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**SECTION 00010
DIRECTORY OF CONTACTS**

FACILITY OWNER

DESCHUTES COUNTY 911
20355 POE SHOLES DRIVE, #300
BEND, OREGON 97701
PHONE: 541-322-6101
FAX:
E-MAIL:

PROJECT MANAGER

ADCOMM ENGINEERING COMPANY
TOM MANLEY
2307 CASCADE PLACE WEST
UNIVERSITY PLACE, WA 98466
PHONE: (206) 954-7485
FAX: (206) 374-2834
E-MAIL: T.MANLEY@ADCOMM911.COM

CIVIL ENGINEER/PLANNING

CHARLES A. ROWLES, PE
CA ROWLES ENGINEERING & DESIGN
1345 NW WALL STREET, SUITE 200
BEND, OREGON 97703
(541) 585-2207

STRUCTURAL ENGINEER

JOK ANG, PE, SE
MORTIER ANG ENGINEERS
1355 OAK STREET, SUITE 200
EUGENE, OR 97401
(541) 484-9080

PROPERTY OWNER

CITY OF BEND
PO BOX 431
BEND, OREGON 97709

GEOTECHNICAL ENGINEER

CARLSON GEOTECHNICAL
BRAD WILCOX, P.E., G.E.
P.O. BOX 230997
TIGARD, OR 97281
PHONE: (503) 684-3460
E-MAIL:
BWILCOX@CARLSONTESTING.COM

ELECTRICAL SERVICE

Pacific Power
ATTN: RYAN COBURN
328 NE Webster
Bend, OR 97701
Cell Phone: (541) 388-7129
E-MAIL:
RYAN.COBURN@PACIFICORP.COM

**SECTION 00020
INVITATION TO BID**

**DESCHUTES COUNTY 911 PUBLIC SAFETY COMMUNICATIONS FACILITY PROJECT
BEND, OREGON**

Deschutes County 911 (hereinafter referred to as “Owner”) will receive bids for the development of a public safety radio site consisting of: site work construction, base building, electrical, grounding, antenna structure, etc. of the 911 Public Safety Communications Facility in Bend, Oregon.

Work: The work consists of:

1. Site preparation work, including clearing, grubbing, excavation and compaction, new fencing and gate installation.
2. Installation of a free-standing manufactured wood pole antenna structure with Contractor-supplied ice bridge, a stick-framed equipment shelter. Installation of an owner supplied generator, transfer switch, and propane fuel tank.
3. Extension of power service to the equipment shelter with the placement of a meter base.
4. Furnishing and installing a buried ground electrode system.

<u>Schedule of Events:</u>	Advertisement for Bids -	11/05/19
	Site Walk-thru -	see below
	Last Day for Questions -	11/14/19 at 2:00 pm
	Addendum 1 Issued -	11/21/19
	Bids Due -	12/12/19 at 2:00 pm
	Anticipated Award Decision -	12/20/19
	Contract and Notice to Proceed -	01/03/20
	Construction start	01/10/20
	Construction Substantial completion -	06/05/20
	Site Walk and Punch List -	06/10/20
	Site Final Acceptance -	07/01/20

Bid Deadline: Bids must be submitted no later than 2 p.m. Tuesday, December 12th, 2019 to Sara Crosswhite, at Deschutes County 911 Building located at 20355 Poe Sholes, Bend, Oregon. Bids received after this time will not be considered. Facsimile and electronic format bids will not be accepted. Bids will be opened at **2 PM** on Tuesday, December 12th, 2019, at the same location. All bids for the above project will be publicly opened and pricing read aloud. Subcontractor Disclosure shall be submitted no later than 4 p.m. on the same date in a separate envelope and shall be clearly marked, **“SUBCONTRACTOR DISCLOSURE FOR 911 PUBLIC SAFETY COMMUNICATIONS FACILITY PROJECT.”** The official bid clock is located in the office of the Deschutes County 911 Building reception.

Bids shall be made on the forms furnished by Owner, incorporating all contract documents, including all addenda and the Bid Bond or Cashier’s Check for the minimum amount of 10 percent of the Bid Price. The envelope shall be clearly marked **“CONSTRUCTION BID FOR 911 PUBLIC SAFETY COMMUNICATIONS FACILITY PROJECT”** and shall contain the name and address of the bidder.

Site Walk-through: A site visit and walkthrough may be requested by contacting Sara Crosswhite at Deschutes County 911, (541) 322-6111, 20355 Poe Sholes Dr, Bend, OR 97702.

Since this project is for a public work, it is subject to the state prevailing rates of wage under ORS 279C.800 to 279C.870. No bids will be received or considered by Owner unless the bid contains a statement by the bidder that the bidder will comply with the provisions of ORS 279C.838 & 279C.840,

“Payment of prevailing rate of wage; posting of rates and fringe benefit plan provisions.” Each bid must contain a statement as to whether the bidder is a resident bidder, as defined in ORS 279A.120.

Owner may reject any bid not in compliance with all prescribed bidding procedures and requirements and may reject for good cause any or all bids upon a determination of Owner that it is in the public interest to do so. The protest period for this procurement is seven (7) calendar days.

NOTE: All proposals submitted in response to this RFP shall become the property of Deschutes County and may be utilized in any manner and for any purpose by Deschutes County. Be advised that proposals and all documents submitted in response to this RFP are subject to public disclosure as required by applicable state and/or federal laws. If you intend to submit any information with your proposal which you believe is confidential, proprietary or otherwise protected from public disclosure (trade secret, etc.), you must separately bind and clearly identify all such material. The cover page of the separate binding must be **red**, and the header or footer for each page must provide as follows: “Not Subject to Public Disclosure.” Where authorized by law, and at its sole discretion, Deschutes County will endeavor to resist disclosure of properly identified portions of the proposals.

Bidders shall be licensed by OREGON CONSTRUCTION CONTRACTORS BOARD.

Specifications and Bid Documents: Electronic copies of the documents may be obtained by requesting same by emailing a request to t.manley@adcomm911.com. Subject line must read “Request for RFP Packet – DC 911 Public Safety Communications Facility Project” Questions pertaining to this RFP shall be directed to Tom Manley, ADCOMM Engineering Company, via email or mailing address listed above. All questions and bid walk-through clarifications will be addressed in an Addendum issued on November 21, 2019.

Documents may also be Requested/Inspected at the following locations:

Central Oregon Builders Association (COBA)
 1051 NE 4th Street
 Bend, OR 97703
 541-389-1058
www.coba.org

ARC Document Solutions
 1151 SE Centennial Ct. #3
 Bend, OR 97702
 541-749-2151
https://order.e-arc.com/arcEOC/PWELL_PublicList.asp?mem=45

Published in Bend Bulletin:
 _____, 2019

Published in Daily Journal of Commerce:
 _____, 2019

**SECTION 00150
INSTRUCTIONS TO BIDDERS**

1. LIST OF BIDDING DOCUMENTS:

CA Rowles Engineering Permit Drawings, dated 10/23/19
CA Rowles Specification Manual, dated October 23, 2019
Deschutes County Standard Contract
Deschutes County General Conditions to the Contract
Milestone Schedule

2. RESIDENT BIDDER: Bid form must state whether the Bidder is a “resident bidder” and clearly indicate “State” of residency.

3. CONTRACTOR LICENSE: During Bid Evaluation if Bidder is found not to be in good and current standing with the Oregon Construction Contractors Board, bid will be rejected. All subcontractors required to be licensed by the Oregon Construction Contractors Board shall be in good standing at bid evaluation and remain so during the course of the project.

4. SUBCONTRACTORS: Subcontractors must be licensed and may only perform work on the project pursuant to a written contract. All provisions of the bid documents shall be incorporated into each subcontractor’s written contract. The Owner reserves the right to reject any subcontractor proposed or to further qualify a proposed subcontractor if Owner determines it is in the Owner’s best interest to do so. Subcontractors must comply with the requirements of ORS 279C.836, “Public works bonds; rules.”

5. CLARIFICATION OF NON-DISCRIMINATION: The Bidder shall certify that Bidder has not discriminated against minority, women, or emerging small business enterprises in obtaining any required subcontracts.

6. SUMMARY OF WORK: The summary of work is described in the Invitation to Bid, Bidding Documents and Addendums.

7. BID FORM: All Bids must be submitted on the "Bid for Lump Sum Bid" form attached hereto as Attachment C to these Instructions to Bidders. All alternates, if any, must be bid; there are no exceptions. All bid forms bound herewith shall be submitted with the bid.

The Base Bid is the sum stated in the Bid for which the Bidder offers to perform all the work shown and described in the bidding documents as a lump sum bid, to which work may be added or deducted for the sums stated in Alternate Bids, if any.

An Alternate bid is the amount stated in the bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the work, as described in the bidding documents, is accepted by Owner. Alternates shall be selected in the order set forth in the bid documents starting with Alternate A. The Owner may select all or none of the Alternates or may select fewer than all of the Alternates. For purposes of bid comparison, all bids will be compared incorporating the alternates selected by the Owner. Selection of alternates will occur after bid opening.

8. QUALIFICATIONS OF BIDDERS:

- a. Before the bid is considered for award, the Owner reserves the right to request the bidder to complete within seventy-two (72) hours a bidder qualification form and/or a current financial statement prepared by a Certified Public Accountant. Bidder qualifications to be listed upon the qualification form will include at a minimum, a listing of Bidder’s previous contracts of a similar nature in terms of technical complexity, operations, and size to that being bid upon; a listing of Bidder’s staff to include managerial, technical, and laboring positions; summary of

Bidder's plan and equipment available for use in the construction of the project; and the listing of the projects to which Bidder is currently obligated or anticipates being obligated during this work.

- b. Pursuant to ORS 279C.375, a Bidder may be deemed "not responsible" to perform the Contract if any of the following conditions appear:
 1. Bidder is listed on the Construction Contractors Board list of bidders who are not qualified to hold a public improvement contract.
 2. Prospective bidder has not met the standards of responsibility. In making the determination, Owner shall consider whether the bidder has:
 - A. Available the appropriate financial, material, equipment, facility, and personnel resources and expertise, or the ability to obtain the resources and expertise, necessary to indicate the capability of the prospective bidder to meet all contractual responsibilities;
 - B. A satisfactory record of performance. Owner shall document the record of performance of a prospective bidder if the Owner finds the prospective bidder not to be responsible under this subsection;
 - C. A satisfactory record of integrity. The Owner shall document the record of integrity of a prospective bidder if the Owner finds the prospective bidder not to be responsible under this subsection;
 - D. Qualified legally to contract with the Owner;
 - E. Supplied all necessary information in connection with the inquiry concerning responsibility. If a prospective bidder fails to promptly supply information requested by the Owner concerning responsibility, the Owner shall base the determination of responsibility upon any available information, or may find the prospective bidder not to be responsible.
 3. The Owner has rejected a bid based upon one or more permissible reasons for rejection set forth in OAR 137-049-0440.
- c. Bidder's representations concerning his qualifications will be construed as a covenant under the Contract. Should it appear that Bidder has made a material misrepresentation, the Owner shall have the right to terminate the Contract for Contractor's breach, and the Owner may then pursue such remedies as exist elsewhere under this Contract, or as otherwise are provided at law or equity.
- d. Any determination that a Bidder is not responsible will be made by the Owner. Such determination will be made in writing and identify the reasons why the Bidder is deemed not responsible. A letter will be sent to the Bidder deemed not responsible, stating the reasons for such determination, and the Bidder's right to request a review of this determination by appeal pursuant to OAR 137-049-0450.
- e. Post-bid Submittals
 1. The selected Bidder shall within 48 hours after notification of his successful Bid submit in writing the following to the Architect:
 - A. A designation of the Work to be performed with the Bidder's own forces; and

- B. The proprietary names and the suppliers of principal Product, Systems, and Equipment proposed for the Work.
2. The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.
 3. Prior to the award of the Contract, the Architect will notify the Bidder in writing if either the Architect or the Owner, after due investigation, has reasonable objection to any person or entity proposed by the Bidder. If the Owner or Architect has a reasonable objection to a proposed person or entity on such List, and refuses in writing to accept such Person or Entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid, or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover not more than the proven difference in cost occasioned by such substitution. The Owner may, at its discretion, accept the increased bid price or disqualify the Bidder. In the event of either withdrawal or disqualification under this paragraph, Bid Security will not be forfeited.
 4. Failure to object to a Manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents, and all Products furnished by the listed Manufacturer must conform to such requirements.
9. **SERVICE OF PROTESTS:** If a bid protest is made, it shall be served to David Doyle, Deschutes County Legal Counsel, 1300 NW Wall Street, Suite 205, Bend, Oregon 97703, in writing within 7 calendar days of mailing of the notice of intent to award letter. The bid protest must specify the grounds for protest.
10. **BID ACCEPTANCE PERIOD:** All bids shall be valid for sixty (60) calendar days from the date of receipt by OWNER. In the event OWNER is unable to contract with the apparent low bidder, OWNER may select the next qualified low bidder, and so on in its discretion.

END OF SECTION

BID FORMS (Attachments A-E)

INDEX OF ATTACHMENTS TO INSTRUCTIONS TO BIDDERS

Attachment A	-	Bid Bond
Attachment B	-	Non-Collusive Affidavit
Attachment C	-	Proposal for Lump Sum Bid
Attachment D	-	Subcontractor Disclosure Form
Attachment E	-	BOLI Requirements Form

Attachment A - Instructions to Bidders

BID BOND

DC 911 PUBLIC SAFETY COMMUNICATIONS FACILITY – OVERTURF BUTTE

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned Bidder, _____
_____ as Principal, and the undersigned Bonding Company,
_____, as

Surety; are hereby held and firmly bound Deschutes County 911, in the Sum of ten (10) percent (%) of Bidder's Bid, _____ Dollars (\$) for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns. Signed, this _____ day of _____, 20_____.

The conditions of the above obligation is such that whereas the Principal has submitted to the OWNER a certain Bid, attached hereto and hereby made part hereof to enter into a contract in writing, for work known as the Overturf Butte Communications build.

NOW THEREFORE,

- a) If said Bid shall be rejected, or in the alternate,
- b) If said Bid shall be accepted the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a Bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid,
- c) Then this obligation shall be void, otherwise the same shall remain in force and effect, it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety has hereunto affixed their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

PRINCIPAL

By: _____

SURETY

By: _____

Attorney-in Fact
Attach Surety's Power of Attorney
for Attorney-in-Fact Signature Requirements

Attachment B - Instructions to Bidders

NON-COLLUSIVE AFFIDAVIT

DC 911 PUBLIC SAFETY COMMUNICATIONS FACILITY – OVERTURF BUTTE

State of _____) ss:

County of _____)

_____, being first duly sworn deposes and says:

That I am the owner, a partner or an officer of _____, the party making the foregoing proposal or bid, that such proposal or bid is genuine and not collusive or sham, that said bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference with any person, to fix the bid price of affiliate or of any other bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any other bidder, or to secure any advantage against Deschutes County 911, or any person interested in the proposed contract, and that all statements in said proposal or bid are true.

Individual, Partner, or Corporate Officer

Subscribed and sworn to before me this _____ day of _____, 20__.

(SEAL) Notary Public for the State of _____

Residing at _____

My commission expires: _____

Attachment C - Instructions to Bidders

PROPOSAL FOR LUMP SUM BID

Project: DC 911 PUBLIC SAFETY COMMUNICATIONS FACILITY – OVERTURF BUTTE
222 NW Skyliner Summit Loop
Bend, Oregon
Date: _____

Bid of _____, a Corporation organized and existing under the laws of the State of Oregon or a Partnership existing under the laws of the State of Oregon, or an Individual doing business as _____, hereinafter called the Bidder.

To: Sara Crosswhite, Technology Director
Deschutes County 9-1-1 Service District (hereinafter called "OWNER")
20355 Poe Sholes Drive
Bend, OR 97701

- 1. The undersigned acknowledges having visited the site and familiarized himself/herself with the local conditions affecting the cost of the work. The undersigned further acknowledges that he/she has received and has familiarized himself/herself with the following:

Bidding and Contract Documents: Addenda(s) _____ through _____
Invitation to Bid
Instructions to Bidders
Attachments to Instructions to Bidders
Deschutes County 911 Contract
Deschutes County 911's General Conditions of the Contract for Construction

Bidder Initials and Date: _____

- 2. In submitting this bid, the undersigned agrees:
 - A. To furnish all material, labor, tools, expendable equipment, and all utility and transportation services necessary to perform and complete, in a workmanlike manner, all the work required for the above-described project in accordance with the contract documents for the consideration hereinafter set forth.
 - B. To hold this bid open for Sixty (60) calendar days after the receipt of bids and to accept the provisions of the Instructions to Bidders and Special Instructions to Bidders regarding disposition of bid security.
 - C. To execute and deliver a contract in the prescribed form if awarded on the basis of this bid, and to furnish a performance and payment security acceptable to the OWNER in accordance with the General Conditions, Instructions to Bidders, and Special Instructions to Bidders within ten (10) days after the contract is presented to him for signature.
 - D. To commence work at the time stipulated in a notice to proceed and to complete the work to Substantial Completion within 98 calendar days after the receipt of the notice to proceed.
- 3. **BASE BID:** The undersigned hereby proposes and agrees to perform the foregoing and to complete the work required for constructing the above-described project:

DC 911 PUBLIC SAFETY COMMUNICATIONS FACILITY – OVERTURF BUTTE

Base Bid: _____

Dollars (\$ _____).

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

4. ALTERNATES:

Alternate A

_____ Dollars (\$ _____)

5. The undersigned has attached the required References, Bid Bond, and Non-Collusive Affidavit;

6. The undersigned **is** or **is not** a resident bidder (circle one). State of Residency_____.

7. The undersigned agrees to be bound by BOLI wage requirements and ORS 279C.840 and ORS 279C.836. BOLI requirements form attached.

8. The undersigned certifies that Bidder has not discriminated against minority, women, or emerging small business enterprises in obtaining any required subcontracts.

In submitting this bid, it is understood that the right to reject any and all bids and to waive irregularities in the bidding has been reserved by Deschutes County 911.

Dated this _____ day of _____, 20_____.

Name of Bidder

Address of Bidder

Authorized Officer Signature

Title & Contractor's License number

Attachment D – Subcontractor Disclosure Form

SUBCONTRACTOR DISCLOSURE FORM

AGENCY SUPPLIED INFORMATION:

PROJECT NAME: DC 911 PUBLIC SAFETY COMMUNICATIONS FACILITY – OVERTURF BUTTE
 BID CLOSING DATE: Thursday, December 12, 2019 Time: 2 p.m.
 REQUIRED DISCLOSURE DEADLINE: Friday, January 3, 2019 Time: 4 p.m.
 Deliver Form to (Agency): DESCHUTES COUNTY 911
 Designated Recipient (Person): Sara Crosswhite, Technology Director
 Agency's Address: 20355 Poe Sholes Drive, Bend OR 97701 if mailing

INSTRUCTIONS:

This form must be submitted at the location specified in the Invitation to Bid on the advertised bid closing date at the time specified on the Invitation to Bid and in the Instructions to Bidders.

List below the Name of each subcontractor that will be furnishing labor or materials and that are required to be disclosed, the category of work that the subcontractor will be performing, and the dollar value of the subcontract. Enter "NONE" if there are no subcontractors that need to be disclosed. (ATTACH ADDITIONAL SHEETS IF NECESSARY.)

BIDDER DISCLOSURE:

	SUBCONTRACTOR NAME	DOLLAR VALUE	CATEGORY OF WORK
1.		\$	
2.		\$	
3.		\$	
4.		\$	
5.		\$	
6.		\$	

Failure to submit this form by the disclosure deadline or in the manner specified by Owner will result in a non-responsive bid. A non-responsive bid will not be considered for award.

Form Submitted by (Bidder Name): _____

Contact Name: _____ Phone No.: _____

Deschutes County 911



REQUEST FOR PROPOSAL REQUIREMENTS

August 1, 2019

Project: Deschutes County 911 Public Safety Communications Facility – Overturf Butte

This is an Oregon Bureau of Labor and Industries (BOLI) prevailing wage project, using the July 1, 2019 BOLI Prevailing Wage Rates and amendments. Workers will be paid the applicable prevailing wage rates. The following items 1-8 will apply to the accepted Contractor. (ORS 279C.830 (1) (c); OAR 839-025-0020 (3) (a).

1. Publications:

- July 1, 2019 Prevailing Wage Rates for Public Works Contracts in Oregon
<http://www.oregon.gov/boli/WHD/PWR/Pages/PWR-Rate-Publications---2019.aspx>
- Amendments as applicable
- BOLI Website <http://www.oregon.gov/boli>

2. If Contractor or subcontractor fails to pay for labor or services, Deschutes County 911 can pay and withhold these amounts from payments due the contractor (Ref. ORS 279C.515).

3. Daily, weekly, weekend, and holiday overtime will be paid as required in ORS 279C.540. (Ref. ORS 279C.520).

4. Employer must give a written schedule to employees showing the number of hours per day and days per week the employee may be required to work (ref. ORS 279C.520).

5. The employer must promptly pay for any medical services they have agreed to pay (Ref. ORS 279C.530; ORS 279C.830; OAR 839-025-0020(2)).

6. Every contract awarded by Deschutes County 911 requires the Contractor to file a public works bond with Construction Contractors Board (CCB) prior to starting work on the project, unless exempt. Contractor to require in every subcontract that the subcontractor file a public works bond with CCB prior to starting work on the project, unless exempt.

7. The Contractor and subcontractors must submit insurance requirements as required by Deschutes County 911, if proposal is accepted. Contact Kimberly.Morse@deschutes.org for specific language and special endorsement guidelines. Insurance documents to be submitted ONLY if Contractor's proposal is accepted.

8. WH-38 BOLI certified payroll reports should be submitted by the 5th business day of the following month to Deschutes County 911. The reports should be numbered or a statement of no work supplied. All forms, including insurance, should be submitted electronically to Kimberly.Morse@deschutes.org or mailed to:

Deschutes County 911
20355 Poe Sholes Dr. #300
Bend, Oregon 97703

Questions regarding certified payroll reports or insurance submittals should be directed to:

Kimberly Morse Kimberly.Morse@deschutes.org 541-322-6102

Company Name: _____

Signature _____ Date _____

**SECTION 02225
TRENCHING****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Excavating trenches for utilities. This includes, but is not limited to: telephone and electrical (as necessary).
- B. Compacted fill from top of utility bedding to sub-grade elevations.
- C. Backfilling and compaction.

1.2 RELATED SECTIONS

- A. Section 02220 - Earthwork.
- B. Section 02231 – Aggregate Base.

1.3 REFERENCES

- A. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- B. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.5 FIELD MEASUREMENTS

- A. Verify that survey benchmark, control point, and intended elevations for the Work are as shown on drawings.

PART 2 – PRODUCTS**2.1 FILL MATERIALS**

- A. Trench Backfill: As specified in the electrical drawings.

PART 3 – EXECUTION**3.1 PREPARATION**

- A. The Contractor shall be responsible for scheduling and coordinating with the commercial power provider. Site walks, estimates, and installation plan have not yet been developed for the commercial power installation.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect trees, plant life, and other features called out to remain.

- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above- and below-grade utilities which are to remain.
- F. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal to or greater than requirements for subsequent backfill material.

3.2 EXCAVATING

- A. Excavate subsoil required for utilities indicated on the drawings.
- B. Cut or re-open trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with work. Provide shoring as required to comply with Department of Labor and Industries requirements. Contractor is responsible for design of shoring means and methods.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- E. Remove lumped subsoil, boulders, and rock up to 1/6 cubic yard by volume.
- F. Correct areas over excavated.

3.3 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen fill materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- D. Employ a placement method that does not disturb or damage utilities in trench, or adjacent structures.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Remove surplus fill materials from site.

3.4 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1/10 foot from the required elevations.

3.5 FIELD QUALITY CONTROL

- A. Compaction testing will be performed by contractor provided testing agency in accordance with ASTM D1557 and ASTM D2922.
- B. If tests indicate Work does not meet specified requirements, remove work, replace, compact, and retest at no additional cost to Deschutes County.

3.6 PROTECTION OF FINISHED WORK

- A. Protect finished Work.

- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

**SECTION 02231
AGGREGATE BASE**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aggregate base course for site finish surfacing.

1.2 REFERENCES

- A. Reference Standards:
 - 1. Oregon Standard Specifications for Construction 2018
 - 2. Compaction standard: Modified Proctor Density ASTM D1557. Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 in. Drop.

1.3 SUBMITTALS

- A. Product Data: Submit gradation for base course, bedding and initial backfill, and drainage gravel.

1.4 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install aggregate base when subgrade is wet, contains excess water, or is frozen.
 - 2. Do not install aggregate base when temperature is 35 degrees F or below.
 - 3. When temperature falls below 35 degrees F, protect areas of completed base course against detrimental effects of freezing.
 - 4. Correct areas that have been damaged by freezing, rainfall, or other weather conditions.

PART 2 - PRODUCT

2.1 MATERIALS

- A. Base Course: Crushed stone, gravel, sand, or other sound, durable materials processed and blended and naturally combined.
 - 1. Aggregates: Untreated Base Course.
 - 2. Aggregate Grading:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/4"	100
3/8"	92 - 77
No. 4	55 - 67
No. 16	27 - 38
No. 200	7 - 11

- a) Plasticity index: Maximum 5.
- b) Percentage of wear: Maximum 40.

PART 3 - EXECUTION

3.1 BASE COURSE DESIGN

- A. Thickness: shall be provided as indicated on drawings.

3.2 EXAMINATION

- A. Verification of Conditions:
 - 1. Layout: Verify layout of work before beginning installation.
 - 2. Subgrade: Examine subgrade to verify elevation and compaction requirements.
 - 3. Notification: Notify Project Manager of unsatisfactory conditions in writing.
 - 4. Acceptance: Beginning work means acceptance of existing conditions.

3.3 PREPARATION

- A. Subgrade:
 - 1. Clean subgrade of foreign substances.
 - 2. Protect previously prepared subgrade from traffic and other operations prior to placement of aggregate base. Maintain previously prepared base in satisfactory condition until aggregate base is placed.
 - 3. Perform minor cut and fill work required to bring grade to correct level to receive aggregate base. Provide smooth unyielding surface to receive aggregate base.

3.4 AGGREGATE BASE INSTALLATION

- A. Aggregate Base:
 - 1. Compaction: Minimum 95 percent of modified density, ASTM D1557 at 2%+/- of optimum moisture.
 - 2. Compacted thickness tolerance: Average thickness within 1/4 inch of indicated or specified thickness, but in no case more than minus 1/2 inch of indicated or specified thickness.
 - 3. Compacted surface tolerance:
 - a) Surface: Smooth and true to established crown and grade.
 - b) Smoothness: Maximum variation of 1/2 inch measured with 10 foot straight edge parallel to and perpendicular to area of aggregate base.
 - 4. Rework areas not complying with tolerances to conform to requirements of this section.

3.5 PROTECTION

- A. Aggregate Base Course: Maintain in satisfactory condition until covered by subsequent layers of construction.

END OF SECTION

**SECTION 02821
CHAIN-LINK FENCES AND GATES**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Chain-Link Fences: Industrial.
 - 2. Gates: swing.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations, components, materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

1.3 QUALITY ASSURANCE

- A. Fence Installer Qualifications: Minimum 5 years experience installing commercial fencing.

PART 2 - PRODUCTS

2.1 GENERAL

- A. For conflicts between drawings and specifications, most stringent requirement shall govern.

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Height indicated on Drawings. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:
 - 1. Steel Wire Fabric: Metallic-coated wire with a diameter of 0.148 inch.
 - a. Mesh Size: 2 inches.
 - b. Metallic (Zinc) Coating: ASTM A 392, Type II.
 - 2. Selvage: Twisted bottom and knuckled top.

2.3 INDUSTRIAL FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
 - 1. Group: IA, round steel pipe, Schedule 40.
 - 2. Fence Height: 6 feet.
 - 3. Strength Requirement: Heavy industrial according to ASTM F 1043.
 - 4. Coating for Steel Framing:
 - a. Metallic coating.

2.4 TENSION WIRE

- A. General: Provide horizontal tension wire at bottom of fence fabric.
- B. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824.
 - 1. Metallic Coating: Type III, Zn-5-Al-MM alloy.

2.5 INDUSTRIAL SWING GATES

- A. General: Comply with ASTM F 900 for double swing gate types.
 - 1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.
- B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:
 - 1. Gate Fabric Height: 2 inches less than adjacent fence height.
 - 2. Leaf Width: As indicated.
 - 3. Frame Members:
 - a. Tubular Steel: 1.66 inches round.
- C. Frame Corner Construction:
 - 1. Welded and 3/8-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches as required to attach barbed wire assemblies.
- E. Hardware: Latches permitting operation from both sides of gate, hinges, center gate stops and keepers for each gate leaf more than 5 feet wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.6 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. zinc.
 - 2. Aluminum: Mill finish.

2.7 BARBED WIRE

- A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A 121; 2-point round barbs spaced not more than 5 inches o.c.

2.8 FENCE GROUNDING

- A. Conductors: See drawings.
- B. Connectors and Grounding Rods: Comply with UL 467.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
- D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment.
- E. Line Posts: Space line posts uniformly at 10 feet o.c.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567. Install braces at end and gate posts and at both sides of corner and pull posts.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing.
- H. Top Rail: Install according to ASTM F 567.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated.
- J. Tie Wires: Attach wire per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- L. Privacy Slats: Install slats in direction indicated, securely locked in place.
- M. Barbed Wire: Uniformly spaced as indicated on Drawings. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

3.2 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.3 GROUNDING AND BONDING

- A. Fence Grounding: See drawings.
- B. Bonding Method for Gates: See drawings.

3.4 FIELD QUALITY CONTROL

- A. Grounding-Resistance Testing: Electrical Contractor's responsibility.

END OF SECTION

**SECTION 13500
PRE-ENGINEERED ANTENNA SUPPORT STRUCTURE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The 70-ft laminated wood pole self-supporting antenna support structure shall be supplied by the Owner. The Contractor shall be responsible for coordinating delivery of the wood pole with the wood pole supplier. This includes arranging for delivery, off-loading, and standing the pole at the specified location as required by the construction drawings.

There will be no antenna, mounts, microwave dish, or waveguide installation as part of this project. Antenna mounts as called out on the Construction Drawing, Overturf Butte DC911 Public Safety Communications Facility, are for illustration only and are not part of this project.

- B. The intent of the contract is to prescribe a complete work. Omissions from the contract of details of work which are necessary to carry out the intent of the contract, or which are customarily performed, shall not relieve the Contractor from performing the omitted work. The equipment shall be complete, installed, and ready for operation by DC911 as required.
- C. Unless specifically excepted by the terms of these specifications, any parts or accessories ordinarily furnished or required to make the equipment herein specified a complete operating unit or system shall be furnished by the Contractor whether directly mentioned in the specifications or not. This also includes excavation, backfilling, removal of excess earth, cleanup, concrete foundations, boxes, anchors, ground rods, etc.

1.02 Not Used

1.03 REFERENCES

- A. The following specifications, rules, regulations, codes, and standards form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue in effect shall apply.

1. TIA: Telecommunications Industry Association TIA-222-G.
2. FAA: Federal Aviation Administration FAA Rule Section 77 Circular 70/7460-IF.
3. FCC: Federal Communications Commission FCC Rule Section 17.
4. ASTM: American Society for Testing and Materials.
5. AISC: American Institute of Steel Construction.
6. AWS: American Welding Society.
7. NESC: National Electrical Safety Code.
8. ACI: American Concrete Institute.
9. NEC: National Electrical Code.
10. AHDGA: American Hot Dip Galvanizers Assoc., Inc.
11. ANSI: American National Standards Institute.
12. OSHA: Occupational Safety and Health Act.
13. MSHA: Mine Safety and Health Act.
14. UBC: Uniform Building Code.

- B. Where conflicts occur between the referenced specifications and these specifications, the one establishing the more stringent requirements shall apply. It is recognized that many of the referenced specifications contain restrictions and requirements that are applicable only to buildings and cannot be applied specifically to antenna support structures. Good engineering judgment is required to correctly interpret and apply the appropriate sections. Contact with the Owner and, through the Owner, the Engineer, is encouraged should questions arise.

1.04 SYSTEM DESCRIPTION

- A. This specification describes a 70-foot self-supporting laminated wood pole, antenna mounts, waveguide supports, foundations, grounding, installation required to supply a complete tower system. The Contractor shall supply a complete system as is standard in the industry even if specific items are not individually identified.

1.06 DESIGN REQUIREMENTS

- A. The pole shall be designed to support all the loads shown on sheet S1 of the Construction Drawings. Mounts are called out on Sheet S1 and shall be provided for the specific antennas.
- B. The pole shall be designed to the following requirements of TIA-222-G as called out on Sheet S1 of the Construction Drawings.
- C. The pole shall be designed by or under the direct supervision of a Oregon State-registered professional structural engineer, specifically experienced in the design of antenna support structures.

1.07 SUBMITTALS

Reserved

1.08 QUALITY ASSURANCE

- A. Material and workmanship shall be of the type and grade most suitable for the application and shall conform as a minimum, unless otherwise specified, to the latest applicable standards, specifications, and recommended practices and procedures of such standardizing bodies as the IEEE, TIA, NEMA, NEC, FCC, etc. In particular, applicable TIA standards shall be fully met except as otherwise specified. Upon completion of installation, all material shall be free from defects, corrosion, scratches, or other such conditions as to present an other-than-new appearance. All of the equipment and material shall be of recent manufacture and design, new and unused.

1.09 REGULATORY REQUIREMENTS

Reserved

1.10 DELIVERY, STORAGE, AND HANDLING

- A. The delivery location:

Overturf Butte, OR, Lat: 44° 3'11.26"N, Long: 121°20'33.26"W, Elev: ~3886 feet AMSL
The overall site is a water tank facility for the City of Bend. Site Access is via paved

roads to the NW tank fence perimeter. The communications facility is located in the SW corner of the tank compound and must be approached over a walking trail. The contractor shall be responsible for delivery to the communications facility location.

- B. The Contractor shall be responsible for delivery, off-loading, and installing the pole according to the manufacturer's requirements and the requirements of the Construction Drawings. The Contractor is responsible for determining that adequate access to the sites exists for the delivery and emplacement.

1.11 ENVIRONMENTAL REQUIREMENTS

Covered in other sections.

1.12 DRAWINGS AND CERTIFICATION

The Contractor shall certify in writing that the pole to be furnished, when supporting the antennas and associated equipment specified herein, will meet the requirements of these specifications. In addition, the Contractor shall supply **two (2) complete sets of detailed as-built drawings**.

These drawings shall outline the method of construction, erection, installation, sizes, and dimensions of all mounts, location, number and sizes of bolts, complete details of all anchorages and foundations required, together with the data of the total maximum forces acting on each anchorage under the maximum load and wind conditions specified. Also, any other pertinent information concerning the pole that might be required for maintenance, installation, erection or mounting future appurtenances thereto, shall be furnished.

PART 2 PRODUCTS

2.01 POLE REQUIREMENTS

The paragraphs following in this section are for information only since the Owner is purchasing the pole.

- A. This section describes the material required for the laminated wood pole. All approvals for substitutions from the materials specified shall be obtained in accordance with the instructions to Bidders. The only acceptable manufacturer is McFarland Cascade, Tacoma, WA. The pole must still meet the requirements of this specification. The pole shall be as described in McFarland Cascade Quote #64891, dated 03/22/19 (see the quote in the Attachments).
- B. The pole shall be of coastal Douglas Fir laminated pole and shall be full length pressure penta treated.
- C. The pole shall be pre-drilled before pressure treatment to accept mounting bolts for all the appurtenances called out on the Construction Drawings. No field modifications will be allowed.

2.02 ANTENNA MOUNTS

- A. This section defines the requirements for supporting antennas.

- B. The pole shall be designed to support all of the listed antennas on Sheet S1 of the Construction Drawing. All mount locations shall be pre-drilled prior to the manufacturer pressure treating the pole. No field drilling will be allowed without approval of the Owner.

2.03 WAVEGUIDE/TRANSMISSION LINE SUPPORTS

- A. The pole shall be pre-drilled to allow lag bolting waveguide support cushions to the pole. The cushions are not installed as part of this work.

2.04 POLE FOUNDATION

For tower foundation materials, see Construction Drawing sheet S1.

PART 3 EXECUTION

3.01 INSTALLERS

The pole installers shall have a minimum of 5 years' experience installing poles of this type and shall provide references of same.

3.02 EXAMINATION

The Contractor shall be responsible for examining the site and topographical conditions. The Contractor shall pay particular attention to the site ground level changes and shall be advised the site is not level.

3.03 PREPARATION

Other sections in this specification reference site and ground preparation. For tower foundations, see Section 03300, "Cast In Place Concrete."

3.04 INSTALLATION

Reserved

3.05 ERECTION TOLERANCES

- A. Alignment of the tower shall be maintained during installation. At completion, the tower shall be plumb within 0.25 percent for self-supporting towers; maximum deviation from a straight line between any two points shall not exceed one part in 1,000. All alignments shall be checked by the double transit method.
- B. All connecting bolts shall be tightened to the proper torque by the "turn-of-nut" method as described in AISC.

END OF SECTION

**SECTION 15000
HVAC**

- 1.0 **This section supersedes Division 15 Section 15000 HVAC on CD A1.0.** See the Attachments section herein for the HVAC that shall be used in this project.
- 2.0 The Contractor shall furnish and install the specified HVAC units and a Bard MC4000 Dual Unit Lead/Lag controller.
- 3.0 The Contractor shall coordinate commissioning and testing using by a factory-authorized technician. Notify the Owner a minimum of 72 hours before testing.

END OF SECTION

**SECTION 16060
GROUNDING AND BONDING**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the specifications for grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections. This section supersedes Section 16450 on the Construction Drawings.

1.2 SUBMITTALS

- A. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Apache Grounding/Erco, Inc.
 - 2. Sankosha USA Inc.
 - 3. Boggs, Inc.
 - 4. Chance/Hubbell.
 - 5. Copperweld Corp.
 - 6. Dossert Corp.
 - 7. Erco Inc.; Electrical Products Group.
 - 8. Burndy Electrical.
 - 9. Galvan Industries, Inc.
 - 10. Harger Lightning Protection, Inc.
 - 11. Hastings Fiber Glass Products, Inc.
 - 12. Heary Brothers Lightning Protection Co.
 - 13. Ideal Industries, Inc.
 - 14. ILSCO.
 - 15. Cooper Power Systems.
 - 16. Korn, C. C. Co.; Division of Robroy Industries.
 - 17. Lightning Master Corp.
 - 18. Lyncole XIT Grounding.
 - 19. O-Z/Gedney Co.; a business of the EGS Electrical Group.

- 20. Raco, Inc.; Division of Hubbell.
- 21. Robbins Lightning, Inc.
- 22. Salisbury, W. H. & Co.
- 23. Superior Grounding Systems, Inc.
- 24. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Terminations"
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.
- C. Grounding Electrode Conductors: No.2 AWG, bare, tinned, solid, unless otherwise indicated.
- D. Underground Conductors: No.2 AWG, bare, tinned, solid, unless otherwise indicated.
- E. Bare, Solid-Copper Conductors: ASTM B 3.
- F. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.
- G. Bare, Tinned-Copper Conductors: ASTM B 33.
- H. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
- I. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- J. Tinned-Copper Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- K. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

2.3 GROUNDING ELECTRODES

- A. Install electrolytic ground rods as noted on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- 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.
- D. Equipment Grounding Conductors: 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.
 - 1. Install insulated equipment grounding conductors in all branch circuits.

2. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways.
- E. Ground Rods:
1. Place electrolytic ground rods per manufacturer's written instructions and as shown on drawings.
 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- F. 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.
- G. 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.
- H. Connections: 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.
 6. 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.
 7. 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.
 8. 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.
 9. 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 and UL 486B.

10. 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.
11. 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.
12. The Contractor is responsible for installation of owner-supplied ground straps, attachment to building exterior and ground system.

3.2 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 indicated and at service disconnect enclosure grounding terminal. 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. Maximum resistance shall be less than 5 ohms. If the measured resistance exceeds 5 ohms notify the Owner's representative immediately.
 3. Provide drawings locating each ground rod, 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.

END OF SECTION

**SECTION 16200
ELECTRICITY METERING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes equipment for utility company's electricity metering.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:
 - 1. Electricity-metering equipment.
- B. Shop Drawings for Electricity-Metering Equipment:
 - 1. Dimensioned plans and sections or elevation layouts.
 - 2. Wiring Diagrams: Power, signal, and control wiring specific to this Project. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
- C. Operation and Maintenance Data: For electricity-metering equipment to include in emergency, operation, and maintenance manuals.

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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Receive, store, and handle modular meter center as specified in NECA 400.

1.6 COORDINATION

- A. Electrical Service Connections: Coordinate with Pacific Power and components they furnish as follows:
 - 1. Comply with requirements of utilities providing current transformers.
 - 2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components. Verify the utility requirement for a 400A, single-phase meter.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company. Verify the meter capacity as 400A, single-phase.
- C. Modular Meter Center: Factory-coordinated assembly of a main service terminal box with lugs only, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.
 - 1. Manufacturers:
 - a. Cutler-Hammer; Eaton Corporation.
 - b. General Electric Company; Electrical Distribution & Control Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D; Schneider Electric.
 - 2. Housing: NEMA 250, Type 3R enclosure.
 - a. Structural strength of the housing, its anchorage and component attachment provisions, and anchorage devices recommended for anchoring the housing in place shall be adequate to prevent separation of equipment and its components from their installed positions during a seismic event. Coordinate subparagraph below with Drawings for indication of available fault current at meter center supply terminals.
 - 3. Minimum Short-Circuit Rating: 22,000 amperes symmetrical at rated voltage.

4. Tenant Feeder Circuit Breakers: Series-combination-rated molded case units, rated to protect circuit breakers in downstream tenant and house loadcenters and panelboards that have 10,000-A interrupting capacity.
 - a. Identification: Provide legend identifying tenant's address.
 - b. Physical Protection: Tamper resistant, with hasp for padlock.
5. Meter Socket: Type as approved by utility company, with rating coordinated with indicated tenant feeder circuit rating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
- C. Install modular meter center according to NECA 400 switchboard installation requirements.

END OF SECTION

**SECTION 16231
EMERGENCY POWER GENERATOR**

PART 1 - GENERAL

- 1.01 The generator, its sound attenuating housing, and the transfer switch are supplied by the Owner. **The Contractor shall be responsible for coordinating the delivery of the unit to the site, its storage if needed, and its installation.** The foundation seismic and mounting requirements on CD C4 are specific to the generator and housing called out in the Attachment section of this document. The Contractor shall be responsible for all installation and connection requirements necessary to provide a working generator system. **Specific configurations described below for the Owner-supplied equipment are retained for descriptive purposes.**
- 1.02 Provide new spark ignited propane fueled, radiator and fan cooled engine-generator set including all necessary controls and accessories which, when used with the engine-generator set, will make a complete operating package for installation up to 4,000 feet above sea level in an ambient temperature of 40 degrees C. maximum, -10 degrees C. minimum.
- 1.03 The generator shall be capable of delivering rated output (38 kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.
- 1.04 The generator set manufacturer shall warrant all equipment provided under this section regardless of whether or not equipment is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.
- 1.05 The engine-generator set and accessories shall comply with the requirements of the National Electrical Code and NFPA 37 Combustion Engines and Gas Turbines.
- 1.06 Design Basis – Project design parameters were modeled using Cummins Powersuite Gensize software. Design basis for this project is a Cummins Model C30 N6 30kW/38kVA Propane Standby Generator Set.

PART 2 - MATERIALS

- 2.01 Manufacturers: Engine-generator set and accessories shall be Cummins.
- 2.02 SPEED
- A. The generator set shall operate at 1800 rpm and at a voltage of 120/240 Volts AC, single phase, 60 Hertz.
- 2.03 RATING
- A. 1-Phase: Generator to be provided with alternator to supply 100% full 1-phase kW rating at 1.0 power factor.

2.04 GOVERNOR

The engine speed shall be controlled by a governor to maintain governed speed within plus or minus (+/-) 3 Hertz of 60 Hertz (speed regulation 5 percent) from no load to full load generator output. The steady state frequency at any constant load, including no load, shall be maintained within a band of plus or minus (+/-) 0.25 Hertz. The governor shall not permit frequency modulation (defined as the number of times per second that the frequency varies from the average frequency in cyclic manner) to exceed one Hertz per second.

2.05 FUEL SYSTEM

The fuel system shall be the normal fuel system used by the engine manufacturer. . . . The fuel system shall be plumbed to the generator set pad for ease of site connections to the generator set.

2.06 EXHAUST SYSTEM

The exhaust system is an integral part of the housing specified in the Attachment section.. .

2.07 AUTOMATIC CONTROLS

Fully automatic engine-generator set start-stop controls (located in the generator control panel) shall be provided. "Start" shall be initiated immediately on closing of the starting contact in an automatic transfer switch (see paragraph 2.9). After the starting contact has opened (transfer of all loads back to the normal power source) the unloaded engine shall continue to run for cool-down for an adjustable period of approximately 0-15 minutes, set at 10 minutes. These controls shall provide engine shutdown on low lubricating oil pressure, excessive engine temperature, overspeed, and overcrank, and one auxiliary contact for activating accessories. The controls shall include a cranking timer with limit lockout. The control panel shall indicate the following alarm and status conditions:

1. Low oil pressure (alarm)
2. Low oil pressure (shutdown)
3. Low coolant temperature (alarm)
4. High coolant temperature (alarm)
5. High coolant temperature (shutdown)
6. Low coolant level (shutdown)
7. Overcrank (shutdown)
8. Overspeed (shutdown)
9. Ground fault (alarm)(optional—when required by code or specified)
10. In addition, provisions shall be made for indication of two customer-specified alarm or shutdown conditions.

2.08 ENGINE STATUS MONITORING

The following devices shall be provided on the generator set control:

1. Engine oil pressure gauge
2. Engine coolant temperature gauge
3. Engine operation hour gauge
4. Battery Voltage (DC volts)

2.09 CONTROL INTERFACES FOR REMOTE MONITORING

Provide the following features in the control system:

1. Form "C" dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.
2. One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.
3. A fused 10 amp switched 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
4. A fused 20 amp 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

2.10 AUTOMATIC TRANSFER SWITCH

The automatic transfer switch shall be provided by the Owner. The Contractor shall coordinate with DC911 and shall be responsible for delivery to the site and storage at the site. The Contractor shall provide a complete, tested and fully operational system. Switch shall be rated for the voltage and amperage indicated on the drawings and shall conform with UL Standard 1008. In addition, the switch shall meet the following requirements:

1. Shall be supplied by the generator manufacturer and certified as compatible with the generator supplied by the manufacturer.
2. Shall be electrically operated, mechanically held and supplied with positive mechanical interlocking.
3. Main contacts shall be capable of manual override without exposing personnel to shock hazard.
4. Shall have two pilot lights indicating transfer position as well as corresponding auxiliary contacts for remove annunciation.
5. Shall have test switch for simulating a power failure.
6. Shall have 1-phase voltage failure with adjustable drop out and pick-up.
7. Shall be equipped with adjustable time-delays for engine start, transfer and retransfer signals. Transfer signal shall be used to provide pre-transfer signal to an elevator where applicable.
8. Shall be equipped with (2) sets of auxiliary contacts for transmission of customer provided signal(s).
9. Shall be equipped with exerciser clock to meet NEC 700-4 requirements.

2.11 JACKET WATER HEATER

A water heater with integral thermostatic switch shall be provided to maintain engine jacket water at a temperature which will allow the engine-generator set to meet the 6 second

acceptance of full rated load as specified above in an ambient temperature of 0 degrees F. The heater shall operate on 120 or 240 volts, single phase, 60 Hertz, A.C.

2.12 GENERATOR CIRCUIT BREAKER

Molded case type sized to carry the rated output current of the generator set on a continuous basis.

2.13 BATTERIES

Provide a lead-acid storage battery set of the heavy duty truck engine starting type with #4/0 minimum cables. Provide a corrosion resistant battery rack with seismic restraint battery hold down clamps. Provide hi-low battery monitoring status alarms for local and remote annunciation.

2.14 BATTERY CHARGER

A current limiting voltage compensated battery charger shall be furnished to automatically recharge the batteries. The charger shall operate on 120 volts, single phase. Provide an alarm contact for remote annunciation of battery charger loss of output. When located on set mount via vibration isolators.

2.15 FUEL TANK

Remote propane fuel tank(s) provided by others. Generator control panel shall be capable of remote alarms annunciation for the following conditions:

2.16 ENGINE COOLING

Closed loop, liquid cooled, with radiator unit mounted on generator skid and integral engine driven coolant pumping. Radiator shall be provided with duct adaptor flange. Fill cooling system with 50/50 ethylene glycol/water mixture.

PART 3 - DESIGN & INSTALLATION CRITERIA

3.01 SHOP DRAWINGS

Furnish and submit to Owner complete shop drawings showing all system components, interconnect diagrams, silencer, battery charger, jacket water heater, annunciator, etc.

3.02 COORDINATION

Based on the actual installation requirements for the generator selected the contractor shall coordinate with other disciplines to ensure proper installation and operation. Notify Architect and Owner immediately if a conflict appears to existing.

3.03 SUPPLIER COORDINATION

Coordinate with the generator supplier to ensure that all installation provisions are made properly and in a timely manner to meet all construction schedule requirements.

3.04 OWNER ALARM ANNUNCIATION COORDINATION

Contractor shall coordinate and provide (or assist in provision where supplied by others) all controls wiring and connections for owner required alarm annunciation circuits. Utilize generator control panel and transfer switch auxiliary control points and circuits as needed.

3.05 MOUNTING

See Construction Drawing sheet C4 for mounting details. Mounting details, including seismic requirements, are detailed on CD sheet C4. Any change in the mounting configuration requires the Contractor to provide the appropriate structural engineering calculations and drawings performed by a State of Oregon Registered Structural Engineer.

3.06 SERVICE EQUIPMENT SIGN

Provide sign at service entrance main disconnect to identify type and location of on-site emergency power source per NEC 700-8.

3.07 GENERATOR TESTING

The Contractor shall coordinate testing by a factory authorized representative of the manufacturer who shall conduct tests to confirm satisfactory operation of the generator and all associated components. Submit proposed test dates to the Owner's Representative two weeks in advance. All tests shall be documented in written form and submittal to the Owner's Representative within seven days of completion. Tests shall include the following:

- A. Perform 2-hour on-site running test documenting all conditions (i.e. voltage, frequency, temperature, oil pressure, etc.) on ½ hour intervals.
- B. Perform 4-hour on-site load bank test by applying 100% full load and documenting all conditions (including fuel consumption) on ½ hour intervals.
- C. Simulate all generator and owner required alarm conditions to confirm local alarm panel operation and remote alarm annunciation.
- D. Test all aspects of the sequence of operation by initiating engine start and transfer from the automatic transfer switch. Testing shall include simulating return of utility power and show engine cool down sequence.
- E. Test all time-delays for engine start, transfer and retransfer signals.

3.08 INSTRUCTIONS

The contractor and generator supplier shall conduct a 4-hour training session on site with staff selected by the Owner. Session shall be scheduled at least 2-weeks in advance.

3.09 O&M MANUAL

Provide Operations and Maintenance Manuals including all maintenance procedures, checklists and forms as well as complete parts lists and ordering information. Manuals shall also include all original shop drawing materials and copies of all test documentation. Two manuals shall be provided, contained in binders.

END OF SECTION

**SECTION 16500
LIGHTING**

- 1.0 See the Attachment section of this document for the specific luminaires that shall be used in this work.

END OF SECTION

ATTACHMENTS

Attachment F – Geotech Report

Attachment G– Wood Pole Cut Sheet and Calculations

Attachment H – HVAC Cut Sheet

Attachment I - Generator Cut Sheet and Calculations

Attachment J – Lighting Cut Sheet

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**Report of
Geotechnical Investigation
Overturf Butte Radio Tower
222 NW Skyliner Summit Loop
Bend, Oregon**

CGT Project Number G1804866

Prepared for

ADCOMM Engineering Co.
Attn: Mr. Joe Blaschka, P.E.
3929 184th Place SE
Bothell, Washington 98012

August 2, 2018

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**Report of
Geotechnical Investigation
Overturf Butte Radio Tower
222 NW Skyliner Summit Loop
Bend, Oregon**

CGT Project Number G1804866

Dear Mr. Blaschka:

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing our geotechnical investigation for the proposed Overturf Butte Radio Tower project. The site is located at 222 NW Skyliner Summit Loop in Bend, Oregon. We performed our work in general accordance with CGT Proposal GP8070, dated May 22, 2018. Written authorization for our services was received on May 29, 2018. We appreciate the opportunity to work with you on this project. Please contact us at 503.601.8250 if you have any questions regarding this report.

Respectfully Submitted,
CARLSON GEOTECHNICAL



EXPIRES: 6/30/2020

Brad M. Wilcox, P.E., G.E.
Principal Geotechnical Engineer
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1.0 INTRODUCTION

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this report summarizing our geotechnical investigation for the proposed Overturf Butte Radio Tower project. The site is located at 222 NW Skyliner Summit Loop in Bend, Oregon, as shown on the attached Site Location map, Figure 1.

1.1 Project Description

CGT developed an understanding of the project based on our correspondence with C.A. Rowles Engineering (CAR), and review of the conceptual site plan provided by CAR. Based on our review, we understand the project will include installation of a 40-foot tall, steel-framed, radio tower at the site. The tower will be located southwest of two existing water tanks (to remain) at the site. The project will also include construction of a small shelter building and appurtenant underground utilities. Permanent grade changes at the site are anticipated to be minimal, with cuts and fills limited to 4 feet in depth.

1.2 Scope of Work

Our geotechnical investigation services included the following:

- Contact the Oregon Utility Notification Center to mark the locations of underground utilities at each site within a 30-foot radius of our borings.
- Explore subsurface conditions at the site by advancing two rock core borings to depths of up to about 12½ feet below ground surface (bgs).
- Classify the soils and rock encountered in the borings in general accordance with the American Society for Testing and Materials (ASTM) D2488 (Visual-Manual Procedure) and Oregon Department of Transportation (ODOT) Soil and Rock Classification Manual, respectively.
- Collect representative, disturbed samples of the soils and rock encountered within the borings in order to perform laboratory testing and visual examination.
- Perform laboratory testing of samples taken from within the borings to confirm our field classifications to help estimate in-situ properties, as well as estimate soil and rock strength parameters.
- Provide a site vicinity map and a site plan showing the approximate locations of the subsurface explorations relative to existing site features.
- Provide logs of the explorations, including results of the referenced laboratory testing.
- Provide a technical narrative describing the completed field investigation, descriptions of the subsurface materials encountered in the explorations, and a discussion of groundwater conditions.
- Provide recommendations for use in design and construction of slab-on-grade (mat) foundations.
- Provide geotechnical recommendations for soil parameters for use (by others) in the design of the drilled pier foundations, and construction practices for drilled pier installation.
- Provide geotechnical recommendations for soil parameters for use (by others) in the design of the micro-pile foundations.
- Perform geotechnical analyses to assign the Seismic Site Class and ground motion values in accordance with ASCE 7-10, Chapter 20, for seismic design.
- Provide a written report summarizing the results of our geotechnical investigation.



2.0 SITE DESCRIPTION

2.1 Site Geology

Based on available geologic mapping¹ of the area, the site is underlain by columnar-jointed basalt (Pleistocene and Pliocene). The unit is gray or dark gray and varies from aphyric to moderately porphyritic with phenocrysts of plagioclase and olivine. Locally, this unit erupted from several dissected cinder cones in the central and southern parts of the mapped area, the largest of which is Overturf Butte (230 feet high), the location of the site.

2.2 Site Surface Conditions

A layout of the project site is depicted on the attached Site Plan, Figure 2. The proposed tower is located southwest of two existing water tanks on Overturf Butte as shown therein. The area of the proposed tower is located within an unimproved portion of the facility and surfaced with short grasses and scattered trees. In terms of topography, the area of the proposed tower gently ascends to the southwest.

3.0 FIELD INVESTIGATION

3.1 Drilled Borings

CGT observed the advancement of two drilled borings (B-1 and B-2) at the site on June 5, 2018. The approximate locations of the borings are shown on the attached Site Plan. The locations shown therein were measured relative to existing site features (e.g. fence lines) and should be considered approximate. The borings were advanced using a CME 55, track-mounted drill rig provided and operated by our subcontractor, Western States Soil Conservation of Hubbard, Oregon. Upon completion, the borings were backfilled with cuttings and granular bentonite.

The borings were initially advanced using the mud rotary drilling technique. Where intact rock was encountered, the borings were advanced using an HQ rock coring assembly, consisting of a 61.1-millimeter (2.4-inch) inner diameter, triple-tube core barrel. The maximum core run length was 5 feet. The Rock Quality Designation (RQD) was measured in the field on each rock core interval, and obtained by taking the sum of core pieces in excess of 4 inches and dividing by the total length of the core run (expressed as a percentage). RQD provides a general indication of the degree of jointing or fracturing in a rock mass. Photographs of the rock cores are shown on the attached Figure 3.

3.2 Material Sampling & Logging

A member of CGT's geotechnical staff collected the samples and logged the soils in general accordance with the Visual Manual Procedure (ASTM D2488). An explanation of that procedure is provided on the attached Soil Classification Criteria and Terminology, Figure 4. Rock observed in the borings was classified in accordance with the Oregon Department of Transportation (ODOT) Soil and Rock Classification Manual². An explanation of rock classification is shown on the attached ODOT Rock Classification Criteria and Terminology, Figure 5. The rock core samples were stored in cardboard rock

¹ Mimura, Koji, Reconnaissance Geologic Map of the West Half of the Bend and the East Half of the Shevlin Park 7½-minute Quadrangles, Deschutes County, Oregon, U.S. Geological Survey, Miscellaneous Field Studies Map MF-2189.

² Oregon Department of Transportation Highway Division, 1987.



core boxes and transported to our laboratory for further examination and testing. Our geotechnical staff visually examined all samples returned to our laboratory in order to refine the initial field classifications.

4.0 LABORATORY TESTING

Three compressive strength tests were performed on intact rock core samples, in general accordance with ASTM D7012 - Standard Test Methods for Compressive Strength of Intact Rock Core Specimens (Method C). Intact rock core specimens were prepared in general accordance with ASTM D4543 – Standard Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerances. Results of the compressive strength tests are shown on the attached Boring Logs, Figures 6 and 7.

5.0 SUBSURFACE CONDITIONS

5.1 Soils & Rock

The attached Boring Logs, Figures 6 and 7, provide detailed descriptions of subsurface conditions encountered in each boring. Elevations on the logs were estimated from Google Earth and should be considered approximate. The following describes the subsurface materials encountered at the site.

Silty Sand (SM): Silty sand was encountered at the surface of each boring and extended to depths of about ½ to 2½ feet bgs. The silty sand was generally loose, brown, dry, fine- to medium-grained, and contained varying amounts of subangular gravel and cobbles up to about 6 inches in diameter.

Basalt (RX): Basalt was encountered below the silty sand in each boring and extended to the full depths explored, about 11½ to 12½ feet bgs. The basalt was generally hard (R3 to R4), fresh, gray to red, and highly fractured, and exhibited variable degrees of jointing (RQD values ranged from 0 to 33). No obvious voids were encountered within the basalt.

5.2 Groundwater

Groundwater was not encountered within the depths explored in the borings advanced in June 2018. To determine approximate regional groundwater levels in the area, we researched well logs available on the Oregon Water Resources Department (OWRD)³ website for wells located within Section 31, Township 17 South, Range 12 East, Willamette Meridian. Our review indicated that groundwater levels in the area generally in excess of 300 feet bgs. It should be noted groundwater levels vary with local topography. In addition, the groundwater levels reported on the OWRD logs often reflect the purpose of the well, so water well logs may only report deeper, confined groundwater, while geotechnical or environmental borings will often report any groundwater encountered, including shallow, unconfined groundwater. Therefore, the levels reported on the OWRD well logs referenced above are considered generally indicative of local water levels and may not reflect actual groundwater levels at the project site. We anticipate that groundwater levels will fluctuate due to seasonal and annual variations in precipitation,

³ Oregon Water Resources Department, 2018. Well Log Records, accessed July 2018, from OWRD web site: http://apps.wrd.state.or.us/apps/gw/well_log/.



changes in site utilization, or other factors. The near-surface, silty soils are conducive to the formation of perched water, particularly during or after rainy weather.

6.0 SEISMIC CONSIDERATIONS

6.1 Seismic Hazards

6.1.1 Liquefaction

In general, liquefaction occurs when deposits of loose/soft, saturated, cohesionless soils, generally sands and silts, are subjected to strong earthquake shaking. If these deposits cannot drain quickly enough, pore water pressures can increase, approaching the value of the overburden pressure. The shear strength of a cohesionless soil is directly proportional to the effective stress, which is equal to the difference between the overburden pressure and the pore water pressure. When the pore water pressure increases to the value of the overburden pressure, the shear strength of the soil approaches zero, and the soil can liquefy. The liquefied soils can undergo rapid consolidation or, if unconfined, can flow as a liquid. Structures supported by the liquefied soils can experience rapid, excessive settlement, shearing, or even catastrophic failure.

For fine-grained soils, susceptibility to liquefaction is evaluated based on penetration resistance and plasticity, among other characteristics. Criteria for identifying non-liquefiable, fine-grained soils are constantly evolving. Current practice⁴ to identify non-liquefiable, fine-grained soils is based on plasticity characteristics of the soils, as follows: (1) liquid limit greater than 47 percent, (2) plasticity index greater than 20 percent, and (3) moisture content less than 85 percent of the liquid limit. Soils identified as susceptible to liquefaction are analyzed using the industry standard "simplified procedure", originally published by Seed and Idriss⁵ in 1971 and updated continually since that time. The susceptibility of sands, gravels, and sand-gravel mixtures to liquefaction is typically assessed based on penetration resistance, as measured using SPTs, CPTs, or Becker Hammer Penetration tests (BPTs).

Based on the lack of saturated conditions and presence of near surface basalt bedrock, the soils encountered at the site are considered non-liquefiable within the depths explored.

6.1.2 Slope Instability

Recognizing the relatively gently-sloped topography and presence of near surface basalt bedrock, the risk of seismically-induced slope instability at the site is considered low. Review of the Statewide Landslide Information Database for Oregon (SLIDO)⁶, available at the DOGAMI website, shows no historic or prehistoric landslides mapped on, or adjacent to, the site.

⁴ Seed, R.B. et al., 2003. Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework. Earthquake Engineering Research Center Report No. EERC 2003-06.

⁵ Seed, H.B., and Idriss, I.M., 1971, Simplified Procedure for Evaluating Soil Liquefaction Potential, Journal of Geotechnical Engineering Division, ASCE, 97(9), 1249-1273.

⁶ Oregon Department of Geology and Mineral Industries, 2018. Statewide Landslide Information Database for Oregon (SLIDO), accessed July 2018 from DOGAMI web site: <http://www.oregongeology.org/sub/slido/index.htm>.



6.1.3 Surface Rupture

6.1.3.1 *Faulting*

Although the site is situated in a region of the country with known active faults and historic seismic activity, no known faults exist on or immediately adjacent to the site. Therefore, the risk of surface rupture at the site due to faulting is considered low.

6.1.3.2 *Lateral Spread*

Surface rupture due to lateral spread can occur on sites underlain by liquefiable soils that are located on or immediately adjacent to slopes steeper than about 3 degrees (20H:1V), and/or adjacent to a free face, such as a stream bank or the shore of an open body of water. During lateral spread, the materials overlying the liquefied soils are subject to lateral movement downslope or toward the free face. Given the lack of liquefiable soils at the site, the risk of lateral spread is considered negligible.

6.2 **Seismic Site Class**

Based on the results of the explorations and review of geologic mapping, we have assigned the site as Site Class C for the subsurface conditions encountered in accordance with Table 1613.5.2 of the 2014 Oregon Structural Specialty Code (OSSC). Recommendations for seismic ground motion values at the site are presented in Section 8.5 of this report.

7.0 **CONCLUSIONS**

Based on the results of our geotechnical investigation and analyses, the project may proceed as described in Section 1.1 of this report. Subject to the review of the foundation designer, the tower could be supported on a buried mat ("pad and pedestal") foundation with the option of supplemental lateral (uplift) support from micro-piles. Micro-piles, properly designed for structural integration with the mat foundation, could provide increased lateral capacity in the form of uplift and compressive resistance while reducing the otherwise necessary overall size of the mat footprint. Micro-piling is conventionally designed based on skin friction, ignoring tip resistance. Geotechnical recommendations specific to buried mat and micro-pile foundations are presented in Sections 8.1 and 8.2 of this report, respectively.

The tower may also be supported on a drilled pier foundation. Geotechnical recommendations for use in design and construction of drilled pier foundations are presented in Section 8.3 of this report.

8.0 **RECOMMENDATIONS**

The following paragraphs present options for supporting the proposed tower based on the results of the geotechnical investigation.

8.1 **Buried Mat ("Pad & Pedestal") Foundation**

8.1.1 Foundation Excavation

The primary geotechnical consideration for constructing a buried mat foundation at this site is the depth of required excavation. In the event that cuts need to extend into the fresh basalt (RX) at the tower site (as expected), hydraulic hammering will likely be required for excavation and removal.



In dry working conditions, we anticipate that conventional earthmoving equipment with rock teeth in proper working condition should be capable of making cuts in the surficial silty sand (SM). For use in the planning and construction of temporary excavations at the site, an OSHA soil type “C” should be used for the native silty sand. Sidewall instability should be expected in dry granular soils, or if seepage occurs, particularly during or after heavy rains. If seepage is encountered that undermines the stability of the excavation, or caving of the sidewalls is observed during excavation, the sidewalls should be flattened or shored.

It is the contractor's responsibility to select the excavation methods, to monitor site excavations for safety, and to provide any shoring required to protect personnel and adjacent improvements. All excavations should be in accordance with applicable OSHA and state regulations. A “competent person”, as defined by OSHA, should be on-site during construction in accordance with regulations presented by OSHA.

8.1.2 Minimum Foundation Embedment

To help mitigate potential frost action, mat foundations should be founded a minimum of 18 inches below the lowest, permanent, adjacent grade.

8.1.3 Subgrade Preparation

We recommend that the mat foundation be founded on a minimum 6-inch-thick “leveling course” placed on the native basalt bedrock (RX). The leveling course should conform to the recommendations presented in Section 8.4.3 of this report. The geotechnical engineer or his representative should observe preparation of the completed mat foundation excavation to confirm suitable subgrade conditions. Although not expected, in the event that soft, organic, or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the geotechnical engineer or his representative. The resulting over-excavation should be brought back to grade with imported granular structural fill as described in Section 8.4.2 of this report. All granular pads for footings should be constructed a minimum of 6 inches wider on each side of the footing for every vertical foot of over-excavation.

8.1.4 Bearing Pressure & Settlement

For mat foundations founded as described above, we recommend a maximum allowable soil bearing pressure of 6,000 pounds per square foot (psf). This bearing pressure is a net bearing pressure, applies to the total of dead and long-term live loads, and may be increased by one-third when considering seismic or wind loads. For foundations founded as recommended above, total settlement of foundations is anticipated to be less than ½ inch. Differential settlement (“tilt”) of mat foundations is anticipated to be less than ¼ inch.

8.1.5 Modulus of Subgrade Reaction

For mat foundations founded as recommended above, a modulus of subgrade reaction up to 500 pounds per cubic inch (pci) may be used for design.

8.1.6 Lateral Capacity

A maximum passive (equivalent-fluid) earth pressure of 300 pounds per cubic foot (pcf) is recommended for design for footings confined by the native basalt bedrock or imported granular structural fill that is



properly placed and compacted during construction. The recommended earth pressure was computed using a factor of safety of 1½, which is appropriate due to the amount of movement required to develop full passive resistance. In order to develop the above capacity, the following should be understood:

1. Concrete must be poured neat in the excavation or the perimeter of the foundation must be backfilled with imported granular structural fill,
2. The adjacent grade must be level or rising away from the footing,
3. The static ground water level must remain below the base of the foundation throughout the year, and
4. Adjacent development (e.g., slabs, pavements, etc.) and/or the upper 12 inches of adjacent unpaved, structural fill areas should not be considered when calculating passive resistance.

An ultimate coefficient of friction equal to 0.45 may be used when calculating resistance to sliding for footings founded as recommended above.

8.2 Micro-Pile Foundations

8.2.1 General Discussion

Micro-piles consist of small diameter, high-quality steel, hollow bars typically drilled and grouted into place using a hydraulic rotary (electric, diesel, or pneumatic), track- or truck-mounted, drill rig or drill attachment to track-mounted equipment. Compression (and tension, if required) loads applied at the top of the micro-pile are resisted through grout-to-ground bond strength over a specified length of the micro-pile, referred to as the bond zone or bond length. Due to their relatively small cross-sectional area, resistance developed at the base of the micro-pile is typically ignored in design calculations. For design, the ultimate capacity of the micro-pile is the same in compression and tension (uplift).

The means and methods for drilling and grouting of micro-piles are typically determined by specialty contractors based on their experience with the specific soil conditions. Accordingly, it is recommended that qualified, experienced micro-pile contractor(s) be consulted during the planning phase to participate in selecting method(s) of installation, as well as sizing, locations, and other criteria related to micro-piles.

The geotechnical recommendations presented in the following section are based on design methodology presented in FHWA NHI-05-039⁷, and assume the micro-pile design (including structural capacity) will rest with the structural engineer. If alternative methodology is used, CGT should be consulted for method-specific geotechnical recommendations.

8.2.2 Geotechnical Bond Capacity

For purposes of design and planning, allowable/design axial loads for the micro-piles considering development of grout-to-ground bonding may be based on the following equation⁸:

$$P_{G\text{-allowable}} = [\alpha_{\text{bond}} / \text{FS}] * [3.14 * D_b * L_b]$$

⁷ Micro-pile Design and Construction Manual, Publication No. FHWA NHI-05-039, December 2005.

⁸ Equation 5-9 of FHWA NHI-05-039.



where:	$P_{G\text{-allowable}}$ = Allowable axial load in tension or compression. To be determined by designer.
	α_{bond} = Grout-to-ground bond stress between the subsurface material and the grout.
	FS = Factor of safety used in calculating bond length. Subject to review of the micro-pile designer, a minimum factor of safety of 2 is recommended.
	D_b = Diameter of grout column. To be determined by designer.
	L_b = Bond length of grout column. To be determined by designer.

With regard to micro-pile design, we recommend the highly fractured basalt (RX) be classified as “Gravel (some sand) (medium dense-very dense)” in accordance with Table 5-3 of the FHWA micro-pile manual. An ultimate grout-to-ground bond strength, α_{bond} , equal to 38 pounds per square inch (psi) is recommended for use in preliminary design of micro-piles deriving capacity (bonding) within the on-site weathered basalt. Please note this value reflects the “middle of range” reported for the soil description and micro-pile “Type B” as shown in Table 5-3 of the referenced FHWA manual. The use of micro-pile “Type B” is presented in conformance with Section 5.9.2 of the FHWA manual and is subject to the grouting method preferred by the micro-pile contractor. Accordingly, the value presented for α_{bond} is recommended for preliminary design and planning.

8.2.3 Lateral Capacity

Design procedures for analyzing a single, vertical micro-pile for lateral loading and/or overturning moments are presented in Section 5.18 of the referenced FHWA micro-pile manual. The soil parameters presented below for drilled piers may be used for analyzing vertical micro-piles for lateral loading conditions in industry-standard software (such as LPILE™). It should be noted that individual vertical micro-piles do not offer much lateral load-carrying capacity. Battered micro-pile groups may be considered to provide additional resistance to lateral loading as detailed in Section 5.19.4 of the referenced FHWA micro-pile manual.

8.2.4 Load Testing

The load test program requirements, including actual number of load tests, load increments used during testing, and duration, will rest with the foundation designer. Guidelines for load testing of micro-piles are provided in Sections 5.9.2 and 7.6 of the referenced FHWA manual. The geotechnical engineer or his representative should witness the installation of test and production piles, and all phases of load testing performed at the site.

8.3 **Drilled Pier Foundations**

8.3.1 Construction Considerations

General: Drilled piers are installed by depositing concrete into an uncased or cased shaft excavation. Depending on the design depths of the piers, sloughing and/or sidewall instability of the near surface silty sand (SM) may occur because of the drilling operations, particularly in uncased shaft excavations. Accordingly, the foundation contractor should have suitable experience with installation of drilled piers under unstable conditions. Temporary steel casing may be required to properly drill and maintain open shaft excavations prior to placing concrete. The drilled pier contractor may choose to step-case the



excavation, using larger diameter casings near the surface. As a result, concrete quantities will be somewhat above the neat volumes indicated by the plans for the piers themselves.

Equipment: It is the contractor's responsibility to select the type of drilling rigs and tools that are to be used to construct drilled piers. It is highly recommended that the drilling contractor review the attached boring logs (Figures 6 and 7) and become familiar with site subsurface conditions.

Inspection: Each pier excavation should be verified by inspection and measurements in order to confirm the excavations have been extended to the recommended design depth. The geotechnical engineer or his representative should inspect the bearing material(s), plumbness and eccentricity of the excavations, reinforcing steel placement, and pier configuration prior to placement of concrete.

Cleaning: Loose material should be removed from the bottom of the pier excavations. The drilling contractor should be prepared to clean out the bottom of the pier excavations so that no disturbed materials remain above the bearing surface. As a minimum, we recommend that the drilling contractor have a clamshell bucket or a cleanout bucket on site to remove disturbed materials from the bottoms of the pier excavations, if present.

Dewatering: Although groundwater was not encountered in the borings, depending on the time of year that drilled shaft construction occurs, dewatering of the pier excavations may be required prior to concrete placement. Some localized, short-term seepage is a potential in the shallow basalt due to potential perched groundwater conditions, particularly during, or after, rainy weather. If groundwater is present within the pier excavation(s), foundation concrete should be tremied from the bottom of the excavation to displace the water and minimize the risk of contaminating the concrete mix. As a guideline, we recommend concrete be placed by tremie methods if more than 3 inches of fluid water has accumulated or remains in the pier excavation.

Concrete Placement: Drilled pier concrete should be placed as soon as possible after completion of drilling and cleaning. We recommend that the allowable time between the completion of drilling and placement of concrete not exceed 24 hours. If casing is used for pier construction, it should be withdrawn in a slow continuous manner, maintaining a sufficient head of concrete inside and above the casing bottom to reduce the possibility of the creation of voids and/or necking-down in the shaft concrete. The bottom of the tremie chute should be maintained at least 3 feet below the surface of the concrete. Drilled pier concrete should have a relatively high fluidity when placed in cased holes. As a guideline, concrete with a slump in the range of 6 to 8 inches for dry shaft construction, and 7 to 9 inches for wet shaft construction is recommended. In addition, an air content of approximately 6 percent is recommended during placement. These guidelines are subject to review of the pier designer.

