



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

**Division of Facilities Construction and Management**

**DFCM**

## **STANDARD LOW BID PROJECT**

**January 15, 2008**

# **NEW MAINTENANCE BUILDING SAND HOLLOW STATE PARK**

## **DIVISION OF PARKS AND RECREATION HURRICANE, UTAH**

DFCM Project Number 07025510

Johansen & Tuttle Engineering  
PO Box 487  
Castle Dale, Utah 84513-0487

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov> or are available upon request from DFCM.

DFCM General Conditions dated May 25, 2005.

DFCM Application and Certification for Payment dated May 25, 2005.

Technical Specifications :

Drawings:

**The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>**

## NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

**NEW MAINTENANCE BUILDING - SAND HOLLOW STATE PARK**  
**DIVISION OF PARKS AND RECREATION – HURRICANE, UTAH**  
**DFCM PROJECT NO: 07025510**

Bids will be in accordance with the Contract Documents that will be available at 3:00 PM on Tuesday, January 15, 2008, and distributed in electronic format only on CDs from DFCM, 4110 State Office Building, Salt Lake City, Utah and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Vic Middleton, DFCM, at 801-971-0504. No others are to be contacted regarding this bidding process. The construction budget for this project is \$400,000.00

A **mandatory** pre-bid meeting will be held at 10:00 AM on Wednesday, January 30, 2008 at the Entrance Station, Sand Hollow State Park, 4405 West 3600 South, Hurricane, Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 3:00 PM on Wednesday, February 20, 2008 at DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT  
Marla Workman, Contract Coordinator  
4110 State Office Building, Salt Lake City, Utah 84114

## **PROJECT DESCRIPTION**

This project is the construction of a new maintenance shop (approximately 4,200 sqft) for the Division of Parks and Recreation. It is a concrete structure, sloped roof (single ply membrane) and includes a small office and restroom. Utilities are at the site.

**PROJECT SCHEDULE**

**PROJECT NAME:** NEW MAINTENANCE BUILDING – SAND HOLLOW STATE PARK  
DIVISION OF PARKS AND RECREATION – HURRICANE, UTAH  
**DFCM PROJECT #:** 07025510

Event	Day	Date	Time	Place
Bidding Documents Available	Tuesday	January 15, 2008	3:00 PM	DFCM 4110 State Office Bldg SLC, UT and the DFCM web site *
<b>Mandatory</b> Pre-bid Site Meeting	Wednesday	January 30, 2008	10:00 AM	Entrance Station Sand Hollow State Park 4405 West 3600 South Hurricane, UT
Last Day to Submit Questions	Thursday	February 7, 2008	3:00 PM	Vic Middleton – DFCM E-mail vmiddlet@utah.gov
Addendum Deadline (exception for bid delays)	Tuesday	February 12, 2008	2:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Wednesday	February 20, 2008	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Thursday	February 21, 2008	3:00 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Thursday	July 31, 2008		

\* **NOTE:** DFCM's web site address is <http://dfcm.utah.gov>



## BID FORM

NAME OF BIDDER \_\_\_\_\_ DATE \_\_\_\_\_

To the Division of Facilities Construction and Management  
4110 State Office Building  
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **NEW MAINTENANCE BUILDING – SAND HOLLOW STATE PARK – DIVISION OF PARKS AND RECREATION – HURRICANE, UTAH – DFCM PROJECT NO. 07025510** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: \_\_\_\_\_

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

\_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_ )  
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **July 31, 2008**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$300.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of \_\_\_\_\_

The undersigned Contractor's License Number for Utah is \_\_\_\_\_

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

\_\_\_\_\_  
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

\_\_\_\_\_

Respectfully submitted,

\_\_\_\_\_  
Name of Bidder

ADDRESS:

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Authorized Signature

# INSTRUCTIONS TO BIDDERS

## 1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

## 2. Bids

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the deadline for submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. **THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.**

If the bid bond security is submitted on a bid bond form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **NOTE: A cashier's check cannot be used as a substitute for a bid bond.**

## 3. Contract and Bond

The Contractor's Agreement will be in the form found in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

**4. Listing of Subcontractors**

Listing of Subcontractors shall be as summarized in the “Instructions and Subcontractor’s List Form”, which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

**5. Interpretation of Drawings and Specifications**

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM’s web site at <http://dfcm.utah.gov>. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

**6. Addenda**

Addenda will be posted on DFCM’s web site at <http://dfcm.utah.gov>. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

**7. Award of Contract**

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

**8. DFCM Contractor Performance Rating**

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed “DFCM Contractor Performance Rating” form. The ratings issued on this project will not affect this project but may affect the award on future projects.

**9. Licensure**

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

**10. Permits**

In concurrence with the requirements for permitting in the General Conditions, it is the responsibility of the Contractor to obtain the fugitive dust plan requirements from the Utah Division of Air Quality and the SWPPP requirements from the Utah Department of Environmental Quality and submit the completed forms and pay any permit fee that may be required for this specific project. Failure to obtain the required permit may result in work stoppage and/or fines from the regulating authority that will be the sole responsibility of the Contractor. Any delay to the project as a result of any such failure to obtain the permit or noncompliance with the permit shall not be eligible for any extension in the Contract Time.

**11. Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

**12. Time is of the Essence**

Time is of the essence in regard to all the requirements of the Contract Documents.

**13. Withdrawal of Bids**

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

**14. Product Approvals**

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of

the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

**15. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

**16. Debarment**

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.





**Division of Facilities Construction and**

**INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, based on the following:

**DOLLAR AMOUNTS FOR LISTING**

**PROJECTS UNDER \$500,000: ALL FIRST-TIER SUBS \$20,000 OR OVER MUST BE LISTED**  
**PROJECTS \$500,000 OR MORE: ALL FIRST-TIER SUBS \$35,000 OR OVER MUST BE LISTED**

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- If there are no subcontractors for the job that are required to be reported by State law (either because there are no subcontractors that will be used on the project or because there are no first-tier subcontractors over the dollar amounts referred to above), then you do not need to submit a sublist. If you do not submit a sublist, it will be deemed to be a representation by you that there are no subcontractors on the job that are required to be reported under State law. At any time, DFCM reserves the right to inquire, for security purposes, as to the identification of the subcontractors at any tier that will be on the worksite.

**LICENSURE:**

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

**'SPECIAL EXCEPTION':**

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

**GROUNDS FOR DISQUALIFICATION:**

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for

**INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**  
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such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

**CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:**

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

**EXAMPLE:**

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONTRACTOR LICENSE #
ELECTRICAL	ABCD Electric Inc.	\$350,000.00	123456789000
LANDSCAPING	"Self" *	\$300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	\$298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: \$350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

\* Bidders may list "self", but it is not required.

**PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.**



SUBCONTRACTORS LIST
FAX TO 801-538-3677

PROJECT TITLE: \_\_\_\_\_

Caution: You must read and comply fully with instructions.

Table with 4 columns: TYPE OF WORK, SUBCONTRACTOR, 'SELF' OR 'SPECIAL EXCEPTION', SUBCONTRACTOR BID AMOUNT, CONT. LICENSE #

We certify that:

- 1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed 'Self' or 'Special Exception' in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: \_\_\_\_\_

DATE: \_\_\_\_\_

SIGNED BY: \_\_\_\_\_

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR OWNER'S REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY OWNER. ATTACH A SECOND PAGE IF NECESSARY.

**CONTRACTOR'S AGREEMENT**

FOR:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

THIS CONTRACTOR'S AGREEMENT, made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and \_\_\_\_\_, incorporated in the State of \_\_\_\_\_ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is \_\_\_\_\_.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at \_\_\_\_\_.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

**ARTICLE 1. SCOPE OF WORK.** The Work to be performed shall be in accordance with the Contract Documents prepared by \_\_\_\_\_ and entitled "\_\_\_\_\_."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

**ARTICLE 2. CONTRACT SUM.** The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of \_\_\_\_\_ DOLLARS AND NO CENTS (\$\_\_\_\_\_.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

CONTRACTOR'S AGREEMENT  
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Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

**ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY.** The Work shall be Substantially Complete by \_\_\_\_\_. Contractor agrees to pay liquidated damages in the amount of \$\_\_\_\_\_ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

**ARTICLE 4. CONTRACT DOCUMENTS.** The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

**ARTICLE 5. PAYMENT.** The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to

safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

**ARTICLE 6. INDEBTEDNESS.** Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

**ARTICLE 7. ADDITIONAL WORK.** It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

**ARTICLE 8. INSPECTIONS.** The Work shall be inspected for acceptance in accordance with the General Conditions.

**ARTICLE 9. DISPUTES.** Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

**ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT.** This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

**ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF.** The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

**ARTICLE 12. INDEMNIFICATION.** The Contractor shall comply with the indemnification provisions of the General Conditions.

**ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT.** The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

**ARTICLE 14. RELATIONSHIP OF THE PARTIES.** The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

**ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT.** Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

**ARTICLE 16. ATTORNEY FEES AND COSTS.** Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.



**PERFORMANCE BOND**

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That \_\_\_\_\_ hereinafter referred to as the "Principal" and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, with its principal office in the City of \_\_\_\_\_ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of \_\_\_\_\_ DOLLARS (\$) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has entered into a certain written Contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, to construct \_\_\_\_\_ in the County of \_\_\_\_\_, State of Utah, Project No. \_\_\_\_\_, for the approximate sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which Contract is hereby incorporated by reference herein.

**NOW, THEREFORE**, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**WITNESS OR ATTESTATION:**

\_\_\_\_\_

**PRINCIPAL:**

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)

Title: \_\_\_\_\_

**WITNESS OR ATTESTATION:**

\_\_\_\_\_

**SURETY:**

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)

Attorney-in-Fact

STATE OF \_\_\_\_\_ )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My commission expires: \_\_\_\_\_

Resides at: \_\_\_\_\_

\_\_\_\_\_  
NOTARY PUBLIC

**Agency:** \_\_\_\_\_  
**Agent:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General

**PAYMENT BOND**

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

**KNOW ALL PERSONS BY THESE PRESENTS:**

That \_\_\_\_\_ hereinafter referred to as the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of \_\_\_\_\_, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has entered into a certain written Contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, to construct \_\_\_\_\_ in the County of \_\_\_\_\_, State of Utah, Project No. \_\_\_\_\_ for the approximate sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which contract is hereby incorporated by reference herein.

**NOW, THEREFORE**, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**WITNESS OR ATTESTATION:**

\_\_\_\_\_

**PRINCIPAL:**

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)

Title: \_\_\_\_\_

**WITNESS OR ATTESTATION:**

\_\_\_\_\_

**SURETY:**

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)  
Attorney-in-Fact

STATE OF \_\_\_\_\_ )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My commission expires: \_\_\_\_\_  
Resides at: \_\_\_\_\_

NOTARY PUBLIC

**Agency:** \_\_\_\_\_  
**Agent:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General



CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT \_\_\_\_\_ PROJECT NO: \_\_\_\_\_

AGENCY/INSTITUTION \_\_\_\_\_

AREA ACCEPTED \_\_\_\_\_

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at \_\_\_\_\_ (time) on \_\_\_\_\_ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

\_\_\_\_\_  
\_\_\_\_\_

The Owner acknowledges receipt of the following closeout and transition materials:

- As-built Drawings
- O & M Manuals
- Warranty Documents
- Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of \_\_\_\_\_(Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

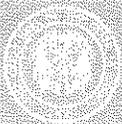
The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within \_\_\_\_\_ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: \$\_\_\_\_\_. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

\_\_\_\_\_  
CONTRACTOR (include name of firm) by: \_\_\_\_\_  
(Signature) DATE

\_\_\_\_\_  
A/E (include name of firm) by: \_\_\_\_\_  
(Signature) DATE

\_\_\_\_\_  
USING INSTITUTION OR AGENCY by: \_\_\_\_\_  
(Signature) DATE

\_\_\_\_\_  
DFCM (Owner) by: \_\_\_\_\_  
(Signature) DATE

**General Contractor Performance Rating Form**

Project Name:		DFCM Project#	
Contractor:  (ABC Construction, John Doe, 111-111-1111)	A/E:  (ABC Architects, Jane Doe, 222-222-2222)	Original Contract Amount:	Final Contract Amount:
DFCM Project Manager:		Contract Date:	
Completion Date:		Date of Rating:	

Rating Guideline	QUALITY OF PRODUCT OR SERVICES	COST CONTROL	TIMELINESS OF PERFORMANCE	BUSINESS RELATIONS
<b>5-Exceptional</b>	Contractor has demonstrated an exceptional performance level in any of the above four categories that justifies adding a point to the score. Contractor performance clearly exceeds the performance levels described as "Very Good"			
<b>4-Very Good</b>	Contractor is in compliance with contract requirements and/or delivers quality product/service.	Contractor is effective in managing costs and submits current, accurate, and complete billings	Contractor is effective in meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is effective
<b>3-Satisfactory</b>	Minor inefficiencies/errors have been identified	Contractor is usually effective in managing cost	Contractor is usually effective in meeting milestones and delivery schedules	Response to inquires technical/service/administrative issues is somewhat effective
<b>2-Marginal</b>	Major problems have been encountered	Contractor is having major difficulty managing cost effectively	Contractor is having major difficulty meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is marginally effective
<b>1-Unsatisfactory</b>	Contractor is not in compliance and is jeopardizing achievement of contract objectives	Contractor is unable to manage costs effectively	Contractor delays are jeopardizing performance of contract objectives	Response to inquiries, technical/service/administrative issues is not effective

<b>1. Rate Contractors quality of workmanship, management of sub contractor performance, project cleanliness, organization and safety requirement.</b>	<b>Score</b>
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

<b>2. Rate Contractor administration of project costs, change orders and financial management of the project budget.</b>	<b>Score</b>
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

<b>3. Rate Contractor's performance and adherence to Project Schedule, delay procedures and requirements of substantial completion, inspection and punch-list performance.</b>	<b>Score</b>
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

<b>4. Evaluate performance of contractor management team including project manager, engineer and superintendent also include in the rating team's ability to work well with owner, user agency and consultants.</b>	<b>Score</b>
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

5. Rate success of Contractor's management plan, completion of the plans mitigation of project risks and performance of value engineering concepts.	Score
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

<b>Signed by:</b>	<b>Date:</b>	<b>Mean Score</b>
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**Additional Comments:**

# PROJECT MANUAL

FOR

STATE OF UTAH  
DIVISION OF FACILITIES AND CONSTRUCTION  
MANAGEMENT

DEPARTMENT OF NATURAL RESOURCES

SAND HOLLOW STATE PARK  
MAINTENANCE SHED  
SAND HOLLOW STATE PARK  
4405 WEST 3600 SOUTH  
HURRICANE, UTAH  
DFCM PROJECT NO: 07025510

JANUARY 2, 2008

PREPARED BY



JAMES T. DRESSLAR  
ARCHITECT, L.L.C.

---

387 PARK LANE  
MOAB, UTAH 84532  
435.259.1155 PHONE / FAX

JTDA PROJECT NO: DFC 0713

**PROJECT MANUAL INDEX**

Sections in Red are not included herewith and are to be furnished by DFCM

SECTION	TITLE
<b>General:</b>	
000101	Certifications
000107	Seals
001113	Advertisement to Bid
002113	Instructions to Bidders
004000	Bid Form
003132	Geotechnical Data
005000	Standard Form of Agreement
006111	Bid Bond
006112	Performance Bond and Payment Bond
007000	General Conditions of the Contract
011000	Summary
012000	Price and Payment Procedures
012900	Form of Application and Certificate For Payment
013000	Administrative Requirements
014000	Quality Requirements
014200	References
014329	Code Required Special Inspections
015000	Temporary Facilities and Controls
016000	Product Requirements
017000	Execution Requirements
<b>Architectural:</b>	
031119	Insulated Concrete Forming
033000	Cast-In-Place Concrete
051200	Structural Steel
052100	Steel Joist Framing
053100	Steel Decking
054000	Cold Formed Metal Framing
055000	Metal Fabrications
055100	Metal Stairs
072100	Thermal Insulation
072400	Exterior Insulation and Finish System (EIFS)
075400	Mechanically Attached Thermoplastic Membrane Roofing
077113	Manufactured Wall Copings
077200	Roof Accessories
079200	Joint Sealants
081113	Hollow Metal Doors And Frames
083113	Access Doors And Frames
083613	Sectional Overhead Doors
084113	Aluminum Framed Entrances and Storefronts
085113	Aluminum Windows

086200	Unit Skylights
087100	Door Hardware
088000	Glazing
092900	Gypsum Board
093000	Tiling
096513	Resilient Base and Accessories
096516	Resilient Sheet Flooring
096519	Resilient Tile Flooring
097700	Fiberglass Reinforced Plastic Panels
099100	Painting
101400	Signage
102600	Wall and Door Protection
102800	Toilet Accessories
104400	Fire Protection Specialties

**Plumbing / Mechanical**

See Drawings

**Electrical:**

16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding
16075	Electrical Identification
16120	Conductors and Cables
16130	Raceways and Boxes
16140	Wiring Devices
16140	Wiring Device Schedule
16410	Enclosed Switches and Circuit Breakers
16442	Panelboards
16511	Interior Lighting
16851	Fire Alarm

**Site Work:**

311000	Site Clearing
312000	Earth Moving
312316	Excavation
312323	Earth Fill
321216	Asphalt Paving (Hot Mixed Asphalt)
321600	Site Concrete for Minor Structures
321610	Site Concrete Steel Reinforcement
321726	Pavement Marking

END OF PROJECT MANUAL INDEX

SECTION 000101 – CERTIFICATIONS

2006 International Energy Conservation Code Envelope Compliance, Mechanical Compliance and Lighting Compliance Certificates follow and are included for reference.

END OF SECTION 000101



# Envelope Compliance Certificate

## 2006 IECC

Report Date: 11/26/07

Data filename: Untitled.cck

### Section 1: Project Information

Project Title: Sand Hollow State Park Maintenance Shed

Construction Site:  
4405 W 3600 S  
Hurricane, UT

Owner/Agent:  
Daniel Clark  
State of Utah, DFCM, Dept of Natural  
Resources  
Salt Lake City, UT 84114-6001

Designer/Contractor:  
James Dresslar  
James T. Dresslar Architect, LLC  
387 Park Lane  
Moab, UT 84532  
435-259-1155

### Section 2: General Information

Building Location (for weather data): **Hurricane, Utah**  
Climate Zone: **3b**  
Heating Degree Days (base 65 degrees F): **3674**  
Cooling Degree Days (base 50 degrees F): **4577**  
Project Type: **New Construction**  
Vertical Glazing / Wall Area Pct.: **4%**

Activity Type(s)	Floor Area
Workshop	4763

### Section 3: Requirements Checklist

Envelope PASSES: Design 40% better than code.

#### Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof 1: Insulation Entirely Above Deck Comments: Thermoplastic Membrane / Rigid Insulation / Steel Deck	3946	---	29.2	0.033	0.063
Skylight 1: Metal Frame with Thermal Break:Double Pane, Tinted, SHGC 0.40 Comments: Acrylic Double Glazed / Thermal Break / White	16	---	---	0.500	0.900
Exterior Wall 1: Other, HC 1.0 Comments: 15" & 10 1/2" Insulated Concrete Form	6762	---	---	0.046	0.089
Window 1: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.29 Comments: Alumimum Storefront / Tinted / Low E / Insulated (includes OH door glass)	275	---	---	0.400	0.650
Door 1: Insulated Metal, Swinging Comments: Steel Door Insulated	84	---	---	0.250	0.700
Door 2: Insulated Metal, Non-Swinging Comments: Steel Overhead Sectional Insulated (net area w/o glass)	560	---	---	0.070	1.450
Floor 1: Slab-On-Grade:Unheated, Vertical 1 ft. Comments: ICF to Footing	196	---	21.0	---	---
Floor 2: Slab-On-Grade:Unheated, Vertical 1 ft. Comments: Rigid Insulation at OH Doors	56	---	7.0	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

**Air Leakage, Component Certification, and Vapor Retarder Requirements:**

- 1. All joints and penetrations are caulked, gasketed or covered with a moisture vapor-permeable wrapping material installed in accordance with the manufacturer's installation instructions.
- 2. Windows, doors, and skylights certified as meeting leakage requirements.
- 3. Component R-values & U-factors labeled as certified.
- 4. Insulation installed according to manufacturer's instructions, in substantial contact with the surface being insulated, and in a manner that achieves the rated R-value without compressing the insulation.
- 5. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- 6. Stair, elevator shaft vents, and other outdoor air intake and exhaust openings in the building envelope are equipped with motorized dampers.
- 7. Cargo doors and loading dock doors are weather sealed.
- 8. Recessed lighting fixtures are: (i) Type IC rated and sealed or gasketed; or (ii) installed inside an appropriate air-tight assembly with a 0.5 inch clearance from combustible materials and with 3 inches clearance from insulation material.
- 9. Building entrance doors have a vestibule and equipped with closing devices.

*Exceptions:*

Building entrances with revolving doors.

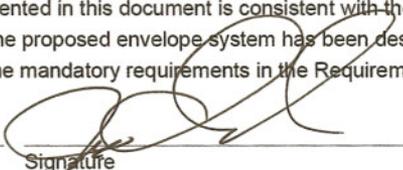
Doors that open directly from a space less than 3000 sq. ft. in area.

Note: Vapor retarder not required in this location.

**Section 4: Compliance Statement**

*Compliance Statement:* The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the 2006 IECC requirements in COMcheck Version 3.5.1 and to comply with the mandatory requirements in the Requirements Checklist.

Jim Dresslar - Architect



11/26/07

Name - Title

Signature

Date



# Mechanical Compliance Certificate

## 2006 IECC

Report Date: 12/15/07

Data filename: C:\Spectrum\Projects\Sand Hollow Redesign\Comcheck\IECC 2006\Sand Hollow Mechanical Comcheck 2006 IECC.cck

## Section 1: Project Information

Project Title: Sand Hollow Maintenance Facility

Construction Site:  
Washington County  
UT

Owner/Agent:  
State of Utah DFCM

Designer/Contractor:  
Frederic J. Nash P.E., CPD, LEED AP.  
Spectrum Engineers  
2195 West Stonebridge Dr.  
St George, UT 84770  
435-656-2429  
fjn@spectrum-engineers.com

## Section 2: General Information

Building Location (for weather data): **Hurricane, Utah**  
Climate Zone: **3b**  
Heating Degree Days (base 65 degrees F): **3674**  
Cooling Degree Days (base 50 degrees F): **4577**  
Project Type: **New Construction**

## Section 3: Mechanical Systems List

### Quantity System Type & Description

- 1 HVAC System 1 Offices: Heating: Central Furnace, Propane / Cooling: Split System, Capacity <54 kBtu/h, Air-Cooled Condenser / Single Zone
- 1 HVAC System 2 Truck Bays: Heating: Unit Heater, Propane / Cooling: Other, Capacity >=135 - <240 kBtu/h, Evaporatively Cooled Condenser
- 1 HVAC System 3 Truck Bays: Heating: Unit Heater, Propane / Cooling: Other, Capacity >=135 - <240 kBtu/h, Evaporatively Cooled Condenser
- 1 HVAC System 4 Truck Bays: Heating: Unit Heater, Propane
- 1 HVAC System 5 Truck Bays: Heating: Unit Heater, Propane
- 1 Storage Water Heater: Gas Storage Water Heater, Capacity: 60 gallons, Input Rating: 125000 Btu/h

## Section 4: Requirements Checklist

### Requirements Specific To: HVAC System 1 Offices :

- 1. Newly purchased heating equipment meets the heating efficiency requirements
- 2. Equipment minimum efficiency: Split System: 10.0 SEER

### Requirements Specific To: HVAC System 2 Truck Bays :

- 1. Equipment minimum efficiency: Unit Heater (Propane): 80% Ec
- 2. Integrated air economizer required
  - Exception: Minimum cooling equipment efficiency: 10.9 EER

### Requirements Specific To: HVAC System 3 Truck Bays :

- 1. Equipment minimum efficiency: Unit Heater (Propane): 80% Ec
- 2. Integrated air economizer required
  - Exception: Minimum cooling equipment efficiency: 10.9 EER

### Requirements Specific To: HVAC System 4 Truck Bays :

- 1. Equipment minimum efficiency: Unit Heater (Propane): 80% Ec

### Requirements Specific To: HVAC System 5 Truck Bays :

- 1. Equipment minimum efficiency: Unit Heater (Propane): 80% Ec

### Requirements Specific To: Storage Water Heater :

- 1. Hot water system sized per manufacturer's sizing guide
- 2. Gas Storage Water Heater efficiency  $\geq$  80% Et, 170 SL, Btu/h
- 3. First 8 ft of outlet piping is insulated
- 4. Hot water storage temperature adjustable down to 120 degrees F or lower
- 5. Heat traps provided on inlet and outlet of storage tanks

### Generic Requirements: Must be met by all systems to which the requirement is applicable:

- 1. Load calculations per 2001 ASHRAE Fundamentals
- 2. Plant equipment and system capacity no greater than needed to meet loads
  - Exception: Standby equipment automatically off when primary system is operating
  - Exception: Multiple units controlled to sequence operation as a function of load
- 3. Minimum one temperature control device per system
- 4. Minimum one humidity control device per installed humidification/dehumidification system
- 5. Thermostatic controls has 5 degrees F deadband
  - Exception: Thermostats requiring manual changeover between heating and cooling
- 6. Automatic Controls: Setback to 55 degrees F (heat) and 85 degrees F (cool); 7-day clock, 2-hour occupant override, 10-hour backup
  - Exception: Continuously operating zones
  - Exception: 2 kW demand or less, submit calculations
- 7. Outside-air source for ventilation; system capable of reducing OSA to required minimum
- 8. R-5 supply and return air duct insulation in unconditioned spaces R-8 supply and return air duct insulation outside the building R-8 insulation between ducts and the building exterior when ducts are part of a building assembly
  - Exception: Ducts located within equipment
  - Exception: Ducts with interior and exterior temperature difference not exceeding 15 degrees F.
  - Exception: Continuously welded and locking-type longitudinal joints and seams on ducts operating at static pressures less than 2 inches w.g. pressure classification
- 9. Mechanical fasteners and sealants used to connect ducts and air distribution equipment
- 10. Ducts sealed - longitudinal seams on rigid ducts; transverse seams on all ducts; UL 181A or 181B tapes and mastics
- 11. Hot water pipe insulation: 1 in. for pipes  $\leq$  1.5 in. and 2 in. for pipes  $>$  1.5 in. Chilled water/refrigerant/brine pipe insulation: 1 in. for pipes  $\leq$  1.5 in. and 1.5 in. for pipes  $>$  1.5 in. Steam pipe insulation: 1.5 in. for pipes  $\leq$  1.5 in. and 3 in. for pipes  $>$  1.5 in.
  - Exception: Piping within HVAC equipment
  - Exception: Fluid temperatures between 55 and 105 degrees F
  - Exception: Fluid not heated or cooled
  - Exception: Runouts  $<$  4 ft in length
- 12. Operation and maintenance manual provided to building owner
- 13. Balancing devices provided in accordance with IMC 603.15
- 14. Piping, insulated to 1/2 in. if nominal diameter of pipe is  $<$  1.5 in.; Larger pipe insulated to 1 in. thickness
- 15. Lavatory faucet outlet temperatures in public restrooms limited to 110 degrees F (43 degrees C)
- 16. Motorized, automatic shutoff dampers required on exhaust and outdoor air supply openings
  - Exception: Gravity dampers acceptable in buildings  $<$  3 stories
  - Exception: Gravity dampers acceptable in systems with outside or exhaust air flow rates less than 300 cfm where dampers are interlocked with fan
- 17. Stair and elevator shaft vents are equipped with motorized dampers

## Section 5: Compliance Statement

*Compliance Statement:* The proposed mechanical design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2006 IECC requirements in COMcheck Version 3.4.2 and to comply with the mandatory requirements in the Requirements Checklist.

---

Name - Title

Signature

Date

Project Notes:

State of Utah Mechanical Engineering License # 171885



# Mechanical Requirements Description

## 2006 IECC

Report Date:

Data filename: C:\Spectrum\Projects\Sand Hollow Redesign\Comcheck\IECC 2006\Sand Hollow Mechanical Comcheck 2006 IECC.cck

The following list provides more detailed descriptions of the requirements in Section 4 of the Mechanical Compliance Certificate.

### Requirements Specific To: HVAC System 1 Offices :

1. The specified heating equipment is covered by Federal minimum efficiency requirements. New equipment of this type can be assumed to meet or exceed ASHRAE 90.1 Code requirements for equipment efficiency.
2. The specified heating and/or cooling equipment is covered by ASHRAE 90.1 Code and must meet the following minimum efficiency:  
Split System: 10.0 SEER

### Requirements Specific To: HVAC System 2 Truck Bays :

1. The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Unit Heater (Propane): 80% Ec
2. An integrated air economizer is required for individual cooling systems over 65 kBtu/h in the selected climate. An integrated economizer allows simultaneous operation of outdoor-air and mechanical cooling.
  - Exception: An economizer is not required because high-efficiency air-conditioning equipment has been specified. To qualify, the air conditioner must meet the following minimum efficiency: 10.9 EER

### Requirements Specific To: HVAC System 3 Truck Bays :

1. The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Unit Heater (Propane): 80% Ec
2. An integrated air economizer is required for individual cooling systems over 65 kBtu/h in the selected climate. An integrated economizer allows simultaneous operation of outdoor-air and mechanical cooling.
  - Exception: An economizer is not required because high-efficiency air-conditioning equipment has been specified. To qualify, the air conditioner must meet the following minimum efficiency: 10.9 EER

### Requirements Specific To: HVAC System 4 Truck Bays :

1. The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Unit Heater (Propane): 80% Ec

### Requirements Specific To: HVAC System 5 Truck Bays :

1. The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Unit Heater (Propane): 80% Ec

### Requirements Specific To: Storage Water Heater :

1. Service water heating system design loads for the purpose of sizing systems and equipment must be determined in accordance with manufacturers' published sizing guidelines.
2. Service water heating equipment used solely for heating potable water, pool heaters, and hot water storage tanks must meet the following minimum efficiency: Gas Storage Water Heater efficiency  $\geq$  80% Et, 170 SL, Btu/h
3. Insulation must be provided for the first 8 ft of outlet piping for a constant temperature nonrecirculating storage system and for the inlet pipe between the storage tank and a heat trap in a storage system.
4. Temperature controls must be provided that allow for storage temperature adjustment from 120 degrees F or lower to a maximum temperature compatible with the intended use except when the manufacturer's installation instructions specify a higher minimum thermostat setting to minimize condensation and resulting corrosion. Documentation of the installation instructions must be provided to be exempted from this requirement.
5. Heat traps must be provided on inlet and outlet vertical pipe risers serving storage water heaters and storage tanks not having integral heat traps and serving a nonrecirculating system. Heat traps must be installed as close as practical to the storage tank. Acceptable heat traps are either a) a device specifically designed for the purpose or b) an arrangement of tubing that forms a loop of 360 degrees F, or c) piping that from the point of connection to the water heater (inlet or outlet) includes a length of piping directed downwards before connection to the vertical piping of the supply water or hot water distribution system.

### Generic Requirements: Must be met by all systems to which the requirement is applicable:

1. Design heating and cooling loads for the building must be determined using procedures in the ASHRAE Handbook of Fundamentals or an approved equivalent calculation procedure.
2. All equipment and systems must be sized to be no greater than needed to meet calculated loads. A single piece of equipment providing both heating and cooling must satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

- Exception: The equipment and/or system capacity may be greater than calculated loads for standby purposes. Standby equipment must be automatically controlled to be off when the primary equipment and/or system is operating.
  - Exception: Multiple units of the same equipment type whose combined capacities exceed the calculated load are allowed if they are provided with controls to sequence operation of the units as the load increases or decreases.
3. Each heating or cooling system serving a single zone must have its own temperature control device.
  4. Each humidification system must have its own humidity control device.
  5. Thermostats controlling both heating and cooling must be capable of maintaining a 5 degrees F deadband (a range of temperature where no heating or cooling is provided).
    - Exception: Deadband capability is not required if the thermostat does not have automatic changeover capability between heating and cooling.
  6. The system or zone control must be a programmable thermostat or other automatic control meeting the following criteria:a) capable of setting back temperature to 55 degrees F during heating and setting up to 85 degrees F during coolingb) capable of automatically setting back or shutting down systems during unoccupied hours using 7 different day schedulesc) have an accessible 2-hour occupant overridden) have a battery back-up capable of maintaining programmed settings for at least 10 hours without power.
    - Exception: A setback or shutoff control is not required on thermostats that control systems serving areas that operate continuously.
    - Exception: A setback or shutoff control is not required on systems with total energy demand of 2 kW (6,826 Btu/h) or less.
  7. The system must supply outside ventilation air as required by Chapter 4 of the International Mechanical Code. If the ventilation system is designed to supply outdoor-air quantities exceeding minimum required levels, the system must be capable of reducing outdoor-air flow to the minimum required levels.
  8. Air ducts must be insulated to the following levels:a) Supply and return air ducts for conditioned air located in unconditioned spaces (spaces neither heated nor cooled) must be insulated with a minimum of R-5. Unconditioned spaces include attics, crawl spaces, unheated basements, and unheated garages.b) Supply and return air ducts and plenums must be insulated to a minimum of R-8 when located outside the building.c) When ducts are located within exterior components (e.g., floors or roofs), minimum R-8 insulation is required only between the duct and the building exterior.
    - Exception: Duct insulation is not required on ducts located within equipment.
    - Exception: Duct insulation is not required when the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15 degrees F.
    - Exception: Continuously welded and locking-type longitudinal joints and seams on ducts operating at static pressures less than 2 inches w.g. pressure classification.
  9. Mechanical fasteners and seals, mastics, or gaskets must be used when connecting ducts to fans and other air distribution equipment, including multiple-zone terminal units.
  10. All joints, longitudinal and transverse seams, and connections in ductwork must be securely sealed using weldments; mechanical fasteners with seals, gaskets, or mastics; mesh and mastic sealing systems; or tapes. Tapes and mastics must be listed and labeled in accordance with UL 181A and shall be marked '181A-P' for pressure sensitive tape,'181A-M' for mastic or '181A-H' for heat-sensitive tape. Tapes and mastics used to seal flexible air ductsand flexible air connectors shall comply with UL 181B and shall be marked '181B-FX' for pressure-sensitive tape or'181B-M' for mastic. Unlisted duct tape is not permitted as a sealant on any metal ducts.
  11. All pipes serving space-conditioning systems must be insulated as follows: Hot water piping for heating systems: 1 in. for pipes <=1 1/2-in. nominal diameter 2 in. for pipes >1 1/2-in. nominal diameter. Chilled water, refrigerant, and brine piping systems: 1 in. insulation for pipes <=1 1/2-in. nominal diameter 1 1/2 in. insulation for pipes >1 1/2-in. nominal diameter. Steam piping: 1 1/2 in. insulation for pipes <=1 1/2-in. nominal diameter 3 in. insulation for pipes >1 1/2-in. nominal diameter.
    - Exception: Pipe insulation is not required for factory-installed piping within HVAC equipment.
    - Exception: Pipe insulation is not required for piping that conveys fluids having a design operating temperature range between 55 degrees F and 105 degrees F.
    - Exception: Pipe insulation is not required for piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
    - Exception: Pipe insulation is not required for runout piping not exceeding 4 ft in length and 1 in. in diameter between the control valve and HVAC coil.
  12. Operation and maintenance documentation must be provided to the owner that includes at least the following information:a) equipment capacity (input and output) and required maintenance actionsb) equipment operation and maintenance manualsc) HVAC system control maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions; desired or field-determined set points must be permanently recorded on control drawings, at control devices, or, for digital control systems, in programming commentsd) complete narrative of how each system is intended to operate.
  13. Each supply air outlet or diffuser and each zone terminal device (such as VAV or mixing box) must have its own balancing device. Acceptable balancing devices include adjustable dampers located within the ductwork, terminal devices, and supply air diffusers.
  14. Service hot water piping, where required, must be insulated to 1/2 in. if pipe less than 1.5 in. nominal diameter. Larger pipe must be insulated to 1 in.. Pipe insulation will have a conductivity of less than 0.28 Btu.in/(h-ft2-degrees F).
  15. Temperature controlling means must be provided to limit the maximum temperature of water delivered from lavatory faucets in public facility restrooms to 110 degrees F.

