
   d. Test Reports
   e. Equipment Warranty Data

3. RC Clearance Stands
   a. Vendor Data Sheets/Literature
   b. General Arrangement Drawings
   c. Equipment Warranty Data

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following manufacturer is identified. Procurement will not be limited to the listed manufacturer.

1. Portable Vacuum Cleaners
   a. American Vacuum Company
   b. Nortec Corporation
   c. CAT VAC

2. Vacuum Lifting Equipment
   a. Anver Corporation
   b. Airlock Manufacturing Company
   c. Woods Powr Grip Inc.

3. RC Clearance Stands
   a. Aluminum Ladder Company
   b. Cotterman

2.02 MATERIALS

A. Material of construction for the miscellaneous equipment are detailed in the data sheets in Appendix A.

B. The purchase of all miscellaneous equipment not be made until buyer provides written approval on submittals listed in section 1.05.B.

2.03 EQUIPMENT

A. Equipment to be procured is as follows:

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<tr>
<th>Code</th>
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<tr>
<td>W113-X-02-102</td>
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<tr>
<td>W113-X-02-104</td>
<td>Vacuum Lifter</td>
</tr>
<tr>
<td>W113-X-02-106</td>
<td>RC Clearance Stand (3 foot)</td>
</tr>
<tr>
<td>W113-X-02-107</td>
<td>RC Clearance Stand (5 foot)</td>
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</table>
B. The purchase of all miscellaneous equipment not be made until buyer provides written approval on submittals listed in section 1.05.B.

2.04 COMPONENTS: NOT USED
2.05 FABRICATION: NOT USED
2.06 SHOP QUALITY CONTROL: NOT USED

PART 3 EXECUTION

3.01 PREPARATION: NOT USED
3.02 ERECTION, INSTALLATION & APPLICATION: NOT USED
3.03 FIELD QUALITY CONTROL: NOT USED
3.04 ADJUSTING AND CLEANING: NOT USED
3.05 DEMONSTRATION

A. The seller shall demonstrate that the vacuum lifter is capable of lifting and safety holding an 8'(L) x 4'(W) x 3/4"(THICK) sheet of marine plywood for 15 minutes.

3.06 PROTECTION: NOT USED.

END OF SECTION
# APPENDIX A

## DATA SHEETS

<table>
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September 1995

Rev 0
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**REVISIONS**

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**NAME:**

PORTABLE VACUUM CLEANER

**CONDITIONS OF SERVICE**

**APPLICATION:** Miscellaneous Debris Retrieval

**UNIT LOAD DESCRIPTION:** Wood Chips, Tarps Shreds (Dry, Moist or Wet)

**UNIT LOAD SIZE:** Less than 2½" in any direction

**UNIT LOAD WEIGHT:** Less than 1 lb.

**SEALED PRESSURE:** 105° H₂O

**CFM:** 110 (2½" Orifice)

**LOCATION:** Inside Trench Enclosure - Limited Outside Operation

**DUTY:** Intermittent

**RATED CAPACITY (WET/DRY):** 55 gal

**CONSTRUCTION**

**UNIT WEIGHT SHIPPING:** 85 lbs. (approx)

**UNIT DIMENSIONS:** 24" x 24" x 42"

**ELECTRICAL RATING:** 120V/60Hz/12A

**TANK SIZE:** 55 gal

**FILTER TYPE:** Cartridge

**CORD LENGTH:** 18’

**HOSE TYPE:** Crush Proof

**HOSE DIM:** 12’ x 2½" Dia.
## VACUUM LIFTER

### CUSTOMER & LOCATION

- **Raytheon, Engineers & Constructors**
- **Customer & Location**: WHC Hanford, WA

### EQUIPMENT DATA SHEET

- **Tag No.:** W113-X-02104
- **Model:** SWOC - W113
- **Design Basis Manufacturer:** Vacuum Lifter
- **Application:** Lift marine plywood sheets
- **Unit Load Description:** Lift 8' x 4' x ½'' marine plywood sheets
- **Unit Load Size:** 8' x 4' x ½''
- **Unit Load Weight:** 70 lbs. Maximum
- **Rated Load Capacity:** 500 lbs.
- **Power:** 3/4 HP

### CONDITIONS OF SERVICE

- **Location:** Inside trench enclosure
- **Duty:** Approx. every 3 days for 30 mins.

### CONSTRUCTION

- **Power Pack:** Electrically powered vacuum generator
- **Electrical Rating:** 120V/60 Hz
- **Control:** Remote via extendable pendant unit
- **Electrical Plug:** P5-20 twist lock
- **Seal Type:** Soft foam seals - necessary as plywood surface is assumed to be rough, uneven and covered in soil overburden.
- **Filter Type:** Integral filter on vacuum generator, plus additional filter due to presence of soil overburden.

### NOTES:

1. The maximum dimension of the vacuum lifter must not extend beyond the 8' x 4' area of the plywood. The total height of the vacuum lifter may not exceed 4'.
**EQUIPMENT DATA SHEET**

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**DESIGN BASIS MANUFACTURER:** 3 FOOT CLEARANCE STAND

**CONDITIONS OF SERVICE**

**APPLICATION:** ALLOWS A RC OPERATOR TO ACCESS DRUMS ON AN ELEVATED CONVEYOR

**UNIT LOAD DESCRIPTION:** RC OPERATOR

**UNIT LOAD WEIGHT:** 250 LBS.

**LOCATION:** RC CLEARANCE STATION POSITIONS 2 AND 3, INSIDE TRENCH ENCLOSURE

**DUTY:** EVERY WORKING DAY TO FACILITATE CONTAMINATION CHECKS ON WASTE DRUMS. THE OPERATOR MAY STAND ON THE CLEARANCE STATION STAND 8 HOURS/DAY

**CONSTRUCTION**

**MATERIAL:** ALUMINUM

**HEIGHT TO PLATFORM:** 3 FT

**FEATURES:**
- MOBILE (lockable casters)
- SLIP RESISTANT PLATFORM AND STEPS
- HANDRAIL AROUND PLATFORM

**NOTES:**
EQUIPMENT DATA SHEET

CUSTOMER & LOCATION
WHC
HANFORD, WA.

PROJECT
SWOC FACILITY
MODULE W113

NAME
RC CLEARANCE STAND
TAG No.
W113-X-02-105

RAYTHEON JOB NO.
9164.006

DATE
08-01-95

SPEC. NO.
14552

BY:
A. SHARPE

DIMENSIONS:

A: 36"  C: 77" MAX  E: 40" MAX  G:
B: 36" MAX  D: 36" MAX  F:
H:
K:
M:

09-19-95  CAD NO: X106
**EQUIPMENT DATA SHEET**

**NAME:** RC Clearance Stand  
**TAG NO:** W113-X-02-107  
**RAYTHEON JOB NO.:** 9164.006  
**DATE:** 07/17/95  
**SPEC. NO.:** BY: SAS

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| DESIGN BASIS MANUFACTURER: | 5 FOOT CLEARANCE STAND |

**CONDITIONS OF SERVICE**

**APPLICATION:** ALLOWS ONE RC OPERATOR TO ACCESS DRUMS ON AN ELEVATED CONVEYOR

**UNIT LOAD DESCRIPTION:** RC OPERATOR

**UNIT LOAD WEIGHT:** 250 LBS.

**LOCATION:** RC CLEARANCE STATION POSITIONS 2 AND 3. INSIDE TRENCH ENCLOSURE

**DUTY:** EVERY WORKING DAY TO FACILITATE CONTAMINATION CHECKS ON WASTE DRUMS. THE OPERATOR MAY STAND ON THE CLEARANCE STATION STAND 8 HOURS/DAY

**CONSTRUCTION**

**MATERIAL:** ALUMINUM

**HEIGHT TO PLATFORM:** 5 FT

**FEATURES:**
- MOBILE (lockable casters)
- SLIP RESISTANT PLATFORM AND STEPS
- HANDRAIL AROUND PLATFORM

**NOTES:**
RC CLEARANCE STAND

EQUIPMENT DATA SHEET

CUSTOMER & LOCATION
WHC
HANFORD, WA.

PROJECT
SWOC FACILITY
MODULE W113

NAME: RC CLEARANCE STAND
TAG NO: W113-X-02-107

RAYTHEON JOB NO.
9164.005

SPEC. NO.
14552

DATE: 08-01-95

BY: A. SHARPE

DIMENSIONS:
A: 60"  B: 36" MAX
C: 77" MAX  D: 36" MAX
E: 40" MAX
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2 09-19-85 CAD NO: X107
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APPENDIX

APPENDIX A DATA SHEETS
SECTION 14640
CRANES, ROTATING HOOKS, AND DRUM GRAPPLE

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the minimum design, fabrication, installation, and testing requirements of the cranes, drum grapple, rotating hooks, and all associated appurtenances.

1.02 RELATED SECTIONS

A. Section 16151 NEMA Frame Electric Motors
B. Section 16152 Electrical Specification For Packaged Mechanical Equipment
C. Section 05100 Structural Steel and Miscellaneous Metals
D. Section 14641 Man Basket
E. Section 14453 Diesel Fork Lift Truck and 85 Gallon Drum Grab

1.03 REFERENCES

A. Applicable Codes and Standards: Codes, specifications and standards referred to by number or title, shall form a part of this specification to the extent required by the references hereto.

B. American Gear Manufacturers Association (AGMA):

1. AGMA 6001-C-88 Design and Selection of Components for Enclosed Gear Drives
2. AGMA 6010-E-88 Standard for Spur, Helical, Herringbone and Bevel Enclosed Gears
3. AGMA 6019-E-89 Gearmotors Using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears

C. Anti-Friction Bearing Manufacturers Association (AFBMA):

1. AFBMA Std. 9-90 Load Ratings and Fatigue Life for Ball Bearings
2. AFBMA Std. 11-90 Load Ratings and Fatigue Life for Roller Bearings

September 1995
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D. American Institute of Steel Construction (AISC):
   1. AISC M016-89 Manual of Steel Construction Allowable Stress Design

E. American National Standard Institute (ANSI):
   2. ANSI MH2 DOT 17H-85 American National Standard for 55-Gallon Full-Removable-Head Steel Drums
   3. ANSI B30.5-1994 Mobile and Locomotive Cranes
   4. ANSI B30.20 1985 Below-the-Hook Lifting Devices
   5. ANSI B30.10-87 Hooks
   7. ANSI/SAE J-1063-Oct80 Cantilevered Boom Crane Structures - Method of Test

F. American Society for Testing and Materials (ASTM):
   1. ASTM A-36-91 Structural Steel

G. American Welding Society (AWS):
   1. AWS D1.1-90 Structural Welding Code-Steel
   2. AWS D14.1-85 Specifications for Welding Industrial and Mill Cranes

H. United States Code of Federal Regulations (CFR), 1990:
   1. 29 CFR 1910 and 1926 Occupational Safety and Health Standards (OSHA)

I. National Fire Protection Association (NFPA):
   1. NFPA 70-90 National Electric Code

J. Washington Administrative Code (WAC):
   2. Chapter 296-155-24510 1995 Fall Restraint, Fall Arrest Systems
K. National Fluid Power Association Hydraulic system standards
L. Factory Mutual Research Corporation (FMRC)
   1. FMRC Approval Guide - 1994 Hydraulic Fluids
M. American Society of Mechanical Engineers (ASME)
   1. ASME HST-4M-91 Performance Standard for Overhead Electric Wire Rope Hoists: DoD Adapted
N. National Electrical Manufacturer’s Association (NEMA)
   1. NEMA MG-1-87 Motors and Generators
O. International Council of Building Officials
   1. UBC-94 Uniform Building Code

1.04 SYSTEM DESCRIPTION

A. The Drum Retrieval Crane, W113-CR-02-101, will lift individual 55 gallon drums and L-10 drums from a stack of drums four or five tiers high and move them to grade. The crane shall be equipped with a power rotating load hook and a manually operated 55 gallon drum grapple capable of placing the 55 gallon drum into an 85 gallon overpack drum and the L-10 drum into an overpack box. This crane shall also assist in maneuvering the vacuum hose during soil removal operations.

B. The Man-Basket Crane, W113-CR-02-104, will lift and maneuver a Man Basket for purposes of inspecting and monitoring the drums being lifted by the Drum Retrieval Crane and for attaching the drum grapple to the drum being lifted. This crane shall also assist in maneuvering the vacuum hose during soil removal operations and for retrieving certain waste boxes. The crane shall be equipped with a power rotating load hook. Design of the crane shall comply with 29 CFR 1926.550(g)(3).

C. Each crane shall be mounted on a trailer with hydraulic stabilizing outriggers and shall be electrically powered.

D. The use of the cranes, rotating hooks, and drum grapple are shown on the contract drawings.

1.05 SUBMITTALS

A. Reference Division 1.0, Submittals, for details regarding the standard submittal schedule, distribution and number of copies required.
B. The following submittals, required for this Section, are to be provided for review and approval.

1. Data Sheets: Seller specific information shall be filled in appropriately on the Equipment Data Sheets provided in Appendix A.

2. Drawings:
   a. Equipment outline (general arrangement) drawings showing dimensions, required clearances, weight, location and description of mechanical and electrical interfaces, location of major components, and the location of instrumentation.
   b. Electrical wiring diagrams, connection diagrams, and schematics, with electrical characteristics and connection requirements.
   c. Hydraulic schematics with description of all modes of operation.
   d. Complete crane load charts, for the supplied cranes mounted on trailers, showing the load capacities for the entire working envelopes of the cranes. The load charts shall include the entire 360° rotation of the cranes.

3. Test & Inspection Reports:
   a. Indicating test results that verify nominal efficiency and power factor for the electric motors, and showing results of any other tests or inspections performed to prove compliance with this specification and assure delivery of a quality product.
   c. Results of required NDE tests of all crane hooks.

4. Calculations
   a. Reliability, Availability, and Maintainability (RAM): A calculation of the predicted availability shall be included. Failure rate data shall be provided. Methods for improving the reliability and availability predictions (e.g. maintenance intervals, self checking, redundancy) shall be provided. See 2.03.F for further RAM information.
   b. For the load conditions indicated on the Data Sheets in Appendix A, calculations of 1) the counterweight masses and sizes required, and 2) the maximum ground loads imposed by the outriggers.
c. Seismic calculations: Calculations in accordance with UBC seismic requirements.

5. Proposed frequencies for each radio remote control station.

C. The following data shall be provided for information and record.

1. Descriptive Literature: Descriptive literature shall include catalog cut-sheets showing general product information.

2. List of recommended spare and maintenance parts with unit pricing and list of suppliers in Washington State and surrounding area.

3. Operation and Maintenance information, including normal and emergency operating procedures, initial and daily startup procedures, temporary storage procedures, maintenance intervals and procedures, maintenance parts and materials requirements, safety inspection procedures, and problem trouble-shooting procedures.

4. Motor nameplate data.


1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage, and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this Specification, and subject to compliance with the requirements herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Cranes
   a. National Crane
b. Quiklift Cranes  
c. Ekegard Cranes  
d. Simon/RO  
e. JLG Industries  

2. Power Rotation Hooks  
   a. Bradley  
   b. Industrial Crane Maintenance  

3. Drum Grapple  
   a. Liftomatic  
   b. Bradley  

2.02 MATERIALS  

A. General:  

1. All castings and forgings shall be free from scale and mismatching. No process such as peening, plugging or filling with solder or paste shall be used for reclaiming any defective part.  

2. All material specifications shall be a U.S. specification (ASTM, UNS, SAE, etc.). All materials shall be specified and procured in accordance with a recognized specification. Steel shall comply with ASTM A-36-91.  

3. Lubricants and fluids shall be of U.S. manufacture.  

4. The seller's standard primer and finish paints shall be applied to each piece of equipment subject to corrosion.  

5. All materials and components shall be of new and current manufacture.  

6. The hydraulic fluid shall be of the "less Flammable" type as defined in Factory Mutual Research Corporation (FMRC) data sheet 7-98 and shall be approved and listed in the FMRC Approval Guide. The fluid shall be recommended by the manufacturer for the service conditions to be encountered.  

7. All materials that normally come in contact with the hydraulic fluid shall be compatible with the fluid.
2.03 EQUIPMENT

A. General:

1. Each crane shall be a telescoping-boom hydraulic crane, and shall be mounted on a trailer equipped with cross-frame hydraulic outriggers. Power input to the hydraulic pump shall be by electric motor.

2. Cranes shall be designed per ANSI B30.5 and WAC 296-24 Part D. Trailers shall be standard highway vehicles.

3. The cranes and components shall be designed and arranged for serviceability and maintainability to the greatest extent practical. Items requiring normal periodic maintenance shall be readily accessible and not require disassembly of other components for access.

4. Each crane shall be provided with a power operated rotating hook equipped with cable remote control, in addition to the standard hook.

5. The drum grapple shall lift the 55 gallon or L-10 drum from the drum stack and place it into an overpack 85 gallon drum or overpack box on the ground adjacent to the crane, with manual assistance to lock onto and release from the drum.

6. Each crane shall meet the stability requirements of ANSI/SAE J-765 at maximum rated capacities, while mounted on the trailer equipped with outriggers.

7. Structural design of the cranes, trailers, and outriggers shall be in accordance with the requirements in UBC Section 1632, with the following factors:

   \[
   I = 1.25 \\
   Z = 0.2 \text{ (Zone 2B)} \\
   R_w = 4
   \]

B. Cranes:

1. Each crane shall be a telescoping-boom hydraulic crane with hydraulic boom extension/retraction, hydraulic boom raising/lowering, hydraulic boom rotation, and hydraulic winch.

2. Power input to the hydraulic pumps shall be from 480 volt electric motors as indicated on the Data Sheets in Appendix A.
3. Each crane shall be equipped with an anti-two-blocking device that positively prevents a two-block condition.

4. Each crane shall be provided with a Load Moment Indicator (LMI) that shall shut down crane movements that endanger crane stability.

5. Each crane shall be provided with radio remote control of boom extension/retraction, boom raise/lower, boom rotation, and winch raise/lower, in addition to the standard fixed control station attached to the crane.

C. Crane Trailers:

1. Each trailer shall be suitable and licensable for unrestricted over-the-road travel.

2. Each trailer shall be fitted with hydraulic cross-frame outrigger stabilizers capable of transferring the maximum crane vertical loads and overturning moments to the ground.

D. Power Rotating Hooks:

1. Each crane shall be provided with a power rotating hook suspended from the crane’s standard hook.

2. The power rotating hooks shall be sized for the respective cranes as shown on the Data Sheets in Appendix A.

3. The power rotating hooks shall be operated by cable electrical remote controls.

4. The power rotating hooks shall derive their power from the 480 volt crane services.

E. Drum Grapple:

1. The manual drum grapple shall lift 55 gallon or L-10 drums and place them into 85 gallon overpack drums or boxes.

2. The drum grapple shall be suspended from the power rotating hook on the drum retrieval crane.

F. Reliability and Maintainability (RAM) Requirements:

1. Each crane (including the controls and all associated equipment) shall have an operational availability of 99.9% or greater. The 99.9% minimum operational availability requirement includes all unplanned periods of downtime when the unit is not operational. Scheduled maintenance and diagnostic checks are excluded from the downtime figure.
Operational availability is defined as:

\[ Ao = \frac{MTBM}{MTBM + MTTM} \]

Where:

- \( Ao \) = Operational availability
- \( MTBM \) = Mean-time-between-maintenance (unplanned)
- \( MTTM \) = Mean-time-to-maintain clock hours to restore to full operations (assuming no administrative delays)

2. The Seller shall provide an estimate of \( MTBM \) and \( MTTM \) and provide the basis to substantiate the estimate (including actual data from testing or maintenance records).

3. Target values for \( MTBM \) and \( MTTM \) should be:
   a. \( MTBM \): Not less than 3,000 hours.
   b. \( MTTM \): Not more than 3.0 hours.

### 2.04 COMPONENTS

#### A. Motors:

1. Refer to Specification Section 16151, Electric Motors, for motor design specifications and details.

2. Motors shall be of a type recommended for hydraulic crane service and rated for the service required as specified in NEMA MG-1 and NFPA 70.

#### B. Instruments:

1. Manufacturer’s standard components shall be used, subject to meeting the criteria in this Specification Section.

2. Reference the Equipment Data Sheets in Appendix A for further definition of required instrumentation and controls.

#### C. Electrical:

1. Reference Specification Section 16152, Electrical Specification for Packaged Equipment, for details regarding electrical design requirements.

2. Power Supply:
   a. The crane’s hydraulic pumps shall be electrically powered from a 480 volt/3 phase/60 Hz portable skid located in the enclosure trench. Seller to provide one 100 foot long power supply cable for each crane to connect the cranes to the portable skid. The power supply cables shall
be SO cord for heavy usage, be permanently attached to the crane, and shall terminate in a 100 amp, 3 pole, 4 wire end plug, such as Meltric Corporation type DS, number 33-91043, or approved equal, with PVC protective cap.

3. Motor Starters:
   a. The Seller shall provide and mount motor starters complete with all necessary relay contacts.

4. Power feed to the power rotating hooks and man-basket shall be via cable feed from the crane trailer. Additional 120 V power shall be supplied to the man-basket, as indicated in Specification Section 14641. Seller shall provide and mount cable reels and step down transformers to supply 120 V power to the power rotating hooks and man-basket.

5. Provide green wire safety ground with all power circuits to the crane, power hooks, and Man Basket.

6. The power rotating hooks shall be supplied with strain relief and electrical receptacles to allow the power hooks and Man Basket to be removed from the cranes without the use of tools. See the data sheets in Appendix A.

D. Controls:

1. Each crane shall be equipped with both a fixed control station and a portable radio remote station. Control layout shall consider human factors in design to facilitate operator use. Controls shall be key locked against unauthorized operations.

2. Each fixed and radio station shall control rotation, boom angle, boom extension and retraction, and winch raise and lower. The fixed stations shall control all of the above, and in addition shall control electric drive motor on/off, enable and disable of the radio remote, and operation of the outriggers. Both stations shall have emergency stop.

3. The fixed control consoles shall be hinged or otherwise mounted to allow easy access to the valve bank. Control levers shall be mounted 40 to 50 inches above the platform.

4. A glycerine filled hydraulic system pressure gage and a calibrated bubble level shall be installed at the fixed control station.

5. The fixed station shall be furnished with durable weatherproof placards describing appropriate capacity data, operating instructions, and safety information.
6. All crane controls shall be capable of infinitely variable speeds, forward and reverse. Simultaneous motion shall not be restricted.

7. Radio controlled crane systems will utilize reduced bandwidth digital radio transceivers in the frequency band specified by the Hanford Site Frequency Manager. Seller shall coordinate frequency selections for the radio controllers (Buyer requires at least 6 months prior to operation).

8. Radio control system shall detect loss of signal and/or interference, and shall stop all crane movements in that event. The radio control system shall be manually reset following reestablishment of clear signal.

E. Turret:

1. The crane turret shall be welded structural steel fabricated from structural plates and shapes per AISC M016. The manufacturer shall specify the type and the construction. The turret shall rest on ball bearings.

2. The turret shall be hydraulically motorized for rotation. Rotation shall be 360° continuous. The turret drive shall have the ability to slip to reduce impact loads on the rotation system due to side loads on the boom. Turret gears shall comply with appropriate AGMA standards.

3. The turret shall be equipped with a spring-applied hydraulically-released brake. The brake shall have the ability to slip to reduce impact loads on the rotation system due to side loads on the boom.

F. Boom:

1. The boom shall provide proportional hydraulic extension and retraction under full load.

2. The boom shall provide hydraulic raising and lowering.

3. The boom sections shall telescope on lubricated wear pads.

4. A suitable boom rest shall be provided for use during transport and maneuvering.

5. The boom shall be welded structural steel fabricated from structural plates and shapes per AISC M016. The manufacturer shall specify the type and the construction to be furnished.

6. Holding valves shall prevent cylinder movement except under power.
G. Winch:

1. The crane shall be equipped with a boom mounted hydraulically powered winch. The load shall be lowered under power.

2. The load line shall be at least 200 feet of rotation resistant wire rope with a minimum safety factor of 5:1 at the maximum rated crane capacity.

3. The hoist design shall provide for plumb hook lift.

4. The rope sheaves shall be guarded so that wire ropes cannot leave the sheave groove.

5. All winch bearings shall be anti-friction with a minimum 25,000 hour L-10 bearing life as defined in AFBMA Standard 9 and 11.

6. All winch gears shall be mounted between bearings. No overhung gears will be allowed. All winch gears and pinions shall be pressed and keyed on the shaft or integral with the shaft. Winch gears shall comply with appropriate AGMA standards.

7. The winch drum shall be constructed of welded steel and shall be machined to match the wire rope.

8. Normal winch speed shall be approximately one half of the available speed shown on the data sheets.

9. In the event of power failure, the winch shall stop and hold the suspended load.

H. Standard Crane Hooks:

1. The forged steel hook design and testing shall be per ASME HST-4M, ANSI B30.10, and B30.17.

2. The hook shall be capable of 360 degrees swivel with bearing supported rotation. The rotation shall be capable of being locked in a fixed position for use with the power rotating hook.

3. The hook shall have a spring loaded safety latch to prevent the load from accidentally slipping off.

4. The hook shall have punch marks indicating throat opening distances for inspection purposes.
I. Power Rotating Hooks:

1. The forged steel hook design and testing shall be per ASME HST-4M, ANSI B30.10, and B30.17. Overall device design shall comply with ANSI B30.20.

2. The hook shall be capable of 360 degrees swivel in 1 minute.

3. The hook shall have a spring loaded safety latch to prevent the load from accidently slipping off.

4. The hook shall have punch marks indicating throat opening distances for inspection purposes.

5. Control of the rotation motor shall be by cable remote control with momentary push buttons for left and right rotation.

J. Anti-two-block device

1. The crane shall be equipped with an automatic device to prevent contact between the boom and the load block (a condition known as "two-blocking").

2. The anti-two-block device shall sense the position of the block and winch cable end attachments relative to the boom sheave case and shut down the "winch up" and "boom telescope out" functions that can cause two-blocking.

3. The anti-two-block device shall provide audible and visible warnings to alert the operator to impending two-block conditions.

K. Load Moment Indicator (LMI)

1. Each crane shall include an electronic LMI system customized for the trailer mounted configuration.

2. The LMI shall provide electronic display of boom angle, boom length, boom radius, boom tip height, relative load moment, maximum permissible load, and actual load at all possible ranges of the crane.

3. The LMI shall provide audible and visible warning at the fixed operator position to alert the operator to impending unsafe conditions, and shall lock out those crane functions that could lead to overload or instability.

4. The display for the LMI shall be mounted so that it is in a position that is visible from as large a portion of the crane trailer deck as possible.
L. Crane Trailer

1. Each trailer shall be fitted with a braking system that can be locked out so that the trailer can be maneuvered at the site without the aid of a tractor unit or any outside compressed air or electrical power source.

2. Each trailer shall be fitted with a towing tongue suitable for both over-the-road travel as well as maneuvering via an appropriate tow hook on the diesel powered fork lift truck, W113-FT-02-102. The tongue shall be capable of rapid removal and reattachment at the site without the use of tools.

3. Each trailer shall be provided with a removable counter-weight of a size that the seller determines is necessary to maintain stability of the crane when lifting the maximum anticipated loads as indicated on the Data Sheets in Appendix A.

4. The crane trailers shall include full sized decks to allow ease of personnel movement over the entire surface of the trailer. decking material shall be skid resistant, either open grating or solid, and non-combustible.

5. Each crane trailer shall be fitted with two fixed ladders for access to the deck from the ground. The ladders shall be at the approximate midpoint of each side of the trailer.

M. Outriggers

1. Each crane shall be equipped with four independently operated hydraulic jack and beam stabilizing outriggers.

2. Each outrigger shall have a minimum ground line penetration of 6 inches.

3. Cylinders shall be fully enclosed for protection against dirt and damage.

4. Each outrigger shall be fitted with the manufacturer’s standard ground pad, but not less than 18 inches square. The Buyer shall furnish cribbing for leveling and load distribution, if required.

5. Seller shall coordinate the outrigger configuration of the two cranes to ensure that the outriggers will not unduly interfere with each other, as indicated in the data sheets in Appendix A.
N. Hydraulic System

1. The hydraulic pump shall be sized for the power available from the electric motors specified in the data sheets in Appendix A, 50 HP for each crane.

2. The hydraulic system shall use standard components for ease of replacement and maintenance. All components shall comply with applicable National Fluid Power Association Hydraulic System Standards.

3. The fluid reservoir shall be sized to reduce heat build-up in the fluid and shall be equipped with sight level gage, breather, suction strainer, clean-out port, and magnetic drain plug. Fluid shall be 100% filtered.

4. The major components of the hydraulic system, including pump, reservoir, and controls shall be located over a leak tight drip pan to contain any fluid leakage that may occur during normal operations or maintenance.

O. Drum Grapple:

1. The drum grapple shall be furnished for 55 gallon drums conforming to ANSI MH2 DOT 17H and for L-10 drums, as indicated on the data sheets in Appendix A. Grapple design shall conform to ANSI B30.20.

2. The drum grapple shall be capable of operation with minimal manual intervention required to engage and disengage the grapple.

3. The drum grapple shall descend over the top of a lidded drum, grasp the drum just under the top rim, and maintain a positive hold on the drum while being maneuvered by the drum crane and the power rotating hook.

4. The drum grapple shall not wobble under either a no-load or loaded condition.

5. Upon reaching a terminal point, the drum grapple and drum shall be lowered directly into an 85 gallon overpack drum by the crane winch. The grapple shall be manually disengaged from the drum.

2.05 FABRICATION

A. The cranes are to be fully shop assembled and operable when delivered to the Buyer’s facilities.

B. Welding: Welding shall be per AWS D1.1 and D14.1, by certified welders.
C. Nameplates of corrosion-resistant metal shall be permanently attached to the crane components such as motors, pumps, and hand-held radio controls. In addition to the manufacturer's name, the following information shall be included:

1. Model number
2. Serial number
3. Contract number and date - month and year
4. Date of manufacture - month and year
5. Capacity
6. Parent item tag number from Appendix A

D. Tag Number Display

1. The tag number from Appendix A of each crane, power rotating hook, and the drum grapple shall be displayed on the item in a prominent location. This number shall be in letters at least 2 inches high and of a style and contrasting color to be easily visible from a distance of 20 feet. The tag numbers of the cranes shall be displayed on each side of the boom. The tag numbers of the power rotating hooks shall be displayed on two opposite sides of the motor housing. The tag number of the drum grapple shall be displayed on each side.

2. The tag number of each crane shall also be prominently displayed in a location visible from the fixed control station.

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality control requirements.

PART 3 EXECUTION

3.01 PREPARATION Not Used
3.02 ERECTION, INSTALLATION & APPLICATION Not Used
3.03 FIELD QUALITY CONTROL Not Used
3.04 ADJUSTING AND CLEANING Not Used
3.05 DEMONSTRATION

A. Division 1.0 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for the product(s) contained in this specification, which may also be used by the Seller in preparing the system ATP's.

B. All equipment shall be operationally checked in all specified operating modes, and under all conditions of service necessary to assure acceptable operation. The test shall include verification that the cranes, outriggers, power hooks, and drum grapple operate satisfactorily in all operating modes specified, and that all alarms, indicators, safety devices and interlocks are set correctly and function properly.

1. Check crane rotation, rope clearances, boom and winch raising and lowering, drum grapple functions and the functioning of all safety devices.

2. Check proper functioning of power supply systems and power supply cables to power receptacles.

3. Check running speeds for all motions and compare with theoretical values. Results should not vary by more than 15%.

4. A complete operational test shall be performed on the crane assemblies per ANSI B30.5, incorporating but not limited to the following:
   a. Crane rotation
   b. Boom extension and retraction
   c. Winch raising and lowering
   d. Outrigger extension and retraction
   e. Load Moment Indicator operations
   f. Anti-two-blocking device operation
   g. Power rotating hook operation
   h. Drum grapple grip, lifting, and release, including satisfactory lowering and release into an 85 gallon overpack drum.
   i. Proof load testing to 110% of rated capacity at extremes of range of motion
C. Following the successful completion of the demonstration in 3.05.B, the cranes, power hooks, and drum grapple shall be placed in temporary storage in accordance with the manufacturer's instructions. The equipment shall not be used to assist in the construction of the W113 facilities.

3.06 PROTECTION: Not Used

END OF SECTION
## APPENDIX A

### EQUIPMENT DATA SHEETS

<table>
<thead>
<tr>
<th>Service</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drum Retrieval Crane</td>
<td>W113-CR-02-101</td>
</tr>
<tr>
<td>Man-Basket Crane</td>
<td>W113-CR-02-104</td>
</tr>
<tr>
<td>Drum Grapple</td>
<td>W113-RT-02-103</td>
</tr>
<tr>
<td>Drum Retrieval Crane Power Rotating Hook</td>
<td>W113-RT-02-105</td>
</tr>
<tr>
<td>Man-Basket Crane Power Rotating Hook</td>
<td>W113-RT-02-106</td>
</tr>
</tbody>
</table>
## CRANE

**NAME:** DRUYRECR~EVALCR~~NE

**CUSTOMER & LOCATION**
- WHC
  - Location: HANFORD, WA

**PROJECT**
- SWOC MODULE W113

**RAYTHEON JOB NO.**
- 9164.006

**DATE:**
- 08/04/96

**SPEC. NO.**
- 14640

**BY:**
- M. Perovich

### CONDITIONS OF SERVICE

**UNIT LOAD DESCRIPTION:** 55 GALLON AND L-10 DRUMS AND VACUUM HOSE

**UNIT LOAD SIZE:**
- 55 GALLON DRUMS: 24" DIA. X 34-5/8" HIGH
- L-10 DRUMS: 24" DIA. X 72" HIGH

**UNIT LOAD WEIGHT:**
- 1,000 LBS DRUM OR HOSE
- 300 LBS POWER HOOK AND GRAPPLE

**RATED MAX CAPACITY:**
- 14,000 LBS AT 4' RADIUS
- 1,730 LBS AT 28' RADIUS (DRUM)
- 1,730 LBS AT 32' RADIUS (HOSE)

**NEC AREA CLASS:** UNCLASSIFIED

**AVAILBLE POWER:** 480V/3P/60 HZ

**IMPACT LOADING:** LIGHT

**LOCATION:** INDOORS UNHEATED

**DUTY:** 20 DRUMS/8 HOUR SHIFT

**UBC SEISMIC ZONE:** 2B

### CONSTRUCTION

**EQUIP. WEIGHT:**
- 10,000 LBS

**BARE ERECTED SIZE:**
- 8' WIDE X 20' LONG X 14' HIGH

**BRAKES:** AIR OPERATED HIGHWAY BRAKES

**TONGUE:** REMOVABLE

**HITCH AXLE:** 180 DEGREE ROTATION

**DECK:** SKID-RESISTANT, NON-COMBUSTIBLE

### ELECTRICAL

**MOTOR DESCRIPTION:** MOTOR WITH STARTER

**EQUIP. MOTOR HP/KVA NAMEPLATE:** 54.9 KVA

**EQUIP. MOTOR VOLTAGE:** 480

**VOLTAGE PHASE:** 3

**FREQUENCY:** 60 HZ

**EQUIP. MOTOR RPM:** 1800

**NEMA RATING:** 4 (OUTDOORS)

**MAXIMUM MOTOR HORSEPOWER:** 50 HP

**BOOM END LOAD:**
- 120 V/1PH/60 HZ, 1/2 HP

**NOTES:**
1. TO BE CONFIRMED BY VENDOR.
2. SEE PAGES 3-6 FOR LOAD REACH DIAGRAMS. RADII MEASURED HORIZONTALLY.
3. DERATE CRANE BY 25%. REQUIRED CAPACITY IS 133% OF DRUM OR HOSE (1,000 LBS) + POWER HOOK + GRAPPLE (300 LBS), OR 1,730 LBS RATED CAPACITY.
OUTRIGGERS FOR W113-CR-02-104

OUTRIGGERS ON TWO CRANES SHALL BE STAGGERED SO CRANES CAN BE PARKED WITHIN 6' OF EACH OTHER.

COUNTER WEIGHT

REMOVABLE TONGUE

FIXED LADDER

ELEVATION

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>A: 8'-0&quot;</th>
<th>C: 20'-0&quot;</th>
<th>E: 3'-11&quot; MAX</th>
<th>G:</th>
<th>J:</th>
<th>L:</th>
<th>N:</th>
</tr>
</thead>
<tbody>
<tr>
<td>B: 7'-6&quot;</td>
<td>D: 18'-6&quot;</td>
<td>F: 14'-6&quot;</td>
<td>H:</td>
<td>K:</td>
<td>M:</td>
<td>P:</td>
<td></td>
</tr>
</tbody>
</table>

08-10-95

CAD NO: CR101
REACH DIAGRAM PLAN
FOR VACUUMING SOIL

DIMENSIONS:

A:  C:  E:  G:  J:  L:
B:  D:  F:  H:  K:  M:

08-07-95  CAD NO: CR101A
REACH DIAGRAM PLAN
FOR DRUM RETRIEVAL AND PLACEMENT

DIMENSIONS:

REACH DIAGRAM ELEVATION
FOR DRUM RETRIEVAL AND PLACEMENT

DIMENSIONS:

| A | B | C | D | E | F | G | H | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
### Equipment Data Sheet

**Name:** Man Basket Crane  
**Tag No:** W113-CR-02-104  
**Page:** 1 of 6

**Customer & Location:**  
**Project:** SWOC Module W113  
**Raytheon Job No.:** 9184.006  
**Date:** 08/04/96  
**Spec. No.:** 14640  
**By:** M. Pervich

#### Conditions of Service

**Unit Load Description:** Man Basket, Waste Boxes, and Vacuum Hose  
**Winch Hoisting Speed:** 0 to 80 FPM, Variable  
**Winch Extending Speed:** 60 Feet in 45 Seconds  
**Boom Extending Speed:** 60 Feet in 30 Seconds  
**Boom Retracting Speed:** 60 Feet in 30 Seconds  
**Boom Raising Speed:** 0 to +80 Degrees in 20 Sec.  
**Boom Lowering Speed:** +80 to 0 Degrees in 15 Sec.  
**Rotation Speed:** 360 Degrees at 1 RPM Continuous  
**Extended Boom Length:** 60 Feet in 3 Sections  
**Location:** Indoors Unheated  
**Ubc Seismic Zone:** 2B

#### Construction

**Equip. Weight:** 40,000 lbs  
**Bare Erected Size:** 8' Wide X 20' Long X 14' High  
**Type:** Infinitely Variable, Forward and Reverse  
**Configuration:** (1) Fixed and (1) Radio Remote  
**Brakes:** Air Operated Highway Brakes  
**Tongue:** Removable  
**Hitch:** 180 Degree Rotation  
**Deck:** Skid-Resistant, Non-Combustible

#### Electrical

**Motor Description:** Motor with Starter  
**Nema Rating:** 4 (Outdoors)  
**Equip. Motor HP/KVA Nameplate:** 56.0 KVA  
**Maximum Motor Horsepower:** 50 HP  
**Equip. Motor Voltage:** 460  
**Boom End Loads:** 120 V/1PH/60 Hz, 1/2 + 3/4 HP  
**Voltage Phase:** 3  
**Frequency:** 60 Hz  
**Equip. Motor RPM:** 1800

### Notes

1. To be confirmed by vendor  
2. See Pages 3-6 for Load Reach Diagrams. Radii Measured Horizontally.  
3. Derate Crane by 50%. Required Capacity is 200% of Actual Load of Basket (5,450 LBS) + Power Hook (1,200 LBS), or 13,300 lbs rated capacity.  
4. Derate Crane by 25%. Required Capacity is 133% of Actual Load of Box (15,000 LBS) + Power Hook (1,200 LBS), or 21,550 lbs rated capacity.  
5. Derate Crane by 25%. Required Capacity is 133% of Actual Load of Hose (1,000 LBS) + Power Hook
OUTRIGGERS FOR W113-CR-02-101

OUTRIGGERS ON TWO CRANES SHALL BE STACKED SO CRANES CAN BE PARKED WITHIN 6' OF EACH OTHER.

PLAN

COUNTER WEIGHT

REMOVABLE TONGUE

FIXED LADDER

ELEVATION

DIMENSIONS:

A: 8'-0"  C: 20'-0"
B: 9'-0"  D: 25'-0"
E: 3'-11" MAX  F: 14'-0"

08-10-95  CAD NO. CR104
REACH DIAGRAM PLAN
FOR SOIL VACUUMING

DIMENSIONS:

<table>
<thead>
<tr>
<th>A:</th>
<th>C:</th>
<th>E:</th>
<th>G:</th>
<th>J:</th>
<th>L:</th>
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<td>B:</td>
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<td>F:</td>
<td>H:</td>
<td>K:</td>
<td>M:</td>
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</table>

NAME: MAN-BASKET CRANE
TAG NO: W113-CR-02-104
RAYTHEON JOB NO. 9184.008
SPEC. NO. 14840
DATE: 06-04-95
BY: M. PERVICH
REACH DIAGRAM PLAN
BASKET OPERATIONS

DIMENSIONS:

A:  
C:  
E:  
G:  
J:  
L:  
N:  
B:  
D:  
P:  
H:  
K:  
M:  
P:
REACH DIAGRAM ELEVATION

BASKET OPERATIONS
## CONDITIONS OF SERVICE

- **UNIT LOAD DESCRIPTION:** 55 GALLON OR L-10 DRUMS
- **OPERATION:** MANUAL GRAB AND RELEASE ACTIONS
- **UNIT LOAD SIZE:** 55 GALLON DRUMS; 24" DIA. X 34-5/8" HIGH  
  L-10 DRUMS; 24" DIA X 72" HIGH
- **UNIT LOAD WEIGHT:** 1,000 LBS
- **IMPACT LOADING:** LIGHT
- **LOCATION:** INDOORS UNHEATED
- **DUTY:** 20 DRUMS/8 HOUR SHIFT

## CONSTRUCTION

- **EQUIP. WEIGHT:** 18 LBS
  (NOTE 1)
- **BARE ERECTED SIZE:** 16' WIDE X 10' LONG X 22' HIGH
- **CONTROLS:** NONE

## ELECTRICAL

- **NOT APPLICABLE**

## NOTES:

1. TO BE VERIFIED BY VENDOR.

2. GRAPPLE SHALL LOWER 55 GALLON WASTE DRUM TO THE BOTTOM OF 85 GALLON OVERPACK DRUM WITHOUT INTERFERENCE AND WITHOUT DROPPING THE 55 GALLON DRUM. GRAPPLE SHALL BE MANUALLY REMOVED FROM 55 GALLON DRUM AND LIFTED OUT OF THE 85 GALLON OVERPACK WITHOUT INTERFERENCE.
55 GALLON OR L-10 CONTAINERS
MAX COVER OD

OVERALL HEIGHT

F (L-10 CONTAINER MAX WITH COVER)
E (85 GALLON WITHOUT COVER)
D (55 GALLON MAX WITH COVER)

55 GALLON ID
85 GALLON ID
L-10 CONTAINER ID

ELEVATION

DIMENSIONS:
A: 22 1/2"
B: 26"
C: 22 1/2"
D: 34 3/4"
E: 38 5/8"
F: 69 1/2"
G: 24"
J:
L:
N:
K:
M:
P:
<table>
<thead>
<tr>
<th>CONDITIONS OF SERVICE</th>
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<tr>
<td>UNIT LOAD SIZE: 55 GALLON DRUMS; 24&quot; DIA. X 34-5/8&quot; HIGH</td>
</tr>
<tr>
<td>L-10: DRUMS; 24&quot; DIA. X 72&quot; HIGH</td>
</tr>
<tr>
<td>UNIT LOAD WEIGHT: 1,000 LBS</td>
</tr>
<tr>
<td>RATED HOOK CAPACITY: 2,000 LBS</td>
</tr>
<tr>
<td>NEC AREA CLASS: UNCLASSIFIED</td>
</tr>
<tr>
<td>AVAILABLE POWER: 480V/3P/60 HZ</td>
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<tr>
<td>IMPACT LOADING: LIGHT</td>
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<tr>
<td>LOCATION: INDOORS UNHEATED</td>
</tr>
<tr>
<td>DUTY: 20 DRUMS/8 HOUR SHIFT</td>
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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>EQUIP. WEIGHT: 250 LBS ESTIMATED</td>
</tr>
<tr>
<td>BARE ERECTED SIZE: TBD</td>
</tr>
<tr>
<td>MOTOR BRAKE: SPRING SET, ELECTRICALLY RELEASED</td>
</tr>
<tr>
<td>DESIGN FACTOR: 5:1</td>
</tr>
<tr>
<td>LOAD HOOK: 1 TON</td>
</tr>
<tr>
<td>SHOCK CLUTCH: ON FINAL DRIVE PINION</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>ELECTRICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR DESCRIPTION: MOTOR WITH STARTER</td>
</tr>
<tr>
<td>NEMA RATING: 4 (OUTDOORS)</td>
</tr>
<tr>
<td>EQUIP. MOTOR HP/KVA NAMEPLATE: 1/2 HP</td>
</tr>
<tr>
<td>MOTOR HORSEPOWER: 1/2 HP</td>
</tr>
<tr>
<td>EQUIP. MOTOR VOLTAGE: 120</td>
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<tr>
<td>ADDITIONAL LOADS BELOW HOOK: NONE</td>
</tr>
<tr>
<td>VOLTAGE PHASE: 1</td>
</tr>
<tr>
<td>MOTOR STARTER LOCATION: CRANE TRAILER</td>
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<tr>
<td>EQUIP. MOTOR RPM: 3600</td>
</tr>
<tr>
<td>FREQUENCY: 60HZ</td>
</tr>
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</table>

NOTES:
1. TO BE CONFIRMED BY VENDOR
2. DERATE HOOK BY 25%. REQUIRED CAPACITY IS 133% OF DRUM (1,000 LBS), OR 1,330 LBS RATED CAPACITY.
POWER ROTATING HOOK

EQUIPMENT DATA SHEET

TAG NO: W113-RT-02-105

CUSTOMER & LOCATION
WHC HANFORD, WA.

PROJECT
SWOC-W113

NAME: DRUM RETRIEVAL CRANE
POWER ROTATING HOOK

RAYTHEON JOB NO. 9164.006
DATE: 08-04-95

SPEC. NO. 14640
BY: M. PERVICH

 DIMENSIONS:

A: TBD C: TBD E: TBD G: TBD J: TBD L: N: 
B: TBD D: TBD F: TBD H: TBD K: TBD M: P: 

"H" "A" "B" APPROX. "F" "E" "G" "D" "K" "J" 

ROTATE DRIVE JUNCTION BOX 

CAP. 2,000 LBS 

LETTERS BOTH SIDE 

STEEL CRANE HOOK W/ LATCH 

MOTOR W/ BRAKE 

"H"
# Power Rotating Hook Equipment Data Sheet

## Conditions of Service

<table>
<thead>
<tr>
<th>Load Description: Man Basket, Waste Boxes</th>
<th>Rotation Speed: 1 RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Sizes: Man Basket: 3' Wide x 7.5' Long x 7' High</td>
<td>Rotation Range: 360 Degrees Continuous</td>
</tr>
<tr>
<td>Waste Boxes: 8' Wide x 12' Long x 6' High</td>
<td></td>
</tr>
<tr>
<td>Load Weights: Basket: 5,450 LBS Loaded</td>
<td></td>
</tr>
<tr>
<td>Waste Boxes: 15,000 LBS</td>
<td></td>
</tr>
</tbody>
</table>

**Rated Hook Capacity:** 20,000 LBS  
**Nec Area Class:** Unclassified  
**Available Power:** 480V/3P/60 Hz  
**Impact Loading:** Light  
**Location:** Indoors Unheated  
**Duty:** Intermittent During 8 Hour Shift

## Construction

<table>
<thead>
<tr>
<th>Equip. Weight: 1,200 LBS Estimated</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare Erected Size: 27&quot; Wide x 32&quot; Long x 40&quot; High</td>
<td>Type: Momentary Pushbuttons, Left/Right</td>
</tr>
<tr>
<td>Motor Brake: Spring Set, Electrically Released</td>
<td>Configuration: Pendant on 20 Foot Coiled Cable</td>
</tr>
<tr>
<td>Design Factor: 5:1</td>
<td>Emergency Stop: On Pendant</td>
</tr>
<tr>
<td>Load Hook: 10 Ton</td>
<td></td>
</tr>
<tr>
<td>Shock Clutch: On Final Drive Pinion</td>
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</tr>
</tbody>
</table>

## Electrical

<table>
<thead>
<tr>
<th>Motor Description: Motor with Starter</th>
<th>Nema Rating: 4 (Outdoors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equip. Motor HP/KVA Nameplate: 1/2 HP (Note 1)</td>
<td>Motor Horsepower: 1/2 HP (Note 1)</td>
</tr>
<tr>
<td>Equip. Motor Voltage: 120 (Note 1)</td>
<td>Additional Loads Below Hook: 1.2 KVA</td>
</tr>
<tr>
<td>Voltage Phase: 1 (Note 1)</td>
<td>Motor Starter Location: Motor Housing</td>
</tr>
<tr>
<td>Frequency: 60Hz</td>
<td></td>
</tr>
<tr>
<td>Equip. Motor RPM: 3600 (Note 1)</td>
<td>Hook Receptacle: Nema L5-20</td>
</tr>
</tbody>
</table>

**Notes:**
1. To be confirmed by vendor.
2. Derate hook by 50%. Required capacity is 200% of basket maximum weight (5,450 LBS), or 10,900 LBS rated capacity.
3. Derate hook by 25%. Required capacity is 133% of box weight (15,000 LBS), or 20,000 rated capacity.
POWER ROTATING HOOK

NAME: MAN-BASKET CRANE POWER ROTATING HOOK
TAG NO: W113-RT-02-105

CUSTOMER & LOCATION
WHC HANFORD, WA.

PROJECT
SWOC-W113

RAYTHEON JOB NO.
9154.006

SPEC. NO. 14640

DATE: 08-04-95

BY:

EQUIPMENT DATA SHEET

Motor
W/ Brake

Junction box for power below hook. Receptacle by seller

Steel crane hook w/ latch

Dimensions:

A: 10"    C: 10"    E: 4 3/4"    G: 32"    J: 27"    L:    N:
B: 24"    D: 3 5/8"    F: 3 1/4"    H: 4"    K: 3"    M:    P:
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<td>3.06</td>
<td>PROTECTION:</td>
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APPENDIX

APPENDIX A DATA SHEETS

September 1995 14641 - 1 RAYTHEON PROJECT 9164.006
SECTION 14641

MAN BASKET

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the minimum design, fabrication, installation, and testing requirements of the man basket and all appurtenances.

1.02 RELATED SECTIONS

A. Section 16152 Electric Specification For Packaged Mechanical Equipment
C. Section 05100 Structural Steel and Miscellaneous Metals
D. Section 14640 Cranes, Rotating Hooks, and Drum Grapple
E. Section 13451 Health Physics Instrumentation

1.03 REFERENCES

A. Applicable Codes and Standards: Codes, specifications and standards referred to by number or title, shall form a part of this specification to the extent required by the references hereto.

B. American Institute of Steel Construction (AISC):
   1. AISC M016-89 Manual of Steel Construction

C. American Society for Testing and Materials (ASTM):
   1. ASTM A-36-91 Structural Steel

D. American Welding Society (AWS):
   1. AWS D1.1-90 Structural Welding Code-Steel

I. United States Code of Federal Regulations (CFR), 1990:
   1. CFR Title 29, Occupational Safety and Health
      Parts 1910 and 1926 Standards (OSHA)

J. National Fire Protection Association (NFPA):
   1. NFPA 70-90 National Electric Code
K. Washington Administrative Code (WAC):

1. WAC 296-155-24510 Fall Restraint, Fall Arrest Systems

1.04 SYSTEM DESCRIPTION

A. The Man Basket will be used for inspecting, monitoring the, and attaching the grapple to the drums being lifted by the Drum Retrieval Crane. The man basket will be suspended from a hook on the man basket crane, W113-CR-02-104. Design of the man basket shall comply with 29 CFR 1926.550(g)(4) and WAC 296-155-24510.

B. The man basket shall be furnished with steel radiation shielding, both fixed position and movable. The basket shall have lead glass shielding windows to provide the occupants with a view to the outside.

C. The man basket shall be furnished with electrical power for an air sampler and a convenience outlet.

1.05 SUBMITTALS

A. Reference Division 1.0, Submittals, for details regarding the standard submittal schedule, distribution and number of copies required.

B. The following submittals, required for this Section, are to be provided for review and approval.

1. Data Sheets: The Buyer’s requirements are provided on the Equipment Data Sheets provided in Appendix A. The Seller shall verify and/or provide information as requested on the data sheets.

2. Drawings:

a. Equipment outline (general arrangement) drawings showing dimensions, required clearances, weight, location and description of mechanical and electrical interfaces, and location of major components.

b. Electrical wiring diagrams, connection diagrams, and schematics, with electrical characteristics and connection requirements.

3. Test and inspection reports indicating test results that verify compliance with this specification and assure delivery of a quality product.
C. The following data shall be provided for information and record.

1. Descriptive Literature: Descriptive literature shall include catalog cut-sheets showing general product information.

2. List of recommended spare and maintenance parts with unit pricing, and list of local suppliers of spare parts in the Washington State area.

3. Operation and Maintenance information, including normal and emergency operating procedures, initial and daily startup procedures, temporary storage procedures, maintenance intervals and procedures, maintenance parts and materials requirements, safety inspection procedures, and problem trouble-shooting procedures.


5. Calculations
   a. Calculations demonstrating the integrity of the structural design of the basket, personal fall protection anchorages, and suspension system.
   b. Mill test reports for chemical and physical properties and material certifications that verify compliance with standards for structural and shielding steel plates and shapes and for fasteners and bridle components.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage, and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this Specification, and subject to compliance with the requirements herein, the following list of manufacturers is identified. Procurement need not be limited to these listed manufacturers.

1. Basket
   a. United States Crane
   b. Lifting Technologies
2. Shield windows
   a. Hot Cell Services

2.02 MATERIALS

A. General:
   1. All castings and forgings shall be free from scale and mismatching. No process such as peening, plugging or filling with solder or paste shall be used for reclaiming any defective part.

   2. All material shall be specified and procured in accordance with a recognized U. S. specification (ASTM, UNS, SAE, etc.).

   3. The seller’s standard primer and finish paints shall be applied to each piece of equipment subject to corrosion. The color shall be high-visibility yellow or orange. Floor shall be unpainted galvanized steel.

   5. All materials and components shall be of new and current manufacture.

2.03 EQUIPMENT

A. General:
   1. The man basket shall be as indicated in the data sheets in Appendix A.

   2. The basket shall comply with the requirements of 29 CFR 1926.550(g)(4).

2.04 COMPONENTS

A. Basket:
   1. The factor of safety for the basket structure and bridle shall be 5:1 and shall be based upon the entire gross weight of the loaded basket including framework, shielding, and occupant loading.

   2. The door to the basket shall open only inward and shall have positive latches to retain the door in the closed and open positions. The closed latch must be operable from both the inside and outside.

   3. The basket shall have overhead protection from falling objects.

   4. The basket framework shall be fitted with three fall restraint anchorages meeting the requirements of WAC 296-155-24510(1).
B. Radiation Shielding:

1. The basket shall be furnished with radiation shielding, as shown on the data sheets in Appendix A.

2. The fixed shielding walls shall be removable and fastened in place with hex head bolts and nuts. Fasteners shall be plated for corrosion resistance. Upper and lower wall sections shall be separate pieces so that the upper sections may be removed independently of the lower sections.

3. The floor shall be hot dipped galvanized skid resistant plate steel. The floor shall be tack welded in place followed by touch up of the galvanizing damaged by the welding.

4. Movable shielding panels shall be provided for the front of the basket. They shall move from side to side on ball or roller bearing rollers with one panel on the outer track and two panels on the inner track. Each panel shall have a positive means of locking the panel in the center and end positions.

5. Lead glass shield windows shall be installed where indicated in the data sheets in Appendix A.
   a. The shield windows shall be 1/2 inch thick lead glass of 3.3 g/cm², 30% lead by weight, or approved equal. The surfaces shall be polished for optical clarity.
   b. The window frame shall be designed to prevent radiation streaming between the glass and the wall to which the window is mounted.

6. Seller shall provide two extra end and one extra front lower shield plates, 1/4" in thickness. These extra plates shall be approximately 3'-7" tall and designed to fit on the outside of the man basket to provide additional shielding when required. They shall be trial fitted to the basket prior to shipping but shall be shipped loose.

C. Electrical:

1. Reference Specification Section 16152, Electrical Specification for Packaged Equipment, for details regarding electrical design requirements.

2. The basket shall be provided with one 120 V, 20 A circuit terminating in two single twist-lock NEMA L5-20 receptacles in a two gang box, as indicated on the data sheets in Appendix A. Power shall be supplied to the receptacle via a cable connecting to the NEMA L5-20 twist-lock receptacle on the man basket power rotating hook, W113-RT-02-106, as described in section 14640.
3. The basket and electrical system shall be grounded via a green wire ground wire through the receptacle on the man basket power rotating hook.

4. All electrical enclosures shall be NEMA 12.

D. Test weights

1. The seller shall include a set of calibrated and marked test weights for use in periodic load testing of the basket at 125% of the rated maximum gross capacity.

2.05 FABRICATION

A. The basket shall be fully shop assembled and operable when delivered to the Buyer’s facilities.

B. Welding: Welding shall be per AWS D1.1, by certified welders.

C. A nameplate of corrosion-resistant metal shall be permanently attached to the basket. In addition to the manufacturer’s name, the following information shall be included:

1. Model number
2. Serial number
3. Contract number and date - month and year
4. Date of manufacture - month and year
5. Capacity, in number of persons and weight
6. Empty weight, including bridle

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality control requirements.

PART 3 EXECUTION

3.01 PREPARATION Not Used

3.02 ERECTION, INSTALLATION & APPLICATION Not Used

3.03 FIELD QUALITY CONTROL Not Used

3.04 ADJUSTING AND CLEANING Not Used

3.05 DEMONSTRATION
A. **Division 1.0** delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for the product(s) contained in this specification, which may also be used by the Seller in preparing the system ATP's.

B. All equipment shall be operationally checked in all specified operating modes, and under all conditions of service necessary to assure acceptable operation.

1. Check functioning, including latches, of basket entry door and sliding shield panels.

2. Check proper functioning of basket electrical power circuit.

3. Proof load testing to 125% of rated capacity using the test weights supplied by the manufacturer.

C. Following the successful completion of the demonstration in 3.05.B, the man basket shall be placed in temporary storage in accordance with the manufacturer's instructions. The equipment shall not be used to assist in the construction of the W113 facilities.

**3.06 PROTECTION: Not Used**

**END OF SECTION**
## APPENDIX A

### EQUIPMENT DATA SHEET

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>ITEM NUMBER</th>
</tr>
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<tbody>
<tr>
<td>Man-Basket</td>
<td>W113-X-02-103</td>
</tr>
</tbody>
</table>

This flag specified on the drawing/spec denotes critical radiation shielding dimension or material of construction. Sign off of this stamp certifies all minimum radiation shielding dimensions and/or material of construction have been complied with.

Radiation Shielding Engineer: Walter Guy Rhoden
Printed Name: Walter Guy Rhoden
Signature: Walter Guy Rhoden
Date: 9/20/95

September 1995 14641 - A1  RAYTHEON PROJECT 9164.006
Rev 0
## Equipment Data Sheet

**Name:** MAN BASKET  
**Tag No.:** W113-X-02-103  
**Page:** 1 of 3

### Customer & Location

- **Customer:** WHC  
- **Location:** HANFORD, WA

### Project

- **Project:** SWOC MODULE  
- **Module:** W113

### Construction

- **Empty Weight:** 4,700 LBS  
- **Occupied Weight:** 5,450 LBS  
- **Bare Erected Size:** 3' Wide x 7.5' Long x 7.5' High

### Electrical

- **Equipment Motor HP/KVA Nameplate:** 1.2 KVA Maximum  
- **Voltage:** 120  
- **Voltage Phase:** 1  
- **NEMA Rating:** 12  
- **Receptacles:** L5-20 Twist Lock, 2 EA.  
- **Plug:** P5-20 Twist-Lock, 1 EA.

### Notes

- **Note 1:** Vendor to confirm
- **Note 2:** Seller coordinate with receptacle on power hook, W113-RT-02-106, specification section 14640  
- **Note 3:** Includes 1/4" additional shielding from Spec paragraph 2.04.B.6.
# SECTION 15800
DUCTWORK AND ACCESSORIES

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SECTION 15800

DUCTWORK AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the minimum technical requirements for the design, fabrication, materials of construction, and installation of HVAC ductwork and accessories.

1.02 RELATED SECTIONS

A. Section 13452 Isokinetic Effluent Monitoring System

1.03 REFERENCES

A. National Fire Protection Association (NFPA):
   1. NFPA 90A-1989 Installation of Air Conditioning and Ventilating Systems

B. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
   1. HVAC Duct Construction Standards, Metal and Flexible - 1985 (DCS).

C. American Welding Society (AWS):
   1. AWS D1.1-92 Structural Welding Code, Steel
   2. AWS D1.3-89 Specification for Welding Sheet Steel in Structures
   3. AWS D9.1-90 Sheet Metal Welding Code

D. American Society for Testing and Materials (ASTM):
   1. ASTM A525-91 Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
1.04 SYSTEM DESCRIPTION

A. Ductwork and accessories are utilized for exhaust air ducts containing isokinetic samplers.

B. Type of accessories required include the following:
   1. Flexible connections
   2. Access doors
   3. Gaskets and Sealants
   4. Bird Screening

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Ductwork Drawings: Submit (for Review and Approval) shop drawings, drawn to scale, of complete duct layout.
   1. Indicate all flexible connections, access doors, and accessories.
   2. Note any potential interferences with conduit, structural elements, equipment and building features.

C. Equipment Data: Submit (for Information and Records) data on all products specified hereunder to include physical dimensions, configuration, materials of construction and other information as required to demonstrate compliance with these Specifications.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

B. Prefabricated ductwork shall be delivered factory wrapped such that it will be protected from dirt, debris, crushing and bending.

C. Store the ductwork and accessories to protect from weather and construction traffic. When stored outdoors, enclose the equipment with weatherproof wrapping.
D. Deliver sealant materials to site in original unopened containers or bundles.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Ductwork, fittings, duct sealer.
   a. United McGill Corporation
   b. Semco Mfg. Inc.

2.02 MATERIALS

A. Ductwork: Spiral seam, 16 gauge, galvanized steel to ASTM A525, with rolled angle ring flange joints, in accordance to SMACNA DCS and Round Industrial Duct Construction Standards.