Free-fall of the concrete during placement in a dry, drilled pier excavation will only be acceptable if provisions are taken to avoid striking the concrete on the sides of the hole and reinforcing steel. The use of a bottom-dump hopper, or tremie chutes near the bottom of the hole to minimize concrete segregation, is recommended. Maximum heights of free-fall should not exceed 5 feet.



8.3.2 Design Considerations

Geotechnical recommendations for use in design of drilled pier foundation(s) are presented in the attached Appendix A.

8.4 **Structural Fill Materials**

The geotechnical engineer should be provided the opportunity to review all materials considered for use as structural fill a minimum of five business days prior to placement. The geotechnical engineer or his representative should be contacted to evaluate compaction of structural fill as the material is being placed. Evaluation of compaction may take the form of in-place density tests and/or proof-roll tests with suitable equipment. Compaction of structural fill should be evaluated at intervals not exceeding every 2 vertical feet as the fill is being placed.

8.4.1 On-Site Soils (General Use)

Recognizing the relatively limited grading (fill placement) associated with this project, soil moisture sensitivity, and other special considerations; we do not recommend the on-site materials be re-used as structural fill. We recommend using imported granular material for structural fill as described below.

8.4.2 Imported Granular Structural Fill (General Use)

Imported granular structural fill should consist of angular pit or quarry run rock, crushed rock, or crushed gravel that is fairly well graded between coarse and fine particle sizes. The granular fill should contain no organic matter, debris, or particles larger than 4 inches, and have less than 8 percent material passing the U.S. Standard No. 200 Sieve. For fine-grading purposes, the maximum particle size should be limited to 1½ inches. The percentage of fines can be increased to 15 percent of the material passing the U.S. Standard No. 200 Sieve if placed during dry weather, and provided the fill material is moisture-conditioned, as necessary, for proper compaction. Imported granular fill material should be compacted to not less than 95 percent of the material's maximum dry density, as determined in general accordance with ASTM D1557 (Modified Proctor). Proper moisture conditioning and the use of vibratory equipment will facilitate compaction of these materials.

Granular fill materials with high percentages of particle sizes in excess of 1½ inches are considered non-moisture-density testable materials. As an alternative to conventional density testing, compaction of these materials should be evaluated by proof roll test observation (deflection tests), where accepted by the geotechnical engineer.

8.4.3 Mat Foundation Leveling Course

Mat foundation leveling course should consist of well-graded granular material (crushed rock) containing no organic matter or debris, have a maximum particle size of ¾ inch, and have less than 8 percent material passing the U.S. Standard No. 200 Sieve. Floor slab base rock should be placed in one lift and compacted to not less than 95 percent of the material's maximum dry density as determined in general accordance with ASTM D1557 (Modified Proctor). We recommend "choking" the surface of the base rock with sand just prior to concrete placement. Choking means the voids between the largest aggregate particles are filled with sand, but does not provide a layer of sand above the base rock. Choking the base rock surface reduces the lateral restraint on the bottom of the concrete during curing.



8.4.4 Trench Backfill Material

Trench backfill for the utility pipe base and pipe zone should consist of granular material as recommended by the utility pipe manufacturer. Trench backfill above the pipe zone should consist of well-graded granular material containing no organic matter or debris, have a maximum particle size of ¾ inch, and have less than 8 percent material passing the U.S. Standard No. 200 Sieve. As a guideline, trench backfill should be placed in maximum 12-inch-thick lifts. The earthwork contractor may elect to use alternative lift thicknesses based on their experience with specific equipment and fill material conditions during construction in order to achieve the required compaction. The following table presents recommended relative compaction percentages for utility trench backfill.

Table 3 Utility Trench Backfill Compaction Recommendations

Backfill Zone	Recommended <u>Minimum</u> Relative Compaction	
	Structural Areas ¹	Landscaping Areas
Pipe Base and Within Pipe Zone	90% ASTM D1557 or pipe manufacturer's recommendation	85% ASTM D1557 or pipe manufacturer's recommendation
Above Pipe Zone	92% ASTM D1557	88% ASTM D1557
Within 3 Feet of Design Subgrade	95% ASTM D1557	90% ASTM D1557

¹Includes proposed buildings, structural fill areas, exterior hardscaping, etc.

8.4.5 Controlled Low-Strength Material (CLSM)

CLSM is a self-compacting, cementitious material that is typically considered when backfilling localized areas. CLSM is sometimes referred to as "controlled density fill" or CDF. Due to its flowable characteristics, CLSM typically can be placed in restricted-access excavations where placing and compacting fill is difficult. If chosen for use at this site, we recommend the CLSM be in conformance with Section 00442 of the most recent, State of Oregon, Standard Specifications for Highway Construction. The geotechnical engineer's representative should observe placement of the CLSM and obtain samples for compression testing in accordance with ASTM D4832. As a guideline, for each day's placement, two compressive strength specimens from the same CLSM sample should be tested. The results of the two individual compressive strength tests should be averaged to obtain the reported 28-day compressive strength. If CLSM is considered for use on this site, please contact the geotechnical engineer for site-specific and application-specific recommendations.

8.5 Seismic Design

As indicated in Section 8.2 of this report, the site was assigned as Seismic Site Class C. Earthquake ground motion parameters for the site were obtained based on the United States Geological Survey (USGS) Seismic Design Maps Web Application⁹. The site Latitude 44.053205° North and Longitude 121.342591° West were input as the site location. The following table presents the recommended seismic design parameters for the site.

⁹ United States Geological Survey, 2018. Seismic Design Parameters determined using: "U.S. Seismic Design Maps Web Application - Version 3.1.0," from the USGS website <http://earthquake.usgs.gov>.



Table 4 Seismic Ground Motion Values (2014 OSSC)

	Parameter	Value
Mapped Acceleration Parameters	Spectral Acceleration, 0.2 second (S_s)	0.411g
	Spectral Acceleration, 1.0 second (S_1)	0.210g
Coefficients (Site Class C)	Site Coefficient, 0.2 sec. (F_A)	1.200
	Site Coefficient, 1.0 sec. (F_V)	1.590
Adjusted MCE Spectral Response Parameters	MCE Spectral Acceleration, 0.2 sec. (S_{MS})	0.494g
	MCE Spectral Acceleration, 1.0 sec. (S_{M1})	0.334g
Design Spectral Response Accelerations	Design Spectral Acceleration, 0.2 seconds (S_{DS})	0.329g
	Design Spectral Acceleration, 1.0 second (S_{D1})	0.223g

9.0 RECOMMENDED ADDITIONAL SERVICES

9.1 Design Review

Geotechnical design review is of paramount importance. We recommend the geotechnical design review take place prior to releasing bid packets to contractors.

9.2 Observation of Construction

Satisfactory earthwork and foundation performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those encountered during our subsurface explorations, and recognition of changed conditions often requires experience. We recommend qualified personnel visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those observed to date and anticipated in this report.

We recommend the geotechnical engineer or their representative attend a pre-construction meeting coordinated by the contractor and/or owner. The project geotechnical engineer or their representative should provide observations and/or testing of at least the following earthwork elements during construction:

- Subgrade Preparation for Structural Fills and Shallow Mat Foundations (if incorporated)
- Compaction of Base Rock for Mat Foundations (if incorporated)
- Installation & Load Testing of Micro-Piles (if incorporated)
- Excavation of Drilled Piers (if incorporated)
- Compaction of Structural Fill & Utility Trench Backfill

It is imperative that the owner and/or contractor request earthwork observations and testing at a frequency sufficient to allow the geotechnical engineer to provide a final letter of compliance for the earthwork activities.



10.0 LIMITATIONS & CLOSURE

We have prepared this report for use by the client and other members of the design and construction team for the proposed development. The opinions and recommendations contained within this report are not intended to be, nor should they be construed as, a warranty of subsurface conditions, but are forwarded to assist in the planning and design process.

We have made observations based on our explorations that indicate the soil conditions at only those specific locations and only to the depths penetrated. These observations do not necessarily reflect soil types, strata thickness, or water level variations that may exist between or away from our explorations. If subsurface conditions vary from those encountered in our site explorations, CGT should be alerted to the change in conditions so that we may provide additional geotechnical recommendations, if necessary. Observation by experienced geotechnical personnel should be considered an integral part of the construction process.

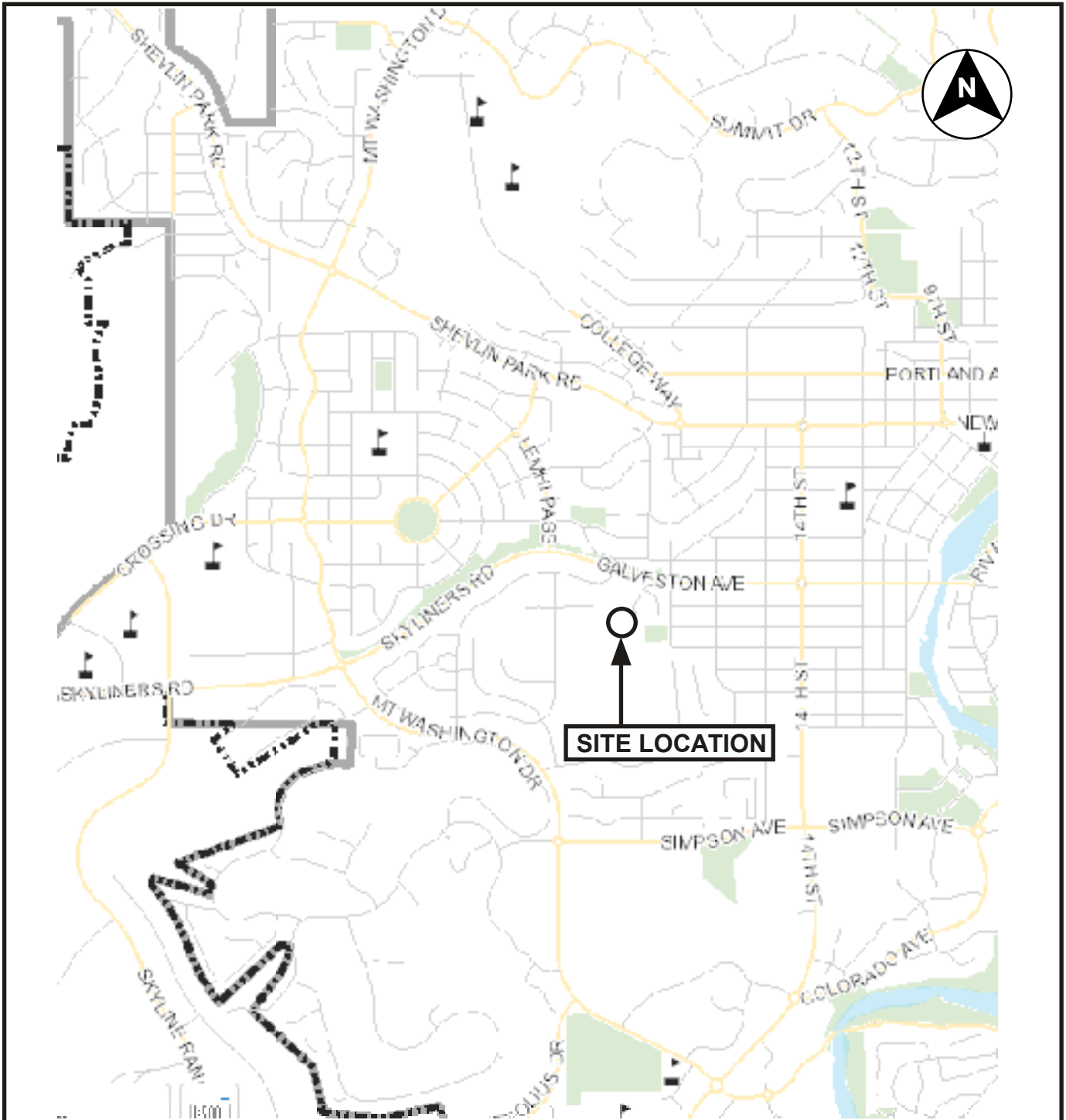
The owner is responsible for insuring that the project designers and contractors implement our recommendations. When the design has been finalized, prior to releasing bid packets to contractors, we recommend that the design drawings and specifications be reviewed by our firm to see that our recommendations have been interpreted and implemented as intended. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a written modification or verification. Design review and construction phase testing and observation services are beyond the scope of our current assignment, but can be provided for an additional fee.

The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design.

Geotechnical engineering and the geologic sciences are characterized by a degree of uncertainty. Professional judgments presented in this report are based on our understanding of the proposed construction, familiarity with similar projects in the area, and on general experience. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared; no warranty, expressed or implied, is made.

SITE LOCATION

OVERTURF BUTTE RADIO TOWER - BEND, OREGON



Map created with City of Bend Map Viewer

Scale 1 Inch = 2,000 feet

Township 17 South, Range 12 East, Section 31 Willamette Meridian



Carlson Geotechnical
35 SE Bridgeford Blvd.
Bend, Oregon 97702
541-330-9155

CGT Job No. G1804866

FIGURE 1


SITE PLAN
OVERTURF BUTTE RADIO TOWER - BEND, OREGON



NOTES:

Drawing based on site plan prepared by CA Rowles Engineering and observations made while on site. All locations are approximate.

LEGEND

B-1 (1/2')  Drilled boring. Depth to basalt bedrock indicated in (').

Approximate Scale: 1 Inch = 100 feet



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FIGURE 2



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Photograph 1: Rock core from Boring B-01 from 1/2' to 10 1/2' bgs.



Photograph 2: Rock core from Boring B-01 from 10 1/2' to 11 1/2' bgs.



Photograph 3: Rock core from Boring B-02 from 2 1/2' to 11 1/2' bgs.



Rock core photographs were taken at CGT's Bend Laboratory.

SOIL CLASSIFICATION CRITERIA AND TERMINOLOGY

OVERTURF BUTTE RADIO TOWER - BEND, OREGON

Classification of Terms and Content	USCS Grain Size		
NAME : MINOR Constituents (12-50%); MAJOR Constituents (>50%); Slightly (5-12%) Relative Density or Consistency Color Moisture Content Plasticity Trace Constituents (0-5%) Other: Grain Shape, Approximate gradation, Organics, Cement, Structure, Odor... Geologic Name or Formation: Fill, Willamette Silt, Till, Alluvium...	Fines	<#200 (.075 mm)	
	Sand	Fine	#200 - #40 (.425 mm)
		Medium	#40 - #10 (2 mm)
		Coarse	#10 - #4 (4.75)
	Gravel	Fine	#4 - 0.75 inch
		Coarse	0.75 inch - 3 inches
Cobbles	3 to 12 inches; scattered <15% est., numerous >15% est.		
Boulders	> 12 inches		

Relative Density or Consistency						
Granular Material		Fine-Grained (cohesive) Materials				
SPT N-Value	Density	SPT N-Value	Torvane tsf Shear Strength	Pocket Pen tsf Unconfined	Consistency	Manual Penetration Test
		<2	<0.13	>0.25	Very Soft	Thumb penetrates more than 1 inch
0 - 4	Very Loose	2 - 4	0.13 - 0.25	0.25 - 0.50	Soft	Thumb penetrates about 1 inch
4 - 10	Loose	4 - 8	0.25 - 0.50	0.50 - 1.00	Medium Stiff	Thumb penetrates about 1/4 inch
10 - 30	Medium Dense	8 - 15	0.50 - 1.00	1.00 - 2.00	Stiff	Thumb penetrates less than 1/4 inch
30 - 50	Dense	15 - 30	1.00 - 2.00	2.00 - 4.00	Very Stiff	Readily indented by thumbnail
>50	Very Dense	>30	>2.00	>4.00	Hard	Difficult to indent by thumbnail

Moisture Content				Structure	
Dry: Absence of moisture, dusty, dry to the touch Damp: Some moisture but leaves no moisture on hand Moist: Leaves moisture on hand Wet: Visible free water, likely from below water table				Stratified: Alternating layers of material or color >6 mm thick Laminated: Alternating layers < 6 mm thick Fissured: Breaks along definite fracture planes Slickensided: Striated, polished, or glossy fracture planes Blocky: Cohesive soil that can be broken down into small angular lumps which resist further breakdown Lenses: Has small pockets of different soils, note thickness Homogeneous: Same color and appearance throughout	
Plasticity	Dry Strength	Dilatancy	Toughness		
ML Non to Low	Non to Low	Slow to Rapid	Low, can't roll		
CL Low to Med.	Medium to High	None to Slow	Medium		
MH Med to High	Low to Medium	None to Slow	Low to Medium		
CH Med to High	High to V. High	None	High		

Unified Soil Classification Chart (Visual-Manual Procedure) (Similar to ASTM Designation D-2488)						
Major Divisions		Group Symbols		Typical Names		
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: 50% or more retained on the No. 4 sieve	Clean Gravels	GW	Well graded gravels and gravel-sand mixtures, little or no fines		
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines		
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures		
			GC	Clayey gravels, gravel-sand-clay mixtures		
			SW	Well-graded sands and gravelly sands, little or no fines		
	Sands: more than 50% passing the No. 4 Sieve	Clean Sands	SP	Poorly-graded sands and gravelly sands, little or no fines		
			SM	Silty sands, sand-silt mixtures		
		Sands with Fines	SC	Clayey sands, sand-clay mixtures		
			ML	Inorganic silts, rock flour, clayey silts		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays		
Fine-Grained Soils: 50% or more Passes No. 200 Sieve	Silt and Clays Low Plasticity Fines	OL	Organic silt and organic silty clays of low plasticity			
		MH	Inorganic silts, clayey silts			
		CH	Inorganic clays of high plasticity, fat clays			
	Silt and Clays High Plasticity Fines	OH	Organic clays of medium to high plasticity			
		PT	Peat, muck, and other highly organic soils			
Highly Organic Soils						

	Carlson Geotechnical 35 SE Bridgeford Blvd. Bend, Oregon 97702	CGT Job No. G1804866	FIGURE 4
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ODOT ROCK CLASSIFICATION CRITERIA AND TERMINOLOGY OVERTURF BUTTE RADIO TOWER - BEND, OREGON

Table 22: Scale of Relative Rock Weathering

Designation	Field Identification
Fresh	Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric.
Slightly Weathered	Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric. Decomposition extends up to 1-inch into rock.
Moderately Weathered	Rock mass is decomposed 50% or less. Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits.
Predominantly Weathered	Rock mass is more than 50% decomposed 50%. Rock can be excavated with geologist's pick. All discontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water.
Decomposed	Rock mass is completely decomposed. Original rock fabric may be evident. May be reduced to soil with hand pressure.

Table 23: Scale of Relative Rock Hardness

Term	Hardness Designation	Field Identification	Approximate Unconfined Compressive Strength
Extremely Soft	R0	Can be indented with difficulty by thumbnail. May be moldable or friable with finger pressure.	<100 psi
Very Soft	R1	Crumbles under firm blows with point of geology pick. Can be peeled by pocket knife. Scratched with finger nail.	100-1000 psi
Soft	R2	Can be peeled by pocket knife with difficulty. Cannot be scratched with finger nail. Shallow indentation made by firm blow of geology pick.	1000-4000 psi
Medium Hard	R3	Can be scratched by knife or pick. specimen can be fractured with a single firm blow of hammer/geology pick.	4000-8000 psi
Hard	R4	Can be scratched with knife or pick only with difficulty. Several hard blows required to fracture specimen.	8000-16000 psi
Very Hard	R5	Cannot be scratched by knife or sharp pick. Specimen requires many blows of hammer to fracture or chip. Hammer rebounds after impact.	>16000 psi

Table 24: Stratification Terms

Term	Characteristics
laminations	thin beds (<1cm.)
fissile	tendency to break along laminations
parting	tendency to break parallel to bedding, any scale
foliation	non-depositional, e.g., segregation and layering of minerals in metamorphic rock.

Tables adapted from the 1987 Soil and Rock Classification Manual, Oregon Department of Transportation



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Bend, Oregon 97702

CGT Job No. G1804866

FIGURE 5

OVER TURF BUTTE RADIO TOWER, BEND, OREGON

Logged by: T. Farstvedt

Date Advanced: June 5, 2018

Location: See Figure 2

Surface Elevation: 3,883 feet MSL*

Depth (ft)	Rock Coring Data				Soil Data			Material Description
	Core Run	RQD %	Recovery %	Uni-axial Comp. Strength (psi)	Sample Type	SPT N-Value	ASTM D2488	
1	Core C-1	0	100				SM	SILTY SAND WITH GRAVEL , loose, fine to medium grained sand, sub-angular gravel to 3 inches in diameter, cobbles to 6 inches in diameter, brown, dry.
2							RX	BASALT BEDROCK , hard (R4), fresh, highly fractured, red and gray striped.
3								
4								
5								
6								Vertical fracture present in Core C-2.
7	Core C-2	23	100					
8								
9								
10								Red below 9½ feet bgs.
11				990				
12								Boring terminated at about 11 feet bgs. No groundwater or caving observed during exploration. Boring backfilled with granular bentonite upon completion of drilling.
13								*Elevation, in feet above Mean Sea Level (MSL), determined from online media.
14								
15								
16								
17								

Job No. G1804866

Log of Boring B- 1

Figure: 6



OVER TURF BUTTE RADIO TOWER, BEND, OREGON

Logged by: T. Farstvedt

Date Advanced: June 5, 2018

Location: See Figure 2

Surface Elevation: 3,883 feet MSL*

Depth (ft)	Rock Coring Data				Soil Data			Material Description				
	Core Run	RQD %	Recovery %	Uni-axial Comp. Strength (psi)	Sample Type	SPT N-Value	ASTM D2488					
1							SM	SILTY SAND WITH GRAVEL , loose, fine to medium grained sand, sub-angular gravel to 3 inches in diameter, cobbles to 6 inches in diameter, brown, dry.				
2												
3	Core C-1	0	100				RX	BASALT BEDROCK , hard (R4), fresh, highly fractured, red and gray striped. Massive and gray below about 3½ feet bgs. Red and gray striped below about 7½ feet bgs.				
4												
5	Core C-2	33	100	7690				Red below about 10 feet bgs.				
6												
7												
8												
9												
10												
11												
12												
13								Boring terminated at about 12½ feet bgs. No groundwater or caving observed during exploration. Boring backfilled with granular bentonite upon completion of drilling.				
14												
15								*Elevation, in feet above Mean Sea Level (MSL), determined from online media.				
16												
17												

Job No. G1804866

Log of Boring B- 2

Figure: 7



Carlson Geotechnical

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Appendix A Drilled Pier Design Recommendations

Overturf Butte Radio Tower
222 NW Skyliner Summit Loop
Bend, Oregon

CGT Project Number G1804866

August 2, 2018

Prepared For:

ADCOMM Engineering Co.
Attn: Mr. Joe Blaschka, P.E.
3929 184th Place SE
Bothell, Washington 98012

Prepared by
Carlson Geotechnical

Brom's Method (Cohesionless Soils)..... Figure A1

A.2 LATERAL LOADING

A.2.1 Option 1 - “P-y Method” of Analysis

In the event the drilled pier foundation must be designed based on acceptable lateral deflection limits, the “p-y method” of analysis is recommended. We anticipate drilled pier design will be performed (by others) using commercially available, industry-standard software (such as LPILE™). We have provided recommended values for soil parameters for use in drilled pier design using this method of analysis in the following table.

As shown therein, a 2½-foot layer (Layer 1) was assigned at the site surface with a recommendation to neglect any contribution of this layer during calculation of lateral resistance for the drilled pier. This is recommended recognizing the possible loss of contact between the soil and the drilled pier in the upper 2½ feet below the ground surface from seasonal effects and other factors.

Table A1: Recommended LPILE™ Drilled Pier Design Parameters

Layer	Description	Depth (feet)	IGM	LPile Soil Type	γ' (pcf)	Soil Properties						
						ϕ' (deg.)	c' (psf)	$S_{u(ave)}$ (psf)	K_p	k (pci)	ϵ_{50}	E_s (ksi)
1	Neglect Strength Contribution	0 to 2½	1	Sand (Reese)	120	0.1	0	0	0.1	0.1	---	0.01
2	Highly Fractured Basalt	2½ to 12	1	Sand (Reese)	145	46	0	0	6.1	225	---	17.0

Notes: Variable Descriptions and Source Information

Depth	The depths listed in this table are with respect to the existing ground surface.
IGM	Idealized geomaterial. Layers were defined as idealized geomaterials in accordance with FHWA –NHI-10-016 (FHWA, 2010). A numbering system was used to represent the IGM in the table as follows: 1= Cohesionless Soil. 2= Cohesive Soil. 3= Rock. 4= Cohesive IGM.
LPile	LPILE soil model assigned consistent with idealized soil models in LPILE 2016.9.09.
γ'	Effective unit weight. Values presented based on local experience with similar soil types.
ϕ'	Internal angle of friction. Values presented are based Equation 3-8 (FHWA, 2010).
c'	Effective cohesion.
$S_{u(ave)}$	Averaged undrained shear strength of layer.
K_p	Passive lateral earth pressure coefficient, based on Equation 13-10 (FHWA, 2010).
k	P-y modulus. Values presented based on “Soil Modulus Parameter k Value” tables (for sands) in the Help Menu of LPILE 2016.9.09. Please note the presented k values are for <i>static loading conditions</i> .
ϵ_{50}	Strain Factor for clays and/or silts.
E_s	Young’s modulus for soil (E_s). Value presented based on Table 3-6 (FHWA, 2010) – SPT correlations (for cohesionless soils) and the average value within the soil profile.

We recommend a geotechnical plans review of the drilled pier design be performed to confirm the recommendations presented within this section are implemented as intended.

A.2.2 Option 2 - Brom’s Method of Analysis

The Brom’s Method is a simplified method for lateral load analysis of a single drilled pier and may be utilized to estimate the minimum length of the drilled pier foundation. It should be noted that this method assumes a homogeneous soil profile. In addition, this method assumes lateral deflections are not considered a service limit state. In the event the drilled pier foundation must be designed based on acceptable lateral deflection limits, the “p-y method” of analysis, as described in Section A.2.1 above, is recommended.

Recognizing the limitations of this analysis method, the minimum length, L_{min} , of the drilled pier may be based on first equation shown on the attached Figure A1. This minimum length is required to satisfy geotechnical strength requirements. The values for the soil parameters required in the calculation, including soil unit weight (γ) and passive coefficient (K_p), are equal to those shown in Table A1 above.

We recommend a geotechnical plans review of the drilled pier design be performed to confirm the recommendations presented within this section are implemented as intended.

A.3 AXIAL LOADING

The following equations are presented to calculate nominal side and base resistance of rigid, circular drilled pier(s) supporting the tower.

A.3.1 Side Resistance

For the purposes of design, the ultimate side resistance for circular drilled piers may be based on the following equation¹:

$$\sum R_{SN,i} = \pi * B * \Delta z * f_{SN,i}$$

where:	$R_{SN,i}$ = Nominal side resistance, in pounds, for layer i . (Note: For piers passing through two or more layers, the side resistance is calculated for each layer.) To be determined by designer.
	B = Pier diameter, in feet. To be determined by designer.
	Δz = Thickness of the soil layer, in feet, over which resistance is calculated. To be determined by designer.
	$f_{SN,i}$ = Nominal unit side resistance, in feet, for layer i . See Table A2 below for values.

For allowable stress design (ASD), we recommend a factor of safety (FS) equal to 2 be used to calculate the allowable side resistance for drilled pier foundations in compression loading. Similarly, we recommend a FS equal to 3 be used to calculate the allowable side resistance for drilled pier foundations in tension (uplift) loading.

A.3.2 Base Resistance

For the purposes of design, the ultimate base resistance for circular drilled piers may be based on the following equation²:

$$R_{BN} = \frac{1}{4} * \pi * B^2 * q_{BN,i}$$

where:	R_{BN} = Nominal base resistance, in pounds. To be determined by designer.
	B = Pier diameter, in feet. To be determined by designer.
	$q_{BN,i}$ = Nominal unit base resistance, in psf, for layer i . See Table A2 below for values.

For ASD, we recommend a FS equal to 2 be used to calculate the allowable base resistance for drilled pier foundations.

A.3.3 Soil Parameters

We have provided recommended values for soil parameters for use in drilled pier design in the following table in general accordance with Federal Highway Administration (FHWA) design methodologies³.

¹ Adapted from Equation 13-3 of FHWA-NHI-10-016, Drilled Shafts Manual, April 2010.

² Adapted from Equation 13-4 of FHWA-NHI-10-016, Drilled Shafts Manual, April 2010.

As shown therein, Layer 1 was assigned with the recommendation to neglect any contribution during calculation of side (friction), base, or lateral resistance for the drilled pier. This is typically recommended within the upper 2 feet, where the soil is susceptible to expansion and contraction due to seasonal moisture changes or freeze-thaw cycles, which can potentially eliminate the contact between the shaft and the soil.

Table A2: Recommended Drilled Pier Axial Design Parameters

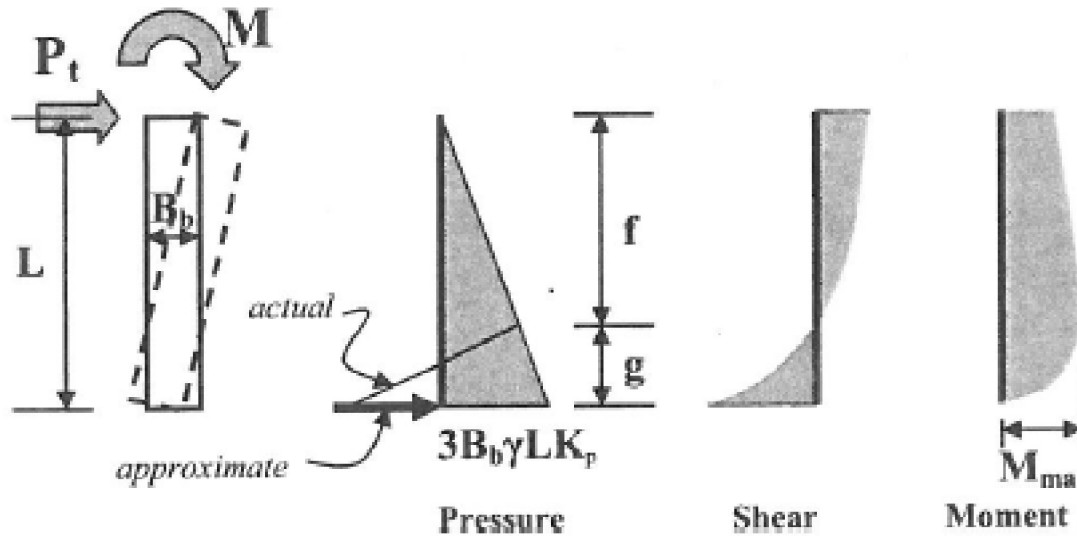
Layer	Description	Depth (feet bgs)	Average Ultimate Unit Side Friction ¹ (psf)	Average Ultimate Unit End Bearing (ksf)
1	Neglect Strength Contribution	0 to 2½	n/a	n/a
2	Highly Fractured Basalt (RX) (Modeled as Very Dense Cohesionless Soil)	2½ to 12	2,830	60

¹ If permanent casing is used and extends through layers of cohesionless soil, a casing reduction factor of between 0.60 and 0.75 should be applied to the unit side friction value.

We recommend a geotechnical plans review of the drilled pier design be performed to confirm the recommendations presented within this section are implemented as intended.

³ FHWA-NHI-10-016, Drilled Shafts: Construction Procedures and LRFD Design Methods, Federal Highway Administration, Washington, D.C., May 2010.

Brom's Earth Pressure for Cohesionless Soils



$$\begin{aligned} \Sigma M_b = 0 &= M_t + P_t L_{\min} - 3B_b \gamma L_{\min} K_p (L_{\min}/2)(L_{\min}/3) \\ 0 &= M_t + P_t L_{\min} - \frac{1}{2} B_b \gamma L_{\min}^3 K_p \end{aligned} \quad 1$$

$$P_t = 3B_b \gamma f K_p (f/2) = 1.5 B_b \gamma f^2 K_p \quad 2$$

$$f = [P_t / (1.5 B_b \gamma K_p)]^{1/2} \quad 3$$

$$M_{\max} = \Sigma M_f = M_t + P_t (f) - (\frac{1}{2} B_b \gamma f^3 K_p) \quad 4$$

Notes

¹ Adapted from Figure 12-29 of FHWA-NHI-10-016.
² Adapted from Figure 12-30 of FHWA-NHI-10-016.

³ Adapted from Figure 12-31 of FHWA-NHI-10-016.
⁴ Adapted from Figure 12-32 of FHWA-NHI-10-016.



1640 Marc Avenue
Tacoma, WA 98421-2939

Fax: 253-627-4188
Phone: 503-437-0612
E-mail: jbradfield@stella-jones.com

Quotation

To: ADCOMM
ATTN: Joe Blashka Jr.
j.blaschka@adcomm911.com
Date: 03/22/19

Quote #: 64891
RFQ: Overturf Butte
Engineering Contact: Mike Liebel, E.I. (MT)
E-mail: cliebel@stella-jones.com
Phone: (253)798-5852

Coastal Douglas Fir laminated poles, full length pressure penta treated to a final net retention of 0.60# per cubic foot, roof only and/or framed plant inspection and conforming to ANSI/AITC A190.1, ANSI 05.2 and AWPAs specifications.

BID ITEM	QUANTITY	CL/LEN	EST WGT (LBS) EACH	PRICE EACH	EXTENDED
1	1	MDT-H2-70.5	4,776	\$8,503	\$8,503
				Total:	\$8,503

1. Structures were designed in PLS
2. Foundation hardware (fins, nuts, bolts, and washers) are included.
3. No upper pole framing hardware quoted.
4. Class 6 level undisturbed native soils assumed - contact if more soils information becomes available or if soils are expected to be worse.
5. Pole twist limited to 3°.
6. A Topographical Factor (Kzt) of 1.77 was used.

See attached documents for additional information.

Prices firm for acceptance to: 04/21/2019

Terms: Net 30 days from shipment upon credit approval.

Pole Shipment: 5-7 Weeks after receipt of approved (signed) pole erection drawings, plus transit time.

Destination: Bend, OR

FOB: Destination via flatbed truck-customer unload

Products covered by this quotation are subject to the following terms and conditions unless explicitly amended by the parties in writing signed by both parties at time of final order placement. Supplier is responsible for the design and production of a product that meets the loading requirements provided in the bid documents. Products covered by this quotation are warranted to comply with Buyer provided specifications, or where no detailed specifications are provided minimum referenced industry standards, if applicable, at time of sale and for twelve months thereafter. McFarland Cascade excludes any implied warranties of merchantability or fitness for a particular purpose in the absence of line specific information. Buyer has sole responsibility for product specifications (including selection of preservative), installation and all engineering or other direction related to line design, selection of delivery location and location suitability for storage and installation. McFarland Cascade is not responsible for occupational safety and health issues of Buyer, or its employees, agents or servants or any other claims, liabilities or fines of any type resulting from the products purchased by Buyer if treated and produced in accordance with Buyer's specifications and applicable industry standards. In no event will McFarland Cascade be liable to Buyer in an amount exceeding the purchase price of the subject products. In no event will McFarland Cascade be liable for indirect, special, incidental, exemplary or consequential damages of any kind sustained from any cause or arising out of any legal theory, whether contract, negligence, strict tort liability, contribution, indemnity, or otherwise. Buyer shall make all claims within ten days of receipt regarding delivery, quantity or quality after which the products shall be deemed to have been received and accepted by the Buyer. Any lawsuit by Buyer against McFarland Cascade will be filed within one year from delivery of the subject product.

Sales or other applicable taxes will be added to the quoted prices unless customer supplies a resale or exemption certificate valid to the delivery location of the material covered by the quotation. Any sales or other taxes that are found to be applicable to the transaction shall be the liability of the Buyer at time of sale or at anytime thereafter.

This quotation does not provide any form of indemnification nor does it provide for the payment of any liquidated and/or consequential damages unless Buyer and McFarland Cascade mutually execute a formal agreement containing these specific terms.

By:

James Bradfield
Regional Sales Manager
jbradfield@stella-jones.com
503-437-0612



CIVIL | STRUCTURAL | FIRE

Structural Calculations

Deschutes 911 Tower

222 NW Skyliner Summit Loop. Bend OR.

Prepared For: C A Rowles Engineering
Work Order: 22129
Date: 15 May 2019

Project Abstract:

Structural engineering for a wood pole telecommunications tower to be used by emergency services. The design includes the design of the wood pole and foundation as well as review of connections made to the pole. MAE has worked with the pole manufacturer in the design and analysis of the pole and foundation. The manufacturer is required to submit stamped shop drawings and calculations for review by MAE.

CODE: Oregon Structural Specialty Code, 2014 Edition
ANSI/TIA-222-G

LOADING: (determined by ANSI/TIA-222-G as standard referenced in OSSC)

Risk Category III (OSSC risk category IV)
Structure Class: 3
Design Ice Thickness: 0.25"
Wind: 85 mph Nom.
Exposure C
Topographic Factor: $K_{TZ} = 1.1898$
Seismic: $S_{DS}=0.329$, $S_{D1} = 0.223$, Site class C (See Geotech. Report)

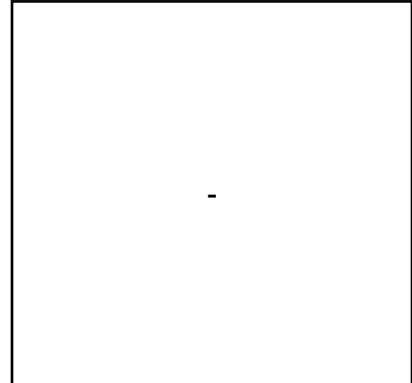
Allowable Soil Bearing = 6,000 psf per Geotech. Report No. G1804866

Table of Contents

Structural Calculations

Deschutes 911 Tower 222 NW Skyliner Summit Loop. Bend OR

Prepared For: C A Rowles Engineering
Work Order: 22129
Date: 15 May 2019



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<i>Attachment: Manufacturers calculations</i>	17-65

The attached manufacturers calculations were done under the direction of MAE and represent the loading as determined in our above calculations. The manufacturer is required to submit stamped shop drawings and calculations as part of the review process with MAE.

ATC Hazards by Location

Search Information

Coordinates: 44.053050719996214, -121.34254310258563
Elevation: 3884 ft
Timestamp: 2019-03-05T22:25:29.611Z
Hazard Type: Wind



ASCE 7-16

MRI 10-Year 68 mph
 MRI 25-Year 73 mph
 MRI 50-Year 79 mph
 MRI 100-Year 83 mph
 Risk Category I 92 mph
 Risk Category II 98 mph
 Risk Category III 105 mph
 Risk Category IV 109 mph

ASCE 7-10

MRI 10-Year 72 mph
 MRI 25-Year 79 mph
 MRI 50-Year 85 mph
 MRI 100-Year 91 mph
 Risk Category I 100 mph
 Risk Category II 110 mph
 Risk Category III-IV 115 mph

ASCE 7-05
 ASCE 7-05 Wind Speed 85 mph

used based on
 TIA-222-G standard

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

State	County	Min. Basic Wind Speed V (mph)	Max. Basic Wind Speed V (mph)	Min. Basic Wind Speed with Ice V _i (mph)	Max. Basic Wind Speed with Ice V _i (mph)	Min. Design Ice Thickness t _i (in.)	Max. Design Ice Thickness t _i (in.)	Design Frost Depth (in.)	Min. S _s	Max. S _s	Notes
OR	BAKER	85	85	40	40	0.25	0.25	30	0.35	0.60	-
OR	BENTON	85	85	30	30	0.25	0.50	10	0.93	1.50	1
OR	CLACKAMAS	85	85	30	30	0.25	1.00	20	0.50	1.06	1, 2
OR	CLATSOP	85	85	30	30	0.25	0.25	10	1.15	1.50	1
OR	COLUMBIA	85	85	30	30	0.25	0.75	10	0.98	1.17	1
OR	COOS	85	85	30	30	0.00	0.25	5	1.36	1.50	1
OR	CROOK	85	85	40	40	0.25	0.25	20	0.30	0.40	1
OR	CURRY	85	85	30	30	0.00	0.25	5	1.39	1.50	1
OR	DESCHUTES	85	85	30	40	0.25	0.25	20	0.31	0.59	1, 2
OR	DOUGLAS	85	85	30	30	0.25	0.25	10	0.54	1.50	1, 2
OR	GILLIAM	85	85	40	40	0.25	0.25	20	0.33	0.46	-
OR	GRANT	85	85	40	40	0.25	0.25	30	0.30	0.39	-
OR	HARNEY	85	85	40	40	0.25	0.25	30	0.29	0.97	-
OR	HOOD RIVER	85	85	30	40	0.25	1.25	20	0.50	0.65	1, 2
OR	JACKSON	85	85	30	30	0.25	0.25	10	0.60	1.13	2
OR	JEFFERSON	85	85	30	40	0.25	0.25	20	0.34	0.50	1, 2
OR	JOSEPHINE	85	85	30	30	0.25	0.25	5	0.96	1.50	1, 2
OR	KLAMATH	85	85	30	40	0.25	0.25	20	0.47	1.75	1, 2
OR	LAKE	85	85	40	40	0.25	0.25	20	0.32	1.12	1
OR	LANE	85	85	30	30	0.25	0.50	10	0.44	1.50	1, 2
OR	LINCOLN	85	85	30	30	0.25	0.25	5	1.26	1.50	1
OR	LINN	85	85	30	30	0.25	0.50	10	0.45	1.04	2
OR	MALHEUR	85	85	40	40	0.25	0.25	30	0.28	1.19	-
OR	MARION	85	85	30	30	0.25	0.75	10	0.47	1.06	2
OR	MORROW	85	85	40	40	0.25	0.25	30	0.32	0.50	-
OR	MULTNOMAH	85	85	30	40	0.50	1.50	10	0.62	1.09	1, 2
OR	POLK	85	85	30	30	0.25	0.50	10	0.98	1.41	1
OR	SHERMAN	85	85	40	40	0.25	0.25	20	0.39	0.46	-
OR	TILLAMOOK	85	85	30	30	0.25	0.25	10	1.16	1.50	1
OR	UMATILLA	85	85	40	40	0.25	0.25	30	0.32	0.57	-
OR	UNION	85	85	40	40	0.25	0.25	30	0.34	0.50	-
OR	WALLOWA	85	85	40	40	0.25	0.25	40	0.29	0.52	-
OR	WASCO	85	85	30	40	0.25	0.75	20	0.36	0.63	1, 2
OR	WASHINGTON	85	85	30	30	0.25	1.25	10	1.03	1.22	1
OR	WHEELER	85	85	40	40	0.25	0.25	20	0.31	0.39	-
OR	YAMHILL	85	85	30	30	0.25	0.75	10	1.02	1.50	1
PA	ADAMS	90	90	40	40	0.75	0.75	30	0.19	0.21	-
PA	ALLEGHENY	90	90	40	40	0.75	0.75	40	0.13	0.14	-
PA	ARMSTRONG	90	90	40	40	0.75	0.75	40	0.13	0.13	2
PA	BEAVER	90	90	40	40	0.75	0.75	40	0.13	0.13	-
PA	BEDFORD	90	90	30	40	0.75	0.75	40	0.16	0.19	2
PA	BERKS	90	90	40	40	0.75	1.00	40	0.25	0.32	-
PA	BLAIR	90	90	40	40	0.75	0.75	40	0.16	0.17	2
PA	BRADFORD	90	90	40	40	0.75	0.75	50	0.17	0.19	2
PA	BUCKS	90	95	40	40	0.75	1.00	40	0.31	0.35	-
PA	BUTLER	90	90	40	40	0.75	0.75	40	0.13	0.13	-
PA	CAMBRIA	90	90	40	40	0.75	0.75	40	0.15	0.16	2

Wood Column

\\jeffe\DOCUME~1\MAE-PR-1\22129--1_BE\300ENG-1\320CAL-1\Deschutes 911 tower calc workbook v2.ec6 .
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30 .

Lic. # : KW-06004985

Licensee : AE GROUP

Description : Pole as column - C.1 Light antenna loading (55 sf no ice) - strong axis loading

Code References

Calculations per 2012 NDS, IBC 2012, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-05

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	18 x 27 GLB	
End Fixities	Top Free, Bottom Fixed			Wood Grading/Manuf.	UserDefined	
Overall Column Height	60.0 ft			Wood Member Type	Glu-Lam - Western	
<i>(Used for non-slender calculations)</i>						
Wood Species	Douglas Fir - Coastal			Exact Width	18.0 in	
Wood Grade	MDT-H8			Exact Depth	27.0 in	
Fb +	2,200.0 psi	Fv	190.0 psi	Area	486.0 in ²	
Fb -	2,200.0 psi	Ft	200.0 psi	Ix	29,524.5 in ⁴	
Fc - Prll	625.0 psi	Density	35.0 pcf	Iy	13,122.0 in ⁴	
Fc - Perp	625.0 psi					
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	Allow Stress Modification Factors		
	Basic	2,300.0	2,300.0	2,300.0 ksi	Cf or Cv for Bending	0.7322
	Minimum	2,300.0	2,300.0		Cf or Cv for Compression	0.7322
					Cf or Cv for Tension	0.7322
					Cm : Wet Use Factor	1.0
					Ct : Temperature Factor	1.0
					Cfu : Flat Use Factor	1.0
					Kf : Built-up columns	1.0 <small>NDS 15.3.2</small>
					Use Cr : Repetitive ?	No
Brace condition for deflection (buckling) along columns :						
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 60.0 ft, K = 1.						
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 60.0 ft, K = 1.						

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 7,087.50 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 60.0 ft, Yecc = 3.0 in, D = 0.650, L = 1.740 k

Axial Load at 60.0 ft, Xecc = 2.750 in, D = 0.70, L = 1.750 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.07330 k/ft

Lat. Point Load at 50.0 ft creating Mx-x, W = 2.184, E = 5.030 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.520 : 1**
 Load Combination +D+W+H
 Governing NDS Formula $\frac{P}{A} + \frac{M_x}{S_x} + \frac{M_y}{S_y}$, NDS Eq. 3.9-
 Location of max.above base 0.0 ft
 At maximum location values are . . .
 Applied Axial 8.438 k
 Applied Mx -241.303 k-ft
 Applied My -0.1604 k-ft
 Fc : Allowable 677.90 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.0 k Bottom along Y-Y 6.582 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 6.901 in at 60.0 ft above base
 for load combination : E Only
 Along X-X 0.05748 in at 60.0 ft above base
 for load combination : +D+L+H

Other Factors used to calculate allowable stresses . . .
Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.06683 : 1**
 Load Combination +D+W+H
 Location of max.above base 0.0 ft
 Applied Design Shear 20.315 psi
 Allowable Shear 304.0 psi

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.871	0.003288	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+L+H	1.000	0.846	0.008702	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+Lr+H	1.250	0.778	0.002279	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+S+H	1.150	0.806	0.002488	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+0.750Lr+0.750L+H	1.250	0.778	0.005691	PASS	58.792 ft	0.0	PASS	60.0 ft
+D+0.750L+0.750S+H	1.150	0.806	0.006204	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+W+H	1.600	0.678	0.520	PASS	0.0 ft	0.06683	PASS	0.0 ft

Wood Column

\\jeffe\DOCUME~1\MAE-PR-1\22129--1_BE\300ENG-1\320CAL-1\Deschutes 911 tower calc workbook v2.ec6 .
 Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30 .

Lic. #: KW-06004985

Licensee : AE GROUP

Description : Pole as column - C.1 Light antenna loading (55 sf no ice) - strong axis loading

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D+0.70E+H	1.600	0.678	0.3802	PASS	0.0 ft	0.03575	PASS	49.933 ft
+D+0.750Lr+0.750L+0.750W+H	1.600	0.678	0.3943	PASS	0.0 ft	0.05012	PASS	0.0 ft
+D+0.750L+0.750S+0.750W+H	1.600	0.678	0.3943	PASS	0.0 ft	0.05012	PASS	0.0 ft
+D+0.750Lr+0.750L+0.5250E+H	1.600	0.678	0.2891	PASS	0.0 ft	0.02681	PASS	49.933 ft
+D+0.750L+0.750S+0.5250E+H	1.600	0.678	0.2891	PASS	0.0 ft	0.02681	PASS	49.933 ft
+0.60D+W+H	1.600	0.678	0.5172	PASS	0.0 ft	0.06683	PASS	0.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft	Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top		@ Base	@ Top
D Only						8.438		0.160			0.163
+D+L+H						11.928		0.561			0.597
+D+Lr+H						8.438		0.160			0.163
+D+S+H						8.438		0.160			0.163
+D+0.750Lr+0.750L+H						11.055		0.461			0.489
+D+0.750L+0.750S+H						11.055		0.461			0.489
+D+W+H				6.582		8.438		0.160			241.303
+D+0.70E+H				3.521		8.438		0.160			176.213
+D+0.750Lr+0.750L+0.750W+H				4.937		11.055		0.461			181.344
+D+0.750L+0.750S+0.750W+H				4.937		11.055		0.461			181.344
+D+0.750Lr+0.750L+0.5250E+H				2.641		11.055		0.461			132.526
+D+0.750L+0.750S+0.5250E+H				2.641		11.055		0.461			132.526
+0.60D+W+H				6.582		5.063		0.096			241.238
+0.60D+0.70E+H				3.521		5.063		0.096			176.148
D Only						8.438		0.160			0.163
Lr Only											
L Only						3.490		0.401			0.435
S Only											
W Only				6.582							241.140
E Only				5.030							251.500
H Only											

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance	Max. Y-Y Deflection		Distance
	in	ft		in	ft	
D Only	0.0164	0.00137	60.000	0.007	0.00058	60.000
+D+L+H	0.0575	0.00471	60.000	0.027	0.00223	60.000
+D+Lr+H	0.0164	0.00137	60.000	0.007	0.00058	60.000
+D+S+H	0.0164	0.00137	60.000	0.007	0.00058	60.000
+D+0.750Lr+0.750L+H	0.0472	0.00391	60.000	0.022	0.00183	60.000
+D+0.750L+0.750S+H	0.0472	0.00391	60.000	0.022	0.00183	60.000
+D+W+H	0.0164	0.00137	60.000	6.012	0.501	60.000
+D+0.70E+H	0.0164	0.00137	60.000	4.838	0.403	60.000
+D+0.750Lr+0.750L+0.750W+H	0.0472	0.00391	60.000	4.526	0.377	60.000
+D+0.750L+0.750S+0.750W+H	0.0472	0.00391	60.000	4.526	0.377	60.000
+D+0.750Lr+0.750L+0.5250E+H	0.0472	0.00391	60.000	3.645	0.304	60.000
+D+0.750L+0.750S+0.5250E+H	0.0472	0.00391	60.000	3.645	0.304	60.000
+0.60D+W+H	0.0099	0.00082	60.000	6.009	0.501	60.000
+0.60D+0.70E+H	0.0099	0.00082	60.000	4.835	0.403	60.000
D Only	0.0164	0.00137	60.000	0.007	0.00058	60.000
Lr Only	0.0000	0.00000	0.000	0.000	0.00000	0.000
L Only	0.0411	0.00342	60.000	0.020	0.00167	60.000
S Only	0.0000	0.00000	0.000	0.000	0.00000	0.000
W Only	0.0000	0.00000	0.000	6.005	0.500	60.000
E Only	0.0000	0.00000	0.000	6.901	0.575	60.000
H Only	0.0000	0.00000	0.000	0.000	0.00000	0.000

Wood Column

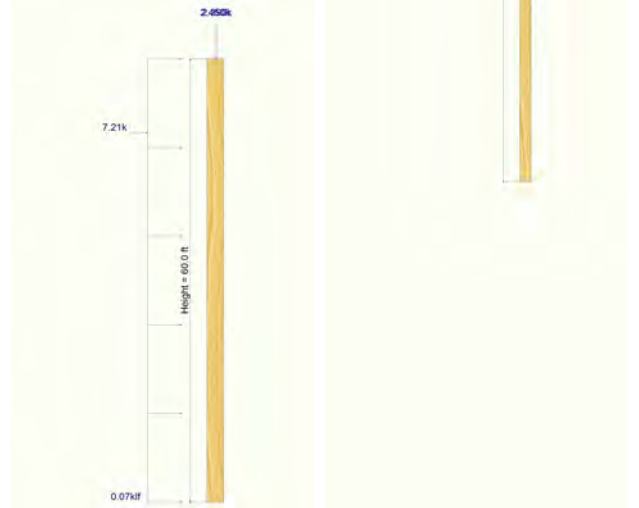
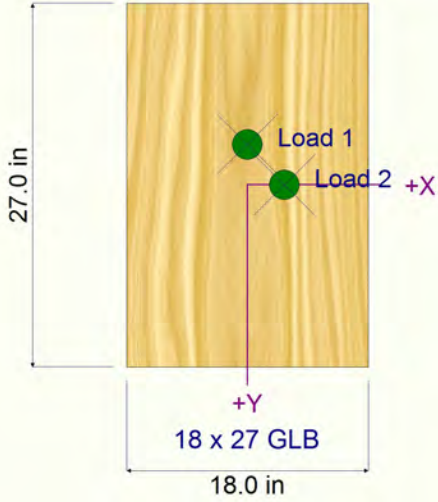
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Description : Pole as column - C.1 Light antenna loading (55 sf no ice) - strong axis loading

Sketches



Wood Column

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Description : Pole as column - C.1 Light antenna loading (55 sf no ice) - weak axis loading

Code References

Calculations per 2012 NDS, IBC 2012, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-05

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	18 x 27 GLB	
End Fixities	Top Free, Bottom Fixed			Wood Grading/Manuf.	UserDefined	
Overall Column Height	60.0 ft			Wood Member Type	Glu-Lam - Western	
<i>(Used for non-slender calculations)</i>						
Wood Species	Douglas Fir - Coastal			Exact Width	18.0 in	
Wood Grade	MDT-H8			Exact Depth	27.0 in	
Fb +	2,200.0 psi	Fv	190.0 psi	Area	486.0 in ²	
Fb -	2,200.0 psi	Ft	200.0 psi	Ix	29,524.5 in ⁴	
Fc - Prll	625.0 psi	Density	35.0 pcf	Iy	13,122.0 in ⁴	
Fc - Perp	625.0 psi					
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	Allow Stress Modification Factors		
	Basic	2,300.0	2,300.0	2,300.0 ksi	Cf or Cv for Bending	0.7322
	Minimum	2,300.0	2,300.0		Cf or Cv for Compression	0.7322
					Cf or Cv for Tension	0.7322
					Cm : Wet Use Factor	1.0
					Ct : Temperature Factor	1.0
					Cfu : Flat Use Factor	1.0
					Kf : Built-up columns	1.0 <small>NDS 15.3.2</small>
					Use Cr : Repetitive ?	No
Brace condition for deflection (buckling) along columns :						
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 60.0 ft, K = 1.						
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 60.0 ft, K = 1.						

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 7,087.50 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 60.0 ft, Yecc = 3.0 in, D = 0.650, L = 1.740 k

Axial Load at 60.0 ft, Xecc = 2.750 in, D = 0.70, L = 1.750 k

BENDING LOADS . . .

Lat. Uniform Load creating My-y, W = 0.07330 k/ft

Lat. Point Load at 50.0 ft creating Mx-x, W = 2.184, E = 5.030 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.890 : 1**
 Load Combination +D+W+H
 Governing NDS Formula $\rho + M_{xx} + M_{yy}$, NDS Eq. 3.9-
 Location of max.above base 0.0 ft
 At maximum location values are . . .
 Applied Axial 8.438 k
 Applied Mx -109.363 k-ft
 Applied My -132.10 k-ft
 Fc : Allowable 677.90 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.0 k Bottom along Y-Y 5.030 k
 Top along X-X 0.0 k Bottom along X-X 4.398 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 6.901 in at 60.0 ft above base
 for load combination : E Only
 Along X-X 6.785 in at 60.0 ft above base
 for load combination : +D+W+H

Other Factors used to calculate allowable stresses . . .
Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.04465 : 1**
 Load Combination +D+W+H
 Location of max.above base 0.0 ft
 Applied Design Shear 13.574 psi
 Allowable Shear 304.0 psi

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.871	0.003288	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+L+H	1.000	0.846	0.008702	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+Lr+H	1.250	0.778	0.002279	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+S+H	1.150	0.806	0.002488	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+0.750Lr+0.750L+H	1.250	0.778	0.005691	PASS	58.792 ft	0.0	PASS	60.0 ft
+D+0.750L+0.750S+H	1.150	0.806	0.006204	PASS	0.0 ft	0.0	PASS	60.0 ft
+D+W+H	1.600	0.678	0.890	PASS	0.0 ft	0.04465	PASS	0.0 ft

Wood Column

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Lic. #: KW-06004985

Licensee : AE GROUP

Description : Pole as column - C.1 Light antenna loading (55 sf no ice) - weak axis loading

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D+0.70E+H	1.600	0.678	0.3802	PASS	0.0 ft	0.03575	PASS	49.933 ft
+D+0.750Lr+0.750L+0.750W+H	1.600	0.678	0.6743	PASS	0.0 ft	0.03349	PASS	0.0 ft
+D+0.750L+0.750S+0.750W+H	1.600	0.678	0.6743	PASS	0.0 ft	0.03349	PASS	0.0 ft
+D+0.750Lr+0.750L+0.5250E+H	1.600	0.678	0.2891	PASS	0.0 ft	0.02681	PASS	49.933 ft
+D+0.750L+0.750S+0.5250E+H	1.600	0.678	0.2891	PASS	0.0 ft	0.02681	PASS	49.933 ft
+0.60D+W+H	1.600	0.678	0.8826	PASS	0.0 ft	0.04465	PASS	0.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft	Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top		@ Base	@ Top
D Only						8.438		0.160			0.163
+D+L+H						11.928		0.561			0.597
+D+Lr+H						8.438		0.160			0.163
+D+S+H						8.438		0.160			0.163
+D+0.750Lr+0.750L+H						11.055		0.461			0.489
+D+0.750L+0.750S+H						11.055		0.461			0.489
+D+W+H	4.398			2.184		8.438		132.100			109.363
+D+0.70E+H				3.521		8.438		0.160			176.213
+D+0.750Lr+0.750L+0.750W+H	3.299			1.638		11.055		99.416			82.389
+D+0.750L+0.750S+0.750W+H	3.299			1.638		11.055		99.416			82.389
+D+0.750Lr+0.750L+0.5250E+H				2.641		11.055		0.461			132.526
+D+0.750L+0.750S+0.5250E+H				2.641		11.055		0.461			132.526
+0.60D+W+H	4.398			2.184		5.063		132.036			109.298
+0.60D+0.70E+H				3.521		5.063		0.096			176.148
D Only						8.438		0.160			0.163
Lr Only											
L Only						3.490		0.401			0.435
S Only											
W Only	4.398			2.184				131.940			109.200
E Only				5.030							251.500
H Only											

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0164 in	60.000 ft	0.007 in	60.000 ft
+D+L+H	0.0575 in	60.000 ft	0.027 in	60.000 ft
+D+Lr+H	0.0164 in	60.000 ft	0.007 in	60.000 ft
+D+S+H	0.0164 in	60.000 ft	0.007 in	60.000 ft
+D+0.750Lr+0.750L+H	0.0472 in	60.000 ft	0.022 in	60.000 ft
+D+0.750L+0.750S+H	0.0472 in	60.000 ft	0.022 in	60.000 ft
+D+W+H	6.7849 in	60.000 ft	3.004 in	60.000 ft
+D+0.70E+H	0.0164 in	60.000 ft	4.838 in	60.000 ft
+D+0.750Lr+0.750L+0.750W+H	5.1235 in	60.000 ft	2.269 in	60.000 ft
+D+0.750L+0.750S+0.750W+H	5.1235 in	60.000 ft	2.269 in	60.000 ft
+D+0.750Lr+0.750L+0.5250E+H	0.0472 in	60.000 ft	3.645 in	60.000 ft
+D+0.750L+0.750S+0.5250E+H	0.0472 in	60.000 ft	3.645 in	60.000 ft
+0.60D+W+H	6.7783 in	60.000 ft	3.001 in	60.000 ft
+0.60D+0.70E+H	0.0099 in	60.000 ft	4.835 in	60.000 ft
D Only	0.0164 in	60.000 ft	0.007 in	60.000 ft
Lr Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
L Only	0.0411 in	60.000 ft	0.020 in	60.000 ft
S Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
W Only	6.7684 in	60.000 ft	2.996 in	60.000 ft
E Only	0.0000 in	0.000 ft	6.901 in	60.000 ft
H Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Wood Column

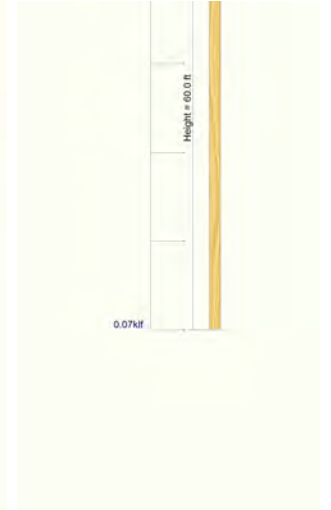
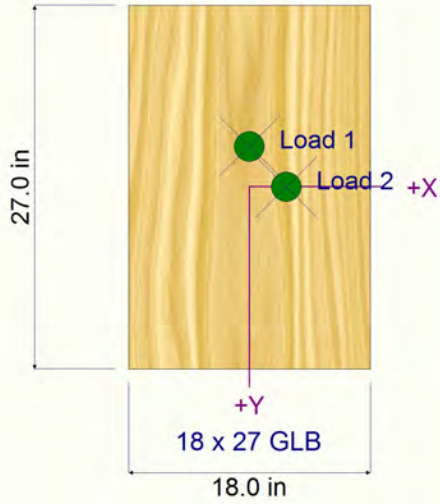
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Description : Pole as column - C.1 Light antenna loading (55 sf no ice) - weak axis loading

Sketches



Pole Footing Embedded in Soil

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Description: Pole embedment Design - C.1 Light loading (55 SF max antennas - no ice)

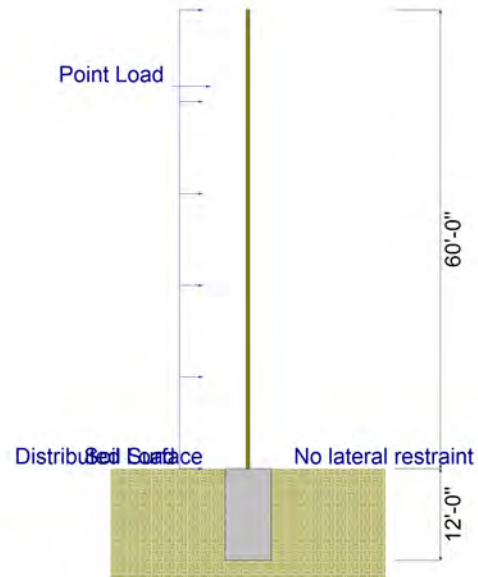
Code References

Calculations per IBC 2012 1807.3, CBC 2013, ASCE 7-10
 Load Combinations Used: ASCE 7-05

General Information

Pole Footing Shape: Circular
 Pole Footing Diameter: 72.0 in
 Find Lateral Pressure for Given Depth
 No Lateral Restraint at Ground Surface
 Allow Passive: 300.0 psf
 Max Passive: psf
 Embedment Depth of Footing: 12.0 ft

Controlling Values	
Governing Load Combination:	+1.046D+1.050E+H
Lateral Load	5.282 k
Moment	264.075 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	953.0 psf
Allowable	1,200.0 psf
Footing Base Area: 28.274 ft ²	
Maximum Soil Pressure: 0.3626 ksf	



Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (klf)		Vertical Load (k)	
D: Dead Load	k		k/ft		9.80 k
Lr: Roof Live	k		k/ft		k
L: Live	k		k/ft		k
S: Snow	k		k/ft		k
W: Wind	2.184 k	0.0680	k/ft		k
E: Earthquake	5.030 k		k/ft		k
H: Lateral Earth	k		k/ft		k
Load distance above ground surface	50.0 ft	TOP of Load above ground surface	60.0 ft	BOTTOM of Load above ground surface	ft

Load Combination Results

Load Combination	Forces @ Ground Surface		Pressure at 1/3 Depth		Soil Increase
	Loads - (k)	Moments - (ft-k)	Actual - (psf)	Allow - (psf)	Factor
D Only	0.000	0.000	1.0	1,200.0	1.000
+D+L+H	0.000	0.000	1.0	1,200.0	1.000
+D+Lr+H	0.000	0.000	1.0	1,200.0	1.000
+D+S+H	0.000	0.000	1.0	1,200.0	1.000
+D+0.750Lr+0.750L+H	0.000	0.000	1.0	1,200.0	1.000
+D+0.750L+0.750S+H	0.000	0.000	1.0	1,200.0	1.000
+D+W+H	6.264	231.600	889.0	1,200.0	1.000
+1.046D+1.050E+H	5.282	264.075	953.0	1,200.0	1.000
+D+0.750Lr+0.750L+0.750W+H	4.698	173.700	667.0	1,200.0	1.000
+D+0.750L+0.750S+0.750W+H	4.698	173.700	667.0	1,200.0	1.000

Mortier Ang Engineers
5 NW Franklin Ave.
Bend, OR. 97703

Project Title: Deschutes Country 911 Tower
Engineer: JA
Project ID: 22129
Project Descr: New communication tower on Overturf Butte

Printed: 15 MAY 2019, 10:05AM

Pole Footing Embedded in Soil

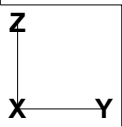
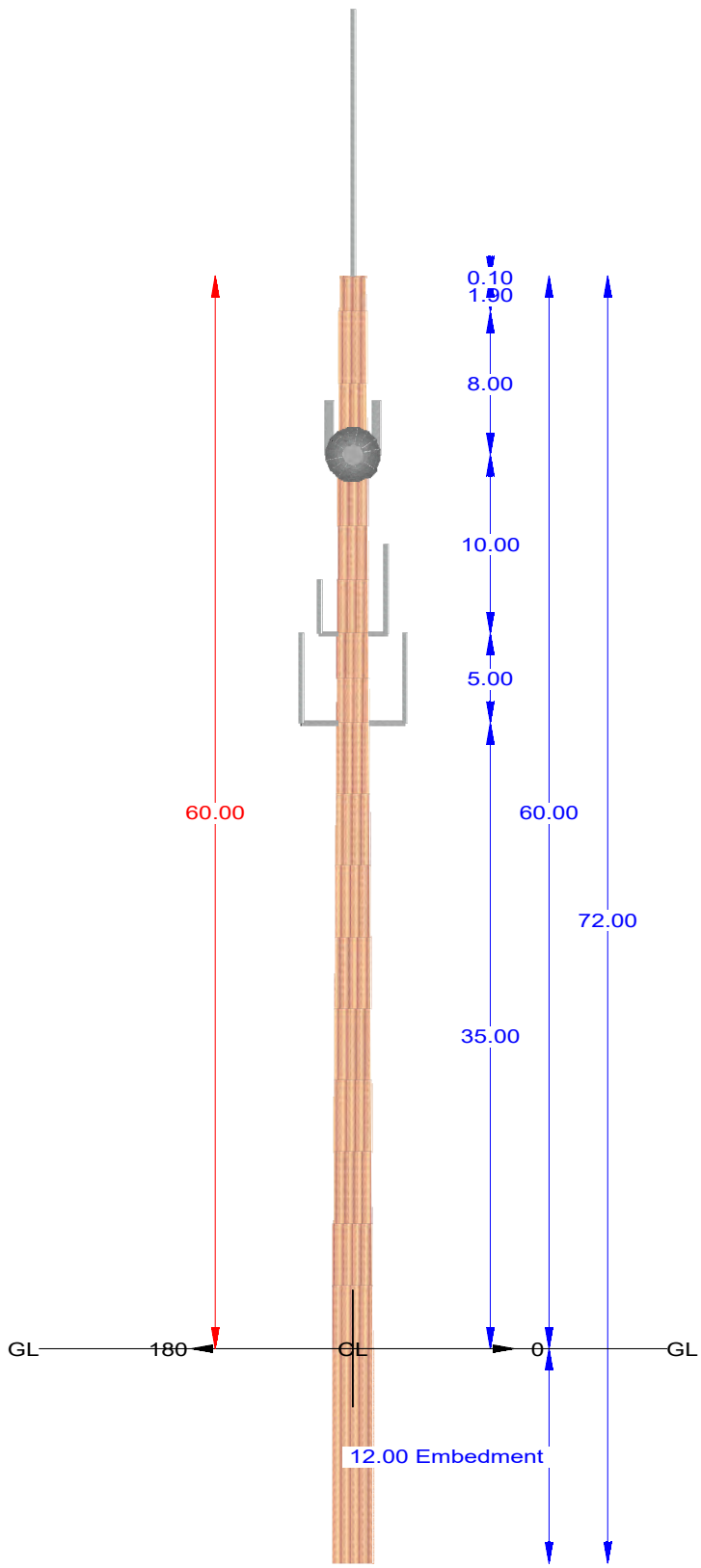
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Description : Pole embedment Design - C.1 Light loading (55 SF max antennas - no ice)

+1.035D+0.750Lr+0.750L+0.7875E+H	3.961	198.056	715.0	1,200.0	1.000
+1.035D+0.750L+0.750S+0.7875E+H	3.961	198.056	715.0	1,200.0	1.000
+0.60D+W+H	6.264	231.600	889.0	1,200.0	1.000



CUSTOMER: **ADCOMM**
 PROJECT TITLE: **Overturf Butte**
 QUOTE NUMBER: **64891**
 DELIVERY LOCATION: **Bend, OR**
 DATE: **4/15/2019**
 DESIGNED BY: **CML**

General Design Specifications

Loading District _____ EIA-TIA 222-G _____

Structure Specifications - Structure 1

Quantity	1
Pole Property	MDT-H8-72
Length (ft)	72
Width (in)	18
Tip Depth (in)	18
Base Depth (in)	27
Embed. Depth (ft)	12
Pole Height Above Grade (ft)	60
Foundation Diameter (ft)	3.5
Soil Class	5 (Assumed)
Trans. Ground Line Moment [GLM] (ft-k)	280.8
Max. Transverse GLM Capacity (ft-k)	919
Max. Applied Longitudinal GLM (ft-k)	452.9
Max. Longitudinal GLM Capacity (ft-k)	1033

Foundation Hardware (Per Pole)

Item	Quantity	Description
21	16	3/4" Ø Rd. Washers
22	8	3/4" Ø MF Locknuts
23	8	3/4" Ø x 22" Sq. Headed Bolt
24	8	L12" x 4" x 3/8" by 24" long

Project Name :
 Project Notes:
 Project File : R:\Quotes and Orders\64891 - ADCOMM - Overturf Butte\Engineering\Overturf Butte.rev2.POL
 Date run : 11:06:13 AM Monday, April 15, 2019
 by : PLS-POLE Version 15.30
 Licensed to : McFarland Cascade

Successfully performed nonlinear analysis

The model has 0 warnings.

Loads from file: R:\Quotes and Orders\64891 - ADCOMM - Overturf Butte\Engineering\OverturfButte.rev2.eia

*** Analysis Results:

Maximum element usage is 93.37% for Laminated Wood Pole "lam" in load case "1: 1.2D + 1.0 Dg + 1.6Wo (45 Deg Angle)"

Foundation Design Forces For All Load Cases:

Note: loads are factored.