16. Outdoor air supply and exhaust systems must have motorized dampers that automatically shut when the systems or spaces served are not in use. Dampers must be capable of automatically shutting off during preoccupancy building warm-up, cool-down, and setback, except when ventilation reduces energy costs (e.g., night purge) or when ventilation must be supplied to meet code requirements. Both outdoor air supply and exhaust air dampers must have a maximum leakage rate of 3 cfm/ft<sup>2</sup> at 1.0 in w.g. when tested in accordance with AMCA Standard 500.
  - Exception: Gravity (non-motorized) dampers are acceptable in buildings less than three stories in height.
  - Exception: Systems with a design outside air intake or exhaust capacity of 300 cfm (140 L/s) or less that are equipped with motor operated dampers that open and close when the unit is energized and de-energized, respectively.
17. Stair and elevator shaft vents must be equipped with motorized dampers capable of being automatically closed during normal building operation and interlocked to open as required by fire and smoke detection systems. All gravity outdoor air supply and exhaust hoods, vents, and ventilators must be equipped with motorized dampers that will automatically shut when the spaces served are not in use. Exceptions: - Gravity (non-motorized) dampers are acceptable in buildings less than three stories in height above grade. - Ventilation systems serving unconditioned spaces.



COMcheck Software Version 3.4.2

# Mechanical Compliance Certificate

## 90.1 (2004) Standard

Report Date: 11/26/07

Data filename: C:\Spectrum\Projects\Sand Hollow Redesign\Comcheck\Sand Hollow Mechanical Comcheck.cck

## Section 1: Project Information

Project Title: Sand Hollow Maintenance Facility

Construction Site:  
Washington County  
UT

Owner/Agent:  
State of Utah DFCM

Designer/Contractor:  
Frederic J. Nash P.E., CPD, LEED AP.  
Spectrum Engineers  
2195 West Stonebridge Dr.  
St George, UT 84770  
435-656-2429  
fjn@spectrum-engineers.com

## Section 2: General Information

Building Location (for weather data): **Hurricane, Utah**  
Heating Degree Days (base 65 degrees F): **3674**  
Cooling Degree Days (base 50 degrees F): **4577**  
Project Type: **New Construction**

## Section 3: Mechanical Systems List

### Quantity System Type & Description

- |   |  |
|---|--|
| 1 | HVAC System 1 Offices: Heating: Central Furnace, Propane, Heating Capacity <65 kBtu/h / Cooling: Split System, Capacity <54 kBtu/h, Air-Cooled Condenser / Single Zone |
| 4 | HVAC System 2 Truck Bays: Heating: Total four (4) Unit Heaters, Propane, Heating Capacity >=65 - <225 kBtu/h each unit heater.   |
| 2 | HVAC System 3 Truck Bays: Cooling: Other, Capacity >=135 - <240 kBtu/h each, Two Evaporative Coolers on the roof.  |
| 1 | Storage Water Heater: Propane Storage Water Heater, Capacity: 60 gallons, Input Rating: 125000 Btu/h   |

## Section 4: Requirements Checklist

### Requirements Specific To: HVAC System 1 Offices:

- 1. Newly purchased equipment meets the efficiency requirements
- 2. Equipment minimum efficiency: Split System: 12.0 SEER

### Requirements Specific To: HVAC System 2 Truck Bays Heating:

- 1. Equipment minimum efficiency: Unit Heater (Propane): 80% Ec

### Requirements Specific To: HVAC System 3 Truck Bays Evaporative Cooling:

- 1. Equipment minimum efficiency: Evaporative Coolers: 80%.

### Requirements Specific To: Storage Water Heater:

- 1. Hot water system sized per manufacturer's sizing guide
- 2. Propane Storage Water Heater efficiency >= 80% Et, 170 SL, Btu/h
- 3. First 8 ft of outlet piping is insulated
- 4. Hot water storage temperature adjustable down to 120 degrees F or lower
- 5. Heat traps provided on inlet and outlet of storage tanks

**Generic Requirements: Must be met by all systems to which the requirement is applicable:**

- 1. Load calculations per 2001 ASHRAE Fundamentals
- 2. Thermostatic controls has 5 degrees F deadband  
Exception: Thermostats requiring manual changeover between heating and cooling
- 3. Automatic Controls: Setback to 55 degrees F (heat) and 85 degrees F (cool); 7-day clock, 2-hour occupant override, 10-hour backup  
Exception: Continuously operating zones
- 4. Hot water pipe insulation: 1 in. for pipes <=1.5 in. and 2 in. for pipes >1.5 in. Chilled water/refrigerant/brine pipe insulation: 1 in. for pipes <=1.5 in. and 1.5 in. for pipes >1.5 in. Steam pipe insulation: 1.5 in. for pipes <=1.5 in. and 3 in. for pipes >1.5 in.  
Exception: Piping within HVAC equipment  
Exception: Fluid temperatures between 55 and 105 degrees F  
Exception: Fluid not heated or cooled  
Exception: Runouts <4 ft in length
- 5. Piping, insulated to 1/2 in. if nominal diameter of pipe is <1.5 in.; Larger pipe insulated to 1 in. thickness
- 6. Lavatory faucet outlet temperatures in public restrooms limited to 110 degrees F (43 degrees C)
- 7. Where separate thermostats are used for heating and cooling, acceptable measures are used to prevent simultaneous heating and cooling
- 8. Motorized, automatic shutoff dampers required on exhaust and outdoor air supply openings  
Exception: Gravity dampers acceptable in buildings <3 stories  
Exception: Gravity dampers acceptable in systems with outside or exhaust air flow rates less than 300 cfm where dampers are interlocked with fan
- 10. Acceptable measures used to prevent simultaneous humidification and dehumidification  
Exception: Desiccant systems and systems for uses requiring specific humidity levels (approval required)
- 11. Automatic controls for freeze protection systems present
- 12. Automatic ventilation controls (e.g., CO2 controls) or exhaust air heat recovery present for high design occupancy areas (>100 person/1000 ft2) with >3,000 cfm outside air capacities
- 13. Duct, plenum, and piping insulation surfaces suitably protected from weather, moisture, or likely damage
- 14. Duct Sealing: Pressure sensitive tape is not used as the primary sealant Longitudinal and transverse seams for ducts in unconditioned spaces Longitudinal and transverse seams and duct wall penetrations for ducts outside the building Transverse seams on buried ducts
- 15. R-6 for supply air ducts located outside the building, in ventilated attics and in unvented attic above insulated ceiling R-3.5 for supply air ducts in unvented attic with roof insulation, unconditioned and underground spaces R-3.5 for return air ducts located outside the building, in ventilated attics and in unvented attic above insulated ceiling
- 17. Exhaust air heat recovery included for systems 5,000 cfm or greater with more than 70% outside air fraction or specifically exempted

**Section 5: Compliance Statement**

*Compliance Statement:* The proposed mechanical design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 90.1 (2004) Standard requirements in COMcheck Version 3.4.2 and to comply with the mandatory requirements in the Requirements Checklist.

Frederic J. Nash, P.E.  
Principal Mechanical Engineer  
State of Utah Mechanical License # 171885

*Fred Nash*

11-26-2007

Name - Title

Signature

Date

**Section 6: Post Construction Compliance Statement**

- HVAC record drawings of the actual installation and performance data for each equipment provided to the owner within 90 days after system acceptance.
- HVAC O&M documents for all mechanical equipment and system provided to the owner within 90 days after system acceptance.
- Written HVAC balancing report provided to the owner.



COMcheck Software Version 3.4.2

# Mechanical Requirements Description

## 90.1 (2004) Standard

Report Date:

Data filename: C:\Spectrum\Projects\Sand Hollow Redesign\Comcheck\Sand Hollow Mechanical Comcheck.ckk

The following list provides more detailed descriptions of the requirements in Section 4 of the Mechanical Compliance Certificate.

### Requirements Specific To: HVAC System 1 Offices:

1. The specified equipment is covered by Federal minimum efficiency requirements. New equipment of this type can be assumed to meet or exceed ASHRAE 90.1-2004 Standard requirements for equipment efficiency.
2. The specified heating and/or cooling equipment is covered by ASHRAE 90.1-2004 Standard and must meet the following minimum efficiency: Split System: 12.0 SEER

### Requirements Specific To: HVAC System 2 Truck Bays Heating:

1. The specified heating and/or cooling equipment is covered by the ASHRAE 90.1-2004 Standard and must meet the following minimum efficiency: Unit Heater (Propane): 80% Ec

### Requirements Specific To: HVAC System 3 Truck Bays Evaporative Cooling:

1. The specified heating and/or cooling equipment is covered by the ASHRAE 90.1-2004 Standard and must meet the following minimum efficiency: Evaporative Coolers: 80%.

### Requirements Specific To: Storage Water Heater:

1. Service water heating system design loads for the purpose of sizing systems and equipment must be determined in accordance with manufacturers' published sizing guidelines.
2. Service water heating equipment used solely for heating potable water, pool heaters, and hot water storage tanks must meet the following minimum efficiency: Propane Storage Water Heater efficiency  $\geq$  80% Et, 170 SL, Btu/h
3. Insulation must be provided for the first 8 ft of outlet piping for a constant temperature nonrecirculating storage system and for the inlet pipe between the storage tank and a heat trap in a storage system.
4. Temperature controls must be provided that allow for storage temperature adjustment from 120 degrees F or lower to a maximum temperature compatible with the intended use except when the manufacturer's installation instructions specify a higher minimum thermostat setting to minimize condensation and resulting corrosion. Documentation of the installation instructions must be provided to be exempted from this requirement.
5. Heat traps must be provided on inlet and outlet vertical pipe risers serving storage water heaters and storage tanks not having integral heat traps and serving a non-recirculating system. Heat traps must be installed as close as practical to the storage tank. Acceptable heat traps are either a) a device specifically designed for the purpose or b) an arrangement of tubing that forms a loop of 360 degrees F, or c) piping that from the point of connection to the water heater (inlet or outlet) includes a length of piping directed downwards before connection to the vertical piping of the supply water or hot water distribution system.

### Generic Requirements: Must be met by all systems to which the requirement is applicable:

1. Design heating and cooling loads for the building must be determined using procedures in the ASHRAE Handbook of Fundamentals or an approved equivalent calculation procedure.
2. Thermostats controlling both heating and cooling must be capable of maintaining a 5 degrees F deadband (a range of temperature where no heating or cooling is provided).  
Exception: Deadband capability is not required if the thermostat does not have automatic changeover capability between heating and cooling.
3. The system or zone control must be a programmable thermostat or other automatic control meeting the following criteria: a) capable of setting back temperature to 55 degrees F during heating and setting up to 85 degrees F during cooling. b) capable of automatically setting back or shutting down systems during unoccupied hours using 7 different day schedules. c) have an accessible 2-hour occupant override) have a battery back-up capable of maintaining programmed settings for at least 10 hours without power.

Exception: A setback or shutoff control is not required on thermostats that control systems serving areas that operate continuously.

4. All pipes serving space-conditioning systems must be insulated as follows: Hot water piping for heating systems: 1 in. for pipes  $\leq$  1 1/2-in. nominal diameter 2 in. for pipes  $>$  1 1/2-in. nominal diameter. Chilled water, refrigerant, and brine piping systems: 1 in. insulation for pipes  $\leq$  1 1/2-in. nominal diameter 1 1/2 in. insulation for pipes  $>$  1 1/2-in. nominal diameter. Steam piping: 1 1/2 in. insulation for pipes  $\leq$  1 1/2-in. nominal diameter 3 in. insulation for pipes  $>$  1 1/2-in. nominal diameter.

Exception: Pipe insulation is not required for factory-installed piping within HVAC equipment.

Exception: Pipe insulation is not required for piping that conveys fluids having a design operating temperature range between 55 degrees F and 105 degrees F.

Exception: Pipe insulation is not required for piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.

Exception: Pipe insulation is not required for runout piping not exceeding 4 ft in length and 1 in. in diameter between the control valve and HVAC coil.

5. Service hot water piping, where required, must be insulated to 1/2 in. if pipe less than 1.5 in. nominal diameter. Larger pipe must be insulated to 1 in.. Pipe insulation will have a conductivity of less than 0.28 Btu.in/(h-ft<sup>2</sup>-degrees F).

6. Temperature controlling means must be provided to limit the maximum temperature of water delivered from lavatory faucets in public facility restrooms to 110 degrees F.

7. Where zone heating and cooling are controlled by separate zone thermostats, means (such as limit switches, mechanical stops, or, for DDC systems, software programming) must be provided to prevent simultaneous heating and cooling to the zone.

8. Outdoor air supply and exhaust systems must have motorized dampers that automatically shut when the systems or spaces served are not in use. Dampers must be capable of automatically shutting off during preoccupancy building warm-up, cool-down, and setback, except when ventilation reduces energy costs (e.g., night purge) or when ventilation must be supplied to meet code requirements. Both outdoor air supply and exhaust air dampers must have a maximum leakage rate of 3 cfm/ft<sup>2</sup> at 1.0 in w.g. when tested in accordance with AMCA Standard 500.

Exception: Gravity (non-motorized) dampers are acceptable in buildings less than three stories in height.

Exception: Systems with a design outside air intake or exhaust capacity of 300 cfm (140 L/s) or less that are equipped with motor operated dampers that open and close when the unit is energized and de-energized, respectively.

9. All gravity outdoor air supply and exhaust hoods, vents, and ventilators must be equipped with motorized dampers that will automatically shut when the spaces served are not in use. Exceptions: - Gravity (non-motorized) dampers are acceptable in buildings less than three stories in height above grade. - Ventilation systems serving unconditioned spaces.

10. Where a zone is served by a system(s) with both humidification and dehumidification capability, means (such as limit switches, mechanical stops, or software programming) must be provided to prevent simultaneous operation of humidification and dehumidification equipment.

Exception: Zones served by desiccant systems, used with direct evaporative cooling in series; Systems serving zones where specific humidity levels are required.

11. All freeze protection systems, including self-regulating heat tracing, must include automatic controls capable of shutting off the systems when outside air temperatures are above 40 degrees F or when the conditions of the protected fluid will prevent freezing. Snow- and ice-melting systems must include automatic controls capable of shutting off the systems when the pavement temperature is above 50 degrees F and no precipitation is falling, and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40 degrees F.

12. Systems with design outside air capacities  $>$ 3,000 cfm serving areas having an average design occupancy density exceeding 100 people per 1000 ft<sup>2</sup> must include means to automatically reduce outside air intake below design rates when spaces are partially occupied. Ventilation controls must be in compliance with ASHRAE Standard 62 and local standards.

13. Duct and pipe insulation exposed to weather must be suitable for outdoor service; e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation must be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material insulation covering chilled water piping, refrigerant suction piping, or cooling ducts located outside the conditioned space must include a vapor retardant located outside the insulation (unless the insulation is inherently vapor retardant), all penetrations and joints of which must be sealed.

14. Duct Sealing Requirements: - Pressure sensitive tape prohibited as the primary sealant - Longitudinal and transverse seams for ducts in unconditioned spaces - Longitudinal and transverse seams and duct wall penetrations for ducts outside the building - Transverse seams on buried ducts

15. All supply and return ducts and plenum installed as part of an HVAC air distribution system must be thermally insulated: R-6 for supply air ducts located outside the building, in ventilated attics and in unvented attic above insulated ceiling, R-3.5 for supply air duct insulation in unvented attic with roof insulation, unconditioned and underground spaces, R-3.5 for return air ducts located outside the building, in ventilated attics and in unvented attic above insulated ceiling.

17. Individual fan systems with a design supply air capacity of 5000 cfm or greater and minimum outside air supply of 70% or greater of the supply air capacity must have an energy recovery system with at least a 50% effectiveness. Exceptions: - Systems serving spaces that are not cooled and heated to  $<$ 60 degrees F. - Commercial kitchen hoods (grease) classified as Type 1 by NFPA 96 - Systems exhausting toxic, flammable, paint, or corrosive fumes or dust If an air economizer is also required, heat recovery must be bypassed or controlled to permit air economizer operation.



# COMcheck Software Version 3.4.1 Lighting Compliance Certificate

## 2006 IECC

Report Date: 12/26/07

Data filename: P:\2007\20070547\0Quality\_Control\Design\_and\_Calculations\16Electrical\Lighting\comcheck.cck

### Section 1: Project Information

Project Title: Sand Hollow State Park Maintenance Garage

Construction Site:

Owner/Agent:  
State of Utah

Designer/Contractor:

### Section 2: General Information

Building Use Description by: **Activity Type**  
Project Type: **New Construction**

<u>Activity Type(s)</u>	<u>Floor Area</u>
Workshop	4574

### Section 3: Requirements Checklist

#### Interior Lighting:

1. Total actual watts must be less than or equal to total allowed watts.

Allowed Watts	Actual Watts	Complies
6404	5795	YES

#### Exterior Lighting:

2. Efficacy greater than 45 lumens/W.

*Exceptions:*

Specialized lighting highlighting features of historic buildings; signage; safety or security lighting; low-voltage landscape lighting.

3. Comply with Sections 505.2.4 and 505.6 of IECC 2006 and attach documentation.

#### Controls, Switching, and Wiring:

4. Independent controls for each space (switch/occupancy sensor).

*Exceptions:*

Areas designated as security or emergency areas that must be continuously illuminated.

Lighting in stairways or corridors that are elements of the means of egress.

5. Master switch at entry to hotel/motel guest room.
6. Individual dwelling units separately metered.
7. Each space provided with a manual control to provide uniform light reduction by at least 50%.

*Exceptions:*

Only one luminaire in space;

An occupant-sensing device controls the area;

The area is a corridor, storeroom, restroom, public lobby or sleeping unit.

Areas that use less than 0.6 Watts/sq.ft.

8. Automatic lighting shutoff control in buildings larger than 5,000 sq.ft.

*Exceptions:*

Sleeping units, patient care areas; and spaces where automatic shutoff would endanger safety or security.

9. Photocell/astronomical time switch on exterior lights.

*Exceptions:*

Lighting intended for 24 hour use.

10. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).

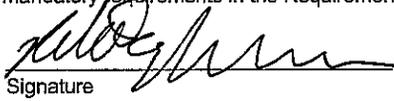
*Exceptions:*

Electronic high-frequency ballasts; Luminaires on emergency circuits or with no available pair.

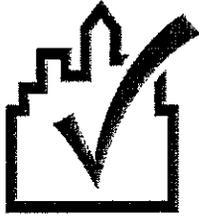
#### Section 4: Compliance Statement

*Compliance Statement:* The proposed lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2006 IECC requirements in COMcheck Version 3.4.1 and to comply with the mandatory requirements in the Requirements Checklist.

Peter Johansen Engineer  
Name - Title

  
Signature

12/27/07  
Date



# Lighting Application Worksheet

## 2006 IECC

Report Date:

Data filename: P:\2007\20070547\0Quality\_Control\Design\_and\_Calculations\16Electrical\Lighting\comcheck.cck

### Section 1: Allowed Lighting Power Calculation

A Area Category	B Floor Area (ft <sup>2</sup> )	C Allowed Watts / ft <sup>2</sup>	D Allowed Watts (B x C)
Workshop	4574	1.4	6404
Total Allowed Watts =			6404

### Section 2: Actual Lighting Power Calculation

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
<b>Workshop (4574 sq.ft.)</b>				
HID 1: HB-8: Metal Halide 400W / Electronic	1	9	510	4590
Linear Fluorescent 1: S-3: 48" T8 32W / Electronic	2	11	55	605
Linear Fluorescent 2: WB-3: 48" T8 32W / Electronic	2	3	55	165
Linear Fluorescent 3: W-3: 48" T8 32W / Electronic	2	3	55	165
Linear Fluorescent 4: Q3-6: 48" T8 32W / Electronic	3	2	85	170
Compact Fluorescent 1: DF-47: Triple 4-pin 32W / Electronic	1	2	50	100
Total Actual Watts =				5795

### Section 3: Compliance Calculation

If the Total Allowed Watts minus the Total Actual Watts is greater than or equal to zero, the building complies.

Total Allowed Watts = 6404  
 Total Actual Watts = 5795  
 Project Compliance = 609

**Lighting PASSES. Design 10% better than code.**

SECTION 000107 – SEALS

Architectural, Civil and Electrical seals are included herewith. See drawings for mechanical and structural specifications and seals.

ARCHITECTURAL SEAL:

CIVIL SEAL:

ELECTRICAL:

END OF SECTION 000107

SECTION 003132 – GEOTECHNICAL DATA

The attached copy of the Geotechnical Investigation, prepared by RB & G Engineering, Inc., dated January 2008 is included for reference.

END OF SECTION 003132



GEOTECHNICAL INVESTIGATION

**SAND HOLLOW  
STATE PARK  
MAINTENANCE  
SHED**

Washington County, Utah

*Prepared for:  
Johansen & Tuttle Engineering*

*January 2008*

**RB&G**  
ENGINEERING, INC.

January 9, 2008

Johansen & Tuttle Engineering  
Box 487  
Castle Dale, UT 84513  
[jt@etv.net](mailto:jt@etv.net)

Subject: Sand Hollow State Park Maintenance Shed  
Geotechnical Investigation

Gentlemen:

A Geotechnical Investigation has been completed for the proposed Maintenance Shed to be located at the Sand Hollow State Park in Washington County, Utah. The results of the study are summarized in the report transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.

  
Bradford E. Price, P.E.



bep/jal

Geotechnical Investigation

**Sand Hollow  
State Park  
Maintenance  
Shed**

Washington County, Utah

*Prepared for:  
Johansen & Tuttle Engineering*

*January 2008*

RB&G ENGINEERING, INC.

**SAND HOLLOW  
STATE PARK MAINTENANCE SHED  
Washington County, Utah**

***Geotechnical Investigation***

**I. INTRODUCTION**

This report outlines the results of a geotechnical investigation performed for the Sand Hollow State Park Maintenance Shed to be located north of the Sand Hollow State Park Entrance Building as shown in Figure 1. The purpose of this investigation was to determine the characteristics of the subsurface material throughout the site so that satisfactory substructures can be designed to support the proposed facility. The results of the investigation, along with pertinent recommendations for foundation design, are outlined in the following sections of this report.

The information contained in the report is discussed under the following headings: (1) Geological and Existing Site Conditions, (2) Field and Laboratory Testing Procedures, (3) Subsurface Soil and Water Conditions, (4) Foundation Considerations and Recommendations, and (5) Site Preparation, Compacted Fill Requirements and Flexible Pavement Design.

**II. GEOLOGICAL AND EXISTING SITE CONDITIONS**

**A. REGION GEOLOGY**

The St. George region is located in southwestern Utah within the transition zone between the Basin and Range Province to the west and the Colorado Plateau Province to the east (Higgins and Wills, 1995). The area sits within the Intermountain Seismic Belt (ISB), which roughly corresponds with the eastern edge of the Basin and Range Province. The ISB is a zone of seismic activity about 60 to 120 km wide, which trends from Montana down to through northern Arizona. The zone contains many well-documented Pleistocene and Holocene age fault scarps (Arabasz and Smith, 1981).

Bedrock exposed in the St. George area consists predominately of Permian to Jurassic age sedimentary deposits, and younger Late Tertiary to Quaternary Basalts.

The region has undergone compressional forces during the Late Cretaceous Sevier Orogeny, resulting in the St. George Syncline and the Virgin anticline, which includes the Harrisburg, Bloomington and Washington Domes (Higgins and Wills, 1995). More recent extensional forces have resulted in the normal faulting and basalt flows seen throughout the area.

## B. SITE GEOLOGY

The Sand Hollow maintenance shed is located just west of the reservoir near the entrance to the State Park. This area is overlain with Quaternary age Holocene to Upper Pleistocene eolian (wind blown) sand deposits (Qes). These deposits are typically well-sorted, fine to medium grained, well-rounded, quartz sand. In this area the sand is primarily derived from the Navajo Sandstone Formation and locally forms small sand dunes. This relatively loose sand deposit can locally contain a hard calcium rich caliche layer. During this investigation no evidence of a hardpan or caliche layer was noted.

Bedrock beneath the eolian sand consists of the Lower Jurassic age Navajo Sandstone Formation. The Navajo was laid down as part of a vast costal and inland wind blown dune field, which extended across much of Utah and into Wyoming Arizona and Nevada. The sandstone is a pale-reddish-orange and consists of well-sorted, well-rounded, fine to medium-grained, frosted quartz sand (Biek and other, 2007). The sandstone exhibits large crossbedding and is well jointed. The Navajo Sandstone is one of the principal aquifers in the region.

## C. GEOLOGIC HAZARDS

No geologic hazards associated with debris flows, landslides, rockfall, unstable slopes, or expansive, collapsible or soluble soil and rock were encountered at this site. As mentioned earlier, the site is within a tectonically active region, where several faults could generate large earthquakes with significant ground shaking.

## D. FAULTING AND SEISMICITY

Ground shaking during a moderate to large earthquake in the region is likely the most significant geologic hazard at this site. While no active faults has been identified within the immediate vicinity of the site several potentially active normal faults area located within about 6 miles of the site. The Hurricane fault is located about 4.5 miles to the east. With the Washington fault about 6 miles to the west. Historic earthquakes in the region have not been greater than magnitude 6.5. Geologic studies have found that faults in the region could generate magnitudes on the order of 7 to 7.5. On September 2, 1993 a 5.8 magnitude event took place with an epicenter about 5 miles east of St. George. Ground shaking was strongly felt in the area and likely triggers landslides in Springdale about 95 miles to the east (Higgins and Willis, 1995).

## E. EXISTING SITE CONDITIONS

The topography throughout the site slopes gently downward towards the south. The site is unoccupied at the present time with the exception of some utilities that appear to have been installed relatively recently. At the time the field investigation was performed, it was evident that some surface grading had recently occurred over much of the proposed building and pavement area. Vegetation in areas which had not been recently graded consisted of sparse short grasses.

The Sand Hollow West Dam is located approximately 1000 feet south and east of the site. There are no other major water bodies or water conveyance facilities in the immediate area which would influence the groundwater level. Other than the information provided above, no conditions appear to exist at this site which would adversely affect foundation performance.

## III. FIELD AND LABORATORY TESTING PROCEDURES

The subsurface investigation within the proposed building area was performed using a CME 55 rotary drill rig with a tri-cone rock bit and NW casing to advance the boring and water as the drilling fluid. During the subsurface investigation, sampling was performed at three foot intervals throughout the depth investigated. Disturbed samples were obtained by driving a 2-inch split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. The standard penetration value, corrected for overburden and hammer energy, provides a good indication of the in-place density of sandy material.

It will be noted that it was not possible to drive the sampling spoon through the full 18 inches at some sampling locations. Where the sampling tube could not be driven through the full 18 inches, the number of blows to drive the spoon through a given depth of penetration is shown on the boring logs.

Each sample obtained in the field was classified in the laboratory according to the Unified Soil Classification System. The symbol designating the soil type according to this system is presented on the boring logs. A description of the Unified Soil Classification System is presented in the appendix, and the meaning of the various symbols, shown on the logs, can be obtained from this figure.

Laboratory tests performed during this investigation to define the characteristics of the subsurface material throughout the proposed site included natural moisture content, mechanical analyses, pH, resistivity and sulfate tests. Testing was performed following procedures outlined in the American Society for Testing and Materials (ASTM) standards.

#### **IV. SUBSURFACE SOIL AND WATER CONDITIONS**

The characteristics of the subsurface material were evaluated by drilling 2 borings to depths of 9 and 12 feet within the proposed building area, and drilling 3 borings and excavating 1 test pit to depths between 3 and 4 feet in the parking and driveway areas at the approximate locations shown in Figure 2. The logs for the borings are presented in the appendix, and it will be observed that the subsurface profile consists of a surface layer of loose silty sand extending to a depth of between 2 and 5.5 feet, underlain by sandstone bedrock.

No groundwater was encountered within the depth investigated at the time the field investigation was performed (January 2008).

The results of classification and moisture tests are presented on the boring logs and the results of all laboratory tests are summarized in Table 1 in the appendix. It will be noted from Table 1 that the non-plastic silty sand has 1 to 3% gravel size particles, 79 to 85% sand and 13 to 19% silt.

It will also be observed from Table 1 that the silty sand has relatively high resistivity and is considered to have excellent corrosion resistance. These soils have low percentages of water soluble sulfate. While Type I or Type II cement is acceptable, it is recommended that Type II cement be used for concrete in contact with the native soils due to its increased resistance to sulfate attack.

#### **V. FOUNDATION CONSIDERATIONS AND RECOMMENDATIONS**

##### **A. FOUNDATION TYPES AND BEARING CAPACITIES**

We understand that the building will be a single story masonry type structure approximately 58 feet wide and 73 feet long. The site grading plan was not available at the time this report was prepared; however, it is assumed that finished floor elevation will be within 1 to 2 feet of the existing ground surface.

It is anticipated that the building will be supported using continuous and spot footings. The magnitude of the structural loads are not known as of the preparation of this report; however,

it has been assumed that wall loads will not exceed 4 klf and column loads, if any, will not exceed 75 kips.

We recommend that all exterior foundations be located at a depth at least 1.5 foot below finished grade to provide frost protection, and that interior footings be located at least 1 foot below floor level. The loose to very loose silty sand at the footing level has low bearing capacity and footings supported directly on this material will likely experience poor performance associated with creep settlement. It is recommended, therefore, that no footings be supported directly on this material. We recommend that foundation areas be over excavated with the excavations extending through the loose silty sand to the underlying sandstone bedrock. This will require over excavation of 1.5 to 3.5 feet. The footings should either extend to the bedrock, or compacted fill should be used to backfill the excavation to the footing grade. If fill is used, the width of the excavations should extend at least 2 feet beyond the footing periphery. The on-site silty sand can be used as structural fill provided that it is moisture conditioned to within 2% of optimum, placed in lifts not exceeding 8 inches in thickness, and compacted to an in-place density equal to at least 95% of the maximum laboratory density as determined by ASTM D 1557.

If the above recommendations are complied with, footings can be designed using an allowable bearing capacity of 2,500 psf for footings up to 4 feet wide, except that in no case should the width of any footing be less than 24 inches. If footings larger than 4 feet in width are required, an allowable bearing capacity of 4,000 psf can be used.

If footings are designed and constructed following the above recommendations, total settlement should not exceed 1 inch and differential settlement should not exceed ½ inch, which should be entirely satisfactory for the proposed structure.

## B. LATERAL EARTH PRESSURES

It is not anticipated that earth-retaining structures will be required for the proposed facility. If earth-retaining structures are required, however, and if backfilling is performed using granular material, we recommend that the earth pressures be calculated using the following equation, along with the earth pressure coefficient outlined below:

$$P = \frac{1}{2} \gamma K H^2$$

Where  $P$  = total lateral force on the wall, plf  
 $K$  = earth pressure coefficient  
 $\gamma$  = unit weight of the soil (125 pcf)  
 $H$  = height of the wall

The earth pressure coefficient used in designing the walls will depend upon whether the wall is free to move during backfilling operations, or whether the wall is restrained during backfilling. If the wall is free to move during backfilling operations and the backfill material is granular soil, we recommend an earth pressure coefficient of 0.30 be used in the above equation to calculate the lateral earth pressures. If the walls are restrained from any movement during backfilling and the backfill material is granular soil, we recommend an earth pressure coefficient of 0.45 be used to calculate the lateral earth pressures. It should be recognized that the pressures, calculated by the above equation, are earth pressures only and do not include hydrostatic pressures. Where hydrostatic pressures may exist behind a retaining structure, we recommend either the wall be designed to resist hydrostatic pressure, or that a drainage system be placed behind the wall to prevent the development of hydrostatic pressures.

### C. SEISMIC CONSIDERATIONS

The site is classified as Site Class C, as per Section 1613 of the 2006 International Building Code. The site is located at latitude 37.1194° North and longitude 113.3883° West. Probabilistic peak ground acceleration (PGA) values are tabulated below:

PGA	Probabilistic ground motion values in %g.	
	10%PE in 50 yr	2%PE in 50 yr
PGA	9.5	25.0
0.2 sec SA	22.4	59.9
1.0 sec SA	7.1	9.5

The allowable soil bearing pressure indicated above may be increased by one-third where seismic forces are involved in the structural loads. If the passive pressures associated with footings and walls are used to resist seismic forces, and if backfilling is performed using granular material, we recommend that the passive pressures be calculated from the lateral earth pressure equation using an earth pressure coefficient of 2.0. If the frictional resistance of the footings and floor slabs are used to resist seismic forces, we recommend a coefficient of friction of 0.40 be used to calculate these forces.

It is not anticipated that groundwater will rise above the bedrock into the silty sand, therefore, problems associated with liquefaction during a seismic event are unlikely at this site, and no special mitigation of the foundation soils is required.

## VI. SITE PREPARATION, COMPACTED FILL REQUIREMENTS & FLEXIBLE PAVEMENT DESIGN

### A. SITE PREPARATION AND COMPACTED FILL REQUIREMENTS

As indicated above, the vegetative cover, where present, throughout the building site consists of short grasses. We recommend that the upper 4 inches be stripped from where organic material is present in the upper portion of the soil profile.

We recommend that the upper 10 inches of silty sand beneath floor slabs be scarified, moisture conditioned to within 2% of optimum and compacted to at least 92% of the maximum density as determined by ASTM D 1557.

Grading around each structure should be performed in such a manner that all surface water will flow freely from the area and that no ponding will occur adjacent to the structure which will permit deep percolation into the foundation area. Roof drains should extend well beyond the building lines to prevent seepage into the foundation soils. Sprinkler heads located adjacent to the building should be directed away from the structure to prevent the percolation of water into the foundation zone.

Backfilling around foundation walls should be performed using granular material densified to an in-place unit weight equal to at least 90% of the maximum laboratory density indicated above.

### B. FLEXIBLE PAVEMENT DESIGN

In providing recommendations for flexible pavement design for driveways and parking areas, an equivalent single axle load (ESAL) of 10,000 has been used. This value is comparable to 600 passenger cars and light trucks per day and 10 heavy trucks per month over a design life of 20 years. The flexible pavement thickness has been determined using the AASHTO Structural Number Procedure. The following additional assumptions have been made in determining the flexible pavement thickness:

Design E-18's	= 10,000
Reliability	= 85%
Overall Deviation	= 0.45
Resilient Modulus	= 7,500 psi
Initial Serviceability	= 4.2
Terminal Serviceability	= 2.0

The results of the analysis indicates that a flexible pavement consisting of 2.5 inches of an asphalt surface course plus 6 inches of untreated granular base will be adequate to support the contemplated traffic. In performing the analysis, it has been assumed that the upper 8 inches of the natural material will be scarified and re-densified to an in-place unit weight equal to 90% of the maximum laboratory density, as determined by ASTM D 1557, resulting in a CBR value of 5.0 for the natural material.