2.03 EQUIPMENT

A. Flexible Connections at Fan: Provide between fans and their connecting ductwork as shown on the Drawings.

1. Connectors shall be of 30 ounce-per-square-yard tightly woven neoprene-coated glass fabric prefabricated with 24 gauge galvanized steel mounting strips.

2. Connector fabric and metal edges shall be 10 inches wide maximum with an active length of 3 to 4 inches, and shall be securely fastened to the unit and adjacent ductwork in a manner that provides a leaktight connection while permitting easy adjustment or removal.

3. Misalignment between equipment and its connecting ductwork shall not be taken up in a flexible connection.

4. Duct ends of flexible connectors shall be supported and positioned such that they do not tension the fabric.
B. Duct Sealer:

1. All ducts shall be sealed as Class C ductwork in accordance with the SMACNA HVAC DCS.

2. Sealing shall include all joints, holes and other openings.

C. Isokinetic Sampler: HVAC duct Seller shall be provided duct penetration interface requirements from the Isokinetic Sample System (ISS) Seller (reference to Specification Section 13452).

D. Bird Screens: Shall be constructed of galvanized steel with no smaller than \( \frac{3}{8}'' \times \frac{3}{4}'' \) mesh.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION

A. Duct elbows shall be five segment mitered elbows.

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Supports:

1. Supports for ductwork and ductwork-connected equipment plus other specialties and accessories shall be in accordance to SMACNA DCS, and installed in a manner that will not result in or produce excessive stress, deflection, swaying, sagging or vibration in the ductwork or in the building structure either during erection, cleaning, testing or normal operation of the system. Ductwork shall not be so restrained as to cause it to snake or buckle between supports or anchors or to prevent movement due to expansion and contraction.

2. Ductwork shall be installed at equipment such that equipment can be disconnected and removed without further supporting the ductwork. Ductwork shall not introduce any strains or distortion to the connected equipment.

3. Coordinate the location of the ductwork support system with that of all other installations.
4. Hangers and supports shall be installed complete, including lock nuts, rods, bolts, couplings, swivels, inserts and required accessory items, all in accordance with SMACNA DCS as applicable. All bolts, nuts, washers, screws, and other fasteners shall be cadmium plated, stainless steel or otherwise corrosion resistant.

5. Ductwork shall be supported individually, and not in combination with piping, conduit, and similar items, unless shown otherwise on Contract Drawings.

B. Welding of Ductwork and Hangers: Welding procedures, welders, and welding operators shall be AWS qualified. For material thicknesses greater than or equal to 0.125 inches, AWS D1.1 shall be used. Sheet metal shall be welded in accordance with AWS D9.1. Production welds shall be visually inspected in accordance with AWS D1.1, AWS D1.3, or AWS D9.1 as applicable. Acceptance criteria for welds produced to AWS D1.1 shall be per Sections 8.15 and 10.17 of AWS D1.1. Acceptance criteria for welds produced per AWS D1.3 shall be to AWS D1.3. Acceptance criteria for welds produced per AWS D9.1 shall be to AWS D9.1. Procedures and qualification records shall be made available to the Buyer, if requested.

C. Coordinate Isokinetic Sampler System 4" flange as specified in Specification Section 13452, and as shown on the drawings.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Startup: Prior to operating exhaust systems all foreign material shall be removed from interior of ductwork, and fans.

C. Control Elements: Install isokinetic sample probes where indicated on Drawings, and as specified under Specification Section 13452.

D. Equipment Connections: Make connections to mechanical equipment as indicated on Contract Drawings and/or as called for in Equipment Specifications Sections.

1. Make transition as required to connect to equipment furnished.

E. Field Corrections and Modifications: Ductwork shall be coordinated with the work of other trades as required.

3.04 ADJUSTING AND CLEANING

A. Clean the system prior to final acceptance to remove dust and debris.
3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
SECTION 15830
FOR
PORTABLE HEATERS

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SECTION 15830
PORTABLE HEATERS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the minimum technical requirements for the design, materials of construction, fabrication, and installation of portable electric heaters (radiant heaters and salamanders).

1.02 RELATED SECTIONS:

A. Section 16152 Electrical Specification for Packaged Mechanical Equipment

1.03 REFERENCES

A. UL Standard 1025-91 Underwriter Laboratories, Standard for Safety, Electric Air Heaters
B. NFPA 70-93 National Electrical Code

1.04 SYSTEM DESCRIPTION

A. Radiant Heaters and Salamanders shall be portable electric units utilized to provide localized heating at the work face in the Trench Enclosure Building.

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Product Data: Submit (for Information and Record) manufacturer’s specifications for units showing dimensions, weights, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

C. Shop Drawings: Submit (for Information and Record) assembly-type shop drawings showing unit dimensions, construction details, and field connection details.
D. Wiring Diagrams: Submit (for Information and Record) manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

B. Handle units and components carefully to prevent damage, breaking, denting and scoring.

C. Store units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

D. Comply with manufacturer's installation instructions.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Chromalox (Design Basis)
2. Aitken Products, Inc.
3. Dayton
4. McMaster-Carr

2.02 MATERIALS: NOT USED

2.03 EQUIPMENT

A. Portable Electric Salamanders: Provide heaters with capacities and electrical characteristics as scheduled on the Drawings.
1. Casings shall be constructed of die formed steel with baked enamel finish. Fabricate casing to enclose coil, louver and fan blades. Provide adjustable louvers to direct air up or down. Heater and supply wiring diagram shall be permanently attached to the inside of the access door.

2. Electric element shall be high mass, all steel, tubular finned type, furnace brazed.

3. Motor shall be totally enclosed air over, with sealed bearings to ensure permanent lubrication.

4. Heater wiring shall be single circuit with elements, motor, and control circuits subdivided with factory fuses to conform to NEC and UL Standard 1025. All three phase heaters shall have balanced phases (460 volts).

5. All heaters shall be equipped with automatic reset thermal overloads which will shutdown the element and motor during unsafe operating temperatures.

6. Provide factory installed contactor, 120 volt control circuit transformer, thermostat, on-off switch, pilot light, auto shut-off for tipped over units, and fan-only switch.

7. Heater shall be mounted on a base with two heavy duty nylon casters and two rubber feet.

B. Portable Radiant Heaters: Provide heaters secured on, but removable from two wheel carts with heating capacities and electrical characteristics as scheduled on the Drawings.

1. Incoloy sheathed heating elements shall have a maximum sheath temperature of 1500°F.

2. Heating elements shall be mounted in a heavy gauge aluminum housing with polished interior surfaces. Reflector shall have a beam of 60°. Reflector shall have safety bars and plated steel safety screen on the front.

3. Heater shall be suitable for operating in any position, built to withstand rough handling and cleaning by hosing down when not energized.

4. Provide with a weatherproof steel terminal box.

5. Provide cart mounted percentage timing input controller includes per-wired combination of input controller, pilot lights, fuse blocks, and on-off switch.
a. Provide a minimum 10' electrical power cord (3 wire plus 1 ground). Plug will be supplied and attached by Division 16.

b. Provide a means of storing power cord during transit.

6. Provide caution signs to each unit as shown on the drawings.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Installation of power cords in accordance with manufacturer’s instructions, by Division 16.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
### SECTION 15860

**FANS**

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**September 1995**

**Rev 0**
SECTION 15860

FANS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the minimum technical requirements for the materials of construction and fabrication of centrifugal fans.

1.02 RELATED SECTIONS

A. Section 15050 Basic Mechanical Materials and Methods.
B. Section 16151 NEMA Frame Electric Motors.
C. Section 16152 Electrical Specification for Packaged Mechanical Equipment.

1.03 REFERENCES

A. The Anti-Friction Bearing Manufacturers Association (AFBMA):
   1. AFBMA Std. 9-1978 Load Ratings and Fatigue Life for Ball Bearings.
   2. AFBMA Std. 11-1978 Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association, Inc. (AMCA):
   1. AMCA 210-85 Laboratory Methods of Testing Fans for Rating.
   3. AMCA 301-76 Methods for Calculating Fan Sound Ratings From Laboratory Test Data.

C. Occupational Safety Health Administration (OSHA).

1.04 SYSTEM DESCRIPTION

A. Vaneaxial and portable propeller fans are required for the project.
1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Shop Drawings: Submit (for Information and Records) assembly-type drawings showing fan dimensions, required clearances, construction details and field connection details.

C. Product Data: Submit (for Information and Records) manufacturer’s technical product data for (non-portable) fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gauges and finishes of materials, dimensions, weights, accessories furnished, and installation instructions.

D. Operations and Maintenance Manual: (For Information and Records) The Seller shall provide complete information regarding the following:

1. Operating parameters, preventive maintenance plans, recommended operating and maintenance procedures and complete lists of spare parts.

2. Maintenance Data: Seller’s literature, cleaning and lubrication procedures, replacement parts lists, and repair data.

3. Availability of parts and service: Address of nearest factory from which replacement parts will be available for all major equipment supplied. Address of Seller’s nearest service facility to the project site.

4. Motor nameplate data.

E. Submit copies of guarantee and warranties, showing dates of expiration.

1.06 DELIVERY, STORAGE, & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

B. Deliver fans with factory supplied shipping skids and lifting lugs. Pack components in factory - supplied protective containers.
C. Handle fans and components properly to prevent damage, breaking, denting or scoring. Do not install damaged units, or components. Comply with manufacturer's rigging and installation instructions.

D. Store units in clean dry place and protect from weather and construction traffic.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Vaneaxial Fans
   a. New York Blower (design basis)
   b. Buffalo Forge Company
   c. Chicago Blower
   d. Industrial Air Div. of Lau
   e. Joy Technologies Inc.
   f. Twin City Fan

2. Portable Cooling Fans (Man coolers)
   a. McMaster-Carr (design basis)
   b. Industrial Air Div. of Lau
   c. Leading Edge Inc.

2.02 MATERIALS: NOT USED

2.03 EQUIPMENT

A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, capacities and electrical characteristics as scheduled on contract Drawings.

B. Vaneaxial Fans

1. General: The fans shall be Vaneaxial design. Fan wheels shall utilize cast aluminum, airfoil blades.

2. Performance: Fan ratings shall be based on tests made in accordance with AMCA Standard 210 and licensed to bear the AMCA Certified Ratings Seal for Air Performance.
3. Sound: Fan manufacturers shall provide sound power level ratings for fans tested and rated in accordance with AMCA Standards 300 and 301. Sound power ratings shall be in decibels (reference 10^-10 watts) in eight octave bands. dBA levels only are not acceptable.

   a. Maximum 85 dBA at 5' is permissible.

4. Construction: Fan housings are to be heavy gauge, continuously welded construction. Housings with lock seams or partially welded construction are not acceptable. Aerodynamically designed straightening vanes are to be integral to the fan housing. Housing shall have two wide hinged doors permitting removal of wheel, shaft and bearings with fan in place. Provide arrangement 9-S for suspended mounting complete with spring hanger vibration isolators.

5. Bearings: Bearings on belt drive fans are to be heavy duty, precision anti-friction ball or spherical roller, self-aligning design. Bearings shall be designed for an average minimum L-10 life of 80,000 hours when rated at the fan’s maximum cataloged operating speed, in accordance to AFBMA Standards.

6. Shaft: Shafts on belt drive fans are to be precision turned, ground and polished. The shaft’s first critical speed shall be at least 140% of the fan's maximum operating speed. The drive end of the fan shaft shall be counter-sunk for tachometer readings.

7. Paint: All fan surfaces are to be thoroughly prepared prior to painting using a combination of washing and hand and power tool cleaning as required. After cleaning, all surfaces are to be coated with an industrial grade alkyd enamel. Surfaces of bolted components not accessible after assembly shall be coated and allowed to dry prior to final assembly. Primer only will not be accepted.

8. Balance and Run Test: All fan wheels shall be precision balanced prior to assembly. Fans complete with motors and drives shall receive a final test balance at the specified operating speed.

9. Accessories: Accessories shall be provided as listed in the plans and specifications. Required accessories include:

   a. External Bearing Lubrication Fittings
   b. Belt Guard
   c. Inlet Flange
   d. Outlet Flange
   e. Companion Flanges
   f. Variable-Pitch Drive Pulley
10. Final Inspection: All fans shall receive a final inspection by a qualified inspector prior to shipment. Inspection to include: fan description and accessories, balance, welding, dimensions, bearings, duct and base connection points, paint finish, and overall workmanship.

C. Portable Cooling Fans (Man Coolers)

1. Deep pitch four-bladed propeller fan, with motor and belt drive mounted within heavy gauge cold-rolled steel fan barrel. OSHA approved front and rear guards. Fan barrel shall be mounted on a tubular frame dolly with two four-inch wheels and pull handle. Tilt control, knobs, and friction clutches located on both ends of dolly shall allow a minimum of 15° up or down tilt of the fan barrel. Unit shall have a baked enamel finish. On-Off switch mounted on the side of the barrel shall control fan motor. Motor shall be open type with permanently lubricated ball bearings. Furnish with 10-foot, NEMA 5-20P power cord.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

B. Fan performance curves shall be provided in accordance with AMCA 210. Tests performed on same model fan is acceptable.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION INSTALLATION & APPLICATION

A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as shown on Contract Drawings, using the vibration control devices indicated.

B. Electrical Connections: The following requirements apply:

1. Electrical power wiring is specified in Specification Section 16152.

2. Grounding: Connect unit components to ground in accordance with Specification Section 16152.

3. Motor Starter: Shall be furnished and installed by Division 16 in accordance with Specification Section 16152.
3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING, AND CLEANING

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:

1. Verify unit is secure on mountings and supporting devices and that connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motor starters.

2. Verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations.

3. Lubricate bearings and other moving parts with factory-recommended lubricants.

3.05 DEMONSTRATION

A. Perform an exhaust fan(s) demonstration test.

1. Notify Buyer 3 days prior to test.

2. Prior to starting the exhaust fan(s), the following conditions shall exist:
   a. All equipment operable in safe and normal condition.
   b. Proper thermal overload protection in place for electrical equipment.

3. If it is determined that drive changes are required, inform Buyer.

4. Notify Buyer if any conditions are observed during operation, such as:
   a. Over current
   b. Excessive vibration
   c. Excessive noise
   d. Fan rotation: airflow direction

5. Each system shall be adjusted to the required quantities with a tolerance of ± 10%.

6. Set the fan RPM to provide design total CFM within acceptable tolerances.

7. Fan speed shall not exceed the maximum allowable RPM as established by the manufacturer.
8. The final setting of fan RPM shall not result in the overloading of the fan motor in any mode of operation.

9. Following values shall be measured and recorded:
   a. Fan CFM
   b. Fan RPM
   c. Motor voltage and amp (each phase)
   d. Static pressure entering and leaving the fan

10. Provide a letter report of the demonstration and submit to Buyer.

3.06 PROTECTION: NOT USED

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SECTION 15940

AIR OUTLET8 AND INLETS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the minimum technical requirements for the materials of construction and fabrication of louvers.

1.02 RELATED SECTIONS: NOT USED

1.03 REFERENCES

A. Air Movement and Control Association, Inc. (AMCA):

1. AMCA 500-89 Test Methods for Louvers, Dampers and Shutters.

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


C. American Society of Civil Engineers (ASCE):


1.04 SYSTEM DESCRIPTION

A. Louvers shall be utilized for air intake at the exterior walls as shown on the Contract Drawings.

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittal than listed herein.

B. Submit (for Information and Records) product data for all products specified hereunder to include noted capacities of selected model clearly indicating, CFM, pressure drop, physical dimensions, configuration, materials of construction, and other information as required to demonstrate compliance with these specifications.

C. Submit (for Information and Records) installation
instructions.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

B. Deliver air outlets and inlets wrapped in factory provided fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

C. Store outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors, when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable Site Conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

Louvers

1. Ruskin Mfg. Co. (Design Basis)

2. American Warming and Ventilating, Inc.

3. Construction Specialties, Inc.

2.02 MATERIALS: NOT USED
2.03 EQUIPMENT

A. Louvers:

1. General: Provide louvers where shown on Contract Drawings; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

2. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.


4. Air pressure drop across fixed louvers equipped with bird screen at free area velocity of 700 fpm in either intake or exhaust mode, shall not exceed 0.05 inches of water.

5. Fixed louvers shall be designed to withstand a wind load of 70 mph with an importance factor of 1.07, and exposure C in accordance with ASCE 7.

6. Fixed Louvers (LV):

a. Louvers shall have minimum free area of 45 percent for 4 by 4 foot face area and larger.

b. Louvers shall have 4 inch deep frame, fabricated from 0.100 inch minimum thickness aluminum alloy.

   1) Heads, jambs, sills and mullions shall be one piece structural members with integral caulking slot.

   2) Mullions shall be designed with internal drains capable of draining 8 foot length of blade under conditions outlined in AMCA Standard No. 500.

   3) Frame shall be welded construction with corner bracing using gussets or straps on all sizes 10 square feet or larger.

   4) Other methods of assembly shall be submitted to Buyer for approval.
c. Blades shall be of the drainable type.

1) Drain gutters shall have sufficient capacity to drain blades 12 feet long under conditions outlined in AMCA Standard No. 500.

2) Blade shall be extruded aluminum alloy with minimum thickness of 0.081 inch.

d. Louver blades shall have a maximum unsupported span of 4 feet.

e. A bird screen fabricated from 3/4 inch aluminum flattened expanded metal with minimum thickness of 0.051 or 0.500 inch mesh, 0.062 inch diameter aluminum wire intercrimp in removable frame.

f. Design Basis Model: Ruskin ELF 375D

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. General: Install air outlets and inlets in accordance with manufacturer’s written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED
# SECTION 10522

## FIRE EXTINGUISHERS

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SECTION 10522
FIRE EXTINGUISHERS

PART 1 GENERAL

1.01 SECTION SCOPE

A. Provide portable fire extinguishers and mounting brackets.

1.02 RELATED SECTIONS

A. None.

1.03 REFERENCES

A. National Fire Protection Association (NFPA)

1. NFPA 10 - 1994, Portable Fire Extinguishers

B. Factory Mutual Approval Guide, 1994

C. Underwriters Laboratory Inc. Fire Protection Equipment Directory, 1994

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Submit the following documents on a "Information and Record" basis.

1. Data sheet or catalog cut sheet on each type of extinguisher.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS: NOT USED
PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. To provide procurement references under this specification and subject to compliance with the requirements specified herein, the following is identified. Procurement will not be limited to the listed manufacturers.
   B. Potter-Roemer, Inc.

2.02 MATERIALS
   A. Provide fire extinguishers that meet the requirements of NFPA 10.
   C. Provide fire extinguishers with 1/2 inch O.D. extinguisher hose.

2.03 EQUIPMENT
   A. Fire extinguishers
      1. Fire extinguisher type: ABC multi-purpose dry chemical
         Size and type discharge: 10 lbs with hose; 4A:60B:C – refer to Contract Drawings.
         a. Potter-Roemer catalog number: 3010 or equivalent.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL
   A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION
   A. Install material and systems in accordance with manufacturer’s instructions and submittals. Install material and systems in proper relation with adjacent construction and with uniform appearance.

3.03 FIELD QUALITY CONTROL
   A. Refer to Division 1.0 for standard field quality requirements.
3.04  ADJUSTING AND CLEANING:  NOT USED

3.05  DEMONSTRATION:  NOT USED

3.06  PROTECTION:  NOT USED

END OF SECTION
SECTION 15300
FIRE PROTECTION

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SECTION 15300
FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION SCOPE

A. This section establishes the minimum technical requirements for the materials, design, installation and acceptance testing of a dry pipe sprinkler system.

B. Work Included:

1. The following itemization is intended to identify major work elements and is not all inclusive.

   a. System design, installation and certification for a complete dry pipe sprinkler system including all piping, valves, sprinkler heads, sprinkler cabinets, pipe supports and hangers, earthquake sway bracing, water flow device, air compressor, and fire department connections.

   2. Design drawings must be sealed by a designer or engineer with a Level III certificate of competency for the State of Washington.

1.02 RELATED SECTIONS

A. Section 16720 Fire Alarm and Smoke Detection Systems

1.03 REFERENCES

A. National Fire Protection Association (NFPA)
   1. NFPA 13 - 1994 Installation of Sprinkler Systems
   2. NFPA 1963-1985 Screw Threads and Gaskets for Fire Hose Connections

B. Factory Mutual Approval Guide, 1994

C. Underwriters Laboratory Inc. Fire Protection Equipment Directory, 1994

D. American Society for the Testing of Materials (ASTM)

1.04 SYSTEM DESCRIPTION

A. Sprinkler system coverage in the Trench Enclosure Building shall be via a dry pipe system.

B. All sprinkler systems shall be hydraulically designed.

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C. Sprinkler systems shall be designed to NFPA 13 ordinary hazard, Group 2 occupancy requirements.

1. Dry pipe system design density is 0.20 gpm per sq. ft. over 3000 sq ft. Allow 500 gpm for hose demand.

D. Water system data (flow and pressure) at the interface point to the existing fire water main system must be obtained from the Hanford Fire Department. The water supply must be verified by a current flow test performed by the Hanford Fire Department.

E. Sprinkler system alarms (e.g., water flow alarm) interface with the building fire and smoke alarm system.

F. Fire department connections shall be provided as indicated on Contract Drawings.

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein. Prepare drawings per Division 1.0 requirements. The submittals must provide all information specified in NFPA 13, Section 6.1.

B. The following documents are required for "Review and Approval":

1. Layout of sprinkler system showing location of sprinkler heads, hose connections, and arrangement of sprinkler system riser. Clearly indicate hydraulic calculation node points on the layout drawing(s).

2. Hydraulic calculations for each system, with hydraulic reference nodes clearly labeled.

3. System detail drawings showing location of all hangers, supports, and earthquake sway bracing (both two way and four way).

C. The following documents are required for "Information and Record":

1. Catalog sheets for all components including sprinkler heads, hangers, valves, and switches.

2. Operation and maintenance information for all components.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.
1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification and subject to compliance with the requirements specified herein, the following list of manufacturers is provided. Procurement will not be limited to the listed manufacturers.

1. Grinnell (GEM)
2. Reliable
3. Viking

2.02 MATERIALS

A. Provide only fire protection equipment which is listed in the UL Fire Protection Equipment Directory, or in the Factory Mutual Approval Guide.

B. Provide ASTM A795, galvanized, Schedule 40 pipe.

C. Provide fittings in accordance with NFPA 13. Mechanical groove fittings may only be used on 2 1/2 inch diameter and larger pipe.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS

A. Sprinkler Heads

1. Exposed Area Type:

   a. Type: Standard 1/2" or 17/32" orifice, dry upright type.

   b. Head Finish: Brass

   c. Fusible Link: Center strut or glass bulb type, intermediate temperature rated (286°F).

   d. Sprinklers shall have a Response Time Index (RTI) of no more than 265.

2. Sidewall Type:

   a. Type: Standard 1/2" orifice, dry horizontal sidewall type with matching push on.
b. Head Finish: Brass.

c. Fusible Link: Center strut or glass bulb type, intermediate temperature rated (286°F).

d. Sprinklers shall have a Response Time Index (RTI) of no more than 265.

B. Piping Specialties:

1. Dry Pipe Valve: Differential type clapper valve, with rubber faced clapper and alarm trim.


C. Fire Department Connection:

1. Type: Straight flush mounted wall type with brass finish.

2. Outlets: Two way, 2 1/2 inch x 2 1/2 inch x 4 inch with National Hose thread hose connection (per NFPA 1963) and National Pipe thread outlet connection. Threaded dust caps and chains of matching material and finish.


4. Label: "Sprinkler - Fire Department Connection."

D. Air Compressor (Dry Pipe System):

1. UL listed, riser mounted air compressor capable of pressurizing the system to 40 psi in a maximum of 30 minutes. GAST Model No. GLCF-13-N616X, or equal.

E. Air Pressure Switch

1. Provide pressure switch with SPDT contact as required to supervise the air pressure (low and high) in dry pipe sprinkler systems.

2. Operating pressure of switch: Field adjustable between 20 and 225 psi.

F. Valve Enclosure

1. An outdoor valve enclosure shall be provided to house the fire protection riser, including the backflow preventer, dry pipe valve, and air compressor.

2. Two thermostatically controlled 1500W heaters shall be provided with the enclosure.
3. Power feed to the enclosure will be 480V, 3 phase, to a single terminal box located on the outside of the enclosure. Vendor shall wire all components inside the enclosure to the terminal box.

4. Enclosure shall be HOT BOX or equal.

5. Provide temperature switch to monitor enclosure temperature. Set point shall be 45°F.

6. At least one light shall be provided in the enclosure.

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Install all systems in accordance with NFPA 13.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION

A. Division 1.0 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for the product(s) contained in the specification, which may also be used by the Seller in preparing the system ATP’s.

1. Test systems in accordance with NFPA 13, Chapter 8.

2. Complete and deliver appropriate contractor’s material and test certificate as required by Chapter 8 of NFPA 13.

3.06 PROTECTION: NOT USED

END OF SECTION
# SECTION 16720

## FIRE ALARM AND SMOKE DETECTION SYSTEMS

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SECTION 16720
FIRE ALARM AND SMOKE DETECTION SYSTEMS

PART 1  GENERAL

1.01  SECTION SCOPE

A.  This section establishes the minimum technical requirements for the materials, design, installation and acceptance testing of automatic fire alarm and thermal detection systems.

B.  Work Included: The following itemization is intended to identify major work elements and is not all inclusive.

1.  Automatic thermal detection system, including all detector heads and detector bases.


3.  Alarm horns and lights.


5.  Interface devices required between alarm devices and panels supplied in related sections.


1.02  RELATED SECTIONS

A.  Section 15300  Fire Protection

B.  Section 16050  Basic Electrical Materials and Methods

C.  Section 16110  Raceways

D.  Section 16120  Wires and Cables

1.03  REFERENCES

A.  National Fire Protection Association (NFPA)


1.04 SYSTEM DESCRIPTION

A. Regulatory Requirements:

1. The fire alarm and detection system is to be UL listed or FM approved.

2. The fire alarm and detection system is to conform to the requirements of NFPA 101, Chapter 28 (Industrial Occupancies).

3. The fire alarm and detection system design is to comply with the requirements of NFPA 72.

4. Signaling appliances are to conform to the requirements of NFPA 72.

B. System Design: Design the system with the following features:

1. Install initiating circuits in separate conduit system from signal circuits or auxiliary circuits.

2. In areas with ceiling heights greater than 10 feet, mount the alarm bells at 10 feet (nominal) above the floor.

3. Surface mount the fire alarm control panel with the top of the panel six feet above grade.

C. Fire Alarm System: NFPA 72 automatic fire alarm system with and radio fire alarm master box to relay alarm and trouble signals to the Hanford Fire Department Central Station.

D. Alarm and Detection Zones: Provide individual alarm and/or trouble zones per Appendix A, minimum requirement are as follows:

1. Dry Pipe Sprinkler System Waterflow (dry valve pressure switch).


3. Thermal Detection.

4. Low enclosure temperature.

E. Fire Alarm Control Panel

1. System Supervision: Provide electrically-supervised system, with supervised alarm initiating and alarm signaling circuits.
2. Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode.

3. Component or power supply failure places system in TROUBLE mode.

4. Low valve enclosure temperature, low dry pipe air pressure, and other off normal conditions result in a SUPERVISORY alarm at the FACP.

5. FACp transmits common trouble and common alarm signals to fire department and DAS.

F. Alarm Sequence of Operation: Actuation of manual or automatic initiating device causes system to enter ALARM, which includes the following operations:

1. Sound and display local fire alarm signaling devices.

2. Transmit signal to remote station equipment, located at the Hanford Fire Department Central Station.

   NOTE: The radio fire alarm master box used to transmit signals to the remote location is government-furnished equipment. The radio fire alarm master box, and associated equipment and circuitry, comply with NFPA 1221.

3. Indicate location of alarm zone on fire alarm control panel.

4. In addition, a non-silencable outside alarm bell sounds in the event of any fire extinguishing system waterflow condition.

5. Transmit signal to DAS. Refer to Section 13407.

G. Trouble Sequence of Operation: System trouble, including grounding or open circuit of supervised circuits, or power or system failure causes system to enter TROUBLE mode, including the following operations:

1. Visual and audible trouble alarm at control panel.

2. Transmit trouble signal to remote station located at the Hanford Fire Department Central Station.

3. Transmit trouble signal to DAS.

H. All fire alarm and detection signals, including those initiated or required by related sections, are to be processed through the Fire Alarm Control Panel. The Seller is to coordinate the work of this section and the related sections.
1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein. Prepare drawings per Division 1.0 requirements.

B. The following documents are required for "Review and Approval":

1. Layout of alarm and detection system showing location of detector heads, bells, lights, and fire alarm control panel.

2. System riser diagram, showing all alarm initiating and indicating devices, and all end of line devices required. Clearly indicate termination points, wire size, item number or designation, power requirements, etc.

3. Panel and device wiring diagrams showing all required field terminations, clearly labeled and identified in a manner consistent with other supplied drawings.

4. Panel drawing(s) showing physical arrangement of alarm indication lights, labeling, etc. Indicate panel dimensions and mounting requirements.

5. System design calculations, including backup battery sizing and wire sizing calculations.

C. The following documents are required for "Information and Record":

1. Catalog sheets for all components including detector heads and bases, manual pull stations, panel enclosures, etc.

2. Operation and maintenance instructions for all components supplied.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Cerberus Pyrotronics
2. Fenwall, Inc.
4. Fire Control Instruments, Inc. (FCI)

B. All components of the alarm and detection system are to be of the same manufacturer and listed for use together as a system.

2.02 MATERIALS

A. Raceways: Conduit, with minimum size of 3/4 inch.
B. Wire required is per Appendix A.

2.03 EQUIPMENT

A. Provide only fire alarm and detection equipment and materials which are listed in the UL Fire Protection Equipment Directory, or in the Factory Mutual Approval Guide.

2.04 COMPONENTS

A. Fire Alarm Control Panel

1. Control Panel: Modular construction with surface wall-mounted enclosure. Provide the required number of zones, plus 10% spare zones (1 minimum), to accommodate the dry pipe system (waterflow, and low/high air pressure), thermal detection system, manual pull stations, and all fire alarm indicating devices. Provide one normally open alarm contact and one normally closed trouble contact. Connect contact to Buyer furnished radio fire alarm master box.

2. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, and alarm signaling devices.
3. **Detection Circuits:** Supervised zone module with alarm and trouble indication for each zone.

4. **Signal Circuits:** Supervised signal module, sufficient for signal devices connected to system.

5. **Remote Station Signal Transmitter:** Government furnished radio fire alarm master box, capable of transmitting both trouble and alarm signals.

6. **Remote Station Signal Receiver:** Government furnished equipment, located in Hanford Fire Department Central station.

7. Provide TROUBLE ACKNOWLEDGE, RESET, BELL BYPASS, AUXILIARY SHUTDOWN BYPASS and ALARM SILENCE switch(es).

8. Provide spare zones and signal modules for future expansion or use by Buyer, as required by Appendix A.

### B. Initiating Devices

1. **Manual Pull Station:**

2. **Thermal Detector:**
   a. Rate compensated type thermal detector, ordinary temperature (135°F) rated.
   b. Provide visual indication of detector actuation.
   c. Provide plug-in type unit, complete with twist-lock base.
   d. Detector operates on two-wire circuit.

### C. Signaling Devices

1. **Alarm Bells:**
   a. Electric single stroke, 10 inch bell with operating mechanism behind dome.
   b. Sound Rating: Per Appendix A.
c. Provide integral strobe lamp and flasher with red lettered FIRE on white lens.

2. Alarm Lights: Strobe lamp and flasher with red lettered FIRE on white lens.

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL
   A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION
   A. Install all systems in accordance with NFPA 72, and the manufacturers instructions.

3.03 FIELD QUALITY CONTROL
   A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION
   A. Division 1.0 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for the product(s) contained in the specification, which may also be used by the Seller in preparing the system ATP's).

   1. Test systems in accordance with NFPA 72.

3.06 PROTECTION: NOT USED

END OF SECTION
APPENDIX A

STANDARD ELECTRICAL DESIGN CRITERIA FOR FIRE ALARM SYSTEMS
(SDC = 7.8)
SDC-7.8

STANDARD ELECTRICAL DESIGN CRITERIA

FOR

FIRE ALARM SYSTEMS

This Specification consists of 7 pages
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7.8 FIRE ALARM SYSTEMS

A. GENERAL

1. Fire alarm systems shall be designed and constructed in accordance with the latest edition of the following National Fire Codes as issued by the National Fire Protection Association (NFPA), and DOE orders.
   a. NFPA 70 - National Electrical Code
   b. NFPA 72 - Installation, Maintenance and Use of Protective Signaling System
   c. NFPA 72E - Automatic Fire Detectors
   d. NFPA 72G - Installation, Maintenance and Use of Notification Appliances for Protective Signaling Systems
   e. NFPA 72H - Testing Procedures for Local, Auxiliary, Remote Station, and Proprietary Protective Signaling Systems
   g. NFPA 1221 - Public Fire Service Communication System
   h. 6430.1A - General Design Criteria
   i. 5480.7 - Fire Protection
   j. RLIP 5480.7 - Fire Protection


3. The word "municipal," as used in NFPA publications and in this Design Criteria shall be construed to refer to a group of manufacturing, warehouse or office buildings which comprise a separate "area" or group of areas at Hanford.
4. New installations and modifications or additions to existing systems shall be of manufacture and type as approved by the Fire Protection Engineering (FPE) staff of each contractor.

5. Components/Equipment installed per this Design Criteria, shall be listed by Underwriters Laboratories Inc. (UL), or approved by the Factory Mutual Systems, where applicable.

6. The designer of a complete fire detection and alarm system is advised to consult the manufacturer's current catalogs for information relevant to proper system design and installation.

7. The fire alarm control panel(s) should be in a convenient location near the building main entrance, shall be readily accessible, and readily visible.

8. It is required to have an authorized installer (regularly in the fire protection system installation business) install the fire alarm system.

9. An acceptance test procedure shall be written for each fire alarm system designed. The design document shall require the installation contractor to perform and document acceptance testing according to the procedure provided, to the satisfaction of the Government’s Representatives.

10. For multi-zoned fire detection systems, the Hanford Fire Department (HFD) shall be consulted regarding the separation of zones.

B. RADIO FIRE ALARM REPORTING BOXES

1. The municipal fire alarm boxes for the Hanford Site are radio fire alarm reporting (RFAR) boxes. The boxes are manufactured by the GH Harlow company and are furnished to site projects by the Hanford Site Telecommunications group. RFAR boxes can be used as a street-type, manually operated fire reporting system or as a directly connected, automatically operated auxiliary fire reporting system. The auxiliary-type RFAR boxes can provide 8, 16, 24, 32, 40, and 48 zones for connection to local fire alarm control panels.

2. RFAR box code numbers are assigned by the Hanford Fire Department.

3. RFAR boxes shall be grounded to the building ground grid or by other approved grounding methods with a No. 4 AWG copper wire. The resistance to ground shall not exceed 25 ohms during the dry season. A suitable alternative would be to
connect the RFAR to a grid of two 8 ft ground rods connected with No. 4 AWG wire.

4. The installation of more than one fire alarm control panel reporting a single RFAR box shall be approved by the contractor's fire protection engineer.

5. RFAR antennas are provided by the Hanford Site Telecommunications group. The location of the RFAR box and antenna on the outside of buildings shall be as directed by the telecommunications group. The conduit for the RFAR antenna shall be 3/4 inch IMC or rigid conduit.

6. Conduit entry into the RFAR boxes shall be in the bottom of the RFAR box or within 2 inches of the bottom of the RFAR box. Conduit entries shall be made with watertight connectors.

7. Final wiring connections in RFAR enclosures shall be made by the Hanford Site Telecommunications group.

C. MANUAL FIRE ALARM BOXES


2. Manual fire alarm boxes (pull stations) shall be located in accordance with NFPA 101 and NFPA 72. In addition, fire alarm boxes (pull stations) shall be installed at each designated and/or emergency building exit or stairwell in multi-story buildings. Buildings requiring protection shall have one box at each floor level. Manual fire alarm box (pull station) coverage shall not exceed 10,000 square feet of floor area.

D. FIRE ALARM CONTROL PANELS (FACP)

1. A Fire Alarm Control Panel (FACP) shall provide the following functions:

   a. Actuating devices to trip the RFAR box shall be provided as required by the operating contractor’s FPE.

   b. Operate the fire alarm bells to alert the building occupants. Cycle time of the bells shall have march time of approximately 120 stokes per minute.

   c. Alarm indicators shall reset only when the control panel is reset. There shall be at least one indicator for each floor or each fire zone of the building.
Separate zone messages will be provided for each type of suppression system, detection or alarm system.

d. Future expansion capability (20 percent minimum) shall be provided in accordance with the growth potential of the building.

e. Auxiliary relays with bypass switches shall be provided to control equipment as required by the design.

f. The standby power supply shall be provided as required by the FPE and the NFPA codes.

g. Complete supervision of sprinkler systems including, but not limited to, post indicator valves, sectional sprinkler system control valves, and air pressure for dry systems shall be provided.

h. Terminal blocks for connection of external wiring to the control panel may be included to facilitate field wiring of complex systems.

i. Fire alarm controls shall be housed in key-locked control cabinets. Locks furnished with this equipment shall be Corbin Cabinet Lock, Division of Emhart Corp., Key Cat. No. 60 or others as approved by Hanford Fire Department.

j. Alarm indicator lights shall be visible and identified.

E. SIGNALING DEVICES

1. Local audible fire alarm indicators shall be located in accordance with NFPA 72.

2. Audible indicating devices shall be single-strike chimes or gongs and shall be sufficient in number and intensity to produce a sound level of at least 10 decibels above maximum expected background noise (up to 100 decibels). The audible indicating devices shall provide a march time rate of 120 strokes per minute. When background noise levels normally exceed the 100 decibels in operating conditions, a visual alarm device is needed in addition to the chimes or bells. Any change to the march time rate to accommodate visual alarm devices shall be coordinated through fire protection engineering, but in no case shall the march time rate be less than 60 strokes per minute.

3. A survey shall be made to ensure signals can be heard under normal background conditions in spaces that may be occupied.
This shall be the responsibility of the operating contractor(s) for the building involved.

F. AUTOMATIC FIRE DETECTORS

1. NFPA 72E shall be used for the criteria of the location and installation of fire detectors.

2. Detectors shall be located and installed as required by DOE Order 6430.1A and the FPE for the operating contractor.

G. WIRING

1. Wiring for fire alarm systems shall comply with NFPA 70, NFPA 1221, and the following.
   
a. Splices in fire alarm wiring shall be made mechanically strong, by use of pressure-type solderless connections or terminal lugs. Connectors shall be installed according to the manufacturer's instructions and with the proper tool for the connector or terminal.

b. Conductors for interior, power-limited, auxiliary fire alarm circuits shall be no smaller than No. 15 AWG for single conductors and No. 18 AWG for multi-conductor cables.

c. Conductors for interior, nonpower-limited, auxiliary fire alarm circuits shall be no smaller than No. 14 AWG.

d. Terminal ends of approved stranded conductors shall be completed with crimp-on terminal lugs.

e. Single conductors installed in conduit and panels shall have THHN/THWN insulation.

2. Wiring may be installed in intermediate metal conduit, rigid galvanized steel conduit, electrical metallic tubing, or nonmetallic sheathed cable. Cables may be used without conduit in the concealed spaces in office buildings of 15,000 square feet or less. This installation must be made in accordance with NFPA 70.

3. Electrical power for fire alarm control panels, RFAR boxes and locator lights shall preferably be obtained from separate breakers. The breakers shall be fitted with a suitable guard requiring manual removal before the breakers can be operated. The breakers shall serve the fire alarm equipment only and shall be clearly identified as FIRE
ALARM. The fire alarm power circuits shall be connected to the emergency power sources if available.

4. Wiring shall be identified with wire markers and by color coding. Conductor colors for new installations shall be as shown in the following table. For expansion of existing systems, the conductor color convention previously used shall be maintained. Colored tape, according to the following table, may be used to identify the conductors of existing wiring. The color codes do not apply to shielded or multi-conductor cables.

<table>
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<tr>
<th>CIRCUIT</th>
<th>COLOR OF WIRE INSULATION</th>
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<tr>
<td>Initiating device, input to fire alarm panel, detectors, manual pull station etc.</td>
<td>one red and one black</td>
</tr>
<tr>
<td>Alarm device, output from fire alarm panel, bells, gongs, strobes</td>
<td>one dark blue and one light blue</td>
</tr>
<tr>
<td>supervisory device, input to the fire alarm panel, limit switches, pressure switches, supervisory switches, etc.</td>
<td>one yellow and one tan</td>
</tr>
<tr>
<td>Between the fire alarm control panel and RFAR box</td>
<td>Orange</td>
</tr>
<tr>
<td>Output from the fire alarm panel to devices other than alarms</td>
<td>Blue or different color from preceding colors.</td>
</tr>
<tr>
<td>Incoming power (phase/line) to the fire alarm panel, RFAR box, or indicator light</td>
<td>Black</td>
</tr>
<tr>
<td>Incoming power (neutral) to the fire alarm panel, RFAR box, or indicator light</td>
<td>White</td>
</tr>
<tr>
<td>Ground wire</td>
<td>Green/Bare</td>
</tr>
<tr>
<td>Battery wiring</td>
<td>Brown</td>
</tr>
</tbody>
</table>

5. The ground point for shielded conductors shall be in the fire alarm control panel.
6. Junction box covers associated with fire alarm systems shall be identified by decals or red paint.

7. Relays, switches, pushbuttons, terminals, terminal boards, etc., in the control panels shall be marked and identified, and properly coordinated with the nomenclature on the drawings.

8. New fire alarm wiring between the RFAR box and the fire alarm control panel shall be shielded.

H. GENERAL DESIGN AND INSTALLATION

1. Building layout drawings showing conduit runs with wire counts and size, and device locations with individual device indicating zone (zone data of approvals) shall be provided.

2. Fire alarm control panel point-to-point wiring diagram showing the interconnection wiring in the panel and connecting wiring to the field devices terminals shall be provided.

3. Each alarm initiating/indicating appliance shall be provided with an individual identifier by zone as allowed by the FACP.
# SECTION 13401

**BASIC INSTRUMENTATION AND CONTROL REQUIREMENTS**

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### Appendices

- Appendix A Maintenance Manuals
- Appendix B User Manuals
- Appendix C Software Documentation
SECTION 13401
BASIC INSTRUMENTATION AND CONTROL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section describes the basic scope of work to be performed in the design and fabrication of all instrumentation and control equipment.

B. This Specification Section applies to all instrumentation, controls and systems purchased and furnished by the Seller.

C. If there is a discrepancy between any of the requirements of this Specification Section and the applicable equipment Specification Section, the equipment Specification Section shall take precedence.

D. Deviations shall be allowed only after written approval per Division 1.0 has been received from the Buyer.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods

B. Section 16152 Electrical Specification for Packaged Mechanical Equipment

C. Section 16151 NEMA Frame Electric Motors

D. Section 16120 Wire and Cables

1.03 REFERENCES

A. All equipment covered by this specification shall be designed, manufactured, installed and tested in accordance with the following codes, standards and regulations. Specific requirements are identified in each section.

1. Aluminum Association Inc. (AA):

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   b. ANSI N42.17B-89 Performance Specifications for Health Physics Instrumentation - Occupational Airborne Radioactivity Monitor Instrumentation

3. Institute of Electrical & Electronic Engineers (IEEE):
   e. IEEE-829-1983 Standard for Software Test Documentation
   g. IEEE-1028-1988 Standard for Software Reviews and Audits
   i. IEEE-1063-1987 Standard for Software User Documentation

4. International Society for Measurement and Control (ISA):
   a. ISA-S5.1-84 Instrumentation Symbols & Identification.
   b. ISA-S5.3-83 Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic & Computer Systems.
   c. ISA-S5.4-74 Instrument Loop Diagrams.
d. ISA-S5.5-85  Graphic Symbols for Process Displays

e. ISA-S18.1-79  Annunciator Sequences & Specifications.

f. ISA-S50.1-82  Compatibility of Analog Signals for Electronic Industrial Process Instrumentation.

g. ISA-S51.1-79  Standard Process Instrumentation Terminology.


a. MIL-STD-810D  Environmental Test Methods and Engineering Guidelines


c. MIL-STD-1189B  Standard DOD Bar Code Symbology

d. MIL-L-61002  Labels, Pressure-sensitive Adhesive for Bar Coding

6. Military Hand Book (MIL-HDBK)

a. MIL-HDBK-419A  Grounding, Bonding and Shielding for Electronic Equipment and Enclosures

7. National Electric Manufacturers Association (NEMA):

a. ICS-4-83, R1988  Terminal Blocks for Industrial Use.

b. ICS-6-1988  Enclosures for Industrial Controls & Systems.


8. National Telecommunications Information Administration (NTIA)

9. Occupational Safety and Health Administration (OSHA):


10. Department of Energy (DOE)

a. DOE 5480.11  Radiation Protection for Occupational Workers

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11. Underwriter’s Laboratories (UL)
   a. UL 969 Standard for Marking and Labelling Systems

   a. 40CFR60, Appendix A, Method 1, 1990
      Sample and Velocity Traverse for Stationary Sources
   b. 40CFR60, Appendix A, Method 2
      Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
   c. 40CFR60, Appendix A, Method 5, 1990
      Determination of Particulate Emissions From Stationary Sources
   d. 40CFR61, Subpart H, 1990
      National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities
   e. 40CFR61, Appendix B, Method 114, 1990
      Test Methods for Measuring Radionuclide Emissions from Stationary Sources

B. Acronyms:

   ATP                Acceptance Test Procedure
   CAM                Continuous Air Monitor
   DAS                Data Acquisition System
   DMS                Data Management System
   EMI                Electromagnetic Interference
   FM                 Factory Mutual
   GFE                Government-furnished Equipment
   GOB                General Office Building
   HGS                Head Gas Sampling
   HLAN               Hanford LAN
   LAN                Local Area Network
   MMI                Man-Machine Interface
   MTBF               Mean Time Before Failure
   MTBR               Mean Time Between Repair
   MTTR               Mean Time To Repair
   NDA/NDE            Non-destructive Assay/Non-destructive Examination
   RFI                Radio Frequency Interference
   SCADA              Supervisory Control and Data Acquisition
   TEB                Trench Enclosure Building
   TBD                To Be Determined
UL Underwriter’s Laboratory
UPS Uninterruptible Power Supplies
UHF Ultra High Frequency (Radio)
VHF Very High Frequency (Radio)

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. GENERAL

1. Refer to Division 1.0, for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

2. Technical information shall be submitted for classes rather than for each device supplied.

3. Specific submittals are defined by the applicable equipment Specification Sections.

B. FORMAT

1. All drawings, manuals, and other printed material shall be in English. Final drawings shall be CAD-generated, utilizing Autocad software and reproduced on mylar or paper with the Buyer’s title block and drawing numbers. The final drawings shall also be submitted on optical or magnetic media in a format to be determined by Buyer.

2. Identify documentation with descriptive title, Seller’s document number, revision letter, and revision date.

3. Dimensions shown on drawings and scale of drawings shall be in English units. Calculations shall be prepared using customary U.S. units. Charts, scales, and other documents covered by this Specification Section shall also be in U.S. units.

4. Documentation submitted shall conform with the symbols, identification and terminology as defined by ISA standards S5.1, S5.3, S5.4, S5.5, and S51.1.

5. The Buyer reserves the right to reject any or all reproducibles, prints or copies whose poor quality or legibility will not permit reproduction by diazo or Xerox copy processes. In these cases the Seller shall provide acceptable replacements at no additional cost to the Buyer.

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6. Reproducibles shall be rolled, not folded, and enclosed in mailing tubes when mailed to the Buyer.

7. Vendor drawings may be furnished in vendor’s standard format.

8. Software files on optical or magnetic media shall be separately packaged from equipment and mailed by insured express mail to Buyer. Two separate identical copies, or original and backup, shall be mailed in separate packages.

9. Optical or System documentation shall be delivered as hard-copy and as files on magnetic media in type and quantity to be defined by Buyer.

C. DRAWINGS

The specific requirements for each type of drawing are described below.

1. General Arrangement Drawings: Dimensioned general arrangement drawings (with plan, elevation and section views), drawn to scale, showing configuration of the system and with all major components identified. Overall external dimensions shall be shown, along with all dimensions needed to confirm interface compatibility with referenced facility systems, specified on the Contract Drawings. Dimensions showing fits, clearances, tolerances, and extremes of operation shall be provided, which includes space requirements for equipment access and maintenance. The location of local panels shall be specified and shown on the General Arrangement Drawings.

2. Assembly Drawings: Fabrication level drawings showing all components, including racks, power supplies, terminal blocks, panel devices, and all enclosure components. Bill of materials must be included.

3. Electrical Drawings: Detailed electrical schematics, electrical wiring diagrams, power distribution and grounding diagrams, termination schedules, and cable details. Wiring diagrams shall delineate termination panels for field devices and provide space to label each I/O point with field instrumentation tag numbers. Provide two-way traceability for wire run and tag numbers. Diagrams shall show equipment in enough detail to permit troubleshooting. Designate wires with numbers or letters and retain same designation throughout, independent of splices at terminal blocks.

4. Computations: Equipment heat emission, power consumption, and shielding requirements.

5. Block diagrams: Drawings shall delineate equipment locations and interconnections schematically.
6. Process and Instrument Diagrams (P&ID’s): Shall conform to ISA standards. Symbols and tag numbering to denote instrumentation and controls including all interfaces with rest of plant equipment shall be used. Instrument tag numbers will be assigned by Buyer.

D. DOCUMENTS/LISTS

1. Seller shall submit an index of all system documentation together with a key to the index.

2. A schedule of all devices shall be submitted, including: tag numbers, manufacturer, model, type, size, detailed operating data including set points, and how shipped (premounted or loose). Instrument List shall conform to Buyer’s format.

3. For each control device Seller shall provide a comprehensive Input/Output List. I/O List shall conform to Buyer’s format.

4. The Seller shall provide a list of consumables and spare parts for maintenance during the first year of operation. The parts list shall include the cost, the original manufacturer, model, and type identification for all parts not manufactured by the Seller. Each item shall indicate the quantity used and the quantity necessary for spare parts. Provide list of local suppliers.

5. The Seller shall submit for Buyer approval test plans, schedules, procedures, and test case specifications governing the tests to be performed at the shop and in the field. These tests shall demonstrate proper assembly, wiring, and communication among components and that the system performs in accordance with the requirements of the applicable Section. Division 1.0 delineates the Acceptance Test Procedures (ATP).

6. The Seller shall provide a list of normal test equipment required for the maintenance of the devices.

7. Storage and handling instructions describing methods of packaging, unloading and lifting instructions, and storage requirements shall be submitted.

E. MANUALS

1. Manuals shall contain comprehensive information to allow the installed system to be maintained and operated. Refer to Appendixes A and B.
F. SOFTWARE

1. All custom software shall be developed in accordance with the following standards:
   
   
   
   
   
   e. IEEE Std. 1028-1988, IEEE Standard for Software Reviews and Audits
   
   
   g. IEEE Std. 1063-1987, Standard for Software User Documentation

2. Source programming shall be included for software and configuration programming that is not ordinarily off-the-shelf. All tools required to create, debug, maintain and manage the source programming shall be included. All source programming shall be delivered on media readable by the computer hardware delivered.

3. Design documentation for software shall be supplied in accordance with Appendix C.

1.06 DELIVERY, STORAGE & HANDLING

A. Equipment that is not installed by Seller shall be delivered and stored as designated by Buyer.

1.07 SITE CONDITIONS:

A. Refer to Division 1.0 for general site conditions.

B. The interior of the Trench Enclosure Building will be dusty from soil removal operations and traffic. Temperature and humidity will be same as outdoor ambient. Interior equipment will not be exposed to rain.
PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIAL

A. Equipment shall be manufacturer’s standard industrial equipment. The Buyer reserves the right to approve manufacturer and model.

B. Provide new, first quality materials, components and equipment in accordance with this Specification Section, and referenced codes and standards.

C. Buyer shall be registered as the owner of all equipment for warranty and registration purposes.

D. Seller shall provide licensed and registered originals for all software. Licenses shall be in Buyer’s name.

2.03 EQUIPMENT

A. General

1. The selection of all accessories, materials, and methods of fabrication not specifically covered in this Specification Section, but which are necessary to complete the fabrication of control systems, shall be the responsibility of the Seller and shall be carried out in accordance with good engineering practices subject to approval by the Buyer.

2. All control systems shall be engineered and designed for safe failure positions in the event of a loss of power.

3. Equipment shall be designed such that noise exposure to personnel will be less than the noise exposure limits in OSHA standard 1910.95. All equipment sound levels shall be below 90 dBA at a distance of 3 feet from the source.

B. Instruments

1. Electrical switches employing mercury ampules are not permitted.

2. Each control device digital output shall be isolated from each other, and from ground so that output contact interrogation voltage can be provided from another power source without contaminating the ground of the other interrogation source.

3. Each control device digital input shall be isolated from each other and from ground so that the inputs do not contaminate the ground of another electronic system.
4. Analog instrumentation which interfaces with the Buyer’s control system shall use isolated electronic signals with power supplied from the control system where possible. Analog signals from process instrumentation shall be 4-20 milliamps DC and shall conform to ISA S50.1.

5. Switches for discrete signals shall have a minimum rating of 3 Amps at 120 VAC and 3 Amps at 28 VDC, resistive loads, with double Form C contacts.

6. Any major shutdown logic or sequence control logic shall be accomplished using a microprocessor based controller. Hard wired relay systems may be used where the logic or sequence control logic requirements are minimal. The Seller shall be responsible for procuring, installing, wiring, programming, and debugging the controller.

7. All shutdown sensors shall be dedicated devices.

C. Electrical

1. All electrical equipment and installation shall conform to requirements as called for in Section 16152, Electrical Specification for Packaged Mechanical Equipment.

2. All interconnecting cables from one panel section or device to another shall be labelled at each end.

3. At no time shall any voltage in excess of 24VDC or 120VAC, 60 Hz be allowed in any panels except as specifically approved by the Buyer. Where transformers are required to step down the supply, they shall be mounted external to the panel.

4. Instrument systems requiring 120 VAC power for operation shall have individual over-current protection.

5. All power wires going out to field devices shall be individually fused.

6. Electrical equipment that is plugged into a 120 VAC source shall be fitted with a NEMA 5-20 plug.

7. Design shall minimize the effects of voltage transients. Guidelines contained in IEEE-C62.41 and MIL-HDBK-419A shall be used for proper grounding, bonding, shielding and protection against surge voltages.

8. All motors shall conform to Section 16151, NEMA Frame Electric Motors.
9. All wiring and cable shall conform to Section 16120, Wire and Cables.

10. All electrical work and equipment shall conform to Section 16050, Basic Electrical Materials Methods.

D. Panels

1. Human factors engineering practices in accordance with MIL-STD-1472D shall be used when designing panels or consoles.

2. Panels shall comply with the requirements of Specification Section 16152, NEMA ICS-6 and NEMA 250.

3. Fluorescent lights are prohibited in panels with low level signal wiring.

4. Terminal blocks in panels shall comply with ICS-4. 25% spare terminal points shall be provided.

5. Rear of panel wiring shall not interfere with spare space for possible future installation on the panels, or accessibility for maintenance.

6. All panel-mounted devices shall be flush-mounted.

7. All devices associated with a given section of the process shall be grouped together.

8. Panels shall be provided with breather and drain fittings, with the exception of ventilated panels.

9. Control panel shall be furnished as a complete system, including instrumentation and controls wired to terminal blocks. Pushbuttons and indicating lights shall be installed and wired on control panel.

10. Panels to be mounted not in an environment controlled area shall be thermally insulated and provided with strip heaters and thermostatic controls.

11. Panels shall be of welded steel or aluminum construction, framed, braced with angle or channel steel as necessary. Panel shall be rigid and self-supporting.

12. A copper ground bus shall be provided at the bottom or side of the panel.

13. Each panel which is not permanently mounted by the Seller on an equipment package shall be provided with removable lifting lugs.
14. All panels including instrument components and electrical wiring and devices must conform to the electrical area classification specified.

15. Panels for outdoor service shall be rated NEMA 4. All panel doors shall be gasketed. All panel doors shall include a locking 3-point latch. NEMA 4 panels with door clips instead of 3 point latches shall not be supplied without written authorization from Buyer.

16. All connections and devices shall be located for maximum convenience of operation and serviceability. Any components shall be removable without the removal of another component.
17. Convenient access to all parts for disassembly, calibration and/or adjustment shall be provided. All signals needed for any periodic adjustments or for basic troubleshooting shall be brought out to easily accessible test points.

18. Panels shall be sandblasted, given a phosphate treatment, and painted with primer. Final coat for panels intended for general service shall be a polyurethane paint system, with outdoor catalyst.

E. Alarms

1. Seller shall provide interface for alarms as specified in the applicable Specification Section.

2. Alarm systems shall be fail-safe, i.e. an alarm condition is annunciated on a loss of electrical signal.

3. Audio alarms shall have selectable distinct sounds with nominal output of 85 to 115 dB at 10 feet. Frequency range shall be between 200 and 5000 Hz. Warning lights and beacons shall be visible from any angle in a horizontal plane.

4. Protective systems with more than one alarm/trip condition shall be supplied with a "first-out" feature. That is, the first alarm received from a predefined group of alarms, shall be identified by means defined in ISA-S18.1 Annunciation Sequences and Specifications.

5. Alarms shall meet the applicable requirements of MIL-STD-1472D.

F. EMI/RFI Protection

1. Electromagnetic/Radio Frequency Interference (EMI/RFI) protection against hardware and signal errors shall be incorporated into the design of devices and systems.

2. RF sources expected in the area include:

   a. Hand held transceivers 150 MHz to 175 MHz
      406 MHz to 900 MHz

   b. Airplane flyover 108 MHz to 132 MHz
      161 MHz to 165 MHz

   c. Amateur radio 3.5 MHz to 30 MHz
      144 MHz to 148 MHz
      430 MHz to 440 MHz

   d. Microwave 1 GHz to 8 GHz
e. VHF Radio transceiver 160 MHz to 173 MHz
f. UHF Radio transceiver 406 MHz to 420 MHz
g. Spread-spectrum RF 902 MHz to 928 MHz
h. Crane Controls TBD

G. Identification and Marking

1. For purposes of identification, all instrument items shall have instrument information stamped on a stainless steel tag that is affixed to the body of the instrument or attached by stainless steel wire to the body of the instrument. Stainless steel tag shall be a minimum of 1.5" long x 0.5" wide. Seller shall use instrument tag numbers as specified on the Contract Drawings or as specified in the applicable Specification Section. Where Seller provides additional devices than indicated on the Contract Drawings, Buyer shall provide the additional tag numbers as required.

2. All panel and console devices, switches and similar devices shall have nameplates on front with item identification and service description. All devices, switches, and similar devices in back of panels shall have permanent type labels with item identification. Nameplates shall generally be 1 inch by 3 inches with up to 4 lines of engraving with 15 characters per line. Nameplates shall be engraved lamacoid, white with black core. Nameplates shall be fastened to panels with stainless steel screws. Wiring and terminal blocks shall be tagged with permanent markers. Nameplates shall not be attached to removable covers or relays.

H. Reliability, Availability, Maintainability

1. Seller shall include redundancy (if required), loop distribution, component specifications and testing quality control, etc. to assure the highest level of system availability.

2. Instruments and all of their components shall be designed for maintenance by Facility personnel. Convenient access to all parts for disassembly, decontamination and/or adjustment shall be provided. All signals needed for any periodic adjustments or for basic troubleshooting shall be brought out to easily accessible test points (any necessary extender cards shall be provided with the Instruments).

3. Where practicable, devices shall be capable of being calibrated with standard tools and meters, such as, multimeter and milliamp signal generator.
4. The Seller shall furnish a minimum of one (1) complete set of new, unused special tools and devices required for operation and maintenance of the equipment furnished under this specification. Special Tools and Devices shall be delivered with the equipment, in a separate container clearly identified with the name of the equipment.

I. Software

A. Where DOS/Windows - compatibility is required, the intent is to ensure use of latest versions of MicroSoft products, and compatibility between workstation operating system software and the various applications programs to be used. Seller must coordinate all software to ensure a fully functional system.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 and the applicable equipment Specification Section for shop quality control requirements.

B. The instruments shall be calibrated at Seller's facility before shipment to the Facility.

C. Factory tests shall include, but not be limited to, complete functional tests of all instrument and control components, verification of instrument calibration, and full functional testing of control systems.

D. Prior to any inspection and testing performed and/or witnessed by the Buyer, the Seller shall perform adequate inspections and tests to ensure that the equipment meets specifications and is suitable for the intended service. Seller's own inspections shall be appropriate for the intended purpose and shall conform to good industry practices and to applicable regulations, codes and standards. Seller shall adequately document the inspections and shall maintain adequate files of such information and make such files available to the Buyer upon request.
E. The Buyer intends to provide and/or require inspection and testing of major equipment and systems during fabrication and prior to delivery, with witnessing as may be specified, sufficient to ensure that all specifications have been met and that the equipment will be satisfactory for its intended service. All inspection and testing requirements will be in accordance with accepted codes and standards and approved test plans with Buyer’s established hold/witness points as identified in Division 1.0.

F. Seller shall cooperate fully with the Buyer in planning, scheduling, and conducting any prescribed performance tests, and shall make test information and reports promptly available. Seller shall submit detailed test schedules and procedures to the Buyer for approval in advance of scheduled testing. Where witnessing is required, Seller shall notify the Buyer in advance of scheduled testing. The test schedules and procedures shall list the test details, dates, expected duration and reference materials such as manuals and drawings that are required for the Buyer factory acceptance test.

G. All equipment, labor, and technical assistance used for testing and inspection performed by Seller and/or the Buyer shall be supplied by Seller.

H. Seller shall advise Buyer when panel steel fabrication is complete. An inspection will be conducted at this time or waived. A detailed inspection with functional checkout may be required when the panels are 100% complete.

I. Seller shall energize all electrical devices at least 24 hours before tests are conducted. All these devices shall remain energized throughout the test.

J. If the Seller fails to perform the necessary checks or is unable to present the equipment for inspection when the Buyer arrives, the vendor shall be liable for backcharges by the Buyer for extra time required for the Inspection Personnel Services.

PART 3 EXECUTION

3.01 PREPARATION NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. General

1. Reference the applicable Specification Section for details regarding erection, installation and application of devices.
2. Seller shall perform the following tasks:

   a. Equipment delivery, unloading, and storage prior to installation at jobsite.

   b. Equipment installation, startup, and commissioning, and support of Buyer testing.

B. Installation

1. All installations and locations shall be as indicated in the Contract Drawings.

2. Devices mounted outdoors shall be protected by weatherproof and heated housings, if required.

3. As much as practical, instrument mounting height shall be 4 feet 6 inches above equipment base or platform, but in no case shall it be lower than 2 feet 6 inches or higher than 5 feet 0 inches.