Load Case	Foundation Description	Axial Force (kips)	Shear Force (kips)	Bending Moment (ft-k)	Foundation Usage %
1: 1.2D + 1.0 Dg + 1.6Wo (0 Deg Angle)	lam:g	9.73	11.89	452.94	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (45 Deg Angle)	lam:g	9.73	10.71	414.00	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (60 Deg Angle)	lam:g	9.73	10.14	396.86	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (90 Deg Angle)	lam:g	9.73	8.00	280.80	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (-45 Deg Angle)	lam:g	9.73	10.71	413.94	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (-60 Deg Angle)	lam:g	9.73	10.14	396.77	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (-90 Deg Angle)	lam:g	9.73	8.00	280.67	0.00
2: 0.9D + 1.0Dg + 1.6Wo (0 Deg Angle)	lam:g	7.30	11.89	450.41	0.00
2: 0.9D + 1.0Dg + 1.6Wo (45 Deg Angle)	lam:g	7.30	10.71	411.87	0.00
2: 0.9D + 1.0Dg + 1.6Wo (60 Deg Angle)	lam:g	7.30	10.14	394.99	0.00
2: 0.9D + 1.0Dg + 1.6Wo (90 Deg Angle)	lam:g	7.30	8.00	280.03	0.00
2: 0.9D + 1.0Dg + 1.6Wo (-45 Deg Angle)	lam:g	7.30	10.71	411.83	0.00
2: 0.9D + 1.0Dg + 1.6Wo (-60 Deg Angle)	lam:g	7.30	10.14	394.93	0.00
2: 0.9D + 1.0Dg + 1.6Wo (-90 Deg Angle)	lam:g	7.30	8.00	279.93	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (0 Deg Angle)	lam:g	9.73	1.48	56.55	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (45 Deg Angle)	lam:g	9.73	1.33	51.71	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (60 Deg Angle)	lam:g	9.73	1.26	49.57	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (90 Deg Angle)	lam:g	9.73	1.00	35.04	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (-45 Deg Angle)	lam:g	9.73	1.33	51.65	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (-60 Deg Angle)	lam:g	9.73	1.26	49.48	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (-90 Deg Angle)	lam:g	9.73	1.00	34.90	0.00
4: 1.2D + 1.0Dg + 1.0E	lam:g	9.73	0.84	37.35	0.00
5: 0.9D + 1.0Dg + 1.0E	lam:g	7.30	0.84	37.12	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (0 Deg Angle)	lam:g	8.11	4.61	175.09	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (45 Deg Angle)	lam:g	8.11	4.15	160.08	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (60 Deg Angle)	lam:g	8.11	3.93	153.49	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (90 Deg Angle)	lam:g	8.11	3.10	108.70	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-45 Deg Angle)	lam:g	8.11	4.15	160.03	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-60 Deg Angle)	lam:g	8.11	3.93	153.42	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-90 Deg Angle)	lam:g	8.11	3.10	108.58	0.00

Summary of Joint Support Reactions For All Load Cases:

Load Case	Joint Label	Long. Force (kips)	Tran. Force (kips)	Vert. Force (kips)	Shear Force (kips)	Tran. Moment (ft-k)	Long. Moment (ft-k)	Bending Moment (ft-k)	Vert. Moment (ft-k)	Found. Usage %
1: 1.2D + 1.0 Dg + 1.6Wo (0 Deg Angle)	lam:g	-11.89	-0.00	-9.73	11.89	0.07	-452.94	452.94	0.14	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (45 Deg Angle)	lam:g	-9.26	-5.39	-9.73	10.71	182.21	-371.75	414.00	-2.63	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (60 Deg Angle)	lam:g	-7.45	-6.88	-9.73	10.14	240.12	-315.97	396.86	-3.04	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (90 Deg Angle)	lam:g	0.02	-8.00	-9.73	8.00	280.80	0.91	280.80	-0.21	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (-45 Deg Angle)	lam:g	-9.26	5.39	-9.73	10.71	-182.07	-371.75	413.94	2.82	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (-60 Deg Angle)	lam:g	-7.45	6.88	-9.73	10.14	-239.99	-315.97	396.77	3.17	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (-90 Deg Angle)	lam:g	0.02	8.00	-9.73	8.00	-280.66	0.91	280.67	0.21	0.00
2: 0.9D + 1.0Dg + 1.6Wo (0 Deg Angle)	lam:g	-11.89	-0.00	-7.30	11.89	0.05	-450.41	450.41	0.13	0.00
2: 0.9D + 1.0Dg + 1.6Wo (45 Deg Angle)	lam:g	-9.26	-5.39	-7.30	10.71	181.71	-369.62	411.87	-2.60	0.00
2: 0.9D + 1.0Dg + 1.6Wo (60 Deg Angle)	lam:g	-7.45	-6.88	-7.30	10.14	239.46	-314.13	394.99	-3.01	0.00
2: 0.9D + 1.0Dg + 1.6Wo (90 Deg Angle)	lam:g	0.02	-8.00	-7.30	8.00	280.03	0.93	280.03	-0.21	0.00
2: 0.9D + 1.0Dg + 1.6Wo (-45 Deg Angle)	lam:g	-9.26	5.39	-7.30	10.71	-181.61	-369.62	411.83	2.79	0.00
2: 0.9D + 1.0Dg + 1.6Wo (-60 Deg Angle)	lam:g	-7.45	6.88	-7.30	10.14	-239.36	-314.13	394.93	3.15	0.00
2: 0.9D + 1.0Dg + 1.6Wo (-90 Deg Angle)	lam:g	0.02	8.00	-7.30	8.00	-279.92	0.93	279.93	0.21	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (0 Deg Angle)	lam:g	-1.48	-0.00	-9.73	1.48	0.07	-56.55	56.55	0.02	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (45 Deg Angle)	lam:g	-1.15	-0.67	-9.73	1.33	22.77	-46.42	51.71	-0.07	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (60 Deg Angle)	lam:g	-0.93	-0.86	-9.73	1.26	29.98	-39.47	49.57	-0.08	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (90 Deg Angle)	lam:g	0.00	-1.00	-9.73	1.00	35.04	0.02	35.04	-0.03	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (-45 Deg Angle)	lam:g	-1.15	0.67	-9.73	1.33	-22.63	-46.42	51.65	0.09	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (-60 Deg Angle)	lam:g	-0.93	0.86	-9.73	1.26	-29.85	-39.47	49.48	0.10	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0Owi + 1.0Ti (-90 Deg Angle)	lam:g	0.00	1.00	-9.73	1.00	-34.90	0.02	34.90	0.03	0.00
4: 1.2D + 1.0Dg + 1.0E	lam:g	-0.84	0.00	-9.73	0.84	0.07	-37.35	37.35	0.00	0.00
5: 0.9D + 1.0Dg + 1.0E	lam:g	-0.84	0.00	-7.30	0.84	0.05	-37.12	37.12	0.00	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (0 Deg Angle)	lam:g	-4.61	-0.00	-8.11	4.61	0.06	-175.09	175.09	0.05	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (45 Deg Angle)	lam:g	-3.59	-2.09	-8.11	4.15	70.57	-143.69	160.08	-0.46	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (60 Deg Angle)	lam:g	-2.89	-2.67	-8.11	3.93	92.98	-122.12	153.49	-0.53	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (90 Deg Angle)	lam:g	0.01	-3.10	-8.11	3.10	108.70	0.30	108.70	-0.08	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-45 Deg Angle)	lam:g	-3.59	2.09	-8.11	4.15	-70.46	-143.69	160.03	0.53	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-60 Deg Angle)	lam:g	-2.89	2.67	-8.11	3.93	-92.87	-122.12	153.42	0.58	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-90 Deg Angle)	lam:g	0.01	3.10	-8.11	3.10	-108.58	0.30	108.58	0.08	0.00

Summary of Tip Deflections For All Load Cases:

Note: positive tip load results in positive deflection

Load Case	Joint Label	Long. Defl. (in)	Tran. Defl. (in)	Vert. Defl. (in)	Resultant Defl. (in)	Long. Rot. (deg)	Tran. Rot. (deg)	Twist Rot. (deg)
1: 1.2D + 1.0 Dg + 1.6Wo (0 Deg Angle)	lam:t	28.61	0.00	-0.67	28.62	3.26	-0.00	-0.00
1: 1.2D + 1.0 Dg + 1.6Wo (45 Deg Angle)	lam:t	24.07	5.62	-0.51	24.72	2.77	-0.65	0.01
1: 1.2D + 1.0 Dg + 1.6Wo (60 Deg Angle)	lam:t	20.94	7.57	-0.41	22.27	2.44	-0.88	0.01
1: 1.2D + 1.0 Dg + 1.6Wo (90 Deg Angle)	lam:t	-0.07	8.88	-0.07	8.88	-0.01	-1.04	0.00
1: 1.2D + 1.0 Dg + 1.6Wo (-45 Deg Angle)	lam:t	24.07	-5.61	-0.51	24.72	2.77	0.65	-0.01
1: 1.2D + 1.0 Dg + 1.6Wo (-60 Deg Angle)	lam:t	20.94	-7.56	-0.41	22.27	2.44	0.88	-0.01

1: 1.2D + 1.0 Dg + 1.6Wo (-90 Deg Angle)	lam:t	-0.07	-8.88	-0.07	8.88	-0.01	1.04	-0.00
2: 0.9D + 1.0Dg + 1.6Wo (0 Deg Angle)	lam:t	28.42	0.00	-0.66	28.42	3.24	-0.00	-0.00
2: 0.9D + 1.0Dg + 1.6Wo (45 Deg Angle)	lam:t	23.91	5.60	-0.50	24.56	2.76	-0.65	0.01
2: 0.9D + 1.0Dg + 1.6Wo (60 Deg Angle)	lam:t	20.80	7.54	-0.41	22.13	2.42	-0.88	0.01
2: 0.9D + 1.0Dg + 1.6Wo (90 Deg Angle)	lam:t	-0.07	8.85	-0.07	8.85	-0.01	-1.04	0.00
2: 0.9D + 1.0Dg + 1.6Wo (-45 Deg Angle)	lam:t	23.91	-5.59	-0.50	24.56	2.76	0.65	-0.01
2: 0.9D + 1.0Dg + 1.6Wo (-60 Deg Angle)	lam:t	20.80	-7.53	-0.41	22.13	2.42	0.88	-0.01
2: 0.9D + 1.0Dg + 1.6Wo (-90 Deg Angle)	lam:t	-0.07	-8.85	-0.07	8.85	-0.01	1.04	-0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (0 Deg Angle)	lam:t	3.58	0.00	-0.01	3.58	0.41	-0.00	-0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (45 Deg Angle)	lam:t	3.01	0.70	-0.01	3.09	0.35	-0.08	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (60 Deg Angle)	lam:t	2.62	0.95	-0.01	2.79	0.31	-0.11	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (90 Deg Angle)	lam:t	0.00	1.11	-0.00	1.11	0.00	-0.13	0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-45 Deg Angle)	lam:t	3.01	-0.70	-0.01	3.09	0.35	0.08	-0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-60 Deg Angle)	lam:t	2.62	-0.94	-0.01	2.78	0.31	0.11	-0.00
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-90 Deg Angle)	lam:t	0.00	-1.10	-0.00	1.10	0.00	0.13	-0.00
4: 1.2D + 1.0Dg + 1.0E	lam:t	2.45	0.00	-0.01	2.45	0.28	-0.00	-0.00
5: 0.9D + 1.0Dg + 1.0E	lam:t	2.43	0.00	-0.01	2.43	0.28	-0.00	-0.00
Service: 1.0D + 1.0Dg + 1.0Wo (0 Deg Angle)	lam:t	11.06	0.00	-0.10	11.06	1.26	-0.00	-0.00
Service: 1.0D + 1.0Dg + 1.0Wo (45 Deg Angle)	lam:t	9.30	2.17	-0.08	9.55	1.07	-0.25	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (60 Deg Angle)	lam:t	8.10	2.93	-0.06	8.61	0.94	-0.34	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (90 Deg Angle)	lam:t	-0.02	3.44	-0.01	3.44	-0.00	-0.40	0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-45 Deg Angle)	lam:t	9.30	-2.17	-0.08	9.55	1.07	0.25	-0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-60 Deg Angle)	lam:t	8.10	-2.92	-0.06	8.61	0.94	0.34	-0.00
Service: 1.0D + 1.0Dg + 1.0Wo (-90 Deg Angle)	lam:t	-0.02	-3.43	-0.01	3.43	-0.00	0.40	-0.00

Summary of Laminated Wood Pole Usages:

Laminated Wood Pole Label Usage %	Load Case Segment Weight Number (lbs)
lam 93.37 1: 1.2D + 1.0 Dg + 1.6Wo (45 Deg Angle)	18 8579.2

*** Maximum Stress Summary for Each Load Case

Summary of Maximum Usages by Load Case:

Load Case	Maximum Usage %	Element Label	Element Type
1: 1.2D + 1.0 Dg + 1.6Wo (0 Deg Angle)	90.38	lam Laminated Wood	
1: 1.2D + 1.0 Dg + 1.6Wo (45 Deg Angle)	93.37	lam Laminated Wood	
1: 1.2D + 1.0 Dg + 1.6Wo (60 Deg Angle)	88.37	lam Laminated Wood	
1: 1.2D + 1.0 Dg + 1.6Wo (90 Deg Angle)	30.06	lam Laminated Wood	
1: 1.2D + 1.0 Dg + 1.6Wo (-45 Deg Angle)	93.35	lam Laminated Wood	
1: 1.2D + 1.0 Dg + 1.6Wo (-60 Deg Angle)	88.35	lam Laminated Wood	
1: 1.2D + 1.0 Dg + 1.6Wo (-90 Deg Angle)	30.05	lam Laminated Wood	
2: 0.9D + 1.0Dg + 1.6Wo (0 Deg Angle)	89.77	lam Laminated Wood	
2: 0.9D + 1.0Dg + 1.6Wo (45 Deg Angle)	92.79	lam Laminated Wood	
2: 0.9D + 1.0Dg + 1.6Wo (60 Deg Angle)	87.83	lam Laminated Wood	
2: 0.9D + 1.0Dg + 1.6Wo (90 Deg Angle)	29.88	lam Laminated Wood	
2: 0.9D + 1.0Dg + 1.6Wo (-45 Deg Angle)	92.78	lam Laminated Wood	
2: 0.9D + 1.0Dg + 1.6Wo (-60 Deg Angle)	87.82	lam Laminated Wood	
2: 0.9D + 1.0Dg + 1.6Wo (-90 Deg Angle)	29.87	lam Laminated Wood	
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (0 Deg Angle)	11.65	lam Laminated Wood	
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (45 Deg Angle)	12.02	lam Laminated Wood	
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (60 Deg Angle)	11.40	lam Laminated Wood	
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (90 Deg Angle)	4.10	lam Laminated Wood	
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-45 Deg Angle)	12.01	lam Laminated Wood	
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-60 Deg Angle)	11.39	lam Laminated Wood	
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-90 Deg Angle)	4.08	lam Laminated Wood	
4: 1.2D + 1.0Dg + 1.0E	7.84	lam Laminated Wood	
5: 0.9D + 1.0Dg + 1.0E	7.69	lam Laminated Wood	
Service: 1.0D + 1.0Dg + 1.0Wo (0 Deg Angle)	35.13	lam Laminated Wood	
Service: 1.0D + 1.0Dg + 1.0Wo (45 Deg Angle)	36.29	lam Laminated Wood	
Service: 1.0D + 1.0Dg + 1.0Wo (60 Deg Angle)	34.36	lam Laminated Wood	
Service: 1.0D + 1.0Dg + 1.0Wo (90 Deg Angle)	11.81	lam Laminated Wood	
Service: 1.0D + 1.0Dg + 1.0Wo (-45 Deg Angle)	36.28	lam Laminated Wood	
Service: 1.0D + 1.0Dg + 1.0Wo (-60 Deg Angle)	34.34	lam Laminated Wood	
Service: 1.0D + 1.0Dg + 1.0Wo (-90 Deg Angle)	11.80	lam Laminated Wood	

Summary of Laminated Wood Pole Usages by Load Case:

Load Case	Maximum Usage %	Laminated Wood Pole Label	Segment Number
1: 1.2D + 1.0 Dg + 1.6Wo (0 Deg Angle)	90.38	lam	18
1: 1.2D + 1.0 Dg + 1.6Wo (45 Deg Angle)	93.37	lam	18
1: 1.2D + 1.0 Dg + 1.6Wo (60 Deg Angle)	88.37	lam	18
1: 1.2D + 1.0 Dg + 1.6Wo (90 Deg Angle)	30.06	lam	18
1: 1.2D + 1.0 Dg + 1.6Wo (-45 Deg Angle)	93.35	lam	18
1: 1.2D + 1.0 Dg + 1.6Wo (-60 Deg Angle)	88.35	lam	18
1: 1.2D + 1.0 Dg + 1.6Wo (-90 Deg Angle)	30.05	lam	18
2: 0.9D + 1.0Dg + 1.6Wo (0 Deg Angle)	89.77	lam	18
2: 0.9D + 1.0Dg + 1.6Wo (45 Deg Angle)	92.79	lam	18
2: 0.9D + 1.0Dg + 1.6Wo (60 Deg Angle)	87.83	lam	18
2: 0.9D + 1.0Dg + 1.6Wo (90 Deg Angle)	29.88	lam	18
2: 0.9D + 1.0Dg + 1.6Wo (-45 Deg Angle)	92.78	lam	18
2: 0.9D + 1.0Dg + 1.6Wo (-60 Deg Angle)	87.82	lam	18
2: 0.9D + 1.0Dg + 1.6Wo (-90 Deg Angle)	29.87	lam	18
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (0 Deg Angle)	11.65	lam	18
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (45 Deg Angle)	12.02	lam	18
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (60 Deg Angle)	11.40	lam	18
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (90 Deg Angle)	4.10	lam	18
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-45 Deg Angle)	12.01	lam	18
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-60 Deg Angle)	11.39	lam	18
3: 1.2D + 1.0Dg + 1.0Di + 1.0OWi + 1.0Ti (-90 Deg Angle)	4.08	lam	18
4: 1.2D + 1.0Dg + 1.0E	7.84	lam	18
5: 0.9D + 1.0Dg + 1.0E	7.69	lam	18
Service: 1.0D + 1.0Dg + 1.0Wo (0 Deg Angle)	35.13	lam	18
Service: 1.0D + 1.0Dg + 1.0Wo (45 Deg Angle)	36.29	lam	18
Service: 1.0D + 1.0Dg + 1.0Wo (60 Deg Angle)	34.36	lam	18
Service: 1.0D + 1.0Dg + 1.0Wo (90 Deg Angle)	11.81	lam	18
Service: 1.0D + 1.0Dg + 1.0Wo (-45 Deg Angle)	36.28	lam	18
Service: 1.0D + 1.0Dg + 1.0Wo (-60 Deg Angle)	34.34	lam	18



THE WALL-MOUNT™ AIR CONDITIONERS - 9.0 EER, (60HZ)

Models W17A2 to W60A2
Models W17L2 to W60L2
1.5 to 5 Ton

Right-Side Control Panel
Left-Side Control Panel
(16,400 to 55,000 Btuh)

GREEN REFRIGERANT
R-410A

The Bard Wall-Mount Air Conditioner is a self contained energy efficient system, which is designed to offer maximum indoor comfort at a minimal cost without using valuable indoor floor space or outside ground space. This unit is the ideal product for versatile applications such as: new construction, modular offices, school modernization, telecommunication structures, portable structures or correctional facilities. Factory or field installed accessories are available to meet specific job requirements.

Engineered Features

Aluminum Finned Copper Coils:

Grooved tubing and enhanced louvered fin for maximum heat transfer and energy efficiency.

Twin Blowers:

Move air quietly. Most models feature multispeed blower motors providing airflow adjustment for high and low static operation. Motor overload protection is standard on all models.

Air Conditioner Compressor:

Scroll Compressors eliminate need for crankcase heater. Standard on all models.

R-410A Refrigerant:

Designed with R-410A (HFC) non-ozone depleting refrigerant in compliance with the Montreal protocol and 2010 EPA requirements.

Phase Rotation Monitor:

Standard on all 3 phase scroll compressors. Protects against reverse rotation if power supply is not properly connected.

Galvanized 20 Gauge Zinc Coated Steel Cabinet:

Cleaned, rinsed, sealed and dried before the polyurethane primer is applied. The cabinet is handsomely finished with a baked on textured enamel, which allows it to withstand 1000 hours of salt spray tests per ASTM B117-03.

Foil Faced Insulation:

Standard on all units.

Full Length Mounting Brackets:

Built into cabinet for improved appearance and easy installation.

NOTE: Bottom mounting bracket included to assist in installation.

Electrical Components:

Are easily accessible for routine inspection and maintenance through a right side, service panel opening. Features a lockable, hinged access cover to the circuit breaker or toggle disconnect switch.

Electric Heat Strips:

Features an automatic limit and thermal cut-off safety control. Heater packages can be factory or field installed.

Filter Service Door:

Separate service door provides easy access for filter change.

One Inch, Disposable Air Filters:

Are standard equipment. Optional one inch washable filters available and filter racks permit the addition of 2" pleated filter. Factory or field installed.

Condenser Fan and Motor Shroud Assembly:

Slides out for easy access.

Barometric Fresh Air Damper:

Standard on all units. Allows up to 25% outside fresh air. Optional ventilation packages available.

Built-in Circuit Breakers:

Standard on all electric heat versions of single (230/208 volt) and three phase (230/208 volt) equipment. Toggle disconnects are standard on all electric heat versions of three phase (460 volt) equipment.

Slope Top:

Standard feature for water run-off.

Top Rain Flashing:

Standard feature on all models.

Liquid Line Filter Drier:

Standard on all units. Protects system against moisture.



Compressor Control Module:

Standard on all units. Built-in off-delay timer adjustable from 30 seconds to 5 minutes. 2-minute on-delay if power interrupt. 120-second bypass for low pressure control, and both soft and manual lockouts for high and low pressure controls. Alarm output for alarm relay.

High & Low Pressure Switches are Auto-Reset:

Standard on all units. Built-in lockout circuit resets from the room thermostat. Provides commercial quality protection to the compressor.



Bard is an
 ISO 9001:2008
 Certified Manufacturer

- Complies with efficiency requirements of ASHRAE/IESNA 90.1-2010.
- Certified to ANSI/ARI Standard 390-2003 for SPVU (Single Package Vertical Units).
- Intertek ETL Listed to Standard for Safety Heating and Cooling Equipment ANSI/UL 1995/CSA 22.2 No. 236-05, Fourth Edition.
- Commercial Product - Not intended for Residential application.

Capacity and Efficiency Ratings

Models	W17A2 / W18A2 W17L2 / W18L2	W24A2 W24L2	W30A2 W30L2	W36A2 W36L2	W42A2 W42L2	W48A2 W48L2	W60A2 W60L2
Cooling Capacity BTUH Ⓣ	16,400	23,600	29,400	35,000	40,000	48,500	55,000
EER	9.00	9.00	9.00	9.00	9.50	9.00	9.00

① Capacity is certified in accordance with ANSI/ARI Standard 390-2003.

② EER = Energy Efficiency Ratio and is certified in accordance with ANSI/ARI Standard 390-2003.

All ratings based on fresh air intake being 100% closed (no outside air introduction).

Specifications 1-1/2 Ton through 3 Ton

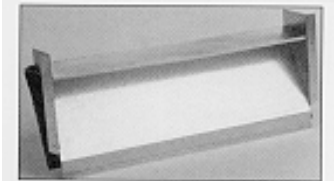
MODELS	W17A2-A W17L2-A	W18A2-A W18L2-A	W24A2-A W24L2-A	W24A2-B W24L2-B	W24A2-C	W30A2-A W30L2-A	W30A2-B W30L2-B	W30A2-C W30L2-C	W36A2-A W36L2-A	W36A2-B W36L2-B	W36A2-C W36L2-C
Electrical Rating – 60 Hz	230/208-1	230/208-1	230/208-1	230/208-3	460-3	230/208-1	230/208-3	460-3	230/208-1	230/208-3	460-3
Operating Voltage Range	197-253	197-253	197-253	197-253	414-506	197-253	197-253	414-506	197-253	197-253	414-506
Compressor--Circuit A											
Voltage	230/208	230/208	230/208	230/208	460	230/208	230/208	460	230/208	230/208	460
Rated Load Amps	6.5/7.4	6.3/7.2	9.6/11.2	6.3/7.3	4.5	12.2/13.9	7.8/8.9	5.6	15.3/17.2	11.3/12.7	5.8
Branch Circuit Selection Current	9.0	9.0	12.9	8.4	5.2	14.2	9.0	5.7	18	13.3	6.0
Lock Rotor Amps	48/48	48/48	64/64	58/58	28	77/77	71/71	38	112/112	88/88	44
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Fan Motor & Condenser											
Fan Motor--HP--RPM	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075	1/5 - 1075
Fan Motor--Amps	1.2	1.2	1.2	1.2	0.8	1.5	1.5	0.8	1.5	1.5	0.8
Fan--DIA/CFM	18" - 1700	18" - 1700	18" - 1700	18" - 1700	18" - 1700	20" - 2200	20" - 2200	20" - 2200	20" - 2000	20" - 2000	20" - 2000
Blower Motor & Evap.											
Blower Motor--HP-RPM-SPD	1/6-1100-2	1/6-1100-2	1/6-1100-1	1/6-1100-1	1/6-1100-1	1/3-1100-2	1/3-1100-2	1/3-1100-2	1/3-1100-2	1/3-1100-2	1/3-1100-2
Blower Motor--Amps	1.0	1.0	0.8	0.8	.45	2.1	2.1	1.0	2.1	2.1	1.0
CFM Cooling & E.S.P. w/Filter (Rated-Wet Coil)	600 - .40	550 - .45	800 - .30	800 - .30	800 - .30	1000 - .3	1000 - .3	1000 - .3	1100 - .2	1100 - .2	1100 - .2
Filter Sizes (inches) STD.	16x25x1	16x25x1	16x25x1	16x25x1	16x25x1	16x30x1	16x30x1	16x30x1	16x30x1	16x30x1	16x30x1
Shipping Weight --LBS.	325	325	325	325	325	360	360	360	375	375	375
Basic Unit Weight-LBS.	310	310	310	310	310	343	343	343	361	361	361
Barometric Fresh Air Damper	6.0	6.0	6.0	6.0	6.0	7.5	7.5	7.5	7.5	7.5	7.5
Blank-Off Plate	3.5	3.5	3.5	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0
Motorized Fresh Air Damper	10.75	10.75	10.75	10.75	10.75	12.25	12.25	12.25	12.25	12.25	12.25
Commercial Room Ventilator	32	32	32	32	32	48	48	48	48	48	48
Economizer	32	32	32	32	32	48	48	48	48	48	48
Energy Recovery Ventilator	50	50	50	50	50	60	60	60	60	60	60

Specifications 3-1/2 Ton through 5 Ton

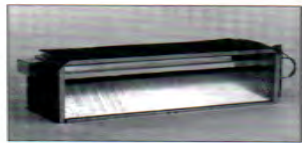
MODELS	W42A2-A W42L2-A	W42A2-B W42L2-B	W42A2-C W42L2-C	W48A2-A W48L2-A	W48A2-B W48L2-B	W48A2-C W48L2-C	W60A2-A W60L2-A	W60A2-B W60L2-B	W60A2-C W60L2-C
Electrical Rating – 60 Hz	230/208-1	230/208-3	460-3	230/208-1	230/208-3	460-3	230/208-1	230/208-3	460-3
Operating Voltage Range	197-253	197-253	414-506	197-253	197-253	414-506	197-253	197-253	414-506
Compressor--Circuit A									
Voltage	230/208	230/208	460	230/208	230/208	460	230/208	230/208	460
Rated Load Amps	15.9/17.8	10.5/11.8	5.5	21/23.5	13.4/15	6.7	21.9/24.9	13/14.8	7.4
Branch Circuit Selection Current	19.9	13.2	6.1	25	15.9	7.1	26.3	15.7	7.8
Lock Rotor Amps	109/109	83.1/83.1	41	134/134	110/110	52	134/134	110/110	52
Compressor Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Fan Motor & Condenser									
Fan Motor--HP--RPM-SPD	1/3-825-2	1/3-825-2	1/3-825-1	1/3-825-2	1/3-825-2	1/3-825-1	1/3-825-2	1/3-825-2	1/3-825-1
Fan Motor--Amps	2.5	2.5	1.3	2.5	2.5	1.3	2.5	2.5	1.3
Fan--DIA/CFM	24" - 2700	24" - 2700	24" - 2700	24" - 2700	24" - 2700	24" - 2700	24" - 2500	24" - 2500	24" - 2500
Blower Motor & Evap.									
Blower Motor--HP-RPM-SPD	1/3-985-2	1/3-985-2	1/3-985-2	1/3-985-2	1/3-985-2	1/3-985-2	1/2-1070-2	1/2-1070-2	1/2-1070-2
Blower Motor--Amps	2.3	2.3	1.2	2.3	2.3	1.2	3.5	3.5	1.9
CFM Cooling & E.S.P. w/Filter (Rated-Wet Coil)	1400 - .45	1400 - .45	1400 - .45	1550 - .3	1550 - .3	1550 - .3	1700 - .4	1700 - .4	1700 - .4
Filter Sizes (inches) STD.	20x30x1	20x30x1	20x30x1	20x30x1	20x30x1	20x30x1	20x30x1	20x30x1	20x30x1
Shipping Weight --LBS.	475	475	475	475	475	475	500	500	500
Basic Unit Weight-LBS.	451	451	451	457	457	457	479	479	479
Barometric Fresh Air Damper	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Blank-Off Plate	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Motorized Fresh Air Damper	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Commercial Room Ventilator	45	45	45	45	45	45	45	45	45
Economizer	45	45	45	45	45	45	45	45	45
Energy Recovery Ventilator	76	76	76	76	76	76	76	76	76

Ventilation System Packages

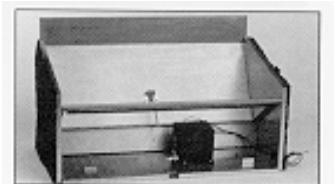
Bard Wall-Mounts are designed to provide optional ventilation packages to meet all of your ventilation and indoor air quality requirements. All units are equipped with a barometric fresh air damper as the standard ventilation package. All ventilation packages can be built-in at the factory or field-installed at a later date.



Barometric Fresh Air Damper



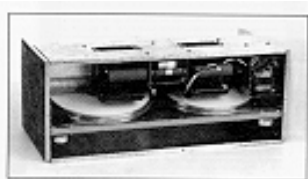
Motorized Fresh Air Damper



Commercial Room Ventilator



Economizer



Energy Recovery Ventilator

BAROMETRIC FRESH AIR DAMPER - BFAD

STANDARD

The barometric fresh air damper is a standard feature on all models. It is installed on the inside of the service door and allows outside ventilation air, up to 25% of the total airflow rating of the unit, to be introduced through the air inlet openings and to be mixed with the conditioned air. The damper opens during blower operation and closes when the blower is off. Adjustable blade stops allow different amounts of outside air to be introduced into the building and can be easily locked closed if required.

BLANK OFF PLATE - BOP

OPTIONAL

A blank off plate is installed on the inside of the service door. It covers the air inlet openings, which restricts any outside air from entering the unit. The blank off plate should be utilized in applications where outside air is not required to be mixed with the conditioned air.

MOTORIZED FRESH AIR DAMPER - MFAD

OPTIONAL

The motorized fresh air damper is internally mounted behind the service door and allows outside ventilation air, up to 25% of the total airflow rating of the unit, to be introduced through the air inlet openings and to be mixed with the conditioned air. The two position damper can be fully open or closed. The damper blade is powered open by a 24VAC motor with spring return on power loss. The damper can be controlled by indoor blower operation or can be field connected to be managed based on building occupancy.

NOTE: The above vent systems are intake only without built-in exhaust capability. Building will likely require separate field installed barometric relief or mechanical exhaust elsewhere within the conditioned space. Balancing dampers in the return air grille may be required to achieve specified amount of outdoor air intake.

COMMERCIAL ROOM VENTILATOR - CRV

OPTIONAL

The built-in commercial room ventilator is internally mounted behind the service door and allows outside ventilation air, up to 50% of the total airflow rating of the unit, to be introduced through the air inlet openings. It includes a built-in exhaust air damper.

The commercial room ventilator (CRV) is a simple and innovative approach to improving the indoor air quality by providing fresh air intake and exhaust capability through the CRV. The damper can be easily adjusted to control the amount of fresh air supplied into the building. The CRV can be controlled by indoor blower operation or field controlled based on room occupancy. Two versions available (except on 1.5 and 2-Ton models). The CRV and CRVS are power open - spring return on power loss, and CRVP is power open and power close. Complies with ANSI/ASHRAE Standard 62.1 "Ventilation for Acceptable Indoor Air Quality".

ECONOMIZER – ECONWM-Series

OPTIONAL

The built-in economizer system is internally mounted behind the service door and allows outdoor air to be introduced through the air inlet openings. The amount of outdoor air varies in response to the system controls and settings defined by the end user. It includes a built-in exhaust air damper. The economizer is designed to provide "free cooling" when outside air conditions are cool and dry enough to satisfy cooling requirements without running the compressor. This in turn provides lower operating costs, while extending the life of the compressor.

- ECONWMT Equipment Building versions have extended 11" air intake hood to deliver up to 100% of cooling rated airflow.
- ECONWMS Standard versions have 3" air intake hood to deliver up to 75% of cooling rated airflow.

Standard Features:

- Fully modulating
- Honeywell Direct Drive Hi-Torque Actuator
- 11" Intake hood with filter
- No linkage required
- Simple single blade design
- Positive shut-off with non-stick gaskets
- Electronic DB and/or Enthalpy sensors depending upon version
- Honeywell JADE electronic economizer module with precision settings and diagnostics
- DB or Enthalpy economizer versions available

WALL-MOUNT ENERGY RECOVERY VENTILATOR - ERVF

OPTIONAL

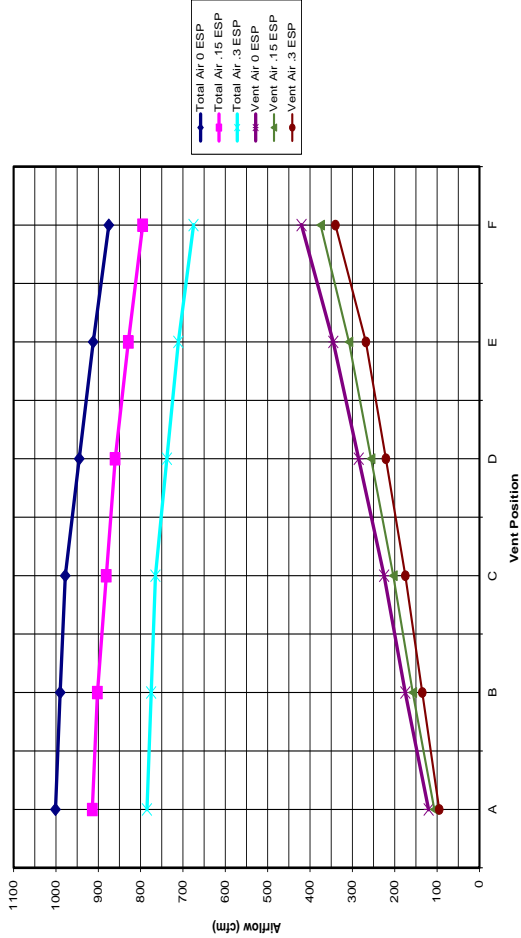
The wall-mount energy recovery ventilator (ERV) is a highly innovative approach to meeting indoor air quality ventilation requirements as established by ANSI/ASHRAE Standard 62.1. The ERV allows from 200 to 450 CFM (depending upon model) of fresh air and exhaust through the unit while maintaining superior indoor comfort and humidity levels. In most cases this can be accomplished without increasing equipment sizing or operating costs. Heat transfer efficiency is up to 67% during summer and 75% during winter conditions.

The ERV consists of a unique "rotary energy recovery cassette" that provides effective sensible and latent heat transfer capabilities during summer and winter conditions. Various control schemes are addressed including limiting ventilation during building occupancy only.

The ERV is designed to be internally mounted behind the service door in the W**A or W**L model wall-mount units. It can be built-in at the factory (W**A only) or field installed as an option. ERVF-*3 and ERVF-*5 can be independently adjusted for intake and exhaust rates.

Commercial Room Ventilator Performance Data - CRV-2

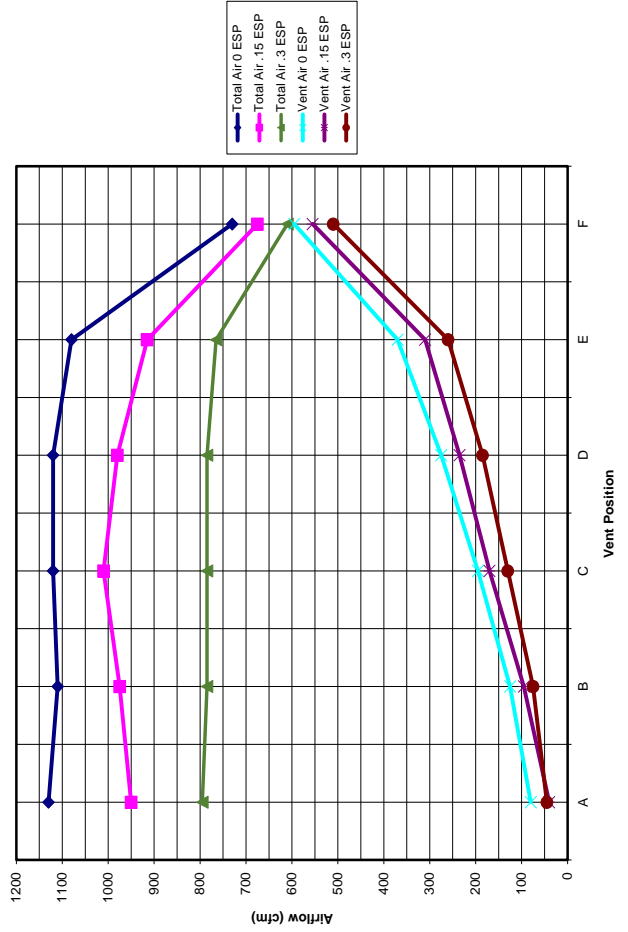
W17/W18 & W24 TOTAL AND VENTILATION AIRFLOW



Airflow amounts less than 100 CFM may not be achievable.

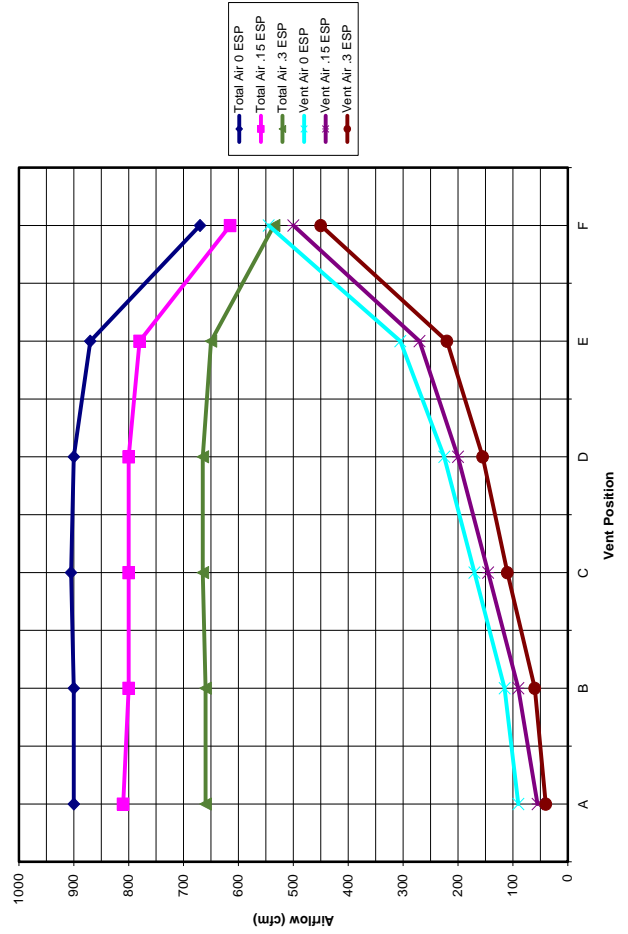
Commercial Room Ventilator Performance Data - CRVS-3 and CRVP-3

W30 & W36 HIGH SPEED TOTAL AND VENTILATION AIRFLOW



Airflow amounts less than 100 CFM may not be achievable.

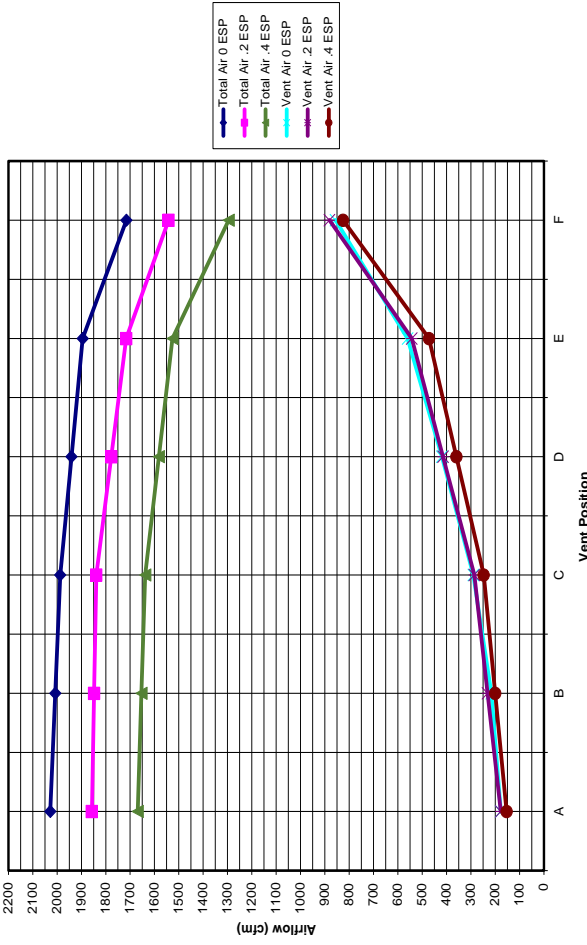
W30 & W36 LOW SPEED TOTAL AND VENTILATION AIRFLOW



Airflow amounts less than 100 CFM may not be achievable.

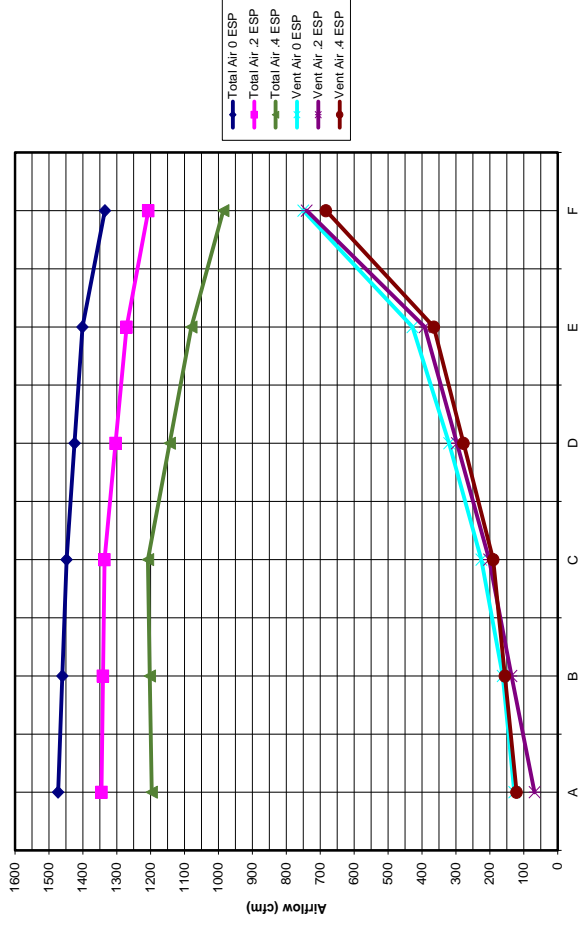
Commercial Room Ventilator Performance Data - CRVS-5 and CRVP-5

W60 HIGH SPEED TOTAL AND VENTILATION AIRFLOW



Airflow amounts less than 100 CFM may not be achievable.

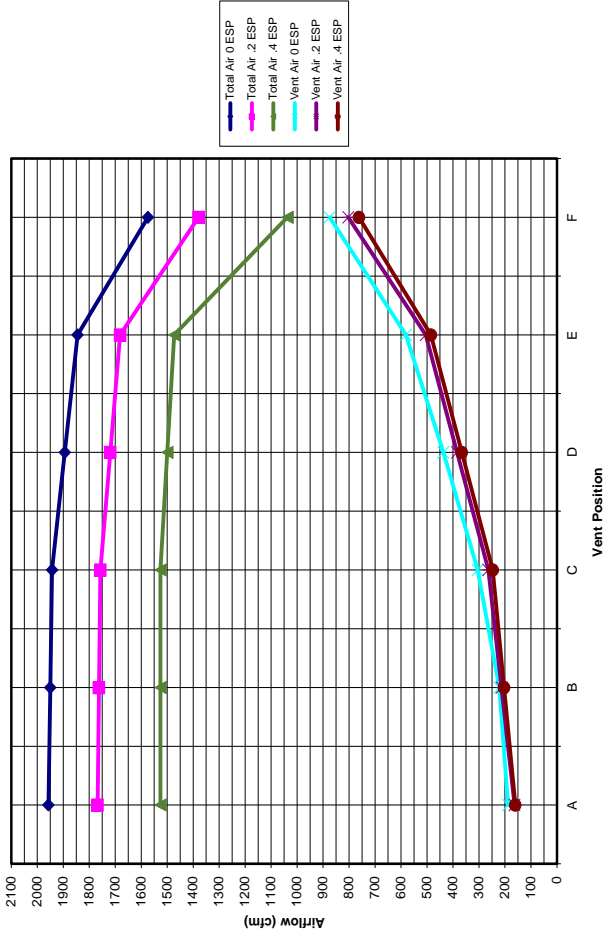
W60 LOW SPEED TOTAL AND VENTILATION AIRFLOW



Airflow amounts less than 100 CFM may not be achievable.

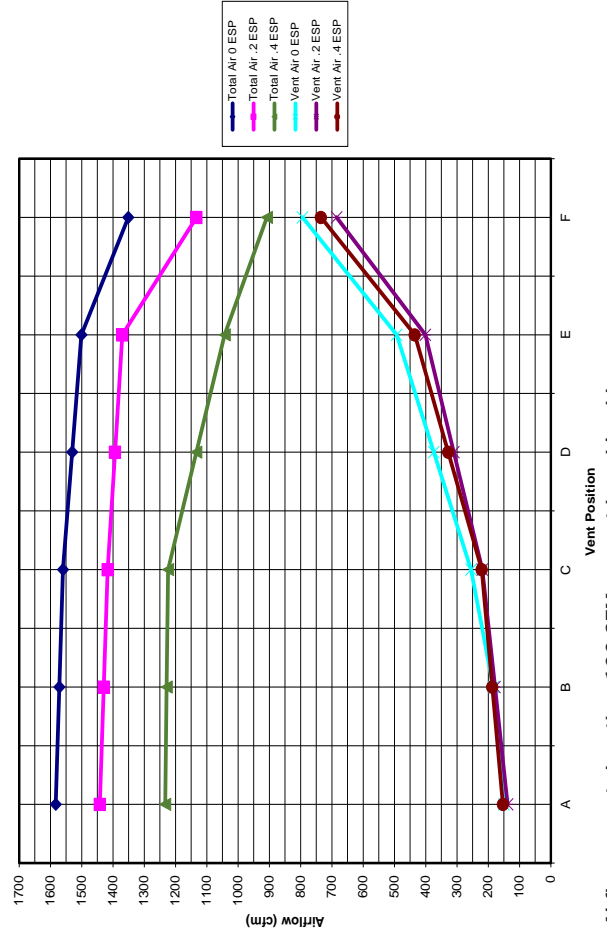
Commercial Room Ventilator Performance Data - CRVS-5 and CRVP-5

W42 & W48 HIGH SPEED TOTAL AND VENTILATION AIRFLOW



Airflow amounts less than 100 CFM may not be achievable.

W42 & W48 LOW SPEED TOTAL AND VENTILATION AIRFLOW



Airflow amounts less than 100 CFM may not be achievable.

Performance and Application Data- ERVF-A2

SUMMER COOLING PERFORMANCE (INDOOR DESIGN CONDITIONS 75°DB/62°WB)

Ambient O.D.		VENTILATION RATE -- 250 CFM 62% EFFICIENCY						VENTILATION RATE -- 225 CFM 63% EFFICIENCY						VENTILATION RATE -- 200 CFM 63% EFFICIENCY					
DB/WB	F	VLT	VLS	VLL	HRT	HRS	HRL	VLT	VLS	VLL	HRT	HRS	HRL	VLT	VLS	VLL	HRT	HRS	HRL
105	75	11925	8100	1325	7394	5022	822	10727	7287	3441	6758	4591	2168	9540	6480	3060	6010	4082	1928
	70	8100	8100	0	5022	5022	0	7287	7287	0	4591	4591	0	6480	6480	0	4082	4082	0
	65	8100	8100	0	5022	5022	0	7287	7287	0	4591	4591	0	6480	6480	0	4082	4082	0
100	80	17550	6750	10800	10881	4185	6696	15788	6072	9716	9946	3826	6121	14040	5400	8640	8845	3402	5443
	75	11925	6750	5175	7394	4185	3209	10727	6072	4655	6758	3826	2933	9540	5400	4140	6010	3402	2608
	70	6863	6750	113	4255	4185	70	6173	6072	101	3889	3826	64	5490	5400	90	3458	3402	56
	65	6750	6750	0	4185	4185	0	6072	6072	0	3826	3826	0	5400	5400	0	3402	3402	0
95	80	17550	5400	12150	10881	3348	7533	15788	4858	10930	9946	3060	6886	14040	4320	9720	8845	2722	6124
	75	11925	5400	6525	7394	3348	4046	10727	4858	5870	6758	3060	3698	9540	4320	5220	6010	2722	3289
	70	6863	5400	1463	4255	3348	907	6173	4858	1315	3889	3060	829	5490	4320	1170	3458	2722	737
	65	5400	5400	0	3348	3348	0	4858	4858	0	3060	3060	0	4320	4320	0	2722	2722	0
90	80	17550	4050	13500	10881	2511	8370	15788	3643	12145	9946	2295	7651	14040	3240	10800	8845	2041	6804
	75	11925	4050	7875	7394	2511	4883	10727	3643	7084	6758	2295	4463	9540	3240	6300	6010	2041	3969
	70	6863	4050	2813	4255	2511	1744	6173	3643	2530	3889	2295	1594	5490	3240	2250	3458	2041	1417
	65	4050	4050	0	2511	2511	0	3643	3643	0	2295	2295	0	3240	3240	0	2041	2041	0
85	80	17550	2700	14850	10881	1674	9207	15788	2429	13359	9946	1530	8416	14040	2160	11880	8845	1361	7484
	75	11925	2700	9225	7394	1674	5720	10727	2429	8298	6758	1530	5228	9540	2160	7380	6010	1361	4649
	70	6863	2700	4163	4255	1674	2581	6173	2429	3744	3889	1530	2359	5490	2160	3300	3458	1361	2098
	65	2700	2700	0	1674	1674	0	2429	2429	0	1530	1530	0	2160	2160	0	1361	1361	0
80	75	11925	1350	10575	7394	837	6557	10727	1214	9513	6758	765	5993	9540	1080	8460	6010	680	5330
	70	6863	1350	5513	4255	837	3418	6173	1214	4959	3889	765	3124	5490	1080	4410	3458	680	2778
	65	2363	1350	1013	1465	837	628	2125	1214	911	1339	765	547	1890	1080	810	1190	680	510
	60	1350	1350	0	837	837	0	1214	1214	0	765	765	0	1080	1080	0	680	680	0
75	70	6863	0	6863	4255	0	4255	6173	0	6173	6889	0	3889	5490	0	5490	3458	0	3458
	65	2363	0	2363	1465	0	1465	2125	0	2125	1339	0	1339	1890	0	1890	1190	0	1190
	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ERVF-A2 WINTER HEATING PERFORMANCE (INDOOR DESIGN CONDITIONS 70°F DB)

Ambient O.D.	VENTILATION RATE					
	250 250 CFM 74% EFF.		225 CFM 75% EFF.		200 CFM 75% EFF.	
DB/°F	WVL	WHR	WVL	WHR	WVL	WHR
65	1350	999	1214	911	1080	810
60	2700	1998	2429	1822	2160	1620
55	4050	2997	3643	2733	3240	2430
50	5400	3996	4858	3643	4320	3240
45	6750	4995	6072	4554	5400	4050
40	8100	5994	7287	5465	6480	4860
35	9450	6993	8501	6376	7560	5670
30	10800	7992	9716	7287	8640	6480
25	12150	8991	10930	8198	9720	7290
20	13500	9990	12145	9108	10800	8100
15	14850	10989	13359	10019	11880	8910

LEGEND:

- VLT = Ventilation Load - Total
- VLS = Ventilation Load - Sensible
- VLL = Ventilation Load - Latent
- HRT = Heat Recovery - Total
- HRS = Heat Recovery - Sensible
- HRL = Heat Recovery - Latent
- WVL = Winter Ventilation Load
- WHR = Winter Heat Recovery

NOTE: Sensible performance only is shown for winter application.

Performance and Application Data- ERV-F-3

SUMMER COOLING PERFORMANCE
(INDOOR DESIGN CONDITIONS 75°DB/62°WB)

Ambient O.D.	VENTILATION RATE -- 400CFM						VENTILATION RATE -- 325 CFM						VENTILATION RATE -- 250 CFM						
	63% EFFICIENCY		64% EFFICIENCY		65% EFFICIENCY		63% EFFICIENCY		64% EFFICIENCY		65% EFFICIENCY		63% EFFICIENCY		64% EFFICIENCY		65% EFFICIENCY		
DB/WB	F	VL	VLS	VLL	HRT	HRS	HRL	VL	VLS	VLL	HRT	HRS	HRL	VL	VLS	VLL	HRT	HRS	HRL
105	75	19080	12960	6120	12020	8164	3835	15502	10530	4972	9921	6739	3182	11925	8100	3825	7751	5265	2486
	70	12960	12960	0	8164	8164	0	10530	10530	0	6739	6739	0	8100	8100	0	5265	5265	0
	65	12960	12960	0	8164	8164	0	10530	10530	0	6739	6739	0	8100	8100	0	5265	5265	0
100	75	19080	10800	8280	17690	6804	10886	22815	8775	14040	5616	8995	17550	6750	10800	11407	4387	7019	3763
	70	10800	10800	0	12020	6804	5216	15502	8775	6727	9921	5616	4305	11925	6750	5175	7751	4387	3363
	65	10800	10800	0	6804	6804	0	8775	8775	0	5616	5616	0	6750	6750	0	4387	4387	0
	60	10800	10800	0	6804	6804	0	8775	8775	0	5616	5616	0	6750	6750	0	4387	4387	0
95	75	19080	8640	10440	17690	5443	12247	22815	7020	15795	14601	4492	10108	17550	5400	12150	11407	3510	7897
	70	8640	8640	0	12020	5443	6577	15502	7020	8482	9921	4492	5428	11925	5400	6525	7751	3510	4241
	65	8640	8640	0	5443	5443	0	7020	7020	0	4492	4492	0	5400	5400	0	3510	3510	0
	60	8640	8640	0	5443	5443	0	7020	7020	0	4492	4492	0	5400	5400	0	3510	3510	0
90	75	19080	6480	12600	17690	4082	13608	22815	5265	17550	14601	3369	11232	17550	4050	13500	11407	2632	8774
	70	6480	6480	0	12020	4082	7938	15502	4082	10237	9921	3369	6552	11925	4050	7875	7751	2632	5118
	65	6480	6480	0	4082	4082	0	2835	5265	3656	5709	3369	2340	6862	4050	2812	4460	2632	1828
	60	6480	6480	0	4082	4082	0	5265	5265	0	3369	3369	0	4050	4050	0	2632	2632	0
85	75	19080	4320	14760	17690	2721	14968	22815	3510	19305	11232	2246	12355	17550	2700	14850	11407	1755	9652
	70	4320	4320	0	12020	2721	9298	15502	3510	11992	9921	2246	7751	11925	2700	9225	7751	1755	5996
	65	4320	4320	0	2721	2721	0	4195	8921	5911	5709	2246	3463	6862	2700	4162	4460	1755	2705
	60	4320	4320	0	2721	2721	0	3510	3510	0	2246	2246	0	2700	2700	0	1755	1755	0
80	75	19080	2160	16920	17690	1360	10659	22815	1755	13747	9921	11232	8798	11925	1350	10575	7751	877	6873
	70	2160	2160	0	12020	1360	5556	8921	1755	7166	5709	11232	4586	6862	1350	5512	4460	877	3583
	65	2160	2160	0	1360	1360	0	3071	1755	1316	1965	11232	8362	1350	1012	1535	877	687	
	60	2160	2160	0	1360	1360	0	1755	1755	0	11232	11232	0	1350	1350	0	877	877	0
75	75	19080	0	10980	6917	0	6917	8921	0	8921	5709	0	5709	6862	0	6862	4460	0	4460
	65	3780	0	3780	2381	0	2380	3071	0	3071	1965	0	1965	2382	0	2382	1535	0	1535
	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LEGEND:

- VL = Ventilation Load - Total
- VLS = Ventilation Load - Sensible
- VLL = Ventilation Load - Latent
- HRT = Heat Recovery - Total
- HRS = Heat Recovery - Sensible
- HRL = Heat Recovery - Latent
- WVL = Winter Ventilation Load
- WVR = Winter Heat Recovery

NOTE: Sensible performance only is shown for winter application.

Performance and Application Data- ERV-F-5

SUMMER COOLING PERFORMANCE
(INDOOR DESIGN CONDITIONS 75°DB/62°WB)

Ambient O.D.	VENTILATION RATE -- 400CFM						VENTILATION RATE -- 325 CFM						VENTILATION RATE -- 250 CFM						
	63% EFFICIENCY		64% EFFICIENCY		65% EFFICIENCY		63% EFFICIENCY		64% EFFICIENCY		65% EFFICIENCY		63% EFFICIENCY		64% EFFICIENCY		65% EFFICIENCY		
DB/WB	F	VL	VLS	VLL	HRT	HRS	HRL	VL	VLS	VLL	HRT	HRS	HRL	VL	VLS	VLL	HRT	HRS	HRL
105	75	21465	14580	6884	13952	9477	4475	17887	12150	5737	11805	8018	3786	14310	9720	4590	9387	6512	3075
	70	14580	14580	0	9477	9477	0	12150	12150	0	8018	8018	0	9720	9720	0	6512	6512	0
	65	14580	14580	0	9477	9477	0	12150	12150	0	8018	8018	0	9720	9720	0	6512	6512	0
100	75	21465	12150	9314	13952	7897	12635	17887	10125	16200	17374	6882	10692	21060	8100	12960	14110	5427	8683
	70	12150	12150	0	7897	7897	0	10125	10125	0	6882	6882	0	8100	8100	0	5427	5427	0
	65	12150	12150	0	7897	7897	0	10125	10125	0	6882	6882	0	8100	8100	0	5427	5427	0
95	75	21465	9720	11744	13952	6318	14215	17887	8100	18225	17374	5345	12028	21060	6480	14580	14110	4341	9768
	70	9720	9720	0	6318	6318	0	8100	8100	0	5345	5345	0	6480	6480	0	4341	4341	0
	65	9720	9720	0	6318	6318	0	8100	8100	0	5345	5345	0	6480	6480	0	4341	4341	0
90	75	21465	7290	24300	13952	4738	15794	17887	6075	20250	17374	4009	13365	21060	4860	16200	14110	3256	10854
	70	7290	7290	0	4738	4738	0	6075	6075	0	4009	4009	0	4860	4860	0	3256	3256	0
	65	7290	7290	0	4738	4738	0	6075	6075	0	4009	4009	0	4860	4860	0	3256	3256	0
85	75	21465	4860	26730	13952	3159	17374	17887	4050	22275	17374	2672	14701	21060	3240	17820	14110	2170	11959
	70	4860	4860	0	3159	3159	0	10793	13837	4050	13837	1805	6272	14310	3240	11070	9587	2170	7416
	65	4860	4860	0	3159	3159	0	10793	13837	4050	13837	1805	6272	14310	3240	11070	9587	2170	7416
80	75	21465	2430	19035	13952	1580	12372	17887	2025	18682	11805	1336	1336	14310	1620	12690	9587	1085	8502
	70	2430	2430	0	1580	1580	0	6449	10233	2025	8235	1336	5457	8235	1620	6615	5517	1085	4432
	65	2430	2430	0	1580	1580	0	6449	10233	2025	8235	1336	5457	8235	1620	6615	5517	1085	4432
75	75	21465	0	12352	4230	1822	2764	17887	1822	1518	2338	1336	1002	2835	1620	1215	1899	1085	814
	65	4230	4230	0	1822	1822	0	1579	1580	0	10233	6793	0	1620	1620	0	1085	1085	0
	60	0	0	0	1822	1822	0	1579	1580	0	10233	6793	0	1620	1620	0	1085	1085	0
75	65	4230	0	0	4230	2764	0	2764	3543	0	3543	2338	0	2835	1620	0	2835	1899	0
	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ERV-F-5 WINTER HEATING PERFORMANCE
(INDOOR DESIGN CONDITIONS 70°F DB)

Ambient O.D.	VENTILATION RATE						VENTILATION RATE					
	450 CFM		375 CFM		300 CFM		450 CFM		375 CFM		300 CFM	
DB/F	WVL	WHR	WVL	WHR	WVL	WHR	WVL	WHR	WVL	WHR	WVL	WHR
65	2430	1944	2025	1640	1620	1328	2430	1944	2025	1640	1620	1328
60	4860	3888	4050	3280	3240	2656	4860	3888	4050	3280	3240	2656
55	7290	5832	6075	4920	4860	3985	7290	5832	6075	4920	4860	3985
50	9720	7776	8100	6561	6480	5313	9720	7776	8100	6561	6480	5313
45	12150	9720	10125	8201	8100	6642	12150	9720	10125	8201	8100	6642
40	14580	11664	12150	9841	9720	7970	14580	11664	12150	9841	9720	7970
35	17010	13608	14175	11481	11340	9298	17010	13608	14175	11481	11340	9298
30	19440	15552	16200	13122	12960	10627	19440	15552	16200	13122	12960	10627
25	21870	17496	18225	14762	14580	11955	21870	17496	18225	14762	14580	11955
20												

Electrical Specifications — W**A2 Series

MODEL	Rated Volts & Phase	No. Field Power Circuits	Single Circuit				Dual Circuit									
			③ Minimum Circuit Ampacity	① Maximum External Fuse or Ckt. Brkr.	② Field Power Wire Size	② Ground Wire	③ Minimum Circuit Ampacity		① Maximum External Fuse or Ckt. Breaker		② Field Power Wire Size		② Ground Wire Size			
							Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B		
W17, 18A2-A00, A0Z A05 A08 A10	230/208-1	1 1 1 1	16 30 46 56	20 30 50 60	12 10 8 6	12 10 10 10										
W24A2-A00, A0Z A04 A05 A08 A10	230/208-1	1 1 1 1 1	21 25 30 46 56	30 30 30 50 60	10 10 10 8 6	10 10 10 10 10										
W24A2-B00, B0Z B06	230/208-3	1 1	15 22	20 25	12 10	12 10										
W24A2-C00, C0Z C06	460-3	1 1	9 11	15 15	14 14	14 14										
W30A2-A00*, A0Z* A05* A08 A10* A15	230/208-1	1 1 1 1 1 or 2	24 32 47 58 84	35 35 50 60 90	8 8 8 6 4	10 10 10 10 8	58	26	60	30	6	10	10	10	10	
W30A2-B00*, B0Z* B06 B09* B15	230/208-3	1 1 1 1	18 24 33 51	20 25 35 60	12 10 8 6	12 10 10 10										
W30A2-C00*, C0Z* C06 C09* C12 C15	460-3	1 1 1 1 1	11 12 17 21 26	15 15 20 25 30	14 14 12 10 10	14 14 12 10 10										
W36A2-A00*, A0Z* A05* A08 A10* A15	230/208-1	1 1 1 1 1 or 2	29 32 47 58 84	35 35 50 60 90	8 8 8 6 4	10 10 10 10 8	58	26	60	30	6	10	10	10	10	
W36A2-B00*, B0Z* B06* B09* B15	230/208-3	1 1 1 1	23 24 33 51	30 30 35 60	10 10 8 6	10 10 10 10										
W36A2-C00*, C0Z* C06* C09* C12 C15	460-3	1 1 1 1 1	11 12 16 21 26	15 15 20 25 30	14 14 12 10 10	14 14 12 10 10										
W42A2-A00, A0Z A05 A10 A15 A20	230/208-1	1 1 1 1 or 2 1 or 2	32 32 58 84 110	50 50 60 90 125	8 8 6 4 2	10 10 10 8 6	58 58	26 52	60 60	30 60	6 6	10 6	10 10	10 10	10 10	
W42A2-B00, B0Z B09 B15 B18	230/208-3	1 1 1 1	24 33 51 60	35 35 60 60	8 8 6 6	10 10 10 10										
W42A2-C00, C0Z C09 C15	460-3	1 1 1	12 17 26	15 20 30	14 12 10	14 12 10										
W48A2-A00, A0Z A05 A10 A15 A20	230/208-1	1 1 1 1 or 2 1 or 2	39 39 58 84 110	50 50 60 90 125	8 8 6 4 2	10 10 10 8 6	58 58	26 52	60 60	30 60	6 6	10 6	10 10	10 10	10 10	
W48A2-B00, B0Z B09 B15 B18	230/208-3	1 1 1 1	27 33 51 60	40 40 60 60	8 8 6 6	10 10 10 10										
W48A2-C00, C0Z C09 C15	460-3	1 1 1	13 17 26	20 20 30	12 12 10	12 12 10										
W60A2-A00, A0Z A05 A10 A15 A20	230/208-1	1 1 1 1 or 2 1 or 2	42 42 60 86 112	60 60 60 90 125	8 8 6 3 2	10 10 10 8 6	60 60	26 52	60 60	30 60	6 6	10 6	10 10	10 10	10 10	
W60A2-B00, B0Z B09 B15 B18	230/208-3	1 1 1 2	28 35 53 N/A	40 40 60 N/A	8 8 6 N/A	10 10 10 N/A	35	28	40	30	8	10	10	10	10	
W60A2-C00, C0Z C09 C15	460-3	1 1 1	15 18 27	20 20 30	12 12 10	12 12 10										

① Maximum size of the time delay fuse or HACR type circuit breaker for protection of field wiring conductors.

② Based on 75C copper wire. All wiring must conform to the National Electrical Code and all local codes.

③ These "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electrical code (latest version), Article 310 for power conductor sizing.

Caution: When more than one field power circuit is run through one conduit, the conductors must be derated. Pay special attention to note 8 of Table 310 regarding Ampacity Adjustment Factors when more than three (3) current carrying conductors are in a raceway.

* Top outlet supply option is available only factory installed and only on the selected models.

IMPORTANT: While this electrical data is presented as a guide, it is important to electrically connect properly sized over-current protection and conductor wires in accordance with the National Electrical Code and all local codes.

Electrical Specifications — W**L2 Series

MODEL	Rated Volts & Phase	No. Field Power Circuits	Single Circuit				Dual Circuit							
			③ Minimum Circuit Ampacity	① Maximum External Fuse or Ckt. Brkr.	② Field Power Wire Size	② Ground Wire	③ Minimum Circuit Ampacity		① Maximum External Fuse or Ckt. Breaker		② Field Power Wire Size		② Ground Wire Size	
							Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B	Ckt. A	Ckt. B
W17, 18L2-A00,AOZ A05 A08 A10	230/208-1	1	16	20	12	12								
		1	30	30	10	10								
		1	46	50	8	10								
		1	56	60	6	10								
W24L2-A00, AOZ A05 A08 A10	230/208-1	1	21	30	10	10								
		1	30	30	10	10								
		1	46	50	8	10								
		1	56	60	6	10								
W24L2-B00, BOZ B06	230/208-3	1	15	20	12	12								
		1	22	25	10	10								
W30L2-A00, AOZ A05 A08 A10 A15	230/208-1	1	24	35	8	10								
		1	32	35	8	10								
		1	47	50	8	10								
		1	58	60	6	10								
		1 or 2	84	90	4	8	58	26	60	30	6	10	10	10
W30L2-B00, BOZ B09 B15	230/208-3	1	18	20	12	12								
		1	33	35	8	10								
		1	51	60	6	10								
W30L2-C00, COZ C09 C15	460-3	1	11	15	14	14								
		1	17	20	12	12								
		1	26	30	10	10								
W36L2-A00, AOZ A05 A10 A15	230/208-1	1	29	35	8	10								
		1	32	35	8	10								
		1	58	60	6	10								
		1 or 2	84	90	4	8	58	26	60	30	6	10	10	10
W36L2-B00, BOZ B09 B15	230/208-3	1	23	30	10	10								
		1	33	35	8	10								
		1	51	60	6	10								
W36L2-C00, COZ C09 C15	460-3	1	11	15	14	14								
		1	16	20	12	12								
		1	26	30	10	10								
W42L2-A00, AOZ A05 A10 A15	230/208-1	1	32	50	8	10								
		1	32	50	8	10								
		1	58	60	6	10								
		1 or 2	84	90	4	8	58	26	60	30	6	10	10	10
W42L2-B00, BOZ B09 B15	230/208-3	1	24	35	8	10								
		1	33	35	8	10								
		1	51	60	6	10								
W42L2-C00, COZ C09 C15	460-3	1	12	15	14	14								
		1	17	20	12	12								
		1	26	30	10	10								
W48L2-A00, AOZ A05 A10 A15	230/208-1	1	39	50	8	10								
		1	39	50	8	10								
		1	58	60	6	10								
		1 or 2	84	90	4	8	58	26	60	30	6	10	10	10
W48L2-B00, BOZ B09 B15	230/208-3	1	27	40	8	10								
		1	33	40	8	10								
		1	51	60	6	10								
W48L2-C00, COZ C09 C15	460-3	1	13	20	12	12								
		1	17	20	12	12								
		1	26	30	10	10								
W60L2-A00, AOZ A05 A10 A15	230/208-1	1	42	60	8	10								
		1	42	60	8	10								
		1	60	60	6	10								
		1 or 2	86	90	3	8	60	26	60	30	6	10	10	10
W60L2-B00, BOZ B09 B15	230/208-3	1	28	40	8	10								
		1	35	40	8	10								
		1	53	60	6	10								
W60L2-C00, COZ C09 C15	460-3	1	15	20	12	12								
		1	18	20	12	12								
		1	27	30	10	10								

① Maximum size of the time delay fuse or HACR type circuit breaker for protection of field wiring conductors.

② Based on 75C copper wire. All wiring must conform to the National Electrical Code and all local codes.

③ These "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electrical code (latest version), Article 310 for power conductor sizing.

Caution: When more than one field power circuit is run through one conduit, the conductors must be derated. Pay special attention to note 8 of Table 310 regarding Ampacity Adjustment Factors when more than three (3) current carrying conductors are in a raceway.

IMPORTANT: While this electrical data is presented as a guide, it is important to electrically connect properly sized over-current protection and conductor wires in accordance with the National Electrical Code and all local codes.

Indoor Blower Performance (60 Hz) - CFM at Rated Volts

Speed	W17/W18				W24		W30				W36				W42/W48				W60			
	High		Low ①		Single ①		High ①		Low		High ①		Low		High ①		Low		High ①		Low	
ESP (Inch H2O)	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil
0.0	1045	1025	760	745	990	970	1370	1285	910	885	1415	1275	955	925	1850	1800	1605	1555	2080	2015	1505	1460
0.1	1010	970	730	715	945	925	1305	1225	885	860	1350	1215	945	915	1775	1725	1545	1500	2020	1960	1450	1405
0.2	940	905	700	685	890	870	1225	1135	850	815	1265	1125	925	900	1685	1640	1460	1415	1925	1865	1395	1355
0.3	860	830	670	655	820	800	1115	1020	790	755	1190	1060	875	850	1590	1550	1390	1345	1870	1815	1340	1300
0.4	780	750	610	595	735	720	1005	910	695	660	1085	975	780	755	1495	1460	1310	1270	1755	1705	1225	1185
0.5	665	640	485	455	605	590	865	775	590	560	970	865	640	615	1400	1365	1225	1185	1660	1610	1125	1085

Above data is with 1" standard throwaway filter and 1" washable filter.

For optional 2" pleated filter - reduce ESP by .15 in.

See installation instructions for maximum ESP information on various KW application.

① **Factory Connected Speed.**

Electric Heat Table - Refer to Electrical Specifications for Availability by Unit Model

Nominal KW	At 240V (1)				At 208V (1)				At 480V (2)			At 460V (2)		
	Kw	1-Ph Amps	3-Ph Amps	Btuh	Kw	1-Ph Amps	3-Ph Amps	Btuh	Kw	3-Ph Amps	Btuh	Kw	3-Ph Amps	Btuh
5.0	5.0	20.8		17,065	3.75	18.0		12,799						
6.0	6.0		14.4	20,478	4.50		12.5	15,359	6.0	7.2	20,478	5.52	6.9	18,840
8.0	8.0	33.3		27,304	6.00	28.8		20,478						
9.0	9.0		21.7	30,717	6.75		18.7	23,038	9.0	10.8	30,717	8.28	10.4	28,260
10.0	10.0	41.7		34,130	7.50	36.1		25,598						
15.0	15.0	62.5	36.1	51,195	11.25	54.1	31.2	38,396	15.0	18.0	51,195	13.80	17.3	47,099
18.0	18.0		43.3	61,434	13.50		37.5	46,076	18.0	21.7	61,434	16.56	20.8	56,519
20.0	20.0	83.3		68,260	15.00	72.1		51,195						

(1) These electric heaters are available in 230/208V units only.

(2) These electric heaters are available in 480V units only.

Heater Packages - Field Installed W**AA Series Right-Hand Units

- Designed for adding Electric Heat to 0 KW Units
- ETL US & Canada Listed
- Circuit Breaker Standard on 230/208V Models
- Toggle Disconnect Standard on 460V Models

Air Conditioner Models	-A00 Models 230/208-1		-B00 Models 230/208-3		-C00 Models 460-3	
	Heater Model #	KW	Heater Model #	KW	Heater Model #	KW
W17A2 W18A2	EHWA02-A05B EHW02A-A08B EHWA02A-A10B	5 8 10	N/A		N/A	
W24A2	EHWA24A-A04B EHWA02-A05B EHW02A-A08B EHWA02A-A10B	4 5 8 10	EHWA24-B06B	6	EHWH24B-C06	6
W30A2	EHWA03-A05B EHWA03-A08B EHWA03-A10B EHWA03-A15B	5 8 10 15	EHWA03-B06B EHWA03-B09B EHWA37-B15B	6 9 15	EHWC03A-C06 EHWC03A-C09 EHWA03A-C12 EHWA03A-C15	6 9 12 15
W36A2	EHWA03-A05B EHWA03-A08B EHWA03-A10B EHWA03-A15B	5 8 10 15	EHW36A-B06B EHWA03-B09B EHWA37-B15B	6 9 15	EHWC03A-C06 EHWC03A-C09 EHWA03A-C12 EHWA03A-C15	6 9 12 15
W42A2 W48A2	EHWA05-A05B ① EHWA05-A10B ① EHWA05-A15B EHWA05-A20B	5 10 15 20	EHWA05-B09B ① EHWA05-B15B EHWA05-B18B ①	9 15 18	EHWA05A-C09 ① EHWA05A-C15	9 15
W60A2	EHWA60-A05B ① EHWA05-A10B ① EHWA05-A15B EHWA05-A20B	5 10 15 20	EHW60A-B09B ① EHWA05-B15B ① EHW05A-B18B ①	9 15 18	EHWA05A-C09 ① EHWA05A-C15	9 15

NOTE: Field installed Heater Packages are not approved for use with top supply opening models.

① These heater packages approved for use in dehumidification versions with hot gas reheat.

Heater Packages - Field Installed W**LA Series Left-Hand Units

Air Conditioner Models	-A00 Models 230/208-1		-B00 Models 230/208-3		-C00 Models 460-3	
	Heater Model #	KW	Heater Model #	KW	Heater Model #	KW
W17L2 W18L2	EHWA02A-A05LB EHW02A-A08LB EHWA02-A10LB	5 8 10	N/A		N/A	
W24L2	EHWA02A-A05LB EHW02A-A08LB EHWA02-A10LB	5 8 10	EHWA24-B06LB	6	N/A	
W30L2	EHWA03-A05LB EHWA03-A08LB EHWA03-A10LB EHWA03-A15LB	5 8 10 15	EHWA03-B09LB EHWA37-B15LB	9 15	EHWC03-C09L EHWA03-C15L	9 15
W36L2	EHWA03-A05LB EHWA03-A10LB EHWA03-A15LB	5 10 15	EHWA03-B09LB EHWA37-B15LB	9 15	EHWC03-C09L EHWA03-C15L	9 15
W42L2 W48L2	EHWA05-A05LB EHWA05-A10LB EHWA05-A15LB	5 10 15	EHWA05-B09LB EHWA05-B15LB	9 15	EHWA05A-C09L EHWA05A-C15L	9 15
W60L2	EHWA05-A05LB EHWA05-A10LB EHWA05-A15LB	5 10 15	EHWA60-B09LB EHWA05-B15LB	9 15 18	EHWA05A-C09L EHWA05A-C15L	9 15

Clearances Required for Service Access and Adequate Condenser Inlet Airflow

MODELS	LEFT SIDE	RIGHT SIDE
W17A, W18A, W24A, W30A, W36A	15"	20"
W42A, W48A, W60A	20"	20"

NOTE: For side-by-side installation of two (2) WA models, there must be 20" between units. This can be reduced to 15" by using a WL model (left side compressor and controls) for the left unit and WA (right side compressor and controls) for right unit.