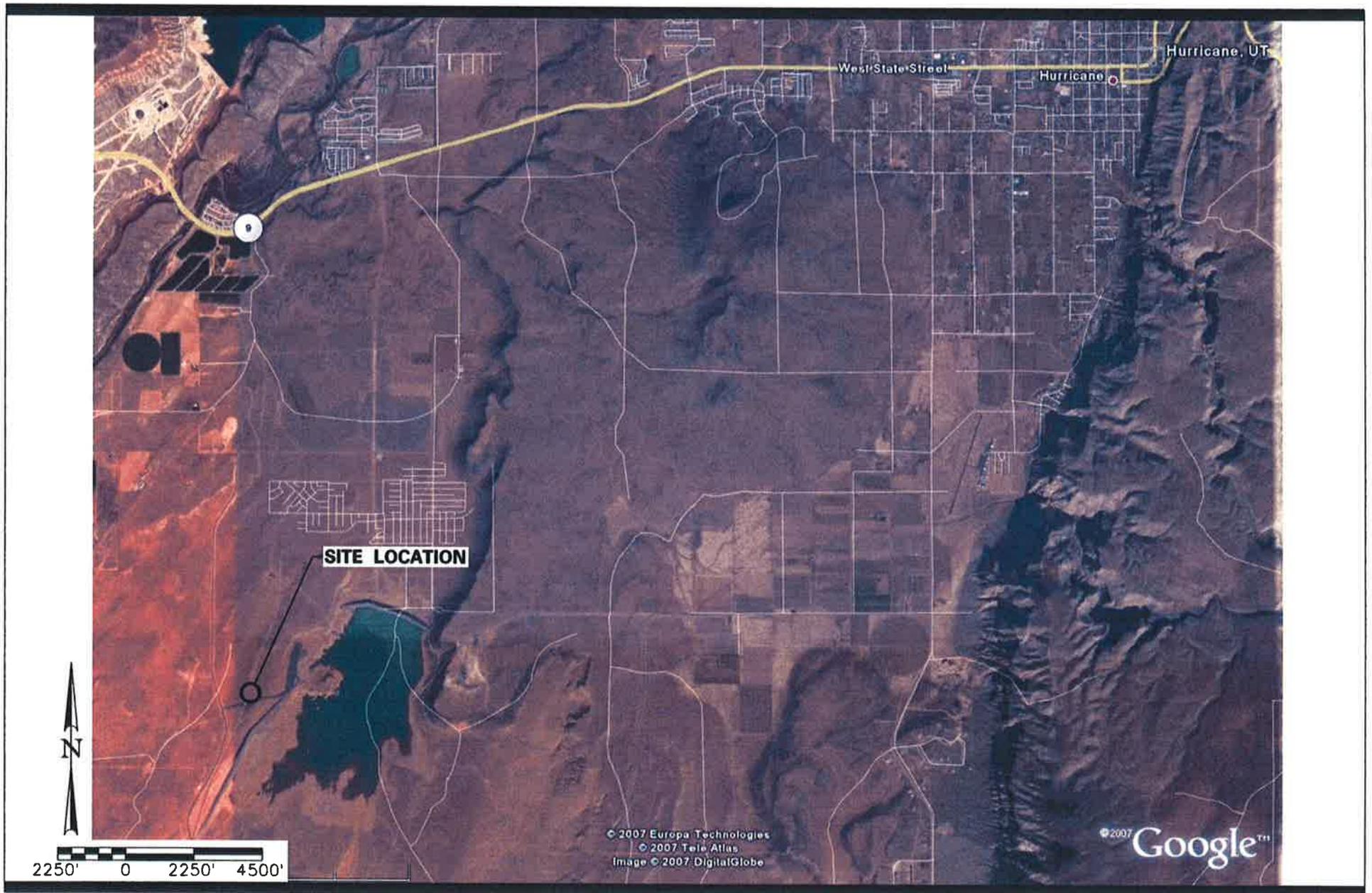
All base material should be densified to an in-place unit weight equal to 95% of the maximum laboratory density indicated above and all untreated granular base should conform to Utah Department of Transportation Specifications. Mineral aggregates used in the asphalt surface course should conform to Section 02741 of the standard specifications of the Utah State Department of Transportation. Mixing, placing, and densification of all asphalt materials should also conform to UDOT standards.

## **VII. LIMITATIONS**

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests which, in our opinion, define the characteristics of the subsurface material throughout the site in a satisfactory manner. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist throughout this site which could not be defined during this investigation. If during construction, conditions are encountered which appear to be different than those presented in this report, it is requested that we be advised in order that appropriate action may be taken. If structural fill is used, testing should be performed at one foot intervals for spot footings and every 50 feet at one foot intervals for continuous footings to verify that compaction requirements are met.

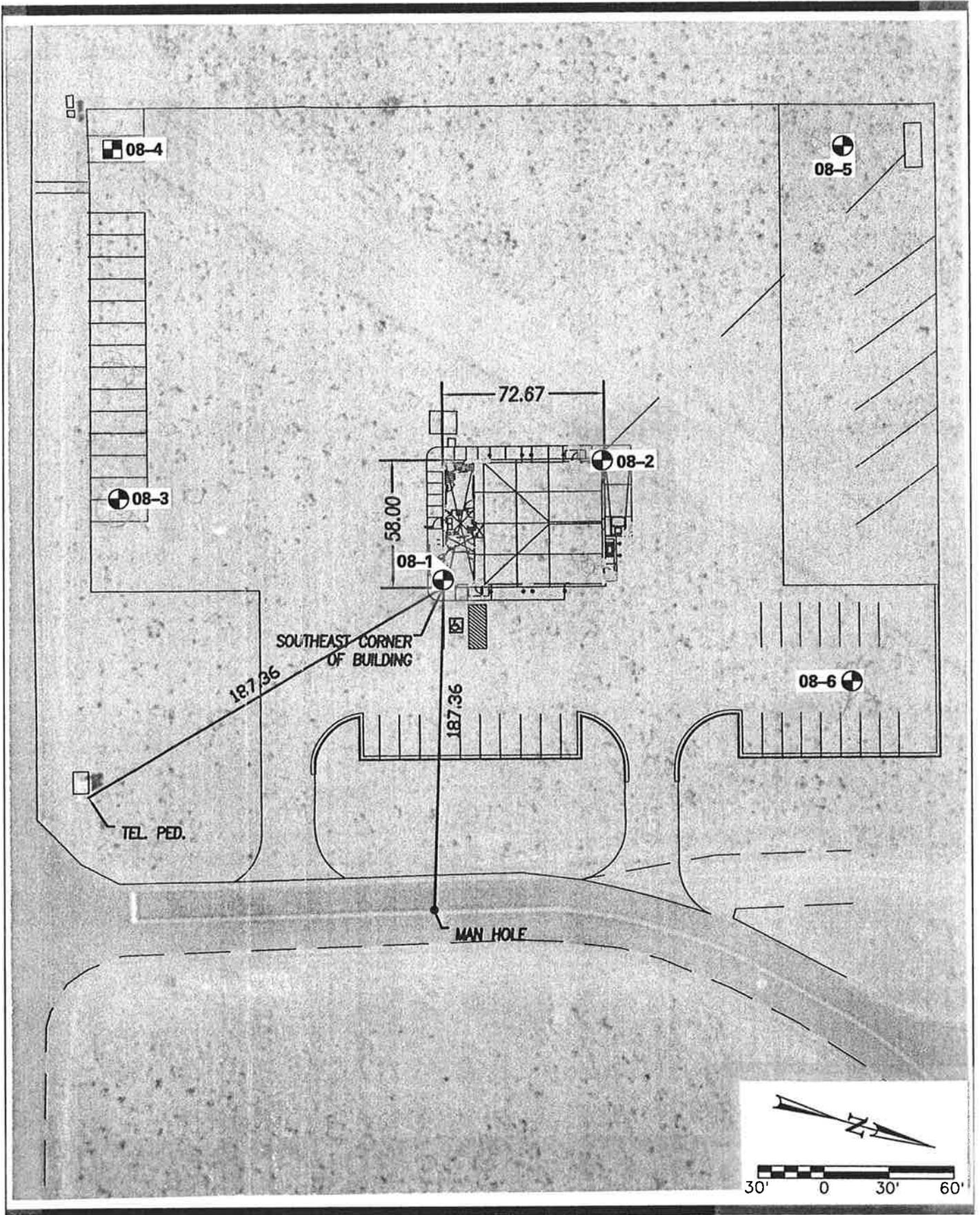
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Figure 1 VICINITY MAP  
*Sand Hollow State Park Maintenance Shed  
Washington County, Utah*



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Figure 2 SITE PLAN & TEST HOLE LOCATIONS  
*Sand Hollow State Park Maintenance Shed*  
*Washington County, Utah*

# Appendix

# Unified Soil Classification System

Major Divisions		Group Symbols	Typical Names	Laboratory Classification Criteria				
<b>COARSE-GRAINED SOILS</b>  <i>more than half of material is larger than No. 200 sieve</i>	<b>Gravels</b>  <i>more than half of coarse fraction is larger than No. 4 sieve size</i>	<b>Clean Gravels</b>  <i>little or no fines</i>	<b>GW</b>	Well graded gravels, gravel-sand mixtures, little or no fines	<p><i>For laboratory classification of coarse-grained soils</i></p> $C_u = \frac{D_{60}}{D_{10}} \quad \text{Greater than 4}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} \quad \text{Between 1 and 3}$ <p>Determine percentage of gravel and sand from grain-size curve.</p> <p>Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:</p> <p><b>Less than 5% GW, GP, SW, SP</b></p> <p><b>More than 12% GM, GC, SM, SC</b></p> <p><b>5% to 12% Borderline cases requiring use of dual symbols**</b></p>	$C_u = \frac{D_{60}}{D_{10}} \quad \text{Greater than 4}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} \quad \text{Between 1 and 3}$		
			<b>GP</b>	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW		
		<b>Gravels With Fines</b>  <i>appreciable amount of fines</i>	<b>GM*</b>	<b>d</b>		Silty gravels, poorly graded gravel-sand-silt mixtures	Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
				<b>u</b>				
			<b>GC</b>	Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, or PI greater		
	<b>Sands</b>  <i>more than half of coarse fraction is smaller than No. 4 sieve size</i>	<b>Clean Sands</b>  <i>little or no fines</i>	<b>SW</b>	Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}} \quad \text{Greater than 6}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} \quad \text{Between 1 and 3}$	$C_u = \frac{D_{60}}{D_{10}} \quad \text{Greater than 6}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} \quad \text{Between 1 and 3}$	
			<b>SP</b>	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW		
		<b>Sands with Fines</b>  <i>appreciable amount of fines</i>	<b>SM*</b>	<b>d</b>		Silty sands, poorly graded sand-silt mixtures	Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
				<b>u</b>				
			<b>SC</b>	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line, or PI greater		
<b>FINE-GRAINED SOILS</b>  <i>more than half of material is smaller than No. 200 sieve</i>	<b>Silts and Clays</b>  <i>liquid limit is less than 50</i>	<b>ML</b>	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	<p><i>For laboratory classification of fine-grained soils</i></p> <p><b>Plasticity Chart</b></p>				
		<b>CL</b>	Inorganic clays of low to medium plasticity, sandy clays, silty clays, lean clays					
		<b>OL</b>	Organic silts and organic silt-clays of low plasticity					
	<b>Silts and Clays</b>  <i>liquid limit is greater than 50</i>	<b>MH</b>	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts					
		<b>CH</b>	Inorganic clays of high plasticity, fat clays					
		<b>OH</b>	Organic clays of medium to high plasticity, organic silts					
		<b>Pt</b>	Peat and other highly organic soils					
<b>HIGHLY ORGANIC SOILS</b>								

\*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

\*\*Borderline classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. (For example GW-GC, well graded gravel-sand mixture with clay liner.)

# DRILL HOLE LOG

# BORING NO. 08-1

PROJECT: SAND HOLLOW STATE PARK MAINTENANCE SHED

SHEET 1 OF 1

CLIENT: JOHANSEN & TUTTLE ENGINEERS

PROJECT NUMBER: 200701.070

LOCATION: SEE SITE PLAN

DATE STARTED: 1/2/08

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING

DATE COMPLETED: 1/2/08

DRILLER: D. SAMPSON

GROUND ELEVATION: 101.8\*

DEPTH TO WATER - INITIAL: ▽ 9.0' AFTER 24 HOURS: ▼ DRY TO 11.5'

LOGGED BY: B. HORROCKS, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			PID (ppm)
			Type	See Legend	USCS				Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	Silt/Clay (%)	
			18	2,3,3	SM	red-brown, moist, loose		4.6	NP	2	83	15		
100			18	1,2,5	SM	SILTY SAND random silty clay lenses red-brown, moist, loose		7.8	NP	3	80	17		
5			2	50/2*	-	red-brown								
95			0	56/1*	-	no recovery								
			0	56/1*	-	no recovery								
10			0	56/1*	-	no recovery								
90			0	56/1*	-	no recovery								
						*Manhole shown on site plan = 100.0'								

200601.054 SANDHOLLOWSHED.GPJ US EVAL.GDT 1/9/08



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**LEGEND:**

DISTURBED SAMPLE

2,3,2 ← Blow Count per 6"  
0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

PUSHED  
0.45 ← Torvane (tsf)

**OTHER TESTS**

UC = Unconfined Compression  
CT = Consolidation  
DS = Direct Shear  
TS = Triaxial Shear  
CBR = California Bearing Ratio

# DRILL HOLE LOG

**BORING NO. 08-2**

SHEET 1 OF 1

PROJECT: SAND HOLLOW STATE PARK MAINTENANCE SHED

CLIENT: JOHANSEN & TUTTLE ENGINEERS

PROJECT NUMBER: 200701.070

LOCATION: SEE SITE PLAN

DATE STARTED: 1/2/08

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING

DATE COMPLETED: 1/2/08

DRILLER: D. SAMPSON

GROUND ELEVATION: 102.7\*\*

DEPTH TO WATER - INITIAL:  $\nabla$  7.1' AFTER 24 HOURS:  $\nabla$  DRY TO 4.5'

LOGGED BY: B. HORROCKS, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation		PID (ppm)
			Type	See Legend	USCS				Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	
			18	2,5,3	SM	red-brown, moist, loose							
			16	0,2,50/5*	SM	red-brown, moist, very loose							
					-	red-brown							
	5		0	56/1*	-	no recovery							
						SANDSTONE BEDROCK							
	95		0	56/1*	-	no recovery							
						*Manhole shown on site plan = 100.0'							

200601.054 SANDHOLLOWSHED.GPJ US EVAL.GDT 1/9/08



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**LEGEND:**

DISTURBED SAMPLE

2,3,2 ← Blow Count per 6"  
0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

$\nabla$  PUSHED  
0.45 ← Torvane (tsf)

**OTHER TESTS**

UC = Unconfined Compression  
CT = Consolidation  
DS = Direct Shear  
TS = Triaxial Shear  
CBR = California Bearing Ratio



# TEST PIT LOG

TEST PIT NO. 08-4

SHEET 1 OF 1

PROJECT: SAND HOLLOW STATE PARK MAINTENANCE SHED

CLIENT: JOHANSEN & TUTTLE ENGINEERS

PROJECT NUMBER: 200701.070

LOCATION: SEE SITE PLAN

DATE STARTED: 1/2/08

DIGGING METHOD: HAND TOOLS

DATE COMPLETED: 1/2/08

OPERATOR: S. BAILEY

GROUND ELEVATION: 97.9'

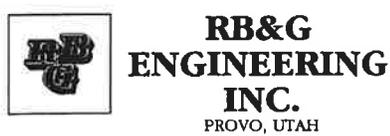
DEPTH TO WATER - INITIAL: ∇ DRY' AFTER 24 HOURS: ∇ N.M.

LOGGED BY: B. HORROCKS, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			Other Tests	
			Type	Rec. (in)	See Legend				USCS	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)		Silt/Clay (%)
					Bulk	SM	red-brown, moist								
					Bulk	SM	red-brown, moist								
95															
	5														
90															

TP\_LOGV1B SANDHOLLOWSHED\_TP.GPJ US EVAL\_GDT 1/9/08

\*Manhole shown on site plan = 100.0'



**LEGEND:**

DISTURBED SAMPLE Bucket  
 0.45 Torvane (tsf)

UNDISTURBED SAMPLE

← Type of Sample  
 ← Torvane (tsf)

**OTHER TESTS**  
 UC = Unconfined Compression  
 CT = Consolidation  
 DS = Direct Shear  
 TS = Triaxial Shear  
 CBR = California Bearing Ratio



# DRILL HOLE LOG

**BORING NO. 08-6**

SHEET 1 OF 1

PROJECT: SAND HOLLOW STATE PARK MAINTENANCE SHED

CLIENT: JOHANSEN & TUTTLE ENGINEERS

PROJECT NUMBER: 200701.070

LOCATION: SEE SITE PLAN

DATE STARTED: 1/2/08

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING

DATE COMPLETED: 1/2/08

DRILLER: D. SAMPSON

GROUND ELEVATION: 103.7\*\*

DEPTH TO WATER - INITIAL:  $\nabla$  DRY' AFTER 24 HOURS:  $\nabla$  N.M.

LOGGED BY: B. HORROCKS, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample			Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.		Gradation			PID (ppm)
			Type	See Legend	USCS				Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	Silt/Clay (%)	
					SM	red-brown, moist SILTY SAND W/GRAVEL								
			18	2,45,45										
			11	23/60/5*		SANDSTONE BEDROCK weathered								
						*Manhole shown on site plan = 100.0'								

200601.054 SANDHOLLOWSHED.GPJ US EVAL.GDT 1/9/08



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**LEGEND:**

DISTURBED SAMPLE

2,3,2 ← Blow Count per 6"  
0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

PUSHED  
0.45 ← Torvane (tsf)

**OTHER TESTS**

UC = Unconfined Compression  
CT = Consolidation  
DS = Direct Shear  
TS = Triaxial Shear  
CBR = California Bearing Ratio



SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Project Identification: As follows:

1. Project: Sand Hollow Utah State Park Maintenance Shed  
Sand Hollow Utah State Park  
4405 West 3600 South  
Hurricane, Utah 84737
2. Owner: State of Utah  
Department of Natural Resources  
1594 West North Temple  
PO Box 146001  
Salt Lake City, Utah 84114-6001  
Daniel Clark – Facilities and Construction Manager

B. Contract Documents, dated January 16, 2008 were prepared by James T. Dresslar Architect, LLC, 387 Park Lane, Moab, Utah 84532 (435) 259-1155.

C. The Work consists of a new municipal vehicle maintenance facility, including associated site improvements, as described within the Contract Documents.

D. Work not included: The following will be either furnished or provided by others, as indicated, under separate contract with the Owner (Owner's Workforce):

1. Air Compressor: To be furnished by Owner, installed by Contractor.
2. Propane Tank: To be provided by Owner. Piping from building to tank to be provided by Contractor.
3. Laundry Equipment: To be provided by Owner.
4. Toilet Accessories: To be provided by Owner or Contractor, as scheduled.
5. Furnishings: To be provided by Owner.

E. Coordination of Work with Owner's Workforce: The Contractor shall review Contract Documents and shop drawings furnished by the Owner's Workforce for Work to be provided by the Contractor.

1.2 DEFINITIONS

- A. Furnish: Furnish materials for installation by parties indicated.
- B. Install: Install materials furnished by parties indicated.
- C. Provide: Furnish and install materials.

1.3 WORK RESTRICTIONS

A. Contractor's Use of Premises: During construction, Contractor shall have full use of site area indicated.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 - END OF SECTION 011000

## SECTION 014000 - QUALITY REQUIREMENTS

## PART 1 - GENERAL

## 1.1 RELATED SECTIONS

- A. 014329 Code Required Special Inspections

## 1.2 SECTION REQUIREMENTS

- A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. Unless otherwise noted, the Owner will provide these services. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Testing and inspecting services are specified in other Sections of these Specifications or are required by authorities having jurisdiction and shall be performed by independent testing agencies.
  - 2. Where quality-control services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these services.
  - 3. Contractor is responsible for scheduling times for tests, inspections, and obtaining samples and notifying testing agency.
  - 4. Retesting and Reinspecting: Contractor shall pay for additional testing and inspecting required as a result of tests and inspections indicating noncompliance with requirements.
- B. Submittals: Testing agency shall submit a certified written report of each test and inspection to Contractor, Owner, Architect, and to authorities having jurisdiction when they so direct. Reports of each inspection, test, or similar service shall include the following:
  - 1. Name, address, and telephone number of testing agency.
  - 2. Project title and number.
  - 3. Date of issue.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - 6. Names of individuals making tests and inspections.
  - 7. Description of the Work and test and inspection method.
  - 8. Complete test or inspection data, test and inspection results, an interpretation of test results, and comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 9. Recommendations on retesting and reinspecting.
  - 10. Name and signature of laboratory inspector.
- C. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated; and where required by authorities having jurisdiction, that is acceptable to authorities.

- D. **Testing Agency Responsibilities:** Testing agency shall cooperate with Architect and Contractor in performing its duties and shall provide qualified personnel to perform inspections and tests.
  - 1. Agency shall promptly notify Architect and Contractor of irregularities or deficiencies in the Work observed during performance of its services.
  - 2. Agency shall not release, revoke, alter, or increase requirements of the Contract Documents nor approve or accept any portion of the Work.
  - 3. Agency shall not perform any duties of Contractor.
  
- E. **Auxiliary Services:** Cooperate with testing agencies and provide auxiliary services as requested, including the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of materials for testing, and assistance in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Security and protection for samples and for testing and inspecting equipment.
  
- F. **Special Tests and Inspections:** Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections.
  
- G. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014000

## SECTION 014200 - REFERENCES

## PART 1 - GENERAL

## 1.1 GENERAL REQUIREMENTS

- A. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- B. Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.aashto.org	(202) 624-5800
ACI	American Concrete Institute/ACI International www.aci-int.org	(248) 848-3700
AFPA	American Forest & Paper Association (See AF&PA)	
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AHA	American Hardboard Association www.hardboard.org	(847) 934-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(202) 626-7300

AISC	American Institute of Steel Construction, Inc. www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALSC	American Lumber Standard Committee www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
APA	APA-The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industries International) www.awci.org	(703) 534-8300
AWI	Architectural Woodwork Institute	(800) 449-8811

	www.awinet.org	(703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(817) 326-6300
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BOCA	BOCA International, Inc. www.bocai.org	(708) 799-2300
CABO	Council of American Building Officials (See ICC)	
CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CFR	Code of Federal Regulations www.access.gpo.gov/nara/cfr	(888) 293-6498 (202) 512-1530
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CRD	Army Corps of Engineers Handbook for Concrete and Cement www.wes.army.mil	(601) 634-2355
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000

CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
DOC	Department of Commerce www.doc.gov	(202) 482-2000
DOD	Department of Defense Military Specifications and Standards www.dodssp.daps.mil	(215) 697-6257
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EPA	Environmental Protection Agency www.epa.gov	(202) 260-2090
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FS	Federal Specification Available from Department of Defense Single Stock Point www.dodssp.daps.dla.mil	(215) 697-6257
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association) www.glasswebsite.com	(785) 271-0208
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HUD	Department of Housing and Urban Development	(202) 708-1112

	<a href="http://www.hud.gov">www.hud.gov</a>	
IAS	International Approval Services (See CSA International)	
ICC	International Code Council (Formerly: CABO - Council of American Building Officials) <a href="http://www.intlcode.org">www.intlcode.org</a>	(703) 931-4533
ICBO	International Conference of Building Officials <a href="http://www.icbo.org">www.icbo.org</a>	(800) 284-4406 (562) 699-0541
ICEA	Insulated Cable Engineers Association, Inc. <a href="http://www.icea.net">www.icea.net</a>	(770) 830-0369
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) <a href="http://www.ieee.org">www.ieee.org</a>	(212) 419-7900
IESNA	Illuminating Engineering Society of North America (The) <a href="http://www.iesna.org">www.iesna.org</a>	(212) 248-5000
IGCC	Insulating Glass Certification Council <a href="http://www.igcc.org">www.igcc.org</a>	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance (The) (Formerly: SIGMA - Sealed Insulating Manufacturers Association) <a href="http://www.igmaonline.org">www.igmaonline.org</a>	(613) 233-1510
ITS	Intertek Testing Services <a href="http://www.itsglobal.com">www.itsglobal.com</a>	(800) 345-3851 (607) 753-6711
KCMA	Kitchen Cabinet Manufacturers Association <a href="http://www.kcma.org">www.kcma.org</a>	(703) 264-1690
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association) <a href="http://www.lma.org">www.lma.org</a>	(201) 664-2700
LPI	Lightning Protection Institute <a href="http://www.lightning.org">www.lightning.org</a>	(800) 488-6864 (847) 577-7200
MBMA	Metal Building Manufacturers Association <a href="http://www.mbma.com">www.mbma.com</a>	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association <a href="http://www.maplefloor.org">www.maplefloor.org</a>	(847) 480-9138
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry, Inc. <a href="http://www.mss-hq.com">www.mss-hq.com</a>	(703) 281-6613

NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFPA	NFPA International www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NWWDA	National Wood Window and Door Association (See WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting and Decorating Contractors of America www.pdca.com	(800) 332-7322 (703) 383-0800
RCSC	Research Council on Structural Connections c/o AISC www.boltcouncil.org	
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930

SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	SPRI (Single Ply Roofing Institute) www.spri.org	(781) 647-7026
SBCCI	Southern Building Code Congress International, Inc. www.sbcci.org	(205) 591-1853
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(412) 281-2331 (877) 281-7772
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TFS	Texas Forest Service www.txforests-service.tamu.edu	(936) 639-8180
TIA/EIA	Telecommunications Industry Association/ Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(608) 833-5900
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (See WCSC)	(212) 661-4261

WCSC	Window Covering Safety Council www.windowcoverings.org	(800) 506-4636 (212) 661-4261
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WIC	Woodwork Institute of California www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014200

## SECTION 014329 – CODE REQUIRED SPECIAL INSPECTIONS

## PART 1 - GENERAL

## 1.1 RELATED SECTIONS

- A. 014000 Quality Requirements

## 1.2 SECTION REQUIREMENTS

- A. Submittals: Each contractor responsible for the construction of a main wind or seismic force resisting system, designated seismic system or a wind or seismic resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
  - 1. Acknowledgement of awareness of the special requirements contained in the statement of special inspections;
  - 2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official;
  - 3. Procedures of exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports; and
  - 4. Identification and qualifications of the person(s) exercising such control and their positions(s) in the organization.
- B. Special Inspection services are required to verify compliance with requirements specified or indicated. Unless otherwise noted, the Owner will provide these services. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Special inspection services are specified in this section and are required by authorities having jurisdiction and shall be performed by independent testing agencies.
  - 2. Contractor is responsible for scheduling times for tests, inspections, and obtaining samples and notifying testing agency.
  - 3. Retesting and Reinspecting: Contractor shall pay for additional testing and inspecting required as a result of tests and inspections indicating noncompliance with requirements.
- B. Special inspectors shall keep records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. **If** the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.
- C. Inspection of fabricators: Where fabrication of structural load-bearing members and assemblies

is being performed on the premises of a fabricator's shop, special inspection of the fabricated items shall be required by this section.

1. Fabrication and implementation procedures. The special inspector shall verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards. The special inspector shall review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.

- A. Exception: Special inspections required by this section are not required where the work is done on the premises of a fabricator registered and approved to perform such work without special inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents.

D. Steel Construction:

1. Welding: Welding inspection shall be in compliance with AWS D1.1. The basis for welding inspector qualification shall be AWS D 1.1.
2. Details: The special inspector shall perform an inspection of the steel frame to verify compliance with the details shown on the approved construction documents, such as bracing, stiffening, member locations and proper application of joint details at each connection.
3. Material verification of structural steel.
  - A. Identification markings to conform to AWS specification in the approved construction documents per ASTM A 6 or ASTM A 568.
  - B. Manufacturer's certified mill test reports.
4. Material verification of weld filler materials.
  - A. Identification markings to conform to AWS specification in the approved construction documents per AISC 360, Section A3.5.
  - B. Manufacturer's certificate of compliance required.
5. Periodic inspection of floor and deck welds and single fillet welds < 5/16 inch.
6. Periodic inspection of steel frame joint details for compliance with approved construction documents.

E. Concrete:

1. Periodic Inspection of reinforcing steel per ACI 318: 3.5, 7.1-7.7.
2. Periodic verification of use of required design mix per ACI 318: Ch. 4, 5.2-5.4.
3. Continuous verification that at the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.
4. Continuous inspection of concrete placement for proper application techniques.
5. Periodic inspection for maintenance of specified curing temperature and techniques.
6. Periodic inspection of formwork for shape, location and dimensions of the concrete member being formed.
7. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapter 3 of ACI 318, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapter 3 of ACI 318.

F. Soils:

1. During fill placement, the special inspector shall determine that proper materials and procedures are used in accordance with the provisions of the approved soils report.
2. Periodically verify materials below footings are adequate to achieve the design bearing capacity.
3. Periodically verify excavations are extended to proper depth and have reached proper material.
4. Periodically perform classification and testing of controlled fill materials.
5. Continuously verify use of proper materials, densities and lift thicknesses during placement and compaction of controlled fill.
6. Prior to placement of controlled fill periodically observe subgrade and verify that site has been prepared properly

G. Cold Formed Steel Framing:

1. Periodic special inspection is required during welding operation of elements of the seismic force resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of components within the seismic force resisting system, including struts, braces, and hold-downs.

H. Mechanical and Electrical Systems:

1. Periodic special inspection is required during installation of piping systems intended to carry flammable, combustible or high toxic contents and their associated mechanical units.

END OF SECTION 014329

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Use Charges: Cost or use charges for temporary power and water will be paid for by the Owner. Other cost or use charges for temporary facilities, including connection fees for temporary power and water shall be included in the Contract Sum.
- B. Electrical Service: Contractor shall install temporary electric service in accordance with NEMA, NECA, NFPA 70 and UL standards and regulations.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT

- A. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained heaters with thermostatic control.
  - 1. Use of gasoline-burning space heaters or open-flame heaters is prohibited.
  - 2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### PART 3 - EXECUTION

#### 3.1 TEMPORARY UTILITIES

- A. General: Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
- C. Heating and Cooling: Provide temporary heating and cooling required for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- D. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

#### 3.2 TEMPORARY SUPPORT FACILITIES

- A. Provide field offices, storage and fabrication sheds, and other support facilities as necessary for construction operations.
- B. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Collect waste daily and, when containers are full, legally dispose of waste off-site. Comply with requirements of authorities having jurisdiction.
- C. Install a project identification sign near entrance point through temporary construction fencing to inform the public and persons seeking entrance to Project.

3.3 TEMPORARY SECURITY AND PROTECTION FACILITIES

- A. Provide temporary environmental protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- C. Provide temporary enclosures for protection of construction and workers from inclement weather and for containment of heat.
- D. Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- E. Provide site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
- F. Install and maintain temporary fire-protection facilities. Comply with NFPA 241.

3.4 TERMINATION AND REMOVAL

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
- B. Remove temporary facilities and controls no later than Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

END OF SECTION 015000

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- B. Product Substitutions: Substitutions include changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor after award of the Contract.
  - 1. Submit five copies of each request for product substitution.
  - 2. Submit requests within twenty one days after the Notice of Award.
  - 3. Do not submit unapproved substitutions on Shop Drawings or other submittals.
  - 4. Identify product to be replaced and show compliance with requirements for substitutions. Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified, a list of changes needed to other parts of the Work required to accommodate proposed substitution, and any proposed changes in the Contract Sum or the Contract Time should the substitution be accepted.
  - 5. Architect will review the proposed substitution and notify Contractor of its acceptance or rejection. If product substitution is accepted, it will be identified by Change Order.
- C. Comparable Product Requests:
  - 1. Submit five copies of each request for comparable product. Do not submit unapproved products on Shop Drawings or other submittals.
  - 2. Identify product to be replaced and show compliance with requirements for comparable product requests. Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified.
  - 3. Architect will review the proposed product and notify Contractor of its acceptance or rejection.
- D. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 4. Store materials in a manner that will not endanger Project structure.
  - 5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

- E. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 PRODUCT OPTIONS

- A. Provide products that comply with the Contract Documents, are undamaged, and are new at the time of installation.
  - 1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
  - 2. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- B. Product Selection Procedures:
  - 1. Where Specifications name a single product or manufacturer, provide the item indicated that complies with requirements.
  - 2. Where Specifications include a list of names of products or manufacturers, provide one of the items indicated that complies with requirements.
  - 3. Where Specifications include a list of names of products or manufacturers, accompanied by the term "available products" or "available manufacturers," provide one of the named items that complies with requirements. Comply with provisions for "comparable product requests" for consideration of an unnamed product.
  - 4. Where Specifications name a product as the "basis-of-design" and include a list of manufacturers, provide the named product. Comply with provisions for "comparable product requests" for consideration of an unnamed product by the other named manufacturers.
  - 5. Where Specifications name a single product as the "basis-of-design" and no other manufacturers are named, provide the named product. Comply with provisions for "comparable product requests" for consideration of an unnamed product by another manufacturer.
- C. Unless otherwise indicated, Architect will select color, pattern, and texture of each product from manufacturer's full range of options that includes both standard and premium items.

## PART 3 - EXECUTION (Not Applicable)

END OF SECTION 016000

## SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  1. Supporting devices for electrical components.
  2. Electricity-metering components.
  3. Access Panels
  4. Concrete equipment bases.
  5. Earthwork.
  6. Cutting and patching for electrical construction.
  7. Touchup painting.
  8. Temporary Power and Communication
  9. Permits and Fees

#### 1.3 SUBMITTALS

- A. Product Data: For electricity-metering equipment.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
- C. Submittal Procedures: Submittal procedures are specified in Division 1.
  1. Prepare submittals in three-ring "hard cover" binders with project name and volume on the binding. Include tabs identified by the specification section and in numerical order. Include plastic sleeves to hold drawings that exceed 8-1/2" x 11".
  2. Include cover sheet with the following information: date, project name, address, and title; Installer's name, address and phone number; Project manager, and Engineering firm names and phone numbers.
- D. Project Record Documents: Project Record Documents are specified in Division 1.
  1. Redline changes or information recognized to be of importance to the Owner. Include wiring changes, panelboard changes, etc.
  2. Dimension underground wiring and other concealed electrical features.
  3. Redline actual equipment electrical characteristics on equipment schedules.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

- C. Comply with Owner Standards.
- D. Installer Qualifications: All workmen doing electrical work shall be duly licensed with the required supervision in the State or Locality as legally required.
  - 1. Site Review: All electricians must carry their electrician's license with them and show it upon request.

#### 1.5 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical equipment installation with other building components.
  - 1. Verify all dimensions be field measurements.
  - 2. Minimize costs to resolve equipment and other conflicts by successfully concluding preinstallation conferences. Include the following:
    - a. Review Division 15 shop drawings. Compare equipment electrical specifications with equipment schedule. Prevent Div 15 equipment encroaching on clearances required by NEC. Request clarification of conflicts prior to installation.
    - b. Determine whether lighting fixtures and other electrical items conflict with the location of structural members and mechanical or other equipment.
    - c. Coordinate connecting electrical service to components furnished in other sections of the specification or by the User. Verify electrical requirements including voltage, full load amps, and minimum wire ampacity prior to installing or purchasing the associated electrical equipment and wiring.
    - d. Review systems furniture electrical specifications and compare with wiring indicated. Request dimensional layout from furniture installer including electrical connection locations. Request clarification of conflicts prior to installation.
- D. Coordinate electrical service connections to components furnished by electric utility companies.
  - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
  - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
  - 3. Notify Architect a minimum of seven days in advance of any proposed utility interruption and obtain approval prior to proceeding. Comply with requirements of the Owner, User, and Utility.
  - 4. Include all costs, including Owner, municipal or utility costs that will need to be paid to obtain electric service.
- E. Coordinate communication service connections to components furnished by communication utility companies.
  - 1. Coordinate installation and connection of exterior underground and overhead utilities and services.
  - 2. Comply with requirements of authorities having jurisdiction.

3. Notify Architect a minimum of seven days in advance of any proposed utility interruption and obtain approval prior to proceeding. Comply with requirements of the Owner, User, and Utility.
  4. Include all costs, including Owner, municipal or utility costs that will need to be paid to obtain communication services.
- F. Temporary Power and Communication are specified in Division 1 Section "Construction Facilities and Temporary Controls".
1. Comply with requirements for temporary electric and communication services with the proper [utility][Owner's representative].
  2. Comply with Article 305 of the NEC.
- G. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- H. Coordinate with Authorities Having Jurisdiction including: city, county, state, university, federal and other governmental authorities.
1. Obtain all permits (including excavation permits) prior to beginning construction.
  2. Pay all fees.
  3. Request inspections required by Authorities Having Jurisdiction in a timely manner and in order to comply with sequencing requirements.

## PART 2 - PRODUCTS

### 2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
1. Channel Thickness: Selected to suit structural loading.
  2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- G. Expansion Anchors: Carbon-steel wedge or sleeve type.
- H. Toggle Bolts: All-steel springhead type.
- I. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.
  - 1. Housing: NEMA 250, [Type 1] [Type 3R] enclosure.

**2.**

2.3 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."

2.4 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. For Nonequipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
- C. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.
- E. Existing Utilities: Locate and identify existing underground utilities in excavation areas or in demolition areas. Maintain services to areas outside demolition limits or excavated areas. When services must be interrupted, install temporary services for affected areas.
- F. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements indicated in the Contract Documents.
- G. Record drawings and Shop Drawings: Mark up drawings daily during construction with changes or deletions in the scope of the project.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

### 3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
  - 1. Comply with NFPA 70. In addition, install supports within 12" of couplings, fittings, and boxes, with a minimum of two supports per 10 foot length of raceway. Install supports at each change of direction. Similarly support cables in cable trays or raceways as indicated; except, provide J-hooks to support cables.
  - 2. Support suspended conduit and cables independently from all other electrical or mechanical systems by attaching directly from building structure, unless prior approval in writing has been obtained from the Architect after engineering calculations have been submitted.
  - 3. Coordinate installation of supports so as not to interfere with the removal of ceiling tiles, the service of mechanical equipment, etc.
  - 4. Install bracing parallel to trusses, beams, joists, bridging, etc.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Support parallel runs of cables together on trapeze or bracket type hangers, either vertically or horizontally.
- E. Size supports for multiple raceway and cable installations so capacity can be increased by a 25 percent minimum in the future.
- F. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- G. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.
- H. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- I. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- J. Simultaneously install vertical conductor supports with conductors.