4. Devices are not to be mounted on handrails, ladders, in pathways or on pipe or equipment that is subject to vibration.

5. All devices shall be installed and mounted in accordance with manufacturer’s recommendations.

C. Training

1. On-site training shall be provided as indicated in each Specification Section.

2. Training shall be conducted by experienced personnel who are familiar with the product supplied. Seller shall submit resume’s of training personnel for Buyer approval.

3. Training shall use actual hands-on techniques, using equipment identical to the installed equipment. Installed equipment may be used with Buyer’s approval.

4. Training classes shall use equipment manuals and project documentation. Seller shall supply appropriate bound sets for each facility employee attending the class.

5. Schedule, attendance and coordination of training classes shall be subject to Buyer’s approval.
3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 and the applicable Specification Section for field quality requirements.

B. Inspection

1. System inspections shall be conducted. Inspection records shall be made available for review and approval prior to system testing.

2. Areas of inspection shall include verification of fabrication and installation in accordance with the Contract Drawings. The inspection shall be performed prior to commencement of Field Acceptance Testing.

C. Seller shall verify complete installation of software at each device. Latest versions must be used. Seller shall maintain records of serial numbers and licenses loaded into each device.

3.04 ADJUSTMENT AND CLEANING: NOT USED

3.05 DEMONSTRATION

A. Field tests shall be performed in accordance with the ATP.

3.06 PROTECTION: NOT USED

END OF SECTION
APPENDIX A

MAINTENANCE MANUALS

Maintenance manuals shall be written to ensure that plant personnel are provided with information to assist in the diagnosis and rectification of both hardware and software related faults. It shall also include descriptive maintenance procedures for all tasks that could reasonably be performed by a technician or engineer working on the system. The manual shall be based on the following contents list:

a. Introduction

b. Section 1 - Related Documentation: A cross reference to other documentation and standards used.

c. Section 2 - Overview: An overall description of the system including a functional block diagram showing the relationship between the inputs, hardware and software processes, data storage and outputs.

d. Section 3 - Functional Description: The purpose of each function shall be described. The hierarchy of the functions shall be clearly defined. This section shall include sub-sections for the following:

1) Normal control functions.
2) Maintenance functions.
3) Diagnostic functions.
4) Safety features.
5) Security features.

e. Section 4 - Operation Description: This section shall describe the operation of the system from a maintenance viewpoint. The normal operation of the system shall be described in detail in the user manual and therefore only a brief description will be necessary in this section. However, detailed descriptions of maintenance operations shall be provided by inclusion of separate sub-sections for the following:

1) Normal operation.
2) Start-up and shut-down procedures.
3) Regeneration of operating system/language software.
4) Regeneration of application software.
f. Section 5 - Hardware Description: This section shall describe the elements of the hardware and their relationship with each other. Reference shall be made to the literature that contains detailed specifications and descriptions of the equipment. The methods of fault diagnosis and replacement of the hardware elements shall be described. A bill of materials shall be included.

g. Section 6 - Maintenance: All items relating to the maintenance of the system shall be described. This section shall include sub-sections for the following:

1) System power-up and initialization procedures.
2) Starting/regenerating the system, i.e. load/dump of software.
3) Routine backup of software.
4) Planned maintenance procedures.
5) Diagnostic procedures.
6) Calibration procedures.
7) Fault rectification and component replacement procedures.
8) Maintenance equipment.
9) Special precautions.
10) Parts lists.

h. Section 7 - System Development: A full description and set of instructions shall be provided to allow the user to expand, modify and test both hardware and software. A procedure shall be provided to identify the location of any relevant information in the documentation that must be revised when changes are made to the system. Sub-sections shall be included for the following:

1) Development equipment, such as programming software or terminals.
2) Limitations and constraints of development.
3) Special precautions.
4) Development of hardware.
5) Procedures for development and modification of software.
6) Version control.
7) Related documentation.
i. Appendices: Separate appendices shall be provided for the following:

1) Drawings.
2) Software documentation (Refer to Appendix C).
3) Manufacturer’s literature.
4) Glossary and abbreviations.
APPENDIX B

USER MANUALS

User manuals shall be used mainly by plant operational staff. The normal operational and emergency operational procedures shall be described in a step by step manner. The document shall be written so that each type of operator refers to an appropriate section or sub-section of the manual. All control facilities, keyboard data entry, screen and printer formats shall be fully defined. The use of menu driven/computer based tools to describe the normal and emergency operational procedures shall be considered to aid the speed of operation and fault diagnosis. The manual shall be based on the following contents list:

a. Introduction

b. Section 1 - Related Documentation: A cross reference to other documentation and standards used.

c. Section 2 - General Description: A description of all the system and individual components, citing their purpose and overall function.

d. Section 3 - Normal Operational Procedures: A description of the normal operational procedures for each function shall be provided. This shall include the normal start-up and shut-down procedures.

e. Section 4 - Emergency Procedures: This shall contain the procedures to be employed when normal operational procedures cannot be used. It shall describe the emergency operation and shutdown procedures.

f. Section 5 - Messages and Alarms: Messages and alarms shall be defined in terms of the cause and consequence of each and the recommended operator action.

g. Section 6 - Keyboard Data Entry: Where the keyboard is used describe how the operator makes keyboard entries.

h. Section 7 - External Conditions: This section shall have a description of the effect of external conditions upon the operational aspects of the system, e.g. loss of power supply, device failures, loss of signals.
APPENDIX C
SOFTWARE DOCUMENTATION

The Seller shall submit for approval documents which describe in detail how the software meets the requirements of the Specification.

Detailed Software Design Description (DSDD): The DSDD shall detail the methods by which the requirements of this Specification Section are fully satisfied. The DSDD shall define the functions performed by the software. The DSDD shall be based on the following contents listing:

a. Introduction

b. Section 1 - Related Documentation: A cross reference to all other project documentation and standards used.

c. Section 2 - System Overview: An overall description of the software design, including a functional block diagram showing the inter-relationship of inputs, hardware and software. Context diagrams, state transition diagrams and data flow diagrams shall be submitted for the software and its interfaces.

d. Section 3 - Description of System Functions: The hierarchy and purpose of each separate function shall be described. This section shall include sub-sections for the following:

1) Normal functions.
2) Maintenance functions.
3) Safety features.
4) Security features.
5) Diagnostic functions.

e. Section 4 - Interface Requirements: This section shall detail all the interfaces with personnel, plant and other systems. The purpose of each interface and the data transferred shall be provided. An integral part of this section shall be the list of system inputs and outputs. The following sub-sections shall be included:

1) Operator interfaces (e.g. displays, alarms, keyboards).
2) Plant interfaces (e.g. input/output points).
3) Computer interfaces (e.g. communications protocols and I/O requirements).
4) Utilities interface (e.g. electrical).

f. Section 5 - Description of Operation: A description of the proposed methodology of operation shall be presented from the viewpoint of the operator. Consideration shall be given to restoration of the system in the event of equipment failure and the procedures for start-up and shut-down.

g. Section 6 - Operator Facilities: This section shall contain a description of the facilities for the operator that will use the system. Menus and screens shall be described from an operator's view point.

h. Section 7 - Description of Software: The software shall be described to identify the assignment of specific application software processes for the functions of the system. A description of the use of the operating system, language, compilers and any task-builders shall be provided. Details of the system data structure, data tables, database elements and intersystem messages shall be included.

Sub-sections shall be included for each of the following:

1) Operating system software.

2) Source language software.

3) Custom applications software descriptions shall include process descriptions with structure diagrams and module descriptions with structure diagrams. For each separate module and process the descriptive text shall indicate the following:

   a) Purpose of the module.
   b) Interface to other modules.
   c) Module initialization.
   d) Data and parameter input.
   e) Data and parameter output.
   f) Data and files accessed.
   g) Data and files modified.
   h) Functional description of the module.
   i) Error conditions and module termination.
j) Size of module.

k) Global references.

l) Data flow diagrams.

m) A memory usage table showing location of program, data and operation system usage.

n) Data structure and database:

o) Purpose of file table.

p) Data dictionary.

q) Definition of table rows and columns.

r) Description of each data entry.

s) The modules that write to the entry.

t) The modules that read the entry.

u) Physical range of the variable.

v) Size of file/table/field.

w) Type of data (digital, floating point, ASCII) and range.

x) Annotated listing of all supplied software identifying:

y) Reference to the software modules and sequences.

z) Comments to describe the operation of the code on a line by line basis.

aa) The page number and title of each page of listing.

bb) An index page that cross refers each page of listing to sequence number.

cc) A report of the contents of all registers and data tables and their function in the program.

4) Configuration software. Provide manuals that delineate methods to configure the software. Manual shall include graphics and text editors and database manager supplied with the system.
5) Control software shall be documented using an annotation package. The Seller shall provide programming manuals describing how the Buyer may develop user programs. Annotation shall comprise the following, as applicable:

   a) Descriptors for each relay contact and coil located above the contact or coil and including descriptive text and tag number.

   b) Descriptors for each timer, math, communication or file handling function.

   c) Description of the function of each software module or sub-module.

   d) Cross reference facilities for all plant and pseudo inputs and outputs.

   e) Individual line or rung comments.

   f) A report listing all the program files or networks used and their associated reference number and title.

   g) The code associated with each program or sub-program file or network shall include a description of the function and method of implementation of the code.

   h) An index page that states the salient features of the hardware and software, including description and location of input/output modules, memory usage/spare, register/data table usage/spare, system input/output count.

   i) A cross reference report for all inputs, outputs, registers, data table elements, math and function blocks identifying their locations within the annotated listing.

   j) A listing of all descriptors, comments and titles used in the annotation.

6) List of error messages including cause, consequence and corrective action of each.

7) Diagnostic facilities and procedures.

8) Details of consumables (media) and any special formatting requirements.

9) Interface design to Local Area Network and other network nodes or applications.
i. Section 8 - User documentation shall be provided which specify and describe the required data, input sequences, options, program limitations, and other activities/items necessary for the execution of the software. All error messages shall be identified in text meaningful to the user and possible corrective actions described. Refer to Appendix B.

j. Section 9 - Maintenance: This section shall describe the proposed maintenance philosophy, the built-in features and the extent of preventive maintenance. Refer to Appendix A.

k. Section 10 - Performance: A description of all performance criteria shall be included.

l. Section 11 - Project Quality Assurance Plan (QAP): A QAP shall be submitted which describes the procedures to be implemented for adequate planning and resourcing of all the quality related activities to be performed. The program shall provide for any special controls, processes, test equipment, tools, and skill to attain the required quality and for verification of quality. The plan shall be based upon non-nuclear commercial grade equipment.

m. Section 12 - Configuration Control Plan: Software source code and software documentation shall be baselined and delivered to the Buyer after successful completion of the Buyer's Field Acceptance Test. A configuration control plan shall be submitted which addresses Seller's procedures describing how the software will be modified due to upgrades or detection of bugs and deficiencies and how the baseline will be modified and delivered to Seller. Problems (errors, faults, failures, etc.) detected in released software shall be promptly reported to Buyer and corrected by Seller. The following documents shall be considered QA records.

1) Detailed Software Design Description.


3) Verification and validation records including test procedures, test case specification and test reports.
SECTION 13406
BAR CODE EQUIPMENT

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APPENDICES

APPENDIX A  EQUIPMENT LIST
SECTION 13406
BAR CODE EQUIPMENT

PART 1 GENERAL

1.01 SECTION SCOPE
A. This Specification Section covers engineering, design, fabrication, delivery, installation and testing of bar code identification equipment.

1.02 RELATED SECTIONS
A. Section 13401 Basic Instrumentation & Control Requirements

1.03 REFERENCES
A. Codes, specifications and standards referred to by number or title shall form a part of this specification.
B. Refer to Specification Section 13401 for additional applicable Codes and Standards that may apply.
C. Refer to Specification Section 13401 for a list of applicable acronyms.
D. Specific codes applicable to this equipment include:
   1. Aluminum Association Inc. (AA):
   2. UL 969

1.04 SYSTEM DESCRIPTION
A. The Seller shall provide bar code equipment consisting of bar code laser scanners, portable RF terminals, bar code label printers, printer driver, communication cables, battery chargers, accessories and other components as required for complete installation. The portable units shall have the ability to function as remote DMS terminals, as well as transmit bar codes to the DMS.
B. Seller shall provide two portable radio frequency (RF) based hand-held terminals with scanners.
C. A bar code label printer and printer control software shall be provided.
D. RF transceivers and network controller shall be provided.
E. System configuration software shall be provided.
F. Bar code label design software shall be provided.

G. Custom host software shall be provided for DMS software interface.

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Refer to Specification Section 13401 for standard requirements for submittals.

C. The following documents shall be submitted for Review and Approval:
   2. General Arrangement drawings of each device.
   3. Product literature for each device.
   4. Detailed Software Design Description (per Section 13401, Appendix C) of Bar Code host software, as developed based on Buyer’s DMS interface definition document and the requirements of this section.
   5. Acceptance Test Procedures (ATP).

D. The following documents shall be submitted for Information and Records:
   1. Manuals.
   2. Software/configuration documentation.

E. Buyer will provide DMS interface definition document describing specific transactions completed using Bar Code terminals.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements and 13401 for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 and Section 13401 for applicable Site Conditions.
B. RF transceiver and network controller will be installed in heated, ventilated DAS panel. Minimum temperature will be 40°F. Refer to Section 13407.

C. Seller shall perform site survey to confirm adequacy of design.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Allen Bradley
2. Intermec
3. Laser Data Corp.
4. LXI, Inc.
5. Metrologic Instruments
7. Telxon Corp.
8. Zebra Technologies Corp.
9. Hand Held Corp.
10. Norand Corp.

2.02 MATERIAL

A. Refer to Section 13401 for standard requirements.

B. The Bar Code System shall use the same vendor’s hardware family throughout its architecture.

2.03 EQUIPMENT

1. Design and fabrication shall conform to Section 13401, Basic Instrumentation and Control Requirements.

2. Seller shall tag each device, using the instrument tag numbers supplied in Appendix A of this Specification Section for equipment identification, per Section 13401.
3. Equipment shall be able to withstand the harsh usage in an industrial environment. Equipment shall meet the requirements of MIL-STD-810D method 506.2 procedure II and 510.2 procedure II (wind blow dust and rain) and SAE off road vehicle specification (Class II) for vibration.

4. RF based systems shall operate using spread spectrum technology. Seller shall provide product specifications conforming to National Telecommunications Information Administration (NTIA) requirements. No license shall be required.

2.04 COMPONENTS:

A. Hand Held Bar Code Scanners

1. Scanner shall be non-contact type and utilize a Visible Laser Diode. Scan rate shall be a minimum of 30 scans per second.

2. Scanner shall be capable of reading bar codes on media complying with Military Specification MIL-L-61002 and UL 969 up to a maximum distance of 20 inches Standard code shall be medium to low density Code 39 per MIL-STD-1189B.

3. Scanners shall clearly and accurately read bar codes in ambient light as follows:
   a. 450 Foot candles/fluorescent.
   b. 300 Foot candles/incandescent.
   c. 450 Foot candles/sodium vapor
   d. 1,200 Foot candles/soft outdoors

4. Scanner shall have an optical resolution to detect a minimum element width of 15 mils.

5. Each scanner shall have pistol grip to allow for one hand operation, or may be integral to the hand-held terminal.

6. Portable hand held scanners shall be provided with a 6 foot coiled cord, unless integral to terminal.

7. First Read Rate (FRR) shall be no less than 90 percent.

B. Bar Code Terminal - RF/Portable

1. The bar code terminals shall have visual readout and audible alarm capability for providing feedback, error detection, and messages to the operator.

2. Each terminal shall have sufficient power to supply its Hand Held Bar Code Scanner.
3. Terminals shall have Auto-Discrimination capability to read and decipher code 39.

4. Terminals shall have the capability to store data if the host is lost.
5. Terminals shall provide multiple scans of the Bar Code to ensure correct data acquisition.

6. Communication link shall be via Spread Spectrum Radio Frequency which transmits a full ASCII 128 character set at a rate exceeding 256k Baud.

7. Terminal shall be powered by a battery pack capable of operating for 8 hours with a minimum of 2000 one second scans. Battery packs shall be capable of being fully recharged within 6 hours from a completely discharged state. A means shall be provided for retaining the on-board memory/data during battery replacement.

8. The terminal shall have a minimum screen size to present 21 lines of text, each being 26 characters in length.

9. Belt and holster shall be included. Design shall be such that bar code can be scanned using one (gloved) hand.

C. Radio Frequency Base Station Transceiver

1. Base Station shall be capable of linking a minimum of 5 RF Remote Terminals.

2. Base Station shall be a single channel, single Host unit.

3. Power supply shall be 120 VAC, 60HZ.

4. Base Station communication link to network controller shall be manufacturer’s standard.

5. Base Station shall have an RF error redundancy checking capability.

6. RF power output shall be sufficient to cover a minimum distance of 500 ft. to terminals.

7. The Base Station shall be supplied to be installed in a panel. An external antenna shall be supplied. Refer to Section 13407

8. Transceiver may be integrated with network controller.

D. Radio Frequency Network Controller

1. Network controller shall be capable of transceiving data from the Base Station transceiver over communications link up to a maximum distance of 300 feet.
2. Network controller shall be a single channel, single Host unit.

3. Power supply shall be 120VAC, 60HZ.

4. Network controller shall be supplied to be installed in a panel. Refer to Section 13407.

5. Network controller shall interface to LAN. The LAN is Ethernet running TCP/IP, with 10 Base T connectors. Refer to Section 13461 for details.

E. Bar Code Label Printer

1. Printer
   a. Printer shall print labels for use on steel drums and boxes.
   b. Printer shall be capable of printing at least 200 labels in a 4 hour period. Labels will be printed in groups of 3 identical labels.
   c. Printer shall be suitable for operation in an environmentally controlled area. Printer will be placed on a tabletop.
   d. Power supply shall be 120VAC, 60HZ.
   e. Printer shall include re-winder to store batches of printed labels for later use.
   f. Printer shall be capable of printing labels at 90 degree rotation angles.
   g. Printer will be connected to the LAN for shared printing. Printer shall include all hardware required to connect to the LAN port. LAN interface port is described in Section 13461.
   h. Printer shall meet requirements for UL 969 indoor-outdoor use.
   i. Printer shall use thermal transfer technology.

2. Labels
   a. Labels shall be 2.5 inches wide and 5.0 inches long.
   b. Labels shall be medium to low density Code 39 bar code symbology per MIL-STD-1189B in characters at least 1 inch high and alpha numeric characters at least 1/2 inch high.
c. All printed Bar Code Labels must be reasonably expected to remain legible and affixed to the container for a period of 10 years. Labels shall meet requirements of MIL-I-61002 and UL 969 indoor-outdoor use. Labels shall be suitable for application at extreme temperatures. Refer to paragraph 1.07.

d. The label shall have four (4) lines of entry spaced at least 2 inches wide beneath the unique bar code number to allow manual data entry pertaining to safety and precautions.

e. Bar code label design, or other label designs developed by Buyer, may include custom type styles and complex images. Printer shall support this requirement.

F. Software

1. Software for Bar Code label printer control shall be provided. It shall be DOS/WINDOWS-compatible.

2. Software for configuring the system shall be provided. Such software shall be DOS/WINDOWS compatible.

3. Bar Code label design software shall be supplied. It shall be DOS/WINDOWS-compatible and offer WYSIWYG capability. Full support for custom type styles and complex images is required.

4. Custom host software shall be provided. It shall act as an interface to the DMS software, sending data from the terminals to the DMS and returning data to them. It shall be UNIX-based and shall reside in the LAN file server. It shall provide the following features:

   a. Interactive terminal screens to allow selection of current terminal location, display of bar code, display drum data, and display shipping inventory list for confirmation.

   b. Screens will be customized to fit on terminal screen without scrolling or paging, to the maximum extent possible.

   c. Current location shall be retained until modified by operator. It shall be displayed on screen.

   d. System error messages will be displayed, and sent to DMS.

   e. Transactions will be menu-based with operator prompts. Text entry using keypad shall be minimized.

2.05 FABRICATION: Not USED
2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 and Section 13401 for standard shop quality requirements.

B. The Bar Code system shall be given the following tests to ensure the system is complete and functional.

1. Seller Factory Test (requires witness and approval by Buyer).

   a. General Requirements

      1. The Seller factory tests shall demonstrate that the system is complete and functional. An integrated test, which includes the DMS equipment, the DAS equipment, the Bar Code equipment and SCADA software, is to be performed. A complete system test with actual hardware, communications equipment, applications programs, but not the DMS software, is required. Communications to the DMS software will be verified during Seller's field tests. All equipment is to be assembled, configured and ready for shipment to site, except temporary network cabling may be used. Simulated signals for external inputs are to be provided by Seller.

   b. Specific Requirements

      1. Each scanner correctly reads a test case bar code identification label with code 39 bar code. Readings shall be performed in the process environment for which the scanner is intended as given in this specification and in the contract drawings.

      2. Each scanner correctly transmits the bar code to the Host software and displays correct data received from the Host software. Each screen display and transaction shall be verified.

      3. The bar code printer correctly prints out a test case label with Code 39 bar code.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED
APPENDIX A

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# SECTION 13407

## DATA ACQUISITION SYSTEM EQUIPMENT

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### APPENDICES

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  Equipment List
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SECTION 13407

DATA ACQUISITION SYSTEM EQUIPMENT

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification covers engineering, design, fabrication, shipping, delivery, installation and testing of a data acquisition system and panel.

1.02 RELATED SECTIONS

A. Section 13401 Basic Instrumentation and Control Requirements

1.03 REFERENCES

A. Codes, specifications and standards referred to by number or title shall form a part of this specification.

B. Refer to Specification Section 13401 for additional applicable Codes and Standards that may apply.

C. Refer to Specification Section 13401 for a list of applicable acronyms.

D. Specific codes that apply include:

a. Institute of Electrical & Electronic Engineers (IEEE)


b. National Electric Manufacturers Association (NEMA)

   Pub. 250-85 Enclosures for Electrical Equipment

1.04 SYSTEM DESCRIPTION

A. The DAS shall be a modular, microprocessor-based design capable of accepting analog and contact-closure signals, and with capability to generate similar outputs. Each DAS subsystem must include an Ethernet port for communication over the LAN.
B. Two separate subsystems are to be provided. A smaller system will be installed at the General Office Building (GOB) for monitoring local alarms and status. A larger system will be installed at the Trench Enclosure Building (TEB) for monitoring local alarms and status, trending and logging process signals. Refer to Appendix A for equipment list.

C. The TEB DAS will be in a Seller-supplied panel. See Appendix B, Figure 1. Other equipment is to be installed in the panel as indicated in the figure. Refer to Sections 13406 and 13461.

D. Programming terminals, software and documentation shall be provided.

1.05 SUBMITTALS

A. Reference Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Refer to Specification Section 13401 for standard requirements for submittals.

C. The following documents shall be submitted for Review and Approval.

1. General Arrangement drawings of each DAS sub-system and the panel.
2. Assembly drawings for the panel.
3. Electrical drawings for the panel.
4. Description of interface to LAN.
5. Acceptance Test Procedure (ATP).
6. DAS program (separate GOB DAS and TEB DAS) documentation.
7. Product literature.

D. The following documents shall be submitted for Information and Records.

1. Manuals.
1.06 DELIVERY STORAGE & HANDLING

A. Refer to Division 1.0 and Section 13401 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 and Section 13401 for applicable site conditions.

B. GOB DAS will be in Telecommunications Room in an environmentally controlled area.

C. TEB DAS shall be in Seller-supplied panel. Conditions in the TEB are similar to the external site conditions as described in Division 1.0 and Section 13401.

PART 2 PRODUCT

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Allen-Bradley
2. AEG Modicon
3. GE/Fanuc
4. Opto 22

2.02 MATERIALS

A. Refer to Section 13401 for standard requirements.

B. The DAS shall use the same control system vendor’s hardware family throughout its architecture.

2.03 EQUIPMENT

A. General

1. Design and fabrication shall conform to Specification Section 13401, Basic Instrumentation and Control Requirements.
2. Utility Power (Non-UPS) provided on site is expected to be ± 10% at the utilization point. No special power conditioning equipment will be employed within the electrical distribution system other than small UPS systems for selected loads. DAS equipment shall operate on 120 VAC at 60 Hz within the regulation tolerance stated above. If the Seller's equipment is not capable of operating within these tolerances, the Seller shall provide a power conditioning unit as necessary.

2.04 COMPONENTS

A. DAS Hardware

1. The DAS shall continuously monitor itself for failure of its various components and provide a means of advising the operator when a failure is detected. As a minimum, the diagnostics shall have the following features:

   a. Perform automatic self-diagnostics after power up or restart conditions.

   b. Self-diagnostics shall isolate faults to module level.

   c. Diagnostics shall test, as a minimum, processors, memory, I/O buses, peripherals, and communication links critical to the ability of the DAS to perform monitoring and control.

   d. Execution of diagnostics shall not inhibit DAS from performing monitoring and control functions.

   e. Indications of faults shall be made available to the SCADA software (via the LAN) for alarm display.

2. Utilization of module configuration space/logic gates shall not exceed 80% for any computing module at time of shipment. The system shall be shipped with a minimum of 25% spare I/O installed.

3. Spare rack and panel space shall be available at shipment to expand the logic capacity and I/O capacity of the system by an additional 25% by adding the appropriate modules and equipment.

4. System programs and configuration shall reside in nonvolatile or battery backed up memory. Processor configuration shall not require reloading after system power failure. Any volatile memory shall be easily re-instatable.
5. To help locate a failure, the electronics cards shall be equipped with indicators, such as LEDs, which change state upon failure. It shall be possible to replace electronics cards on line, with power on, without causing any interruption in the normal operation of the DAS other than the momentary disabling or holding of the point contained in the affected device. Devices that are replaced on line shall be restarted either automatically or manually. Failure of any electronics card component in the system shall be detected and alarmed. Failure of any component shall not cause incorrect data to be transferred/used in any control program.

6. Interconnecting cables between Seller’s equipment shall be via prefabricated cables, including connectors, supplied by Seller. The cable assembly, including the conductors and connectors, shall be resistant to heat, moisture, and flame.

7. All I/O, digital and analog, shall be updated at a rate of at least once per second. Communications with the SCADA software over the LAN shall support the requirements of SCADA performance, and meet the limitations of the LAN traffic, as defined in the applicable sections.

8. Analog-to-digital conversion of inputs shall have resolution of not less than 12 bits plus sign bit and input impedance of 1 megohm minimum.

9. Combined error attributed to nonlinearity, drift, offset, resolution, etc. shall not exceed 0.25 percent of full scale.

10. Common mode rejection ratio shall be at least 60 decibels from DC to 60Hz achieved by differential input.

11. Outputs shall be capable of driving 0 to 600 ohms at 20 mA.

12. Discrete inputs shall be optically isolated. Isolation shall be 1200 volts minimum.

13. Discrete input module shall be provided capable of sourcing 120VAC to interrogate field devices. High density modules providing sixteen (16) input points shall be used.

14. Discrete outputs for control of ac voltages shall be dry contacts.

15. The TEB and GOB DAS shall be designed to accommodate the I/O per the lists in Appendix C.

16. DAS shall provide continuous control and monitoring independently of LAN or other devices on the LAN.
17. DAS shall accept supervisory control information (set point change, start/stop, sequence initiation, and tuning parameter changes), and provide process status information (alarms, analog values) to/from SCADA software via the LAN.

18. Process control changes shall not require entering configuration mode or interruption of control.

19. Processors shall be multi-loop with capability for both discrete and analog I/O.

20. Processor shall automatically reload after power failure. Operator shall have to do no more than change processor from "Standby" to "Run" mode.

21. Processor shall retain database including tuning constants on power failure. If volatile memory is used, the memory battery system shall include charger with an alarm for malfunction and low voltage.

22. Terminals on DAS I/O cards shall be large enough for #14 AWG wire.

23. GOB DAS shall be supplied as an assembly, ready for surface-mounting on Buyer's telecommunications panel.

24. Hardware shall be provided to connect DAS device to an Ethernet (IEEE 802.3) LAN, running TCP/IP network software at 10 MBPS, using 10BaseT (unshielded twisted pair, category 5 cables with RJ45 jacks) connectors.

25. Some analog signals may be a logarithmic scale. The DAS shall be capable of linearizing and converting the signal to engineering units.

26. A network time synchronization signal is provided and shall be used for system clocks and time stamping.

B. Programming

1. Seller shall supply DAS programming software for use in a DOS/WINDOWS or UNIX environment. Such software will allow off-line program development, program download and upload, diagnostics, and program documentation.

2. A portable or laptop PC, pre-loaded with the programming software, and including all necessary connectors and cables for communication to the DAS devices, shall be provided.

3. It shall be possible to have a different configuration at each DAS device.
4. Programming/documentation system shall be menu driven and require minimal knowledge of computer programming or operating system.

5. It shall be possible to compare currently active program configuration with file version and determine if mismatch exists.

C. Panel

1. The panel for the TEB DAS shall be designed and supplied by the Seller in accordance with Appendix B, Figure 1.

2. The panel shall be NEMA 12. Ventilation openings with internal, washable filters shall be provided. A drip shield, 3-point latch and double door with center seal shall be provided. Access shall be from the front only.

3. Exterior shall be painted tan. Interior shall be painted white. Panel shall be thermally insulated except for bottom.

4. One portion of the interior shall include a rack, provided for mounting various electronic devices. At least 1/3 of the panel interior shall remain open to allow for installation of devices which are not rack mounted. This portion shall have a back panel, made from steel or aluminum and painted white.

5. A heater strip with thermostat shall be provided. Heater shall be sized to maintain interior temperature above 40°F, with all other equipment off, at an exterior temperature of 10°F.

6. Ventilation shall maintain internal temperatures below the maximum allowed ambient temperature for each device in the panel, with all equipment in operation, at an external temperature of 110°F.

7. A 480VAC fused disconnect and 480/120VAC transformer, mounted externally, shall be provided for power distribution. Refer to schematic in Appendix B, Figure 1.

8. A multi-outlet power strip shall be provided and centrally located such that power cords from all devices can be plugged into it. At least one outlet shall be left unused for maintenance uses.

9. Conduit entry areas shall be allocated to each side. Five (5) 1 inch knockouts are to be provided for each area, and shall include plugs.

10. Panel shall be provided with mounting tabs.
11. The Bar Code RF Transceiver will include an external antenna. This antenna will be mounted on top of panel with an electrically isolated, weather-proof connection.

12. Rack-mounted devices shall be installed on slide-out racks for maintenance access to top and rear of devices. Slack shall be left in all cables to allow for full use of slide.

13. A 1/4 inch diameter drain hole shall be provided in bottom of panel.

14. Provide 24VDC loop power for analog inputs, unless identified in I/O List as being powered by the instrument or field device.

15. Wire 120VAC power inside panel for discrete input interrogation voltage.

16. Transmitter loop power shall be fused or current limited so shorting of one or more loops does not affect other loops on same supply.

17. Buyer will supply one power feed to the TEB DAS panel. Power feed will be 480VAC, 1-phase, 2-wire.

2.05 FABRICATION

A. All equipment in the DAS panel shall be installed, connected and functional for shop testing prior to shipment.

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 and Section 13401 for standard shop quality requirements.

B. The DAS and associated panel-mounted equipment shall be given the following tests to ensure that the equipment meets the specification.

1. Seller Factory Test (requires witness and approval by Buyer).

   a. General Requirements

      1. The Seller factory tests shall demonstrate that the system is complete and functional. An integrated test, which includes the DMS equipment, the DAS equipment, the Bar Code equipment and SCADA software, is to be performed. A complete system test with actual hardware, communications equipment, applications programs, but not the DMS software, is required. Communications to the DMS...
software will be verified during Seller’s field tests. All equipment is to be assembled, configured and ready for shipment to site, except temporary network cabling may be used. Simulated signals for external inputs are to be provided by Seller.

b. Specific Requirements

1. Each input signal shall be verified.
2. System functions and diagnostics shall be verified.
3. DAS panel internal wiring, including power distribution and heater circuits, shall be tested in accordance with Division 16.

PART 3 EXECUTION

3.01 PREPARATION NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Refer to Division 1.0 and Section 13401 for standard field quality requirements.

B. Seller shall program the DAS to be fully functional and ready for integration with the DMS and SCADA software.

C. Seller shall provide on-site training for operations personnel. Topics to be covered include:

1. Maintenance of equipment.
2. Programming and program documentation.

3.03 FIELD QUALITY CONTROL: NOT USED

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION

A. The following tests must be performed.

1. Seller Field Test (requires witness and approval by Buyer).

The Seller field test shall be a repeat of the integrated factory test using installed equipment and performed with real-time communications. Additional tests to verify the DMS software are required.

September 1995
Rev 0
3.06 PROTECTION: NOT USED

END OF SECTION
APPENDIX A

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Figure 1  DAS Panel
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SECTION 13408

SUPERVISORY CONTROL AND DATA ACQUISITION / MAN-MACHINE INTERFACE (SCADA) SOFTWARE

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APPENDICES

APPENDIX A 1/O LISTS
SECTION 13408

SUPERVISORY CONTROL AND DATA ACQUISITION/MAN-MACHINE INTERFACE (SCADA) SOFTWARE

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section provides the design requirements for selection, configuration and operation of SCADA software for interface to distributed nodes over the LAN.

1.02 RELATED SECTIONS

A. Section 13401 Basic Instrumentation and Control Requirements

1.03 REFERENCES

A. Codes, specifications and standards referred to by number or title shall form a part of this specification.

B. Refer to Spec Section 13401 for additional applicable Codes and Standards that may apply.

C. Refer to Spec Section 13401 for a list of applicable acronyms.

D. Specific codes that apply include:

1. Institute of Electrical & Electronic Engineers (IEEE)

2. International Society for Measurement and Control (ISA)
   a. ISA-S5.5-85 Graphic Symbols for Process Displays
   b. ISA-S18.1-79 Annunciator Sequences & Specifications
1.04 SYSTEM DESCRIPTION

A. The SCADA software shall interface to distributed nodes over the LAN. The SCADA software shall provide alarm management, process display, control interface, trending and logging capability.

B. Supervisory control of the plant shall be performed from workstations provided under Section 13461, using the SCADA software. Data acquisition hardware, functioning as nodes on the LAN, are described in Section 13407. Additional interfaces are located at the NDA/NDE and HGS trailers, which also function as nodes on the LAN, and which are GFE. The SCADA software must interface with the GFE equipment as generally described herein, but the detailed interface definitions will be provided later.

C. The DMS will track container locations and status via interface to the Bar Code equipment and the GFE trailer equipment. These locations will be made available to the SCADA software for use in the displays. The DMS will also generate alarms. The DMS interface will be defined later.

D. An off-site alarm surveillance system (TMACS) will poll the DAS during off-shift times over the LAN. This interface will be defined later.

E. The SCADA software shall be configured for the inputs as defined in Appendix A. Discrete inputs are for alarms. Analog inputs are for display trending and logging, and calculated alarms.

F. The workstations in the GFE trailers (NDA/NDE and HGS) may require special control displays for drum transport and equipment control. These special control displays will be developed as part of the interface definition document provided by the Buyer.

G. Data entry and retrieval to/from the DMS will also be provided at the workstations. The SCADA software must be capable of running in simultaneous sessions on the workstations with the DMS software.

H. Workstation operating system software is described in this section.

K. Each workstation shall be configured for the selected SCADA software displays appropriate for that workstation’s functions. Buyer will make these selections during SCADA screen display development and review.
1.05 SUBMITTALS

A. Reference Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Refer to Spec Section 13401 for standard requirements for submittals.

C. The following documents shall be submitted for Review and Approval:
   1. Acceptance Test Procedures (ATP).
   2. Prints of screen displays.
   3. Point descriptions.
   4. System configuration parameters.
   5. Product literature.

D. The following documents shall be submitted as Information and Records:
   1. Operating system software and manuals.
   2. SCADA application software and manuals, specific to this application.
   3. SCADA development software and manuals.

E. The SCADA/MMI software has interfaces to other equipment and software which is either existing or government furnished. In order to develop the SCADA software and coordinate the workstation operating system software selection, the interfaces to these other items must be provided to the Seller. These are termed Buyer Submittals. Seller shall use these to complete the development of the SCADA software. Buyer Submittals include:
   1. NDA/NDE equipment interface definition.
   2. HGS equipment interface definition.
   3. DMS interface definition.
   4. TMACS interface definition.
1.06 DELIVERY STORAGE & HANDLING

A. Refer to Division 1.0 and Section 13401 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 and Section 13401 for applicable site conditions.

PART 2 PRODUCT

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. WonderWare InTouch
2. Intellution FIX
3. GE/Fanuc Cimplicity
4. Allen-Bradley Control View
5. Hewlett-Packard RTAP/Plus
6. US Data Factory Link

2.02 MATERIALS

A. Provide licenses and software copies in suitable quantities to allow installation of the operating system and application software on each of the workstations. Reference Contract Drawings and Section 13461 for workstations.

B. Refer to Section 13401 for additional requirements.

2.03 EQUIPMENT

A. General System Requirements

1. The SCADA software shall have a minimum capacity as defined below:

   a. Display screens    20 screens
   b. Points              500 tags
   c. Trends              20 points

2. Points may consist of analog or discrete variables, computed values, or pre-defined messages to/from other applications on the LAN.
3. Point IDs (tags) shall be composed of string of alphanumeric characters. Provide free format approach to generation of tags. This approach will preclude use of tag dictionary lists and non-ISA tag formats.

4. In the event of a failure, the displayed variables and control outputs of the system shall fail "off". After restoration, the system status shall be checked for proper operation before any action is initiated.

5. The SCADA software shall have self-diagnostics that will identify problems and provide error messages.

6. Security and access into the system shall be controlled to restrict access to different levels consistent with the user's need for access. Software changes and access shall be controlled by password protection. Accomplish separation of levels by passwords. Additional levels of security may be accomplished by keyed locks, separate terminals, and removable keyboards. Provide the following four levels of control.

   a) Level 1: Supports monitor-only functions; change displays; pan and zoom trends.

   b) Level 2: Supports control functions; modification of set points or output signals; auto/manual selection; on/off control; start/stop control; batch sequence initiation; initiation of current trending; and alarm acknowledgment.

   c) Level 3: Support Level 2 capabilities and modification of alarm limits and alarm inhibits.

   d) Level 4: Support Level 3 capabilities and modification of tuning parameters and configuration functions.

7. System shall use exception reporting with time-out to minimize LAN traffic. Network traffic shall not exceed 50% of capacity.

8. A network time synchronization signal is provided and shall be used for system clocks and time stamping.

9. Process control functions such as modification of set points, tuning parameters, control status (auto/manual), output state (on/off), and other control parameters shall require two-step (select before execute) permissive actions.

10. The workstations will be connected to the LAN using Ethernet Version 2 and configured for IEEE 802.3. The LAN will be communicating at a peak rate of 10 Mbits/second. The LAN protocol is TCP/IP.
B. System Performance

1. System shall be capable of monitoring and dynamically updating all inputs, digital and analog, at a rate of at least once per second. All outputs shall be dynamically updated at a rate of at least once per second.

2. Dynamic information on displays shall be updated with new information at least once every 2 seconds.

3. Control commands entered shall be executed within 2 seconds.

4. Time to call up pre-formatted displays shall not exceed 2 seconds. Graphic display call up shall not require more than 2 seconds and tag values for maximum display shall appear within the same 2 seconds.

5. System shall have capacity to trend up to 20 variables simultaneously. Sample rate and interval shall be selectable by second, minute or hour.

C. Displays

1. Uniquely label and identify each display and include a display of the current date and time with resolution to 1 second.

2. Each display shall be directly accessible by name.

3. Displays shall be selectable from other displays as configured during display development.

4. DMS software shall be accessible via screen selection icon.

5. Provide representation of alarm status, by color coding and flashing that is consistent on all displays that provide alarm status. An alarm display icon shall pop up on all displays when an unacknowledged alarm exists.

6. Display numeric values, such as alarm points, set points, process variables, and tuning parameters, consistently in engineering units.

7. Dynamically update displays when they contain variables or status information.

8. Display shall provide feedback in response to control actions.
9. The system graphics symbols, CRT presentation and format shall use the same standard throughout the displays. Status, rather than demand information, shall be displayed for important parameters. Displays shall indicate whether they reflect demand or actual status. Each display shall be formatted and designed to ensure that both the display and display content are readable, understandable, and accessible.

10. Control Displays

a. Provide graphical and textual representations of device status, alarms, loop set points, loop outputs, and process variables for loop. Use simulated control station faceplates for each loop. Displays shall include following, as applicable.

1) Tag name of point, loop, or device.

2) Alphanumeric description of point, loop, or device.

3) Numeric and bar graph display of point or loop including alarm level, set point, output, and process variable.

4) Range of process variable in engineering units.

5) Indication of alarm status by color coding and flashing.

6) Control status of loop including auto/manual and on/off.

7) Device status.

b. Control displays shall include the following control functions.

1) Alarm acknowledgment.

2) Modification of set points.

3) Modification of output signals.

4) Change of control status (e.g., auto/manual).

5) Change of output state (on/off).

6) Modification of loop tuning parameters including proportional gain, reset, and rate.

7) Modification of alarm limits.
8) Modification of set point and output high/low limit.

11. Alarm Displays

a. Provide functions to perform operator alarm acknowledgement.

b. Alarm display parameters are to be configurable from a menu driven entry system. Alarm sequences per ISA S18.1-79 shall be available for selection.

c. Provide reverse chronological listing of current alarms (latest on top). Display shall include time of alarm occurrence, tag name, alarm type, and alarm description.

d. Indicate alarm status (activated, acknowledged, and cleared) by combination of color coding and flashing. Use flashing for unacknowledged alarms.

e. Remove alarms that have been acknowledged and cleared, and display alarm list restacked to eliminate blank lines.

f. Alarm capability shall be provided for both analog inputs and calculated variables for the following conditions. User shall be able to select which are active.

1) High operating limit.

2) Low operating limit.

3) Excessive rate of change.

4) Deviation from set point.

5) Point out of range.

g. Alarms shall be provided for one or zero state of discrete input or calculated discrete value (logic calculation).

h. System shall be capable of discriminating time of occurrence among alarms separated by 1 second or more.

i. Diagnostic alarms for equipment failures for each node shall be provided.

j. Activation of alarm shall be annunciated, both visually and audibly, so that attention is commanded without preempting current activities.
k. Control of alarms shall be logically configurable to prevent them from becoming a nuisance, as in case of simultaneous or chattering alarms.

1. Alarm activation shall be automatically logged. Alarms shall be logged with a one second resolution between subsequent alarms. Logged information shall be printable on demand and include date and time of occurrence, tag name, alarm type, and alarm description.

m. Acknowledgment shall cause alarm indicator to be set from flashing to steady and cause audible annunciator to be silenced. Acknowledgment shall be logged, logically linked to alarm annunciation information and include date and time of acknowledgement, tag name, and alarm type.

n. Alarm shall remain active on appropriate displays until it has cleared. Clearing of alarm shall be logged and logically linked to alarm annunciation and acknowledgment information, and include date and time of clearing, tag name, and alarm type.

o. Alarm setpoints shall only be changed through the configuration system.

12. Diagnostic Displays

a. Provide status of major system components including network nodes, I/O at point level, and communications network.

b. Information displayed shall include name and operational status of each major component such as primary or secondary, online or offline, operational or failed, etc.

13. Trend Displays

a. Current trend variables shall be stored online for quick recall. Current trend variables shall be sampled and stored at user selectable rate by second, minute or hour. A minimum of 60 samples shall be saved for each variable. When storage buffer is full, new values shall replace oldest values.

b. Trend displays shall support the following control functions:

   1) Selection of trended process variables.
   2) Selection of time region of interest.
3) Selection of range scale.
4) Selection of trend time scale.
5) Selection of sample frequency.
6) Selection of duration for current trends.

c. Show variables in different color when multiple variables are trended on combined display.

d. Dynamically update display when trending current process variables.

e. Displays shall provide trend plots with a minimum of three selected current or historical process variables on either segmented display or combined display.

f. Clearly indicate missing data on plots.

g. Plots shall provide the following information.

1) Tag name and description of each variable being trended.

2) Time scale on horizontal axis.

3) Range scale on vertical axis.

4) Most recent numeric value for current trend displays.

h. System shall have capability to print trend plots in color.

14. Graphic Displays

a. Provide graphical representations of status and control of processes. Displays shall consist of standard process symbols that, in combination, represent the process being monitored and shall provide the following.

1) Dynamic update on discrete event occurrence (valve open/close, alarm generation, discrete I/O, etc.) by changing color, blinking, shape, size, or orientation of process symbols.

2) Indication of alarm status by color coding and flashing with inclusion of text messages. Use flashing red for unacknowledged alarms, steady red for acknowledged alarms.
3) Capability to generate custom messages initiated from alarms or discrete inputs.

b. Graphic displays shall support the same control functions as control displays.

D. Configuration System

1. Provide application development software with pre-formatted display definition capability, graphics display editor.

2. System shall be menu driven and require minimal knowledge of computer programming or operating system. Fill-in-the-blanks approach is required.

3. Provide interactive display definitions with the capability to configure and construct pre-formatted displays. The capability shall provide the following functions.


   b. Fully support features of pre-formatted displays.

   c. Reference process variables by tag name during display definition and construction.

   d. Add new displays and modify existing displays.

   e. Delete displays and automatically recover disk storage.

4. Provide interactive graphics editor that supports definition and construction of User-formatted graphics displays. Editor shall provide the following functions.

   a. The graphics display editor shall use "CAD-like" techniques for graphic screen development without total reliance on hand-coding by the developer. The editor shall not rely on complex graphics generation language but shall be user friendly and menu driven.

   b. Support fully the features of User-formatted displays.

   c. Reference process variables by tag name during display elements definition and display construction. Display elements and tag attribute elements shall be directly linked.

   d. Add new displays.

   e. Modify content of existing displays.
f. Delete existing displays and automatically recover disk storage.

g. Build new display from existing displays.

h. Use predefined standard process symbols.

i. Be able to create User-defined symbols and place into library for later use.

j. Select colors for symbols, tag, and alarm states.

k. Random and selective delete, copy, or move of picture elements.

5. Provide interactive editor that supports definition and configuration of points. Editor shall provide capability to add, modify, and delete points and support following:

   a. Point source definition such as LAN node location and address.

   b. Point tag name definition.

   c. Point type definition in terms of analog, discrete, calculated, etc.

   d. Conversion from raw data to engineering units definition.

   e. Set point and tuning parameters definition.

   f. Process variables alarm limits definition to support alarm activation conditions.

   g. Point scan frequency definition.

   h. Backup point definition on mass storage and provide hard copy listing of tag configuration sorted by tag name.

E. Logging Capability

1. Provide capability of selectively sending to a log file or printer the following events and information. Information shall include date and time of occurrence.

   a. Log of setpoint changes and other control actions.

   b. Alarm log.

   c. Periodic recording of process variables.
2. Data compression algorithms may be used to reduce amount of data recorded.

3. Provide interactive retrieval package capable of retrieving information from the log files so it can be accessed for historical trending and reporting. Information to be retrieved shall be selectable, as a minimum, by the following:
   a. Date and time
   b. Tag number
   c. Paging back and forward in time

4. Provide capability to generate periodic reports of selected process variables initiated by event, demand, or chronology. Reports shall provide, as a minimum, date, time, tag name, process variable reading, and engineering units.

5. Provide capability to print reports of selected process variables as custom-formatted reports or graphs.

2.04 COMPONENTS

   A. TCP/IP protocol stacks shall be provided as virtual device drivers, if not native to the operating software. Network communications shall not be affected by program crashes, or by switching between DMS and SCADA sessions. TCP/IP protocol implementation shall conform to WINSOCK 2.0, if applicable.

   B. The operating software provided by Seller must be multi-tasking and support network communications. Acceptable software includes MS-WINDOWS, UNIX, MS-WINDOWS NT, or IBM OS/2.

   C. The OS must support the DMS and general-purpose office software which will be loaded into the workstations. The DMS software resides on the File Server running under UNIX, and is accessed by terminal emulation. The office software is DOS/WINDOWS-based.

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

   A. Refer to Division 1.0 and Section 13401 for standard shop quality requirements.
B. The SCADA software shall be given the following tests to ensure that it meets the specification.

1. Seller Factory Test (requires witness and approval by Buyer).
   a. General Requirements
      1. The Seller factory tests shall demonstrate that the system is complete and functional. An integrated test, which includes the DMS equipment, the DAS equipment, the Bar Code equipment and SCADA software, is to be performed. A complete system test with actual hardware, communications equipment, applications programs, but not the DMS software, is required. Communications to the DMS software will be verified during Seller's field tests. All equipment is to be assembled, configured and ready for shipment to site, except temporary network cabling may be used. Simulated signals for external inputs are to be provided by Seller.

   b. Specific Requirements
      1. All display screens and points shall be verified.
      2. Verify compatibility with Buyer's office PC software by actual tests and use.

PART 3 EXECUTION

3.01 PREPARATION
   A. Verify the workstations, LAN, and DAS are installed and operational prior to loading the SCADA software.
   B. Coordinate work with loading the DMS software.

3.02 ERECTION, INSTALLATION & APPLICATION
   A. Refer to Division 1.0 and Section 13401 for standard requirements.
   B. Seller shall provide on-site training for operations personnel. Topics shall include:
      1. Program use
      2. Program development
      3. Program documentation

3.03 FIELD QUALITY CONTROL
   A. Refer to Division 1.0 and Section 13401 for standard field quality requirements.
3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION

A. The following tests shall be performed.

1. Seller Field Test (requires witness and approval by Buyer).

   The Seller field test shall be a repeat of the integrated factory test using installed equipment and performed with real-time communications. Additional tests to verify the DMS software are required.

3.06 PROTECTION: NOT USED

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APPENDIX A

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SECTION 13451

RADIOLOGICAL MONITORING INSTRUMENTATION

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APPENDICES

Appendix A Equipment List
SECTION 13451
RADIOLOGICAL MONITORING INSTRUMENTATION

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section describes the complete Radiological Monitoring Instrumentation package required for project W113 with the exception of the aerial effluent monitoring instrumentation which is covered in Specification Section 13452.

B. The scope of this work includes engineering, design, fabrication, delivery, installation and testing of radiological monitoring instrumentation.

1.02 RELATED SECTIONS

A. Section 13401 Basic I&C Requirements

1.03 REFERENCES

A. Codes, specifications and standards referred to by number or title shall form a part of this specification.

B. Refer to Specification Section 13401 for additional applicable Codes and Standards that may apply.

C. Refer to Specification Section 13401 for a list of applicable acronyms.

D. Specific standards for this equipment include:

1. American National Standards Institute (ANSI):
   b. ANSI N42.17B, 1989 Performance Specifications for Health Physics Instrumentation - Occupational Airborne Radioactivity Monitor Instrumentation
2. DOE Orders  
   a. DOE Order 5480.11 Radiation Protection for Occupational Workers

1.04 SYSTEM DESCRIPTION

A. The term "Instruments" or "Instrumentation" throughout this Specification Section will refer generically to all Instruments (including both monitors and sampling systems) in this package. The primary function of the Instrumentation will be to sample, and/or where appropriate monitor, radiation within the Facility, for the purposes of internal and external radiation exposure control.

B. Monitoring equipment shall provide real-time measurement of radioactivity. The equipment includes detectors and associated readout indication and alarms.

C. Sampling equipment collects particulate matter for later analysis.

1.05 SUBMITTALS

A. Reference Division 1.0, for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Reference Division 1.0 for additional submittals not listed here.

B. Refer to Specification Section 13401 for standard requirements for submittals.

C. The following information shall be submitted for Review and Approval.

   1. Acceptance Test Procedure (ATP).
   2. General Arrangement drawings.
   3. Electrical drawings.
   4. Product literature.
   5. Assembly drawings.

D. The following items shall be submitted for information and records:

   1. CAM Certification Report.
   2. Test Results.

E. The Seller shall provide an operation manual for each type of Instrument.
F. The Seller shall provide a maintenance manual for each type of Instrument.

1.06 DELIVERY, STORAGE & HANDLING

A. Reference Division 1.0, for standard requirements and 13401 for delivery, storage and handling requirements.

1.07 SITE CONDITIONS

A. Reference Division 1.0 and Section 13401 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this Specification Section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement shall not be limited to these listed manufacturers.

1. Eberline, Sante Fe, New Mexico, 87504.

2. SAIC Commercial Products Division, 4161 Campus Point Court, San Diego, CA 92121.

2.02 MATERIALS

A. Refer to Section 13401 for standard requirements.

2.03 EQUIPMENT

A. The Instruments shall sample airborne particulate matter and/or detect the specified type of radiation (alpha or gamma, as specified) in and around the Facility in accordance with the requirements described below in this section.

B. Requirements for continuous air monitoring for alpha radioactivity in particulates shall be in accordance with guidance provided in ANSI N13.1-1969 Sections 4.2 and 5.2. Particulate alpha emissions shall be assumed to be Pu-239.

C. Requirements for monitoring of Facility areas for gamma radioactivity shall be in accordance with guidance provided in ANSI/ANS-HPSS C-6.8.1, 1981.

D. Requirements for representative collection of particulate matter at operator work locations for periodic off-site analysis shall be in accordance with guidance provided in ANSI N13.1-1969.
E. The Instruments shall be calibrated by a laboratory equipped with radioactive sources and flow rate measurement devices that are traceable to the National Institute of Standards and Technology (NIST).

F. All routine functions of the Instrumentation shall be automatically controlled by the Instruments and the associated electronics, independent of any operator intervention.

G. The Instruments shall initiate a complete automatic restart with no operator interaction following a loss of power.

H. Information from the Instruments on status or radioactivity data shall be available locally at the Instrument.

I. Within the Instruments, all alarms shall be independent of each other (i.e., a high-level radiation alarm shall not be used as a failure alarm).

J. Shielding or circuitry shall be provided to mitigate the effects of background activity. If this mitigation is accomplished by electronic means (e.g., background subtraction), then the effectiveness of this mitigation shall be verified during calibration.

K. Radiation detector assemblies, electronic modules, readout and display devices, and power supplies shall have in-place functional testing capability.

L. For each Instrument type, radiation detector assemblies, electronic modules, readout and display devices, and power supplies shall be modular and interchangeable.

M. All Instruments shall be designed and fabricated in accordance with Section 13401.

2.04 COMPONENTS

Instruments shall be provided in accordance with Appendix A.

A. Portable Alpha Continuous Air Monitoring system (CAM)
   Tags RITA-11-106 and RITA-11-107.

   1. Two mobile CAM’s, complete with pump and supporting mobile structure meeting the following requirements.

   2. The Continuous air monitors shall be designed to monitor gross alpha radioactive particulate present in the Facility area. Drawings H-2-823407 sheets 1 and 2 depict the proposed location of the portable alpha CAM’s.
3. The CAM's shall comprise the Eberline model ALPHA6A-1 or similar, with integral radial entry detector head, analog output and high radiation and loss of count failure alarm switches. The analog output from the unit shall be 2 wire, 4-20mA. Radiation high and fail alarms shall consist of dry contact switches opening on alarm.

4. The CAM's shall incorporate radon-thoron rejection background facilities.

5. The CAM's shall be ranged from 10 to $10^6$ cpm with a maximum count rate capability of 500,000 cpm.

6. The overall CAM system design shall meet ANSI 42.17B and DOE order 5480.11 as a minimum. Performance specifications in ANSI N42.17B shall be met or exceeded and a certified report shall be provided. These include performance standards for detection, range, accuracy, sensitivity, precision, and response time. Detection standards in ANSI N42.17B shall be achieved based on Plutonium-239.

7. The pump shall consist of a constant positive displacement vacuum pump.

8. The pump shall comprise the Eberline model RAP-1/5 or similar.

9. The whole assembly (CAM and pump) shall be self-contained and operate on 120 VAC power.

10. The pump shall incorporate an airflow regulator to maintain a constant pressure drop and be locally adjustable.

11. The alpha detector head shall be positioned such that it samples the air at a height of 3 feet minimum. Dimensional general arrangement drawings shall be submitted.

12. One of the units (tag reference RITA-11-106) shall be mounted on a cart with wheels and associated suspension suitably designed to enable the cart to be moved over an asphalt surface. A brake shall be incorporated. The other unit (tag reference RITA-11-107) shall be mounted on either a skid, tripod or other equivalent device which will enable the assembly to be moved over rough ground and parked on slopes of up to 34 degrees from the horizontal.

B. Portable Area Radiation (gamma) monitor
Tag RIA-11-109

1. One portable gamma area monitor, complete with carrying handle and tripod or other mounting device meeting the following requirements.
2. The monitor shall comprise the Eberline model EC4-1 or similar.

3. The detector shall be sensitive to gamma radiation in the range 40 keV to 1.25 MeV.

4. The system shall be configured to measure and display in the range of 0.1 to 1000 mR/hr. Minimum saturation level shall be 100 R/hr.

5. The displays shall indicate the gamma radiation continuously on a logarithmic scale.

6. Each system shall incorporate local status indicators for the following conditions: instrument normal (healthy), instrument fault and high gamma. The alarm set point shall be adjustable over the full range.

7. Each system shall incorporate a beacon and horn, activated on either high gamma detection, instrument failure or both.

8. The horn shall sound at a sound level of at least 90 dB at 10 feet.

9. Each system shall be powered from 120 VAC, 60 Hz.

10. The total weight shall not exceed 14 Kg.

11. Each system shall incorporate a check source.

12. Both units shall be mounted on either a tripod or other equivalent device which will enable the assembly to be positioned and periodically moved over rough ground and parked on slopes of up to 34 degrees from the horizontal.

C. Mobile "low volume" constant flow air sampler

Tags RE-11-103 and RE-11-104

1. Two mobile constant flow air samplers complete with 47 mm diameter particulate sample head meeting the following requirements.

2. The samplers shall be designed to sample general background air with potential radioactive particulate matter present in the Facility area. Drawing H-2-823407 depicts the proposed location of the portable samplers.

3. The system shall comprise the SAIC RadeCO model HD-29A or equivalent.

4. The system shall be capable of collecting air samples on a continuous basis.
5. The controlled flow rate shall be adjustable from 0.5 to 3.5 CFM and shall comprise an air regulator to maintain a constant air flow of 2 CFM up to 12 inches wg across the filter.

6. The system shall incorporate an air flow indicator and an elapsed time meter.

7. The system shall incorporate a sample head suitable for holding a 47 mm diameter filter, open face, SAIC model No. 2500-42 or equivalent.

8. The system shall be powered from 120 VAC.

9. The unit shall weigh less than 20 Kg and shall be mounted on wheels. Brakes or wheel locking mechanisms shall be included.

D. Portable High volume air samplers


1. Two high volume air samplers complete with 47 mm diameter particulate sample head meeting the following requirements.

2. The samplers shall be designed to sample localized operator breathing air with potential radioactive particulate matter present in the Facility area. Drawings H-2-823407 sheets 1 and 2 depict the proposed location of the portable samplers.

3. The system shall comprise the SAIC RADeCO model H-810 or equivalent.

4. The system shall be capable of collecting air samples on a continuous basis.

5. The controlled flow rate shall be adjustable up to 7 CFM and shall comprise an air regulator to maintain a constant air flow.

6. The system shall incorporate LCD displays of elapsed time, flow rate and total volume sampled.

7. The unit shall incorporate a sample head suitable for holding a 47 mm diameter filter (without cartridge), open face model No. LB-5211.

8. The system shall be powered from 120 VAC.
E. Frisker Monitors and Probes  
Tag RI-11-111.

1. One Frisker monitor comprising meter and probe meeting the following requirements.

2. The system shall comprise the meter Eberline model RM14SA or similar. The meter shall be scaled in cps.

3. The system shall comprise an Eberline model HP100BGS alpha/beta probe.

4. The system shall be powered from 120 VAC.

F. Personnel Contamination Monitor  
Tag RIA-11-112.

1. One Personnel Contamination Monitor (PCM), complete with Hand frisker probe, external gas cylinder Enclosure, Gas management system and interconnecting pipework meeting the following requirements.

2. The monitor shall comprise the Eberline model PCM-2 or similar.

2. The monitor shall be capable of detecting and locating both alpha and beta/gamma contamination over the full surface of personnel.

3. The monitor shall support either maximum sensitivity or minimum count time counting modes.

4. The detector elements shall comprise gas-flow proportional detectors operating on P-10 gas. The beta detectors shall have an efficiency of at least 25% The alpha detectors shall have an efficiency of at least 20%.

5. The displays shall indicate both alpha and beta/gamma contamination zones.

6. The system shall be powered from 120 VAC, 60 Hz.

7. The total weight of the PCM (excluding gas bottles) shall not exceed 660 lbs.

8. The system shall include the following options:

   a. One gas bottle enclosure Eberline model PCM2 OPT9 or similar.

   b. One gas management system Eberline model PCM2 OPT 12 and interconnecting pipework.
c. One 100cm² hand held frisking probe Eberline model PCM2 OPT1.

G. Shielded Boxes

1. Three shielded boxes shall be supplied to allow operators to examine smears using portable equipment in a reduced background environment in order to obtain a proper Minimum Detectable Count rate.

2. Each box shall be sized with the following internal dimensions:
   - Length: 12 inches minimum
   - Width: 12 inches minimum
   - Height: 9 inches minimum

3. Each box shall comprise at minimum of 0.75 inches of lead on each of its six sides.

4. Each box shall be designed and fabricated to allow a pancake type probe to be inserted into the box from the side. This will require one of the side faces to be suitably hinged and will allow a cable to protrude from the closed door during counting.

5. Each box shall be free standing to be mounted on a table to be provided by the Buyer.

6. Each box shall have an external surface area of no more than 18 inches by 18 inches and shall weigh no more than 350 pounds.

7. Each box shall comprise lifting lugs to allow the box to be lifted by either a crane of a fork lift truck.

8. The box shall be of modular laminated carbon steel and lead construction with the lead laminated to the steel and fully enclosed. All joints shall be lapped so as to prevent radiation leakage.
9. Application of the lead shall be accomplished by spot gluing lead to the enclosure with Hysol (or equivalent) epoxy adhesive, covering the lead with carbon steel cladding, overlapping the edges of the lead and seal welding to the shell of the enclosure at overlaps and other junctions with the enclosure hardware. There shall be no gaps in the lead joints. Lead applied in multiple layers shall have staggered joints. Gaps between lead sheets and structural framing shall be no larger than 1/8". Lead wool shall be used to pack all joints and gaps in the lead sheet application. All lead applications shall be covered with a 16 gauge cover sheet or 'skin' with all edges lapped back to the box shell and the perimeter seal welded. Seller may suggest alternative (to the above) way(s) for Buyer review and approval.