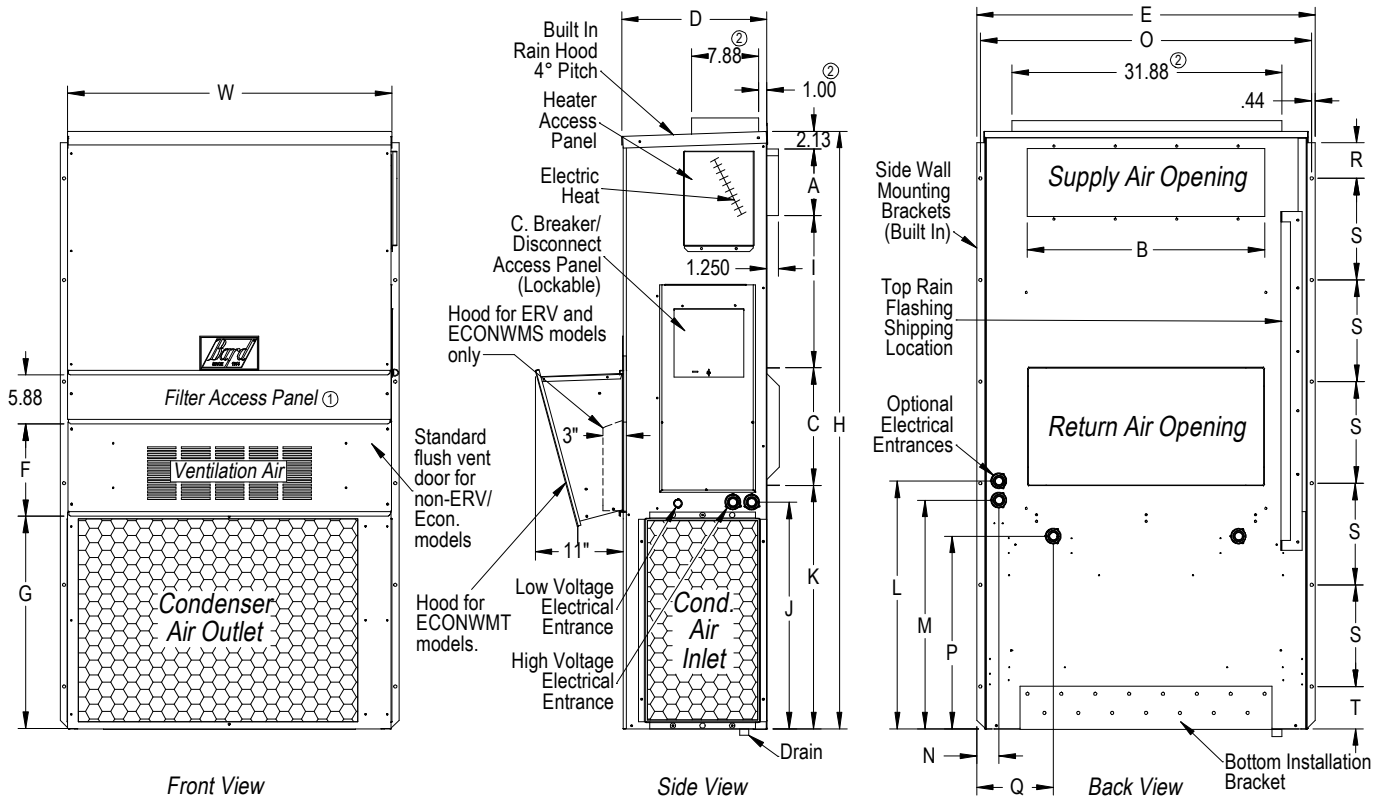
Minimum Clearances Required to Combustible Materials

MODELS ①	SUPPLY AIR DUCT FIRST THREE FEET	CABINET
W17A, W18A, W24A	0"	0"
W30A, W36A	1/4"	0"
W42A, W48A, W60A	1/4"	0"

① Refer to the Installation Manual for more detailed information.

Dimensions of W17-60A Basic Unit for Architectural & Installation Requirements (Nominal)

MODEL	WIDTH (W)	DEPTH (D)	HEIGHT (H)	SUPPLY		RETURN		E	F	G	I	J	K	L	M	N	O	P	Q	R	S	T
				A	B	C	B															
W17A2 W18A2 W24A2	33.300	17.125	70.563	7.88	19.88	11.88	19.88	35.00	10.88	25.75	20.56	26.75	28.06	29.25	27.00	2.63	34.13	22.06	10.55	4.19	12.00	5.00
W30A2 W36A2	38.200	17.125	70.563	7.88	27.88	13.88	27.88	40.00	10.88	25.75	17.93	26.75	28.75	29.25	27.00	2.75	39.13	22.75	9.14	4.19	12.00	5.00
W42A2 W48A2 W60A2	42.075	22.432	84.875	9.88	29.88	15.88	29.88	43.88	13.56	31.66	30.00	32.68	26.94	34.69	32.43	3.37	43.00	23.88	10.00	1.44	16.00	1.88



MIS-2487 H

① Not used when ECONWMT Economizers installed. Filter access is through the ECONWMT hood.

② Optional top outlet (factory installed only) in place of standard front supply air opening for W30A and W36A models only.

Clearances Required for Service Access and Adequate Condenser Inlet Airflow

MODELS	LEFT SIDE	RIGHT SIDE
W17L, W18L, W24L, W30L, W36L	20"	15"
W42L, W48L, W60L	20"	20"

NOTE: For side-by-side installation of two (2) WL models, there must be 20" between units. This can be reduced to 15" by using a WL model (left side compressor and controls) for the left unit and WA (right side compressor and controls) for right unit.

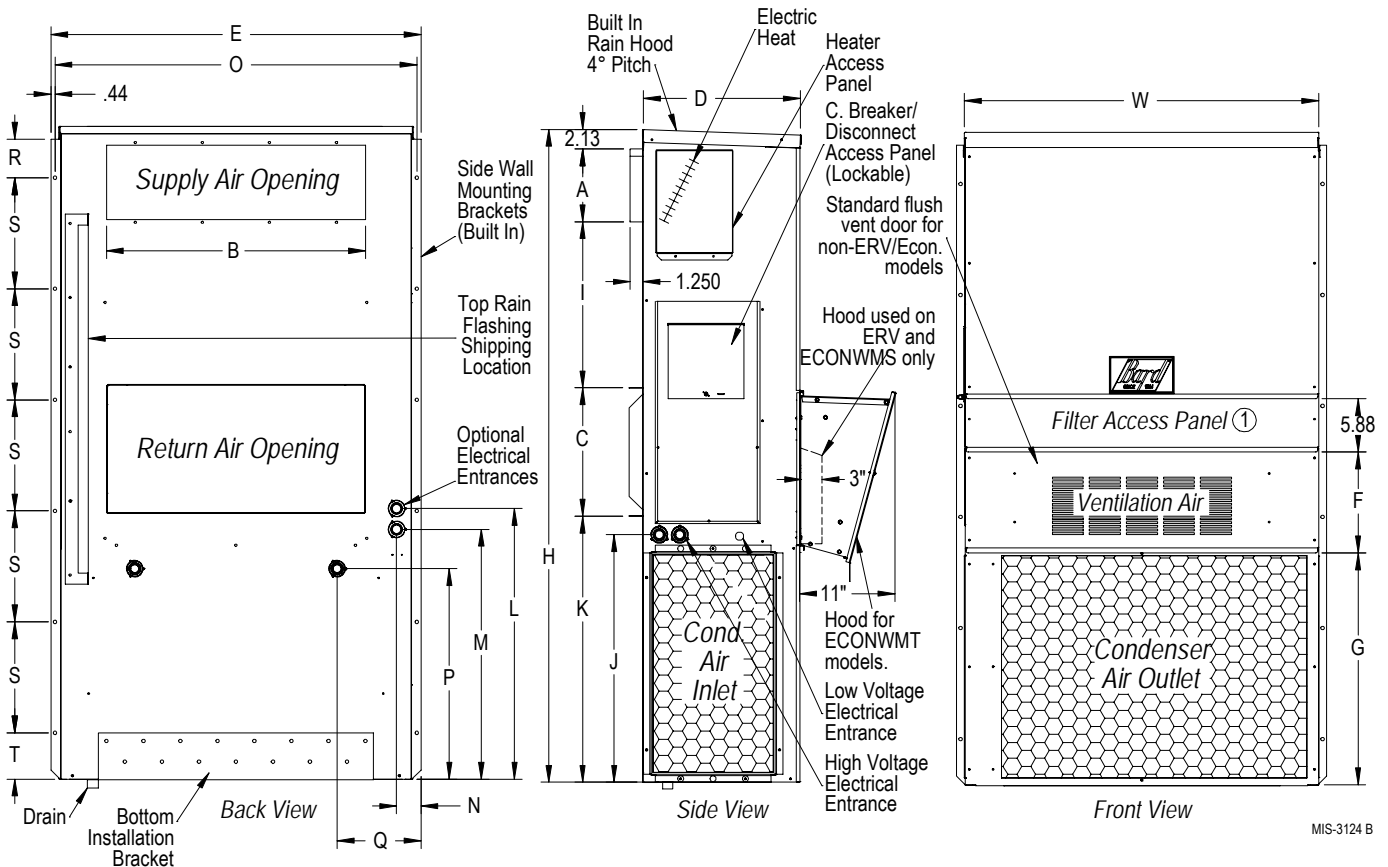
Minimum Clearances Required to Combustible Materials

MODELS ①	SUPPLY AIR DUCT FIRST THREE FEET	CABINET
W17L, W18L, W24L	0"	0"
W30L, W36L	1/4"	0"
W42L, W48L, W60L	1/4"	0"

① Refer to the Installation Manual for more detailed information.

Dimensions of W17-60L Basic Unit for Architectural & Installation Requirements (Nominal)

MODEL	WIDTH (W)	DEPTH (D)	HEIGHT (H)	SUPPLY		RETURN																
				A	B	C	B	E	F	G	I	J	K	L	M	N	O	P	Q	R	S	T
W17L2 W18L2 W24L2	33.300	17.125	70.563	7.88	19.88	11.88	19.88	35.00	10.88	25.75	20.56	26.75	28.06	29.25	27.00	2.63	34.13	22.06	10.55	4.19	12.00	5.00
W30L2 W36L2	38.200	17.125	70.563	7.88	27.88	13.88	27.88	40.00	10.88	25.75	17.93	26.75	28.75	29.25	27.00	2.75	39.13	22.75	9.14	4.19	12.00	5.00
W42L2 W48L2 W60L2	42.075	22.432	84.875	9.88	29.88	15.88	29.88	43.88	13.56	31.66	30.00	32.68	26.94	34.69	32.43	3.37	43.00	23.88	10.00	1.44	16.00	1.88



MIS-3124 B

① Not used when ECONWMT Economizers installed. Filter access is through the ECONWMT hood.

Cooling Application Data - Outdoor Temperature ①②

Model	Return Air (DB/WB) ③	Cooling Capacity	75°F	80°F	85°F	90°F	95°F	100°F	105°F	110°F	115°F	120°F
W17A2 W17L2	75/62	Total Cooling	17200	16500	15700	15000	14300	13700	13100	12500	11900	11300
		Sensible Cooling	13900	13600	13400	13000	12700	12400	12000	11700	11400	11000
	80/67	Total Cooling	18300	17900	17400	16900	16400	15900	15400	14900	14300	13700
		Sensible Cooling	13400	13300	13200	13000	12800	12600	12300	12100	11800	11500
	85/72	Total Cooling	21800	21000	20000	19100	18300	17400	16600	15900	15100	14300
		Sensible Cooling	13800	13500	13300	13000	12600	12200	11800	11400	10900	10400
W18A2 W18L2	75/62	Total Cooling	17700	16800	16000	15200	14300	13600	12900	12200	11600	10900
		Sensible Cooling	14200	13800	13400	13000	12600	12300	11900	11600	11300	10900
	80/67	Total Cooling	18900	18300	17700	17100	16400	15800	15200	14500	13900	13200
		Sensible Cooling	13700	13500	13200	13000	12700	12500	12200	11900	11700	11400
	85/72	Total Cooling	22600	21400	20400	19300	18300	17300	16400	15500	14600	13800
		Sensible Cooling	14100	13700	13300	13000	12500	12100	11700	11200	10800	10300
W24A2 W24L2	75/62	Total Cooling	25000	23800	22700	21600	20600	19600	18700	17600	16700	15800
		Sensible Cooling	19800	19300	18800	18300	17900	17300	16900	16400	15900	15400
	80/67	Total Cooling	26600	25900	25200	24400	23600	22800	22000	21000	20100	19100
		Sensible Cooling	19200	18900	18600	18300	18000	17600	17300	16900	16500	16100
	85/72	Total Cooling	31700	30300	29000	27600	26200	25000	23800	22400	21200	19900
		Sensible Cooling	19700	19200	18700	18200	17700	17100	16500	15900	15200	14600
W30A2 W30L2	75/62	Total Cooling	30200	29000	27900	26800	25600	24500	23300	22200	21000	19700
		Sensible Cooling	23500	23400	23200	22700	22300	21700	21100	20300	19500	18600
	80/67	Total Cooling	32200	31600	31000	30300	29400	28500	27500	26400	25200	23800
		Sensible Cooling	22800	22900	22900	22700	22500	22100	21600	21000	20300	19400
	85/72	Total Cooling	38400	37000	35600	34200	32700	31200	29700	28100	26500	24800
		Sensible Cooling	23400	23300	23000	22600	22100	21400	20600	19700	18700	17600
W36A2 W36L2	75/62	Total Cooling	37100	35400	33700	32100	30500	29000	27700	26300	25000	23700
		Sensible Cooling	27700	27100	26400	25700	25100	24300	23600	22800	21900	21100
	80/67	Total Cooling	39600	38500	37400	36200	35000	33800	32600	31300	30100	28700
		Sensible Cooling	26800	26500	26100	25700	25300	24700	24200	23500	22800	22100
	85/72	Total Cooling	47200	45000	43000	40900	38900	37000	35200	33300	31700	29800
		Sensible Cooling	27500	26900	26200	25600	24800	23900	23100	22100	21000	20000
W42A2 W42L2	75/62	Total Cooling	42500	40300	38400	36600	34800	33400	32000	30700	29600	28600
		Sensible Cooling	32800	32600	32100	31500	30800	30100	29200	28200	27000	25800
	80/67	Total Cooling	45300	43900	42600	41300	40000	38900	37700	36600	35600	34600
		Sensible Cooling	31800	31900	31800	31500	31100	30600	29900	29100	28100	27000
	85/72	Total Cooling	54000	51300	48900	46600	44500	42600	40700	39000	37400	36000
		Sensible Cooling	32600	32400	32000	31300	30500	29600	28500	27300	25900	24400
W48A2 W48L2	75/62	Total Cooling	53400	50200	47300	44700	42200	40200	38200	36600	35100	33800
		Sensible Cooling	39900	38800	37700	36600	35500	34500	33400	32400	31400	30500
	80/67	Total Cooling	57000	54700	52500	50500	48500	46800	45100	43600	42200	40900
		Sensible Cooling	38700	38000	37300	36600	35800	35100	34300	33500	32700	31900
	85/72	Total Cooling	67900	64000	60300	57000	53900	51200	48600	46400	44400	42500
		Sensible Cooling	39600	38600	37500	36400	35100	34000	32700	31400	30100	28800
W60A2 W60L2	75/62	Total Cooling	57000	54700	52400	50200	47900	45800	43500	41300	39100	36800
		Sensible Cooling	43700	42800	41700	40700	39600	38600	37500	36500	35400	34200
	80/67	Total Cooling	60800	59600	58200	56700	55000	53300	51300	49200	47000	44600
		Sensible Cooling	42400	41900	41300	40700	40000	39300	38500	37700	36800	35800
	85/72	Total Cooling	72400	69700	66800	64000	61100	58300	55300	52400	49400	46400
		Sensible Cooling	43400	42500	41500	40400	39200	38000	36700	35400	33900	32400

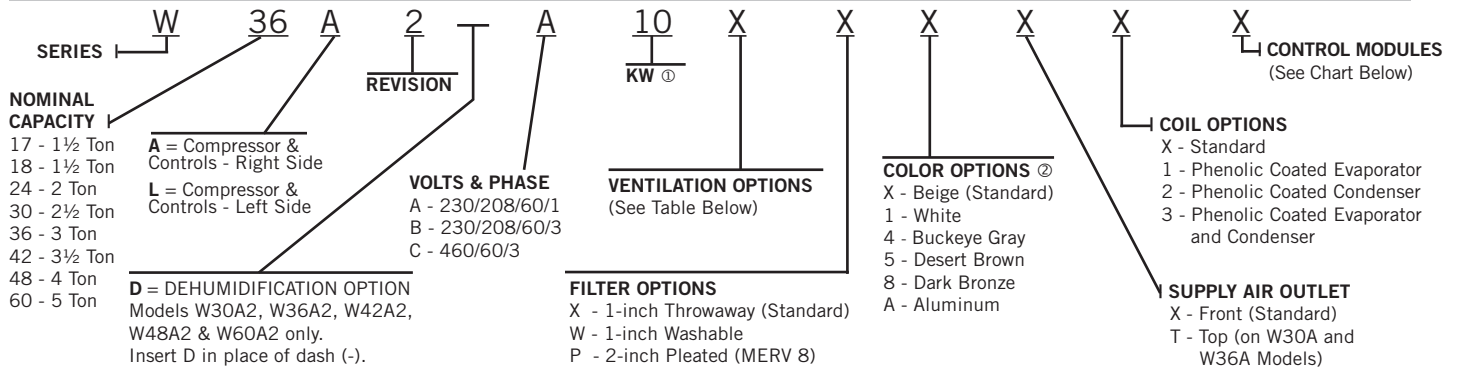
① Below 65°F, unit requires a factory or field installed low ambient control.

② Outdoor temperatures shown are measured at the condenser section air inlet.

③ Return air temperature °F.

Capacity Multiplier Factors			
% of Rated Airflow	-10	Rated	+10
Total BTUH	0.975	1.0	1.02
Sensible BTUH	0.950	1.0	1.05

Air Conditioning Wall-Mount Model Nomenclature



- ① For OKW and circuit breakers (230/208 Volt) or toggle disconnects (460 Volt) applications, insert OZ in the KW field of the model number. See Pages 8 & 9 for available Factory Installed KW options and Page 11 for Field Installed Heater Packages.
- ② Aftermarket corrosion resistance coating is necessary if unit is installed in a corrosive environment or coastal area where the unit will be exposed to salt water.

Ventilation Options

Models	W17A2, W18A2, W24A2 W17L2, W18L2, W24L2		W30A2, W36A2 W30L2, W36L2		W42A2, W48A2, W60A2 W42L2, W48L2, W60L2	
	Factory Installed Code No.	Field Installed Part No.	Factory Installed Code No.	Field Installed Part No.	Factory Installed Code No.	Field Installed Part No.
Barometric Fresh Air Damper - Standard	X	BFAD-2	X	BFAD-3	X	BFAD-5
Blank-Off Plate	B	BOP-2	B	BOP-3	B	BOP-5
Motorized Fresh Air Damper	M	MFAD-2	M	MFAD-3	M	MFAD-5
Commercial Ventilator - Spring Return w/Exhaust	V	CRV-2	V	CRVS-3	V	CRVS-5
Commercial Ventilator - Power Return w/Exhaust	---	---	P	CRVP-3	P	CRVP-5
Economizer - Standard Versions, Enthalpy ④	S	ECONWMS-E2B ②	S	ECONWMS-E3B ②	S	ECONWMS-E5B ②
Economizer - Equipment Bldg., Enthalpy ⑤	W	ECONWMT-E2B ②	W	ECONWMT-E3B ②	W	ECONWMT-E5B ②
Economizer - Equipment Bldg., DB Temp ⑤	T	ECONWMT-T2B ②	T	ECONWMT-T3B ②	T	ECONWMT-T5B ②
Energy Recovery Ventilator - 230 Volt ③	R ⑦	ERV-A2	R ⑦	ERV-A3 ①	R ⑦	ERV-A5 ①
Energy Recovery Ventilator - 460 Volt ③	N/A	ERV-C2 ⑥	R ⑦	ERV-C3 ①	R ⑦	ERV-C5 ①
Door Kit for ERV (Required)	N/A	WMDK2- ③	N/A	WMDK3- ③	N/A	WMDK5- ③

- ① Intake and exhaust can be independently adjusted.
- ② Insert color to match unit ("X" = Beige; "4" = Buckeye Gray; etc.)
- ③ WMDK Door Kit must be ordered in addition to ERV Assembly & color matched to unit ("X" = Beige; "4" = Buckeye Gray; etc.)
- ④ Partial Full Flow (75% of Rated Cooling CFM). All ECONWMS versions have 3" deep intake hood.
- ⑤ Full Flow (100% of Rated Cooling CFM). All ECONWMT versions have 11" deep intake hood.
- ⑥ Model W24A2-C & W24L2-C only.
- ⑦ Energy Recovery Ventilator must be field-installed on W**L models. Also see Note ③.

Air Conditioning Control Modules

All Models Except As Noted									W17A2 W17L2 Factory Only	
HPC ①	LPC ②	CCM ③	LAC ④	ALR ⑤	SK ⑥	SK ⑦	ODT ⑧	DDC ⑨	Factory Installed Code	Field Installed Part
STD	STD	STD							X	N/A
STD	STD	STD	●						E ⑩	CMA-28
STD	STD	STD	●	●					J ⑪	Factory Only
STD	STD	STD	●	●	●				K ⑫	CMC-15 and CMA-28
STD	STD	STD	●	●	●				M ⑬	Factory Only
STD	STD	STD		●					N, W18A Only ⑭	N/A
STD	STD	STD			●				Field Installed Only	CMC-15
STD	STD	STD					●		Field Installed Only	CMA-14
STD	STD	STD	●	●				●	V ⑯⑰	Factory Only
STD	STD	STD						●	Field Installed Only	CMA-23 for W17-36 CMA-24 for W42-70
STD	STD	STD					●		Field Installed Only	SK111 Except W70 SK121 W70 Only

STD = Standard equipment for these specified models.

- ① HPC. High pressure control is auto reset. Always used with compressor control module (CCM) which is included. See note ③.
- ② LPC. Low pressure control is auto reset. Always used with compressor control module (CCM) which is included. See note ③.
- ③ CCM. Compressor control module has adjustable 30-second to 5-minute delay-on-break timer. On initial power-up, or any time the power is interrupted, the delay-on-make will be 2-minutes plus 10% of the delay-on-break setting. There is no delay-on-make during routine operation of the unit. The module also provides the lockout feature (with 1 retry) for high and/or low pressure controls, and a 2-minute timed bypass for low-pressure control.
- ④ LAC. Low ambient control permits cooling operation down to 0°F. LAC is fan-cycling control for outdoor fan motor on all models except W42, W48, W60 Dehum. units, which have modulating control.
- ⑤ ALR. The alarm relay has a set of normally open and normally closed dry contacts to provide the ability to signal a condition of shutdown on either high or low pressure controls.
- ⑥ SK. PTCR start kit can be used with all -A single phase models. Increases starting torque 2-3x. Not used for -B or -C three phase models. Do not use if SK111 or SK121 is used.
- ⑦ SK. Start capacitor & potential relay start kit can be used with all -A single phase models. Increases starting torque 9x. Not used for -B or -C three phase models. Do not use if CMC-15 is used.
- ⑧ ODT. Outdoor thermostat is adjustable from 0 to 50°F. It is suitable for use as a compressor cut-off thermostat.
- ⑨ DDC. Incorporates 4 additional sensors: discharge air temperature, indoor blower airflow, compressor current, and dirty filter. These sensing devices function to input analog data such as temperature, as well as digital data such as airflow, compressor status or filter status. Special economizer required; consult factory.
- ⑩ "V" control module should be ordered in conjunction with direct digital controller (DDC). Refer to "V" Module document F1605 for more information.
- ⑰ Option not available for Model W18A.
- ⑱ Use option N for Alarm Relay on Model W18A only.
- ⑲ LAC consists of special heat transfer device suitable for operation down to 0°F. Fan-cycling control is not used.



Bard Manufacturing Company, Inc.
Bryan, Ohio 43506
www.bardvac.com

**Due to our continuous product improvement policy,
all specifications subject to change without notice.**

Before purchasing this appliance, read important energy
cost and efficiency information available from your retailer.

Form No. S3461 March 2018
Supersedes S3461-617

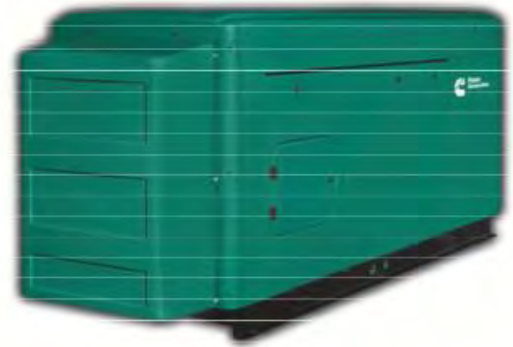
Specification sheet



Spark-ignited generator set

20-40 kW Standby

EPA emissions



Description

Cummins® generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby applications.

Features

Gas engine - Rugged 4-cycle Cummins QSJ2.4 spark-ignited engine delivers reliable power. The electronic air/fuel ratio control provides optimum engine performance and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Control system - The PowerCommand® 1.1 electronic control is standard equipment and provides total generator set system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard cooling package provides reliable running at up to 50 °C (122 °F) ambient temperature.

Enclosures - The aesthetically appealing enclosure incorporates special designs that deliver one of the quietest generators of its kind. Aluminum material plus durable powder coat paint provides the best anti-corrosion performance. The generator set enclosure has been evaluated to withstand 180 MPH wind loads in accordance with ASCE7-10. The intelligent design has removable panels and service doors to provide easy access for service and maintenance.

NFPA - The generator set accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

Model	Natural gas		Propane		Data sheets 60 Hz
	Standby 60 Hz		Standby 60 Hz		
	kW	kVA	kW	kVA	
C20 N6	20	25	20	25	NAD-5693-EN
C25 N6	25	31	25	31	NAD-5695-EN
C30 N6	30	38	30	38	NAD-5696-EN
C36 N6	36	45	36	45	NAD-5697-EN
C40 N6	40	50	40	50	NAD-5698-EN

Generator set specifications

Governor regulation class	ISO8528 Part 1 Class G3
Voltage regulation, no load to full load	± 1.0%
Random voltage variation	± 1.0%
Frequency regulation	Isochronous
Random frequency variation	± 0.25% @ 60 Hz
Radio frequency emissions compliance	Meets requirements of most industrial and commercial applications

Engine specifications

Design	Naturally aspirated or turbocharged (varies by generator set model)
Bore	86.5 mm (3.4 in.)
Stroke	100.0 mm (3.94 in.)
Displacement	2.4 liters (143.5 in ³)
Cylinder block	Cast iron, in-line 4 cylinder
Battery capacity	550 amps at ambient temperature of 0 °F to 32 °F (-18 °C to 0 °C)
Battery charging alternator	50 amps
Starting voltage	12 volt, negative ground
Lube oil filter type(s)	Spin-on with relief valve
Standard cooling system	50 °C (122 °F) ambient cooling system
Rated speed	1800 rpm

Alternator specifications

Design	Brushless, 4 pole, drip proof, revolving field
Stator	2/3 pitch
Rotor	Direct coupled, flexible disc
Insulation system	Class H per NEMA MG1-1.65
Standard temperature rise	120 °C (248 °F) Standby
Exciter type	Torque match (shunt) with PMG/EBS as option
Alternator cooling	Direct drive centrifugal blower
AC waveform Total Harmonic Distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic
Telephone Influence Factor (TIF)	< 50 per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	< 3%

Available voltages

1-phase	3-phase			
• 120/240	• 120/208	• 120/240 delta	• 277/480	• 347/600

Generator set options

Fuel system

- Single fuel - natural gas or propane vapor, field selectable
- Dual fuel – natural gas and propane vapor auto changeover
- Low fuel gas pressure warning

Engine

- Engine air cleaner – normal or heavy duty
- Shut down – low oil pressure
- Extension – oil drain

Alternator

- 120 °C (248 °F) temperature rise alternator
- 105 °C (221 °F) temperature rise alternator
- Excitation Boost System (EBS) or PMG
- Alternator heater, 120 V

Control

- AC output analog meters (bargraph)
- Stop switch – emergency
- Auxiliary output relays (2)
- Auxiliary configurable signal inputs (8) and relay outputs (8)

Electrical

- Single circuit breaker
- Dual circuit breakers
- 80% rated circuit breakers
- 100% rated circuit breakers

Enclosure

- Aluminum enclosure Sound Level 1 or Level 2, with muffler installed, sandstone or green color
- Open set

Cooling system

- Shutdown – low coolant level
- Warning – low coolant level
- Extension – coolant drain
- Cold weather options:
 - <4 °C (40 °F) – cold weather
 - <-17 °C (0 °F) – extreme cold weather

Exhaust system

- Exhaust connector NPT

Generator set application

- Base barrier – elevated generator set
- Battery rack, larger battery
- Radiator outlet duct adapter

Generator set options (continued)

Warranty

- Base warranty – 2 year, 1000 hour, Standby
- Standby, 3 year, 1500 hour, parts
- Standby, 5 year, 2500 hour, parts
- Standby, 3 year, 1500 hour, parts and labor
- Standby, 5 year, 2500 hour, parts and labor
- Standby, 3 year, 1500 hour, parts, labor and travel
- Standby, 5 year, 2500 hour, parts, labor and travel

Note: Some options may not be available on all models - consult factory for availability.

Generator set accessories

- Extreme cold weather kit
- Battery rack, larger battery
- Battery heater kit
- HMI211RS in-home display, including pre-configured 12" harness
- HMI211 remote display, including pre-configured 12" harness
- HMI220 remote display
- Auxiliary output relays (2)
- Auxiliary configurable signal inputs (8) and relay outputs (8)
- Annunciator – RS485
- Remote monitoring device – PowerCommand 500
- Battery charger – stand-alone, 12 V
- Circuit breakers
- Enclosure Sound Level 1 to Sound Level 2 upgrade kit
- Enclosure paint touch up kit
- Base barrier – elevated generator set
- Mufflers – industrial, residential or critical
- Alternator Excitation Boost System (EBS) or PMG
- Alternator heater
- Maintenance and service kit
- Engine lift kit

Control system PowerCommand 1.1



PowerCommand control is an integrated generator set control system providing voltage regulation, engine protection, operator interface and isochronous governing (optional). Major features include:

- Battery monitoring and testing features and smart starting control system.
- Standard PCCNet interface to devices such as remote annunciator for NFPA 110 applications.
- Control boards potted for environmental protection.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.

Operator/display panel

- Manual off switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating generator set running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -40 °C to +70 °C
- Bargraph display (optional)

AC protection

- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload

Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown

Alternator data

- Line-to-Line and Line-to-Neutral AC volts
- 3-phase AC current
- Frequency
- Total kVa

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Engine speed

Other data

- Generator set model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)

Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

- Integrated digital electronic voltage regulator
- 2-phase Line-to-Line sensing
- Configurable torque matching

Control functions

- Time delay start and cooldown
- Cycle cranking
- PCCNet interface
- (2) Configurable inputs
- (2) Configurable outputs
- Remote emergency stop
- Automatic Transfer Switch (ATS) control
- Generator set exercise, field adjustable

Options

- Auxiliary output relays (2)
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand 500/550 for remote monitoring and alarm notification (accessory)
- Auxiliary, configurable signal inputs (8) and configurable relay outputs (8)
- Digital governing
- AC output analog meters (bargraph)
 - Color-coded graphical display of:
 - 3-phase AC voltage
 - 3-phase current
 - Frequency
 - kVa
- Remote operator panel

Ratings definitions

Emergency Standby Power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-Time Running Power (LTP):

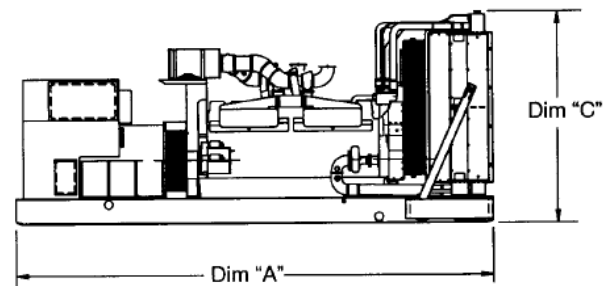
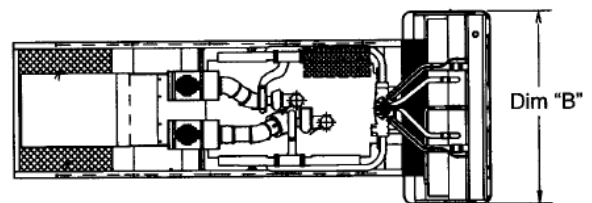
Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.

Prime Power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base Load (Continuous) Power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.





Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set weight* dry kg (lbs)	Set weight* wet kg (lbs)
Open set					
C20 N6	1669 (65.7)	864 (34)	1123 (44.2)	423 (933)	440 (969)
C25 N6	1669 (65.7)	864 (34)	1123 (44.2)	441 (972)	457 (1008)
C30 N6	2225 (87.6)	864 (34)	1123 (44.2)	491 (1083)	508 (1119)
C36 N6	2225 (87.6)	864 (34)	1123 (44.2)	520 (1146)	536 (1182)
C40 N6	2225 (87.6)	864 (34)	1123 (44.2)	548 (1208)	564 (1244)
Sound attenuated enclosure Level 1					
C20 N6	1829 (72)	864 (34)	1156 (45.5)	469 (1034)	485 (1070)
C25 N6	1829 (72)	864 (34)	1156 (45.5)	487 (1073)	503 (1109)
C30 N6	2388 (94)	864 (34)	1156 (45.5)	542 (1195)	558 (1231)
C36 N6	2388 (94)	864 (34)	1156 (45.5)	571 (1258)	587 (1294)
C40 N6	2388 (94)	864 (34)	1156 (45.5)	599 (1320)	615 (1356)
Sound attenuated enclosure Level 2					
C20 N6	2073 (81.6)	864 (34)	1156 (45.5)	474 (1045)	490 (1081)
C25 N6	2073 (81.6)	864 (34)	1156 (45.5)	492 (1084)	508 (1120)
C30 N6	2626 (103.4)	864 (34)	1156 (45.5)	547 (1206)	563 (1242)
C36 N6	2626 (103.4)	864 (34)	1156 (45.5)	576 (1269)	592 (1305)
C40 N6	2626 (103.4)	864 (34)	1156 (45.5)	604 (1331)	620 (1367)

* Weights based on 1-phase generator set. Weights may vary with a different configuration.

Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.		The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies.
	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.	U.S. EPA	Engine certified to U.S. EPA SI Stationary Emission Regulation 40 CFR, Part 60.
	All low voltage models are CSA certified to product class 4215-01.	International Building Code	The generator set is certified to International Building Code (IBC) 2012.

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

For more information contact your local Cummins distributor or visit power.cummins.com

Our energy working for you.™





CIVIL | STRUCTURAL | FIRE

Structural Calculations

Deschutes 911 Tower Generator 222 NW Skyliner Summit Loop. Bend OR

Prepared For: C A Rowles Engineering
Work Order: 22129
Date: 15 May 2019

Project Abstract:

Structural design of the attachment of the backup power generator attachment to the structural slab to resist wind and seismic forces. The design is for a Cummins C30 N6 power generator with a F231.2 enclosure.

CODE: Oregon Structural Specialty Code, 2014 Edition

LOADING:

Risk Category IV
Snow (Roof): 25 psf Min.
Wind: 115 mph Ult.
Exposure C
Topographic Factor: $K_{TZ}=2.04$
Seismic: $S_{DS}=0.329$, $S_{D1} = 0.223$, Site class C (See Geotech. Report)

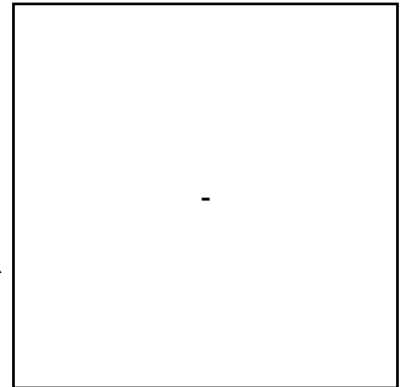
Assumed Allowable Soil Bearing = 1,500 psf

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Structural Calculations

Deschutes 911 Tower Generator 222 NW Skyliner Summit Loop. Bend OR

Prepared For: C A Rowles Engineering
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ASCE 7-10 Wind Forces Chpt 28, Pt2 & Chpt 30, Pt2

Lic. #: KW-06004985

AE GROUP

DESCRIPTION: Generator wind

Analytical Values

Calculations per ASCE 7-10

V : Basic Wind Speed per Sect 26.5-1 A, B or C **115.0** mph
 Roof Slope Angle **10** degrees
 Occupancy per Table 1.5-1 **IV** Buildings and other structures designated as essential

Exposure Category per 26.7 **Exposure C**
 MRH : Mean Roof Height **3.0** ft
 Lambda : per Figure 28.6-1, Page 305 **1.21**
 Effective Wind Area of Component & Cladding **ft^2**
 Roof pitch for cladding pressure **0 to 7 degrees**
 User specified minimum design pressure **10.0** psf
 Topographic Factor Kzt per 26.8 **2.04**
 LHD : Least Horizontal Dimension **3.0** ft
 a = max (0.04 * LHD, 3, min(0.10 * LHD, 0.4*MRH)) **3.00** ft max (0.04 * LHD, 3, min(0.10 * LHD, 0.4*MRH))

Design Wind Pressures

Horizontal Pressures . . .

Zone: A =	58.58 psf	Zone: C =	38.81 psf
Zone: B =	-24.22 psf	Zone: D =	-14.09 psf

Vertical Pressures . . .

Zone: E =	-62.29 psf	Zone: G =	-43.26 psf
Zone: F =	-38.07 psf	Zone: H =	-29.17 psf

Overhangs . . .

Zone: Eoh =	-87.26 psf	Zone: Goh =	-68.22 psf
-------------	------------	-------------	------------

ASCE 7-10 Section 28.6.4 Minimum Design Wind Loads requires that the load effects of the design wind pressures from Section 28.6.3 shall not be less than a minimum load defined by assuming the pressures, ps, for zones A and C equal to +16 psf, Zones B and D equal to +8 psf, while assuming ps for Zones E, F, G, and H are equal to 0 psf.

Component & Cladding Design Wind Pressures

*Design Wind Pressure = Lambda * Kzt * Ps30 per Eq 30.5-1*

Roof Zone 1 :	Positive :	23.977 psf
	Negative :	-58.831 psf
Roof Zone 2 :	Positive :	23.977 psf
	Negative :	-98.629 psf
Roof Zone 3 :	Positive :	23.977 psf
	Negative :	-148.562 psf
Wall Zone 4 :	Positive :	58.831 psf
	Negative :	-63.775 psf
Wall Zone 5 :	Positive :	58.831 psf
	Negative :	-78.854 psf
Roof Overhang Zone 2:		-41.503 psf
Roof Overhang Zone 3:		-68.365 psf

AE GROUP, INC.

1355 Oak Street
 EUGENE, OR 97401
 (541)341-1332

Project: Overturf Butte
 Job No.: WO22129
 Date: 05/13/09
 By: STK
 Page No.:

SEISMIC ANALYSIS FOR ANCHORAGE OF EQUIPMENT

-ASCE 7-10, section 13

tool description **Generator**
 component name **Cummins Power Gen.**
 tool ID # **C30 N6**
 location **grade**

Unit information:

anchor spacing for overturning, a 2.67 ft.
 c.g. height, h1 1.50 ft.
 unit operating weight 1250 lb.
 total weight of unit (unit wt.+2%), Wp 1275 lb.

Seismic criteria:

0.2-second (short) period spectral response acceleration (s.r.a.), S_s 0.411 *S.D.P. 3.10*
 site coefficient, F_a 1.20 *Table 1615.1.2(1)*
 importance factor, Ip 1.5 *13.1.3*
 response modification factor, Rp 2.5 *Tables 13.5-1, 13.6-1*
 response amplification factor, ap 1.0
 height of unit above grade, z 0.5 *13.3.1*
 height of roof, h 0.5 *13.3.1*
 maximum s.r.a. for short period, S_{MS} = F_aS_s 0.49 *S.D.P. 3.10*
 design s.r.a. for short period, S_{DS} = 2/3 S_{MS} 0.33

Seismic Force Calculations per 13.3.1

- | |
|---|
| 1.) $F_p = (.4 a_p S_{DS} W_p) / (R_p / I_p) \times (1 + 2(z/h))$ |
| 2.) $F_p = 0.3 S_{DS} I_p W_p$ (min.) |
| 3.) $F_p = 1.6 S_{DS} I_p W_p$ (max.) |

F_p = **0.237** x Wp
 F_p = 302 lb. in LRFD
 F_p / 1.4 = **216** lb. in ASD
 # connections resisting lateral force = 4
 lateral force @ each connection = 54 lb.
 uplift = 0 lb.
 # connections resisting uplift force = 2
 uplift @ each connection = 0 lb.
 total downforce = 759 lb.
 # leveler legs resisting downward force = 2
 Reaction @ each support leg = 379 lb.

WORK ORDER:

PROJECT:

ENGR:

DATE:

Generator Anchorage

$$R = 1.25, I = 1.5, roe = 2, Cd = 2.5$$

$$\text{if } T < 0.06s \quad V = 0.30SDsW Ie \quad (15.4-5)$$

$$\text{period } T = Ct(hn) \quad Ct = 0.02, hn = 0.75, h = 0.5' \quad T = 0.02 * 0.75 * 0.5ft = 0.007s$$

$$V = 0.30 * (0.329) * 1275 \text{ lb} * 1.5 = 189 \text{ lbs}$$

Wind

35.08 psf (ASD)

$$V_{\text{wind}} = (7.85') * (3.8') * 35.08 \text{ psf} = 1042 \text{ lb}$$

$$\text{OTM} = 1042 \text{ lb} (1.9') = 1980 \text{ ft-lb} \quad \text{Bolt ten. } 1980 \text{ ft-lb} / 2.67ft = 742 \text{ lb} \quad \text{Bolt spacing } 32''$$

$$\text{OTM} * FS = 1980 \text{ lb} * 1.5 = 2970 \text{ ft-lb}$$
$$(742 \text{ lb} / 2 \text{ bolt}) * 2 = 742 \text{ lb} \quad \text{design over strength bolt tension}$$

slab 50" x 110" x 6" min.

$$RM = (2/3 * 1242 \text{ lb} * 2.08') + ((48.3 \text{ psf} * 4.16' * 9.16') * 2.06') = 5552 \text{ ft-lb} > 2970 \text{ ft-lb} \quad \text{OK}$$

See bolt calc. (4) 5/8" dia. x 3 5/8" min embed Simpson Strong Bolt -2



Company:		Date:	5/13/2019
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Project:			
Address:			
Phone:			
E-mail:			

1. Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description: Typical sill bolts

Location: Generator Anchors
Fastening description:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-14
Units: Imperial units

Anchor Information:

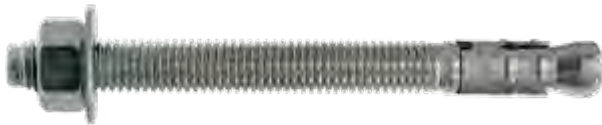
Anchor type: Torque controlled expansion anchor
Material: Carbon Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 3.375
Effective Embedment depth, h_{ef} (inch): 2.750
Code report: ICC-ES ESR-3037
Anchor category: 1
Anchor ductility: Yes
 h_{min} (inch): 5.50
 C_{ac} (inch): 7.50
 C_{min} (inch): 6.50
 S_{min} (inch): 5.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 6.00
State: Cracked
Compressive strength, f_c (psi): 2500
 $\Psi_{c,v}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6d requirement: Not applicable
Build-up grout pad: No

Recommended Anchor

Anchor Name: Strong-Bolt® 2 - 5/8"Ø CS Strong-Bolt 2, h_{nom} : 3.375" (86mm)
Code Report: ICC-ES ESR-3037





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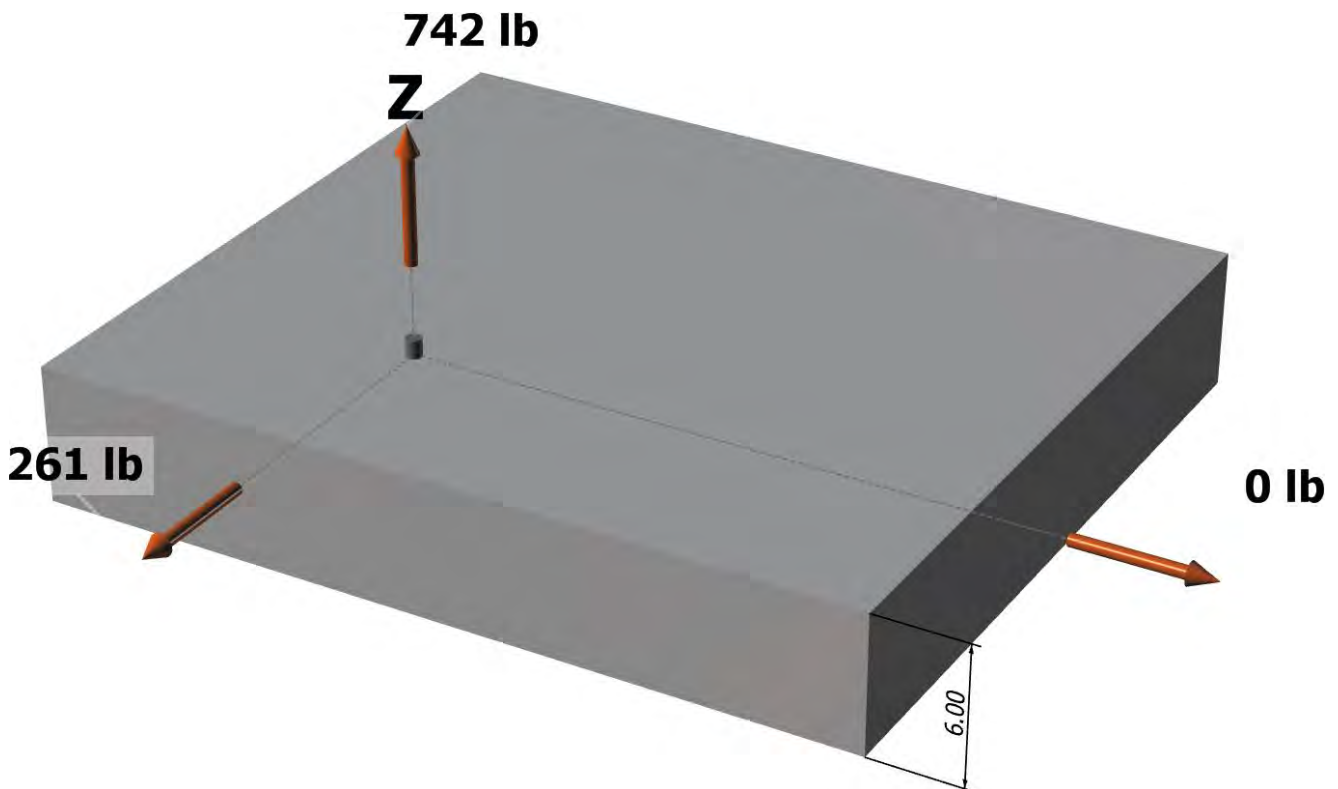
Load and Geometry

Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.2.3.4.2 not applicable
Ductility section for shear: 17.2.3.5.3 (b) is satisfied
 Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

Strength level loads:

N_{ua} [lb]: 742
 V_{uax} [lb]: 261
 V_{uay} [lb]: 0

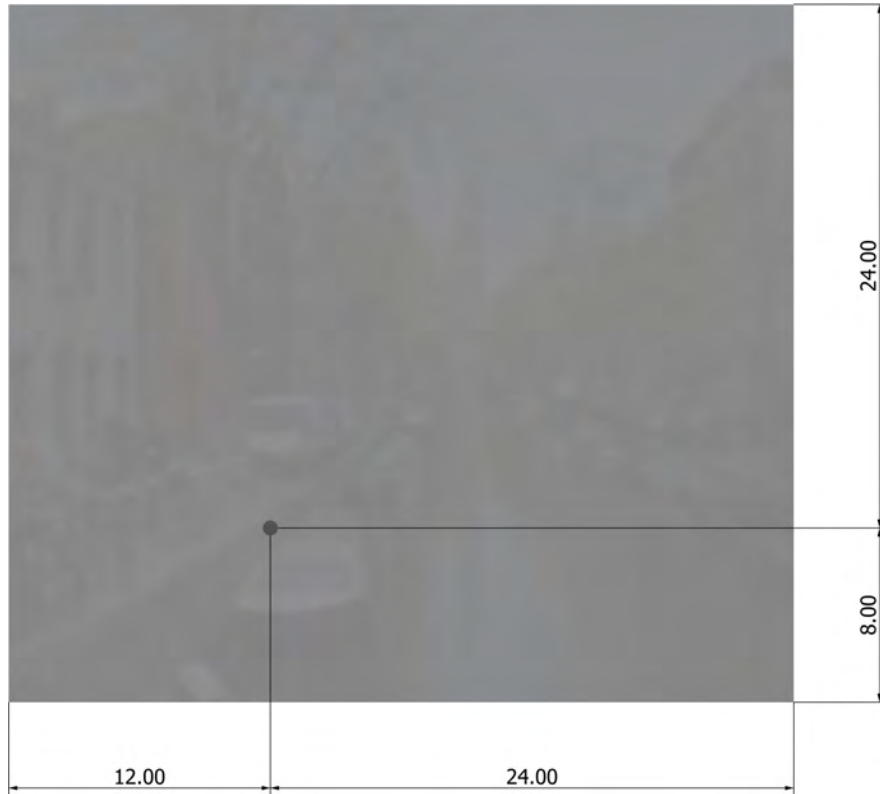
<Figure 1>





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<Figure 2>





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3. Resulting Anchor Forces

Anchor	Tension load, N _{ua} (lb)	Shear load x, V _{uax} (lb)	Shear load y, V _{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	742.0	261.0	0.0	261.0
Sum	742.0	261.0	0.0	261.0

Maximum concrete compression strain (%): 0.00
 Maximum concrete compression stress (psi): 0
 Resultant tension force (lb): 742
 Resultant compression force (lb): 0
 Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
 Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
 Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
 Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N _{sa} (lb)	φ	φN _{sa} (lb)
19070	0.75	14303

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = k_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

k _c	λ _a	f _c (psi)	h _{ef} (in)	N _b (lb)
17.0	1.00	2500	2.750	3876

$$0.75 \phi N_{cb} = 0.75 \phi (A_{Nc} / A_{Nco}) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. 17.3.1 \& Eq. 17.4.2.1a)}$$

A _{Nc} (in ²)	A _{Nco} (in ²)	c _{a,min} (in)	Ψ _{ed,N}	Ψ _{c,N}	Ψ _{cp,N}	N _b (lb)	φ	0.75 φN _{cb} (lb)
68.06	68.06	8.00	1.000	1.00	1.000	3876	0.65	1890

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$$0.75 \phi N_{pn} = 0.75 \phi \Psi_{c,P} \lambda_a N_p (f_c / 2,500)^n \text{ (Sec. 17.3.1, Eq. 17.4.3.1 \& Code Report)}$$

Ψ _{c,P}	λ _a	N _p (lb)	f _c (psi)	n	φ	0.75 φN _{pn} (lb)
1.0	1.00	3877	2500	0.50	0.65	1890



Company:		Date:	5/13/2019
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8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
9930	1.0	0.65	6455

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in x-direction:

$$V_{bx} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f_c}c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{bx} (lb)
2.75	0.625	1.00	2500	8.00	8420

$$\phi V_{cbx} = \phi (A_{Vc}/A_{Vco})\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx} \text{ (Sec. 17.3.1 \& Eq. 17.5.2.1a)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbx} (lb)
144.00	288.00	1.000	1.000	1.414	8420	0.70	4168

Shear parallel to edge in x-direction:

$$V_{by} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f_c}c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{by} (lb)
2.75	0.625	1.00	2500	12.00	15469

$$\phi V_{cbx} = \phi (2)(A_{Vc}/A_{Vco})\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by} \text{ (Sec. 17.3.1, 17.5.2.1(c) \& Eq. 17.5.2.1a)}$$

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbx} (lb)
156.00	648.00	1.000	1.000	1.732	15469	0.70	9030

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$$\phi V_{cp} = \phi k_{cp}N_{cb} = \phi k_{cp}(A_{Nc}/A_{Nco})\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,NN_b} \text{ (Sec. 17.3.1 \& Eq. 17.5.3.1a)}$$

k_{cp}	A_{Nc} (in ²)	A_{Nco} (in ²)	$\Psi_{ed,N}$	$\Psi_{c,N}$	Ψ_{cp,NN_b}	N_b (lb)	ϕ	ϕV_{cp} (lb)
2.0	68.06	68.06	1.000	1.000	1.000	3876	0.70	5427

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.6.)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status	
Steel	742	14303	0.05	Pass	
Concrete breakout	742	1890	0.39	Pass (Governs)	
Pullout	742	1890	0.39	Pass	
Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status	
Steel	261	6455	0.04	Pass	
T Concrete breakout x+	261	4168	0.06	Pass (Governs)	
 Concrete breakout y-	261	9030	0.03	Pass (Governs)	
Pryout	261	5427	0.05	Pass	
Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.39	0.00	39.3 %	1.0	Pass

5/8"Ø CS Strong-Bolt 2, hnom:3.375" (86mm) meets the selected design criteria.

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



Anchor Designer™
Software
Version 2.6.6794.10

Company:		Date:	5/13/2019
Engineer:		Page:	6/6
Project:			
Address:			
Phone:			
E-mail:			

12. Warnings

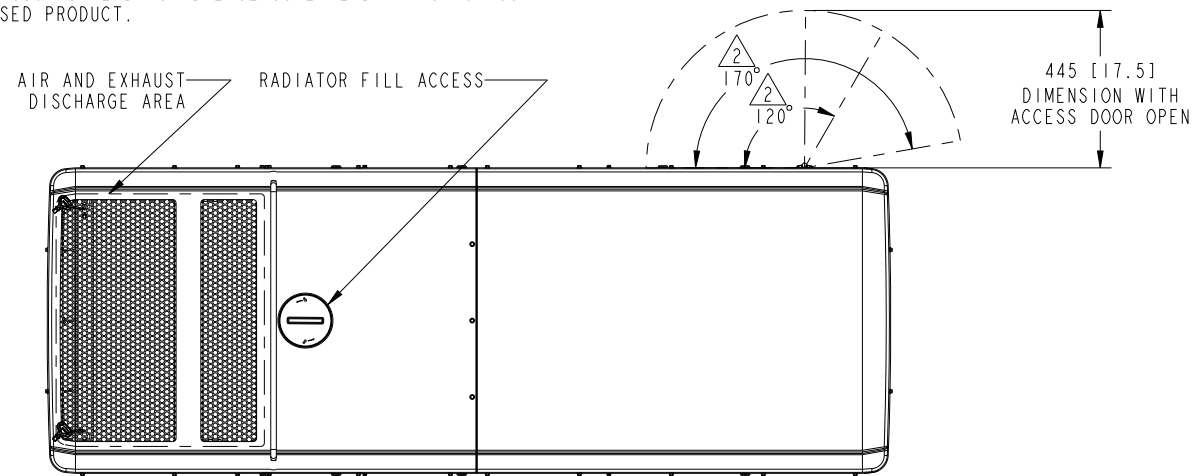
- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.
- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.
- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

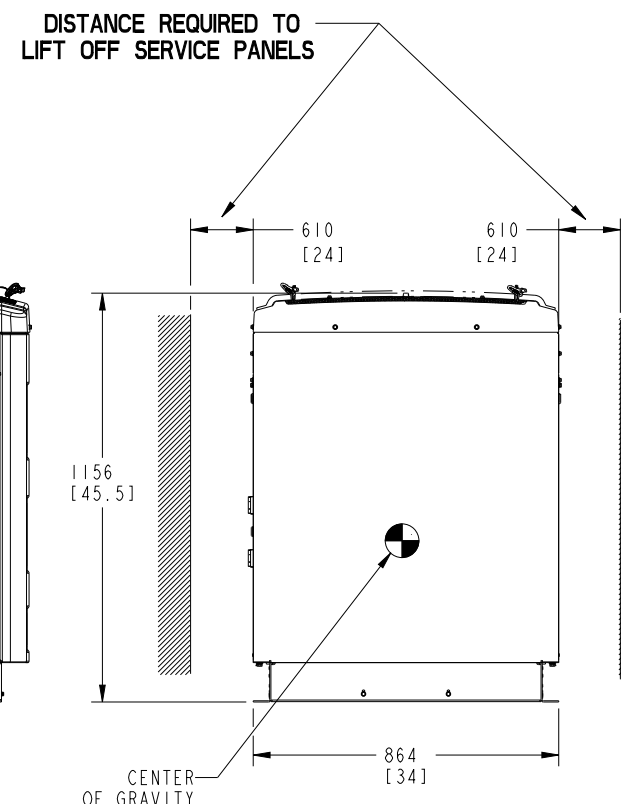
REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-178681	E	1	ZONE A4; F231-2 AND F216-2... CONFIGURATIONS WAS F231-2...				
			CONFIGURATION	PPP	KAM	WINGFIELD	09JUL18
		2	UPDATE VIEWS PICTORIALLY	PPP	KAM	WINGFIELD	09JUL18

NOTES:

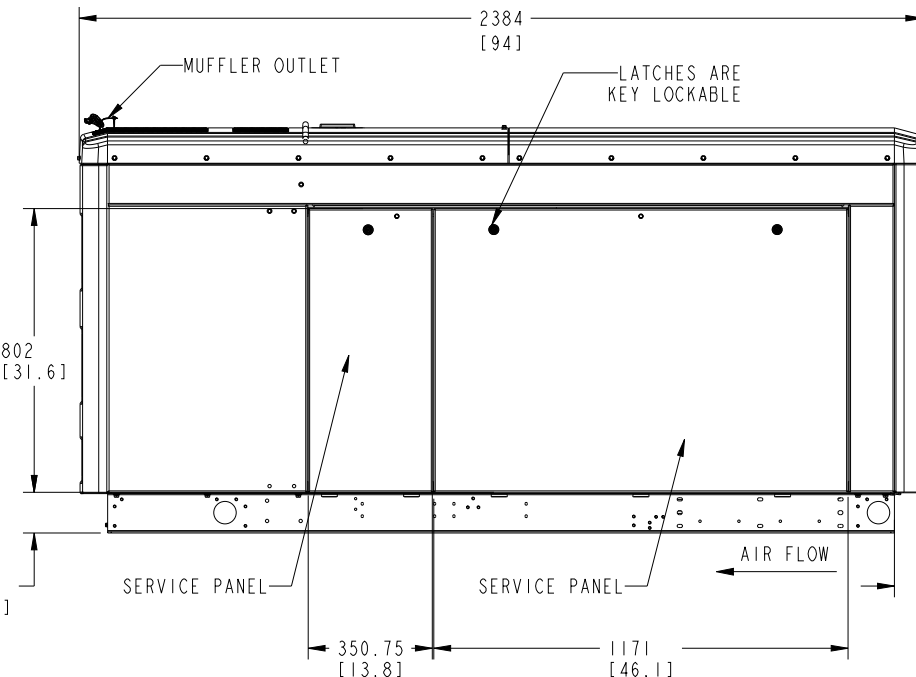
1. DIM [] IN INCHES
2. 120° AND 170° ARE DETENTED OPEN ANGLE FOR HINGE.
3. WHEN THE HOUSING INSTALLED ON AN OPEN GENERATOR SET, THE TOTAL WEIGHT WILL INCREASE BY 98 KG (216 LBS). THIS INCLUDES THE MUFFLER.
4. THE CENTER OF GRAVITY (CG) OF THE GENERATOR SET WHEN EQUIPPED WITH THIS HOUSING SHIFTS APPROXIMATELY 8MM (0.31 INCH) TOWARDS THE AIR DISCHARGE END OF THE HOUSING AND 38MM (1.5 INCH) HIGHER FROM THE GROUND. COMPARED TO THE EQUIVALENT NON-HOUSED PRODUCT WITH THE F179 SKID. SEE HOUSING READY SKID BASE OUTLINE DRAWING FOR CG LOCATION OF NON HOUSED PRODUCT.



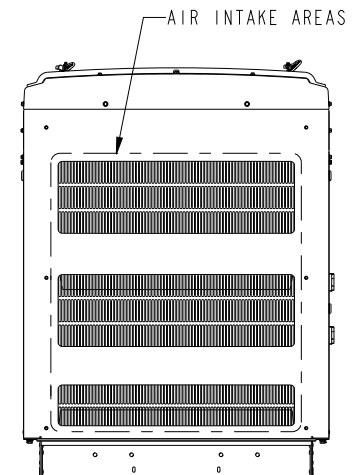
TOP VIEW



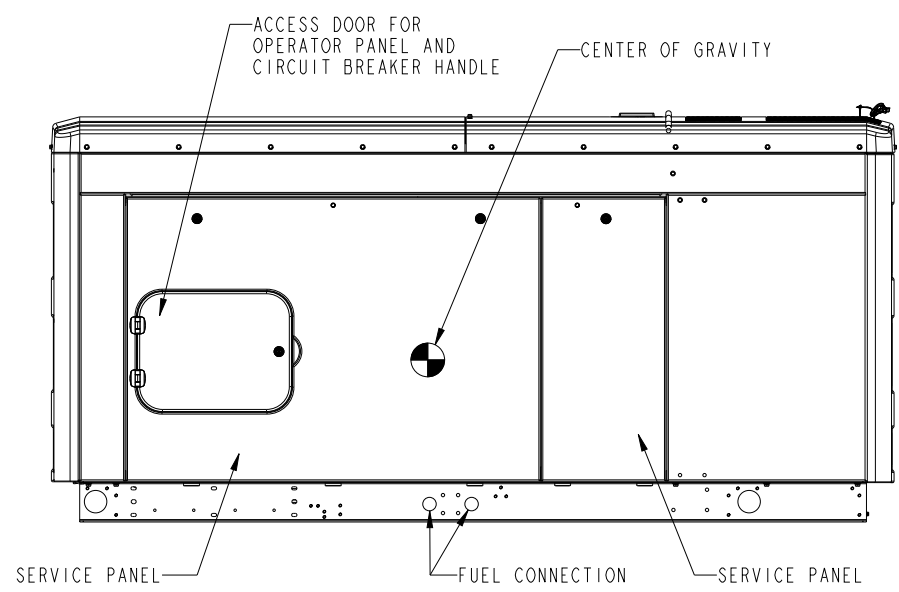
OUTLET VIEW



LEFT SIDE VIEW



INLET VIEW

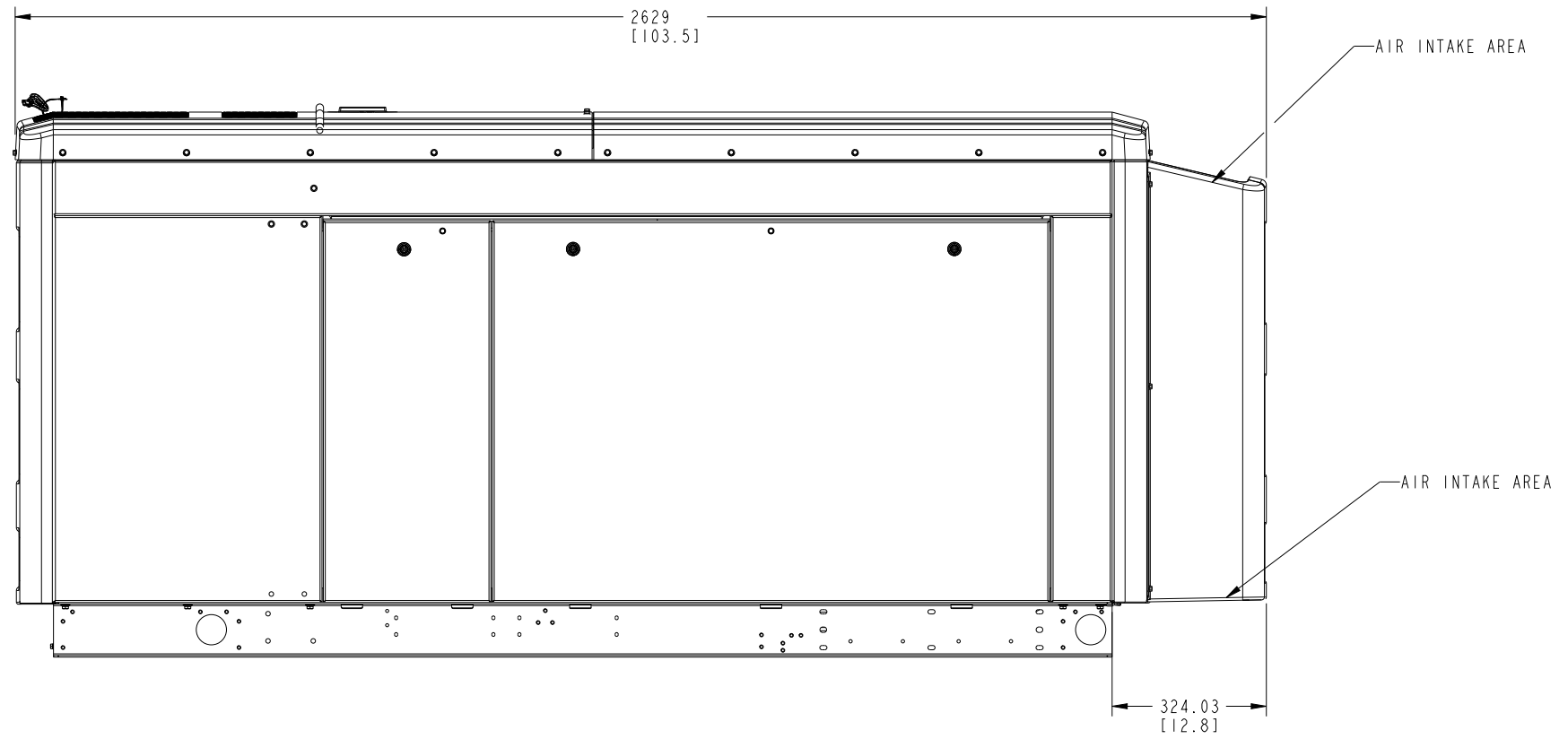
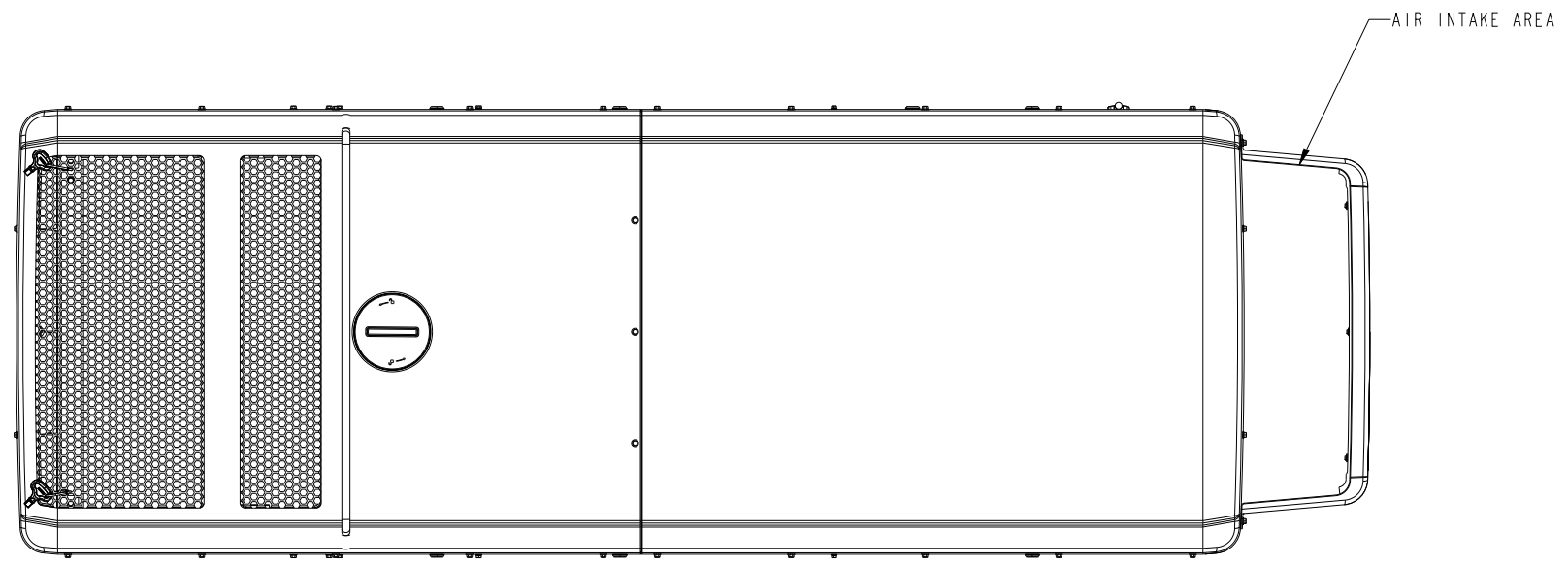


RIGHT SIDE VIEW

F231-2 AND F216-2 ENCLOSURE CONFIGURATIONS

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SH TO NONE	DWN S_GAMBHIRE		CUMMINS POWER GENERATION		
DO NOT SCALE PRINT			CKD T_RADKE		OUTLINE, ENCLOSURE		
DIM	TOLERANCE		APVD J_MATTHEWS	SITE CODE	PGF		
X ± 1	0.00- 4.99 +0.15/-0.08		DATE 17JAN13				
.X ± 0.8	5.00- 9.99 +0.20/-0.10						
.XX ± 0.38	10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13						
ANG TOL: ± 0.5°	SCALE: 1/10						

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-178681	E	-	---	AM	RN	M.WINGFIELD	09 JUL 18



F217-2 ENCLOSURE CONFIGURATION

REFER TO PAGE 1 (F231-2 ENCLOSURE) FOR OTHER F217-2 ENCLOSURE DIMENSIONS.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DIM TO NONE		DWN S_GAMBHIRE			CUMMINS POWER GENERATION																				
DO NOT SCALE PRINT				CKD T_RADKE			OUTLINE, ENCLOSURE																				
<table border="1"> <tr> <th>DIM</th> <th>TOLERANCE</th> <th>HOLE</th> <th>ANGLE</th> </tr> <tr> <td>X ± 1</td> <td>0.00-4.99 +0.15/-0.08</td> <td></td> <td></td> </tr> <tr> <td>.X ± 0.8</td> <td>5.00-9.99 +0.20/-0.10</td> <td></td> <td></td> </tr> <tr> <td>.XX ± 0.38</td> <td>10.00-17.49 +0.25/-0.13</td> <td></td> <td></td> </tr> <tr> <td></td> <td>17.50-24.99 +0.30/-0.13</td> <td></td> <td></td> </tr> </table>		DIM	TOLERANCE	HOLE	ANGLE	X ± 1	0.00-4.99 +0.15/-0.08			.X ± 0.8	5.00-9.99 +0.20/-0.10			.XX ± 0.38	10.00-17.49 +0.25/-0.13				17.50-24.99 +0.30/-0.13			DATE 17 JAN 13		SITE CODE			
DIM	TOLERANCE	HOLE	ANGLE																								
X ± 1	0.00-4.99 +0.15/-0.08																										
.X ± 0.8	5.00-9.99 +0.20/-0.10																										
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	17.50-24.99 +0.30/-0.13																										
ANG TOL: ± 0.5°		SCALE: 1/10		- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP		FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ARROW FIRST USED ON PGF																					
				PGF		SHEET 2 OF 2 Dwg REF E																					

Part A043J729 E

Description	Legacy Name	External Regulations	Application Status	Release Phase Code	Security Classification	Alternates
OUTLINE,ENCLOSURE	A043J729	No External Regulations Apply	Production Only	Production	Internal Use Only	

Part Specifications :A043J729 E

Name	Description	Legacy Name
A030B356	SPECIFICATION,MATERIAL	CES10903
A043J730	DRAWING,ENGINEERING	A043J730



FEATURES & SPECIFICATIONS

INTENDED USE

For applications that require the clean appearance of a low profile, brightness controlled wraparound. Provides broad distribution of light for offices, schools and corridors. **Certain airborne contaminants can diminish integrity of acrylic.**

[Click here for Acrylic Environmental Compatibility table for suitable uses.](#)

CONSTRUCTION

Metal parts are die formed from code-gauge steel. Prismatic diffuser is 100% acrylic with sonically welded luminous ends. Continuous side flanges on fixture body provide light trap and continuous diffuser support to prevent accidental opening and simplify maintenance.

Curved prismatic diffuser with linear side prisms minimize lamp image and provides high angle brightness control. Luminous end plates soften appearance for improved aesthetics.

Five stage iron-phosphate pretreatment assures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, high-reflectivity baked white polyester enamel (low VOC).

ELECTRICAL

Thermally-protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast is standard. Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

UL/CSA listed ballast disconnect w/strain relief and leads provided standard.

MVOLT ballasts are Full light output - reduced energy. Less than 10% THD. Multi-volt operation, 120-277V.

120V ballasts are ENERGY STAR® qualified FCC Class B for residential and commercial applications. Less than 10% THD. Quieter applications.

LISTING

UL and C-UL Listed.

WARRANTY

2-year limited warranty. Complete warranty terms located at

www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

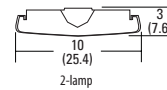
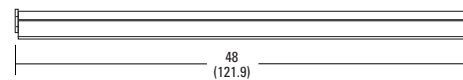
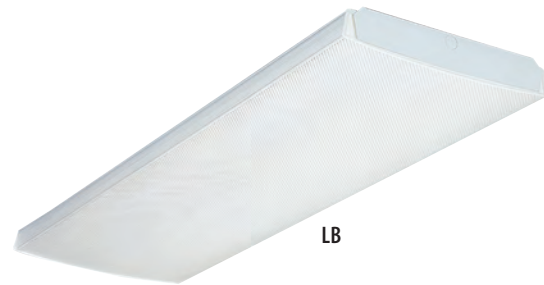
Actual performance may differ as a result of end-user environment and application.

Note: Specifications subject to change without notice.

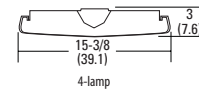
Catalog Number
Notes
Type

Contractor Select

Curved-Basket Wraps



2-lamp



4-lamp

2-lamp Specifications

Length: 48" (121.9)

Width: 10" (25.4)

Depth: 3" (7.6)

4-lamp Specifications

Length: 48" (121.9)

Width: 15-3/8" (39.1)

Depth: 3" (7.6)

All dimensions are inches (centimeters).

