

**ADDENDUM NO. 2****2308.01 / LAMOINE STATE PARK / BGS 3519**

Lewis + Malm Architecture

10OCT2024

This Addendum forms a part of the contract documents. It modifies them as follows:

DISCIPLINES: Civil, Structural, Architecture, Mechanical, Electrical, Plumbing

CLARIFICATIONS:

BID FORM The Owner intends to award only one GC with a Construction Contract.

REVISED CONTRACTOR BID FORM included in this Addendum.

SUB-PROJECTS The sub-projects will not be awarded to separate GCs.

BASE BID There is only one Base Bid, as indicated in the Contract Documents.

BUDGET The Owner has not released a project budget.

SCHEDULE Construction can start upon signature of a BGS conform Owner/General Contractor agreement with all required attachments, as indicated in the Contract Documents.

FUNDING

- a. Funding to complete all listed projects indicated in the contract documents is not fully confirmed at this time and will be determined based on the bid results.
- b. Funding for Sub-Projects: SERIES 100: Barn Renovations and SERIES 200: DMR OFFICE Renovations is almost guaranteed.
- c. Funding for SERIES 500 Gatehouse Building & Gate and SERIES 600 Pole Barn may or may not be awarded under this bid.

REFURBISH In Series 100, DWGs A103 & A104 the term "Refurbish" appears with regard to the three (3) existing sliding barn doors. The design intent is to repair/replace any damaged wood at door frames and/or panels, scrape, prime and paint w/minimum two (2) finish coats on all surfaces of the barn door panels, replace all existing barn door hardware with new heavy duty hot galvanized metal components, new ball-bearing rollers & new tracks, and add new protective track covers made of wood, flashed beneath existing siding (ground level sliding doors), and existing water table (basement sliding door).

SERIES 300 + 400 For funding reasons, the Owner has determined that these two projects are no longer included in the Contract Documents (See DRAWINGS & SPECIFICATIONS adjustments below).

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10OCT2024**UNIT PRICES**

The Owner has determined this Section remains in the Contract Documents.

DRAWINGS:**SERIES 000:**

S.000

REVISE Sheathing Notes (Provided with Addendum 1) reading "10d nails indicated may be substituted with galvanized ring shank nails, provided they are a minimum of 2-7/8" long and have a diameter of at least 0.121". GC shall submit samples of nails intended for this purpose."

To read "10d nails indicated shall be galvanized ring shank nails, with a minimum length of 2-7/8" and have a diameter of at least 0.121". GC shall submit samples of nails intended for this purpose."

SERIES 100:

A106

Detail 1: REVISE note reading "V-600-TE" to read "V-300".

SERIES 200:

XXX

No adjustments in this Addendum.

SERIES 300:

ALL DWGS

DELETE this series of drawings in its entirety. The Owner has determined that this project shall not be included (see Section 000115-REV1 as per this Addendum).

SERIES 400:

ALL DWGS

DELETE this series of drawings in its entirety. The Owner has determined that this project shall not be included (see Section 000115-REV1 as per this Addendum).

SERIES 500:

R500-REV1

DELETE in its entirety.
ADD DWG R500-REV1 attached to this Addendum in its entirety.

R500-REV1

ADD NEW NOTE reading "Saw-cut and remove the exterior exposed concrete slab located on the West (transaction side) of the Gatehouse (at least 40 SF), assumed to be at least 5-inches thick. Prep (excavation, compaction, formwork, insulation, 4-inch x 4-inch reinforcement mesh), for new reinforced concrete slab, w/ brushed finish and 3-inch smooth borders on all sides, including salt-guard sealer.

**ADDENDUM NO. 2****2308.01 / LAMOINE STATE PARK / BGS 3519**

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R500-REV1 ADD NEW NOTE reading "Saw-cut and remove the exterior exposed concrete slab located on the East (entry roadway side) of the Gatehouse (at least 30 SF), assumed to be at least 5-inches thick. Prep (excavation, compaction, formwork, insulation, 4-inch x 4-inch reinforcement mesh), for new reinforced concrete slab consisting of landing with two (2) 1:20 inclined walkways, w/ brushed finish and 3-inch smooth borders on all sides, including salt-guard sealer.

A500-REV1 DELETE in its entirety (provided with Addendum 1).
ADD DWG A500-REV2 attached to this Addendum in its entirety.

A501 DELETE in its entirety (provided with Addendum 1).
ADD DWG A501-REV1 attached to this Addendum in its entirety.

A503-REV1 DELETE in its entirety (provided with Addendum 1).
ADD DWG A503-REV2 attached to this Addendum in its entirety.

SERIES 600:

XXX No adjustments in this Addendum.

SPECIFICATIONS: Note: Specifications apply to all four (4) Sub-Projects according to indicated scope. Specifications pertaining to Series 300: Campsite Infrastructure & Series 400: Well System Upgrades, have been edited/deleted accordingly as per this Addendum.

00 01 10 DELETE this section in its entirety.
ADD SECTION 000110-REV1 attached to this Addendum in its entirety.

00 01 15 DELETE this section in its entirety.
ADD SECTION 000115-REV1 attached to this Addendum in its entirety.

00 41 13 DELETE this section in its entirety.
ADD SECTION 004113-REV1 attached to this Addendum in its entirety.

This is the REVISED CONTRACTOR BID FORM for this project.



ADDENDUM NO. 2

2308.01 / LAMOINE STATE PARK / BGS 3519

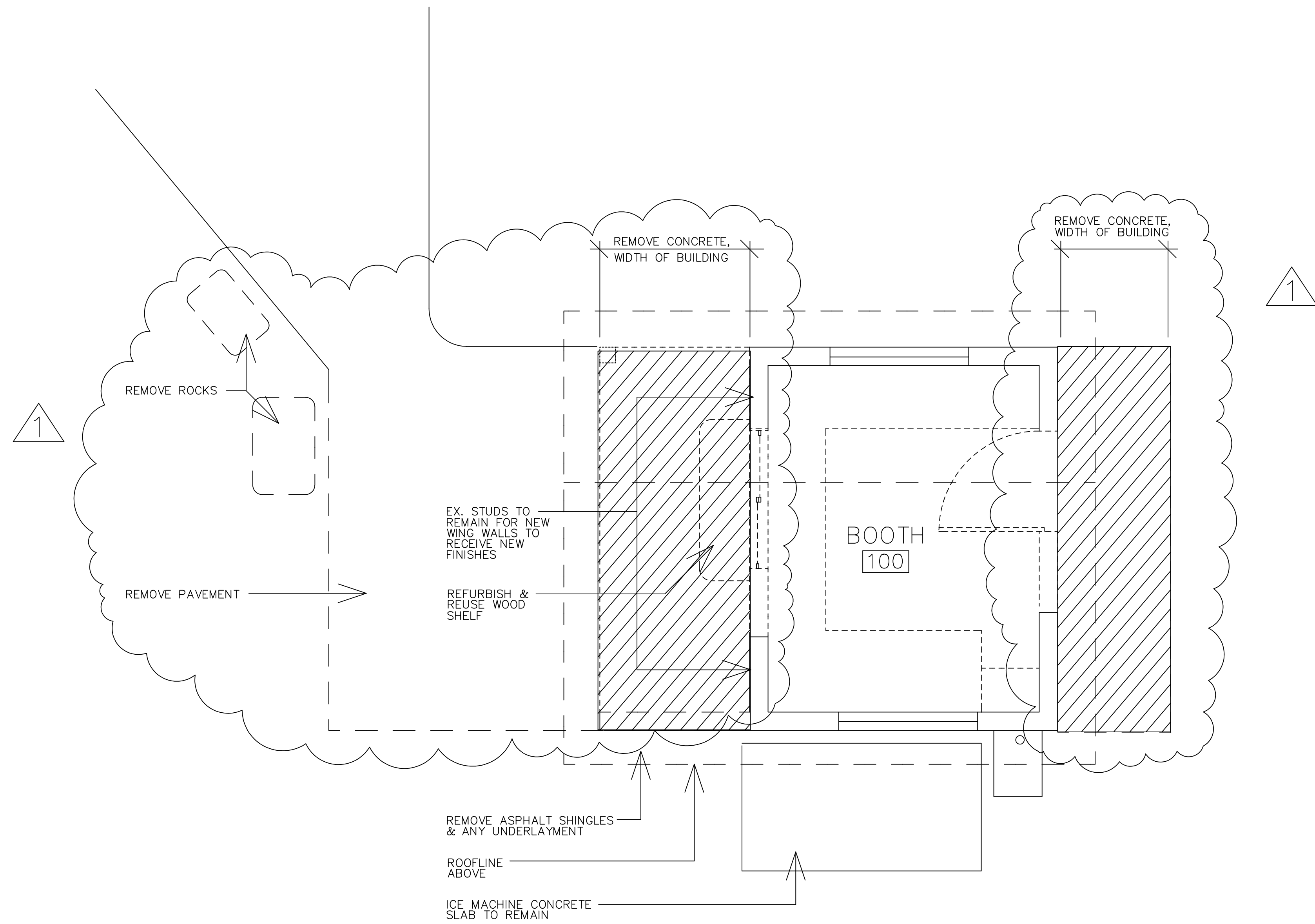
Lewis + Malm Architecture

10OCT2024

- 01 10 00 DELETE this section in its entirety.
ADD SECTION 011000-REV1 attached to this Addendum in its entirety.
- 07 31 13 DELETE this section (provided with Addendum 1) in its entirety.
ADD SECTION 073113-REV2 attached to this Addendum in its entirety.
- 22 00 10 DELETE this section in its entirety.
ADD SECTION 220010-REV1 attached to this Addendum in its entirety.
- 22 11 23 DELETE this section in its entirety.
- 22 31 00 DELETE this section in its entirety.
- 23 00 10 DELETE this section in its entirety.
ADD SECTION 230010-REV1 attached to this Addendum.
- 26 00 10 DELETE this section in its entirety.
ADD SECTION 260010-REV1 attached to this Addendum.
- 33 25 10 DELETE this section in its entirety.
- 33 25 15 DELETE this section in its entirety
- 33 26 41 DELETE this section in its entirety

ATTACHMENTS: As mentioned above.

END OF ADDENDUM NO. 2

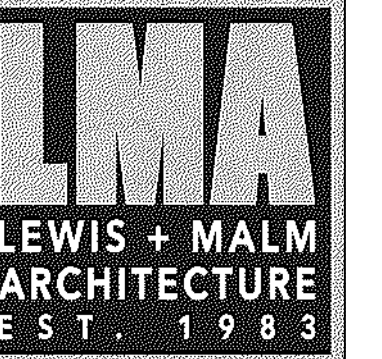


LEGEND
----- TO BE REMOVED

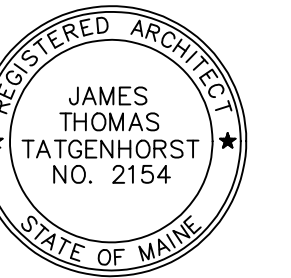
1
R300

REMOVALS PLAN

SCALE: 1/2" = 1'-0"



124 MAIN ST.
P.O. BOX 1459
BUCKSPORT
MAINE 04416
207.469.7440



GC BID SET

20SEP2024

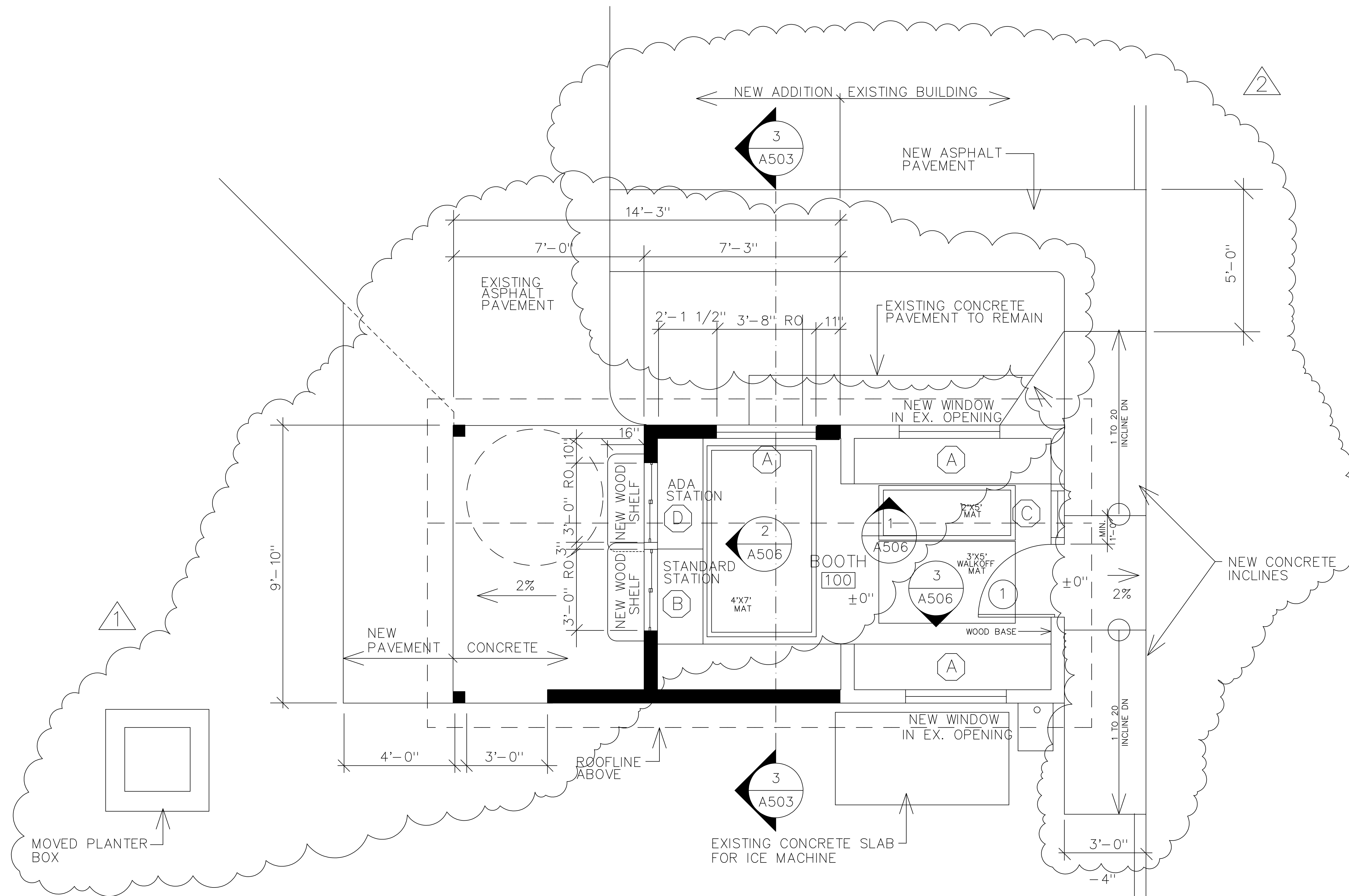
REV	DATE
1	10OCT2024

LA MOINE STATE PARK ENTRY BOOTH ADDITION
LA MOINE, MAINE

REMOVALS FLOOR PLAN

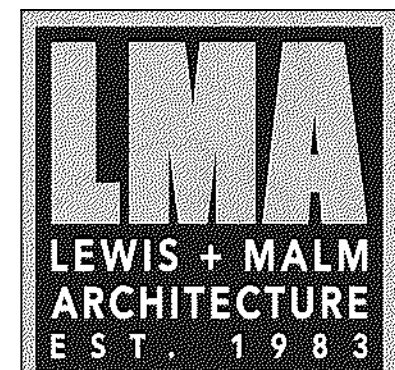
2308.1

R500

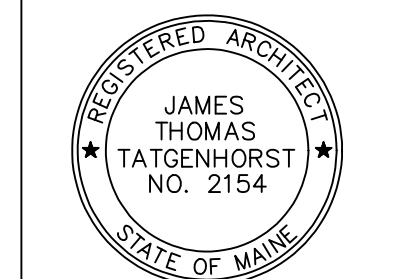


1 FLOOR PLAN
SCALE: 1/2" = 1'-0"

LEGEND	
	NEW WALLS
	WINDOW SYMBOL SEE DWG A502
	DOOR # SEE DWG A502



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GC BID SET

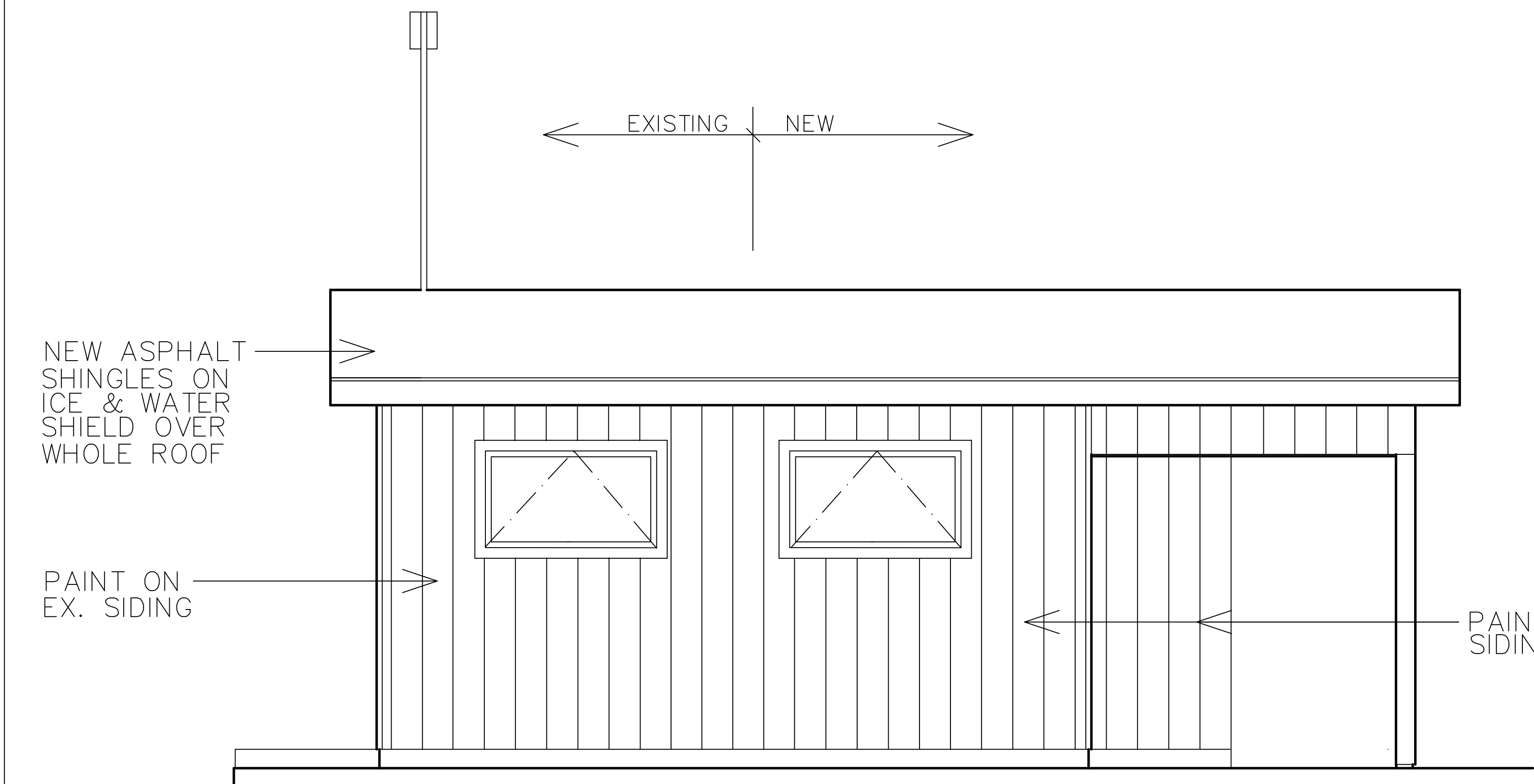
REV	DATE
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2	10OCT2024

LAMOINE STATE PARK ENTRY BOOTH ADDITION
LAMOINE, MAINE

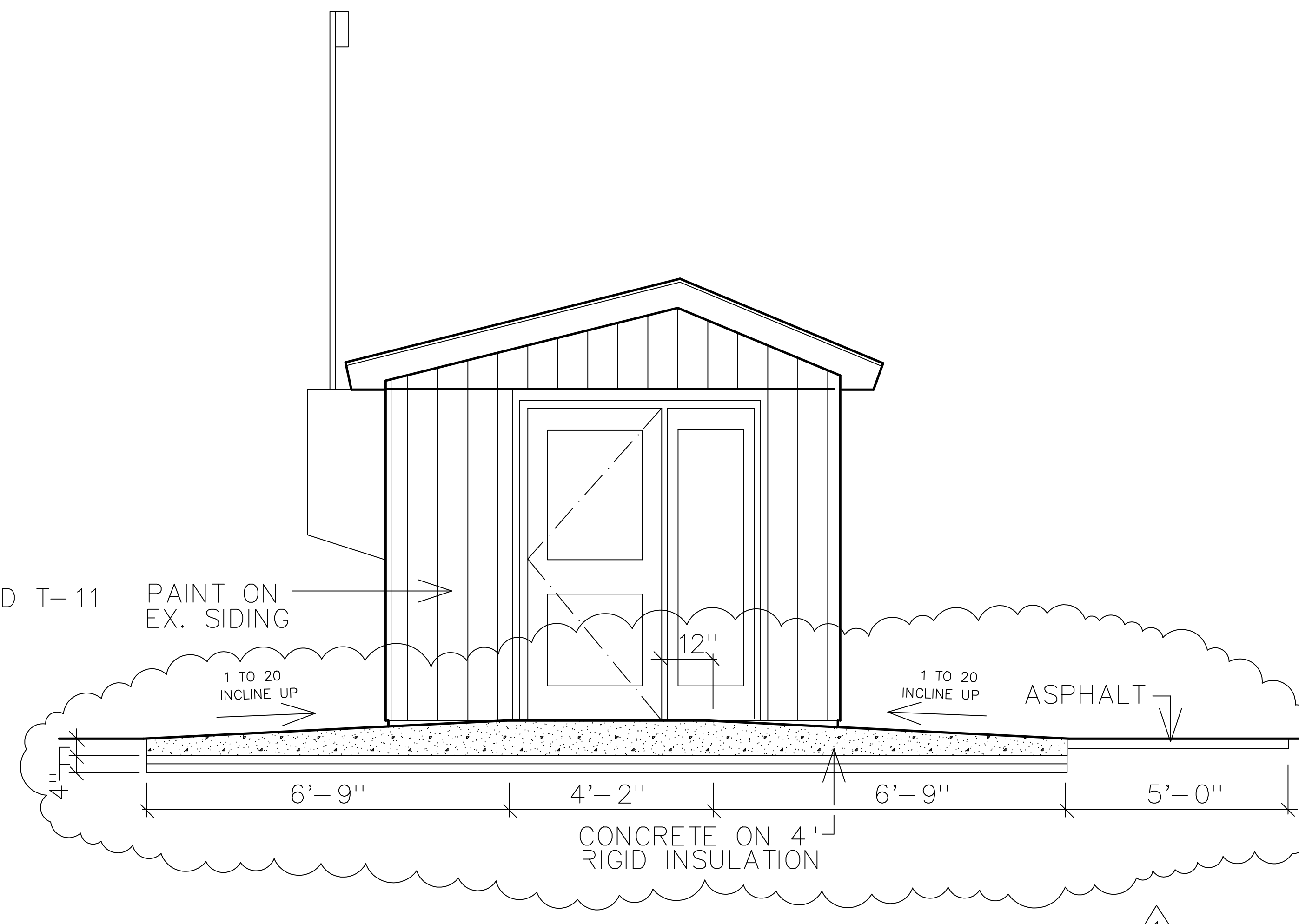
FLOOR PLAN

2308.1

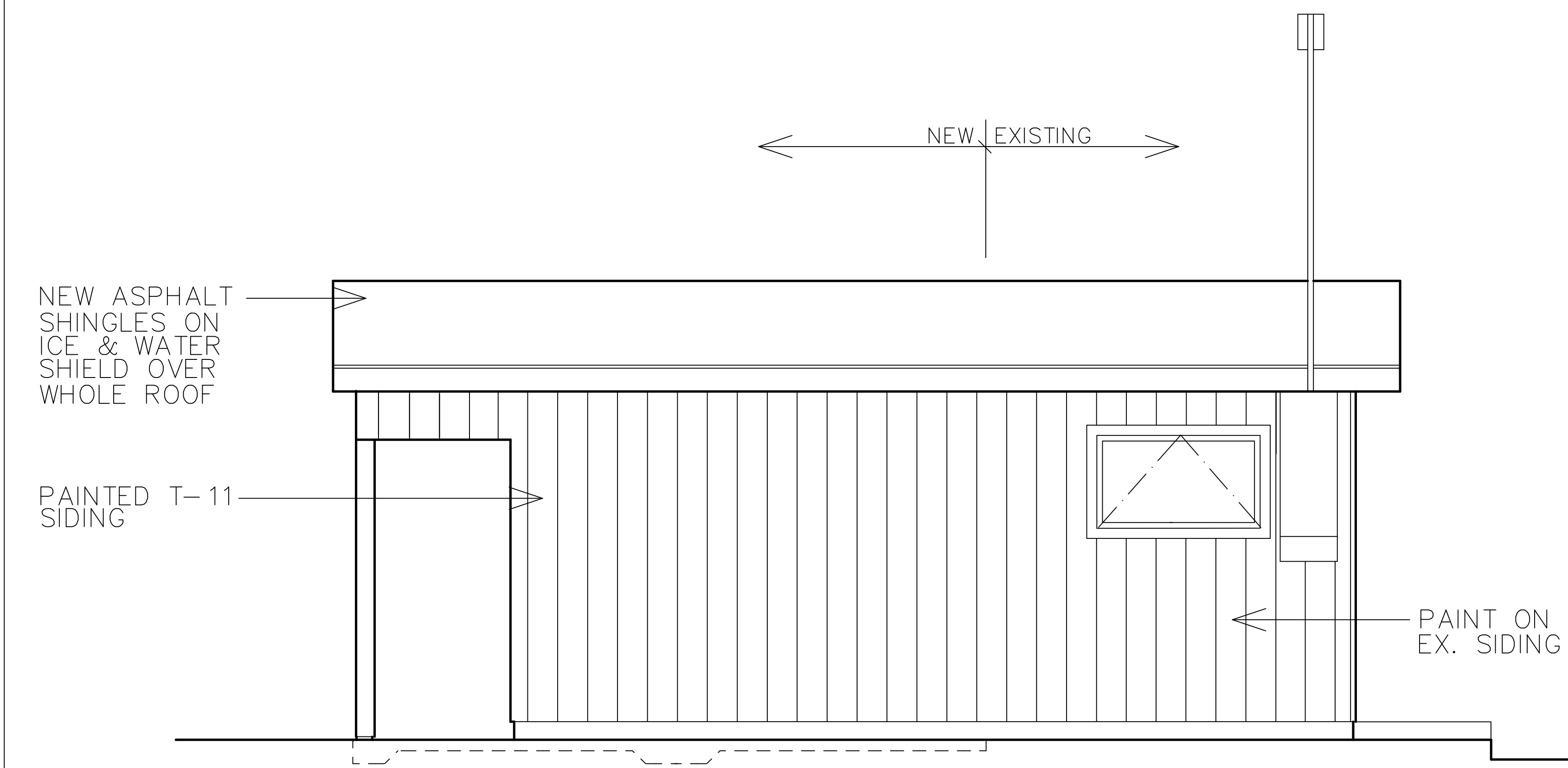
A500



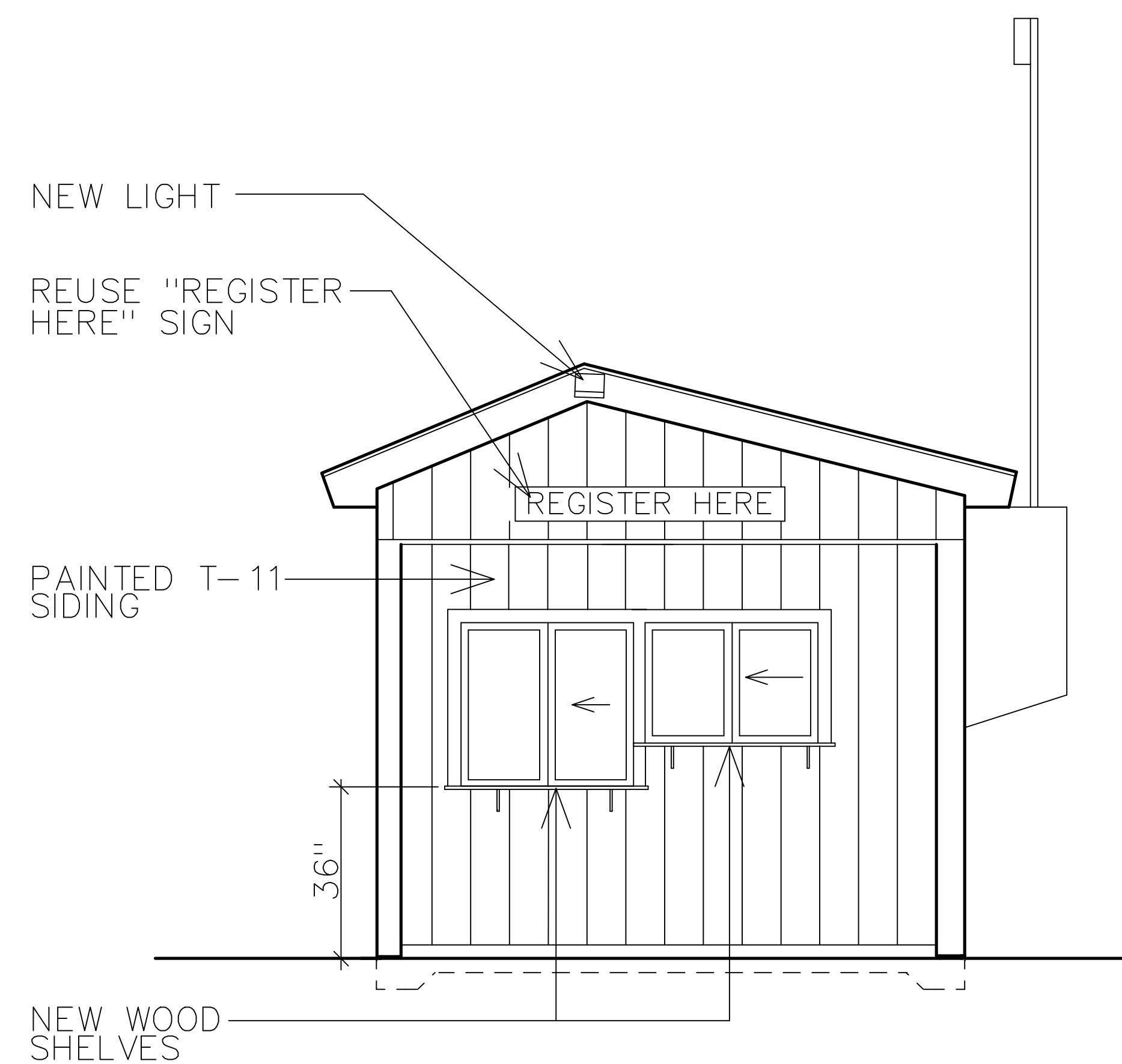
1 NORTH ELEVATION
A501
SCALE: 1/2" = 1'-0"