2.05 FABRICATION

A. Reference Specification Section 13401, Basic I&C Requirements, for general fabrication requirements.

2.06 SHOP QUALITY CONTROL

A. Reference Division 1.0 and Section 13401 for standard shop quality requirements.

B. Instruments shall pass these tests before acceptance by the Buyer. These are:


   a. The Instruments shall be tested for correct operation over the specified range of temperature and humidity conditions specified.

   b. The tests shall be performed with a constant radiation source.

   c. All Instruments shall be tested for correct operation over an electrical supply voltage of 120 VAC ±10% and a range of frequencies of 60 Hz ±1%. The tests shall be performed with the check source. The total count rate and net activity shall be recorded throughout the test.

   d. The Seller’s standard functional, operational and performance tests shall be used to demonstrate that all hardware functions correctly. All interfaces to the Instruments shall be included and inputs and outputs shall be simulated by active signals.

   e. The Shop Tests shall include accuracy testing of the flow meters, utilizing flow rate measurement traceable to the NIST.
f. The Shop Tests shall include accuracy testing of the continuous air monitors and area radiation monitors, utilizing a known quantity of radioactive materials traceable to the NIST.

g. Shop Tests shall include Instrument leak testing per procedures proposed by the Seller and approved by the Buyer.

2. The Buyer may witness the Factory Tests of the Instruments.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. The Seller shall install, at the Buyer’s site, all equipment which requires a permanent mounting. This includes the equipment with the following tags RE-11-101, RE-11-102 and RIA-11-112.

B. The installation requirements for samplers (tags RE-11-101, RE-11-102) are as follows:

1. The samplers shall be installed in the general locations shown in drawing H-2-823407. Sampler RE-11-101 shall be installed in the Man Basket. Refer to Section 14641. Sampler RE-11-102 shall be mounted on the drum retrieval crane.

2. Air sample heads and probes shall face upstream into the expected direction of air flow.

3. Collecting filters should be oriented in a vertical plane (unless the direction of air flow dictates a different orientation) and supported with a porous backing free of sharp edges and burrs.

4. Whenever possible and reasonable, the collecting filter shall be located in the air stream to be sampled rather than diverting a portion of the air stream to the collecting filter.

5. Air sample heads shall be located at approximately five and one-half feet above local grade or platform level to aid in changing the filter.

6. Air sample heads shall not be located where they would cause a safety problem or otherwise interfere with the performance of work.
7. A compression sealing ring designed to press the perimeter of the filter against the backing support should be provided to ensure an airtight seal.

8. Sample vacuum lines should be designed to be as short and bend free as possible.

C. The installation requirements for the PCM, tag RIA-11-112, are as follows:

1. The scope of installation for the PCM shall include the PCM, the gas bottle enclosure and the interconnecting gas supply pipework.

2. This equipment shall be installed in the locations shown in the Retrieval Staff Change Building, drawing H-2-823413.

D. Seller shall provide on-site training for operations personnel. Topics shall include:

   1. Maintenance of equipment.
   2. Operation and adjustment of equipment.

3.03 FIELD QUALITY CONTROL

A. Reference Division 1.0 and Section 13401 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION

A. The following test must be performed.

   1. Seller Field Test: The Seller shall conduct and the Buyer shall witness the Field Tests of the Instruments on-site in final location and configuration. The Field Tests shall be a repeat or a subset of the Factory Tests.

3.06 PROTECTION: NOT USED

END OF SECTION
APPENDIX A

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# ISOKINETIC SAMPLING SYSTEM

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## APPENDICES

APPENDIX A EQUIPMENT LIST
SECTION 13452

ISOKINETIC SAMPLING SYSTEM

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section describes the Isokinetic Sampling System (ISS) for the Trench Enclosure Building HVAC, hereafter referred to as ISS or the System. The primary function of the System shall be to sample the Facility aerial effluent during normal and upset conditions.

B. Scope includes the design, coordination with duct supplier, manufacture, testing, documentation, quality control, system configuration, delivery, on-site installation, startup assistance, and all other services required to meet this Specification Section.

1.02 RELATED SECTIONS

A. Section 13401 Basic I & C Requirements

B. Section 15800 Ductwork and Accessories

1.03 REFERENCES

A. Codes, specifications and standards referred to by number or title shall form a part of this specification.

B. Refer to Specification Section 13401 for additional applicable Codes and Standards that may apply.

C. Refer to Specification Section 13401 for a list of applicable acronyms.

D. Specific standards for this equipment include:

1. American National Standards Institute (ANSI):


   b. ANSI N42.18, Specifications and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents
2. Code of Federal Regulations:

a. 40CFR60, Appendix A, Method 1, 1990
   Sample and Velocity Traverse for Stationary Sources

b. 40CFR60, Appendix A, Method 2
   Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

c. 40CFR60, Appendix A, Method 5, 1990
   Determination of Particulate Emissions From Stationary Sources

d. 40CFR61, Subpart H, 1990
   National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities

e. 40CFR61, Appendix B, Method 114, 1990
   Test Methods for Measuring Radionuclide Emissions from Stationary Sources

1.04 SYSTEM DESCRIPTION

A. The function of the System shall be to provide a continuous record sample by isokinetically collecting particulate on a filter for periodic off-site analysis.


1.05 SUBMITTALS

A. Reference Division 1.0, for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Reference Division 1.0 for additional submittals not listed here.

B. Refer to Specification Section 13401 for standard requirements for submittals.

C. The following information shall be submitted for Review and Approval.

1. Plateout Calculation.
2. Acceptance Test Procedures (ATP)
3. General Arrangement Drawings
4. Electrical Drawings
5. Assembly Drawings
6. Product literature.

D. The following information shall be submitted for Information and Records.

1. Test Results

2. The Seller shall provide an operation manual for all System equipment and for the System as a whole.

3. The Seller shall provide a maintenance manual.

1.06 DELIVERY, STORAGE AND HANDLING

A. Reference Division 1.0 and Section 13401 for standard requirements for delivery, storage and handling requirements.

1.07 SITE CONDITIONS

A. Reference Division 1.0 and Section 13401 for applicable site conditions.

B. Inside Duct (For Isokinetic Probe Assembly). Reference Specification Section 15800, Ductwork and Accessories, for more details.

1. Ambient Temperature

Ambient outside temperature, as specified in Division 1.

2. Relative Humidity

Ambient outside humidity as specified in Division 1.

3. Duct Pressure at Sampling Plane

0.75 inch W.G.

4. Duct Flow Rate

25,000 cfm

5. Exhaust Duct Data

a. Duct ID (inches) 48
b. Duct Wall Thickness Refer to Duct Fabrication Dwg.
c. Duct Material of Construction Galvanized steel
6. Flow Monitoring/Sampling Location Data
   a. Upstream Unobstructed 20 ft. minimum Straight Duct
   b. Downstream Unobstructed 8 ft. minimum Straight Duct

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under included in this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement shall not be limited to these listed manufacturers.

1. Texas A&M Research Foundation.
3. Air Monitor Corporation, Santa Rosa, Cal., 95406.

2.02 MATERIALS

A. Refer to Section 13401 for standard requirements.

2.03 EQUIPMENT

A. The entire System shall be calibrated by a laboratory equipped with radioactive sources (ANSI N42.18-1985) and flow rate measurement (40 CFR60, Appendix A, Method 2) devices that are traceable to the National Institute of Standards and Technology (NIST).

B. All routine functions shall be automatically controlled, independent of any operator intervention.

C. The ISS shall initiate a complete automatic restart with no operator interaction following a loss of power. Status shall be displayed locally.

D. The Seller shall coordinate the duct penetration interface with the HVAC Ducts (Specification Section 15800).

E. One 480 VAC, 20 A, 1φ, 2 wire, 60 Hz circuit for the ISS cabinets will be provided by the Buyer. The Seller shall convert this to whatever voltages are required for any loads within the cabinet.

F. All alarms within ISS shall be independent of each other.
G. Each ISS shall generate an alarm upon detection of low sample air flow. A visual alarm on the ISS electronic cabinet shall annunciate locally within 1 second of detection of any abnormal condition.

H. Shielding or circuitry shall be provided to mitigate the effects of background activity. If the mitigation is accomplished by electronic means (e.g., background subtraction), then the effectiveness of this mitigation shall be verified during calibration.

I. The Equipment shall include the isokinetic probe assembly, sample transport tubing, sample collectors, redundant vacuum pumps, sample flowmeters and flow control valves. In all instances, where conflict(s) exists between 40CFR61 and ANSI N13.1 for sample probe design and location, the guidance of 40CFR61 shall take precedence.

J. All equipment except the probe and transport pipework shall be housed in the ISS Cabinets.

2.04 COMPONENTS


B. Isokinetic Probe Assembly
   Tags RP-12-113 and RP-12-117

   1. Each isokinetic shrouded probe assembly shall consist of a single shrouded probe assembly mounted by direct insertion into the duct mounting flange.

   2. Each isokinetic probe assembly and all associated transport tubing shall be fabricated from type 316 stainless steel throughout.

   3. Interface and installation to duct must be coordinated by Seller.

   4. The nozzles should have tapered knife edges (30° taper - outside edge of orifice) and face directly into the exhaust stream.

   5. The orifice should be located on a straight portion of the nozzle. The length of the straight portion of the nozzle should be approximately five times the diameter of the orifice. The minimum inside diameter of the nozzle should be greater than 3.2mm to minimize clogging problems.

   6. Each nozzle bend should have a radius of greater than, or equal to, five times the orifice diameter.

   7. Nozzles should be sized to provide isokinetic extraction.
8. Particulate Size

a. Each particulate sampling system shall capture a significant portion of the sampled airborne particulates in the size range 0.01-15 micron aerodynamic equivalent diameters (AED).

b. Sample nozzles shall be sized to extract at the same velocity as the effluent stream sampled when particle AED exceeds 0.5 micron.

c. Each sample nozzle shall deliver a representative sample to the sample collectors having a loss of less than 25% for a 5.0 micron AED particle and 60% for a 15 micron AED particle.

B. Transport Lines

1. Tubing size should be selected to minimize particle deposition due to gravitational settling and/or impaction.

2. Total length of the lines between the sampling probes and filter holders should be as short as practical.

3. Horizontal runs should be minimized.

4. The number and the angle of bends should be minimized. Bends should have a radius of at least ten times the inside diameter of the transport line. The sum of the bends should be less than 110°. Note that this requirement is exclusive of the 90° bend in the probe.

5. Use of pipe or tubing fittings between the sample probe and filter holder should be minimized.

6. Condensation shall be minimized. Thermostatically-controlled electrical heat tracing shall be used on transport lines where condensation is a potential problem. The sample transport lines shall be insulated.

7. Sample tubing shall be electrically grounded to the point where the particles are collected.

8. The sample transport tubing shall be constructed of seamless type 316 stainless steel and shall be rigid and adequately supported to prevent sagging.

9. The Seller shall consult the Contract Drawings to determine lengths for the sample inlet line, routing between the isokinetic probe assembly and the sample holder, and assist in calculation of sample line size and sample flow rates.
10. Easily accessible calibration taps shall be included in the sample line to allow in-place verification of the sample line flow rate. A block valve shall be included in the sample delivery lines upstream and downstream of the electronic cabinet to isolate the cabinet from the duct effluent for maintenance. Block valves shall also be located upstream and downstream of the sample delivery pumps for isolation.

11. For the sample transport tubing, the Seller shall provide standard plateout calculation and sample tubing layout instructions certified by the Seller to minimize plateout. The System shall be designed so that plateout will be minimal and under worst conditions be less than 50% of the actual sample. The System output shall compensate for plateout and the Seller shall state how this shall be done.

C. Sample Filter Holder
   Tags RE-12-113 and RE-12-117.

1. The filter assembly shall use a standard 47 mm diameter filter media size, allow easy access for filter changing, be weatherproof and have an inlet full port ball valve.

2. The particulate sample filter holder should be located as close as practical to the probe.

3. The particulate sample filter holder should have tapered expansion and contraction cones upstream and downstream of the sample filter.

4. The particulate filter holder should have a permanently mounted porous filter-backing free of sharp edges and protrusions.

5. The particulate filter holder should have a compression sealing ring designed to provide an airtight seal around the filter paper.

6. The sample filter holder should be easily opened and closed.

7. The sample filter holder should be fabricated of materials that are neither reactive to the effluent nor conducive to electrostatic deposition.

8. The filter holder shall be oriented in a vertical plane and supported with a porous backing free of sharp edges and burrs.

D. A clock shall be provided to indicate the accumulated operating time.
E. Redundant Vacuum Pumps

1. For each ISS, the Seller shall provide two constant positive displacement vacuum pumps, with manual switchover control on pump failure.

2. Each pump shall be sized to provide a minimum vacuum of 20 in. Hg when the filter pipe is inserted plus a reserve capacity of 15% or more.

3. The pumps will pull sampled air through the record sampler filters.

4. The pumps shall use synthetic lubricants to improve the life of the pump bearings.

5. The vacuum should be locally adjustable.

6. The vacuum system should have the means of providing a near constant flow rate.

F. Sample Flowmeters/Flow Switches

Tags FISL-12-113 and FISL-12-117

1. For each ISS, the Seller shall supply one direct indicating sample flow meter complete with low flow switch, Brooks model 1350 & 7949 or equivalent.

2. The flowmeters shall have an accuracy of ±10% of full scale from 100% to 10% of scales reading and a repeatability of 12% of full scale.

3. Low flow alarm shall be dry contacts, opening on alarm.

4. The air-flow measuring devices should have a range suitable for anticipated flow rates.

5. The average record sample flow rate should be at least 2.0 cfm. The air through the sampler should not exceed 3 cfm and the vacuum source should be no greater than 6 inches of mercury.

G. Flow Control Valves

1. Sample flow control valves shall be manually operated.

2.05 FABRICATION

A. Reference Section 13401, Basic I & C Requirements for General Fabrication Requirements.
2.06 SHOP QUALITY CONTROL

A. Reference Division 1.0 and Section 13401, for standard shop quality requirements.

B. The ISS shall pass these tests before acceptance by the Buyer. These are:

1. Seller Factory Test.

   a. The ISS equipment shall be tested for correct operation over the specified range of temperature and humidity conditions specified.

   b. The tests shall be performed with a constant radiation source.

   c. All ISS equipment shall be tested for correct operation over a range of electrical supply voltage of 480 VAC ±10% and a range of frequencies of 60 Hz ±1.0%. The tests shall be performed with the built-in check source. The total count rate and net activity shall be recorded throughout the test.

   d. The Seller’s standard functional, operational and performance tests shall be used to demonstrate that all hardware functions correctly. All interfaces to the System shall be included and inputs and outputs shall be simulated by active signals.

   e. The System shall operate continuously for a minimum of 48 hours without error. If error occurs, the cause shall be corrected and the test restarted until a minimum of 48 hours continuous operation is achieved.

   f. The Shop Tests shall include accuracy testing of the flow meters, utilizing flow rate measurement traceable to the NIST.

   g. Shop Tests shall include System leak testing per procedures proposed by the Seller and approved by the Buyer.

2. The Buyer may witness the Factory Tests of the System.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED
3.02  **ERECTIO, INSTALLATION & APPLICATION**

A. The Contract Drawings establish the insertion points for the isokinetic probe assemblies and the locations and sizes of the test ports. The Seller shall confirm this design meets the requirements of 40CFR61, Subpart H and 40CFR60, Appendix A, Method 1.

B. The Contract Drawings establish one option for routing and support of the sample transport tubing. The Seller shall determine the final configuration for the tubing size, routing and support based on the most efficient method of particle collection.

C. Equipment installation shall include attachment of the equipment to the supports as shown on the Contract Drawings.

D. Seller shall provide on-site training for operations personnel. Topics shall include:

1. Maintenance of equipment.
2. Operation and adjustment of equipment.

3.03  **FIELD QUALITY CONTROL**

A. Reference Division 1.0 and Section 13401 for standard field quality requirements.

3.04  **ADJUSTING AND CLEANING: NOT USED**

3.05  **DEMONSTRATION**

A. The following tests must be performed:

1. Seller Field Tests

A. The Seller shall conduct and the Buyer shall witness a Field Operational Test of the System on-site in final location and configuration. The Field Operational Tests shall be a repeat or a subset of the Factory Tests.

B. Seller shall perform a compliance test in accordance with 40CFR61, Subpart H. HVAC duct flows shall be determined using 40CFR60, Appendix A, Method 2. Particulate sampling shall be performed per 40CFR60, Appendix A, Method 5. Radionuclides shall be measured per 40CFR61, Appendix B, Method 114.

3.06  **PROTECTION: NOT USED**

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# SECTION 13461

## DATA MANAGEMENT SYSTEM EQUIPMENT

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### APPENDICES

APPENDIX A EQUIPMENT LIST

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SECTION 13461
DATA MANAGEMENT SYSTEM EQUIPMENT

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section covers engineering, design, fabrication, shipping and delivery, installation and performance tests, and other requirements for computer workstations, file server, LAN equipment, UPS, and telecommunications racks.

B. The LAN infrastructure is described in Section 16740 and the Contract Drawings.

C. The operating software and SCADA software to be used in the workstations is described in Section 13408. The requirements for network operating software are described in this Section. The operating system software for the File Server is included in this Section.

D. Other equipment on the LAN includes DAS equipment (refer to Section 13407), office equipment (GFE; refer to Contract Drawings), and Bar Code equipment (refer to Section 13406).

1.02 RELATED SECTIONS

A. Section 13401 Basic Instrumentation and Control Requirements

B. Section 16740 Voice and Data Systems

1.03 REFERENCES

A. Codes, specifications and standards referred to by number or title shall form a part of this specification.

B. Refer to Section 13401 for additional applicable Codes and Standards that may apply.

C. Refer to Section 13401 for a list of applicable acronyms.
D. Specific codes that apply include:

1. Institute of Electrical & Electronic Engineers (IEEE)

2. National Electric Manufacturers Association (NEMA)
   a. Pub. 250-85 Enclosures for Electrical Equipment

1.04 SYSTEM DESCRIPTION

A. The DMS equipment consists of PC-based workstations linked via a LAN in a star configuration. LAN hubs (concentrators) are placed in the various buildings to connect all the workstations and LAN users in the vicinity to the fiber-optic LAN cable connecting buildings. A file server acts as the network server to all connected clients.

B. The LAN infrastructure consists of fiber-optic cables between buildings (hubs) and 10BaseT cable and RJ45 connectors inside the buildings.

C. The LAN is Ethernet Version 2, per IEEE-802.3, running at 10MBPS. The LAN protocol is TCP/IP.

D. The DMS software to be run on the File Server is GFE. It is an ORACLE-based relational database, run under UNIX.

E. Network operating software is by Seller.

F. Telecommunications racks shall be supplied for all the hubs except the one for the Trench Enclosure Building.

1. The TEB hub and UPS is installed in the DAS Panel. The UPS in the DAS Panel shall supply some equipment in the panel. Refer to Section 13407 for details of the panel.

2. The rack for the General Office Building shall contain the File Server, the hub and a UPS. The UPS in the GOB rack shall supply the hub and the File Server, as well as the DAS equipment located nearby. Refer to Contract Drawings.

3. The rack for the Staff Change Facility shall contain only the hub.

4. The rack for the NDA/NDE trailer shall contain the hub and UPS. The UPS in the trailer rack shall supply only the hub.
G. Workstations are desktop/tower designs, except the enclosure-mounted one in the TEB. They shall be fully functional PCs, capable of running software independent of the network.

H. Initially, the hub in the DAS Panel will support the users in the TEB while the trailers are outside. After the trailers are placed inside the TEB, all users will be re-connected to the hub in the trailer and the DAS Panel hub will not be used.

1.05 SUBMITTALS

A. Reference Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Refer to Section 13401 for standard requirements for submittals.

C. The following documents shall be submitted for Review and Approval.

1. General Arrangement Drawings for the TEB workstation enclosure, telecommunications racks, and each rack-mounted device.

2. Assembly Drawings for the TEB workstation enclosure and telecommunications racks.

3. Electrical Drawings for the TEB workstation enclosure and the UPS.

4. Computations shall be provided for equipment heat emission and power consumption.

5. Acceptance Test Procedure (ATP).

6. Product literature.

D. The following documents shall be submitted for Information and Records:

1. Network operating system software and manuals.

2. File Server operating system software and manuals.

3. Operation and Maintenance manuals for all hardware.
1.06 DELIVERY STORAGE & HANDLING

A. Refer to Division 1.0 and Section 13401 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 and Section 13401 for applicable site conditions.

B. Equipment located in the buildings, except the TEB, is located in an environmentally-controlled area. In the TEB, conditions are as described in Section 13401. The DAS Panel has ventilation and heating for protection. The TEB workstation enclosure shall be designed similarly to protect the equipment inside it.

PART 2 PRODUCT

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. LAN Equipment
   Cabletron

2. Workstations/File Server
   Dell
   IBM
   Gateway 2000
   Hewlett-Packard
   DEC
   Sun MicroSystems
   AST

3. UPS
   BEST

4. Racks
   Electrorack

5. Industrial PC
   Eaton IDT
   Xycom

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2.02 MATERIALS

A. Refer to Section 13401 for standard requirements.

2.03 EQUIPMENT

A. Utility Power (Non UPS) provided on site is expected to be ± 10% at the utilization point. No special power conditioning equipment will be employed within the electrical distribution system. DMS equipment shall operate on 120 VAC at 60 Hz within the regulation tolerance stated above. If the Seller’s equipment is not capable of operating within these tolerances, the Seller shall provide power conditioning/filtering units as necessary.

2.04 COMPONENTS

A. LAN Equipment

1. LAN hubs shall be stackable and intelligent. Each shall support required fiber-optic links. All other links shall be 10BaseT with RJ45 jacks. Sufficient ports shall be provided to connect all users, plus all connected outlets, plus at least 25% unused spares. System programs and configuration shall reside in nonvolatile or battery-backed-up memory. Jabber protection shall be included. Hubs must be compliant with Simple Network Management Protocol (SNMP). A diagnostic/management port shall be provided.

2. To help locate a failure, the equipment shall be equipped with indicators, such as LEDs, which indicate status. It shall be possible to replace electronics cards on line, with power on, without causing any interruption in normal operation other than the momentary disabling or holding of the point contained in the affected device. Devices that are replaced on line shall be restarted either automatically or manually. Failure of any electronics card component in the system shall be detected and alarmed. Failure of any component shall not cause incorrect data to be transferred.

3. The Bar Code label printer (refer to Section 13406) shall be connected to the LAN with an appropriate network interface. This interface shall be configured for 10BaseT/RJ45, with serial and parallel ports, and must be TCP/IP-compatible.
4. Network operating software shall be provided which allows full connectivity for all workstations, regardless of individual operating system software. Network operating software must be compatible with TCP/IP, and run in UNIX on File Server. Network shall provide a time synchronization utility available to all users, which shall be controlled by the master clock signal received via HLAN. Network traffic shall be limited to 50% of capacity. LAN management software will be provided by Buyer.

B. Telecommunications Racks

1. Telecommunications racks shall be 71 inches high, 30 inches deep, and suitable for standard 19 inch rack-mounted equipment. Racks shall be ventilated with open grill tops, and shall have transparent front doors for viewing internal equipment. They shall be fully assembled from 14-gauge steel, be of frame construction and have solid side panels. They shall have two pairs of tapped adjustable mounting angles. Each cabinet shall have a multiple-outlet power strip.

2. Rack for File Server (and associated equipment) shall be 71 inches high, 30 inches deep, and 30 inches wide. It shall have a work surface suitable for one keyboard and mouse pad. It shall have adjustable shelves for server and peripherals. It shall be of H-frame construction.

C. TEB Workstation and Enclosure

1. Workstation CPU, monitor and peripherals shall be industrially hardened and mounted in an enclosure meeting NEMA 4 requirements.

2. The keyboard shall be protected either by a membrane design or a water-resistant transparent covering. It shall be rated NEMA 4. A track ball or touch operated device shall be used in lieu of a mouse.

3. Enclosure shall be free standing and completely fabricated and wired in the Seller's factory and shall be totally enclosed except for required ventilation. Terminals and breaker shall be provided for a non-UPS power circuit. If power conditioning is required, it shall be included in the enclosure.

4. Enclosure shall be an industrialized design, vibration and shock resistant, suitable for a dusty environment. Equipment inside shall be rack-mounted with access via lockable doors. CRT screen shall be protected with a transparent cover.
5. Enclosure shall be stable and self-supporting as it will not be anchored to any permanent supports. The enclosure must be easily moveable as the work progresses at the facility. A crane is available at the facility to move it.

6. The TEB workstation enclosure external paint color shall be a high-visibility color such as orange, with the exception that the display and keyboard surfaces shall be painted non-glossy black. Enclosure internal paint color shall be white.

7. An audible alarm horn and alarm beacon shall be mounted at the top of the enclosure to signal unacknowledged alarms as determined by the SCADA software in the TEB workstation. Horn may be silenced by a pushbutton near the horn, but this will not acknowledge the alarm.

D. Workstations

1. Workstations shall contain processors, communication devices, and memory required to meet performance requirements of this specification.

2. The workstations shall have the latest version Intel CPU with 16MB RAM and 256K cache memory. They shall have a mini-tower case, minimum 600MB hard drive, PCI or better bus, enhanced IDE or better interface, and graphics accelerator with 2MB video RAM to support 1024x768 resolution. A 1.44MB 3.5 inch floppy disk drive and quad-speed CD-ROM shall be provided. A 17" monitor shall be supplied. The workstations shall be provided with two (2) parallel and two (2) serial communications ports. Keyboard and mouse shall be supplied. Network interface card shall be included.

3. Color CRTs shall be 17 inch monitors with at least 1,024 pixels horizontal by 768 pixels vertical resolution. CRTs shall have coatings, hoods, or other means for reducing glare. The monitors shall be non-interlaced with 72Hz minimum refresh rate. Video controls shall be digital, with on-screen display.

4. The user interface shall include both a keyboard and a mouse (or trackball). The keyboard keys shall be arranged in the traditional "qwerty" arrangement for the alphanumeric portion. The keyboard shall support a minimum of ninety six (96) ASCII character set, numeric keypad, twelve (12) function keys and separated cursor control keypad.

5. No operator action shall be required to restart workstations on power failure. Workstations shall automatically reboot from hard disk and display the main menu from which operator may perform power loss recovery procedures.

E. File Server

1. The File Server for the Data Management System shall be similar to the workstations with additional features to function as a File Server/Application Server. RAM shall be 32MB minimum. 2GB of hard drive capacity, mirrored, with Fast/Wide SCSI-2 interface, shall be provided. A DAT must be included. It must be capable of running UNIX operating system. Seller shall supply UNIX software with File Server.

F. UPS

1. UPS shall be capable of supporting the loads of all equipment in the rack, and external loads as defined in the Contract Drawings. For the GOB and DAS Panel UPS, such external loads include the DAS I/O devices. It shall be 120/208V wye output, with break-before-make external cutover switch. A bypass around the UPS must be provided. An RS232 diagnostic port shall be provided, with cable and diagnostic software included. The batteries shall sustain operation for 30 minutes at full load. An alarm contact for failure of normal feed, indicating the UPS is on battery backup operation, shall be provided. Contact shall be rated for 120VAC interrogation.

2.05 FABRICATION

Refer to Section 13401 for standard requirements for enclosure fabrication.

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 and Section 13401 for standard shop quality requirements.

B. The DMS shall be given the following tests to ensure that it meets the specification.

1. Seller Factory Test (requires witness and approval by Buyer).

a. General Requirements

1. The Seller factory tests shall demonstrate that the system is complete and functional. An integrated test, which includes the DMS equipment, the DAS equipment, the Bar Code equipment and SCADA software, is to be performed. A complete system test with actual hardware, communications equipment, applications programs, but not the DMS software, is required. Communications to the DMS software will be
verified during Seller's field test. All equipment is to be assembled, configured and ready for shipment to site, except temporary network cabling may be used. Simulated signals for external inputs are to be provided by Seller.

b. Specific Requirements

1. Each UPS shall be verified.

2. Each workstation (including File Server) and its components must be verified.

3. Each hub must be verified.

4. All components of the TEB workstation must be verified, including electrical tests per Division 16.

5. All network functions must be verified.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify the facility utilities interface conditions to ensure electrical, computer data link, ventilation, or any other required utilities are in satisfactory condition to properly connect with DMS equipment.

3.02 ERECTION, INSTALLATION & APPLICATION

A. Refer to Division 1.0 and Section 13401 for standard requirements.

B. Seller shall provide on-site training for operations personnel. Topics shall include:

   1. Maintenance of equipment.

   2. Software function and use.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 and Section 13401 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED
3.05 DEMONSTRATION

A. The following tests must be performed.

1. Seller Field Test (requires witness and approval by Buyer).

The Seller field test shall be a repeat of the integrated factory test using installed equipment and real time communications. Additional tests to verify the DMS software are required.

3.06 PROTECTION: NOT USED

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SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section establishes the minimum requirements for materials and methods that are common to more than one Section of Division 16.

1.02 RELATED SECTIONS

A. Section 03300 Cast-In-Place Concrete
B. Section 15970 Controls and Instrumentation
C. Section 16151 NEMA Frame Electric Motors
D. Section 16152 Electrical Specification for Packaged Mechanical Equipment

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

1. American Welding Society
2. Factory Mutual (FM)
4. National Electrical Manufacturers Association (NEMA)
5. National Electrical Code (NEC) 1993
6. Occupational Safety and Health Act (OSHA)
   a. CFR Title 29, Part 1910
7. Underwriters Laboratories (UL)

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.
1.04 SYSTEM DESCRIPTION:

A. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS:

A. Acceptance Test Procedure (per 3.05 for Buyer review and approval).

1.06 DELIVERY STORAGE & HANDLING

A. Refer to Division 1.0, for standard delivery, storage, and handling requirements.

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

B. In general, this facility is electrically classified as non-hazardous.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. All electrical equipment and materials shall be new, free of defects, identified as to suitability for a specific purpose, environment, or application by a qualified testing laboratory, inspection agency, or other product evaluating organization, such as Underwriters Laboratories, Inc., or Factory Mutual acceptable to the authority having jurisdiction and concerned with product evaluation.

1. Equipment or materials identification shall consist of an attached identifying label and/or inclusion of the equipment in a list published by the product evaluating organization.

B. Manufacturer’s name and/or trademark shall be placed on all equipment installed along with other applicable markings, such as voltage, current, wattage and similar related items.

C. Select transformers, contactors, light fixtures and other equipment for quietness of operation.

2.03 EQUIPMENT: NOT USED
2.04 COMPONENTS

A. Expansion and Toggle Bolts

1. Where necessary to make attachment of any material, fixture or equipment which may be bolted to masonry, concrete walls and floors, properly embedded bolts in masonry or concrete may be used for such attachment.

2. Where bolting is not practical, use suitable expansion anchors, such as Ackerman Johnson, Rawl Star or approved equal.

3. Do not use wood or plastic plugs or fiber expansion shields under any circumstances.

B. Junction, Terminal, and Pull Boxes

1. Junction and pull boxes shall be sized as indicated on the Drawings.

   a. Where not specifically sized on the Drawings, all boxes shall be sized in accordance with Article 370 of the NEC.

2. Junction and pull boxes located indoors shall be code gauge galvanized sheet steel, welded construction, with conduit knockouts or raceway openings, and hinged or screwed covers as noted on the Drawings, NEMA 1.

   a. Boxes located outdoors shall have screwed, gasketed covers and watertight hubs, NEMA 4.

   b. Boxes located in the trench enclosure shall be NEMA 12.

3. Terminal boxes shall be provided with a removable panel for mounting relays, wiring devices, and terminal blocks.

C. Device and Outlet Boxes

1. Device and outlet boxes shall be pressed steel, zinc, or cadmium coated unless otherwise specified on the Drawings.

2. Outlet boxes shall not be smaller than 4 inches octagon by 1 1/2 inches deep and shall be provided with the proper size knockouts for the conduits used.

   a. All unused knockouts shall remain closed or shall be sealed with knockout closures.
3. Device or utility boxes shall be of unit construction of a size required for the number of switches or outlets called for on the Drawings. No sectional device boxes will be permitted.

4. Outlet or utility boxes concealed in the construction shall be firmly secured in place, set true, square, and flush with the finish surfaces for the application for the appropriate cover plate.
   a. Where required, boxes shall be provided with plastering rings.

5. Surface mounted outlet boxes for receptacles, switches, etc., located in industrial areas shall be cast type.

D. Conduit Fittings

1. Cast malleable iron or steel conduit fittings used with rigid steel or IMC conduit shall be thoroughly coated with metallic zinc or cadmium inside and outside after all machine work is completed.

2. Cast conduit outlets used with rigid steel or IMC conduit shall be made of rust resisting alloys of iron or steel.
   a. Fittings shall be Crouse-Hinds, Appleton, or Killark.

3. Nonmetallic insulating type bushings shall be used on rigid steel and threaded IMC conduit.

E. Labeling

1. Label all switches, panelboards, MCC’s, panels, and each device with a three-ply laminated phenolic plate (white-black-white) plastic nameplate engraved with 3/16 inch minimum black letters designating the equipment number designation, feeder power source, system voltage, and load served (for switches and devices only).

F. Spare Parts

1. Provide spare parts and keys as follows:
   a. Three spare fuses for each fuse size installed.
   b. Two keys for each cabinet, panelboard and switch lock.
   c. Spare Fluorescent Lamp Ballasts: Spare ballasts shall be above and beyond those required to be replaced during the guarantee period.
1) Provide one spare ballast for every 50 fixtures of a given type supplied.

2) Provide one ballast minimum of the type required for every type fixture, where less than 50 fixtures are supplied.

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality control requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Workmanship

1. Workmanship and neat appearance of the electrical installation shall be of equal importance with its electrical and mechanical efficiency.

   a. Work shall be executed by qualified electricians in conformity with the best accepted trade practice and with the proper tools of the trade.

2. Install equipment and run raceways parallel with or at right angles to the lines of the building unless shown otherwise on the Drawings.

3. Lay out Work and be responsible for lines, elevations and measurements required for the installation of the Work.

4. It is the intent that all work done under the Contract will be completed and electrically operational.

B. Equipment Supports, Foundations, and Stands

1. Where supports, foundations, curbs, stands for switchboards, panelboards and other electrical equipment are indicated on the Drawings or specified or required for proper installation, perform as specified herein.

   a. Locate supports for equipment so as to avoid undue strain on enclosure and interference with raceway connections to the equipment.
2. Provide foundation bolts, sleeves, washers, nuts and templates to locate position of bolts.

   a. Make sleeves of steel pipes, finish flush with top of rough concrete, or as shown on the Drawings.

   b. For anchorage, make embedded end of bolts hooked.

3. Where equipment is indicated on the Drawings and/or specified to be floor mounted on stands or legs, construct floor stands with structural steel members or steel pipes and fittings; brace and fasten with flanges bolted to floor.

C. Concrete Work: See Section 03300 Cast In Place Concrete

1. Provide concrete work as specified or indicated on Drawings for electrical work, such as for duct bank envelopes and equipment foundations or curbs.

   a. Reinforcing Steel For Concrete: Use where duct banks run under roadways, as indicated on Drawings.

D. Sleeves, Openings, and Locations

1. Provide all sleeves and notches in grade beams and similar related items for raceways, as shown on the Drawings or as required by the Work for the accommodation of his Work and be responsible for the accurate location of same.

2. Coordinate equipment and raceway to openings in walls, floors and equipment pads, as shown on the Drawings.

   a. Special attention shall be paid to coordination with other trades where openings are to be jointly shared, or limited working space is available for installation of raceways and equipment.

E. Cutting and Patching

1. Perform all cutting and patching that may be necessary for the installation of the system specified and make necessary repairs under the direction and to the satisfaction of the Buyer.

2. No cutting of structural work shall be done without the written consent of the Buyer being previously obtained in each case, and all such work shall be done in accordance with the Buyer’s directions and under his supervision.

3. All cutting and patching work shall be done by mechanics skilled in the appropriate building trade.
4. Restore all floors and surfaces to an original or satisfactory condition as approved by the Buyer.

F. MaterialsPenetratingWalls, Floors, and Ceilings

1. Wherever piping, conduit, ducts, steel members, brackets, equipment, including any items or material that penetrates or passes through a wall, ceiling or floor, the voids surrounding each item or material shall be completely sealed with cement grout, plaster or an approved fire barrier sealant when penetrating a fire rated wall, ceiling or floor. Embed the sealing material the full thickness of the wall, ceiling or floor. Where surfaces are exposed, finish with same materials specified in the Finish Schedule or with material that is on finished surfaces.

2. Cable tray penetrations through fire rated walls shall be sealed by KBS firestop sealbags manufactured by International Protective Coating Corp., or approved equal.

G. Welding

1. Welding For Electrical Work: Such as required for equipment supports, shall conform as to appearance, quality of welds and methods of correcting defective work, in compliance with the AWS, Code for Arc- Welding in Building Construction, Section 4 - Workmanship.

2. Weld and welders certifications shall be made available for review upon request from the Buyer.

H. Mechanical Equipment, Wiring, and Connections

1. Motors for mechanical equipment will be furnished and set in place under the work of other divisions of the specifications.

   a. 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 final connection to the motor shall be furnished and installed under the Work of Division 16.
2. Packaged mechanical equipment containing motors and control devices for starting and stopping the motor(s), including internal power and control wiring installed at the factory or in the field, and main power supply disconnecting device if specified, will be furnished and set in place under the work of other divisions of the specifications.

   a. Electrical power wiring between the branch circuit protective device and via any disconnecting and equipment overcurrent protection device if required and final connection to incoming line terminals of the packaged mechanical equipment shall be furnished and installed under the work of Division 16.

3. When shown or listed on the Electrical Drawings, furnish and install the manual and magnetic starters with accessories, control relays for automatically controlled equipment, switches including 120 volt single pole toggle control, remote function selector as Hand-Off-Auto, thermostatic and safety disconnecting, and complete the indicated power and control wiring.

4. All low-voltage and pneumatic temperature control devices and wiring will normally be furnished and installed under the work of other divisions of the specifications.

   a. Where the control devices are defined and control and power wiring are shown on the Electrical Drawings, as wiring of pneumatic-electric switches or electro-pneumatic valves, the devices and wiring shall be furnished and installed under the Work of Division 16.

5. Refer to Section 16152, Electrical Specification for Packaged Mechanical Equipment, and Section 15970, Controls and Instrumentation for information to aid in coordination of Electrical and Mechanical Division responsibilities.

6. Seller shall obtain complete information required for wiring and connecting electrically operated equipment specified in the Mechanical Sections under Division 15.

7. 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 for connection of external wiring.
8. Electrical Drawings indicate branch circuit conductor sizing and overcurrent protective device ratings for the Mechanical heating/ventilation/air-conditioning equipment specified or named on the Mechanical Drawings. Seller shall verify from nameplate of mechanical equipment and from manufacturers heater table for motor controllers installed that designed circuits are correct or Seller shall revise installation as required for minimum circuit ampacity, maximum fuse, circuit breaker or MCP size, and maximum overcurrent device ampere rating.

   a. When electrically-driven equipment furnished under other sections of these Specifications differ in size or rating from the indicated design, make the necessary adjustments to the wiring system, disconnect devices, starters, controls and branch circuit protection to accommodate the equipment actually installed at no additional expense to the Contract amount.

I. In case of conflict between the referenced standards and/or these Specifications, the one having the most stringent requirements shall govern.

J. Should any change in the Drawings and Specifications be required to comply with these requirements, notify the Buyer.

K. 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. Drawings and Specifications are complementary to each other, and what is called for by either shall be as binding as if called for by both.

3. Data presented on the Drawings is as accurate as planning can determine, but accuracy is not guaranteed and field verification of all dimensions is directed.

4. Drawings indicate required sizes and points of termination of raceways and may suggest proper routes.

5. Make installation in such a manner as to conform to structure, preserve clearances, avoid obstructions, preserve headroom and keep openings and passageways clear without further instructions.

6. Exact locations, distances and levels shall be governed by field conditions.
L. Drawings and Specifications at Project Site: Keep a set of Drawings and Specifications on the Project site, along with reviewed shop drawings upon which changes shall be recorded, and furnish information for project record drawings.

1. Record location of all concealed or semi-concealed equipment, junction boxes or other items which may require inspection, repair or maintenance.

2. Record actual location and elevation of all buried raceways and equipment.

M. Coordination Of Work:

1. Coordinate electrical work with Work of all other trades.

2. Where conflicts of work occur and departure from the indicated arrangements are necessary, consult with other subcontractors involved; come to agreement as to changed locations and elevations and similar items; obtain the approval of the Buyer of proposed changes before proceeding with Work.

N. Existing Services:

1. Active Services: When encountered in Work, brace and support existing active sewers, gas, water, electric and other services where required for proper execution of the Work.

   a. If existing services are encountered that are not indicated on the Drawings and require relocation, notify the Buyer and proceed as directed.

   b. Do not prevent or disturb the operation of active services that are to remain.

2. Inactive Services: When encountered in the Work, remove, cap or plug inactive services.

   a. When not indicated on the Drawings, notify the Buyer.

   b. Protect or remove these services as directed by the Buyer.
3. Interruption Of Services: Where work makes temporary shut-down of services unavoidable, shut down the services at night or at such time as approved by the Buyer which will cause the least interference with the Owner's established operating routine or the utility company.

   a. Arrange to work continuously, including overtime, if required, to assure that services will be shut down only during time actually required to make necessary connection to existing work.

4. Protection Of Utilities: Reasonable effort has been made to obtain locations of existing utilities in and around the Project site.

   a. Field locate all existing utilities and contact all appropriate utility owners prior to performing any excavation.

   b. Repair any damage to existing utilities resulting from working operations.

   c. Make repairs to the satisfaction of the utility owners and the Buyer.

5. Protection Of Work: Effectively protect work, materials and equipment which are liable to injury during the construction period.

   1. Close all raceway openings with caps or plugs during installation.

   2. Tightly cover and protect all fixtures and equipment against dirt, water and chemical or mechanical injury.

   3. Repair all damages to other work caused by electrical work or through the neglect of workmen.

      a. All patching and repairing of damaged work will be done by whoever installed the work, as directed by the Seller.

3.03 FIELD QUALITY CONTROL

   A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED
3.05 DEMONSTRATION

A. Division 1.0 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for the product(s) contained in this specification section, which may also be used by the Seller in preparing the system ATPs.

B. Testing and Adjusting: The following requirements are supplementary to tests specified for individual equipment or systems under the electrical sections of the specification sections.

1. All testing shall be scheduled by the Seller and cleared through the Buyer.

   a. Complete test and inspection records shall be made and incorporated into a report for each piece of equipment tested.

      1) Record all readings taken.

      2) Submit two copies to Buyer for review.

   c. Furnish necessary meters, instruments, temporary wiring and labor to perform all required tests and adjustments of equipment and wiring installed and/or connected under this Contract, including electrical equipment furnished under other contracts to determine proper polarity, phasing, freedom from grounds and shorts and operation of equipment.

   d. All materials and manner of installation shall be in strict accordance with the applicable requirements of state and local authorities, the utility company, and the NEC.

   e. Wherever any of the aforementioned codes, laws or similar regulations require that any work be tested and/or approved, Seller shall provide proper facilities for access and for inspection.

   f. All testing shall be done in strict accordance with safety standards set forth by the organizations in Paragraph A. titled References under Article 1.03 of this Section 16050 and any other standards as further required by the Buyer.

   g. Following established procedures, energize equipment after certification by the Buyer that the installation is satisfactory.
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 no greater than specified on the drawings.

   b. Grounding System: Inspect to ensure all above ground cables and connections are suitably protected.

   c. Ground Resistance Tests: Make all test points as required including requirements by the Buyer.

   d. Correct or replace any nominal current carrying circuit which is defective or grounded, and correct all other troubles encountered by these tests.

3. Lighting: Check all lighting fixtures for cracked lenses, noisy ballasts, failure to operate and similar related items, and check receptacles for proper ground, open circuits, reversed phase and neutral connections.

   a. Replace all burned out lamps and ballasts.

4. Motors: Before start up, check motor nameplates for horsepower, speed, phase and voltage.

   a. Check all bearings making sure they are properly filled with oil or grease.

      1) Check coupling alignment and shaft end play.

   b. During or immediately after start up, check shaft rotation, shaft rpm, bearing temperature, and check for excessive vibration.

      1) Take current reading at full load using a clamp on ammeter.

      2) If ammeter reading is over the rated full load current, determine the reason for the discrepancy and take the necessary corrective action.

   c. Adjust and check overload elements in motor starters for suitability to motor characteristics.

      1) Replace any overload element that is inadequate.

      2) Cause of any motor operating above full load rating shall be investigated and the cause removed instead of increasing the overload relay trip rating.
3) These final operational tests shall determine that the installation is correct.

   a) Do not make such tests without permission of a responsible party designated by the Buyer.

5. Miscellaneous:

   a. Demonstrate that all illuminating and control devices function properly.

   b. Replace all defective transformers, coils and similar related items.

   c. Demonstrate that all power operating devices function properly.

   d. Demonstrate that all switches, relays, transfer switches, remote control switches and similar related items function properly.

   e. Demonstrate that all systems, including sound, fire, signal, communication, and similar related items function properly.

3.06 PROTECTION: NOT USED

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## Section 16110

**Raceways**

**APPENDICES**

**APPENDIX A: HANFORD STANDARD DRAWINGS**
SECTION 16110

RACEWAYS

PART 1  GENERAL

1.01  SECTION SCOPE

A. This Specification Section establishes the requirements for the types of raceways and their installation.

1.02  RELATED SECTIONS

A. Section 02200 Earth Work
B. Section 03300 Cast-In-Place Concrete
C. Section 16050 Basic Electrical Materials and Methods
D. Section 16740 Voice and Data Systems

1.03  REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect September 1995 of:

7. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
8. Underwriters Laboratories (UL).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.
1.04 SYSTEM DESCRIPTION

A. This section is specifically for power raceways only with exception to paragraph 3.02 which applies to all raceways. Refer to Section 16740 for control, instrumentation and communication raceways.

B. All electrical systems associated with this section shall conform to the National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1.0 for Submittal Procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed here.

B. The following information shall be submitted for all cable tray:

1. RAA-Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Dimensions/Outline
   c. Weights

2. RFR-Review for Records (for Information and/or Records).
   a. Installation Instructions

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

B. Deliver all raceway with an acceptable testing laboratory or inspection agency label and bearing manufacturer’s name on each length.

C. Store and handle raceway so as not to subject it to corrosion or mechanical damage.

D. All openings to any part of the raceway system, as well as all associated fixtures and equipment, both before and after being in place, must be securely covered or otherwise protected to prevent obstruction of the raceway or injury due to carelessly or maliciously dropped tools, paint, materials, grit, dirt or any foreign matter.

E. Raceway ends shall be covered with capped bushings or pipe plugs until used or for future use.
1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. Rigid Galvanized Steel Conduit (RGS): Comply with all applicable requirements of the latest revisions of the following:
   1. ANSI C80.1.
   2. NEC Article 346-15.

B. PVC Externally Plastic Coated Rigid Galvanized Steel Conduit: Shall be conduit conforming to the requirements for RGS and complying with NEMA Standard Publication No. RN-1, with a coating of polyvinylchloride of minimum thickness of 30 mils.
   1. Use PVC externally coated RGS sleeves and elbows passing through concrete.

C. Intermediate Metal Conduit: Comply with all applicable requirements of the latest revisions of the following:
   1. ANSI C80.1.
   2. NEC Article 345-16.

D. Electrical Metallic Tubing (EMT): Comply with all applicable requirements of the latest revisions of the following:
   1. ANSI C80.3.
   2. UL 797
   3. NEC Article 348-15.

E. Rigid Non-Metallic Conduit: Comply with Schedule 40 and Schedule 80 thermoplastic conduit rated for 90 degrees C. and meet all applicable requirements of the latest revisions of the following:
   1. NEMA Standard TC-2.
   2. UL 651
   3. NEC Article 347-17.
F. Flexible Metal Conduit: Shall be Type 2 zinc coated steel, spirally wound upon itself and interlocked in such a manner as to provide a round cross-section of high mechanical strength and flexibility.
   1. Comply with all applicable requirements of latest revisions of the following:
      a. FS WW-C-566.
      b. NEC Article 350.

2. Flexible Metal Conduit Fittings: Comply with FS W-F-406, Type 1, Class 1, and Style A.

G. Liquid-Tight Flexible Metal Conduit: Shall be flexible metal conduit provided with a flame and abrasion resistant polyvinyl chloride jacket to form a liquid tight flexible conduit assembly and shall comply with all applicable requirements of the latest revisions of NEC Article 351.
   1. Liquid-Tight Flexible Metal Conduit Fittings: Comply with FS W-F-406, Type 1, Class 3, Style G.

H. Wireway: Shall consist of a sheet metal trough with a hinged or screw cover providing a full lay-in feature throughout its length.
   1. Finish shall be a gray enamel inside and out over rust resistant primer or treatment, and shall meet the requirements of NEC Article 362.

I. Underground PVC Plastic Utilities Duct: NEMA TC 6, Type I for encased burial in concrete, Type II for direct burial.

J. PVC and ABS Plastic Utilities Duct Fittings: NEMA TC 9, mate and match to duct type and material.

K. Minimum conduit size shall be 3/4".

L. Cable Trays: Comply with NEMA VE-1.

2.03 EQUIPMENT: NOT USED
2.04 COMPONENTS: NOT USED
2.05 FABRICATION: NOT USED
2.06 SHOP QUALITY CONTROL
   A. Refer to Division 1.0 for standard shop quality requirements.
PART 3  EXECUTION

3.01  PREPARATION:  NOT USED

3.02  ERECTION, INSTALLATION & APPLICATION

A. Application

1. RGS Conduit: Utilize in the following areas:
   a. Above grade including where exposed to mechanical damage.
   b. Below grade where maximum mechanical protection is required.
   c. Where underground runs emerge through floor slabs on grade.
   d. Where specifically required by the NEC.
   e. In concrete not containing additives that could cause corrosion or damage to the conduit zinc coating.
   f. Do not use threadless couplings and connectors.

2. Plastic Coated Rigid Galvanized Steel Conduit: Utilize in the following areas:
   a. In concrete containing additives that could cause corrosion or damage to the conduit zinc coating.
   b. Below grade, direct buried.
   c. Below grade, concrete encased.

3. Rigid Aluminum Conduit: Not Used

4. Intermediate Metal Conduit: Utilize in the following areas:
   a. Above grade.
   b. Below grade.
   c. Where underground runs emerge through floor slabs on grade.
   d. Where specifically required by the NEC.
   e. Embedded in concrete not containing additives that could cause corrosion or damage to the zinc coating.
5. Electrical Metallic Tubing (EMT): Utilize in the following areas:
   a. Concealed locations in furred walls and ceilings, and in space above suspended ceilings.
   b. Exposed in unfinished areas where not exposed to mechanical damage.

6. Rigid Non-Metallic Conduit: Utilize in the following areas:
   a. Underground by direct burial.
   b. Underground with concrete encasement.
   c. Embedded in concrete slabs.

7. Flexible Metal Conduit: Utilize in dry locations for the connection of equipment subject to vibration or displacement.

8. Liquidtight Flexible Metal Conduit: Install in wet or dry locations for the connection of equipment subject to vibration or displacement.

9. Wireway: Install in exposed, unfinished areas where not subject to mechanical damage.

10. Cable Tray: Install multi-tier half-rack cable tray system as shown on the drawings. The system shall be made of straight sections, fittings and accessories as defined in the latest NEMA standards publication VE-1.

   a. The cable tray system shall be aluminum or galvanized steel.
   b. All straight sections shall be supplied in standard lengths of 12 feet, width and depth to be as shown on the drawings.
   c. The multi-tier system shall allow for addition of another tier.
   d. Provide cable drop outs, bonding jumpers, hanger/support clamps, expansion splice hangers, etc. As required for a complete system.
   e. Power shall be routed on the top tier, control, instrumentation and communications shall be routed on the lower tier.
B. Installation

1. General: Install raceways as indicated; in accordance with manufacturer's written installation instructions, and in compliance with NEC, and NECA's "Standards of Installation".

   a. Install units plumb and level, and maintain manufacturer's recommended clearances.

2. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.

3. Install all raceways concealed in building structure except that exposed raceways may be used for the following:

   a. Motor and equipment connections.

   b. Electrical, telephone and mechanical equipment rooms and closets.

   c. Unfinished areas which may have painted walls and ceilings consisting of the basic building structure.

   d. Finished laboratories where the raceway will be concealed when laboratory furniture is installed.

4. Concealed raceways shall be run in a direct line, and where possible with long sweep bends and offsets.

5. Route exposed raceways parallel or perpendicular to building lines with right-angle turns and symmetrical concentric bends.

6. Exposed Conduit: Shall have supports per NEC Chapter 3.

   a. Support all raceways on approved types of wall brackets, ceiling trapeze hangers, clip-type fastening devices or malleable iron straps.

      1. Plumbers perforated straps are not permitted as a means of support.

      2. Do not support raceways or equipment from steam, water or other piping or ductwork, but support independently.

      3. 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 screws, lag bolts or through bolts on wood construction.

         a) Obtain permission from the BUYER for use of powder-actuated anchorage devices.
b) Do not drill, pierce or weld structural members without BUYER's approval.

7. Underground Installation Of Conduit: Shall be installed to exceed the minimum cover requirements of NEC Table 300-5 or Table 710-3(b).

8. Below grade raceways terminated under main service equipment, pad-mounted transformers and similar related items, above floor slabs and equipment foundations shall project 2 inches minimum above the floor or foundation finish to prevent water entry.

9. Provide flashing and counterflashing or pitch pockets for waterproofing all raceways, outlets, fittings, roof jacks, and similar related items which penetrate the roof.
   a. Pitch pocket shall receive prior approval by BUYER.

10. If required, core drilling of concrete walls and floor slabs for passage of raceways will require approval of the BUYER before any drilling is done.

11. Install all raceways a minimum of 6 inches from ducts, hot water pipes or other heated lines.

12. RGS, IMC and/or EMT Conduit Bends Made In Field: Make with approved hickey or conduit bending machine.

13. Crushed Or Deformed Conduit: Shall not be used.

14. Rough-In Work: Complete before wires are pulled into conduits.
   a. Clean out conduits by first pulling a swab through, prior to pulling wires.
   b. Wire Pulling: No oil or grease shall be used to lubricate wire other than approved Soapstone, Wire Lube, Yellow 77 or other similar lubricating materials reviewed by BUYER where required to facilitate wire pulling.

15. Raceway Sizes Not Shown On Drawings: Size in accordance with requirements of NEC for the quantities and sizes of wire installed therein.
   a. Raceways Utilized For Home Runs: 3/4 inch minimum trade size.

16. Raceway Expansion Joints: Provide raceway expansion joints with necessary bonding conductor at building expansion joints and where required to compensate for raceway or building thermal expansion and contraction.
17. Raceways Serving Any Electrical System Inside of Building:

a. Do not install in topping of precast concrete floor tees where less than one inch of concrete cover over the raceway cannot be provided.

b. Do not install in topping of concrete roof tee deck, in roof slabs or above the roof thermal and moisture protection system.

c. Do not install in concrete slab which is less than 3 inches thick.

d. Conduit outside diameter larger than one third of the slab thickness is not permitted.

e. Install conduits approximately at the center of the slab.

18. Ducts: Arrange in tiers and at elevations as noted on the duct bank cross-sections.

a. Separators: Provide a minimum of 2 inch spacing between conduits and install at 5 feet intervals.

1) Conduits shall be held securely in place to prevent movement when backfilling or floating when placing concrete slurry for encasement.

b. Before closing ends of ducts, swab clean and pull a mandrel of proper conduit inside diameter through each duct to assure integrity of the raceway.


a. PVC Conduit Joints: Solvent weld in accordance with manufacturer’s instructions.

b. PVC Conduit Bends and Elbows: Make with required heat box or use factory-fabricated elbows of radius as specified.

c. Bends and Elbows For Underground Ducts: Shall have a minimum radius of 24 inches.

d. Bends and Elbows In Underground Ducts For Telephone Circuits: Shall have a minimum radius of 48 inches.

20. Wherever a change in direction is made in the underground duct run and PVC bends or elbows are used, a concrete slurry shall be placed around the ducts and shall extend at least 6 inches beyond the edges of any duct on all edges.

a. Installation of concrete slurry into formed duct bank shall be done with a minimum of free drop, and deflection shall be provided to prevent direct drops onto the PVC ducts.
b. Exercise extreme care in tamping or vibration to eliminate voids so that PVC ducts are not damaged.

21. Excavation For Electrical Ducts: Extend an adequate distance from the work area to allow sufficient space as required for construction operations and for inspection of the Work.
   a. Where excavations are made to greater depth than required, fill excess cuts and compact to backfill density as specified for backfilling below.
   b. Excavation work shall be timed to immediately precede the placing of ducts.
   c. Before placing of ducts, remove rocks, debris and other objectionable materials subject to termite attack, rot or corrosion.
   d. Coordination with other underground work is required to avoid conflict with other underground utility installations and to prevent undermining of installed duct runs.

22. Backfilling: Shall not start until all construction below grade has been approved. See Earthwork Section 02200.
   a. Install an underground tape warning system, approximately one foot below finished grade, on top of all underground duct banks.
      1) Tape to be a minimum 6 inches wide, of metallic foil material, color-coded orange for telephone and yellow for electric duct banks, and with printing to identify type of lines installed below the tape.

23. Empty Raceway Systems: Provide a pulling string such as installed by a jetline gun or equivalent in all empty conduit runs.
   a. Identify conduit use at opposite end termination point with suitable tag attached to line at each end and held in position with plastic bushing penny and plastic bushing.
   b. Plug or seal empty raceways from underground duct banks to prevent drainage or gas from entering any manhole or building.

3.03 FIELD QUALITY CONTROL
A. Refer to Division 1 for standard field control requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
## APPENDIX A

### HANFORD STANDARD DRAWINGS

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</tr>
<tr>
<td>38</td>
<td>Elect STD - Riser and Drain-Encased Underground Steel Conduit</td>
</tr>
</tbody>
</table>
1. Conduit for concrete-encased ducts shall be Type I, high-impact styrene plastic, high-impact PVC plastic, or zinc-coated rigid steel as specified.

2. Ducts shall be sloped a minimum of 3 inches per 100 feet to drain into a manhole, vault or conduit drain. All low points shall be drained. See H-5-881.S4 37 and 39 for conduit drains.

3. At railroad crossings, the top of conduit shall be a minimum of 42 inches below bottom of rails.

4. Seating of conduit supports shall not exceed 6 feet. Length of vertical bars shall be as required for firm anchorage. The horizontal reinforcing bars shall be wire tied or welded to the vertical driven bars. Each conduit shall be tied to the vertical bars to maintain a 2-inch minimum separation between conduits. For single duct installations, the conduit shall be wired to a single driven bar at each support location.

5. Sides of encasements may be formed, or concrete may be poured directly into the excavation except where forming is specified.

6. The concrete shall develop a minimum compressive strength of 3000 lbs in 28 days. The maximum size of coarse aggregate shall be 3/4 inch.

7. At construction joints in encasements, except those for steel conduit, 4 foot lengths of ¾ inch reinforcing bars shall be placed in each corner of the encasement, a minimum of 2 inches from the outside edges and centered across the joint.

8. A grounding cable shall be installed in encasements unless specified otherwise. The conductor shall be ⅝ inch diameter, 7 strand, Special Low Carbon Grade steel cable. Cable coating shall be Class B zinc in accordance with ASTM A 475. This conductor may be used for interconnection of grounding grids and for grounding of conduit risers, cable shields, etc. It shall not be used for the equipment grounding conductor on the load side of service equipment.

9. Concrete encasement requirement for rigid non-metallic conduit shall be deleted for conduits approved or shown on the construction drawings for direct burial in accordance with NFPA-NEC '70, Articles 300-5 and 347.

10. Concrete Cure Requirement - Backfill operation may begin 72 hours after concrete pour. Minimum concrete compressive strength prior to backfill is 1500 psi.

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**UTILITIES AND TELECOMMUNICATIONS**

**IMPACT LEVEL III**

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**REFERENCE DRAWINGS**

U.S. Department of Energy
Richland Operations Office

Rockwell-Union Operations
Richland, Washington 99352

ELECT STD CONCRETE ENCASED UNDER GND DUCTS - ONE & TWO CONDUITS

Dwg No: H-5-881

Sheet No: 34

Sheets: 100
Pole Riser (See H-5-881 SH-15) or Other Termination

Conduit Coupling - with Welded lugs to Prevent Rotation - Extend Approx 1/2" Above Top of Concrete Encasement

3" Min All Sides

Concrete Encasement

Long Radius Elbow - 18" Minimum Radius

Type C Conduit Body with Blank Cast Iron Cover - Drill 1/2" Dia Hole in Cover and Brazed to 6" Length of 1/2" Pipe

Wood or Sheet Metal Form Over Gravel - Close Fit Around 1/2" Pipe - May Be Left in Place

3/4" Round or Crushed Rock

Grade
NOTES

1. The drain shall be installed at the lowest point in the conduit run.

2. The minimum slope of underground conduits shall be 3 inches per 100 feet.

3. Concrete for encasement shall develop a minimum compressive strength of 3000 lbs in 28 days. The maximum size of coarse aggregate shall be 3/4 inch.

4. The drawing is approximately to scale for 2 inch conduit and a 30 inch radius elbow.
# PART 1 GENERAL

1.01 SECTION SCOPE: NOT USED

1.02 RELATED SECTIONS

1.03 REFERENCES

1.04 SYSTEM DESCRIPTION

1.05 SUBMITTALS

1.06 DELIVERY, STORAGE & HANDLING

1.07 SITE CONDITIONS

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# PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 MATERIALS

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

---

# PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

3.03 FIELD QUALITY CONTROL

3.04 ADJUSTMENT AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED
SECTION 16120
WIRE AND CABLES

PART 1 GENERAL

1.01 SECTION SCOPE: NOT USED

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods.

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

1. National Electrical Manufacturers Association (NEMA).


3. National Electrical Code (NEC) 1993

4. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.

5. Underwriters Laboratories (UL).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.
B. The following information shall be submitted for:

All wire and cable.

1. Review and Approval (for approval)
   a. Catalog cut sheets
   b. Specifications

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

B. Store and handle cable reels so as not to subject any of the equipment to mechanical damage or deterioration of electrical characteristics.

C. Protect both before and after installation to prevent damage due to carelessly or maliciously dropped tools, paint, materials, grit, grout or any foreign matter.

1.07 SITE CONDITIONS

A. Refer Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified therein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Belden Wire and Cable Co.
2. Houston Wire and Cable
3. Okonite
4. Phelps Dodge Cable and Wire Co.
5. Rockbestos
2.02 MATERIALS

A. Low Voltage Wire and Cable: Shall include wire and cable for use on power systems rated at less than 600 volts.

1. Conductors: Copper for all branch circuits, control circuits and feeder circuits.
   
   a. All circuits on the Drawings are based on copper conductors.
   
   b. Conductors No. 10 and smaller shall be solid; No. 8 and larger shall be stranded, except No. 14 stranded shall be utilized for control circuits.