ORDERING INFORMATION

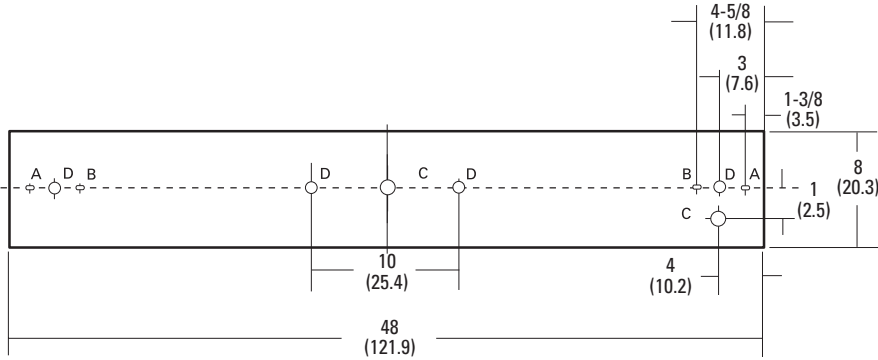
Catalog Number	UPC	Description	# of Lamps	Wattage	# of Ballasts	Voltage	Ballast Type	Lamp Included	Pallet Qty.	Standard Carton Qty.
LB232 MV	745975088508	Wraparound	2	32	1	120-277	Electronic, instant start	N	56	1
LB432 MV	745975088492	Wraparound	4	32	1	120-277	Electronic, instant start	N	34	1

Curved-Basket Wraps Low-Profile

DIMENSIONS

Inches (centimeters). Subject to change without notice

- A = 1/4 x 1/2 (.635 x 1.27) Oval Hole
- B = 1/4 x 1/2 (.635 x 1.27) K.O.
- C = 7/8 (2.22) Dia.K.O.
- D = 11/16 (1.74) Dia. K.O.
- E = 2 (5.08) Dia. K.O. and 7/8 (2.22) Dia. K.O.
- G = 1-1/8 (2.85) Dia. K.O.



PHOTOMETRICS

Calculated using the zonal cavity method in accordance with IESNA LM41 procedure. Floor reflectances are 20%. Lamp configurations shown are typical. Full photometric data on these and other configurations available upon request.

LB232 MV

Test # BAL16520 Lumens per lamp = 2950

S/MH (along) 1.24 (across) 1.34

ROCR	pf	pc	pw	Coefficients of Utilization												
				20%												
				80%			50%			30%			10%			0%
				50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	0%
0	103	103	103	92	92	92	86	86	86	80	80	80	77			
1	89	86	82	80	77	75	75	73	70	70	68	66	64			
2	79	73	68	71	66	63	66	63	59	62	59	56	54			
3	70	63	57	63	58	53	59	54	51	55	52	48	46			
4	62	55	49	56	51	46	53	48	44	50	46	42	40			
5	56	48	42	51	45	40	48	43	39	45	41	37	35			
6	50	43	37	46	40	35	43	38	34	41	36	33	31			
7	46	38	33	42	36	31	40	34	30	38	33	29	28			
8	42	35	30	39	32	28	36	31	27	35	30	26	25			
9	38	31	27	35	30	25	34	28	25	32	27	24	22			
10	35	29	24	33	27	23	31	26	23	30	25	22	20			

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1383.1	23.4	26.3
0° - 40°	2263.3	38.4	43.1
0° - 60°	3676.3	62.3	69.9
0° - 90°	4533.6	76.8	86.3
90° - 180°	722.4	12.2	13.7
0° - 180°	5256.0	89.1	100.0

LB432 MV

Report LTL 5614 - Lumens per lamp = 2900

S/MH (along) 1.2 (across) 1.3

Coefficient of Utilization

Ceiling	Coefficient of Utilization											
	20%											
	80%			70%			50%			0%		
Wall	70%	50%	30%	70%	50%	30%	50%	30%	10%	0%	0%	0%
0	89	89	89	86	86	86	80	80	80	68		
1	81	78	75	78	75	73	71	69	67	58		
2	75	69	64	72	67	63	63	59	56	50		
3	69	62	56	66	60	55	57	52	49	43		
4	63	55	49	61	54	48	51	46	42	38		
5	58	49	43	56	48	42	45	40	36	33		
6	54	44	38	52	43	37	41	36	32	29		
7	50	40	34	48	39	33	37	32	28	25		
8	46	36	30	44	35	29	33	28	24	22		
9	42	32	26	41	31	26	30	25	21	19		
10	39	29	23	38	29	23	27	22	19	16		

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	2376	20.5	27.0
0-40	3914	33.7	44.1
0-60	6499	56.0	73.7
0-90	7883	68.0	89.4
90-180	932	8.0	10.6
0-180	8815	76.0	100.0

BP-19-2116-CELL OVERTURF BUTTE DC911 PUBLIC SAFETY COMMUNICATIONS FACILITY

GENERAL NOTES:

- ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE 2012 EDITION OF THE INTERNATIONAL BUILDING CODE (IBC), THE 2014 OREGON STRUCTURAL SPECIALTY CODE (OSSC) AND THE STRUCTURAL STANDARD FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS TIA-222-G, LOCAL RULES AND STANDARDS OF GOVERNING AGENCIES HAVING JURISDICTION.
- PRIOR TO DIGGING VERIFY LOCATION AND DEPTH OF UTILITIES AND ANY OTHER UNDERGROUND INTERFERENCES. CALL 8-1-1 TWO BUSINESS DAYS PRIOR TO DIGGING. EXISTING UTILITIES: PROTECT EXISTING UTILITIES SHOWN ON THE DRAWINGS. UTILITIES UNCOVERED DURING EARTHWORK AND NOT SHOWN ON THE DRAWINGS SHALL BE PROTECTED AND THE PROJECT MANAGER NOTIFIED. CONTRACTOR IS RESPONSIBLE FOR DAMAGE TO AND REPAIR OF UTILITIES WHETHER OR NOT THEY ARE SHOWN ON THE DRAWINGS. THE OWNER ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF UTILITY INFORMATION.
- CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF SITE CONDITIONS, INSTALLATION STANDARDS AND CONSTRUCTION CONDITIONS. FIELD VERIFY ALL DIMENSIONS. DISCREPANCIES BETWEEN SITE CONDITIONS AND THE CONSTRUCTION DRAWINGS SHALL BE CALLED TO THE ATTENTION OF THE PROJECT MANAGER. WORK DONE WITHOUT THE PROJECT MANAGER'S APPROVAL IS THE RESPONSIBILITY OF THE CONTRACTOR.
- CONTRACTOR TO COORDINATE OPERATIONS INCLUDING AREAS FOR MATERIALS STORAGE, ACCESS TO AND FROM AREAS OF WORK, AND TIMING OF WORK.
- CONTRACTOR IS RESPONSIBLE FOR REPAIR OF DAMAGE TO ALL OFF-SITE EXISTING ROADWAYS AND DRIVEWAYS TO PRE-CONSTRUCTION CONDITIONS, INCLUDING ANY EXISTING DIRT TRAILS USED TO ACCESS THE SITE. TO VERIFY PRE-CONSTRUCTION CONDITIONS, PRIOR TO STARTING CONSTRUCTION, CONTRACTOR SHALL PREPARE DIGITAL PHOTOS OR DIGITAL VIDEO IMAGES OF THE ACCESS ROADWAYS AND/OR DRIVEWAYS BETWEEN THE NEAREST PUBLIC DOCUMENTED JURISDICTION'S RIGHT-OF-WAY TO PROJECT SITE AND TRANSMIT TO THE PROJECT MANAGER. UPON APPROVAL BY THE PROJECT MANAGER OF THE DIGITAL PHOTOS OR DIGITAL VIDEO IMAGES, ACCESS ON THE EXISTING ROADWAYS AND/OR DRIVEWAYS CAN PROCEED FOR CONSTRUCTION.
- SITE CLEARING AND PREPARATION SHALL CONSIST OF GRUBBING AND REMOVING ANY EXISTING GRASSES, TREE ROOTS, DEBRIS AND ORGANIC TOP SOIL. THE EXPOSED SUBGRADE SHALL BE PROOF-ROLLED TO DETECT ANY LOCAL WEAK AREAS, WHICH SHALL BE EXCAVATED AND RE-COMPACTED.
- ALL FILL OR BACKFILL AND GRAVEL PAVING SHALL BE COMPACTED TO 95% OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D1557 AT WITHIN ±2% OF OPTIMUM MOISTURE CONTENT. REMOVE ALL DEBRIS FROM THE AREA TO BE BACKFILLED PRIOR TO BACKFILLING. PLACE LOAD BEARING BACKFILL IN LAYERS NOT MORE THAN 8 INCHES THICK, LOOSE MEASUREMENT. SPREAD AND COMPACT EACH LAYER UNIFORMLY TO THE REQUIRED DENSITY.
- CONCRETE FOR FOUNDATION FOR STICK FRAMED BUILDING SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS. SPECIAL INSPECTION REQUIRED. TOOL ALL EXPOSED EDGES OF CONCRETE WITH A CONCAVE TOOLING DEVICE. ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH ACI 301.
- REINFORCEMENT SHALL CONFORM TO ASTM A615, GRADE 60 (DEFORMED). FABRICATE REINFORCEMENT PER ACI 318, CLASS "B" SPLICES. REINFORCEMENT SHALL BE CONTINUOUS BENT AROUND CORNERS, OR CORNER BARS OF THE SAME SIZE MAY BE INSTALLED WITH MINIMUM LEG LENGTH THAT CONFORMS TO ACI 318, CLASS "B" SPLICES.
- CAST IN PLACE CONCRETE SHALL MEET THE FOLLOWING REQUIREMENTS:
ACI 117 - STANDARD SPECIFICATIONS FOR TOLERANCES FOR CONCRETE CONSTRUCTION MATERIALS
ACI 301 - SPECIFICATIONS FOR STRUCTURAL CONCRETE
ACI 302 - GUIDE FOR CONCRETE FLOOR AND SLAB CONSTRUCTION
ACI 305 - HOT WEATHER CONCRETING
ACI 306 - COLD WEATHER CONCRETING
- REFER TO PROJECT 18-09 BY CENTRAL OREGON LAND SURVEYING FOR SITE SURVEY INFORMATION.
- CONTRACTOR TO REVIEW PROJECT PERMITS AND AUTHORIZATIONS FOR COMPLIANCE WITH SEPARATION DISTANCE REQUIREMENTS TO PROPERTY LINES, LEASE LINES, AND ADJACENT BUILDINGS PER IBC AND ANY ZONING SETBACKS OR OTHER REQUIREMENTS. NOTIFY PROJECT MANAGER OF DISCREPANCIES.
- ALL SOLID WASTE NOT USED FOR SITE GRADING SHALL BE REMOVED FROM PROJECT SITE AND DISPOSED OF IN AN APPROVED SOLID WASTE DISPOSAL AREA.
- CONTRACTOR SHALL CONSTRUCT STICK-FRAMED EQUIPMENT SHELTER PER DESIGN DOCUMENTS. CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE FOUNDATION, BUILDING ANCHORS, CONNECTIONS OF UTILITIES AND PROPANE FEEDS. CONTRACTOR SHALL PROVIDE EXTERIOR GROUNDING PER THE ELECTRICAL ENGINEER'S DESIGN AND CONNECT TO INTERIOR GROUNDING SYSTEM AS REQUIRED.
- CONTRACTOR SHALL INSTALL THE OWNER-SUPPLIED SELF-SUPPORTING WOOD POLE, MANUFACTURED PER SPECIFICATION BY MCFARLAND CASCADE, INCLUDING:
-CONTRACTOR SHALL PROVIDE ALL LABOR AND MATERIALS REQUIRED FOR TOWER FOUNDATION PER DESIGN DOCUMENTS AND MANUFACTURER'S SPECIFICATIONS.
-CONTRACTOR SHALL PROVIDE ALL LABOR AND MATERIALS REQUIRED FOR MONOPOLE GROUNDING PER SHEET E3.
-CONTRACTOR SHALL PROVIDE, OR CAUSE TO BE PROVIDED, ALL LABOR AND MATERIALS REQUIRED FOR ERECTION AND INSTALLATION OF THE TOWER UPON ITS FOUNDATION.
- CONTRACTOR SHALL FURNISH AND INSTALL NEW CABLE BRIDGE AND RELATED COMPONENTS, AND SHALL ERECT COMPONENTS PER MANUFACTURER'S DESIGN.
- CONTRACTOR SHALL TRENCH FROM THE UTILITY POLE-MOUNTED TRANSFORMER LOCATION TO THE NEW METER BASE POSITION AS DESIGNATED BY PACIFIC POWER. THE CONTRACTOR SHALL FURNISH AND INSTALL CONDUIT AND PULLSTRING, AS SPECIFIED BY PACIFIC POWER. PACIFIC POWER IS RESPONSIBLE FOR INSTALLING THE UTILITY FEEDERS FROM THE UTILITY POLE TO THE METER BASE AS WELL AS THE METER ITSELF. THE CONTRACTOR SHALL TRENCH FROM THE METER BASE TO THE SHELTER LOCATION AND SHALL FURNISH AND INSTALL CONDUIT AND FEEDER CONDUCTORS AS SPECIFIED HEREIN.
- ALL STEEL EXPOSED TO WEATHER SHALL BE GALVANIZED, UNLESS OTHERWISE NOTED.
- MAKE ALL EXTERIOR PENETRATIONS WEATHERTIGHT.
- ENVIRONMENTAL PROTECTION: COMPLY WITH ALL REQUIREMENTS OF PUBLIC AUTHORITIES HAVING JURISDICTION.
- STATEMENT OF WORK ISSUED BY DESCHUTES COUNTY 9-1-1 SERVICE DISTRICT (DC911) AND CONTRACT BETWEEN DC911 AND CONTRACTOR INCLUDES ADDITIONAL INFORMATION AND REQUIREMENTS.
- ONE SET OF THE APPROVED PLANS BEARING THE STAMP OF THE CITY OF BEND BUILDING DIVISION MUST BE MAINTAINED ON THE PROJECT SITE THROUGHOUT ALL PHASES OF CONSTRUCTION AND MUST BE MADE AVAILABLE TO BUILDING AND FIRE INSPECTORS FOR REFERENCE PER 2014 OSSC 107.
- PROJECT MANAGER OR ENGINEER SHALL REVIEW ALL DEFERRED DRAWINGS, PLACE A SHOP DRAWING REVIEWED STAMP ON EACH SHEET, THEN SUBMIT DOCUMENTS TO THE BUILDING DEPARTMENT FOR THEIR REVIEW AND APPROVAL. 2014 OSSC 107.3.4.2.

FRACTIONAL LOT #4, SEC 31, TOWNSHIP 17S, RANGE 12E, WILLAMETTE MERIDIAN
SOMETIMES CALLED THE SW 1/4 OF THE SW 1/4 OF SAID SEC 31-17-12
CITY OF BEND, DESCHUTES COUNTY, OREGON

SHEET INDEX:

CIVIL DRAWINGS:

- C1 - COVER SHEET & NOTES
- C2 - OVERALL SITE PLAN & EXISTING CONDITIONS
- C3 - FINAL SITE PLAN
- C4 - GENSET DETAILS & SPECIFICATIONS
- C5 - PROPANE SYSTEM DETAILS & SPECIFICATIONS
- C6 - MISCELLANEOUS DETAILS

STRUCTURAL DRAWINGS:

- S1 - POLE ELEVATION AND SECTIONS

ELECTRICAL DRAWINGS:

- E1 - POWER ROUTING MAP
- E2 - ELECTRICAL PLAN & DETAILS
- E3 - GROUNDING PLAN & DETAILS
- E4 - GROUNDING PLAN & DETAILS
- E5 - ELECTRICAL SPECIFICATIONS
- E6 - ELECTRICAL SPECIFICATIONS
- E7 - ELECTRICAL SPECIFICATIONS

ARCHITECTURAL DRAWINGS:

- A0.1 - GENERAL NOTES
- A1.0 - SHELTER SPECIFICATIONS
- A1.1 - EQUIPMENT SHELTER PLAN & SECTION
- A3.1 - ELEVATIONS

SURVEY NOTES:

- THE SURVEY'S DATUM IS BASED ON THE NATIONAL AMERICAN VERTICAL DATUM OF 1988 (NAVD88), BASED ON A TIE TO THE OREGON REAL-TIME GNSS NETWORK (ORGN).
- THE SURVEY'S COORDINATE SYSTEM IS BASED ON THE OREGON COORDINATE REFERENCE SYSTEM (OCRS) BEND-REDMOND-PRINEVILLE ZONE.
- THE SURVEY DRAWING WAS PREPARED BY CENTRAL OREGON LAND SURVEYING LLC.
- THE SURVEY DRAWING REPRESENTS A TOPOGRAPHIC MAP ONLY. NO BOUNDARY SURVEY WAS MADE OTHER THAN THE FOUND MONUMENTS OF RECORD AS SHOWN.

UTILITY LOCATING NOTE:

CONTRACTOR TO PROVIDE UTILITY LOCATES PER OREGON ADMINISTRATIVE RULES CHAPTER 952. CONTRACTOR TO NOTIFY DESIGN ENGINEER & OWNER'S REPRESENTATIVE IMMEDIATELY IN THE EVENT OF DISCREPANCY OR CONFLICT.

PROJECT DESCRIPTION:

- SITE PREPARATION WORK, INCLUDING CLEARING, GRUBBING, EXCAVATION & COMPACTION, NEW FENCING & GATE INSTALLATION.
- CONSTRUCTION OF FOUNDATIONS FOR SELF-SUPPORTING WOOD POLE, STICK-FRAMED EQUIPMENT SHELTER, GENERATOR AND CABLE BRIDGE.
- EXTENSION OF POWER SERVICE TO PROJECT SITE.
- INSTALL OWNER-SUPPLIED OF SELF-SUPPORTING WOOD POLE, CONSTRUCTION OF EQUIPMENT SHELTER.
- FURNISHING AND INSTALLATION OF CABLE BRIDGE, PROPANE TANK, GROUNDING SYSTEM, ELECTRICAL SERVICE, FENCING, GRAVEL PAD.
- CONNECTION OF ELECTRICAL SERVICE, GROUNDING SYSTEM, PROPANE TANK, AND FUEL ALARM SYSTEM TO NEW BUILDING.



SITE SUMMARY:

TAX LOT: 171231C000400
ADDRESS: 222 NW SKYLINER SUMMIT LOOP

TOTAL PARCEL AREA: 36.85 AC

ZONE: PF (PUBLIC FACILITIES)
COMP PLAN: PF (PUBLIC FACILITIES)

EXISTING USE: WATER TANK FACILITY, PASSIVE RECREATION
PROPOSED USE: WIRELESS & BROADCAST COMMUNICATIONS FACILITIES

PROPOSED BUILDING AREA: 195 SF
EXISTING BUILDING AREA (WATER TANK FACILITY): 15,000 SF

LOT COVERAGE: 1%

CITY OF BEND RELATED APPLICATIONS: PZ-18-1021 & PZ-18-1022

LAND OWNER:

CITY OF BEND
PO BOX 431
BEND, OREGON 97709

PLANNING/CIVIL ENGINEERING:

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CA ROWLES ENGINEERING & DESIGN
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(541) 585-2207

PROJECT MANAGER:

TOM MANLEY
ADCOMM ENGINEERING COMPANY
2307 CASCADE PLACE W
UNIVERSITY PLACE, WA 98466
(206) 954-7485

STRUCTURAL ENGINEERING:

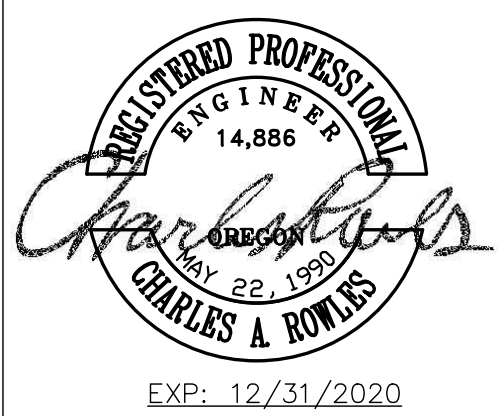
JOK ANG, PE, SE
MORTIER ANG ENGINEERS
1355 OAK STREET, SUITE 200
EUGENE, OR 97401
(541) 484-9080

CONSULTANT:

RICK ALLEN
RL ALLEN GROUP, LLC
384 SW 5TH STREET
MADRAS, OR 97741
(541) 475-2220

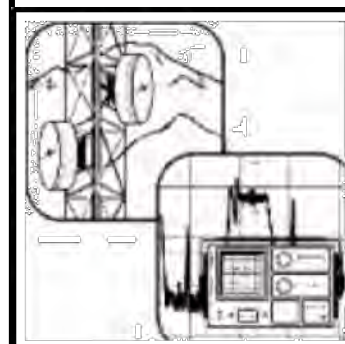
TOWER CRITERIA

OSSC RISK CATEGORY: IV SITE CLASS: C
WIND SPEED: 115 MPH (ULTIMATE) CONSTRUCTION TYPE: V-B
WIND EXPOSURE: C OCCUPANCY TYPE: U
SEISMIC DESIGN CATEGORY: D



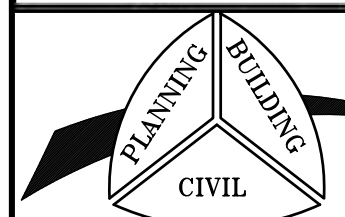
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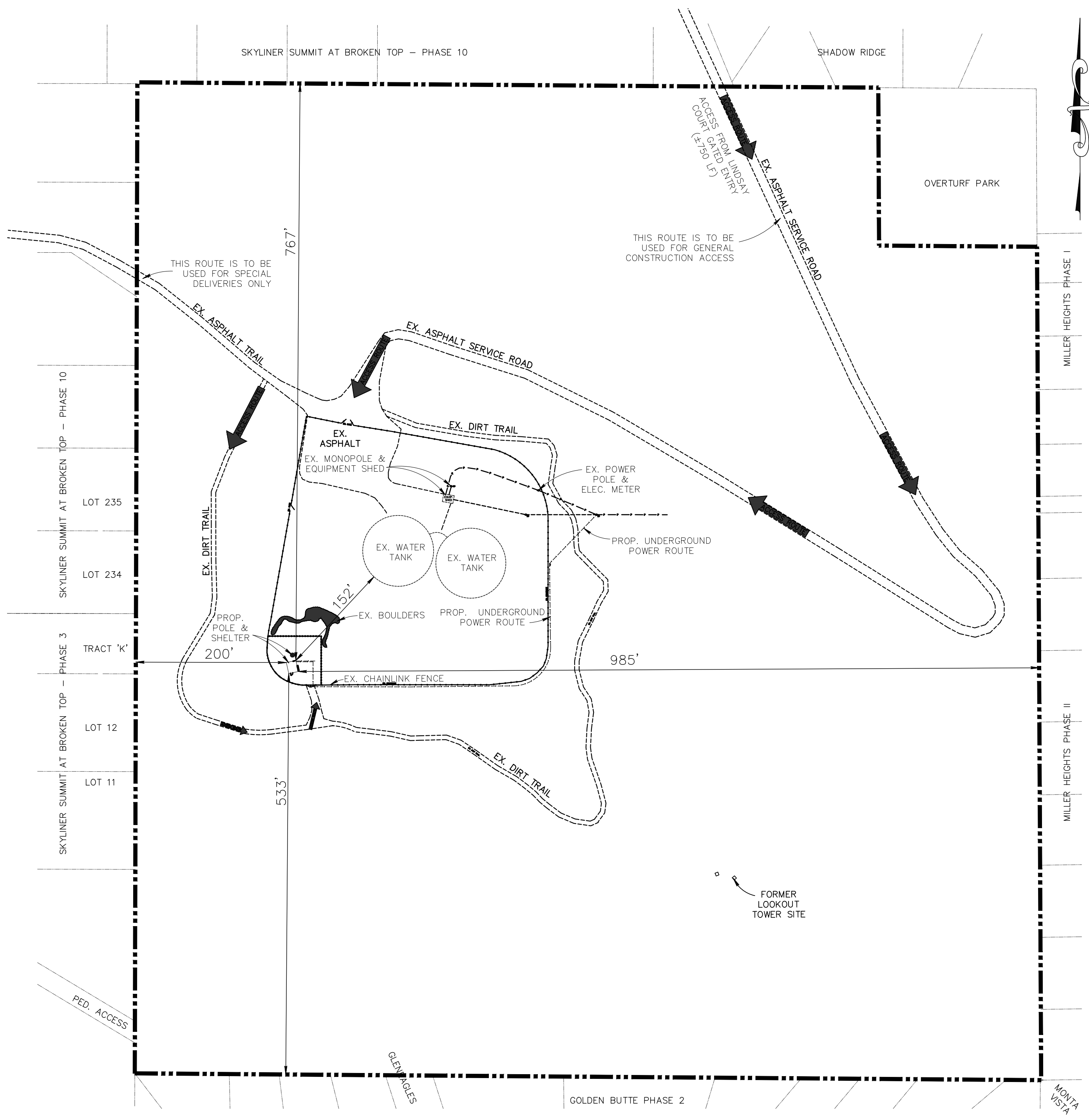
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Developer:
DESCHUTES COUNTY 9-1-1 SERVICE DISTRICT
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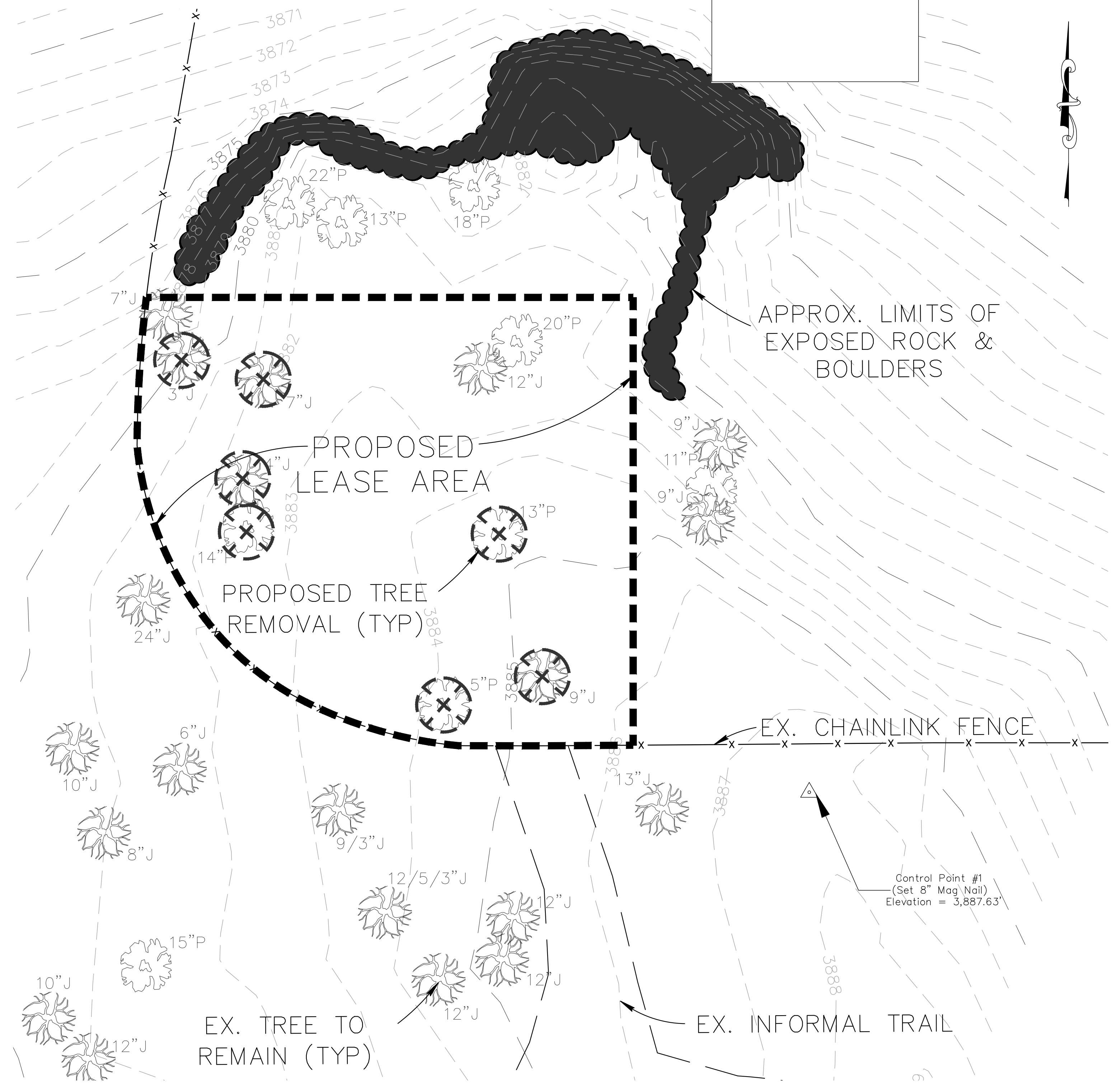
COVER SHEET & NOTES
222 NW SKYLINER SUMMIT LOOP
BEND, OREGON 97703

		NO.	DATE	REVISIONS	
Drafting	MAW				sh.t.
Design	MAW				
Scale	AS SHOWN				
Date	05/14/19				of
W.O. No.	18-718	1	10/23/19	UPDATE DRAWINGS PER BID CHANGES	

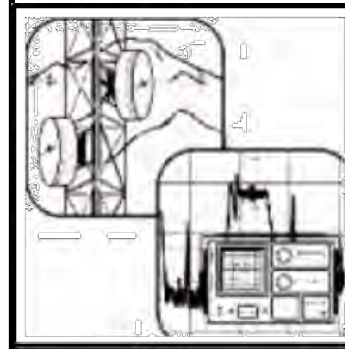
OVERTURF BUTTE - DC911 PUBLIC SAFETY COMMUNICATIONS FACILITY



OVERALL SITE PLAN
SCALE: 1" = 100'
GRAPHIC SCALE IN FEET

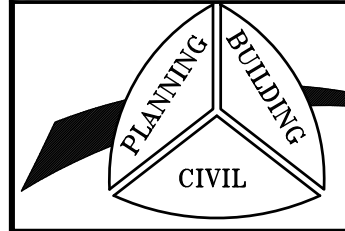


EXISTING CONDITIONS
SCALE: 1" = 10'
GRAPHIC SCALE IN FEET



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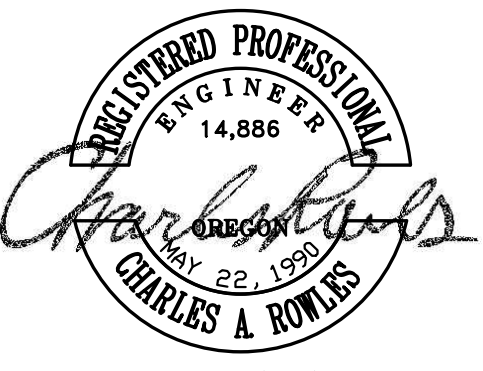


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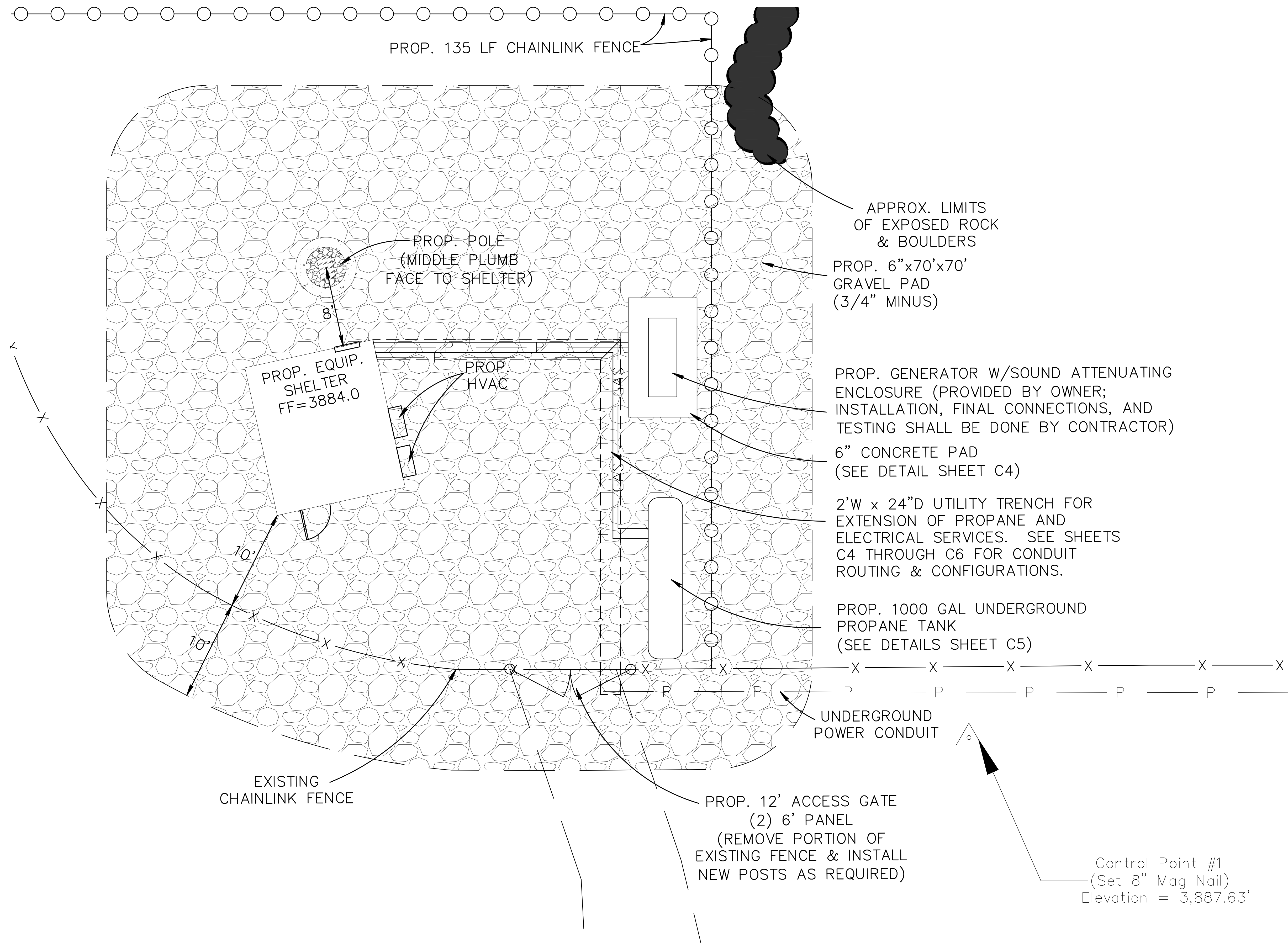
OVERALL SITE PLAN & EXISTING CONDITIONS
222 NW SKYLINER SUMMIT LOOP
BEND, OREGON 97703

Drafting	NO.	DATE	REVISIONS
MAW			
Design			
Scale			
Date			
W.O. No.			

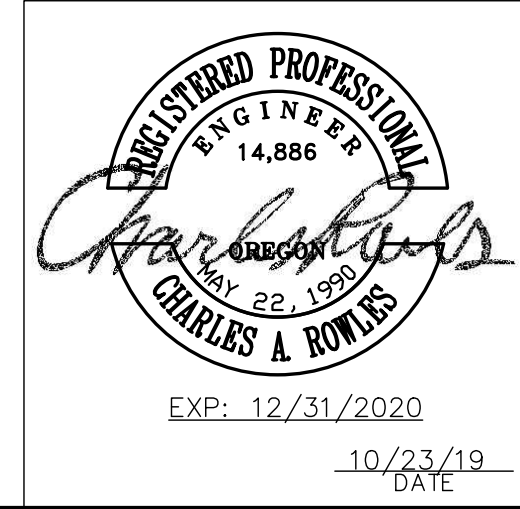
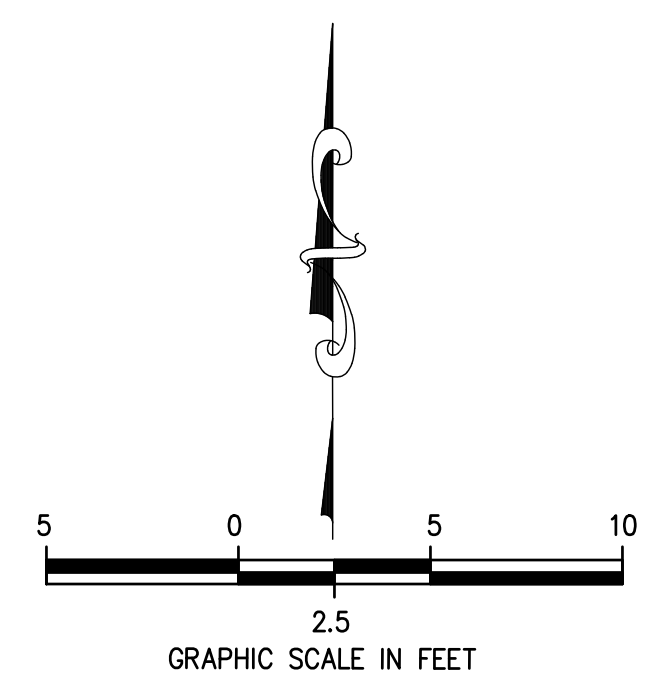
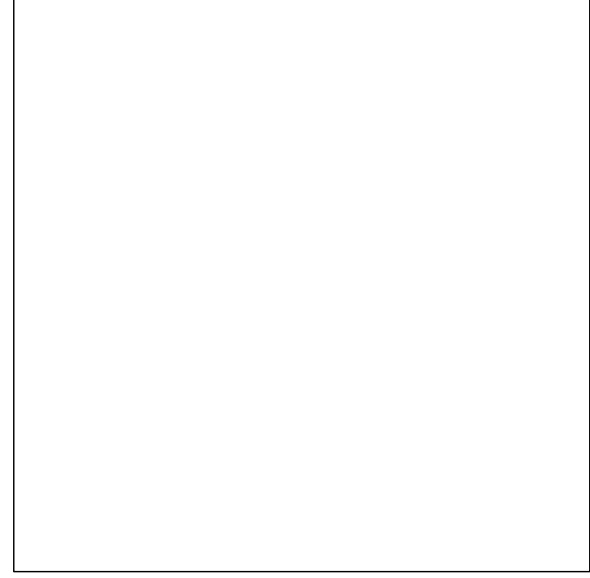


EXP: 12/31/2020
10/23/19
DATE

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of



FINAL SITE PLAN
SCALE: 1" = 5'



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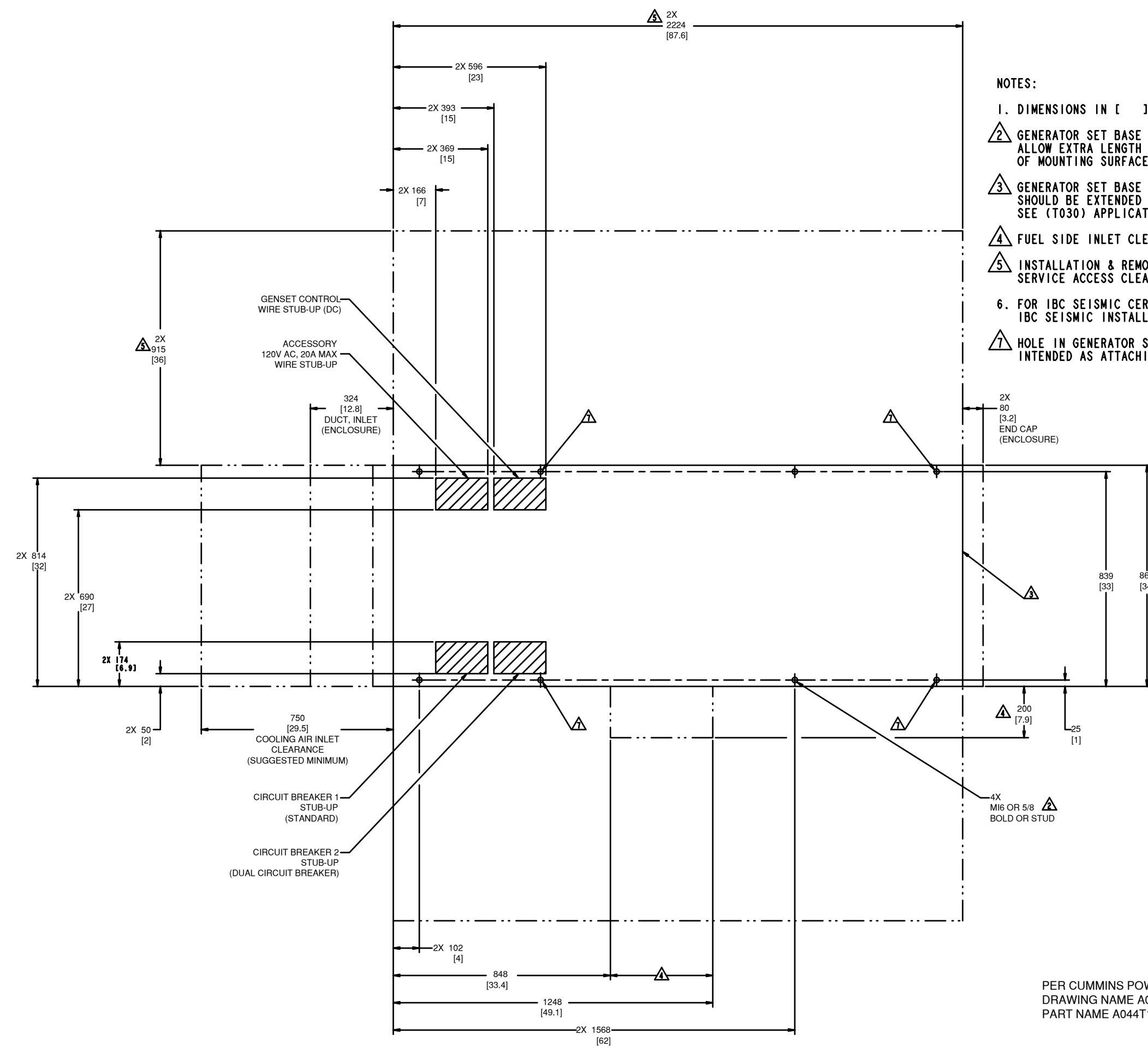
Developer:
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FINAL SITE PLAN
222 NW SKYLINER SUMMIT LOOP
BEND, OREGON 97703

		NO.	DATE	REVISIONS	sh.
Drafting	MAW				C3
Design	MAW				
Scale	AS SHOWN				
Date	05/14/19				
W.O. No.	18-718	1	10/23/19	UPDATE DRAWINGS PER BID CHANGES	of

GENSET FOUNDATION OUTLINE

DETAIL--NO SCALE



- NOTES:
- 1. DIMENSIONS IN [] ARE IN INCHES.
 - 2. GENERATOR SET BASE HAS A FLANGE THICKNESS OF 3.42MM. ALLOW EXTRA LENGTH ON HARDWARE FOR UNEVENNESS OF MOUNTING SURFACE.
 - 3. GENERATOR SET BASE PERIMETER IS SHOWN. FOUNDATION SHOULD BE EXTENDED BEYOND THIS PERIMETER. SEE (T030) APPLICATION MANUAL.
 - 4. FUEL SIDE INLET CLEARANCE.
 - 5. INSTALLATION & REMOVAL LIFTING AND SERVICE ACCESS CLEARANCE (SUGGESTED MINIMUM).
 - 6. FOR IBC SEISMIC CERTIFIED INSTALLATIONS, SEE GENSET IBC SEISMIC INSTALLATION REQUIREMENTS DRAWING.
 - 7. HOLE IN GENERATOR SET BASE AT THIS LOCATION NOT INTENDED AS ATTACHING POINT TO MOUNTING STRUCTURE.

GENSET MODEL APPLICATION
C30 NH
C36 NH
C40 NH
C44 NH
C48 NH
C52 NH
C56 NH
C60 NH

PER CUMMINS POWER GENERATION DRAWING NAME A044T183, REV E PART NAME A044T182, REV E

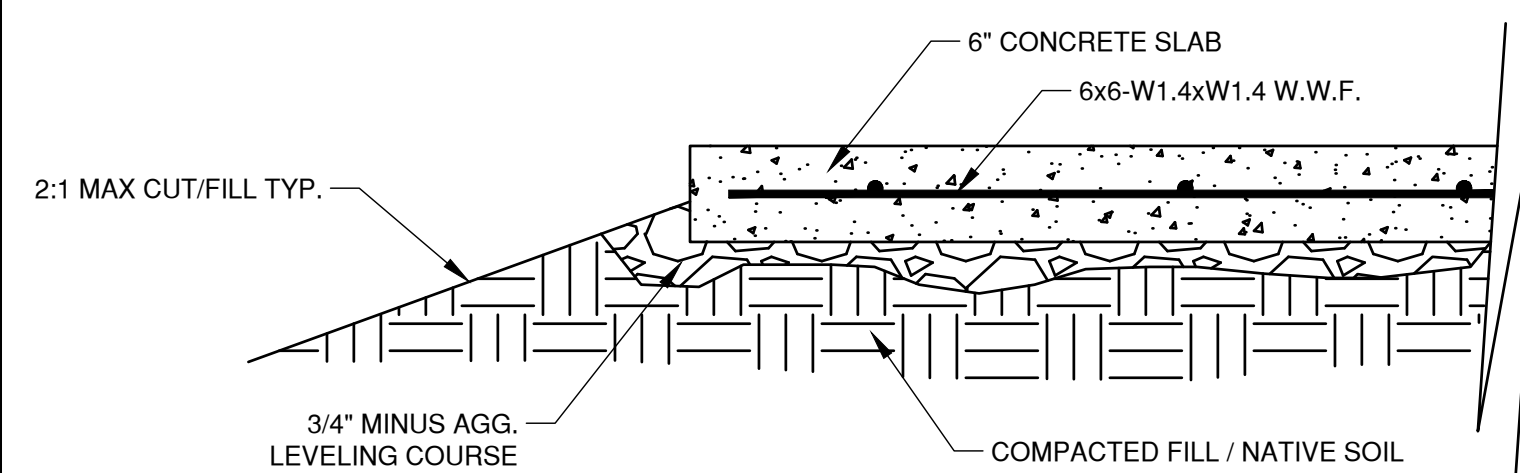
SEISMIC INSTALLATIONS NOTES:

1. THE DESIGN OF POST-INSTALLED ANCHORS IN CONCRETE USED FOR THE COMPONENT ANCHORAGE IS PRE-QUALIFIED FOR SEISMIC APPLICATIONS IN ACCORDANCE WITH "ACI 308.2R-07" AND DOCUMENTED IN A REPORT BY A REPUTABLE TESTING AGENCY. (EX. THE EVALUATION SERVICE REPORT ISSUED BY THE INTERNATIONAL CODE COUNCIL)
2. ANCHORS MUST BE INSTALLED TO AN EMBEDMENT DEPTH AS RECOMMENDED IN THE PRE-QUALIFICATION TEST REPORT AS DEFINED IN NOTE 1. FOR "CBC 2013" APPLICATIONS.
3. ANCHORS MUST BE INSTALLED IN MINIMUM 3000 PSI COMPRESSIVE STRENGTH NORMAL WEIGHT STRUCTURAL CONCRETE. CONCRETE AGGREGATE MUST COMPLY WITH "ASTM C33".
4. ANCHORS MUST BE INSTALLED TO THE TORQUE SPECIFICATION AS RECOMMENDED BY THE ANCHOR MANUFACTURER.
5. ANCHORS MUST BE INSTALLED IN LOCATIONS SPECIFIED ON THIS INSTALLATION DRAWING.
6. WASHERS MUST BE INSTALLED AT EACH ANCHOR LOCATION BETWEEN THE ANCHOR HEAD AND EQUIPMENT FOR TENSION LOAD DISTRIBUTION. WASHERS MUST BE TYPE A OR B PLAIN WASHERS MEETING ASME B18.21.1-2009. WASHER SIZE TO MATCH ANCHOR DIAMETER.
7. CONCRETE FLOOR SLAB AND CONCRETE HOUSEKEEPING PADS MUST BE DESIGNED AND REBAR REINFORCED FOR SEISMIC APPLICATIONS IN ACCORDANCE WITH "ACI 318-11".
8. ALL HOUSEKEEPING PAD THICKNESSES MUST BE DESIGNED IN ACCORDANCE WITH THE PRE-QUALIFICATION TEST REPORT AS DEFINED IN NOTE 1 OR A MINIMUM OF 1.5X THE ANCHOR EMBEDMENT DEPTH, WHICHEVER IS LARGEST (UNLESS NOTED OTHERWISE).
9. ALL HOUSEKEEPING PADS MUST BE DOWELLED OR CAST INTO THE BUILDING STRUCTURAL FLOOR SLAB AND DESIGNED FOR SEISMIC APPLICATION PER "ACI 318-11" AND AS APPROVED BY THE STRUCTURAL ENGINEER OF RECORD.
10. (NOTE REMOVED)
11. FLOOR MOUNTED EQUIPMENT (WITH OR WITHOUT A HOUSEKEEPING PAD) MUST BE INSTALLED TO A STEEL REINFORCED STRUCTURAL CONCRETE FLOOR THAT IS SEISMICALLY DESIGNED AND APPROVED BY THE ENGINEER OF RECORD TO RESIST ALL LOADS FROM EQUIPMENT BEING ANCHORED TO THE FLOOR.
12. COORDINATE REINFORCEMENT OF SUPPORT STRUCTURE WITH EQUIPMENT ANCHOR LOCATIONS.
13. ATTACHING SEISMIC CERTIFIED EQUIPMENT TO FLOOR OTHER THAN THOSE DESIGNED TO ACCEPT THE SEISMIC LOADS FROM CERTIFIED EQUIPMENT BY THE STRUCTURAL ENGINEER OF RECORD IS PROHIBITED.
14. (NOTE REMOVED)
15. (NOTE REMOVED)
16. (NOTE REMOVED)
17. (NOTE REMOVED)
18. CONNECTIONS TO THE EQUIPMENT, INCLUDING BUT NOT LIMITED TO CONDUIT, WIRING FROM CABLE TRAYS, OTHER ELECTRICAL SERVICES OR OTHER CONNECTIONS, ARE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR. FLEXIBLE ATTACHMENTS MUST BE USED FOR SEISMIC CONNECTIONS TO ISOLATED COMPONENTS OR ISOLATED EQUIPMENT. THE FLEXIBLE ATTACHMENT MUST PROVIDE FOR ENOUGH RELATIVE DISPLACEMENT TO REMAIN CONNECTED TO THE EQUIPMENT AND FUNCTIONAL DURING AND AFTER A SEISMIC EVENT.

PER CUMMINS POWER GENERATION DRAWING NAME A044H912, REV G PART NAME A044H911, REV G

GENSET PAD SECTION

DETAIL--NO SCALE

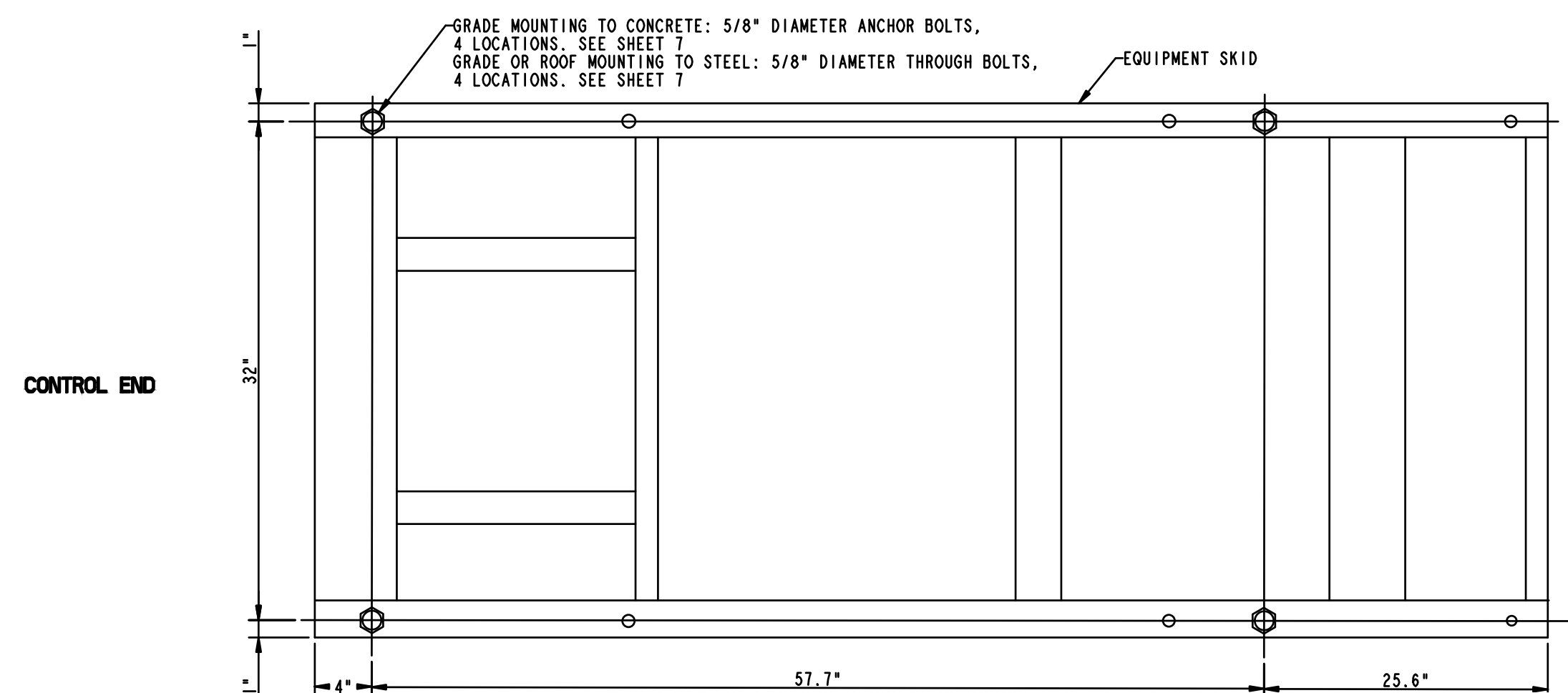


GRADE MOUNTED GENERATOR SETS

CUMMINS GENSET MODEL	CONFIGURATION	ATTACHMENT TO CONCRETE				
		EVALUATION PARAMETERS	CONCRETE ANCHORS	ANCHOR EMBEDMENT	ANCHOR SPACING	DISTANCE TO NEAREST EDGE
C20 NH C22 NH C25 NH C30 NH C36 NH C40 NH C44 NH C48 NH C52 NH C56 NH C60 NH	GENERATOR SET WITH OR WITHOUT ENCLOSURE	SEE STRUCTURAL CALCULATIONS FOR GENERATOR ANCHORAGE BY MORTIER ANG ENGINEERING, DATED 5/13/19, WO#22129, FOR EVALUATION PARAMETERS & CONCRETE ANCHORAGE CALCULATIONS				

GENSET MOUNTING HOLE LOCATIONS

DETAIL--NO SCALE



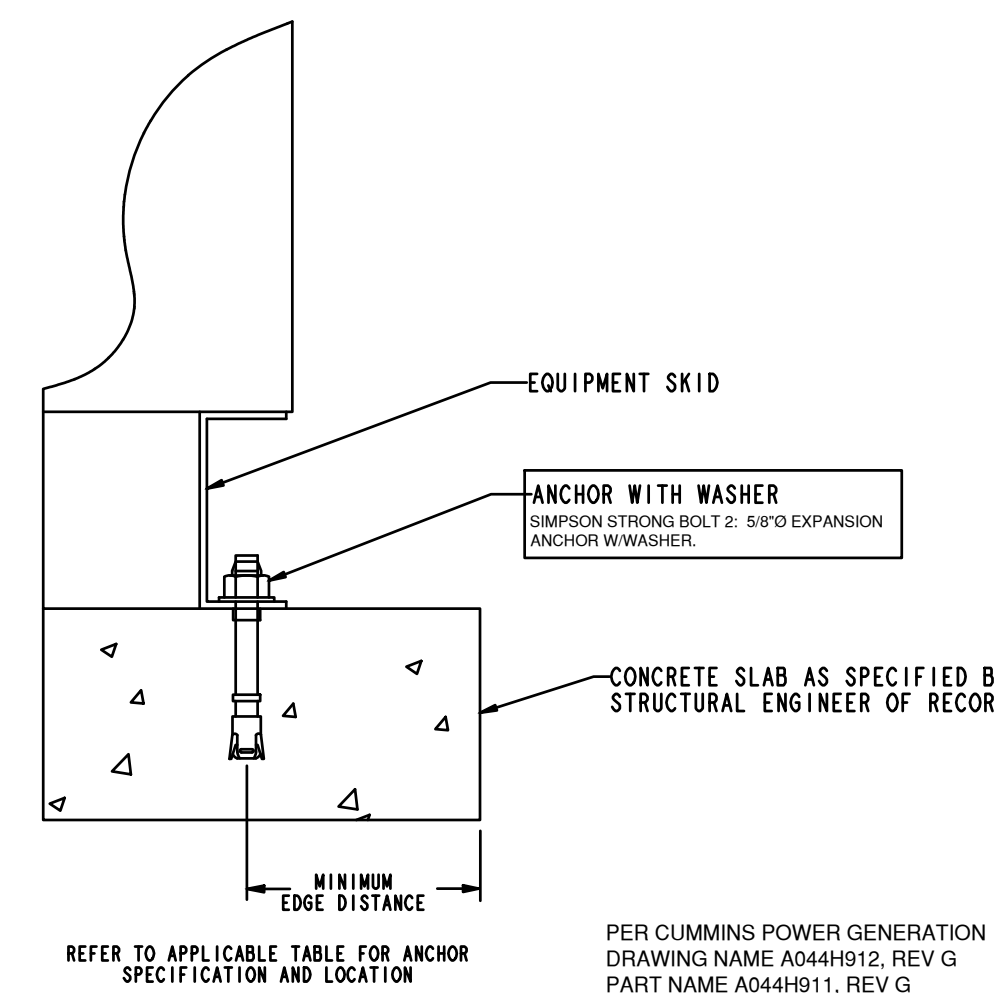
NOTE TO CONTRACTOR: CONFIRM WITH GENSET MANUFACTURER FOR FINAL HOLE AND MOUNTING LOCATIONS.

C30 NH, C36 NH, C40 NH, C36 NH, C40 NH, C45 NH, C50 NH, C60 NH

PER CUMMINS POWER GENERATION DRAWING NAME A044H912, REV G PART NAME A044H911, REV G

CONCRETE CONNECTION DETAIL

DETAIL--NO SCALE



REFER TO APPLICABLE TABLE FOR ANCHOR SPECIFICATION AND LOCATION

PER CUMMINS POWER GENERATION DRAWING NAME A044H912, REV G PART NAME A044H911, REV G

1.1 ON-SITE ACCEPTANCE TEST

- A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system.
- B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.
- C. Installation acceptance tests to be conducted on site shall include a "cold start" test, a two hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
- D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.
 1. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record battery voltages.
 2. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 3. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 4. Verify acceptance of charge for each element of the battery after discharge.
 5. Verify that measurements are within manufacturer's specifications.
 6. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
- E. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- F. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
- G. Exhaust Emissions Test: Comply with applicable government test criteria.
- H. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
- I. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
- J. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations, and compare measured levels with required values.
- K. Coordinate tests with tests for transfer switches and run them concurrently.

1.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

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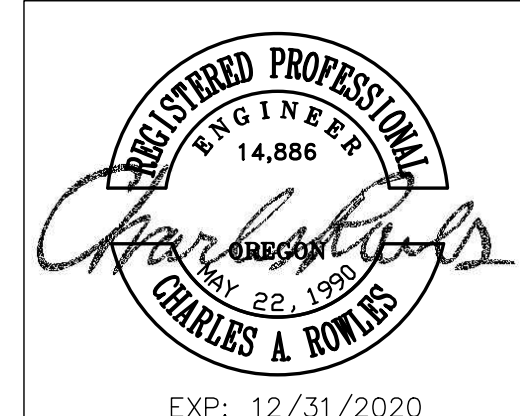
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Developer:
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20355 POE SHOLES DR. #300
BEND, OREGON 97703

GENSET DETAILS & SPECIFICATIONS
222 NW SKYLINER SUMMIT LOOP
BEND, OREGON 97703

NO.	DATE	REVISIONS	sh.	C4
W.O. No.	18-718	1	10/23/19	UPDATE DRAWINGS PER BID CHANGES

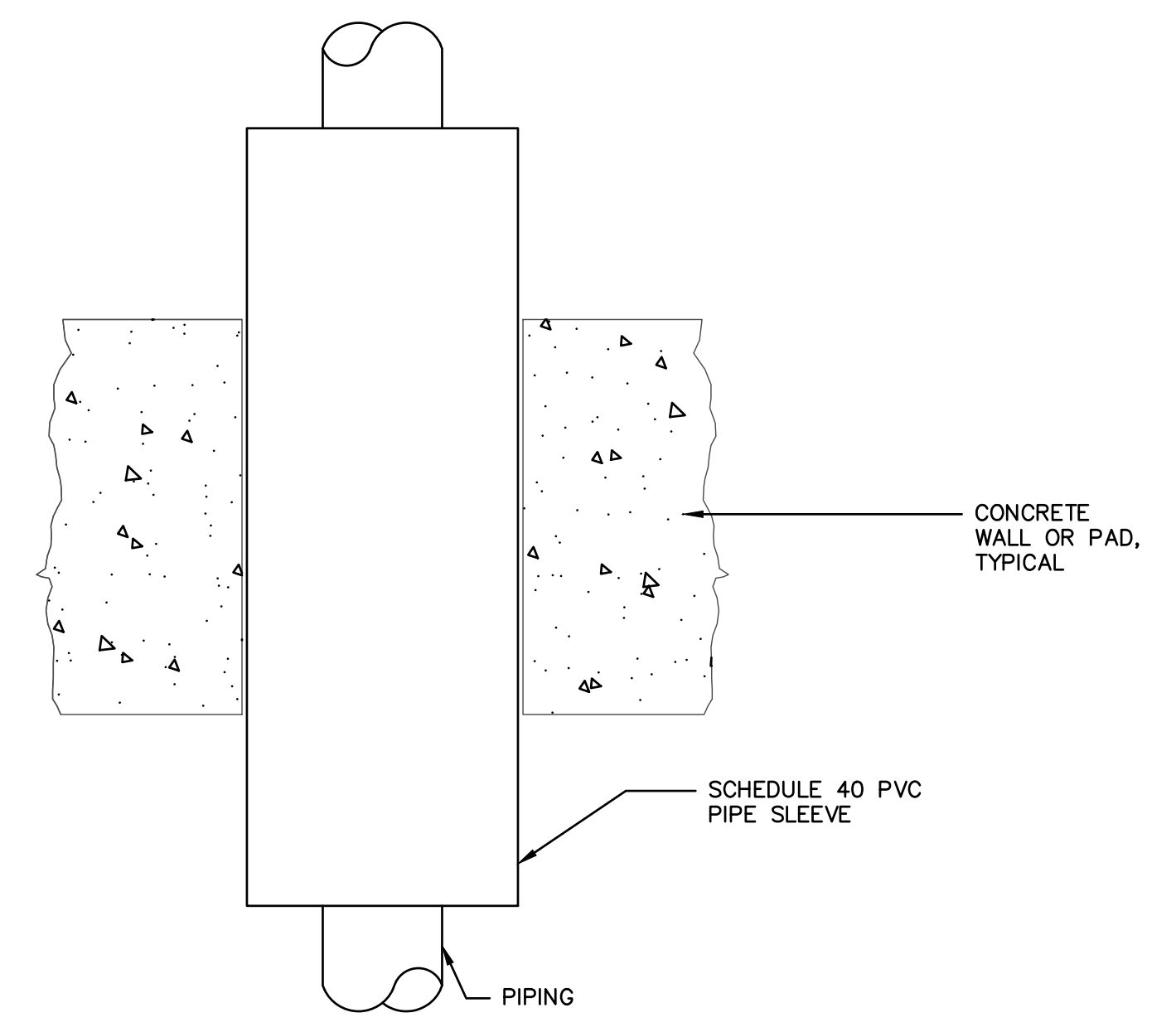


EXP: 12/31/2020
10/23/19 DATE

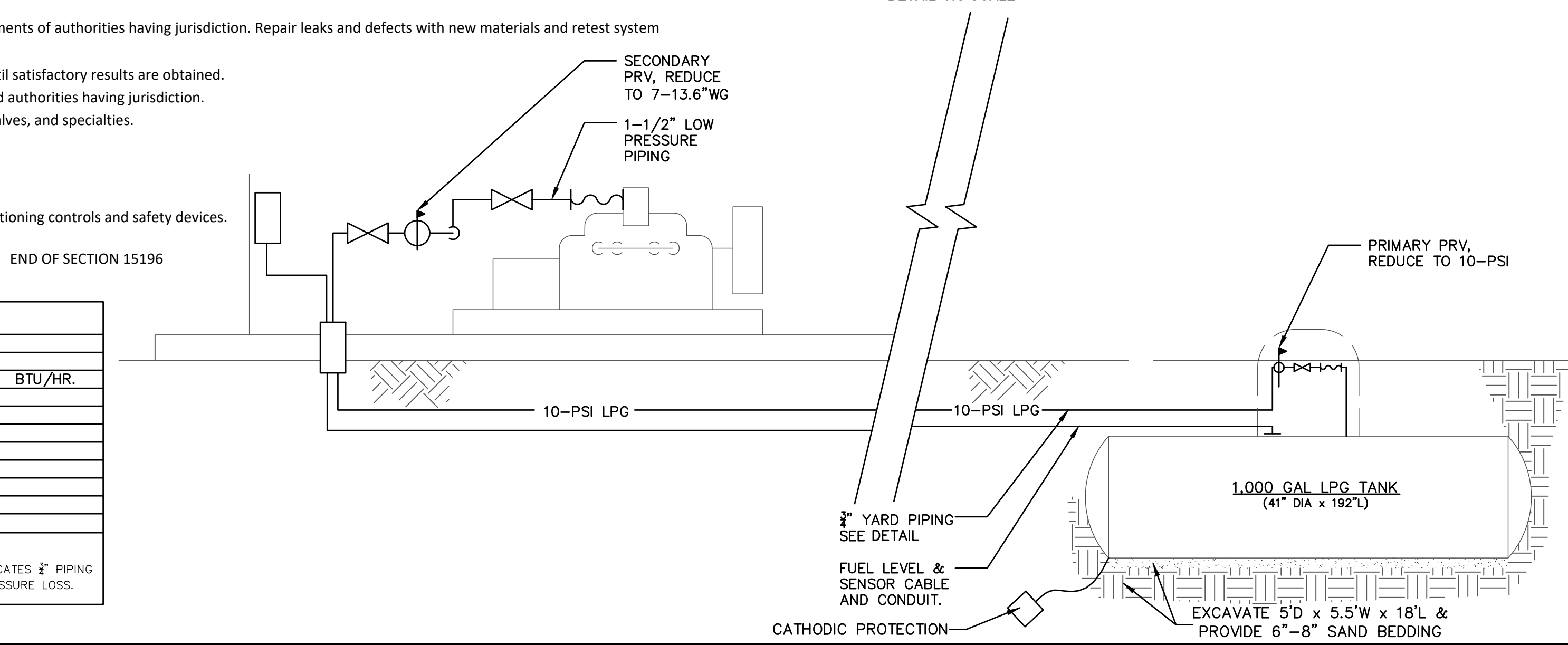
- PART 1 - GENERAL**
1.1 SUMMARY
 A. This Section includes a propane storage tank, piping, specialties, and accessories for a complete propane gas system from the storage tank to the emergency generator.
- 1.2 SUBMITTALS**
 A. Product Data: For each type of propane gas specialty and special-duty valves.
 1. 1,000-gallon propane storage tank with valves, gages, and accessories.
 2. Pressure regulator.
 3. Gas piping.
 4. Remote Tank level monitoring system.
 B. Include pressure rating, rated capacity, and settings of selected models.
 C. Field quality-control test reports.
 D. Operation and maintenance data.
- 1.3 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. NFPA Standard: Comply with NFPA 54, "National Fuel Gas Code."
 C. Comply local, and state codes for gas piping materials and components; installations; and inspecting, testing, and purging.
 D. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
- 1.4 DELIVERY, STORAGE, AND HANDLING**
 A. Handling Flammable Liquids: Handle cautiously to avoid spillage and ignition. Notify gas supplier. Handle flammable liquids used by installer with proper precautions and do not leave on premises from end of one day to beginning of next day.
- PART 2 - PRODUCTS**
2.1 MANUFACTURERS
 A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
- 2.2 PROPANE STORAGE TANKS**
 A. Below Ground Tanks: 1,000-gallon carbon steel double wall type in conformance with UL-142, NFPA, and ASME suitable for a 250 psig working pressure.
 B. Valves and Gauges: Provide tanks with the following:
 1. Fill Valve.
 2. Liquid Level Gauge.
 3. Pressure Relief Valves.
 4. Shut-off Valve.
 C. Tank shall be filled to maximum level allowed by tank design and authority having jurisdiction.
- 2.3 PIPING MATERIALS**
 A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
 B. Corrugated, Stainless-Steel Tubing Systems: Comply with AGA LC 1 and include the following:
 1. Tubing: Corrugated stainless steel with plastic jacket or coating.
 2. Fittings: Copper alloy with ends made to fit corrugated tubing. Include ends with threads according to ASME B1.20.1 if connection to threaded pipe or fittings is required.
 3. Striker Plates: Steel, designed to protect tubing from penetrations.
 C. Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; black. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.
 1. Malleable-iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
 2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
 4. Cast-iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
 5. Joint Compound and Tape: Suitable for propane gas.
- 2.4 PROTECTIVE COATING**
 A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in contact with materials that may corrode the pipe. Coating properties include the following:
 1. Applied to pipe and fittings treated with compatible primer before applying tape.
 2. Overall Thickness: 20 mils, synthetic adhesive.
 3. Water-Vapor Transmission Rate: Maximum 0.10 gal./100 sq. in.
 4. Water Absorption: 0.02 percent maximum.
- 2.5 PIPING SPECIALTIES**
 A. Gas Pressure Regulators: ANSI Z21.18, single-stage, steel-jacketed, corrosion-resistant pressure regulators. Include atmospheric vent, elevation compensator, with threaded ends conforming to ASME B1.20.1 for 2-inch NPS and smaller. Regulator pressure ratings, inlet and outlet pressures, and flow volume in cubic feet per hour of natural gas at specific gravity are as indicated.
 1. Line Gas Pressure Regulators: Inlet pressure rating not less than system pressure.
 2. Gas Pressure Regulator Vents: Factory or field-installed corrosion-resistant screen in opening when not connected to vent piping. Vent piping to be terminated to prevent the entry of water.
 B. Flexible Connectors: ANSI Z21.24, copper alloy.
 C. Strainers: Y pattern, full size of connecting piping. Include stainless-steel screens with 3/64-inch perforations, except where other screens are indicated.
 1. Pressure Rating: 175-psig WOG working pressure, except where otherwise indicated.
 2. 2-inch NPS and Smaller: Bronze body, with threaded ends conforming to ASME B1.20.1.
 3. Screwed screen retainer with centered blow-down and pipe plug/Quick-Disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.
- 2.6 SPECIALTY VALVES (CONTINUED)**
 A. Valve End Connections: Threaded, according to ASME B1.20.1.
 B. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.
 1. Locking Device: Include locking (tamperproof) feature.
 C. Gas Valves: ASME B16.33 and CSA International-listed bronze body and 125-psig pressure rating.

- 2.6 SPECIALTY VALVES (CONTINUED)**
 D. Gas Pressure Regulators:
 1. American Meter Co.
 2. Equimeter, Inc.
 3. Fisher Controls International, Inc.
 4. Maxitrol Co.
 5. National Meter.
 6. Richards Industries, Inc.; Jordan Valve Div.
 7. Schlumberger Industries; Gas Div.
- 2.7 TANK LIQUID LEVEL MONITORING**
 A. Furnish and install a level monitoring configuration.
 1. Magnetic Liquid-Level Gauge 6241 with Twinsite sensor TS011 by Rochester Gauges Inc. (972) 241-2161, or approved equal.
- PART 3 - EXECUTION**
3.1 PREPARATION
 A. Close equipment shutoff valves before turning off propane gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.
 B. Comply with NFPA 54 Paragraph "Prevention of Accidental Ignition."
- 3.2 PIPING APPLICATIONS**
 A. Use flanges, unions, transition, and special fittings in applications below, unless otherwise indicated.
 B. Propane Gas Piping, 0.5 psig or Less:
 1. NPS 1-1/4 to NPS 2: Steel pipe, malleable-iron threaded fittings, and threaded joints.
 C. Propane Gas Piping, More than 0.5 psig:
 1. 1-1/4-Inch NPS and Larger: Steel pipe, butt-welding fittings, and welded joints.
 D. Underground Propane Gas Systems, All Pressures: Steel pipe, butt-welding fittings, and welded joints. Encase gas carrier piping in containment conduits if required by jurisdictions.
- 3.3 VALVE APPLICATIONS**
 A. Use gas stops for shutoff to appliances with 2-inch NPS or smaller low-pressure gas supply.
 B. Piping Line Valves, NPS 2 and Smaller: Gas valve.
- 3.4 INSTALLATION**
 A. Refer to authority having jurisdiction and industry standards for basic piping installation requirements.
 B. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
 C. Install propane gas piping at uniform grade of 0.1 percent slope upward toward risers.
 D. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
 E. Connect branch piping from top or side of horizontal piping.
 F. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
 G. Install corrugated, stainless-steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.
 H. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.
 I. Install dielectric fittings (unions and flanges) with ferrous and brass or bronze end connections, separated by insulating material, where piping of dissimilar metals is joined.
 J. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.
- 3.5 JOINT CONSTRUCTION**
 A. Refer to authority having jurisdiction and industry standards for basic piping joint construction.
 B. Use materials suitable for propane gas service.
 1. Brazed Joints: Make joints with brazing alloy having melting point greater than 1000 deg F. Brazing alloys containing phosphorus are prohibited.
- 3.6 VALVE INSTALLATION**
 A. Install valves in accessible locations, protected from damage. Tag valves with metal tag indicating piping supplied. Attach tag to valve with metal chain.
 B. Install gas valve upstream from each gas pressure regulator. Where 2 gas pressure regulators are installed in series, valve is not required at second regulator.
 C. Install pressure relief or pressure-limiting devices so they can be readily operated to determine if valve is free; test to determine pressure at which they will operate; and examine for leakage when in closed position.
- 3.7 CONNECTIONS**
 A. Install gas piping next to equipment and appliances using gas to allow service and maintenance.
 B. Connect gas piping to equipment and appliances using gas with shutoff valves and unions. Install gas valve upstream from and within 72 inches of each appliance using gas. Install union or flanged connection downstream from valve. Include flexible connectors when indicated.
 C. Sediment Traps: Install tee fitting with capped nipple in bottom forming drip, as close as practical to inlet for appliance using gas.
- 3.8 FIELD QUALITY CONTROL**
 A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
 B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
 C. Report test results promptly and in writing to Project Manager and authorities having jurisdiction.
 D. Verify capacities and pressure ratings of gas meters, regulators, valves, and specialties.
 E. Verify correct pressure settings for pressure regulators.
 F. Verify that specified piping tests are complete.
- 3.9 ADJUSTING**
 A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

PIPE SLEEVE THROUGH WALL OR PAD DETAIL
 DETAIL-NO SCALE



GENERATOR LPG PIPING SCHEMATIC
 DETAIL-NO SCALE



LP GAS PIPE SIZING				
INLET PRESSURE	10	PSI		
PRESSURE DROP:	1	PSI		
LOAD	96	CFH OR	238,848	BTU/HR.
ASSUME:	.75"	PIPE SIZE		
FITTING	COUNT	EQUIVALENT LENGTH		
PIPE - 3/4"	25	25	FT.	
ELBOW - 3/4"	8	24	FT.	
VALVES - 3/4"	4	8	FT.	
TOTAL EQUIVALENT LENGTH		57		
2014 OREGON MECHANICAL SPECIALTY CODE (OMSC) APPENDIX C, TABLE C402.4(25) INDICATES 3/4" PIPING HAS ADEQUATE CAPACITY TO SUPPLY 150 LF OF PIPE 1,610,000 BTU/HR AT 1.0 PSI PRESSURE LOSS.				