- K. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If supported directly from the building structure, attach box to framing on opposite sides of the box. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- L. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- M. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
  - 1. Install wrapped or coated RMC sleeves with 3 feet extending on each side through penetrations of foundations or concrete walls by RNC.
- N. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - 4. Existing Concrete: Expansion bolts. Drill holes in concrete so holes do not cut main reinforcing bars. Fill and seal holes drilled in concrete and not used.
    - a. Obtain prior approval from project structural engineer prior to drilling prestressed or post-tension concrete slabs and beams.
  - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
  - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
    - a. Field Welding: Comply with AWS D1.1.
  - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
  - 8. Light Steel: Sheet-metal screws.
  - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load. Do not support electrical equipment or conduits with toggle bolts, moly-bolts, or screws in sheetrock or plaster. Do not support electrical equipment or conduit from tie wires.
  - 10. Do not use wooden plugs in concrete or masonry units for fastening conduits, tubing, boxes, cabinets, etc.

### 3.4 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

### 3.5 TEMPORARY ELECTRIC AND COMMUNICATION SERVICES

- A. Provide electric service, metering, main disconnect and distribution. Connect to [electric utility's][Owner's] temporary service location.
  - 1. [Where connecting to the institution's electric service, report initial meter reading and obtain written permission prior to energizing temporary facilities.]

2. As soon as permanent power and metering is available, disconnect the temporary power supply and remove from the construction site.

B. Provide temporary wiring and light fixtures for temporary lighting.

C. Protect receptacles with 20 amp GFI circuit breakers.

D. Provide temporary wiring for communication services. Connect to [communication utility's][Owner's] temporary service location.

1. [Where connecting to the institution's communication service, obtain written permission prior to connecting to temporary facilities.]

### 3.6 ACCESS DOORS

A. Install access panels where required by accessibility requirements of NEC for electrical installations such as junction boxes, ballasts, and other electrical equipment requiring access.

### 3.7 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

B. Gypsum Board Tenting: Apply to lighting fixture or electrical equipment penetrations of fire rated floor, ceiling and wall assemblies, unless product is UL listed with integral fire rating Perform tenting as specified in appropriate Division 9 section to reestablish the original fire-resistance rating of the assembly at the penetration.

### 3.8 CONCRETE BASES

A. Construct concrete bases of dimensions indicated for all floor mounted electrical equipment, but not less than 4 inches (100 mm) larger, in both directions, than supported unit and 3" above floor, unless indicated otherwise. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

1. [For equipment containing hazardous liquids, such as generators, oil-filled transformers, and similar equipment, include containment curb sized for quantity of liquid.]

### 3.9 EARTHWORK

A. Excavating, filling, and grading: As specified in Division 2 Section "Earthwork."

B. Fill: Backfill for underground raceways (not concrete encased) in roadways or parking lots with concrete encased slurry (1 bag mix). Backfill underground raceway (not concrete encased with sand 6" above and below in other than roadways or parking lots.

C. Remove rubbish, waste, and excess soils.

### 3.10 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
  - 1. Core drilling: X-Ray post-tension slabs prior to core drilling to assure that post-tension cables are not damaged.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

### 3.11 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Supporting devices for electrical components.
  - 2. Electricity-metering components.
  - 3. Concrete bases.
  - 4. Cutting and patching for electrical construction.
  - 5. Touchup painting.
- B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
  - 1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
  - 2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
  - 3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
  - 4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
  - 5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.
- C. Test all electrical work to ensure that they test free of mechanical and electrical defects.
  - 1. Comply with testing requirements of authorities having jurisdiction.
  - 2. Comply with Owner's standards for testing in documents listed in "Quality Assurance".

### 3.12 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
  - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
  - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.13 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

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1. Remove labels that are not permanent labels.
  2. Wipe surfaces of electrical equipment. Remove excess lubrication and other substances.
  3. Clean exposed exterior and interior hard-surface finishes to a dust-free condition, free of stains, films and similar foreign substances.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 16050

## SECTION 16060 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

#### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Ground rods.
- B. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grounding Conductors, Cables, Connectors, and Rods:
    - a. Apache Grounding/Erico Inc.
    - b. Boggs, Inc.
    - c. Chance/Hubbell.
    - d. Copperweld Corp.
    - e. Dossert Corp.
    - f. Erico Inc.; Electrical Products Group.
    - g. Framatome Connectors/Burndy Electrical.
    - h. Galvan Industries, Inc.
    - i. Harger Lightning Protection, Inc.
    - j. Hastings Fiber Glass Products, Inc.

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- k. Heary Brothers Lightning Protection Co.
- l. Ideal Industries, Inc.
- m. ILSCO.
- n. Kearney/Cooper Power Systems.
- o. Korns: C. C. Korns Co.; Division of Robroy Industries.
- p. Lightning Master Corp.
- q. Lyncole XIT Grounding.
- r. O-Z/Gedney Co.; a business of the EGS Electrical Group.
- s. Raco, Inc.; Division of Hubbell.
- t. Robbins Lightning, Inc.
- u. Salisbury: W. H. Salisbury & Co.
- v. Superior Grounding Systems, Inc.
- w. Thomas & Betts, Electrical.
- x. VFC, Inc.

## 2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Material: copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- H. Copper Bonding Conductors: As follows:
  - 1. Bonding Conductor: as noted on the drawings, stranded copper conductor. Comply with NEC minimum requirements.
  - 2. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

## 2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

## 2.4 GROUNDING ELECTRODES

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- A. Ground Rods: Sectional type; copper-clad steel.
  - 1. Size: 3/4 by 120 inches in diameter.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Underground Grounding Conductors: Use tinned- copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

#### 3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and branch wiring.
- C. Computer Outlet Circuits: Install insulated equipment-grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment-grounding conductor connected to the receptacle-grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. Nonmetallic Raceways: Install an equipment-grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- F. Air-Duct Equipment Circuits: Install an equipment-grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- G. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment-grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- H. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide as noted on the drawings insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

- I. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

### 3.3 COUNTERPOISE

- A. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 2/0 AWG for counterpoise and for tap to building steel. Bury counterpoise not less than 18 inches (450 mm) below grade and 24 inches (600 mm) from building foundation.

### 3.4 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
  1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  2. Interconnect ground rods with grounding electrode conductors. Uses exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
  3. Install minimum 2 ground rods in main switchboard rooms along with a visible connection to the ground rods.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, valves, or service unions. Connect to pipe with grounding clamp connectors.
- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

- H. Metal Frame of the building where effectively grounded: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to metal frame of building. Exothermically weld grounding conductors to metal frame. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- I. Concrete encased steel reinforcing bar or rod in underground footings or foundations: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to reinforcing bar or rod. Exothermically weld grounding conductors to reinforcing bar or rod. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

### 3.5 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Non-contact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.6 SEPARATELY DERIVED SYSTEMS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of grounding electrode conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Do not ground system neutral conductor under any circumstances after it has been grounded at the service entrance disconnect except for separately derived systems. Interconnect or bond all grounding systems to the main system ground. Do not use neutral conductors for grounding equipment. Do not bond the neutral bus to distribution cabinets, except for separately derived systems.

### 3.7 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
  - 3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
    - a. Equipment Rated 500 kVA and Less: 10 ohms.
  - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

### 3.8 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 16060

## SECTION 16075 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

#### 1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

#### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

### PART 2 - PRODUCTS

#### 2.1 RACEWAY AND CABLE LABELS

- A. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend indicating type of underground line.
- C. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- D. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

#### 2.2 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.

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2. Punched or drilled for mechanical fasteners.

C. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

### 2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: According to color-coding.

B. Paint: Formulated for the type of surface and intended use.

1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Install painted identification according to manufacturer's written instructions and as follows:

1. Clean surfaces of dust, loose material, and oily films before painting.
2. Prime surfaces using type of primer specified for surface.
3. Apply one intermediate and one finish coat of enamel.

F. Paint fire alarm junction boxes red.

G. Circuit Identification Labels on Boxes: Install labels externally for all installed boxes prior to installation of conductors.

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
2. Concealed Boxes: Plasticized card-stock tags.
3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

H. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

- I. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker..
  
- J. Color-Coding of Secondary Phase Conductors: Color code switch legs, travelers and other wiring for branch circuits other than those listed below. Use the following colors for service, feeder and branch-circuit phase conductors:
  1. 208/120-V Conductors:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Neutral: White.
    - e. Ground: Green.
    - f. Insulated Ground: Green with white stripe.
  2. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 6 AWG:
    - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
  
- K. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
  1. Legend: 1/4-inch- steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
  2. Tag Fasteners: Nylon cable ties.
  3. Band Fasteners: Integral ears.
  
- L. Apply identification to conductors as follows:
  1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
  2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
  3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
  
- M. Apply warning, caution, and instruction signs as follows:
  1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
  2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
  3. Install caution signs for enclosures Over 600 V: Indicate system voltage on black, preprinted on orange field.

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- N. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch- high lettering on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Interior and exterior of panelboards, electrical cabinets, and enclosures.
    - a. Distribution Panelboards: Identify Distribution Panelboard designation and circuit serving distribution panelboard; label main and distribution overcurrent protection showing load served and location (identify room numbers).
    - b. Branch Panelboards: Identify distribution panel and circuit serving panelboard.
    - c. Main Overcurrent Protection: Identify main device and service disconnects.
  2. Access doors and panels for concealed electrical items.
  3. Electrical switchboards.
    - a. Identify switchboard, label main and distribution overcurrent protection showing load served and location (identify room numbers).
  4. Disconnect switches.
    - a. Identify equipment designation, fla.
  5. Telephone switching equipment.
  6. Fire alarm master station or control panel.
  7. Security-monitoring master station or control panel.
- O. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

END OF SECTION 16075

## SECTION 16120 - CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field Quality-Control Test Reports: From Contractor.

#### 1.4 QUALITY ASSURANCE

- A. Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

#### 2.2 CONDUCTORS AND CABLES

- A. Manufacturers:
  - 1. Copper Wire and Cables:
    - a. Alcan Aluminum Corporation; Alcan Cable Div.
    - b. American Insulated Wire Corp.; a Leviton Company.
    - c. General Cable Corporation.
    - d. Senator Wire & Cable Company.
    - e. Southwire Company.

- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper, minimum size #12 for phase conductors and #14 for control conductors complying with NEMA WC ;.
- D. Conductor Insulation Types: Type THWN-2 complying with NEMA WC 5 .
- E. Multiconductor Cable: Metal-clad cable (Type MC), with ground wire.

### 2.3 CONNECTORS AND SPLICES

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc.
  - 2. AMP Incorporated/Tyco International.
  - 3. Burndy.
  - 4. Hubbell/Anderson.
  - 5. IlSCO.
  - 6. O-Z/Gedney; EGS Electrical Group LLC.
  - 7. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type THWN-2, single conductors in raceway .
- B. Exposed Feeders: Type THWN-2, single conductors in raceway .
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THWN-2, single conductors in raceway .
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THWN-2, single conductors in raceway. Exposed Branch Circuits, including in Crawlspace: Type THWN-2, single conductors in raceway .
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THWN-2, single conductors in raceway Metal-clad cable, Type MC, in lengths between outlets 30' or less and not as home runs.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THWN-2, single conductors in raceway.
- H. Underground Feeders and Branch Circuits: Type THWN-2, single conductors in raceway.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- J. Fire Alarm Circuits:

1. Type THWN-2 in raceway for fire alarm power circuits, for horn circuits, and for strobe circuits.
  2. Power-limited, fire-protective, signaling circuit cable in raceway for initiating loop circuits.
- K. Emergency circuits: Install in separate raceways from all other wiring, except where they connect to the same equipment for two-source operation.
- L. Class 1 Control Circuits: Type THWN-2, in raceway.
- M. Class 2 Control Circuits: Type THWN-2, in raceway .
- N. Fixture Conductors: Install conductors in lighting fixtures with insulation ratings as recommended by the manufacturer's written instructions or a minimum 90 degrees C., whichever is higher.
- O. Communication Conductors: Install communication conductors in raceway.

### 3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Multi-wire branch circuits: install no more than three circuits in a raceway, unless specifically shown otherwise. Install #10 conductors for branch circuits for which the distance from panelboard to furthest outlet is more than 100' for 120 volt or more than 140' for 277 volt circuits.
- C. GFI circuit breakers or feed-thru outlets to outlets served: provide separate neutrals.
- D. Panelboards, switchboards, MCCs, switchgear: Do not route conductors through a section which terminate in another section, except for interconnecting control conductors.
- E. Remove existing conductors from raceway before pulling in new wires and cables.
- F. Parallel conductors: Where parallel conductors are installed in parallel raceways, install in each raceway conductors of phase, neutral and/or ground as specified. Carefully cut parallel conductors to identical length for each phase leg. Do not parallel conductors less than #1/0.
- G. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- H. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- I. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- J. Do not install wiring through any part of a transformer vault or elevator equipment room and shaft that is does not serve equipment in the respective room. Also, coordinate that piping or other items foreign to the transformer vault, elevator equipment room or shaft is not installed in these spaces.

- K. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- L. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."
- M. Identify and color-code conductors and cables according to Division 16 Section " Electrical Identification."

### 3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Conductor splices: Minimize conductor splices. Do not install in conduit bodies.
- C. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors. Install compression type connectors for aluminum conductors or copper pigtail adapters for installation in mechanical lugs.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
- E. Furniture connections: connect systems furniture to power supply circuits per manufacturer's written instructions.
- F. Panelboard connections: do not splice conductors in panelboards.
- G. Utility Service Connections: Provide lugs, cable, and all other materials necessary to complete connections to the transformer or service lateral for the building.
  - 1. Measure voltage at main disconnect and adjust taps if necessary to obtain the proper value.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
  - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 16120

## SECTION 16130 - RACEWAYS AND BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
  - 2. Division 16 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
  - 3. Division 16 Section "Seismic Controls for Electrical Work" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
  - 4. Division 16 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. LFNC: Liquidtight flexible nonmetallic conduit.
- F. RNC: Rigid nonmetallic conduit.

#### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

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2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

#### 2.2 METAL CONDUIT AND TUBING

- A. Manufacturer:
  1. AFC Cable Systems, Inc.
  2. Alflec Inc.
  3. Anamet Electrical, Inc.; Anaconda Metal Hose.
  4. Electri-Flex Co.
  5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  6. LTV Steel Tubular Products Company.
  7. Manhattan/CDT/Cole-Flex.
  8. O-Z Gedney; Unit of General Signal.
  9. Wheatland Tube Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- E. Plastic-Coated IMC and Fittings: NEMA RN 1.
- F. EMT and Fittings: ANSI C80.3.
  1. Fittings: Steel Set-screw or compression type. Do not use die-cast fittings.
- G. FMC: .

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- H. LFMC: Flexible steel conduit with PVC jacket.
- I. Fittings: NEMA FB 1; compatible with conduit and tubing materials. Do not use die-cast fittings.

## 2.3 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturer:
  - 1. American International.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arnco Corp.
  - 4. Cantex Inc.
  - 5. Certainteed Corp.; Pipe & Plastics Group.
  - 6. Condux International.
  - 7. ElecSYS, Inc.
  - 8. Electri-Flex Co.
  - 9. Lamson & Sessions; Carlon Electrical Products.
  - 10. Manhattan/CDT/Cole-Flex.
  - 11. RACO; Division of Hubbell, Inc.
  - 12. Spiralduct, Inc./AFC Cable Systems, Inc.
  - 13. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- D. LFNC: UL 1660.

## 2.4 METAL WIREWAYS

- A. Manufacturer:
  - 1. Hoffman.
  - 2. Square D.
- B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA .
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers: Hinged type .
- F. Finish: Manufacturer's standard enamel finish.

## 2.5 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating
  - 1. Manufacturer:
    - a. Thomas & Betts Corporation.
    - b. Monosystems.

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c. Wiremold Company (The); Electrical Sales Division.

## 2.6 BOXES, ENCLOSURES, AND CABINETS

### A. Manufacturer:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

## 2.7 EXPANSION FITTINGS:

### A. Manufacturer:

1. O-Z Gedney; Unit of General Signal.

B. Expansion Fittings: Malleable Iron, hot dipped galvanized, weatherproof suitable for raceway and applications

1. Coordinate expansion requirements with Architect.

## 2.8 FACTORY FINISHES

A. Finish: provide manufacturer's standard prime-coat finish ready for field painting for:

1. Raceways

B. Finish: provide manufacturer's standard paint applied before shipping to factory-assembled products for:

1. Surface raceways:

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2. Enclosures: Standard Grey in electrical rooms,.
3. Cabinets: Standard Grey in electrical rooms,.

### PART 3 - EXECUTION

#### 3.1 RACEWAY APPLICATION

##### A. Outdoors:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC (except coated or wrapped rigid steel for bends greater than 22 degrees), coated or wrapped rigid steel.
4. Underground, Grouped: RNC (except coated or wrapped rigid steel for bends greater than 22 degrees), coated or wrapped rigid steel.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R.

##### B. Indoors:

1. Exposed:
  - a. Above 6' from finished floor: EMT, or Rigid Steel.
  - b. Below 6' from finished floor, or subject to mechanical damage: IMC, or Rigid Steel.
2. Underground: refer to underground installation selections in outdoor paragraph above.
3. Concealed: EMT,.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Damp or Wet Locations: Rigid steel conduit.
6. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
  - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

##### C. Minimum Raceway Size:

1. Metallic Conduits: 3/4-inch trade size.
2. Nonmetallic Conduits: 3/4-inch trade size.

##### D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Metal Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated. Engage a minimum of five full threads.
2. Intermediate Metal Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated. Engage a minimum of five full threads.
3. PVC Externally Coated or wrapped Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
4. EMT: set screw or compression for dry interior locations; compression for damp or wet locations; compression with tape for installations in concrete slabs above grade.
5. Building Expansion joints: use expansion fittings with 36" of wrapped metal raceways on either side of joint.

##### E. Do not install aluminum conduits embedded in or in contact with concrete.

#### 3.2 INSTALLATION

##### A. Outlet Boxes:

1. Frame construction: 4"X4"X1-1/2" with suitable plaster-ring, except:

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- a. 2-1/8" deep for boxes with 3 conduit entrances or for communication outlets
  - b. 4-11/16" boxes for boxes with 4 or more conduits.
  2. Masonary or concrete construction: 1g or multiple gang by 3-1/2" deep.
  3. Fixture Outlets: minimum 4" outlet box with 3/8" fixture stud supported adequately for minimum of 200 lbs.
  4. Do not use gangable boxes.
- B. Keep raceways at least 12 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
- E. Install temporary closures to prevent foreign matter from entering raceways.
- F. Stub-ups: Embed coupling flush with finished floor. If to remain a spare, the flush plug is to remain in the coupling.
- G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated. Make bends in parallel or banked runs from same centerline to make bends parallel.
1. Nonmetallic Conduits: Use rigid elbows for all bends 22 degrees or greater.
  2. Communication Systems Raceways: comply with long sweep radius elbows minimum dimensions in Table 5.2-1 of ANSI/TIA/EIA-569A for all bends or offsets for backbone cables.
- H. Raceways below grade: Install RNC or wrapped/coated Rigid Steel minimum 24" below grade, unless specifically noted otherwise. Where noted encase in concrete.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors, except at surface mounted panels and apparatus or unless otherwise indicated. Install surface raceways only where indicated or where directed by Architect.
1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
  2. Install surface raceways in rooms where surface mounted panels are indicated or for exposed equipment in mechanical, electrical, or communication rooms.
- J. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
1. Maximum conduit size: Lesser of 1-inch trade size or 1/3 the concrete cover.
    - a. For conduits larger than 1-inch trade size
  2. Layout: Route conduits without crossovers. Space conduit at least 18" apart. Space raceways laterally to prevent voids in concrete.
    - a. Where concentrations of conduit occur, support slab independent of steel deck. Coordinate with structural engineer.
  3. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  4. Install taped compression type fittings or fittings approved for such use.
  5. Change from nonmetallic tubing to rigid steel conduit before rising above the floor.
- K. Raceways Penetrating foundation walls: Install rigid conduit through the foundation wall or 3' each side.

- L. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - 1. Run parallel or banked raceways together on common supports.
  - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- M. Join raceways with fittings designed and approved for that purpose and make joints tight.
  - 1. Use insulating bushings to protect conductors.
- N. Tighten set screws of threadless fittings with suitable tools.
- O. Cap open ends of empty conduit to keep out debris until the project is completed.
- P. Terminations:
  - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. For RMC and IMC, use two locknuts, one inside and one outside box and a bushing. For EMT, use insulated throats or plastic bushings (except for grounding bushings where required).
  - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
  - 3. Service Conduits or conduits installed in concentric/eccentric knock-outs or reducing washers: terminate raceway with grounding bushings.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Plug empty raceways at both ends.
- R. Low Voltage, Telephone, and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- S. Install seals for conduit penetrations of slabs on grade and exterior walls below grade. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.
- T. Roof Penetrations: Install flashings for conduit penetrations of roofs under the direct supervision of the roofing installer.
- U. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where conduits pass through airtight spaces or plenums to prevent air leakage.
  - 3. Where conduits pass from hazardous areas to nonhazardous.
  - 4. Where otherwise required by NFPA 70.
- V. Hazardous Wiring:
- W. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with

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finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

- X. Raceway Cleaning: Prevent accumulation of water, dirt or concrete in raceways. Where water or foreign matter have entered raceways, thoroughly clean or replace conduits where such accumulation cannot be removed by methods approved by this Engineer.
- Y. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- Z. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- AA. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- BB. Spare conduits:
  - 1. Provide 300' of ¾" C as directed by Architect/Engineer, where not required, credit unused portion.

### 3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 16130

**Standard Wiring Device Schedule**

Note to Bidders: Comply with Section 16140 of the specifications. The catalog numbers listed below have been carefully prepared with the assistance of the manufacturer's representatives with the objective of assisting the bidders in determining the quality and ratings of the wiring device specified; however, the catalog numbers may not be complete or accurate. In addition, the color of the wiring device is not intended to be determined by the catalog numbers listed below, but shall be selected by the Architect as indicated in the specification. Each manufacturer prior to bidding shall compare catalog numbers shown with the description and shall notify the Architect/Engineer of any discrepancies.

NEMA	DESCRIPTION	CATALOG NUMBERS
NEMA 5-20R	20A, 125V 2 pole 3 wire simplex grounding receptacles. Nylon or Lexan Faces. Back and side wired. Comply with FS W-C-596 and UL 498.	Bryant 5361 Hubbell HBL5361 Leviton 5351 P&S 5351
NEMA 5-20R	20A, 125V 2 pole 3 wire duplex grounding receptacles. Nylon or Lexan Faces. Back and side wired. Comply with FS W-C-596 and UL 498.	Bryant 5352 Hubbell CR5352 Leviton 5352 P&S 5352
NEMA 5-20R GFCI	20A, 125V 2 pole 3 wire duplex feed thru GFCI receptacles with indicator light. Nylon or Lexan decorator faces. Back and side wired. Internal components shall comply with FS W-C-596 where applicable. Comply with UL 498 and UL 493.	Bryant GFR53FT Hubbell GF5352 Leviton 6898 P&S 2091 S
NEMA 5-20R Waterproof (Weatherproof in use)	20A, 125V 2 pole 3 wire duplex grounding receptacles. Nylon or Lexan Faces. Back and side wired. Comply with FS W-C-596 and UL 498. Fully gasketed weatherproof while in use enclosure.	Hubbell CR5352/5051-0
NEMA 5-20R Weatherproof	20A, 125V 2 pole 3 wire duplex grounding receptacles. Nylon or Lexan Faces. Back and side wired. Comply with FS W-C-596 and UL 498. Cast aluminum and UL listed for wet locations.	Hubbell HBL5206WO
20A Single Pole	20A single pole 125V-277V standard toggle switch labeled as complying UL standard 20 and with Federal Specification W-S-896. Provide Nylon or Lexan face, back and side wired. Rated 1 HP 120V.	Hubbell CS1221 Leviton 1221 P & S 521 Bryant 4901
20A Three-way	20A three-way 125V-277V standard toggle switch labeled as complying UL standard 20 and with Federal Specification W-S-896. Provide Nylon or Lexan face, back and side wired. Rated 1 HP 120V.	Hubbell CS1223 Leviton 1223 P & S 523 Bryant 4903
20A Double Pole	20A double pole 125V-277V standard toggle switch labeled as complying UL standard 20 and with Federal Specification W-S-896. Provide Nylon or Lexan face, back and side wired. Rated 2 HP 240V. Double pole.	Hubbell CS1222 Leviton 1222 P & S 522 Bryant 4902

## SECTION 16140 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  1. Single and duplex receptacles, ground-fault circuit interrupters, and isolated-ground receptacles.
  2. Single- and double-pole snap switches and dimmer switches.
  3. Device wall plates.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Field quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

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1. Cord and Plug Sets: Match equipment requirements.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Wiring Devices:
    - a. Bryant Electric, Inc./Hubbell Subsidiary.
    - b. Eagle Electric Manufacturing Co., Inc.
    - c. Hubbell Incorporated; Wiring Device-Kellems.
    - d. Leviton Mfg. Company Inc.
    - e. Pass & Seymour/Legrand; Wiring Devices Div.
  2. [Multioutlet Assemblies:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Wiremold Company (The).]
  3. Floor Service Outlets and Telephone/Power Poles:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Pass & Seymour/Legrand; Wiring Devices Div.
    - c. Square D/Groupe Schneider NA.
    - d. Thomas & Betts Corporation.
    - e. Wiremold Company (The).
  4. Dimming Switches:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Leviton Lighting Controls
    - c. Lightolier Controls
    - d. Lutron Electronics, Inc.

### 2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.
  1. Thermoplastic face.
  2. Thermoset base.
  3. Back and side wired.
  4. Rating: 20 A minimum
- B. Straight-Blade (30 A thru 50A) and Locking Receptacles: Heavy -Duty grade.
- C. [Hospital Grade Straight-Blade Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.
  1. Thermoplastic face.
  2. Thermoset base.
  3. Back and side wired.
  4. Rating: 20 A minimum.]
- D. GFCI Receptacles: Straight blade, feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter.
- E. Isolated-Ground Straight-Blade Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498; configure with equipment grounding contacts connected only to

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the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap.

1. Devices: Listed and labeled as isolated-ground receptacles.
2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.
3. Thermoplastic face.
4. Thermoset base.
5. Back and side wired.
6. Rating: 20 A minimum

## 2.3 SWITCHES

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
1. Rating: Minimum 20A.
  2. Thermoplastic face.
  3. Thermoset base.
  4. Back and side wired.
- B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
1. Control: Continuously adjustable vertical slider ; with single-pole or three-way switching to suit connections.
  2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz, continuously; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.
  3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 1 percent of full brightness.
  4. Magnetic Low-Voltage Lamp Dimmers: Modular, 120 V or 277 V, 60 Hz, continuously adjustable; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; DC protection; and 5-inch wire connecting leads.
  5. Electronic Low-Voltage Lamp Dimmers: Modular, 120 V or 277 V, 60 Hz, continuously adjustable; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; DC protection; and 5-inch wire connecting leads. Exclusively designed product for electronic low voltage transformers.

## 2.4 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish, except screwless devices for locations where only dimmers are shown.
  2. Material for Finished Spaces: Smooth, high-impact thermoplastic .
  3. Material for Unfinished Spaces: Galvanized steel.
  4. Material for Wet Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.

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- B. Install wall dimmers with capacity to achieve 60% of circuit loads indicated on drawings after derating for ganging according to manufacturer's written instructions.
- C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.
- D. Install control wiring for electronic fluorescent dimmers (low voltage or line voltage) per manufacturers written instructions.
- E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- F. Wallplates and coverplates: install wallplates and coverplates for all outlets, including blank outlets.
- G. GFI Devices: Install separate GFCI devices, except where installed under the same multi-gang plate.
- H. Remove wall plates and protect devices and assemblies during painting.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- J. Install cord and plug sets for appliances, mechanical equipment, and other equipment per manufacturer's written instructions.

### 3.2 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
  - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 16140

## SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
  - 1. Service disconnecting means.
  - 2. Feeder and branch-circuit protection.
  - 3. Motor and equipment disconnecting means.
- B. Related Sections include the following:
  - 1. Division 16 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
  - 2. Division 16 Section "Fuses" for fusible devices.

#### 1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.
- D. MCP: Motor Circuit Protectors (Adjustable instantaneous trip circuit breakers).

#### 1.4 SUBMITTALS

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switch and circuit breaker.
  - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations and layout of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Current and voltage ratings.
    - c. Short-circuit current rating.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:
  - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- E. Field Test Reports: Submit written test reports and include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Manufacturer's field service report.
- G. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
  - 1. Routine maintenance requirements for components.
  - 2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
  - 3. Time-current curves, including selectable ranges for each type of circuit breaker.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA AB 1 and NEMA KS 1.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

#### 1.7 COORDINATION

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- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Spares: For the following:

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Fusible Switches:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Control Division.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.
  - 2. Molded-Case Circuit Breakers:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Control Division.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.
  - 3. Combination Circuit Breaker and Ground-Fault Trip:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Control Division.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.

### 2.2 ENCLOSED SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

### 2.3 ENCLOSED CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
    - a.
  - 2. GFCI Circuit Breakers: Single- and two-pole configurations with 5 -mA trip sensitivity, unless noted otherwise on the drawings.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.

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2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.

## 2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  1. Outdoor Locations: NEMA 250, Type 3R.
  2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

## 2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard gray paint applied to factory-assembled and -tested enclosures before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Equipment Disconnects
  1. Maximum elevation: 48".
  2. Locate lockable disconnect near each motor complying with clearance requirements.
  3. Multiple speed motors: provide switch in all motor leads.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- C. Fusible Switch Labels: Label each enclosure with "REPLACE WITH CURRENT LIMITING FUSES ONLY. CATALOG NUMBER: (FUSE CAT. NO.)."

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3.4 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
  - 2. Test continuity of each line- and load-side circuit.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### 3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16410

## SECTION 16442 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
  - 1. Lighting and appliance branch-circuit panelboards.
  - 2. Distribution panelboards.
- B. Related Sections include the following:
  - 1. Division 16 Section "Seismic Controls for Electrical Work."

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. TVSS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. Layout of overcurrent devices in panelboard.
    - e. **[UL listing for series rating of installed devices.]**
    - f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

- C. **Manufacturer Seismic Qualification Certification:** Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:
  - 1. **Basis of Certification:** Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. The term "withstand" means "the unit will remain in place without separation of internal and external parts during a seismic event and the unit will be fully operational after the event."
  - 3. **Dimensioned Outline Drawings of Equipment Unit:** Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. **Qualification Data:** Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- E. **Field Test Reports:** Submit written test reports and include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. **Maintenance Data:** For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

#### 1.5 QUALITY ASSURANCE

- A. **Testing Agency Qualifications:** Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
  - 1. **Testing Agency's Field Supervisor:** Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

#### 1.7 EXTRA MATERIALS

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A. Keys: Six spares of each type of panelboard cabinet lock.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Control Div.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.

### 2.2 FABRICATION AND FEATURES

- A. Enclosures: Flush- and surface-mounted cabinets as indicated on the drawings. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
- B. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- E. Bus: [Hard-drawn copper, 98 percent conductivity] [Tin-plated aluminum].
- F. Main and Neutral Lugs: Compression type suitable for use with conductor material.
- G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- H. Insulated Equipment Ground Bus: Adequate for feeder and branch-circuit equipment insulated ground conductors; insulate from box.
- I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- J. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- K. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
- L. Feed-through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

### 2.3 PANELBOARD SHORT-CIRCUIT RATING

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- A. Spectrum Practice is to specify series rated devices unless the client requires fully-rated devices. Confirm with institutional clients such as University of Utah, etc. USU requires fully-rated devices.
  
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

#### 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
  
- B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

#### 2.5 DISTRIBUTION PANELBOARDS

- A. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.
  
- B. Main Overcurrent Protective Devices: as indicated on drawings.
  
- C. Branch overcurrent protective devices shall be one of the following:
  - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
  - 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

#### 2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. [Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.]
  - 2. GFCI Circuit Breakers: Single- and two-pole configurations with [5] [30]-mA trip sensitivity.
  
- B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.
  - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Examine areas where panelboards are planned to be installed. Coordinate with other installers so that installation complies with NEC 110-26.
  - 1. Do not locate panelboards so that the door swing swings through the clear area.

### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."
- C. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Circuit Directory: Create a directory to indicate installed circuit loads showing locations (final room numbers as determined by user) and use. Obtain approval for room numbers to be used before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
  - 1. Existing Panelboards: verify existing circuits and create new circuit directory.
- F. Install filler plates in unused spaces.
- G. Provision for Future Circuits at Flush Panelboards: Stub six 1-inch empty conduits from panelboard section into accessible ceiling space or space designated to be ceiling space in the future. Stub five 1-inch empty conduits into raised floor space or below slab not on grade.
- H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- C. Phase Conductor Color Code Identification: Permanently post at each branch-circuit panelboard the color coding scheme for phase conductors of all voltages used in the project.

### 3.4 CONNECTIONS

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- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### 3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442

## SECTION 16511 - INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Interior lighting fixtures with lamps and ballasts.
  - 2. Lighting fixtures mounted on exterior building surfaces.
  - 3. Emergency lighting units.
  - 4. Exit signs.
  - 5. Division 16 Section "Lighting Controls" for manual or programmable control systems employing low-voltage control wiring or data communication circuits.
  - 6. Division 16 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

#### 1.3 DEFINITIONS

- A. BF: Ballast factor. Ratio of light output of a given lamp(s) operated by the subject ballast to the light output of the same lamp(s) when operated on an ANSI reference circuit.
- B. CRI: Color rendering index.
- C. CU: Coefficient of utilization.
- D. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:
  - 1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.
- E. RCR: Room cavity ratio.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of fixture, including dimensions and verification of indicated parameters.
  - 2. Emergency lighting unit battery and charger.
  - 3. Fluorescent and high-intensity-discharge ballasts.
  - 4. Lamps.
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. Wiring Diagrams: Power, signal, and control wiring.

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- D. Product Certificates: For each type of ballast for dimmer-controlled fixtures, signed by product manufacturer.
- E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.
- F. Warranties: Special warranties specified in this Section.
- G. Spare Parts: include spare parts materials and quantity.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Test products to UL standards by nationally recognized testing laboratory, where an appropriate standard exists.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Unit Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- B. Special Warranty for Fluorescent Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
  - 2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

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2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Products: Subject to compliance with requirements, provide one of the products specified.

### 2.2 FIXTURES AND COMPONENTS, GENERAL

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
  1. Equip recessed fixtures with six foot flexible conduit whips for connection to external j-boxes, except that junction boxes may integral for prewired framing kits for incandescent and PL fluorescent downlights.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
  1. White Surfaces: 92 percent.
  2. Specular Surfaces: 83 percent.
  3. Diffusing Specular Surfaces: 75 percent.
  4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
  1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is scheduled.
    - b. UV stabilized.

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2. Glass: Annealed crystal glass, unless otherwise indicated.

## 2.3 LIGHTING FIXTURES

- A. Fixtures: Refer to Lighting Fixture Schedule on the drawings.

## 2.4 FLUORESCENT LAMP BALLASTS

- A. Description: Include the following features, unless otherwise indicated:
  1. Designed for type and quantity of lamps indicated at full light output, unless 1.2 BF is specified.
    - a. Linear Electronic Ballasts: full light output is defined as .88 BF.
    - b. Compact Fluorescent Ballasts: full light output is defined as 1.0 BF.
  2. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
- B. Electronic ballasts (nondimming) for linear lamps shall include the following features, unless otherwise indicated:
  1. Comply with NEMA C82.11.
  2. Energy savings ballasts
  3. Ballast Type: Programmed start with two-step lamp starting to extend life of frequently started lamps; if not available from any manufacturer, provide rapid start.
  4. Sound Rating: A.
  5. Total harmonic distortion rating of less than 20 percent according to NEMA C82.11.
  6. Transient Voltage Protection: IEEE C62.41, Category A.
  7. Operating Frequency: 20 kHz or higher.
  8. Lamp Current Crest Factor: Less than 1.7.
  9. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
- C. Ballasts for compact fluorescent lamps in recessed fixtures shall have the following features, unless otherwise indicated:
  1. Type: Electronic .
  2. Power Factor: 90 percent, minimum.
  3. Flicker: Less than 5 percent.
  4. Lamp Current Crest Factor: Less than 1.7.
  5. Electronic Ballast Operating Frequency: 20 kHz or higher.
  6. Lamp end-of-life detection and shutdown circuit.
  7. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
- D. Ballasts for compact lamps in nonrecessed fixtures shall include the following features, unless otherwise indicated:
  1. Power Factor: 90 percent, minimum.
  2. Ballast Coil Temperature: 65 deg C, maximum.
  3. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
- E. Ballasts for Low-Temperature Environments:
  1. Temperatures 0 deg F and Higher: Electronic or electromagnetic type rated for 0 deg F starting temperature.
  2. Temperatures Minus 20 deg F and Higher: Electromagnetic type designed for use with high-output lamps.