2. Insulation: Shall be 600 volt, 75°C.
   
   a. Type XHHW for No. 4 AWG and larger conductors.
   
   b. Type THWN/THHN for sizes smaller than No. 4 AWG.
   
   c. Grounding conductor insulation shall match phase conductor insulation regardless of size.
   
   d. Cables in the cable tray shall be rated for cable tray use, type TC.
   
   e. Cords and other cable types, as shown on the drawings shall be rated as shown.
3. Color Coding: Grounded conductors and grounding conductors shall be color coded in accordance with NEC Article 200, 210, 250 and 310.

   a. Power circuit conductor color shall be:

<table>
<thead>
<tr>
<th>SERVICE, FEEDER OR BRANCH CIRCUIT</th>
<th>CONDUCTOR</th>
<th>INSULATION COLOR</th>
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<tr>
<td>480Y/277 volt three phase systems</td>
<td>Phase A</td>
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<td>Neutral</td>
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<tr>
<td></td>
<td>Equip. Ground. Conductor</td>
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<tr>
<td>208Y/120 volt three phase systems</td>
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<tr>
<td></td>
<td>Phase B</td>
<td>Purple</td>
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<tr>
<td></td>
<td>Phase C</td>
<td>Brown</td>
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<tr>
<td></td>
<td>Neutral</td>
<td>White or Gray</td>
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<td>Equip. Ground. Conductor</td>
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<td></td>
<td>Equip. Ground. Conductor</td>
<td>Green or bare</td>
</tr>
</tbody>
</table>

   b. Where insulation pigmentation and/or coding is not available for large conductor sizes, colored plastic tape applied in a spiral half-lap manner may be used to identify the exposed portions of the conductors.

c. The above coding shall be maintained throughout the power systems including service, feeders, and all branch circuits that supply utilization equipment.

d. Raceways, boxes, and conductors shall be individually labeled to distinguish between 208V and 480V systems.

B. Grounding Conductors: Stranded and solid copper

1. When insulated, shall be 600 volt, green.

C. 600 Volt Control and Instrument Cables

1. Multiconductor control cables shall be moisture-resistant, small diameter type unless otherwise specified on the Drawings.

   a. Cables shall meet NEMA WC-5 standards and be approved by Underwriters’ Laboratories, Inc., for conduit, cable tray and underground duct installations.
b. Multiple conductor cable shall be No. 14 AWG minimum size, 7-strand copper conductors, 600 volt with PVC, thermo-plastic polyethylene (THHN) or cross-linked insulation.

2. Conductors shall be stranded copper with heat and moisture resistant PVC insulation, .15 mils thick minimum, and covered with clear nylon jacket, .5 mils thick minimum.
   a. Conductors shall be color coded in accordance with NEMA WC-5 Method 1, Table K-1.
   b. Cables shall have an overall flame-resistant sheath of PVC, .45 mils thick minimum.

3. The number and size of conductors and the exact color coding requirements shall be as specified on the Drawings, and as in 2a above.

4. Cables shall be rated for 600 volts and 75°C operation.

D. AC and DC Discrete and Low-Level Control Signals:

1. Wiring for AC and DC discrete control signals and for DC analog control signals shall be a shielded twisted pair multi-conductor cable with #16 AWG, 7-strand copper conductors, aluminum 100% shield and #18 AWG, 7-strand copper drain wire, 90°C PVC primary insulation, 80°C jacket.

2. Multi-pair or triad cables shall have matched, multiple shielded pairs or triads, with each pair or triad twisted together and with adjacent pairs or triads numbered consecutively, starting with number one. Individual pair or triad conductors shall be #20 AWG. Each pair or triad shall have a .85 mil 100% coverage aluminum-Mylar or aluminum/polyester shield tape and a continuous 7 strand, #22 AWG tinned copper drain wire, in continuous contact with the aluminum side of the shielding tape.

   The overall cable shield shall have a 2.35 mil aluminum-Mylar or aluminum/polyester shield tape and a continuous 7 strand #20 AWG, tinned copper drain wire, in continuous contact with the aluminum side of the shielding tape.

   **Note:** Overall shield and individual twisted pair or triad shields must be electrically isolated from each other over the entire length of the cable.
E. Portable and Retractile Cords: Portable and Retractile electrical power cords shall be UL type SO or SJO, neoprene jacketed, 600V, 16 x 34 stranded copper, #16 AWG minimum, with a 5 to 1 extension range, with number of conductors and length as shown on the drawings.

F. For all conductor sizes, green, gray, or white colors are reserved exclusively for grounding, grounded and neutral conductors, except:

1. Multiconductor cables used for low-voltage circuits as defined in NEC Article 725-16 will not be restricted in the use of green, gray or white color-coded insulated conductors whether these colors are used as the main color, in pairs or as tracers.

2. These colors shall not be used in any way to identify an ungrounded power conductor.
   a. Green shall only be used to identify a grounding conductor.
   b. Gray or white, as required by the appropriate color code, shall be used only for the grounded or neutral conductor identification.
   c. Painting, taping or other alteration of the color of green, white or gray colored conductors is prohibited.

G. Color coding for conductors in sizes No. 8 and smaller shall be by means of colored insulation or jacket.

H. For conductors larger than No. 8 AWG not generally furnished with colored insulation, identification shall be achieved by the use of plastic tape or sleeves of the appropriate color. Yellow or orange phase tape shall consist of two separate bands at each application point in order to avoid confusion with white or gray after aging. All wire markers and phase tape shall be covered by clear shrink sleeving. Colored phase tape shall not cover wire markers.

I. All wire and cable markers shall be permanent. All conductors shall be identified with self-adhering, oil and moisture proof vinyl labels, covered with clear heat shrink tubing or white heat shrink tubing with black typed on letter with nonsmear ink as manufactured by Brady, T&B or approved equal. Hand lettered labels shall not be used. All conductors shall be labeled with point-to-point destination.
J. Wire and cable markers shall be located at origin and destination. Wire markers shall be within 3 inches of a termination or splice. Cable markers shall be within 3 inches of the spread, cable end, penetration, or box exit. Cable markers may be stamped or embossed on stainless steel or plastic tags attached by plastic tie wraps. Wire markers shall not cover colored phase tape. A minimum of 1/2 inch of colored tape shall remain exposed.

K. Each multiconductor power cable shall include a bare copper or green insulated copper equipment grounding conductor, sized per table 250-95 of the NEC, unless indicated otherwise on the drawings.

L. Metal-clad cable, where specified on the drawings, shall be type MC with corrugated aluminum sheath and overall PVC jacket and shall meet the requirements of this specification section and of Article 334 of the NEC.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. General: Install electrical cable, and wire as indicated on the drawings, in accordance with manufacturer’s written instructions, applicable requirements of NEC and NECA’s "Standard of Installation", and in accordance with recognized industry practices to ensure products serve intended functions.

B. Coordinate cable and wire installation work with electrical raceway and equipment installation work as necessary for proper interface.

C. At no time shall cable be bent to radius smaller than that specified by the manufacturer.

1. Where manufacturer’s data is not available, use the minimum bending radius as specified in NEMA WC 3-1969 and WC 5-1968 or the NEC.
D. Wire and Cable: Do not subject to pulling tensions exceeding the maximum allowed as may be calculated by recognized formulas or as specified by the manufacturer.

E. Pull conductors together where more than one is being installed in a raceway.

F. Use pulling compound or lubricant where necessary; compound must not deteriorate conductor or insulation.

G. Use pulling means including fish tape, cable, or rope which cannot damage raceway.

H. Splicing of Wire: No splices are allowed except in lighting and receptacle conductors. If splicing is necessary, it shall be done in an accessible pull, junction or outlet box.

1. Splices: Use T & B indenter-type connectors, or equal, and make tight to provide a firm mechanical and electrical connection.

2. Insulation Value of Splice: Shall equal that of the conductor insulation, and shall be made up with Scotch No. 33 electrical tape.

3. Conductor Terminations: Make with the conductor inserted full depth into pressure-type lug or wrapped fully around binding screw for other equipment supplied with terminals.

   a. Taps to Lighting Fixtures and Receptacles: Make with T & B Sta-Kon crimp type (stranded), Buchanan B - cap twist-on type or equivalent connectors.

   b. Termination or Splice Devices: Shall be approved for conductor material to be installed.

I. Splices and Connection to Devices: A minimum of 8 inches of conductor shall be left in boxes.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Meggering: Prior to terminating, test cable or wire of 25 feet or longer for insulation resistance with megger (500 VDC megger for 300 V insulation, 1000 VDC megger for 600 V insulation and 2500 VDC megger for cable insulation ratings above 600 volts). Any wire with less than 10 megohms to ground or other conductors shall be replaced before proceeding with the terminating.
C. Electrical Continuity: After conductor connectors are installed and conductors are labeled, but prior to termination to terminals or devices, an electrical continuity test shall be performed on each conductor using a battery powered buzzer or ohmmeter to determine that all power, control, grounding and other conductors are properly installed and identified. List all conductors tested on required test data submittal sheets.

D. Seller shall correct such conditions and retest until proper readings are obtained.

3.04 ADJUSTMENT AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
# SECTION 16123

## 15KV CONDUCTORS

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SECTION 16123

15KV CONDUCTORS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section establishes the requirements for 15KV conductors for the W113 facilities.

1.02 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

2. Association of Edison Illuminating Companies (AEIC).
3. Insulated Cable Engineers Association (ICEA).
6. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
   7. Underwriters Laboratories (UL).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).
1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Certified Reports (for information and records).

1. Certified Test Reports shall be submitted for each order to include the following:
   a. Name of Purchaser
   b. Date
   c. Purchaser’s Order Number
   d. Cable Description
   e. Number of Reels and Length per Reel
   f. A Report Number
   g. DC Conductor Resistance and Temperature of Conductor
   h. AC Test Voltage and Test Duration
   i. DC Test Voltage and Test Duration
   j. Insulation Resistivity Corrected to 15.6 Degrees C
   k. X-Y Plot of Coronal Discharge

2. For the balance of tests required by AEIC CS6-82 and ICEA S-68-516, copies of Certificates of compliance showing conformance to these Standards shall be submitted for each.

C. The following information shall be submitted for:

   15KV Conductors
   1. Review and Approval (for Approval)
      a. Catalog Cut Sheets
      b. Specifications
      c. Dimensions/Outline
2. Review for Records (for Information and/or Records)
   a. Installation Instructions

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

B. Deliver, store, and handle material in accordance with manufacturer's instructions and recommendations.

C. Shipment:

1. Ship cable in one continuous length per reel, on non-returnable reels in accordance with NEMA Standard WC 21-1978.

2. Drum diameters of shipping reels shall comply with Appendix M, ICEA S-68-516.

3. Provide for each reel Class 2 protection covering in accordance with NEMA Standard WC 25-1975.

4. Both ends of each shipping length of cable shall be sealed with heat shrinkable caps or approved equal.

5. Each reel shall be durably labeled to show the name of purchaser, purchaser's order number, cable description, cable length, and shipping weight.

1.07 SITE CONDITIONS

A. Reference Division 1.0.

PART 2 PRODUCTS
2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Cablec
2. Kerite
3. Okonite
4. Southwire

2.02 MATERIALS

A. Conductor


B. Conductor Strand Screen

1. An extruded layer of semi-conducting ethylene-propylene rubber compound with volume resistivity not in excess of 50,000 ohm-cm at 90°C shall be applied.

   a. Compound shall have a minimum elongation after an oven air test at 121°C for 168 hours of 100 percent and a brittleness temperature not warmer than minus 30°C.

   b. Compound shall be free-stripping from the conductor and thickness shall be as follows:

      1) Conductor Size AWG/KCMIL: As shown on drawings.

      2) Conductor Screen Thickness:

         a) Minimum Average: 25 mils.

         b) Minimum At Any Point: 20 mils.
C. Insulation

1. Insulation shall be an ethylene-propylene rubber meeting the electrical and physical requirements of AEIC CS6-82 and S-68-516.

2. Minimum average insulation thickness shall be 220 mils.
   a. Minimum thickness at any cross-section of the insulation shall be not less than 90 percent of the average thickness.

3. Insulation shall be suitable for operation in wet or dry locations at conductor temperatures not exceeding 90°C for normal operations, 130°C for emergency overload conditions and 250°C for short-circuit conditions.

4. Insulation level shall be 133 percent for use on an ungrounded neutral system.

5. Insulation shall be fully bonded to the conductor screen.

D. Insulation Screen

1. The insulation screen shall be extruded semi-conducting EPR with a volume resistivity not in excess of 50,000 ohm-cm at 90°C when tested per AEIC No. CS-6-82.

2. The peel strength of the extruded screen from the insulation shall be between 4-28 pounds per 0.5 inch width when tested per AEIC CS-6-82.
   a. Compound shall have a minimum elongation after an air oven test at 121°C for 168 hours of 100 percent and a brittleness temperature not warmer than minus 30°C.

3. Thickness of the extruded insulation screen shall be as follows:
   a. Conductor: As shown on drawings.
   b. Insulation Screen Thickness:
      1) Minimum Average: 40 mils.
      2) Minimum Point: 32 mils.
4. Outer surface of the insulation screen shall be printed with white ink - "Semi-Conducting-Remove when Splicing or Terminating."

E. Metallic Shield

1. A bare copper tape, 5 mils in thickness, shall be helically applied over the insulation screen with a minimum 12.5 percent overlap.

2. Shield tape shall be electrically continuous through-out each cable length and shall be in contact with the insulation screen.

3. Shield tape shall be applied in such a manner that electrical continuity or contiguity will not be distorted or disrupted during normal installation.

F. Jacket

1. Non-Metallic Thermoplastic Jacket: Shall be poly-vinyl-chloride and shall meet the physical requirements of Part 4, ICEA S-68-516 for this type of jacket.

2. Jacket Thickness: Shall be as follows:
   a. Conductor Size: As shown on Drawings.
   b. Jacket Thickness - Minimum Average: 80 mils.

G. Identification

1. A permanent marker indicating "The manufacturing company, year of manufacture, and sequential footage number" repeated each foot shall be inserted under the copper shield tape.

2. Print every 24 inches on the jacket the name of manufacturer, plant number, type of material, insulation thickness, conductor size, rated voltage, and year of manufacturer.

H. Factory made splices in delivered cable are not acceptable.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED
2.06 SHOP QUALITY CONTROL (SHOP TESTS)

A. Tests on production samples on finished lengths of production cable to be supplied on each order shall be performed in accordance with the requirements of AEIC CS6-82 and ICEA S-68-516.

B. Frequency of testing shall be in accordance with Paragraph J of AEIC CS6-82 and Part 6 of ICEA S-68-516, except that a minimum of one test of each type shall be performed for each order.

C. Cable shall carry a UL listing as Type MV-90 cable.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Installation

1. Three single conductor 15KV cables shall be installed in the conduit run as indicated on the Drawings.

   a. All three cables shall be pulled into the conduit at the same time.

2. Cables shall be pulled into conduits in such a manner as to avoid sharply bending or kinking conductor, damaging insulation, or stressing cable.

   a. Maximum pull tension shall not exceed values recommended by the cable manufacturer when measured by a tension dynamometer.

3. Each section of cable shall be protected with temporary tape and/or coatings to prevent moisture from entering cable ends before termination is complete.

4. Cable splices shall not be permitted on this installation.
B. Cable Terminations

1. Terminations of the power cables at riser structures and transformers shall be performed by the Seller.
   
   a. Furnish all material for terminations and make all cable terminations.

2. Installation of materials will require working on new power circuits rated at 13.8KV.
   
   a. Before any work is energized to connect to the present electrical system, correct phasing shall be established by the Seller in the presence of the Buyer.

3. Manufactured termination kits for stress cones shall be used with prior approval from the Buyer.
   
   a. Cables shall be marked for phase identification and circuit number at each termination.

4. Cable terminations shall have voltage ratings of not less than 15,000 volts (ungrounded neutral 133 percent).
   
   a. The standard withstand test voltage of the completed terminations shall conform to IEEE Standard No. 48, 1990.

   b. Stress-relief cones shall be provided at the terminals of all shielded cables.

5. Field fabricated (taped) stress-relief cones shall not be made.

6. Termination kits shall be as shown on Contract Drawings, and shall be suitable for conductors of the gauge and type used.

7. Install sealing bushings on primary conduit risers.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Prior to terminating the 15KV cable, testing of the cable shall be performed in the presence of the Buyer.
C. The 15KV cable tests will be made by the Seller.

1. Tests will be to 65KV DC or as recommended in ICEA S-68-516, Table 6-9.

2. Each cable shall be checked with a DC High Potential Tester in 5KV steps.
   a. The duration of each step shall be long enough for current to obtain stabilization.
   b. Leakage current readings and voltage hold time shall be recorded for each step.
   c. Leakage current shall not be in excess of 5 microamps. If cable and termination is improperly done and leakage current is in excess of minimum leakage requirements, the ends shall be redone and the test rerun at the Seller’s expense.

3. Exposed ends of cable with stress cones, potheads or load break connectors shall be prepared and cleaned prior to testing in order to minimize any leakage current.
   a. Ends shall be covered with plastic or polyethylene envelopes of plastic or glass containers to contain the space charge and reduce corona current.

4. Each cable shall be tested with a 2,500 Volt DC megger prior to any testing to determine that the cable has not been damaged during pulling, and to insure proper phase identification.

5. Cable circuit ends shall be cleaned and guarded for personnel safety during cable testing.
   a. Circuits not under test in the immediate vicinity shall be grounded.

6. Exposed circuit ends under test require a minimum separation from all elements not subjected to test of one inch per 10KV of test potential.
   a. After testing, cables shall be grounded for a period not less than 4 times the charging time to remove any residual charge.
7. Test results shall be recorded on the Field Test Record or as indicated and submitted to the Buyer within 24 hours of test completion.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
SECTION 16141
FOR
SWITCHES, RECEPTACLES, AND ACCESSORIES

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SECTION 16141
SWITCHES, RECEPTACLES, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the requirements for detailed design, fabrication, installation, and acceptance testing of switches, receptacles, and accessories.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods

1.03 REFERENCES

A. All materials, equipment, fabrication and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

1. National Electrical Manufacturers Association (NEMA).
3. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
4. Underwriters Laboratories (UL).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS: NOT USED

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.
1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Arrow-Hart
2. Bryant
3. General Electric
4. Hubbell
5. Pass and Seymour
6. Sierra
7. Slater
8. Appleton
9. Meltric

2.02 MATERIALS

A. Switches

1. Toggle Switches for Lighting Circuits: Shall be single-pole single-throw or three way, manufacturer’s Specification Grade, 120-277 volt AC, with grounding means, grounding screw, grounding pigtail or self-grounding strap.
   a. 20 Ampere: Hubbell No. 1220-G Series
   b. Color of Switches: Ivory for finished areas and brown for unfinished areas

2. Switches in Trench Enclosure shall be NEMA 12.

B. Receptacles

1. Convenience Receptacles for 120 Volt, Single-Phase Wall Outlets: Shall be manufacturer’s Specification Grade, 2 pole, 3 wire, grounding type, 125 volts AC or DC, NEMA configuration No. 5-20R.
   a. 20 Ampere: Hubbell No. 5360 Series, Duplex
b. Color of Receptacles: Ivory for finished areas and brown for unfinished areas

2. Power Receptacles for Voltages Above 120 Volts, Single- and Three-Phase: Shall be single, grounding type, twist lock, as specified on Drawings.

C. Cover Plates for Surface-Mounted Devices: Shall be stainless steel.

D. Cover Plates for Wiring Devices in Outdoor and Indoor Damp Locations: Shall be of cast material and equipped with a neoprene gasketed spring door.

E. Cover Plates for Flush Mounted Devices in Finished Areas: Shall be stainless steel in general occupancies, laboratories and restrooms.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Install switches, receptacles, and accessories of types indicated, where shown and at indicated heights; in accordance with Manufacturer’s written instructions and with recognized industry practices; to ensure that fixtures comply with requirements and serve intended purposes.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality control requirements.

3.04 ADJUSTMENT AND CLEANING: NOT USED
3.05 DEMONSTRATION

A. Functional Verification (requires witness and acceptance by Buyer): Upon completion of installation of switches, receptacles and accessories, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

3.06 PROTECTION: NOT USED

END OF SECTION
SECTION 16151
NEMA FRAME ELECTRIC MOTORS

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September 1995

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SECTION 16151
NEMA FRAME ELECTRIC MOTORS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section shall supplement all applicable equipment specifications sections which utilize electric motors. Motors included with the scope of this Specification Section shall include single-phase, polyphase and squirrel-cage induction electric motors.

B. The Seller shall be responsible for performing all required tests and inspections. The Seller shall furnish the data required by this Specification Section to document that required tests and inspections have been performed.

1.02 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods

B. Section 16152 - Electrical Specification for Packaged Mechanical Equipment.

1.03 REFERENCES

A. Applicable Codes and Standards: Codes, specifications and standards referred to by number or title in effect, September 1995, shall form a part of this specification to the extent required by the references hereto.

B. Anti-Friction Bearing Manufacturers Association, (AFBMA):

1. AFBMA 9-90 Load Ratings and Fatigue Life for Ball Bearings

2. AFBMA 11-90 Load Ratings and Fatigue Life for Roller Bearings

C. Institute of Electrical and Electronic Engineers (IEEE):

1. IEEE 85-73 Test Procedure for Airborne Noise Measurements on Rotating Electric Machinery

2. IEEE 112-84 Standard Test Procedure for Polyphase Induction Motors and Generators


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D. National Electric Manufacturer’s Association (NEMA):

1. NEMA MG1-78 Motors and Generators

E. United States Code of Federal Regulations (CFR) 1990:

1. CFR Title 29, Occupational Safety and Health
   Part 1910 Standards (OSHA)

1.04 SYSTEM DESCRIPTION

A. All electrical systems associated with this section shall
   conform to National Fire Protection Association, NFPA 70,
   American National Standards (ANSI) C2, National Electric
   Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1.0 for Submittal procedure including
   details regarding standard submittal schedule, distribution and
   number of copies required. Note that Division 1.0 may required
   additional submittals than listed herein.

B. The following submittals shall be provided:

1. Submit for review and approval:
   a. Equipment: Electric Motors
      1) Drawings
      2) Test Reports

2. Submit for information and record:
   a. Equipment: Electric Motors
      1) Descriptive Literature
      2) Hazardous Material Certification
      3) Recommended Spare parts
      4) Operations and Maintenance Data
      5) Motor Nameplate Data
      6) Bill of Material
C. Detailed Submittals:

1. Descriptive Literature: Descriptive literature detailing the selected motor shall include all catalog cut sheets, outline dimensions, weights, size and location of electrical terminal box.

2. Hazardous Materials: Certification that no asbestos-containing insulation or gaskets will be used, in any electric motor furnished.

3. Drawings: Electrical wiring diagrams with electrical characteristics and connection requirements. In addition, the Seller shall provide a dimensioned motor outline drawing locating all electrical connections.

4. Test Reports: Indicate test results verifying nominal efficiency and power factor for motors larger than 1/2 horsepower.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Baldor (less than 10 Horsepower)
2. Reliance (All Horsepowers)
3. Toshiba (All Horsepowers)
4. U.S. Motors (All Horsepowers)
5. Westinghouse (All Horsepowers)

2.02 MATERIALS

A. The Seller shall provide new, first quality materials, components and equipment in accordance with this Specification Section and the referenced Codes and Standards.
B. All castings and forging shall be free from scale and mismatching. No process such as peening, plugging or filling with solder or paste shall be used for reclaiming any defective part.

C. All material specifications shall be a U.S. specification (ASTM, UNS, SAE, etc.).

D. Greases and oils shall be of U.S. manufacture.

E. The Seller’s standard primer and finish shall be applied to each piece of equipment.

2.03 EQUIPMENT

A. General:

1. The electric motor mechanical design shall be in accordance with Codes, Standards and recommended practices listed in Article 1.03 of this Specification Section.

2. The nominal motor efficiency shall be stamped on the motor nameplate.

3. All electric motors that are 1/2 horsepower and less shall be 120 VAC, single-phase. Motors greater than 1/2 horsepower shall be squirrel cage induction 480 VAC, 3 phase.

4. When electric motors are factory assembled and coupled to the driven equipment, installation of each unit assembly shall require only setting in place and making electrical cable connections.

5. All electric motors shall operate successfully at their design load horsepower at the ambient temperatures and altitude specified in Article 1.07.

6. Single-phase electric motors shall be capacitor-start induction electric motors, except where otherwise approved for special application.

7. All motors shall be supplied with suitable lifting attachments.

8. All electric motors shall be provided with drain plugs or other openings for condensate drainage.

9. All totally encloses motors shall be furnished with drain breather elements, Crouse-Hinds Type ECD "Universal" or approved equal.

10. Provisions shall be made to eliminate the possible path of shaft currents on large electric motors.
11. When electric motors are furnished separately or with the driven equipment as a package, the torque characteristics and speed specified shall be the responsibility of the driven equipment manufacturer.

B. Motor Efficiency: Electric motors provided with this specification section shall be high efficiency with the minimum efficiencies as follows:

<table>
<thead>
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<th>Horsepower</th>
<th>Efficiency</th>
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<tr>
<td>1/3 &amp; Less</td>
<td>≥77%</td>
</tr>
<tr>
<td>1/2 &amp; 3/4</td>
<td>≥82%</td>
</tr>
<tr>
<td>1 to 2</td>
<td>≥85%</td>
</tr>
<tr>
<td>3 &amp; 15</td>
<td>≥86%</td>
</tr>
<tr>
<td>20 to 125</td>
<td>≥91%</td>
</tr>
<tr>
<td>125 to 250</td>
<td>≥95%</td>
</tr>
</tbody>
</table>

C. Enclosures: The types of enclosures required for individual motor applications shall be suitable for the environment in which the motor shall be installed.

1. By location they shall be:
   a. Outdoors, in Trench Enclosure, or in wet locations - totally enclosed fan cooled (TEFC).
   b. Indoors in dry locations - open drip proof.

D. Insulation:

1. The insulation of all electric motors shall meet or exceed the requirements established by NEMA for Class B or better insulation.

2. Electric motors with weatherproof enclosures or for outdoor application shall have sealed or encapsulated insulation systems produced by a vacuum pressure impregnation process.

E. Horsepower:

1. The continuous nameplate rating shall be greater than or equal to the maximum brake horsepower required by the driven equipment when that equipment is operating at the design load conditions specified in the applicable equipment specification. Any service factor rating greater than 1.0 shall not be used to meet this requirement.

2. The service horsepower for subfractional and fractional horsepower single-phase electric motors shall be determined in accordance with NEMA MG1 Part 18.
F. Service Factor: Electric motors shall have service factors in accordance with NEMA MG1-12.47 for NEMA frame induction motors.

G. Torque and \( W_{K2} \):

1. All electric motors shall have characteristics suitable for the torque and \( W_{K2} \) characteristics of the driven equipment when the driven equipment is operating as specified in the applicable equipment specification section.

2. Unless specified otherwise or if other design is required by the driven equipment load characteristics, electric motors shall have a torque characteristic similar to either NEMA Design B or NEMA Design C. Other torque characteristics for special application shall be approved by the Buyer.

H. Vibration: Electric motors shall operate without exceeding the applicable vibration allowances provided by NEMA Standard MG1-12.05.

I. Temperature Rise: Per NEMA MG1.

J. Voltage and Frequency:

1. Motors shall be rated for the voltage and frequency specified in the applicable specification section. Permissible voltage and frequency variations shall be in accordance with NEMA MG1.

2. When specified in the Equipment Specification, electric motors shall be capable of producing satisfactory operation of the driven equipment during short duration (up to one minute) dips to 75 percent of rated voltage.

K. Starting:

1. All electric motors shall be designed for full voltage starting. Full voltage starting equipment will be furnished by others, unless specified otherwise in the applicable equipment 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 the applicable equipment specification.

2. Electric motor starters and control equipment, if supplied, shall be suitable for the type of service. All starting equipment shall be fully described in the Seller's proposal, complete with Seller's catalog data and descriptive bulletins. Enclosures shall be as specified in Specification Section 16050 paragraph 2.04.B.
3. Electric motor starting current shall not exceed 6.5 times rated full load current. Electric motors shall be capable of withstanding the number of starts imposed by the driven equipment without appreciable loss of service life.

4. Electric motor starting current for single-phase subfractional and fractional horsepower electric motors shall conform to NEMA Design L, M, N, or O.

5. Electric motors shall be capable of starting and accelerating their driven equipment to full speed at a starting voltage as required in the applicable specification section. The temperature rise during a restart following continuous full-load operation shall not produce injurious heating.

L. Noise: Electric motors shall operate with an equivalent A-weighted sound level not to exceed the table in MG1-12.49, unless otherwise approved. Noise shall be determined by test in accordance with IEEE 85, "Test Procedure for Airborne Noise Measurements on Rotating Electric Machinery" only when specifically called for.

M. Horizontal foot-mounted electric motors used in vertical service (e.g., air coolers), shall be equipped with a shaft seal which will preclude entry of moisture. TEFC-motors used in vertical service shall be provided with a drip cover and shall have a combination breather and drainhole. Drainage shall be through the lower end bell.

N. Integral fans shall be of nonsparking, corrosion-resistant material, accurately balanced before assembly and suitable for rotation in either direction. Plastic, fiberglass or other nonmetallic fan housings are not acceptable.

2.04 COMPONENTS

A. Bearings:

1. General:

   a. All electric motors with anti-friction bearings shall be furnished with grease fittings for bearing lubrication and drain plugs for draining excess grease, except as specified in paragraph 2.04.A.1.b below.

   b. Fractional horsepower electric motors may be furnished with pre-lubricated sealed ball bearings or oil lubricated sleeve bearings if greaseable ball bearings are not available. All sleeve bearings shall have provisions for oiling.
c. Electric 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.

d. All electric motors with anti-friction bearings shall have the AFEMA anti-friction rating and number stamped on the Electric Motor nameplate.

2. Horizontal Electric Motors:

a. All horizontal electric motors shall be furnished with either anti-friction or sleeve bearings in accordance with the Seller’s standard practice for the particular frame size and application.

b. Anti-friction bearings shall be in accordance with AFEMA 9-90 for ball bearings or AFEMA 11-90 for roller bearings.

c. Anti-friction bearings in direct-coupled electric 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 AFEMA system.

d. Anti-friction bearings in belt or chain drive electric motors will be evaluated based on AFEMA L-10 rating life stated in the applicable specification section.

e. Sleeve bearings shall be split, oil ring-lubricated, with split end bells. Electric 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, electric motors with oil ring-lubricated bearings shall have a transparent window for oil ring inspection.

f. Horizontal electric motors with sleeve bearings shall have a minimum electric motor rotor end float and a maximum coupling end float in accordance with NEMA MG1.

3. Vertical Electric Motors:

a. Vertical electric motors shall be equipped with a bearing system designed to carry the weight of the electric motor rotor, the dead weight of the rotating parts of the driven equipment and the thrust produced by the driven equipment.
b. All vertical electric motors shall be furnished with anti-friction thrust bearings which meet the requirements of AFBMA 9-90 for ball bearings or AFBMA 11-90 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 system.

c. Thrust bearings and/or guide bearings in vertical electric motors may be oil lubricated, if required. Sight-glass oil gages marked to indicate normal oil level shall be furnished.

B. Space Heaters:

1. All electric 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.

2. All indoor totally enclosed motors over 100 horsepower shall have space heaters.

3. Space heaters shall be of sufficient capacity to keep the electric motor windings and internal parts dry when the electric motors are not operating. Heaters shall be chrome steel sheath strip, ring or disc elements.

4. Space heaters shall be designed for operation on 120 volts, single phase.

C. Terminal Boxes:

1. Boxes shall be of cast iron or fabricated steel, preferably be suitable for rotation in 90-degree increments, and of heavy-duty class (and weatherproof).

2. Electric motor lead terminal boxes shall be the Seller’s standard size.

3. All terminal boxes shall have a bolt-type copper ground connector, sized as follows and brazed, welded or bolted inside the box:

<table>
<thead>
<tr>
<th>Motor Horsepower</th>
<th>Size, AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 thru 10</td>
<td>12</td>
</tr>
<tr>
<td>15 thru 20</td>
<td>10</td>
</tr>
<tr>
<td>25 thru 50</td>
<td>8</td>
</tr>
<tr>
<td>60 thru 75</td>
<td>6</td>
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<tr>
<td>100 thru 250</td>
<td>2</td>
</tr>
</tbody>
</table>

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4. Separate terminal boxes or approved condulets or fittings shall be furnished for terminating all heater, thermocouple, thermostat, etc., wiring as required. When space allows, wiring shall be terminated with ring-type connectors on washer-head screw terminal blocks.

D. Motor Connections:

1. All internal leads and terminals that are not permanently connected shall be designated or marked with numbers or letters in a manner which will permit convenient reference and will prevent confusion with terminal and polarity markings.

2. All leads shall be identified on the nameplate or on the connection diagram.

2.05 FABRICATION

A. Electric motors shall be dynamically balanced in accordance with NEMA MG1. Solder or similar balancing deposits are not acceptable. Parent metal removed to achieve dynamic or static balance shall be drilled out in such a manner as to not affect the structural strength of the rotating element.

B. Nameplates:

1. Nameplate data shall be furnished in accordance with NEMA Standard MG1-10.38

2. Correct direction of rotation shall be permanently marked on the electric motor based on required motion of the motor driven equipment.

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

B. The Seller is responsible for all shop acceptance testing required by this Specification Section. Seller shall provide equipment and instrumentation of certified accuracy and any supplementary temporary connections and auxiliary parts necessary to fully execute the tests. This includes providing test personnel qualified to conduct, record and verify test results.

C. Decision by the Buyer to witness the shop tests or to conduct shop inspection shall in no way relieve the Seller from full responsibility for the quality and correctness of work.
D. Acceptance of shop inspection and tests shall not constitute a waiver of requirements to meet field performance under specified operating conditions, nor does inspection relieve the Seller of his responsibilities.

E. Testing:

1. Each electric motor shall be given a routine commercial test to demonstrate that it is free from mechanical and electrical defects. Routine tests shall be as listed in NEMA MG1 and shall be made in accordance with IEEE 112 and/or 114.

PART 3 EXECUTION

3.01 PREPARATION

A. Reference the applicable equipment specification section for details regarding preparations for field installation.

3.02 ERECTION, INSTALLATION & APPLICATION:

A. Reference the applicable equipment specification section for details regarding erection, installation and application of components for field installation.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Reference the applicable equipment specification section for details regarding field quality control, including inspection and testing, of components for field installation.

3.04 ADJUSTING AND CLEANING

A. Reference the applicable equipment specification section for details regarding adjusting and cleaning of components for field installation.

3.05 DEMONSTRATION

A. Reference the applicable equipment specification section for details regarding demonstration of components for field installation. At a minimum, the demonstration must require the motor to be "bumped" in the field.

3.06 PROTECTION

A. Reference the applicable equipment specification section for details regarding protection of components for field installation.

END OF SECTION
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<td>3.05</td>
<td>DEMONSTRATION: NOT USED</td>
<td>21</td>
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<tr>
<td>3.06</td>
<td>PROTECTION: NOT USED</td>
<td>21</td>
</tr>
</tbody>
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SECTION 16152
ELECTRICAL SPECIFICATION FOR PACKAGED MECHANICAL EQUIPMENT

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section describes material and work to be performed in the electrical design and construction of packaged mechanical equipment.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods
B. Section 16151 NEMA Frame Electric Motors
C. Section 16475 Overcurrent Protective Devices
D. Packaged Mechanical Equipment Specification which this specification accompanies.

1.03 REFERENCES

A. Standards: The packaged mechanical equipment shall be designed, completely factory assembled, wired and tested in accordance with the following applicable standards in effect, September 1995:

1. Factory Mutual (FM).
2. Institute of Electrical and Electronic Engineers (IEEE).
3. Joint Industry Council (JIC).
4. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
6. National Electrical Manufacturer’s Association (NEMA).
7. Underwriters’ Laboratories Inc. (UL).
B. If there is a conflict between any of the requirements of this Specification Section and the standards and requirements stipulated in Paragraph A above, or of any applicable statute, ordinance or code, then the most stringent requirements shall apply.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. The intent of this specification section is to present reference standards as to quality of electrical material and workmanship. This specification section is not all inclusive and the specific specification section for the packaged equipment involved will cover more detailed requirements. In case of conflict, the mechanical equipment specification section shall control.

B. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

C. General

1. Complete items as required on the Mechanical Equipment Data Sheets.

2. Each equipment item furnished shall be a complete assembly.

   a. Installation of the packaged equipment shall require only 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.

3. Accessible external surfaces of the equipment which operate at surface temperatures exceeding 60°C (140°F) shall be physically guarded, isolated or thermally insulated to protect against contact by personnel.

D. All electrical equipment shall be new and complete unit. All equipment shall be guaranteed to be free of defects in materials and workmanship.
E. All electrical material and equipment shall be listed or labeled by 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 published standards of UL, FM or equivalent testing laboratory.

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. See the packaged equipment specification section which this specification accompanies.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

B. Service Conditions

1. All packaged equipment shall operate successfully at their design load horsepower at the ambient temperatures and altitude specified on the Mechanical Equipment or Motor Data Sheet.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this Specification Section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement shall not be limited to these listed manufacturers.

1. Circuit Breakers (Westinghouse, General Electric, ITE, Allen Bradley, or ASEA Brown Boveri)

2. Control Fuses For all applications (Gould Shawmut, Bussman)
3. Enclosures
Control panel, operators panel
(Hoffman)-NEMA 1, 4, and 12
Junction boxes - JIC Type
(Hoffman, Carlon)-NEMA 1, 4, and 12

4. Control Devices

Push Buttons: Heavy Duty, (Crouse-Hinds,
Allen Bradley) NEMA 1, 4, and 12

5. 120 Volt Manual Motor Starters

a. Outdoor: (Allen Bradley-Bulletin 600,
Crouse-Hinds Type NSS)
b. All others: (Allen Bradley-Bulletin
600, Crouse-Hinds Type NFS)

Note: All momentary contacts shall be rocker-arm type.

6. Relays. Auxiliary relay and timer contact developments
shall be in accordance with the applicable schematic diagrams.
Relays shall be mounted inside the control panels or in
separate relay cabinets. Relays shall have convertible
contacts rated 600-V ac or 250-V dc insulation class, as
appropriate, or Buyer approved equal. The contacts shall be
rated for an interrupting duty in inductive circuits of 10 A
at 120-V ac and 1 A at 125-V dc.

a. Relays, non-time delay
A.C.: Industrial control type-
Allen Bradley Bulletin 700 type
P, Westinghouse Type AR, G.E.
Type CR, Cutler Hammer Type
M-600.

D.C.: Allen-Bradley Bulletin
700 Type N, Westinghouse Type
ARD.

A.C./D.C.: hermetically sealed
contact type - Allen-Bradley
Bulletin 700 Type R or General
Electric CR120 Series.
b. Relays, time delay


Solid state timing relays of an industrial grade, having temperature compensation with plug-in headers, similar and equal to Agastat Series 9000, Allen Bradley Bulletin 852S.

7. 120-Volt Receptacles

125V A.C., 20 amp, 3-wire grounding type, Hubbell, Leviton or equal. (In box with cover).

8. Panelboards (Non-hazardous)

General Electric or Westinghouse.

9. Transformers - Dry Type

Energy efficient Westinghouse Type DT-3, ACME Opti-Miser, with encapsulated windings 3 phase, 60 HZ or approved equal.

- Control Type

Single Phase, 60 Hz 1KVA and less, ACME type TA, Square D Class 9070, Allen-Bradley Bulletin 500 or approved equal.

10. Wire Markers

Brady or Thomas and Betts all temperature or sleeve type.

11. Terminal Blocks

With saddle terminal points, G.E. Type CR151B, Cinch Series 142, Kulka 602 series or approved equal.

12. Wire Lugs

Compression Type (T&B -Stakon, Burndy YAEV-RS).

13. Ground Lugs

Mechanical Type (Burndy, T&B).

2.02 MATERIALS: NOT USED

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2.03 EQUIPMENT

A. Electrical equipment installed shall be in accordance with the following:

1. Seller shall furnish and prewire all components necessary for the complete and proper operation of packaged equipment.

B. All devices requiring external connections shall be routed to terminals in a junction terminal box or control panel. Separate terminal boxes shall be provided for:

1. AC control circuits wired to a separate terminal box.

2. Thermocouple circuits, which shall be wired to a separate Thermocouple Terminal Box. Shields shall be wired to separate terminal points.

3. DC Analog, RTD's, digital signal or measurement circuits may occupy the same Instrumentation Terminal Box, but shall be terminated on separate terminal blocks. Shields shall be wired to separate terminal points.

4. 480 volt power and 208/120 volt power circuits wired to a separate terminal box.

C. Power supplies and voltages

1. Nominal ratings of power supplies available to supply the packaged equipment are as follows:

   120 volts and 240 volts, 1-phase; 480 volts, 3-phase, 60 Hertz

2. All incoming power to main control panel of an equipment package shall terminate at a main breaker(s).

   a. If a control panel receives power from more than one source, a permanent warning sign shall be mounted on the panel stating the location and identification of each source.

3. Motors shall be rated as shown on the Motor Data Sheets and comply with the following:

   a. Motors, greater than ½ Hp shall be powered from motor starters provided by Seller and be rated 480V, 3 phase, 60 Hertz. The Seller shall provide all necessary control, local disconnect means to comply with NEC 430-102, and switching equipment for these motors.
b. Fractional Horsepower loads $\frac{1}{2}$ Hp and less, shall be rated 120 VAC single phase. The Seller shall provide all necessary control, local disconnect means to comply with NEC 430-102, and switching equipment for these motors.

c. Motors shall be heavy duty type enclosure for long life and dependability.

4. The Seller shall supply the necessary transformers and associated switching and protection equipment for voltages other than those listed above.

5. Control circuits shall be 120 volts, AC, 60 Hertz, grounded neutral.

6. The voltage to ground on any instrument device for control and/or indication shall not exceed 120 volts. Normal instrument power shall be 120 volts, 60 Hertz, single phase.

D. Enclosures and Miscellaneous Material

1. Enclosures shall be constructed of #16 minimum gauge to assure rigidity and durability and shall be either stainless steel, primed and painted steel, fiberglass, or fiberglass-reinforced polyester or per equipment specification. Back plates shall be fabricated from 16-gauge steel.

2. All miscellaneous material such as channel, angle, strut, hanger rods, clamps, angle clips, etc., shall be provided.

3. All attachment hardware such as bolts, nuts, screws, washers, etc., shall be stainless steel. Cadmium plating or electro galvanizing is not acceptable.

4. All hardware shall be heavy duty industrial quality. Items such as Korn Klamps, speed clips, scissors clips, flange clips, set screw couplings, etc., are not acceptable.

5. All junction boxes, terminal boxes, enclosures for relays, and enclosures for controls shall be mounted not less than 1 foot above the base of the packaged unit assembly.

6. Space heaters shall be installed where required on motor data sheets.
7. Enclosures for electrical equipment shall be suitable for the environment in which they will be located and shall be as follows:

<table>
<thead>
<tr>
<th>Indoor Locations</th>
<th>Outdoor Locations</th>
<th>Trench Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMA Type 1</td>
<td>NEMA Type 4</td>
<td>NEMA Type 12</td>
</tr>
</tbody>
</table>

8. Suitably located, flush-hinged access doors shall be provided with a maximum width not to be more than 30 inches. The doors shall be constructed with stiffening members, to ensure rigidity. Door handles shall be corrosion resistant and capable of being padlocked.

9. Enclosures shall be suitable for cable entry from above and below as specified on the equipment data sheets. The panel drawings shall show the areas for cable entrance including pertinent dimensions.

10. Engraved nameplates identifying function shall be provided for each instrument or device where mounted on the face of the panel or within the panel enclosure.

11. All devices such as disconnect switches, relays, fuses, etc, shall be identified and shown on Sellers Drawing.

12. Nameplates shall be legible, substantial and permanent - suitable for the items location.

13. Each free-standing enclosure shall be provided with the following.

   a. Interior lighting to illuminate adequately (50 footcandles, maintained) the enclosure interior. Lighting shall be controlled from conveniently located specification grade switches.

   b. One specification grade duplex receptacle, grounded type, (2 places) 125 VAC, NEMA 5-20R configuration, located inside on a side wall in a readily accessible position.

E. Control Equipment and Devices

1. Refer to the Electrical Material List in Article 2.01 for acceptable manufacturers and equipment types.

2. In addition to contacts required by the system, relays shall have two spare convertible contacts for use by others.
3. Controls shall be mounted on supports (racks) that will not transmit vibration to the control device. These supports shall not be mounted on the machinery or attached to its base.

4. Schematic diagrams shall use JIC standards and identification.

F. Motor Control Equipment: Where motor controls and wiring are specifically to be provided as part of a mechanical equipment package, they shall be as specified below:

1. Starters and Contactors: Shall be of proper NEMA size (minimum size 1) for voltage, load and environmental conditions per equipment specification.

   a. Combination Magnetic Starters and Switches: Shall be enclosed type, with circuit breaker, or motor circuit protector.

      1) Switches shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.

      2) Enclosures shall be NEMA 1, 4 or 12 as shown on Drawings or mechanical equipment data sheet.

      3) Where types of motor controller enclosures are not indicated, they shall be NEMA types which are suitable for the environmental conditions where motor controllers are being installed.

      4) Doors shall be mechanically interlocked to prevent opening unless the switch is open.

2. Push Buttons, Selector Switches, Pilot Lights: Furnish in starter cover, control panel door or as specified.

   a. Provide engraved nameplates to identify the function of each item.

3. Auxiliary Contacts: Provide one extra convertible auxiliary contacts for each magnetic motor starter in addition to the holding contacts and any required interlocking contacts.
4. Overload Heater Elements: Size based on the actual motor nameplate full load current rating and the manufacturer’s recommended heater based on starter and motor ambient temperatures and motor service factor.

   a. Quantity: One for each pole.
   b. Type: Thermal or induction type.

5. Switch and Fuse Units: Not acceptable for motor overload protection unless specifically indicated and approved by the Buyer.

6. Raceway, Wire and Cable: Raceway, wire, cable and accessories shall conform to the requirements of this Specification and the NEC.

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 up to 1800 watt rating shall be rated for 120 volt, single phase operation. Heaters over 1800 watts shall be suitable for 480 volt three phase operation.

3. Heaters where specified shall be readily accessible for replacement and shall be provided with protective screens if located where they may be directly contacted by personnel. Each space heater shall be protected with a properly rated fuse of the nonrenewable type.

H. Wiring

1. Wire and Cable Types
   a. All wire and cable shall be stranded copper.
   b. Cable for power service 0-600 volts shall be black, type XHHW, #12 AWG minimum, rated for 600 volts, 3 wire plus equipment grounding conductor.
   c. Conductors for 120 volt motor control circuits, interlocks, etc., shall be 600 volt, type XHHW, No. 14 AWG minimum.
   d. Conductors for lighting service 0-600 volts shall be type XHHW, No. 12 AWG minimum.
   e. Low-level instrumentation wiring shall be 600 volt 2/c,
3/c or 4/c twisted, and/or twisted shielded cable not less than No. 16 AWG stranded copper conductor.

f. 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, Dekoron Type 1802 or equal.

g. Control panel wiring (internal) shall be single conductor, stranded copper conductor with 600 volt class, 90 degrees C rated, switchboard wire, type SIS insulation. Minimum wire size shall be No. 14 AWG.

h. Wiring shall be so arranged that instruments or devices may be removed and or serviced without unduly disturbing the wiring. No wire shall be routed across the face or rear of an instrument, junction box, or device in a manner which will prevent the opening of covers, removal of equipment, or access to leads, terminals, or instruments.

i. Wiring for AC and DC discrete control signal and for DC analog control signals shall be a shielded twisted pair multi-conductor cable with #16 AWG, 7-strand copper conductors, aluminum 100% shield, and #18 AWG, 7 strand tinned copper drain wire, 90°C PVC primary insulation, 80°C jacket.

j. Retractile Cord: Retractable electrical power cords shall be UL type SO or SJO, permanent coiled spring like, neoprene jacketed, 600V, 16 X 34 stranded copper, 16 GA minimum, with a 5 to 1 extension range, with number of conductors and length as shown on the Contract Drawings.

2. Circuit/Wire Identification

a. Each circuit and/or wire shall be identified at each end and in all junction, terminal connector pin, and pull boxes with an identifying number. Identifying labels shall be firmly attached to the cable, wire, or wires and shall be of a permanent non-weathering type.

b. An individual wire shall have the same assigned number at each end and at each location where it is terminated.

3. Wire Color Coding, Unless Otherwise Specified

a. Single Phase, AC

<table>
<thead>
<tr>
<th>Line</th>
<th>Neutral</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Black</td>
<td>- White</td>
<td></td>
</tr>
</tbody>
</table>
b. DC Circuits (Power & Control)

Positive Leads & Busses - Red
Negative Leads & Busses - Black

c. Thermocouple Wiring - Per NEMA Standard WC 55-86

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. Power circuit conductor color shall be:

<table>
<thead>
<tr>
<th>SERVICE, FEEDER OR BRANCH CIRCUIT</th>
<th>CONDUCTOR</th>
<th>INSULATION COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>480Y/277 volt three phase systems</td>
<td>Phase A</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Phase B</td>
<td>Yellow</td>
</tr>
<tr>
<td></td>
<td>Phase C</td>
<td>Blue</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>White or Gray</td>
</tr>
<tr>
<td></td>
<td>Equip. Ground. Conductor</td>
<td>Green or bare</td>
</tr>
<tr>
<td>208Y/120 volt three phase systems</td>
<td>Phase A</td>
<td>Black</td>
</tr>
<tr>
<td></td>
<td>Phase B</td>
<td>Purple</td>
</tr>
<tr>
<td></td>
<td>Phase C</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>White or Gray</td>
</tr>
<tr>
<td></td>
<td>Equip. Ground. Conductor</td>
<td>Green or bare</td>
</tr>
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<td>120/240 volt single phase systems</td>
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<td>Black</td>
</tr>
<tr>
<td></td>
<td>Hot No. 2</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>White or Gray</td>
</tr>
<tr>
<td></td>
<td>Equip. Ground. Conductor</td>
<td>Green or bare</td>
</tr>
</tbody>
</table>

1) Where insulation pigmentation and/or coding is not available for large conductor sizes, colored plastic tape applied in a spiral half-lap manner may be used to identify the exposed portions of the conductors.
2) Raceways, boxes, and conductors shall be individually labeled to distinguish between 208V and 480V, 3 phase systems.

4. Where it is necessary to terminate 120 volt (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.

5. Terminal Box and Control Panel Wiring Details

a. All control wiring external to enclosures shall be terminated within the enclosures using T&B Sta-Kon or Buyer approved equal insulated spade lugs on devices with screw-type terminals. Terminals shall be sized to the current carrying requirements of the conductor. Splicing of any circuits is not permitted.

b. 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, Panduit or equal may also be used as an alternate to nylon ties. Self-adhesive "stick-on wire" tie bases are not acceptable.

c. 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.

d. 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.

e. A minimum of 25 percent spare terminals shall be provided in all terminal boxes and control panels.

f. Terminal and junction boxes shall be sized per Article 370 of the NEC 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.

g. 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.
h. 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.

i. For ease of maintenance, a minimum of 2 inches shall be maintained between individual terminal strips and between terminal blocks and components. Junction boxes 8 inches deep or less shall have no side panel mounted terminal strips.

j. Each analog signal shall utilize two terminals. Each digital signal externally powered signal shall utilize two terminals. Terminals shall be provided to ground the shield of shielded cables. The enclosure wiring side of these terminals shall be wired to the appropriate ground bars. Where there is insufficient space on proprietary equipment to provide terminal identification, propose alternative methods of identification.

k. Flexible conductors and metallic braiding subject to flexing at their terminations shall not be soldered but shall be fitted with crimped lugs.

6. Miscellaneous Wiring Details

a. 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.

b. Components requiring soldered connections for installation and/or replacement shall be performed at the Seller facility at the component level. Soldering required for field installation is not permitted.

c. Splices or taps shall be avoided in power or control wiring. 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 condition.

d. 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 the shield of each pair shall be bonded to the thermocouple well.
e. When dressing individual shielded multi-pair or triad cable at termination points, tape shall be installed on stripped pairs or triads to prevent unraveling of wrapped coverings.

f. Shielded wires shall contain no splices between terminating points.

g. 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.

h. Wiring for AC and DC power or control circuits shall be kept segregated and shall not be mixed in the same conduit or in the conductors of multi-conductor cables.

i. Instrument wiring shall be in separate conduits from power wiring.

j. No open wiring or exposed live parts shall be allowed. All live parts of equipment shall be guarded, isolated or insulated by a grounded metal enclosure.

k. All devices requiring periodic operator adjustment; i.e., timers, overloads, resets, etc., shall be accessible without having to open/enter areas containing exposed live parts.

l. 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.

m. All wiring connections to screw type terminal blocks will be made using insulated ring lugs, T&B STA-KON or equal.

n. 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.
I. Conduit Systems

1. Packaged Mechanical Equipment shall have a complete conduit system. 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, etc.

2. Electrical circuits shall be run in Intermediate Metal Conduit, IMC (preferred), or rigid conduit, threaded, and bearing the label of a manufacturer listed by UL. Conduit in and on gloveboxes shall be stainless steel. 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 per the NEC, Chapter 3.

3. Conduit and pull fittings shall not be located in inaccessible places where difficulty would be experienced in wire pulling, but shall be placed unobtrusively so as to not be unsightly or interfere with operation. Conduit and/or 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 as a "hot" line when operating at a temperature of 225 degrees F, or more.

4. Conduit sizes shall be 3/4 inch, 1 inch, 1-1/2 inch, 2 inches, 3 inches or 4 inches. Conduit fittings, unless otherwise noted, shall be compatible with conduit with covers and solid neoprene gaskets. Sizing of conduit bodies and boxes to accommodate splices shall be per the NEC. The 480 volt conduit system shall be sized for 75 degrees C rated wire and cable. 1/2 inch or 1-1/4 inch conduit sizes shall not be used.

Note: Conduit used for instrumentation wiring between instrumentation and junction box shall be 3/4 inch minimum size except where 1/2 inch NPT instrument conduit connection is required, 1/2 inch conduit is acceptable.
5. All conduit shall be terminated in threaded hubs or insulated bushings designed to prevent damage to wire during pulling operation.

6. Conduit entrance into boxes shall be made with threaded terminal adapters with "O" ring seal and non-metallic bushing.

7. All conduit bends shall be made with a Buyer approved conduit bending machine. The use of a pipe tool, vise or heat for bending shall not be permitted.

8. Radius of conduit bends shall be not less than specified in the NEC.

9. Flexible non-metallic conduit shall be employed at all apparatus or devices subject to vibration, movement for belt adjustments, operational inspection and maintenance. Flexible connections shall be Carlon Carflex liquid-tight flexible conduit or equal.

10. 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.

11. Liquid-tight flexible non-metallic conduit shall be terminated at both ends using insulated, threaded, watertight connectors, Carlon type LT or equal.

12. 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.

13. 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.

14. Conduits or wireways containing thermocouple lead wires shall not contain any other wiring.

J. Grounding and Bonding

1. Where residual voltage may exist following equipment disconnection from the power source, a warning sign shall be provided.
2. Electrical circuits, exposed non-current carrying metal parts of electrical equipment and metal structures shall be grounded in accordance with provisions of the NEC and IEEE standard 142. A separate grounding conductor shall be provided. Raceway systems shall not be used as a ground path.

3. All grounding cables and wires shall be insulated to prevent corrosion.

4. Green insulated wire shall be used only for the grounding conductor, and for no other purpose.

5. A ground wire sized in accordance with the provisions of the National Electric Code, shall be installed in the conduit to all motors.

6. 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.

7. Electrical equipment rated 600 volts or less which is solidly mounted on a metallic switchrack will be considered adequately grounded providing the switchrack is solidly grounded.

8. 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.

9. The cases of all instruments, relays and meters in a control panel shall be grounded effectively to the panel frame.

10. Isolated DC signal grounds and shield drainoffs shall be connected to a grounding bar which is isolated from the case.

K. Indicating Lights

1. Indicating lights, unless otherwise noted, shall be suitable for operation on either 125-V dc or 120-V ac and supplied with resistor or transformer to allow use of low-voltage bulb. Lamps and color caps shall be replaceable from the front.
2. Color caps shall be as follows unless otherwise specified:

   a. Motors, Circuit Breakers, and Electrical Devices:

      1) Green - General meaning is "Not Operating".
         "On" when: Motor is not running
                     Device deenergized
                     Valve is closed.

      2) Red - General meaning is "Operating"
         "On" when: Motor is running
                     Device is energized
                     Valve is open

      3) Amber - General meaning is "Warning"
         "Take Note", or to indicate abnormal equipment or system status.
         "On" to show: System or subsystem is in a mode which is other than a normal operating or steady state mode.

      4) White - Used for advisory information function for example
         DC voltage available
         Heater circuit power available
         Bus energized

   b. Valves

      1) Green - "Closed" (Off only when valve is fully open)
      2) Red - "Open" (Off only when valve is fully closed)
      3) Red and Green - Intermediate positions

L. Nameplates- Equipment and Device Identification

   1. Seller shall provide a firmly attached nameplate for each item of electrical equipment and each control station consisting of a three-ply laminated phenolic plate engraved to show the equipment device number, function and service. Nameplates for equipment shall be white-black-white with black lettering at 3/16" minimum size. Edges of all nameplates shall be beveled at 45 degrees. Nameplates for emergency equipment or for warning shall be red-white-red with white lettering at 3/16" minimum size.
2. Nameplates shall be attached with stainless steel screws.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL:

A. Refer to Division 1.0 for standard shop quality requirements.

B. Factory tests shall include, but not be limited to, complete functional test of all electrical components to insure that the packaged mechanical equipment performs its intended function.

C. Seller shall perform continuity test on all electrical circuits to verify all devices are installed and connected in accordance with drawings and/or specifications.

D. Meggering: Prior to terminating, test all cable or wire for insulation resistance with megger (500 VDC megger for 300 V insulation, 1000 VDC megger for 600 V insulation and 2500 VDC megger for cable insulation ratings above 600 volts). Any wire with less than 10 megohms to ground or other conductors shall be replaced before proceeding with the terminating.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION: NOT USED

3.03 FIELD QUALITY CONTROL: NOT USED

3.04 ADJUSTMENT AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
# SECTION 16170

CIRCUIT AND MOTOR DISCONNECTS & MOTOR CONTROL EQUIPMENT

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SECTION 16170

CIRCUIT AND MOTOR DISCONNECTS & MOTOR CONTROL EQUIPMENT

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section establishes the requirements for Circuit and Motor Disconnects and Motor Control Equipment, and their installation.

1.02 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.
B. Section 16475 - Overcurrent Protective Devices.

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995, of:

1. National Electrical Manufacturers Association (NEMA).
4. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
5. Underwriters Laboratories (UL).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. Furnish electrical connections to mechanical equipment motors, starters, transformers, and other pieces of equipment or appliances through a disconnecting device as required by these Specifications, the Drawings and NEC.
B. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1 may require additional submittals than listed herein.

B. Submit drawings and catalog cut sheets (for information and/or records).

C. Submit three copies of motor overloads installed.

1.06 DELIVERY, STORAGE & HANDLING: NOT USED

1.07 SITE CONDITIONS

A. Refer to Division 1.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General Electric.

B. Allen-Bradley.

C. Westinghouse/Cutler-Hammer.

D. Square D.

2.02 MATERIALS: NOT USED

2.03 EQUIPMENT

A. Safety Switches: Quick-make, quick-break type, horsepower rated, voltage as required, heavy-duty, non-fusible or fusible with Buss Fusetron fuses as shown or required.

B. Manual Motor Starting Switch, Without Overload Protection: Shall be multiple pole type selected for voltage, phase and motor horsepower to be connected. Switch shall have toggle or pushbutton operated mechanism providing quick-make and quick-break operation.
1. Switch shall be as manufactured by Square D Class 2510, General Electric Type CR101, Westinghouse Type B101, or Arrow Hart Bulletin AS-10.

C. HVAC Branch Circuit Protective and Disconnecting Equipment: Shall consist of a safety switch with fuses or box cover units with toggle switch or receptacle and fuse holders under hinged covers.

1. Box Cover Units: Shall have fuse and switch or receptacle components as specified on the Drawings and shall be as manufactured by Bussman, FPE Economy Fuse Division, or equivalent.

D. Motor Control Equipment:

1. Starters and Contactors: Shall be of proper NEMA size (minimum size 1) for voltage, load and environmental conditions and conform to NEMA ICS standards, and UL-508.

a. Combination Magnetic Starters and Switches: Shall be enclosed type, with circuit breaker, or motor circuit protector.

1) Switches shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.

2) Doors shall mechanically interlocked to prevent opening unless the switch is open.

b. Control Voltage: 120V, 60 Hz.

c. Control Circuit Transformer Fusing: 2 in primary, 1 in secondary.

2. Push Buttons, Selector Switches, Pilot Lights: Furnish in starter cover, control panel door or as specified.

a. Provide engraved nameplates to identify the function of each item.

3. Auxiliary Contacts: Provide one extra convertible auxiliary contacts for each magnetic motor starter in addition to the holding contacts and any required interlocking contacts.
4. Overload Heater Elements: Size based on the actual motor nameplate full load current rating and the equipment manufacturer's recommended heater based on starter and motor ambient temperatures and motor service factor.
   a. Quantity: One for each pole.
   b. Type: Thermal or induction type.

5. Switch and Fuse Units: Not acceptable for motor overload protection unless specifically shown on the drawings.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL
   A. Refer to Division 1 for standard shop quality control requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION AND APPLICATION
   A. Install safety switches, motor starting switches, motor control equipment and HVAC branch circuit and disconnecting equipment where indicated on the Drawings.
   B. Mount all safety switches no less than 54 inches above finished floor, unless specified otherwise.

3.03 FIELD QUALITY CONTROL
   A. Refer to Division 1 for standard field quality control requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION
   A. Division 1 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for the product(s) contained in this specification section, which may also be used by the Seller in preparing the system ATPs.

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B. Upon completion of installation of disconnects and motor control equipment, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

3.06 PROTECTION: NOT USED

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AERIAL POWER DISTRIBUTION

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section defines the design and construction for the extension of an overhead 13.8KV power line to the W113 facilities.