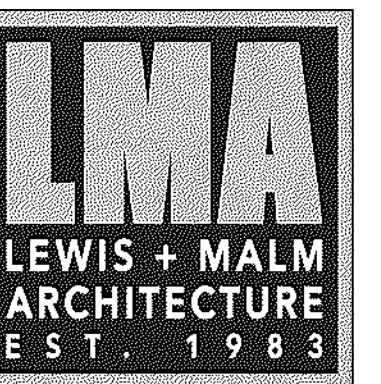
2 EAST ELEVATION
A501
SCALE: 1/2" = 1'-0"



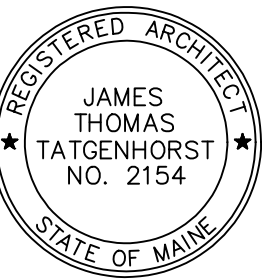
3 SOUTH ELEVATION
A501
SCALE: 1/2" = 1'-0"



4 WEST ELEVATION
A501
SCALE: 1/2" = 1'-0"



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GC BID SET

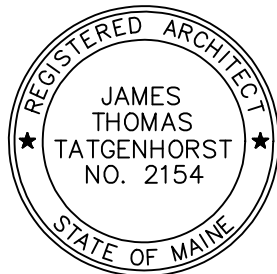
REV	DATE
1	10OCT2024

20SEP2024
LAMOINE STATE PARK ENTRY BOOTH ADDITION
LAMOINE, MAINE
ELEVATIONS

2308.1
A501



124 MAIN ST.
P.O. BOX 1459
BUCKSPORT
MAINE 04416
207.469.7440



GC BID SET

20SEP2024	
REV	DATE
1	03OCT2024
2	10OCT2024

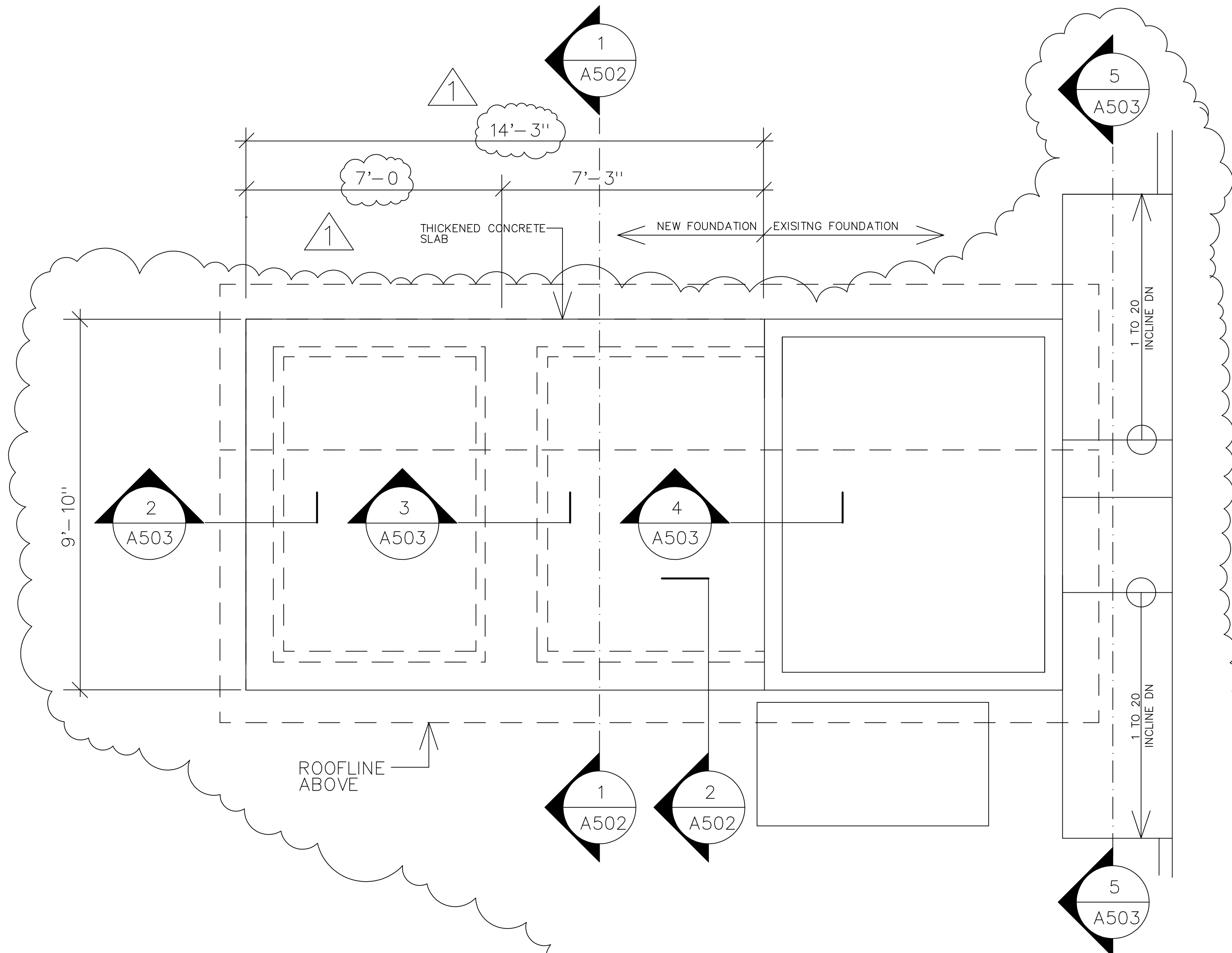
LAMOINE STATE PARK ENTRY BOOTH ADDITION

LAMOINE, MAINE

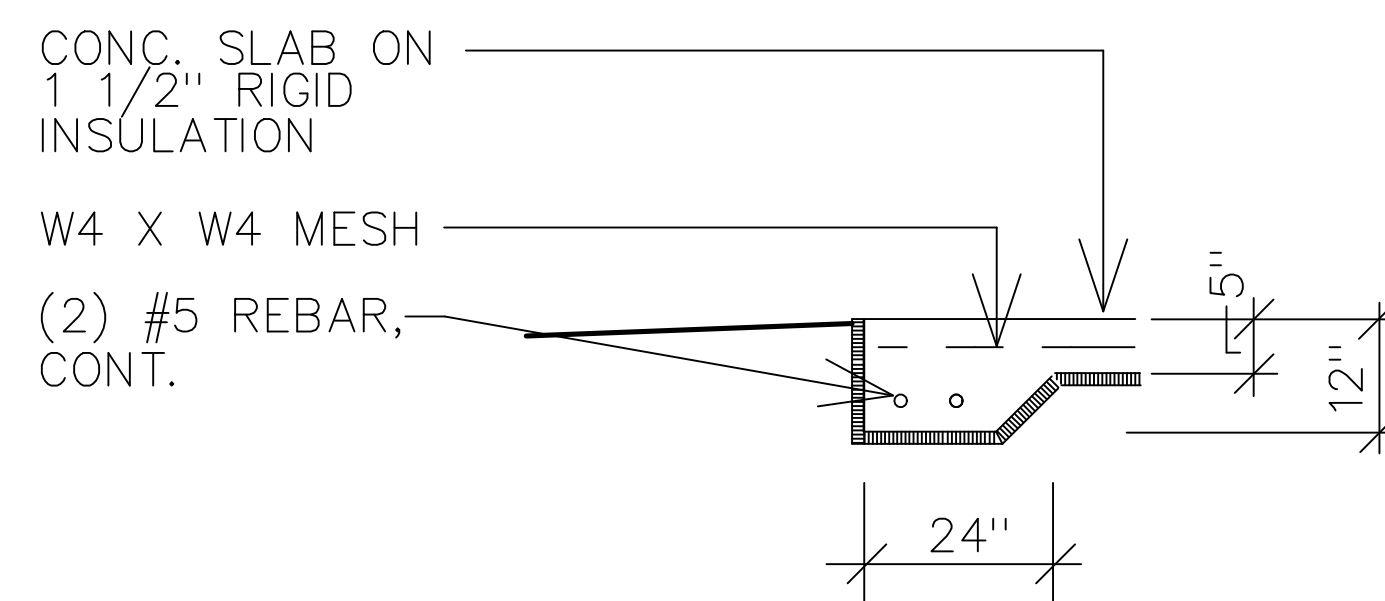
FOUNDATION PLAN

2308.1

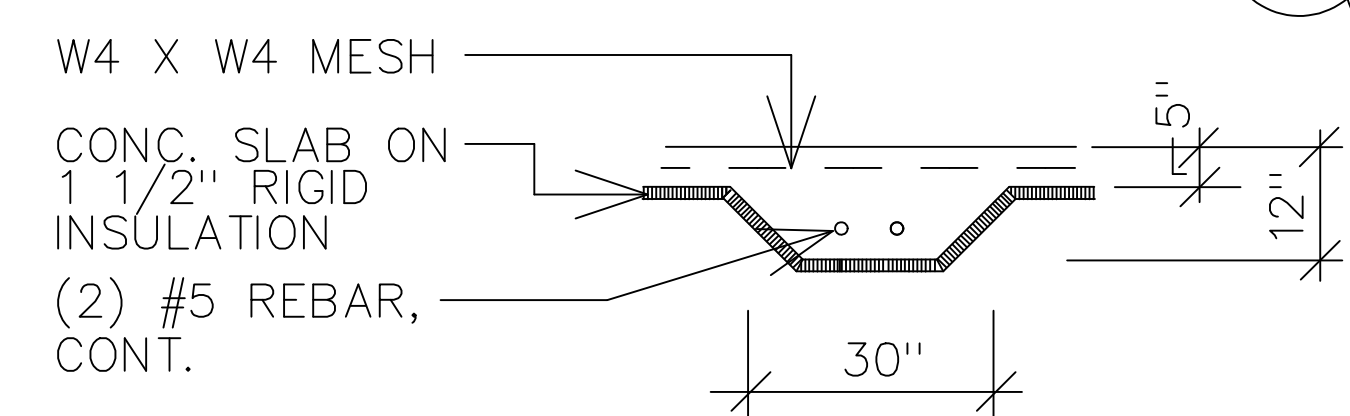
A503



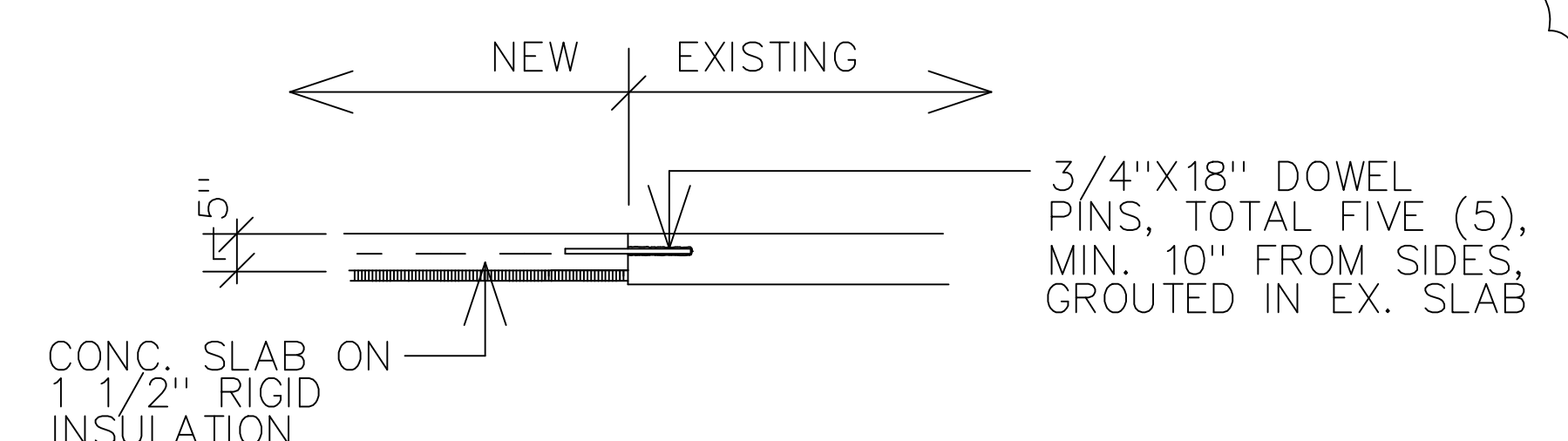
1 FOUNDATION PLAN
SCALE: 1/2" = 1'-0"



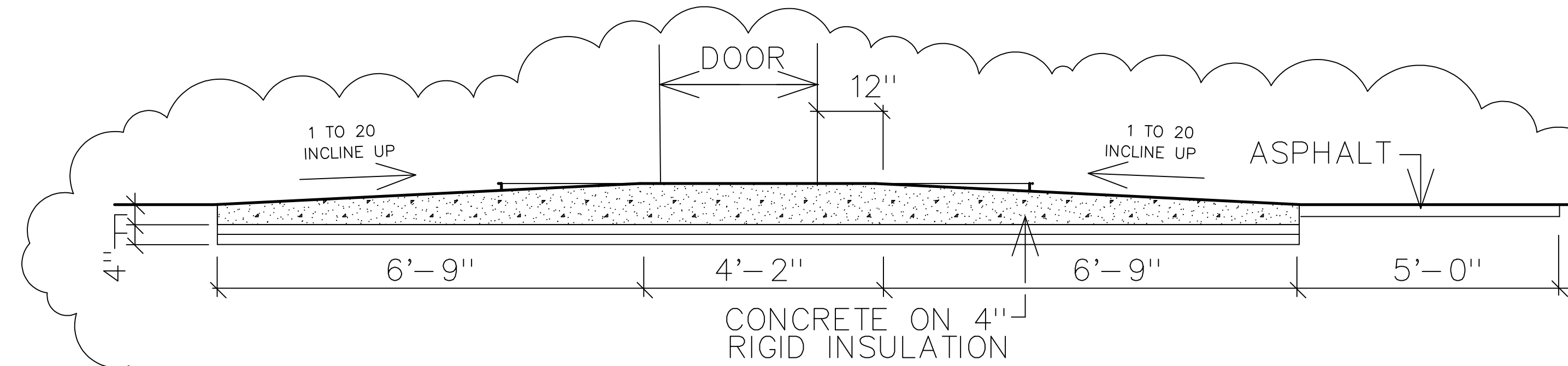
2 THICKENED SLAB
SCALE: 1" = 1'-0"



3 THICKENED SLAB
SCALE: 1" = 1'-0"



4 NEW/EX. CONCRETE SLAB
SCALE: 1" = 1'-0"



5 CONC. INCLINE SECTION
SCALE: 1" = 1'-0"

SECTION 00 01 10 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

of Pages

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

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DIVISION 14:	CONVEYING EQUIPMENT (NOT USED)	0
DIVISION 15-19:	RESERVED	0
FACILITY SERVICES SUBGROUP (NOT USED)		
DIVISION 20:	RESERVED (NOT USED)	0
DIVISION 21:	RESERVED (NOT USED)	0

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23 05 00	COMMON WORK RESULTS FOR HVAC	6
23 05 93	TESTING, ADJUSTING AND BALANCING	4
23 07 00	HVAC INSULATION	4
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23 23 00	REFRIGERATION PIPING	2
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26 51 00	INTERIOR LIGHTING	4
27 10 00	TELEPHONE AND DATA WIRING SYSTEM	5

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DIVISION 28:	ELECTRONIC SAFETY AND SECURITY (NOT USED)	0
DIVISION 29:	RESERVED (NOT USED)	0

SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 30:	RESERVED (NOT USED)	0
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DIVISION 31:	EARTHWORK	
31 22 30	CLEARING & GRUBBING	5
31 22 50	SOIL COMPACTION	4
31 22 70	EROSION CONTROL	9
31 23 10	SITE GRADING	6
31 23 15	EXCAVATION	3
31 23 16	AGGREBATES, FILL & BACKFILL	7

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32 27 41	PAVEMENT REPLACEMENT	3
32 29 01	RESTORATION OF SURFACES	3
32 29 21	TOPSOIL AND SEEDING	4
32 17 23	PAVEMENT MARKINGS	3

DIVISION 33:	UTILITIES	
33 25 10	WATER DISTRIBUTION	3
33 25 15	DISINFECTION OF WATER DISTRIBUTION	2
36 23 41	BURIED VALVES & STOPS	X

DIVISION 34:	TRANSPORTATION (NOT USED)	0
DIVISION 35:	WATERWAY AND MARINE CONSTRUCTION (NOT USED)	0
DIVISION 36-39:	RESERVED (NOT USED)	0

PROCESS EQUIPMENT SUBGROUP

DIVISION 40:	PROCESS INTEGRATION (NOT USED)	0
DIVISION 41:	MATERIAL PROCESSING AND HANDLING EQUIPMENT (NOT USED)	0
DIVISION 42:	PROCESS HEATING, COOLING, AND DRYING EQUIPMENT (NOT USED)	0
DIVISION 43:	PROCESS GAS & LIQUID HANDLING, PURIFICATION, & STORAGE EQUIPMENT (NOT USED)	0
DIVISION 44:	POLLUTION CONTROL EQUIPMENT (NOT USED)	0
DIVISION 45:	INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT (NOT USED)	0
DIVISION 46-47:	RESERVED (NOT USED)	0
DIVISION 48:	ELECTRICAL POWER GENERATION (NOT USED)	0
DIVISION 49:	RESERVED (NOT USED)	0

Note: Since the Construction Specifications for this project are being distributed to bidders electronically, bidders shall confirm by email to jim@lewisandmalm.com that all Construction Specifications listed above have been transferred successfully at the time of Pre-Bid Construction Document distribution. Failure to provide said confirmation releases the Architect/Engineer team of any Contractor claims of missing Contract Documents.

END OF SECTION

SECTION 00 01 15
LIST OF DRAWING SHEETS

000 SERIES / GENERAL DRAWINGS:

Drawing 1 A0 MAIN COVER SHEET (6 Sub-Projects)

NOTE: Each Sub-Project Drawing Series is provided with its own A0 Cover Sheet for that specific group of drawings (these additional cover sheets are not listed herein).

GENERAL NOTES:

Drawing 2 C001 GENRAL SITE NOTES
Drawing 3 C002 EROSION CONTROL NOTES
Drawing 4 C003 SITE LOCATION
Drawing 5 NOT USED
Drawing 6 E001 LIGHTING FIXTURE SCHEDULE

100 SERIES / BARN RENOVATION DRAWINGS:

CIVIL:

Drawing 7 C100 SITE REMOVALS PLAN
Drawing 8 C101 SITE LAYOUT PLAN
Drawing 9 C102 SITE DETAILS

STRUCTURAL:

Drawing 10 S.000 MISCELLANEOUS DETAILS
Drawing 11 S.101 SECOND FLOOR FRAMING PLAN
Drawing 12 S.102 ROOF FRAMING PLAN
Drawing 13 S.110 TYPICAL X-SECTION @ INTERIOR ROOF TRUSS / MISC. DETAILS
Drawing 14 S.201 BASEMENT FOUNDATION PLAN (Price w/ Sub-Project #1: BARN RENO)
Drawing 15 S.202 FIRST FLOOR FRAMING PLAN (Price w/ Sub-Project #1: BARN RENO)
Drawing 16 S.210 MISCELLANEOUS DETAILS (Price w/ Sub-Project #1: BARN RENO)

ARCHITECTURAL:

Drawing 17 R100 REMOVALS – FIRST & SECOND FLOOR BARN PLANS
Drawing 18 R102 REMOVALS – OFFICE AREA (Price w/ Sub-Project #1: BARN RENO)
Drawing 19 A100 FIRST FLOOR BARN PLAN
Drawing 20 A101 SECOND FLOOR BARN PLAN
Drawing 21 A102 DOOR SCHEDULE, DOOR & WINDOW TYPES
Drawing 22 A103 ELEVATIONS
Drawing 23 A104 ELEVATIONS
Drawing 24 A105 BUILDING SECTION
Drawing 25 A106 BUILDING DETAILS
Drawing 26 A107 WINDOW DETAILS
Drawing 27 A108 WINDOW DETAILS
Drawing 28 A109 WALL SECTIONS

MECHANICAL & PLUMBING:

Drawing 29 M101 FIRST FLOOR HVAC PLANS

ELECTRICAL:

Drawing 30 E101 REMOVALS OFFICE AREA (Price w/ Sub-Project #1: BARN RENO)
Drawing 31 E102 SECOND FLOOR LIGHTING PLAN

200 SERIES / OFFICE RENOVATION DRAWINGS:

CIVIL: (Not Used)

STRUCTURAL: (Refer to BARN RENO)

ARCHITECTURAL:

Drawing 32 A200 OFFICE FLOOR PLAN & ELEVATIONS
Drawing 33 A201 DOOR SCHEDULE, DOOR & WINDOW TYPES
Drawing 34 A202 INTERIOR ELEVATIONS
Drawing 35 A203 ADA TYPICAL DIMENSIONS
Drawing 36 A204 DECK & RAMP FRAMING
Drawing 37 A205 FINISH SCHEDULE & FINISH FLOOR PLAN
Drawing 38 A206 DECK DETAILS

MECHANICAL:

Drawing 39 M201 FIRST FLOOR HVAC REMOVALS PLANS
Drawing 40 M202 FIRST FLOOR HVAC PLAN
Drawing 41 M203 SECOND FLOOR HVAC PLAN
Drawing 42 M204 HVAC SCHEDULE & DETAILS

ELECTRICAL:

Drawing 43 E200 FIRST FLOOR ELECTRICAL REMOVALS PLAN
Drawing 44 E201 FIRST FLOOR LIGHTING PLAN
Drawing 45 E202 FIRST FLOOR POWER & SYSTEMS PLAN
Drawing 46 E203 SECOND FLOOR POWER & SYSTEMS PLAN

PLUMBING:

Drawing 47 P201 BASEMENT & FIRST FLOOR REMOVALS PLAN
Drawing 48 P202 FIRST FLOOR & BASEMENT PLUMBING PLANS

~~TEXT WITH STRIKE THROUGH DELETED FROM BID WITH ADDENDUM #2~~

300 SERIES / CAMPSITE INFRASTRUCTURE UPGRADE DRAWINGS:

~~CIVIL: _____~~

~~Drawing 49 C300 EXISTING CONDITIONS~~
~~Drawing 50 C301 WATER PLAN~~
~~Drawing 51 C302 WATER PLAN~~
~~Drawing 52 C303 WATER PLAN~~
~~Drawing 53 C304 SITE LAYOUT PLAN~~
~~Drawing 54 C305 SITE LAYOUT PLAN~~
~~Drawing 55 C306 SITE LAYOUT PLAN~~
~~Drawing 56 C307 SITE DETAILS~~

~~STRUCTURAL:~~ (Not Used)

~~ARCHITECTURAL:~~ (Not Used)

~~MECHANICAL:~~ (Not Used)

~~ELECTRICAL:~~

~~Drawing 57 E300 ELECTRICAL SITE PLAN~~
~~Drawing 58 E301 SITE ELECTRICAL RISER DIAGRAM~~
~~Drawing 59 E302 CAMPSITE SCHEDULES & DETAILS~~
~~Drawing 60 E303 ELECTRICAL PLAN~~

PLUMBING:

~~Drawing 61 — P301 COMFORT STATION PLANS~~

~~Drawing 62 — P302 PLUMBING SCHEDULES & DETAILS~~

400 SERIES / WELL SYSTEM UPGRADE DRAWINGS:

~~CIVIL: (Not Used, Refer to 300 Series for NEW PUMPHOUSE Location)~~

~~STRUCTURAL: (Not Used, Refer to Architectural)~~

ARCHITECTURAL:

~~Drawing 63 — A401 WATER TREATMENT SYSTEM PUMPHOUSE BUILDING~~

~~MECHANICAL: (Not Used)~~

ELECTRICAL:

~~Drawing 64 — E401 ELECTRICAL PLAN~~

PLUMBING:

~~Drawing 65 — P401 PLUMBING SCHEDULES & DETAILS~~

500 SERIES / ENTRY GATEHOUSE & GATE DRAWINGS:

CIVIL:

Drawing 66 C500 SITE REMOVALS PLAN

Drawing 67 C501 SITE LAYOUT PLAN

Drawing 68 C502 SITE DETAILS

STRUCTURAL: (Not Used)

ARCHITECTURAL:

Drawing 69 R500 REMOVALS FLOOR PLAN

Drawing 70 R501 REMOVALS ELEVATION

Drawing 71 A500 FIRST FLOOR PLAN

Drawing 72 A501 ELEVATIONS

Drawing 73 A502 BUILDING SECTION, WINDOW & DOOR TYPES

Drawing 74 A503 FOUNDATION PLAN

Drawing 75 A504 FRAMING PLAN

Drawing 76 A505 WINDOW & DOOR DETAILS

Drawing 77 A506 INTERIOR ELEVATIONS

Drawing 78 A507 CASEWORK DETAILS

Drawing 79 A508 GATE DETAILS

MECHANICAL: (Not Used)

ELECTRICAL:

Drawing 80 E501 ELECTRICAL PLAN

PLUMBING:

Drawing 81 P501 PLUMBING PLANS, SCHEDULE & DETAILS

TEXT WITH STRIKE-THROUGH DELETED FROM BID WITH ADDENDUM #2

600 SERIES / POLE BARN DRAWINGS:

CIVIL:

Drawing 82 C600 POLE BARN SITE REMOVALS PLAN
Drawing 83 C601 POLE BARN SITE LAYOUT PLAN
Drawing 84 C602 POLE BARN SITE DETAILS

STRUCTURAL: (Not Used, Refer to Architectural)

ARCHITECTURAL:

Drawing 85 A600 PINNACLE HILL ENGINEERING COVER SHEET
Drawing 86 A601 FLOOR PLAN
Drawing 87 A602 ELEVATIONS
Drawing 88 A603 FOUNDATION PLAN
Drawing 89 A604 FOUNDATION SECTION
Drawing 90 A605 FOUNDATION DETAILS
Drawing 91 A606 FRONT & REAR WALL FRAMING – 5 BAY
Drawing 92 A607 END WALL FRAMING
Drawing 93 A608 BRACING DETAILS
Drawing 94 A609 ROOF DETAILS
Drawing 95 A610 GENERAL NOTES & TIMBER SCHEDULE
Drawing 96 A611 STAIRWAY OPTION ELEVATIONS
Drawing 97 A612 STAIR FRAMING & FOUNDATIONS
Drawing 98 A613 STAIRWAY DETAILS
Drawing 99 A614 FRONT WALL SLIDING DOOR TRACK DETAILS
Drawing 100 A615 SLIDING DOOR DETAILS
Drawing 101 A616 END WALL LOFT DOOR OPTION

MECHANICAL: (Not Used)

ELECTRICAL: (Not Used)

PLUMBING: (Not Used)

Total number of Drawings: 107 (including all cover sheets)

Note: Since the Construction Documents for this project are being distributed to bidders electronically, bidders shall confirm by email to jim@lewisandmalm.com that all Construction Drawings listed above have been transferred successfully upon receipt. Failure to provide said confirmation releases the Architect/Engineer team of any Contractor claims of missing Contract Documents.

END OF SECTION 00 01 15

SECTION 00 41 43 CONTRACTOR BID FORM

**BARN ENVELOPE AND INTERIOR RENOVATIONS AND PARK UTILITY IMPROVEMENTS
AT LAMOINE STATE PARK IN LAMOINE MAINE**

BGS Project #3519 (= BGS 3519 + BGS 3660)

Bid Form submitted by:

Bid Administrator:

Deane Rykerson, Project Manager
Bureau of General Services
111 Sewall Street, Cross State Office Building, 4th floor
77 State House Station
Augusta, Maine 04333-0077

BGS.Architect@Maine.gov

Bidder:

Signature:	_____
Printed name and title:	_____
Company name:	_____
Mailing address:	_____
City, state, zip code:	_____
Phone number:	_____
Email address:	_____
State of incorporation, if a corporation:	_____
List of all partners, if a partnership:	_____

1. The Bidder agrees, if the Owner offers to award the contract, to provide any and all bonds and certificates of insurance, as well as Schedule of Values, Project Schedule, and List of Subcontractors and Suppliers, and to sign the designated Construction Contract within twelve (12) calendar days after the date of notification of such acceptance, except if the twelfth (12th) day falls on a State of Maine government holiday or other closure day, or a Saturday, or a Sunday, in which case the aforementioned documents must be received before 12:00 noon on the first available business day following the holiday, other closure day, Saturday, or Sunday.
2. As a guarantee thereof, the Bidder submits, together with this bid, a bid bond, based on the Overall Project Base Bid amount, or other acceptable instrument as and if required by the Bid Documents.

SECTION 00 41 43 CONTRACTOR BID FORM

3. The Bidder, having carefully examined the BARN ENVELOPE AND INTERIOR RENOVATIONS AND PARK UTILITY IMPROVEMENTS AT LAMOINE STATE PARK IN LAMOINE MAINE Project Manual dated 20. September, 2024, prepared by Lewis + Malm Architecture, as well as Specifications, Drawings, and any Addenda, the form of contract, and the premises and conditions relating to the work, proposes to furnish all labor, equipment and materials necessary for and reasonably incidental to the construction and completion of this project for the

A. **Overall Project Base Bid** (Total) amount of: \$ _____ .00

*The Base bid shall include the sum of the **four (4)** sub-project amounts in 3.1 below, plus Allowances and General Contractor markup costs (General Conditions, Overhead & Profit, Insurance & Bonds):*

- 3.1 The Base Bid includes the following **four (4)** Sub-Project Base Bid Amounts (breakdown required):

A.	Drawing series 100 / Barn Renovations (BGS 3519)	\$ _____ .00
B.	Drawing Series 200 / DMR Office Fit-Out (BGS 3660)	\$ _____ .00
C.	Drawing Series 300 / Campsite Infrastructure Upgrades (BGS 3519)	\$ _____ .00
D.	Drawing Series 400 / Well System Upgrades & Pumphouse (BGS 3519)	\$ _____ .00
E.	Drawing Series 500 / Entry Building Expansion & Gate (BGS 3519)	\$ _____ .00
F.	Drawing Series 600 / 5-Bay Pole Barn (BGS 3519)	\$ _____ .00

Notes:

- Failure to submit separate Bid amounts for each of the **four (4)** Sub-Projects above shall constitute a non-compliant Overall Project Bid.
 - BGS Project Numbers 3519 + 3660 are for the Owner's funding monitoring use. The GC is advised that two (2) Schedules of Values will therefore be required at all Requisitions.
 - ~~**TEXT WITH STRIKE THROUGH DELETED FROM BID WITH ADDENDUM #2**~~
4. Allowances are part of this project and the Bidder acknowledges that the total Allowance amount listed herein is included in the Overall Project Base Bid amount.