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C A ROWLES ENGINEERING
 1345 NW WALL STREET, SUITE 200 BEND, OREGON 97703 541.585.2207

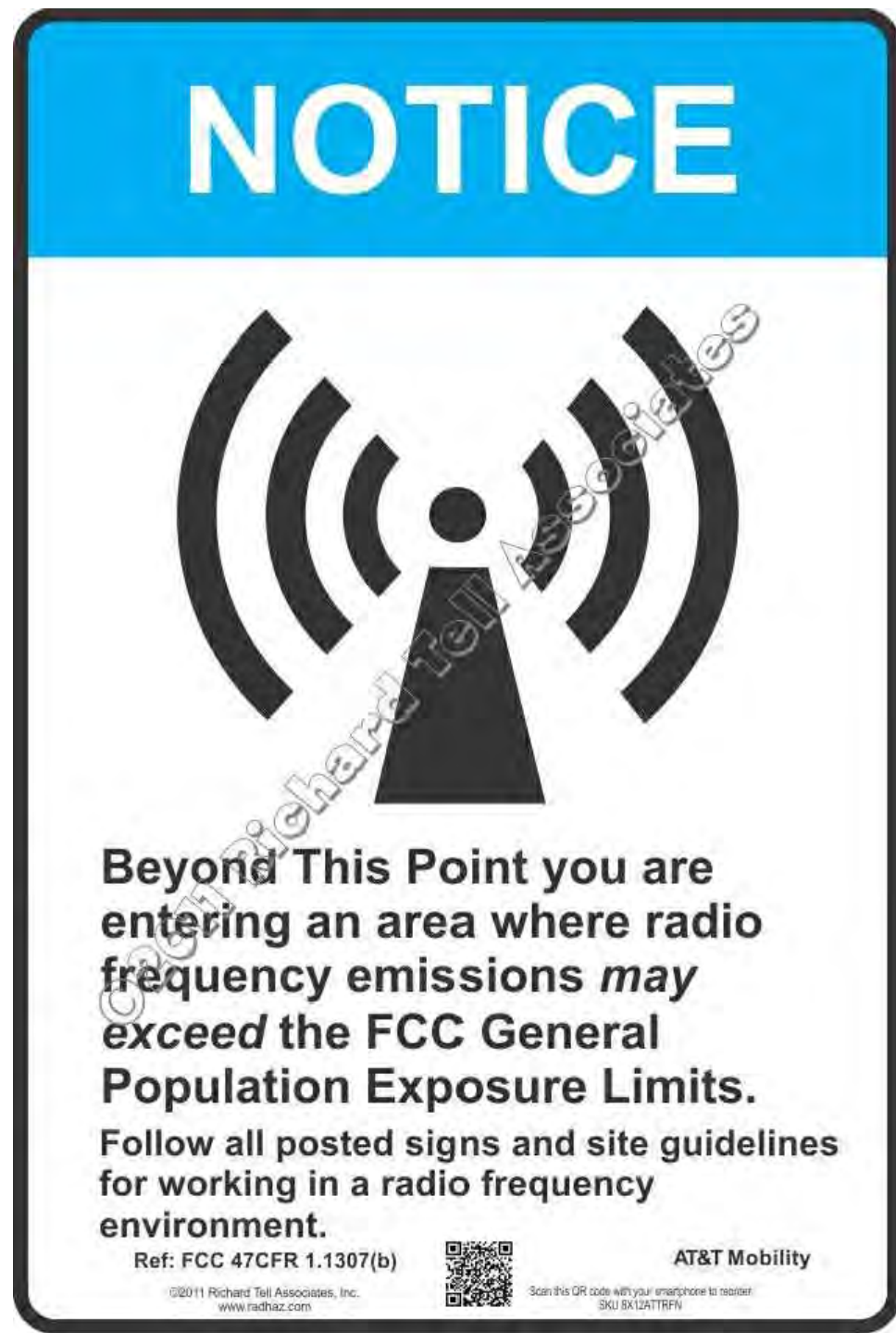
Developer:
 DESCHUTES COUNTY 9-1-1 SERVICE DISTRICT
 20355 POE SHOLES DR. #300
 BEND, OREGON 97703

PROPANE SYSTEM DETAILS & SPECIFICATIONS
 222 NW SKYLINER SUMMIT LOOP
 BEND, OREGON 97703

Drafting	Design	Scale	Date	W.O. No.	NO. DATE REVISIONS		sh.	C5
MAW	MAW	AS SHOWN	05/14/19	18-718	1	10/23/19	UPDATE DRAWINGS PER BID CHANGES	

REGISTERED PROFESSIONAL ENGINEER
 14,886
Charles A. Rowles
 MAY 22, 1990
CHARLES A. ROWLES
 EXP: 12/31/2020
 10/23/19 DATE

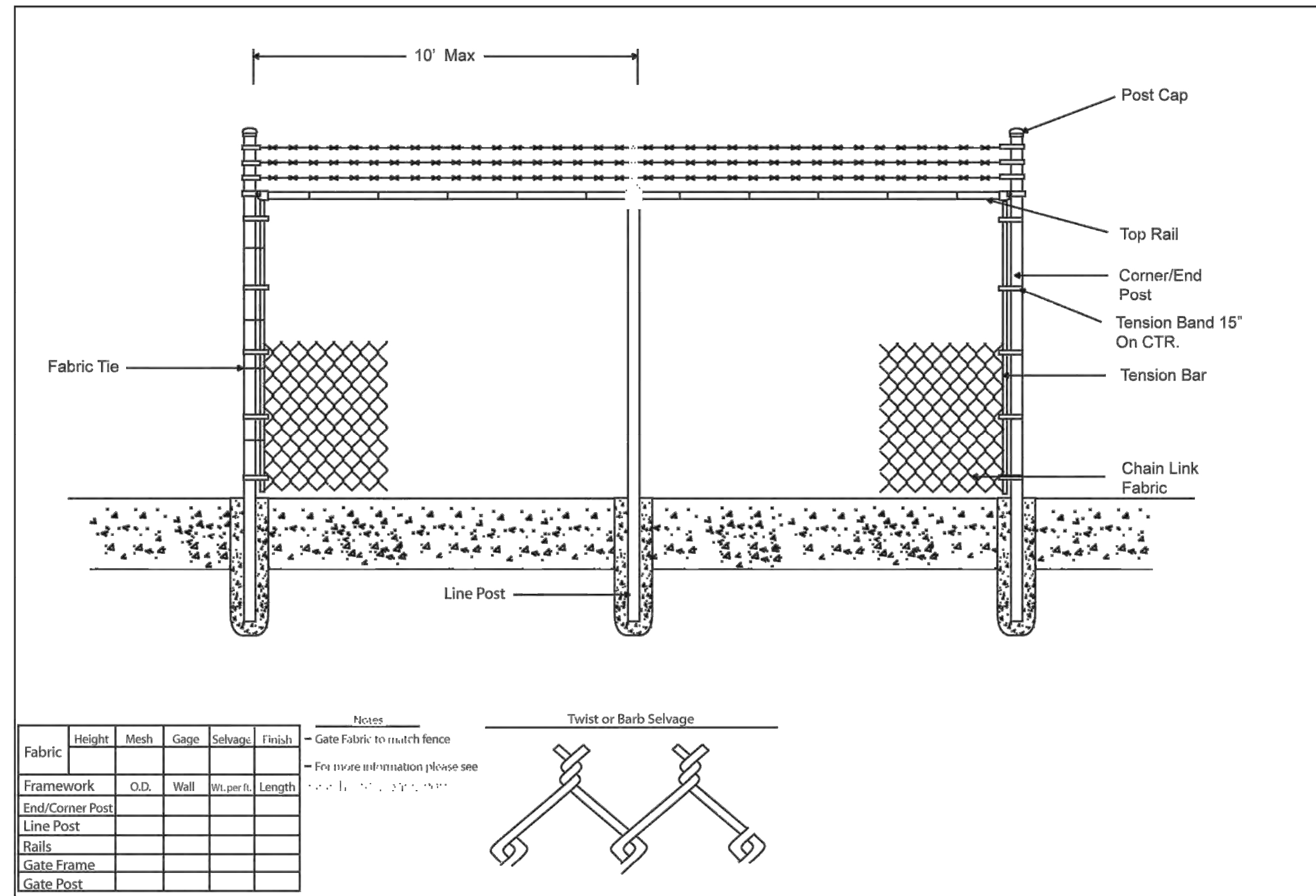
SIGN DETAIL
(INSTALL AT BASE OF MONOPOLE)



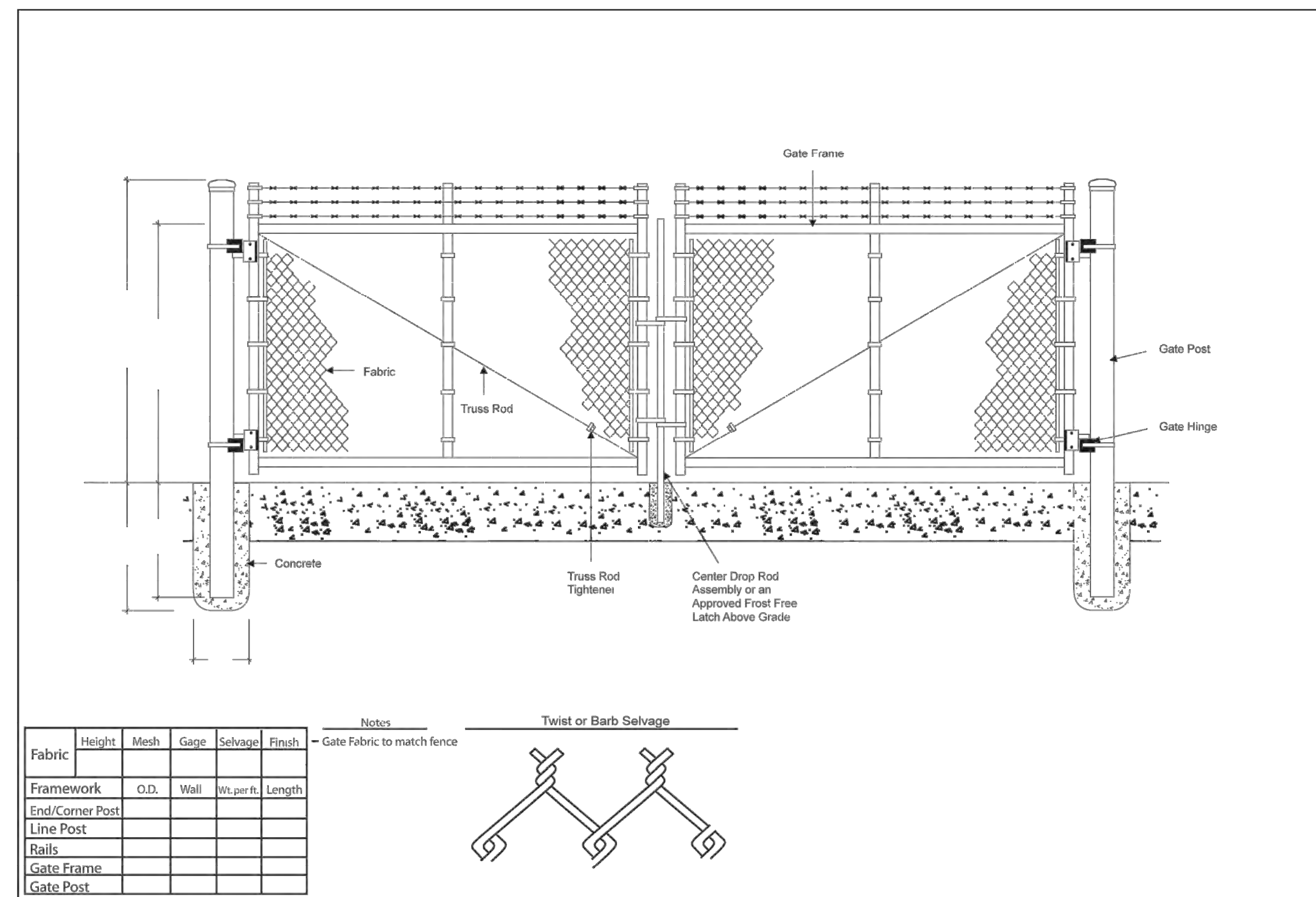
SIGN DETAIL
(INSTALL AT GATE TO SITE)



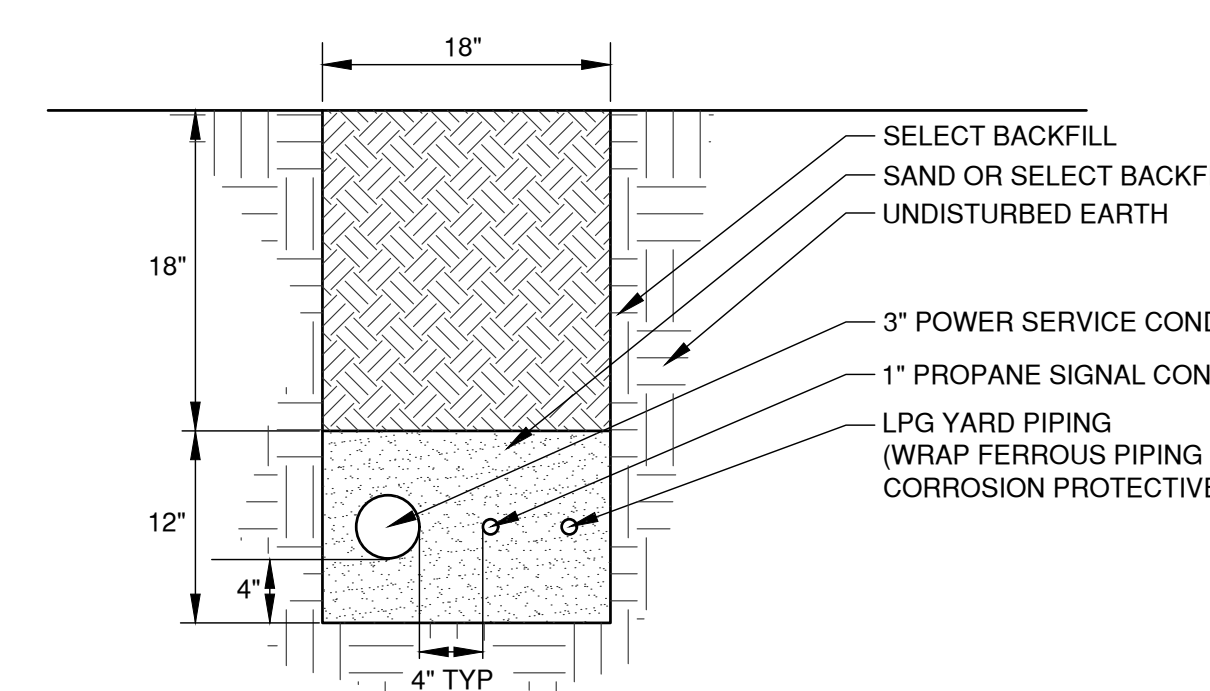
6' CHAIN LINK FENCE W/TOP RAIL & BARB WIRE DETAIL
(N.T.S.)



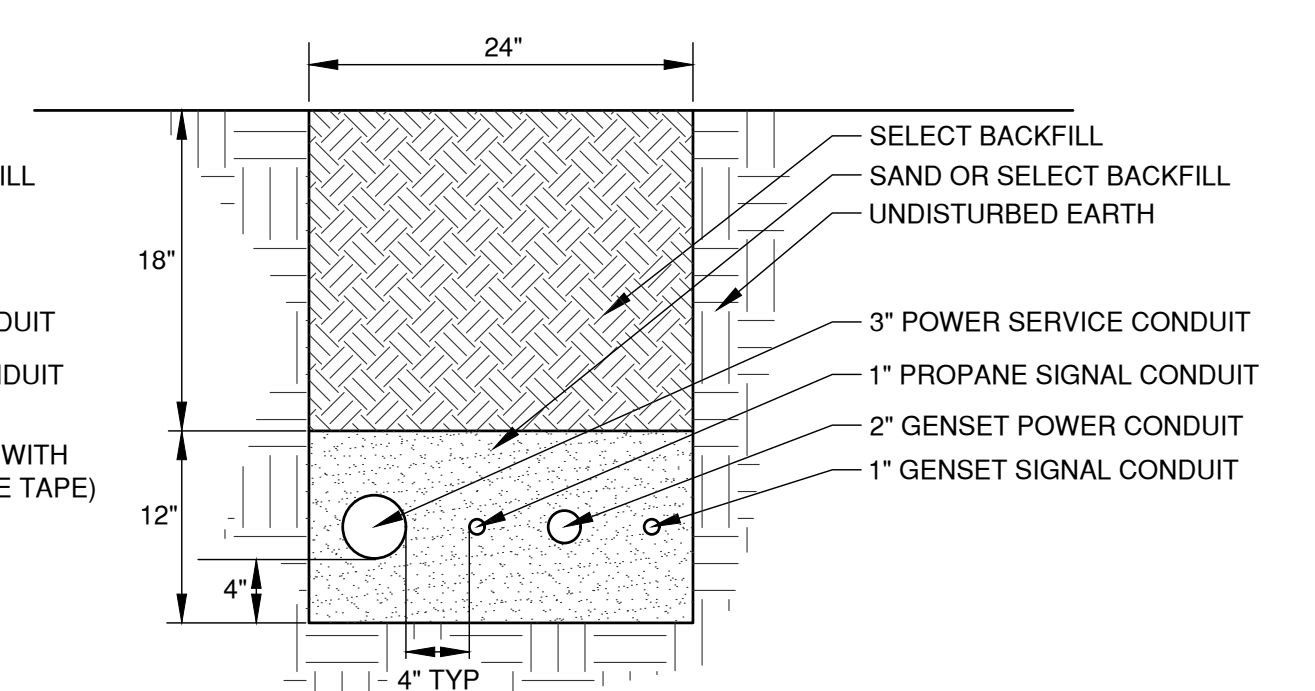
12' DOUBLE SWING CHAIN LINK GATE W/BARB WIRE
(N.T.S.)



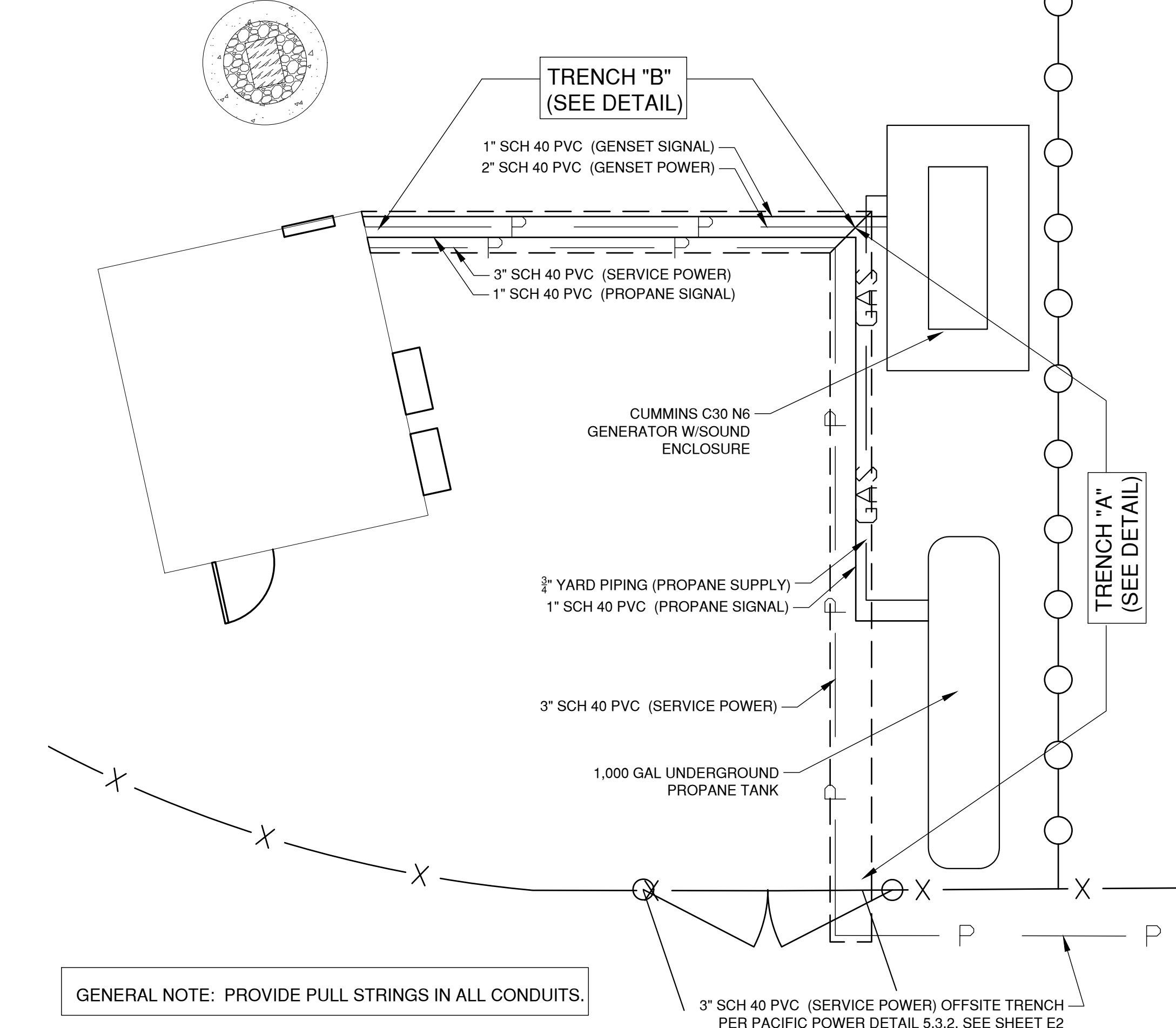
ONSITE UTILITY TRENCH "A" DETAIL
DETAIL-NO SCALE



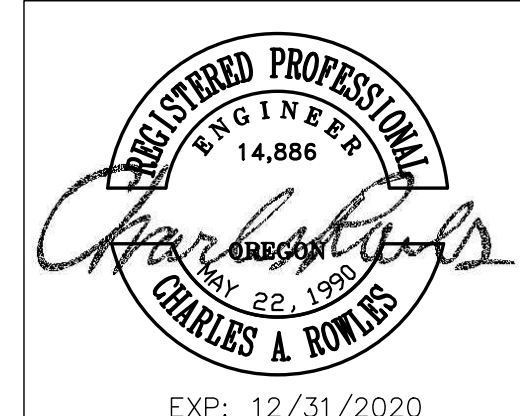
ONSITE UTILITY TRENCH "B" DETAIL
DETAIL-NO SCALE



ONSITE TRENCH & CONDUIT PLAN
DETAIL-NO SCALE



GENERAL NOTE: PROVIDE PULL STRINGS IN ALL CONDUITS.



EXP: 12/31/2020
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Developer: DESCHUTES COUNTY 9-1-1 SERVICE DISTRICT
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MISCELLANEOUS DETAILS
222 NW SKYLINER SUMMIT LOOP
BEND, OREGON 97703

Drafting	NO.	DATE	REVISIONS	sh.t.
MAW				C6
Design				
Scale				
Date				
W.O. No.	18-718	10/23/19	UPDATE DRAWINGS PER BID CHANGES	

GENERAL STRUCTURAL NOTES:

- CONSTRUCTION TO COMPLY WITH THE FOLLOWING CODES AS ADOPTED BY THE CITY OF BEND:
 - A. 2014 OREGON STRUCTURAL SPECIALTY CODE BASED ON THE 2012 IBC.
- LOADING CRITERIA:
 - A. TO BE DETERMINED BASED USING ANSII/TIA-222-G STRUCTURAL STANDARDS FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS.
 - B. OSSC RISK CATEGORY IV, ANSII/TIA-222-G RISK CATEGORY III.
 - C. STRUCTURE CLASS 3
 - D. DESIGN ICE THICKNESS = 0.25'
 - E. WIND: BASIC WIND SPEED = 85 MPH, BASIC WIND SPEED W/ICE = 40 MPH
 - F. WIND EXPOSURE C
 - G. TOPOGRAPHIC FACTOR KZT1=1.898 BASED ON H = 255'
 - H. SEISMIC DESIGN CATEGORY D, SITE CLASS C, SDS = 0.329, SD1 = 0.223
 - I. WIND DESIGN SHALL ACCOMMODATE A MINIMUM OF 55 SF OF ANTENNA PER TIA-222-G TABLE C.1 FOR LIGHT LOADING.
 - J. MAXIMUM ALLOWED SOIL BEARING PRESSURE = 6,000 PSF (SEE GEOTECH. REPORT G1804866)
- STANDARDS REFERRED TO IN THE PLANS AND SPECIFICATIONS SHALL APPLY TO THE LATEST EDITION OF SUCH STANDARDS. WHERE SPECIFIC STANDARDS FOR MATERIALS, EQUIPMENT, INSTALLATION OR FABRICATION METHODS ARE NOT SPECIFIED IN THE PLANS AND SPECIFICATIONS, THE MINIMUM STANDARD INDICATED IN THE DESIGNATED CODE AND MANUFACTURERS DATA SHALL APPLY.
- IF CERTAIN FEATURES ARE NOT FULLY SHOWN OR CALLED FOR ON THE DRAWINGS OR SPECIFICATIONS, THEIR CONSTRUCTION SHALL BE OF THE SAME CHARACTER AS FOR SIMILAR CONDITIONS THAT ARE CALLED FOR OR SHOWN. ALL WORK SHALL COMPLY WITH THE REQUIREMENTS OF ALL CODES AND REFERENCED STANDARDS.
- THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE WORK OF THE TRADES AND SHALL CHECK ALL DIMENSIONS. DISCREPANCIES SHALL BE CALLED TO THE ATTENTION OF THE ENGINEER AND BE RESOLVED BEFORE PROCEEDING WITH THE WORK.
- SHOP DRAWINGS FOR THE WOOD POLE AND ATTACHMENTS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL, PRIOR TO FABRICATION AND DELIVERY.
- MATERIALS ARE TO BE HANDLED, STORED AND INSTALLED IN STRICT COMPLIANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
- CONTRACTOR IS RESPONSIBLE FOR TEMPORARY SHORING AND BRACING REQUIRED BY THE WORK.
- CONTRACTOR TO VERIFY EXISTING SITE CONDITIONS AND DIMENSIONS PRIOR TO CONSTRUCTION.
- SITE PREPARATION TO BE IN ACCORDANCE WITH THE GEOTECHNICAL REPORT G1804866BY CARLSON TESTING. THE GEOTECHNICAL ENGINEER SHALL PROVIDE OBSERVATION OF EXCAVATION, SUBGRADE PREPARATION AND COMPACTION OF STRUCTURAL FILLS AND AS SHOWN IN SPECIAL INSPECTION REQUIREMENTS OR OTHERWISE NOTED ON THESE DRAWINGS.
- ALL REQUIRED ELECTRICAL GROUNDING, COMPONENT SELECTION AND CONFIGURATION IS THE RESPONSIBILITY OF OTHERS.

GENERAL STRUCTURAL SPECIFICATIONS:

- SITWORK:**
- ASSUMED ALLOWABLE SOIL BEARING = 1500 PSF EXCEPT AS NOTED OTHERWISE IN GEOTECH REPORT.
 - FOOTINGS TO BE PLACED ON LEVEL UNDISTURBED SOIL/ROCK OR APPROVED STRUCTURAL FILL.
 - STRUCTURAL FILL SHALL CONSIST OF CLEAN WELL-GRADED, CRUSHED ROCK/GRAVEL AS SPECIFIED BELOW.
 - A GEOTECHNICAL ENGINEER SHALL EVALUATE ANY UNCOMPACTED FILL, EXPANSIVE SOILS, OR OTHER PROBLEMS DISCLOSED DURING EXCAVATION AND/OR CONSTRUCTION.
 - STRUCTURAL FILL SHALL BE PLACED IN 6" MAXIMUM LIFTS AND SHALL BE COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY AS OBTAINED BY ASTM D1557, MODIFIED PROCTOR TEST.
 - THE STATIC GROUND WATER LEVEL MUST REMAIN BELOW THE BASE OF THE FOUNDATION THROUGHOUT THE YEAR. IF WATER IS PRESENT DEWATER PRIOR TO WORK.
- STRUCTURAL FILL MATERIAL:**
- LEVELING COURSE BELOW POLE SHOULD BE A MINIMUM OF 12" THICK AND CONSIST OF WELL-GRADED GRANULAR MATERIAL (CRUSHED ROCK) CONTAINING NO ORGANIC MATTER OR DEBRIS. THE MAXIMUM PARTICLE SIZE SHOULD BE 3/4 INCH AND HAVE LESS THAN 8% MATERIAL PASSING THE U.S. STANDARD NO. 200 SIEVE.
 - IMPORTED GRANULAR STRUCTURAL FILL (GRAVEL) SHOULD CONSIST OF ANGULAR PIT OR QUARRY ROCK, CRUSHED ROCK, OR CRUSHED GRAVEL THAT IS FAIRLY WELL GRADED BETWEEN COURSE AND FINE PARTICLES. THE GRANULAR FILL SHOULD CONTAIN NO ORGANIC MATTER, DEBRIS, OR PARTICLES LARGER THAN 1 1/2". LESS THAN 8% OF MATERIAL SHOULD PASS THE U.S. STANDARD NO. 200 SIEVE. THE PERCENTAGE OF FINES MAY BE INCREASED TO 15% PASSING THE U.S. STANDARD NO. 200 SIEVE IF PLACED DURING DRY WEATHER.
 - CONTROLLED LOW-STRENGTH MATERIAL (CLSM) SHALL CONFORM TO THE STATE OF OREGON STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION SECTION 0042. PROPOSED MIX DESIGN SHALL BE SUBMITTED TO ENGINEER FOR REVIEW A MINIMUM OF 7 DAYS PRIOR TO ANTICIPATED USE. THE 28 DAY COMPRESSIVE STRENGTH SHOULD BE BETWEEN 50 PSI AND 100 PSI WITH A 6% +/-2% AIR ENTRAINMENT.
 - CONCRETE SHALL DEVELOP A UNIT COMPRESSIVE STRENGTH OF 3000 PSI MINIMUM AT 28 DAYS AND CONFORM TO OSSC SECTION 1904. CONCRETE EXPOSED TO FREEZING AND THAWING OR DEICING CHEMICALS SHALL BE AIR ENTRAINED IN ACCORDANCE WITH ACI 318, SECTION 4.2.1. CONCRETE MUST BE POURED NEAT IN THE EXCAVATION. ROD ALL CONCRETE TO ELIMINATE VOIDS.

WOOD TOWER POLE:

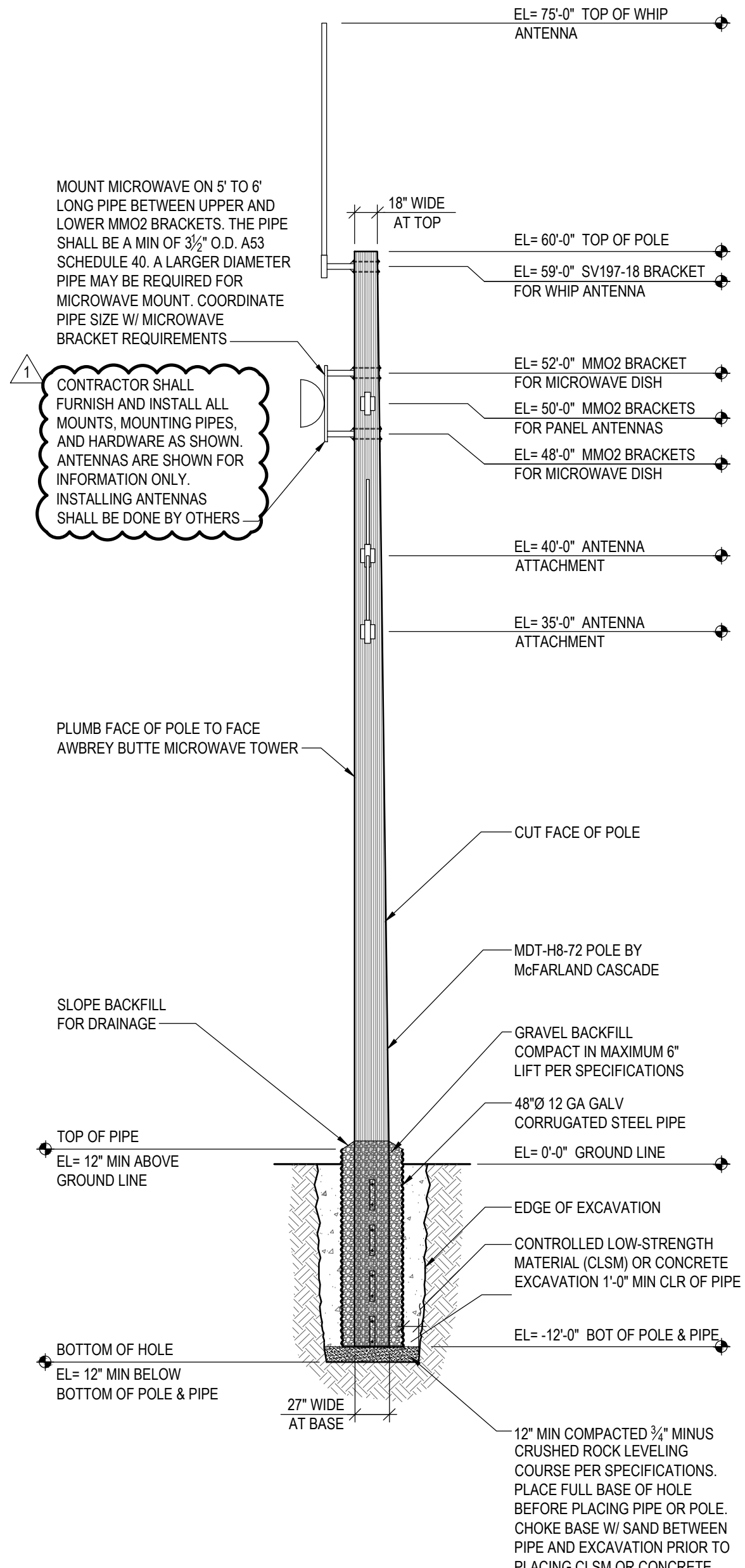
- POLE SHALL BE AN MDT-H8-72 GLUE LAMINATED COASTAL DOUGLAS FIR POLE WITH E= 2,300 KSI, FB = 2,200 PSI AND FV=190 PSI AS DESIGNATED AND MANUFACTURED BY MCFARLAND CASCADE.
- POLES TO BE FULL LENGTH PRESSURE TREATED USING PENTACHLOROPHENOL OR APPROVED EQUAL TO A MINIMUM OF AWPA USE CATEGORY 4C, RATED FOR GROUND CONTACT.
- SHOP DRAWINGS SHOWING SIZE, GRADE, MATERIALS AND PROPOSED ATTACHMENTS AS WELL AS POLE EMBEDMENT SHOULD BE SUBMITTED FOR APPROVAL PRIOR TO FABRICATION OR DELIVERY OF POLE.
- POLE SHOULD NOT BE CUT AFTER PRESSURE TREATMENT. IF THE POLE MUST BE CUT, THE CUT SHALL NOT OCCUR AT THE BOTTOM OF THE POLE. ANY REQUIRED CUT SHALL BE AT THE TOP OF THE POLE AND THE CUT SHALL BE TREATED AND CAPPED.
- FIELD DRILLED HOLES SHOULD BE AVOIDED. WHERE FIELD DRILLED HOLES ARE REQUIRED, HOLES SHOULD BE SPOT TREATED PER AWPA M4-11.
- THE ADJACENT GRADE TO THE POLE MUST BE LEVEL OR RISING AWAY FROM THE FOOTING.
- ADJACENT DEVELOPMENT AND/OR THE UPPER 12" OF ADJACENT UNPAVED, STRUCTURAL FILL AREAS SHOULD NOT BE CONSIDERED WHEN DETERMINING EMBEDMENT.
- MANUFACTURER TO PROVIDE MATERIAL HANDLING AND QUALITY CONTROL PROCEDURES FOR THE TRANSPORTATION AND INSTALLATION OF THE POLE.

STRUCTURAL STEEL AND MISCELLANEOUS METAL FABRICATION:

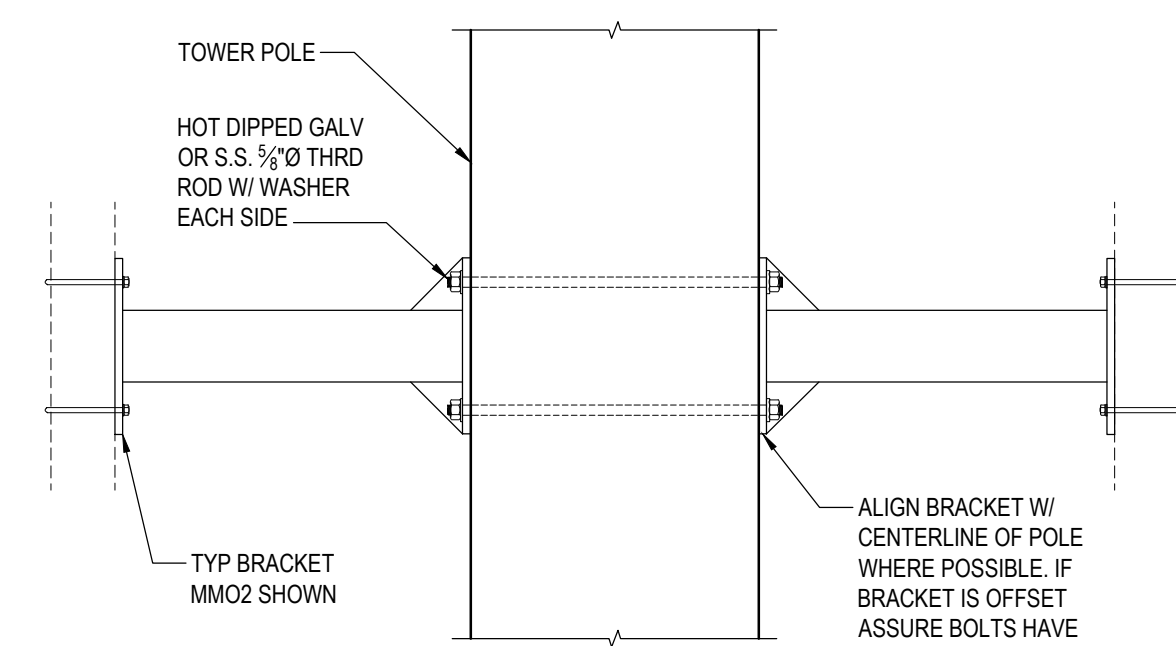
- ALL WORK SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE:
 - AISC STEEL CONSTRUCTION MANUAL
 - AISC SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS
 - AISC CODE OF STANDARD PRACTICE
- STRUCTURAL STEEL SHAPES AND PLATE SHALL CONFORM TO:
 - ROLLED WIDE FLANGE SHAPES: ASTM A-992 (FY=50 KSI)
 - MISC. PLATE, BAR, ANGLE AND CHANNEL: ASTM A36, (FY = 36 KSI)
 - HOLLOW STRUCTURAL SECTIONS (HSS): ASTM A-500, GRADE B (FY=46 KSI)
 - PIPE: ASTM A-53, GRADE B, TYPE (FY=35 KSI)
- BOLTS AND RODS SHALL CONFORM TO:
 - MACHINE BOLTS: ASTM A307 OR BETTER
 - HIGH STRENGTH BOLTS: ASTM A325 U.O.N.
 - ANCHOR BOLTS: ASTM A307 U.O.N.
 - ANCHOR RODS: ASTM F1554 GRADE 36 UNLESS OTHERWISE NOTED ON DRAWINGS.
- ALL STEEL EXPOSED TO WEATHER, MOISTURE, SOIL, AND PRESERVATIVE-TREATED WOOD OR AS NOTED SHALL BE HOT DIP GALVANIZED PER ASTM A-123 OR ASTM A-153, CLASS B.

WELDING:

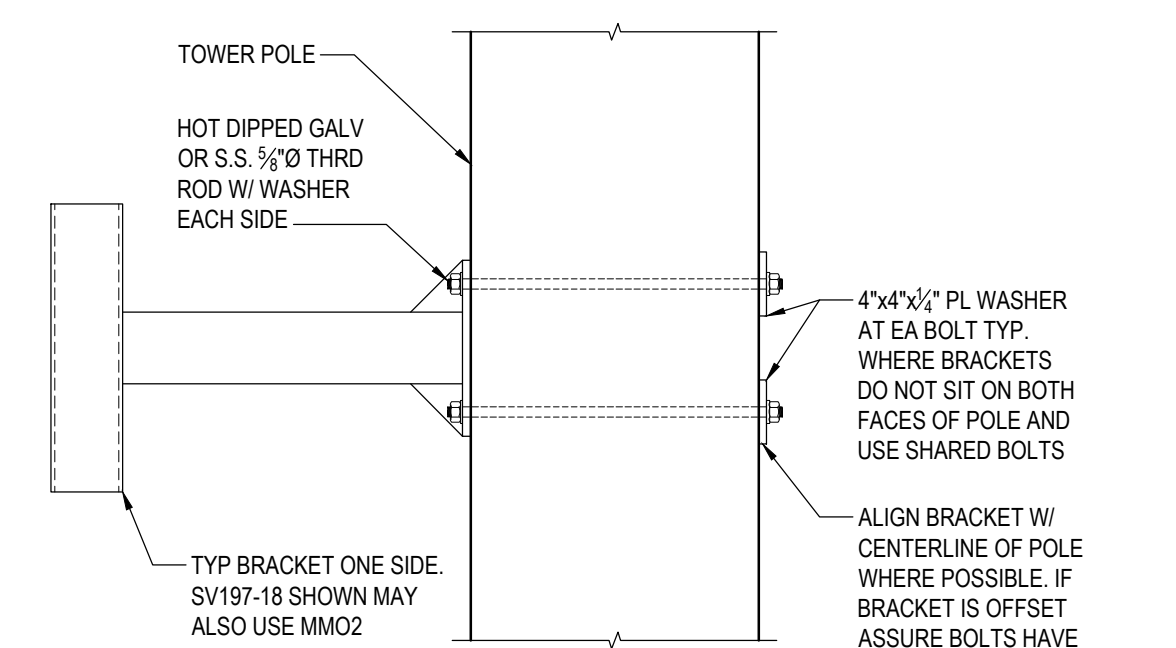
- ALL WELDS SHALL BE IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS:
 - A. AWS STRUCTURAL WELDING CODE
 - B. AISC SPECIFICATIONS
- ALL SHOP WELDS SHALL BE DONE IN AN APPROVED FABRICATORS SHOP IN ACCORDANCE WITH SECTION 1701.7 OF THE OSSC OR CONFORM TO SECTION "C" BELOW.
- ALL FIELD WELDS SHALL:
 - A. BE PERFORMED BY AN AWS CERTIFIED WELDER
 - B. HAVE A SPECIAL INSPECTOR INSPECT THE WELDS PER SECTION 1701.7 OF THE OSSC. THE SPECIAL INSPECTOR SHALL VERIFY THE FOLLOWING:
 - a. LOCATION, QUANTITY AND THROAT SIZE OF FIELD WELDS.
 - b. VISUAL INSPECTION FOR APPARENT DEFECTS IN WELDS.
 - C. SPECIAL INSPECTOR SHALL BE AS SHOWN FOR THIS PROJECT.
 - a. THE SPECIAL INSPECTOR SHALL BE PROVIDED BY THE OWNER.
 - b. SPECIAL INSPECTION SHALL OCCUR PRIOR TO PAINTING FIELD WELDS.
- WELDING ELECTRODE SHALL BE:
 - ET0XX ELECTRODE TYPICAL U.O.N.
 - E60XX ELECTRODE FOR LIGHT GAGE AND DECKING U.O.N.



1 SIDE ELEVATION
SCALE: 1/8" = 1'-0"

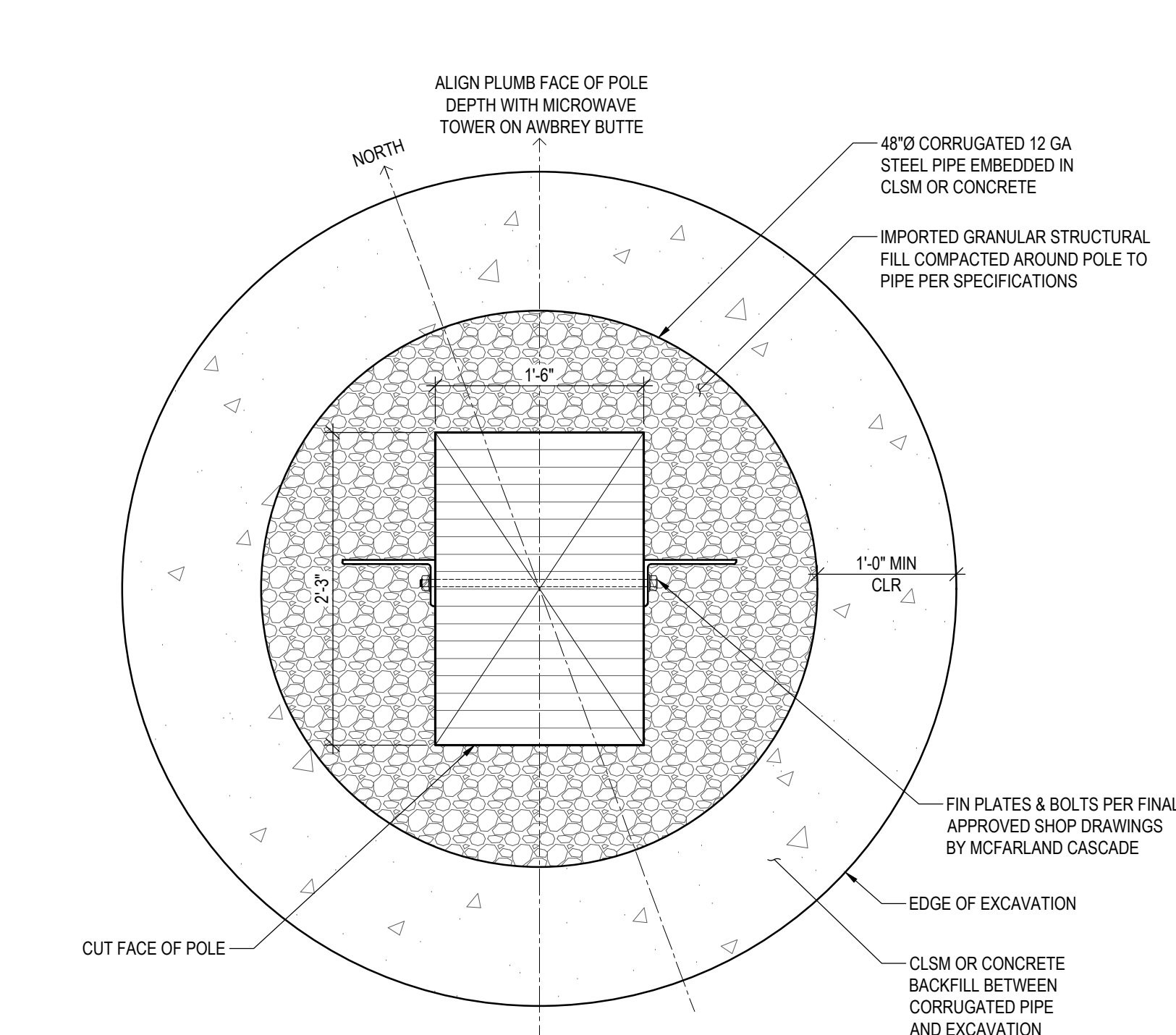


5 BRACKET ATTACHMENT
SCALE: 1" = 1'-0"



6 BRACKET ATTACHMENT
SCALE: 1" = 1'-0"

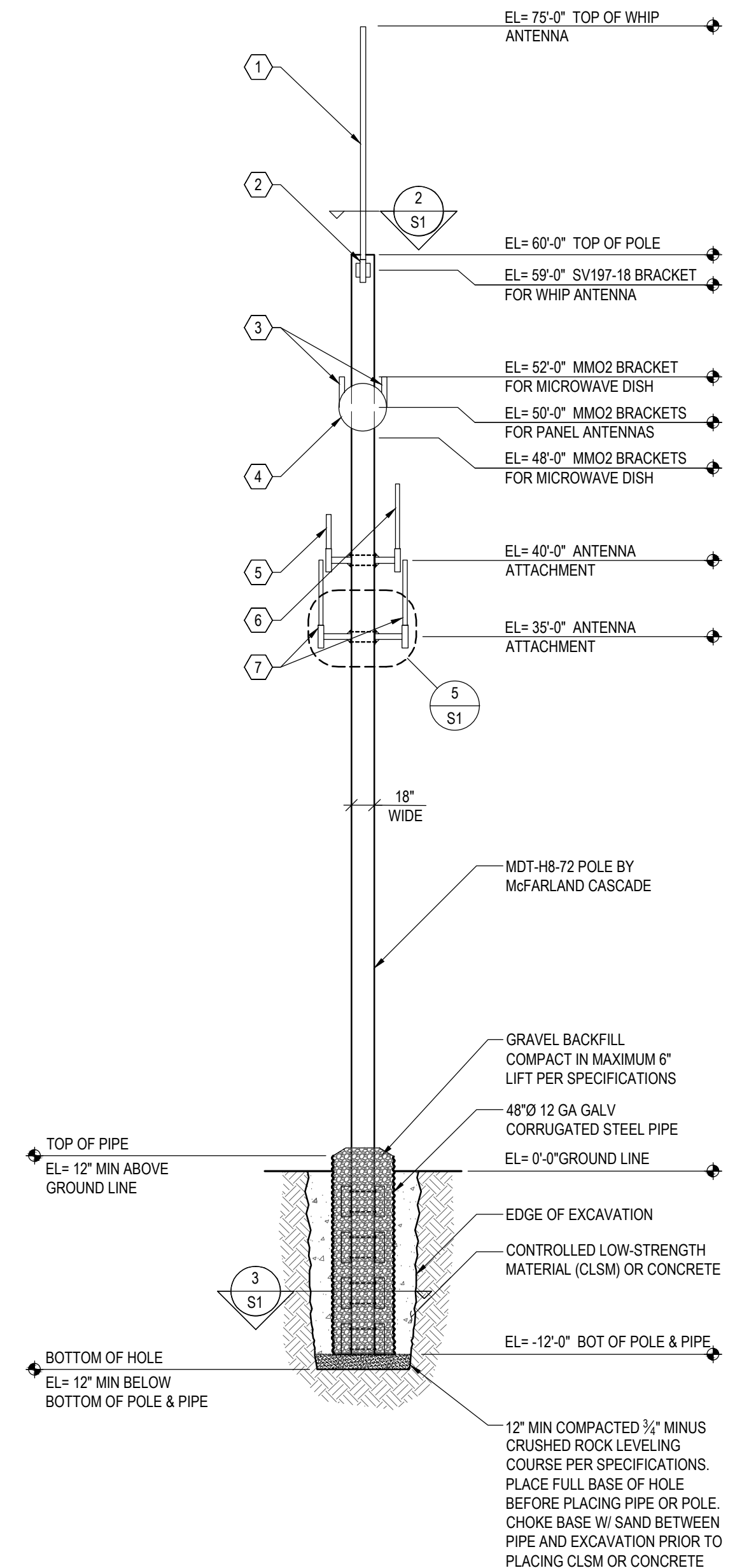
2 PLAN VIEW AT TOP
SCALE: 1" = 1'-0"



3 PLAN VIEW AT GRADE
SCALE: 1" = 1'-0"

SPECIAL INSPECTIONS SCHEDULE					
TABLE 1					
SYSTEM OR MATERIAL	IBC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY		REMARKS
			CONTINUOUS	PERIODIC	
REQUIRED GEOTECHNICAL SPECIAL INSPECTIONS					
GEOTECHNICAL INVESTIGATIONS	TABLE 1702.6 1903				GEOTECHNICAL INVESTIGATION SHALL INCLUDE ITEMS OF SPECIAL INSPECTION AND TESTING AS NOTED IN TABLE 5 OF THE GUIDELINES
VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY	TABLE 1702.6			X	BY THE GEOTECHNICAL ENGINEER
VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL	TABLE 1702.6			X	
PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS	TABLE 1702.6 1902.5.1			X	TESTING OF COMPACTED FILL MATERIALS (SEE TABLE 5)
VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL	TABLE 1702.6			X	BY THE GEOTECHNICAL ENGINEER
PRIOR TO PLACEMENT OF COMPACTED FILL, OBSERVE SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY	TABLE 1702.6			X	
TABLE 5					
REQUIRED TESTING FOR SPECIAL INSPECTIONS					
TESTING					
SYSTEM OR MATERIAL	IBC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY		REMARKS
GEOTECHNICAL					
GEOTECHNICAL ENGINEER TO PERFORM TESTING OF COMPACTED FILL MATERIALS	1903				TESTING PER GEOTECHNICAL REPORT
FILL IN PLACE DENSITY OR PREPARED SUBGRADE DENSITY	1702.6			X	BY THE GEOTECHNICAL ENGINEER
MATERIAL VERIFICATION	1702.6	VARIABLES: CLASSIFICATION AND TESTING OF CONTROLLED FILL MATERIALS		X	BY THE GEOTECHNICAL ENGINEER
TENSION ANCHORS	1702.6		PERFORMANCE TEST FIRST 100 ANCHORS TO XXXX DL AND PROF' LOAD REMAINING ANCHORS TO XXXX DL		PER GEOTECHNICAL REPORT
CONCRETE					
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					
CONCRETE STRENGTH	TABLE 1702.3	ASTM C 172 ASTM C 37 AC 318 5.6.5.8		X	FABRICATE SPECIMENS AT TIME FRESH CONCRETE IS PLACED. ONCE EACH DAY FOR A GIVEN CLASS OF CONCRETE, OR LESS THAN ONCE FOR EACH 150 YDS OF CONCRETE, OR LESS THAN ONCE FOR EACH 1,000 FT ² OF SURFACE AREA FOR SUBWALLS. ONCE EACH SHIFT FROM IN PLACE WORK OR FROM TEST PANEL AND MINIMUM ONE SPECIMEN FOR EACH 50 CUBIC YARDS. *PRECONSTRUCTION TESTS AS REQUIRED PER THE BUILDING OFFICIAL.
CONCRETE SLUMP	TABLE 1702.3	ASTM C143		X	BY THE GEOTECHNICAL ENGINEER
CONCRETE AIR CONTENT	TABLE 1702.3	ASTM C231		X	PER GEOTECHNICAL REPORT
CONCRETE TEMPERATURE	1910.10	ASTM C1064		X	
SHOTCRETE STRENGTH	1910.10	ASTM C42		X	
TABLE 2					
REQUIRED STRUCTURAL SPECIAL INSPECTIONS					
SYSTEM OR MATERIAL	IBC CODE REFERENCE	CODE OR STANDARD REFERENCE	FREQUENCY		REMARKS
CONCRETE					
VERIFYING USE OF REQUIRED MIX DESIGNS	TABLE 1702.3 1904 1904.2 1910.2 1910.3	AC318 CHAPTER 4 AC 318 5.2.4		X	

(a) PERIODIC SPECIAL INSPECTION FREQUENCY AND TIMING TO BE DEFINED BY THE REGISTERED DESIGN PROFESSIONAL.



4 FRONT ELEVATION
SCALE: 1/8" = 1'-0"

KEY NOTES						
KEY	ITEM	QTY	MODEL	WEIGHT	BRACKET MODEL	NOTES
1	15' WHIP ANTENNA	1	DBSPECTRA DSB400F35D-D		SV197-18	BRACKETS ON POLE W/ THRU BOLTS & BACKER PLATES
2	TOWER TOP AMPLIFIER	1	TTA 799	8 LBS		DIRECT ATTACHMENT
3	PANEL ANTENNA	2	TERRA WAVE SOLUTIONS T09110P1000690	6.6 LBS EACH	MM02	(2) BRACKETS SANDWICH POLE W/ SHARED BOLTS
4	3' MICROWAVE ANTENNA	1	DRAGONWAVE W/ 3' DISH	50 LBS	(2) MM02	BRACKETS ON POLE W/ THRU BOLTS & BACKER PLATES
5	3' FIBERGLASS COLLINER ANTENNA	1	ANT480F2	9 LBS	MM02	(2) BRACKETS SANDWICH POLE W/ SHARED BOLTS
6	5' FIBERGLASS COLLINER ANTENNA	1	ANT140F2	13 LBS	MM02	(2) BRACKETS SANDWICH POLE W/ SHARED BOLTS
7	5' FIBERGLASS COLLINER ANTENNA	2	ANT140F2	13 LBS	MM03	(2) BRACKETS SANDWICH POLE W/ SHARED BOLTS

NOTE: ACTUAL ANTENNA MODELS MAY VARY. SEE ELECTRICAL FOR FINAL MODELS TO BE USED.



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POLE ELEVATIONS AND SECTIONS

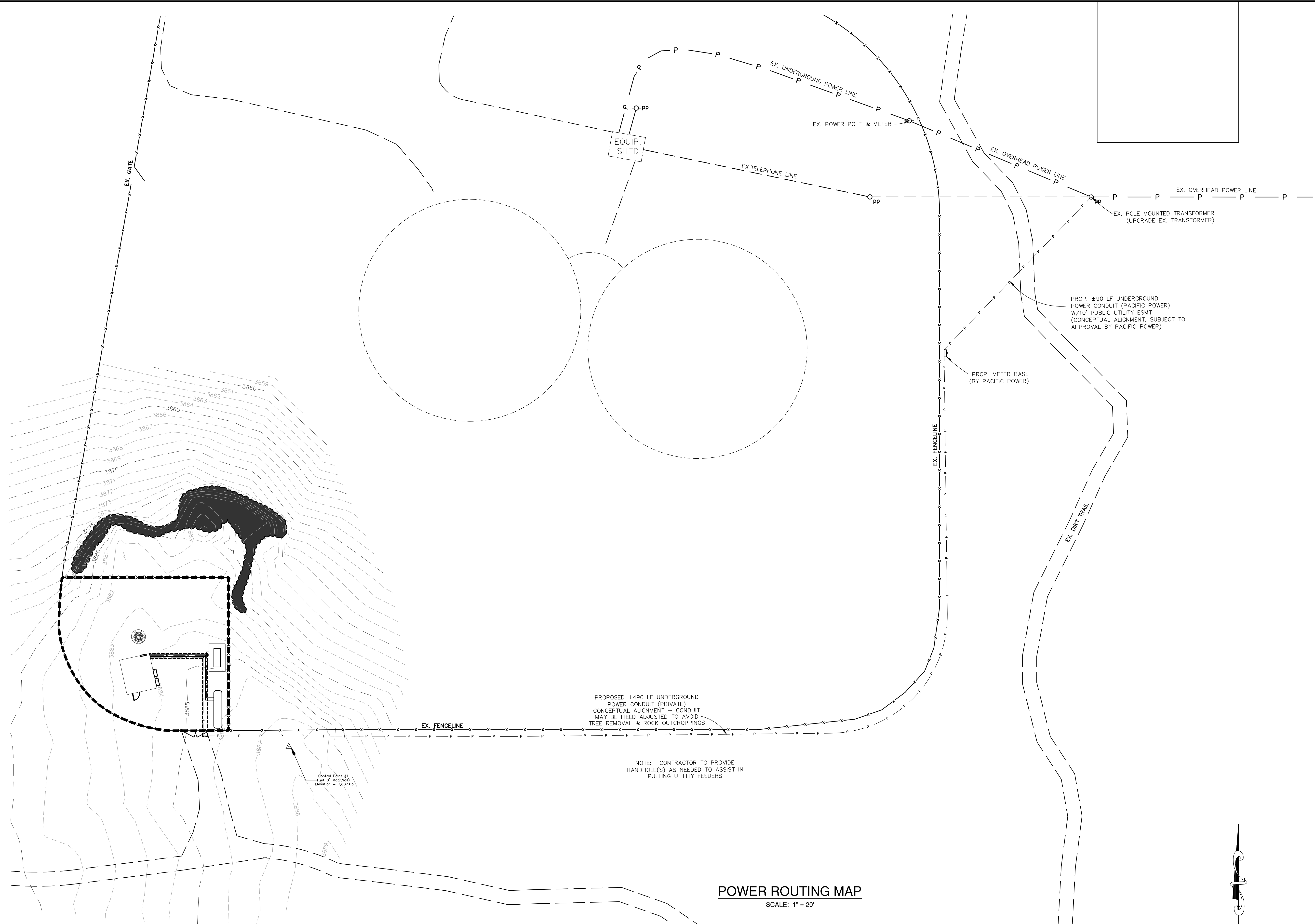
DESCHUTES 911 OVERTURF BUTTE
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BEND, OR 97703

REVISIONS:
10/25/2019

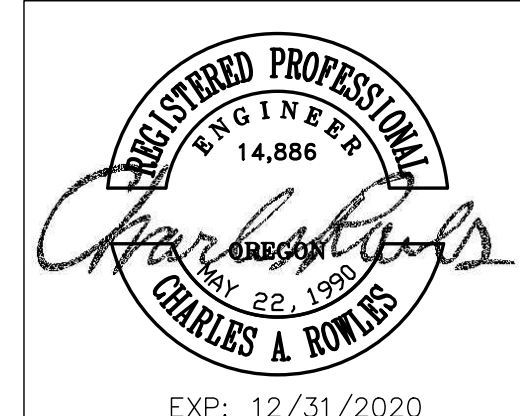
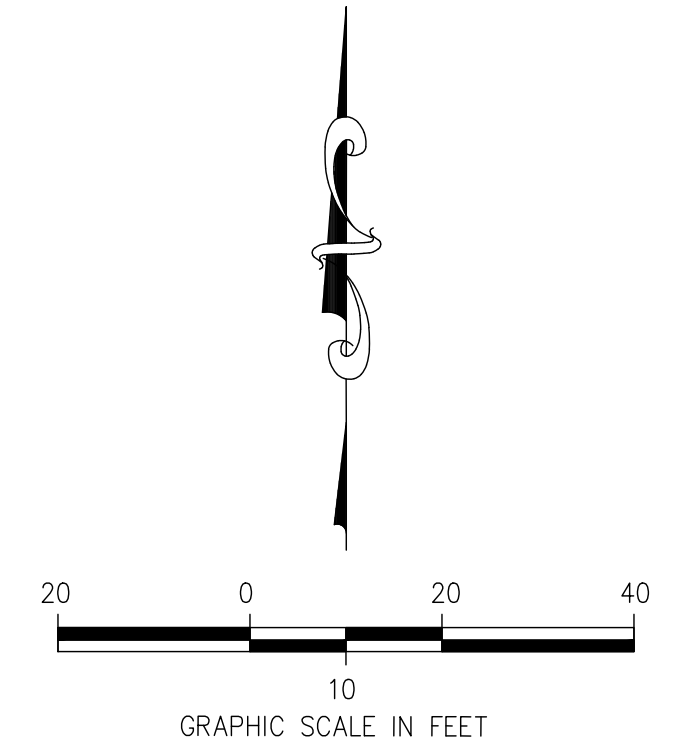
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DRAWN BY: BA
CHECKED BY: JE
WORK ORDER NO: 22129

SHEET: S1

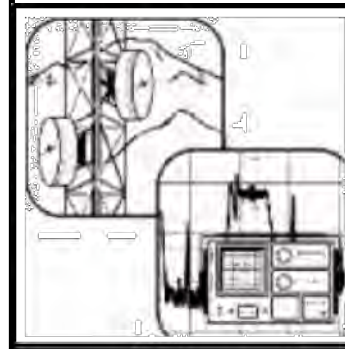
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 Sheet No: 10/20/19 3:29 PM
 2019 MORTIER ANGEERS



POWER ROUTING MAP
SCALE: 1" = 20'



EXP: 12/31/2020
10/23/19
DATE



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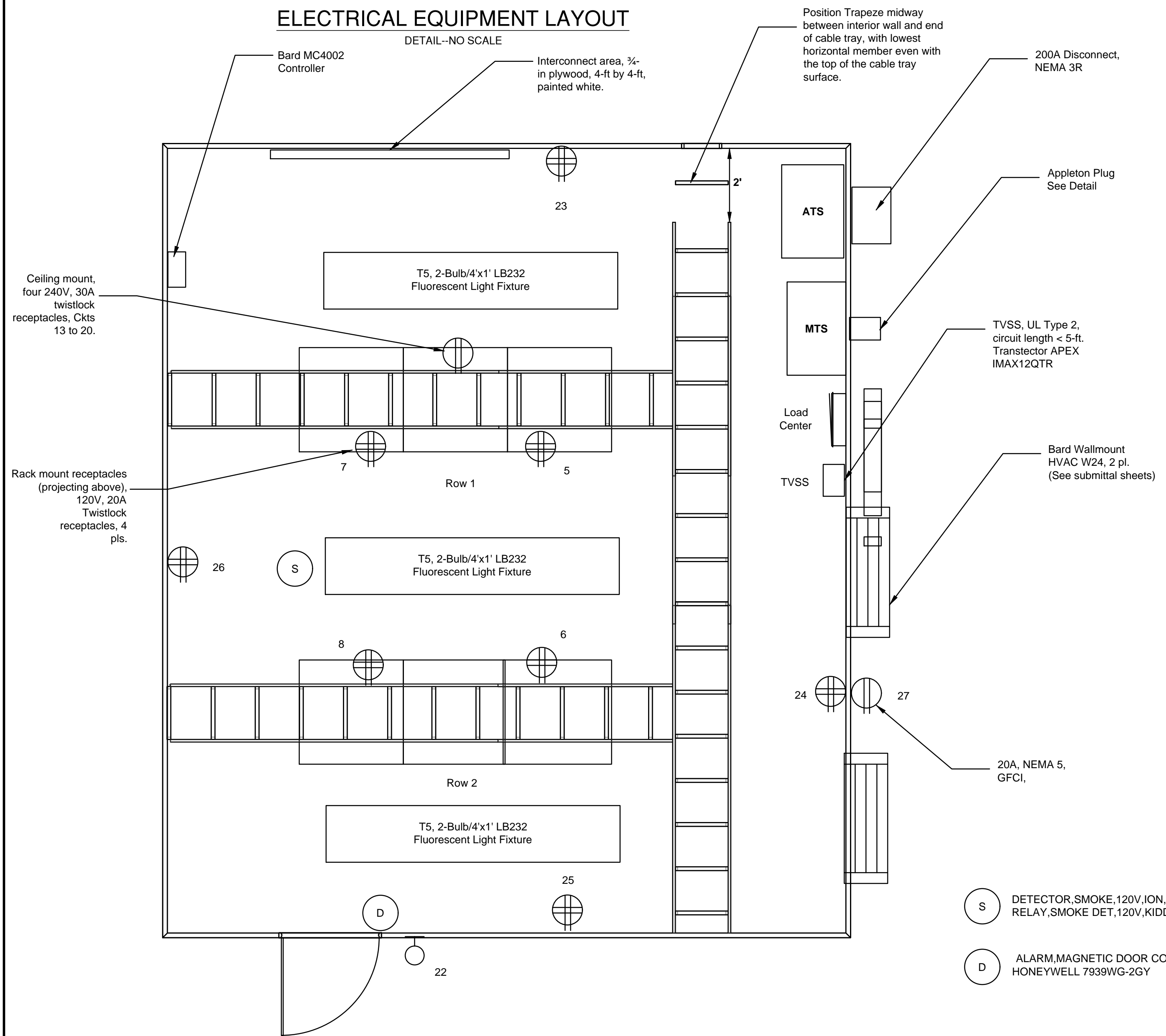
Developer:
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20355 POE SHOLES DR. #300
BEND, OREGON 97703

POWER ROUTING MAP
222 NW SKYLINER SUMMIT LOOP
BEND, OREGON 97703

		NO.	DATE	REVISIONS	sh.t.
Drafting	MAW				E1
Design	MAW				
Scale	AS SHOWN				
Date	05/14/19				of
W.O. No.	18-718	1	10/23/19	UPDATE DRAWINGS PER BID CHANGES	

ELECTRICAL EQUIPMENT LAYOUT

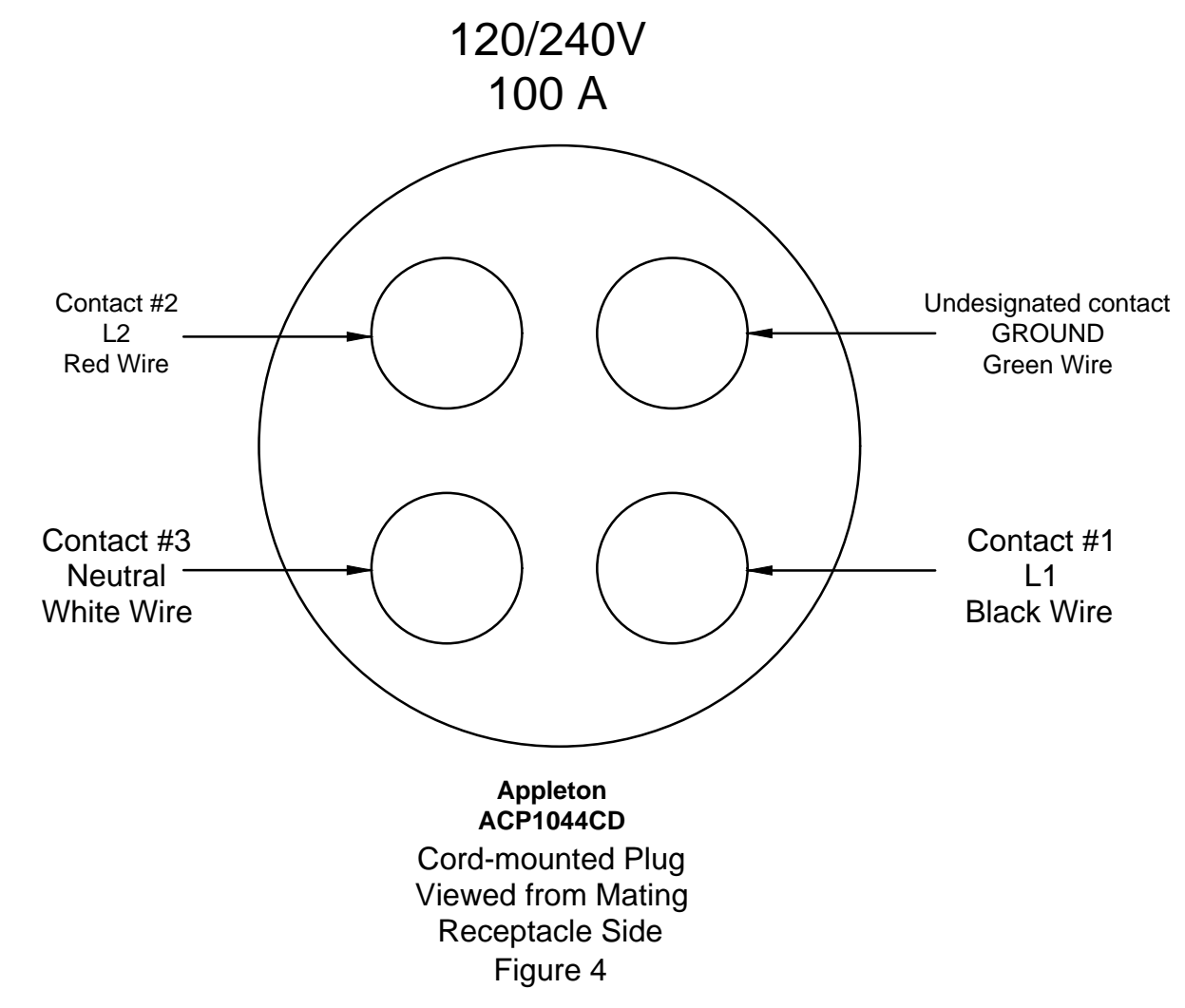
DETAIL-NO SCALE



- (S) DETECTOR, SMOKE, 120V, ION, KIDDE/FYRN RELAY, SMOKE DET, 120V, KIDDE, SM120X
- (D) ALARM, MAGNETIC DOOR CONTACT (OR EQUAL) HONEYWELL 7939WG-2GY

APPLETON PLUG DETAIL

DETAIL-NO SCALE

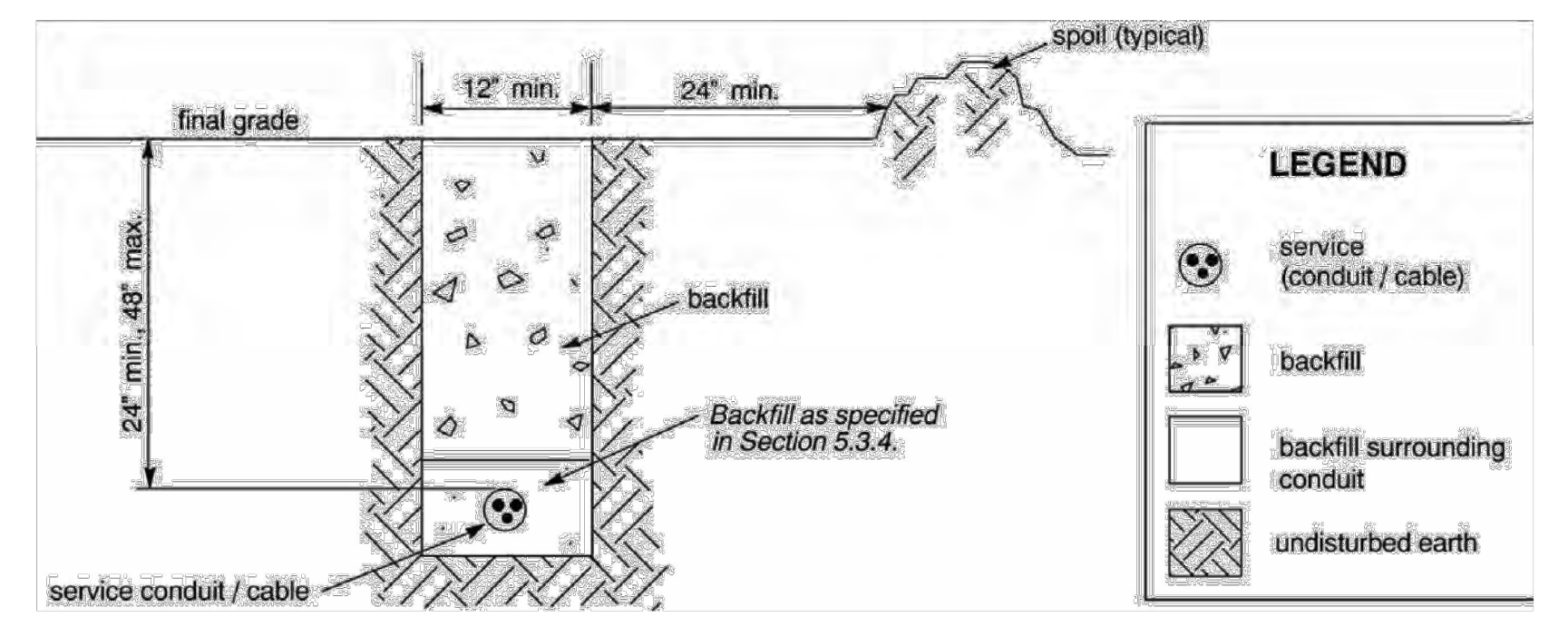


Electrical Loads			
Service	Voltage	Running Load (kVA)	Peak Load (kVA)
DC Plant	240	8	8
HVAC	240	2.56	16.53
Receptacles	120	0.53	0.53
Lighting	120	0.53	0.53
Total Load		11.6	25.6
Amps		59.0	129.9

PANEL DIRECTORY			
CB (A)	240/120 1Ø	CB (A)	
1	60	2	TVSS
3		4	Spare
5	20	6	Receptacle Row 1A
7	20	8	Receptacle Row 1B
9	30	10	HVAC 1
11		12	HVAC2
13	20	14	DC Plant 1
15		16	DC Plant 2
17	20	18	DC Plant 3
19		20	DC Plant 4
21	20	22	Lighting, interior
23	20	24	Lighting, exterior
25	20	26	Wall Receptacles
27	20	28	Wall Receptacles
29		30	Wall Receptacles
31		32	Receptacle, exterior
33		34	Spare
35		36	Spare
37		38	Spare
39		40	Spare

5.3.2 SERVICE TRENCH DETAIL

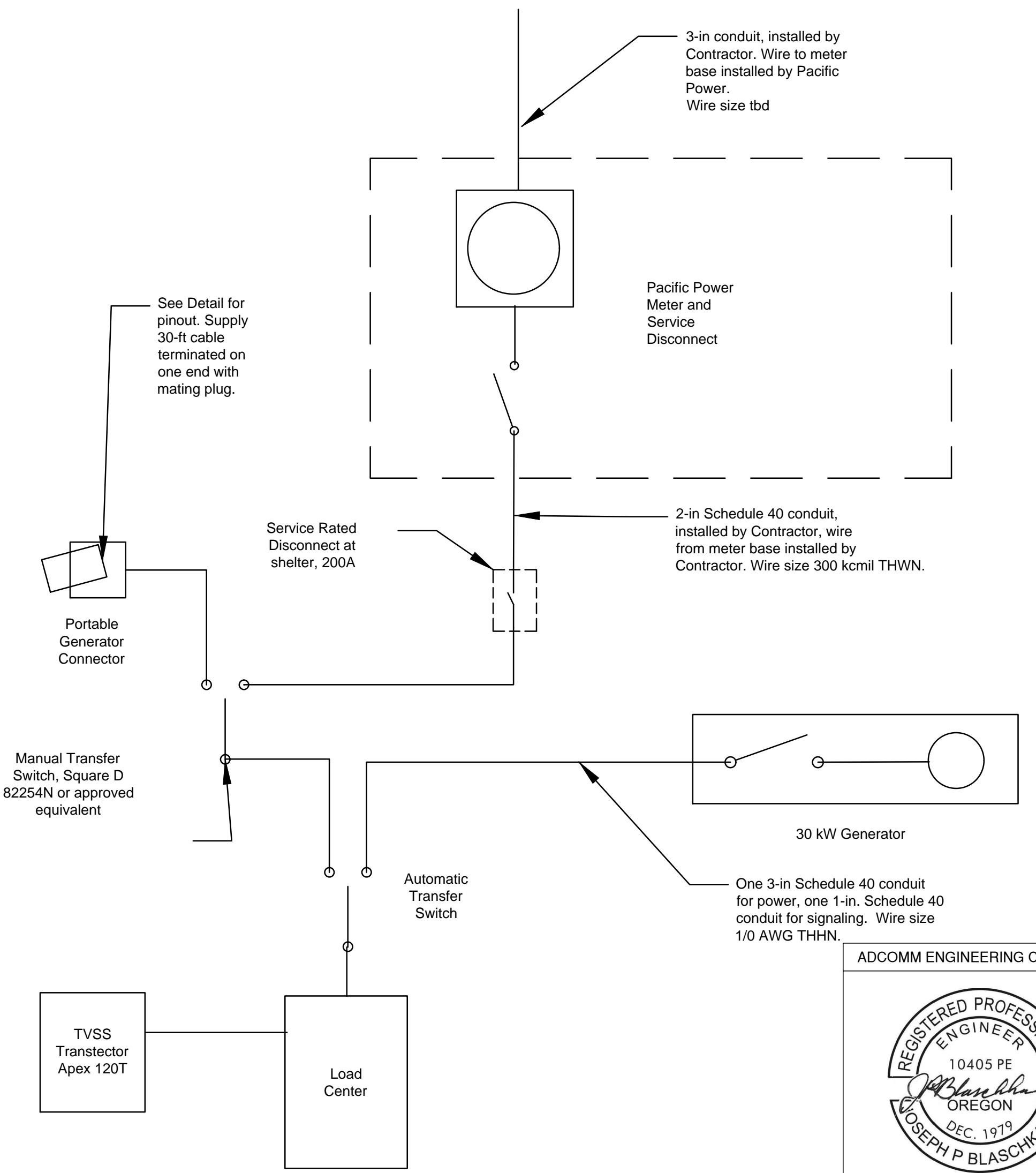
DETAIL-NO SCALE



Per PacifiCorp Electric Service Requirements Manual, 3rd Edition, 2018

1-LINE DIAGRAM

DETAIL-NO SCALE



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B. Blumhagen
OREGON
DEC. 1979
JOSEPH P. BLASCHKA JR.