## 2.5 EXIT SIGNS

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- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

## 2.6 FLUORESCENT EMERGENCY LIGHTING FIXTURES

- A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.
  - 1. Emergency Connection: Operate one fluorescent lamp continuously to 1100 lumens minimum. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
  - 2. Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
  - 3. Battery: Sealed, maintenance-free, with minimum seven-year nominal life.
  - 4. Charger: Fully automatic, solid-state, constant-current type.

## 2.7 FLUORESCENT LAMPS

- A. Low-Mercury Lamps: Comply with Federal toxic characteristic leaching procedure (TCLP) test, and yield less than 0.2 mg of mercury per liter, when tested according to NEMA LL 1.
- B. Premium T8 rapid-start low-mercury lamps, CRI of 82 (minimum), color temperature of 4100 K, and average rated life of 20,000 hours, unless otherwise indicated.
- C. Compact Fluorescent Lamps: CRI 80 (minimum), color temperature 4100, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated.

## 2.8 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 16 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.
- E. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

## 2.9 FINISHES

- A. Fixtures: Manufacturers' standard, unless otherwise indicated.
  - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
  - 2. Metallic Finish: Corrosion resistant.

## 2.10 SOURCE QUALITY CONTROL

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- A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.
- B. Factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceilings and walls. Adjust trims for recessed fixtures to eliminate light leaks. Install lamps in each fixture.
  - 1. Install fixtures with the separation from combustible material as required by lighting fixture rating, per manufacturer's written instructions; in no case, install recessed fixture within ½" of combustible material.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
  - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
  - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel or at the intersection of four tiles, and support fixtures independently with at least two ¾-inch metal channels spanning and secured to ceiling tees.
  - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Suspended Fixture Support: As follows:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
- D. Adjust aimable fixtures to provide required light intensities.

### 3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
  - 1. Clean transparent materials. Replace chipped or broken lenses and other damaged transparent materials.
  - 2. Restore reflective surfaces to their reflective conditions.
  - 3. Clean light fixtures and lamps.
- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

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- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
  
- E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION 16511

## SECTION 16851 - FIRE ALARM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes fire alarm systems with manual stations, detectors, signal equipment, controls, and devices.
- B. Related Sections include the following:
  - 1. Division 8 Section "Hardware" for door closers/holders/smoke detectors, electric door locks, and release devices that interface with fire alarm systems.

#### 1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

#### 1.4 SYSTEM DESCRIPTION

- A. General: Noncoded, addressable-analog system with manual and automatic alarm initiation; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
  - 2. Battery: Sizing calculations.
  - 3. Floor Plans: Indicate final outlet locations and routings of raceway connections.
  - 4. Device Address List: Coordinate with final system programming.
  - 5. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
- C. Operating Instructions: For mounting at the FACP.

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- D. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
- F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.
- G. Maintenance Data: For fire alarm systems to include in maintenance manuals specified in Division 1. Comply with NFPA 72.
- H. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 1 Section "Submittals," make an identical submission to authorities having jurisdiction. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- I. Certificate of Completion: Comply with NFPA 72.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.
- D. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
- E. Comply with NFPA 72.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Horn/Strobe and Strobe Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
  - 2. Smoke Detectors, Fire Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than one unit of each type.
  - 3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than one unit of each type.
  - 4. Keys and Tools: One extra set for access to locked and tamperproofed components.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

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- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Siemens.
  2. Edwards Systems Technology; Unit of General Signal.
  3. Fire Control Instruments, Inc.
  4. Notifier; Div. of Pittway Corp.
  5. Simplex Time Recorder Co.

## 2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Control of System: By the FACP.
- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.
- E. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground or open circuit occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.
- H. Loss of primary power at the FACP initiates a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.
- I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of initiating device initiates the sequence of operation as indicated in the fire alarm matrix.
- J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP and the remote annunciator.
1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
  2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

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- K. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory and are printed out by the system printer.
- L. Removal of an alarm-initiating device or a notification appliance initiates the following:
  - 1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
  - 2. Recording of the event by the system printer.
  - 3. Transmission of trouble signal to remote alarm receiving station.
- M. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

## 2.3 MANUAL PULL STATIONS

- A. Description: Fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.
  - 1. Double-action mechanism requires two actions, such as a push and a pull, to initiate an alarm.
  - 2. Station Reset: Key or wrench operated; double pole, double throw; switch rated for the voltage and current at which it operates.
  - 3. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

## 2.4 SMOKE DETECTORS

- A. General: Include the following features:
  - 1. Operating Voltage: 24-V dc, nominal.
  - 2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  - 3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
  - 4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
  - 5. Sensitivity: Can be tested and adjusted in-place after installation.
  - 6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  - 7. Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
- B. Photoelectric Smoke Detectors: Include the following features:
  - 1. Sensor: LED or infrared light source with matching silicon-cell receiver.
  - 2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
- C. Duct Smoke Detector: Photoelectric type.

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1. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.

## 2.5 OTHER DETECTORS

- A. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
  1. Mounting: Plug-in base, interchangeable with smoke detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

## 2.6 NOTIFICATION APPLIANCES

- A. Description: Equip for mounting as indicated and have screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
- B. Horns: Electronic-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet (3 m) from the horn.
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  1. Rated Light Output: as shown on drawings.
  2. Synchronization option.
  3. Strobe Leads: Factory connected to screw terminals.

## 2.7 CENTRAL FACP

- A. Cabinet: Lockable steel enclosure. Arrange interior components so operations required for testing or for normal maintenance of the system are performed from the front of the enclosure. If more than one unit is required to form a complete control panel, fabricate with matching modular unit enclosure to accommodate components and to allow ample gutter space for field wiring and interconnecting panels.
  1. Identify each enclosure with an engraved, red, laminated, phenolic-resin nameplate with lettering not less than 1 inch high. Identify individual components and modules within cabinets with permanent labels.
  2. Mounting: Surface.
- B. Alarm and Supervisory Systems: Separate and independent in the FACP. Alarm-initiating zone boards consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.
- C. Control Modules: Include types and capacities required to perform all functions of fire alarm systems.
- D. Indications: Local, visible, and audible signals announce alarm, supervisory, and trouble conditions. Each type of audible alarm has a different sound.

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- E. Resetting Controls: Prevent the resetting of alarm, supervisory, or trouble signals while the alarm or trouble condition still exists.
- F. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components, including annunciation, supervision, and control.
  - 1. Display: A minimum of 80 characters; alarm, supervisory, and component status messages; and indicate control commands to be entered into the system for control of smoke detector sensitivity and other parameters.
  - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

## 2.8 EMERGENCY POWER SUPPLY

- A. General: Components include valve-regulated, recombinant lead acid battery; charger; and an automatic transfer switch.
  - 1. Battery Nominal Life Expectancy: 10 years, minimum.
- B. Battery Capacity:
  - 1. Comply with NFPA 72.
  - 2. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
  - 3. Minimum Capacity: 24 hour operation of complete system (except where specifically noted otherwise) plus 15 minutes with all indicating devices. In addition, include 25% spare capacity.
- C. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.
- D. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

## 2.9 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.

## 2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled under UL 864 and NFPA 72.
- B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP panel, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising two lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble

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signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

- C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
- D. Self Test: Conducted automatically every 24 hours with report transmitted to central station.

## 2.11 WIRE

- A. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

- A. Connect the FACP with a disconnect switch with lockable handle or cover.
- B. Manual Pull Stations: Mount semiflush in recessed back boxes.
- C. Ceiling-Mounted Smoke Detectors: Not less than 4 inches from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet apart in any direction.
- D. Wall-Mounted Smoke Detectors: At least 4 inches, but not more than 12 inches, below the ceiling.
- E. Smoke Detectors near Air Registers: Install no closer than 60 inches.
- F. Duct Smoke Detectors: Comply with manufacturer's written instructions.
  - 1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  - 2. Install sampling tubes so they extend the full width of the duct.
- G. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- H. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.
- I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
  - 1. Synchronization: synchronize any two strobes located such that they are visible from the same location.
- J. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.
- K. Annunciator: Install with the top of the panel not more than 60 inches (1830 mm) above the finished floor.

- A. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways and Boxes." Conceal raceway except in unfinished spaces and as indicated.
- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- E. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors or zones.
- F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."
  - 1. Paint all fire alarm system junction boxes, device boxes, and pull boxes with red paint.
- B. Install instructions frame in a location visible from the FACP.
- C. Prepare laminated drawings showing each device and identifying the device address or zone
- D. Paint power-supply disconnect switch red and label "FIRE ALARM."

### 3.4 GROUNDING

- A. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.
- B. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements in Division 16 Section "Grounding."
- C. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and

other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

### 3.5 FIELD QUALITY CONTROL

- A. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. **Pretesting:** After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
- C. **Report of Pretesting:** After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.
- D. **Final Test Notice:** Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.
- E. **Minimum System Tests:** Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
  - 1. Verify the absence of unwanted voltages between circuit conductors and ground.
  - 2. Test all conductors for short circuits using an insulation-testing device.
  - 3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
  - 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
  - 5. Test initiating and indicating circuits for proper signal transmission under open circuit and ground fault conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
  - 6. Test each initiating and indicating device for alarm operation and proper response at the control unit.
    - a. Test smoke detectors with actual products of combustion.
    - b. Test each heat detector with hair dryer or other means approved by the manufacturer.
    - c. Test fan shut down, sprinkler flow and tamper switches, door closers, magnetic door holders, and elevator return.
  - 7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.
  - 8. **Test Both Primary and Secondary Power:** Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
    - a. Disconnect fire alarm from primary power source 24 hours prior to test, or longer as specified. Test all indicating devices to determine whether audio and visual devices comply with testing requirements for a 15 minute test.

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- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.
- H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

### 3.6 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
  1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 8 hours' training.
  2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
  3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

### 3.8 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.

END OF SECTION 16851

SECTION 031119 – INSULATED CONCRETE FORMING

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. 033000 Cast in Place Concrete
- B. 051200 Structural Steel Framing
- C. 055000 Metal Fabrications
- D. 074200 Exterior Insulation and Finish System
- E. 092900 Gypsum Board

1.2 SECTION REQUIREMENTS

A. Submittals:

- 1. Product Data model code evaluation report at notice of Consideration of Contract Award.
- 2. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements.
- 3. Certificate from ICF manufacturer indicating approval of product installer.

B. References:

- 1. ACI 318 Building Code Requirements for Reinforced Concrete.
- 2. ASTM C236 Steady State Thermal Performance of Building Assemblies.
- 3. ASTM C473 Physical Testing of Gypsum Board Products and Gypsum Lath.
- 4. ASTM D1761 Mechanical Fasteners in Wood.
- 5. ASTM E84 Surface Burning Characteristics of Building Materials.
- 6. UBC 26-3 Uniform Building Code Standard Room Fire Test.

C. System Description / Performance Requirements:

- 1. Insulated concrete wall form system shall consist of two flame resistant panels of expanded polystyrene (EPS) connected by high density polypropylene webs. Where forms are to receive exterior EIFS, provide manufacturer's purpose designed form unit with web members concealed on side to receive EIFS.
- 2. Wall system to provide minimum 10" and 6" concrete wall sections as indicated, at all respective locations throughout the wall area.
- 3. Wall system webs to provide minimum 1" wide fastening strips at 8" on center, flush with wall face for full wall height to facilitate finish fastening at interior and exterior.
- 4. Wall system to provide accurate positioning of steel within form cavity to conform to reinforcing requirements of ACI 318.
- 5. EPS foam panels with concrete to provide minimum insulation as follows:
  - a. 6" Cavity Form Unit: R22.1

- b. 10" Cavity Form Unit: R21.8
  - 6. EPS foam to provide maximum vapor permeation of 3.5 Perm-in.
  - 7. Finished wall assembly to provide minimum Sound Transmission Class rating of STC 50.
- D. Quality Assurance:
- 1. ICF wall system shall be installed by a contractor authorized by the ICF manufacturer prior to bidding.
- E. Delivery, Storage and Handling:
- 1. Deliver products in original factory packaging, bearing identification of product, manufacturer and batch/lot number.
  - 2. Handle and store products in location to prevent damaging and soiling.
  - 3. Ensure that UV protection is provided for material, should on-site storage extend beyond 30 days.

## PART 2 - PRODUCTS

### 2.1 ICF UNITS

- A. Manufacturers:
- 1. Arxx Building Products, Cobourg, Ontario Canada, (800) 293-3210.
  - 2. Amvic Building Systems, Toronto, Canada (416) 410-5674.
  - 3. American Polysteel, Albuquerque, NM, (505) 345-8153.
- B. Components: Provide forms as listed below, in nominal sizes indicated, and as may be required for proper execution of the work:
- 1. 6" Core: 48" L x 11 1/2" W x 16 3/4" H.
  - 2. 10" Core: 48" L x 14 7/8" W x 16 3/4" H.
  - 3. Left and right 90 degree corners.
  - 4. End caps.
  - 5. Height adjusters.

### 2.2 PARGING

- A. ICF manufacturer's recommended acrylic based stucco finish coat parging shall be provided at all ICF formwork exposed at grade, where transition to stucco system exterior wall finish occurs. Parging color to match adjacent stucco system finish color and texture.

### 2.3 MISCELLANEOUS

- A. ICF manufacturer's standard pre-formed opening buck form stop, cut and joined to 5/8" plywood.

2.4 WALL ALIGNMENT SYSTEM

- A. To aid in the construction of the wall system, and to provide an adjustable device for ensuring plumbness of the wall during construction, where appropriate, the ICF manufacturer's wall alignment system shall be used.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Verify footings are installed within +/- 1/4" of level.
- B. Ensure that reinforcing dowels are in place at specified centers, either centered or offset along length of footings to match indicated vertical reinforcing of ICF wall.
- C. Clean top of footings prior to commencing Work.
- D. Installation of forms shall be in strict accordance with ICF manufacturer's product manual.
- E. The Installation Contractor shall ensure conformance with ICF manufacturer's procedures for, but not limited to, the following:
  - 1. First course placement.
  - 2. Horizontal and vertical reinforcement placement.
  - 3. Successive course placement.
  - 4. Door and window openings.
  - 5. Form alignment and scaffolding installation.
  - 6. Pre-construction placement inspection.
  - 7. Concrete placement.
  - 8. Alignment assembly removal.

3.2 OPENINGS

- A. Provide pre-formed opening buck form stop around openings to contain concrete within forms. Brace opening buck as required to maintain square profile at opening edges.

3.3 SERVICE PENETRATIONS

- A. Service penetrations (e.g., electrical service conduits, water service pipes, air supply and exhaust ducts, etc.) shall be installed at the required locations as indicated.
- B. Service penetrations exceeding 16" x 16" in area shall be reinforced.
- C. Prior to concrete placement, install service penetration sleeves at designated locations to create voids where services can be installed.

3.4 CLEANUP

- A. Clean up and properly dispose of all debris remaining on job site related to the installation of insulated concrete forms.

3.5 PROTECTION

- A. Provide temporary coverage of installation to reduce exposure to ultraviolet light should finish application be delayed longer than 60 days.

END OF SECTION 031300

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. 014000 Quality Requirements
- B. 031119 Insulated Concrete Forms
- C. 312000 Earth Moving
- D. 321600 Site Concrete for Minor Structures

1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Warranty: Contractor shall provide a two year warranty, effective from the date of Substantial Completion, to promptly remove and/or repair defective concrete (pitting, spalling, cracking, honeycombing, etc.).
- C. Ready-Mixed Concrete Producer Qualifications: ASTM C 94/C 94M.
- D. Comply with ASTM C 94; ACI 301, "Specification for Structural Concrete"; ACI 117, "Specifications for Tolerances for Concrete Construction and Materials"; and CRSI's "Manual of Standard Practice."

1.3 QUALITY ASSURANCE:

- A. Owner's testing agency to provide the following test reports:
  - 1. Field density of base course at areas as follows:
    - a. Foundations: Four dispersed locations.
    - b. Interior concrete slabs: No less than four dispersed locations.
  - 2. Concrete testing will be performed in accordance with the specifications of ACI 301 as modified as follows:
    - a. ACI 301: 16.3.4.2 At foundations, walls, interior slabs on grade, ICF walls and overhead door aprons, mold and cure three (3) specimens from each sample.
    - b. ACI 301: 16.3.4.4 Compressive strength tests: One set of specimens for each 50 cubic yards or fraction thereof of each concrete class placed in any one day; one specimen tested at seven ( 7 ) days, two specimens tested at 28 days.
    - c. ACI 301: 16.3.8 Concrete Temperature: Test hourly when air temperature is below 40 degrees F. and each time a set of specimens is made.
- B. Comply with ACI 305 during hot weather; ACI 306 during cold weather.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Fiber Reinforcement: ASTM C 1116, Type III, synthetic fibers, ½ inch to 1 inch.
- B. Deformed Reinforcing Bars: ASTM A 615/A 615M, Grade 60.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets, 6 x 6 x W1.4 x W1.4.
- D. Plain Steel Wire: ASTM A 82, as drawn.
- E. Portland Cement: ASTM C 150, Type I or II. Use Type II cement where concrete is to be in direct contact with native soil. Use low alkali cement for concrete in contact with earth.
- F. Fly Ash: ASTM C 618, Type C or F.
- G. Aggregates: ASTM C 33, uniformly graded.
- H. Air-Entraining Admixture: ASTM C 260.
- I. Joint-Filler Strips: ASTM D 1751, cellulosic fiber, or ASTM D 1752, cork.
- J. Repair Underlayment: Factory-packaged, portland or blended hydraulic cement-based, polymer-modified, self-leveling underlayment with minimum 28-day compressive strength of 4100 psi.
- K. Repair Topping: Factory-packaged, portland or blended hydraulic cement-based, polymer-modified, self-leveling traffic-bearing topping with minimum 28-day compressive strength of 5700 psi.
- L. Self Adhering Sheet Flashing Membrane: Minimum 40-mil- thick, 36-inches wide, self-adhering, polymer-modified, bituminous sheet membrane; complying with ASTM D 1970.
- M. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

### 2.2 MIXES

- A. Proportion normal-weight concrete mixes to provide the following properties:
  - 1. Compressive Strength at 28 Days: 2,500 psi insulated concrete form walls; 3,000 psi footings; 4,000 psi foundation and walls, slab on metal deck and interior slabs on grade.
  - 2. Slump Limit: 5 – 6 inches, +/- 1 inch for ICF walls, 4 inches, +/- 1 inch elsewhere, at point of placement.
  - 3. Air Content: For concrete exposed to freezing and thawing, provide 6-1/2%+ 1-1/2% for ¾" maximum aggregate size; 6%+ 1-1/2%; for 1" maximum aggregate size; 5-1/2"+1% for maximum 1-1/2" aggregate size. Provide 2 to 4 percent elsewhere.
  - 4. Limit water to cement ratio to no more than 50%.

5. Fly Ash: A maximum of 10% by weight of the cement may be replaced with fly ash at the ratio of one pound of fly ash for every one pound of cement removed.
- B. Do not re-temper mix by adding water in the field.
- C. Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116.
1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
  2. Maximum Aggregate Size at ICF Walls: 3/8" for 6 inch core ICF walls, 3/4" for 10 inch core ICF walls

### PART 3 - EXECUTION

#### 3.1 CONCRETING

- A. Interior Concrete Slabs on Grade: Provide concrete slabs in 6 inch thickness over 6 inches of compacted drainage fill unless otherwise indicated. Reinforce slabs with #4 at 24 inches on center each way.
- B. Provide fiber reinforcement in interior concrete slabs and in exterior building concrete walks, landings and slabs.
- C. Construct formwork and maintain tolerances and surface irregularities within ACI 117 limits of Class A for concrete exposed to view and Class C for other concrete surfaces.
- D. Accurately position, support, and secure reinforcement.
- E. Install construction, isolation, and contraction joints where indicated. Install full-depth joint-filler strips at un-sealed isolation joints. Install joint filler strips in depth equal to pour thickness.
- F. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.
- G. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.
- H. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.
- I. Slab Finishes: Troweled finish for floor surfaces and floors to receive floor coverings, paint, or other thin film-finish coatings. Nonslip, light broom finish to exterior concrete slabs, walks, and landings. Provide roughened surface finish in base slabs receiving housekeeping pads.
- J. Cure formed surfaces by moist curing for at least seven days.
- K. Begin curing concrete slabs after finishing. Apply membrane-forming curing compound to concrete.
- L. Protect concrete from damage. Repair surface defects in formed concrete and slabs.
- M. Repair slabs not meeting surface tolerances by grinding high areas and by applying a repair underlayment to low areas receiving floor coverings and a repair topping to low areas to remain exposed.

- N. Thoroughly vibrate exposed formed surfaces to consolidate aggregate. Honeycomb face at exposed formed surfaces will not be accepted.
- O. Remove and replace concrete that is broken, damaged, or defective. Exclude traffic from gutter and drive approaches for at least 14 days.

END OF SECTION 033000

## SECTION 051200 - STRUCTURAL STEEL

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data Shop Drawings.
- B. Comply with AISC's "Specification for Structural Steel Buildings-Allowable Stress Design and Plastic Design," RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts," and AWS D1.1, "Structural Welding Code--Steel."

### PART 2 - PRODUCTS

#### 2.1 STRUCTURAL STEEL AND ACCESSORIES

- A. Structural-Steel Shapes, Plates, and Bars: ASTM A 36/A 36M, carbon steel.
- B. Cold-Formed Structural-Steel Tubing: ASTM A 500, Grade B.
- C. Anchor Rods, Bolts, Nuts: ASTM A 36/A 36M, unheaded rods ASTM A 325, headed bolts, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
- D. Bolts, Nuts, and Washers: ASTM A 307, Grade A; nonhigh-strength carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers, uncoated.
- E. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd, rust-inhibiting primer.
- F. Grout: ASTM C 1107, nonmetallic, shrinkage resistant, premixed.

#### 2.2 FABRICATION

- A. Fabricate structural steel according to AISC specifications and tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- B. Shop Priming: Prepare surfaces according to SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning." Shop prime steel to a dry film thickness of at least 1.5 mils. Do not prime surfaces to be embedded in concrete or mortar or to be field welded.

### PART 3 - EXECUTION

#### 3.1 ERECTION

- A. Erect structural steel according to AISC specifications and within erection tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- B. Set base and bearing plates on wedges, shims, or setting nuts. Tighten anchor bolts, cut off wedges or shims flush with edge of plate, and pack grout solidly between bearing surfaces and plates.
- C. Bolted Connections: Install and tighten nonhigh-strength bolts, unless high-strength bolts are indicated. Snug tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Weld Connections: Comply with AWS D1.1.

END OF SECTION 051200

## SECTION 052100 - STEEL JOIST FRAMING

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data Shop Drawings and manufacturer certificates certifying that joists comply with requirements.
- B. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
- C. Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.
- D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

### PART 2 - PRODUCTS

#### 2.1 JOISTS AND ACCESSORIES

- A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.
- B. Steel Bearing Plates: ASTM A 36/A 36M.
- C. Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.
- D. Primer: Comply with performance requirements in SSPC-Paint 15.
- E. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members.
- F. Bridging: Provide bridging anchors and horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- G. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated.
- H. Shop Priming: Prepare surfaces according to SSPC-SP 2 or SSPC-SP 3. Apply 1 coat of shop primer to joists and joist accessories to provide a dry film thickness at least 1 mil.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications" and joist manufacturer's written recommendations.
  - 1. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- B. Field weld joists to supporting steel bearing plates.
- C. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data Shop Drawings and product certificates.
- B. Comply with SDI Publication No. 30.
- C. Comply with AWS D1.3, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum; shop primed.

2.2 DECKING

- A. Roof Deck: Fabricate panels from prime-painted steel sheet, without top-flange stiffening grooves, to comply with the following:
  - 1. Deck Profile: Type B.
  - 2. Profile Depth: 1-1/2 inches.
  - 3. Design Uncoated-Steel Thickness: 0.0358 inch (20 gauge).
- B. Composite Steel Floor Deck: Fabricate panels from prime-painted steel sheet with integrally embossed or raised pattern ribs and interlocking side laps, to comply with the following:
  - 1. Profile Depth: 3 inches.
  - 2. Design Uncoated-Steel Thickness: 0.0474 inch (18 gauge).

2.3 MISCELLANEOUS

- A. Accessories: Manufacturer's recommended roof deck accessory materials and floor deck pour stops and closures. Sheet metal accessories of same material and finish as deck.

PART 3 - EXECUTION

3.1 DECK INSTALLATION

- A. Place, adjust, align, and bear deck panels on structure. Do not stretch or contract side-lap interlocks.
- B. Place deck panels flat and square and weld to structure without warp or deflection.
- C. Cut, reinforce, and fit deck panels and accessories around openings and projections.
- D. Roof Deck Accessories: Install sump pans, sump plates, ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels. Weld to substrate.
- E. Floor Pour Stops and Girder Fillers: Weld pour stops and girder fillers to structure.
- F. Floor Deck Closures: Weld steel sheet closures to deck to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels.
- G. Prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A 780.
- H. Wire brush, clean, and paint scarred areas, welds, and rust spots on both surfaces of painted deck panels.

END OF SECTION 053100

## SECTION 054000 - COLD-FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED SECTIONS

- A. 092900: Gypsum Board

#### 1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data and material certificates.
- B. Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing.
- C. Comply with AWS D1.3, "Structural Welding Code--Sheet Steel."
- D. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 zinc coated; Structural Steel (SS); Grade 33.
- B. Load Bearing Steel Studs: C-shaped, with flange width of not less than 1-3/8 inches, minimum uncoated metal thickness of 0.0329 inch (20 gauge), and of depths indicated.
- C. Load Bearing Steel Stud Track: U-shaped, minimum uncoated metal thickness same as studs used with track, with flange widths of 1-1/4 inches, of web depths indicated.
- D. Guard Wall Load Bearing Stud: C-shaped, with flange width of not less than 2 inches, minimum uncoated metal thickness of .0566 inch (16 gauge), 6 inches deep.
- E. Guard Wall Load Bearing Steel Stud Track: U-shaped, minimum uncoated metal thickness same as studs used with track, with flange widths of 2 inches, of web depths indicated.
- F. Roof Deck Ledger: C-shaped, with flange width of not less than 2-1/2 inches, minimum uncoated metal thickness of .0566 inch (16 gauge), 6 inches deep.
- G. Corner Angle: L-shaped, with leg dimensions indicated, minimum uncoated steel thickness to match associated framing members.

- H. Joists: C-shaped, with flange width of not less than 1-5/8 inches, minimum uncoated metal thickness of 0.0478 inch (18 gauge), 3-1/2 inches deep.
- I. Joist Track: U-shaped, minimum uncoated metal thickness same as joists used with track, with flange widths of 1-1/4 inches, of web depths indicated.
- J. Box Headers: C-shaped, with flange widths of not less than 1-3/8 inches for 6 inch member and 1-5/8" for 10 inch member, minimum uncoated metal thickness of not less than 0.0329 inch (20 gauge) for 6 inch member, 0.0451 inch for 10" member, of web depths indicatd.
- K. Box Header Track: U-shaped, minimum uncoated metal thickness of 0.0329 inch (20 gauge), with flange widths of 1-1/2 inches, of web depths indicated.
- L. Coping Nailer (Track): U-shaped, minimum uncoated metal thickness of 0.0329 inch (20 gauge), with flange widths of 1-1/2 inches, 12 inches deep.

## 2.2 ACCESSORIES

- A. Accessories: Fabricate from the same material and finish used for framing members, of manufacturer's standard thickness and configuration, unless otherwise indicated.
- B. Cast-in-Place Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws.
- D. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

## PART 3 - EXECUTION

### 3.1 FRAMING

- A. Install framing and accessories level, plumb, square, and true to line, and securely fastened, according to ASTM C 1007. Temporarily brace framing until entire integrated supporting structure has been completed and permanent connections are secured.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten framing members by welding or screw fastening.
  - 3. Install insulation in built-up exterior framing members.
  - 4. Fasten reinforcement plates over web penetrations larger than standard punched openings.
- B. Erection Tolerances: Install cold-formed metal framing with a maximum variation of 1/8 inch in 10 feet and with individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

- C. Studs: Install continuous top and bottom tracks securely anchored at corners and ends. Squarely seat studs against webs of top and bottom tracks. Space studs as indicated, set plumb, align, and fasten both flanges of studs to top and bottom tracks.
  - 1. Install and fasten horizontal bridging in stud system, spaced in rows not more than 48 inches apart, unless otherwise indicated.
  - 2. Install miscellaneous framing and connections to provide a complete and stable wall-framing system.
  
- D. Joists: Install and securely anchor perimeter joist track sized to match joists. Install joists bearing on supporting framing, brace and reinforce, and fasten to both flanges of joist track.
  - 1. Install bridging and fasten bridging at each joist intersection.
  - 2. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. 055100 Metal Stairs

1.2 SECTION REQUIREMENTS

- A. Submittals: Shop Drawings showing details of fabrication and installation.

PART 2 - PRODUCTS

2.1 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Rolled Steel Floor Plate: ASTM A 786/A 786M.
- C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
- D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.

2.2 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

2.3 FABRICATION

- A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
- B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.
- C. Fabricate ladders for locations shown, complying with ANSI A14.3, welded steel construction.
- D. Fabricate pipe bollards from Schedule 40 steel pipe.

- E. Fabricate door and entry canopies from tube steel and plate, complying with ANSI A14.3, welded steel construction. Provide welded plate closure at all exposed ends of members.
- F. Steel Pipe Handrail:
  - 1. Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose.
  - 2. Form changes in direction of railings by bending or by inserting prefabricated fittings.
  - 3. Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

## 2.4 STEEL AND IRON FINISHES

- A. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.
- B. Fit exposed connections accurately together to form hairline joints.
- C. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- D. Anchor bollards in concrete and fill solidly with concrete, mounding top surface.
- E. Attach handrails to wall with wall brackets. Use type of bracket with predrilled hole for exposed bolt anchorage.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. 055000 Metal Fabrications

1.2 SECTION REQUIREMENTS

- A. Structural Performance of Stairs, Handrails and Railing Systems:
  - 1. Provide railings capable of withstanding structural loads required by ASCE 7.
  - 2. Design, engineer, fabricate and install stairs, handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935.
  - 3. Structural Performance: Design, engineer, fabricate and install to withstand structural loads specified in the governing building codes, including anchors and connections
  - 4. General configuration of stairs and handrails is indicated.

1.3 SUBMITTALS: Shop Drawings.

PART 2 - PRODUCTS

2.1 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- C. Rolled Steel Floor Plate: ASTM A 786/A 786M.
- D. Iron Castings: Either gray iron, ASTM A 48/A 48M, Class 30, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30.
- F. Expanded Metal, Carbon Steel: ASTM F 1267, Class 1 (uncoated).
- G. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

2.2 MISCELLANEOUS MATERIALS

- A. Concrete: Comply with Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

- B. Welded Wire Fabric: ASTM A 185, 6 by 6 inches - W1.4 by W1.4.

## 2.3 FABRICATION

- A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
- B. Welding: Use materials and methods that minimize distortion and develop strength of base metals. At exposed connections, finish welds and surfaces smooth.
- C. Stair Framing: Fabricate stringers of steel channels. Construct platforms of steel plate or channel headers and miscellaneous framing members.
- D. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch thick.

## 2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal stairs after assembly.
- B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

END OF SECTION 055100

## SECTION 072100 - THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED SECTIONS

- A. 075400 – Thermoplastic Membrane Roofing

#### 1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data for each type of insulation product specified.
- B. Surface-Burning Characteristics: ASTM E 84, flame-spread ratings of 75 or less and smoke-developed ratings of 450 or less where insulation is concealed within construction assemblies; ASTM E 84, flame spread ratings of 25 or less and smoke-developed ratings of 25 or less where insulation is exposed.

### PART 2 - PRODUCTS

#### 2.1 INSULATION PRODUCTS

- A. Extruded-Polystyrene Board Insulation at Foundations: ASTM C 578, Type IV, 1 ½” thick, R7.5 at 75 degree mean temperature.
- B. Mineral-Fiber-Blanket Insulation, ASTM C 665:
  - 1. Sound Attenuation Walls: Type I, unfaced with fibers manufactured from glass, thickness to equal full depth of wall framing.

#### 2.2 ACCESSORIES

- A. Kraft paper or foil tape to match insulation facing for tear repair.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install insulation in areas and in thickness indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.
- B. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage.

END OF SECTION 072100

SECTION 072400 - EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. 031119 Insulated Concrete Forming

1.2 SECTION REQUIREMENTS

- A. System is acceptable to authorities having jurisdiction based on evaluation per ICC-ES AC219, "Acceptance Criteria for Exterior Insulation and Finish Systems."
- B. Impact Classification: High Impact Resistance per EIMA 101.86.
- C. Submittals: Product Data model code evaluation report at notice of Consideration of Contract Award and Samples of finishes.
- D. Installer Qualifications: Certified in writing by system manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. El Rey Stucco Company, Grand Junction, Colorado, (970) 242-5491, "Insul-Flex"
- B. Dryvit Systems Inc., West Warwick, RI, 800-556-7752. "Outsulation".
- C. Sto Corporation, Atlanta, GA (404) 346-3666, "Stotherm".

2.2 MATERIALS

- A. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, complying with EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board." Shaped to profile indicated.
- B. Reinforcing Mesh:
  - 1. Standard Reinforcing Mesh: Balanced, alkali-resistant, open-weave glass-fiber mesh treated for compatibility with other system materials, complying with ASTM D 578, and with minimum weight not less than 4.5 oz./sq. yd..
  - 2. Heavy-Duty Reinforcing Mesh: Not less than 20 oz./sq. yd. Installed in first layer base coat from bottom of wall to +8'.
  - 3. Corner Mesh: Reinforcing mesh used as corner reinforcement in conjunction with Heavy Duty Reinforcing Mesh.

- C. Adhesives: Copolymer based, factory blend of Portland cement, dry polymer and proprietary ingredients.
- D. Base-Coat Materials: EIFS manufacturer's standard mixture of portland cement complying with ASTM C 150, Type I, and copolymer-emulsion adhesive designed for use indicated.
- E. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating, consisting of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
- F. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written requirements; manufactured from UV-stabilized PVC.
- G. Sealants: ASTM C 920, Grade Non Sag, low modulus, minimum 50% elongation and 25% minimum compression.
- H. Sealant Backer Rod: Closed cell polyethylene foam.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.
  - 1. Install tracks, back-wrap mesh, or edge wrap mesh at system terminations at base of walls. Install mesh wrap at all other system terminations. Coordinate with installation of insulation.
  - 2. Adhesively attach insulation to substrate in compliance with ASTM C 1397 and with EIFS manufacturer's written requirements, using notched trowel. Install insulation board without gaps, in running bond pattern and interlocked at corners.
  - 3. Rasp irregularities off insulation board and insulated concrete forms, after adhesive has dried.
  - 4. From grade to +8', install base coat with a minimum total thickness at least 1/8 inch, and completely covering Heavy Duty Reinforcing Mesh so reinforcing-mesh color and pattern are not visible. Include diagonal mesh patches at corners of openings and reinforcing mesh patched at joints of track sections.
  - 5. Apply base coat and Standard Reinforcing Mesh over lower initial base coat and insulated concrete form and shaped rigid insulation substrate above. Do not apply until lower initial base coat has cured.
  - 6. Apply finish coat over dry base coat, in thickness required by EIFS manufacturer to produce a uniform color and texture, free of variations. Finish coat color and texture to match existing entrance station.
- B. Prepare joints and apply sealants to comply with applicable requirements in Division 07 Section "Joint Sealants" and with ASTM C 1481.
- C. Protection / Clean-up:
  - 1. Protect surrounding material surfaces and areas during installation of EIFS.

2. Protect EIFS material against freezing in cold weather. Provide temporary heated enclosures as required by ambient air temperature to prevent material from freezing during installation and during curing.
3. Remove excess and waste materials from job site and dispose of legally.
4. Clean stucco material from surfaces and work area of foreign materials resulting from EIFS operations.