Refer to SECTION 00 21 00 Allowances for details.

\$ 98,000.00

5. Unit Prices are on this project.

Refer to SECTION 01 22 00 Unit Prices for details and the Unit Prices bidding requirements indicated therein. GC shall attach their Unit Prices List to this Bid Form.

SECTION 00 41 43 CONTRACTOR BID FORM

6. Filed Sub-bids *are not required* on this project.
7. Bid security *is required* on this project and shall be based solely on the Overall Project Base Bid (Total) amount listed in 3.A. above (see SECTION 00 43 13 Contractor Bid Bond Sample).
8. Alternate Bids are on this project.

Refer to SECTION 01 23 00 Alternates for details and the Alternate Bids listed on the following page.

Any dollar amount line below that is left blank by the Bidder shall be read as a bid of **\$0.00**.

<i>1 Alternate #1: BARN GUTTER SYSTEM</i>	<i>\$_____</i> <u>.00</u>
<i>2 Alternate #2: DMR OFFICE VESTIBULE</i>	<i>\$_____</i> <u>.00</u>
<i>3 Alternate #3: DMR OFFICE CARPET TILE</i>	<i>\$_____</i> <u>.00</u>
<i>4 Alternate #4: ADDITIONAL SLIDING DOORS</i>	<i>\$_____</i> <u>.00</u>

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Start of construction.
4. Work by Owner.
5. Work under separate contracts.
6. Future work.
7. Purchase contracts.
8. Owner-furnished products.
9. General Contractor-furnished, Owner-installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and drawing conventions.

- B. Related Section:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities, if applicable.

1.3 PROJECT INFORMATION

- A. Project Identification:

1. BGS project #3519 (= BGS-3519 + BGS 3660) / Architect project #2308.1
2. Project Location: Lamoine State Park, Lamoine, Maine.
3. Overall Project BID: The total sum of all four (4) individual Sub-Projects BID amounts, when added together, plus GC markups as indicated in SECTIONs 001113 Notice to Contractors and 004113 – REV1 Contractor Bid Form.
4. Project BID Bond: The Project Bid Bond shall be based solely on the amount of the Overall Project BID, as indicated in item 1.3.A.3 above, and as per SECTION 004313 Contractor Bid Bond.

5. Sub-Projects Bidding: The Project is broken down into the following four (4) Sub-Projects, for each of which the GC shall provide individual pricing amounts (failure to submit said pricing shall constitute a non-compliant Overall Project Bid):

Drawing Series 100 Barn Renovations (RENO / BGS-3519)

Drawing Series 200 DMR Office Fit-Out (RENO /BGS-3660)

~~*Drawing Series 300 Campsite Infrastructure Upgrades (RENO + NC / BGS 3519)*~~

~~*Drawing Series 400 Well System Upgrades & Pumphouse (RENO +NC / BGS 3519)*~~

Drawing Series 500 Entry Building Expansion & Gate (RENO &+ NC / BGS-3519)

Drawing Series 600 5-Bay Pole Barn (NC / BGS-3519)

Note: BGS Project Numbers 3519 + 3660 are for the Owner's funding monitoring use. The GC is advised that two (2) Schedules of Values will therefore be required at all Requisitions.

6. Wage Determination: Refer to:
1. SECTION 00 73 46 Wage Determination Schedule.
 2. SECTION 00 72 13 General Conditions.
 3. SECTION 00 72 14 Supplemental General Conditions.
 - 1) Clarification: The Owner has confirmed that the Davis-Bacon Act does not apply to this contract.
7. Allowances: Refer to:
1. SECTION 00 41 13 – REV1 Contractor Bid Form.
 2. SECTION 01 21 00 Allowances.
 3. Clarification: Allowances can be applied across all four (4) Sub-Projects at the Owner's and Architect's mutual discretion.
8. Unit Prices: Refer to:
1. SECTION 00 41 13 – REV1 Contractor Bid Form.
 2. SECTION 01 22 00 Unit Prices.
 3. SECTION 01 15 00 Measurement and Payment
9. Alternates: Refer to:
1. SECTION 00 41 13 – REV1 Contractor Bid Form.
 2. SECTION 01 23 00 Alternates.
 3. Clarification: Alternates apply to specific Sub-Projects, as indicated.

- B. Owner: State of Maine, Department of Agriculture, Conservation and Forestry, Bangor, Maine.
- C. Architect: Lewis + Malm Architecture (LMA), 119 Main Street, Suite C, PO Box 1459, Bucksport, ME 04416. Tel: 207.469.7440, Cell: 207.659.6683 (Charles Earley, Project Manager/Senior Designer), Cell: 207.356.8369 (Jim Tatgenhorst, Architect of Record).
- D. Professional Consultants to Architect: The Architect has hired the following engineering consultants for the Project:
1. Civil Engineer: Dubois & King, Bangor, ME, John Kenney, P.E.
 2. Structural Engineer: Lincoln Haney & Associates, Michael Cunningham, P.E.
 3. Mechanical & Plumbing Engineer: Hewett & Whitney Engineers, Ken Whitney, P.E.

4. Electrical Engineer: Hewett & Whitney Engineers, Colin Hewett, P.E.
- E. General Contractor: To be determined by public bid, on the basis of the Contract Documents, as indicated. The abbreviation “GC” is synonymous with General Contractor.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and involves all safety measures, protection, removals, new construction and installations.
- B. Sub-Project Descriptions by Drawing Series: (See Construction Documents for detailed scope).
 1. Drawing Series 100: Barn Renovations includes select removals, some minor civil works, structural framing reinforcements, some mechanical & plumbing upgrades, electrical system upgrades, new windows, some new doors, exterior wall cladding improvements, roofing replacements, exterior paintwork.
 2. Drawing Series 200: DMR Office Renovations includes select removals, some minor civil works, some structural raised floor framing reinforcements & sub-flooring, mechanical & plumbing upgrades, electrical system upgrades, new interior doors, ADA improvements to an existing deck, new floor finishes interior paintwork.
 3. ~~Drawing Series 300: Campsite Infrastructure Upgrades includes select removals, civil & gravel roadway works, new underground power & water infrastructure to existing campsites, and RV Hookups.~~
 4. ~~Drawing Series 400: Well System Upgrades includes select removals, a new Pump House Building w/ some minor civil works, wooden skids, insulated wood framing, insulated roofing, asphalt shingle or metal roofing, mechanical & plumbing installations, electrical system installations.~~
 5. Drawing Series 500: Entry Building Expansion & Gate includes select removals, some minor civil works, new structural wood framing, some minor electrical system upgrades, new windows, existing building upgrades, built-in casework, exterior wall cladding improvements, roofing replacements, exterior paintwork, and a new traffic barrier gate (see Drawing Series 500).
 6. Drawing Series 600: 5-Bay Pole Barn includes some site preparations & gravel pad, new structural pole driving & pole barn wood framing, new barn- and personnel-doors, exterior wall cladding, and roofing (see Drawing Series 600). There are no MEP installations in this Sub-Project.
- C. Type of Contract: The Project will be constructed under a single prime contract based on State of Maine norms.

1.5 START OF CONSTRUCTION

- A. The General Contractor mobilization may begin upon receipt of a signed agreement (see SECTION 00 52 13 Construction Contract Sample), unless agreed otherwise in writing.

1.6 REMOVAL MATERIALS

- A. The General Contractor is advised that the Owner has determined that all debris resulting from removals performed by the GC and/or his Sub-Contractors must be completely removed from the Lamoine campground property.
- B. It is absolutely prohibited to deposit any removal or construction debris on the campground property.

1.7 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Adjacent Areas: The Owner has determined that the rest of the Lamoine State Park Campground (outside of Sub-Project scope areas), is not part of the Project area, unless indicated otherwise. The General Contractor shall coordinate & maintain Owner's direct access to existing facilities and areas during the entire construction period. The GC is responsible to coordinate with Owner and allow ample time in construction schedule to allow construction to progress smoothly without delaying the work.

1.8 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate General Contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Concurrent Work: The Owner will award a separate contract for the following construction operations in the Project Building & Project Scope Areas. Those operations will be conducted prior to the start of the General Contractor's work under this Contract.
 - 1. Existing Lamoine State Park Outdoor Storage Items in SERIES 600: Pole Barn site area.
- C. Potential Concurrent Work: The Owner will award a separate contract for the following construction operations in the Project Building & Project Scope Areas. Those operations may be conducted prior to the start of the General Contractor's work under this Contract.
 - 1. Emergency Power Generator (EPG) system (Housekeeping Pad, EPG Unit, Automatic Transfer Switch), serving SERIES 100: Barn Renovations, SERIES 200: Office Renovations (Fit-Out), and the Existing Marine Science Laboratory.

1.9 CONTRACTOR SUPPLIED / CONTRACTOR INSTALLED PRODUCTS (CS/CI)

- A. The General Contractor will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Contractor-furnished products.
- B. This article defines responsibilities of Contractor-Supplied / Contractor Installed (CS/CI) Products:
 - 1. All works indicated and specified.
 - 2. All Alternate Bid Items (if accepted by the Owner after the BID), as specified.

1.10 OTHER SALVAGED ITEMS

- A. This article defines the responsibilities of the General Contractor of other salvaged items.
 - 1. None.

1.11 ACCESS TO SITE

- A. General: The General Contractor shall have limited use of Project site for construction operations.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Driveways & Walkways: The General Contractor is responsible to maintain all driveway & walkway surfaces during construction, do not impede automobile & pedestrian traffic. Refill any depressions causing standing water.
 - 2. Staging & Material Storage Area: The Owner will designate an outdoor area adjacent to the project scope area for General Contractor staging. The General Contractor is responsible to provide security, protect & maintain during construction. Coordinate location of temporary enclosures provided by the General Contractor for his own equipment, access & gates with Owner and Architect.
 - 3. Parking: The General Contractor shall coordinate a designated parking area for staff and sub-contractors with the Owner and Architect, and mark it with adequate weatherproof signage, barriers, traffic cones and other safety measures as required. The General Contractor shall maintain this designated parking area and provide for trash removal in this area.

1.12 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Work shall be generally performed inside the existing buildings during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: As approved by Architect and Owner.
 2. Early Morning Hours: As approved by Architect and Owner.
 3. Hours for Utility Shutdowns: As approved by Architect and Owner.
 4. Provide 24 hour notice to the Owner and the Architect when performing work other than normal working hours.
- C. Nonsmoking Construction Site: Smoking is not permitted on campus. The General Contractor is responsible to instruct, monitor & maintain observance of this strict rule by all staff & Sub-Contractors. Violators may be removed from the Project site.

1.13 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 48-division format and CSI/CSC's "Master Format" numbering system.
- B. Specification Applications: There is one set of Specifications for the Overall Project covering all four (4) Sub-Projects. The General Contractor is advised that not all Spec Sections apply to all Sub-Projects. The GC is responsible to determine specification applications required to meet the needs of each Sub-Project.
- C. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by General Contractor unless specifically stated otherwise.
- D. Familiarity with Construction Documents: At all times (prior to bidding, administratively and during construction in the field), the General Contractor's-Project Director(s), -Project Manager(s), -Superintendent(s) and -Foremen shall familiarize themselves with the content of the Construction Documents (Drawings and Specifications).
- E. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
- F. Drawings & Specifications are complimentary and one shall not be used against the other by the General Contractor or its Sub-Contractors. The GC shall report any discrepancies discovered in the Drawings & Specifications prior to proceeding with construction to the Architect in writing. In the instance of a discrepancy, the higher value shall be interpreted by the Owner, Architect and GC as being included in the GC's base bid.

- G. General Contractor's proposals/alternate solutions: The GC shall work with the Architect in terms of the design intent indicated in the construction documents. Should the GC have alternate solutions and approaches that meet the same desired result without reducing the quality of the construction, the GC shall submit such proposals or ideas in writing in the form of an RFI for the Architect's and Owner's consideration, including product data, sketches, drawings or other information to support final decision making by the Owner and Architect.

END OF SECTION

SECTION 07 31 13 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Sections 1, 2, 3, and Division 1 of Section 4 apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Removal of existing roofing system.
 - 2. Asphalt shingles and factory formed ridge cap asphalt shingles.
 - 3. Underlayment.
 - 4. Self-Adhering Sheet Underlayment.
 - 5. Ridge Vents.
 - 6. Penetration accessories.
- B. Related Sections:
 - 1. Division 06 Section "Rough Carpentry" for wood framing.
 - 2. Division 06 Section "Sheathing" for roof sheathing.
- C. Replace damaged or missing asphalt roof shingles with matching shingles in appearance, color, etc.

1.3 DEFINITION

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Selection: For each type of asphalt shingle indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.
- D. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.
- E. Warranties: Sample of special warranties, confirm at the time of submittals that roofing products being used are approved by the asphalt shingle manufacturer for maximum warranty protection.

1.5 QUALITY ASSURANCE

- A. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
 - 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install asphalt shingles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.8 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time.
 - 2. Material Warranty Period: Manufacturer's limited lifetime warranty.
 - 3. Wind-Resistance: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 130 mph.
 - 4. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor 25 years from date of Substantial Completion.
 - 5. Workmanship Warranty Period: 10 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 100 sq. ft of each type, in unbroken bundles.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated (Architectural) Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing. Match existing shingles in appearance, color, etc.

1. Manufacturers: Basis of Design: Owens Corning Duration Flex, or proven equal, subject to compliance with requirements, provide products by one of the following:
 - a. Owens Corning.
 - b. CertainTeed Corporation.
 - c. GAF Materials Corporation.
2. Tab Arrangement: Manufacturer's standard spacing.
3. Cutout Shape: Square.
4. Butt Edge: Straight cut.
5. Nailing Strip Type & Size: Manufacturer's standard, web-reinforced for maximum pull-out strength.
6. Algae Resistance: Granules treated to resist algae discoloration.
7. Nominal Size: 13-1/4" x 39-3/8".
8. Exposure: 5-5/8".
9. Shingles per Square: 64.
10. Bundles per Square: 3.
11. Coverage per Square: 98.4 SF.
12. Ridge Cap Shingles: Factory formed, field forming is not acceptable. Fasten through specified ridge vent, ensure secure adhesion. Trim each side of lapped portion of unit to taper approximately 1 inch.
13. Color and Blends: Basis of Design: Black Onyx, or as selected by Architect from manufacturer's full range and availability.

- B. Applicable Standards:

1. PRI ER 1378E01
2. ASTM D228
3. ASTM D3018, Type I
4. ASTM D3161, Class F Wind Resistance
5. ASTM D3462
6. ASTM D7158
7. ASTM E108/UL 790, Class A Fire Resistance
8. CSA A123.5
9. FM 4473 (Class 4 Impact Resistance)
10. UL 2218 (Class 4 Impact Resistance)

2.2 UNDERLAYMENT MATERIALS

- A. Basis of Design: Rooftopguard II Premium Synthetic, high performance underlayment as provided by Rosenlew RKW Finland Ltd. PO Box 22, FIN-28601 PORI, Finland www.rooftopguard.com, or proven equal. Confirm product compliance w/ shingle manufacturer warranty.
1. Applicable Standards:
 - a. ICBO: ITS Report #484-1932, #484-2143
 - b. Metro Dade County: Passed PA 104-95 Testing - NOA No.07-0320.03 Exp.06/14/12
 - c. ICC-ES: Approval #ESR-2928
 - d. CAN/CSA: A220.1
 - e. Florida Building Code: FL 1258-RI
 - f. Meets ASTM E108/UL 790 / Class A fire rating
 2. Product Data:
 - a. "Fiber Grip" top side construction
 - b. 43 lbs per roll
 - c. Roll width 5 feet, 10 squares per roll
 - d. Deck-side surface composed of high-friction film
 - e. Color: Grey 50-year guarantee
- B. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil-thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Confirm product compliance w/ shingle manufacturer warranty.
- C. Basis of Design: RoofTopGuard SA as provided by Underlayment Specialties Plus, LLC, 805 West 5th Street, Unit 10A, Lansdale, PA 19446, www.uspunderlayment.com, or proven equal. Confirm product compliance w/ shingle manufacturer warranty.
- a. Self-Adhered High-Temp Underlayment, Synthetic based, high-temp, ice & water roof underlayment.
 - b. Suitable for steep slope applications for use under asphalt based shingles.
 - c. Polyethylene/polypropylene construction, lightweight, extra-wide roll width.
 - d. Adhesive shall allow for very low installation temperatures (15 degrees or higher), while providing a larger service temperature (-20 degrees to 260 degrees).
 - e. Constructed to be directional by having a 5" self-adhered topside selvage provides a secure watertight lap adhesive bond.
2. Subject to compliance with requirements, provide products by the following:
 - a. Rosenlew RKW Finland Ltd
 - b. Underlayment Specialties Plus, LLC
 - c. Grace, W. R. & Co. - Conn.
 - d. Certainteed.
 - e. Contractor's proposal, proven equal.

2.3 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips; for use under ridge shingles.
 - 1. Basis of Design: Cor-A-Vent V300, as provided by Cor-A-Vent, Inc.
 - 2. 13.5 sq. in NFVA per lineal foot.
 - 3. 5/8 inch low profile design.
 - 4. Widths to choose from: 11" (5-1/2" on each side of ridge).
 - 5. Suitable for slopes from 3/12 to 16/12.
 - 6. Crush Proof Design.
 - 7. Made from heat resistant polypropylene.
 - 8. Covered with factory formed asphalt cap shingles.
 - 9. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Vent, Inc.; a Gibraltar Industries company.
 - b. Cor-A-Vent, Inc.
 - c. GAF Materials Corporation.
 - d. Obdyke, Benjamin Incorporated.
 - e. Owens Corning.

2.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- diameter, smooth shank, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or wood sub-strates.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.
- D. Staples: Not allowed.

2.5 METAL FLASHING AND TRIM

- A. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
 - 1. Gauge: 24.

2. Drip Edges: Pre-fabricated 8-inch stock width, in lengths not exceeding 10 feet formed with 3.625-inch flat top edge, 3.5-inch fascia, minimum 0.5-inch kick with 0.375-inch hemmed drip edge, Kynar coated or proven equal, color: white.
- B. Vent Pipe Flashing: Pipes penetrating shingled roofs shall be ARFCO self-sealing neoprene collar with aluminum flange.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Remove existing roofing materials to wooden substrate. Remove existing fasteners completely top avoid telegraphing.
 2. Remove all existing roofing debris from project site immediately and clean ground area around the building of all roofing debris to Owner's satisfaction.
 3. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 4. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
 5. Confirm quantities of any rotten wooden substrates and replace with matching new wooden substrate materials.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Rake Drip Edges: Install Rake drip edge flashing over underlayment, fasten to roof sheathing, 16" O.C. with flat head roofing nails, staples are not permitted.
- C. Single-Layer Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with underlayment nails.
1. Install underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of underlayment over self-adhering sheet underlayment not less than 3 inches in direction to shed water. Lap ends of underlayment not less than 6 inches over self-adhering sheet underlayment.
 2. Install fasteners at no more than 36 inch o.c.

- D. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
1. Eaves: Extend 6'0" from edges of eaves.
 2. Rakes: Extend 3'0" from edges of rakes.
 3. Ridge: Extend 3'0" from edges of ridge (6'0" total).
 4. Cupola Roof: Cover in its entirety.
 5. Flashing: Tape off continuously with min. 3" wide Self-Adhering Sheet Underlayment rolls, overlap joints min. 6".
 6. Roll all Self-Adhering Sheet Underlayment flat and secure with weighted rollers.

3.3 METAL FLASHING INSTALLATION

- A. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
- B. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by Manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
1. Fasten asphalt shingles to roof sheathing with flat head roofing nails, staples are not permitted.
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed with self-sealing strip face up at roof edge. Starter shingles shall overhang drip-edge below minimum 3/8-inch, or according to manufacturer's recommendations. Manufacturer's starter shingles are allowed.
1. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of six roofing nails per piece, located according to manufacturer's written instructions.
- E. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- F. Ridge Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION

SECTION 22 00 10- BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY OF PLUMBING WORK

- A. The Work includes, but is not limited to, the following:
 - 1. Furnish all labor, materials, equipment, transportation and perform all operations as required to install a complete plumbing system in accordance with these specifications and applicable Drawings.
 - 2. Study the drawings and specifications and coordinate Mechanical and Plumbing work with that of Architectural and other trades. Report all discrepancies to the Engineer prior to submitting a bid.
 - 3. Other work as required to provide complete and operating mechanical and plumbing systems.

1.2 RELATED DOCUMENTS

- A. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to Division 22 and all its Sections.

1.3 RELATED WORK DESCRIBED ELSEWHERE

- A. Provide under the appropriate Section, all cutting, patching, trenching, plastering, chases, slots, furring, grounds, masonry foundations, excavation, backfilling, pads, conduits, etc., incidental to the installation of plumbing apparatus. Execute the work by qualified trades as shown on the Drawings and under the direction of this Section.
- B. Electrical work: Plumbing work shall include the installation of all motors, temperature controls, limit switches, etc., as herein specified. Work by the electrical sub-contractor (EC) shall include all other switches, pilot lights, fused and non-fused disconnect switches, outlets, motor starters, except as herein specified, and all necessary wiring and fuses to properly connect all mechanical/electrical equipment.
- C. The following work shall be provided under the designated Sections:
 - 1. Cutting and patching: By the General Contractor.
 - 2. Division 01, General Requirements: Temporary toilets.
 - 3. Division 31, Earth Work, Division 33 Utilities: New sanitary sewers and manholes and new storm sewers and drywells.
 - 4. Division 31, Earth Work, Division 33 Utilities: New water mains and services.
 - 5. Division 31, Earthwork: Trenching and backfilling
 - 6. Division 07, Division 08, Openings: Flashing for vents and roof drains at roof.
 - 7. Division 26, Electric Work.

1.4 ALTERNATES

- A. There are no plumbing alternates in the project.

1.5 ENGINEER/ARCHITECT

- A. The term “Engineer” shall refer to the mechanical consulting Engineer whose seal appears on the mechanical drawings for this project and, for the purposes of contractual matters, shall be synonymous with the term “Architect” or “Architect/Engineer.”

1.6 WORK SEQUENCE & COORDINATION

- A. Provide on a timely basis the proper trade with all locations and details as required.
- B. Install work under this section so as to conform to the progress of the work of other sections. Complete the mechanical work as soon as conditions of the building will permit.
- C. Coordinate in advance with other trades the shape, size and position of all necessary openings, sleeves, supports and related to avoid conflicts. In the event of unavoidable conflicts, consult Engineer for resolution.
- D. Refer to Division 26 specifications for electrical work required for mechanical. Verify that the electrical characteristics of the mechanical equipment being provided is compatible with the project electric power circuits available; if in doubt consult Engineer.
- E. The Plumbing Contractor shall coordinate with the electrical contractor and the project and/or site electrical service and distribution to verify supply power, voltage, etc.
- F. Prior to ordering plumbing equipment, the Plumbing Contractor shall verify equipment voltage and all required electrical accessories to be provided including, but not limited to disconnects, starters, VFD’s, controls (if applicable), etc. with the Electrical Contractor.

1.7 STANDARDS OF MATERIALS

- A. All materials and equipment shall be new and of the latest design of the respective manufacturers. All material and equipment of the same classification shall be the product of the same manufacturer unless otherwise specified.
- B. Where standards have been established by the following, they shall conform to those standards as to quality, fabrication, application, and installation and be not less than further required under this specification.
 - 1. Underwriters Laboratories, Inc. (UL).
 - 2. American National Standards Association (ANSI).
 - 3. National Fire Protection Association (NFPA).
 - 4. Occupational Safety and Health Administration (OSHA).
 - 5. Standards of local Building Codes
 - 6. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

1.8 SUBSTITUTIONS

- A. Any proposal for a substitution shall be made in writing by the Contractor, who shall submit full details for consideration and obtain written acceptance of the Engineer.

- B. Acceptance of a proposed substitution by the Engineer shall not relieve the Contractor from his responsibility to provide a satisfactory installation of the Work in accordance with the intent of the plans and specifications and shall not affect his guarantee covering all parts of the work.
- C. Any material or equipment submitted for acceptance which is arranged differently or of a different physical size and/or weight from that shown or specified shall be accompanied by shop drawings indicating the different arrangements of size and the method of making the various connections to the equipment. The final results shall be compatible with the system as designed.
- D. Any additional cost, by this or other trades, resulting from the substitution of equipment shall be paid by this Contractor.
- E. Any cost savings resulting from a substitution shall be deducted from the contract amount.
- F. In the event a proposed substitution for material or equipment has been rejected, Engineer will only review subsequent submittals for that material or equipment that are not substitutes.

1.9 SUBMITTALS

- A. Submit under procedures given in Division 01.
- B. Shop Drawings: Before any materials are purchased or released for production, submit to the Engineer an electronic set of shop drawings showing all the HVAC materials proposed to be furnished and installed.
- C. Record Drawings: During progress of the Work, maintain an accurate record of all changes made in the system installation from the layout and materials shown on the approved shop drawings. At the completion of the project, transfer all information onto a set of new blue-line prints and submit them to the Engineer.
- D. Owner's Manual: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer for the Owner two copies of a manual describing the system:
 1. Provide manuals in durable plastic ring binders, nominal 8½ x 11" size.
 2. Identification on, or readable through, the front cover stating general nature of the manual.
 3. A copy of all reviewed submittals and shop drawings.
 4. Complete instructions regarding operation and maintenance of all equipment involved.
 5. Complete name and address of nearest vendor of replaceable parts.
 6. Copy of all guarantees and warranties issued.
 7. Where contents of manuals include manufacturer's catalog pages, clearly indicate the precise items included in this installation.
- E. Submit shop drawings and product data grouped in sets to include complete submittals of related systems, products, and accessories in a single submittal. Clearly mark each submittal with appropriate specification section and paragraph reference.
- F. Mark dimensions and values in units to match those specified.
- G. Submittals shall be reviewed by, and carry the approval stamp of, the subcontractor and be initialed and dated by the reviewer.

- H. Submit certificate of final inspection and approval from authority having jurisdiction, and record electrical drawings.
- I. Upon request, provide samples for inspection. Samples will be returned after inspection is completed.

1.10 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to Work specified in other sections. Obtain permission of Engineer before proceeding.
- C. Inspection:
 - 1. Prior to commencing the work of this Section, carefully inspect the installed work of all other trades to verify that the work is complete to the point where this installation may properly commence.
 - 2. Verify that plumbing work may be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.
- D. Discrepancies
 - 1. In the event of discrepancy, immediately notify the Engineer.
 - 2. Do not proceed with installation in areas of discrepancy until the discrepancies have been fully resolved.

1.11 DEMOLITION

- A. **All existing plumbing equipment shall remain unless noted otherwise.**
- B. The plumbing contractor shall be responsible for removal and/or relocation of existing fixtures and equipment and the removal and/or capping of associated waste, vent, hot, cold and gas lines.
- C. Removed equipment shall be turned over to the owner or properly disposed of by the contractor as directed by the owner.

1.12 DEFINITIONS

- A. In this Section, the word “furnish” means to supply and deliver to the site ready for installation. The word “install” means to unload and place in proper position at the site and perform all operations necessary for secure mounting and correct operation ready for the intended service or use. The word “provide” means to furnish and install.

1.13 WORKMANSHIP

- A. Qualifications of Workmen: Use sufficient qualified workmen and competent supervisors in the execution of the work to ensure proper and adequate installation of system throughout and to comply with the project schedule.

- B. Codes: Work and/or mechanical equipment shall conform with all Local and State Rules and Regulations as well as the most recent state and city adopted versions of the National Fire Protection Association and the Building Officials and Code Administrators (BOCA), Maine Uniform Building and Energy Code, Maine State Plumbing Code, Ventilation Standard ASHRAE 62.1 and the Maine State Energy Code (ASHRAE 90.1). These codes are considered a part of these specifications.
- C. In the event of a conflict with required codes or an obvious misapplication of equipment, material, or other installation, before proceeding, promptly notify the Engineer. In no event shall any work be installed that is contrary to applicable codes.
- D. Qualification of Workmen: Use sufficient journeyman plumbers and competent supervisors in the execution of this portion of the work to ensure proper and adequate installation of plumbing throughout.

1.14 PRODUCT HANDLING

- A. Protection: Protect all materials before, during and after installation and protect the installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Engineer at no additional cost to the Owner.

1.15 DEVIATIONS AND DISCREPANCIES

- A. The Drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the mechanical work and exact locations shall be determined in the field subject to approval by the Engineer. Work indicated, but having minor details obviously omitted such as pipe and duct rise, drop and/or fittings, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, and electrical drawings so that work under this section is properly installed and coordinated with other sections.
- B. The Drawings and specifications are complementary each to the other and what is called for in one shall be as binding as if called for by both. In the event of conflicting information on the drawings, or between or within drawings and specifications, or between trades, that which is better, best, most stringent, or most expensive will govern, except as may otherwise be permitted by Engineer.
- C. Bidders shall study plans and specifications and in the event there are any apparent errors, omissions, conflicts, or ambiguities, shall contact Engineer for clarification prior to submitting their bid.

1.16 INSURANCE

- A. The Contractor shall purchase and maintain all Workers' Compensation Insurance, Public Liability and Property Damage Insurance during the progress of the Work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS.

1.17 SAFETY REGULATIONS

- A. All work shall be performed and/or installed to conform to all requirements of the Occupational Safety and Health Act and all amendments thereto.

1.18 TEMPORARY HEAT

- A. The Mechanical Contractor shall comply with the requirements for temporary heat as specified in Division 01.
- B. The use of electric heaters for temporary heating is prohibited.

1.19 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.20 PERMITS

- A. Apply for, obtain and pay for all permits and inspections required by law and notify proper authorities in ample time for inspections to be made prior to completion of the Work.

1.21 ASBESTOS ABATEMENT

- A. If during the course of the work, the existence of asbestos or asbestos containing materials is encountered or suspected in the structure or building, promptly notify the Owner and Engineer. The Owner shall be responsible for all asbestos related activities that may be required including: site surveys, sampling, testing, removal specifications and removal.
- B. Do not perform any work prior to receipt of written instructions from the Owner.