1.02 RELATED SECTIONS

A. Section 16050  Basic Electrical Materials and Methods
B. Section 16123  15kV Conductors
C. Section 16450  Grounding

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995, of:

3. Edison Electric Institute (EEI).
6. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
7. Underwriters Laboratories (UL).

C. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

D. Contract Drawings.
1.04 SYSTEM DESCRIPTION

A. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal procedure, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The following information shall be submitted for:

15KV Combination Loadbreak Cutouts/Surge Arresters

1. Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Specifications
   c. Dimensions/Outline

2. Review for Records (for Information and/or Records).
   a. Installation/Instructions
   b. Operation/Maintenance Manual
   c. Spare Parts, 1 year.
   d. Fuse Curves

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

B. The Seller shall coordinate with the Buyer for tie-in to the existing 13.8kV line.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED
2.02 MATERIALS

A. Conductors

1. Open Wire Conductors.

a. Open wire on crossarms shall be used.

b. The phase sequence (A-B-C) of open wire conductors and cables shall be from top to bottom and left to right when facing the source of power.

c. Wire extension shall be #1/0 ACSR construction.

d. All conductor clearances shall be per ANSI-C2 Section 234.

e. Open-wire line conductor splices shall not be permitted on this installation.

f. Line conductors shall be secured to pin insulators with soft annealed hand-wrapped wire ties.

   1) Each tie should securely bind the conductor to the insulator to resist chafing.

   2) The tie shall snugly engage the conductor on each side of the insulator.

   3) Composition of ties must be similar to the composition of the conductors.

   4) Preformed aluminum armor rods with center marking shall be used for conductor protection at tie points.

B. Supports: Wood poles and wood crossarms are standard and shall be used.

1. Wood Poles:

a. Poles shall be Western Red Cedar cut from live stock and shall conform to ANSI Standard 5.1, Specifications and Dimensions for Wood Poles.

   1) All poles shall be air seasoned and butt treated in accordance with the American Wood Preservers’ Association (AWPA) Standard C7.

   2) Each pole shall be branded or marked as described in ANSI 05.1 as follows:
The brand or mark shall be placed squarely on the face of the pole and at 10 feet from the butt of poles 50 feet or less in length. The face brand shall designate the supplier’s code or trademark; plant location and year of treatment; species and preservative code; and class and length of pole.

3) The pole roof and gain shall be brush coated with pentachlorophenol-petroleum solution conforming to AWPA Standards P8 and P9.

4) The top of each pole shall have a one-way roof cut sloping 30 degrees (120 degrees with pole axis) and the cut surface shall face at right angles to the pole face.

b. The size of poles shall be as shown on the Contract Drawings, but the following is required:

1) Poles smaller than Class 4 shall not be used.

2) Transformer poles, poles at line angles exceeding 30 degrees and dead-end structure poles shall not be smaller than Class 2.

c. The minimum setting depth for poles shall be according to the following:

<table>
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<tr>
<td>30</td>
<td>5'-6&quot;</td>
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d. Holes for wood poles shall have reasonably straight sides.

1) Holes shall not be grossly oversize, but shall be sufficiently large to permit use of a tamping bar all around the pole.
e. Backfill around poles in sand and gravel areas shall preferably be compacted by flooding the backfill material as it is placed with copious quantities of water.

1) Where the use of water is impracticable, the backfill shall be placed in six-inch lifts and thoroughly compacted by hand tamping.

2) Surplus excavated material shall be placed around the pole in a cone approximately one foot in height.

2. Crossarms.

a. Size shall be as shown on the Contract Drawings.

1) Shall be machined, chamfered, trimmed, and bored for stud and bolt holes before pressure treatment.

2) Factory drilling shall be provided for pole and brace mounting, for pins, and for suspension insulators, except where otherwise indicated or required.

3) Drilling shall provide required climbing space and wire clearances.

4) Crossarms shall be straight and free of twists to within 1/10-inch per foot of length.

5) Bend or twist shall be in one direction only.

b. Crossarms shall face each other on alternate spans on level construction.

c. Line deviations for 20 degrees or less may be on a double arm mounted to bisect the angle.

d. Crossarm braces shall be as shown on the Drawings.

3. Insulators: For supporting power conductors shall be wet process grey porcelain and shall conform to EEI-NEMA standards for the class.

C. Guy and Anchors:

1. Shall be designed and installed according to Hanford Plant Standards in Appendix A.

2. In order to avoid confusion, guy strand shall be limited to two grades; Siemens-Martin grade for distribution lines, and High Strength grade for communications messenger and 230 kV structures.
D. Combination Loadbreak Cutout/Surge Arresters:

1. Loadbreak cutouts provide means of switching the 13.8 KV underground feeder cables at the transition pole. They shall be sized as shown on the Contract Drawings.

2. Surge arresters shall be distribution class and sized as shown on the Contract Drawings.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Seller shall install the 13.8kV line, riser structure, and underground ducts as shown on the Drawings.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
APPENDIX A

HANFORD STANDARD DRAWING

H-5-881 SHEETS 6-11, 21, 32.
1. PIN TYPE DISTRIBUTION INSULATOR

ANSI C29.5, Class 55-5
For 13.8 KV Distribution
1 Inch Pin Hole Threads
Color shall be other than white

2. FORGED STEEL HIGH TENSION INSULATOR PIN

Standard 1 Inch Lead Threads
Tapered Body
3/4" x 6" Long Shank
With Square Washer, Nut and Locknut for Flat Wood Crossarms
A. B. Chance Co.
No. 990

EACH ITEM SHALL BE AS SPECIFIED OR COG. ENGINEER APPROVED EQUAL.

QUALITY ASSURANCE LEVEL III

H-5-881 SHI DRAWING LIST

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<tr>
<td>H-5-881</td>
<td>ELECTRICAL STANDARD PIN AND INSULATOR ASSEMBLY 13.8 KV</td>
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</table>

REFERENCE DRAWINGS:

U. S. Department of Energy
Richland Operations Office
Rockwell Hanford Operations
Richland, Washington 99352

ELECTRICAL STANDARD PIN AND INSULATOR ASSEMBLY 13.8 KV
1. **CLEVIS TYPE SUSPENSION INSULATOR** - 2 REQUIRED
   AMSI C29.2, Class 52-4
   For 13.8 KV Distribution

2. **STRAIN CLAMP** - FORGED STEEL
   GALVANIZED
   Interface/Lap No. 75118

3. **STANDARD EYE NUT** - 3/4 INCH

AMS

EACH ITEM SHALL BE AS SPECIFIED OR COG ENGINEER APPROVED EQUAL

**QUALITY ASSURANCE LEVEL III**
3.12 The dimensions and drilling shall be as shown. Dimensional tolerances shall be in accordance with Appendix I of the Specification.

3.13, 3.14(a) & 3.15(b) Crossarms shall be incised Douglas Fir and shall have a pentachlorophenol preservative treatment to an 8 pounds per cubic foot retention.

3.16 The identifying letters 'DF' are required.

3.17 The top center 8 inch dimension shown is for 'roofed' arms. Where arms in accordance with Spec TD-90 are furnished, the top center 12 inches shall not be chamfered or rounded.
5 FT - 7 IN,
2 PIN ARM FOR 13.8 kV CONSTRUCTION

NOTES
Crossarms shall be in accordance with the Edison Electric Institute (EEI) Specification TD-90, 1960, Douglas Fir Crossarms, except that 'roofed' arms as shown in the Detail on this Standard may be furnished.

The following items apply to the options covered in Section 5 of Specification TD-90:
3.11 Grade of wood may be Dense or Close Grain as defined in the Specification, or a mixture of both grades.

(Continued at lower left)

QUALITY ASSURANCE LEVEL III

U.S. Department of Energy
Richland Operations Office
Rockwell Hanford Operations
Richland, Washington 99352

ELECTRICAL STANDARD WOOD CROSSARM

500 GEN

8003

N.E. McNeil
7/31/84

W.P. INGLE
7/25/84

L. Clark
7/24/84

W.P. INGLE
7/25/84

REF CHECK

REV NO

REV ED

DATE

APPROVED BY

DATE

PCN

MICRO

M

DRAWING LIST

Dwg No

H-5-881

Sheet No

8

Sheets

100
Pin Hole Locations
In Standard Arms

ASSEMBLY 1 - SINGLE ARM

ASSEMBLY 2 - DOUBLE ARM

ASSEMBLY 3

Bore Arms 13/16" dia for
Double Arming Bolts

See Note 1

ASSEMBLY 4 - DOUBLE

5 FT - 7 IN. 2-PIN ARM ASSEMBLIES

10 FT - 0 IN. 4-PIN AR

Where Arm is at
Top Position on Pole

See Note 2

ASSEMBLY 5 - DOUBLE OR TRIPLE ARMS

8 FT - 0 IN. 2-PIN ARMS FOR DEAD END LOADING
ASSEMBLIES

SINGLE ARM

2'-6" 8'

3'-0"

ASSEMBLIES

3'-0"

1. Unless otherwise shown on other Standards or the construction drawings, single crossarm assemblies may be used for conductors No. 4/0 AWG and smaller on pin insulators. Double arms shall be used for conductors larger than 4/0 AWG.

2. Use double arms (Assembly 5) for dead ending conductors No. 1 AWG and smaller at arcing bolt and center positions. Use triple arms for conductors No. 1/0 AWG and larger.

3. Item 4 and 5. Crossarm Brace shall be Douglas fir treated with Pentachlorophenol and shall have galvanized steel end fittings of a type that use a vertical mounting bolt through the crossarm.

QUALITY ASSURANCE LEVEL III

MATERIAL LIST

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<th>QUANTITY</th>
<th>DESCRIPTION</th>
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<tr>
<td>1</td>
<td>12</td>
<td>Crossarm - 5'-7&quot; H-5-881 SH 6</td>
</tr>
<tr>
<td>2</td>
<td>- 12</td>
<td>Crossarm - 10'-0&quot; H-5-881 SH 8</td>
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<tr>
<td>3</td>
<td>- 2</td>
<td>Crossarm - 8'-0&quot; H-5-881 SH 8</td>
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<td></td>
<td></td>
<td>Machine Bolt - 3/4&quot; x Length Required</td>
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<tr>
<td>4</td>
<td>1 1 1</td>
<td>Crossarm Brace - 48&quot; x 48&quot; - See Note 3</td>
</tr>
<tr>
<td>5</td>
<td>1 2 1</td>
<td>Crossarm Brace - 72&quot; x 72&quot; - See Note 3</td>
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<tr>
<td>6</td>
<td>1 1 1</td>
<td>Machine Bolt - 5/8&quot; x Length Required</td>
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<tr>
<td>7</td>
<td>10 2 10</td>
<td>Washer - 3&quot; Square x 1/4&quot; x 13/16&quot; Hole</td>
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<tr>
<td>8</td>
<td>1 1 1</td>
<td>Machine Bolt - 5/8&quot; x Length Required</td>
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<td>9</td>
<td>1 1 1</td>
<td>Washer - 2-1/4&quot; Square x 3/16&quot; x 11/16&quot; Hole</td>
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<td>10</td>
<td>4 2 4 4</td>
<td>Machine Bolt - 1/2&quot; x 6&quot;</td>
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<td>11</td>
<td>2 4 2 4</td>
<td>Washer - 1 3/8&quot; Round x 12 Gauge x 9/16&quot; Hole</td>
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<td>12</td>
<td>2 4 2 4</td>
<td>Double Arming Bolt - 3/4&quot; x Length Required</td>
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</table>

NOTES

U.S. Department of Energy
Richland Operations Office
Rockwell Hanford Operations
Richland, Washington 99352

ELECTRICAL STANDARD WOOD CROSSARM ASSEMBLY 13.8 KV

DRAWING LIST

D/O NO 2184

REFERENCE DRAWINGS

C/O NO 2184

DRAWING TITLE OR INDEX NO

DRAWN 7/24/84

CHECKED 7/25/84

APPROVED 7/30/84

QUALITY ASSURANCE LEVEL III

NONE NOT REQ'D NONE

SHEET NO 1

SHOTS 100
1. Concrete shall develop a minimum compressive strength of 3000 psi at 28 days.

2. Coarse aggregate shall be 3/4 inch maximum.

3. The concrete shall be well-compactible.

QUALITY ASSURANCE LEVEL III
Notes:

1. The Loading Table shows the maximum horizontal line loads for which this standard may be used. Safety factors are for Grade B construction. Allowance has been made in the Material List for the increased tensile in the strand and hardware for 45 degree down guys.

2. High strength grade of guy strand shall be used for telephone and 230 KV line-guying, and Simes-Martik grade shall be used for all other electrical distribution guys unless otherwise specified or the use of a substitute grade is specifically approved.

3. Where horizontal guys are installed with down guys, the horizontal guy may be the same size strand as that required for the down guy.

4. The use of 3-bolt clamp, strandwise, or guy wire hardware is optional at any position in the guy assembly.

5. This standard assembly is designed for telephone and electrical distribution pole guying and should not be applied indiscriminately to other structures.

Medium Duty Guys - Ultimate Horizontal Load of 9500 Lbs Maximum
### ELECTRICAL STAXMRD KDIUH  
DUTY  
HORIZONTAL AND DOH GUY ASSEMBLY

#### 45 Degree Down Guys

<table>
<thead>
<tr>
<th>ITEM NO</th>
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<th>Alternate Grades of Guy Strand</th>
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<td>Length as Required</td>
<td>GUY STRAND</td>
<td>Grade, Size, and Number of Strands</td>
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#### Horizontal Guys

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<tr>
<td>2</td>
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<td>Guy Clamp - Medium Type, 3-1/2&quot; bolts, 6&quot; Lame</td>
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<td>3</td>
<td>4</td>
<td>Saring Clamp - To Suit Guy Strand Used</td>
<td></td>
</tr>
<tr>
<td>4•</td>
<td>4</td>
<td>Guy Grip - Performed Line Products Co. - Catalog No. 2115</td>
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<tr>
<td>5•</td>
<td>2</td>
<td>Strainwise - Short Unit - S204 S233 S102</td>
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<tr>
<td>6•</td>
<td>2</td>
<td>Electric Co. Long Unit - S224 S233 S152</td>
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<td>1</td>
<td>Strain Regulator - AN51 C29.4 Class 54-1</td>
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</table>

#### Alternate A

- Alternate A

#### Alternate B

- Alternate B

#### Quality Assurance Level II


### Electrical Standard Medium Duty

**Horizontal and Down Guy Assembly**

- **Drawing List:** H-5-881
- **Drawing Title or Index No:** 8003
- **Designator:** 500 GEN
- **Scale:** None
- **Classification:** Not Req'd
- **Approval Date:** None
- **Drawing:** LCLARK 7/24/84
- **Printed by:** W.P. INGLE 7/25/84
- **Prepared by:** J.E. Watt 7/3/84
- **Checked by:** W.P. INGLE 7/25/84
- **Designed by:** LCLARK 7/24/84
- **Contributor:** W.P. INGLE 7/25/84
- **Drawing Status:** 7-5-84
- **Drawing Title:** ELECTRICAL STANDARD MEDIUM DUTY
- **Horizontal and Down Guy Assembly**

---

*The items shall conform to Bureau of National Standard Institute.*

*Not manufactured for the size of guy strand shown.*

*Not used for the construction indicated.*
See other H-5-881 or the construction drawings for length of riser and cable termination.

- Pole gusset at each spacer.
- Short nipple.
- Concrete encasement - See H-5-881 SH37 or 38 for continuation.
- Grade 12" minimum.

See Note 4.
UTILITIES AND TELECOMMUNICATIONS

IMPACT LEVEL III

H-F-881SH-2 DRAWWING LIST

REFERENCE DRAWINGS

U. S. Department of Energy
Richland Operations Office
Rockwell Hanford Operations
Richland, Washington 99352

ELECT STD
VENTILATED POLE RISER - STEEL CONDUIT

LIST

CLASSIFIED BY

CLASSIFICATION

NOT REQD

NONE

NONE

500 GEN

8003

H-5-881

100

DRAWN

L.McKimNIS

11/87

APPRO

J.M.Hale

1/88

100

U.S. GOVERNMENT PRINTING OFFICE: 1981-7-747-448
There shall be no metallic connection, either above ground or underground, between this copper grounding system and any buried iron, steel or stainless steel, nor bare, galvanized or otherwise coated.

This drawing shall be used for grounding personnel operated equipment (switching handle, meter cabinets, etc.) mounted on poles. Such apparatus shall be connected to the equipment grounding conductor. A separate conductor shall be used for lightning protection grounding. Ground rods shall be used as shown. At least two rods shall be installed at each location.

If 25 ohms or less drop in resistance cannot be obtained when the first length of grounding rod is driven, a second rod shall be added to reach damp earth.

Erico Products, Inc., 'Cashew', or approved equal, connections may be used in place of the ground rod clamps. Item 2. Galvanized surface damaged during Cashew shall be treated with Inc-Rich compound as manufactured by Gallivan, Corp.

See H-5-881 for other instruction drawings for ground connections on poles.

See H-5-5B-34-9 for distribution grounds to round rods without equipotential ring, and H-866(543) for grounding to underground piping and round grids.

### UTILITIES AND TELECOMMUNICATIONS

**IMPACT LEVEL III**

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**U.S. Department of Energy**

Rockwell Hanford Operations
Richland, Washington 99352

**ELECT STD**

**DISTR GND ASSY FOR PERSONNEL OPERATED EQUIPT.**

**DRAWING LIST**

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<td>DRAFT</td>
<td>D. MARABLE</td>
<td>11/85</td>
<td>T. M. Hale</td>
<td>11/85</td>
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**LIST**

NONE

**CLASSIFIED BY**

NONE

**CLASSIFICATION**

NOT REQ'D
## SECTION 16315

### LOW VOLTAGE POWER SKID

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SECTION 16315
LOW VOLTAGE POWER SKID

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section defines the electrical and mechanical characteristics and requirements for a Low Voltage Power Skid containing dry-type transformer, distribution panelboard, and receptacles as shown on the W113 Master Single Line Diagram, drawing number H-2-823366 and called out as the "Trench Enclosure Power Skid".

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods
B. Section 16120 Wire and Cables
C. Section 16141 Switches, Receptacles and Accessories
D. Section 16450 Grounding
E. Section 16462 Transformers - Dry Type
F. Section 16470 Panelboards
G. Section 16475 Overcurrent Protective Devices

1.03 REFERENCES

A. The low voltage power skid shall be designed, manufactured and tested in accordance with, but not limited to, the applicable requirements in effect, September 1995, of:

4. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
5. Underwriter’s Laboratories (UL).
6. Institute of Electrical and Electronic Engineers (IEEE).
B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings

1.04 SYSTEM DESCRIPTION:

A. Low Voltage Power Skid shall be a steel platform holding panelboards, transformer receptacles. All equipment on the skid shall be NEMA 12.

B. Low Voltage Power Skid shall be constructed according to the "RELATED SECTIONS" of these specifications as listed in paragraph 1.02 above and as additionally specified in this section, and on the contract drawings.

C. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS:

A. Refer to Division 1 for submittal procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1 may require additional submittals than listed herein.

B. The following information shall be submitted for:

Low Voltage Power Skid

1. Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Specifications/Electrical Characteristics
   c. Dimensions/Outline/Layout
   d. Schematic/Wiring Diagrams
   e. Factory test results for Section 2.06.

2. Review for Records (for Information and/or Records).
   a. Installation Instructions
   b. Operation/Maintenance Manuals
c. Spare Parts, 1 year

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1 for standard delivery, storage and handling requirements.

B. Deliver to Project site the assembled, wired and tested Low Voltage Power Skid.

1.07 SITE CONDITIONS

A. Refer to Division 1.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Gilbert Electrical Systems
   P.O. Box 1141
   Beckley, WV, 25802

2. Shallbetter
   640 Arizona Ave. NW
   Huron, SD, 57350

3. PACS Industries Inc.
   61 Steamboat Rd., P.O. Box 379
   Greatneck, NY, 11022

2.02 MATERIALS

A. Skid bottom shall be constructed of 12 gage (minimum) sheet steel with support framing and stiffeners as required to support and transport the installed equipment.

B. Skid shall be rectangular in shape. The base design shall incorporate provisions for screw jacking and towing on steerable wheels. Wheels shall be heavy-duty pneumatic tire wheels, Dayton stock number 2G326 (or equal). Lugs for lifting the complete skid shall be provided.
2.03 EQUIPMENT

A. General

1. All equipment and components shall be as specified in the "RELATED SECTIONS" of these specifications, as listed in paragraph 1.02 above, with the following additional requirements.

2. Grounding and Bonding

a. Where residual voltage may exist following equipment disconnection from the power source, a warning sign shall be provided.

b. Electrical circuits, exposed non-current carrying metal parts of electrical equipment and metal structures shall be grounded in accordance with provisions of the NEC and IEEE standard 142.

c. All grounding cables and wires shall be insulated to prevent corrosion.

d. Green insulated wire shall be used only for the grounding conductor, and for no other purpose.

e. The skid shall include a ground reel as shown on the drawings.

f. A copper ground bus with the necessary mechanical lugs shall be provided in all control and panel enclosures. This bus shall be grounded to the skid steel.

g. The cases of all transformers, panels, instruments, relays and meters shall be grounded effectively to the skid frame.

3. All receptacles shall include covers and be equipped with a NEMA 12 gasketed spring door.

4. Panelboards shall include lockable doors.

5. Portable cords and cables exterior to the Low Voltage Power Skid: By others.
6. Nameplates - Equipment and Device Identification

a. Seller shall provide a firmly attached nameplate for each item of electrical equipment. Nameplate shall consist of a three-ply laminated phenolic engraved to show the equipment device number, function and service. Nameplates for equipment shall be white-black-white. Black lettering shall be 3/16" minimum size. Edges of all nameplates shall be beveled. Nameplates for emergency equipment or for warning shall be red-white-red. White lettering shall be 3/16" minimum size.

b. Nameplates shall be attached with stainless steel screws.

7. Enclosures - NEMA 12.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

B. Factory tests shall include, but not be limited to, complete functional test of all electrical components to insure that the Low Voltage Power Skid and components perform their intended function.

C. Seller shall perform continuity test on all electrical circuits to verify all devices are installed and connected in accordance with drawings and/or specification.

D. Meggering: Prior to terminating, test all cable or wire for insulation resistance with megger (500 VDC megger for 300 V insulation, 1000 VDC megger for 600 V insulation and 2500 VDC megger for cable insulation ratings above 600 volts). Any wire with less than 10 megohms to ground or other conductors shall be replaced before proceeding with the terminating.
PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. The skid shall be rolled into position jacked for stability, and grounded prior to energization each time it is moved.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality control requirements.

3.04 ADJUSTMENT AND CLEANING

A. As specified in the "RELATED SECTIONS" of these specifications, as listed in paragraph 1.02 above.

3.05 DEMONSTRATION

A. Division 1.0 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for the product(s) contained in this specification section, which may also be used by the Seller in preparing the system ATPs.

B. Seller shall demonstrate operation of all equipment and components contained in the Low Voltage Power Skid, as specified in the "RELATED SECTIONS" of these specifications, as listed in paragraph 1.02 above.

3.06 PROTECTION: NOT USED

END OF SECTION
## Part 1: General

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## Part 2: Products

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SECTION 16450

GROUNDING

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the requirements for grounding systems, and their installation.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods.
B. Section 16120 Wire and Cable
C. Section 16670 Lightning Protection System

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995, of:

1. Institute of Electrical and Electronics Engineers (IEEE).


3. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.

4. Underwriters Laboratories (UL).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. Exposed non-current carrying metallic parts of electrical equipment, metal raceways, building structural steel, and neutral of low voltage, and power systems shall be grounded.
B. Ground system shall be categorized as Facility, Lightning and Technical ground systems.

C. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS: Provide Certificate of Compliance per Section 3.05 for information and record.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

1.07 SITE CONDITIONS

A. Reference Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Weaver
2. Burndy
3. Blackburn

2.02 MATERIALS

A. Conductors: Shall be bare copper, or THWN/THHN insulated (green) copper of size indicated on the Drawings or as required by NEC.

B. Ground Rod: Shall be galvanized steel, 5/8 inch diameter, 8 feet long and shall conform to UL 467 for exothermic connections per the Drawings.

C. Ground Connectors: Shall be bolted pressure type, UL 467 for use with copper conductors.

2.03 EQUIPMENT: NOT USED
2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL: NOT USED

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. General: All grounding shall be in accordance with NEC Article 250 and UL 467, as shown on the Drawings.

B. Raceways Of Intermediate and Rigid Metal Conduit: Bond to enclosures.

   1. Feeders and Branch Circuits: Include a separate equipment grounding conductor installed with the circuit for grounded and ungrounded conductors in the raceways.

C. Raceways Of EMT: Include a separate grounding conductor installed with the circuit for grounded and ungrounded conductors in the raceways.

   1. Flexible Metal Conduit: Will be permitted as a grounding means provided all requirements of the National Electrical Code are met. Include a separate equipment grounding conductor installed with the circuit for grounded and ungrounded conductors in the raceways.

D. Raceways of PVC Conduit: Include a separate equipment grounding conductor installed with the circuit for grounded and ungrounded conductors.

E. Equipment Grounding Conductors: Size per Table 250-95 of the NEC, unless otherwise indicated on the Drawings.

F. Ground Connections: Shall have clean contact surfaces.

   1. Connections For Equipment Grounds, System Grounds and Grounding Electrodes: Make with solderless connectors which are accessible and removable to facilitate inspection and testing.

   2. Inaccessible Underground Joints Or Branch Connections Of Copper Grounding Electrode Conductors: Make by brazing, exothermic welding or equivalent process.

   3. Connections shall be 2 feet below finished grade.
G. Underground Grounding Conductors: Lay slack to prevent breakage.

H. Grounding Conductors Extended Above Grade and Exposed To Possible Damage: Adequately protect and route in PVC conduit.

I. Grounding Electrodes: Drive to 2 foot depth (at top) and connect to the main grounding cables where indicated on Drawings.
   1. Sufficient Grounding Electrodes: If necessary, drive additional rods to obtain a resistance to earth of 25 ohms or less with spacing between rods greater than 6 feet.
   2. Testing shall occur not less than 48 hours after installation.

J. Technical Ground: Shall be established as shown on the Drawings.
   1. Connections to the facility system shall occur only as shown on the Drawings.
   2. Ground resistance shall be five ohms or less after interconnecting technical ground to facility at the single earth ground point as shown on the Drawings.

K. For lightning protection system, resistance and bonds of lightning rods, bonds and grounds shall be 5 ohms or less.

L. Bonding resistance of doors, pipes, HVAC ducts, mechanical and electrical equipment shall be 10 milliohms or less.

3.03 FIELD QUALITY CONTROL
   A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTMENT AND CLEANING: NOT USED

3.05 DEMONSTRATION
   A. Certify compliance with items in Sections 3.02.I, K, and L.

3.06 PROTECTION: Certify compliance with items in Sections 3.02.I, K and L.

END OF SECTION
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SECTION 16461
PAD MOUNT DISTRIBUTION TRANSFORMER

PART 1 GENERAL

1.01 SECTION SCOPE
A. General: This Specification Section defines the design, fabrication and testing of a pad mount distribution transformer complete from the incoming line terminals to the outgoing feeder terminals.

1.02 RELATED SECTIONS
A. Section 16050 Basic Electrical Materials and Methods
B. Section 16123 15KV Conductors
C. Section 03300 Cast-In-Place Concrete

1.03 REFERENCES
A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

4. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
5. Underwriters Laboratories (UL).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.
1.04 SYSTEM DESCRIPTION

A. The pad mount distribution transformer will step down the 13.8KV primary service to a utilization voltage of 480 volts, 3 phase wye, 4 wire plus ground.


1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The following information shall be submitted for:

Pad Mount Distribution Transformer, T-01

1. Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Specifications
   c. Dimensions/Outline
   d. Weight
   e. Schematic/Wiring Diagrams
   f. Foundation Requirements
   g. Conduit Entrance Locations/Busway Interface Requirements
   h. Nameplate Legend

2. Review for Records (for Information and/or Records).
   a. Installation Instructions
   b. Shop and Field Performance Test Data per Paragraph 2.03 and 3.03.
   c. Operation/Maintenance Manual
d. Spare Parts, 1 year.

C. Submit "Material Safety Data Sheet" for each product used.

1.06 DELIVERY, STORAGE, & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

B. Preparation for Shipment:

1. Painting shall be Manufacturer's standard finish and color, ANSI 70 Grey in accordance with ANSI Z55.1.

2. Preservation and Packaging:

   a. All equipment and any removed components shall be suitably protected against damage or loss during shipment, as well as to facilitate field handling.

   b. Preparation for shipment shall be made after all testing and inspection of the equipment has been accomplished and the equipment has been approved by the Buyer.

   c. All threaded openings shall be provided with steel caps or solid-shank steel plugs of metallurgy equal to or better than the metallurgy of the component being capped or plugged.

      1) In no case shall nonmetallic plugs be used.

   d. Equipment shall be identified with purchase order, item and serial numbers.

      1) All material shipped separately shall be identified with securely affixed, corrosion-resistant metal tags and fasteners indicating the purchase order, item and serial numbers.

      2) In addition, crated equipment shall have two duplicate packing lists, one inside and one on the outside of the shipping container.

      3) All material per equipment items shall ship concurrently.
e. Equipment shall be shipped in the smallest number of shop fabricated pieces to minimize field assembly.

1) Each equipment item shall be temporarily braced as necessary to prevent damage during shipment.

C. Shipping:

1. Each piece shall be sealed to prevent entrance of water and dust during shipment.

a. Each box, crate and shipping container shall be marked for identification and to indicate contents to permit orderly field assembly.

2. Openings and terminal connections shall be protected by covers or wood guards.

a. Wherever applicable, parts shall be factory boxed, crated or otherwise suitably prepared to prevent shipping and weather damage.

3. All loose components and accessories shall be suitably packaged, labeled, and attached with other shipping units.

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. ASEA Brown Boveri, Plazapad
2. Cooper Industries, Terra-Tran
3. General Electric Co., Compad
4. Square D, Class 7230

2.02 MATERIALS: NOT USED
2.03 EQUIPMENT

A. Pad mount distribution transformer and its accessories shall be in accordance with this specification section and with the requirements specified herein.

B. Equipment shall consist of standard design and first line quality which meet or exceed the requirements of this specification section and shall be UL listed and labeled.

C. Ratings and design parameters of pad mount distribution transformer shall be based on self-cooled conditions.

D. General Design Requirements

1. Pad mount distribution transformer secondary connections shall be cable. The Seller shall coordinate the physical interface between the pad mount distribution transformer and cable raceway to insure a matching assembly in the field.

2. Dimensions of the equipment shall not exceed the maximums shown on the Drawings.

3. Pad mount distribution transformer shall be, outdoor, pad mounted type, compartmental style, self-cooled, liquid filled consisting of:
   a. Primary incoming line compartment, loop feed.
   b. Transformer section.
   c. Secondary low-voltage compartment conduit interface.

4. Pad mount distribution transformer shall have weather protected and tamper resistant construction.

E. Transformer Design Requirements

1. Rating of transformer shall be as follows:
   a. KVA Rating: Per Drawings.
   b. Impedance: 5.75%.
   c. High Voltage: 13,800V Delta.
   d. H.V. BIL: 95 KV.
e. H.V. Taps: Plus and minus two, 2 1/2 percent full capacity.

f. Low Voltage: 480V Wye.

2. Unit shall be mineral oil filled or approved equal.
   a. Insulating liquid shall be shipped in the tank of the transformer.

3. Pad mount distribution transformer shall carry its continuous rating with average winding temperature rise by resistance not to exceed 55/65°C above 40°C ambient.

4. Pad mount distribution transformer shall be designed to carry short time emergency overloads in accordance with ANSI C57.92 and NEMA TR 98 as applicable.
   a. Duration and magnitude of designed withstand capability shall be as outlined in ANSI C57.12.00.

5. Pad mount distribution transformer features and accessories shall include:
   a. No load tap changing, oil immersed switch with externally operated handle, with provisions for padlocking.
   b. Three phase, gang operated, oil immersed, load break, 2-position, (on-off) primary switch between the loop feed and the transformer fuses.
   d. One inch filling plug and filter press connection in cover; one inch drain valve in secondary compartment.
   e. Top liquid thermometer (dial type) with SPDT alarm contacts, located in secondary compartment.
   f. Liquid level gauge with SPDT alarm contacts.
   g. Lifting eyes and jacking pads.
   h. Base for skidding or rolling in two directions.
   i. Automatic pressure relief device that automatically reseals after operation.
   j. Ground pads.
k. Diagrammatic nameplate.

l. Welded-on main tank cover with handhole in cover.

m. NEMA type terminals suitable for copper cable of size shown on Drawings.

n. Sudden pressure relay with DPDT alarm contacts.

o. Universal bushing wells for use with ANSI/IEEE 386 bushing inserts shall be provided for the transformer high voltage connections.

p. The transformer alarms shall be wired to a terminal strip in the low voltage compartment of each transformer.

q. External replaceable bayonet fuse holder with flapper valve.

r. Internal, back-up, current limiting fuse.

s. Elbow style lighting arrestors (18kV, 15.3 MCOV).

6. All high voltage windings shall be wound from copper strap.

a. This strap material shall have insulation applied prior to winding the coils.

b. Insulation between layers of the winding shall be provided by epoxy-coated paper or approved equal.

7. Low voltage windings shall be copper.

8. Main transformer tank and attached components shall be designed to withstand pressures 25 percent greater than the design value without permanent deformation.

a. Construction shall be from carbon steel plate reinforced with external sidewall braces.

b. All seams and joints shall be continuously welded.

9. Each radiator assembly shall be individually welded and receive a quality control pressurized check for leaks.

a. The entire tank assembly shall receive a similar leak test before tanking.
b. A final six hour leak test shall be performed after the transformer is tanked, welded and completed to ensure that there are no leaks before shipment.

10. Tests: The following tests shall be made on the transformer, although not necessarily in the order shown.

a. All tests shall be made in accordance with the latest revision of ANSI Test Code C57.12.90 and/or NEMA TR1:

1) Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of the unit.

2) Ratio tests on the rated voltage connection and on all tap connections.

3) Polarity and phase-relation tests on the rated voltage connections.

4) No-load loss at rated voltage on the rated voltage connection.

5) Exciting current at rated voltage on the rated voltage connection.

6) Impedance and load loss at rated current on the rated voltage connection and on the tap extremes.

7) Temperature Test: Temperature tests shall be made.

a) Tests shall not be required when there is available a record of a temperature test on an essentially duplicate unit.

b) Subject to the limitations of preceding subparagraph a): When a transformer is supplied with auxiliary cooling equipment to provide more than one KVA rating, temperature tests shall be made on the lowest KVA OA rating and the highest KVA FA rating.

8) Applied potential tests.

9) Induced potential tests.

10) Results of the above tests including no load and total loss data shall be submitted with final drawings in the form of certified test reports.
b. The following additional information shall be provided:

1) X/R ratio.
2) Time verses current overload damage curve.
3) Inrush data.
4) Impedance.

11. Transformer primary incoming line compartment and secondary low voltage compartment shall be located in high security cabinets having no exposed screws, bolts or other fastening devices which are externally removable. The cabinet shall be constructed of 12 GA steel and shall be attached to the transformer sealed tank. Cabinet design shall meet all requirements and test specified in NEMA official standards proposal "design test method for cabinet security TR-PG-1977".

a. The cabinet shall have adequate depth to accommodate the connection of low voltage feeder conduits.

b. The primary incoming line compartment and secondary low voltage compartment shall be located side-by-side, separated by steel barrier. When facing the cabinet, the secondary low voltage compartment shall be on the right. Said above compartments shall be full height, air filled with individual doors. The high voltage compartment door fastenings shall not be accessible until the low voltage compartment door has been opened. The low voltage compartment door shall have a 3-point catching mechanism with a cabinet handle having provisions for a single padlock. The doors shall be equipped with lift-off type stainless steel hinges and door stops to hold the doors open when working in the compartments. ANSI tank grounding provision shall be furnished in each compartment.
c. High voltage termination shall be dead front and conform to ANSI C57.12.26 requirements. Provide 9 universal type bushing wells for loadbreak inserts, and parking stands for mounting accessory equipment. The wells shall be externally clamped. One group of 3 bushings shall be used for termination of incoming high voltage line. Another group of 3 bushings, connected in parallel with the first group, shall be used for plugging in of dead front surge arresters, and the third group for loop feed.

1) Gang operated, oil immersed, load break, 2-position (on-off) primary switch for incoming feed shall be installed. The switch handle with eye for operation with distribution hot stick shall be located in the high voltage compartment.

2) Oil immersed, externally replaceable, bayonet type fuses (3 each) shall be provided.

d. The low voltage termination shall be low voltage bushings constructed of molded epoxy and provided with blade type spade terminals with NEMA standard hole spacing arranged for vertical take-off. The low voltage neutral shall be an insulated bushing with spade grounded to the transformer tank by removable grounding strap. Conduit opening shall be provided for low voltage cable entry at the bottom of secondary compartment. Dimensions and details of the conduit opening shall be coordinated with specifics of low voltage cable used.

1) Phase arrangement shall be A-B-C, left to right. Terminals and bus connections shall be silver plated. All buses shall be labeled.

12. Special Tools and Devices: One complete set of all special tools or devices required for operation and/or maintenance of the unit furnished shall be provided and delivered with the equipment in a separate container clearly marked with the name of the equipment.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.
PART 3 EXECUTION

3.01 PREPARATION

A. Seller shall provide a concrete pad per Manufacturers recommendations under the requirements in Specification Section 03300.

B. Verify that surfaces are ready to receive Work.

C. Verify field measurements are as shown on Drawings.

D. Verify that required utilities are available, in proper location, and ready for use.

3.02 ERECTION, INSTALLATION & APPLICATION

A. Install in accordance with Manufacturer’s instructions.

B. Install safety labels to NEMA 260 requirements.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. Test dielectric liquid to ASTM D877, using 25,000 volts minimum breakdown voltage, after installation and before energizing from system.

3.04 ADJUSTING AND CLEANING

A. Adjust primary taps so that secondary voltage is within 2 percent of rated voltage.

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

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SECTION 16462

TRANSFORMERS - DRY TYPE

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the requirements for detailed design, fabrication, installation, start-up, and acceptance testing of the dry type transformers.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods.

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

4. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
5. Underwriters Laboratories (UL).
6. Institute of Electrical and Electronic Engineers (IEEE).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. The dry type transformers will transform 3 phase 480V power to 208Y/120V to serve receptacles, appliances, and miscellaneous 120 Volt loads.

B. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).
1.05 SUBMITTALS

A. Refer to Division 1.0 submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The following information shall be submitted for:

Transformers-Dry Type, All

1. Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Specifications, impedance
   c. Dimensions/Outline, weights
   d. Schematic/Wiring Diagrams

2. Review for Records (for Information and/or Records).
   a. Installation Instructions
   b. Shop and Performance Test Data per Paragraph 2.06.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

2. Square D, Watchdog.
3. General Electric Co., Type QL.

2.02 MATERIALS: NOT USED

2.03 EQUIPMENT

A. Transformer and its accessories shall be in accordance with this specification section and with the requirements specified herein.

B. Equipment shall consist of new standard design and first line quality which meet or exceed the requirements of this specification section and shall be UL listed and labeled where possible.

C. Transformers: Furnish energy efficient, ventilated, dry-type, two-winding transformers of the ratings as indicated on the Drawings and as specified herein.

1. Design: Shall be in full accordance with the latest revisions of ANSI C57.12.01 and ANSI C57.12.50 and NEMA ST-20, and suitable for continuous operation at rated KVA, 24 hours a day, 365 days a year, with normal life expectancy as defined by ANSI C57.96.

2. Average Temperature Rise: With 40 degree C. maximum ambient and 30 degree C. average ambient for:

   a. 15KVA to 500KVA rating the temperature rise shall not exceed 115°C with a 220°C insulation system.

3. Electrical Characteristics: Shall be for operation on a 3 phase, 60 Hertz source with 480 volt primary winding and 208Y/120V secondary winding with a grounded neutral.

   a. Voltage taps shall be as follows:

      1) 15KVA to 500KVA Rating: Shall have two 2-1/2% FCAN and four 2-1/2% FCBN taps.

4. Sound Levels: Shall not exceed standard levels, according to KVA ratings, which have been established by NEMA and ANSI/IEEE.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.
B. Transformers shall be tested per the latest edition of ANSI/IEEE C57.12.91; UL-506, and UL-1561.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. The Seller shall install transformers where shown on the Drawings and as indicated on the W113 Master Single Line Diagram. Install dry-type transformers with circuit connections in flexible metal conduit and in accordance with the best accepted practices of the trade.

B. NEC Compliance: Comply with NEC as applicable to installation of transformers.

C. Install plumb, square, level and in accordance with the manufacturer's instructions and recommendations.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTMENT AND CLEANING

A. Adjust taps such that secondary voltage under load is within 2 percent of rated voltage.

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

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SECTION 16470
PANELBOARDS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the requirements for detailed design, fabrication, installation, start-up, and acceptance testing of panelboards.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods.
B. Section 16462 Transformers - Dry Type
C. Section 16475 Overcurrent Protective Devices

1.03 REFERENCES

A. All materials, equipment, fabrication and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

1. National Electrical Manufacturers Association (NEMA); PB-1.
3. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.
4. Underwriters Laboratories (UL); UL50, UL67.

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. The panelboards will distribute power and provide circuit protection for 120, 277, and 480 volt power and lighting loads.

B. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).
1.05 SUBMITTALS

A. Refer to Division 1.0 for submittals procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The following information shall be submitted for all panelboards:

Panelboards, All

1. Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Specifications
   c. Dimensions/Outline
   d. Schematic/Wiring Diagrams

2. Review for Records (for Information and/or Records).
   a. Installation Instructions

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Square D
2. Cutler-Hammer
3. General Electric
4. Westinghouse Electric, Pow-R-Line
2.02 MATERIALS: NOT USED

2.03 EQUIPMENT

A. Panelboards: Furnish with bolt-in circuit breakers of number, sizes, interrupt ratings and arrangements as shown on the Drawings.

1. Panelboards shall be dead-front, factory assembled, surface or flush mounting of code gauge steel, hinged door, typewritten directory card, flush type lock and catch, keyed alike, indoor NEMA 1, or outdoor NEMA 3R as shown on the drawings.

B. Panel Bussing and Connectors: Arrange to maintain sequence phasing throughout, that is, adjacent poles shall be of unlike polarity and rotated in sequence.

1. Circuit Numbers: Number for each pole space as shown on Panel Schedules on Drawings.

2. Ground Bar: Shall be furnished, secured to the panel enclosure back box. Bar shall have terminals for attaching grounding conductors.

3. Neutral Bar: Shall be furnished when panel service voltages indicate a neutral will be used.

   a. Bar shall be isolated from enclosure, furnished with connector for bonding and grounding neutral conductor and also the neutral bus test link when panel is to be used for service entrance application.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Install panelboards where shown on the Drawings.

B. Install plumb, square, level and in accordance with the manufacturer’s instructions and recommendations.
3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality control requirements.

3.04 ADJUSTMENT AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
SECTION 16475

OVERCURRENT PROTECTIVE DEVICES

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SECTION 16475

OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section establishes the material requirements for Overcurrent Protective Devices.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods.
B. Section 16170 Circuit and Motor Disconnects and Motor Control Equipment.
C. Section 16470 Panelboards.

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

1. National Electrical Manufacturers Association (NEMA).
3. Underwriters Laboratories (UL)

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. This specification section covers devices used as branch circuit protective devices in switchboards, panelboards, and as separately mounted circuit protective devices.

B. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).
1.05 SUBMITTALS

A. Refer to Division 1.0 for submittals procedure including details regarding standard submittals schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. Submit catalog cut sheets for review and approval.

1.06 DELIVERY, STORAGE AND HANDLING: Not Used.

1.07 SITE CONDITIONS: Not Used.

PART 2 PRODUCTS

2.01 MANUFACTURERS: Not Used.

2.02 MATERIALS

A. Circuit Breakers: Molded-case, quick-make, quick-break, on manual as well as automatic operation, thermal-magnetic, trip indicating type.

1. Multi-pole Breakers: Shall have common trip.

2. Panelboard Mounted Breakers: Shall be bolt-on type.

3. Interrupting Rating:

   a. Breakers for 120 volts, 208 volt, or 240 volt application shall have a UL listed interrupting capacity of 10,000 RMS symmetrical amperes, unless indicated otherwise on the Drawings.

   b. Breakers for 277 or 480 volt application shall have a UL listed interrupting capacity of 25,000 RMS symmetrical amperes unless indicated otherwise on the Drawings.

4. Current Limiting Circuit Breakers: Shall be used on the line side of series-connected circuit breaker combination in service entrance equipment, panelboards, load centers and similar applications when so specified on the Drawings:

   a. The series-connected circuit breaker combination shall be UL recognized for the series interrupting ratings as shown in the Circuit Breakers - Series-Connected section of the UL Recognized Component Directory.
b. Equipment shall be marked to indicate the short circuit current interrupting rating of the equipment and the proper UL listed combination of series-connected circuit breakers which can be used with the available fault current.

B. Fuses: All fuses shall be dual-element type except where current limiting fuses are indicated on the Drawings.

1. Dual Element Fuses: Shall be UL Class K5 and rated appropriately for the system voltage.

2. Current Limiting Fuses: Shall be UL listed as current-limiting and shall be suitable for use with fuse mounting clips which prevent the insertion of standard type NEC fuses and dual-element fuses.

a. Fuses shall be appropriately rated for the system voltage.
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SECTION 16501

LAMPS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section establishes the requirements for installation and acceptance testing of lamps utilized in lighting fixtures.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods.

B. Section 16510 Lighting Fixtures.

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

   3. Occupational Safety and Health Act (OSHA).
      a. CFR Title 29, Part 1910.
   4. Underwriters Laboratories (UL).

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION:

A. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.
B. Submit "Material Safety Data Sheet" (for information and/or records) for each product used.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. All materials and manufactured items shall be new and of first quality and shall be designed and furnished in strict accordance with all of the governing codes, ordinances, and applicable standards.

B. Furnish all lamps for all the lighting fixtures to be furnished and installed.

   1. Lamps shall be of the type specified for each Fixture Type in the Lighting Fixture Schedule on the Drawings.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION: NOT USED

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTMENT AND CLEANING

A. Clean lamps of dirt and debris upon completion of installation.
B. Protect installed lamps from damage during remainder of construction period.

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

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SECTION 16510
LIGHTING FIXTURES

PART 1 GENERAL

1.01 SECTION SCOPE
A. Provide and install Lighting Fixtures of sizes, types, and ratings as shown on the drawings; comprised of, but not necessarily limited to, lamps, lampholders, reflectors, switches, ballasts, starters and wiring.

1.02 RELATED SECTIONS
A. Section 16050 Basic Electrical Materials and Methods
B. Section 16501 Lamps

1.03 REFERENCES
A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:
   3. Occupational Safety and Health Act (OSHA).
      a. CFR Title 29, Part 1910.
   4. Underwriters Laboratories (UL).
B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.
C. Contract Drawings:

1.04 SYSTEM DESCRIPTION
A. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS
A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.
B. The following information shall be submitted for all Lighting Fixtures:

1. Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Specifications/Photometrics
   c. Dimensions/Outline/Weights
   d. Schematic/Wiring Diagram

2. Review for Records (for Information and/or Records).
   a. Installation Instructions

C. Submit "Material Safety Data Sheet" (for information and/or records) for each product used.

1.06 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

B. Deliver to Project site the factory-assembled, wired and tested Lighting Fixtures.

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Appleton
2. Brandhurst
3. Exide
4. Gardco
5. Holophane
6. Hubbell

2.02 MATERIALS: NOT USED
2.03 EQUIPMENT

A. Lighting Fixtures and Equipment: Furnish as specified on the Fixture Schedule.

   1. Construct Lighting Fixtures so that all metallic parts will be continuously grounded.

B. All ballasts shall be of the high power factor, high efficiency Class P type, suitable to light in cold weather, and their design and construction shall conform to Certified Ballast Manufacturers Standards. Ballasts shall be nonasphaltic thermosetting compound compatible with any contained fluid. Ballasts shall not contain polychlorinated biphenyls (PCBs) and shall be maximum sound level A.

C. Thermal Protection: Shall be provided for incandescent and high-intensity discharge fixtures per NEC Sections 410-65(c) and 410-73(f) when fixtures are mounted recessed in a ceiling, non lay-in ceiling, which is part of the building structural elements.

   1. Recessed incandescent fixtures installed in poured concrete or fixtures labeled Type I.C., suitable for installation in insulated ceilings, where thermal insulation may be in direct contact with the fixture, do not require thermal protection.

   2. Suspended ceilings comprised of T-bar grids with lay-in panels are not part of the building structural elements, and fixtures installed in suspended ceilings are neither surface nor recessed mounted per UL Bulletin establishing the Suspended Ceiling Fixture listing. Fixture Schedule designates mounting as lay-in for fixtures to be installed in a suspended ceiling.

D. Provide and install all fixtures, lamps and tubes of the types and wattages indicated on the drawings.

E. All fixtures shall be wired from outlet boxes with No. 14 AWG, Type CF fixture or type THHN wire for through wiring of fluorescent fixtures.

F. Provide and install the necessary equipment for supporting or coordinating the hanging of all light fixtures with the pre-fabricated building manufacturer.

G. Indoor Lighting: Fluorescent fixtures - In general, shall be rapid start, bipin type, with individually fused high power factor Class F ballasts.

   1. Fluorescent tubes (lamps) shall be a standard cool white (CW).
2. Diffusers and lenses shall be manufactured of 100 percent virgin acrylic and shall be non-combustible.

H. Emergency lighting shall consist of battery operated, automatic recharging, push-to-test lighting units, located where shown on the Drawings. Minimum battery operation time shall be 90 minutes.

1. Emergency battery and lamp supply unit for fluorescent fixtures: The unit shall conform to UL 924. The unit shall meet or exceed the National Electrical Code, NFPA 70, time (90 minutes) and voltage requirements and shall provide a minimum of 60 percent of initial emergency illumination. The unit shall consist of solid state electronic components and shall be completely self-contained with a nickel cadmium battery and encapsulated inverter/charger housed in a single enclosure.

2. The unit shall automatically supply power to one 40 watt rapid start lamp in the event of failure of the normal supply. When normal supply returns, the unit shall automatically recharge, from full discharge, in 24 hours. During normal conditions the battery charger shall trickle charge the battery from an unswitched circuit to maintain full charge condition. A fully charged condition shall be indicated by a light-emitting diode readily visible to room occupant in the installed configuration.

3. A test switch, conveniently located, shall be provided to test the solid state circuitry and battery readiness. The battery shall have a maintenance-free life of 7 years minimum. The unit shall be equipped for dual input voltage of 120 or 277 volts and shall be packaged for field or factory installation.

I. Indoor high bay lighting shall be high pressure sodium fixtures. Selected high bay lighting fixtures as shown on the drawings shall include integral quartz back-up lighting to provide lighting during restrike time.

J. Outdoor Lighting: Outdoor lighting shall be photocell controlled mercury vapor or low pressure sodium (LPS) wall mounted on the building exterior or on poles, as shown on the drawings.

K. Exit Light: The fixtures shall be self luminous, non-electric, and shall have plainly legible letters not less than 3/4 inches wide and 6 inches high. Fixtures shall have white translucent letters in a green field.

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED
2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. Install Lighting Fixtures of types indicated, where shown and at indicated heights; in accordance with lighting fixture Manufacturer’s written instructions and with recognized industry practices; to ensure that fixtures comply with requirements and serve intended purposes.

B. Fasten fixtures securely to indicated structural support members of building per UBC Seismic Zone requirements; and check to ensure that solid pendant fixtures are plumb.

C. All chain and pendant hung fixtures shall be installed level and plumb and in straight rows.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTMENT AND CLEANING

A. Clean lighting fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during remainder of construction period.

3.05 DEMONSTRATION

A. Functional Verification: Upon completion of installation of Lighting Fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Replace bulbs or tubes that are noticeably dim, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

3.06 PROTECTION: NOT USED

END OF SECTION
# SECTION 16670

## LIGHTNING PROTECTION SYSTEM

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SECTION 16670
LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.01 SECTION SCOPE

A. Provide lightning protection for the Trench Enclosure Building.

1. The system shall be complete with all necessary hardware and fittings as shown on the Drawings and installed properly so that a Master Label can be obtained after the facility is completed.

2. The Trench Enclosure Building contractor (Spec. Section 13121) will design and provide the entire protection system with the exception of the ground perimeter loop, pig tails, and the final connection of the pig tails to the structure.

B. Any such work included in any other specification sections that is not specifically described therein shall comply with the requirements of this section.

C. The following items of work are included in, but not necessarily limited to, the work of this section.

1. Lightning Protection Air Terminals

2. Down Conductors

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods.

B. Section 16450 Grounding

C. Section 13121 Trench Enclosure Building

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect, September 1995 of:

1. Institute of Electrical and Electronics Engineers (IEEE).


4. Occupational Safety and Health Act (OSHA).
   a. CFR Title 29, Part 1910.

5. Underwriters Laboratories (UL), UL-96A.

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings.

1.04 SYSTEM DESCRIPTION

A. The Seller shall provide a complete system to capture, control, and earth a direct lightning strike.

B. The Lightning Protection System shall be connected to the building grounding system per UL 96A. Down conductors will be installed on the exterior of building encased in PVC conduit of a color or painted to match building panels.

C. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution, and number of copies required. Note that Division 1.0 may require additional submittals than listed herein.

B. The following information shall be submitted for:

   Air Terminals
   Mounting Base
   Lightning Protection Cables - 17 GA, 32 Strand

   1. Review and Approval (for Approval)
      a. Catalog Cut Sheets
      b. Specifications/Electrical Characteristics
      c. Dimensions/Outline (except cable)
2. Review for Records (for Information and/or Records)
   a. Installation Instructions (except cable)

1.06 DELIVERY, STORAGE & HANDLING
   A. Refer to Division 1.0 for standard delivery, storage and handling requirements.

1.07 SITE CONDITIONS
   A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. To provide procurement references under this Specification Section, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.
      1. Thompson Lightning Protection Inc.
      2. Lightning and Grounding Systems Inc.

2.02 MATERIALS
   A. Refer to Contract Drawings.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS: NOT USED

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL
   A. Refer to Division 1.0 for standard shop quality control requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED
3.02 ERECTION, INSTALLATION & APPLICATION

A. Install Lightning Protection System as indicated, in accordance with equipment manufacturer's written instructions, and in compliance with applicable requirements of UL-96A and NFPA pamphlet 780 to ensure that Lightning Protection System comply with requirements.

B. Coordinate with other work, including electrical grounding as necessary to interface installation of Lightning Protection System.

C. The Lightning Protection System shall be grounded to the building ground grid as shown on the Drawings.

D. The lightning wire or cables shall not be subjected to a radius smaller than 8 inches.
   1. Large sweep radii shall be employed.

E. Lightning protection material and installation shall be in accordance with the NFPA Pamphlet No. 780 and UL 96A.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality control requirements.

3.04 ADJUSTMENT AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

END OF SECTION
SECTION 16700

EMERGENCY AUDIBLE ALARM SIGNALS

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SECTION 16700
EMERGENCY AUDIBLE ALARM SIGNALS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This specification section establishes the requirements for
detailed design, fabrication, installation, start-up and
acceptance testing of the audible evacuation alarm.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods
B. Section 16152 Electrical Specification for Packaged
   Mechanical Equipment
C. Section 16450 Grounding

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be
   in accordance with, but not limited to, applicable requirements
   in effect, September 1995 of:
   1. Factory Mutual.
   3. Occupational Safety and Health Act (OSHA).
      a. CFR Title 29, Part 1910.
   4. Underwriters' Laboratories (UL).

1.04 SYSTEM DESCRIPTION

A. The audible evacuation alarm shall provide a distinct
   audible signal for evacuation. To insure uniformity, the alarm
   signal (sound) defined in this section shall not be used for
   any other alarm or signaling purpose, nor shall any other sound
   be used for this alarm except as stated in this specification
   section.

B. Audible evacuation alarm shall have a sound level of at
   least 10 dBA above the maximum background noise at any point in
   the trench enclosure but shall not exceed 115dBA. The sound
   transducer shall be omnidirectional.

C. The alarm shall be energized by loss of 480V power to the
   evacuation alarm cabinet as sensed by a 3 phase relay in the
   evacuation alarm cabinet.
D. The audible evacuation alarm shall be battery supported such that the alarm will continue to sound at full volume for a period of 2 minutes after input power has been lost. The batteries shall recharge within 4 hours after discharge.

E. All of the above, except the sound transducer, shall be installed in a NEMA 12 evacuation alarm cabinet, mounted on the trench enclosure power/comm assembly, and fed from panel PP-02-101 as shown on the drawings. The sound transducer shall be mounted on or in the alarm cabinet, and shall be NEMA 12.

F. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required.

B. The following information shall be submitted for:

   Evacuation Alarm

1. Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Electrical Specifications (if tone generated)
   c. Electrical/Mechanical Specifications (if mechanically generated)
   d. Power Requirements
   e. Drawing Package showing details of Equipment Layout, installation, wiring and terminal arrangements
   f. Dimensions/Outline
   g. Wire and Cable Specifications
   h. Proposed On-site Tests

2. Review for Records (for Information and/or Records).
   a. Operation/Maintenance Manuals

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.
B. Deliver to the Project site the factory-assembled and tested components.

C. Store and handle components so as not to subject any of the components to mechanical damage or deterioration of electrical characteristics.

D. Protect both before and after installation to prevent damage due to carelessly or maliciously dropped tools, paint, materials, grit, grout or any foreign matter.

E. Each package shall be individually identified with at least the following information:

1. Purchase Order Number
2. Specification Number
3. Item Number
4. Manufacturer’s Name
5. Manufacturer’s Serial and Model Number

1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. To provide procurement references under this specification section, and subject to compliance with the requirements specified in this section, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Thomas Ind/Benjamin
2. Federal Signal Corporation

2.02 MATERIALS

A. All materials and manufactured items shall be new and of first quality and shall be designed and furnished in strict accordance with all of the governing codes, ordinances and applicable standards.

2.03 EQUIPMENT: NOT USED
2.04 COMPONENTS

A. Evacuation Alarm

1. Shall be either:
   a. Individual motor driven siren producing a steady "on" sound.
   b. Individual electronic horn with a characterized signal generator producing the sound described in la. above.

2. Duration of an evacuation alarm shall be 1 to 2 minutes.

B. Wiring and Components: See Specification Section 16152

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality control requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION & APPLICATION

A. The Seller shall install components, wire and terminate. The completed installation shall be in accordance with the best accepted practices of the trade and the manufacturers instructions and recommendations.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. The Seller shall provide all necessary factory technical assistance and documentation to the Buyer to insure proper installation and operation of the furnished equipment.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION

A. Division 1.0 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required functional demonstrations for products contained in this specification section, which may also be used by the Seller in preparing the system ATPs.
B. The Seller shall demonstrate to the satisfaction of the Buyer that the alarm signal is operable after a loss of power, produces the proper sound for the specified time, and ensure that the alarm can be heard in all required locations.

3.06 PROTECTION: NOT USED

END OF SECTION
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SECTION 16740
VOICE AND DATA SYSTEMS

PART 1 GENERAL

1.01 SECTION SCOPE

A. This Specification Section establishes the requirements for detailed design, fabrication, installation and testing of the wiring infrastructure for the voice and data systems for the facility.

1.02 RELATED SECTIONS

A. Section 16050 Basic Electrical Materials and Methods
B. Section 16110 Raceways
C. Section 16450 Grounding

1.03 REFERENCES

A. All materials, equipment, fabrication, and testing shall be in accordance with, but not limited to, the applicable requirements in effect September 1995 of:


2. Institute of Electrical and Electronic Engineers (IEEE)
   a. IEEE 802.3, 1990: As pertains to 10Base-T.

3. National Electrical Code (NEC) 1993
   a. NEC Article 800

4. Occupational Safety and Health Act (OSHA)
   a. CFR Title 29, Part 1910

5. Underwriters Laboratories (UL)
6. Local telephone operating company codes and standards.

B. In case of a discrepancy or conflict between various applicable standards, the standards with the highest and more stringent requirements shall govern.

C. Contract Drawings

1.04 SYSTEM DESCRIPTION

A. This specification section establishes the requirements for the wiring infrastructure to support the voice and data systems for the facility.

B. All electrical systems associated with this section shall conform to National Fire Protection Association, NFPA 70, American National Standards (ANSI) C2, National Electric Safety Code, and Occupational Safety and Health Act (OSHA).

1.05 SUBMITTALS

A. Refer to Division 1.0 for submittal procedure including details regarding standard submittal schedule, distribution and number of copies required. Note: Division 1.0 may require additional submittals than listed in this section.

B. The following information shall be submitted for:

   All Wire             Terminal Blocks
   Outlets             Cabinets

1. Review and Approval (for Approval)
   a. Catalog Cut Sheets
   b. Electrical/Mechanical Equipment Specifications
   c. Proposed on Site Tests
   d. Shop/Installation Drawings
   e. Wire/Cable Specifications
   f. Drawing package showing details of Equipment Layout and Installation, Wiring and Termination Arrangements
   g. Seller qualification per 3.03.C

2. Review for Records (for Information and/or Records)
   a. Operational Description
   b. Operation/Maintenance Manuals
d. Testing Documentation Requirements. Documentation shall be provided of pre-, post, and acceptance testing. Documented and/or verified recordings of all test-meter readings shall be included.

e. As-Built Documentation Requirements

1) Outlet Locations. The Seller shall provide an as-built chart depicting outlet and cable number by location. This chart shall be posted near the wiring terminal blocks in the telecommunications facility.

2) Wiring Documentation. The Seller shall provide as-built wiring documentation. A copy of this documentation shall be retained in the local telecommunications facility.

3) Outside Plant Drawings. The design drawings shall identify plant stationing, cable counts, cable type, size and gauge, and terminals according to these standards. The manhole drawings shall depict the racking and distribution of cabling in, through, and out of the manholes.

1.06 DELIVERY, STORAGE & HANDLING

A. Refer to Division 1.0 for standard requirements for delivery, storage and handling.

B. Deliver to the Project site the factory-assembled, and tested components.

C. Store and handle components so as not to subject any of the components to mechanical damage or deterioration of electrical characteristics.

D. Protect both before and after installation to prevent damage due to carelessly or maliciously dropped tools, paint, materials, grit, grout or any foreign matter.

E. Each package shall be individually identified with at least the following information:

1. Purchase Order Number
2. Specification Number
3. Item Number
4. Manufacturer’s Name
5. Manufacturer’s Serial and Model Numbers
1.07 SITE CONDITIONS

A. Refer to Division 1.0.

PART 2 PRODUCTS

2.01 MANUFACTURERS: NOT USED

2.02 MATERIALS

A. All materials and manufactured items shall be new and of first quality and shall be designed and furnished in strict accordance with all of the governing codes, ordinances and applicable standards.