END OF SECTION 072400

## SECTION 075400 – MECHANICALLY ATTACHED THERMOPLASTIC MEMBRANE ROOFING

## PART 1 - GENERAL

## 1.1 SECTION REQUIREMENTS

- A. Scope: Material and installation of a mechanically attached, reinforced, single ply roofing membrane with insulation, flashings and other components to comprise a complete roofing system. Any portion of this specification that does not meet manufacturer's requirements shall be installed per manufacturer's requirements at no additional cost. Any portion of this specification that exceeds the manufacturer's minimum requirements shall be installed according to this specification, not manufacturer's minimum requirements.
- B. Submittals:
1. Shop Drawings.
  2. Product Data.
  3. Evidence that the proposed roof system meets the requirements of Factory Mutual Class 1-90 (70 MPH wind speed) and Underwriter's Laboratories Class A assembly.
  4. Certificate from roofing system manufacturer indicating approval of product installer.
  5. Pre-installation notice from the manufacturer prior to start of any work. This will include confirmation that the membrane and all accessories being used meet requirements of specification. This will also include confirmation that the scope of work is in accordance with published technical data as per manufacturer. This also includes confirmation that a warranty has been requested and will be issued on the Owner Agency's warranty form at the completion of roofing.
  6. Documented proof of how they plan to meet warranty obligations.
- C. Exterior Fire-Test Exposure: ASTM E 108, Class A.
- D. Warranties: Provide Owner Agency's 20 year manufacturer's and 5 year applicator's full written warranties, without monetary limitation, signed by roofing system manufacturer and applicator, agreeing to promptly repair leaks resulting from defects in materials or workmanship for the periods indicated. Material and workmanship coverage to include all components provided by the roofing system manufacturer and applicator, i.e., insulation, fasteners, membrane, flashings, terminations, etc. Copies of the referenced warranties are included herewith.
- E. Applicator:
1. Roofing system shall be applied by a Roofing Contractor authorized by the roof membrane manufacturer prior to bidding.
  2. Must have five years experience as a roofing contractor, installing the specified product.
  3. Must document continuing education for the foreman that will daily oversee the Work. A minimum of twelve hours of continuing education per year is required.
  4. The on-site foreman must be able to clearly communicate with the Owner's representative.
  5. Must provide a 24 hour emergency phone number to the Owner's representative.
  6. Must be legally licensed to perform roofing work in the State of Utah and carry liability insurance as required by the State of Utah law.

7. Must be willing to sign and agree to the terms of the DFCM 5 year Contractor Roofing Warranty.
- F. Manufacturer:
1. Must be listed in NRCA's low slope roofing materials guide.
  2. Must have 10 year successful history as a roofing manufacturer.
  3. Must agree to and be willing to sign the appropriate State of Utah (Owner Agency's) Manufacturer's Roofing Warranty for the roof system. This warranty, not the manufacturer's standard warranty, will be required as part of Project Closeout Documents.
  4. Will provide, at no additional cost, Pre-installation Meeting, progress inspections and a final warranty inspection at project completion by a full time technical representative. All inspections will be scheduled by the Owner's Representative.
  5. Must have a certified applicator's program. This program must include continuing education for the applicator.
  6. Must have a history of meeting warranty obligations.
  7. Shall release all inspection reports concerning warranted roof system to the Owner's Representative.
- G. Pre-Installation Meeting: Prior to the beginning roof system installation, the Owner's Representative shall schedule a meeting to be attended by the Owner, Architect, Contractor, Roofing Contractor and any other associated trade contractors to discuss and coordinate issues pertaining to the installation of the roof system.
- H. Project Closeout Requirements: Contractor shall submit Manufacturer and Applicator Warranties and Roof History Record. A copy of the Roof History Record is included herewith.

## PART 2 - PRODUCTS

### 2.1 ROOFING MATERIALS

- A. TPO – Thermoplastic Polyolefin:
1. Must meet or exceed ASTM D 6878-03.
  2. Must have a 10-year minimum performance history on membrane.
  3. Membrane must be manufactured with low-wicking scrim.
  4. Only balanced sheets will be acceptable. Scrim must be in center of membrane with no less than 20 mils polymer above scrim.
  5. 60 mil nominal (57mil minimum) polymer thickness.
  6. Resistance to xenon-arc weathering (ASTM G 155) must be tested and pass a minimum of 17,640 kJ/m<sup>2</sup> or 14,000 hours at an irradiance of 0.35 W/m<sup>2</sup>.
  7. Must meet or exceed ASTM D 4434 for linear dimensional change and for heat aging.
  8. Must meet or exceed ASTM D 5635 for dynamic impact resistance.
  9. Must meet or exceed ASTM D 2136 for low temperature flexibility.
  10. Membrane must be Energy Star Rated.
  11. Standard color (white).
- B. Manufacturers:
1. Stevens Roofing, Holyoke, MA, (801) 541-2238: "EP".
  2. GAF Materials Corporation Inc., Wayne, NJ (973)628-3000: "Everguard".

3. Carlisle Syntec, Carlisle, PA, (800) 4 SYNTEC: "Sureweld".
- C. Auxiliary Materials: Recommended by roofing system manufacturer for intended use and as follows:
1. Air Retarder: 6 Mil reinforced polypropylene. Installed between roof deck and rigid insulation.
  2. Sheet Flashing: Roofing system manufacturer's standard reinforced single ply membrane compatible with indicated substrates.
  3. Walkway: Roofing system manufacturer's standard reinforced single ply membrane, nominal, 36 inches wide. Walkway to extend from roof scuttle to and around roof top mechanical units as indicated.
  4. Sealants, Fasteners, Adhesives, Separators: Manufacturer's standard products, compatible with substrates indicated, as required to provide a complete roofing system.

## 2.2 ROOFING INSULATION

- A. Rigid Insulation: Roofing system manufacturer's approved closed cell HCFC blown isocyanurate foam with heavy felt facers fiberglass reinforced. Provide above deck roof insulation in 2 inch layers for a total thickness of 4 inches; R7.3 per inch (R29.2 total).
- B. Fabricate tapered insulation with slope of 1/2 inch per 12 inches, unless otherwise indicated. Provide pre-formed transition from tapered insulation to deck insulation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Insulation:
  1. Insulation shall be installed according to insulation manufacturer's instructions and shall be neatly cut to fit around penetrations and projections.
  2. Install tapered insulation at drainage crickets and around roof drains, creating a sump.
  3. Install deck insulation in two layers. Offset joints in first insulation course from roof deck joints by a minimum of 6 inches. Offset joints in successive insulation courses by 1/2 panel in both directions to provide a thermal barrier between joints of layered insulation.
  4. Do not install more insulation board than can be covered with roof membrane by the end of the day or the onset of inclement weather.
  5. Mechanical Attachment:
    - a. Insulation shall be mechanically fastened to the deck with approved fasteners and plates at a rate according to the insulation manufacturer's, Factory Mutual's and roof membrane manufacturer's recommendations for fastening rates and patterns. The quantity and locations of fasteners and plates shall also cause the insulation boards to rest evenly on the roof deck so that there are no significant and avoidable air spaces between the boards and the roof deck. Each insulation board shall be installed tight to adjacent boards on all sides.

- b. Fasteners are to be installed with a tool using a depth locator and torque limiting attachment, with minimum penetration into the structural deck as recommended by the fastener and roof membrane manufacturers.

B. Roof Membrane:

- 1. The surface of the insulation shall be inspected prior to installation of the roof membrane. Surface shall be clean, dry, free from debris and smooth, with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.
- 2. Roof membrane is to be attached with fasteners and discs according to roof membrane manufacture's and Factory Mutual's requirements.
- 3. Membrane overlaps shall be shingled with the flow of water where possible.
- 4. Membrane shall be attached with fasteners and seam welding at the rate and method recommended by the roof membrane manufacturer at all unique roof areas: perimeter and corners; interior; curbs and flashings; penetrations.
- 5. All seams shall be hot air welded. Seam overlaps shall be 3 inches wide when automatic machine welding and 4 inches wide when hand welding typically.

C. Membrane Flashings:

- 1. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings are allowed. Flashing shall be adhered to compatible, dry, smooth and solvent-resistant surfaces. The bonded sheet shall be pressed firmly into place with a hand roller.
- 2. Install all fasteners and discs at the base of parapets, walls and curbs, etc. as recommended by the roof membrane manufacturer.
- 3. All flashings shall extend a minimum of 8 inches above the roofing level unless otherwise indicated. Flashings shall terminate with copings, termination bar, band clamps or counterflashings as indicated and as required by roof membrane manufacturer.

- D. Walkway: Place chalk lines on clean, dry deck sheet to indicate location of walkway. Hot air weld walkway to the roof deck membrane per manufacturer's written instruction.

3.2 COMPLETION:

- A. Prior to demobilization from the site, the work shall be reviewed by the Owner's Representative and the Applicator. Any defects noted and non-compliances with the Contract Documents and/or roof membrane manufacturer's recommendations shall be itemized on a punch list, with any items noted being corrected prior to demobilization.

END OF SECTION 075400



## CONTRACTOR ROOFING WARRANTY

WHEREAS \_\_\_\_\_

Of  
(Address) \_\_\_\_\_ (Phone) \_\_\_\_\_

Herein called the "Roofing Contractor", has performed roofing and associated ("work") on the following project:

Owner: State of Utah

Agency: \_\_\_\_\_

Name of Building: \_\_\_\_\_ DFCM Project Number \_\_\_\_\_

Address: \_\_\_\_\_

Area of Work: \_\_\_\_\_ Date of Acceptance: \_\_\_\_\_

Warranty Period: Five (5) years Date of Expiration: \_\_\_\_\_

AND WHEREAS Roofing Contractor has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period.

NOW THEREFORE Roofing Contractor hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work, and as are necessary to maintain said work in watertight condition. In addition to making the work watertight, the Roofing Contractor shall remove and/or repair blisters, ridges, flashings, splits and other irregularities which in the opinion of the Roofing Manufacturer's technical representative do not conform to acceptable roofing practices and conditions. These repairs shall be made prior to expiration of the five (5) year Warranty Period and to the satisfaction of the Roofing Manufacturer's technical representative.

This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by: a) lightning, windstorm; b) fire; c) failure of roofing system substrate including cracking settlement, excessive deflection, deterioration, and decomposition; d) faulty construction of parapet walls, copings, chimneys, skylights, vents, and equipment supports, not part of contractors work and e) activity on roofing by others including construction contractors, maintenance personnel, other persons, and animals whether authorized or unauthorized by Owner,

When work has been damages by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Contractor, and until cost and expense thereof has been paid by Owner or by another responsible party so designated.

- 2 The Roofing Contractor is responsible for damage to work covered by this Warranty, but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.
- 3 During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Contractor, including cutting, patching and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void upon date of said alterations, but only to extent said alterations affect work covered by this Warranty. If Owner engages Roofing Contractor to perform said alterations, Warranty shall not become null and void, unless Roofing Contractor, prior to proceeding with said work, shall claim that said alterations would damage or deteriorate work, thereby reasonably justifying a limitation or termination of this warranty.
- 4 During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void upon date of said change, but only to extent said change affects work covered by this Warranty.
- 5 The Owner shall promptly notify Roofing Contractor of observed, known or suspected leaks, defect or deterioration, and shall afford reasonable opportunity for Roofing Contractor to inspect work, and to examine evidence of such leaks, defects or deterioration.

6 This Warranty is recognized to be the only Warranty of Roofing Contractor on said work, and is in addition to the Roofing Warranty furnished by the Roofing Manufacturer, and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to him in cases of roofing failure. Specifically, this Warranty shall no operate to relieve Roofing. Contractor of responsibility for performance of original work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owners General Contractor.

IN WITNESS THEREOF, this instrument has been dully executed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

Cosigned by General Contractor by:

\_\_\_\_\_  
(General Contractor) (Roofing Contractor)

\_\_\_\_\_  
(Business Address) (Business Address)

\_\_\_\_\_  
(Signature) (Signature)

\_\_\_\_\_  
(Title) (Title)



## CONTRACTOR ROOFING WARRANTY

WHEREAS \_\_\_\_\_

Of  
(Address) \_\_\_\_\_ (Phone) \_\_\_\_\_

Herein called the "Roofing Contractor", has performed roofing and associated ("work") on the following project:

Owner: State of Utah

Agency: \_\_\_\_\_

Name of Building: \_\_\_\_\_ DFCM Project Number \_\_\_\_\_

Address: \_\_\_\_\_

Area of Work: \_\_\_\_\_ Date of Acceptance: \_\_\_\_\_

Warranty Period: Five (5) years Date of Expiration: \_\_\_\_\_

AND WHEREAS Roofing Contractor has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period.

NOW THEREFORE Roofing Contractor hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work, and as are necessary to maintain said work in watertight condition. In addition to making the work watertight, the Roofing Contractor shall remove and/or repair blisters, ridges, flashings, splits and other irregularities which in the opinion of the Roofing Manufacturer's technical representative do not conform to acceptable roofing practices and conditions. These repairs shall be made prior to expiration of the five (5) year Warranty Period and to the satisfaction of the Roofing Manufacturer's technical representative.

This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by: a) lightning, windstorm; b) fire; c) failure of roofing system substrate including cracking settlement, excessive deflection, deterioration, and decomposition; d) faulty construction of parapet walls, copings, chimneys, skylights, vents, and equipment supports, not part of contractors work and e) activity on roofing by others including construction contractors, maintenance personnel, other persons, and animals whether authorized or unauthorized by Owner,

When work has been damages by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Contractor, and until cost and expense thereof has been paid by Owner or by another responsible party so designated.

- 2 The Roofing Contractor is responsible for damage to work covered by this Warranty, but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.
- 3 During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Contractor, including cutting, patching and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void upon date of said alterations, but only to extent said alterations affect work covered by this Warranty. If Owner engages Roofing Contractor to perform said alterations, Warranty shall not become null and void, unless Roofing Contractor, prior to proceeding with said work, shall claim that said alterations would damage or deteriorate work, thereby reasonably justifying a limitation or termination of this warranty.
- 4 During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void upon date of said change, but only to extent said change affects work covered by this Warranty.
- 5 The Owner shall promptly notify Roofing Contractor of observed, known or suspected leaks, defect or deterioration, and shall afford reasonable opportunity for Roofing Contractor to inspect work, and to examine evidence of such leaks, defects or deterioration.

6 This Warranty is recognized to be the only Warranty of Roofing Contractor on said work, and is in addition to the Roofing Warranty furnished by the Roofing Manufacturer, and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to him in cases of roofing failure. Specifically, this Warranty shall no operate to relieve Roofing. Contractor of responsibility for performance of original work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owners General Contractor.

IN WITNESS THEREOF, this instrument has been dully executed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

Cosigned by General Contractor by:

_____	_____
(General Contractor)	(Roofing Contractor)
_____	_____
(Business Address)	(Business Address)
_____	_____
(Signature)	(Signature)
_____	_____
(Title)	(Title)

DFCM Roofing History Record  
Single Ply Roofing

State Building #

DFCM Project #

Facility Name:

Building Name and Address:

Roof Section Description:

Roofing Contractor Name and Address:

Sub-contractors:

Roof System manufacture:

Installation Date:

Warranty Information:

Manufacture:

Contractor:

Roof Area (sq./ft.)

Building Use:

Height above Ground:

Access to Roof Area: Ladder\_\_\_\_\_ Roof Hatch\_\_\_\_\_ Stairs\_\_\_\_\_

Roof System Information

New Construction:\_\_\_\_\_ Re-Roof:\_\_\_\_\_ Old Roof Removed: Yes\_\_\_\_\_ No\_\_\_\_\_

Comments:\_\_\_\_\_

Deck Type:

Slope:

Insulation:

Layer #1	Manufacture:	Thickness:	Attachment:
Layer #2	Manufacture:	Thickness:	Attachment:
Layer #3	Manufacture:	Thickness:	Attachment:

Taper Explain: \_\_\_\_\_

System Type: PVC\_\_\_\_\_ EPDM\_\_\_\_\_ HYPALON\_\_\_\_\_ CSPE\_\_\_\_\_ TPO\_\_\_\_\_

Other\_\_\_\_\_

Field Sheet Description: Manufacture\_\_\_\_\_ Brand Name\_\_\_\_\_ Mils\_\_\_\_\_

Attachment\_\_\_\_\_ Color\_\_\_\_\_ Reinforcement\_\_\_\_\_

Comments\_\_\_\_\_

Flashing Sheet: Manufacture\_\_\_\_\_ Brand Name\_\_\_\_\_ Mils\_\_\_\_\_

Attachment\_\_\_\_\_ Color\_\_\_\_\_ Reinforcement\_\_\_\_\_

Comments\_\_\_\_\_

Separation Sheet: Manufacture\_\_\_\_\_ Brand Name \_\_\_\_\_

Drainage:

Internal Roof Drains\_\_\_\_\_ Perimeter Gutter\_\_\_\_\_ Internal Gutter\_\_\_\_\_ Scuppers\_\_\_\_\_

Primary:

Manufacture:                      Size:                      Quantity:

Overflow:

Manufacture:                      Size:                      Quantity:

Details:

Walls:\_\_\_\_\_

Edge:\_\_\_\_\_

Expansion Joints:\_\_\_\_\_

Walkways:\_\_\_\_\_

Other: \_\_\_\_\_

Roof Top Equipment:

Mechanical: Unit Types: \_\_\_\_\_ Curb Types: \_\_\_\_\_ Quantity \_\_\_\_\_

Fans/Vents: Unit Types: \_\_\_\_\_ Curb Types: \_\_\_\_\_ Quantity \_\_\_\_\_

Other: Unit Types: \_\_\_\_\_ Curb Types: \_\_\_\_\_ Quantity \_\_\_\_\_

Pipe Penetrations:

1" Quantity: \_\_\_\_\_ Flashing Type: \_\_\_\_\_

1 1/2" Quantity: \_\_\_\_\_ Flashing Type: \_\_\_\_\_

2" Quantity: \_\_\_\_\_ Flashing Type: \_\_\_\_\_

3" Quantity: \_\_\_\_\_ Flashing Type: \_\_\_\_\_

4" Quantity: \_\_\_\_\_ Flashing Type: \_\_\_\_\_

5" Quantity: \_\_\_\_\_ Flashing Type: \_\_\_\_\_

6" Quantity: \_\_\_\_\_ Flashing Type: \_\_\_\_\_

Other Quantity: \_\_\_\_\_ Flashing Type: \_\_\_\_\_

Additional Comments or Drawings: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DFCM USE ONLY

State building # \_\_\_\_\_ Vendor ID \_\_\_\_\_

Installation year \_\_\_\_\_ Roof type \_\_\_\_\_

Manufacturer \_\_\_\_\_ Deck type \_\_\_\_\_

## SECTION 077200 - ROOF ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED SECTIONS

- A. 075400: Mechanically Attached Thermoplastic Membrane Roofing

#### 1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data, shop drawings.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90.

#### 2.2 ROOF ACCESSORIES

- A. Roof Curbs and Equipment Supports: Fabricate from 18 gauge, galvanized structural steel; factory primed and painted with welded or sealed mechanical corner joints.
  - 1. Provide units with base profile coordinated with roof insulation thickness and roof deck slope.
  - 2. Provide preservative-treated wood nailers at tops of curbs.
  - 3. Provide manufacturer's standard rigid or semirigid insulation.
  
- B. Roof Scuttle: Fabricate from galvanized structural steel sheet with 12 inch high, integral-curb, double-wall construction with 1-1/2-inch insulation, formed cants and cap flashing, with welded or sealed mechanical corner joints and metal curb liner. Provide double-wall cover (lid) construction with 1- inch- thick insulation core. Provide gasketing and corrosion-resistant hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles.
  - 1. Fabricate units to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loading pressure.
  - 2. Finish: Baked enamel.
  - 3. Size: 30 inches (hinge side) x 36 inches, single leaf.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation: Unless otherwise indicated, install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual." Coordinate with installation of roof deck, vapor barriers, roof insulation, roofing, and flashing to ensure combined elements are secure, waterproof, and weathertight.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

- A. Not Applicable.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.
- B. Elastomeric Sealants: Comply with ASTM C 920.
  - 1. Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. For general exterior use.
  - 2. Single-component, nonsag urethane sealant, Type S; Grade NS; Class 25; and Uses NT, M, A, and O. For use at aluminum storefront.
  - 3. Single-component, pourable urethane sealant, Type S; Grade P; Class 25; Uses T, M, G, A, and O. Use for exposed interior concrete control joints.
  - 4. Single-component, mildew-resistant silicone sealant, Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide. Use for interior sealant joints in ceramic tile, stone, and other hard surfaces in kitchens and toilet rooms and around plumbing fixtures.
- C. Latex Sealant: Single-component, nonsag, mildew-resistant, paintable, acrylic-emulsion sealant complying with ASTM C 834. For interior use only at perimeters of door and window frames.
- D. Acoustical Sealant for Exposed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834. For interior use only at acoustical assemblies.
- E. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound. For interior use only at acoustical assemblies.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with ASTM C 1193.
- B. Comply with ASTM C 919 for use of joint sealants in acoustical applications.

END OF SECTION 079200

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work under this section shall include:
  - 1. Steel doors.
  - 2. Steel door frames.
  - 3. Steel window frames.

1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data and door schedule.
- B. Comply with ANSI 115 and SDI 100.
- C. Fire-Rated Doors and Frames: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing per NFPA 252 UL 10C at positive pressure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M or ASTM A 620/A 620M.
- C. Galvanized Steel Sheets: ASTM A 653/A 653M, commercial steel, or ASTM A 642/A 642M, drawing quality, with A60 or G60 coating designation, mill phosphatized.

2.2 STEEL DOORS AND FRAMES

- A. Steel Doors: 1-3/4-inch- thick of materials and ANSI/SDI 100 grades and models specified below.
  - 1. Interior Doors: Grade II, heavy-duty, Model 2, full flush design, minimum 0.0478-inch-thick, cold-rolled steel sheet faces.
  - 2. Exterior Doors: Grade III, extra heavy-duty, Model 2, full flush design, minimum 0.0635-inch- thick, galvanized steel sheet faces.
    - a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

- B. Door Silencers: Three on strike jambs of single-door frames and two on heads of double-door frames when weather-stripping is not indicated.
- C. Plaster Guards: Provide where mortar might obstruct hardware operation and to close off interior of openings.
- D. Fabricate steel frames to be rigid, neat in appearance, and free from defects, warp, or buckle.
  - 1. Interior Frames: Fabricate with mitered or coped and continuously welded corners, formed from 0.0478-inch- thick, cold-rolled steel for openings 48 inches or less in width and from 0.0598-inch- thick steel for openings more than 48 inches in width.
  - 2. Exterior Frames: Fabricate with mitered or coped and continuously welded corners, formed from 0.0635-inch- thick, galvanized steel sheet.
- E. Prepare doors and frames to receive mortised and concealed hardware according to SDI 107.
- F. Prime Coat: Uncoated steel, ANSI A224.1 shop primer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Place steel frames to comply with SDI 105.
- B. Install steel doors accurately in frames, within clearances specified in ANSI/SDI 100.
- C. Prime Coat Repair: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and repair finish with compatible air-drying primer.
- D. Caulk perimeter of frames to adjacent jamb and head surfaces.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Locations: Locations requiring access doors for items such as plumbing valve or air balance damper locations, etc., shall be as required by the Work. Provide access doors where necessary, in minimum sizes, to provide access and function to concealed items requiring operation.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND PANELS

- A. Flush Access Doors with Exposed Trim: Steel units with 14 gauge door and 16 gauge frames, factory primed finish, in size(s) indicated.
- B. Locks: Flush to finished surface, screwdriver operated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install access doors and panels accurately in position. Adjust hardware and door and panels for proper operation.

END OF SECTION 083113

## SECTION 083613 - SECTIONAL OVERHEAD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED SECTIONS

- A. 088000 Glazing

#### 1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data and Shop Drawings.
- B. Structural Performance: Design and reinforce sectional overhead doors to withstand a 20-lbf/sq. ft. wind-loading pressure.

### PART 2 - PRODUCTS

#### 2.1 SECTIONAL OVERHEAD DOORS

- A. Products:
  - 1. Overhead Door Corporation, Dallas, TX, (800) 887-3667, 591 Series "Thermacore".
  - 2. Wayne Dalton Corporation, Salt Lake City, UT, (801) 975-0889 "Thermomark 5200".
  - 3. Raynor Worldwide, Dixon, IL, (800) 4- RAYNOR, "Thermaseal Basic".
- B. Sectional Door Assembly: Metal / foam / metal sandwich panel construction with EPDM thermal break and ship-lap design:
  - 1. Panel Thickness: 1 5/8"
  - 2. Exterior Surface: Ribbed, textured.
  - 3. Exterior Steel: Galvanized, .015" thick.
  - 4. End Stiles: 16 Gauge.
  - 5. Standard Springs: 10,000 cycles (High cycles).
  - 6. Insulation: CFC free and HCFC free polyurethane, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84; fully encapsulated, with galvanized steel inside face.
  - 7. Thermal Value: R14 minimum.
  - 8. Air Infiltration: .08 CFM at 15 MPH; .08 CFM at 25 MPH.
  - 9. Full Glazing Requiring Aluminum Sash Panels: Insulated, tinted, tempered glass.
- C. Finish: Two coats baked on polyester with industrial brown exterior and white interior colors.
- D. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
- E. Lock: Interior mounted slide lock.

- F. Weather-stripping: EPDM rubber bulb-type strip at bottom with header seal and jamb weather-stripping.
- G. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
- H. Electric Motor Operation: Provide UL listed electric operator size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
  - 1. Entrapment Protection: Photoelectric sensors.
  - 2. Operator Controls: Push button operated control stations with open, close and stop buttons for surface mounting for interior location.
  - 3. Special Operation: Vehicle detector operation.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports.
- B. Fasten vertical track assembly to framing at not less than 24 inches o.c. Hang horizontal track from structural overhead framing with angle or channel hangers. Provide bracing and reinforcement as required for rigid installation of track and door.
- C. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.
- D. Test and adjust controls and safeties.

END OF SECTION 083613

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### PART 1 - GENERAL

#### 1.1 RELATED SECTIONS

- A. 079200: Joint Sealants
- B. 085113: Aluminum Windows
- C. 088000: Glazing

#### 1.2 SECTION REQUIREMENTS

- A. Structural Performance: Provide systems, including anchorage, capable of withstanding loads indicated.
  - 1. Main-Framing-Member Deflection: Limited to 1/175 of clear span or 3/4 inch, whichever is smaller.
  - 2. Structural Testing: Systems tested according to ASTM E 330 at 150 percent of inward and outward wind-load design pressures do not evidence material failures, structural distress, deflection failures, or permanent deformation of main framing members exceeding 0.2 percent of clear span.
- B. Air Infiltration: Limited to 0.06 cfm/sq. ft. of system surface area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 p.s.f. for single doors and 1.567 p.s.f. for pairs of doors.
- C. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 p.s.f. as defined in AAMA 501.
- D. Thermal Transmittance (U- value): When tested to AAMA Specification 1503, the average thermal transmittance (U-value) shall not be more than: .44
- E. Submittals: Product Data, Shop Drawings.
  - 1. For entrance systems, include hardware schedule and locations.

### PART 2 - PRODUCTS

#### 2.1 ALUMINUM-FRAMED STOREFRONTS

- A. Glazed To The Center Storefront Glazing:
  - 1. Vistawall, Terrell, TX (303) 807-5542 "Series 3000".

2. Kawneer, (801) 201-1080 “Trifab VG 451”
  3. Arcadia, Inc., Vernon, CA (323 269-7300, “AR 450+”.
- B. Aluminum: ASTM B 209 sheet; ASTM B 221 extrusions.
- C. Fasteners and Accessories: Compatible with adjacent materials, corrosion-resistant, non-staining, and non-bleeding. Use concealed fasteners except for application of door hardware.
- D. Fabrication: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide sub frames and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- E. Aluminum Finish: Comply with NAAMMs "Metal Finishes Manual for Architectural and Metal Products." Color anodic, Architectural Class I: AA-M12C22A42/A44.
1. Color: Dark Bronze Anodized.
- H. Sill Flashing at Exterior Window Units: .03” Aluminum to match frames.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Isolate metal surfaces in contact with incompatible metal or corrosive substrates, including wood, by painting contact surfaces with bituminous coating or primer, or by applying sealant or tape recommended by manufacturer.
- B. Install components to provide a weatherproof system.
- C. Install framing components true in alignment with established lines and grades to the following tolerances:
1. Variation from Plane: Limit to 1/8 inch in 12 feet; 1/4 inch over total length.
  2. Alignment: For surfaces abutting in line, limit offset to 1/16 inch. For surfaces meeting at corners, limit offset to 1/32 inch.
  3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.
- D. Install exterior window units with through wall sill flashing.

END OF SECTION 084113

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. 084113: Aluminum Framed Storefronts

1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings,.
- B. Quality Standard: Comply with AAMA/NWWDA 101/I.S.2/NAFS.
  - 1. Provide AAMA- or WDMA-certified aluminum windows with an attached label.

PART 2 - PRODUCTS

2.1 ALUMINUM WINDOWS

- A. Products:
  - 1. Vistawall, Terrell, TX, (303) 807-5542, "ZS-2750" Series.
  - 2. Kawneer, Norcross, GA, (801) 201-1080, "6200T Isolock".
  - 3. Arcadia, Inc., Vernon, CA (323) 269-7300, "CV200".,
- B. Window Types: The following types, as indicated on Drawings:
  - 1. Hopper.
- C. Performance Class: LC.
- D. Performance Grade: 25.
- E. Condensation-Resistance Factor: 52 per AAMA 1503.
- F. Thermal Transmittance: Whole-window U-factor not more than 0.59 Btu/sq. ft. x h x deg F at 15-mph wind velocity and winter temperatures per AAMA 1503.
- G. Cam Locks, Handles or Operators: White bronze with white bronze strike for awning windows.
- H. Ventilator Hinges: Four bar with friction device. 300 Series stainless steel with nylon friction block encased in sliding brass shoe.
- I. Ventilator Limited Opening Device Attachment: Fasteners used to attaché limit devices shall be tamper resistant or concealed to prevent removal.

1. Mount each device to permit ventilator to open approximately 6" before stopping.
  2. Operation beyond limiting point shall be by custodial access only.
- J. Equip units with vinyl-coated, glass-fiber mesh insect screens at operable sashes.
- K. Weather-stripping: Dual durometer Santoprenet around perimeter of the exterior of all vents, and a foam-filled bulb vinyl perimeter of the interior face of all vents.
- L. Glaze units with tinted, low-e coated, sealed insulating glass, complying with Division 08 Section "Glazing."
- M. Finish: Class I, color anodic finish; AA-M12C22A44; complying with AAMA 611: Dark bronze.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Set units level, plumb, and true to line, without warp or rack of frames and panels. Provide proper support and anchor securely in place.
- B. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- C. Adjust operating panels, screens, and hardware to provide a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- D. Clean aluminum surfaces and glass immediately after installing windows. Remove nonpermanent labels from glass surfaces.

END OF SECTION 085113

SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, and finish Samples.
- B. Fire-Test-Response Characteristics of Plastic Glazing: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing indicated below:
  - 1. Self-Ignition Temperature: 650 deg F or greater when tested per ASTM D 1929.
  - 2. Smoke-Developed Index or Smoke Density: 450 or less when tested per ASTM E 84 or 75 or less when tested per ASTM D 2843.
  - 3. Relative-Burning Characteristics: Class CC1 or Class CC2 when tested per ASTM D 635.

PART 2 - PRODUCTS

2.1 SKYLIGHTS

- A. Products:
  - 1. Major Industries, Wausau, WI, (888) 759-2678, "Auburn Standard".
  - 2. Bristolite Skylights, Santa Ana, CA, (800) 854-8618.
  - 3. O'Keeffes Inc, San Francisco, CA (888) 653-3333
- B. Type: Self-flashing with integral curb.
- C. Aluminum: ASTM B 209 sheet; ASTM B 221 extrusions.
- D. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).
  - 1. Double-Glazing Profile: Pyramid or dome.
  - 2. Double-Glazing Color:
    - a. Outer Glazing Color: White, translucent.
    - b. Inner Glazing Color: White, translucent.
- E. Fabrication: Factory assemble unit with an extruded-aluminum glazing retainer, gasketing, self-contained flashing, and integral gutters with weeps for condensation control.
- F. Curb: Fabricate units with separate formed or extruded-aluminum curb with cants or flashing flange to receive roof flashing and counterflashing.
- G. Liner: Provide units with aluminum curb liner at interior of curbs.

- H. Thermal Break: Fabricate unit skylights with thermal barrier separating interior metal framing from materials exposed to outside temperature.
- I. Aluminum Finish: Clear anodic, Architectural Class I: AA-C22A41, complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NRCA's "Roofing and Waterproofing Manual." Coordinate with installation of vapor barriers, roof insulation, roofing, and flashing as required to ensure combined elements are waterproof and weathertight.
- B. Isolate metal surfaces in contact with incompatible metal or corrosive substrates, including wood, with bituminous coating on concealed metal surfaces.

END OF SECTION 086200

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Hardware Schedule.
- B. Provide Owner with construction keys for access during construction.

PART 2 - PRODUCTS

2.1 PRODUCTS: Manufacturer's listed within the Hardware Schedule indicate a quality standard for basis-of-design. Provide products from listed manufacturers, or comply with provisions for "comparable product requests" in Division 1.

2.2 HARDWARE

- A. Hinges: Provide the following:
  - 1. Nonremovable hinge pins for exterior and public interior exposure.
  - 2. Three hinges for 1-3/4-inch- thick doors 90 inches or less in height; four hinges for doors more than 90 inches in height.
- B. Locksets and latchsets as follows:
  - 1. BHMA A156.2, Series 4000, Grade 2 for bored locks and latches.
  - 2. BHMA A156.3, Grade 1 for exit devices.
  - 3. Lever handles on locksets and latchsets, Schlage series scheduled.
  - 4. Provide trim on exit devices matching locksets.
- C. Provide construction keying. Owner will key locks to Owner's new master-key system, when owner is ready to take occupancy.
  - 1. Cylinders with six-pin tumblers.
- D. Closers: Provide the following:
  - 1. Mount closers on interior side (room side) of door opening. Provide regular-arm, parallel-arm, or top-jamb-mounted closers as necessary.
  - 2. Adjustable delayed opening (accessible to the disabled) feature on closers.
  - 3. Provide hold open feature on closers indicated.
- E. Provide wall stops or floor stops at all doors.
- F. Provide hardware finishes as follows:
  - 1. Hinges: Matching finish of lockset/latchset.
  - 2. Locksets, Latchsets, and Exit Devices: Satin chrome plated

3. Closers: Matching finish of lockset/latchset.
4. Other Hardware: Matching finish of lockset/latchset.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount hardware in locations recommended by the Door and Hardware Institute, unless otherwise indicated.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and 12” square sample of tinted glass.
- B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
- C. Comply with written instructions of glass product manufacturers; GANA's "Glazing Manual;" and publications of GANA, AAMA, and SIGMA as applicable to products indicated, unless more stringent requirements are indicated.
- D. Insulating-Glass Units: Permanently mark with appropriate certification label of one of the inspecting and testing agencies indicated below:
  - 1. Insulating Glass Certification Council.
  - 2. Associated Laboratories, Inc..
  - 3. National Accreditation and Management Institute.

PART 2 - PRODUCTS

2.1 GLASS

- A. Float Glass: Glass Type 1: ASTM C 1036, Type I, Class 2 (tinted, heat absorbing, and light reducing), PPG “Solarcool (2) Bronze With Sungate 500 Low E (3)” and Quality Q3, basis of design.
- B. Heat-Treated Float Glass: Glass Type 2: ASTM C 1048, Condition A (uncoated), Type I, Class 2 (tinted) PPG “Solarcool (2) Bronze With Sungate 500 Low E (3)”, Quality Q3, Kind FT (fully tempered), basis of design.
- C. Heat-Treated Float Glass Glass Type 4: ASTM C 1048, Condition A (uncoated), Type I, Class 1 (clear), Quality Q3, Kind FT (fully tempered).
- D. Insulated, Tinted Glass with Low-E Coating Characteristics:
  - 1. Visible Light Transmittance: 18%.
  - 2. Solar Heat Gain Coefficient: .29
  - 3. Light to Solar Gain Ratio: 0.62

2.2 FABRICATED GLASS PRODUCTS

- A. Sealed Insulating-Glass Units Glass Type 1 and 2: Factory-assembled units complying with ASTM E 774 for Class CBA units, with two 6.0-mm- thick sheets of glass separated by a 1/2-inch dehydrated space filled with air.
  - 1. Inboard Lite: Float or heat treated float glass as indicated.
  - 2. Outboard Lite: Float or heat treated float glass as indicated.
  - 3. Low-Emissivity Coating: Second surface.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are contained in GANA's "Glazing Manual."
- B. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

END OF SECTION 088000

## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.