1.22 CLOSING IN UNINSPECTED WORK

- A. General: Do not cover up or enclose work until it has been properly and completely inspected and approved.
- B. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required, and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Engineer and at no additional cost to the Owner.

1.23 CONTRACT CLOSEOUT

- A. Final Cleaning:

1. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the plumbing installation, removing all labels and all traces of foreign substance.
 2. Execute final cleaning prior to final inspection.
 3. Clean interior and exterior surfaces. Vacuum carpeted and soft surfaces.
 4. Clean debris from site, roofs, gutters, downspouts, and drainage systems.
 5. Clean all strainers and floor drains.
- B. Project Record Documents: Submit the following
1. Record Documents and Shop Drawings: Legibly mark each item to record actual construction.
 2. Submit documents to Engineer prior to claim for final application for payment.
- C. Final Adjustment: Provide necessary mechanics and/or engineers as necessary to make final adjustment of operation of the systems so that the systems are turned over to the Owner in first class operating condition.
- D. Owner Training: On completion of the job, the Contractor shall provide a competent technician to thoroughly instruct the owner's representative in the care and operation of the system. The time of instruction shall be arranged with the Owner.
- E. Warranties: Warrant all work and materials for a period of one year commencing with the acceptance by the Owner of the completed installation in accordance with the Contract Documents. Replace any work, materials, equipment, or system, which develops defects within the warranty period, without cost to the Owner. Specific equipment may require a warranty greater than one year and shall be complied with as noted within the equipment specification.

END OF SECTION

SECTION 22 05 00 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Exterior Sleeves and Mechanical Seals
2. Interior Pipe Sleeves and Escutcheons.
3. Firestopping.
4. Hangers and Supports.
5. Valves.
6. Backflow Prevention.
7. Thermometers.
8. Mixing Valves.
9. Electric Heating Cable – Freeze Protection.
10. Fire Extinguishers and Cabinets.
11. Equipment Identification.
12. Electric Motor Efficiency Requirements.

1.2 RELATED SECTIONS

1. Section 22 00 10, Basic Plumbing Requirements.

1.3 SUBMITTALS

- A. Submit in accordance with Section 22 00 10.
- B. Product Data: Provide catalog data for the following:
1. All equipment included in this section.

PART 2 - PRODUCTS

2.1 EXTERIOR SLEEVES AND MECHANICAL SEALS

- A. Exterior Sleeves: Where piping passes through exterior walls, provide and install a complete pipe sleeve/hydrostatic wall closure system.
1. Wall sleeve: Steel pipe, two sizes larger than active pipe and the same length as the thickness of the wall, ASTM A 53, Type E, Grade B, Schedule 40, galvanized, non-threaded ends.
- B. Mechanical Seals: Modular sealing unit, designed for field assembly, to fill annular space between pipe and sleeve:
1. Link-Seal Model LS wall seal by Thunderline Corp. or approved equal, hydrostatic closure device comprised of identical interlocking links of solid synthetic rubber compounded to resist ozone, water, chemicals and extreme temperature variations.

2. Each link shall be connected by corrosion resistant bolts and nuts to form a belt which is to fit snugly around the pipe. Under each bolt and nut there shall be a metal pressure plate so that when each nut is tightened the rubber links will expand between the pipe and sleeve to form a continuous, air and water tight seal.

2.2 INTERIOR PIPE SLEEVES AND ESCUTCHEONS

- A. Masonry and/or fire rated wall and floor penetrations: Steel Pipe, ASTM A 53, Type E, Grade B, Schedule 40, galvanized, non-threaded ends.
- B. Non-masonry wall penetrations: Schedule 40 PVC with non-threaded ends, or #24 gauge galvanized steel tubes with wired or hemmed ends.
- C. Sealing:
 1. Caulk spaces between sleeves and pipes with a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened to make smoke and watertight. Thunderline Link-Seal or equal.
- D. Escutcheons: Two piece nickel plated steel floor and ceiling plates.

2.3 FIRESTOPPING

- A. Refer to Section 23 05 00, Common Work Results for HVAC for firestopping at all fire rated penetrations.

2.4 HANGERS AND SUPPORTS

- A. General
 1. All hangers and supports shall be specially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.
 2. Piping specified herein shall not be supported from piping or equipment of other trades.
 3. Hangers shall be heavy duty steel adjustable band type; plain for steel and cast iron pipe, and copper plated for copper tubing.
 4. Exposed vertical risers 3/4" and smaller shall be supported at the mid-point between each floor with split-ring type hangers; copper plated for copper tubing.
 5. Provide insulation saddles for all cold water and roof leader piping.
- B. Hanger Rods
 1. Hanger rods shall be all-thread rod in concealed areas, and rods threaded on ends of rod only in finished areas and the Boiler Room. Rod size shall be 3/8" for piping 2" and under; 1/2" for 2 1/2" to 6"; 5/8" over 6".
 2. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks or structural slabs and compound anchor shields and bolts in poured concrete.
 3. Supports: Provide structural iron supports, as required.

2.5 VALVES

- A. Provide valves by a single manufacturer by one of the following: Jenkins, Nibco, Crane, Fairbanks, Stockham, or approved equal.
 - 1. Gate Valves - Shall be 125# WSP bronze, soldered ends, Nibco S-121 Disc, Jenkins 1242, Crane 1334.
 - 2. Globe Valves - 2" and under shall be 125# WSP bronze, solder ends, with renewable composition disc, Nibco S-235 (Y) Crane 1310.
 - 3. Check Valves - 300# WOG bronze swing check, regrinding bronze disc, screw-in cap, Nibco S-413 (BWY), Jenkins 1222, Crane 1342.
 - 4. Drain Valves - Shall be 125# WSP hose-end boiler drains. Nibco No. 72 or equivalent.
 - 5. Ball Valves - Acceptable in lieu of gate and globe valves, in sizes ½" to 2". 400 lb. WOG bronze body, screwed or solder ends, bronze ball, Buna stem seals, Buna-N or equal resilient seats, lever handle. Equal to Nibco T-580.
- B. Isolation valves: Provide isolation valves at the base of all hot and cold water risers supplying two or more floors.

2.6 BACKFLOW PREVENTION

- A. General: Install backflow preventers at all cross connections to prevent the backflow of contaminated water into the potable water supply in accordance with the local and state plumbing codes. Units shall be of bronze construction with bronze strainer and stainless steel internal parts and tight seating rubber check valve assemblies. The device (specified or indicated on the plans) shall meet the requirements of A.S.S.E. Standard 1013.
- B. Reduced Pressure Zone Type: A reduced pressure backflow preventer shall be a complete assembly including tight-closing shut-off valves before and after the device and also be protected by a strainer. The design shall include test cocks, a pressure-differential relief valve located between two positive seating check valves. The device, (specified or indicated on plans) shall meet the requirements of A.S.S.E. Standard 1013 and AWWA-C511-92. It shall be suitable for supply pressure up to 175 psi and temperatures up to 140°F, Watts Regulator Company 909, Febco 825Y or Wilkens 575.
- C. Double Check Valve Type
 - 1. ½ and ¾" sizes: Watts No.9D backflow preventer with intermediate atmospheric vent shall be used to prevent flow of polluted water into the potable water system. Unit shall be suitable for supply pressures up to 175 psi and supply temperatures up to 210°F constant and 250°F intermittent. The device shall meet the requirements of ASSE standard 1012. Unit may be installed vertically or horizontally and is suitable for use under continuous pressure, Febco 815.
 - 2. ¾" and larger: Watts No. 007/700 has bronze body construction and is standardly equipped with a strainer, gate valves and ball type test cocks that may be installed either horizontally or vertically. Sizes: ¾", 1", 1½" and 2". The device shall meet the requirements of ASSE standard 1015 and AWWA - C510-92. Suitable for supply pressures up to 175 lbs. and for supply water temperatures up to 140°F. Febco 805, Wilkens 550.
- D. Vacuum Breakers
 - 1. Pressure Type Vacuum Breakers: Watts No. 800 are suitable for working temperatures from 33°F. to 210°F. and pressures from 15 psi to 150 psi. Unit includes test cocks and tight seating gate valves. Units are suitable for continuous supply pressure.

2. Atmospheric Vacuum Breakers: Watts No. 288A are suitable for working pressures up to 125 psi and maximum temperatures to 210°F. Unit No. 8 series shall be used to prevent backflow of polluted water at hose connections.

E. Schedule

1. All hose bibbs and service sinks - Type 8A.

2.7 THERMOMETERS

- A. Furnish and install thermometers at the water heater outlets and elsewhere as indicated on the Drawings. Thermometers to be bi-metal, adjustable angle dial type with 3" stainless steel case and glass window. Provide each unit with a brass separable socket. All thermometers shall be provided with stems long enough to get a true reading of the water temperatures and set in a location to be visible. Thermometers to be as manufactured by Trerice, Weiss or Moeller. Equal to Trerice B-83600.

B. Schedule

1. DHW Heater: 0-180°F

2.8 MIXING VALVES

- A. Multiple Unit: Leonard Model 270, 370, 470 Thermostatic Mixing Valves, bronze body, copper encapsulated thermostat, brass and engineered polymer internals, stainless steel spring, lead free, locking temperature adjustment knob (tamper-resistant), integral check valves on inlets, MIPS connections, rough bronze finish. Unit shall comply with ASSE 1070.
1. Makes - Leonard, Powers, Symmons or equal.

2.9 ELECTRIC HEATING CABLE (FREEZE PROTECTION)

A. General

1. An electric self-regulating heating cable shall be applied as indicated to maintain freeze protection to -20 F. Coordinate location with the architect.

B. Materials

1. The self-regulating heater shall consist of two (2) 16 AWG nickel-coated copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be cross over itself without over-heating, to be used directly on plastic pipe, and to be cut to length in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket. (Optional: For installation on plastic piping, the heater shall be applied using aluminum tape (AT180). To provide a good ground path where none exists and to enhance the heater's ruggedness, the heater shall have an outer braid of tinned-copper and an outer jacket of modified polyolefin (-CR).)
2. In order to provide energy conservation and to prevent overheating, the heater shall have a self-regulation factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heater output going from 40 F pipe temperature operation to 150 F pipe temperature operation.
3. **The heater shall operate on line voltages of 240 volts single phase without the use of transformers.**

4. The required heater output rating shall be 8 watts per foot at 50 F. (Heater selection based on 1" fiberglass insulation on metal piping).
 5. The heater shall be XL-Trace as manufactured by Raychem Corporation or equal.
 6. Power connection, end seal, splice and tee kit components shall be applied in the field.
 7. The system shall be controlled by an ambient sensing thermostat set at 40 F, either directly or through an appropriate contactor.
 8. Ground fault circuit breaker shall be provided as required by NEC.
 9. Installation
 - a. Apply the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or fiberglass tape.
 - b. Apply "electric traced" signs to the outside of the thermal insulation.
- C. After installation and before and after installing the thermal insulation, subject heat to testing using a 2500 VDC megger. Minimum insulation resistance should be 20 megaohms regardless of length. The installer shall test for both heating cable bus wires to verify the connection of any splices.

2.10 FIRE EXTINGUISHERS AND CABINETS

- A. Provide and install U.L. approved fire extinguishers with cabinets or brackets as shown. Location of extinguishers and cabinets shall be as shown on the DRAWINGS or as directed.
- B. Extinguishers
1. Type - All purpose "A-B-C" dry chemical extinguishers, 5 or 10 lb. as indicated. Provide wall mounting bracket.
 2. Type - K wet chemical extinguishers, 5 or 10 lb. as indicated, suitable for kitchen use (Class K fires). Provide wall mounting bracket.
 3. Extinguishers shall be charged and ready for use.
- C. Cabinets: Recessed/semi-recessed series 1700 cabinets for single portable fire extinguisher. Cabinet shall include: 22 gauge steel box, one piece 22 gauge tubular steel door, one piece 20 gauge steel frame with continuous steel hinge. Cabinet furnished with white baked enamel finish. Provide full 1/4" clear glass door with acrylic glazing and cam latch door.
- D. Mount extinguishers with top not more than 5 ft. above floor. Coordinate height, recess depth and location with architect.
- E. Fire extinguishers and cabinets shall be as manufactured by Potter Roemer, J&L, Standard, or Moon.

2.11 ELECTRIC MOTOR EFFICIENCY RATINGS

- A. Motors 1/3 hp and smaller shall be wired for 120 volt, 1 phase, 60 hz; motors 1/2 hp and larger shall be wired for 3 phase, 60 Hz, unless specifically shown otherwise. Motors 1 Hp and larger shall be NEMA Premium Efficiency Motors in accordance with The NEMA Premium™ efficiency levels are contained in NEMA Standards Publication MG 1- 2006, in Tables 12-12 and 12-13, respectively. Additionally, all mechanical equipment shall comply with efficiency requirements as outlined in ASHRAE 90.1 2016 or MUBEC (Maine Uniform Building and Energy Code).

PART 3 - EXECUTION

3.1 GENERAL

- A. Inspection
 - 1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 - 2. Verify that plumbing can be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.
- B. Discrepancies
 - 1. In the event of discrepancy, immediately notify the Architect/Engineer.
- C. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 CLEANING

- A. Prior to acceptance of the building, thoroughly clean all exposed portions of the plumbing installation, remove all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.
- B. Clean debris from site, roofs, gutters, downspouts, and drainage systems.
- C. Clean all strainers and floor drains.
- D. Fill all traps.

3.3 EQUIPMENT IDENTIFICATION

- A. Valves shall be provided with brass tags and chains securely attached to the stem or body. They shall be suitably identified by number or name to indicate the service. A framed and glazed directory of these items shall be prepared to show the location and function of each item. The directory shall be mounted in the mechanical room and will be incorporated as part of the Operating and Maintenance Instructions.
- B. All mechanical equipment shall be neatly stenciled in a conspicuous place indicating the service or equipment number.
- C. All pipes shall be identified and provided with flow arrows in accordance with the Maine State Plumbing Code.

END OF SECTION

SECTION 22 07 00 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes mechanical insulation for the following:
 - 1. Cold water lines.
 - 2. Hot water lines.
 - 3. Piping below handicapped sinks and lavatories.

1.2 RELATED SECTIONS

- 1. Section 22 00 10, Basic Plumbing Requirements.
- 2. Section 22 11 16, Domestic Water Piping
- 3. Section 22 13 19, Sanitary Waste & Vent Piping

1.3 SUBMITTALS

- A. Submit in accordance with Section 22 00 10.
- B. Product Data: Provide catalog data for the following:
 - 1. All equipment included in this section including thickness and application.

1.4 QUALITY ASSURANCE

- A. Manufacturer: A company specializing in the manufacture of mechanical insulation with a minimum of five years experience.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Insulation systems shall have a flame spread rating per ASTM E 84 of 25 or less and a smoke developed and fuel contributed rating of 50 or less.

2.2 PIPING INSULATION

- A. Glass Fiber Insulation: Provide manufacturer's standard product by one of the following acceptable manufacturers:
 - 1. CertainTeed
 - 2. Knauf Fiberglass
 - 3. Owens-Corning
 - 4. Schuller International, Inc.
 - 5. Approved equal.

- B. Minimum pipe insulation thickness (inches), based on minimum thermal resistance (R) of 4.0 per inch of thickness on a flat surface at a mean temperature of 75°F: Unit to be fiberglass heavy density sectional pipe insulation system having a factory applied vapor barrier laminate all-service jacket.

Piping System Type	Fluid Temp Range, °F	Runouts	Size 0<1"	Size 1" to <1 1/2"	Size 1 1/2" to <4"	Size 4" to 8"	Size 8" and Larger
Domestic cold water		1/2	1/2	1/2	1	1	1
Domestic hot water	105+	1	1	1	1	1	1
Recirculation water	105+	1	1	1	1	1	1

Piping System Type	Fluid Temp Range, °F	Size 0≤ 1 1/2"	Size >1 1/2" to <4"	Size 4" to 8"	Size 8" and Larger
Process or safe system		1/2	1/2	1	1
Heating, hi pres/temp	350+/-	2 1/2	3	4	4
Heating, med pres/temp	251 – 350	1 1/2	3	3	3
Heating, low pres/temp	201 - 250	1 1/2	3	3	3
Heating, low temp	141 - 200 105 - 140	1 1/2	2	2	2
Cooling, chilled water, brine, Refrigerant	40 – 60 <40	1 1/2	1 1/2	1 1/2	1 1/2

2.3 PIPING BELOW HANDICAPPED LAVATORIES AND SINKS:

- A. Handicapped lavatory P-Trap and angle valve assemblies shall be insulated with the fully molded, Truebro, Handi Lav-Guard insulation kit, Model #102, light gray color with three-piece interlocking trap assembly and two-piece interlocking angle valve assemblies. Fasteners shall be nylon-type supplied with kit.

PART 3 - EXECUTION

3.1 PIPING

- A. Cold Water: Insulate all cold water piping above grade with fiberglass heavy density sectional pipe insulation system having a factory applied vapor barrier laminate all-service jacket. Entire insulation jacket lap, butt closure strips, exposed butt ends, and fitting covers to be sealed with white vapor barrier adhesive. Provide additional sealing of jacket with flare type staples to eliminate "fishmouths." Staples shall not penetrate more than 1/2 the insulation thickness.

- B. Hot Water Lines: Insulate all hot water and hot water recirculation piping with fiberglass heavy density sectional pipe insulation system with all-service jacket. Longitudinal jacket flaps to be secured with flare type staples to eliminate "fishmouths." Cut insulation to include hangers.
- C. Wrap all fittings with fiberglass insulation and cover with a one piece PVC fitting cover secured with flare type staples. Cover joints with 4" insulation straps over.
- D. Finish the ends of insulation on exposed pipes at valves, flanges, unions, etc., neat with covering to match jacket and secured with mastic.
- E. Do not insulate valves, flanges and unions.

END OF SECTION

SECTION 22 11 16 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:
 - 1. Interior and exterior water piping service and distribution

1.2 RELATED SECTIONS

- 1. Section 22 00 10, Basic Plumbing Requirements.
- 2. Section 22 05 00, Common Work Results for Plumbing.
- 3. Section 22 07 00, Plumbing Insulation.

1.3 SUBMITTALS

- A. Submit in accordance with Section 22 00 10 for the following:
 - 1. Pipe and fittings for all types of piping utilized.

PART 2 - PRODUCTS

2.1 PIPE

- A. Domestic Water Piping
 - 1. All hot and cold water piping shall be hard drawn copper tube with wrought or cast brass copper fittings and made up with 95-5 tin antimony solder.
 - 2. Below grade and below slab piping shall be type "K" soft temper; all other copper piping shall be type "L".
 - 3. Lead solder or flux with more than .2% lead content is prohibited.
 - 4. PEX cross-linked polyethylene tubing manifold system suitable for potable water use.
Floor drain primers only
 - a. ASTM F877.
 - b. Maximum temperature use 140°F.
 - c. Sustained pressure test 1000 hours at 190 psi at 180°F.
 - d. Brass or copper insert fittings with crimp rings, ASTM F1807.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING AND EQUIPMENT

- A. General
 - 1. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
 - 2. Provide uniform pitch of 1/4" per foot wherever possible but never less than 1/8" per foot or as shown on DRAWINGS for all horizontal waste and drainage piping within the

- building; pitch all vents for proper drainage; install vent piping with each bend 45° minimum from the horizontal wherever structural conditions will permit.
3. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the job site.
 4. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load-carrying structural members without the approval of the Architect/Engineer.
 5. Back vent all fixtures where required by the Plumbing Code.
 6. All risers and off-sets shall be substantially supported.
 7. Maximum Hanger Spacing:
 - a. Copper - ½ to 1": 6' on run; 2' from offset
 - b. Copper - 1 1/4" up: 10' on run; 4' from offset
 - c. Steel - All sizes: 10' on run; 6' from offset
 - d. Plastic - All: 6' on run; no sags permitted
 8. Arrange all piping to maintain required grade and pitch to lines and to prevent vibration. Provide expansion loops and anchors where shown on DRAWINGS.
 9. Make all changes in pipe size with reducing fittings.
 10. Provide drains at all low points in water piping with ½" gate valve with hose nipple, or hose-end boiler drain.
 11. No piping shall be installed in such a manner as to permit back siphonage or reverse flow of any liquid in water piping under any conditions.
- B. Joints and Connections
1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all cleanout plugs.
 2. Pack all joints in cast iron soil and waste pipe and fittings, using oakum and securing with one inch deep lead caulking, fully and properly caulked and smoothly finished, or install "push-on" or "no-hub" joints per manufacturer's requirements.
- C. Make all joints in copper pressure pipe with a 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations, except underground water to be silver soldered. Make joints in non-pressure copper tube with 50-50 tin-lead solder.

3.2 STERILIZATION OF WATER PIPES

- A. General: Purge new or repaired potable water systems of deleterious matter and disinfect prior to use. Follow the method prescribed by the health authority having jurisdiction, or, if a method is not prescribed by that authority, then follow the procedure described in either AWWA C601 or AWWA D105, or as described below. This requirement shall apply to "on-site" or "in-plant" fabrication of a system or a modular portion of a system.
1. Flush the pipe system with clean, potable water until dirty water does not appear at the points of outlet.
 2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours.
 3. The system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for three hours.
 4. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.

5. Repeat the procedure if it is shown by a bacteriological examination made by the authority that contamination is still present in the system.
 6. Provide all labor, equipment, materials, and test kits for chlorine application and tests.
 7. Chlorinate only when the building is unoccupied.
- B. Submit letter to Engineer certifying that sterilization has been performed and tested according to the above requirements.

3.3 TESTING

- A. General
1. Test all parts of the plumbing installation as specified, as required by applicable codes, and where and as directed by the Engineer. Make tests before work is covered by earth fill, building construction, or pipe covering. All testing, test gauges and equipment by the Contractor at no additional cost to Owner.
- B. Piping Tests
1. Hot and cold water piping shall be subjected to a hydrostatic pressure test of 100 psi for two hours with no pressure loss. Locate and repair leaks and repeat tests until work is tight.

END OF SECTION

SECTION 22 13 19 – SANITARY WASTE & VENT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:
 - 1. Sanitary waste and vent piping and associated fittings.
 - 2. Cleanouts
 - 3. Low temperature condensate drainage

1.2 RELATED SECTIONS

- 1. Section 22 00 10, Basic Plumbing Requirements.
- 2. Section 22 05 00, Common Work Results for Plumbing.
- 3. Section 22 07 00, Plumbing Insulation.

1.3 SUBMITTALS

- A. Submit in accordance with Section 22 00 10 for the following:
- B. Product Data: Provide catalog data for the following:
 - 1. All equipment included in this section.
 - 2. Submittal sheets to include all sizes and dimensions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide basic materials as specified in Section 22 00 10, and as additionally required by this Section.

2.2 PIPE

- A. Sanitary Soil, Waste, Vents, and Roof Drainage (Choice of following)
 - 1. Service weight cast iron soil pipe and fittings with B&S "push-on" gasket joints or "No-Hub" sleeve couplings CISPI Standard 301-72.
 - 2. Type "DWV" copper tubing and solder type drainage fittings, 50/50 solder. (Type "K" copper on urinal wastes.)
 - 3. Schedule 40 polyvinyl-chloride "PVC-DWV" pipe and solvent cemented socket drainage fittings.
- B. Vents through roof shall be black "ABS-DWV" pipe.

2.3 CLEANOUTS

- A. Provide cleanouts for soil, waste and storm piping at base of all stacks, where shown on the Drawings and as required by code.
 - 1. Floor Cleanouts: Flush with floor, round adjustable tops, bronze plug and lead seal, scoriated secured nickel bronze top, flashing flange with flashing device, inside caulk. Units shall be Josam 58000(-25) (-41); Smith Fig. 4026F-C or equal by Zurn, Watts or Wade.
 - 2. Wall Cleanouts: "T" fittings with bronze slotted plug and lead seal, stainless steel wall cover; Josam 58790 Smith Fig. 4531 or 4551 or equal by Zurn, Watts or Wade.
 - 3. Urinals: Provide a cleanout above the fixture connection fitting serving each urinal.

2.4 LOW TEMPERATURE CONDENSATE DRAINAGE

- A. General: Provide condensate drainage system for all cooling/refrigeration equipment. Piping shall be schedule 40 PVC with solvent cemented socket drainage fittings. Discharge into the sanitary system shall be through an air gap.
- B. Air gap fitting shall be used when piped into sanitary drainage. Fitting shall be equal to Josam, Model 88910 coated cast iron air gap with air ports and female threaded inlet and outlet.
- C. Provide "P" trap in condensate drainage piping from evaporator drain pans in cooling units. Trap rise shall be sufficient to maintain trap seal at fan inlet suction pressure.
- D. Provide condensate drainage for the following systems:
 - 1. DSS Units

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide pipe insulation according to Section 22 07 00.

3.2 INSTALLATION OF PIPING

- A. General:
 - 1. Provide uniform pitch of 1/4" per foot wherever possible but never less than 1/8" per foot or as shown on Drawings for all horizontal waste and drainage piping within the building; pitch all vents for proper drainage; install vent piping with each bend 45° minimum from the horizontal wherever structural conditions will permit.
 - 2. Back vent all fixtures where required by the Plumbing Code.
 - 3. All risers and offsets shall be substantially supported.
 - 4. Maximum Hanger Spacing: According to Section 22 05 00.
- B. Joints and Connections:
 - 1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all cleanout plugs.
 - 2. For cast iron soil and waste pipe and fittings, pack all joints with oakum and secure with one inch deep lead caulking, fully and properly caulked and smoothly finished, or install "push-on" or "no-hub" joints per manufacturer's requirements.

3. Make all joints in copper pressure pipe with a 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations, except underground water to be silver soldered. Make joints in non-pressure copper tube with 50-50 tin-lead solder.

3.3 TESTING

- A. Test all parts of the plumbing installation as specified, as required by applicable codes, and where and as directed by the Engineer. Make tests before work is covered by earth fill, building construction, or pipe covering. All testing, test gauges and equipment by the Contractor at no additional cost to Owner.
- B. Piping Tests: Plug all openings except at the highest point above the roof, and fill the entire system with water to the point of overflow. Water level shall hold constant for two (2) hours. Inspect each joint for visible leaks. All leaks shall be repaired. Doping of pinholes in soil pipe or fittings is not permitted.

3.4 CLEANING

- A. Prior to acceptance of the building, thoroughly clean all exposed portions of the plumbing installation, remove all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.
- B. Clean all floor drains and traps. Fill all traps. Clean all strainers and faucet aerators.

END OF SECTION

SECTION 22 33 00 – DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:
 - 1. Water Heaters

1.2 RELATED SECTIONS

- 1. Section 22 00 10, Basic Plumbing Requirements.
- 2. Section 22 05 00, Common Work Results for Plumbing.
- 3. Section 22 07 00, Plumbing Insulation.
- 4. Section 22 11 16, Domestic Water Piping.

1.3 SUBMITTALS

- A. Submit in accordance with Section 22 00 10 for the following:
 - 1. Water Heaters

PART 2 - PRODUCTS

2.1 ELECTRIC WATER HEATER

- A. Glass lined steel storage heater, 150 psi working pressure, 2" thick high density fiberglass insulation and heavy steel jacket with acrylic finish.
- B. Ten year warranty.
- C. 98% efficient immersion type low watt density heating elements with capacities as indicated on the drawings.
- D. Adjustable thermostats with automatic overheat safety control and manual reset.
- E. Unit shall have valved drain, pressure/temperature relief (Watts # 40 XL) and vacuum relief valves and thermometer in outlet. Provide Taco WAGS (Water and gas safety) valve in drain pan of unit.
- F. Provide insulation blanket
- G. Unit shall be Lochinvar, State or A.O. Smith.

2.2 LEAK DETECTOR

- A. General: Provide Taco LeakBreaker, or equal, which is installed on the incoming cold water supply to the water heater, shutting off the water to a leaking water heater. The plumb and plug

design is specifically engineered for use on a new or retrofit installation. Components are pre-wired to simplify the installation process, just plug in the sensor, valve, power supply and/or batteries. LeakBreaker can be tested anytime and then be reset to guard against a future leak. The LeakBreaker with eLink™ technology uses Wi-Fi® to send alerts via email or text. Notifications will be sent when the device detects status changes for the following: alarm activation, AC or battery power, sensor and valve connection, and module connectivity.

B. Construction:

1. Control Panel:
 - a. High performance engineered polymer
 - b. Actuator Body: High performance engineered polymer
 - c. Gears: High performance, internally lubricated, engineered polymer
2. Valve
 - a. Body: Forged brass
 - b. Stem: Brass
 - c. Press Ring: Brass
 - d. Ball: Brass (Chrome Plated)
 - e. Seats: Modified Teflon®
 - f. O-Rings: Viton®

C. Features:

1. eLink™ sends text and/or email alerts
2. WLAN 802.11 — b/g/n Compatible
3. Re-Settable and Testable
4. Quick Connect Wiring
5. Operates on Batteries or Power Supply - Power Supply with Battery Backup on eLink Model
6. Multi-Color LED Status Light
7. Audible Alarm
8. Alarm Mute
9. 2 N/O; N/C Dry Contacts
10. Full Port Valve
11. Easy Removable Actuator

D. Specifications:

1. Max. Operating Pressure140 PSI
2. Max. Shut Off Pressure.....125 PSI
3. Max. Static Pressure.....300 PSI
4. Maximum Ambient Temp.....135°F
5. Water Temp.....33°F to 220°F
6. ServicePotable Water
7. Flow Coefficient.....Cv 32 Kv 27.3

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide 4” high drip pan and Taco leak detector where indicated on the plans.

- B. Pipe the discharge from the pressure relief valve to the drain pan using copper tubing. Properly support piping both in the horizontal and vertical.
- C. Maintain manufacturers recommended clearances around units.

END OF SECTION

SECTION 22 40 00 – PLUMBING FIXTURES & EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:
 - 1. Plumbing fixtures.

1.2 RELATED SECTIONS

- 1. Section 22 00 10, Basic Plumbing Requirements.
- 2. Section 22 05 00, Common Work Results for Plumbing.
- 3. Section 22 11 16, Domestic Water Piping
- 4. Section 22 13 19, Sanitary Waste & Vent Piping.

1.3 SUBMITTALS

- A. Submit in accordance with Section 22 00 10.
- B. Product Data: Provide catalog data for the following:
 - 1. All plumbing fixtures including, drains, supplies and all accessories and options.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES AND EQUIPMENT

- A. General:
 - 1. Furnish and install all plumbing fixtures shown on the Drawings and as hereinafter Scheduled.
 - 2. To establish a standard of quality and design desired, specifications have been based generally on the use of Kohler Company fixtures; Elkay sinks and Sloan flush valves. An equal type and quality of fixture as manufactured by Zurn, American Standard or Eljer Company or flush valve by Coyne and Delaney is acceptable. Stainless steel sinks by Just are also acceptable.
 - 3. All fixtures are to be white vitreous china where not otherwise specified. All fittings shall have chromium finish.
 - 4. **Refer to Architectural drawings for mounting heights of all fixtures.**
- B. Water Closets:
 - 1. Type P-1A (Tank Type Suitable for ADA)
 - a. Fixture: K-3999-U Highline vitreous china toilet with elongated bowl, 1.28 gallons per flush gravity flush, insuliner tank lining, 12" rough in, flush valve and float valve assembly.
 - b. Supply: K-7637 3/8" angle supply with annealed vertical tube and stop.
 - c. Seat: K-4731-C Lustra solid plastic open front seat with check hinge.