2.03 EQUIPMENT: NOT USED

2.04 COMPONENTS

A. Raceways/Enclosures:

1. It shall be permissible to use a common raceway system for the telephone, local area network, and multi-mode fiber systems within facilities.

2. Control, instrumentation and communication cables shall be routed on the lower tier of a two tier half rack. Refer to Section 16110 Para. 3.02.A.10 for Trench Enclosure Cable Tray description.

3. Underground conduit shall be Schedule 40 PVC, 4 inch, equipped with 6-cell innerduct. Cabling for each system shall be pulled in a separate innerduct.

4. All 4 inch underground conduit sweeps shall have a minimum radius of 1.2 m (4 ft.), regardless of material used. Sweeps must have the same inside diameter as the conduit to which they will attach and may be constructed of Schedule 40 PVC for runs under 295 ft. or of fiberglass or concrete-encased PVC over 295 ft. The seller shall use fiberglass or concrete-encased PVC sweeps when accumulated bend radius exceeds 180 degrees.

5. Enclosures within the trench enclosure shall be NEMA 12 rated. All outdoor installations shall be NEMA 4.

6. Above ground Telecom/LAN conduits shall be 2 inch and shall have a minimum sweep radius of 0.6 m (2 ft.), regardless of material used.
B. Outlets:

1. Work areas, shall be provided with telephone, fiber optic, and Local Area Network (LAN) outlets as shown on the contract drawings.

2. Outlets in each area shall be clearly marked indicating cable type (i.e., LAN, telephone or fiber) and cable number.

3. Outlet markings shall be of a removable type.

C. Inside wire and cable installations shall be installed with plenum-rated cable having a ripcord for removing the external sheath.

1. Telephone Wiring. The inside building wiring for telephone connections must be compatible with the Hanford site telephone switching system. The accepted cable standard is eight-conductor Telecommunications Industry Association (TIA) Category 3 cable. Analog and ISDN telephones shall be terminated with a TELCO Standard RJ-11 connector.

2. Network Wiring (LAN). Twisted pair cabling shall be used for terminating administrative workstations and other network equipment, such as printers. Twisted-pair network connections shall be wired using eight-conductor TIA Category 5 cable. Network connections shall be terminated with a data standard RJ-45 connector.

a. Installation

1) Routing and Structure

a) The cabling shall be installed from the outlet location to the telecommunications rooms.

b) The cabling shall be installed using, J hooks, caddy bridle rings, or other Buyer approved cable distribution methods and in conduit.

2) Cable Runs

a) The cabling shall be installed as one continuous segment, with no splices.

b) Pull strings shall be left in all conduits after installation.
c) Table I shows the maximum length for cable runs with respect to cable type. The Buyer shall approve any exceptions to this requirement before installation.

<table>
<thead>
<tr>
<th>Cable Type</th>
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<tr>
<td>Level 5 Twisted pair</td>
<td>100 m (328 ft)</td>
</tr>
<tr>
<td>Multimode Fiber Optic</td>
<td>2 km (1.24 miles)</td>
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3) The Seller shall insure that;
   a) The pulling tension is not exceeded, and
   b) breaks have not occurred from stepping on the cable or other damage from installation.

3. Electro-Magnetic Interference Hazards. The following measures shall be taken to reduce electro-magnetic interference (EMI) hazards.
   a. Power Sources. Cable runs shall avoid obvious sources of high-frequency energy such as elevators, heating, ventilation, and air-conditioning (HVAC) systems, radio transmitters and electric motors of any type.
   b. Minimum Distance. When the above types of interference cannot be avoided, cables shall be placed no closer to the source than 1 m (40 in.).
   c. Fluorescent Lighting. A minimum separation of 30.5 cm (12 in.) shall be maintained from fluorescent lighting.

4. Conduits Inside Trench Enclosure
   a. The conduit shall be a minimum of 1.9 cm (3/4 in.) diameter.
   b. Insulated-throat bushings shall be used to protect cabling from damage during installation.
   c. Conduit sweeps shall ensure cable manufacturers bend radius recommendations are not exceeded.
   d. Where surface mounted communications outlets are used, surface mounted raceways are required.
e. The raceways shall be sized per the NEC.

f. Conduit extending to building exterior shall be underground and be a minimum of 10.2 cm (4 in.) in diameter.

5. Wall Plates/Terminations

a. Consolidated Terminations. Collocated installations of telephone, network, and fiber optic terminations shall be into a single modular wall plate.

b. Standard Modular Wall Plate Designs. Modular wall plate designs shall be standardized. Refer to the contract drawings.

D. Termination Systems

1. Installation

a. Spacing. The termination block frames shall be placed side by side leaving 7.6 cm (3 in.) space, in between and room below, for jumpers.

b. Connector Blocks. The network connection blocks shall be located starting at the right of the assembly.

c. Termination Blocks. The station termination blocks shall be located starting at the left of the assembly.

d. Grounding. The metal frames shall be grounded.

e. Spare Requirements. Include the capacity (appropriate number of blocks) to terminate all of the expected cabling, and an additional 25% for future.

2. Terminal Blocks. The Seller shall use different types of termination systems for voice, fiber data, and metallic data to ensure a visual difference in the appearance of the installation and promote efficient system maintenance.

a. Telephone Terminal Blocks

1) Physical Specification. The telephone circuits shall be terminated on split 50 telephone termination assemblies (AT&T 110 Terminal Blocks or equivalent).

2) Assembly. Each assembly shall include Anixter #005815 blocks or equivalent and one blue metal frame with stand-off brackets (frame & brackets Anixter #894096 or equivalent). The telephone termination assemblies shall be stacked and grounded.
3) Grounding

a) Assembly Frames. The metal frames shall be grounded.

E. Grounding

1. Cable Shields. A ground shall be provided for the shield of each data cable at each outlet location in facilities in which the ground reference within the facility is constant.

2. Grounding Standards. Equipment and cabling grounds shall be made in compliance with ANSI/EIA/TIA Standards.

F. Labeling

1. Cable Labeling

a. Telephone Cable Labeling. Telephone cable shall be labeled in accordance with the system established by the Buyer.

b. Data Cable Labeling. The data cable labeling standard shall be per TIA 606.

2. Terminal Block Labeling. For the network cabling, the room number shall be placed next to the cable number on the Krone blocks.

3. Wallplate Labeling. The AMP wallplates shall be labeled above the telephone insert with the number of the telephone cable. The Seller shall label the network and laser ports.

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.
3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

B. The Seller shall provide all necessary factory technical assistance and documentation to the Buyer to insure proper installation and operation of the furnished equipment.

C. Installers shall have experience and training in the installation of similar systems. References and proof of training certification shall be provided by the Seller, for the Buyers review and approval.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION

A. Division 1.0 delineates the Acceptance Test Procedures (ATP) that provide functional demonstration to ensure that a system performs as specified. Following is a description of required testing for the products contained in this specification section, which may also be used by the Seller in preparing the system ATPs.

B. Testing and Acceptance

1. Pre-Installation Cable Testing. The Seller shall test the cable to verify it meets requirements before installation.

   a. Metallic Cable Testing.

      1) The testing shall be performed using a near-end cross talk (NEXT) scanner or Buyer approved equivalent.

      2) If it can be determined that a given amount of cable on one or multiple reels was produced during a continuous cable manufacturing run, then testing of one section of copper cabling to verify it meets the accepted criteria shall be acceptable.

   b. Fiber Optics Cable Testing. The testing shall be performed per manufacturers recommendations and documented by the Seller for acceptance from the Buyer.

   c. Test Records

      1) Print Capability. Test equipment shall be capable of producing records of the tests performed for each cable and/or reel.

      2) Record Copy. A copy of the records shall be provided before the test and acceptance phase.
2. Post Installation Cable Testing. The Seller shall perform certification testing of all cabling installed. The testing shall verify the cabling installed meets the specified network criteria.

   a. Testing shall include proof of cabling length and attenuation.

   b. The Seller shall verify all terminations are made and labelled accurately.

   c. A copy of network cabling test records shall be provided before test and acceptance is complete.

   d. The telephone cabling shall be tested using standard telephone audible tone indicator instrument. The Seller shall document that this testing has been performed.

3. Acceptance Cable Testing

The installation shall be subject to acceptance test procedures after the Seller has provided the certification testing documentation to the Buyer. Installation work shall pass all tests before the project is accepted.

   a. The installation shall undergo a walk-through inspection.

   b. After termination, if it is determined the cabling is not usable due to improper cabling installation (i.e. cuts, abrasions, exceeding bend radius), Seller shall be required to replace and reinstall the affected cable run.

   c. Technical Testing

      1) The copper cabling installed shall be subjected to a test using a NEXT scanner or Buyer approved equivalent.

      2) Each fiber of the fiber optic circuit shall be tested on an Optical Time Domain Reflectometer (OTDR).

   d. The Seller shall conduct and document the test results.

3.06 PROTECTION: NOT USED

END OF SECTION
SECTION 01010

SUMMARY OF WORK

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SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.1 INTRODUCTION

1.1.1 Project W113 Phase 1 is for the construction of Solid Waste Retrieval Facilities; and is located in the 200 West Area of the Controlled Access Area of the Hanford Site, approximately 38 road miles northwest of Richland, Washington.

1.1.2 This Specification is a part of the general contract for the supply and construction of these facilities and equipment.

1.1.3 Throughout the contract documents different terms are used to define the various organizations involved in this fixed-price contract. To better understand the different nomenclature that is used, the following clarifications are given:

- U.S. Department of Energy (DOE)  
  - Owner
- Westinghouse Hanford Company (WHC)  
  - Operating Contractor, Operator
- Kaiser Engineers Hanford Company (KEH)  
  - Buyer, Construction Manager
- Raytheon Engineers & Constructors (Raytheon)  
  - Architect/Engineer Contractor
  - Seller, Fixed Price Contractor
  - Subcontractor, Supplier, Designer, Fabricator, Manufacturer

1.2 STATEMENT OF WORK

1.2.1 Scope

Work consists of furnishing all labor, equipment, and materials to provide "ready for use" (unless otherwise noted) facilities and equipment in accordance with the Contract Documents.
1.2.2 Integration

1. The work under a single, prime contract includes:

- Providing site infrastructure for the project consisting of separate facility access drives, sanitary sewerage system, and the extension of utility services.

- Detailed design/build of four (4) specialized building structures and the supply of two storage containers.

- Provide plant management systems, complete with related equipment; except for the external (to the buildings), interconnecting fibre optic cables.

- Provide certain operations equipment; fueled, serviced, tested, demonstrated and delivered to the owner for his use.

- Provide miscellaneous instruments and equipment that are either portable or to be installed at a later phase of operation by the Buyer.

- Miscellaneous construction related to the above major work elements.

Refer to figure No. 1.

2. The intent of the contract documents is to include all items necessary for the proper execution and completion of the work, including all labor, materials, equipment, and services. The Contractor shall ensure that each work element is complete and functional except where it is dependent upon work specifically indicated in the contract documents to be performed by others.

3. Reference drawings have been provided to communicate the intended function and use of the project facilities and equipment by Buyer, and are here included for information purposes only.

4. The project is associated with waste trench 4C-T04 located in the 200 West Area Burial Ground 218-W-4C which is within a Controlled Access Area of the Hanford Nuclear Site. The work shall be accomplished under the special procedures and conditions set forth in these contract documents.
1.2.3 Work Included

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

1.2.3.1 Trench Enclosure Building

Design, fabricate and erect a movable frame-covered tension membrane structure to span across the waste filled trench; and be mounted on a continuous rail system which runs the entire length of the Trench 4C-T04. Includes:

- All access openings, portals, and closure systems in the enclosure.
- Wheel/rail move system, including written procedures for relocation.
- Design and Construction of foundation and anchoring system.
- Design and installation of lightning protection and lighting systems.

1.2.3.2 Related Work - Trench Enclosure Building

- Site preparation including partial excavation of trench back fill cover and trench side slope, grading and base course driveways.
- Construction of equipment access driveways.
- Provide movable, metal, personnel stair and platforms.
- Provide through wall, drum exit conveyor with controls.
- Design, furnish and install fire detection and automatic sprinkler fire protection system.
- Provide building ventilation system.
- Provide portable heating and supplemental cooling fan units.
- Provide electrical power distribution, and exit and exterior lighting equipment.
- Connection of site utility services.
1.2.3.3 General Office Building

Design, fabricate and install a plant fabricated, modular, mobile building. Includes:

- Interior partitions, finishes, and built-in furnishings as indicated.
- Built-in kitchen appliances, toilet accessories, and shelving.
- Complete plumbing system with fixtures and all piping to single point of connection.
- Complete electrical power distribution and lighting systems to single point of connection.
- Complete HVAC system with all equipment, distribution, and controls.
- Distribution system and terminal outlets to single point of connection for telephone and data systems.
- Construction of foundation and anchoring system.
- Setting, field assembly, and skirting of modular units.
- Supply of metal panel material for wind screen for entry stairs.

1.2.3.4 Related Work - General Office Building

- Site preparation including grading, base course, and access drive.
- Construct wood entry stairs including concrete pads, wood structures, handrails, and windscreens as indicated.
- Provide connections to site utilities.
- Provide integrated voice and data systems within building.
- Install GFE fire extinguishers.

1.2.3.5 Retrieval Staff Change Building

Design, fabricate, and install a plant fabricated, modular, mobile building. Includes:

- Interior partitions, finishes, and built-in furnishings as indicated.
• Metal lockers and built-in toilet accessories and shelving.
• Complete plumbing system with fixtures, equipment and all piping to single point connection.
• Complete electrical power distribution and lighting systems to single point connection.
• Complete HVAC system with all equipment, distribution, and controls.
• Distribution system and terminal outlets for telephone and data systems.
• Construction of foundation and anchoring system.
• Setting, field assembly, and skirting of modular units.
• Supply of windscreen material for entry stairs.

1.2.3.6 Related Work – Retrieval Staff Change Building
• Site preparation including grading, base course, and access drive.
• Construct wood entry stairs including concrete pads, wood structures, handrails, and windscreens as indicated.
• Provide connection to site utilities.
• Install integrated voice, data, and instrumentation systems within building.
• Install GFE fire extinguishers.
• Furnish and install Personal Contamination Monitor (PCM) System.
1.2.3.7 Change Facility Storage Building

Provide a prefabricated, self-framed, metal building as indicated. Includes:

- Interior partition
- Field assembly and erection

1.2.3.8 Related Work - Change Facility Storage Building

- Site preparation.
- Construction of concrete slab-on-grade foundation.
- Provide metal shelving units.

1.2.3.9 Tool Crib Container Overpack Staging Container

Furnish two refurbished, metal Sea/Land shipping containers.

- Supply portable dockboards for each container.

1.2.3.10 Related Work - Tool Crib Container & Overpack Staging Container

- Site preparation, including grading, and base course.
- Set and level containers.
- Install dockboards.

1.2.3.11 NDE/NDA and HGS Trailers

Not in contract.

1.2.3.12 Related Work - NDE/NDA and HGS Trailers

- Site preparation including grading pad, base course and paving (for the start-up position only).
- Provide portable, metal operation platform with access stair and guard rails.
- See Plant Management Systems - Provide equipment to be installed later by others.
- Provide power, telephone, and data services to the extent indicated.
1.2.3.13 Site Infrastructure

- Construct access driveways, pads, and parking areas to connect facilities with existing Dayton Avenue as indicated. Pave where shown. Trench Dayton Avenue as required for utility crossings and repair.

- Tap into the existing sanitary water main along 19th Avenue and extend service to the trench enclosure building fire protection and utility water dust suppression systems at the enclosure’s first position; and construct extension with fire hydrants and branches to serve the structure in its future, second and third positions.

- Also extend Sanitary Water lines to serve the General Office building and the Retrieval Staff Change Building.

- Extend primary 13.8 kV power overhead from 19th Avenue south to project site; transform and distribute 480V power (underground) at the site for each of the Project facilities.

- Construct sewerage system to serve the General Office and Retrieval Staff Change Buildings, including sewer lines, septic tank, pump chamber, pumps, and absorption field.

- Install new telecommunications hand hole at the location of site cross-connect cabinet (by others) and extend empty conduit(s) to indicated project facilities for installation of fibre-optic, HLAN cable by others.

- Extend empty conduit(s) from new hand hole at the location of site cross-connect cabinet (by others) to indicated project facilities for installation of telephone service by others.

1.2.3.14 Plant Management Systems

- Design, procure, install, and test special Data Acquisition and Data Management Systems; including Bar Code equipment, data acquisition devices, LAN devices, and associated software.

- Design, procure, install, and test Radiation Monitoring Instrumentation, Isokinetic Sampling System, and miscellaneous other Control and Instrumentation Systems.
Support field testing of Data Acquisition and Management Systems after installation of NDE/NDA Trailers and Fibre-optic cables (by others).

1.2.3.15 Operations Equipment

Provide miscellaneous individual pieces of equipment as specified, for use by the owner during future waste retrieval operations.

1.2.4 Work Not Included

- Items indicated in documents as "NIC" (not in contract).
- Supply and installation of "outside", site service fibre optic data cable and telephone trunk line from existing Hanford service to single point of connection at each of the project facilities.
- Supply, set-up, and services connection of the NDE/NDA and HGS trailers.
- Buyer will furnish software, interface definition documents for NDE/NDA and HGS equipment; and DMS and TMDS systems.
- Setting or positioning of those equipment or trench enclosure building components which require excavation beyond that indicated to be accomplished prior to the start up of retrieval operations (e.g., certain portable exit stairs).
September 1995
Rev 0

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SECTION 06100
Carpentry

PART 1 GENERAL

1.01 SECTION SCOPE
A. This Section includes:

1. The fabrication and erection of wooden stairs with landings, and wood framing supports for a metal panel wind screen, to be fabricated of dimensioned lumber, steel angles, steel joist hangers, anchors, screws, and nails, and protected with a water repellent preservative.

   a. The design and size of stairs, landings, and wind screen support for the General Office Building and Retrieval Staff Change Building shall be as shown on the Contract Drawings.

2. The provision and installation of adjustable metal shelving units for the Retrieval Staff Change Storage Building as indicated on the Contract Drawings.

1.02 RELATED SECTIONS
A. Section 02200 Earthwork
B. Section 03300 Cast In Place Concrete
C. Section 05100 Structural Steel and Miscellaneous Metal
D. Section 13123 General Office and Retrieval Staff Change Buildings
E. Section 13125 Retrieval Staff Change Storage Buildings

1.03 REFERENCES
A. American Society for Testing Materials, ASTM:
B. American Wood Preservers Association, AWPA:
   2. M4-84 Standard for the Care of Preservative-Treated Wood Products.
C. Federal Specifications (FS):
   1. FF-N-105B-87 Nails, Brads, Staples and Spikes
2. FF-S-111D-89 Screw, Wood
3. FF-B-561D-93 Bolts, (Screw), Lag

D. National Bureau of Standards, Product Standards, NBS:
   1. PS 20-94 American Softwood Lumber Standard

E. Western Wood Products Association, WWPA:
   1. Grading Rules For Western Lumber.

1.04 SYSTEM DESCRIPTION: NOT USED

1.05 SUBMITTALS

A. Wood treatment data including type of preservative solution and pressure process used, and compliance with applicable standards for information and record.

B. Product data on metal framing anchors.

C. Product data and Material Safety Data Sheet (MSDS) for field applied sealer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Time the delivery of wood members and anchorage devices to the Project site to avoid extended storage.

B. Lumber and metal shelving shall be covered and stored off the ground so as to insure proper ventilation and protection from the weather.

C. Place spacers between each bundle.

D. Repair or replace damaged material.

1.07 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

   1. Metal Connectors: Simpson Strong-Tie Company, Inc.

   2. Sealer (field applied): Osmose Wood Preserving, Inc.
2.02 MATERIALS

A. Provide structural framing and miscellaneous lumber of hand selected, pressure treated Douglas Fir or Hem-Fir, No. 2 grade under WWPA rules.

1. Each piece of lumber shall bear the grade and trademark of the association under whose rules it is produced.

   a. Furnish dressed, S4S lumber to comply with NBS PS 20 and with applicable grading rules of WWPA.

2. Preservative treated lumber shall comply with AWPA standards C-2. Pressure-treat with water-borne preservatives to a minimum retention of 0.25 psf.

3. All lumber shall be either air or kiln dried. Moisture content shall not exceed 19 percent.

B. Provide clip type, adjustable metal shelving units consisting of open, five heavy duty 18 gage shelves with integral box beam design at front and back, with a 700 lb. minimum shelf capacity, supported by 14 gage metal posts punched for one-inch shelf adjustment and 16 gage side and back braces. The unit size shall be 24" x 36" x 85" minimum and 24" x 48" x 85" minimum as indicated on the drawings. The finish shall be baked enamel paint, the color shall be gray.

C. Provide 3/4 inch fire retardant plywood board, size and location as shown on the drawings.

2.03 COMPONENTS

A. General: Provide galvanized metal hangers, holdowns, angles, connectors and fasteners of size, type, material, and finish as indicated on the drawings that comply with requirements specified in this specification.

B. Nails, Wire, Brads, and Staples: FS FF-N-105B.

C. Wood Screws: FS FF-S-111D.

D. Lag Screws: FS FF-B-561D.

E. Bolts: Steel bolts complying with ASTM A 307, Grade A.

F. Angles, Joist Hangers, Post Base: Provide galvanized steel hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails, screws, nuts, washers and other anchoring devices.

   1. Simpson Strong-Tie Connectors manufactured by Simpson Strong-Tie Company, Inc. or approved equal.
G. Sealer: Clear penetrating preservative complying to FS TT-W-572 for water repellency.

   1. Osmose Clear Wood Preservative by Osmose Wood Preserving, Inc. or approved equal.

H. Metal Siding: Material provided under Specification 13125.

2.05 FABRICATION: NOT USED

2.06 SHOP QUALITY CONTROL

A. Refer to Division 1.0 for standard shop quality requirements.

PART 3 EXECUTION

3.01 PREPARATION: NOT USED

3.02 ERECTION, INSTALLATION AND APPLICATION

A. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of nailers, blocking and similar supports to allow attachment of other construction.

B. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated on Contract Drawings and as required by recognized standards. Tie platforms securely to modular buildings.

C. Install wood members with size and shapes as shown on Contract Drawings to required levels and lines, with members plumb. Make tight connections between members.

D. Follow published requirements of manufacturer of metal framing anchors.

E. Install fasteners without splitting of wood; predrill as required. Use common wire nails unless otherwise indicated.

F. Set heads of fasteners flush with surface in all locations subject to contact.

G. Stairs: Notch stringers where indicated to receive treads and supports; leave at least 3.5 inches of effective depth.

H. Fabricate stair framing not to exceed the following variation within each flight:

   1. Adjacent treads and risers: 3/16 inch.

   2. Between largest and smallest tread and riser: 3/8 inch.

I. Coat all cut surfaces with heavy brush cut of the same chemical used for treatment to comply with AWPA M4.
J. Finish: Complete all fabrication prior to application of sealer:

1. Finish all wood members with a water repellent sealer.

2. Brush apply one heavy coat; use as much material as wood will absorb without leaving an excess.

K. Assemble adjustable metal shelving components in accordance with manufacturer’s directions.

a. Erected units shall be rigid, straight and plumb.

b. Thoroughly clean all surfaces.

L. Securely fasten the fire retardant plywood boards at the locations as shown on the drawings.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 1.0 for standard field quality requirements.

3.04 ADJUSTING AND CLEANING: NOT USED

3.05 DEMONSTRATION: NOT USED

3.06 PROTECTION: NOT USED

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SECTION 13020

SEA/LAND STORAGE CONTAINERS

1.0 GENERAL

1.01 SECTION SCOPE

A. This Section includes the supply of two (2) used/refurbished sea/land storage containers with dock boards provided at the Project site where indicated on the Contract Drawings.

1.02 RELATED SECTIONS  NONE

1.03 REFERENCES  NONE

1.04 SUBMITTALS

A. Submit data sheets indicating size, weight and description of containers and dock boards for information and record.

1.05 DELIVERY, STORAGE AND HANDLING

A. Transport containers in a manner to provide protection from damage.

B. Repair or replace damaged container.

1.06 SITE CONDITIONS

A. Refer to Division 1.0 for applicable site conditions.

2.0 PRODUCT

A. The sea/land containers are manufactured to be used as cargo containers or ground storage containers as required.

B. Provide used containers rated "good" units; structurally sound; and in wind and water tight condition.

1. Size: 8 feet wide, 20 feet long, and 8.5 feet high.

2. Weight: Approximately 5,000 pounds.

3. Structure: Steel or aluminum wall and ceiling, supported by a sub-structure consisting of metal rails at side, end, top and bottom connected to four steel corner posts, or equal.

4. Floor consists of hard wood planks, pest and weather treated, that are supported by cross members.

5. Container shall have double doors at one end and necessary hardware to secure doors capable of receiving a padlock.
2.01 SUPPLIERS

A. To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of suppliers is identified. Procurement will not be limited to these listed suppliers.

1. E.D.I. Inc, Point Richmond, California.
2. Container Care, Seattle, Washington.

2.02 COMPONENTS

A. Provide a portable dock board for each container.
   1. Aluminum non-skid, raised pattern tread plate.
   2. Crown design with underside stop angle.
   3. Size: 60" width by 48" length.
   5. Steel safety side curbs.
   7. Provide one optional set of lifting chains.

3.0 EXECUTION

3.01 ERECTION, INSTALLATION AND APPLICATION

A. Set and level sea/land storage containers on prepared site.
B. Place dock boards.

3.02 INSPECTION

A. Surveillance will be performed by Buyer to verify compliance of the work to the drawings and specifications.
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SECTION 13121
TRENCH ENCLOSURE BUILDING

1.0 STATEMENT OF WORK

A. This Section includes the design, fabrication, shipment and on-site erection of a one-story, movable frame-covered tension membrane structure. The frame shall consist of arched steel (aluminum is not permitted) truss framework or equal; which is covered with a fabric membrane. The nominal length, width, minimum inside clear heights, and maximum overall height are as indicated on the Contract Drawings and as specified herein. This structure shall be designed to be movable on a wheel/rail system.

1. The building will be used to provide protection from inclement weather during excavation and retrieval operations of buried radioactive waste.

1.01 SCOPE

A. General:

1. Design and fabricate the frame-covered tension membrane building, including foundation and rail system, to withstand loads from winds, gravity, earthquake, snow, auxiliary loads of fire-protection sprinkler system, lightning protection, lighting and ventilation, other miscellaneous items attached to the framing as shown on contract drawings, and loads which will be induced during moving operations on a continuous rail system.

a. The building area shall be approximately 28,800 square feet. The length is approximately 288 feet and the width is approximately 100 feet. The minimum inside clear heights shall be as indicated on the drawings; the exterior building height shall not exceed 40 ft from the base of the wall. The length of the rail system shall be 540 feet to facilitate future positions of the structure.

2. Ship all necessary components to the Project site and erect the building for the first position only with the rail system and all accessories and items herein specified and as shown on the drawings.

3. Supply all specified submittals.
B. Work Description:

1. Engineered design for the Trench Enclosure Building includes structural steel framing, footings and anchorage of the structure, framing of openings in walls and roof, and a wheel/rail system on which to relocate the building to two additional positions along length of the trench.
   a. Design the building structure for imposed dead, live and supplemental combination of loads as specified.
   b. Design the building structure and rail system for future disassembly and reassembly at a new location. Concrete foundations do not have to be relocatable.
   c. Design building general lighting and lightning protection system.

2. Construction includes, but is not limited to the following:
   b. Construction of rail system.
   c. Structural steel framing, including endwall framing members and horizontal and vertical bracing, and miscellaneous steel as required for framed openings, portals, rail structure and equipment supports as indicated on the drawings.
   d. Exterior walls and roof shall be covered with factory-assembled, finished fabric attached to framing members using factory recommended fastening system.

3. Furnish and install all specified doors with hardware.

4. A set of synchronized winches shall be provided and mounted as required to move the structure on the rail system to the future positions as indicated on the reference drawings.

5. Provide building general lighting system including fixtures, wiring, and switching.

6. Provide lightning protection for the structure.

1.02 RELATED SECTIONS

A. Section 01010  Summary of Work
B. Section 02200  Earthwork
C. Division 15  Mechanical
D. Section 15300  Fire Protection
E. Section 16050  Basic Electrical Materials & Methods
F. Section 16110  Raceways
G. Section 16120  Wire & Cables
H. Section 16141  Switches, Receptacles & Accessories
I. Section 16450  Grounding
J. Section 16501  Lamps
K. Section 16510  Lighting Fixtures
L. Section 16670  Lightning Protection System

2.0 APPLICABLE CODES AND DOCUMENTS

A. American Concrete Institute (ACI):
   1. ACI 318-89  Building Code Requirements for Reinforced Concrete.
   2. ACI 349-85  Code Requirements for Nuclear Safety Related Concrete Structures.

B. American Institute of Steel Construction (AISC):

C. American Iron and Steel Institute (AISI):
   1. AISI SG-673 I, II, and III-86 - Specification for the Design of Cold Formed Steel Structural Members.
   2. 1987 The Cold Formed Steel Design Manual

D. American National Standards Institute (ANSI):
   1. A156 Series American National Standards for Architectural Hardware (hinges, closures, trim, hinge dimension, locks & latches, auxiliary hardware and finishes).

E. American Society of Civil Engineers (ASCE):
   1. ASCE 7-93 Minimum Design Loads for Buildings and Other Structures
F. American Society for Testing and Materials (ASTM):

1. A 36-91 Specification for Structural Steel
2. A 53-90b Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
4. A 307-91 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
5. A 325-90 Standard Specification for High-Strength Bolts for Structural Steel Joints
6. A 500-90a Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
7. A 501-89 Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
10. A 570-92 Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
11. A 572-92 High-Strength, Low-Alloy Columbian-Vanadium Steels of Structural Quality
12. A 687-89 High Strength Non-Headed Steel Bolts and Studs
13. C 150-92 Portland Cement
14. C 33-90 Concrete Aggregates
15. C 260-86 Air-Entraining Admixtures for Concrete
16. C 494-92 Chemical Admixtures for Concrete

G. American Welding Society Inc. (AWS):

1. D1.1-92 Structural Welding Code

H. National Fire Protection Association (NFPA):

1. 70-1993 National Electrical Code (NEC)
2. 701 Standard, Method of Fire Tests for Flame Resistant Textiles and Films.

3. 780-92 Lightning Protection Code

I. Lawrence Livermore National Laboratory (LLNL), UCRL-15910, June 1990. "Design and Evaluation Guidelines for Department of Energy Facilities Subject to Natural Phenomena Hazards".

J. Steel Door Institute (SDI):

1. SDI 100-85 Recommended Specifications, Standard Steel Doors and Frames


3.0 REQUIREMENTS

3.01 GENERAL REQUIREMENTS

A. The Trench Enclosure Building shall be designed and fabricated in conformance with listed standards, specified design criteria and as indicated on the drawings.

B. Manufacturer's Qualifications: A firm having a minimum of five years experience in engineering and manufacturing building structures that are similar to the building indicated for this project.

C. Manufacturers: Subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. American Space Frames, Inc.

2. Rubb Building Systems.

D. Installer Qualifications: The installer shall be certified in writing by the building manufacturer as being qualified to erect the manufacturer's product.

3.02 STRUCTURAL

A. Material:

1. Hot-Rolled Structural Steel Shapes: Comply with ASTM A-36 or A 529.

2. Steel Tubing or Pipe: Comply with ASTM A500, Grade B, ASTM A501, or ASTM A53 Type E or S, Grade B.

3. Steel Members Fabricated from Plate or Bar Stock: Provide 42,000 psi minimum yield strength. Comply with ASTM A529, ASTM A570, or ASTM A572.
4. Bolts for Structural Framing: Comply with ASTM A307 or ASTM A325 as necessary for design loads and connection details. Nuts for A325 bolts shall conform to ASTM A563, Grade DH, Heavy Hex Nuts and nuts for A307 shall conform to ASTM A563, Grade A, Heavy Hex Nuts. High strength non-headed steel bolts shall comply with A687.

5. Cold formed steel members shall comply with "The Cold Formed Steel Design Manual".

6. Concrete:
   a. Cement: ASTM C150, Type I or Type II.
   b. Concrete Aggregate: ASTM C33, size to comply with ACI 318.
   d. Water Reducing Admixtures: ASTM C494, Type A, used in proportions recommended by the manufacturer.
   e. 28 day compressive strength: minimum 3000 psi.

B. Design Criteria:

1. Structural Steel and Concrete:
   b. Light Gage Steel: Comply with the AIST "Specification for the Design of Cold Formed Steel Structural Members".
   c. Welded Connections: Comply with the AWS D1.1 requirements for welding procedures.
   d. Welded steel shall be hot dip galvanized to comply with ASTM A123. All other steel components shall be either zinc coated or painted with a high zinc content paint as per manufacturers recommendations.
   e. All components of the structural framework shall be fabricated from steel. Primary steel tubing shall comply with ASTM A500 or A501. Flat bar and other shapes shall be ASTM A36 or A529 or equal.
   f. Foundations designed for load combinations which include seismic loading shall comply with ACI 349. Anchor bolt embedment lengths, spacing and edge distances shall comply with ACI 349 when designed to resist seismic loads. For wind loading cases, anchor bolt anchorage requirements shall be in accordance with ACI 318.
g. Structural framing designed for load combination which include seismic loading shall comply with AISC N690. For wind loading, framing design shall comply with AISC Specification for Structural Steel Buildings.

h. Load combinations which include seismic loads from the dynamic analysis can be assumed to be severe when applying stress limit coefficients and load factors for AISC N690 and ACI 349 respectively.

2. Design Loads: The Trench Enclosure Building has been classified according to UCRL-15910 requirements to be a "Moderate Hazard" facility for seismic design and a "Low Hazard" facility for wind loading. The Trench Enclosure Building shall be designed for the following applied loads and combination of loads in accordance with UCRL-15910:

a. Seismic: Member design to be performed for the most severe loading condition obtained from the two static analysis and one dynamic analysis requirements as follows:

Static Analysis
1) UBC Zone 2B, seismic importance Factor I = 1.25.

2) UCRL-15910, peak ground acceleration: 0.12g, amplification factor for 5% critical damping: c = 2.083, Importance Factor: I = 2.0

Dynamic Analysis
1) The Trench Enclosure Building structure shall also be designed for seismic induced stresses calculated from a three dimensional dynamic analysis using loading and design criteria per UCRL-15910 and the following:
   a) Peak ground acceleration 0.12g.
   b) Response spectrum: Hanford Plant Standard SDC 4.1, Figure 5. (see page 9)
   c) Damping ratio: UCRL 15910.

2) Dynamic analysis shall include the effects of seismic acceleration occurring along the two horizontal orthogonal and vertical axes simultaneously according to the requirements of UCRL-15910.

b. Wind Load: 70 mph, exposure "C", importance Factor I = 1.07 (per ASCE 70-93).

c. Minimum Roof Live Load: 20 psf (roof live load does not act combined with snow load).

d. Ground Snow Load: 15 psf.

e. Allowable Soil Bearing: 3000 psf.
f. Frost depth: Bottom of footings shall be located a minimum of 2'-6" below grade unless the enclosure structure is designed to accept appropriate differential movements of the foundation.


g. Dead Load: Includes actual weight of building framing, roof and wall fabric material, rail system, fire protection sprinkler system, lighting system, electrical and mechanical equipment, and other installed items.

C. Structural Components

1. Structural Framing and Fabric Covered Roof and Wall: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the referenced standards and design criteria.

2. Provide frame clear span and spacing of frames as indicated. Slight variations in frame span and frame spacing may be acceptable if necessary to meet manufacturer’s standard.

3. Side and Endwall Framing: Provide primary side and endwall framing members fabricated for field-bolted assembly:

4. Steel Channel and Tube Frames: Fabricate frames for all wall and roof openings indicated.

5. Provide zinc-plated or cadmium-plated nuts, bolts and washers.

6. Design of the foundation for the building shall be based on the maximum frame and rail system reactions as determined and provided by the building manufacturer.
FIGURE 5  RESPONSE SPECTRA - NON-REACTOR SAFETY CLASS 2, FOR 2, 5, 7, AND 10% CRITICAL DAMPING, 0.12g
3.03 ARCHITECTURAL

A. Design Criteria: The completed building shall be complete, and result in a weathertight enclosure.

1. Overall Building Structure Tolerance: The building dimensions shall be the building manufacturer's standard nearest to the dimensions shown on the drawings.

2. The gross building area shall be within plus or minus one percent of that indicated.

3. Minimum clear heights within the building envelope, and all door and louver sizes shall be as indicated on the drawings.

4. Enclosure Penetrations: Provide shapes and sizes as indicated.
   a. Reinforce openings such as to prevent damage to the surrounding fabric from movement and vibration of penetrating building components.
   b. Provide openings with flaps to seal off openings when not in use, and boots which can be utilized to seal around penetrating building components.

5. The design of the end walls shall provide for the partial dismantling required to clear obstructions during relocation of the structure; and the adjustment necessary to accommodate the varying grade conditions at the three building positions as indicated.

6. The cladding membrane shall form a continuous, uninterrupted weathertight shell over the framework.
   a. The shell design shall incorporate a "skirt" at the perimeter of the structure as required to form a weather seal against the earth conditions.

B. Building Components:

1. Roof and Wall Cladding Membrane:
   a. Cladding Membrane: Factory-fabricated material consisting of flame and U.V. resistant, polyester, PVC shop coated on both sides, fabric. The material shall repel dirt and be waterproof.
      1) Temperature range shall be -25°F to 180°F.
      2) Exterior fabric color shall be standard white translucent fabric at the roof and blue fabric at the wall.
3) Fabricate roof and wall shell material joints between panels in a manner to form weathertight seals.

4) Coated fabric weight: 24 oz/sy minimum.

5) Basic fabric weight: 5 oz/sy minimum.

6) Grab tensile strength: 375/350 lbs.

7) Trapezoidal tear: 50/60 lbs.

8) Cold crack resistance: -40 degree F.

9) Flame resistance: 2 sec flameout based on NFPA 701 flame retardant resistance.

b. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

c. Fabric Accessories: Provide the accessories factory-formed as required to support the cladding membrane.

2. Specialty Doors:


1) Provide overhead hoist-up door of heavy duty vinyl coated fabric, attached to both sides of the intermediate beam, top beam, bottom beam with screws through aluminum batten strips.

2) Fabric: The weight to be approximately 19-22 ounces per square yard to carry 250 pounds per inch per panel, UV stabilized, to be suitable to withstand a temperature down to -38° F. Color: blue.

3) The door shall be designed to meet wind load requirements of 70 miles per hour.

4) The vertical door guides to be of extruded aluminum with weatherseals.

5) Drive unit to be designed for size of door with a hand crank for manual operation.

6) Power supply shall be 480V, 3-phase, 60 Hz. Required control voltage shall be locally transformed from 460V to 480V power supply. Transformer to be supplied with door control.
7) Provide three button control for "open", "closed" and "hold".

8) The safety arrestor for protection of cable or belt in case of breakage and protection against heavy wind uplift.

9) The header box shall be constructed of carbon steel, shop primed and coated.

10) Door frames shall be prefinished in blue color baked enamel finish.

11) Provide door windows as indicated. Material shall be a scratch resistant, transparent film. Comply with NFPA 701.

b. Flexible Strip Door: Exterior flexible strip door as manufactured by Frommelt Industries, Inc. or approved equal.

1) Provide flexible strip door with 8 inch wide full overlap strips with inside overhead door mount. Material to be of clear PVC.

3. Personnel Doors, Frames and Hardware: Hollow metal doors and hollow metal frames shall comply with SDI-100 and for hardware with ANSI A156 requirements. All metal shall be finished with factory applied paint. Color to be medium blue.

1) Door Hardware:

   a) 3 each 4 1/2" x 4 1/2" steel hinges, Type 2117, 26D satin chrome finish.

      b) Cylindrical key in knob lockset, 26D satin chrome finish.

   c) Removable core, 6 pin tumbler cylinders.

   d) Extruded aluminum threshold.

   e) Weatherstripping on four sides.

   f) Door closer, parallel arm, US 28.

4. Accessories:

   a. Rain Skirt: Provide rain skirt of the same cladding membrane material to be attached to the bottom of all walls long enough to insure protection from weather, close to the ground with portable weights as required to maintain weather seal.

   b. Repair Kit: Provide a repair kit with instructions consisting of cladding membrane and means to mend a damaged portion of the fabric should the need occur.
3.04 ELECTRICAL

A. Refer to 1.02 Related Sections, for additional requirements for the following work:

1. Branch circuiting for the lighting circuits shall be so arranged, such that loss of a single lighting circuit does not deprive an entire area of illumination.

B. Lighting: Design and install only high bay lighting and switching to provide 30 footcandles illumination at grade in the trench enclosure. The remainder of the trench enclosure lighting will be by others. The fixtures shall be 277 V, high pressure sodium with integral quartz backup lighting to provide lighting during restrike time.

1. The lighting system shall be divided into four approximately equal area zones. The zones will be controlled by four switches in a gang box at the west end of the enclosure as shown on the Drawings.

2. A 277 V feeder will be provided under Division 16 to the gang box which will be the interface point.

3. The lighting shall be circuited such that the loss of a single branch circuit shall not cause loss of lighting for the entire enclosure.

C. Lightning Protection: Design and install a lightning protection system in conjunction with the ground perimeter loop shown on the Drawings (Division 16) so that a master label can be obtained after the facility is completed.

1. The system shall be designed and installed in accordance with NFPA 780, UL 96A, and IEEE Standard 142, latest editions.

2. The system shall utilize the metal frame of the enclosure as the downcomers. Provide Burndy Type KC or equal Servit posts affixed to structure near grade, such that a 2/0 SDBC grounding pigtail (Division 16) may be attached to the structure at 50 foot intervals, both sides of structure, at no less than 14 places.

3.05 FABRICATION

A. General: Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly.

1. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged, and reassembled with a minimum amount of labor.
2. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

B. Structural Framing: Shop-fabricate framing components with base plates, bearing plates, and other plates required for erection, welded in place. Provide holes for anchoring or connections shop-drilled or punched to template dimensions.

1. Shop Connections: Provide bolted, or welded shop connections.

2. Field Connections: Provide bolted field connections.

3. Structural members shall be fabricated to referenced standards.

C. Electrical Provisions: Add provision for attachment of lightning points and required support members as indicated on Drawings.

3.06 ASSEMBLY AND ERECTION

A. Restrictions and Limitations: Refer to Specification Section 01010 for applicable restrictions and limitations for required access over the buried waste.

B. Building Erection: Erect building true to line, weathertight, level, plumb, rigid, and secure in accordance with AISC Code of Standard Practice and applicable code requirements. Level base plates and structural members to a true even plane with full bearing to supporting structures.

C. Foundation and Anchorage: Construct foundations and provide building anchorage and all other embedments required to comply with the design and specifications.

D. Roof and Wall Cladding Membrane:

1. Install cladding membrane and associated items for neat and weathertight enclosure. Avoid "fabric panel creep" or application not true to line. Protect cladding material and finishes from damage.

   a. Seal wall and roof fabric covered panels at joints as recommended by fabricator.

2. Align bottom of cladding membrane material to covered wall and attach rain skirt in a manner to keep the weather out.

E. Install standard doors with hardware and specialty doors with hardware according to manufacturers recommendation.
F. Sheet Metal Accessories: Install sheet metal accessories in accordance with manufacturer’s recommendations for positive anchorage to building and airtight mounting.

3.07 ADJUSTING AND CLEANING

A. Remove all protective wrapping material before any installation or attachments.

B. Repair or replace damaged cladding membrane material, accessories, structural members and trim to the satisfaction of the Buyer.

C. Cleaning and Touch-Up of Structural Steel: Clean component surfaces of matter; Touch up abrasions, marks, skips, or other defects to hot dip galvanized surfaces.

D. Clean and touchup paint as required doors, frames and other items necessary for the overall structure to the satisfaction to the Buyer.

4.0 DELIVERY, STORAGE AND HANDLING

A. The Seller shall be fully responsible for delivery of the frame-covered tension membrane structure to the project site. Any damages resulting from transporting the structure shall be repaired and/or replaced at Seller’s expense and to the Buyers satisfaction.

B. Mark all individual parts or bundles clearly to correspond with the marked items on the erection drawings.

C. Stack materials on platforms or pallets, covered with suitable weathertight covering. Store cladding membrane material so that weather will do no damage until ready for installation.

5.0 APPROVAL DATA AND VENDOR INFORMATION

A. The Seller shall submit the following items to the Buyer for approval prior to fabrication or upon delivery. The number of copies of each submittal shall be per Division 1.0.

1. Fabricator and installer qualifications. Submit manufacturer’s and installers statement of experience and list of completed projects which verify qualifications.

2. Engineering calculations, shop drawings and erection drawings signed and sealed by a registered professional engineer legally authorized to practice in the jurisdiction where the Project is located, verifying that the structural framing, foundation and cladding membrane meet loading requirements and referenced code requirements.
a. Structural Framing: Furnish complete erection drawings. Include details showing fabrication and assembly of the building system and complete foundation details.

b. Foundation: Furnish complete foundation detail drawings.

c. Cladding Membrane: Provide layouts of panels on walls and roofs, details of edge conditions, joints, corners, custom profiles, penetration supports, anchorages, trim, closures, and special details.

d. Building Accessory Components: Provide details of building accessory components to clearly indicate methods of installation including the following:

1) Provide details for supplemental framing and closures, and details for the rail and movement system.

2) Indicate preparations made and installation details that include size, length and location of anchor bolts where applicable for building enclosure components, and door frame installation herein specified.

3. Lighting calculations and power requirements (amps or volt amps at 277V).

4. Lighting and lightning protection materials and details.

B. Submit the following for information/record:

1. Product data consisting of frame-covered tension membrane structure product information, building components and accessories.

2. A full set of shop detail drawings for the building framing. Welding and bolting of built-up members shall be shown on the shop drawings.

3. An erection plan showing the sequence and methods to be utilized in the erection of the Trench Enclosure Building including proposed required access on top of the waste storage area.

4. Certification: The Seller shall submit a certified statement that all roof and wall fabric covered panels, structural framing and foundation have been installed in strict accordance with the approved erection documents.

6.0 INSPECTION

A. During the performance execution of this Project the Buyer will perform surveillance to verify compliance of the work to the drawings and specifications.
7.0 WARRANTY

A. Roof and Wall Fabric Enclosure Warranty: Furnish the roof and wall enclosure manufacturer’s written warranty, covering failure of the cladding membrane material attached to metal structure for wall and roof coverage within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Buyer may have against the Seller under the Contract Documents.

B. The cladding fabric material shall carry a minimum five year manufacturer’s warranty.

C. The structure shall be designed to provide a minimum 20 year operational use period, which shall include, if necessary, one installation/disassembly cycle per year with appropriate inspection and maintenance.

END OF SECTION
SECTION 13123

GENERAL OFFICE AND RETRIEVAL STAFF CHANGE BUILDINGS

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SECTION 13123
GENERAL OFFICE AND RETRIEVAL STAFF CHANGE BUILDINGS

1.0 STATEMENT OF WORK

A. This Section includes the design, construction, shipment and erection of two one-story, plant fabricated modular, mobile buildings with all specified utilities. Each building consists of double-wide modules, siteassembled, each of the nominal length, width, inside clear height, and roof pitch as indicated on the Contract Drawings and specified herein.

1.01 SCOPE

A. General: Engineer, design and fabricate two modular building structures to physical dimensions shown on drawings and to withstand loads from winds, gravity, earthquake, and to resist in-service use conditions, without failure.

1. Floor building area for the General Office Building and for the Retrieval Staff Change Building is approximately 2,240 square feet for each.

2. Engineered design for the buildings includes foundation, structural framing for the building shell, framing of interior partitions and wall and roof openings, and design of HVAC, plumbing and electrical/telecommunications utility systems that include necessary equipment, fixtures and distribution systems.

3. Furnish all components necessary to provide complete and weathertight buildings:

   a. Interior partitions with prefinished wall paneling, roof covering, supplemental structural framing and bracing members, ceiling, finishes, personnel doors, trim, flashings, gaskets, and fasteners.

   b. Provide built-in furnishings, built-in kitchen appliances, lockers, shelving and toilet accessories where indicated on drawings.

4. The plant fabricated modular units shall include all HVAC, plumbing, and electrical systems ready for connection below the floor to the utility lines at the Project site.

   a. Provide distribution conduits, wiring, and terminal outlets for telephone and data systems as indicated on the drawings.
5. Supply metal siding material as indicated on the drawings, to be installed for wind screens on entry stairs.

6. Work by Seller includes, but is not limited to the following:
   a. Design and construction of concrete pier foundation and lateral restraint supports. Provide all required anchor bolts and accessories required to securely anchor building.
   b. Supply of complete drawings and recommended instructions for the erection of the modular buildings and hook-up of utility lines.
   c. On-site erection and leveling of plant fabricated, modular building; joining of the modular units of the prefabricated building with complete closure at marriage line on floor, roof and walls; anchorage to the concrete pier foundations or other lateral restraints as recommended by the building fabricator; installation of interior finishes across marriage lines and perimeter foundation skirting.

B. Related work which is not a part of this Section includes:
   1. Site preparation.
   2. Providing of site utilities and all utility connections and hook ups to a single point of connection.
   4. Modular work station, and other movable furnishings indicated on the drawings as Not In Contract (NIC).
   5. Installation of telecommunication equipment and Personnel Contamination Monitor System (PCM).

2.0 APPLICABLE CODES AND DOCUMENTS

A. American Concrete Institute (ACI)
   1. ACI 318-89 Building Code Requirements for Reinforced Concrete.

B. American National Standards Institute (ANSI)
   1. I.S.1-87 Wood Flush Doors

3. A156.1-88 Butts & Hinges.

4. A156.4-86 Door Controls - Closers.

5. A156.6-86 Architectural Door Trim.

6. A156.13-87 Mortise Locks and Latches.

C. Air Conditioning and Refrigeration Institute (ARI):


D. American Society of Civil Engineers (ASCE)


E. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)


2. 1989 ASHRAE Handbook HVAC Applications (with 1992 editions)


4. 90A-80 Energy Standards.

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


2. A 82-90 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

4. A 185-90a Welded Wire Fabric, Plain, for Concrete Reinforcement.

6. A 463-88  Standard Specification for Steel Sheet, Cold-Rolled, Aluminum-Coated, Type 1 and Type 2

7. A 615-90  Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

8. C 33-90  Concrete Aggregates


10. C 150-92  Portland Cement

11. C 207-84  Specification for Hydrated Lime for Masonry Purposes

12. C 260-86  Air-Entraining Admixtures for Concrete


18. D 2661-89  ABS DWV Pipe and Fittings.


21. E 1264-90  Standard Classification for Acoustical Ceiling Products

G. American Water Works Association (AWWA)

1. C 651-86  Disinfecting Water Mains.

H. American Welding Society Inc. (AWS)

1. AWS D1.1-92  Structural Welding Code
I. Code of Federal Regulations (CFR)

1. 10 CFR 435 Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings

J. Federal Specifications (FS)

2. QQ-W-461H Steel Wire, Carbon for General Use, 11988.
3. L-F-475A Floor Covering Vinyl, Surface (Tile and Roll), with Backing, 1985.


1. 90 B-89 Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

M. Occupational Safety and Health Administration (OSHA).

N. Steel Door Institute (SDI)

1. 100-85 Recommended Specifications, Standard Steel Doors and Frames.

O. Sheet Metal and Air Conditioning Contractors National Association Inc (SMACNA).


1. WAC Chapter 51-11 Heating, Ventilation and Air Conditioning
2. WAC Chapter 296-150A Rules and Regulations for Factory
Built Housing and Commercial Structures and Governor’s
Advisory Board Administrative Rules.

3.0 REQUIREMENTS

A. Design and Fabrication: The plant fabricated, modular
mobile buildings shall be designed and fabricated in
conformance with the best industry practice; and shall meet the
latest requirements of the Washington State energy rules, and
WAC Chapter 296-150A except provisions pertaining to
accessibility for the disabled.

B. Manufacturers: To provide procurement references under
this specification, and subject to compliance with the
requirements specified herein, the following list of
manufacturers is identified. Procurement will not be limited to
these listed manufacturers.

1. Evergreen Mobile Co.
2. Redsal Mobile Offices
3. Modern Building Systems
4. Pacific Mobile Structures

C. Manufacturer Qualifications: Engage a plant fabricated
modular, mobile building fabricator who has a minimum of five
years experience in the fabrication and installation of types
of mobile building systems similar to that required for this
project and who is certified to comply with the Washington
State rules and regulations for factory built housing and
commercial structures and Governor’s Advisory Board
administrative rules and as specified.

3.01 GENERAL REQUIREMENTS

A. Modular Design: Buildings shall be designed for placement
of the completed modules on concrete foundation piers, joining
of the modules, anchorage to the concrete piers, and metal
panel perimeter skirting.

1. The concrete pier building foundation shall be designed
and constructed for the support and anchorage of the plant
fabricated modular, mobile buildings.

2. Each building shall be designed and fabricated in either
two or four (optional) modules to facilitate transport

3. Design components and necessary field connections to
permit easy assembly and minimize required on-site work.
4. Building components include, but are not limited to trim, flashing, gutters and downspouts, doors and windows, interior partitions and finishes, and such fixtures and built-in furnishings as herein specified and indicated on the drawings.

5. Additional exterior wall panels with required trim and fasteners shall be furnished for the construction of a wind screen to be located at the stair landings as indicated on drawings.

3.02 STRUCTURAL

A. Design Loads: The building shall be designed for the following applied loads and combinations of loads in accordance with UCRL-15910:

1. Seismic:
   a. UBC seismic Zone 2B, seismic importance Factor I = 1.25.

2. Wind 70 mph, exposure "C", importance Factor I: 1.07 (per ASCE 7-93).

3. Minimum Roof Live Load: 20 psf

4. Ground snow load: 15 psf

5. Floor Load: Dead load plus 50 psf uniform live load with a 2000 lb concentrated load in a 2 1/2 ft square area located to produce maximum bending and shear in supporting members.

6. Live load deflection:
   a. Roof: L/180
   b. Sidewall: L/180
   c. Floor: L/240

7. Other loads: Ductwork, piping, electrical system

8. Allowable soil bearing: 3000 psf at bottom of footings

9. Frost depth: Bottom of footings shall be located a minimum of 2'-6" below grade.
10. **Dead Load**: Includes actual weight of building framing, roofing, siding, floor and interior wall system, electrical and mechanical equipment and other permanently installed items.

11. **Structural Framing for Floor, Roof and Walls**: Design and fabricate primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the rules and regulations for factory built housing and commercial structures and Governor’s Advisory Board administrative rules based on U.S. Federal and State of Washington codes and as specified.

   a. All welding shall be in accordance with AWS D1.1.

**B. Concrete:**

1. Cement: ASTM C 150, Type I or II.

2. Concrete Aggregate: ASTM C 33, size to comply with ACI 318

3. Air-Entraining Admixture: ASTM C260, use per manufacturer’s recommendations.

4. Reinforcing: ASTM A 615, grade 60.

5. 28 day compressive strength: 3000 psi.

**3.03 ARCHITECTURAL**

**A. Design Criteria:**

1. **Overall Building Shell Tolerance**: The building dimensions shall be the building manufacturer’s nearest standard to the dimensions shown on the Drawing.

   a. The gross building area shall be within plus or minus 1 percent of that indicated.

   b. The roof slope shall slope to provide positive drainage.

2. Roof system shall meet the Class A ICBO UBC requirements.

3. Building shall be weathertight.

4. Building shall be insulated to meet referenced energy requirements.
5. Finished ceiling height to be 95 inches. The mechanical duct systems shall be located above the ceiling and placed through the truss system.

6. The structural frame for each building module shall have a bolt-on hitch assembly with springs and axles. Seller shall remove the tires and wheels from the mobile unit and transport off site. The hitch shall be removed and stored under the unit.

7. Joint sealant shall be as recommended by the building manufacturer.

B. Masonry: Design and construct plumb and true to line cast-in-place concrete footings with concrete masonry block piers. Concrete footings for piers shall follow the referenced concrete criteria. The masonry block piers shall be designed for full mortar coverage of 8 inch x 16 inch x 8 inch concrete masonry units.

1. The medium-weight hollow load bearing units shall comply with ASTM C90 Grade N, Type I requirements. Minimum compressive strength shall be 800 psi.

2. Wire reinforcement for cold-drawn steel wire shall comply with ASTM A 82; welded steel wire fabric shall meet ASTM A 185 and billet steel deformed bars shall follow ASTM A 615, No. 3 bars grade 40 and No. 4 bars and larger grade 60.

3. Cementitious material shall comply with ASTM C 270 Type M for mortar to develop a strength of 2,500 psi and with ASTM C 476 for grout; ASTM C 150 for portland cement Type I, II, or III; ASTM C 404 for aggregates, ASTM C 207 for hydrated lime, Type S; and clean and potable water to develop a strength of 2000 psi minimum. Slump test shall be 10 inches plus or minus one inch.

C. Floor System:

1. Rim Joist shall be 2 inch by 8 inch minimum continuous, kiln dried, number 2 or better, HEM/FIR. Double rim joists are required at marriage lines.

2. Floor joists shall be 2 inch by 8 inch minimum at 16 inch on center, kiln dried, number 2 or better, HEM/FIR. Double floor joists shall be placed at shear wall locations.

3. Bottom sealer material shall be of a weather and rodent proof material secured to the bottom edge of the joists with a Class A fire rating.
4. Penetrations shall be caulked to provide a complete weatherseal.

5. Insulation shall be of R-19, foil backed, with UL listed "flame spread" and "fuel contributed" rating of 25 or less and "smoke developed" rating of 50 or less. Insulation blankets shall be mineral fiber batts meeting the FS HH-I-521F requirements.

6. The floor decking shall be 3/4 inch C-D T&G structural interior grade Douglas fir plywood subfloor with 7/16 inch overlay interior grade waferboard. Plywood shall be glued to the floor system with the grain perpendicular to the framing. Waferboard shall be installed perpendicular to the plywood. Both plywood and waferboard shall be fastened to comply with the UBC, Chapter 25 requirements.

7. Floor Covering Material:
   a. Resilient Flooring: Sheet vinyl shall be of the type "Fields" as manufactured by Mannington or approved equal.
      1) Comply with FS L-F-475A, Type II, Grade A.
      2) Critical Radiant Flux not less than 0.45 Watts per square centimeter per NFPA 253 test.
      3) Color: No. 10128 "Stone Gray" or approved substitute.
      4) Size: 6 ft wide sheet vinyl by 0.089 inch thick.
      5) Location: As indicated on Drawings.
      6) Sheet Vinyl Adhesive: Provide the type and brands of adhesives as recommended by the manufacturer of the floor covering materials for installation.
   b. Base: Provide rubber wall base 4 inch high, 1/8 inch thick with matching end stops and preformed or molded corner units conforming to FS SS-W-40A, Type I, by VPI Series 700, Color No. 774, Papyrus or approved substitute. Location of the standard top-set cove shall be at all resilient flooring and the straight back base at carpeted areas.
   c. Edging: Provide rubber or vinyl floor reducer strip with thickness to suit abutting floor covering material. Location shall be where carpeting abuts resilient flooring.
d. Joint Cover: Provide joint floor cover with expansion insert, 1/8 inch maximum height with eased edges. Location shall be at the marriage line where the modular units will be joined together, like at the lunchroom/conference and hallway.

e. Carpet: Carpet shall be of the type Dearborn, Class I, as manufactured by Atlas Carpet Mills Inc., or approved equal.

1) Construction: Loop pile.

2) Pile Yarn and Gauge: Nylon, soil and stain resistant; gauge 1/10 inch.

3) Carpet Width: 12 foot minimum.

4) Pile Height: 0.218 inch.

5) Pile Weight: 28 ounces per yard.

6) Total Weight: 60 ounces per yard minimum.

7) Primary Backing: Woven polypropylene.

8) Secondary Backing: Engineered for direct glue down.

9) Critical Radiant Flux: Not less than 0.45 Watts per square centimeter per NFPA 253.

10) Static Control: Permanent static control.

11) Color: No. 9421, Grey Haven or approved substitute.

12) Location: Refer to Drawings for location.

13) Carpet Adhesive: Vinyl or latex base as recommended by carpet manufacturer.

   a) Seam Cement: Vinyl or latex base compatible with carpet backing.

   b) Contact Cement: Fast dry bond without heat or clamps.

f. Accessory Materials: Furnish a carpet edge guard at exterior doorways as manufactured by Roberts "Universal Molding System" with metal floor shoe for nailing or approved equal.

g. The carpet and installation shall be warranted for a minimum of five years.
D. Wall System:

1. Bottom plate and wall studs shall be of 2 inch by 6 inch for exterior walls and 2 inch by 4 inch for interior walls of continuous kiln dried HEM/FIR, grade number 2 or better. Studs for exterior and interior walls shall be 16 inch on center with double studs and double headers at openings.

2. Top plate shall be double, continuous, kiln dried HEM/FIR, grade number 2 or better.

3. The exterior wall insulation shall be Type IIII mineral fiber batts meeting R-19 thermal resistance and FS HH-I-521F requirements without a vapor barrier. Insulation shall be UL listed with "flame spread" and "fuel contributed" rating of 25, and "smoke developed" rating of 50 or less.

4. Sound attenuation blankets shall be provided in all interior walls to meet sound transmission class STC 50 requirements and a "flame spread" rating of 25 or less, and "smoke developed" rating of 50 or less.

5. Sheathing shall be of 3/8 inch (minimum) exterior grade plywood or 7/16 (minimum) inch wafferboard. Sheathing to be installed vertically and attached as per UBC, Chapter 25.

6. Exterior metal siding, type MVW, shall be by Ceco Building Systems or approved equal. The panel shall be of 0.0217 inch minimum (26 gauge) vertical galvanized steel siding, 36 inch wide, ribs at 12 inches on center with required trim and closures and with baked on enamel finish, corrugated to give the appearance of a reverse board and batten installation. The color shall be of standard white.

   a. Exterior siding shall be held back from the marriage line as required to allow for connection of the modular units on the Project site. Provide marriage line closure panels and trim to match the adjacent wall panel siding.

7. Exterior skirting shall be of the same material that will be used for exterior wall siding, installed on a supporting wood frame, consisting of 2 inch by 4 inch wood studs insulated to meet R-8 minimum requirements. The bottom rail shall be of cedar, redwood or pressure treated lumber. Studs shall be 24 inch on center.

   a. Access doors set into the exterior perimeter skirting shall be a minimum of 3 ft wide by 2 ft high, material shall match exterior wall siding material installed over 3/8 inch exterior plywood. Hardware to include hinges and hasp-type latch. Location of one of the access doors shall line up with the water supply connection.
8. Interior Wall Finish: Provide 5/8 inch vinyl covered gypsum board, Vinyl Durasan as manufactured by Gold Bond Building Products or approved equal. Gypsum board joints shall be covered with an "H" mold joint. Interior gypsum wall board shall be held approximately 12 inch back from the marriage line for field installation.

   a. Color: Light buff with orange peel texture.

   b. Flame spread rating: Vinyl shall meet Class A to comply with ASTM E 84.