### PART 2 - PRODUCTS

#### 2.1 GYPSUM BOARD

- A. Gypsum board products in maximum lengths available to minimize end-to-end butt joints.
  - 1. Gypsum Panels, Regular: ASTM C 36, 5/8" thick unless otherwise indicated, with manufacturer's standard edges. Regular type, unless otherwise indicated. Type X where required by fire resistance rated assemblies. Sag-resistant type for ceiling surfaces.
  - 2. Water-Resistant Gypsum Panels (at Toilet / Shower area walls and south and west walls of Utility): ASTM C 630, 5/8" unless otherwise indicated.

#### 2.2 ACCESSORIES

- A. Trim Accessories:
  - 1. Edge trim, and control joints complying with ASTM C 1047, formed from steel sheet zinc coated by hot-dip process or rolled zinc or plastic.
  - 2. Cornerbead: Metal, 3/4" radius unless 90 degree type indicated.
- B. Aluminum Accessories: Extruded-aluminum accessories indicated with manufacturer's standard corrosion-resistant primer.
- C. Gypsum Board Joint Treatment Materials: Comply with ASTM C 475. Paper reinforcing tape and drying-type, ready-mixed, all-purpose compounds.
- D. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834.
- E. Miscellaneous Materials: Auxiliary materials for gypsum board construction that comply with referenced standards.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install and finish gypsum panels to comply with ASTM C 840 and GA-216.
  - 1. Isolate the perimeter of non-load-bearing gypsum board partitions where they abut structural elements, except floors, by providing a 1/4- to 1/2-inch- wide space between gypsum board and the structure. Trim edges with USG “Series 400” metal U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
  - 2. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.
  - 3. Multilayer Fastening Methods: Fasten base layers and face layer separately to supports with screws.
  
- B. Finishing Gypsum Board Assemblies:
  - 1. Unless otherwise indicated, provide Level 4 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.

PART 2 - PRODUCTS

2.1 PRODUCTS: Manufacturer's indicated define a quality standard for design intent. Provide products from available manufacturers.

2.2 CERAMIC TILE

- A. Ceramic tile that complies with standard grade requirements of ANSI A137.1, "Specifications for Ceramic Tile."
- B. Glazed Wall Tile (Service Sink Surround): Cushion-edged, flat tile.
  - 1. Module Size: 6 x 6 inches at walls.
  - 2. Color: Indicated.

2.3 INSTALLATION MATERIALS

- C. Setting and Grouting Materials: Comply with material standards in ANSI's "Specifications for the Installation of Ceramic Tile" that apply to materials and methods indicated.
  - 1. Setting (Bonding) Materials: Custom Building Products "MasterBlend" Thin Set Mortar.
  - 2. Grout:
    - A. Joints up to 1/8" wide: Custom Building Products "Polyblend" Unsanded Tile Grout.
    - B. Grout Color: Indicated.
- D. Setting-Bed Accessories: Comply with ANSI A108.1A.
  - 1. Setting Material Admixture: Custom Building Products "Acrylic Mortar Admix".
- E. Cementitious Backer Units: Complying with ANSI A118.9, 1/2" thick unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with tile installation standards in Tile Council of America's "Handbook for Ceramic Tile Installation" that apply to materials and methods indicated:

1. Framed Walls (Service Sink Surround): W244
  - B. Lay tile in grid pattern, unless otherwise indicated. Align joints where adjoining tiles on floor, base, walls, and trim are the same size.
  - C. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

END OF SECTION 093000

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
- B. Extra Materials: Deliver to Owner at least six linear feet, of each type and color of resilient wall base installed.

PART 2 - PRODUCTS

2.1 WALL BASE BC-1

- A. Products:
  - 1. Johnsonite Inc., Chagrn Falls, OH (800) 889-8916, "Traditional Wall Base".
  - 2. Armstrong World Industries Inc., Lancaster, PA., (800) 233-3823.
  - 3. Roppe Corporation, Fostoria, OH, (800) 537-9527, "Pinnacle".
- B. Color and Pattern: Johnsonite "Cinnamon".
- C. ASTM F 1861, Type TP (rubber, thermoplastic).
- D. Group (Manufacturing Method): I (solid).
- E. Style: Cove (with top-set toe).
- F. Minimum Thickness: 0.125 inch.
- G. Height: 4 inches.
- H. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard lengths.
- I. Outside Corners: premolded.
- J. Inside Corners: premolded.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement- or blended hydraulic cement-based formulation provided or approved by flooring manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Adhesively install resilient wall base and accessories.
- B. Install wall base in maximum lengths possible. Apply to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is required.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
- B. Extra Materials: Deliver to Owner at least six linear feet, in roll form and in full roll width, for each type and color of resilient sheet flooring installed.

PART 2 - PRODUCTS

2.1 SHEET VINYL FLOOR COVERING:

- A. Products:
  - 1. Armstrong World Industries Inc., Lancaster, PA., (800) 233-3823, "Safeguard Spa".
  - 2. Mannington, Salem, NJ, (856) 935-3000, "Assurance II".
  - 3. Congoleum Corporation, Mercerville, NJ, (800) 274-3266, "Specifications".
- B. Color and Pattern: SVC-1: Armstrong Safeguard Spa "Corn" (39508).
- C. Sheet Vinyl Floor Covering With Backing: ASTM F 1303, , Grade 1.
  - 1. Overall Thickness: .080 inch.
- D. Wearing Surface: Embossed with embedded abrasives.
- E. Sheet Width: As standard with manufacturer.
- F. Seaming Method: Heat welded.

2.2 WALL BASE MATERIALS

- A. For integral flash cove base: Provide integral flash cove wall base by extending sheet flooring 4 inches up the wall using adhesive, welding rod, and accessories recommended and approved by the flooring manufacturer.

2.3 INSTALLATION ACCESSORIES

- G. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement- or blended hydraulic cement-based formulation provided or approved by flooring manufacturer for applications indicated.

- H. Adhesives: Water-resistant type recommended by manufacturer to suit sheet vinyl floor covering and substrate conditions indicated.
- I. Heat-Welding Bead: Solid-strand product of floor covering manufacturer.
  - 1. Color: Match floor covering.
- J. Integral-Flash-Cove-Base Accessories: 1-inch- radius cove strip and square vinyl, or rubber cap, both provided and approved by floor covering manufacturer.
- K. Vinyl or Rubber Reducer Strips: Manufacturer's standard trim accessories for finishing and transitioning exposed edges of sheet material at doorways and other exposed conditions.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Prepare concrete substrates according to ASTM F 710. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
- B. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.
- C. Maintain uniformity of resilient sheet flooring direction, and match edges for color shading at seams.
- D. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in substrates.
- E. Install reducer strips at edges of floor coverings that would otherwise be exposed.
- F. Integral Flash Cove Base: Cove floor coverings dimension indicated up vertical surfaces. Support on cove strip and butt against cap strip.
  - 1. Install metal corners and end stops.

END OF SECTION 096516

## SECTION 096519 - RESILIENT TILE FLOORING

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
- B. Fire Test Response: Resilient tile has critical radiant flux classification of Class I, not less than 0.45 W/sq. cm per ASTM E 648.
- C. Extra Materials: Deliver to Owner 1 box for every 50 boxes or fraction thereof, of each type and color of resilient floor tile installed.

### PART 2 - PRODUCTS

#### 2.1 VINYL COMPOSITION FLOOR TILE

- A. Products:
  - 1. Armstrong World Industries Inc., Lancaster, PA., (800) 233-3823, Excelon "Imperial Texture".
  - 2. Mannington, Salem, NJ, (856) 935-3000, "Essentials".
  - 3. Congoleum Corporation, Mercerville, NJ, (800) 274-3266, "Selections".
- B. Color and Pattern:
  - 1. VCT 1: Armstrong "Cinnamon Brown (51948)".
- C. ASTM F 1066, Class 2 (through-pattern tile).
- D. Wearing Surface: Smooth.
- E. Thickness: 0.125 inch.
- F. Size: 12 by 12 inches.

#### 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement- or blended hydraulic cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

- C. Vinyl or Rubber Reducer Strips: Manufacturer's standard trim accessories for finishing and transitioning exposed edges of sheet material at doorways and other exposed conditions.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Prepare concrete substrates according to ASTM F 710. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
- B. Lay out tiles so tile widths at opposite edges of room are equal and are at least one-half of a tile.
- C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged. Lay tiles with grain running in two directions.
- D. Provide reducer strip at exposed terminations of floor tile.
- E. Fill concrete slab control joints with patching and leveling compound, providing a smooth, continuous substrate for floor tile.

END OF SECTION 096519

## SECTION 097700 - FIBERGLASS-REINFORCED PLASTIC PANELS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Surface-Burning Characteristics: ASTM E 84, flame-spread index of 200 or less and smoke-developed index of 450 or less.

### PART 2 - PRODUCTS

#### 2.1 FIBERGLASS REINFORCED PLASTIC PANELS

- A. Products:
  - 1. Crane Composites, Inc. / Kemlite, Joilet, IL, (800) 435-0080, "Glasbord P".
  - 2. Marlite, Dover Ohio, (330) 343-6621, "Marlite FRP".
- B. Color: Kemlite "Ivory"
- C. Finish: Embossed.
- D. Comply with ASTM D2583 and ASTM D5420.

#### 2.2 FABRICATION

- A. Panels: Fabricate units as large as possible to minimize joints, with embossed finished surfaces. Panel size to be 4' x 8' x .09" thick.
- B. Moldings: Provide harmonizing PVC moldings to match panel color. Installation to include all cap, inside corner, outside corner, battens, etc., as required by the Work to provide a complete, finished appearance.
- C. Adhesives: Provide panel adhesive as recommended by panel manufacturer, specifically formulated for adhering panels to substrates indicated.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Panels:
  - 1. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
  - 2. Install panels with manufacturer's recommended gap for panel field and corner joints.

3. Install fiberglass reinforced plastic panels level, true, and aligned with adjacent materials.
4. Adhere panels to wall substrate. Trowel adhesive to substrate at rate and method defined by adhesive manufacturer. Roll wall panel with laminate roller starting from the top molding, working down and away from molding, removing any trapped air.
5. Install moldings with continuous bead of silicone sealant applied within channels prior to placing over panels.

B. Install units to the following tolerances:

1. Plane Alignment (Panel to Panel): 1/16 inch.
2. Variation from Plumb: Plus or minus 1/8 inch per 10 feet.
3. Variation from Straightness: Plus or minus 1/4 inch per 25 feet.

C. Cleaning: Remove and adhesive or excessive sealant from panel face and moldings using solvent or cleaner recommended by panel manufacturer.

END OF SECTION 097700

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Summary: Paint all exposed surfaces, unless otherwise indicated.
  - 1. Do not paint pre-finished items, finished metal surfaces, operating parts, labels, and materials obviously intended to be left exposed such as brick and tile.
  - 2. Unless otherwise indicated do not paint concealed surfaces.
  - 3. Paint exposed exterior, vent lines and wall mounted electrical equipment color to match CMU wall. Paint exposed propane lines black.
- B. Submittals: Product Data. Samples of paint colors.
- C. Obtain, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- D. Extra Materials: Deliver to Owner a 1-gallon container, properly labeled and sealed, of each color and type of finish coat paint used on Project, excluding epoxy products.

PART 2 - PRODUCTS

2.1 PAINT AND COATING PRODUCTS

- A. Paint Colors: Indicated at Finish Schedule / Color Summary.
- B. Manufacturers:
  - 1. Paint:
    - a. Sherwin Williams, St. George, Utah, (435) 674-4024
    - b. Benjamin Moore, St. George, Utah, (435) 673-6141
    - c. Porter Paints, St. George, Utah (435) 674-3720
  - 2. Wood Stain:
    - a. Messmers, West Jordan, Utah (800) 731-3669.
    - b. Olympic, St. George, Utah (435) 688-0286.
    - c. Behr Process Corporation, Santa Ana, California 714-545-7101
- C. Material Quality:
  - 1. Exterior, Oil Based, Semi-transparent Wood Stain: Messmers, West Jordan, Utah, 800-731-3669, "U.V. Plus MC 502 Natural Cedar".
  - 2. Interior Concrete Water Based Epoxy Paint: Sherwin Williams "Waterbased Tile Clad".
  - 3. Interior Concrete Waterproofing Floor Sealer: Sherwin Williams "Concrete and Terrazo Sealer".
  - 4. Interior Concrete Solvent Borne Epoxy Floor Sealer: Sherwin Williams "ArmorSeal 1000 HS".

5. Interior / Exterior Ferrous and Galvanized Metal Acrylic Primer: Sherwin Williams “Pro Cryl Universal Acrylic Primer”.
  6. Interior Gypsum Board: Sherwin Williams “Prep Rite 200”
  7. Interior Concrete Acrylic Primer: Sherwin Williams “Loxon Block Surfacer”.
  8. Interior / Exterior Ferrous and Galvanized Metal Paint: Sherwin Williams “DTM Acrylic Latex”.
  9. Interior Drywall: Sherwin Williams “ProMar 200 Interior Acrylic Latex”.
  10. Interior Ferrous Steel Roof Joists and Roof Deck: Sherwin Williams B42W2 “Waterborne Acrylic Dry Fall”.
- D. Material Compatibility: Complete system of compatible components that is recommended by manufacturer for application indicated.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Comply with paint manufacturer’s written instructions for surface preparation, environmental and substrate conditions, product mixing, and application.

#### 3.2 EXTERIOR PAINT APPLICATION SCHEDULE

- A. Canopy Logs:
1. Oil based semi-transparent wood stain. One coat brush or roller applied.
- B. Ferrous Metal:
1. Semigloss Acrylic Enamel Paint: Two coats over rust-inhibitive primer.
- C. Galvanized Metal:
1. Semigloss Acrylic Enamel Paint: Two coats over galvanized metal primer.

#### 3.3 INTERIOR PAINT APPLICATION SCHEDULE

- A. Sealed Concrete Slabs (Storage, Utility and Mezzanine areas):
1. Solvent based, low gloss sealer: One coat roll or spray applied.
- B. Sealed Concrete Slabs (Shop area):
1. Solvent based, two part epoxy floor sealer: Two coats roll applied.
- B. Water Based Epoxy Painted Concrete Walls:
1. Water based epoxy paint: Two coats over primer.
- C. Acrylic Painted Gypsum Board Walls and Ceilings:

1. Low lustre acrylic paint: Two coats over primer.

D. Ferrous Metal Roof Joists and Roof Deck:

1. Waterborne Acrylic Dry Fall: Two coats over shop applied primer.

E. Ferrous Metal:

1. Semigloss Acrylic Latex Paint: Two coats over primer.

F. Galvanized Metal:

1. Semigloss Acrylic Latex Paint: Two coats over primer.

END OF SECTION 099100

## SECTION 101400 - SIGNAGE

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Plastic Laminate: High-pressure, melamine plastic laminate engraving stock with dark bronze core and white face.
- B. Aluminum Sheet: Alloy and temper recommended by the sign manufacturer, with not less than the strength and durability of 5005-H15.
  - 1. .08 Inches thick for traffic signs.
- C. Aluminum Extrusions: Alloy and temper recommended by the sign manufacturer, with not less than the strength and durability of 6063-T5.
- D. U-Channel Posts: Sign manufacturer's standard, galvanized steel, 8' long, using standard mounting hardware of galvanized steel carriage bolts.

#### 2.2 SIGNS

- A. Traffic Signs: Aluminum, with white baked enamel surface and screen print copy, symbols and border. Corners shall have 1 inch radius.
  - 1. Provide signs for locations indicated.
- B. Unframed Panel Signs: Matte-finished opaque acrylic with adhesively applied vinyl film characters with square-cut or beveled edges and square or rounded corners.
  - 1. Provide signs for locations indicated.
  - 2. Provide text in sizes indicated. Font to be raised, sans serif, upper case, in contrasting color to background.
  - 3. Color: Indicated.
  - 4. Provide pictograms at signs indicated. Graphics to be raised, in contrasting color to background.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Locate signs where indicated or directed by Architect. Use mounting methods of the type indicated and per manufacturer's written instructions. Install level, plumb, and at height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Mount panel signs to wall surfaces as indicated.
- C. Mount traffic signs on building wall with tamper resistant fasteners or on "U" channel posts as indicated.

END OF SECTION 101400

## SECTION 102600 – WALL AND DOOR PROTECTION

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and material Samples.
- B. Provide impact-resistant finishes with flame-spread and smoke-developed indexes of 25 or less and 450 or less, respectively, when tested according to ASTM E 84.
- C. Provide components with a minimum impact resistance of 25.4 ft-lbf/in. of width when tested according to ASTM D 256, Test Method A.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Stainless steel: To be type 304 alloy with #4 satin finish.
- B. Adhesive: Recommended by manufacturer for use with material on the substrate indicated.

#### 2.2 WALL PROTECTION

- A. Wall Protection System: Corner guard.
  - 1. Size and Profile: 3 ½ x 3 ½ x 16 gauge x 4' high or x height indicated.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
- B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.
- C. Install components level, plumb, and true to line without distortions.
- D. Apply impact resistant wall covering with adhesive as recommended by manufacturer.

END OF SECTION 102600

SECTION 102800 – TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PRODUCTS:

- A. Manufacturers:
  1. General Accessory Manufacturing Company (GAMCO), Durant, OK. Phone (800) 451-5766.
  2. Bradley Corporation, Menomonee Falls, WI. Phone (800) BRADLEY.
  3. Bobrick, Bluffdale, Utah, (801) 446-4383

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19, ASTM B 16, or ASTM B 30 castings.
- C. Sheet Steel: ASTM A 366/A 366M, 0.0359-inch minimum nominal thickness.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.
- E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.
- G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
- H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

- J. Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six keys to Owner's representative.

## 2.2 TOILET AND BATH ACCESSORIES

- A. Mirror Unit (Accessory 1):
  - 1. Custom, size indicated.
  - 2. Frame: Heavy gauge stainless-steel channel,  $\frac{3}{4}$  x  $\frac{3}{4}$  x 7/16.
  - 3. Mounting: Surface mounted with concealed wall hanger.
- B. Accessible Paper Towel Dispenser (Accessory 2):
  - 1. Provided by Owner.
- C. Liquid-Soap Dispenser (Accessory 3):
  - 1. Provided by Owner.
- D. Grab Bars (Accessories 4, 5 & 7):
  - 1. Bradley 832
  - 2. Material: .05" Thick stainless steel.
  - 3. Mounting: Concealed.
  - 4. Gripping Surfaces: Smooth, satin finish.
  - 5. Outside Diameter: 1-1/4 inches for medium-duty applications
- E. Toilet Tissue Dispenser (Accessory 6):
  - 1. Provided by Owner.
- F. Shower Curtain Rod (Accessory 8):
  - 1. Bradley 9532
  - 2. Chrome Plated Brass, 20 Gauge.
  - 3. Outside Diameter: 1-inche for light-duty applications.
  - 4. Mounting: Surface.
- G. 24" Mop Rack (Accessory 9):
  - 1. Bradley 9953
  - 2. Frame: Stainless steel, 22 gauge.
  - 3. Mounting: Surface.
- H. Hat and Coat Hook (Accessory 10):
  - 1. Bradley 9134
  - 2. Material: Brushed stainless steel
  - 3. Mounting: Surface

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
- B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION 102800

SECTION 104400 - FIRE- PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Fire Extinguishers: NFPA 10, listed and labeled for the type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS AND CABINETS

- A. Fire Protection Cabinets: Aluminum, semi-recessed cabinets for fire extinguisher.
  - 1. Trim Style: 2 ½" Aluminum rolled trim, white.
  - 2. Door Style: Contemporary tempered vision glass with safety lock.
  - 3. Accessories: Mounting brackets; Identification lettering; 10 pound, U.L. rated 4-A, chemical filled fire extinguisher rated for Class A, B or C fires.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cabinets and brackets at heights indicated or, if not indicated, at heights to comply with applicable regulations of authorities having jurisdiction.

END OF SECTION 104400

## SECTION 311000 - SITE CLEARING

### PART 1 - GENERAL

#### 1.1 RELATED SECTIONS

- A. 312316 Excavation

#### 1.2 SECTION REQUIREMENTS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Notify utility locator service for area where Project is located before site clearing.
- D. Do not begin site-clearing operations until temporary erosion and sedimentation control measures are in place.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance.
- B. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- C. Protect site improvements to remain from damage. Restore damaged improvements to condition existing before start of site clearing.
- D. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  - 1. Arrange with utility companies to shut off indicated utilities.

#### 3.2 SITE CLEARING

- A. Remove obstructions, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out obstructions and grubbing roots.

- B. In areas not to be further excavated, fill depressions resulting from site clearing. Place and compact satisfactory soil materials in 6-inch- thick layers to density of surrounding original ground.
- C. Dispose of waste materials, including trash, debris, and excess topsoil, off Owner's property. Burning waste materials on-site is not permitted.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. 312316 Excavation

1.2 SECTION REQUIREMENTS

- A. Unauthorized excavation consists of excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- B. Do not interrupt existing utilities serving facilities occupied by Owner or others unless permitted in writing by the Owner's Representative and then only after arranging to provide temporary utility services according to requirements indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, or other deleterious matter.
- B. Unsatisfactory Soil: ASTM D 2487 Soil Classification Groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- C. Backfill and Fill: Satisfactory soil materials.
- D. Base Course (Un-treated Base Course): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, Utah State Department of Transportation 1 inch gradation specification, with 100 percent passing a 1 inch sieve, 79 – 91 percent passing a ½" sieve, 49 – 61 percent passing a number 4 sieve, 27 – 35 percent passing a number 16 sieve, and 7 – 11 percent passing a number 200 sieve. Alternatively, ¼" washed chip under-slab fill material may be used if sides of fill are contained.
- E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 200 sieve. Material passing a No. 200 sieve shall have a plasticity index of less than 6.

## PART 3 - EXECUTION

## 3.1 EARTHWORK

- A. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- B. Protect subgrades and foundation soils from softening and damage by water, freezing temperatures, or frost.
- C. Explosives: Do not use explosives.
- D. Excavate to subgrade elevations regardless of character of materials and obstructions encountered.
- E. Excavate for structures, building slabs, pavements, and walkways. Trim subgrades to required lines and grades.
- F. Utility Trenches: Excavate trenches to indicated slopes, lines, depths, and invert elevations. Maintain 12 inches of working clearance on each side of pipe or conduit.
  - 1. Place, compact, and shape bedding course to provide continuous support for pipes and conduits over rock and other unyielding bearing surfaces and to fill unauthorized excavations.
  - 2. Place and compact initial backfill of satisfactory soil material or base course material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit. Place and compact final backfill of satisfactory soil material to final subgrade.
- G. Plow strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal to receive fill.
- H. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface, pulverize, moisture-condition or aerate soil, and recompact.
- I. Place backfill and engineered compacted fill in layers not more than 8 inches in loose depth at moisture content within 2% of optimum. Compact each layer under foundations and building slabs to 95% of maximum dry unit weight according to ASTM D 698; 92% under exterior slabs, walkways, curb, gutter and pavements; elsewhere to 90 percent.
- J. Grade areas to a smooth surface to cross sections, lines, and elevations indicated. Grade lawns, walkways, and unpaved subgrades to tolerances of plus or minus 1 inch and pavements and areas within building lines to plus or minus 1/2 inch.
- K. Under pavements and walkways, place base course material on prepared subgrades and compact at optimum moisture content to required grades, lines, cross sections, and thicknesses.
- L. Under interior slabs-on-grade, place drainage course on prepared subgrade and compact to required cross section and thickness by means of four passes with a smooth drum 5-ton vibratory roller or equivalent.
- M. Allow testing agency to inspect and test each subgrade and each fill or backfill layer and verify compliance with requirements.

- N. Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 312316 - EXCAVATION

1. **SCOPE**

The work shall consist of the excavation required by the drawings and specification and disposal of the excavated materials.

2. **CLASSIFICATION**

Excavation will be classified as common excavation or rock excavation in accordance with the following definitions or will be designated as unclassified.

Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrappers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.

Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

Excavation will be classified according to the above definitions by the Engineer, based on his judgement of the character of the materials and the site conditions.

The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

For the purpose of this classification, the following definitions shall apply:

Heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of 200-300 net horsepower (at the flywheel).

Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12-20 yards. Pusher tractor shall be defined as a track type tractor have a power rating 200-300 net horsepower (at the flywheel) equipped with appropriate attachments.

Pusher tractor shall be defined as a track type tractor having a power rating of 200-300 net horsepower (at the flywheel) equipped with appropriate attachments.

3. **UNCLASSIFIED EXCAVATION**

Items designated as "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section 12 of this specification shall apply.

4. **BLASTING**

The transportation, hauling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements in Section 12 of this specification.

5. **USE OF EXCAVATED MATERIALS**

Method 1

To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

Method 2

Suitable materials from the specified excavations may be used in the construction of required earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer.

6. **DISPOSAL OF WASTE MATERIALS**

Method 1

All surplus or unsuitable material will be designated as waste and shall be disposed of at the location approved by the Engineer.

7. **BRACING AND SHORING**

EXCAVATION

312316-2

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The Contractor shall furnish, place and subsequently remove such supporting installations. Bracing and shoring shall be in accordance with OSHA standards.

8. **STRUCTURE AND TRENCH EXCAVATION**

Structure or trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earth fill is placed or any piles are driven within the limits of the excavation.

9. **BORROW EXCAVATION**

When the quantities or suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as directed by the Engineer.

Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

10. **OVER EXCAVATION**

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the Engineer.

Concrete that will be exposed to the atmosphere when construction is completed shall contain not less than 6 sacks of cement per cubic yard of concrete. The concrete shall be placed and cured as specified by the Engineer. Over excavation in other material shall be backfilled and fine graded with granular material having less than 15% fines.

11. **MEASUREMENT AND PAYMENT**

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end area. Regardless of quantities excavated, the measurement for payment will be made to the specified pay limits, except that excavation outside the specified lines and grades directed by

the Engineer to remove unsuitable material will be included, but only to the extent the unsuitable condition is not the result of the Contractor's operations.

Method 1

The pay limits shall be as designated on the drawings.

Method 2

The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be modified ground surface resulting from the specified previous excavation or fill.
- b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

Method 3

The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.
- b. The lower and lateral limits shall be the true surface of the completed excavation as authorized by the Engineer.

Method 4

The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.
- b. The lower limit shall be at the bottom surface of the proposed structure.
- c. The lateral limits shall be 18 inches outside of the outside surfaces of the proposed

structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d, below.

- d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the under side of the proposed lining or structure.
- e. For the purpose of the definitions in b, c, and d, above, any specified bedding or drain fill directly beneath or beside the structure will be considered to be a part of the structure.

Use with all Methods:

Payment for each type and class of excavation will be made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work, except that extra payment for backfilling required over excavation will be made in accordance with the following provision:

- a. Payment for backfilling over excavation, as specified in Section 12 of this specification outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's operations.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 12 of this specification.

## 12. **ITEMS OF WORK AND CONSTRUCTION DETAILS**

Items of work to be performed in accordance with this specification and the construction details thereof are as follows:

- a. Excavation
  - 1. This specification applies to all items which require excavation and shall consist of the work and materials required to complete the site work as shown on the drawings including clearing, excavating, leveling the inside of the shed, and parking area.

2. Untreated base course shall be placed and compacted under all concrete and asphalt work as shown on the drawings. The work and materials shall conform to Specification No. 23.
3. This item will also include:
  - a. The two 40-foot CSP culverts and four metal end sections at the front entrance to the shed.
4. Measurement will not be made. Compensation for this item will be in accordance with the lump sum contract price, and shall constitute full compensation labor, equipment, materials, and all other items necessary or incidental to completion of the work.

END OF SECTION 312316

SECTION 312323 – EARTH FILL

1. **SCOPE**

The work shall consist of the construction of earth embankments and other earth fills required by the drawings and specifications.

2. **MATERIALS**

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing and disposition of materials in the various fills shall be subject to approval by the Engineer.

Fill materials shall contain no sod, brush, roots or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The type of material used in the various fills shall be as listed and described in the specifications and drawings.

3. **FOUNDATION PREPARATION**

Foundations for earth fill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened material shall be controlled as specified for the earth fill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earth fill as specified for subsequent layers of earth fill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture content that the earth fill can be compacted against them to effect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose materials by hand or other effective means and shall be free of standing water when fill is placed upon them.

Occasional rock outcrops in earth foundations for earth fill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation of initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be not steeper than 1 horizontal to 1 vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earth fill conforming to the specifications for the earth fill to be placed upon foundation.

4. **PLACEMENT**

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the Engineer. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers, The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windows shall be spread uniformly to no more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed 4-inches.

Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assure the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earth fill in dams, levees and other structures designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

- a. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks or layers of material differing substantially in texture or gradation from the surrounding material.
- b. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.
- c. The top surface of embankments shall be maintained approximately level during construction, except that a crown of cross-slope of not less than 2 percent shall be maintained to insure effective drainage, and except as otherwise specified for drain fill zones. If the drawings or specifications require or the Engineer directs that the fill be placed at a higher level in one part of an embankment than another, the top surface of each part shall be maintained as specified above.

- d. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of stream flow during construction is specifically authorized in the contract.
- e. Embankment built at different levels as described under c or d above shall be constructed so that the slope of the bonding surfaces between embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all loose material, and shall be scarified, moistened and recompactd when the new fill is placed against it as needed to insure a good bond with the new fill and to obtain the specified moisture content and density in the junction of the place and new fill.

5. **CONTROL OF MOISTURE CONTENT**

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary. Uniform moisture distribution shall be obtained by dicing, blending or other approved methods prior to compaction of the layer.

Material that is too wet when deposited on the fill shall either be removed or be dried to the specified content prior to compaction.

If the top surface of the preceding layer of compacted fill or a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall be scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

6. **COMPACTION**

Earth fill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

Class B compaction. Each layer of fill shall be compacted as to a mass density not less than the minimum density specified.

Class C compaction. Each layer of fill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Fill adjacent to structures shall be compacted a density equivalent to that of the surrounding fill by means of hand tamping if permitted by the Contracting Officer, or manually directed power tampers or plate vibrators. Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist will not be permitted.

The passage of heavy equipment will not be allowed: (1) over cast-in-place conduits prior to 14 days after placement of the concrete; (2) over cradled precast conduits prior to 7 days after placement of the concrete cradle, or (3) over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 2 feet, whichever is greater.

Compacting of fill adjacent to structures shall not be started until the concrete has attained the strength specified in Specification No. 32, Concrete, for this purpose.

The strength will be determined by compression testing of test cylinders cast by the Engineer for this purpose and cured at the work site in the manner specified in ASTM Method C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of fill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

<u>Structure</u>	<u>Time Interval</u>
Retaining walls and counterforts	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and spillway risers, cast-in- place (with inside forms in place)	7 days
Conduits and spillway risers, cast-in- place (inside forms removed)	14 days

<u>Structure</u>	<u>Time Interval</u>
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Conduits, precast & cradled	2 days
Conduits, precast & bedded	1 day
Antiseep collars and cantilever outlet bents	3 days

7. **REMOVAL AND PLACEMENT OF DEFECTIVE FILL**

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

8. **TESTING**

During the course of the work, the Contractor will perform such tests as are required to identify materials, to determine compaction characteristics, to determine content, and to determine density of fill in place. These tests performed by the Contractor will be used to verify that the fills conform to the requirements of the specifications.

Densities of fill requiring Class A compaction will be determined by the Engineer in accordance with ASTM Method D 1557 (or by equivalent methods), except that the volume and moist weight of included rock particles larger than those used in the compaction test method specified for the type of fill will be determined and deducted from the volume and moist weight of the total sample prior to computation of density. The density so computed will be used to determine the percent compaction of the fill matrix.

9. **MEASUREMENT AND PAYMENT**

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earth fill within the specified zone boundaries and pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified, no deduction in volume will be made for embedded conduits and appurtenances.

The pay limits shall be as defined below, with the further provision that earth fill required to fill voids resulting from over-excavation of the foundation, outside specified lines and grades, will be included in the measurement for payment only where such over-excavation is

directed by the Engineer to remove unsuitable material and where the unsuitable condition is not a result of the Contractor's operations.

(Method 1) The pay limits shall be as designated on the drawings.

(Method 2) The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the specified neat lines of the fill surface.

(Method 3) The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the measured surface of the completed fill.

(Method 4) The pay limits shall be the specified pay limits for excavation and the specified neat lines of the fill surface.

(Method 5) The pay limit shall be the specified pay limits for excavation and the measured surface of the completed fill.

(Method 6) Payment for each type and compaction class of earth fill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

(Method 7) Payment for each type and compaction class of earth fill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work, except furnishing, transportation, and applying water to the foundation and fill materials.

Water applied to the foundation and fill materials will be measured and payment will be made as specified in Construction Specification.

(Use with All Methods) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

## 10. **ITEMS OF WORK AND CONSTRUCTION DETAILS**

Items of work to be performed in conformance with this specification and the construction details are:

EARTH FILL

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a. 6-Inches Untreated Base Course ( 1" Minus.)

- 1. This item shall consist of furnishing, transporting, placing, watering, blading, and compacting the untreated base course in the HA, UTBC parking areas and the entrance access roads, as shown on the drawings.
- 2. The dry mineral aggregate shall conform to the following 1-inch gradation:

<u>Sieve Size</u>	<u>% Passing Gradation Band</u>
1"	100
2"	79-91
#4	49-61
#16	27-35
#200	7-11

- 3. Untreated Base material will be placed, watered, and compacted to 95% standard proctor. as directed by the Engineer.
- 4. Material not complying with these specifications will be removed from the project and replaced with material that meets these specifications.
- 5. Measurement will not be made. Payment will be in the lump sum contract price and will constitute full compensation for the untreated base course with all other items necessary and incidental to the completion of the work.

b. Granular Borrow

- 1. This item shall consist of furnishing and installing the granular borrow required in both the HMA and UTBC parking areas, along with the entrance access roads as shown on the drawings.
- 2. The granular borrow may be pit-run, plastic index must be zero. However, the maximum size of rock can not exceed the depth of the layer in which it is placed. All material must be approved by the Engineer.
- 3. Material will be placed in horizontal layers, watered, and compacted to 95% standard proctor.

4. Measurement will not be made. Payment will be made at the contract unit price and shall be full compensation for all labor, material, equipment, and all other items necessary and incidental to complete the work.

END OF SECTION 312323

## SECTION 321216 – ASPHALT PAVING (HOT MIXED ASPHALT)

1. SCOPE

The work shall consist of the construction of a surface course composed of mineral aggregate and bituminous binder, placed and compacted within the lines and grades shown on the plans.

2. MATERIALS

- a. Asphaltic Cements: Viscosity grades of asphalt cement prepared from petroleum shall conform to the requirements of AASHTO Designation M-226.
- b. Asphaltic Emulsions: Anionic emulsified asphalt shall conform to the requirements of AASHTO Designation M-140.
- c. Mineral Aggregate: Mineral aggregate shall consist of crusher processed virgin aggregate material consisting of crushed stone, and gravel, conforming to the following requirements:
  1. Course aggregate retained on the No. 4 sieve shall consist of clean, hard, tough, durable, and sound fragments, with not more than 3 percent by weight of flat, elongated, soft or disintegrated particles, and shall be free from vegetable matter or other deleterious substances.
  2. That portion of the aggregate retained as the No. 4 sieve shall have not less than 50% of particles by weight with at least two mechanically fractured face, or clean angular face.
  3. The aggregate shall have a percentage of wear not exceeding 50% for road mix and 40% for plant mix, when tested in accordance with AASHTO Designation T-96. The Contractor shall certify that the mineral aggregate used on the job shall meet this wear test prior to its placement in the surface course.
  4. Fine aggregate passing the No. 4 sieve, may be either a natural or manufactured product. The aggregate shall be clean, hard-grained and moderately sharp, and shall contain not more than 2 percent by weight of vegetable matter or other deleterious substances.
  5. That portion of the fine aggregate passing the No. 40 sieve shall be nonplastic when tested in accordance with AASHTO Designation T-90.
  6. The weight of minus 200 mesh sieve material retained in the aggregate as determined by the difference in percent passing a No. 200 sieve by washing and dry sieving without washing shall not exceed 6 percent of the total sample weight.
  7. The combined mineral aggregate plus any specified additives, when mixed with the specified bituminous binder in accordance with ASTM Designation D-1559, shall conform to the following requirements:

Marshall Stability.....1200-2500 lbs.  
 Flow (0.01 inch).....10-18  
 Voids content.....1.5% to 3.0%

The requirements specified in this subsection shall be used to determine the suitability of the aggregate sources.