C. Lavatories:

1. Type P-2A (Wall Lavatory Suitable for ADA)
 - a. Fixture: K-2032 Greenwich 20" x 18" vitreous china wall mounted lavatory with 4" faucet centers. Drilled for concealed arm carrier.
 - b. Trim: K-15182 Coralais single lever, 4-1/4" reach, 4" height, pop-up drain, spout, aerator and drain with 1-1/4" tailpiece.
 - c. Supplies: K-13711 3/8" I.P.S. supplies with loose key stops.
 - d. Trap: K-8998 1 1/4" cast brass "P" trap.
 - e. Support: Model 0700-M31, floor mounted lavatory supports with concealed arms or 0700-D-Z for back to back applications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide traps in wastes and stop valves on hot and cold water supplies to all fixtures.

END OF SECTION

SECTION 23 00 10 – BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY OF MECHANICAL WORK

- A. The Mechanical Work includes, but is not limited to, the following:
 - 1. Furnish all labor, materials, equipment, transportation and perform all operations as required to install a complete plumbing system in accordance with these specifications and applicable Drawings.
 - 2. Study the drawings and specifications and coordinate Mechanical and Plumbing work with that of Architectural and other trades. Report all discrepancies to the Engineer prior to submitting a bid.
 - 3. Other work as required to provide complete and operating mechanical and plumbing systems.

1.2 RELATED DOCUMENTS

- A. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to Division 23 and all its Sections.

1.3 RELATED WORK DESCRIBED ELSEWHERE

- A. Provide under the appropriate Section, all cutting, patching, trenching, plastering, chases, slots, furring, grounds, masonry foundations, excavation, backfilling, pads, conduits, etc., incidental to the installation of HVAC apparatus. Execute the work by qualified trades as shown on the Drawings and under the direction of this Section.
- B. Electrical work: HVAC work shall include the installation of all motors, temperature controls, limit switches, etc., as herein specified. Work by the electrical sub-contractor (EC) shall include all other switches, pilot lights, fused and non-fused disconnect switches, outlets, motor starters, except as herein specified, and all necessary wiring and fuses to properly connect all mechanical/electrical equipment.
- C. The following work shall be provided under the designated Sections:
 - 1. Cutting and patching: By the General Contractor.
 - 2. Division 01, General Requirements: Temporary toilets.
 - 3. Division 31, Earth Work, Division 33 Utilities: New sanitary sewers and manholes and new storm sewers and drywells.
 - 4. Division 31, Earth Work, Division 33 Utilities: New water mains and services.
 - 5. Division 31, Earthwork: Trenching and backfilling
 - 6. Division 07, Division 08, Openings: Flashing for vents and roof drains at roof.
 - 7. Division 26, Electric Work.

1.4 ALTERNATES

- A. Under Alternate #2 the DMR Office vestibule is deleted. Under Alternate #2 relocate the electric heater EH-1 to common wall between Office #1 and Office #2.

1.5 ENGINEER/ARCHITECT

- A. The term “Engineer” shall refer to the mechanical consulting Engineer whose seal appears on the mechanical drawings for this project and, for the purposes of contractual matters, shall be synonymous with the term “Architect” or “Architect/Engineer.”

1.6 WORK SEQUENCE & COORDINATION

- A. Provide on a timely basis the proper trade with all locations and details as required.
- B. Install work under this section so as to conform to the progress of the work of other sections. Complete the mechanical work as soon as conditions of the building will permit.
- C. Coordinate in advance with other trades the shape, size and position of all necessary openings, sleeves, supports and related to avoid conflicts. In the event of unavoidable conflicts, consult Engineer for resolution.
- D. Refer to Division 26 specifications for electrical work required for mechanical. Verify that the electrical characteristics of the mechanical equipment being provided is compatible with the project electric power circuits available; if in doubt consult Engineer.

1.7 STANDARDS OF MATERIALS

- A. All materials and equipment shall be new and of the latest design of the respective manufacturers. All material and equipment of the same classification shall be the product of the same manufacturer unless otherwise specified.
- B. Where standards have been established by the following, they shall conform to those standards as to quality, fabrication, application, and installation and be not less than further required under this specification.
 - 1. Underwriters Laboratories, Inc. (UL).
 - 2. American National Standards Association (ANSI).
 - 3. National Fire Protection Association (NFPA).
 - 4. Occupational Safety and Health Administration (OSHA).
 - 5. Standards of local Building Codes
 - 6. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

1.8 SUBSTITUTIONS

- A. Any proposal for a substitution shall be made in writing by the Contractor, who shall submit full details for consideration and obtain written acceptance of the Engineer.
- B. Acceptance of a proposed substitution by the Engineer shall not relieve the Contractor from his responsibility to provide a satisfactory installation of the Work in accordance with the intent of the plans and specifications and shall not affect his guarantee covering all parts of the work.

- C. Any material or equipment submitted for acceptance which is arranged differently or of a different physical size and/or weight from that shown or specified shall be accompanied by shop drawings indicating the different arrangements of size and the method of making the various connections to the equipment. The final results shall be compatible with the system as designed.
- D. Any additional cost, by this or other trades, resulting from the substitution of equipment shall be paid by this Contractor.
- E. Any cost savings resulting from a substitution shall be deducted from the contract amount.
- F. In the event a proposed substitution for material or equipment has been rejected, Engineer will only review subsequent submittals for that material or equipment that are not substitutes.

1.9 SUBMITTALS

- A. Submit under procedures given in Division 01.
- B. Shop Drawings: Before any materials are purchased or released for production, submit to the Engineer an electronic set of shop drawings showing all the HVAC materials proposed to be furnished and installed.
- C. Record Drawings: During progress of the Work, maintain an accurate record of all changes made in the system installation from the layout and materials shown on the approved shop drawings. At the completion of the project, transfer all information onto a set of new blue-line prints and submit them to the Engineer.
- D. Owner's Manual: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer for the Owner two copies of a manual describing the system:
 - 1. Provide manuals in durable plastic ring binders, nominal 8½ x 11" size.
 - 2. Identification on, or readable through, the front cover stating general nature of the manual.
 - 3. A copy of all reviewed submittals and shop drawings.
 - 4. Complete instructions regarding operation and maintenance of all equipment involved.
 - 5. Complete name and address of nearest vendor of replaceable parts.
 - 6. Copy of all guarantees and warranties issued.
 - 7. Where contents of manuals include manufacturer's catalog pages, clearly indicate the precise items included in this installation.
- E. Submit shop drawings and product data grouped in sets to include complete submittals of related systems, products, and accessories in a single submittal. Clearly mark each submittal with appropriate specification section and paragraph reference.
- F. Mark dimensions and values in units to match those specified.
- G. Submittals shall be reviewed by, and carry the approval stamp of, the subcontractor and be initialed and dated by the reviewer.
- H. Submit certificate of final inspection and approval from authority having jurisdiction, and record electrical drawings.

- I. Upon request, provide samples for inspection. Samples will be returned after inspection is completed.

1.10 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to Work specified in other sections. Obtain permission of Engineer before proceeding.
- C. Inspection:
 - 1. Prior to commencing the work of this Section, carefully inspect the installed work of all other trades to verify that the work is complete to the point where this installation may properly commence.
 - 2. Verify that H & V work may be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.
- D. Discrepancies
 - 1. In the event of discrepancy, immediately notify the Engineer.
 - 2. Do not proceed with installation in areas of discrepancy until the discrepancies have been fully resolved.

1.11 DEMOLITION

- A. **All existing HVAC equipment shall remain unless noted otherwise.**
- B. The mechanical contractor shall be responsible for the removal or relocation of existing HVAC equipment and the associated piping, ductwork and controls.
- C. Removed equipment shall be turned over to the owner or properly disposed of by the contractor as directed by the owner.

1.12 DEFINITIONS

- A. In this Section, the word “furnish” means to supply and deliver to the site ready for installation. The word “install” means to unload and place in proper position at the site and perform all operations necessary for secure mounting and correct operation ready for the intended service or use. The word “provide” means to furnish and install.

1.13 WORKMANSHIP

- A. Qualifications of Workmen: Use sufficient qualified workmen and competent supervisors in the execution of the work to ensure proper and adequate installation of system throughout and to comply with the project schedule.
- B. Codes: Work and/or mechanical equipment shall conform with all Local and State Rules and Regulations as well as the most recent state and city adopted versions of the National Fire Protection Association and the Maine Uniform Building and Energy Code, Maine State

Plumbing Code, Ventilation Standard ASHRAE 62.1, the Maine State Energy Code (ASHRAE 90.1). These codes are considered a part of these specifications.

- C. In the event of a conflict with required codes or an obvious misapplication of equipment, material, or other installation, before proceeding, promptly notify the Engineer. In no event shall any work be installed that is contrary to applicable codes.
- D. Qualification of Workmen: Use sufficient journeyman plumbers and competent supervisors in the execution of this portion of the work to ensure proper and adequate installation of plumbing throughout.

1.14 PRODUCT HANDLING

- A. Protection: Protect all materials before, during and after installation and protect the installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Engineer at no additional cost to the Owner.

1.15 DEVIATIONS AND DISCREPANCIES

- A. The Drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the mechanical work and exact locations shall be determined in the field subject to approval by the Engineer. Work indicated, but having minor details obviously omitted such as pipe and duct rise, drop and/or fittings, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, and electrical drawings so that work under this section is properly installed and coordinated with other sections.
- B. The Drawings and specifications are complementary each to the other and what is called for in one shall be as binding as if called for by both. In the event of conflicting information on the drawings, or between or within drawings and specifications, or between trades, that which is better, best, most stringent, or most expensive will govern, except as may otherwise be permitted by Engineer.
- C. Bidders shall study plans and specifications and in the event there are any apparent errors, omissions, conflicts, or ambiguities, shall contact Engineer for clarification prior to submitting their bid.

1.16 INSURANCE

- A. The Contractor shall purchase and maintain all Workers' Compensation Insurance, Public Liability and Property Damage Insurance during the progress of the work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the GENERAL CONDITIONS AND SUPPLEMENTARY CONDITIONS.

1.17 SAFETY REGULATIONS

1.18 All work shall be performed and/or installed to conform to all requirements of the Occupational Safety and Health Act of 1970 and all amendments thereto

1.19 TEMPORARY HEAT

- A. The Mechanical Contractor shall comply with the requirements for temporary heat as specified in Division 01.
- B. The use of electric heaters for temporary heating is prohibited.

1.20 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.21 PERMITS

- A. Apply for, obtain and pay for all permits and inspections required by law and notify proper authorities in ample time for inspections to be made prior to completion of the Work.

1.22 ASBESTOS ABATEMENT

- A. If during the course of the work, the existence of asbestos or asbestos containing materials is encountered or suspected in the structure or building, promptly notify the Owner and Engineer. The Owner shall be responsible for all asbestos related activities that may be required including: site surveys, sampling, testing, removal specifications and removal.
- B. Do not perform any work prior to receipt of written instructions from the Owner.

1.23 EFFICIENCY MAINE REQUIREMENTS

- A. The Contractor shall coordinate with the Engineer, equipment distributors and Efficiency Maine to obtain energy efficiency incentives and discounts. Refer to Efficiency Maine for the most recent and applicable programs.

1.24 CLOSING IN UNINSPECTED WORK

- A. General: Do not cover up or enclose work until it has been properly and completely inspected and approved.
- B. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required, and after it has been completely

inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Engineer and at no additional cost to the Owner.

1.25 CONTRACT CLOSEOUT

A. Final Cleaning:

1. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the heating installation, removing all labels and all traces of foreign substance. Provide clean air filters in all air handling equipment.
2. Execute final cleaning prior to final inspection.
3. Clean interior and exterior surfaces. Vacuum carpeted and soft surfaces.
4. Clean debris from site, roofs, gutters, downspouts, and drainage systems.
5. Replace filters of operating equipment.
6. At the closeout of the project and before occupancy the building shall be flushed for 48 hours with all air handling units set at 100% of their respective scheduled outside air quantities.

B. Project Record Documents: Submit the following

1. Record Documents and Shop Drawings: Legibly mark each item to record actual construction.
2. Submit documents to Engineer prior to claim for final application for payment.

C. Final Adjustment: Provide necessary mechanics and/or engineers as necessary to make final adjustment of operation of the systems so that the systems are turned over to the Owner in first class operating condition.

D. Owner Training: On completion of the job, the Contractor shall provide a competent technician to thoroughly instruct the owner's representative in the care and operation of the system. The time of instruction shall be arranged with the Owner.

E. Warranties: Warrant all work and materials for a period of one year commencing with the acceptance by the Owner of the completed installation in accordance with the Contract Documents. Replace any work, materials, equipment, or system, which develops defects within the warranty period, without cost to the Owner. Specific equipment may require a warranty greater than one year and shall be complied with as noted within the equipment specification.

END OF SECTION

SECTION 23 05 00 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Interior Pipe Sleeves and Escutcheons.
2. Firestopping.
3. Hangers and Supports.
4. Equipment Identification.
5. Electric Motor Efficiency Requirements.
6. General equipment installation requirements

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Product Data: Provide catalog data for the following:
1. All equipment included in this section.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify welder personnel and install according to AWS D1.1, “Structural Welding Code—Steel”,
- B. Steel Piping Welding: Qualify welder personnel and install according to ASME Boiler and Pressure Vessel Code, Section IX, “Welding and Brazing Qualifications.” Comply with ASME B31 Series, “Code for Pressure Piping” for all piping installations.
- C. Certify that all welder personnel have passed AWS qualification tests applicable to the work and that their certification is current.
- D. The Mechanical Contractor shall coordinate with the electrical contractor and the project and/or site electrical service and distribution to verify supply power, voltage, etc.
- E. Prior to ordering mechanical equipment, the Mechanical Contractor shall verify equipment voltage and all required electrical accessories to be provided including, but not limited to disconnects, starters, VFD’s, controls (if applicable), etc. with the Electrical Contractor.

PART 2 - PRODUCTS

2.1 INTERIOR PIPE SLEEVES AND ESCUTCHEONS

- A. Masonry and/or fire rated wall and floor penetrations: Steel Pipe, ASTM A 53, Type E, Grade B, Schedule 40, galvanized, non-threaded ends.
- B. Non-masonry wall penetrations: Schedule 40 PVC with non-threaded ends, or #24 gauge galvanized steel tubes with wired or hemmed ends.
- C. Sealing:
 - 1. Caulk spaces between sleeves and pipes with a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened to make smoke and watertight. Thunderline Link-Seal or equal.
- D. Escutcheons: Two piece nickel plated steel floor and ceiling plates.

2.2 FIRESTOPPING MATERIALS

- A. Provide under this section in accordance with Section 07841.
- B. Use only through-penetration firestop products that have been tested for specific fire resistance rated conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating required for the application:
 - 1. Latex Sealants: Single component latex formulations that when cured do not re-emulsify during exposure to moisture.
 - 2. Firestop Devices: Factory assembles steel collars lined with intumescent material sized to fit a specific outside diameter of penetrating item.
 - 3. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
 - 4. Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film.
 - 5. Firestop Pillows: Re-useable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag.
 - 6. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or non-sag) or vertical surface (non-sag).
 - 7. Silicone Foam: Multi-component, silicone based, liquid elastomers that when mixed expand and cure in place to produce a flexible, non-shrinking foam.
- C. Firestop systems shall be UL classified and rated for the type of construction where it is applied.

2.3 HANGERS AND SUPPORTS

- A. General
 - 1. All hangers and supports shall be specifically manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.
 - 2. Piping specified herein shall not be supported from piping or equipment of other trades.
 - 3. Hangers shall be heavy duty steel adjustable clevis type; plain for steel and cast iron pipe and copper plated for copper tubing.

4. Exposed vertical risers 3/4" and smaller shall be supported at the mid-point between each floor with split ring type hangers; copper plated for copper tubing.
5. All hangers on chilled water piping are to be installed on the exterior of the insulation with appropriate saddles.

B. Hanger Rods

1. Hanger rods shall be all thread rod in concealed area, and rods threaded on ends of rod only in finished areas and the Boiler Room. Rod size and spacing shall be as follows:

Nominal Pipe Size (in)	Maximum Span (ft)	Minimum Rod Diameter (in)
1	7	3/8
1 1/2	9	3/8
2	10	3/8
3	12	1/2
3 1/2	13	1/2
4	14	5/8
5	16	5/8
6	17	3/4
8	19	7/8
10	22	7/8
12	23	7/8

2. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks or concrete structural slabs and compound anchor shields and bolts in poured concrete.

C. Supports

1. Provide and install angle iron supports for pipe hangers as required. Angle iron supports shall be adequate size for span and piping load.

D. Safety

1. **Any support for piping, ductwork or equipment which is installed below seven (7) feet above finished floor shall have sharp edges blunted or rounded-off and shall be padded with 1" foam insulation to prevent possible personnel injury.**

2.4 ELECTRIC MOTOR EFFICIENCY RATINGS

- A. Motors 1/3 hp and smaller shall be wired for 120 volt, 1 phase, 60 hz; motors 1/2 hp and larger shall be wired for 3 phase, 60 Hz, unless specifically shown otherwise. Motors 1 Hp and larger shall be NEMA Premium Efficiency Motors in accordance with The NEMA Premium™ efficiency levels are contained in NEMA Standards Publication MG 1- 2006, in Tables 12-12 and 12-13, respectively.

- B. Additionally, all mechanical equipment shall comply with efficiency requirements as outlined in ASHRAE 90.1 2016 or MUBEC (Maine Uniform Building and Energy Code).

PART 3 - EXECUTION

3.1 GENERAL

- A. Inspection
 - 1. Prior to commencing the work of this Section, carefully inspect the installed work of all other trades to verify that such work is complete to the point where this installation may properly commence.
 - 2. Verify that equipment can be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Architect/Engineer.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION OF PIPING AND EQUIPMENT

- A. General:
 - 1. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
 - 2. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the job site.
 - 3. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load-carrying structural members without the approval of the Architect/Engineer.
 - 4. All risers and offsets shall be substantially supported.
 - 5. Arrange all piping to maintain required grade and pitch and to prevent vibration.
 - 6. Provide expansion loops and anchors where shown on Drawings.
 - 7. Make all changes in pipe size with reducing fittings.
 - 8. Provide drains at all low points in water piping with ½" gate valve with hose nipple, or hose-end boiler drain.
 - 9. Install piping to prevent back siphoning or reverse flow of liquid under all operating conditions.
- B. Joints and Connections:
 - 1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all cleanout plugs.
 - 2. Make all joints in copper pressure pipe with a 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations, except underground water to be silver soldered. Make joints in non-pressure copper tube with 50-50 tin-lead solder.
- C. Installation of mechanical equipment:
 - 1. In general all equipment is to be installed in accordance with the manufacturers recommendations and installation instructions.

2. All mechanical equipment shall be installed with adequate space available to perform normal maintenance and accessibility shall be provided for filter replacement.

3.3 FIRESTOPPING

- A. Install through penetration firestop systems in accordance with firestop system manufacturer's written installation instructions for products and applications indicated.
- B. Engage an experienced installer who is trained, certified, licensed, or otherwise qualified by the firestop system manufacturer to install the firestop products.
- C. Coordinate construction of openings and penetrating items to ensure that firestop systems are installed according to specified requirements.
- D. Provide firestop systems that are compatible with one another, with the substrates forming openings, with the items penetrating the firestop system, and under the conditions of service for the application being considered.
- E. Provide components for each firestop system that are needed to install fill materials. Use only components specified by the firestop system manufacturer and approved by the qualified testing agency for the designated system.
- F. Keep areas of work accessible until inspection by the AHJ has been completed.
- G. Inspecting Agency: Owner may engage a qualified independent inspecting agency to inspect the completed firestop system. The independent agency shall comply with ASTM E 2174 requirements including inspecting personnel qualifications, method of conducting inspections, and preparation of test reports.
- H. Where deficiencies are found, repair or replace the firestop systems so that they comply with requirements. Proceed with enclosing firestop systems with other construction only after inspection reports are issued and the firestop installations comply with requirements.

- 3.4 Protect the firestop system during and after installation to insure that the systems do not deteriorate and are not damaged during the remaining period of construction. In the event damage or deterioration occurs, remove affected firestop system and replace with new materials in compliance with this specification.]

3.5 EQUIPMENT IDENTIFICATION

- A. Valves: Provide with brass tags and chains securely attached to the stem or body. Identify by number or name to indicate the service.
- B. Provide a framed and glazed directory to show the location and function of each item. The directory shall be mounted in the mechanical room and will be incorporated as part of the Operating and Maintenance Instructions.
- C. All mechanical equipment including pumps, air handling units, boilers, fan coil units, unit heaters, condensers, etc., shall be neatly stenciled in a conspicuous place indicating the service or equipment number.

- D. All pipes shall be identified and provided with flow arrows spaced at 50 foot intervals with the exception of drops or risers to terminal units.

END OF SECTION

SECTION 23 05 93 – TESTING, ADJUSTING & BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this section includes, but is not limited to the following:

1. Demonstration of mechanical equipment.
2. Duct testing, adjusting and balancing.
3. Equipment testing adjusting and balancing.
4. Mechanical equipment starting.
5. Pipe testing, adjusting and balancing.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements
2. Section 23 09 33, Electric / Electronic Temperature Controls

1.3 SUBMITTALS

A. Submit in accordance with Section 23 00 10:

1. Provide report indicating all operational parameters as listed below for all new and existing (where indicated) HVAC and plumbing equipment.

1.4 QUALITY ASSURANCE

A. Balancing Contractor shall be approved by Engineer and be one of the following testing and balancing contractors:

1. Yankee Balancing
2. Central Air Balance
3. Tekon Technical Consultants Inc.
4. Air Solutions and Balancing
5. Maine Air Balance
6. Tab Tek

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING AND BALANCING

A. Upon completion of the heating, ventilating and air conditioning systems of the building, the Mechanical Contractor shall employ an independent balance firm to check, adjust and balance

all HVAC and plumbing equipment included in the contract. Notify Engineer two days in advance of start of balancing.

- B. It is the balancing contractors responsibility to refer to Section 23 09 33 3.1 "Description of Operation" and to coordinate with the temperature control contractor to determine all operating modes and required CFM's, GPM's etc for the mechanical systems, which shall be reflected in the balancing report.
- C. All instruments used in the checking, adjusting and balancing shall be accurately calibrated and maintained. Accuracy tests on instruments shall be performed in the presence of and whenever requested by the Engineer.
- D. Air and water balance and checking shall not begin until systems have been completed and are in full working order. The Mechanical Contractor shall put all heating, ventilating, and air conditioning systems and equipment into full operation and shall continue the operating of same during each working day of testing and balancing. Before starting any air system, the complete system shall be checked to make sure all components are in place and operating properly and that all manual dampers are open.
- E. Duct traverses shall be made to determine air flow and properly balance air quantities in main ducts for all ducted units. Traverse shall be made as close to the unit as possible to get an accurate measurement.
- F. All air terminals shall be tested with three readings taken and the average recorded along with that specified.
- G. Take all necessary air flow measurements to determine the output of the fans and units. Revise the RPM of the equipment as necessary to produce the CFM required at the various air outlets or inlets. The final air flow readings at the air outlets and inlets shall be within -5% to +10% of the air volumes indicated on the plans, however, relative space pressurization shall remain positive or negative as designed.
- H. The various systems shall operate with a minimum of air noise and the use of the air volume control dampers at the diffusers and registers to restrict air flow to the point they are noisy will not be acceptable.
- I. Balancing information shall be provided for all operating conditions on any piece of equipment designed to operate at multiple CFM or GPM settings
- J. Upon completion of the checking, adjusting and balancing, the Contractor shall submit six (6) certified copies of the Mechanical systems Test and Balance Report to the A/E for approval. The Report shall be in tabulated form with each piece of equipment or outlet properly identified by its equipment number or room number and location and shall include the following:
 - 1. Air Systems
 - a. Fan/Air Handling Unit Designation and service Location
Manufacturer
Model Number
Serial Number
 - b. Capacities (specified and actual) Total CFM
Return CFM
Outside air CFM

- Total static pressure
- Inlet static pressure
- Discharge static pressure
- Fan RPM
- c. Motor and Drive Data (specified/actual/manufacture)
- Horsepower
- Phase
- Voltage
- Amperage
- RPM
- Service factor
- Sheave size and number of grooves
- Fan sheave size and number of grooves
- Belts - quantity and model number
- d. Duct Traverse Data
- Equipment designation
- Duct size and location
- Effective area
- Duct velocity (specified/actual)
- CFM (specified/actual)
- Pressure
- e. Outlet Data
- Equipment designation and type
- Equipment location
- Equipment size
- CFM (design, initial, final)

K. Air balance dampers shall be adjusted and the position marked.

L. Water flow fittings shall be adjusted and the position marked.

M. Check operation of fire dampers, reset and tag date of test on side of duct next to access panel.

END OF SECTION

SECTION 23 07 00 – HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes mechanical insulation for the following:
 - 1. Refrigeration piping.
 - 2. Exterior refrigeration piping covers.
 - 3. HRU's (Thickness as indicated below)
 - a. Supply duct from unit.
 - b. Return duct to unit.
 - c. Outside air duct to unit.
 - d. Exhaust air duct from unit to louver, gooseneck or GRV
 - 4. Last seven (7) feet of exhaust ducts (not including HRU's or ERV's) up to wall cap, louver, brickvent or roof fan.

1.2 RELATED SECTIONS

- 1. Section 23 00 10, Basic HVAC Requirements.
- 2. Section 23 05 00, Common Work Results for HVAC.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Product Data: Provide catalog data for the following:
 - 1. Insulation for all equipment listed in this section including type, thickness, application and jacketing.

1.4 QUALITY ASSURANCE

- A. Manufacturer: A company specializing in the manufacture of mechanical insulation with a minimum of five years experience.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Insulation systems shall have a flame spread rating per ASTM E 84 of 25 or less and a smoke developed and fuel contributed rating of 50 or less.

2.2 PIPING INSULATION

- A. Glass Fiber Insulation: Provide manufacturer's standard product by one of the following acceptable manufacturers:

1. CertainTeed
2. Knauf Fiberglass
3. Owens-Corning
4. Schuller International, Inc.
5. Approved equal.

- B. Minimum pipe insulation thickness (inches), based on minimum thermal resistance (R) of 4.0 per inch of thickness on a flat surface at a mean temperature of 75°F: Unit to be fiberglass heavy density sectional pipe insulation system having a factory applied vapor barrier laminate all-service jacket.

Piping System Type	Fluid Temp Range, °F	Runouts	Size 0<1"	Size 1" to <1 1/2"	Size 1 1/2" to <4"	Size 4" to 8"	Size 8" and Larger
Domestic cold water		1/2	1/2	1/2	1	1	1
Domestic hot water	105+	1	1	1	1	1	1
Recirculation water	105+	1	1	1	1	1	1

Piping System Type	Fluid Temp Range, °F	Size 0≤ 1 1/2"	Size >1 1/2" to <4"	Size 4" to 8"	Size 8" and Larger
Process or safe system		1/2	1/2	1	1
Heating, hi pres/temp	350+/-	2 1/2	3	4	4
Heating, med pres/temp	251 – 350	1 1/2	3	3	3
Heating, low pres/temp	201 - 250	1 1/2	3	3	3
Heating, low temp	141 - 200 105 - 140	1 1/2	2	2	2
Cooling, chilled water, brine, Refrigerant	40 – 60 <40	1 1/2	1 1/2	1 1/2	1 1/2

2.3 REFRIGERATION PIPING

- A. Insulate refrigeration suction and liquid lines with Armaflex II elastomeric expanded closed cell insulation, thickness per table above, with a thermal conductivity of 0.27 @ 75°F, temperature range of -40 to 180°F and permeability of 0.17. Insulation shall be installed using adhesive #520 applied to 100% of surface. Apply two (2) coats of vinyl lacquer finish over all exterior insulation.
- B. Exterior Refrigeration Piping Covers: Provide refrigeration covers as manufactured by Fortress, model number LD122 or equal. Fortress professional duct/ fitting system hides unsightly AC line set. 2 duct sizes - 3.5" and 4.5", accommodate single or multiple line-set configurations. Longer ducting length - 8ft. Allows for fewer joints, 17 fittings assure a complete professional finish for even the most demanding installations. 1 Year Warranty. Professional grade polymers

to deliver long lasting durability. Fortress line set cover series was specifically developed to bridge the gap between the lightweight and the more costly lineset cover products available on the market. Made in the USA, Fortress has a number of innovations to suit the USA conditions - such as 8' lengths of duct and a 12 month guarantee. Available in 2 sizes and 4 different colors

1. Available Colors:
 - a. White - LD122W
 - b. Ivory - LD122I
 - c. Gray - LD122G
 - d. Brown - LD122B
 2. Features:
 - a. Application - Fortress is perfect for mini-splits, high velocity and conventional split Air conditioning systems.
 - b. Strong - Fortress ducting is extruded with our special formula rigid polyvinyl chloride, which is UV and weather resistant The result is a long lasting quality product that will remain attractive and provide protection for many years.
 - c. Protective - Fortress protects linesets, wiring and drain pipes from weather, vandalism and pest damage.
 - d. Easy to install - Fortress installs quickly, and can be easily accessed for repairs or replacement of the line set.
 - e. Stylish - Fortress eliminates unsightly line set used in a typical installation. Ducting is available in two lineset sizes and four neutral colors - white, ivory, brown and gray to compliment any residential or commercial building.
- C. Paintable - Brush, spray or roller to match or compliment custom colors. Follow paint manufacturers recommendations for vinyl products.

2.4 DUCT INSULATION

- A. Interior Supply, Return and Exhaust: 1½" thick fiberglass duct wrap with a factory applied vapor barrier facing and an R-value of 5 in accordance with ASTM C518 at a mean temperature of 75 °F. Material to carry U.L. label and be by one of the following acceptable manufacturers:
1. CertainTeed
 2. Knauf Fiberglass
 3. Owens-Corning
 4. Schuller International, Inc.
 5. Approved equal.
- B. Uninsulated Space Outside Air, Supply, Return and Exhaust Ductwork: 3" thick fiberglass duct wrap with a factory applied vapor barrier facing. Material to carry U.L. label and be by one of the following acceptable manufacturers:
1. CertainTeed
 2. Knauf Fiberglass
 3. Owens-Corning
 4. Schuller International, Inc.
 5. Approved equal.