EXPIRES: 12/31/19

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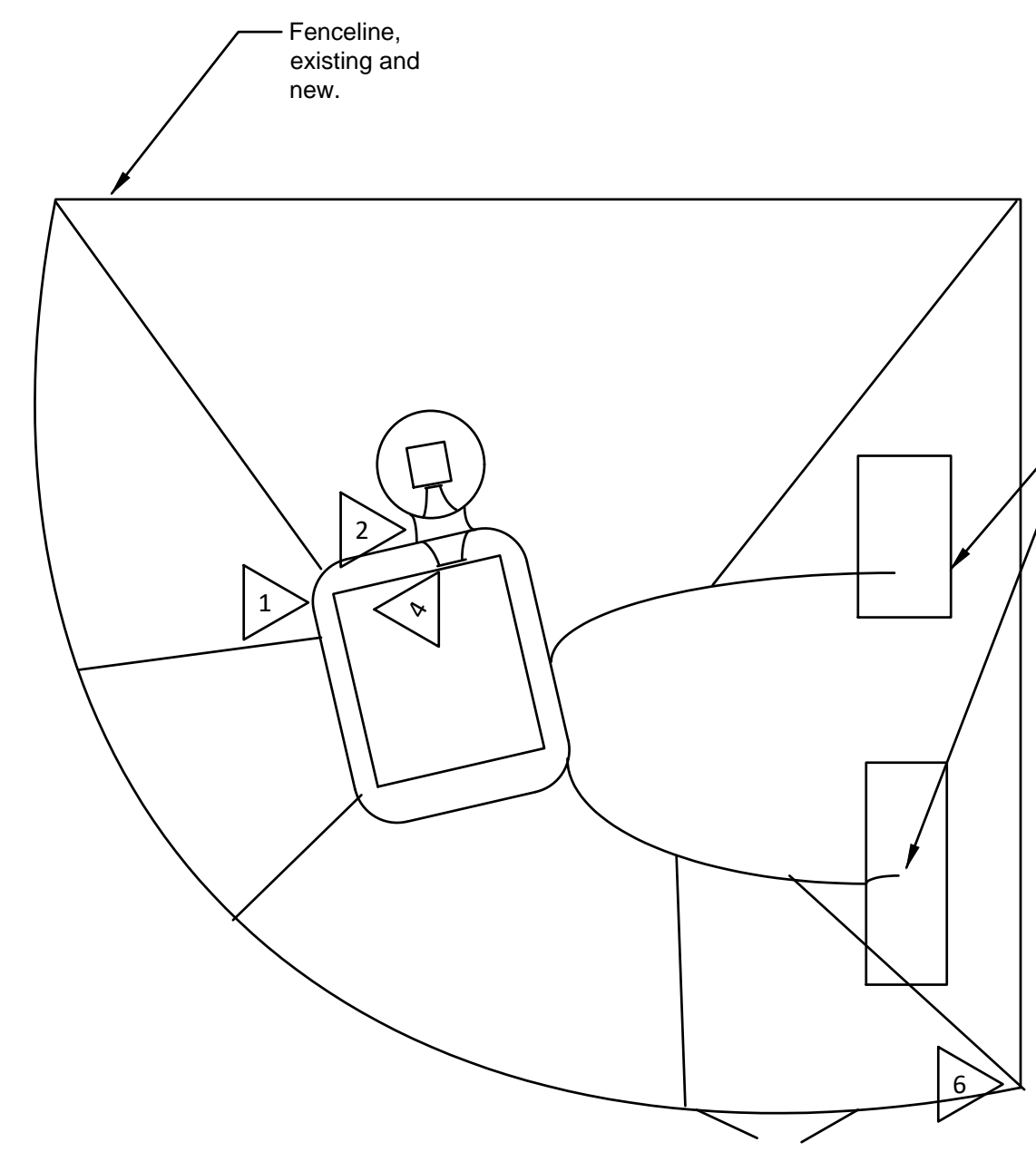
Developer:
DESCHUTES COUNTY 9-1-1 SERVICE DISTRICT
20355 POE SHOLES DR. #300
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ELECTRICAL PLAN & DETAILS
222 NW SKYLINER SUMMIT LOOP
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Drafting	MAW				sh.t. E2
Design	MAW				
Scale	AS SHOWN				
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SITE GROUNDING OVERALL

DETAIL--NO SCALE



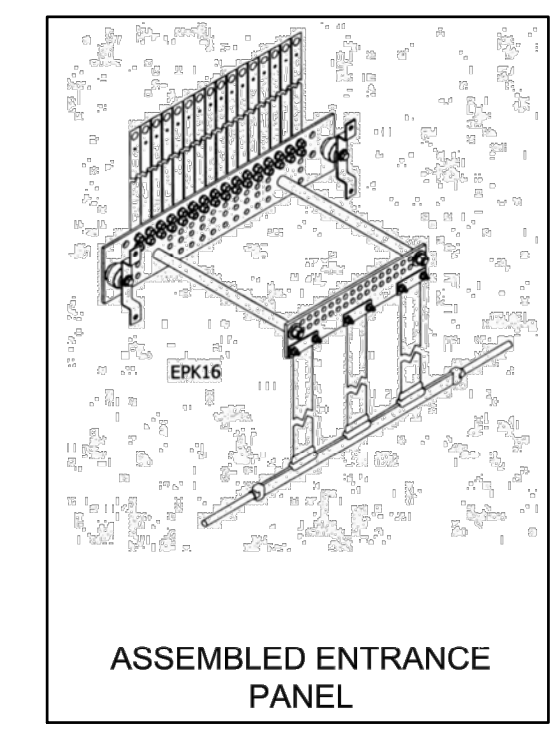
FLAG NOTES:

1. FURNISH AND INSTALL CONTINUOUS GROUND RING AROUND BUILDING AND POLE CONSISTING OF #2 AWG SOLID TINNED COPPER WIRE BURIED 2'-6" MIN BELOW GRADE. BUILDING GROUND RING AND POLE GROUND RING SHALL BE CONNECTED WITH TWO JUMPERS. GROUND RODS AND CONDUCTORS SHALL BE EXOTHERMICALLY WELDED. GROUND RODS SHALL BE L-SHAPED ELECTROLYTIC RODS WITH A 10-FT HORIZONTAL LENGTH. THE HORIZONTAL ELEMENT SHALL BE AT A DEPTH OF 2'-6". SURROUND THE ELECTROLYTIC GROUND RODS ONLY WITH GROUND ENHANCING MATERIAL SPECIFIED BY THE GROUND ROD MANUFACTURER.
2. FURNISH AND INSTALL A MINIMUM OF TWO BONDING JUMPERS FROM POLE GROUND BUS (AKA TOWER GROUND BUS, TGB) TO THE GROUND RING USING #2 AWG SOLID TINNED COPPER WIRE WITH EXOTHERMIC WELDS.
3. FURNISH AND INSTALL 1/2" X 2" X 12" TOWER GROUND BUS BAR (TGB) VALMONT MG215124. TGB SHALL BE CENTERED ON POLE SURFACE 12" BELOW A LEVEL CORRESPONDING TO THE BOTTOM OF THE ENTRY PORT OPENING ON THE SHELTER.
4. FURNISH AND INSTALL ENTRANCE PANEL GROUNDING KIT WITH PROTECTIVE PLASTIC CHANNEL SUPPORT (HARGER EPK16 AND EPKPPCST). SEE SHEET 0606-540 FOR MORE INFORMATION.
5. CONNECT EXISTING EXTERIOR, MGB GROUNDING STRAPS TO NEW GROUND RING USING EXISTING STRAPS (PART OF THE HARGER EPK SYSTEM) AND #2 AWG SOLID TINNED COPPER WIRE EXOTHERMIC WELDED TO GROUND RING. SEE DETAIL.
6. FURNISH AND INSTALL #2 AWG COPPER BONDING JUMPER FROM EACH CORNER FENCE POST. SELECTED FENCE POSTS AT NO MORE THAN 30' BETWEEN FENCE BONDS, AND GATE POSTS TO THE GROUND RING USING EXOTHERMIC WELDS. FURNISH AND INSTALL #6 AWG GREEN JACKETED COPPER BONDING JUMPER TO EACH BARB WIRE STRAND. FURNISH AND INSTALL #2 AWG COPPER WELDING CABLE FROM GATE POST TO GATE. SEE FENCE GROUNDING DETAILS ON E4.
7. FURNISH AND INSTALL #2 AWG COPPER BONDING JUMPER FROM EACH HVAC OR LOUVER SHIELD TO GROUND RING USING NON-REVERSIBLE HIGH-COMPRESSION TWO-HOLE LUG AND STAINLESS STEEL BOLT, NUT, AND LOCK WASHER. SEE DETAIL.
8. FURNISH AND INSTALL INDIVIDUAL BONDING JUMPERS BETWEEN THE PROPANE TANK AND THE GENERATOR FRAME. EACH TO THE BURIED GROUND RING. USING A GROUNDING LUG AT THE EQUIPMENT AND AN EXOTHERMIC WELD AT THE GROUND RING. REMOVE COATING FROM TANK AND GENERATOR AS NEEDED FOR GOOD ELECTRICAL CONNECTION WITH GROUNDING CLAMP. REPAINT, OR TREAT WITH COLD-GALVANIZING PAINT, ANY DISTURBED AREA ON THE EQUIPMENT.
9. ELECTROLYTIC GROUND RODS ARE NOT SHOWN.

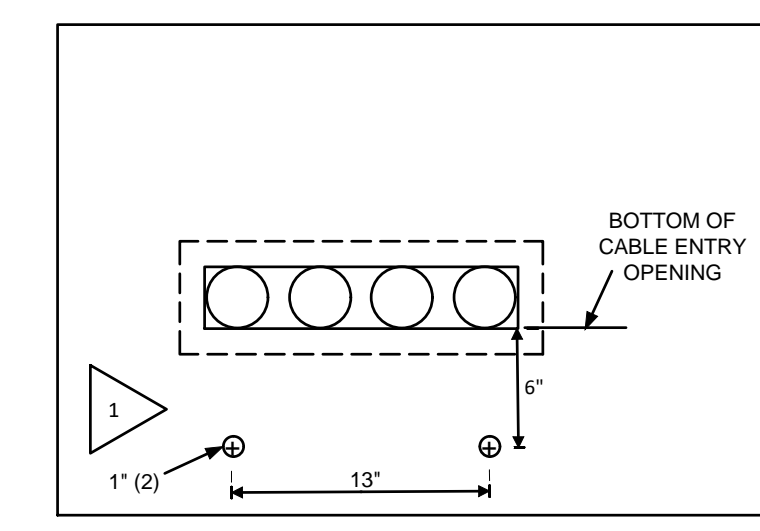
See Details for generator and propane tank grounding

CABLE ENTRY DETAIL

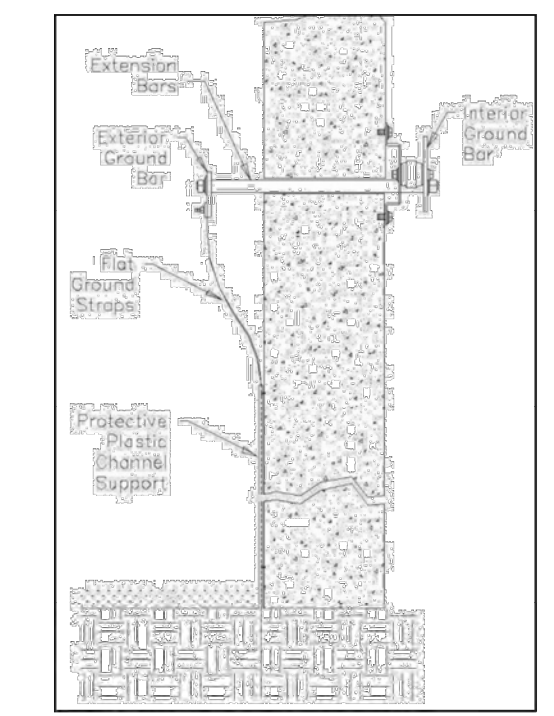
DETAIL--NO SCALE



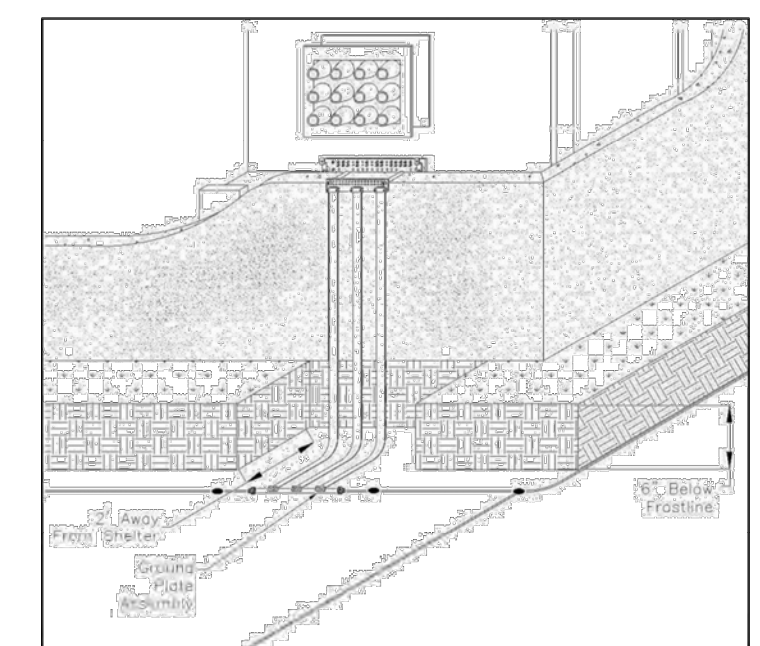
ASSEMBLED ENTRANCE PANEL



THROUGH HOLE INTERIOR VIEW



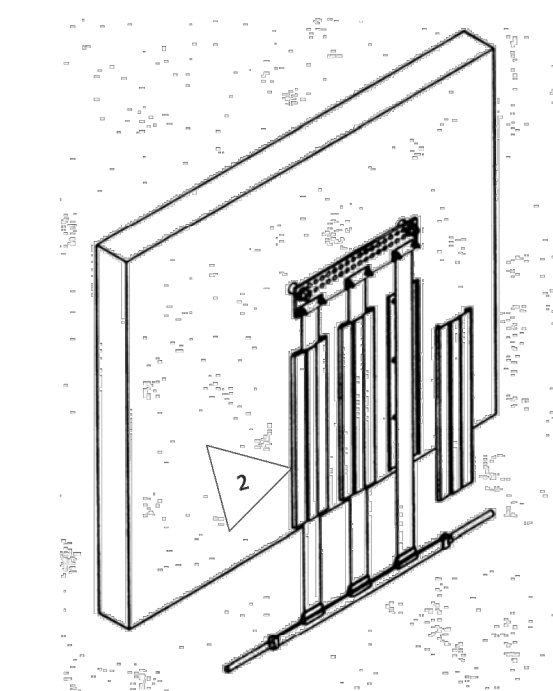
SIDE VIEW GROUND BARS AND STRAPS



TYPICAL EXTERIOR FIELD INSTALLATION

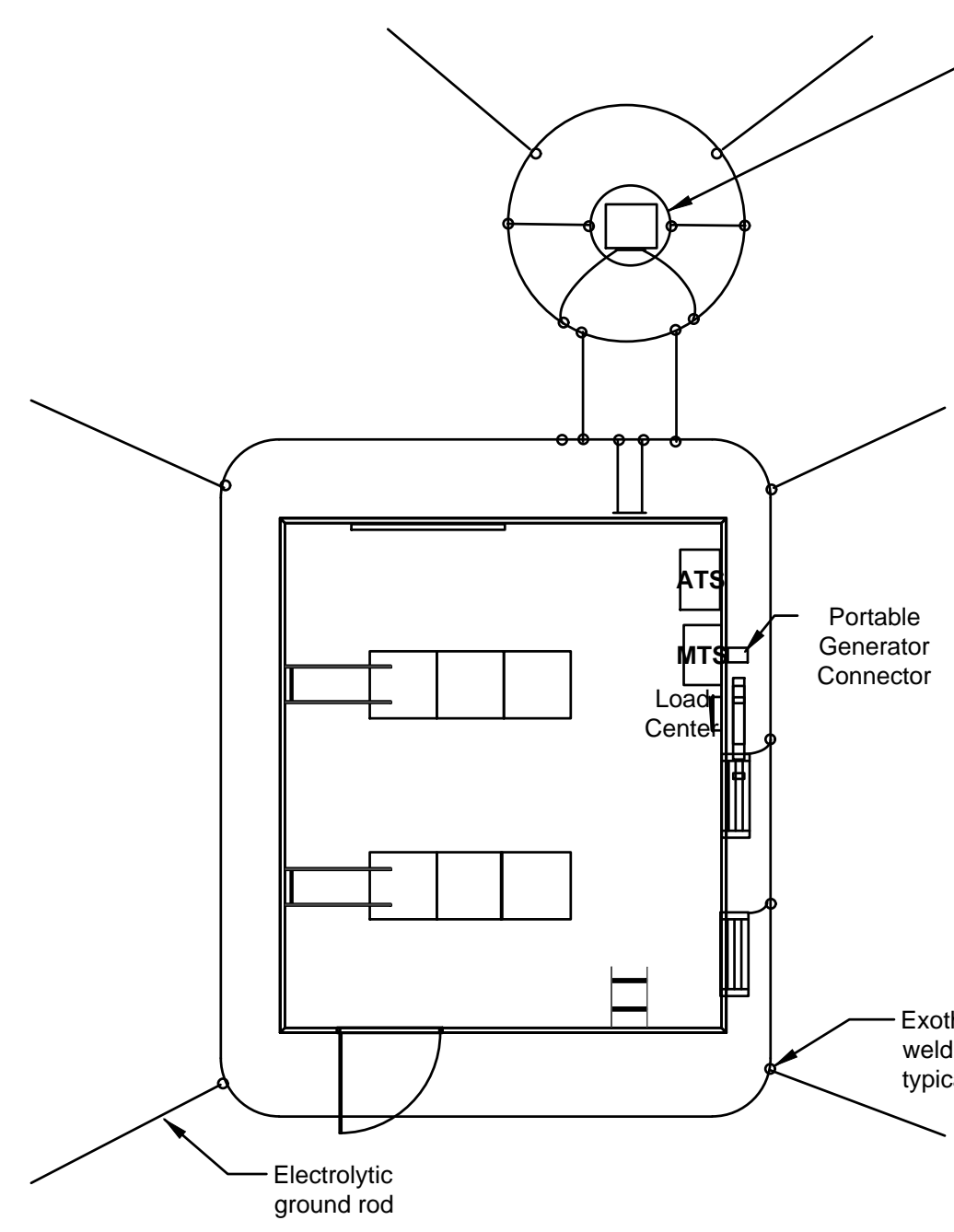
FLAG NOTES:

1. HARGER EPK16 GROUND BUS BAR SHALL BE LEVEL AND CENTERED BELOW NEW CABLE ENTRY PANEL, APPROXIMATELY 6 INCHES BELOW THE BOTTOM OF THE WALL OPENING FOR THE ENTRY PANEL PER MANUFACTURER INSTRUCTIONS. FOLLOW MANUFACTURER INSTALLATION INSTRUCTIONS. ENTRY PORT SHALL BE VALMONT E675, 4", 1X4 (OR APPROVED EQUAL).
2. PROTECTIVE PLASTIC CHANNEL SUPPORT (EPKPPCST) SHALL BE INSTALLED PER MANUFACTURER INSTALLATION INSTRUCTIONS.



SHELTER & POLE GROUNDING DETAIL

DETAIL--NO SCALE



Ground foundation sleeve as shown, Exothermically weld #2 bare copper conductor to sleeve and buried ground ring.

NOTES:

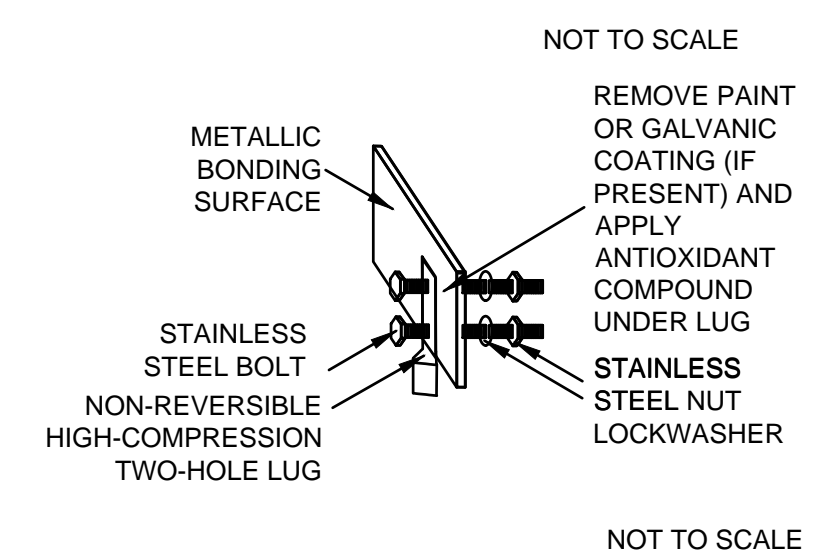
1. SOIL RESISTIVITY IS UNKNOWN BUT PRESUMED HIGH DUE TO THE BASALTIC VOLCANIC SOILS COMMON TO THE REGION. THIS DRIVES THE RECOMMENDATIONS FOR RADIALS AND EMBEDMENT.
2. INABILITY TO DRIVE GROUND RODS TO DEPTH IS ASSUMED. USE THE FOLLOWING METHODS: 1) BARE COPPER CONDUCTOR EMBEDDED IN GROUND-ENHANCING MATERIAL, 2) ELECTROLYTIC GROUND RODS.
3. EMBED ALL BURIED GROUNDING CONDUCTORS, EXCLUDING THE GROUND RODS, IN GROUND ENHANCING MATERIAL, SPECIFICALLY SAN-EARTH, A CEMENTITIOUS MATERIAL. DO NOT USE SAN-EARTH AROUND THE ELECTROLYTIC GROUND RODS; USE MATERIAL RECOMMENDED BY THE GROUND ROD MANUFACTURER SUCH AS HARGER ULTRAFILL.
4. BURIED CONDUCTORS ARE #2 AWG SOLID, BARE, TINNED COPPER.

GROUNDING ELECTRODE SYSTEM

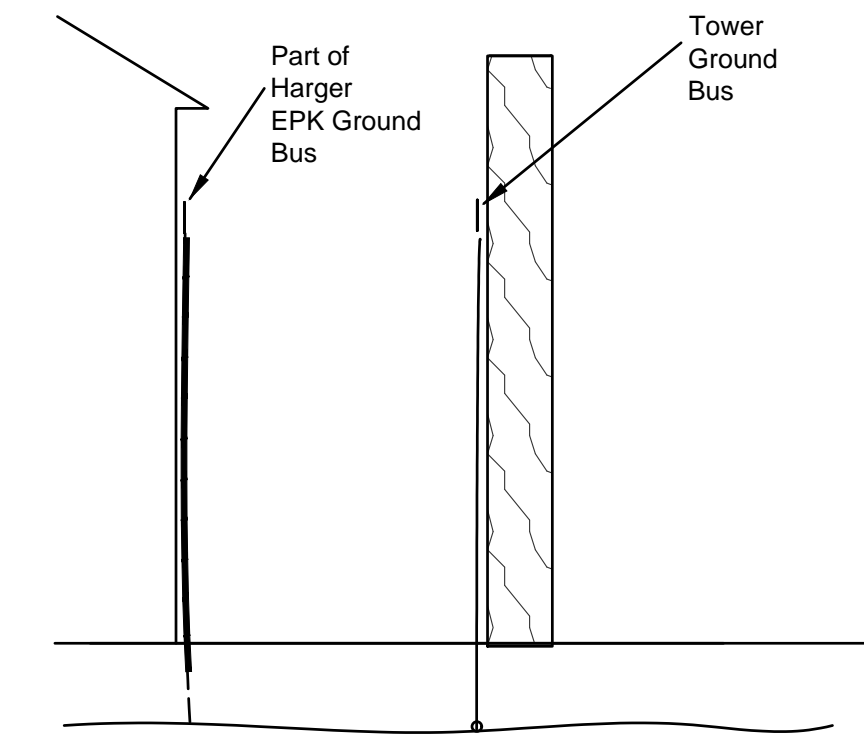
DETAIL--NO SCALE

GROUND LUG CONNECTIONS

DETAIL--NO SCALE



NOT TO SCALE
REMOVE PAINT OR GALVANIC COATING (IF PRESENT) AND APPLY ANTIOXIDANT COMPOUND UNDER LUG
NOT TO SCALE

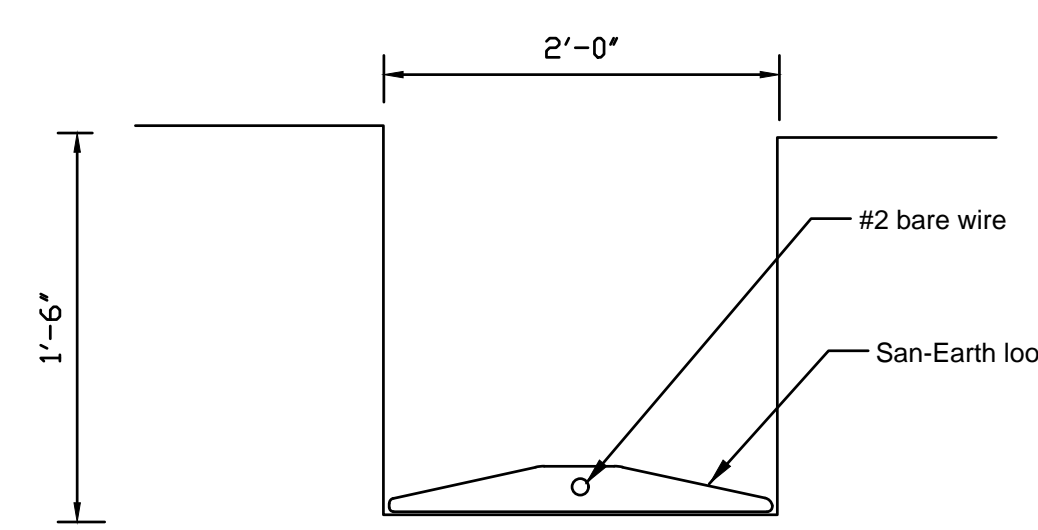


FLAG NOTES:

1. FURNISH AND INSTALL 1/2" X 2" X 12" TOWER GROUND BUS BAR (TGB) SITE PRO GROUND BAR KIT MG21218-K WITH TIN PLATING. TGB SHALL BE CENTERED ON THE POLE AND IMMEDIATELY THE SHELTER ENTRY PORT. THE POLE WILL HAVE PRE-DRILLED PILOT HOLES FOR MOUNTING THE TGB.
2. FURNISH AND INSTALL TWO #2 AWG BARE, TINNED, COPPER BONDING JUMPER IN FLEXIBLE NON-METALLIC CONDUIT FROM TOWER GROUND BUS BAR TO BURIED GROUNDING CONDUCTOR. JUMPER SHALL BE BONDED WITH EXOTHERMIC WELDS. BONDING JUMPER SHALL BE RUN IN A DIRECT MANNER WITH MINIMAL BENDS, NO LOOPS OR BEND ANGLES (INCLUDED ANGLE) LESS THAN 90 DEGREES, AND NO BENDING RADIUS LESS THAN 8 INCHES.
3. LUGS SHALL BE INSTALLED USING CONDUCTIVE ANTI-OXIDANT COMPOUND. EXOTHERMIC WELDS SHALL BE TREATED WITH COLD-GALVANIZING COMPOUND.

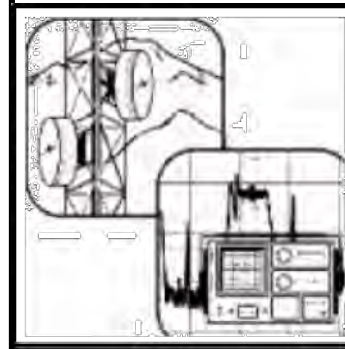
SAN-EARTH INSTALLATION

DETAIL--NO SCALE



NOTES:

1. APPLY SAN-EARTH PER MANUFACTURER'S RECOMMENDED PRACTICE SUMMARIZED HERE.
2. TRENCH SHOWN IS TYPICAL. DEPTH MAY VARY BASED ON SOIL CONDITIONS AND LOCAL FROST DEPTH.
3. LAY THE #2 CONDUCTOR IN THE TRENCH AND MAKE ALL EXOTHERMIC CONNECTIONS. AT POINTS WHERE THE CONDUCTOR WILL EMERGE FROM THE SAN-EARTH MATERIAL, WRAP THE CONDUCTOR WITH ELECTRICAL TAPE.
4. SPREAD THE SAN-EARTH MATERIAL IN THE TRENCH AT A RATE OF ABOUT 10 LINEAL FEET PER BAG. NOTE THAT THE MATERIAL IS PLACED DRY.
5. LIFT THE WIRE SO THAT THE MATERIAL SURROUNDS THE CONDUCTOR.
6. GATHER THE MATERIAL AROUND THE CONDUCTOR TAPERING THE THICKNESS TO ~1/4-IN AT THE EDGES.
7. CAREFULLY BACKFILL SEVERAL INCHES BY HAND SO AS TO NOT DISTURB THE WIRE AND MATERIAL COVER. COMPRESS THE INITIAL BACKFILL.
8. THE MATERIAL ABSORBS WATER FROM THE ENVIRONMENT AND HARDENS OVER TIME.



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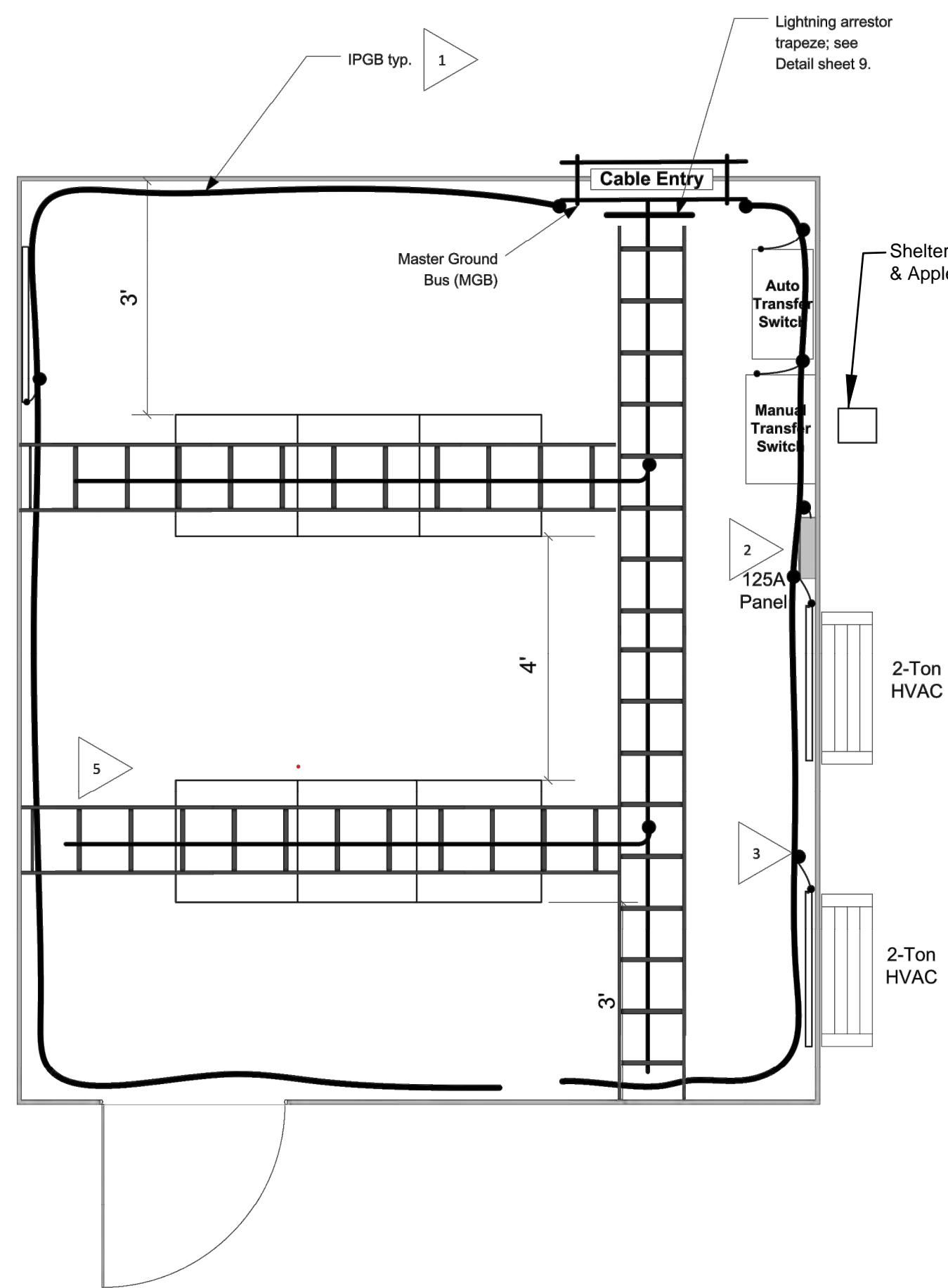
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Drafting	MAW				E3
Design	MAW				
Scale	AS SHOWN				
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INTERIOR BONDING

DETAIL--NO SCALE

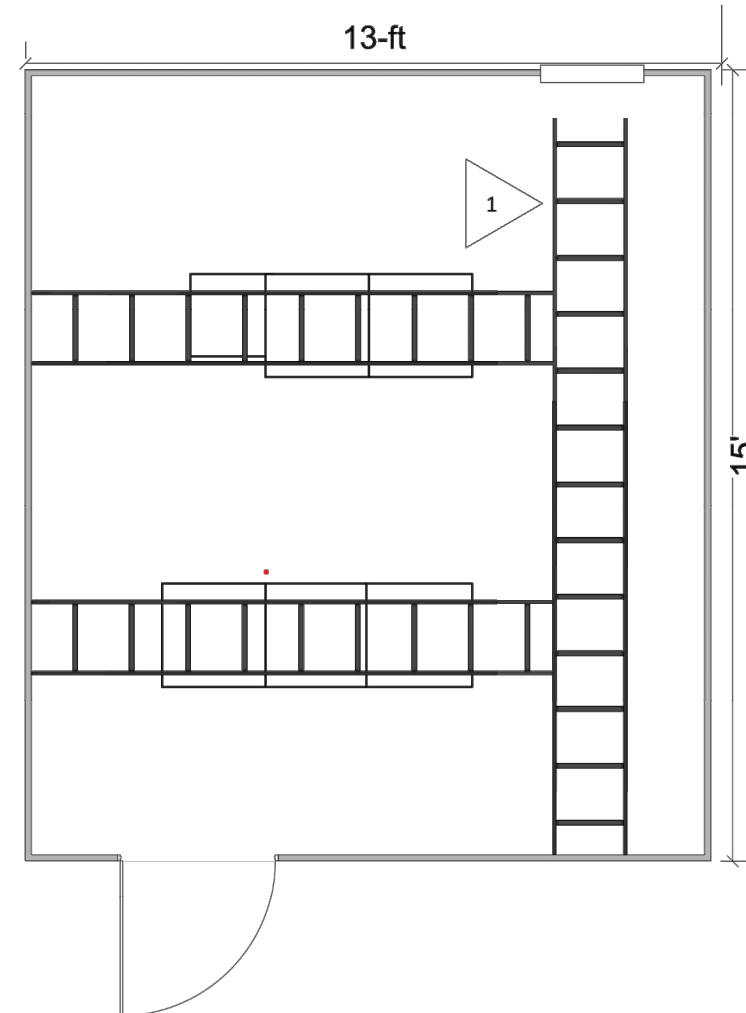


FLAG NOTES:

1. FURNISH AND INSTALL INTERIOR PERIMETER GROUND BUS (IPGB) CONSISTING OF TWO #2 AWG GREEN JACKETED COPPER CONDUCTORS FREE OF SPLICES TO ENCOMPASS THE RADIO ROOM GOING OPPOSITE DIRECTIONS FROM THE INTERIOR MASTER GROUND BUS BAR (MGB). IPGB CONDUCTORS SHALL HAVE A MINIMUM OF 4 INCHES OF SEPARATION AT THE MEET POINT. IPGB CONDUCTORS SHALL BE INSTALLED HORIZONTALLY APPROXIMATELY 8 FEET ABOVE THE FLOOR OR WITHIN 12 INCHES OF THE CEILING. IPGB CONDUCTORS SHALL BE SUPPORTED FROM THE WALL SURFACE WITH 2 INCH INSULATED STANDOFFS. STANDOFFS SHALL BE PLACED AT APPROXIMATELY 2 FOOT INTERVALS OR AS NECESSARY TO KEEP THE CONDUCTORS SECURELY IN PLACE WITHOUT NOTICEABLE SAGS OR BENDS. IPGB CONDUCTORS SHALL BE BONDED TO THE MGB ON ONE END ONLY USING NON-REVERSIBLE HIGH-COMPRESSION TWO-HOLE LUGS, ANTIOXIDANT JOINT COMPOUND, AND STAINLESS STEEL HARDWARE.
2. FURNISH AND INSTALL BONDING JUMPER BETWEEN AC SERVICE EQUIPMENT GROUND BUS IN AC PANEL AND MGB USING #2 AWG GREEN JACKETED COPPER CONDUCTORS FREE OF SPLICES. CONDUCTOR SHALL BE RUN IN A DIRECT MANNER WITH NO SHARP BENDS OR NARROW LOOPS WITH BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES AND NO BENDING RADIUS LESS THAN 8 INCHES. ON WALL SURFACES, THE CONDUCTOR SHALL BE SUPPORTED WITH INSULATED WIRE CLAMPS AT APPROXIMATELY 2 FEET INTERVALS OR AS NECESSARY TO KEEP THE CONDUCTOR SECURELY IN PLACE WITHOUT NOTICEABLE SAGS AND BENDS. CONDUCTORS SHALL BE BONDED TO THE MGB USING NON-REVERSIBLE HIGH-COMPRESSION TWO-HOLE LUGS AND STAINLESS STEEL HARDWARE. LUGS SHALL NOT BE STACKED.
3. FURNISH AND INSTALL #6 AWG GREEN JACKETED COPPER BONDING JUMPER FROM AIR CONDITIONER LOUVERS TO IPGB USING THIN WALL C TAP. COVER THE TAP WITH SUITABLE GREEN TAPE. CONDUCTOR SHALL BE RUN IN A DIRECT MANNER WITH NO SHARP BENDS OR NARROW LOOPS WITH BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES AND NO BENDING RADIUS LESS THAN 8 INCHES. ONE-HOLE LUG IS ACCEPTABLE TO BOND TO HVAC LOUVERS.
4. FURNISH AND INSTALL #6 AWG GREEN JACKETED COPPER BONDING CONDUCTORS FROM METAL DOOR FRAMES AND GROUND STRAP FOR METAL DOORS TO IPGB USING THIN WALL C-TAP. COVER SPLICE WITH SUITABLE GREEN TAPE.
5. FURNISH AND INSTALL GROUND BUS TRIBUTARIES CONSISTING OF #2 AWG GREEN JACKETED COPPER CONDUCTORS. THE LONGITUDINAL TRIBUTARY SHALL BE FREE OF SPLICES OVER ITS LENGTH. TRANSVERSE TRIBUTARIES SHALL BE BONDED TO THE MAIN TRIBUTARY USING THIN WALL C TAPS. CONDUCTOR SHALL BE RUN IN A DIRECT MANNER WITH NO SHARP BENDS OR NARROW LOOPS WITH BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES AND NO BENDING RADIUS LESS THAN 8 INCHES.

CABLE RACEWAY INSTALLATION AND BONDING

DETAIL--NO SCALE

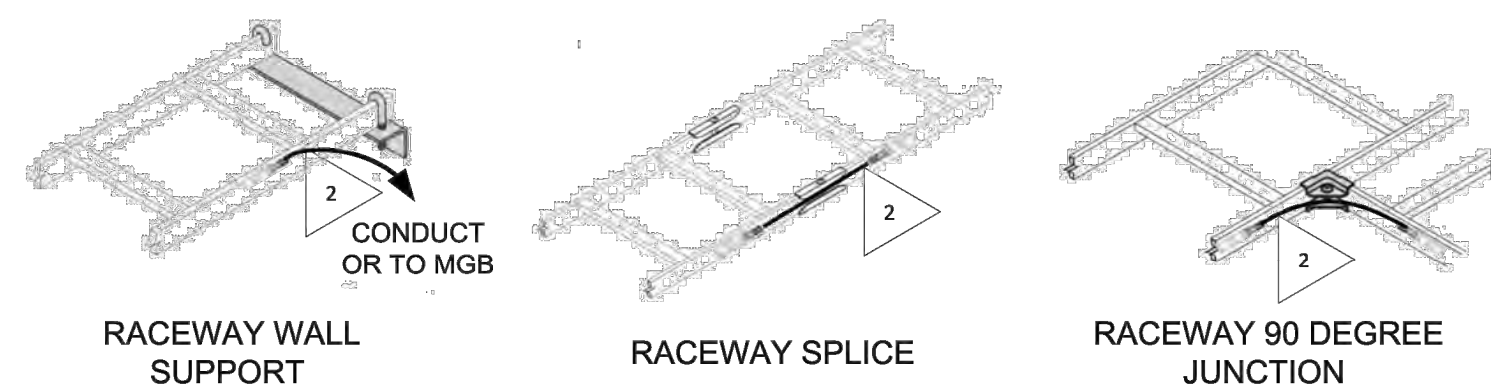


FLAG NOTES:

1. FURNISH AND INSTALL HUBBELL HLS0612B CABLE LADDER, OR APPROVED EQUIVALENT, PER MANUFACTURER'S INSTRUCTIONS.
2. FURNISH AND INSTALL #6 AWG GREEN JACKETED COPPER BONDING JUMPER FROM CABLE RACEWAY TO MGB AND BETWEEN EACH ADJACENT CABLE LADDER SECTION. JUMPER SHALL BE BONDED TO LADDER AND MGB USING NON-REVERSIBLE HIGH-COMPRESSION TWO-HOLE LUGS, ANTIOXIDANT JOINT COMPOUND, AND STAINLESS STEEL HARDWARE. REMOVE PAINT OR ANODIZING FROM LADDER FOR GOOD ELECTRICAL CONNECTION BEFORE INSTALLING LUGS. BONDING JUMPER SHALL BE RUN IN A DIRECT MANNER WITH NO SHARP BENDS OR NARROW LOOPS WITH BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES AND NO BENDING RADIUS LESS THAN 8 INCHES.

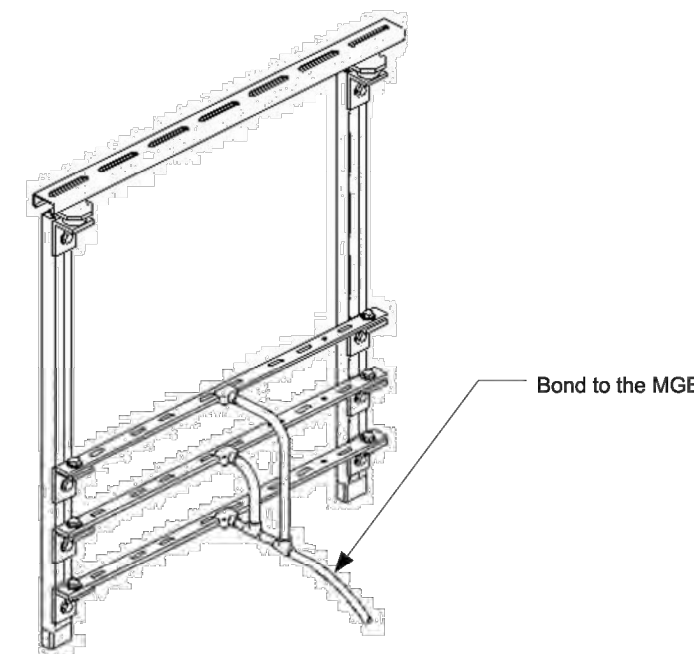
TYPICAL CABLE RACEWAY BONDING

DETAIL--NO SCALE



HARGER CGARRBKT12 LIGHTNING ARRESTOR TRAPEZE

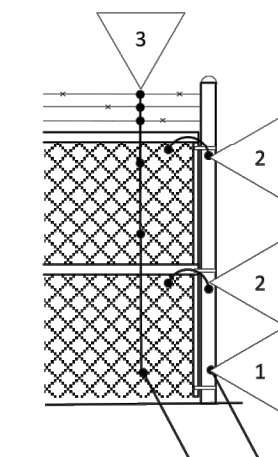
DETAIL--NO SCALE



Note: Trapeze to be positioned midway between interior wall and end of cable tray, with lowest horizontal member even with the top of the cable tray surface.

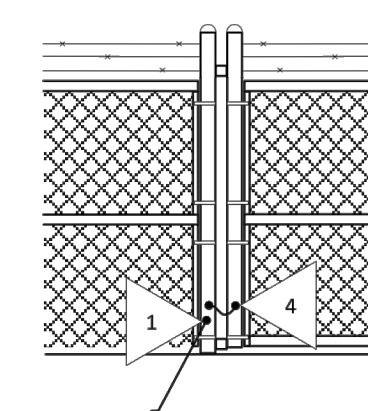
FENCE BONDING

DETAIL--NO SCALE



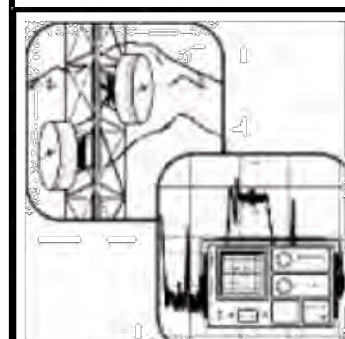
FENCE GATE BONDING

DETAIL--NO SCALE



FLAG NOTES:

1. FURNISH AND INSTALL #2 AWG BARE COPPER BONDING JUMPER FROM FENCE POST TO BURIED GROUND RING. CONNECTIONS SHALL BE EXOTHERMICALLY WELDED AND POST CONNECTION SHALL BE COLD GALVANIZED. CALL THE DIG COUNCIL AT 811 (1-800-424-5555) 48 HOURS PRIOR TO DIGGING.
2. FURNISH AND INSTALL #2 AWG BARE COPPER BONDING JUMPER FROM FENCE POST TO HORIZONTAL RAILS WITH EXOTHERMIC WELDS AND COLD GALVANIZED COATING. BONDING JUMPER SHALL BE RUN IN A DIRECT MANNER WITH NO SHARP BENDS OR NARROW LOOPS WITH BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES AND NO BENDING RADIUS LESS THAN 8 INCHES.
3. FURNISH AND INSTALL #2 AWG BARE COPPER BONDING JUMPER FROM FENCE MESH AND EACH BARBED WIRE STRAND TO BURIED GROUND RING. CONNECTIONS TO FENCE MESH AND BARBED WIRE SHALL USE SPLIT BOLT AND NON-OXIDIZING COMPOUND AT EACH CONNECTION. CONNECTION TO GROUND RING SHALL BE EXOTHERMIC. BONDING JUMPER SHALL BE RUN IN A DIRECT MANNER WITH NO SHARP BENDS OR NARROW LOOPS WITH BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES AND NO BENDING RADIUS LESS THAN 8 INCHES.
4. FURNISH AND INSTALL #2 AWG COPPER WELDING CABLE FROM GATE POST TO GATE WITH EXOTHERMIC WELDS AND COLD GALVANIZED COATING.



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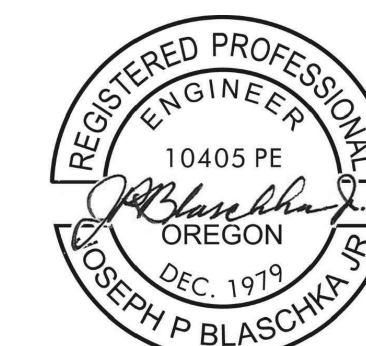
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GROUNDING PLAN & DETAILS
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10/23/19 DATE

SECTION 16010
ELECTRICAL WORK
PART 1 SUMMARY
1.1 Provide complete and operational electrical systems as shown on the drawings or described in the specifications.
1.2 Scope of Work
A. All systems and equipment specified or shown on the drawings shall be appropriately installed and tested to meet the latest codes and standards of the industry and to insure that systems and equipment operate in the manner specified. The Contractor shall provide all materials, labor, temporary construction and apparatus not specifically mentioned herein, but which are necessary to make the installation complete and operational.
1.3 Work of Other Trades
A. The Contractor shall review other divisions of the specifications where the work associated with these divisions requires coordination with Division 16. This work includes but is not limited to the following:
1. Temporary Power
2. Cutting and Patching
3. Door Hardware
4. Painting, Refinishing and Finishes
5. Equipment Wiring
6. Mechanical Control Wiring
7. Mechanical Equipment
8. Electric Power Generation Equipment

PART 2 REQUIREMENTS
2.1 Codes
A. Confirm to the current National Electrical Code as adopted by the State of Oregon, and all local ordinances. If any conflict occurs between government adopted code rules and this specification, the codes shall govern.
2.2 Permits and Fees
A. Obtain and pay for all required licenses, permits and inspections.
2.3 Coordination
A. Coordinate electrical work with other trades. Obtain drawings for all disciplines. Contractor is responsible for reviewing all documents as they relate to the electrical documents and shall notify the Owner's Representative immediately of any conflicts noted.
2.4 Warranty
A. One full year after completion on both labor and materials.
2.5 Branch Circuiting
A. Drawings are diagrammatic only and do not always show wire counts and raceway routing. Where this occurs it shall be the Contractor's responsibility to determine raceway routing and wire counts between devices in adjacent and common walls, and from these devices to the junction boxes shown in the adjacent ceiling space. The Contractor shall provide all raceways, boxes, cables, etc. required for the complete electrical systems indicated.
2.6 Submittals and Shop Drawings
A. Submittals: Within 14 days after award of contract, submit five (5) common brochure(s) with index and divider tabs by specification section, containing all required catalog cuts. The data shall contain sufficient information neatly highlighted with yellow or blue marker to demonstrate that the materials being submitted fully complies with contract documents.
B. Shop Drawings: Shop drawings shall be submitted no later than 21 days after award of contract. Shop drawings shall show floor plans with complete device layout and dimensions, as well as wiring and interconnection diagrams.
C. Equipment and Systems: Submittals and shop drawings shall be provided for, but not be limited to, the following:
1. Wire and Cable
2. Wiring Devices
3. Boxes
4. Starters, Disconnects and Fused Switches
5. Fuses
6. Switchboards and Panelboards
7. Automatic Transfer Switches
8. Power Generation Equipment
9. Seismic Restraints and Attachments
10. Seismic Design Calculations
11. Lighting Fixtures and Ballasts
12. Fire Alarm System (including shop drawings)
13. Voice/Data Cabling Infrastructure (including shop drawings)
2.7 Electrical Equipment Operation and Maintenance (O&M) Manuals
A. The Contractor shall prepare four (4) O&M Manuals for all equipment requiring submittals and/or shop drawings. The information shall identify the specific equipment installed, not a general product list or "line" of the manufacturer, as well as provide information needed to operate and maintain all systems and equipment provided in the project. Refer to individual specification sections for additional requirements.
B. The information shall be grouped in an orderly arrangement by specification section. The completed manuals shall be contained in a 3_ring binder. The covers shall be imprinted with the name of the job, Owner, Architect, Electrical Engineer, Contractor and year of completion. The back edge shall be imprinted with the name of the job, Owner and year of completion.
2.8 Record Drawings: Provide and maintain one (1) full print set at the job site, kept continually updated. All record drawings shall be submitted in Autocad format to Owner's Representative at completion of project.
2.9 Final Acceptance: The Contractor shall submit to the Owner's Representative a copy of Section 16999, Project Closeout Procedures along with a copy of any final Punch Lists or Observation Reports. Adjacent to each closeout and punch list item the Contractor shall note the status of work and provide initials and date. At this time also submit copies of final inspection certificates.

SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS
PART 1 - GENERAL
1.1 SCOPE OF WORK - GENERAL REQUIREMENTS
A. The work shall include, but not be limited to installation of a service entrance metering assembly, installation of a grounding system including electrolytic ground rods, installation of underground service entrance conduit and cable, installation of grounding busses on the antenna tower structure, installation of feeders and bonding of metallic materials per the NEC.
B. This section specifies the general requirements for Electrical work. Detailed requirements for specific electrical items are specified in other sections and are subject to the general requirements in this section. Provide all electrical labor and materials required for installation as indicated in the drawings and the specifications. All materials shall be new. All materials and labor not specifically called out but that are required to provide a complete and operable electrical installation in accordance with the contract shall be provided.
C. Coordinate work under this division with all other work under Contract, including work provided by the Owner's forces. Coordinate location of equipment and devices to avoid conflicts with other work. Plan the work ahead of schedule and verify electrical requirements, connections and interface with other trades. Coordinate the installation work to eliminate cutting and patching. Carefully examine the full set of Contract documents for electrical work and requirements. Extra cost will not be allowed if electrical work is required to be moved due to interference with other work. Extra cost will not be allowed for electrical work indicated in the Contract documents.



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1.2 CODES, STANDARDS AND FEES
A. All labor and materials shall comply with latest rules and regulations of following standards and codes:
2017 Oregon Electrical Specialty Code
National Electrical Code
Applicable NFPA Publications
Applicable ANSI, UL and NEMA Standards
Requirements of Oregon Safe Employment Act
Requirements of Local Utility
B. If any conflict occurs between these rules and the drawings and specifications, the rules are to govern. This does not relieve the contractor of complying with any requirements as defined by the engineer concerning the plans and specifications which are in excess of the codes and regulations.
C. The metering installation shall meet EUSERC standards and the Pacific Power Electric Service Requirements Manual.
D. All equipment and materials supplied for this job are to be UL listed with material displaying the appropriate UL label. If UL labeling is not available for the type of product it shall be noted in the submittals or identified in writing to the Engineer.
E. Contractor shall obtain and pay for all permits and fees required by any government agency having jurisdiction over the work and shall arrange all inspections required by these agencies.
F. Contractor shall include any required utility service fees for any service indicated within the drawings or specifications as being a part of this project.

1.3 SHOP DRAWINGS AND SUBMITTALS
A. A minimum of five copies of the shop drawings shall be submitted; one copy will be retained by the Owner's Representative, one will be retained by the architect and three stamped copies with action taken and returned to contractor for his use. The approval of submittals do not relieve the contractor of responsibility to comply with the contract documents and/or governing codes and standards and shall not be construed as authorizing any deviations from the specifications or drawings unless contractor attaches a letter clearly listing the deviation. The burden of proof of equality, for substitute equipment or materials complying with the specification, is the responsibility of the contractor.
B. Shop drawings, catalog sheets, specification sheets and descriptive material shall be inserted in a common binder and referenced to the specification. These submittals shall be reviewed by the contractor and stamped approved prior to forwarding for approval by the Owner's Representative. Submittals received without contractor's note of approval will be subject to return without review. Submittals of individual items will not be accepted.
C. Submittals on equipment and material shall include: catalog sheets, specification sheets, wiring and connection diagrams, layout and dimensions, descriptive material, performance data, operation description and any other data required to show compliance with contract documents.
D. Contractor shall supply submittals on the following items:
Service Metering Equipment
Grounding System Equipment
Additional items indicated herein

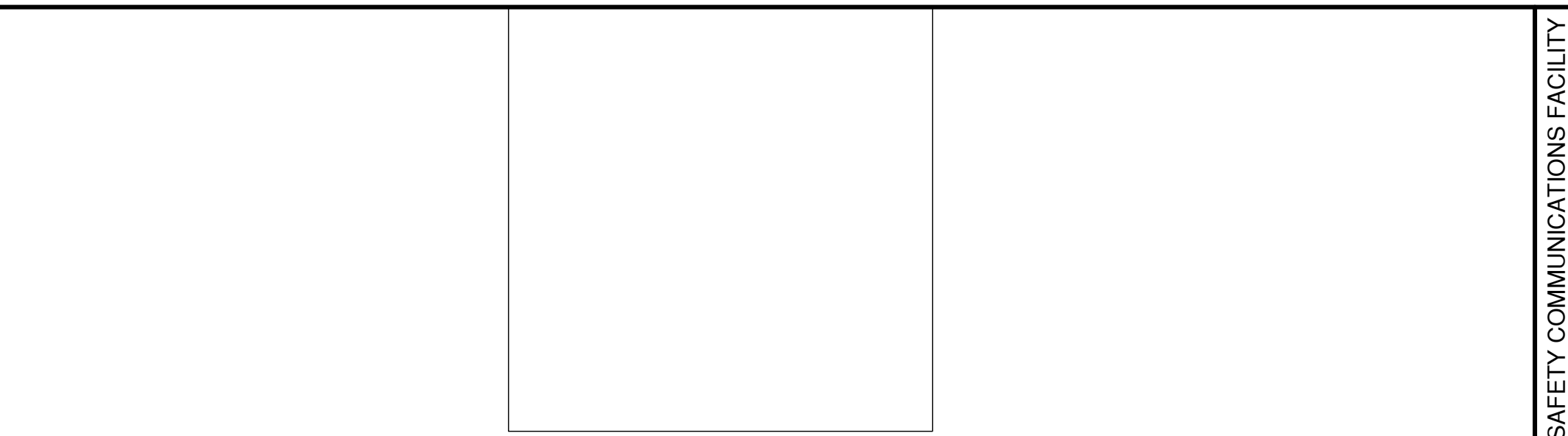
1.4 INSPECTION
A. All materials and workmanship are subject to inspection at any time by the Owner's Representative. Any work or material not in accordance with the intent of these contract documents or found to be deficient or defective by the Owner's Representative or code official shall be corrected or replaced at no cost to the owner.
1.5 DRAWINGS
A. The plans are intended to only show general locations and operation. Specific layout and electrical connections shall be determined by the contractor to conform with intent of contract documents. Any proposed departures from these plans and specifications shall be requested in writing from the Owner's Representative. The request shall be made as soon as practicable and within 30 days after contract award, stating the reasons for the proposed departures.
B. Because exact manufacturers of equipment are not known at the time of design, equipment sizes and types may be different from those shown on the drawings. Contractor will make any necessary changes to electrical rating of equipment or materials to accommodate actual equipment installed.
C. By the act of submitting a bid the contractor shall be deemed to have examined the site and all structural, architectural, mechanical and electrical drawings and to have accepted existing conditions and included allowances for them in the bid. Any contradictions, discrepancies or design work which does not meet code or will not function as intended shall be reported to the Engineer in writing prior to the bid. If contractor does not report any discrepancies then contractor will be held responsible for complete electrical system and make any required changes at no additional cost.
D. While bidding work on an existing installation contractor shall visit the job site and verify all conditions and dimensions. Additional costs will not be allowed when actual conditions and/or dimensions required to make the installation are different than those shown on the drawings.
E. Contractor shall keep a current, up-to-date set of as-built drawings showing all changes or modifications and submit these to the owner at completion of the project.
F. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of the equipment. They shall not be used to obtain quantities or lineal runs of conduit.
G. The drawings show the required size number and type of wires therein and points of termination of the conduits, but do not show the intended routing or total number of conduits required for the circuits shown. Additional conduits shall be installed by the contractor wherever needed to complete the installation of the wiring required for the specific equipment furnished. Circuits may be combined into raceways provided such combinations of circuits are in accordance with the NEC.

1.6 SUBSTITUTION OF EQUIPMENT AND MATERIALS
A. Substitutions may be considered for products. All requests for substitution must be submitted during the bidding process for review by the Owner's Representative. Prior approval requests for substitute manufacturers will not be accepted later than 3 days prior to bid date. If substituted materials result in requiring electrical system or building modifications or in any way increase construction or design costs, the contractor shall pay for all such costs.
1.7 LABELING
A. Provide phenolic labels identifying meter centers, grounding wells and all enclosures that are part of the electrical system.
B. Equipment to be labeled:
1. Electrical Cabinets, and Enclosures.
2. Metering Equipment.
3. Grounding Test Wells.

1.8 INSTALLATION AND COORDINATION
A. The contractor shall coordinate his work with that of all other trades doing work on the building. The contractor is referred to the Architectural, Structural, and Mechanical drawings for additional building details necessary for proper work coordination. The electrical contractor shall provide and install all raceway including cable tray.
B. The Electrical Contractor shall furnish and install all wiring. The Electrical Contractor shall furnish and install all power wiring complete from power source to disconnects or other points of service of mechanical or other equipment requiring electrical service. The Electrical Contractor shall make final connections.
C. There shall be no additional cost for cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between work of the various trades.
D. Contractor shall perform all cutting, drilling and patching that is necessary to properly accomplish his work. All cutting and patching shall be done with materials equal in quality and durability to the existing finish. The finish on patched work shall match the finish on the existing surface or wall any questions on the acceptability of a particular finish shall be referred to the Owner's Representative.

1.9 WORKMANSHIP
A. Conform to the National Electrical Contractor's Association (NECA) standards of installation for general installation practice.
1.10 ENCLOSURES
A. Unless noted in other sections of this specification enclosures for electrical equipment shall be as follows:
NEMA 3R All outdoor, damp or wet locations
1.11 TESTS
A. Testing described below shall be in addition to any other tests required under the specific sections of this specification. Test the electrical systems for proper operation. Perform all tests in accordance with manufacturer's recommendations and International Electrical Testing Association (NETA) specifications.
B. Prior to connection of equipment, electrical circuits 600 V and below shall have an insulation test using a 1000 V DC megohm-meter. Test shall be between each conductor and ground and between phase conductors. Resistance to ground shall not be less than 6 megohms.
C. Where test failures occur, replace the failed device and/or material with new and perform test again.
D. Document all test results and include copies in the O&M manuals.
E. After electrical system is complete and all systems have been appropriately checked, calibrated and adjusted, then contractor shall inform the owner for final inspection and operational check-out. A written report of conditions, required changes, etc. will follow the inspection and contractor will make changes as necessary.

1.12 HOUSEKEEPING
A. The contractor shall continually remove debris, cuttings, crates etc. created by his work. Such shall be done at sufficient frequency to eliminate hazards to the public, other workmen and owner's employees. Contractor shall remove demolished and abandoned material. If directed by owner, designated materials will be removed to a location identified by the owner.




1.13 OPERATION AND MAINTENANCE MANUAL
A. Provide operation and maintenance manuals for training of owner's representative in operation and maintenance of systems and related equipment. Prepare a separate chapter for instruction of each class of equipment or system.
B. Submit copies of Operation and Maintenance Manual for approval. After review make all corrections and additions and provide number of copies as specified in other divisions of this specification.
1.14 GUARANTEE
A. All work and equipment shall be free of defects for a period of one year from date of acceptance. Any defects arising within the one year guarantee period shall be replaced or repaired by the contractor at no cost to the owner.
1.15 FINAL ACCEPTANCE
A. The Contractor shall submit to the Project Manager a copy of Section 16999, Project Closeout Procedures along with a copy of any final Punch Lists or Observation Reports. Adjacent to each closeout and punch list item the contractor shall note the status of work and provide initials and date. At this time also submit copies of final inspection certificates.

END OF SECTION 16050

SECTION 16051
INSPECTIONS AND TESTING
PART 1 GENERAL
1.1 Inspect and test the electrical systems for proper operation and provide certification that the entire installation complies with the contract documents and all applicable codes. Perform all tests in accordance with manufacturer's recommendations and International Electrical Testing Association (NETA) specifications.
PART 2 TESTS AND METHODS
2.1 Receptacles and Devices
A. Test each receptacle installed under this contract for proper polarity and open grounds. Test all ground fault circuit interrupter type receptacles utilizing an instrument specifically manufactured for that purpose. Utilizing the device "TEST" button is not an acceptable substitute for GFCI testing.
2.2 600 Volt Wiring
A. In addition to testing all circuits installed for continuity, all feeder conductors #4 and larger shall be megger tested to show that the resistance to ground is no less than 6 megohms.
2.3 Torque Tests
A. Perform torque test for all bolted type connections to conform with NETA Table 10.12 (ATS_1995) or manufacturers recommendations.
2.4 Power System Tests
A. Test all 3_phase equipment connections for proper phase rotation and test all associated motors for proper rotation.
2.5 Failed Tests
A. Where test failures occur replace the failed device and/or material with new and perform test again.
2.6 Documentation
A. Document all test results confirming "Pass" or "Acceptable" testing and include copies in the O&M Manuals.

SECTION 16100
BASIC MATERIALS AND METHODS
PART 1 GENERAL
1.1 The Contractor's work shall conform with all specified requirements for materials and installation methods, cutting building construction, painting, clean-up, and workmanship. All materials shall be new unless noted otherwise.
PART 2 MATERIALS
2.1 Materials
A. All equipment shall be listed by the Underwriters Laboratories or other approved testing organization and shall be so labeled.
2.2 Substitutions
A. Substitutions may be considered for products, except where noted as "no substitute." All requests for substitution must be submitted during the bidding process for review by the Engineer. If substituted materials result in requiring electrical system or building modifications or in any way increase construction or design costs, the Contractor shall pay for all such costs.
2.3 Prior Approvals
A. Prior approval requests for substitute manufacturers will not be accepted later than 3_days prior to bid date.
PART 3 METHODS
3.1 Painting
A. Repaint any electrical items scratched or marred in shipment or installation.
3.2 Clean Up
A. Continually remove debris resulting from the electrical installation work. Clean all electrical equipment at completion of project.
3.3 Partition Element Penetrations
A. All penetrations shall be properly sealed with approved fire seal material.
3.4 Equipment Connections
A. Provide all electrical connections necessary to serve new or relocated equipment and provide required control connections to all equipment so that the equipment is fully operational upon completion of the project. Notify General Contractor and Architect immediately if it appears that the wiring and devices specified are insufficient to comply with applicable codes and/or provide a complete installation.
B. Prior to rough-in, obtain copies of submittals and shop drawings for all equipment requiring electrical connections being furnished under other divisions. Provide wiring per the wiring diagrams and requirements indicated.
3.5 Interface with Other Trades
A. Continually coordinate work with other trades. When a conflict with another trade becomes apparent, notify General Contractor and Architect immediately.
3.6 Workmanship
A. Preparation, handling and installation of materials shall be in accordance with manufacturers written instructions and technical data particular to the products specified and/or approved.
B. Conform to the National Electrical Contractor's Association (NECA) standards of installation for general installation practice.

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EXPIRES: 12/31/19



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Developer:
DESCHUTES COUNTY 9-1-1 SERVICE DISTRICT
20355 POE SHOLES DR. #300
BEND, OREGON 97703

ELECTRICAL SPECIFICATIONS
222 NW SKYLINER SUMMIT LOOP
BEND, OREGON 97703

NO.	DATE	REVISIONS	sh.t.	E5
Drafting	MAW			
Design	MAW			
Scale	AS SHOWN			
Date	05/14/19			
W.O. No.	18-718	1	10/23/19	UPDATE DRAWINGS PER BID CHANGES

SECTION 16105
ELECTRICAL SITE WORK - GENERAL

PART 1 GENERAL

1.1 Description

- A. Provide all excavation, trenching, backfill and surface restoration required for the electrical work.
- B. The Contractor performing the work in Division 16 shall include in bid all costs required to perform the electrical site work.

PART 2 PRODUCTS

- 2.1 Concrete
 - A. Concrete shall be Class 5, manufactured with 3/4 inch aggregate and Type 1 cement.
- 2.2 Crushed Rock
 - A. Crushed rock shall be 1 1/4" minus unless smaller is required for bedding material.
- 2.3 Sand
 - A. Sand shall be clean and washed building sand.
- 2.4 Topsoil
 - A. Topsoil shall be better or equal in quality to that removed.
- 2.5 Sod
 - A. New sod shall be matured densely rooted grass free of weeds and objectionable grasses.