9. Wall Corner Guard: Provide a 3 inch by 3 inch by 5 foot high rigid vinyl corner guard, that will match the vinyl covered gypsum wall board, to be located at all exposed corners as manufactured by Pawling Corp, Standard Products Division, type CG-101 or approved equal.

10. Additional Material: Furnish additional vinyl covered gypsum wall board, rigid vinyl wall guards and trim where required for use at the marriage line for field installation.

E. Roof System:

1. The roof structures shall be designed and engineered to comply with the UBC, referenced standards, and the design criteria. The roof shall slope a minimum of 1/2 inch per foot. The roof trusses shall be supported by either interior partitioned walls or by wood support columns in compliance with structural requirements. Clear unsupported spans of the roof truss shall not exceed 33 feet in open office areas. Roof sheathing shall be 5/8" (minimum) plywood, EXT, APA C-C, plugged.

2. Single Ply Membrane Roofing: The roof shall consist of single-ply elastomeric membrane roofing, be of UL listed material, provide a Class A fire rating and be in compliance with the ICBO UBC requirements. The entire roofing system shall be warranted for a minimum of 10 years.

3. Roof Insulation: The roof shall be insulated to meet R-30 requirements. Provide Type III mineral foil backed insulation blankets to meet the ASTM C 665 requirements and to comply with FS HH-I-521F requirements. Insulation shall be UL listed with "flame spread" and "fuel contributed" rating of 25 or less, and smoke developed rating of 50 or less.

4. Roof Vent Boots: Provide vent boots compatible with selected roofing system.

5. Additional Material: Furnish additional matching roofing materials for field installation of marriage line closure.
F. Doors: All doors shall be provided by one manufacturer, Fenestra Corporation or approved equal. Size and location shall be as indicated on the drawings.

1. Exterior Doors: Provide prefinished, prehung, flush, 1 3/4 inch insulated Grade I, standard duty, hollow metal doors in accordance with ANSI A115 Series, and SDI 100 and 108, with 18 gauge hollow metal frames. Single door size shall be 36 inch by 80 inch and double door shall be two 36 inch by 80 inch doors. One leaf of the double door shall be secured and without a view lite or exterior hardware.

   a. Commercial grade hardware for exterior doors shall include an entrance lock set, aluminum threshold, door closer, kick down holder, weatherstripping, and door sweep.

   b. Provide a view lite for each door leaf, 5 inch by 20 inch glazing shall be tempered glass.

   c. Door and door frame shall receive two coats of alkyd gloss enamel. Color shall be medium blue.

2. Interior Doors: Provide prefinished, prehung, flush, 1 3/4 inch solid core doors meeting the requirements of ANSI I.S. 1-87, for the doors leading to the restrooms and changerooms, all other doors shall be of 1 3/4 inch hollow core with high density overlay. Provide 18 gauge hollow metal frames for all doors. Single door size shall be 36 inch by 80 inch.

   a. Commercial grade hardware for interior doors shall include push and pull (toilet rooms) or lock sets and door stops unless otherwise indicated.

   b. Doors at the restrooms, changerooms, janitor's closets and telecommunication rooms shall be provided with louvers.

   c. Provide dutch door with shelf where indicated on the drawings.

   d. All doors and frames shall receive two coats of alkyd gloss enamel. Color shall be beige.

   e. Provide view lite of 5 inch by 20 inch for the doors to the Turn-Around Office, Manager's Office/Alarm and Display Area, the door between the Open Office Area and the Hall. Glazing shall be clear, tempered.
3. Hardware:

a. Door Hinges: ANSI A156.1, ball bearing with nonremovable pins on exterior doors by Stanley or approved equal.

b. Locksets and Trim: ANSI A156.13, Series 1000, Grade 1, mortise locks by Corbin Lock Co. or approved equal, with doorknob lockset trim.

c. Lock Cylinders: Furnish removable core, 6 pin tumbler cylinders with Schlage Rhodes D53PD-RHO-C-626 keyway, "0" bitted, 626 finish or approved equal for all exterior and interior doors to the Turn-Around Office, Manager's Office/Alarm and Display Area, WRAM Office, RC Office, Counting Room, Mech/Elec Rooms and Janitor's Closet. Provide two blank keys for each lock cylinder.

d. Door Closers: ANSI A156.4, Grade 1, surface mounted closers with cover, by Corbin or approved equal at exterior doors, restrooms, hallway access into open office area and changerooms.

e. Push/Pull Hardware: Provide push plate and pull trim meeting requirements of ANSI A156.6, 630 finish, for the restroom and changeroom doors.

f. Splash guards: 24 inch high, stainless steel, 0.050" thick. Provide on two walls above each mop sink.

g. Kick Plates: ANSI A156.6, door width minus two inch wide by 12 inch high, 16 gauge stainless steel kickplates, 630 finish, by Builders Brass Works (BBW) or approved equal for restroom, changeroom and exterior doors, both sides.

h. Gasketing and Seals: Provide extruded aluminum, adjustable weatherstripping with solid neoprene seal and internal seal by Pemko or approved equal for all exterior doors.

j. Miscellaneous: Provide door stops for all exterior and interior doors.

i. Provide astragal for double door.
G. Aluminum Fixed Sash Windows: Prefinished extruded aluminum alloy window frames, with thermal break and insulated glass. Frosted glazing shall be provided for the windows at the change rooms and restrooms.

1. Glazing: Double glazed with 1/4 inch clear float glass at the inside and 1/4 inch tinted solar bronze on the exterior lite, except at restrooms and changerooms it shall be 1/4 inch frosted on the inside.

2. Size and Location: As indicated on Drawings.

H. Window Blinds: Provide sill length horizontal, metal, 1 inch, window blinds by Levolor or approved equal. Color shall be off-white.

I. Suspended Ceiling System:

1. Provide exposed tee-bar grid system with lay-in 2 foot by 4 foot ceilings panels.

   a. Exposed Ceiling Suspension System: Wire suspended metal tee-bar grid system of intermediate duty, 500 Snap Grid System, by Chicago Metallic Grid System or approved equal shall be installed 95 inches above the floor not to exceed maximum deflection of 1/360 of the span.

      1) Wire hangers shall be minimum 12 gauge galvanized steel wire conforming to FS QQ-W-461H Finish 5, Class 1 annealed.

      b. Acoustical Ceiling Tile: Panels shall be minimum 5/8 inch thick, 2 ft wide by 4 ft long, white, mineral fiberboard panels, fissured Minaboard as manufactured by Armstrong World Industries, Inc. or approved equal.

         1) Class A per ASTM E 1264, flame spread 25 or less, US labeled, and smoke development of 10 when tested according to ASTM E 84. Minimum noise reduction coefficient shall be .55 - .65 and minimum light reflectance shall be .80.

      c. Water-Resistant Ceiling Tile: Panels shall be minimum 5/8 inch thick, 2 ft wide by 4 ft long. Provide acoustical ceiling tile with plastic coating, as manufactured by Armstrong World Industries, Inc. or approved equal for Women’s Changeroom, Men’s Changeroom, Anti-C’s Change Area and adjacent Hall, Men’s Restroom, Women’s Restroom and Janitor’s Closets.
2. The factory installed suspended ceiling system shall be self-supporting and continuous for the full width of each prefabricated module, thus allowing for easy disassembly of the modules at the marriage lines without disrupting the integrity of the ceiling system.

J. Casework and Shelving:

1. Kitchen Cabinets and Countertops: Cabinets shall be custom grade, flush overlay construction per Architectural Woodwork Institute, with high pressure plastic laminate finish on all exposed surfaces. Color shall be light beige or off-white. Counter shall have 4 inch wall backsplash and 1/2 inch front nosing. Provide an additional 18 inch deep by 42 inch long counter, installed 6 inches off the countertop centered on the 42 inch high wall as indicated on the drawing.

a. Cabinet Bases: Base units shall be 24 inch deep by 36 inch high. The sink base unit shall be provided with a stainless steel, single compartment kitchen type sink. Base units shall have adjustable shelves and one set of four drawers minimum, in addition one drawer shall be located above each door.

1) Provide and install standard 30 inch electric slide-in range oven, white color, Model No. JDP37GL as manufactured by General Electric or approved equal. Provide a white range hood with light, fan and permanent washable filter that will vent to the exterior. Incorporate a cut-out in the base cabinet for the clearance appliance. Location as indicated on Drawing.

b. Wall Hung Cabinets: Provide 12 inches deep by 30 inches high wall hung units. The wall hung cabinets shall receive adjustable shelves. Install wall hung units above counter and range for full length. Provide a finished soffit above the wall hung cabinets.

c. Casework Hardware: Cabinet hardware shall be by Knape and Vogt Manufacturing Co. or approved equal. Drawer slides shall be rated for 60 lb, KV No. 1455 or equal. Doors shall have self-closing hinges, pull hardware and felt pad silencers, support for adjustable shelving and brackets as required.

2. Restroom and Changeroom Counter Tops: Provide plastic laminate counter tops with 4 inch backsplash at walls, and 6 inch skirt, size as required for oval vanity sinks. Location as shown on drawing. The color shall be light beige.

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3. Wall Hung Shelving with Brackets: Provide wall bracket mounted adjustable shelving, 18 inches deep, covered with high pressure plastic laminate finish on all exposed surfaces, color shall be off white.

   a. Provide shelves to support microwave oven, adjustable from a minimum of 12 inches to a maximum of 24 inch height, located in the Kitchen as shown on drawing.

   b. Provide four each shelves at 18 inch on center spacing for the Janitor room and Mech/Elec Room as indicated on drawings.

K. Lockers: Provide and install securely, in accordance with manufacturer’s recommendations, 12 inch wide by 15 inch deep by 72 inch high prefinished steel lockers with a 6 inch continuous base, with doors, and sloped tops as manufactured by Republic Storage Systems Company, Inc. or approved equal. Location of lockers as shown on Drawings. Include the following items:

   1. Number plates on doors and hardware trim handle to receive padlock.

   2. One double prong hook at top and 1 single prong hook on back and on each side for each locker.

   3. One hat shelf for each locker.

   4. Side trim to cover gaps at each side of locker bank.

   5. Color shall be beige.

L. Metal Toilet Partitions, Privacy Screens, Shower Units and Shower Partitions:

   1. Provide and install in accordance with manufacturer’s instructions, floor mounted, baked enamel finished, toilet partitions, wall/floor mounted privacy screens, and shower partitions as manufactured by General Partitions Manufacturing Corporation or approved equal. Color shall be beige.

      a. Hardware and trim shall be stainless steel or chromium plated brass.

      b. Provide one combination hook/bumper on inside of each toilet partition door.
c. Provide shower unit, one-piece, 36 inches by 36 inches, seamless acrylic with integral high-dome ceiling, Model No. K-1566 Sonata and shower door, Model No. K-9848-B in Nevada Silver (SV) frame by Kohler or approved equal.

1) Provide a finished soffit above the shower dome ceiling.

2) Provide shower dressing partitions with bench and curtain for the Women’s Changeroom as indicated on drawings.

d. Location as indicated on drawings.

M. Toilet and Bath Accessories: Provide and install in accordance with manufacturer’s recommendations the following accessories as manufactured by Bobrick Washroom Equipment, Inc. or approved equal:

1. Toilet Seat Cover Dispenser: Surface mounted, one per water closet, Model No. B221.

2. Mirror: 60 inch by 36 inch for the General Office and 84 inch by 36 inch, frameless, by other than Bobrick Washroom Equipment, Inc. shall be located above each vanity counter as indicated on Drawings.

3. Sanitary Napkin/Tampon Dispenser: Surface mounted, non-coin operable, Model No. B282, shall be located one in Women’s Restroom and one in Women’s Changeroom.


5. Hand Dryer: Surface mounted, touch button operation, white color, Model No. B709, one for each changeroom and one for each restroom.

6. Paper Towel Dispenser and Receptacle: Surface mounted, paper towel dispenser Model No. B262 and surface mounted waste receptacle Model No. B279, one for each change room and for each restroom.

7. Toilet Tissue Dispenser: Surface mounted, multi-roll, Model No. B288, one for each water closet.

8. Mop and Broom Holder Rack: Surface mounted, Model No. B223 by 36 inches long, one for each janitor’s mop sink.
9. Liquid Soap Dispenser: Surface mounted, plastic type refillable container, wall hung, secured in place with double faced mounting tape furnished by Georgia Pacific or approved equal. Location as shown on drawings.

N. Telecommunication Backboard: Provide and secure 24 inches above the floor 3/4 inch fire retardant plywood sheet, width as shown on drawing by 4 foot high, at the locations indicated on the drawings.

O. Accessories:

1. Gutters and Downspouts: Overhead rain gutters shall be installed above each exterior door to protect the landing platform area. Provide sections, complete with end pieces and other special items as required. Gutter size shall be of 4 inch width. Finish to match white color of metal wall panels.
   a. Minimum 24 gauge.
   b. Caulk between gutter and siding with clear silicon caulking.

2. Downspouts: Form in sections, complete with elbows and offsets. Finish to match white color of metal wall panels.
   a. Minimum 24 gauge.

P. Signs:

1. Interior room title signs shall be of acrylic plastic or laminated plastic engraving stock 1/8 inch thick, style Helvetica medium, 2 inch wide by length as required for 1 inch high letters. Letters shall be engraved minimum 1/16 inch. Color of letters shall be black on white background. Sign legend shall be as follows: MEN, WOMEN, MECH/ELEC ROOM, TELECOM ROOM, JANITOR, ELEC ROOM. Provide one sign for each room.

2. Exterior building identification signs shall be as required for 5 inch high letters, style Helvetica bold, material as above except for size. Text: XX-XXX with the digits identified later upon award of contract. Color black lettering on white background. Provide two sets for each building, one shall be located at each entry/exit where indicated on drawings.

3. Vinyl adhesive lettering for HVAC unit, 3 inch high, with Helvetica bold type. Text "HVAC 1" and "HVAC 2", black lettering.
Q. Window Sill: Provide wood window sills, covered with high pressure plastic laminate finish on all exposed surfaces. Color be light beige.

3.04 MECHANICAL

A. Heating, Ventilating and Air Conditioning

1. Design Criteria:

   a. The HVAC system shall meet the requirements of NFPA 90B and the latest requirements of WAC 51-11 and the Uniform Mechanical Code. The General Office Building and Retrieval Staff Change Facility shall each be provided with two heat pump HVAC units (one per module) each. These HVAC units shall be capable of maintaining 78°F dry bulb (db) in the summer and 72°F db in the winter based on ambient conditions of 98°F db summer and 12°F db winter. Both buildings shall comply with ASHRAE 62-1989 as follows: each building shall have an occupancy of approximately 30 people, provide 20 CFM outside air per person, minimum outside air setting shall be 300 CFM per HVAC unit. HVAC units shall incorporate an economizer cycle to provide cooling using outside air during mild weather.

2. System Description:

   a. The heat pump units shall be wall-mounted units designed for use on portable modular facilities as manufactured by Bard Manufacturing Co. or equal. The heat pump shall use scroll compressors for increased efficiency, improved reliability, longer life and quieter operation than provided by reciprocating compressors. System shall use HCFC-22 or HFC-134a refrigerant. Each unit shall be rated at 4 tons (nominal) cooling capacity at ARI Standard 210/240-89 conditions with not less than 9 KW (208V rating) electric heating coil capacity. Indoor fan shall be rated for not less than 1500 CFM at 0.3" external static pressure E.S.P. Units shall include factory installed integral economizer package complete with controls. The outside air damper on the economizer shall close automatically when the unit is not in use. The heat pump units shall be 208V, three phase, requiring a single circuit feed. Provide an outside weatherproof switch for each unit in an accessible location no higher than six feet above grade. All internal power and control wiring shall be factory installed. Provide a 120 V weatherproof capped plug-in outlet adjacent to each heat pump unit for maintenance use. Thermostats shall be an electronic programmable type having automatic and constant fan operation for heating and cooling, automatic heating-cooling changeover and night setback. All thermostats shall be of the same design and...
b. Each building shall be served by a ceiling mounted exhaust fan. Exhaust fan operation shall be interlocked to run when the heat pump indoor fans are running. Exhaust fans shall be Penn Ventilator Co., direct drive Zephyr Model with integral backdraft damper or approved substitute. Fans shall have an electronic speed controller mounted at the fan for system balancing. A wall cap or louver with bird screen shall be provided for the exhaust discharge. Fan capacity shall be not less than 600 CFM at 0.375" static pressure (S.P.).

c. The supply and return air system for each heat pump unit shall be designed to not impose more than 0.3" static pressure external to the unit, ducts shall be installed above the ceiling space, supply duct shall be fiberglass insulated with an adequate number of supply registers or diffusers for proper air distribution and to minimize HVAC noise. Air return registers shall be installed in the ceiling, except in the Kitchen and Lunch/Conference Room where sidewall registers may be considered to reduce the overhead duct size. The exhaust air systems shall be designed to not require a fan capacity exceeding 0.375" static pressure. Duct systems shall contain volume dampers to allow air distribution balancing.

3. Calculations:

a. Heating and cooling load calculations in compliance with WAC 51-11, shall be performed to verify specified capacities are adequate.

b. Perform duct sizing calculations in accordance with ASHRAE or SMACNA methods to verify system resistance does not exceed specified values.

4. Drawings:

a. Provide duct layout drawings, indicating duct sizes, damper locations, register and diffuser sizes and design air volumes at each outlet and inlet. Include equipment schedules and a sequence of operation on the drawings and show thermostat locations.
5. Specifications and Product Data:
   a. Provide equipment manufacturer’s performance data, installation instructions, operation and maintenance data including complete wiring diagrams. Where manufacturer’s literature covers more than one size or model clearly mark the equipment furnished for this project.

6. Testing and Balancing:
   a. Air volumes shall be measured and adjusted to ± 10% of design flow rates at each inlet and outlet.

B. Plumbing Systems
   1. General:
      a. The building fabricator shall design and submit complete drawings, diagrams, brochures and other descriptive material as necessary to define the plumbing system to be furnished hereunder.
      b. The fabricator shall furnish, deliver and install all material and work required for complete and operational plumbing systems to a point of interface with site utilities in the building crawl space.
      c. All plumbing systems shall be designed and installed in compliance with the 1994 edition of the Uniform Plumbing Code. Facilities for the physically handicapped shall not be required for the general office and retrieval staff change facility.
   2. Sanitary Drainage System:
      a. The sanitary drainage system serving the toilet rooms, change rooms, kitchen, janitor’s closet, etc. shall flow by gravity to the point of interface with the site sanitary sewer in the building crawl space. All fixtures shall be trapped and vented as required by the Uniform Plumbing Code.
      b. The sanitary waste and vent piping shall consist of ABS (Acrylonitrile-Butadiene-Styrene) DWV (Plastic Fitting Patterns) pipe and fittings joined by solvent cement conforming to ASTM D-2661 and D-3311.
      c. Provide cleanouts at end of runs and at changes of direction for piping run below building in crawl space.
d. The sanitary drainage piping shall cross the building marriage line at only one point, at this point provide a Fernco Series 1056 flexible coupling, or approved equal.

3. Potable Water System:

   a. Potable water will be supplied from the site sanitary water system point of interface in the building crawl space. The site sanitary water pressure is 120 P.S.I.G. provide a water pressure regulating station for each building, locate in the janitor’s closet or mechanical equipment room.

   b. Provide potable water to all fixtures and equipment requiring potable water. The system shall be sized to supply the maximum peak gpm requirement with a minimum of 30 psi residual pressure. Maximum system pressure shall be 70 psi. Backflow preventers or vacuum breakers shall be used where required to protect the potable water system from cross connection and contamination. Stop valves shall be provided at all fixtures. Isolation shutoff valves shall be provided on branch lines and for groups of fixtures.

   c. The potable water piping shall be Type "L" copper tubing with cast bronze or wrought copper solder type fittings. Solder shall be 95:5 (tin:antimony). Lead solder shall not be used.

   d. Potable hot water shall be generated by electric storage water heaters. The Retrieval Staff Change Building shall have three 120 gallon, 12 KW water heaters. ASME construction with balanced flow manifolds. The General Office Building shall have one 40 gallon, 4.5 KW water heater. All heaters shall meet ASHRAE 90A energy standards. Secure heaters to floor and to wall at top of heater for transport. Water heaters shall be set at 140°F. Provide 140°F hot water to showers, kitchen sink, dishwasher and mop service basins. Hot water to lavatories shall be 110°F supplied from in-line thermostatic mixing valves.

   e. Potable cold and hot water piping shall cross the building marriage line at only one point, at this point provide accessible unions.
f. Sterilize the potable water systems with approved chlorinating agent to provide a dosage of not less than 50 PPM after flushing. After a minimum contact period of 24 hours, system shall be flushed with clean water until residual chlorine is no greater than that of the water supply. All procedures shall comply with the State Health Department and AWWA Specification C-601.

g. Insulate all potable cold and hot water piping with rigid molded fiber glass pipe covering having a density of 4 pounds/cubic foot, in compliance with ASTM C547, having a K-factor of approximately 0.22 at 75°F, 1/2" thick for cold water and 1 inch thick for hot water.

4. Freeze Protection:

a. The potable water supply line and all sanitary drainage piping and traps below the floor shall be protected from freezing by Raychem XL-Trace electric self-regulating heating cables or approved equal. Provide 1 inch thick pipe insulation on all heat traced piping. Heating cables shall maintain pipe temperature of 40°F with ambient temperature of -10°F.

5. Plumbing Fixtures and Trim:

a. Provide plumbing fixtures complete with all required trim, including but not limited to, carriers, supports, faucets, stops, waste fittings, traps, seats, flushometers, vacuum breakers, bolts, gaskets and escutcheons.

b. Metal trim, exposed piping and escutcheons shall be chrome plated.

c. Plumbing fixtures for use by the physically handicapped are not required.

d. Subject to compliance with requirements, acceptable manufacturers are:


2) Mop service basins: Fiat, Stern-Williams, and Florestone.


5) Sinks: Elkay, Just and Kohler.
6) Carriers: Josam, Zurn and J.R. Smith.
7) Faucets and trim: Kohler, American Standard, Crane, Symmons, Speakman, Bradley and Chicago Faucet.
8) Flush valves: Sloan, Delany and Zurn.
9) Seats: Kohler, Olsonite, Church and Beneke.

6. Waterclosets:
   a. Floor mounted, "Flushmate" pressure-assisted flush tank. 1.5 gallon per flush, direct fed Siphon jet flush action. White vitreous china elongated rim with white solid plastic open front seat, less cover with self-sustaining check hinge.

7. Urinals:
   a. White, vitreous china wall mounted urinal with integral extended shields, flushing rim, trap and 3/4" top spud, flush valve with vacuum breaker on screwdriver 3/4" angle stop, and carrier with bottom bearing plate feet or block base as required.

8. Lavatories:
   a. White, vitreous china, 21" x 19" self-rimming countertop lavatory. Cast brass 1-1/2" P-trap with cleanout; 1-1/4" tailpiece with integral strainer; flexible supplies with loose key stops, cold and hot water mixing faucet.

9. Mop Service Basin:
   a. Floor mounted molded stone 24" x 24" with 10" high sides and integral cast drain; removable strainer plate; and chrome-plated all brass faucet with rigid hose-end spout and pail hook; integral stops; vacuum breaker and wall brace.

10. Electric Water Cooler:
   a. Wall mounted electric water cooler; stainless steel top, and vinyl-clad steel cabinet; chrome plated cast brass 1-1/2" P-trap; and automatic stream regulator. 1/5 H.P. refrigeration unit, 8.0 GPH flow rate.
11. Shower Cabinet and Trim:
   a. 36" x 36" one-piece shower modules of acrylic or gel-coated fiberglass. Thermostatic mixing valve for concealed piping, metal lever control handle, combination strainer check stops, 3 gpm maximum shower head with spray adjustment, shower arm and escutcheon. See architectural section for shower modules.

12. Kitchen Sink:
   a. Single compartment, self-rimming, 18 gauge type 302 stainless steel. 25" x 21" by a 8" deep. Chrome plated all brass mixing faucet with gooseneck spout. 3/4 H.P. garbage disposal. 1 1/2" cast brass trap.

13. Installation:
   a. Sanitary waste pipe shall be pitched at 1/4" per foot for 3" and smaller and 5/8" per foot for 4" and larger.
   b. Branches and changes in direction in horizontal waste lines shall be made with "Y" branch, combination "Y" 1/2 bends.
   c. Branch fittings in vertical waste pipe may be sanitary "T" branches.
   d. Horizontal waste pipe shall be supported at every joint. The distance between supports shall not exceed 4'.
   e. Domestic water piping shall be installed in such a manner that all parts of the complete system can be drained through drain valves at low points in the system.
   f. Dielectric couplings or unions shall be used where dissimilar piping materials are jointed.

14. Escutcheons:
   a. Shall be attached to all exposed, uninsulated pipe, other than soil pipe, passing through walls and partitions of finished areas.
      1) Shall be chromium plated pressed steel with clasp and set screws.

15. Vent Piping:
   a. Sanitary vent piping shall extend 12" above the roof.
16. Access Panels:

a. Access panels of the required size for walls and ceilings shall be provided where required for access to concealed valves and equipment.

1) Shall be suitable for flush mounting with smooth covers primed for painting.

2) Shall be constructed of 16-gauge steel with 14-gauge doors with concealed hinges.

17. Fixture Installation:

a. Secure fixtures to walls and floor or countertops in accordance with manufacturer’s roughing-in and setting requirements and form a rigid installation.

18. Protection and Cleaning:

a. After installation, protective coverings shall be provided until construction is completed. All plumbing fixtures and accessories shall be thoroughly cleaned. Items marred or damaged shall be replaced by the fabricator at no cost to the Buyer.

19. Testing:

a. All piping shall be thoroughly tested for leaks before being covered or concealed.

b. Drain piping, waste, and vent lines shall be tested at 10 feet of hydrostatic head for not less than 1 hour. If the lines prove to be tight, the water shall be drawn off and fixtures connected.

c. Domestic hot and cold water lines shall be tested after installation, but before insulating, at a hydrostatic pressure of 125 psig and proved tight at that pressure for a period of 1 hour. Any leaks made evident shall be repaired and the test repeated to completion.

20. Pipe Identification:

a. Pipe Markers: Apply on straight pipe runs after insulation is applied at not over 20’ spacing, and adjacent to all valves, and where piping passes through floors. Apply arrows showing direction of flow at all pipe markers.
3.05 ELECTRICAL

A. Supply Voltage: Electrical service will be supplied at 480Y/277 V, 4-wire, 60Hz. (Service shall be below grade through a contractor supplied pull box to a 480 V, 100 A, 3-phase disconnect provided by the trailer manufacturer mounted outside on the south wall of both the General Office Building and the Retrieval Staff Change Facility). See Drawing H-2-823376 for mounting location.

B. General Material and Equipment: Material and equipment provided and furnished shall be new, specification grade, and shall conform to national Manufacturers Association (NEMA) standards. Materials and equipment shall be listed for the intended service by UL. All materials and installations shall be in accordance with NEC.

C. Transformer: Service to the General Office Building shall be extended from the 480 V disconnect switch mounted on the outside wall of the trailer to a 3-phase, 480 - 208Y/120 V dry type transformer located in the Electrical Room. Service to the retrieval staff change facility shall be extended from the 480V disconnect switch mounted on the outside wall of the trailer to a 480V, 3-phase, 4-wire power panel which shall supply power to a 3-phase, 480-208Y/120V dry type transformer located in the mechanical/electrical room. Transformers shall be sized to accommodate the module’s demand load plus 25 percent additional capacity.

D. Panelboard: Provide a 208Y/120V, 3-phase, 4-wire distribution panel board in the General Office Buildings mechanical/electrical room and a 480Y/277V, 3-phase, 4-wire distribution panel board in the retrieval staff change facility mechanical/electrical room with approval by a nationally recognized testing laboratory and labeled as suitable for use as service equipment. Provide a 208Y/120 V, 3-phase, 4-wire distribution panel board in the retrieval staff change facility to be fed from the transformer secondary. Panel boards shall be sized to accommodate the module’s connected load plus 25 percent additional load capacity and breakers. Panels shall have a 3-pole main circuit breaker. Feeder neutrals shall be sized per NEC. Drawing H-2-823376 identifies the panel locations. Provide printed panel directories identifying all circuits, locations of circuits and specific loads served.

E. Crossover Connections: Provide permanently labeled crossover connections between trailer modules to ensure identification is not destroyed during trimming of wires.
F. Electrical Outlets: Electrical outlet installations shall be in accordance with applicable codes. Provide grounded duplex/quadruplex receptacles as indicated on Drawing H-2-823376.

1. Provide separate grounding and neutral conductors for each circuit. Provide dedicated outlets with a 20A circuit as indicated on the drawing. Provide receptacles, mounted at 14-inches above finished floor to top of outlet at all areas, except in kitchen and restrooms above countertops. Provide GFCI outlets at kitchen and restrooms above backsplash of countertops. Provide duplex/quadruplex receptacles with clear identification on the receptacle cover of corresponding panel and circuit breaker number. Example would be P-1-12, indicating electrical panel 1 and breaker 12.

2. Provide Ground Fault Circuit Interrupters (GFCI) at receptacles within 6-feet of sinks, lavatories, and outside entrances, reference Drawing H-2-823376. Provide a dedicated 20A circuit with GFCI protection below the building for heat trace power within 2-feet of the sanitary water service penetration. Provide a weatherproof grounded duplex receptacle outside within 6-feet of the air handling units, as shown on Drawing H-2-823376, for maintenance to the units.

G. Conductors: Provide copper conductors sized as required by NEC. Minimum conductor size for power, lighting and receptacles shall be solid No. 12 AWG, and No. 14 AWG for thermostats. Wires larger than No. 12 AWG shall be stranded type.

H. Wiring Method: Provide raceway and cable wiring methods in accordance with NEC. Minimum conduit size shall be 3/4 in.

   1. Aluminum conduit shall not be used.


J. A mushroom head, heavy duty, maintained contact pushbutton shall be provided in the Counting Room as shown on the drawings. The pushbutton shall be wired to the heat pump and/or ventilation fans so that when pressed, all air flow to the entire trailer shall cease.

   The pushbutton shall be mounted in a shrouded enclosure to prevent accidental activation.
K. Septic Pumps: One 208 V, 3-phase dedicated circuit shall be wired through the east wall of the General Office Building and be terminated at a disconnect switch mounted outside on the east wall as shown on Drawing H-2-823376. Provide mounting struts on the outside wall next to the disconnect for the 13-1/2 in. x 15-1/2 in. x 7 in. septic pump control panel provided and mounted by others.

L. Calculations: Prepare the following.

1. Power system design listing loads, assumptions, and results.

2. Calculations shall include loads for wire and equipment sizing, fault levels, voltage drop, and coordination.

M. Drawings: Prepare the following.

1. Power plans, indicating location of receptacles, equipment hookup, conduit routing, panelboard and panel schedule, service connection, metering, and HVAC feeder conduits.

2. One-line diagram and panel schedule.

3. Wire run list and conduit schedule.

4. Building grounding plan and details.

N. Specification and Product Data. Prepare the following.

1. Electrical Equipment (including panelboard/breaker AIC, time coordination curves, panel board AIC, and all other pertinent technical data).

O. Lighting:

1. Interior Lighting: The lighting shall be of the energy efficient type, 2 ft. x 4 ft., 120 V, drop-in fluorescent fixtures with 2-pin fluorescent lamps. Provide parabolic fluorescent fixtures in offices and counting room. Provide fluorescent fixtures with standard prismatic diffusers in all other areas. The ballasts shall be CBM certified. Diffusers shall be provided for all light fixtures. All light fixtures shall be flush mounted and supported by the tee grid ceiling.
2. Lighting Intensities: The lighting shall provide a minimum of 50 footcandles (fc) illumination at desk height in work stations, 30 fc in work areas conference/lunchroom and office areas, and 10 fc in hallways, restrooms and storage areas. Lighting maintained shall give a maximum uniformity ratio of 4:1 (maximum point to minimum point), 30 inches above the floor.

3. Emergency Egress Lighting: Provide emergency egress lighting with rechargeable battery back-up units within designated florescent fixtures to be located in the hallways, changerooms, "ANTI-C’s" change area, and restrooms.


5. Exterior Lighting: Provide exterior wall mounted, 175 watt, mercury vapor, 120V weather proof halophane wallpack catalog # WL2K175MV12GR, with integral photocell control on the perimeter of each trailer as shown on Drawing H-2-823376.

6. Light Switches: Provide light switches for interior lights at entrances to the areas. Three-way switching shall be provided to control hallway lights at two separate locations.

7. Branch circuiting for the lighting circuits shall be so arranged, such that loss of a single lighting circuit does not deprive an entire area of illumination.

8. Branch circuiting for the electrical outlets shall be so arranged, such that a loss of a single electrical outlet circuit does not deprive an entire area of power.

9. The maximum number of electrical outlets on a 20 amp general use branch circuit shall not exceed eight.

10. Office area electrical outlets shall be circuited at no more than six.

11. Each of the following branch circuit loads shall be provided with its own dedicated power: through-the-wall packaged air conditioning units and electric baseboard heaters.
P. Calculations: Prepare the following.

1. Lighting System Design: Calculations shall include normal and egress light levels and photometric data. Calculations shall state inputs, assumptions, and results in a report form for each area designated.

Q. Drawings: Prepare the following.

1. Lighting plan, indicating interior and exterior perimeter light fixture layout, lighting fixture schedule, and light switches.

R. Specification and Product Data: Prepare the following.

1. Light fixtures and switches (including power requirements for ballast and lamps, and photometric curves).

S. Communications System:

1. Telecommunications Conduit: Provide two 5-inch PVC conduit sleeves in accordance with NEC, below the telecommunications backboard, unless otherwise noted, penetrating the floor and extending a minimum of 3 inches below the vapor barrier and above the finished floor. Provide removable caps over the top of the 5-inch PVC conduit sleeves.

2. Telephone and communication cables shall not be run in ducts or tunnels with steam, water or other piping unless the cables are mechanically protected from failure of the piping systems and unless measures have been taken to assure that the design ambient temperature at the cable locations will not be exceeded. No other communications system wiring shall be installed in raceways in buildings used for telephone wiring.

3. Septic Pump Alarm Cables: Provide 9/C #14 AWG cable from the DAS panel in the telecommunications room through the east wall of the General Office Building to a 12 in. x 12 in. x 12 in. pull box mounted as shown on drawing H-2-823376. Coil 10 feet of excess cable in the pull box for termination into a septic pump alarm panel provided by others.

4. Telecommunications backboard: Install a 4 ft. x 8 ft. x 3/4 in. fire retardant plywood board, painted to match walls, in the General Office Building and the retrieval staff change facility telecommunications rooms. The board shall be mounted horizontally, 24-inches above the floor. Install a grounded #6 AWG copper wire to the telephone board and install a 20 A dedicated outlet in the same location.
5. Telecommunication rooms shall be provided with dedicated electrical outlets required for the equipment.

6. Drawings: Prepare the following.
   a. Plan indicating underground service connection point.
   b. Communications Infrastructure: Proposed telecommunications plan layout and raceway/conduit cable distribution drawings.
   c. Telephone: Telephone specific drawings detailing cable distribution and outlet locations, and termination arrangements.
   d. LAN: LAN specific drawings detailing cable distribution and outlet locations.

T. Distribution Systems

1. Ceiling System Routing
   a. The contractor shall use ceiling space only for the horizontal cabling for the floor below. All cable pathways should be at least 1.2 m (4 ft) from large motors or transformers, 31 cm (1 ft) from conduit and cables used for electrical power distribution, and 12 cm (5 in.) from fluorescent lighting. When it is necessary to cross fluorescent lighting and electrical power cables, the contractor shall ensure that telecommunication cable pathways cross perpendicularly.
      1) Ceiling System Routing Materials. Cable supports shall be free of sharp edges that could damage cable.
      2) Ceiling System Routing Installation. The contractor shall not rest horizontal pathways and cables directly on ceiling panels, framework (T-bars), vertical supports, or other suspended-ceiling components. Raceways must be suspended from or attached to the structural ceiling or walls with hardware specifically designed to support their weight. The contractor shall install the raceways within 35.6 cm (14 in.) above the false ceiling. Pathways must be supported adequately to withstand pulling the cables.
2. Wall Outlet Conduit

a. Wall Outlet Conduit Materials. Metallic conduit, suitable to be used as a ground, shall be run to the communications outlet location. The conduit shall have a minimum diameter of 2.54 cm (1 in.). The contractor shall use bushings to protect cabling from damage during installation. Conduit sweeps shall ensure that the minimum cable bend radius (10 times the cable diameter) is not exceeded.

3. Cable Management

a. Cable Management Materials. The contractor shall secure cable bundles with Velcro\textsuperscript{1} straps to maintain organization of cable instead of cable ties to avoid causing attenuation degradation within the cables. The contractor shall use D-rings to route cable within telecommunications rooms.

b. Cable Management Installation. The contractor shall route all cable symmetrically. Cables coming into the telecommunications room also shall be bundled and labeled with the region and cable count to make it easier to find cables for maintenance and repair.

1) The contractor shall route cable symmetrically to and from racks, patch panels, and punch-down blocks. All cables coming from the one side of a rack, patch panel, or block will be routed through rings or brackets on the same side. If hardware does not exist, the contractor shall install it.

2) The contractor shall eliminate cable stress caused by tension in suspended cable and tightly cinched cable bundles.

3) Telecommunications cables and conduits shall not exceed manufacturer recommended sweep radii.

4) To reduce untwisting of cable, the contractor shall strip back only as much of the cable jack necessary to terminate the cable on connecting hardware.

\textsuperscript{1}Velcro is a trademark of Velcro Industries.
U. CABLE

1. General

a) General Cable Materials. All cable shall be plenum rated with a soft-plenum-type sheath. At a minimum each outlet shall have three cables: a telephone cable, a network cable, and a second network cable.

- The cabling standard configuration for a four-port outlet consists of the following:
  - 4 Pair, Telephone Cable, Unshielded Twisted Pair
  - 4 Pair, Network Cable, Unshielded Twisted Pair
  - 4 Pair, Second Network Cable, Unshielded Twisted Pair

- The contractor shall be responsible for ensuring the cable meets the specifications. Installed cable that does not meet the specifications shall be replaced and installed at the contractor’s expense.

b) General Cable Installation. The contractor shall install cabling as one continuous segment; no midrun splices shall be allowed. Cable runs shall not exceed 90 m (295 ft). The site telecommunications engineer shall approve any exceptions to this requirement before installation. Pull strings shall be left in all conduits after installation.

1) Cabling should be installed beginning with the longest runs first.

2) The contractor shall ensure during all phases of the installation that the manufacturers’ suggested bend radius is not exceeded (10 times outside diameter of the cable) and that the pulling tension (110 N [25 lbf] for unshielded twisted-pair cable) is not exceeded. The contractor shall take care to avoid breaks from stepping on the cable or other poor installation practices. The contractor shall not over tighten cable ties.

3) Installation of cabling shall follow telephone industry standards.

c) General Acceptance Testing. The contractor shall notify the site telecommunications engineer of acceptance testing at least 24 hours before the test is scheduled. The contractor shall provide the necessary materials or tools needed to inspect the cable runs (i.e., ladders, flashlights).
2. Telephone Cable

a. Telephone Cable Materials. The telephone cabling shall have the following characteristics as a minimum.

1) 4 pair, 24 AWG, copper conductors, unshielded by AMP.
2) Impedance: 100 ohms ± 15% @ 100 MHz
3) DC resistance: 9.38 ohms/100 meters @ 20°C
4) Attenuation: 10 MHz ≤ 6.6 dB/100 meters @ 20°C
   100 MHz ≤ 22 dB/100 meters @ 20°C
5) Near-End Cross Talk: 10 MHz ≥ 47 dB/100 meters @ 20°C
   100 MHz ≥ 32 dB/100 meters @ 20°C

b. Telephone Cable Installation. The contractor shall leave at least 61 cm (2 ft) of cable available at the outlet and 30.1 cm (1 ft) available at the cabinet, rack, or back board.

c. Telephone Cable Acceptance Testing. All telephone cable shall be tested from end to end. If the contractor is responsible for placing the jack and/or the terminal equipment, the contractor shall perform the end-to-end test from the jack outlet and the terminal pins.

1) The contractor will test all pairs for opens, shorts, grounds, and reversals. The contractor will document the test results and the methods used. All deviations will be resolved before final acceptance.

3. Network Cable

a. Network Cable Materials. The network cabling shall have the following characteristics as a minimum:

1) 4 pair, 24 AWG, copper conductors, unshielded
2) Impedance: 100 ohms ± 15% @ 100 MHz
3) DC resistance: 9.38 ohms/100 meters @ 20°C
4) Attenuation: 10 MHz ≤ 6.6 dB/100 meters @ 20°C
   100 MHz ≤ 22 dB/100 meters @ 20°C
5) Near-End Cross Talk:

10 MHz ≥ 47 dB/100 meters @ 20°C
100 MHz ≥ 32 dB/100 meters @ 2

b. Network Cable Installation. For the network cabling, also place the room number next to the cable number. The contractor shall leave at least 61 cm (2 ft) of cable available at the outlet and 30.1 cm (1 ft) available at the cabinet, rack, or back board.

c. Network Cable Acceptance Testing. The contractor shall use the Site-approved tester (see Cable Acceptance Tester in the Materials List) to provide Category 5 test acceptance results. The contractor shall provide the results from acceptance testing to the site telecommunications engineer before completion of the job.

V. Outlet Hardware

1. General Outlet Hardware

a. General Outlet Hardware Materials. The exact number and placement of the outlets shall be per contract drawings.

1) For a standard four-port outlet, the contractor shall use the site standard outlet. Provide an AMP outlet system for each communications system location, consisting of a recess box (AMP Model 556598-1), two each unshielded installation kits (AMP Model 555600-1), cover (AMP Model 556599-1), one each blank insert (AMP Model 555644-1) and a faceplate (AMP Model 555670-1). Provide jack inserts for each AMP outlet system consisting of two each RJ45 jack inserts (AMP Model 557248-1) and one each RJ11 jack insert.

2) Provide communication AMP outlet systems, AMP Model 555611-1. The systems shall be located 15 inches to top of recess box above finished floor.

b. General Outlet Hardware Installation. For each recessed outlet, the contractor shall install an RJ11 insert in the top right port, T568A Category 5 inserts in the bottom right port, T568A Category 5 inserts in the top left port of each outlet, and the bottom left ports shall be left empty.
1) The contractor shall label each outlet with its corresponding number and each port with the number of the cable connected to it. The contractor shall label the outlet conduit with the outlet number. The contractor shall install all inserts according to the manufacturer’s recommendations.

2) The contractor shall assign a number to each outlet. The outlets shall be numbered consecutively from one end of the floor to the other. Each cable port shall be a subset of the outlet number. For example, each port in Outlet 13 would be labeled: 13a (second), 13b (telephone), and 13d (network).

3) Methods shall be provided for accessing a building ground connection for the shield of each data cable at each outlet location in facilities in which the ground reference within the facility is constant.

4) The contractor shall supply an as-built chart depicting outlet and cable numbers by location.

2. Recessed Outlets

a. Recessed Outlet Materials. When installing recessed outlets, the contractor shall provide a cover for each recessed outlet.

1) All recessed communications outlets shall have a minimum of two unshielded, dual-port installation kits.

b. Recessed Outlet Installation. The contractor shall coordinate advance to ensure a 2.54 cm (1-in.) conduit is stubbed to the locations where recessed outlets will be. Installing the cable before the drywall may help, however, the contractor must ensure that undamaged cable is available for termination after the drywall is hung.

1) The contractor shall label the most easily visible portion of each outlet with the outlet number and label each port with the corresponding port number.

3. Faceplates

a. All recessed outlets will require an AMP 555670-1 double-gang faceplates. If optical fiber is not specified for installation, a AMP 555644-1 blank insert shall be provided.
W. Outlet Termination

1. Telephone Outlet Termination

   a. The contractor shall open the overall cable sheath at each end and strip it back. At the outlet end at least 0.61 m (2 ft) of cable shall be available. The contractor shall ensure copper conductors are not damaged during the removal of the sheath.

      1) Telephone Outlet Termination Materials. Telephone outlets shall be terminated with standard RJ-11 connectors. Integrated Services Digital Network (ISDN) lines shall be terminated with standard RJ-45 connectors.

      2) Telephone Outlet Termination Installation. The telephone cabling at the telephone termination blocks shall be terminated per telephone industry standards. The contractor shall label the telephone connector with the corresponding cable number.

      • The telephone cabling at the communications outlet location shall be terminated on the connectors per manufacturers recommendations.

2. Network Outlet Termination


   b. Network Outlet Termination Installation. The contractor shall label each individual cable with the cable type, size, year placed or inventoried, and the cable count. Each jack in the outlet shall be labeled with the corresponding cable number connected to it.

      1) The network cabling at the communications outlet location shall be terminated per manufacturers recommendations.

3. Miscellaneous

   a. The cable sheath shall only be opened and stripped back far enough to allow termination. It is imperative that the contractor maintain the twists in Category 5 cabling right up to the point of termination, (1.27 cm [0.5 in.]) is the maximum allowed. If the contractor untwists cable beyond 1.27 cm (0.5 in.) or strips the sheath excessively, the contractor shall reterminate the cable at the contractor’s expense. The contractor shall not exceed the bend radius during termination on either end.
X. Communications Room Termination

1. The contractor shall open the overall cable sheath at each end and strip it back. The contractor shall strip enough cable in the telecommunications room to ensure the cable can reach its termination and/or storage point. The contractor shall ensure copper conductors are not damaged during the removal of the sheath.

a. Telephone Communications Room Termination

1) Telephone Communications Room Termination Materials. The contractor shall terminate telephone cable on Krone punch-down blocks.

2) Telephone Communications Room Termination Installation. The telephone cabling at the telephone termination blocks shall be terminated per telephone industry standards.

b. Network Communications Room Termination

1) Network Communications Room Termination Materials. The contractor shall terminate network cables in the communications room with standard RJ-45 connectors. The contractor shall supply the associated tools required.

2) Network Communications Room Termination Installation. The network cabling in the telecommunications rooms shall be terminated per telephone industry standards.

c. Miscellaneous

1) The cable sheath shall only be opened and stripped back far enough to allow termination. It is imperative that the contractor maintain the twists in Category 5 cabling right up to the point of termination, (1.27 cm [0.5 in.]) is the maximum allowed. If the contractor untwists cable beyond 1.27 cm (0.5 in.) or strips the sheath excessively, the contractor shall reterminate the cable at the contractor's expense. The contractor shall not exceed the bend radius during termination on either end.

4.0 DELIVERY, STORAGE AND HANDLING

A. Deliver prefabricated modular, mobile buildings and components, and other required manufactured items so they will not be damaged or deformed during shipment. Package additional metal wall panels for protection against transportation damage.
B. Clearly and legibly mark each piece and part of the assembly shipped loose to correspond with erection drawings, diagrams, and instruction manuals.

5.0 ERECTION AND ASSEMBLY REQUIREMENTS

A. The personnel responsible for the erection of the mobile units shall follow all OSHA regulations, including provision of safety equipment, clothing and a Fall Protection Plan.

B. Use care during set-up of modular building sections not to cause damage to the structural integrity of the building.

C. Remove all protective covers and wrapping.

D. Erect structural framing true to line, level, plumb, rigid, and secure in accordance with the prefabricated building code of Standard Practice. Level units to a true even plane with full bearing to supporting structures. Use a nonshrinking grout to obtain uniform bearing as required and to maintain a level base line elevation. Moist cure grout for not less than 7 days after placement.

E. Marriage Wall: Connect the prefabricated modular, mobile building units securely and weathertight according to the prefabricated building manufacturer's recommendations. Complete finish all interior walls, floors and ceilings and all exterior wall panels and roof surfaces after connection of the modules. Connect all utility systems.

F. Sheet Metal Accessories: Install gutters, downspouts and other sheet metal accessories in accordance with prefabricated manufacturer's recommendations for positive anchorage to building and watertight mounting.

G. Skirting: Install the perimeter support structure and skirting.

H. Repair or replace damaged items including utilities, walls, roofing, trim, and other accessories to the satisfaction of the Buyer.

   1. Factory finished surfaces shall be touched up as necessary with manufacturer's recommended touch-up paint.

I. Cleaning and Touch-Up of Exterior and Interior of Building: Clean component surfaces of matter that could preclude paint bond. Touch up abrasions, marks, skips, or other defects to shop-primed surfaces with same type material as shop primer. The interior shall be vacuumed and dusted.

J. The hitches shall be removed and stored under each module.
6.0 APPROVAL DATA AND VENDOR INFORMATION

A. The Seller shall submit the following items to the Buyer for approval prior to fabrication or upon delivery. The number of copies of each submittal shall be as shown in Division 1.0.

1. Fabricator and installer qualifications. Submit manufacturer’s and installers statement of experience and list of completed projects to verify qualifications.

2. Engineering calculations, shop drawings and erection drawings shall be signed and sealed by a professional engineer legally authorized to practice in the jurisdiction where the Project is located.

   a. Furnish engineering calculations for foundation and anchorage design, structural construction of building shell; and HVAC and Electrical systems.

   b. A full set of shop drawings that include but shall not be limited to floor plans, wiring diagrams, and electrical, plumbing and mechanical plans, with details, diagrams, sections, and schedules.

   c. Furnish foundation drawings of concrete (masonry) piers, anchor bolt sizes and placing and attachment methods of the building structure to concrete piers.

   d. Show erection methods of the modular, mobile building system of walls, endwalls, floor and roof framing. Include transverse cross-sections. Include detailed information and drawings that indicate locations of single point connections for all utility provisions.

      1) Coordinate location of all utility service connections with site development contractors.

   e. Building Accessory Components: Provide details of and building accessory components to clearly indicate methods of installation.

   f. Samples for initial selection purposes in form of manufacturer’s color charts or chips showing full range of colors, textures, and patterns available for metal wall panels with factory-applied finishes, roofing material, interior wall surfacing, carpeting, and vinyl tile.

   g. Catalog cut sheets of all electrical equipment and materials.
B. Submit the following for information/record:

1. Certification: The Seller shall submit a certified statement that building is in accordance with contract documents.

2. Provide vendor information and installation, operation and maintenance manuals with a spare parts list for all mechanical and electrical equipment located in the buildings.

3. Detailed information and drawing details on hook-up and connection of utilities.

7.0 INSPECTION

A. Inspection and testing shall be performed in accordance with the approved Seller's Quality Assurance Program.

B. The buildings' HVAC, plumbing and electrical system shall be inspected by a Washington State certified energy/building inspector before transporting the modular units to the project site.

1. The HVAC system shall be tested and balanced on-site following assembly of the modules.

2. Electrical equipment and wiring shall be tested for continuity, proper phase, voltage, motor rotation and grounding. The buyer shall be notified before start of testing.

C. Surveillance will be performed by the Buyer to verify compliance of the work to the drawings and specifications.

8.0 WARRANTY

A. A warranty shall be provided for the General Office Building and Retrieval Staff Change Building that warrants the facility in material, equipment and workmanship for a period of not less than one (1) year from date of complete set-up of buildings and to be free of structural defects for a period of not less than five (5) years.

END OF SECTION
SECTION 13125

RETRIEVAL STAFF CHANGE STORAGE BUILDING

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SECTION 13125
RETRIEVAL STAFF CHANGE STORAGE BUILDING

1.0 STATEMENT OF WORK

A. This Section includes the design, fabrication and erection of a portable, one-story, pre fabricated self-framing metal building of the nominal length, width, height, and roof pitch as indicated on the Contract Drawings and specified herein.

1.01 SCOPE

A. Building size is approximately 12 feet by 16 feet.

B. The building shall be of a self-framing design that utilizes the roof and wall panels as the primary structural supporting members. The engineered design includes the framing of wall openings.

C. Furnish all necessary components, including prefinished wall and roof panels and interior wall partition, supplemental structural framing and bracing members, personnel doors with hardware, trim, flashings, gaskets, sealant, and fasteners to form a complete weathertight structure.

D. Supply complete drawings and recommended instructions for the erection and anchorage of the structure.

E. Related work which is not a part of this Section includes:

1. The building foundation design, a concrete slab-on-grade, as shown on the Drawings and as per Specification Section 03300.

   a. Excavation and backfill for concrete slab-on-grade.

   b. Construction of concrete slab-on-grade.

2. Shelving as shown on drawings.

1.02 RELATED SECTIONS

A. Section 03100 Concrete Formwork

B. Section 03200 Concrete Reinforcement

C. Section 03300 Cast-In-Place Concrete

D. Section 06100 Carpentry

2.0 APPLICABLE CODES AND DOCUMENTS

A. American Institute of Steel Construction (AISC):


B. American Iron and Steel Institute (AISI):

   1. AISI SG-673 I, II, AND III-86 — Specification for the Design of Cold Formed Steel Structural Members.

C. American Society of Civil Engineers (ASCE):


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

   1. A 36-91 Standard Specification for Structural Steel
   2. A 307-91 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
   3. A 325-90 Standard Specification for High Strength Bolts for Structural Steel Joints
   4. A 446-91 Standard Specification for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
   5. A 525 E1 Rev B-91 Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   6. A 529-88 Standard Specification for Structural Steel with 42 ksi (290 Mpa) Minimum Yield Point (1/2 inch (13mm) Maximum Thickness)

E. American Welding Society Inc. (AWS):

   1. D1.1-92 Structural Welding Code Steel

F. Metal Building Manufacturers Association Inc (MBMA):


H. Factory Mutual Approval Guide.

I. Steel Door Institute (SDI)

   1. SDI 100-85 Recommended Specifications, Standard Steel Doors and Frames.

J. American National Standards Institute (ANSI)

3.0 REQUIREMENTS

3.01 GENERAL

A. General: Engineer, design and fabricate metal building structure to withstand loads from winds, earthquake, gravity, and movements thermally induced.

B. Structural Framing: Design the structure for the combination of loads in accordance with this specification and the referenced documents and code requirements.

C. Manufacturer's Qualifications: A firm having a minimum of five years experience in manufacturing metal building systems that are similar to that indicated for this project.

D. Provide on-site erection of the structure and anchorage to a concrete slab-on-grade foundation.

E. Building to include personnel doors, door hardware, and adjustable louvers of size and location as indicated on drawings.

F. Manufacturers: To provide procurement references under this specification, and subject to compliance with the requirements specified herein, the following list of manufacturers is identified. Procurement will not be limited to these listed manufacturers.

1. Parkline Co.
2. Kelly Klosure Systems

3.02 STRUCTURAL

A. Design Loads: The building shall be designed for the following applied loads in addition to dead load:

1. Seismic:
   a. UBC seismic Zone 2B, seismic importance Factor I = 1.25.

2. Wind 70 mph, exposure "C", importance Factor I = 1.07 (per ASCE 7-93).

3. Minimum Roof live load: 20 psf. Roof live load and snow load do not have to be applied to the roof concurrently.

4. Ground snow load: 15 psf

5. Dead Load: Includes actual weight of building framing, roofing, siding, and other permanently installed items.

B. Materials:

1. Hot-Rolled Structural Steel Shapes Plate and Bars: Comply with ASTM A 36-91 or A 529.
2. Structural Quality Zinc-Coated (Galvanized) Steel Sheet: Comply with ASTM A 446, Grade B with G90 coating complying with ASTM A 525.

3. Bolts for Structural Framing: Comply with ASTM A 307 or ASTM A 325 as necessary for design loads and connection details.

C. Structural Framing:

1. General: Building shall be designed in accordance with applicable sections of the AISC "Specification for Structural Steel Buildings" and the AISI "Specifications for the Design of Cold Formed Steel Structural Members".
   a. Where required for proper wind load distribution, structural wind bents shall be installed. Wind bents shall consist of a bolted column and rafter assembly of steel conforming to ASTM A 36 specifications.
   b. Shop Connections: Provide bolted, or welded shop connections.
   c. Field Connections: Provide bolted field connections.

2. Design and fabrication of the panel system with components and necessary field connections shall be such that once assembled, they may be disassembled, repackaged, and reassembled with a minimum amount of labor.

3. Clearly and legibly mark each piece and part of the assembly to correspond with erection drawings, diagrams, and instruction manuals.

4. Welded Connections: Comply with AWS D1.1 requirements for welding procedures.

3.03 ARCHITECTURAL

A. Design Criteria:

1. Overall Building Shell Tolerance: The building dimensions shall be the building manufacturer’s nearest standard to the dimensions shown on the drawings.
   a. The gross building area shall be within plus or minus 5 percent of that indicated.
   b. The roof slope shall slope to provide positive drainage.
   c. The eave height shall be nominally 8'-0".

2. Roof system shall meet Factory Mutual Class I roof standards.

3. Completed building shall be totally of non-combustible construction.
4. Building shall be weathertight.

5. Building is not required to be insulated.

B. Building System:

1. Roof Panels:
   a. Roof panels shall consist of a single continuous length from eave line to ridge line and shall be designed with a standing seam, overlap side joint.
   b. Roof panels shall be a minimum 24 gauge galvanized steel conforming to G90 standards conforming to ASTM A-525. Minimum yield strength of panel materials shall be 50,000 PSI.

2. Exterior Wall Panels:
   a. Wall panels of the building shall be a single continuous length from the base channel to the roof line of the building at the sidewalls and endwalls of the building except where interrupted by wall openings. Panel design shall provide for an overlap side joint.
   b. Wall panels shall be a minimum 24 gauge galvanized steel conforming to ASTM A-525 Specifications with the galvanized coating conforming G90 standards. Minimum yield strength of panel material shall be 40,000 PSI.
   c. The bases of the wall panels shall be closed off with closure plugs conforming to the panel profile.

4. Interior Wall Partition: The interior partition, that extends from the floor to the roof, shall be constructed of interlocking metal panels in a minimum of 24 gauge galvanized steel. The partitions will be provided complete with base channel, partition cap, edge trim and all closures and fasteners required for a complete perimeter seal. The panels and trim shall be factory painted white to match adjacent wall surfaces.

5. Perimeter and Penetration Trim and Accessories.
   a. The roof system shall include a gutter and eave trim system at sidewall and matching rake trim at the building endwalls.
   b. Provide corner trim, sill trim, and other such trim and closers as may be required to form a weathertight enclosure.
   c. Accessories include gutters and trim. The gutters, downspouts and trim shall be of a minimum 26 gauge galvanized steel and finished to match the exterior metal panels.
6. Sealing Tape and Joint Sealant: Provide sealing tape, gaskets, and joint sealant as recommended by the manufacturer for a weathertight building.

7. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

8. Provide touch-up paint of a color to blend with adjacent finishes on which it is applied.

9. Panel Exterior Finish: All exterior surfaces of galvanized steel wall and roof panels shall receive two coats of a siliconized polyester paint for a combined minimum 1 mil dry film thickness.
   a. Panel Color: Manufacturer’s standard "White".
   b. Trim, Gutters, Downspouts and Accessories Color: Manufacturer’s standard "white".


11. Door Frames and Door Finish: Shall be finished with factory applied paint. Color to be blue.

12. Doors, door frames and door hardware location and size as shown on Drawings. Doors and door frames shall comply with SDI 100-85.
   a. Doors: All doors shall be 1 3/4 inch thick, 3 foot wide by six foot eight inches, flush construction. Door panels shall be minimum 20 gauge galvanized steel, reinforced and enclosed with a continuous steel perimeter channel. Door shall be reinforced to accept specified hardware.
   b. Door Frames: Door frames shall be double rabbeted type, of minimum 16 gauge galvanized steel.
   c. Door Hardware: Hardware shall comply with ANSI A156.
      1) Door hardware shall consist of 3 each 4 1/2" x 4 1/2" steel hinges, Type T2127, 26D satin chrome finish.
      2) Cylindrical key in knob lockset, 26D satin chrome finish.
      3) Removable core, 6 pin tumbler cylinders.
      4) Extruded aluminum threshold.
      5) Weatherstripping on four sides.
12. Adjustable Wall Louvers: Adjustable louvers shall be of minimum 12 gauge extruded, mill finished aluminum and not require field painting. Blades shall pivot to full closed position operated by means of an operating handle. Louver units shall be complete and provided with an aluminum mesh insect screen.

13. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged, and reassembled with a minimum amount of labor.

D. Perimeter and Opening Trim. Fabricate wall panels in a manner such that joints between panels will form weathertight seals. Fabricate required trim of the same color as the building panels.

E. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry anticipated component loads.

3.04 ERECTION

A. Building Erection: Erect building true to line, level, plumb, rigid, and secure in accordance with the AISC Code of Standard Practice.

B. Erect the building according to the manufacturers recommendations and the erection drawings.

1. Erection Tolerances: Width and/or length equals plus or minus 1/4"; out of square equals plus or minus 1/2".

C. Sheet Metal Accessories: Install gutters, downspouts and other sheet metal trim, doors and frames, and louvers in accordance with manufacturer's recommendations for positive anchorage and weathertight mounting.

D. Non-compatible materials: Isolate non-compatible, dissimilar materials from each other by gaskets or insulating compounds.

4.0 APPROVAL DATA AND VENDOR INFORMATION

A. Submit for information and record certification bearing stamp and signature of professional engineer that building is in accordance with contract requirements; stating design criteria used; and placing sole responsibility for design of building components with building systems manufacturer.

B. Submit the following for approval:

1. Product data consisting of self-framed metal building manufacturer's product information for building components and accessories.
2. Building fabricator shall submit a complete set of drawings prepared specifically for the erection of the building covered; showing anchor bolt size, length and setting location and details; and installation details of accessory components with part numbers, connections and assembly sequence.

5.0 INSPECTION

A. Surveillance will be performed by Buyer to verify compliance of the work to the drawings and specifications.

6.0 DELIVERY, STORAGE AND HANDLING

A. Package structure in a manner to protect it from weather and transportation damage.

   a. Parts shall be identified, marked, packaged and documented by type of component and building.

B. Handle carefully to avoid damage to panel finished surfaces, edges and ends, and related items in loading and transportation.

C. Remove all strippable protective wrap and coatings and provide a dry wipe-down cleaning of the panels.

D. Repair or replace damaged metal panels and trim to the satisfaction of the Buyer.

   1. Factory finished surfaces shall be touched up as necessary with manufacturer's recommended touch-up paint.

7.0 WARRANTY

A. Submit manufacturer's standard written warranty covering buildings structural integrity, materials, and finishes.

   1. Warranty period shall be no less than 12 months after date of contract completion.

END OF SECTION