PART 3 - EXECUTION

3.1 DUCT INSULATION

- A. Installation: Install all insulation using skilled insulation workmen regularly employed in the trade.
- B. Interior: All laps to be sealed and held in place with adhesive and flare staples. All lap joints to be folded under before stapling so no raw insulation will be showing. On the bottom of ducts 24" or wider, provide mechanical fasteners approximately 12" O.C.
- C. Insulation shall be continuous through interior partitions.

END OF SECTION

SECTION 23 09 33 – ELECTRIC/ELECTRONIC CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:
 - 1. HVAC instrumentation.
 - 2. Electric and electronic control.
 - 3. Sequence of operation.

1.2 RELATED SECTIONS

- 1. Section 23 00 10, Basic HVAC Requirements.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Submittal Brochure - The following shall be submitted for approval prior to installation:
 - 1. Control drawings with detailed wiring diagrams, including bill of material and description of operation for all systems.
 - 2. Panel layouts and name plate lists for all local and central panels.
 - 3. Valve and damper schedules showing size, configuration, capacity and location of all equipment.
 - 4. Product data for all control system components.
 - 5. The complete sequence of operation of the control system.
 - 6. The locations of all control equipment.
 - 7. Upon completion of the installation and final system adjustment, provide a full set of As-built Drawings of the installation and the control strategies.

1.4 QUALITY ASSURANCE

- A. General: Furnish and install as hereinafter specified a complete system of electric/electronic temperature controls. The system shall be manufactured by Honeywell, Siemens or Invertek and shall be installed by trained control mechanics regularly employed in installation and calibration of ATC equipment by the manufacturer of temperature control equipment. **It is acceptable to employ the use of DDC controllers to comply with the sequence of operation provided the Owner has access to adjustment points within the system.**
- B. Acceptable installers:
 - 1. Mechanical Contractor – **Assuming all requirements in this section are met.**
 - 2. Maine Controls - Presumpscot Street, Portland, Maine
 - 3. Siemens Controls - Route 1, Falmouth, Maine
 - 4. Honeywell - County Road, Westbrook, Maine
 - 5. XL Mechanical – Odlin Road, Bangor Maine
 - 6. Trane Company – Westbrook, Maine

1.5 COORDINATION

- A. Coordination of The Work: The following work shall be furnished by designated contractor under supervision of the Control Contractor.
1. Heating Contractor shall:
 - a. Install automatic valves and separable wells that are specified to be supplied by the Control Contractor.
 - b. Furnish and install all necessary valved pressure taps, water, drain and overflow connections and piping.
 - c. Provide on magnetic starters furnished, all necessary auxiliary contacts with buttons and switches in the required configurations.
 2. Sheet Metal Contractor shall:
 - a. Install all automatic dampers and associated access panels.
 - b. Provide necessary blank-off plates required to install dampers that are smaller than duct size.
 - c. Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
 - d. Provide access doors or other approved means of access through ducts for service to all control equipment.
 - e. Install smoke detectors in duct or equipment for Electrical Contractor.
 3. The General Contractor shall:
 - a. Provide all necessary cutting, patching, and painting.
 - b. Provide access doors or other approved means of access through ceilings and walls for service to control equipment.
- B. Wiring: All wiring for installation of temperature controls shall be by Temperature Control Contractor. Electrical Contractor shall furnish and install power wiring for equipment and wiring for smoke detectors.
1. All wiring shall comply with the requirements of Division 26, Electrical. Wiring not complying with the requirements of Division 26 shall be corrected by the EC at the expense of the ATC Contractor.
 2. Temperature control panels are indicated on the drawings with power supply by EC. Wiring for additional or relocated panels shall be at the expense of the ATC Contractor.

PART 2 - PRODUCTS

2.1 TEMPERATURE CONTROL

- A. Scope: The control system shall consist of all area thermostats, temperature transmitters, controllers, air stream thermostats, valves, dampers, damper operators, switches, timeclocks and other accessory equipment to fulfill the intent of the specification and provide for a complete and operable system.
1. All electric wiring incidental to the temperature control system shall be provided as a part of the automatic temperature control system.
- B. Thermostats

1. Electric Thermostats
 - a. Instruments shall be commercial style, metal cover, proportional or single acting as noted or required. Contacts shall be rated for motor horsepower as required. Covers shall have visible thermometer, set point adjustment knob except when concealed or removable key adjustment is noted.
 - b. Remote bulb thermostats shall be used as noted and when thermostat cannot be located in controlled space due to space electrical rating or corrosion requirements. Provide guard for bulb sensor.
 - c. Wet area thermostats shall be used where noted. Provide NEMA 4 enclosure for remote bulb thermostat. Cover shall be hinged with snap lock closure. Mount remote bulb on side of enclosure and provide guard. Seal around capillary penetrating enclosure. Other methods of control such as an explosion proof thermostat will be considered if they provide high resistance to moisture.
2. Duct and Immersion Thermostat
 - a. Duct and immersion thermostats of the single input type shall have integral set point adjustments and throttling ranges adequate for the application. Duct thermostats shall have sensing elements of sufficient length, accuracy and type to measure average duct temperature in each location.
 - b. Controllers shall be designed and constructed for equipment room use and shall not be affected by ambient temperature and humidities.
 - c. Duct mounted or immersion type shall have spans of one hundred degrees or two hundred degrees Fahrenheit as required. Averaging element sensors shall have a minimum nine-foot capillary element. Temperature sensors shall be of rigid stem using bimetallic sensing elements except where averaging is required.
 - d. Sensors shall be of corrosion resistant construction, tamper proof, suitable for mounting on a vibrating surface. If capillary, shall be temperature compensated and armored or installed in protective tubing.
 - e. All sensing elements for water pipe mounting shall be furnished complete with separable protecting wells filled with heat conductive compound. Sensors shall be factory calibrated and tamper proof. If easily adjustable sensors are provided, they shall be located inside metal enclosures with cylinder lock and key to prevent unauthorized setting.
- C. Low Temperature Safety Thermostat: Electric two position manual reset with 20-foot low point sensitive elements (not averaging type) installed to cover the entire duct area. Devices used on integral coil face and bypass units shall have remote thermostat and bulb in accordance with manufacturer's requirements.
- D. High Temperature Safety Thermostat: Electric, duct mounted manual reset type with adjustable set point (75 to 165 degrees Fahrenheit).
- E. Miscellaneous Devices
 1. Provide all the necessary relays, positioners, 7-day timeclocks, transformers, etc. to make a complete and operable system.
 2. Locate these devices on local panel unless specified otherwise.
- F. Panels
 1. Provide to enclose all relays, switches and controllers as required.
 2. Panels shall be front access with gasketed, hinged covers, and finished with a corrosion resistant finish.
 3. Install required indicating and control devices in the cover.

4. Provide terminal strips for all electrical connections.
 5. Panels shall be central and/or local as indicated or required.
 6. Each panel shall have its own combination fused disconnect switch as required.
- G. Methane, Hydrogen Sulfide and Chlorine Detectors
1. All gas detectors shall be furnished and installed under Division 13.
 2. Provide power and alarm indication wiring to the Main Control Panel under Division 13.
 3. Provide one set of SPDT dry contacts in each detector for use by the ATC contractor only.
- H. Gauges: Provide thermometers and pressure indicating gauges where shown on the drawings and other points throughout the system where the visual indication of temperature or pressure is required or will prove beneficial to operating personnel in the operation of their control system. Gauges will not be required on room-type thermostats.

PART 3 - EXECUTION

3.1 DESCRIPTION OF OPERATION

- A. Electric Heaters: Electric line voltage wall mounted thermostat shall cycle fan and electric heat to maintain set point.
- B. Electric Baseboard: Electric line voltage wall mounted thermostat shall electric heat to maintain set point. Units in the same room as DDS units shall operate as back-up to the heat pumps. See below
- C. Fans: Provide all fans with speed switches mounted at the unit for balancing. The switch will be wired by the electrical unless noted otherwise.
1. IT Room EF-1 shall cycle on through and electric wall mounted thermostat whenever the temperature rises above 80°F in the IT Room.
 2. EF-2 shall be controlled by local wall switches (by electrical).
- D. Heat Recovery Unit (HRU-1) and Electric Duct Mounted Coil EDH-1:
1. HRU shall be provided with supply and exhaust fans.
 2. Unit shall run continuously in the occupied mode and remain off during the unoccupied mode as cycled by the programmable time clock..
 3. Duct Mounted Coil EDH-1: The duct mounted coil shall be controlled by an electric SCR controller in response to a discharge duct sensor. The unit shall deliver a constant volume of 70°F air to the space.
 4. Provide unit coil freeze protection sensor to de-energize HRU-1 below 38°F.
- E. Ductless Split Systems (DSS): Units shall cycle through its integral controls to maintain setpoint. Unit to be provided with auxiliary contactors to activate back-up electric baseboard radiation in the event the DSS unit cannot maintain temperature.

3.2 SYSTEM TURNOVER AND SERVICE

- A. Upon completion of the installation, start up the system and perform necessary testing and run diagnostics to ensure proper operation. An acceptance test in the presence of the Owner's Representative, the Architect, and the Engineer shall be performed. When the system performance is deemed satisfactory by these observers, the system parts will be accepted for beneficial use and placed under warranty.
- B. Instruction and Adjustment - Upon completion of the project, the Temperature Control Contractor shall:
 - 1. Adjust for use by Owner, all thermostats, controllers, valves, damper operators, and software relays provided under this section.
 - 2. Furnish two (2) instruction manuals covering function and operation of control systems. Provide factory authorized Technician to instruct Owner's personnel in operation and care of control systems and equipment.
- C. Guarantee: The control system shall be guaranteed for a period of one year from the date of acceptance by the Owner.

3.3 TRAINING/OWNER'S INSTRUCTIONS

- A. Provide two copies of an operator's manual describing operating and routine maintenance service procedures to be used with the system.
- B. Provide a competent technician to instruct the owner's representative upon completion of the project. Instructions shall be given by the ATC as scheduled by the Owner, during normal work hours, for a period not more than 16 hours. The instructions shall consist of both hands-on and classroom training at the job site.

END OF SECTION

SECTION 23 23 00 – REFRIGERATION PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:
 - 1. Refrigeration piping.
 - 2. Refrigeration piping specialties.

1.2 RELATED SECTIONS

- 1. Section 23 00 10, Basic HVAC Requirements.
- 2. Section 23 05 00, Common Work Results for HVAC.
- 3. Section 23 07 00, HVAC Insulation.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Product Data: Provide catalog data for the following:
 - 1. Refrigeration piping.
 - 2. Refrigeration piping specialties.
 - 3. Roof penetrations sleeves

PART 2 - PRODUCTS

2.1 REFRIGERATION PIPING

- A. Material shall be as follows:
 - 1. Type "L" hard copper tubing (ACR grade) shall be used in all refrigerant systems. ASTM B280
 - 2. "Stay-Brite" or 95-5 solder shall be used in making all joints.
 - 3. Forged or wrought copper fitting shall be used.
 - 4. Armaflex Type "FR" fire retardant insulation shall be used as indicated.
 - 5. Specialties shall be Sporlan or Alco.
 - 6. Flexible piping connectors shall be used where compressors have vibration isolators. Unit shall be model DM-7407, stainless steel braided suitable for the applicable refrigerant at 380 psi minimum as manufactured by DME Incorporated or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Furnish, install, support and test a refrigerant piping system of the type and size and in the location shown on the Drawings. Refer to Section 23 05 00 for basic materials and installation methods.
- B. Refrigeration work shall be performed by a firm regularly engaged in the installation and service of refrigeration systems of the type specified. Install refrigerant piping in an approved manner in accordance with the best practice of the trade.
- C. Installation shall include the following:
 - 1. Thoroughly clean the inside surfaces of copper tubing using Virginia Number 10 degreasing solvent or refrigerant-113, or approved equal.
 - 2. During soldering, the pipe and fillings shall be kept full of inert gas, N or CO₂ to prevent formation of scale.
 - 3. Thermal expansion and contraction forces shall be absorbed through proper use of directional changes or U bends in the piping layout.
 - 4. The piping shall be properly anchored to minimize the transmission of vibration from the compressor into the piping system.
 - 5. Under minimum load conditions, gas velocity shall not be less than 500 FPM through horizontal lines and 1,000 FPM through vertical lines.
 - 6. Pitch all horizontal lines a minimum of 1/2" in 10' in the direction of refrigerant flow.
 - 7. Horizontal dimensions of traps shall be as small as possible.
 - 8. Keep hot gas bypass valves close to the compressor discharge.
 - 9. Insulate hot gas lines exposed to outdoor ambient with 1" thick unicellular plastic insulation.
 - 10. Insulate all suction lines with unicellular plastic insulation according to Section 23 07 00.
- D. Testing: After the refrigeration system is installed and before any piping is insulated, covered, or anchored, thoroughly leak test the entire system, make any necessary repairs, and retest as necessary.
 - 1. Do not include the compressor in the leak test and exercise care not to damage any controls or relief valves by the test pressure.
 - 2. Use oil-pumped, dry nitrogen with a pressure regulator controlling the system pressure.
 - 3. Each solder connection shall be tapped with a rubber mallet and checked for leaks using a soap solution.
 - 4. Repair all leaks by disassembling the connection, cleaning and remaking the fitting.
 - 5. After all leaks have been repaired, charge the system with refrigerant, initially to 10 psig, then boost to 150 psig (or that required by local codes) using nitrogen. Check the entire circuit for leaks using a halide torch or electronic leak detector. Repair any leaks and repeat test until all leaks are eliminated.
- E. Once all leaks have been repaired, charge the system to 150 psig and seal off. If there is no detectable pressure change after 24 hours, the system will be considered free of leaks.

END OF SECTION

SECTION 23 30 00 –HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work under this section includes all the required sheet metal extensions for grilles, manual dampers, automatic shutter deflectors, setting of control dampers, louvers, grilles, registers, diffusers, flexible connections, fire dampers, etc., as shown on the drawings or required to make the installation complete in accordance with the intent of the drawings and specifications.
- B. The work of this section includes, but is not limited to the following:
 - 1. Ductwork.
 - 2. Ductwork accessories
 - 3. Duct access doors.
 - 4. Diffusers, registers and grilles.
 - 5. Brickvents and backdraft dampers.
 - 6. Fire dampers.

1.2 RELATED SECTIONS

- 1. Section 23 00 10, Basic HVAC Requirements.
- 2. Section 23 05 00, Common Work Results for HVAC.
- 3. Section 23 07 00, HVAC Insulation.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Product Data: Provide catalog data for the following:
 - 1. All equipment, and accessories, included in this section.
- C. **Shop drawing submittals shall show CFM, size, throw, SP and NC levels in tabular form for each grille or diffuser.**
- D. Shop drawings shall be submitted certifying AMCA compliance, and showing free area and pressure drop for each louver and/or brickvent submitted.
- E. Shop drawing submittals for fire dampers shall show size, quantity, rating and orientation of the unit.

PART 2 - PRODUCTS

2.1 DUCTWORK

- A. General:

1. Standing seams shall not be used on any HVAC ductwork 24 inches or less.
 2. For ducts smaller than 24" size provide un-reinforced flat seams using appropriate SMACNA material gauges.
- B. Ductwork Material and Application: Construct ducts using the following materials, in the locations indicated:
1. Galvanized Sheet Metal - Generally used throughout H & V system for supply, return, exhaust and outside air intakes unless noted otherwise. All galvanized ducts and fittings shall be a minimum of G-60 galvanized sheet metal in accordance with ASTM A525 and A527 specifications. Gauges shall be in accordance with current SMACNA standards.
 2. Factory Fabricated Flexible Round Duct - Where shown on Drawings.
 3. United McGill Corporation "Uni-Seal" or equal round spiral lockseam construction duct and fittings for all exposed ductwork throughout the facility.
- C. Requirements:
1. All dampers and deflectors shall be #22 gauge minimum and stiffened as required.
 2. All joints in ducts shall be made substantially airtight. Substantially airtight shall mean that no air leakage is noticeable through the senses of feeling or hearing at all joints and connections. All branches, turns, etc., shall be made with long radius elbow and fittings or shall be provided with fixed turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius elbow with a throat radius of not less than duct width.
 3. All ducts shall be installed with necessary offset, changes in cross sections, risers, or drops, etc., which may be required. Construct with approved joints and substantially support in an approved manner.
 4. Provide flexible equipment connections at the intake and discharge of each fan. Connections shall be made from Venglas neoprene coated glass fabric as furnished by Ventfabrics, Inc.
- D. Galvanized Steel Ducts: Ducts shall be constructed of galvanized steel sheets, with a G60 zinc coating, of lock-forming quality in accordance with SMACNA and ASHRAE recommendations and requirements as to gauge, support, bracing, seams, joints, connections, cross breaking, and accessories.
- E. Duct Sealant: Airseal #33 sealant/mastic, or equal.
1. Fiber reinforced suitable for indoor and outdoor use and shall comply with U.L. Class 1 construction.
 2. Flame spread of 0 and smoke developed rating of 5, per ASTM-E-84, suitable for duct pressures up to 10" W.C.

TABLE #2 RECOMMENDED RECTANGULAR DUCT CONSTRUCTION		
Dimension of Longest Side (Inches)	Galvanized Sheet Gauge	Min. Reinforcing Angle Size & Max. Longitudinal Spacing Between Transverse Joints
	(Low Pressure)	
thru 12	26	None
13-18	24	None
19-30	24	1 x 1 x 1/8 @ 60 in.
31-42	22	1 x 1 x 1/8 @ 60 in.
43-54	22	1½ x 1½ x 1/8 @ 60 in.
55-60	20	1½ x 1½ x 1/8 @ 60 in.
61-84	20	1½ x 1½ x 1/8 @ 30 in.
85-96	18	1½ x 1½ x 3/16 @ 30 in..
97-120	18	2 x 2 x 1/4 @ 30 in.
Over 120	18	2 x 2 x 1/4 @ 30 in.
	(Medium Pressure)	
thru 12	24	None
13-18	24	1 x 1 x 16 ga @ 48 in.
19-24	22	1 x 1 x 1/8 @ 48 in.
25-36	22	1 1/4 x 1 1/4 x 1/8 @ 40 in.
37-48	22	1 ½ x 1 ½ x 1/8 @ 24 in.
49-60	20	2 x 2 x 3/16 @ 24 in.
61-72	20	2½ x 2½ x 3/16 @ 24 in
73-84	18	2½ x 2½ x 3/16 @ 24 in
85-96	18	1½ x 1½ x 1/8 @ 24 in.
97 & over	18	2 x 2 x 1/8 @ 24 in.
	(High Pressure)	
thru 12	22	None
13-18	22	1 x 1 x 16 ga @ 48 in.
19-24	22	1 x 1 x 1/8 @ 48 in.
25-36	22	1 1/4 x 1 1/4 x 1/8 @ 32 in.
37-48	22	2 x 2 x 1/8 @ 30 in.
49-60	20	2 x 2 x 3/16 @ 24 in.
61-72	20	1½ x 1½ x 1/8 @ 24 in.
73-84	18	1½ x 1½ x 1/8 @ 24 in.
85-96	18	1½ x 1½ x 1/8 @ 24 in.
97 & over	16	2 x 2 x 1/8 @ 24 in.

- F. Flexible Duct: Flexible duct shall be insulated, wire reinforced, with vapor barrier coating, and shall be U.L. listed. Performance specifications include: Temperature range -20°F to 250°F; pressure range -1/2" to +2" W.G.; 4000 FPM max. velocity and thermal conductance .19. Type GSL as manufactured by Genflex.
- G. Duct Access Doors: Provide duct access doors in the following locations:
 - 1. Before duct mounted coils.
 - 2. At control dampers.
 - 3. At fire dampers.
 - 4. At smoke dampers.
 - 5. Upstream of smoke detector sampling tubes.
 - 6. At maximum 20 foot intervals and at the base of each vertical riser in horizontal return air, exhaust air and fresh air intake ductwork, in accordance with NFPA 90A.
 - 7. At any location where a duct mounted component required access for maintenance or service.
 - 8. Access doors less than 12 inches square shall be secured with sash locks. Access doors up to 18 inches square shall have 2 hinges and 2 sash locks. Access doors larger than 18 inches square shall have 3 hinges and 2 compression latches.

2.2 AIR DEVICES

- A. Aluminum Backdraft Damper:
 - 1. Provide low leakage backdraft damper. Leakage rate shall be less than 12 CFM per square foot at 1/2" W.G.
 - 2. Frame construction shall be extruded aluminum with .09" wall thickness.
 - 3. Linkage shall be 1/8" x 1/2" aluminum tie bars concealed in frame with Zytel bearings.
 - 4. Blades shall be .025" formed aluminum with overlapping vinyl edge seals.
 - 5. Temperature range shall be -40°F to +200°F.
 - 6. Units shall be Ruskin Model BD2/A1.
- B. Fire Dampers:
 - 1. Fire dampers shall be installed to comply with NFPA Code No. 90A for 2 hour fire wall or 3 hour fire wall, refer to Architectural drawings. Each unit shall bear a U.L. label in accordance with the latest version of UL 555.
 - 2. Fire dampers at ceiling diffusers shall be specifically listed and designed for such use and shall have 1-1/2 hour minimum rating. Fusible element shall be accessible by removing ceiling diffuser. Model shall be Ruskin CFD5 or equal. Provide ceramic fiber thermal blanket as indicated.
 - 3. Fire dampers to be equal to Ruskin. All blades shall be spring loaded and located outside the air stream. Provide types as shown and required. Provide wall sleeves as shown and required. Provide accessible insulated doors in duct at all fire dampers.
 - 4. Transfer grilles with no ductwork shall have Ruskin model IBDT or equal thinline dampers where indicated on the plans.
 - 5. Fire dampers shall be dynamic type suitable for activation with airflow.
- C. Volume Dampers: Provide volume dampers at each branch take off for supply, return, exhaust and outside air ducts. Dampers shall be located as close to main duct as possible.
 - 1. Round Volume Dampers: In lieu of butterfly type dampers Ruskin "Iris" calibrated dampers are acceptable. IRIS damper frame shall be 22 gage steel or 316 stainless (as called for on schedules). Frame shall fully encapsulate IRIS blade segments, holding

them firmly into position, and have rolled mounting beads to increase the overall strength of the assembly. Full circumference duct seal shall be furnished on the air entering and air leaving side of the frame to insure a tight duct connection. Casing leakage shall not exceed 6 cfm. IRIS blade segments shall be internally linked and driven by a factory calibrated manual adjustment knob. All linkage parts shall be fully encapsulated and out of the air stream for years of dependable, maintenance-free operation. Manual adjustment knob shall be calibrated to the exact aperture position and aligned with the K factor set point to provide linear response flow control. Flow measurement shall be +/- 5%. Assembled units shall be furnished with specific charts designed for the exact size and blade aperture configuration. Air pressure taps shall be integral to the damper frame and positioned on either side of the IRIS blade segments. The damper shall have minimal self-generated noise characteristics as detailed on published sound data to be included with submittals. Damper in all respects shall be equivalent to Ruskin Model VFBD35.

2. Dampers Adjacent to Supply Grilles: Provide Young Regulator model 820 volume dampers for locations close to supply grilles to minimize noise at the grille.

D. Brickvents

1. General - Brickvents shall be provided as a portion of this Contract. Pressure drop shall not exceed 0.1 inches of water for a 16"x8" unit at 400 cfm or for a 16"x5" unit at 260 cfm..
2. Materials - All brickvents shall be constructed of extruded aluminum blades and channels. Units shall not be provided with insect screens.
3. Finish - Brickvents shall have a Kynar finish.
4. Brickvent Type - Unit shall be 4 inch thick, equal to Penn model B100 or B68 as indicated on the drawings. Brickvents of other manufacturers are acceptable providing free area, performance, and construction are similar.

2.3 DIFFUSERS, GRILLES AND REGISTERS

- A. Install grilles and registers at the air supply, return and exhaust openings and as shown on the Drawings. The equipment schedule is based generally on model numbers of Metalaire to establish a standard of quality; units of equal distribution, air throw and noise generated as manufactured by Tuttle and Bailey, Titus, Anemostat or equal are acceptable. Units to be provided with white baked enamel finish as noted.

B. Supply Air:

1. 5500-2 square and rectangular ceiling diffusers, extruded aluminum, removable fixed pattern louvered core, straight deflector blades (without a horizontal lip), beveled overlap margin, white paint finish.
2. 5500-6 square and rectangular ceiling diffusers, extruded aluminum, removable fixed pattern louvered core, straight deflector blades (without a horizontal lip), lay-on extension panel for 24"x24" T-bar ceilings, white paint finish.
3. 5500S – Same as 5500 only steel construction.
4. V4004/H4004 supply grilles, double deflection, adjustable louvers, extruded aluminum.
5. V4004S/H4004S same as V4004/H4004 only with steel frame.
6. Registers - Same as V4004/H4004 with opposed blade damper.
7. 6600 series linear slot diffuser suitable for sidewall mounting, extruded aluminum, white finish, directional pattern control.

C. Return/Exhaust Air

1. CC5-1 grille with 1/2"x-1/2"x1/2" grid core, aluminum construction, white finish, suitable for surface mount.
2. CC5-6 grille similar to GC5 with flat border for lay-in ceiling.
3. H4002RS-1 grille, formed steel, fixed horizontal bars on .666" centers, 40° deflection or 0° deflection as indicated on schedule.
4. H4002R-1 same H4002RS-1 only aluminum.
5. Registers - Same as 4538 or H4002R-1 with opposed blade damper.

PART 3 - EXECUTION

3.1 GENERAL

- A. All work shall conform to ASHRAE duct construction recommendations, SMACNA "Low Velocity Duct Construction Standards", and applicable NFPA requirements (see Table #2).
- B. Ducts: The size of ducts as marked on the drawings will be adhered to as closely as possible. The right is reserved by the Engineer to vary the sizes of ducts to accommodate structural conditions during the progress of the work without additional cost to the Owners. The duct layout is schematic to indicate size and general arrangement only. Sizes given are "inside clear" dimensions. All ducts shall be arranged to adjust to "field conditions". The ductwork trade shall coordinate his work with other trades.
- C. All dampers, grilles, registers, ducts, air handling units and fans shall be adjusted to the satisfaction of the Engineer, to obtain an even distribution of the air throughout the system. All of the supply outlets and exhaust registers must be balanced to the air volumes shown to produce the required results. A copy of the balancing report shall be submitted to the Engineer for approval.
- D. On larger ducts all protruding edges and corners shall be rounded and/or turned down to eliminate a potential hazard to workers around ductwork.
- E. Indoor Air Quality: The interior of the duct system and all equipment shall be kept free from dirt, rubbish, etc., during construction. This includes but is not limited to sealing open ductwork, air handling units, fans, fan-coil units, unit ventilators, blower coils etc with polyethylene. No air moving equipment shall be started until construction has been completed to a point such that airborne construction dust is no longer present. At completion of the project, the Contractor shall thoroughly clean all equipment, ductwork, etc., to the satisfaction of the Engineer. If it is determined by the Engineer that the ductwork or air moving equipment contains a significant amount of dust or debris the Contractor shall have, at the contractors expense, the ductwork and equipment cleaned by a recognized duct cleaning contractor approved by the Engineer.
- F. Duct Sealing: Thoroughly clean all new and existing ducts prior to the application of sealant. Seal all transverse joints, longitudinal seams and duct wall penetrations ducts in accordance with SMACNA, Seal Class A. Apply sealant in accordance with the manufacturer's recommendations.
- G. Louvers / Brickvents: The bottom of all ductwork connecting to louvers and brickvents shall slope such that any water entering the unit will drain out off the unit. All ductwork shall be sealed water tight for the last 7 feet of duct up to the louver or brickvent.

END OF SECTION

SECTION 23 34 00 – HVAC FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:

1. Ventilation fans.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 30 00, HVAC Air Distribution.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Product Data: Provide catalog data for the following:
1. Ventilation Fans: Submittals shall include fan curves, CFM, SP, motor horsepower, voltage, size, color, model number, sound data, dimensions and all applicable accessories.

PART 2 - PRODUCTS

2.1 VENTILATION FANS

- A. Acceptable Manufacturers:
1. Penn, Cook, Acme, Greenheck
- B. General: Provide return and exhaust fans with the capacities and of the types shown on the drawings.
1. All fans shall carry the AMCA Certified rating seal and shall be zone rated in accordance with AMCA Bulletin 300, when so indicated.
 2. Direct drive fans shall have performance similar to that shown. If performance is higher, provide a speed control for mounting at fan.
 3. Provide motors with thermal overload protection.
 4. All fans shall be provided with a readily visible label for identification including fan tag and room serviced.
 5. Fans with ECM motors shall either be "external speed control" for variable speed control or "motor mounted speed control" for balancing purposes only, as indicated.
 6. Fans shall be capable of performing at the capacity indicated on the "Fan Schedule". If the "Balance CFM" is less than the fan "CFM" on the schedule, the fan must perform at the larger of the two.

- C. Ceiling/Wall Cabinet Fans - Fans shall include an insulated housing, back draft damper, centrifugal fan wheel, aluminum grille and flange, terminal box, motor and disconnect plug. Fan speeds shall not exceed 1500 RPM.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide flexible connections at all fans.
- B. Fans shall not be operated until construction is complete. Prior to operation it shall be verified that all ductwork, diffusers and filters (where applicable) are clean.
- C. Verify all electrical characteristics are correct and the fan is rotating properly.

END OF SECTION

SECTION 23 72 00 – HEAT RECOVERY UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:

1. Heat Recovery Units.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 30 00, HVAC Air Distribution.
4. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Product Data: Provide catalog data for the following:
1. Heat recovery units including but not limited to: construction, dimensions, size, weight, heating and/or cooling capacity, CFM, GPM, APD, sound data, fan motor horsepower, voltage, filter efficiency, filter, heat recovery efficiency, all entering and leaving temperatures and coil areas.
 2. All applicable accessories.

PART 2 - PRODUCTS

2.1 HEAT RECOVERY UNIT

- A. General: Energy Recovery Ventilator (ERV) shall be a packaged unit as manufactured by RenewAire or equal and shall transfer both heat and humidity using static plate core technology.
- B. Quality Assurance
1. The energy recovery ventilator shall be Certified by the Home Ventilating Institute (HVI) under CSA 439. Both a heating and a cooling test must be run to demonstrate year round energy recovery.
 2. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.

3. Unit shall be Listed under UL 1812 Standard for Ducted Air to Air Heat Exchangers. The unit must pass commercial flammability requirements and shall not be labeled "For Residential Use Only".
4. The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of five years from the date of purchase.