PART 3 INSTALLATION

- 3.1 Existing Utilities
 - A. The existing utilities shown on the contract drawings are based on a combination of civil survey information and field observation. No guarantee is made to the accuracy of the locations indicated, and is shown for whatever benefit the Contractor may derive therefrom.
 - B. Contact all serving utilities and have them locate their lines prior to commencing work.
 - C. Protect shown, visible and located utilities from damage. Promptly have repaired all active shown, visible and located utilities damaged by construction. This repair shall be made solely at the expense of the Contractor.
 - D. When despite all care and caution damage occurs to active utilities not visible, located or shown on the contract documents, the Contractor shall immediately obtain a decision as to repair. When so directed the repair shall be made immediately by the Contractor whose trade is involved. The contract price shall not change when the conditions outlined above and utmost possible care and caution have not been followed.
 - E. Adjust the depth of electrical utilities to avoid existing utilities with no change to contract price.
- 3.2 Securing Site Work
 - A. The Contractor alone is solely responsible for securing all electrical site work with adequate barriers, warning indicators and shoring.
- 3.3 Trenching and Excavations
 - A. Trenching shall be to depths as required by code and the installation intended, the particular installation or as shown on the drawings. Trench width and length as required by the installation or as shown.
 - B. Trench bottom shall be free of debris and graded smooth. Where bottom is rock, or rocky, or contains debris larger than 1", or material with sharp edges, Contractor shall over excavate 3" and fill with 3" of sand.
 - C. Separation between new electrical utilities and other utilities shall be 1'_0" minimum except gas lines shall be 1'_0" both vertical and horizontal and shall be 3'_0" (horizontal) for all water service lines.
 - D. All crossings of concrete or asphalt shall be performed only after the surface material has been saw cut to required width and removed.
- 3.4 Dewatering
 - A. Provide, operate and maintain all pumps or other dewatering equipment required for control of water in trenches and excavations for electrical site work during the entire construction period.
- 3.5 Shoring
 - A. Provide as required by trenching and excavating to secure site work.
- 3.6 Backfill, Bedding and Compaction
 - A. Backfill around raceways per 16110.
 - B. Backfill around vaults and handholes to be free of debris larger than 1 3/4" in all directions to 1'_0" from vault.
 - C. Bedding for all vaults, and any handholes larger than 3'_0" x 3'_0", shall be 0'_6" of pea gravel or sand. For handholes smaller than 3'_0" x 3'_0" shall be 0'_3" pea gravel or sand.
 - D. All other backfill shall be free of debris larger than 6" in diameter.
 - E. All backfill material shall be placed so as to obtain a minimum degree of compaction of 95 percent of the maximum density at optimum moisture content. Moisture backfill material as required to obtain proper compaction.
 - F. Broken pavement, concrete, sod, roots and debris shall not be used for backfill.
 - G. Within the one year guarantee period, re_fill, compact and re_finish all settled areas to grade.
- 3.7 Waste Material Disposal
 - A. Promptly remove from the site and legally dispose of all materials from trenching and excavation which are remaining after backfill and compaction.
- 3.8 Surface Refinishing
 - A. Refinish every disturbed surface to its original condition.
 - B. Return after one year and refinish all settled areas to grade.

SECTION 16110
RACEWAYS

PART 1 GENERAL

- 1.1 Provide a metallic raceway system for all interior power wiring specified and as required by code. Exterior and below grade raceways shall be rigid metal or PVC raceways as allowed by Code.
- 1.2 References
 - A. American National Standard Institute
 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated
 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated
 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC)
 4. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
 5. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
 6. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing
- 1.3 Provide attachments and bracing for raceways conforming the requirements of Section 16050.
- 1.4 Shop Drawings
 - A. Submit shop drawings and calculations for anchorage of raceways. Conform to requirements of Section 16050. Shop drawings shall indicate routings of single and multiple raceways requiring bracing. Indicate on the shop drawings the location and type of bracing to be used and the attachments provided. Typical and special details shall be included to identify bracing and attachment methods and connection configurations. Design calculations and anchor bolt selections shall be performed by a structural engineer licensed to practice in the State of OREGON.

PART 2 MATERIALS

- 2.1 Interior Raceways
 - A. Electrical Metallic Tubing (EMT) or rigid metal conduit shall be used as allowed by applicable NEC Articles and local code authority. All branch wiring minimum raceway size shall be 3/4" unless noted otherwise.
- 2.2 Flexible Raceways
 - A. Use for all connections to motors, solenoid valves, and HVAC equipment.
- 2.3 Exposed Wiring
 - A. Where wiring is to be installed exposed below +72", it shall be installed in rigid steel conduit.
- 2.4 Exterior Raceways
 - A. Rigid galvanized steel or PVC where installed below grade or where otherwise allowed by the authority having jurisdiction.
- 2.5 Raceway Penetrations
 - A. Penetrations through fire rated construction shall be sealed per Code to maintain fire rating using 3M Fire Barrier Caulk, Nelson Electric Flameseal or T & B Flamesafe, or use other method approved by the Architect.
- PART 3 INSTALLATION
- 3.1 Separate of Systems
 - A. High and low voltage systems shall be routed in separate raceways.
- 3.2 Raceways that Stub Up Through Floor
 - A. Install at such depth that the exposed raceway is vertical and no curved section of the elbow is visible.
- 3.3 Sealing of Raceway Penetrations
 - A. Exterior wall surfaces above grade: Provide watertight seal around all raceways. For surfaces below grade, provide watertight seal, cast raceway into wall (or floor) or use manufactured seal assembly. Roof penetrations shall be coordinated with the general contractor and sealed similar to other roof penetrations.
- 3.4 Fire Rated Construction
 - A. All penetrations shall be sealed to maintain fire rating of construction penetrated. Caulk around penetrations with UL listed firestopping material, similar to what was specified on 2_5A of this section.
- 3.5 Hangers for Raceways
 - A. Provide lay-in pipe hangers secured to structure or by 3/8" (minimum) all threaded rods attached to metal ceiling inserts or to structural members. Hangers shall be provided no greater than 10'_0" on center and within 12" of each change in direction.
- 3.7 Raceway Sizes
 - A. Raceways are generally sized based upon THW insulation. Do not reduce raceway sizes from that shown on the drawings. Requirements for 3/4" raceways containing #12 or #10 size conductors shall be determined by the Contractor based upon the wire counts shown on the drawings.
- 3.8 Pull Cords
 - A. Provide a pull cord in all empty raceway run for future conductor pulling.
- 3.9 Expansion Fittings
 - A. Raceways crossing expansion joints shall be provided with an expansion fitting with bonding jumper.

SECTION 16120
CONDUCTORS AND TERMINATIONS

PART 1 GENERAL

- 1.1 Provide all necessary conductors, splices and terminations required to provide complete and operation electrical systems. Comply with applicable codes and standards of practice.
- PART 2 MATERIALS
- 2.1 Copper, insulated for 600V. Aluminum or copper clad aluminum conductors not permitted. Type THW, THWN/THHN or XHHW allowed for larger conductors and where installed in raceways. Minimum size shall be #12 AWG except for control and low voltage wiring.
- 2.2 Color Code
 - A. Conductor insulation shall be color coded as follows for each phase, neutral, and ground respectively:
208Y/120V: Black, Red, Blue, White, Green
- 2.3 Splices
 - A. Solderless type only. Pre-insulated "twist-on" type (limited to size #10 and smaller). Bolt or compression set type with application of preformed insulated cover, heat shrinkable tubing or plastic insulated tape acceptable for all sizes.
- 2.4 Terminations
 - A. Compression set, bolted or screw terminal. Conductors #12 and smaller shall utilize eye or forked tongue type compression set terminator when termination is to a bolted screw set type terminal block or terminal cabinet.

PART 3 INSTALLATION

- 3.1 Wire Fill - Junction and Splice Boxes
 - A. Drawings do not identify junction and device boxes where box extensions or larger than standard boxes are required to comply with the NEC. The Contractor shall review wire counts prior to rough_in and provide appropriately sized boxes. Where through-wiring is shown at lighting fixtures of other equipment supplied with a junction box the Contractor shall confirm the fill requirements for the fixture or equipment and provide additional junction boxes as required.
- 3.2 Conductors in Cabinets
 - A. Neatly group and form conductors within panel, switchboard and terminal enclosures in order to "fan" into terminal locations.
- 3.3 Conductor Supports
 - A. Provide all supporting devices for vertical cable runs to comply with Code.

SECTION 16130
OUTLET, JUNCTION AND PULLBOXES

PART 1 GENERAL

- 1.1 Description
 - A. Provide all necessary outlet, junction and pull boxes required for installation of devices and wiring per code. Review Architectural Elevations to determine exact box locations.
- 1.2 References
 - A. National Electrical Manufacturers Association
 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
 2. NEMA FB 1 - Fittings, Cast metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports
 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports

PART 2 MATERIALS

- 2.1 Interior Wiring
 - A. Pressed steel, zinc coated with plaster ring where applicable. Mount outlet boxes for receptacles and other devices at 18" unless indicated otherwise on drawings.
- 2.2 Surface Metal Raceway
- 2.3 Exterior Wiring
 - A. Cast or malleable iron or shall be cast of corrosion resistant alloy, with conduit hubs compatible with raceway to which it is connected. All boxes shall be labeled for damp or wet locations as applicable.

PART 3 INSTALLATION

- 3.1 Anchoring
 - A. All boxes shall be firmly anchored directly or with concealed bracing to building studs or joists. Boxes shall be mounted so that they do not rock or shift with devices are operated.
- 3.2 Flush Mounting
 - A. Except for boxes located in ceiling spaces or where specifically noted otherwise, all boxes shall be installed so that the front edge of box or plaster ring is flush to the finished surface.
- 3.3 Sound Transfer Avoidance
 - A. To avoid sound transmission outlet boxes shall not be installed back to back, but instead shall be provided with 6" of clear space in between. The Contractor shall coordinate with the General Contractor to accommodate all other sound proofing measures specified under other Divisions.
- 3.4 Mounting Relationships
 - A. Where multiple devices are to be installed adjacent to, or above one another, they shall be aligned exactly on center horizontally or vertically.
- 3.5 Switch Height Verification
 - A. Prior to rough_in of any devices, the Contractor shall coordinate with the local code authority to verify acceptable switch heights under their interpretation of the ADA. If directed to do so, all switches shall be mounted at +46" on center above finished floor.
- 3.6 Blank Covers
 - A. Provide blank covers for all junction boxes and other boxes that do not contain devices.

SECTION 16140
WIRING DEVICES

PART 1 GENERAL

- 1.1 Description
 - A. Section includes all switches, wall dimmers, receptacles, multi-outlet assembly device plates and decorative box covers.
- 1.2 References
 - A. National Electrical Manufacturers Association
 1. NEMA WD 1 - General Requirements for Wiring Devices
 2. NEMA WD 6 - Wiring Devices - Dimensional Requirements
- 1.3 Submittals
 - A. Product Data: Submit manufacturer's catalog information showing dimensions, colors and configuration.
- 1.4 Extra Materials
 - A. Furnish 2 of each style, size and finish wall plate.
- PART 2 MATERIALS
- 2.1 Color
 - A. Ivory except receptacles on emergency power shall be red unless noted otherwise.
- 2.2 Switches - Specification Grade
 - A. Federal Specification W_5 896, back and side wired, rated 120 volts, 20 amp. Provide single pole, double pole, keyed, 3_way, pilot light, locking type or as required. Pass & Seymour 20AC1_1, Bryant 4901_1, Hubbell 1221_1, Leviton 1221_1, Eagle 5252V, Arrow Hart 1991_1, or General Electric GE 5951_26.
- 2.3 Receptacles - Specification Grade
 - A. Federal Specification W_C_596F, duplex NEMA 5_20R configuration (20 amp, 120V) unless shown otherwise. Back and side wired. Pass & Seymour 5252_1, Hubbell 5252_1, Leviton 5252_1, Bryant 5252_1, Eagle 5252V, Arrow Hart 52521, or General Electric GEN 5252_2. (Provide 20 amp devices on dedicated 20 amp circuits.) Install receptacles with ground pin up.
- 2.6 Plates
 - A. Plates for recessed devices shall be high performance nylon wall plates, ivory in color. Plates for surface mounted devices shall be of pressed steel. Exterior device plates shall be weatherproof utilizing Bell #RCH1_DR or Perfect Line WGF100_C hinged and gasketed cover assemblies.
- PART 3 EXECUTION
- 3.1 Examination and Installation
 - A. Verify outlet boxes are installed at proper height, wall openings are neatly cut and completely covered by wall plates. Verify branch circuiting wiring is completed, tested and ready for connection to writing devices.
 - B. Install all devices plumb and level and with wall switches with "OFF" position down. Install receptacles with ground pin up.
- 3.2 Testing
 - A. Verify each receptacle device is energized.
 - B. Test each receptacle device for proper polarity.
 - C. Test each GFCI receptacle device for proper operation.

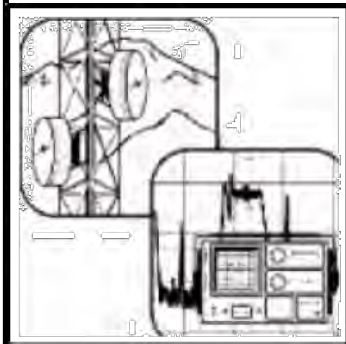
OUVERTURE BUTTE - DC911 PUBLIC SAFETY COMMUNICATIONS FACILITY

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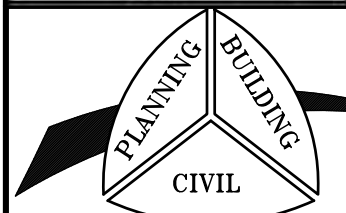
EXPIRES: 12/31/19

10/23/19
DATE



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C A ROWLES ENGINEERING
1345 NW WALL STREET, SUITE 200 BEND, OREGON 97703 541.585.2207

Developer:
DESCHUTES COUNTY 9-1-1 SERVICE DISTRICT
20355 POE SHOLES DR. #300
BEND, OREGON 97703

ELECTRICAL SPECIFICATIONS
222 NW SKYLINER SUMMIT LOOP
BEND, OREGON 97703

		NO.	DATE	REVISIONS		
Drafting	MAW				sht.	E6
Design	MAW					
Scale	AS SHOWN					
Date	05/14/19				of	
W.O. No.	18-718	1	10/23/19	UPDATE DRAWINGS PER BID CHANGES		

SECTION 16190
SEISMIC RESTRAINTS, CONNECTORS AND ATTACHMENTS

- PART 1 GENERAL**
- 1.1 The scope of work under this section includes all required seismic restraints and connectors. Seismic restraints and connectors shall include all anchorage to structures, clamps, rods channels, struts and accessories. Seismic restraints for electrical equipment shall sustain vertical and horizontal loads within the stress limitations specified in the International Building Code. Fixed floor mounted electrical equipment shall be anchored to the structure to resist displacement vertically and on both horizontal axis due to seismic motion. Suspended electrical equipment and associated raceways shall have rigid vertical hangers and be braced in both horizontal directions. Connections by raceways shall not be considered acceptable as equipment anchors.
- Anchorage of electrical equipment and associated raceways shall conform to the 2014 Oregon Structural Specialty Code, 2017 National Electrical Code, and all local amendments to these codes.
 - Refer to Structural Notes on Drawing S1 for Site Class and Seismic Design Category.
 - Total design lateral seismic force: In accordance with IBC. For anchorage of electrical equipment required for life safety systems, the importance factor shall be taken as 1.5. For electrical equipment that is not required for life safety systems, the importance factor shall be taken as 1.0.
 - Life safety systems shall include, but not be limited to the following:
 - Fire alarm system equipment and raceways.
 - The field installation shall be subject to observation by the Architect for general conformance to the approved construction documents and structural tests and special inspections by the Owner's approved agency.
- 1.2 Submittals
- Submit manufacturer's product data in conformance with the requirements of Section 16010, for all materials to be used for seismic restraints and attachments.
 - Submit manufacturer's certificate of compliance. The component manufacturer shall test or analyze the component and the component mounting system or anchorage for the design forces in IBC Chapter 16 for those components having a Component Importance Factor of 1.0 and 1.5 in accordance with Section 16 and these specifications. The basis of certification shall be by test on a shaking table, by three-dimensional shock tests, by an analytical method using dynamic characteristics and forces from IBC Chapter 16 or by more rigorous analysis. Manufacturer of equipment shall maintain an approved quality control program evidenced by permanently labeling each piece of equipment.
 - Drawing Preparation and Submittal: Submit shop drawings and calculations for anchorage of electrical equipment and raceway systems. Design calculations for anchor bolt selection shall follow submittal approval of equipment. Shop drawings shall indicate the routing of single raceways, trapeze raceway systems, and cable trays and cable runways requiring bracing. Indicate on the shop drawings the type and location of bracing to be used and the attachments to be provided. Typical and special details shall be included to identify bracing and attachment methods and connection configurations. Design calculations and anchor bolt selections shall be performed by a structural engineer licensed to practice in the State of OREGON. Design calculations shall not be required for raceways employing pre-approved seismic restraint systems specified herein.
 - Pre-approved seismic restraint details and their approval numbers shall be submitted along with the location in which they are used in the system.
 - Submit selection calculations for anchor bolts. Include ICBO Evaluation Reports for anchor bolts.

PART 2 REQUIREMENTS

- 2.1 Materials
- Manufacturer of Seismic Restraints and Accessories: A system of anchors, bracing and accessories may be provided. Superstrut Seismic Restraint System, Pre-Approval No. R00003, or approved equal.
 - Hanger Rods: Threaded hot rolled steel. Continuously threaded rods shall be electro-galvanized or cadmium-plated, and rods threaded at ends only shall be similarly finished or prime painted. Rods shall be 3/8" minimum diameter.
 - Channel strut type elements shall be No. 12 gage formed steel channels. 1_5/8" square, prime painted or chromate dip finish. Use fittings, brackets and hardware, same manufacturer as channel manufacturer: Superstrut, B-line, Kindorf, or approved equal.
 - Flexible metallic raceways shall be as specified in Section 16110 and shall be installed when raceways cross building seismic joints. Confirm seismic motion anticipated for each crossing with the Architect. Provide flexible raceway length suitable for anticipated motion, anchored at each side of the crossing.
 - Anchor bolts: Steel bolts to ASTM A307. Nuts shall conform to ASTM A194. Shall be drilled-in type, Hilti Kwick-Bolt or Molly Parabol, as described in ICBO evaluation report. Design values for shear and tension shall be in accordance with the ICBO Evaluation Report for the specific anchor.

PART 3 INSTALLATION

- 3.1 General
- All electrical equipment and associated raceways shall be braced or anchored to resist a lateral force acting in any direction in accordance with the IBC, NEC and all local amendments to these codes.
 - Individually hung conduits less than 2_1/2" inside diameter shall not require bracing.
 - Conduits hung by hangers so that the top of the conduit is 12" or less from the bottom of the support for the hanger shall not require bracing.
 - Anchorage to concrete shall be in accordance with the structural drawings. Drilling shall not cut reinforcing steel or pre-stressing tendons.

SECTION 16450
GROUNDING

PART 1 GENERAL

- 1.1 Description
- Grounding systems shall be provided for service neutral power ground and for equipment grounds and bonding as required by code.
- 1.2 References
- IEEE
 - IEEE 142 - Recommended practice for grounding of industrial and commercial power systems
 - IEEE 1100 - Recommended practice for powering and grounding electronic equipment
 - NETA ATS
 - NFPA 70

PART 2 PRODUCTS

- 2.1 Grounding Conductors and Connectors
- Copper only, sized per code, 600 volt insulated. Green tape acceptable for sizes larger than #6 AWG. Green insulated for size #8, 10, 12 AWG.
- 2.2 Ground Rods
- Harger EGR10LWG2T Electrolytic Ground rods or approved equivalent.
- 2.3 Ground Enhancing Material
- Harger Ultrafill for use with Harger ground rods
 - Sankosha San-Earth for use with buried ground conductors

PART 3 INSTALLATION

- 3.1 Grounding, general
- Provide all grounding for electrical systems and equipment as required by codes and as specified herein.
 - All branch circuits shall include a ground wire connected between the branch circuit panelboard ground bus and the wiring device ground terminal that the branch circuit serves.
- 3.2 Ground Rods
- Provide as shown and/or required. Connect the grounding conductor to each rod. Exothermic (CAD) welding shall be used on all ground rod connections.
 - Measure resistance to ground at each rod prior to connections and place in O&M Manual.
- 3.3 Size of Ground Wire
- As required by National Electric Code. Where ground wire is exposed on outside of building or to physical damage, protect with rigid non-ferrous schedule 80 PVC conduit as permitted by applicable code.

- 3.4 Ground Connection to Piping
- Metal internal piping shall be grounded, as a part of this contract.
 - Provide ground strap on incoming cold water main of each building and extend ground conductor to service neutral ground of services and to each service disconnect for each building.
 - Provide ground strap on all piping including hot and cold water. Extend ground conductor to service disconnect(s) ground bus. Bond all piping per electrical code.
 - Provide bonding jumper across all dielectric unions and meters. Bond gas piping.
- 3.5 Connection to the Power Ground Bus
- Furnish and install connections in accordance with the codes; including but not limited to:
 - Raceway system
 - Switchboard
 - Service neutral
 - "Separately derived service" (transformer or emergency power supply)
 - Electrically operated equipment and devices
 - Internal piping
 - Panelboard ground conductors
 - No device or equipment shall be connected for electrical service which has a neutral conductor connected to a grounding conductor or to the frame within the device or equipment.
- 3.6 Method of Connections
- Make all ground connections and ground cable splices by thermal welding or copper compression set type connectors U.L. listed for grounding purposes. Grounding lugs, where provided as standard manufacturer's items on equipment furnished, may be used.
- 3.7 Expansion Fittings
- In conduit runs requiring an expansion fitting, a bonding jumper shall be installed around the fitting to maintain continuous ground continuity.
- 3.8 Testing
- Inspect and test in accordance with NETA, ATS, except Section 4.
 - Grounding and bonding: Perform inspections and testing listed in NETA ATS, Section 7.13.
 - Perform ground resistance testing in accordance with IEEE 142.
 - Perform leakage current tests in accordance with NFPA 99.
 - Perform continuity testing in accordance with IEEE 142.
- 3.9 Receptacles
- Ground receptacles, with green insulated ground wire. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform re-test.

SECTION 16471
PANELBOARDS

PART 1 GENERAL

- 1.1 Provide panelboards, dead front type complete and fully operational. Conform with U.L. 67 and NEMA PB 1.1 current revisions.
- 1.2 Prepare and submit shop drawing submittals including front view, dimensions, and breaker sizes, quantity, layout and fault ratings.
- 1.3 References

- Institute of Electrical and Electronic Engineers:
 - IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
- National Electrical Manufacturers Association
 - NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches
 - NEMA FU 1 - Low Voltage Cartridge Fuses
 - NEMA ICS 2 - Industrial Control and Systems: Controllers, Contractors, and Overload Relays, rated not more than 2000 volts AC or 750 volts DC
 - NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices
 - NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 volts maximum)
 - NEMA PB 1 - Panelboards
 - NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards rated 600 volts or less
- International Electrical Testing Association
 - NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- National Fire Protection Association
 - NFPA 70 - National Electrical Code
- Underwriters Laboratories, Inc.
 - UL 67 - Safety for Panelboards
 - UL 1283 - Electromagnetic Interference Filters
 - UL 1449 - Transient Voltage Surge Suppressors

1.4 Provide attachments and bracing for panelboards conforming to the requirements of Section 16050.

PART 2 MATERIALS

- 2.1 Manufacturer
- Square D, Cutler-Hammer, Siemens, GE
- 2.2 Panelboards shall be rated at proper voltage and current for intended use with bus bars of copper or aluminum. Panels shall be single_phase_3_wire, 100 percent neutral and separate ground bus. Breakers shall be bolt_on 10,000 AIC minimum for 240 volt panelboards and common trip on multiple pole breakers. Breaker and panel AIC ratings shall be equal or exceed what is indicated on panel schedules. Series rated combinations of breakers are not allowed.
- 2.3 Panel Cover and Cabinets
- For flush or surface mounting as indicated on plans with key lock. Provide panelboard phenolic nameplate complete with panel name, serving voltage and source information. Provide typewritten circuit directory with complete load descriptions as typed on panel schedules. See Section 16999 for additional panel index requirements.

PART 3 METHODS

- 3.1 Installation
- Anchor cabinets to building structure with top of cabinet at +78". Coordinate with other trades to maintain code clearances. Notify Architect immediately of any conflicts that occur or are anticipated. Refer to architectural installation details for additional requirements associated with maintaining fire ratings and minimizing sound transmission.
 - Install panelboards plumb. Recessed panelboards shall be flushed with wall finishes.
 - Provide filler plates for unused spaces in panelboards.
 - Install panelboards in accordance with NEMA PB1.1. Ground bond panelboard enclosure per Section 16450. Connect equipment ground bars of panels in accordance with NFPA 70.
 - Provide attachments and bracing conforming to the requirements of Section 16050.
- 3.2 Testing and Inspection
- Inspect and test in accordance with NETA, ATS, except Section 4.
 - Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.
 - Perform switch inspections and tests listed in NETA ATS, Section 7.5
 - Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

SECTION 16476
DISCONNECT SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

- 1.1 Provide safety disconnects and fused switches where indicated for equipment and motor connections, and where otherwise required by the specifications.
- 1.2 Provide attachments and bracing for disconnect switches and circuit breakers conforming to the requirements of Section 16050.
- PART 2 MATERIALS**
- 2.1 Unfused Disconnects
- Heavy duty type, horsepower rated with interlocking cover. NEMA 1 rated, except exterior locations shall be NEMA 3R.
- 2.2 Fused Disconnects
- Same as above with fuse space and clips to accept only Class R fuses.
- 2.3 Circuit Breakers
- Molded case, UL 489 with AIR ratings equal or greater to the SCCR (AIC) ratings of the panelboards.
- 2.4 Nameplates
- Provide permanent nameplate labeling on all disconnects. Include load served, voltage, phase, horsepower, fuse size and type, as well as source panel and circuit.

PART 3 METHODS

- 3.1 Install disconnects where adequate working clearance is maintained. In ceiling spaces or other locations where clearance is limited the Contractor shall review installation with inspector prior to pulling wire to confirm acceptance. Disconnects may be attached to equipment housings only where specifically approved by the Local Code Authority.

SECTION 16999
PROJECT CLOSEOUT

PART 1 GENERAL

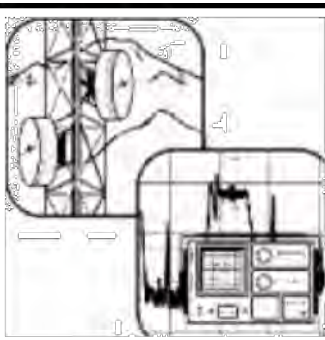
- 1.1 Perform project closeout procedures and provide all "as-built" shop drawings and record "as_built" electrical drawings.

PART 2 MATERIALS

- 2.1 Record Drawings
- Submit one reproducible copy of the construction as-built record drawings. Record drawings shall be incorporated in Autocad format only (no manual drafting on paper is acceptable).
- 2.2 O&M Manuals
- Prepare and submit per Section 16010.

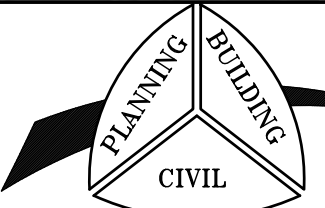
PART 3 PROCEDURES

- 3.1 Closeout Procedures: Perform the following:
- Perform all required tests and include test documentation in O&M Manuals.
 - Provide permanent nameplates on electrical equipment as required by the contract.
 - Provide as-built marked-up copies of all panel schedules showing actual "as-built" circuit descriptions and associated loads for each circuit. Include copy in O&M Manual.
 - Obtain final electrical inspection. Include copies in O&M Manual.
 - Prepare written one-year warranty and include in O&M Manuals.
 - Deliver O&M Manuals to Architect.
 - Deliver As-Built record drawings to Architect.
 - Provide instruction sessions for systems indicated in this specification.
 - Provide final clean-up in all electrical closets, electrical equipment and devices.
- 3.2 Final Acceptance
- To request final acceptance submit a copy of this specification page with each Closeout Procedure initialed and dated as complete, along with a copy of the final observation report punch list(s) with each item also initialed and dated as complete.



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10/23/19
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OVERTURE BUTTE - DC911 PUBLIC SAFETY COMMUNICATIONS FACILITY

GENERAL NOTES

GENERAL

1. All work shall be in strict compliance with the 2012 International Building Code, the 2014 Oregon Structural Specialty Code, and all other state and local regulations which may apply.
2. Design criteria:
 - a. Wind Load - 85 mph Exposure C
 - b. Seismic Design Category - D
 - c. Maximum soil bearing pressure = 1500 psf.
3. Roof Live Load = 25 psf per:
 - Snow Load Analysis For Oregon,
 - Published by S.E.A.O. 12/ 2007
 - Graph A-14
4. Site location: 222 NW SKYLINER SUMMIT LP., BEND OR. 97702
5. Owner: DESCHUTES COUNTY 911, 20555 POE SHOLES DR. SUITE #300 BEND OR. 97703
6. Occupancy class: U (EQUIPMENT SHELTER)

SITE WORK

1. Subbase for slab, grade beams and footings shall be undisturbed natural ground or well compacted granular material compacted to 95% of maximum dry density, ASTM D698. Provide compaction testing data.
2. Base material for the slab shall be a 4" layer of compacted 3/4 minus crushed rock, or approved equal compacted to 95% maximum dry density, ASTM D698.

BUILDING CODE ANALYSIS FIRE AND LIFE SAFETY

ANALYSIS BASED ON 2014 OSSC

CHAP.2 : FIRE SEPARATION DISTANCE: THE MEASURED DISTANCE FROM THE BUILDING FACE - '2. TO THE CENTERLINE OF A STREET, AN ALLEY OR PUBLIC WAY'

310, 312 : AREA OCCUPANCY: PROPOSED BUILDING (U)

CHAP 5 : BUILDING TYPE: V-B
 1. 503 : BUILDING: (U OCC)
 AREA ALLOWED: 5,500 SF, 1 STORY
 DESIGNED: 195 SF., 1 STORY

504.2 : BUILDING IS NOT SPRINKLED.

1.602 : TYPE V-B CONST.
 DESIGN: EAST WALL TO PROPERTY LINE = 986' +/-
 DESIGN: NORTH WALL TO PROPERTY LINE = 764' +/-
 DESIGN: WEST WALL TO PROPERTY LINE = 200' +/-
 DESIGN: SOUTH WALL TO PROPERTY LINE = 536' +/-

1. 705.8 : WALLS ARE NOT REQUIRED TO BE FIRE RESISTANCE RATED

705.8.1. EXC.2 : NORTH WALLS
 NOT REQ'D TO BE FIRE RATED CONST. NO RESTRICTIONS ON OPENINGS.

WEST WALLS
 NOT REQ'D TO BE FIRE RATED CONST. NO RESTRICTIONS ON OPENINGS.

SOUTH WALLS
 NOT REQ'D TO BE FIRE RATED CONST. NO RESTRICTIONS ON OPENINGS.

EAST WALLS
 NOT REQ'D TO BE FIRE RATED CONST. NO RESTRICTIONS ON OPENINGS.

1. 1004.1.2 : (N) BUILDING = 195 SF / 300. = *1 OCC
 * - SPACE IS NOT MEANT TO BE OCCUPIED BESIDES OCCASIONAL REPAIR AND MAINTENANCE

1005.3.2 : MEANS OF EGRESS SIZE = 1 OCC x 0.2 = 0.2"
 (1) 36" WIDE EXIT DOOR PROVIDED

1103.2.5 : BUILDING HAS A 'U' OCCUPANCY. IT IS NOT AN AGRICULTURAL BUILDING NOR IS IT A PRIVATE GARAGE OR CARPORT. THEREFORE IT IS EXEMPT FROM THE ACCESSIBILITY REQUIREMENTS OF CHAPTER 11

1203.1 : BUILDING IS BEING EQUIPPED WITH MECHANICAL VENTILATION IN ACCORDANCE WITH THE MECHANICAL CODE

1204 : THE PRIMARY PURPOSE OF THE BUILDING IS NOT FOR HUMAN OCCUPANCY OR COMFORT.

1.1809.7 : BUILDING STORIES: 1, FTG WIDTH = 12" MIN, THICKNESS OF FTG = 6" MIN.
 DESIGNED: 1 STORY, 12" WD x 24" THK FTG

1907.1 : CONCRETE SLAB ON GRADE IS 4" THICK W/ 6 MIL VAPOR BARRIER

1. 2308.2.1 : SEISMIC DESIGN CATEGORY: (D) BUILDING IS ONE STORY IN HEIGHT.

2308.2.2 : MAX FLOOR-TO-FLOOR HEIGHT: 11'-6" MIN, DESIGNED: 10'-9" ±
 MAX WALL HEIGHT: 10'-0" MIN, DESIGNED: 8'-0"

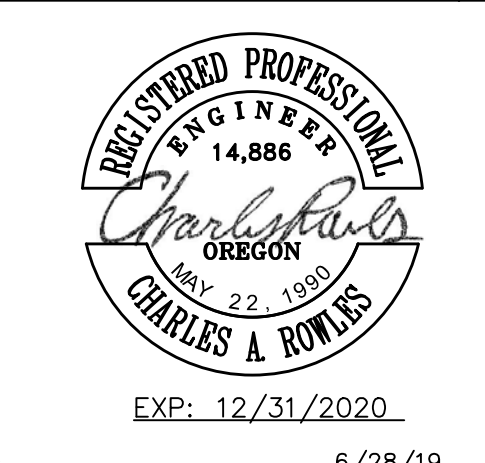
2308.2.4 : V₅₀ = 85 mph < 100 mph = O.K.

2308.2.5 : RAFTER SPAN = 6'-6" < 40'-0" = O.K.

2308.2.6 : BUILDING IS RISK CATEGORY 1

2308.3.1 : REQUIREMENTS FOR SILL PLATES: AB SIZE = 1/2" Ø MIN, SPACING = 6'-0" O.C. MAX, EMBED = 7" MIN.
 DESIGNED: AB SIZE = 1/2" Ø, SPACING = 48" O.C., EMBED = 7"
 ADDITIONALLY ANCHOR BOLTS ARE TO BE SPACED MORE THAN 4" & LESS THAN 12" FROM END OF EACH PIECE OF SILL PLATE

1.2308.5 : WALL FRAMING REQUIRED:
 ALLOWABLE UNSUPPORTED STUD HEIGHT: BEARING WALLS = 10'-0", NON-BEARING = 20'-0"
 MAX SPACING FOR LOAD BEARING WALLS: 24" O.C.
 MAX SPACING FOR NON-LOAD BEARING WALLS: 24" O.C.



NO.	DATE	REVISIONS	sh.
1	6/20/2019	ADDED PRESCRIPTIVE NOTES	AO.1

DATE: 6/28/19

SHELTER ELEV5.DWG 18-718 5-10-19 DC911 - PUBLIC SAFETY COMMUNICATIONS FACILITY

OVERTURF BUTTE SHELTER SPECIFICATIONS

GENERAL NOTES

- All construction shall conform to 2014 Oregon Structural Specialty Code, 2017 Oregon Energy Efficiency Code, 2014 Oregon Mechanical Specialty Code, 2017 Oregon Electrical Specialty Code, and any other local governing codes and ordinances.
- All materials, fixtures and equipment shall comply with 2014 Oregon Structural Specialty code where applicable.
- The plans indicate the general extent of demolition and new construction necessary for the work, but are not intended to be all-inclusive. All demolition and all new work necessary to allow for a finished job in accordance with the intention of the drawings is included regardless of whether shown on the drawings or mentioned in the notes.
- Any errors, omissions or conflicts found in the various parts of the construction documents shall be brought to the attention of the Owner and Designer for clarification before proceeding with the work.
- The General Contractor shall maintain a current and complete set of construction documents on the job site during all phases of construction for use of all trades and shall provide all subcontractors with current construction documents as required.
- The General Contractor shall verify and assume responsibility for all dimensions and site conditions. The General Contractor shall inspect the existing premises and take note of existing conditions prior to submitting prices. No claim shall be allowed for difficulties encountered which could have reasonably been inferred from such an examination.
- Written dimensions take precedence.
- All dimensions when shown in plan are to face of concrete or stud (F.O.C.) unless otherwise noted.
- All dimensions are to top of plate or top of plywood subfloor in section or elevation unless otherwise noted.
- Coordinate all work with existing conditions, including but not limited to: irrigation pipes, electrical conduit, water lines, drainage lines, etc.
- Protect all existing site conditions to remain including trees and shrubs, paving, fences, etc.
- Details shown are typical. Similar details apply in similar conditions.
- Where locations of windows and doors are not dimensioned, they shall be centered in the wall or placed two stud widths from adjacent wall as indicated in the drawings.
- All changes in floor materials occur at centerline of door or framed openings unless otherwise indicated in the drawings.
- Install all equipment and materials per manufacturer's recommendations.
- Verify clearances for flues, vents, chases, soffits, fixtures, etc., before any construction, ordering of, or installation of any item of work.
- Sealant, caulking and flashing, etc. locations shown on drawings are not intended to be inclusive. Follow manufacturer's installation recommendations and standard industry and building practices.
- The General Contractor shall remove all rubbish and waste materials on a regular basis of all sub-contractors and trades, and shall exercise a strict control over job cleaning to prevent any dirt, debris or dust from affecting, in any way, finished areas in or outside of the job site.

DIVISION 1 GENERAL REQUIREMENTS

- 01100 Scope of Work: The work includes site preparation, concrete, framing, exterior finish, interior finish, and mechanical as shown on the drawings and as required for the construction of a equipment shelter/storage building.
- 01300 Submittals: Subcontractors and suppliers shall provide such product data, samples, and shop drawings as required for proper coordination of the work.
- 01400 Quality Control: All work shall conform to the requirements of the latest edition of the governing local code and the strictest industry standards applicable to each portion of the work. Structural design shall conform to the requirements for the Seismic Zone as noted in the Structural General Notes. An independent testing laboratory shall perform testing and inspections required by the governing jurisdiction. Concrete testing shall be provided by the general contractor. Special inspections, if required shall be provided by the Owner.
- 01500 Temporary Facility: Contractor to provide temporary, secure facilities as needed and agreed upon with owner representative for construction activities through the completion of the construction works.
- 01600 Schedules: Work progress and jobsite access schedule based on requirements for all involved trades shall be prepared prior to start of work and updated bi-weekly as appropriate. Notification of after hours access or access beyond the planned schedule shall be coordinated with the General Contractor and as discussed with the owner representative.
- 01700 Record Documents: Maintain at the site a complete set of permit documents for the sole purpose of recording "As-built" information which shall include revisions to the scope of work.
- 01800 Warranties and Guarantees: Provide written warranties and guarantees for all portions of the work binding the contractor, the installers and the product suppliers/manufacturers to make corrections and adjustment to any work not performing as intended for a minimum period of one (1) year following the date of Substantial Completion, and for such additional time as specified below in each section.

DIVISION 2 SITE WORK

- 02200 Excavation, Fill and Related Earthwork: Removal of shrubbery and trees by contractor as per civil drawings. The requirements of the soils investigation report are made a part of these specifications by reference and shall govern in the event of conflict between or within the documents. All conflicts of documents shall be brought to the attention of the engineer of record. Excavate for foundations and utility trenches as shown on the drawings. Existing material excavated from the site may be used for backfill or fill as allowed by the soils report. Imported fill shall be clean, well graded gravel and compacted to 95% of maximum dry density based on ASTM Test Method D1557.
- 02900 Contractor to provide good faith effort to protect natural landscape areas around project site, and outside of project scope. When possible, natural landscape areas substantially visually disturbed to be to be brought back to original condition.

DIVISION 3 CONCRETE

- 03100 Concrete Formwork: Construct, erect and dismantle formwork in accord with American Concrete Institute documents ACI 301 and ACI 347.
- 03200 Concrete Reinforcement: Fabricate and install reinforcing in accord with American Concrete Institute documents ACI 301 and ACI 315, American Welding Society AWS D1.4, and the Concrete Reinforcing Steel Institute manual of Standard Practice.
- Reinforcing Bars: ASTM A615, Grade 60
 - Welded Steel Wire Fabric: ASTM A185, plain type, mats only.
 - Tie Wire: 16 ga annealed type.
 - Chairs, bolsters, bar supports, spacers of size and shape required for proper support during placement of concrete.
 - Concrete cover over reinforcing bars, unless noted otherwise, shall be 3" for concrete cast against and permanently exposed to earth, and 1-1/2" for other concrete with #5 bars and smaller bars.
 - See drawings for typical bar and fabric layout requirements.
- 03300 Cast-In-Place Concrete: Place and finish premixed concrete in accordance with American Concrete Institute document ACI 301, ACI 318 and as shown.
- See A1.1 for concrete and reinforcing notes.
- Footings to be placed on level, undisturbed soil/rock or approved structural fill.
- Design Mixes:
- Foundation Walls and Footings: 3,000 PSI, 28 day compressive strength, w/c ratio .50, maximum slump: 4".
- Slabs on Grade: 3,000 psi min., 28 day compressive strength, w/c ratio 0.45, air-entrained 6% ±1%, maximum slump: 3"
- Exterior Slab on Grade/Sidewalk: Concrete exposed to weather: 3,500 psi min., 28 day compressive strength, w/c ratio 0.45, air-entrained 7% minimum - 8.5% maximum. Maximum slump 3.5" Water reducing agent, 4 oz. per 100lb cement.
- Submit laboratory test reports for concrete materials and mix design test.
- Test concrete in accordance with ASTM C172 and should include:
- Slump: ASTM C143
Air Content: ASTM C173
Temperature: ASTM C1064
Compressive Strength: ASTM C39
- Materials:
- Aggregate: ASTM C33
 - Ready Mixed Concrete: ASTM C94 - strength, slump and other characteristics as shown on the drawings.
 - Portland Cement: ASTM C150
 - Air-entraining Admixtures for Concrete: ASTM C260 - 4% to 6% maximum air content at placement for concrete having and exterior exposure.
 - Chemical Admixtures for Concrete: ASTM 494.
 - Curing Compound: Sonneborn "Kure-Seal" Hardener. Sonneborn "Harcol". At interior slabs with no specified finish, apply second coat of specified curing & sealing compound after 28 days.
 - Moisture Retaining Cover: ASTM C171 - waterproof, non-staining paper; polyethylene film or polyethylene-coated burlap.
 - Vapor retarder: 6 mil black polyethylene between base course & slab
 - Expansion Joint: Asphalt impregnated fiber.
 - Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- Finishing:
- Interior, concealed slab: interior slab to receive trowelled smooth finish
- Exterior, fully exposed slab: exterior slabs to receive broom finish. Slope to drain, 0 < X < 2% Chamfer external corners on exposed exterior concrete 3/4" except where flush walls are detailed to abut and where surfaces are indicated to be otherwise finished.

DIVISION 5 METAL

- 05000 Scope of Work: The work includes site preparation, concrete, framing, exterior finish, interior finish, and mechanical as shown on the drawings and as required for the construction of a equipment shelter/storage building.
- 05050 Anchor Bolts: ASTM F 1554, non-headed type unless otherwise indicated.
- 05300 Cable Raceway metal framing: Reference Electrical Specs
- DIVISION 6 WOOD AND PLASTIC
- 06100 See Drawings for requirements.
- Rough Carpentry:
- Sill Plates/ Wood in contact with Concrete: Pressure/Preservative-treated #2 Douglas Fir/Larch dimensional lumber
- Framing: #2 Douglas Fir/Larch dimensional lumber
- Walls & Roof Sheathing: APA Rated Plywood.
- Roof: Sheathing with conventional nailing, 8d at 6" o.c. supported edges (edge nailing), 12" o.c. at intermediate support. 4" o.c. at diaphragm boundaries.
- Wall: 8d at 6" o.c. panel edges, 8d at 12" field, blocking is required at all panel edges.

Fire stops in wall.
Provide wood backing, furring, stripping, or blocking required for installation and attachment of work of all other trades.

DIVISION 7 MOISTURE AND THERMAL PROTECTION

- 0700 All openings to be caulked, sealed or weatherstripped.
- 07200 Thermal Insulation:
- Wall Insulation: R-21 minimum batt insulation or equal
- Attic Insulation: R-38 minimum rigid insulation between rafters
- Provide faced insulation or Class I or II vapor retarder at warm/inside face of insulation. All tears and joints in insulation to be sealed with tape.
- 07460 Siding: Provide Hardiplank lap siding. Follow manufacturer requirements, preparation, and installation instructions. Provide building wrap/underlayment.
- 07600 Sheet Metal Roofing: Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation.
- Furnish and install a standing seam metal roof system over framed and sheathed substrate (furnished under Section 06100 above). Provide product submittals for approval by Owner. Install all battens, clips, underlayment membranes/roofing felt and flashings required for a complete installation according to manufacturer instructions.
- Sheet Metal Flashings, Counter-flashings and Trims: Provide pre-finished 24 gauge (.05 mm) Kynar (or equal) pre-finished steel.
- Fasteners: Same metal as flashing/ sheet metal or other non-corrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, non-migrating sealant.
- Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessories units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.
- Comply with manufacturer's installation instructions and recommendations and with SMCNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
- 07900 Joint Sealant: Install at exterior openings and joints, expansion joints in concrete slab and where specifically indicated on drawing. Sealants shall be urethane, silicone or polysulfide; select products that are appropriate for each condition and that are recommended by the manufacturer. Install according to manufacturer's written instructions, including surface preparation, priming, backers and tooling. Manufacturer shall certify that each material is compatible with substrate. Products by DOW or GE or equal.
- All openings to be caulked, sealed or weatherstripped.
Caulking and Sealants: Use primers as required by manufacturer, backing rods, or tape as recommended by manufacturer.
- DIVISION 8 OPENINGS
- 08100 Metal Doors and Frames: Provide commercial grade 16 gauge formed sheet steel door and frame. Prefinished. Door and frame prepared for hardware. Provide "High Security" grade hinges, Schlage "AL Saturn" series handles, Schlage "LV9480P" lock with a "Primus" high security cylinder and a "L582-363 EZ Turn" Latch. Exterior Door U-Value: U-.70 maximum, .30 cfm/ft2 infiltration maximum.
- 08900 Louvers/Vents: Provide metal louvers/vents/port covers as noted on the plans.
- DIVISION 9 FINISHES
- 09600 Shed Concrete Slab: Finish with anti-static concrete sealer - "Electraseal ESD Concrete sealer" by United SCP or approved equal.
- 09900 Painting: Prime and paint interior walls, ceiling, hardi plank siding, trim soffit and eaves. Coordinate colors with owner, provide paint chips for approval.
- Siding & trim: Medium/light Brown
Roof: Forest Green,
Metal Door & frame: Medium/light brown
Louvers/Vents/Accessories: to match primary wall/roof color

DIVISION 10 SPECIALTIES

- 10520 Fire Suppression: Fire Extinguisher as noted.

DIVISION 13 SPECIALTIES

- 13850 Alarm System: Provide alarm system as noted, indicate intrusion, and smoke.

DIVISION 15 MECHANICAL

- 15000 HVAC: Mechanical per listings on plan. Install per manufacturers instructions, provide thermostat.

DIVISION 16 ELECTRICAL - Reference Electrical Plans, and plan notes for requirements, lighting, alarms, etc.

SHELTER ELEV5.DWG 18-718 5-10-19 DC011 - PUBLIC SAFETY COMMUNICATIONS FACILITY



EXP: 12/31/2020

5-10-19
DATE

C A ROWLES ENGINEERING & DESIGN
1345 NW WALL ST. #200 BEND, OREGON 97703 541.585.2207

Developer:
DESCHUTES COUNTY 9-1-1 SERVICE DISTRICT
20555 POE SHOLES DR. #300
BEND, OREGON 97703

Title:
SHELTER SPECIFICATIONS
222 NW SKYLINER SUMMIT LOOP
BEND, OR 97703

NO.	DATE	REVISIONS	sh.	AI.O
Drafting	18			
Design	18			
Scale				
Date	5-10-19			
W.O. No.	18-718			

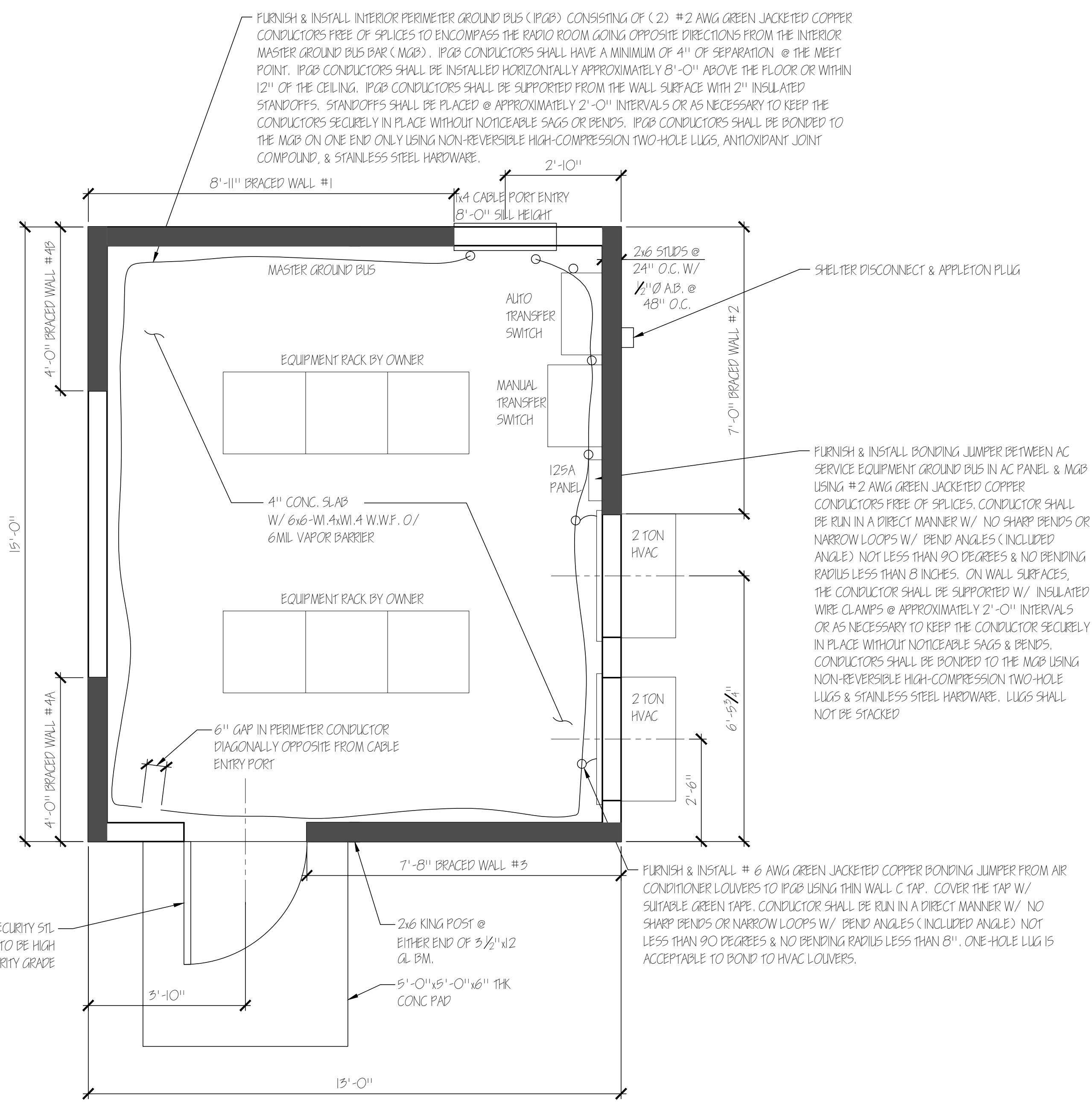
BRACED WALLS:
 - 3/8" STRUCTURAL WALL PANEL (OSB OR 4-PLY OR ABOVE PLYWOOD) ON ONE SIDE
 - PANEL JOINTS TO LAND ON STUDS
 - NAILING: 6d @ 6" O.C. - EDGE & 12" O.C. - FIELD

PER TABLE 2308.6.1:
 SEISMIC CATEGORY: D
 $S_{ps} = 0.329 < 0.50$
 BRACED WALL @ EA. END OR WITHIN 8'-0" OF END
 BRACED WALL MIN OF 48" LONG SPACED AT 25'-0" O.C. OR LESS, (MIN. 21% OF WALL LENGTH)

BRACED WALL #1 - 8'-11" > 21% OF 15'-0"
 BRACED WALL #2 - 7'-0" > 21% OF 15'-0"
 BRACED WALL #3 - 7'-8" > 21% OF 15'-0"
 BRACED WALLS #4A+ #4B - 8'-0" > 21% OF 15'-0"

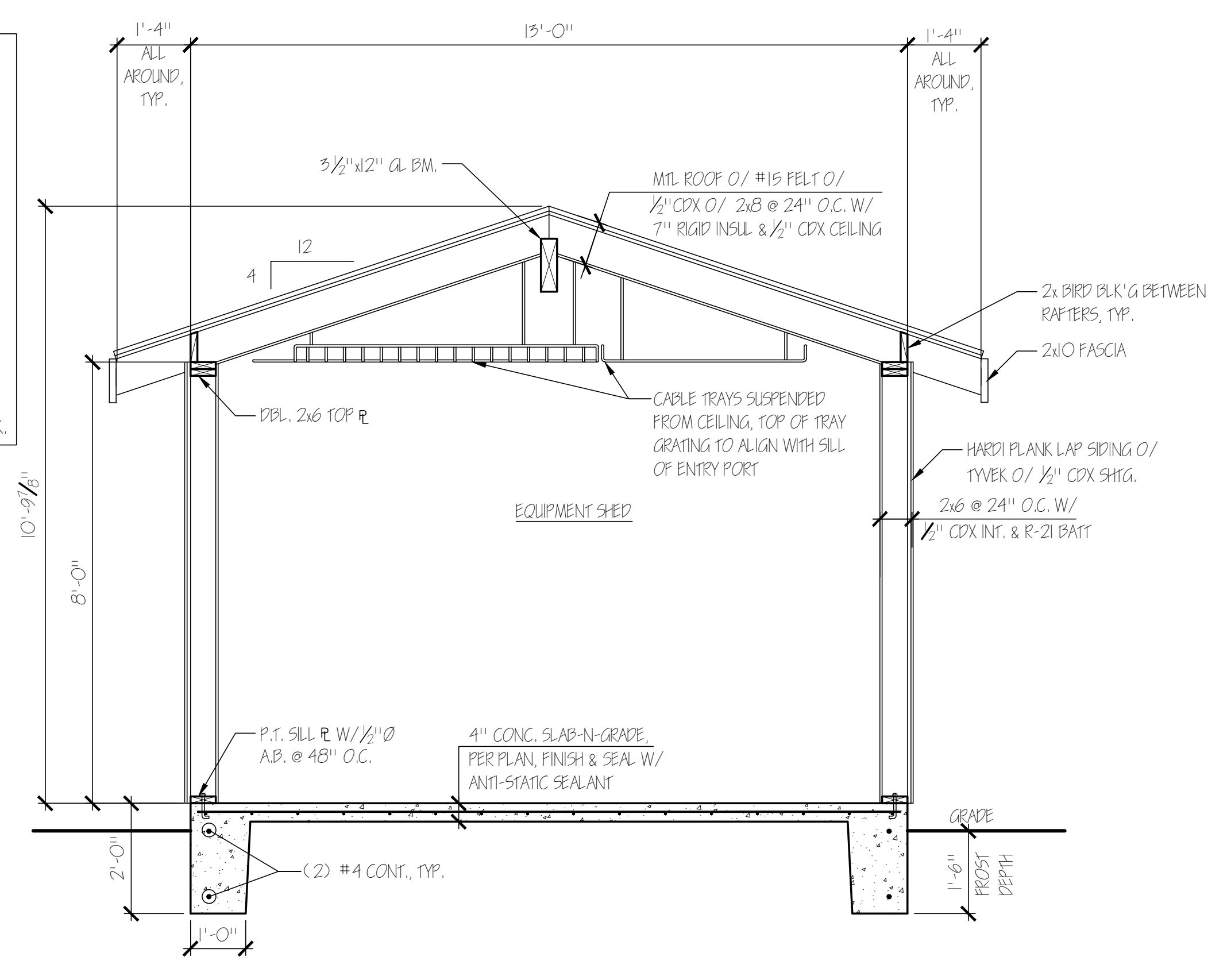
NOTES:
 - FURNISH & INSTALL #6 AWG GREEN JACKETED COPPER BONDING CONDUCTORS FROM METAL DOOR FRAMES & GROUND STRAP FOR METAL DOORS TO IPGB USING THIN WALL C-TAP. COVER SPlice WITH SUITABLE GREEN TAPE.
 - FURNISH & INSTALL GROUND BUS TRIBUTARIES CONSISTING OF #2 AWG GREEN JACKETED COPPER CONDUCTORS. THE LONGITUDINAL TRIBUTARY SHALL BE FREE OF SPLICES OVER ITS LENGTH. TRANSVERSE TRIBUTARIES SHALL BE BONDED TO THE MAIN TRIBUTARY USING THIN WALL C TAPS. CONDUCTOR SHALL BE RUN IN A DIRECT MANNER W/ NO SHARP BENDS OR NARROW LOOPS W/ BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES & NO BENDING RADIUS LESS THAN 8".

HEADERS: ALL HEADERS ARE TO BE MIN 6x8 NOM.



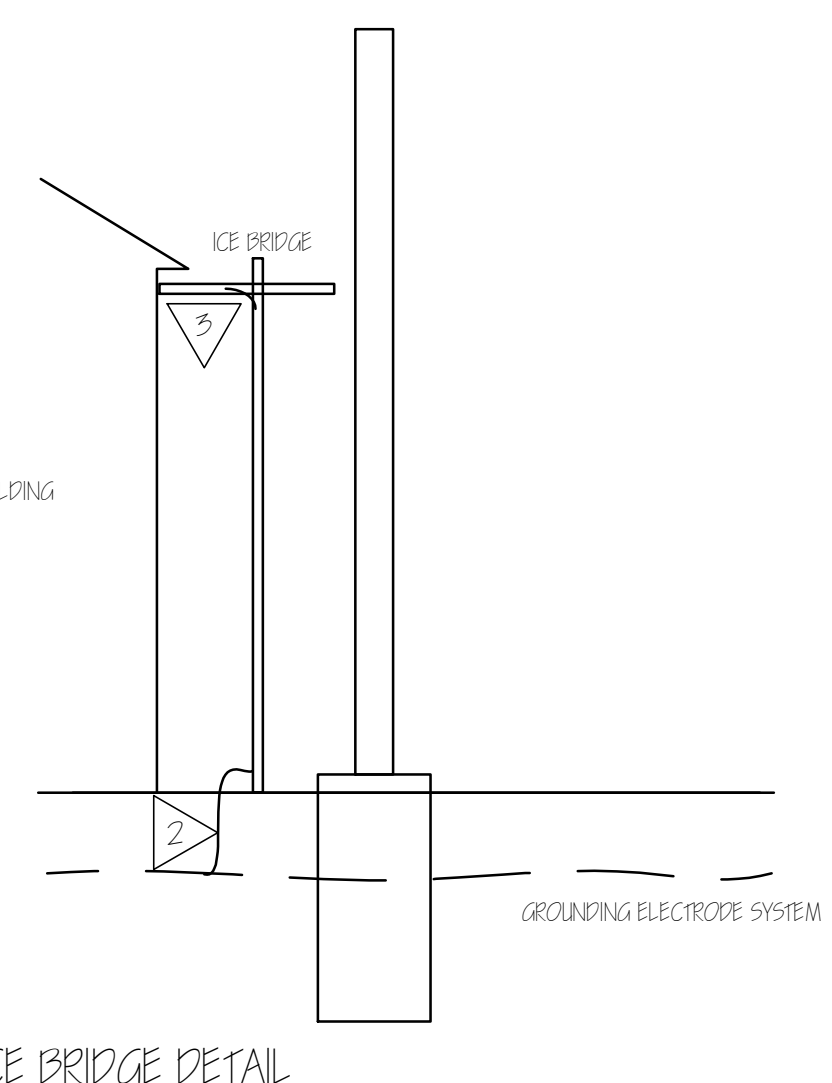
SHELTER CRITERIA
 RISK CATEGORY: I
 $V_{ult} = 100\text{mph}$
 $V_{50} = 85\text{mph}$
 $SFC = D$

NOTE:
 PER TABLE 2308.7.2(6) IN THE 2014 OCSG:
 SNOW LOAD: 50 psf
 DEAD LOAD: 10 psf
 $L/\Delta = 240$
 $2x8$ DF/L #2 RAFTERS SPAN = 14'3"
 PROPOSED SPAN = 6'-6" = O.K.
 GULAM BEAM:
 SNOW LOAD: 50 psf
 DEAD LOAD: 10 psf
 SPAN: 15'-0"
 SPACING: 6'-6"
 $6\text{Opsf} \times 6'-6" = 390\text{plf}$
 $3\frac{1}{2}" \times 12" \text{ GL BM. OR } 5\frac{1}{2}" \times 10\frac{1}{2}" \text{ GL BM.} = \text{O.K.}$



EQUIPMENT SHELTER FLOOR PLAN

EQUIPMENT SHELTER BUILDING SECTION



- FLAG NOTES:**
- CONTRACTOR SHALL FURNISH AND INSTALL AN ICE BRIDGE AS SHOWN. THE ICE BRIDGE SUPPORT POLE MAY BE DIRECT-BURY OR BE EMBEDDED IN CONCRETE AS SITE CONDITIONS DICTATE. ATTACH THE ICE BRIDGE TO THE SHELTER WITH AN APPROPRIATE WALL BRACKET. DO NOT ATTACH THE ICE BRIDGE TO THE ANTENNA POLE.
 - FURNISH AND INSTALL #2 AWG BARE COPPER BONDING JUMPER IN FLEXIBLE NON-METALLIC CONDUIT FROM ICE BRIDGE SUPPORT POST (DIRECT BURIAL) TO UNDERGROUND GROUNDING ELECTRODE SYSTEM. JUMPER SHALL BE BONDED WITH EXOTHERMIC WELDS. BONDING JUMPER SHALL BE RUN IN A DIRECT MANNER WITH NO SHARP BENDS OR NARROW LOOPS WITH BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES AND NO BENDING RADIUS LESS THAN 8 INCHES.
 - FURNISH AND INSTALL #6 AWG GREEN JACKETED COPPER BONDING JUMPER FROM ICE BRIDGE TO SUPPORT POST. JUMPER SHALL BE BONDED TO SUPPORT POST WITH EXOTHERMIC WELD. JUMPER SHALL BE BONDED TO ICE BRIDGE USING EXOTHERMIC WELD OR NON-REVERSIBLE HIGH-COMPRESSION TWO-HOLE LUGS AND STAINLESS STEEL HARDWARE. BONDING JUMPER SHALL BE RUN IN A DIRECT MANNER WITH NO SHARP BENDS OR NARROW LOOPS WITH BEND ANGLES (INCLUDED ANGLE) NOT LESS THAN 90 DEGREES AND NO BENDING RADIUS LESS THAN 8 INCHES.

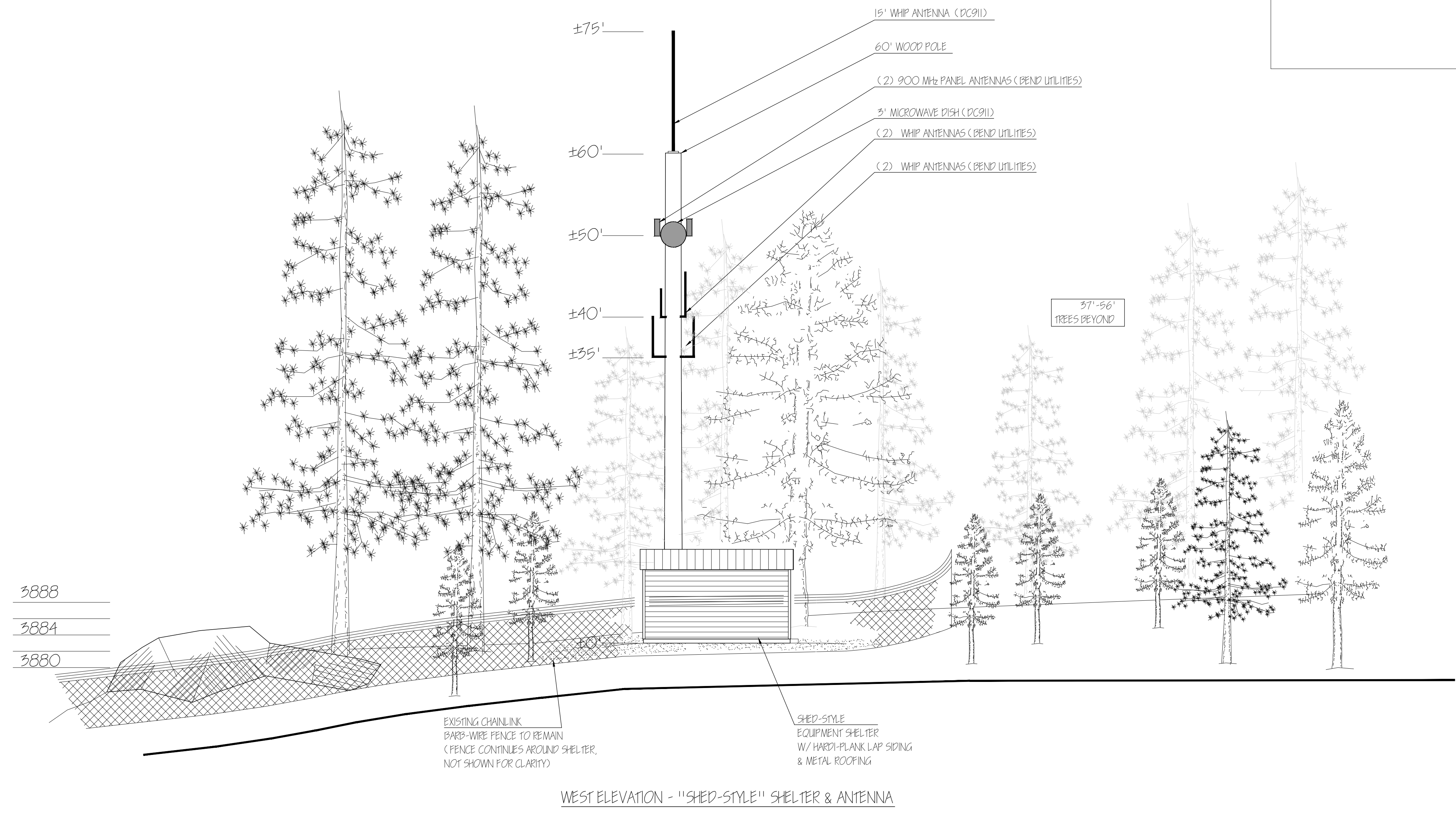
- A. FINISHES**
- * EXTERIOR WALLS: HARDI-PLANK LAP SIDING (BROWN), O/ 2x6 STUD WALL
 - * INTERIOR WALLS: 1/2" CDX O/ 2x6 STUD WALL
 - * INSULATION: R-21 BATT
 - * TELCO BOARD: (1) 4x4 TELCO TERMINATION BOARD, WHITE
 - * FLOOR: SMOOTH TROWEL FINISH
 - * ROOFING: HIDDEN FASTENER STEEL ROOFING (FOREST GREEN) OVER #15 FELT OVER 1/2" PLY OVER 2x RAFTERS
- B. DOORS & OPENINGS**
- * DOOR: (1) 3'-0" x 7'-0" 18 GA STL DOOR W/ 16 GA STL FRAME
 - * LOCK: HIGH SECURITY LOCKSET W/ CHANGEABLE CORE
 - * DOOR HARDWARE: NRP STAINLESS STL HINGES, CLOSURE, KICK PLATE, HOLDER, WEATHER STRIP, ALUMINUM THRESHOLD
 - * DOOR HOOD: DOOR DRIP CAP-2-1/2" WD.
 - * OPENINGS: (4) SIZE PER "2100-58(D) Part IIM.pdf"
 - * COAX PORT: (1) HOLE, 4x4, 4" WAVEGUIDE PORT

- C. POWER**
- * POWER SERVICE: 200A 1PH 120/240V
 - * GENERATOR RECEPTACLE: (1) 200A GEN RECEPTACLE
 - * MANUAL TRANSFER SWITCH: (1) 200A MANUAL TRANSFER SWITCH
 - * MAIN DISTRIBUTION PANEL: (1) 200A 1PH, 40 SPACE DISTRIBUTION PANEL
 - * SURGE SUPPRESSION: (1) TVSS 40 peak amp
 - * CONVENIENCE OUTLETS: (5) 120V/20A DUPLEX OUTLETS
 - * EXTERIOR GFI OUTLETS: (1) 120V/20A OUTLETS
- D. ENVIRONMENTAL SYSTEM**
- * HVAC: (2) 3 TON 1PH HVAC UNIT W/ 5kw HEATER NO ECONOMIZER
 - * CONTROLS: (1) LEAD LAG CONTROLLER
 - * THERMOSTAT: (1) THERMOSTAT
- E. ALARMS**
- * ALARMS: (1) 25 PAIR ALARM TERMINAL BOX W/ INTRUSION, SMOKE, POWER FAILURE & HIGH/LOW TEMP.

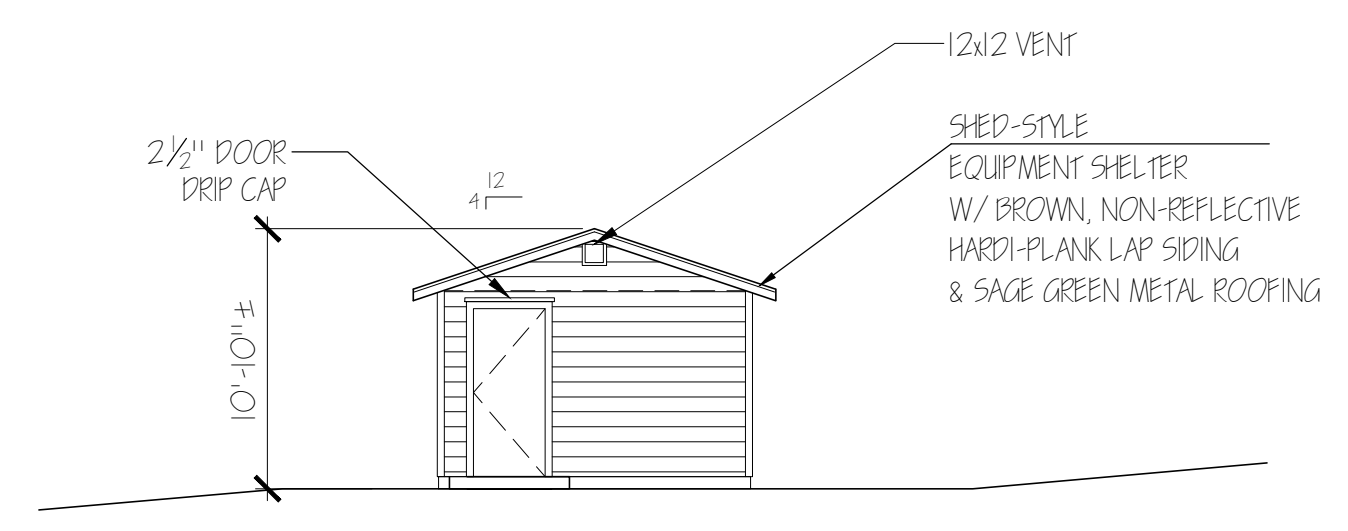
- F. LIGHTING**
- * INTERIOR: (6) 4' FLUORESCENT LIGHTS W/ ELECT. BALLASTS
 - * EXTERIOR: (1) 70W HPS W/ PHOTOCELL
 - * EMERGENCY: (1) EMERGENCY FIXTURE W/ DUAL FLOOD LIGHTS
 - * SWITCHES: (1) 20 amp LIGHT SWITCHES
 - * TIMER: NONE REQUESTED
- G. CABLE LADDER**
- * CABLE LADDER: (12) LINEAL FEET OF 24" WIDE TUBULAR CABLE LADDER, ZINC H. GROUNDING
 - * GROUND BAR: (1) 1/4"x4"x20" GROUND BAR W/ INSULATORS & CAP WELDED #2 SOLID PIGTAIL
 - * HALO GROUNDING: BY OTHERS 1. ADDITIONAL ITEMS
 - * SMOKE DETECTOR: (1) SMOKE DETECTOR
 - * FIRE EXTINGUISHER: (1) 5lb CO2 FIRE EXTINGUISHER
 - * TIE DOWN KIT: (1) SET INCLUDES BRACKETS & BOLTS, SHIPPED LOOSE
 - * OTHER: UNISTRUT BRACING FOR RACKING



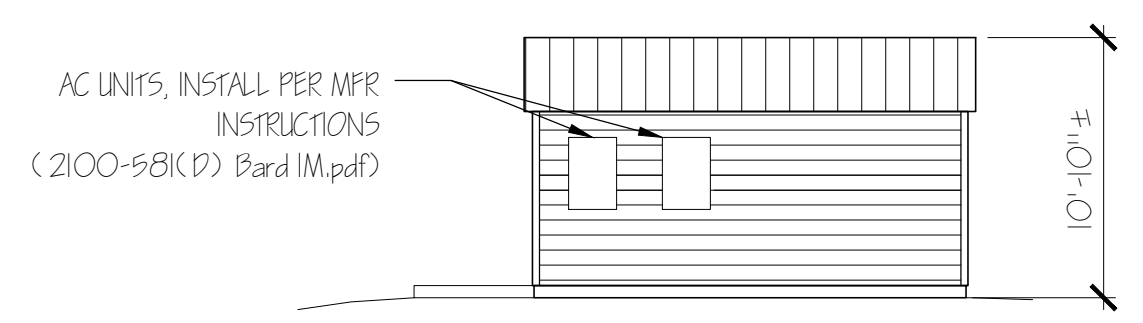
NO.	DATE	REVISIONS	sh.
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Design	BR		
Scale	1/2" = 1'-0"		
Date	5-10-19		
T.O. No.	18-718		



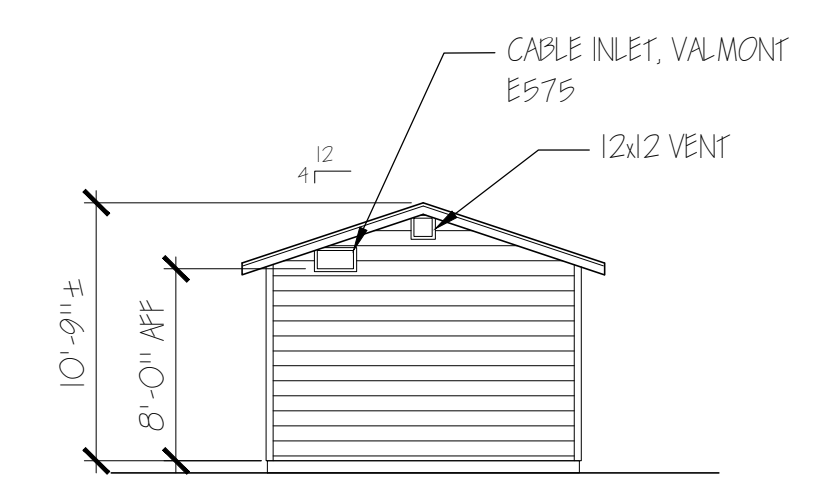
WEST ELEVATION - "SHED-STYLE" SHELTER & ANTENNA



SOUTH ELEVATION - "SHED-STYLE" SHELTER



EAST ELEVATION - "SHED-STYLE" SHELTER



NORTH ELEVATION - "SHED-STYLE" SHELTER



		NO.	DATE	REVISIONS	DATE
Drafting	BR				
Design	BR				
Scale	1/8" = 1'-0"				
Date	5-10-19				
W.O. No.	18-718				

sh. **A3.1**
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