- 8. The combined dry mineral aggregate shall be uniformly graded and of such size that it meets one of the following gradation bands:

<u>2" Gradation</u>	<u>Ideal Gradation of Passing Band</u>	<u>% Passing Gradation Band</u>
2"	100	100
#4	70	60-80
#16	35	28-42
#50	17	11-23
#200	7	5-9

Any deviation from the above Gradation Bands must be approved in writing by the Engineer.

- 9. Contractor will be required to supply the Engineer with a job mix formula based on the proceeding criteria. Job mix formula must be approved by the Engineer.

3. CONSTRUCTION METHODS

- a. Hot Mix Plant: The mineral aggregate and bituminous binder shall be mixed at a central mixing plant. The shortest mixing time consistent with satisfactory coating of the aggregate shall be used, as determined by the Engineer. The mineral aggregate shall be considered satisfactorily coated with bitumen when all of the particles passing the No. 4 sieve and 98 percent of the particles retained on the No.4 sieve are coated.
- b. Spreading and Compaction: Place asphalt concrete pavement of 3-inches or more, in total compacted thickness, in two equal courses. The mixture shall be spread and struck-off in such a manner that finished surface shall conform to the elevations, grades, and cross-sections shown on the drawings or as staked in the field.

After the mixture has been spread, the surface shall be longitudinally rolled, beginning at the outside edge or lower side and proceeding toward the high side. Each pass of one roller shall

overlap the proceeding pass by at least one-half the width of the roller. The surface shall be rolled by 4 passes with a pneumatic or steel-wheel exerting a minimum pressure of 40 psi., or by an approved equal method. Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller.

- c. Finishing: The surface shall be finished to a smooth, uniform line and grade with surface deviations not exceeding 3/8-inch in 10 feet. Determination of compliance with smoothness may be made with a straight edge, chalk-line, or profilograph at the option of the Engineer. Any irregularities shall be satisfactorily corrected at the expense of the Contractor.
- d. Temperature Control: The minimum temperature of the bituminous material at the time of application shall be 250 degrees Fahrenheit.
- e. Weather Limitations: Bituminous material shall not be placed when weather conditions are unfavorable or when the air temperature in the shade is less than 50 degrees Fahrenheit.
- f. Weight Devices: When the method of measurement is by weight, the Contractor shall provide weigh scales, at the job site. Scales will be certified by the Department of Agriculture.

The scales shall be accurate to within 1 percent of the correct weight throughout the range of use. Before using the scales and as frequently thereafter as the Engineer determines necessary to insure accuracy, the Contractor shall have the scales checked, adjusted, and certified by a representative of the State agency. The Contractor shall maintain the scales to the required accuracy.

- g. Sampling of Aggregate: The Contractor shall submit test results and a certification of compliance that states that the gradation of the aggregate meets the contract requirements. The Contractor shall equip crushing, screening, and mixing plants with sampling devices. The Contractor shall take additional samples of material for testing as directed by the Engineer. These samples may be required at any time to validate the certification furnished by the Contractor.

Provisions shall be made for accurate proportioning. Each compartment shall have an outlet feed that can be shut off completely when any bin becomes empty. The bins or aggregate feeding system shall be constructed so samples can be readily obtained.

Positive weight measurement of the combined cold feed shall be maintained to allow regulation of the feed gate and permit automatic correction for variations in load.

The bitumen feed control shall be coupled with the total aggregate weight measurement device to automatically vary the bitumen feed rate and to maintain the required proportion. Means shall be provided for checking the quantity or rate of flow of bitumen into the mixing unit. Thermometers shall be fixed in the bitumen feed line at the charging valve of the mixer

unit and at the discharge chute of the mixer unit. The Engineer may require replacement of any thermometer by an approved temperature-recording apparatus to allow better regulation of the material temperature.

A method shall be provided to automatically adjust the bituminous content in the mix for moisture variations in the cold feed.

- h. Hauling Equipment: Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a material to prevent the moisture from adhering to the beds. Truck beds shall be drained prior to loading. Each truck shall have a cover to protect the mixture from the weather. When necessary to insure that the mixture will be delivered at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.
  
- I. Bituminous Pavers: Bituminous pavers shall be self-contained, power-propelled units, provided with an adjustable activated-screed or strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths and thicknesses shown on the drawings. When shown on the drawings, pavers shall be equipped with a control system capable of automatically maintaining the proper screed elevation. The control system shall be automatically actuated from either a reference line or surface through a system of sensors that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface.

The transverse slope control system shall be capable of being made inoperative so that the screed can be controlled by mechanisms that will independently control the elevation of each end of the screed from reference line or surfaces.

The controls shall be capable of working in conjunction with any of the following attachments:

- 1. Ski-type device of not less than 40 feet in length.
  - 2. Taut stringline (wire) set to grade.
  - 3. Short ski or shoe.
- 
- j. Compaction shall be performed with either vibratory steel-wheel or steel-wheel and pneumatic-tire rollers.

Rolling shall begin at the sides and proceed longitudinally parallel to the road centerline, each trip overlapping one-half the roller width, gradually progressing to the center. When paving in echelons or abutting a previously placed land, the longitudinal joint shall be rolled first, then followed by the above rolling procedure. On superelevated curves the rolling shall begin at the low side and progress to the high side.

Along forms, curbs, header walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers.

- k. Joints, trimming edges, and cleanup: Placing of the bituminous mixture shall be continuous. Rollers shall not pass over the unprotected end of a freshly laid mixture. Transverse joints shall be formed by cutting back into the previous run to expose the full depth of the course. Heat shall be applied to contact surfaces or transverse joints just before any additional mixture is placed against the previously rolled material.

4. FLUSH COAT

When required, the coat shall be placed on the completed surface course. The coat shall not be placed within 7 days after the surface course is laid. Prior to placing the coat, the existing surface shall be cleaned of all dirt, sand, dust, or other objectionable material.

The material shall be sprayed over the prepared surface by means of a pressure distributor.

5. ACCEPTANCE SAMPLING AND TESTING

- a. Finished work samples. When required by the Engineer, the Contractor shall cut samples from the pavement. Samples size and locations will be designated by the Engineer. Samples shall be neatly cut with a saw or core drill. Voids left by sampling shall be backfilled and compacted to the density of the surrounding material.
- b. The Engineer will perform the testing of bituminous mixture (gradation and bituminous content). Acceptance samples of the mixture will be taken after it has been placed on the finished surface and just prior to compaction. Samples will be selected on a random basis and taken as frequently as the Engineer elects.
- c. Acceptance and testing bituminous mixture (compaction). After the bituminous mixture has been placed and compacted, the pavement shall meet the following density requirements.

Percent of Relative  
Maximum Density  
From Job Mix Formula  
94 min.

Samples and test will be taken as frequently and at such locations as the Engineer elects. Compaction testing will be done by the Engineer.

- d. Acceptance sampling and testing of bituminous mixture (surface and thickness tolerance).

1. Surface. Acceptance testing will be performed on the top surface. The surface will be tested by the Engineer with a straightedge. The variation of the surface from the testing edge of the straightedge shall not deviate at any point more than 1/8-inch.
2. Thickness. The total compacted thickness of the mixture shall not vary more than 1/4-inch from the specified thickness. The compacted thickness shall not consistently be below nor consistently above the specified thickness.

The Engineer reserves the right to test areas which appear defective and require immediate correction.

6. Price Adjustments

1. Gradation and Asphalt Content B See Table A. The computation of the adjusted unit price will be based upon the minimum pay factor determined from Table A.
  1. The Engineer may order the removal of the mix if the acceptance tests deviate from the job-mix formula for a particular sieve or sieves, or if the asphalt content is more than the values shown under the 0.70 pay factor for asphalt concrete in Table A.
  2. The pay factor for material allowed to remain will be 0.50 for asphalt concrete.
  3. A lot is the average of three tests taken in the same day and represents the number of square feet placed during each production day.
2. Density
  1. Areas with deficient density will be subject to the following price reductions:

<b>TABLE A</b>	
<b>AVERAGE DENSITY IN PERCENT</b>	<b>PAY FACTOR</b>
<b>ASPHALT CONCRETE</b>	
94 or more	1.00
92 to 93.9	0.90
Less than 92	0.50

<p><b>TABLE A</b> <b>ACCEPTANCE SCHEDULE FOR GRADATION</b></p>
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<b>(Percentage Points)</b>		
<b>SIEVE SIZE</b>	<b>PAY FACTOR A.C.</b>	<b>DEVIATIONS OF THE IDEAL GRADATION ACCEPTANCE TESTS FROM THE JOB-MIX (PERCENTAGE POINTS)</b>
Asphalt Content	1.00	0-0.38
	0.95	0.39-0.43
	0.90	0.44-0.47
	0.80	0.48-0.52
	0.70	0.53-0.56
2 inch & larger	1.00	0-1
	0.95	1.0-2.0
	0.90	2.0-3.0
	0.80	3.0-4.0
	0.70	4.0-5.0
No. 4	1.00	0-10
	0.95	10-11.4
	0.90	11.5-11.9
	0.80	11.9-12.5
	0.70	12.5-13.0
No. 16	1.00	0-7.0
	0.95	7.0-7.3
	0.90	7.4-7.7
	0.80	7.8-8.1
	0.70	8.2-8.4
No. 50	1.00	0-6.0
	0.95	6.0-6.5
	0.90	6.6-6.8
	0.80	6.9-7.1
	0.70	7.2-7.5
No. 200	1.00	0-2.0
	0.95	2.0-2.9
	0.90	3.0-3.1
	0.80	3.2-3.3
	0.70	3.4-3.5

7. MEASUREMENT AND PAYMENT

ASPHALT PAVING

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- a. The bituminous material and mineral aggregate shall be measured by the square foot.
- b. Tack coat is required on all seams and will be subsidiary to this item and not paid for separately.
- c. Payment for the bituminous material, mineral aggregate will be made at the contract unit price. Such payment shall constitute full compensation for furnishing, mixing, spreading, the bituminous material and mineral aggregate, compacting all other items necessary and incidental to the performance of the work.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and construction details are:

- a. 3-Inches Hot Mix Asphalt (HMA) (PG58-22) (1/2-inch Max.)
  - 1. This item shall consist of furnishing the mineral aggregate, bituminous material, mixing the aggregate and bituminous material, spreading, and compacting the mixture as shown on the drawings.
  - 2. Contractor will supply the Engineer with the mix calibration factor, and a set of calibration samples 7 days prior to placement of asphalt.
  - 3. The aggregate shall meet the gradation requirements as listed in Section 2.C.8 of these specifications. The gradation of the aggregate shall be submitted in writing to the Engineer for his approval prior to the placing of the asphalt. The borrow area selected by the Contractor must meet the approval of the Engineer.
  - 4. The asphalt shall be grade PG58-22, viscosity graded.
  - 5. The aggregates and the bituminous material shall be measured or gaged and introduced into the mixer in the amount specified by the job mix formula.  
  
After the required amounts of aggregate and bituminous material have been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of particles and a thorough distribution of the bituminous material throughout the aggregate is obtained.
  - 6. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be placed and finished by hand tools.
  - 7. Hot mixture shall be placed at a temperature not less than 250 degrees Fahrenheit.
  - 8. Material trimmed from the edges and any other discarded bituminous mixture shall be removed from the runway and disposed of by the Contractor in an approved area.

9. Contractor will be required to hand rake all seams.
10. Testing noted in Section 5.a will not be required.
11. Asphalt shall be placed at the finished depth noted on the plans. Tack coat will be required on all asphalt edges.
12. Contractor will not stockpile hot asphalt on existing asphalt roads prior to placement.
13. Bituminous surface course will not be placed during rain, when the roadbed is wet or during other adverse weather conditions. The owner will not be responsible for any bituminous surface course that is on the project site, but unable to spread due to adverse weather.
14. Contractor will be required to excavate all crackage adjacent to the main lay and replace with bituminous surface course material as shown on the drawings or directed by the Engineer.
15. Contractor will be required to deliver to the Engineer a weight invoice prior to placement of the asphalt surface course, invoices not received the day of placement will not be paid for.
16. Contractor will hand sweep and remove all sluffage on and against asphalt and concrete gutters just prior to bituminous surface course placement to assure a clean surface and proper depth. Price adjustment for asphalt material is allowed according to the process outlined in the Special Provisions.
17. Measurement and payment shall be in accordance with the lump sum contract price. Payment of the lump sum contract price will constitute full compensation for all labor, equipment, materials, and all other items necessary and incidental to completion of the work.

b. Asphalt Pavement Saw Cutting

1. This item shall consist of furnishing the equipment and labor required to saw cut the existing asphalt concrete pavement at each entrance road.
2. Saw cut edges shall be required where existing bituminous surface and new bituminous surface join. The edge shall be clean, vertical and full depth of bituminous surface. Cutting the edge shall be made just prior to placing new bituminous pavement. A tack coat will be applied to the edge prior to placing new bituminous pavement.
3. A diamond saw shall be required to make a vertical cut through the full depth of the asphalt surfacing.
4. Traffic or construction equipment shall not be allowed to cross the saw cut edge.
5. Measurement will not be made. Payment shall be according to the lump sum contract price. Such payment shall constitute full compensation for saw cutting the existing asphalt surface, including all equipment, materials, and labor necessary or incidental to the completion of the work.

END OF SECTION 321216

SECTION 321600 – SITE CONCRETE FOR MINOR STRUCTURES

1. **SCOPE**

The work shall consist of furnishing, forming, placing, finishing and curing portland cement concrete as required to build the structure named in Section 24 of this Specification.

2. **MATERIALS**

Portland cement shall conform to the requirements of ASTM Specification C-150 for the specified type.

Aggregates shall conform to the requirements of ASTM Specification C-33 unless otherwise specified. The grading of coarse aggregates shall be as specified in Section 24.

Water shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Performed expansion joint filler shall conform to the requirements of ASTM Specification D 1752.

Waterstops shall conform to the requirements of the applicable ASTM specification for the specified kinds.

3. **CLASS OF CONCRETE**

Concrete for minor structure shall be classified as follows:

<u>Class of Concrete</u>	<u>Maximum Water Content (gallons/bag)</u>	<u>Minimum Cement Content (bags/cu.yd.)</u>
4000M	7	6

4. **AIR CONTENT AND CONSISTENCY**

Unless otherwise specified, the slump shall be 2 to 4 inches. If air entrainment is specified, the air content by volume shall be 5 to 8 percent of the volume of the concrete. When specified or when directed by the Engineer, a water-reducing, set-retarding admixture approved by the Engineer shall be used.

5. **DESIGN OF THE CONCRETE MIX**

The proportions of the aggregates shall be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when

consolidated, but will not segregate or exude free water during consolidation.

Prior to placement of concrete, the Contractor shall furnish the Engineer, for approval, a statement of the materials and mix proportions (including admixtures, if any) he intends to use. The statement shall include evidence satisfactory to the Engineer that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the job mix. After a job mix has been approved, neither the source, character or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the Engineer. If such changes are necessary, no concrete containing such new or altered materials shall be placed until the Engineer has approved a revised job mix.

6. **INSPECTION AND TESTING**

The Engineer will have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the Engineer to inspect materials, equipment and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

7. **HANDLING AND MEASUREMENT OF MATERIALS**

Materials shall be stockpiled and batched by methods that shall prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface- dry weight plus the weight of surface moisture it contains.

Water shall be measured, by volume or by weight, to an accuracy within one percent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of three percent.

8. **MIXERS AND MIXING**

Concrete shall be uniform and thoroughly mixed when delivered to the work. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other means.

For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall not be less than 1 2 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

9. **FORMS**

Forms shall be of wood, plywood, steel or other approved material and shall be mortar tight. The forms and associated false work shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a nonstaining form oil before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed to view when the structure is completed shall be chamfered, unless finished with molding tools as specified in Section 18.

10. **PREPARATION OF FORMS AND SUBGRADE**

Prior to placement of concrete the forms and subgrade shall be free of chips, sawdust debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings.

Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill frozen subgrade will not be permitted.

Unless otherwise specified, when concrete is to be placed over drain fill, the contact surface of the drain fill shall be covered with a layer of asphalt-impregnated building

paper or polyvinyl sheeting prior to placement of the concrete. Forms for weepholes shall extend through this layer into the drain fill.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous materials.

11. **CONVEYING**

Concrete shall be delivered to the site and discharged into the forms within 1 2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. The Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar. Concrete shall not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation.

12. **PLACING**

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved. No concrete shall be placed except in the presence of the Engineer. The Contractor shall give reasonable notice to the Engineer each time he intends to place concrete. Such notice shall be far enough in advance to give the Engineer adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with the specifications before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Unless otherwise specified, slab concrete shall be placed to design thickness in one continuous layer. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Hoppers and chutes, pipes or Aelephant trunks@ shall be used as necessary to prevent splashing of mortar on the forms and reinforcing steel above the layer being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tamping or vibration as necessary to insure smooth surfaces and dense concrete. Each layer shall be consolidated to insure monolithic bond with the preceding layer. If

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the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the Contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified in Section 13.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

13. **CONSTRUCTION JOINTS**

Construction joints shall be made at the location shown on the drawings. If construction joints are needed which are not shown on the drawings, they shall be placed in locations approved by the Engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns, as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coating or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the Engineer. The surfaces shall be kept moist for at least one hour prior to placement of the new concrete.

14. **EXPANSION AND CONTRACTION JOINTS**

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges and expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

When open joints are specified, they shall be constructed by insertion and subsequent removal of a wooden strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of open joints shall be finished with an edging tool prior to removal of the joint strips.

15. **WATERSTOPS**

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in the metal waterstops shall be soldered, brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the Manufacturer.

16. **REMOVAL OF FORMS**

Forms shall not be removed without the approval of the Engineer. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

17. **FINISHING FORMED SURFACES**

Immediately after the removal of the forms:

- a. All fins and irregular projections shall be removed from exposed surfaces.
- b. On all surfaces, the holes produced by the removal of form ties, cone-bolts, and she-bolts, shall be cleaned, wetted and filled with a dry-pack mortar consisting of one part portland cement, three parts sand that will pass a No. 16 sieve, and water just sufficient to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

18. **FINISHING UNFORMED SURFACES**

All exposed surfaces of the concrete shall be accurately screened to grade and then wood float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft shall not be permitted.

The addition of dry cement or water to the surface of the screened concrete to expedite finishing shall not be allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

19. **CURING**

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding, or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand or approved material. Wood forms (except plywood) left in place during the curing period shall be kept wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Concrete, except at construction joints, may be coated with an approved curing compound in lieu of continued application of moisture. The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any; surface until patching, repairs and finishing of that surface are completed. The compound shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be re-sprayed at the rate of application specified above.

20. **REMOVAL OR REPAIR**

When concrete is honeycombed, damaged or otherwise defective, the Contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective parts. The Engineer will determine the required extent of removal, replacement or repair.

Prior to starting repair work the Contractor shall obtain the Engineers approval of his plan for effecting the repair. The Contractor shall perform all repair work in the presence of the Engineer.

21. **CONCRETE IN COLD WEATHER**

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40° F unless facilities are provided to prevent the concrete from

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freezing. The use of accelerators or antifreeze compounds will not be allowed.

22. **CONCRETE IN HOT WEATHER**

The Contractor shall apply effective means to maintain the temperature of the concrete below 90° F during mixing, conveying and placing.

23. **MEASUREMENT AND PAYMENT**

For items of work for which specific unit prices are established in the contract, concrete will be measured to the neat lines shown on the drawings and the volume of the concrete in cubic yards. Measurement of concrete placed against the sides of an excavation without the use of intervening forms will be made only to the neat lines or pay limits shown on the drawings. No deduction in volume will be made for chamfers, rounded or beveled edges or for any void or embedded item that is less than 3 cubic feet in volume.

Payment for each item of concrete for minor structures will be made at the contract unit price or the contract lump sum, whichever is applicable, for that item. Such payment will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, false work, bracing and all other items necessary and incidental to the completion of the work, except items listed for payment elsewhere in the contract.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 24 of this specification.

24. **ITEMS OF WORK AND CONSTRUCTION DETAILS**

Items of work to be performed in conformance with this specification and the construction details include:

- a. **Concrete Sidewalk (4-inches Thick)**
  1. This item shall consist of furnishing, forming, and placing the portland cement concrete, as required to construct the sidewalk around the shed, as shown on the drawings along with the necessary untreated base, excavation and fill.
  2. All concrete used shall be class 4000. Type II cement will be used. A minimum of 6 bags of cement will be used in each yard of concrete.

3. Reinforcing steel used shall conform to ASTM GA-615, Grade 60-S.
4. The Contractor shall furnish and place six-inches of untreated base under all concrete surfaces. This will not be measured but will be paid for in the Lump Sum contract price, and shall conform to Specification No. 23.
5. The earth foundation under the base course shall be moistened and rolled by means of vibratory compactors.
6. The finished concrete shall be scored on 5-ft c.c. to eliminate temperature cracking.
7. Contractor will be required to apply curing compound as soon as finishing has been completed.
8. Measurement will not be made. Payment will be made in the contract lump sum price. The contract lump sum payment will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, bracing, excavation, compacted fill, and all other items necessary and incidental to the completion of the concrete work.

b. 24-Inch Concrete Curb and Gutter

1. This item shall consist of furnishing and placing the portland cement concrete as required to construct the 24-inch curb and gutter, as required and as shown on the drawings along with the necessary untreated base course, excavation and fill.
2. All cement used shall be Type II.
3. Concrete shall be class 4000.
4. Concrete mix design will be in accordance with Section 5.
5. Minimum cement content will be 6 bags per cubic yard.
6. Class 2 course aggregate shall be size 57 (1" to No. 4, ASTM C-33 Table II).
7. Air entrainment shall be required. Air content by volume shall be 5 to 8 percent of the volume of the concrete,

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8. Contractor will be required to backfill all excavation in front and back of curb and gutter and blend to the adjoining ground surface as shown on the drawings, or as directed by the Engineer.
10. Contractor shall be required to apply curing compound as soon as finishing has been completed.
11. Curb and gutter damaged during construction will be replaced by the Contractor at his expense.
12. All rocks and debris exposed during excavation and installation of the curb and gutter will be disposed of by the Contractor.
13. Measurement will not be made. Payment will be made in the contract lump sum contract price. The payment will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, bracing, excavation, compacted fill, and all other items necessary and incidental to the completion of the curb and gutter.

c. Reinforced Concrete

1. This item shall consist of placing the reinforced concrete for the propane pad, wash down pad, oil and sand interceptor box, and other miscellaneous concrete work as shown on the drawings, and as required by these specifications. The work shall also include the untreated base course, as required to complete the permanent works.
2. All concrete used shall be class 4000. Type II cement will be used in the permanent work. A minimum of 6 bags of cement will be used in each yard of concrete.
3. Reinforcing steel used shall conform to ASTM GA-615, Grade 60-S.
4. The Contractor will furnish and place the steel reinforcement as shown on the drawings.
5. All horizontal steel mats will be supported in place by metal chairs or concrete blocks and chairs shall be used for spacing of reinforcing steel.
6. All splicing of bars, concrete cover, placing tolerances and bar spacings

shall conform to "Building Code Requirements for Reinforced Concrete" (ACI 318), as published by the American Concrete Institute, and to recommended practices in "Reinforcement Anchorages and Splices" by the concrete Reinforcing Steel Institute.

- 7. The minimum compression dowel embedment shall be 22 bar diameter.
- 8. The minimum tensional development length shall be:

<u>Bar Size</u>	<u>Top Bars</u>	<u>Other Bars</u>
#4	17"	12"
#5	21"	15"
#6	32"	23"
#8	42"	30"

- 9. All flatwork concrete will be scored on 10-ft. c.c., to prevent temperature cracking. Scoring with a concrete saw should be done within 24 hours of placement. The depth of the saw cut shall be at least 1 1/2-inches.
- 10. All untreated base course shall be fine graded and compacted. Concrete shall not be placed until the foundation is approved by the Engineer.
- 11. Measurement will not be made, but this work shall include the concrete, excavation, and compacted backfill in accordance with the drawings and these specifications. Payment in the lump sum contract price will constitute full compensation for completion of work with all items necessary and incidental to the completion of the work.

END OF SECTION 321600

SECTION 321610 – SITE CONCRETE STEEL REINFORCEMENT

1. **SCOPE**

This work shall consist of furnishing reinforcing steel, bar supports, welding, tools, supplies, equipment and services and placing of concrete reinforcement of the shape and dimensions shown on the structural drawings, and as called for in these specifications.

2. **REINFORCING STEEL**

- a. All reinforcing bars except column spirals, shall be deformed as defined in ASTM specifications.
- b. All reinforcing bars, unless noted on the structural drawings, shall be Grade 60 as defined in the American Society for Testing and Materials' "Specifications for Steel Bars for Concrete Reinforcement" (A615, A616, A617) or A706.
- c. Spiral reinforcing steel shall be fabricated from cold drawn wire (ASTM A 82) or hot rolled plain or deformed bars conforming to ASTM A615, Grade 60, or ASTM A706.
- d. Welded smooth wire fabric shall conform to ASTM A185 "Welded Deformed Steel Wire Fabric for Concrete Reinforcement." (ACE Building Code limits the wire spacing to 16 inches maximum.)

3. **TIE WIRE**

The tie wire used shall be black annealed wire, 16 1/2 gauge or heavier.

4. **REINFORCING BAR SUPPORTS**

Bar supports shall conform to the "Bar Support Specifications" contained in "Manual of Standard Practice," as published by the Concrete Reinforcing Steel Institute.

5. **MILL TEST REPORTS**

A certified copy of mill test on each heat of reinforcing steel delivered showing physical and chemical analysis shall be provided, upon request, at time of shipment.

6. **SURFACE CONDITION**

Metal reinforcement at the time concrete is place shall be free from mud, oil, or other nonmetallic coatings that adversely affect bonding capacity.

Metal reinforcement, except prestressing steel, with rust, mill scale, or a combination of both shall be considered as satisfactory, provided the minimum dimensions, including height of deformations and weight of hand wire brushed test specimen, are not less than the applicable ASTM specification requirements.

7. **PLACING DRAWINGS**

The contractor shall supply placing drawings and bar lists in accordance with latest revision of "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315), as published by the American Concrete Institute.

8. **STANDARD PRACTICE**

All requirements of concrete reinforcement not covered in these specifications or on the structural drawings shall be in accordance with "Manual of Standard Practice," as published by the Concrete Reinforcing Steel Institute.

- a. All hooks shall conform to bend dimensions defined as "Standard Hooks" in "Manual of Standard Practice," as published by the Concrete Reinforcing Steel Institute, unless otherwise shown on the structural drawings.
- b. Reinforcing bars shall not be bent or straightened in a manner that will injure the material.
- c. Reinforcing bars shall conform accurately to within the fabrication tolerances shown in "Manual of Standard Practice," as published by the Concrete Reinforcing Steel Institute.

9. **PLACING REINFORCING STEEL**

- a. The placement of bars should conform to the recommended practices in "Placing Reinforcing Bars," as published by the concrete Reinforcing Steel Institute.
- b. Bars should be securely tied to prevent displacement during the concreting operation and all dowels must be wired in place before depositing concrete. Chairs shall be used for spacing of reinforcing steel.

- c. All splicing of bars, concrete cover, placing tolerances and bar spacings shall conform to "Building Code Requirements for Reinforced Concrete" (ACI 318), as published by the American Concrete Institute, and to recommended practices in "Reinforcement Anchorages and Splices" by the concrete Reinforcing Steel Institute.
- d. The minimum compression dowel embedment shall be 22 bar diameter.
- e. The minimum tensional development length shall be:

<u>Bar Size</u>	<u>Top Bars</u>	<u>Other Bars</u>
#4	17"	12"
#5	21"	15"
#6	32"	23"
#8	42"	30"

10. **MEASUREMENT AND PAYMENT**

(Method 1) For items of work for which specific unit prices are established in the contract, the weight of reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends will be based on the requirements of ACI Standard 315. Computation of weights of reinforcement will be based on the unit weights established in Tables 34-1, 34-2, and 34-3. The are of welded wire fabric reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest square foot by computation from the placing drawings with no allowance for laps. The weight of steel reinforcing in extra spliced or extra-length splices approved for the convenience of the Contractor or the weight of supports and ties will not be included in the measurement for payment.

Payment for furnishing and placing reinforcing steel will be made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists, or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, cutting, bending, cleaning, and securing all reinforcement.

(Method 2) For items of work which specific unit prices are established in the contract, the weight of bar reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest pound by computation from the placing drawings.

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Measurement of hooks and bends will be based on the requirements of ACI Standard 315. Computation of weights of bar reinforcement will be based on the unit weights established in Table 34-1. The weight of steel reinforcing in extra splices or extra-length splices approved for the convenience of Contractor or the weight of supports and ties will not be included in the measurement for payment.

The area of welded wire fabric reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest square foot by computation from the placing drawings with no allowance for laps.

Payment for furnishing and placing bar reinforcing steel will be made at the contract unit price for bar reinforcement. Payment for furnishing and placing welded wire fabric reinforcing steel will be made at the contract unit price for welded wire fabric reinforcement. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists of diagrams; furnishing and attaching ties and supports; and furnishing, transporting, cutting, bending, cleaning, and securing all reinforcement.

(Use with Either Method) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section 8 of this specification.

11. **ITEMS OF WORK AND CONSTRUCTION DETAILS**

Items of work to be performed in conformance with this specification and construction details thereof are:

a. Reinforcing Steel

1. This item shall consist of furnishing all steel reinforcement required in the concrete as shown on the drawings.
2. Reinforcing steel shall be ASTM GA-615. Grade 60-S, A305 deformations. The reinforcing bars shall be cut and bent according to the requirements of the drawings and specifications.
3. Measurement will not be made. Payment will be included in the contract lump sum price. Payment of the lump sum contract price will constitute full compensation for equipment, labor, and materials, and all other items necessary and incidental to completion of the work.

END OF SECTION 321610

SECTION 321726 – PAVEMENT MARKING

1. **SCOPE**

The work shall consist of furnishing and applying ready mixed traffic paint to asphaltic or concrete pavement.

2. **MATERIALS**

Furnish VOC Compliant Solvent Based or Acrylic Water Based Pavement marking paint meeting Federal Specification TTP-115 F for Low Volatile Organic Compounds (VOC) of 1.25 lbs/gal.

Apply to asphaltic or concrete pavement as edge lines, center lines, broken lines, guide lines, symbols and other related markings.

Remove pavement markings.

**REFERENCES**

1. AASHTO M247: Glass Beads Used in Traffic Paint.
2. ASTM D 562: Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using the Stormer-Type Viscometer.
3. ASTM D 711: No-Pick-Up Time of Traffic Paint.
4. ASTM D 2205: Selection of Tests for Traffic Paints.
5. ASTM D 2743: Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography.
6. ASTM D 3723: Pigment Content of Water-Emulsion Paints.
7. ASTM D 3960: Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
8. ASTM D 4451: Pigment Content of Paints
9. ASTM D 5381: S-Ray Fluorescence (XRF) Spectroscopy of Pigments and and Extenders.
10. Federal Standards 595B, 37875, 33538, and 11105.

ACCEPTANCE

1. Repaint any line or symbol failing to meet bead adherence and dimensional requirements.
2. Repaint any line or symbol failing to meet the minimum application requirements for paint or beads. (Road Only)

PAINT

1. Choose an approved pavement marking paint UDOT=s AAccepted Products Listing@. Follow Federal Standards 595B, 37875, 33538, and 11105. Meet the following requirements for VOC Compliant Solvent Based Paint or Acrylic Water Based Paint:

<b>CIELAB (L*a*b*) D65/10E</b>		
White	Yellow	Red
L* 91.9 to 95.6	L* 70.0 to 72.7	L* 31.4 to 33.4
a* -1.8 to -2.1	a* 22.5 to 24.8	a* 51.6 to 52.6
b* 3.8 to 2.2	b* 89.7 to 73.9	b* 34.1 to 35.1

- a. No-track time: Not more than 5 minutes when tested according to ASTM D 711.
- b. Volatile Organic Compounds Content: Less than 1.25 lbs/gal ASTM D 3960.
- c. Free of lead, chromium, or other related heavy metals ASTM D 5381.
- d. Pigment: Percent by weight: Acrylic Water Based minimum of 62.0 ∇ 2.0 VOC Compliant Solvent minimum of 52.0. ASTM D 3723.
- e. Total Solids: Percent by weight: Acrylic Water Based minimum of 77.0 VOC Compliant Solvent minimum of 70.0 ASTM D 2205.
- f. Acrylic water based paint must contain a minimum of 40 percent, by weight, 100 percent acrylic cross-linkable emulsion as determined by infrared analysis and other chemical analysis available to UDOT. ASTM D 2205 and UDOT Manual of Instruction Section 996.
- g. VOC compliant solvent based paint must contain 37.5 percent, by weight, copolymer alkyd-resin ASTM D 2205.

- h. ASTM D 562, ASTM D 2743, ASTM D 4451 and ASTM D 5381: Tests used to verify paint samples meet Accepted Products Listing.®

**GLASS SPHERE (BEADS) USED IN PAVEMENT MARKING PAINT**

- 1. Specific Properties:
  - a. Meet AASHTO M 247.
  - b. Meet type II, uniform gradation.

3. **PREPARATION**

- 1. Line Control.
  - a. Establish control points as required.
  - b. Maintain the line within 0 inches of the established control points and mark the roadway and parking stalls.
    - 1. Remove paint that is not placed within tolerance of the established control points and replace at no expense to the Owner.
- 2. Remove dirt, loose aggregate and other foreign material and follow manufacturers recommendations for surface preparation.

4. **APPLICATION**

- 1. Pavement Marking Paint: Apply at the following rates:
  - a. 4 inch Solid Line: From 270 to 350 ft/gal
  - b. 4 inch Broken Line: From 1080 to 1400 ft/gal
  - c. 8 inch Solid Line: From 135 to 175 ft/gal
- 2. Replace pavement markings that are less than 14 wet mils in thickness.
- 3. No payment for pavement markings placed in excess of 18 wet mils in thickness.
- 4. Painted Legends and Symbols 1 gallon per 100 square feet.
- 5. Glass Sphere (Beads): Apply a minimum of 8 lbs/gal of paint, the full length and width of line and pavement markings.
- 6. Begin striping operations no later than 24 hours after ordered by the Engineer.
- 7. At time of application apply lines and pavement markings only when the air and pavement temperature are:

- a. 40 degrees F and rising for VOC Compliant Solvent Based Paint.
- b. 50 degrees F and rising for Acrylic Water Based Paint.

8. Comply with Traffic Control Drawing TC-16

5. **CONTRACTOR QUALITY CONTROL**

- 1. Application Rate: Verify that the paint and beads are being applied within specified tolerances prior to striping.

6. **ITEMS OF WORK AND CONSTRUCTION DETAILS**

Items of work to be performed in conformance with this specification and the construction details are:

a. **Pavement Striping**

- 1. This item shall consist of the striping in the parking lot as shown on the drawings.
- 2. Line Control
  - ! Establish control points for parking stalls as shown on the drawings.
  - ! Maintain the line within 1 inch of the established control points and mark the parking lot as needed.
  - ! Paint handicap symbols as shown on the drawings.
  - ! Glass sphere (beads) will not be required.
- 3. Broom or Sweep the pavement surface and remove dirt, loose stones and other foreign material prior to painting.
- 4. Equipment

Equipment manufactured specifically for applying paint.  
Use only workmen experienced in operating the equipment.
- 5. Restrictions

- ! The Contractor shall begin striping operations no later than 24 hours after written order by the Engineer.
- ! Apply traffic striping only when the air and pavement temperature are 40EF. or higher.

6. Application Rates

Paint - apply at the following rates:

	<u>Linear Feet/Gallon</u>
4" Solid Stripe	From 310 to 340
4" Dashed Stripe	From 1200 to 1320
8" Solid Stripe	From 160 to 175

Beads - **Not Required**

7. **MEASUREMENT**

Measurement will not be made.

8. **PAYMENT**

Payment will be according to the lump sum contract price. Such payment will constitute full compensation or all labor, materials, equipment, transportation, tools, and all other items necessary and incidental to the completion of this item.

END OF SECTION 321726