C. Performance

1. Energy Transfer: The ERV shall be capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.
2. Passive Frost Control: The ERV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10°F and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be allowed.
3. Continuous Ventilation: Unit shall have the capacity to operate continuously without the need for bypass, recirculation, pre-heaters, or defrost cycles under normal operating conditions.
4. Positive Airstream Separation: Water vapor transfer shall be through molecular transport by hygroscopic resin and shall not be accomplished by "porous plate" mechanisms. Exhaust and fresh airstreams shall travel at all times in separate passages, and airstreams shall not mix.
5. Laminar Flow: Airflow through the ERV core shall be laminar over the products entire operating airflow range, avoiding deposition of particulates on the interior of the energy exchange plate material.

D. Product Construction

1. The energy recovery component shall be of fixed-plate cross-flow construction, with no moving parts.
2. No condensate drain pans or drains shall be allowed and unit shall be capable of operating in both winter and summer conditions without generating condensate.
3. The unit case shall be constructed of 24-gauge steel, with lapped corners and zinc plated screw fasteners. The case shall be finished with textured, powder coat paint (GR90 case shall be constructed of G90 galvanized steel.)
4. Access doors shall provide easy access to blowers, ERV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets.
5. Case walls and doors shall be fully insulated with 1 inch, expanded polystyrene foam insulation faced with a cleanable foil face on all exposed surfaces.
6. The ERV cores shall be protected by a MERV-8 rated, spun polyester, disposable filter in both airstreams.
7. The unit shall have a line-cord power connection and be supplied with an internal 24 VAC transformer and relay (G90 shall have hardwired line voltage connection and be controlled by line voltage controls provided by others.)
8. Standby power draw shall not exceed 1 Watt for the unit along with an optional automatic control.

E. Options

1. Provide unit and duct connection orientation per project schedule.
2. Double wall construction with 24-gauge galvanized steel liner.
3. MERV-13 filters for final installation after construction phase.
4. Electric duct coil and SCR controller with discharge duct sensor
5. 8" wall caps for outside air and exhaust
6. Programmable 24/7 time clock

F. Installation

1. Unit Location: Locate and orient unit to provide the shortest and most straight duct connections. Provide service clearances as indicated on the plans. Locate units distant from sound critical occupancies. Use integral mounting flange and hanging bar system to mount the unit to a structurally suitable surface. The units may be mounted in any orientation.
2. Vibration Isolation: Utilize factory supplied vibration isolation kit following instructions. Provide flexible duct connections at unit duct flanges.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate with other trades and verify that structure is ready to receive work and wall openings are correctly sized.
- B. Indoor Installation
 1. Units may be directly mounted on the floor, suspended on a platform, or hung from solid threaded rod attached to the unit shipping support brackets.
 2. Once in final position, make sure that the unit is level. Use shims if necessary.
 3. Installation must be in accordance with standard air handling structural weight and vibration isolating procedures and requirements.
- C. Provide flexible connectors at all duct connections.

END OF SECTION

SECTION 23 81 26 – SPLIT SYSTEM AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:

1. Ductless split system heat pumps.

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 30 00, HVAC Air Distribution.
4. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Product Data: Provide catalog data for the following:
1. Air handling units or fan coil units including but not limited to: construction, dimensions, size, weight, heating and/or cooling capacity, CFM, GPM, APD, sound data, fan motor horsepower, voltage, filter efficiency, filter and coil areas.
 2. Air-cooled condensing units.
 3. All applicable accessories.

PART 2 - PRODUCTS

2.1 MINI SPLIT HEAT PUMP SYSTEM

- A. System Description / Type:
1. MXZ Branch Box: The heat pump, **hyper heat**, air conditioning system shall be a Mitsubishi Electric MXZ-SM variable capacity multi-zone series. The system shall consist of two (2), three (3), four (4), five (5), six (6), seven (7), or eight (8) wall mounted, ceiling suspended, ceiling recessed, horizontal ducted, floor standing, and/or multi-position ducted indoor units with a wired or wireless remote controller, connected to a compact horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
 2. MXZ Ported: The heat pump air conditioning system shall be a Mitsubishi Electric MXZ-C variable capacity multi-zone series. The system shall consist of two (2), three (3), four (4) or five (5) wall mounted, ceiling suspended, ceiling recessed, horizontal ducted, floor standing and/or multi-position ducted indoor units with a wired or wireless remote controller, connected to a compact horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.

3. MUZ-FS/MSZ-FS: The heat pump air conditioning system shall be a Mitsubishi Electric MSZ-FS split system series. The system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
4. MUFZ-KJ/MFZ-KJ: The heat pump air conditioning system shall be a Mitsubishi Electric MFZ split system series. The system shall consist of a compact, floor mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
5. MUZ-GL/MSZ-GL: The heat pump air conditioning system shall be a Mitsubishi Electric MSZ-GL split system series. The system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
6. MUZ-HM/MSZ-HM: The heat pump air conditioning system shall be a Mitsubishi Electric MSZ-HM split system series. The system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
7. MUZ-WR/MSZ-WR: The heat pump air conditioning system shall be a Mitsubishi Electric MSZ-WR split system series. The system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
8. MUZ-JP/MSZ-JP: The heat pump air conditioning system shall be a Mitsubishi Electric MSZ-JP split system series. The system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
9. SUZ: The heat pump air conditioning system shall be a Mitsubishi Electric M-Series variable capacity mini-split type. The system shall consist of a combination of an indoor unit with a remote controller connected to a compact horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
10. MUY-GL/MSY-GL: The heat pump air conditioning system shall be a Mitsubishi Electric MSY-GL split system series. The system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
11. PUZ Series: The heat pump air conditioning system shall be a Mitsubishi Electric split system with Variable Speed Inverter Compressor technology. The system shall consist of a horizontal discharge, single phase outdoor unit, a matched capacity indoor section that shall be equipped with a wired wall-mounted, wireless wall-mounted, wireless handheld, or other remote controller.
12. PUY Series: The air conditioning system shall be a Mitsubishi Electric split system with Variable Speed Inverter Compressor technology. The system shall consist of a horizontal discharge, single phase outdoor unit, a matched capacity indoor section that shall be equipped with a wired wall-mounted, wireless wall-mounted, wireless handheld, or other remote controller.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with other trades and verify that structure is ready to receive work and wall openings are correctly sized.
- B. Provide flexible connections at all ductwork connections.
- C. ACCU units are to be mounted on a concrete pad for ground installations and on 4"x4" sleepers on rooftop installations.

END OF SECTION

SECTION 23 82 36 – RADIATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:

1. Electric baseboard

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10:
- B. Product Data: Provide catalog data for the following:
1. Radiation including but not limited to: construction, dimensions, size, heating capacity GPM, quantity and color.

PART 2 - PRODUCTS

2.1 RADIATION

- A. **General: It is the Mechanical Contractors responsibility to coordinate the mounting height of radiation with the electrician for coordination with electrical outlets including but not limited to receptacles, data and communication outlets.**
- B. Electric Baseboard (EBB)
1. Units shall be UL approved. Installation shall conform to the National Electrical Code and applicable local codes and regulations.
 2. EBB shall be manufactured by Berko, Qmark, Chromalox or Federal Pacific.
 3. Unit capacity, style and type shall be as shown on the Drawings. Twenty-two gauge, cold-rolled steel front cover shall be of a snap on design to provide easy access. Enclosure shall be painted with baked enamel finish. Terminal boxes shall be provided on both the left and right sides of units. Terminal boxes shall be fitted with a cover. Heating elements shall be aluminum sheathed with aluminum fins pressure bonded to element. Each baseboard electric heater shall be provided with a factory installed, linear type thermal protector. Unit shall be supplied with line voltage double pole thermostat with by-metal sensor and snap action switch to be mounted in junction box.

END OF SECTION

SECTION 23 82 39 – HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The work of this section includes, but is not limited to the following:

1. Electric Heaters

1.2 RELATED SECTIONS

1. Section 23 00 10, Basic HVAC Requirements.
2. Section 23 05 00, Common Work Results for HVAC.
3. Section 23 21 13, Heating and Cooling Hydronic Piping.

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 00 10.
- B. Product Data: Provide catalog data for the following:
1. Unit heaters cabinet unit heaters and toe space heaters including but not limited to: construction, dimensions, size, weight, configuration, heating, CFM, GPM, APD, sound data, fan motor horsepower, color, voltage, filter efficiency, filter and coil areas.
 2. All applicable accessories.

PART 2 - PRODUCTS

2.1 ELECTRIC WALL HEATERS

- A. General: The heating equipment shall include an electric automatic fan forced air heater suitable for small area heating, as manufactured by QMark®, a Marley Engineered Products® Brand, Bennettsville, SC. Or equal. The heater shall be designed for wall mounting, recess or surface. Heaters shall be cETLus listed.
- B. Back Box: The back box shall be designed as a recessed rough-in box in either masonry or frame installations and is also used when surface mounting frames are used in surface mounting installations. The back box shall be heavy gauge galvanized steel and shall contain knockouts through which power leads enter.
- C. Inner Frame Assembly: The heater assembly, which fits into the back box, shall consist of a heavy gauge steel fan panel to which all of the operational parts of the heater are mounted. The inner frame assembly shall be completely pre-wired.
- D. Heating Element: The heating element shall be of the non-glowing design consisting of an 80/20 nickel-chromium resistance wire enclosed in a steel sheath to which plate fins are copper

brazed. The element shall cover the entire air discharge area to ensure uniform heating of all discharged air. It shall be warrantied for 5 years.

- E. On/Off Switch: A double-pole, single throw on/off switch shall be mounted on the back box for positive disconnect of power supply. It will be completely concealed behind the front cover.
 - F. Motor And Controls: The fan motor shall be impedance protected, permanently lubricated. Fan control shall be of the bi-metallic, snap-action type and shall activate fan after heating element reaches operating temperature, and continue to operate the fan after the thermostat is satisfied and until all heated air has been discharged. The thermostat shall be single-pole type on all models. Thermal cutout shall be self-hold (manual-reset) type designed to shut off heat in the event of overheating. The fan shall be four-bladed aluminum. A back-up (End of Life) thermal fuse shall be provided for additional safety.
 - G. Surface Mounting Frame: The surface mounting frame shall be of heavy gauge steel designed to mount around the back box for a finished surface installation. Slot knock outs shall be provided for power supply conduit.
 - H. Front Cover: The louvered front cover shall be of heavy gauge steel with a powder paint finish. A plug button will be provided to replace the thermostat knob and render the unit tamper-resistant.
- 2.2 Finish: All sheet metal parts, except the galvanized steel back box, shall be phosphatized, then completely painted by a powder paint process.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount units level.
- B. Provide flexible connectors for duct connections for ducted units.
- C. Support cabinet unit heaters with RIS vibration isolators.

END OF SECTION

SECTION 26 00 10 – BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Summary of Electrical Work: The electrical work includes, but is not limited to, the following:
 - 1. Underground duct bank for primary electric service and telecommunications and concrete foundation for pad mounted transformer.
 - 2. Site underground wiring.
 - 3. Underground secondary electric service and distribution.
 - 4. Grounding System.
 - 5. Roughing in and branch circuit wiring.
 - 6. Interior and Emergency Lighting System.
 - 7. Emergency generator automatic transfer equipment.
 - 8. Telecommunications Wiring System.
 - 9. Coordination with mechanical subcontractor including supervision of HVAC temperature control system wiring work.
 - 10. Other work as required to provide a complete and operating system.
- B. Site Inspection: Visit the site, before submitting bid, to become familiar with the procedural manner, materials, labor, quantities, and expenses involved in completing the work. No allowances for extra work will be granted to accomplish these ends if the need for which could have been foreseen or anticipated by such a visit.
- C. Cash Allowance: See Section 012100 - Allowances.
 - 1. Allowance includes payment to Versant Power, and Consolidated Communications for installation of distribution conductors, service connections, and equipment to the building and site.
- D. Alternates
 - 1. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
 - 2. Coordinate related work and modify surrounding work as required.
 - 3. Schedule of Alternates:
 - a. Under Alternate #2 the DMR Office vestibule is deleted. Under Alternate #2 relocate the electric strike and proximity card reader to exterior Door #3.
- E. Related Sections:
 - 1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

- A. Submit under procedures given in Section 01 33 00.
- B. Submit shop drawings in electronic form, with product data grouped in sets to include complete submittals of related systems, products, and accessories in a single submittal. Clearly indicate each submittal with appropriate specification section and paragraph reference.
- C. Mark dimensions and values in units to match those specified.

- D. Electrical submittals shall be reviewed by, and carry the approval stamp of, the electrical subcontractor.
- E. Submit certificate of final inspection and approval from authority having jurisdiction, and record electrical drawings.
- F. Upon request, provide samples for inspection. Samples will be returned after inspection is completed.
- G. Manual: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer for the Owner two copies of a manual describing the system:
 - 1. Provide manuals in durable plastic ring binders, nominal 8½ x 11" size.
 - 2. Identification on, or readable through, the front cover stating general nature of the manual.
 - 3. A copy of all reviewed submittals and shop drawings.
 - 4. Complete instructions regarding operation and maintenance of all equipment involved.
 - 5. Complete name and address of nearest vendor of replaceable parts.
 - 6. Copy of all guarantees and warranties issued.
 - 7. Where contents of manuals include manufacturer's catalog pages, clearly indicate the precise items included in this installation.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Electrical: Conform to ANSI/NFPA 70, National Electrical Code.
 - 2. Utility: Conform to the standards of:
 - a. Versant Power
 - b. Consolidated Communications
 - 3. Obtain permits and request inspections from local building inspector.
- B. Electrical materials, devices, and equipment shall be new. Where standards have been established by the following, they shall conform to those standards as to quality, fabrication, application, and installation and be not less than further required under this specification.
 - 1. Underwriters Laboratories, Inc. (UL).
 - 2. National Electrical Manufacturers Association (NEMA).
 - 3. American National Standards Association (ANSI).
 - 4. National Fire Protection Association (NFPA).
 - 5. Occupational Safety and Health Administration (OSHA).
 - 6. National Electrical Contractors Association (NECA).
 - 7. Consolidated Communications.
 - 8. Versant Power; "utility company."
 - 9. Standards of local Building Codes, Electrical, and Fire Departments, Town of Lamoine.

1.4 WORK SEQUENCE & COORDINATION

- A. Install work under this section so as to conform to the progress of the work of other sections. Complete the electrical work as soon as conditions of the building will permit.
- B. Coordinate in advance with other trades the shape, size and position of all necessary openings, sleeves, supports and related and coordinate electrical installation with mechanical equipment, piping and ductwork to avoid conflicts and to provide electric service and wiring as required for a complete and operating system.

- C. Refer to Division 23 for electrical work required for mechanical. Prior to roughing in, verify that the electrical characteristics of the mechanical equipment being provided are compatible with the electric power circuits specified; if in doubt consult Engineer.
- D. Wiring for H&V temperature controls is specified under Division 23 but shall be supervised by and wired to the standards of this section. Coordinate electrical work with controls requirements to provide a complete and operating system.
- E. Supervise installation of wiring provided under Division 23 to ensure that such wiring is installed according to the standards of Division 26. Report discrepancies to Engineer.

1.5 WIRING STANDARD

- A. Follow wiring coding as indicated on the drawings. Use only the approved wiring methods for circuit applications as indicated in Table 1 (unmarked items are not permitted):
- B. Where specifically detailed on drawings, follow wiring method indicated.
- C. In the event an application location is encountered that is not listed in the wiring standards, consult Engineer for instructions.

TABLE 1

		Building Wire & Cables in Raceway							Cable	
	Application Location	RSC	EMT	PVC	Cable Tray	Surface Raceway	Liquidtight	Flex	MC	NM
1	Underground, 5' away from foundation - Primary, no concrete - Secondary, no concrete	SFBC		BC SFBC SF						
2	In/under concrete slab to 5' away from foundation	SFBC		SFBC						
3	In slab above grade	BC		BC						
4	Exposed outdoor	SFBC								
5	Wet Interior	SFBC	SFBC							
6	Concealed dry interior Wall stud spaces Ceiling void	FBC FBC	FBC FBC						BC BC	BC BC
7	Accessible dry interior Ceiling void Lighting fixture whip Casework	SFBC	FBC				BC BC	BC BC	BC BC BC	
8	Exposed dry interior Finished space Unfinished space	SFBC	BC			BC				
9	Motor/equipment connection						B	B	B	

Key: S=Secondary Service, F=Feeders, B=Branch Circuits, C=Control Circuits

1.6 SUBSTITUTIONS

- A. Any proposal for a substitution shall be made in writing, including full details for consideration by Engineer. Substitutions will be permitted only by written acceptance of the Engineer.
- B. Acceptance of a proposed substitution by the Engineer shall not relieve the Contractor from his responsibility to provide a satisfactory installation of the Work in accordance with the intent of the plans and specifications and shall not affect his guarantee covering all parts of the work.
- C. Any material or equipment submitted for acceptance which is arranged differently or of a different physical size from that shown or specified shall be accompanied by shop drawings indicating the different arrangements of size and the method of making the various connections to the equipment. The final results shall be compatible with the system as designed.
- D. Electrical materials and equipment have generally been specified by referencing one or more manufacturer's standard product. Materials of similar quality by listed "Acceptable Manufacturers" will generally not be considered a substitute and will be reviewed for conformance with these specifications. Materials not of similar quality, or by manufacturers not listed as acceptable, will be considered a substitute.
- E. In the event a proposed substitution for material or equipment has been rejected, Engineer will only review subsequent submittals for that material or equipment that are not substitutes.

1.7 ENGINEER/ARCHITECT

- A. The term "Engineer" shall refer to the electrical consulting engineer whose seal appears on the electrical drawings for this project and, for the purposes of contractual matters, shall be synonymous with the term "Architect" or "Architect/Engineer."

1.8 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to Work specified in other sections. Obtain permission of Engineer before proceeding.

1.9 WORKMANSHIP

- A. Workmanship shall be by licensed electricians well skilled in the trade. A Master Electrician licensed in the State of Maine shall be on site and supervise all work.
- B. Install all work according to the best practices of the trade and in accordance with NECA -1-2000, "Standard Practices for Good Workmanship in Electrical Construction."
- C. In the event of a conflict with required codes or an obvious misapplication of equipment, material, wiring practice, or other installation, before proceeding, promptly notify the Engineer. In no event shall any work be installed that is contrary to applicable codes.

1.10 DEVIATIONS AND DISCREPANCIES

- A. The drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the electrical work. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, and mechanical drawings so that work under this section is properly installed and coordinated with other sections.

- B. The drawings and specifications are complementary each to the other and what is called for in one shall be as binding as if called for by both. In the event of conflicting information on the electrical drawings, or between or within drawings and specifications, or between trades, that which is better, best, most stringent, or most expensive will govern, except as may otherwise be permitted by Engineer.
- C. Bidders shall study plans and specifications and in the event there are any apparent errors, omissions, conflicts, or ambiguities, shall contact Engineer for clarification prior to submitting their bid.

1.11 TEMPORARY LIGHT AND POWER

- A. Arrange for, obtain permits, and provide temporary lighting and power for the duration of the project. Electric energy consumed under this provision will be paid for by the Owner or General Contractor.
- B. Provide lighting stringers and lamps to provide reasonable general illumination (20 footcandles) in work areas, plus task lighting as needed, outlets for hand tools at accessible locations reasonably spaced (within 40 feet of all work areas), power for motors not larger than 1.5 hp each, and cooperate with trades in other sections to provide adequate temporary facilities.
- C. The use of electric heaters for temporary heating is prohibited.
- D. Conform to NFPA 70, OSHA regulations, and other codes and agencies having jurisdiction.
- E. Coordinate to provide wiring for welding and larger motors or unusual lighting under other sections as needed.
- F. Remove all temporary wiring as soon as possible after it is no longer needed.

1.12 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.13 RECORD DRAWINGS

- A. Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of diazo blue line or white print electrical drawings. Record on these drawings, completely and accurately, any and all differences between the work as actually installed and the design as shown on the drawings. Record all changes within one week of the time that the changes are authorized. Record drawings shall be maintained in site construction office and be available for inspection by Engineer. At the completion of the work, deliver Record Drawings in accordance with requirement for submittals.

1.14 TESTING AND TRAINING

- A. Conduct operating test for approval in presence of Engineer. The electrical work shall be demonstrated to operate as specified. Furnish instruments, materials, and personnel required for tests. Notify Engineer at least 10 days in advance of proposed test date.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Existing work
2. Grounding and bonding
3. Connection of utilization equipment
4. Supports
5. Identification
6. Conduit and fittings
7. Wireway
8. Underground electrical
9. Electrical boxes
10. Wire and cable
11. Cords and caps
12. Wiring devices
13. Electrical tape
14. Terminations
15. Firestopping

B. Related Sections:

1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Section 26 00 10, Basic Electrical Requirements.
3. Section 31 23 00, Earthwork for Utilities.
4. Section 03 30 00, Cast-in-Place Concrete.

1.2 REFERENCES

- A. Conform to requirements of National Electrical Code (NEC) ANSI-C1/NFPA 70-2020
- B. Conform to requirements of National Electrical Safety Code (NESC) ANSI 2007.
- C. Furnish products listed by Underwriters Laboratories, Inc., or other testing firm acceptable to authority having jurisdiction.

1.3 SUBMITTALS

A. Product Data: Provide catalog data for the following:

1. Grounding and bonding devices
2. Supports
3. Anchors
4. Conduit and fittings
5. Wireway
6. Electrical boxes
7. Wire and cable
8. Wiring devices
9. Mounting brackets/ceiling channels

10. Firestop Materials
 11. Handholes and manholes, access frames and covers
 12. Concrete transformer foundation
- B. Submit product data and shop drawings in electronic form with a separate sheet for each product. Indicate clearly on each sheet product manufacturer, catalog number, product description and other pertinent data.
- C. Test reports.
1. Grounding system continuity and resistance test.
 2. Conductor continuity and insulation resistance test.
- 1.4 PROJECT CONDITIONS
- A. Existing project conditions indicated on drawings are based on casual field observation and existing record documents.
- B. Verify field measurements and circuiting arrangements are as shown on drawings.
- C. Verify removal of existing electric work.
- D. Report discrepancies to Engineer before disturbing existing installation.
- 1.5 COORDINATION
- A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections to determine connection locations and requirements.
- B. Sequence rough-in of electrical connections to coordinate with installation and start up of equipment furnished under other sections.

PART 2 - PRODUCTS

2.1 GROUNDING MATERIALS

- A. Ground Rod: Copper clad steel, 3/4" diameter x 10' length. Die-stamp each near the top with the name or trademark of the manufacturer and the length of the rod in feet. The rods shall have a hard, clean, smooth, continuous, surface throughout the length of the rod.
1. Galvanized steel rods are permitted where required by Utility Company.
- B. Mechanical Connectors: Bronze.
- C. Compression set connectors and components: Burndy "Hyground" compression system, or approved equal.
- D. Thermit Welds: Cadweld.

2.2 BASIC MATERIALS

- A. Steel Channel: Galvanized or painted steel.
- B. Anchors:
1. Masonry Anchors: Rawl-Stud, Lok-Bolt, Saber-Tooth, or equal by Arro, Diamond, or Redhead.
 2. Hollow-Wall Anchors: Toggle bolt by Rawl or equal by Arro, Diamond, or Redhead.
 3. Anchors shall have sufficient holding power for intended use.

4. Plastic anchors and powder actuated anchors are not permitted.
- C. Miscellaneous Hardware: Treat for corrosion resistance.
- D. Nameplates: Engraved three layer laminated plastic (lamicoid), white letters on black background. Embossed plastic adhesive tape labels, with 3/16" white letters on black background.
- E. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

2.3 UNDERGROUND STRUCTURES

- A. Handholes and Manholes:
 1. Cast in place or precast reinforced concrete, suitable for AASHTO H-20 wheel loading, construct in accordance with details on drawings. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of these units.
 2. Provide access ladders, cable racks, and pulling-in eyes.
 3. Locate duct entrances at corners to facilitate cable routing. Locate pulling-in eyes on wall opposite each duct entrance.
 4. Metal Frames and Covers: Provide cast iron frames and covers as indicated, Neenah Foundry Co., R-1682 (21") with Type C lid Series heavy duty, or equal. Provide AASHTO H-20 wheel load rating for installation subject to vehicular traffic.
 5. The word "ELECTRIC" shall be embossed in all access covers.
- B. Concrete Transformer:
 1. Cast in place or precast reinforced concrete, construct in accordance with details on drawings. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of these units.
 2. For precast unit, provide lifting lugs in the slab and base. Assemble slab to the base prior to shipping to the site to ensure proper fit with no rocking of the slab on the base.
 3. Locate duct entrances at corners to facilitate cable routing. Locate pulling-in eyes on wall opposite each duct entrance.
- C. Concrete:
 1. Provide in accordance with Section 03 33 00 for Underground Structures.
 2. Provide concrete with 4000 psi, 28 day compressive strength.
 3. Maximum size of coarse aggregate shall be 1".
- D. Reinforcing Steel:
 1. Provide in accordance with Section 03 33 00 for Underground Structures.
 2. Reinforcing bars shall be of 60,000 psi yield strength and conform to ASTM A615.

2.4 METAL CONDUIT

- A. Acceptable Manufacturers:
 1. Allied Tube and Conduit
 2. Wheatland Tube Company
 3. Jones and Laughlin
 4. Republic Steel
 5. Triangle PWC
- B. Conduit:
 1. Metal Conduit and Tubing: Hot dipped galvanized or sheradized steel.

2. Flexible Conduit: Galvanized steel.
3. Liquidtight Flexible Metallic Conduit: Flexible metal conduit with PVC jacket.

2.5 PLASTIC CONDUIT

A. Acceptable Manufacturers:

1. Carlon
2. National
3. American Pipe & Plastics, Inc.

B. Plastic Conduit:

1. Plastic Conduit: NEMA TC 2; PVC. Use Schedule 40 conduit.
2. Liquidtight Flexible Non-Metallic Conduit: Flexible conduit with hard PVC spiral and flexible jacket, Carlon Carflex or approved equal.

2.6 FITTINGS

A. Manufacturers:

1. Appleton
2. Bridgeport
3. O-Z/Gedney
4. Raco
5. Steel City
6. Thomas and Betts
7. Carlon
8. American Pipe & Plastics, Inc.

B. Conduit Fittings:

1. Metal Fittings and Conduit Bodies: NEMA FB 1.
2. Plastic Fittings and Conduit Bodies: NEMA TC 3.
3. Fittings and Conduit Bodies for RSC: Galvanized steel or malleable iron, couplings and fittings threaded.
4. Fittings for EMT: Watertight compression or set screw type as appropriate for the application.
5. Conduit Bodies for EMT: Cast aluminum, galvanized iron or malleable iron bodies.
6. Insulated Bushings: Appleton "BBU".
7. Grounding Bushings: O-Z/Gedney "BLG".
8. Conduit Sealing Bushings: OZ Gedney Type CSB, or approved equal.
9. Fittings for Liquidtight Flexible Metallic Conduit: Galvanized steel or malleable iron, couplings and fittings threaded.
10. Fittings for Liquidtight Flexible Non-Metallic Conduit: High strength, chemical resistant, glass filled thermoplastic compression nut & ferrule assembly, Carlon Carflex or approved equal.
11. Conduit Clamps: Galvanized malleable iron equivalent to O-Z/Gedney 14-G and 15-G Series with clamp back spacer for RSC, and single hole #15-75G malleable or #15-75S galvanized steel clips for EMT.

2.7 ELECTRICAL BOXES

A. Manufacturers:

1. Appleton
2. Crouse Hinds
3. Hoffman
4. Killark
5. Lee Products
6. Raco
7. Square D
8. Steel City

B. Boxes:

1. Sheet Metal: NEMA OS 1; galvanized steel, 4" x 4" x 2" with raised plaster ring and non-gangable 3" H x 3 1/2" D x 2" W per section masonry boxes. Gangable or sectionalizing boxes are not permitted.
2. Cast Metal: Aluminum or cast alloy, deep type "FD", gasket cover, threaded hubs, "Bell" boxes not permitted.
3. Nonmetallic: PVC meeting above size requirements for metal boxes, conforming to UL-514 and NEMA FB-1 and OS 1.

C. Mounting Brackets and Adjustable Ceiling Channels: Galvanized steel of substantial construction to support boxes by bridging between hollow wall studs or ceiling channels, like Caddy #SGB24 screw gun bracket, Caddy #H4 mounting bracket, and B-Line #BA-12 box hanger, or approved equal.

D. Pull Boxes: Code gauge galvanized steel, no prepunched knockouts.

E. Hinged Cover Enclosures: NEMA 250, Type 1, steel enclosure with manufacturer's standard enamel finish and continuous hinge cover, held closed by flush latch operable by screwdriver.

2.8 WIRE AND CABLE

A. Manufacturers:

1. Anaconda
2. Rome Cable
3. General Cable
4. Okonite
5. Phelps Dodge Cable
6. Southwire
7. Triangle PWC
8. Alcan Cable
9. AFC

B. Building Wire:

1. Feeders and Branch Circuits Larger Than 6 AWG: Stranded annealed copper conductor, 600 volt insulation, XHHW, or copper equivalent ampacity annealed Stabiloy compact stranded A.A. 8000 series aluminum alloy, XHHW-2, by Alcan, increase conduit size to accommodate.
2. Feeders and Branch Circuits 6 AWG and Smaller: Annealed copper conductor, 600 volt insulation, THHN/THWN or XHHW, stranded conductor; use compression set terminals.
3. Control Circuits: Copper, stranded conductor, 600 volt insulation, THHN/THWN.

C. Nonmetallic Sheathed Cable:

1. Nonmetallic Sheathed Cable, Size 12 through 4 AWG: Copper conductor, 600 volt insulation, rated 60E C, Type NM and NMC.
2. Underground Feeder and Branch Circuit Cable: Copper conductor, 600 volt insulation, rated 60E C, Type UF.
3. Service Entrance Cable: Copper conductor, 600 volt insulation, XHHW, Type SE and USE.

D. Metal Clad Cable:

1. Metal Clad Cable, Size 12 through 10 AWG: Interlocked galvanized steel armor, stranded annealed copper conductor, 600 volt insulation, rated 60E C, with separate green ground wire, NEC Type MC.

E. Remote Control and Signal Cable:

1. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 60E C, individual conductors twisted together, shielded, and covered with PVC jacket.
2. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60E C, individual conductors twisted together, shielded, and covered with PVC jacket; UL listed.
3. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60E C, individual conductors twisted together, shielded, and covered with nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.9 TAPE AND TERMINATIONS

A. Manufacturers, Tape:

1. 3M Co., Scotch #33 and #88

B. Manufacturers, Terminations:

1. Dossert
2. Ideal
3. 3M Co.
4. Thomas and Betts

C. Wire Connection Devices/Terminations: Compression set or twist-on type with integral molded insulation and internal metallic compression ring or spiral screw-on connecting device. Twist-on type shall be like Ideal "Wing Nut" series. Push-on type wire terminals are not acceptable.

D. Wire Terminals, Butt Splices: Crimp set with integral insulated sleeve, electro tin plated, fully annealed copper.

2.10 WIRING DEVICES AND WALL PLATES

A. Manufacturers:

1. Bryant
2. Hubbell
3. Arrow-Hart
4. Pass and Seymour
5. General Electric

6. Leviton

- B. Wall Switch: AC general use, specification grade, quiet operating snap switch rated 20 amperes and 120/277 volts AC, with plastic toggle handle, ivory color, Hubbell Model 1221.
 - 1. Pilot Light Type: Lighted handle, Model 1221-1L manufactured by Hubbell, or strap mounted lamp in adjacent gang, Model 48071-R manufactured by Bryant.
- C. Receptacle:
 - 1. Provide straight blade receptacles to NEMA WD 1.
 - 2. Provide locking blade receptacles to NEMA WD 5.
 - 3. Convenience Receptacle Configuration, general use: Type 5-20 R, specification grade, plastic face, ivory color, Bryant Model 5352.
 - 4. USB Receptacle: Type A & C USB combination port charging, specification grade, white color, Hubbell Model USB20X2.
 - 5. GFCI Receptacle, general use: Specification grade duplex convenience receptacle with integral ground fault current interrupter, ivory color, Bryant Model GFR53FT.
 - 6. Specific Purpose Receptacle: Configuration indicated on drawings with ivory nylon face.
- D. Decorative Cover Plate: Ivory smooth rigid nylon or high impact plastic.
- E. Weatherproof Covers: Die cast aluminum, gasketed, duplex receptacle cover, weatherproof when attachment plug is inserted.

2.11 CORDS AND CAPS

- A. Straight-blade Attachment Plug: NEMA WD 1.
- B. Locking-blade Attachment Plug: NEMA WD 5.
- C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.
- D. Cord Construction: Oil resistant thermoset insulated Type SJOW multiconductor flexible cord with identified equipment grounding conductor, suitable for extra hard usage in damp location.
- E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

2.12 FIRESTOPPING MATERIALS

- A. Use only through-penetration firestop products that have been tested for specific fire resistance rated conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating required for the application:
 - 1. Latex Sealants: Single component latex formulations that when cured do not re-emulsify during exposure to moisture.
 - 2. Firestop Devices: Factory assemblies steel collars lined with intumescent material sized to fit a specific outside diameter of penetrating item.
 - 3. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
 - 4. Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film.
 - 5. Firestop Pillows: Re-useable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag.

6. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or non-sag) or vertical surface (non-sag).
 7. Silicone Foam: Multi-component, silicone based, liquid elastomers that when mixed expand and cure in place to produce a flexible, non-shrinking foam.
- B. Firestop systems shall be UL classified and rated for the type of construction where it is applied.

PART 3 - EXECUTION

3.1 EXISTING ELECTRICAL WORK

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Disconnect existing electrical systems in walls, floors, and ceilings indicated for removal.
- C. Coordinate utility service outages and reconnections with Utility Company and Owner.
- D. In any area requiring the work of other trades, carefully remove, store and protect any electrical items in the path of the work and re-install and re-connect after the completion of the other trade's work.
- E. In areas where painting is required, remove all electrical items including, but not limited to, lighting fixtures, devices and cover plates, then reinstall after painting has been completed. In the event any electrical items that were not removed become painted, clean the items, or replace if cleaning cannot be suitably cleaned.
- F. Provide temporary wiring and connections to maintain existing systems in service during construction until replacement circuits and systems are ready for service, including circuits and systems that serve other areas.
 1. Existing electrical feeders and branch circuits.
 2. Existing telecommunications system.
- G. Remove, relocate, and repair existing installations to accommodate new construction.
 1. Remove abandoned wiring to source of supply, and/or back to the serving panelboard and turn off breaker and mark as spare in the panelboard directory.
 2. Remove exposed abandoned conduit and boxes, including abandoned conduit above accessible ceiling finishes.
 3. Disconnect abandoned outlets and remove devices.
 4. Provide blank cover for abandoned outlets which are not removed.
 5. Disconnect and remove abandoned panelboards and distribution equipment.
 6. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
 7. Disconnect and remove abandoned luminaires, brackets, stems, hangers, and other accessories.
 8. Disconnect and remove underfloor wiring, cut raceways flush with floor and patch and restore floor surfaces.
- H. Repair adjacent construction and finishes damaged during removal of existing electrical work.
- I. Maintain access to existing, active electrical installations.
- J. Existing wiring, the need for which remains, found in good condition, properly located, and conforming to the specified wiring standard, may continue in service.

- K. Clean and repair existing materials and equipment within limits of work which remain or are to be reused.
 - 1. Panelboards: Clean and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Revise circuit directory.
 - 2. Luminaires: Clean exterior and interior surfaces. Replace lamps and broken parts.
 - 3. Do not reuse conduit, wire, and other materials except as specifically noted on the drawings.
- L. Extend existing installations using materials and methods compatible with existing electrical installations, and as specified.

3.2 EXAMINATION AND PREPARATION

- A. Verify that the interior of the building has been physically protected from weather.
- B. Verify that supporting surfaces are ready to receive work.
- C. Electrical boxes are shown on drawings, locations are approximate unless dimensioned.
 - 1. Obtain verification from Engineer of floor box locations, and locations of outlets in office and work areas, prior to rough-in.
 - 2. Elevator System: Determine location of outlets for lights, cab circuits, machines, and equipment installed in elevator pit, shaft, and machine rooms with elevator system installer prior to rough-in.
- D. Make electrical connections to utilization equipment in accordance with equipment manufacturer's instructions.
 - 1. Verify that wiring and outlet rough-in work is complete and that utilization equipment is ready for electrical connection, wiring, and energization.
 - 2. Make wiring connections in control panel or in wiring compartment of prewired equipment. Provide interconnecting wiring where indicated.

3.3 GROUNDING

- A. Install grounding electrodes and conductors at locations indicated. Install additional rod electrodes as required to meet Regulatory Requirements.
- B. Provide ground bonding as indicated and to meet Regulatory Requirements. Include a separate green or bare for NM cable ground wire in each branch and feeder circuit and bond to grounding system.
- C. Maintain isolation between neutral and ground conductors in accordance with NEC.
- D. Install grounding system so all conductive materials operate at ground potential and there is a low impedance path to ground in the event of a fault.
- E. Test grounding system for resistance to earth using fall-to-potential method in accordance with IEEE Std. 81. Maximum ground to earth resistance shall not exceed 25 ohms.
- F. Test grounding system continuity resistance (megger); resistance shall not exceed 0.1 ohms.
- G. Submit test reports for ground/earth resistance and continuity resistance.

3.4 SUPPORT SYSTEMS

- A. Install support systems sized and fastened to accommodate weight of equipment and conduit, including wiring, which they carry.

1. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, beam clamps, and spring steel clips as appropriate for the application.
2. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
3. Do not fasten supports to piping, ceiling support wires, ductwork, mechanical equipment, or conduit.
4. Do not use powder actuated anchors.
5. Do not drill structural wood or steel members.
6. Fabricate supports from structural steel or steel channel.
7. Install free standing electrical equipment on concrete pads.
8. Install surface mounted cabinets and panelboards with minimum of four anchors.
9. Provide steel channel supports to stand cabinets 1" off wall in wet locations.
10. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.5 CONDUIT

- A. Size raceways for conductor type installed or for type THW conductors, whichever is larger.
 1. Minimum Size Conduit: 3/4".
 2. Maximum Size Conduit in Slabs Above Grade: 1"; for conduits larger than 3/4", route so they do not cross each other.
- B. Install all conduit concealed in walls or above finished ceilings except where specifically indicated to be surface mounted. Arrange conduit to maintain headroom and to present neat appearance. Install conduit in accordance with the following:
 1. Route exposed raceway parallel and perpendicular to walls and adjacent piping.
 2. Maintain minimum 6" clearance to piping and 12" clearance from parallel runs of flues, steam pipes, and heating appliances. Install horizontal raceway runs above water and steam piping.
 3. Complete raceway installation before installing conductors.
 4. Maintain required fire, acoustic, and vapor barrier rating when penetrating walls, floors, and ceilings. Where indicated on drawings, sleeve penetrations through concrete walls, floors, and ceilings.
 5. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof with pitch pocket.
 6. Group in parallel runs where practical and install on steel channel support system. Maintain spacing between raceways or derate circuit ampacities to NFPA 70 requirements.
 7. Use conduit hangers and clamps; do not fasten with wire or perforated pipe straps.
 8. Use conduit bodies to make sharp changes in direction.
 9. Terminate conduit stubs and box connections with insulated bushings.
 10. Steel conduit joints shall be threaded; clamp on or set screw fittings are not permitted.
 11. Use suitable caps to protect installed raceway against entrance of dirt and moisture.
 12. Provide No. 12 AWG insulated conductor or suitable pull string in empty raceways, except sleeves and nipples.
 13. Install expansion joints where raceway crosses building expansion joints, and where necessary to compensate for thermal expansion.

14. Install plastic conduit and tubing in accordance with manufacturer's instructions; thermoweld or cement PVC joints..
15. Use flexible or liquidtight conduit, short as possible, maximum 72 inches, for motor and equipment hookup; always include a separate green ground wire.
16. Use liquidtight conduit for flexible connections in damp or wet locations.
17. Install conduit so condensation will drain and not be trapped.
18. Prevent lodgement of dirt, trash, and mortar; swab all raceways prior to installation of wire and cable.

3.6 BOXES

A. General:

1. Install electrical boxes where shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and regulatory requirements.
2. Locate and install electrical boxes to maintain headroom and to present neat mechanical appearance.
3. Align wall mounted outlet boxes for switches, thermostats, and similar devices.
4. Coordinate mounting heights and locations of outlets above counters, benches, and back splashes.
5. Install lighting outlets to locate luminaires as shown on reflected ceiling plan.
6. Use expansion anchors, shields, or toggle bolts to fasten boxes in place. Do not use explosive powder driven anchors, except where specifically permitted by Engineer. Do not use nails or wire for permanent support.
7. Secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness; select raised cover depth to assure proper fit.
8. Do not install boxes back-to-back in walls; provide 6" minimum separation, except provide 24" separation, in acoustic rated walls.
9. Use hinged cover enclosure for interior pull and junction boxes larger than 12 inches in any dimension. Install in an accessible location that will allow easy access.
10. Field punch openings in pull boxes using punch/dies of appropriate size. Provide knockout closures for unused openings.

B. Surface mounted applications:

1. Use cast "FD" outlet boxes for all surface mounted applications to 10 feet above finished floor, and for exterior and wet locations.
2. Where pull boxes must be installed in finished areas, consult Engineer to select location, style, and finish. The location shall always be as inconspicuous as possible.

C. Concealed above ceilings:

1. Install 4" x 4" x 2" or larger steel boxes for general wiring.
2. Octagon boxes, 3 ½" or 4" by 1 ½" or larger depth, are permitted for flush mounted lighting fixture outlets, use adjustable steel channel fasteners for support.
3. Locate and install electrical boxes to allow access. Provide access panels where required for practical access, and as required by the NEC.

D. Concealed in GWB or plaster walls:

1. Install 4" x 4" x 2" steel box; select raised plaster ring and set box so that outer edge is not less than 1/8" below finished wall surface.
2. Use stamped steel mounting bracket for flush outlet/device boxes in hollow stud wall.
3. Align wall mounted outlet boxes for switches, thermostats, and similar devices.

4. Coordinate mounting heights and locations of outlets above counters, benches, and back splashes.

3.7 INSTALLATION OF WIRES AND CABLES

- A. Verify that interior of building has been physically protected from weather, that mechanical work which is likely to injure conductors has been completed and completely and thoroughly swab raceway system before installing conductors.
- B. Use wire not smaller than 12 AWG for power and lighting circuits, and not smaller than 14 AWG for control wiring.
 1. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet; and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet.
- C. Neatly train and secure wiring inside boxes, equipment, and panelboards.
- D. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- E. Install wiring according to the Wiring Standard, Section 26 00 10, or in another Division 26 Section, or as directed in applicable section. Protect and support exposed cables (where allowed) above accessible ceilings to keep them from resting on ceiling tiles. Use channel, or running boards as necessary to provide support. Do not support wiring on ceiling support wires, unless ceiling installer has provided certification that ceiling support system is rated to carry the additional load of the cables. Install cables to run parallel and perpendicular to building lines; do not run diagonally, leave ample slack cable at turns.
- F. Make splices, taps, and terminations to carry full ampacity of conductors without perceptible temperature rise.
- G. Terminate spare conductors with electrical tape.
- H. Terminate aluminum wire in accordance with manufacturer's instructions.
 1. Use tin plated, aluminum body with copper pigtail compression connectors like Mac-Adapts. Fill with anti-oxidant compound prior to installation of conductor.
- I. Color code all service, feeder, branch, control, and signalling circuit conductors. Color shall be green for grounding conductors and white for neutrals, except where neutrals of more than one system are installed in same raceway or box, the other neutral shall be white with a colored (not green) stripe. Color code ungrounded conductors operating at 120 volts to ground black, red, and blue for Phases A, B, and C and at 277 volts, brown, orange, and yellow respectively.
- J. Terminate all wire joints #10 AWG or smaller with crimp set or twist-on wire terminating device. Use crimp set or bolted "Burndy" or suitable alternate bolted or crimp set device for conductors larger than #10 AWG.
- K. Cover all joints made with non-insulated connecting devices with electrical tape; use Type #88 at any time or #33 whenever the temperature of the joint or the room is above 60EF. Triple wrap joints, each wrap having a 50% overlay.

3.8 CORDS AND CAPS

- A. Install prefinished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain relief clamps.
- B. Provide suitable strain relief clamps for cord connections to outlet boxes and equipment connection boxes.

- C. Make wiring connections in control panel or in wiring compartment of prewired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.
- D. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.

3.9 DEVICES

- A. Install wiring devices in accordance with manufacturer's instructions.
 - 1. Install wall switches 48" above floor, OFF position down.
 - 2. Install wall dimmers 48" above floor. Derate ganged dimmers as instructed by manufacturer. Do not use common neutral.
 - 3. Install convenience receptacles 18" above floor, 6" above counters and backsplash or as indicated, with grounding pole on top.
 - 4. Install specific purpose receptacles at heights shown on Drawings.
 - 5. Install cord and attachment plug caps on equipment. Size cord for connected load and rating of branch circuit overcurrent protection.
- B. Install wall plates flush and level.
 - 1. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using oversized plates for outlets installed in masonry walls.
 - 2. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.10 FIRESTOPPING

- A. Install through penetration firestop systems in accordance with firestop system manufacturer's written installation instructions for products and applications indicated.
- B. Engage an experienced installer who is trained, certified, licensed, or otherwise qualified by the firestop system manufacturer to install the firestop products.
- C. Coordinate construction of openings and penetrating items to ensure that firestop systems are installed according to specified requirements.
- D. Provide firestop systems that are compatible with one another, with the substrates forming openings, with the items penetrating the firestop system, and under the conditions of service for the application being considered.
- E. Provide components for each firestop system that are needed to install fill materials. Use only components specified by the firestop system manufacturer and approved by the qualified testing agency for the designated system.
- F. Keep areas of work accessible until inspection by the AHJ has been completed.
- G. Inspecting Agency: Owner may engage a qualified independent inspecting agency to inspect the completed firestop system. The independent agency shall comply with ASTM E 2174 requirements including inspecting personnel qualifications, method of conducting inspections, and preparation of test reports.
- H. Where deficiencies are found, repair or replace the firestop systems so that they comply with requirements. Proceed with enclosing firestop systems with other construction only after inspection reports are issued and the firestop installations comply with requirements.
- I. Protect the firestop system during and after installation to insure that the systems do not deteriorate and are not damaged during the remaining period of construction. In the event

damage or deterioration occurs, remove affected firestop system and replace with new materials in compliance with this specification.]

3.11 IDENTIFICATION

- A. Identify electrical distribution and control equipment, and loads served, to meet regulatory requirements and as scheduled.
 - 1. Degrease and clean surfaces to receive nameplates and tape labels.
 - 2. Secure nameplates to equipment fronts using screws, rivets, or adhesive, with edges parallel to equipment lines. Secure nameplate to inside face of recessed panelboard doors in finished locations.
 - 3. Use embossed tape nameplates with 3/16" lettering to identify individual switches and circuit breakers, wall switches, receptacle circuits, and loads served.
 - 4. Use lamicoid nameplates with minimum 1/4" lettering to identify distribution and control equipment.
 - 5. Nameplate information shall suitably identify the device or circuit. Any nameplate that is not suitably descriptive in the opinion of the Engineer shall be replaced as directed.
- B. Install wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connections.
 - 1. Use branch circuit or feeder number to identify power and lighting circuits.
 - 2. Use control wire number as indicated on schematic and interconnection diagrams and equipment manufacturer's shop drawings to identify control wiring.

3.12 UNDERGROUND ELECTRICAL

- A. Install ducts in trenches furnished under Section 31 23 00, minimum 30" below grade or as indicated and slope 3" minimum per 100 feet away from buildings toward drainage points. Run ducts in straight lines except where change in direction is necessary. Protect ducts and bedding material from damage and displacement until backfilling has been completed.
- B. Prior to installing conductors, clean ducts with bristle brush. Pull a test mandrel having a diameter 1/4" less than pipe diameter through duct to verify pipe is clear. Follow with a swab to clean out any remaining dirt or foreign matter.
- C. Install yellow plastic warning tape above ducts approximately 12" below finish grade.
- D. Cables shall be one piece unspliced between connections, except where distance exceeds available cable length, it may be spliced at accessible locations.
- E. Install transformer pad as indicated and set level within 1/4" in 10'-0".
- F. Coat metal conduit installed underground with two coats of Bitumastic allowing 24 hours drying time between coats. After installation is complete, coat joints and touch up nicks and scratches.

3.13 FIELD QUALITY CONTROL

- A. Perform field inspection and testing of wiring as follows:
 - 1. Inspect wire and cables for physical damage and proper connection.
 - 2. Torque test conductor connections and terminations to manufacturer's recommended values.

3. Perform continuity and insulation resistance (megger) test on all power and equipment feeder and branch circuit conductors. Submit test report tabulating the test performed and the results.
 4. Verify proper phasing connections; check rotation of all motors.
- B. Perform field inspection and testing of devices as follows:
1. Test for proper polarity and ground continuity.
 2. Test GFCI operation according to manufacturer's written instructions.
 3. Replace defective units and retest.
 4. Submit test report.

END OF SECTION

SECTION 26 20 00 - SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service entrance and metering
2. Panelboards
3. Enclosed switches
4. Fuses
5. Enclosed circuit breakers
6. Motor starters

B. Related Sections:

1. Division 00, including General and Supplementary Conditions, Division 01 Sections, and the Drawings, apply to this Section.
2. Section 26 00 10, Basic Electrical Requirements.
3. Section 26 05 00, Basic Electrical Materials and Methods.

1.2 REFERENCES

A. Conform to the requirements of the local Utility Company:

1. Versant Power, Construction Standards Manual.

1.3 SYSTEM DESCRIPTION

A. Electric Service System: 240/120 volts, single phase, three wire, 60 Hz.

1.4 SUBMITTALS

A. Provide submittals in accordance with Section 26 00 10 for the following:

1. Panelboards
2. Overcurrent devices
3. Disconnects
4. Motor starters
5. Meter cabinets
6. Enclosed circuit breakers

B. Shop Drawings: Indicate relevant information on switchboards, panelboards, and busways. Indicate circuit breaker arrangement in panelboard, type, size, number of poles, interrupting rating, size of enclosures, and quantities.

C. Product Data: Provide data on enclosed switches and circuit breakers, fuses, panelboards, motor starters, and contactors.

D. Upon request, submit samples for inspection.

E. Test Reports: Submit for field inspection and testing. Include description of procedures, duration, instruments used, and test values obtained. Present information in table comparing acceptable values to actual values.

- F. Operating and Maintenance Instructions:
 - 1. Panelboard: Submit NEMA PB 2.1

PART 2 - PRODUCTS

2.1 METER CABINETS

- 1. Manufacturers: As approved by utility company.
- 2. Provide to meet utility company specification.

2.2 PANELBOARDS

- A. Manufacturers:
 - 1. General Electric
 - 2. ITE/Siemens
 - 3. Square D
 - 4. Cutler-Hammer/Westinghouse
- B. Main and Distribution Panelboards: NEMA PB 1; circuit breaker type.
 - 1. Enclosure: Type 1.
 - 2. Exterior: NEMA 3R
 - 3. Combination Service Entrance and waterproof meter mains and panelboard (CSEDs).
 - 4. Provide flush or surface cabinet front, as indicated, with screw cover and hinged lockable door, keyed alike, two keys per panelboard.
 - 5. Bus: Copper or tin plated aluminum.
 - 6. Ground Bus: Copper.
 - 7. Voltage: 240/120 volts, single phase.
 - 8. Minimum Integrated Equipment Rating: 30,000 amperes rms symmetrical for 240 volt panelboards; 25,000 amperes rms symmetrical for 480 volt panelboards, or as shown on drawings.
 - 9. Nameplate: Lamicoid, white letters on black background.
 - 10. Provide Arc Flash and Shock Hazard labels in accordance with NFPA 70.
- C. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type and similar to type referenced on drawings.
 - 1. Enclosure: NEMA PB 1; Type 1.
 - 2. Provide flush or surface cabinet front, as indicated, with screw cover and hinged lockable door, keyed alike, two keys per panelboard.
 - 3. Bus: Copper or tin plated aluminum.
 - 4. Ground Bus: Copper.
 - 5. Voltage: 240/120 volts, single phase, 4 wire.
 - 6. Minimum Integrated Equipment Rating: As shown on drawings.
 - 7. Provide Arc Flash and Shock Hazard labels in accordance with NFPA 70.
- D. Campground Load Centers: Circuit breaker load center.
 - 1. Enclosure: NEMA 3R.
 - 2. Provide surface box as indicated with lock on door.
 - 3. Provide load centers with tin plated aluminum bus; ratings as scheduled on drawings. Do not use tandem circuit breakers. Snap-in breakers
 - 4. Voltage: 240/120 volts, single phase.

5. Minimum Integrated Equipment Rating: 22,000 amperes rms symmetrical.

6.

- E. Panelboard design shall be such that individual circuit breakers can be removed without disturbing adjacent units or removing supplemental insulation installed to obtain clearances required by UL. Where space only is indicated, make provisions for future installation of breakers of size indicated.
- F. Circuit Breakers: Thermal and magnetic, bolt-on, trip free, trip elements in each pole and single common handle or factory applied handle tie. For GFCI breakers, provide push-to-test button, visible indication of tripped condition, and ability to detect and trip on current imbalance of approximately 6 milliamperes or greater per requirements of UL 943 for Class A GFCI devices. Tripping of GFCI breakers to occur instantaneously without delays.
 - 1. Provide fully rated circuit breakers; series ratings are not permitted unless specifically noted on the drawings
- G. Panelboard Tubs: Code gauge galvanized steel, prepunched knockouts not permitted.

2.3 ENCLOSED SWITCHES

- A. Manufacturers:
 - 1. General Electric
 - 2. ITE/Siemens
 - 3. Square D
 - 4. Cutler-Hammer/Westinghouse
- B. Enclosed Switch Assemblies: NEMA KS 12; Type HD.
 - 1. Fuse clips: Designed to accommodate Class R fuses.
- C. Enclosures: NEMA KS 12; Type 12 or as indicated on drawings.
- D. Motor Disconnect Switches: General duty for up to 240 volts and 1.5 HP, heavy duty for over 240 volts or 1.5 HP, quick make/break type, fused or nonfused (NF) as indicated. For 1/6 HP or less, motor rated toggle switches are permitted.

2.4 FUSES

- A. Manufacturers:
 - 1. Bussman
 - 2. Gould
- B. Fuses 600 Amperes and Less: Current limiting, time delay, one-time fuse, 250 volts, UL Class RK 1.
- C. Fuses Larger Than 600 Amperes: Current limiting, time delay, one-time fuse, 600 volt, UL Class L.
- D. Fuse Interrupting Rating: 200,000 rms amperes.

2.5 ENCLOSED CIRCUIT BREAKERS

- A. Manufacturers:
 - 1. General Electric
 - 2. ITE/Siemens
 - 3. Square D

4. Cutler-Hammer/Westinghouse
- B. Circuit Breaker: NEMA AB 12.
 1. Ratings: As indicated on the drawings.
 2. Enclosure: NEMA AB 12; as indicated on the drawings, NEMA 4X stainless steel for kitchen applications.
 3. Accessories: As indicated on the drawings.

2.6 MOTOR STARTERS

- A. Manufacturers:
 1. Allen-Bradley
 2. General Electric
 3. ITE/Siemens
 4. Square D
 5. Cutler-Hammer/Westinghouse
- B. Manual Motor Starter:
 1. NEMA ICS 2; AC general purpose Class A manually operated, full voltage controller with overload relay, red pilot light, NO and NC auxiliary contact, and push button or toggle operator.
 2. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general purpose Class A manually operated, full voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
 3. Enclosure: NEMA ICS 6; Type 1.
- C. Magnetic Motor Starter: NEMA ICS 2.
 1. Full Voltage Motor Starters: AC general purpose Class A magnetic controller for induction motors rated in horsepower with integral thermal overload elements.
 2. Two Speed Starters: Include integral time delay transition between FAST and SLOW speeds.
 3. Coil Operating Voltage: 120 volts, 60 Hz.
 4. Extra Auxiliary Contacts: 2 normally open or closed, field convertible.
 5. Control Power Transformers: 120 volt secondary, or as required by ATC subcontractor, 100 VA or larger as needed.
 6. Enclosure: Type 12 lockable for indoor and NEMA 3R for outdoor applications.
- D. Provide as specified or indicated with unit packaged equipment provided under other sections.
- E. Combination Motor Starters: Provide motor starters with integral thermal overload and motor circuit protector (MCP) or non-fusible or fusible switch in single enclosure, as indicated. Size starter in accordance with manufacturer's ratings, or as indicated. Include control transformer, manual-off-automatic (MOA) switch, and red motor run pilot light.
- F. For all starters, provide thermal overload protection in each phase wire of motor circuit to automatically interrupt all phases upon activation of overload sensor in any phase, and manual reset mechanism.
- G. Overload protection for motors 1/4 HP and smaller may be integral with the motor.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.

3.2 INSTALLATION

- A. Install utility services in accordance with utility company instructions and as indicated.
 - 1. Install service entrance conduits and conductors to building service entrance equipment as indicated on the drawings.
 - 2. Utility company will provide primary conductors and make final connection of contractor furnished spades, left loose, on transformer secondary terminals.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Install switchboard to NEMA PB 2.1.
- D. Install proper fuses in each fused switch.
- E. Install panelboards and load centers to NEMA PB 1.1.
- F. Mount panelboards, disconnects, starters, and enclosed circuit breakers 6'-6" AFF to top of cabinet on steel channel of sufficient length to bridge studs, except where indicated otherwise or approved by Engineer.
- G. Set flush mounted panelboards such that tub flanges extend within 1/8" of wall surface at all points, covers rest firmly against wall, and completely close all openings to interior of cabinet.
- H. Provide a minimum of three 3/4" spare capped conduits stubbed to accessible ceiling void for future use on all flush mounted panelboards.
- I. Panelboard circuiting has been worked out with breakers numbered and increasing in size and number of poles from top to bottom. If this is not retained, the Contractor shall be responsible for revising contract drawings and paying to have it done. This is not to prohibit an occasional revision approved by Engineer and properly marked on as-built drawings for correction by others.
- J. For each branch circuit panelboard, provide a typewritten tabulation indicating fixture outlets, devices, machines, or apparatus served by each breaker and their room location. This shall follow coding on the drawings with breakers numbered from top to bottom. Mount tabulation inside the door in a frame for the purpose with a transparent plastic cover.
- K. Install drives in accordance with manufacturers written instructions.
- L. Provide manufacturer's technician service assistance for drive set-up, start up, adjustment and field checking and testing.
- M. Coordinate installation with other sections. It is the responsibility of this section to ensure that mechanical ducts and piping maintain code required clearances around electrical equipment and that walls have sufficient thickness to accept recessed panelboards.

3.3 GROUNDING

- A. Bond system neutral and all ground conductors together at the service. Bond all feeder conduits to ground at the service and at the main distribution switchboard. Bond service to water and sprinkler mains on street side of water meter and to heating main.
- B. Bond separately derived systems such as dry transformers and generators to building steel and water main.

- C. Provide grounding and bonding to NFPA 70, include a separate green grounding conductor in each circuit. Bond all panelboards, cabinets, and equipment to service ground.
- D. On all but service equipment and separately derived systems, the neutral bus shall be isolated from ground except for the common bond at the main distribution.

3.4 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point by passing minimum current of 10 amperes DC and measuring voltage drop. Maximum resistance: 10 ohms.

3.5 CLEANING

- A. Clean equipment finishes to remove paint and concrete splatters.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Luminaires
 - 2. LED Drivers
- B. Related Documents
 - 1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
 - 2. Section 26 00 10, Basic Electrical Requirements.
 - 3. Section 26 05 00, Basic Electrical Materials and Methods.

1.2 REFERENCES

- A. Furnish products listed by Underwriters Laboratories, Inc., ETL Testing Laboratories, or other testing firm acceptable to the Owner.
- B. Conform to requirements of IES LM-79 and LM 80.
- C. Conform to requirements of ANSI/NFPA 70.
- D. Conform to requirements of NFPA 101.
- E. Consortium for Energy Efficiency (CEE).
- F. DesignLights Consortium (DLC).

1.3 SUBMITTALS

- A. Submit shop drawings, product data, test data, warranties, and other information as appropriate for the following:
 - 1. Luminaires
 - 2. LED Drivers
- B. Shop Drawings: Indicate construction details for products which are not manufacturer's standard, when product data does not adequately describe fixture physical characteristics, or upon request by Engineer.
- C. Product Data: Provide product data for each luminaire and lighting unit.
- D. Submit written warranty for extended warranty items such as batteries and ballasts.
- E. Submit luminaire shop drawings in electronic form with a separate sheet for each luminaire type. Indicate clearly on each sheet the proposed luminaire "type" designation, manufacturer, luminaire, lamp, and ballast designation.
- F. Submittals shall indicate materials, finishes, metal gauges, overall and detail dimensions, sizes of electrical and mechanical connections, fasteners, welds, joints, end conditions, provisions for the work of others and similar information.

- G. The submittals shall state whether or not the fixture, as an assembly, has been UL tested and approved.
- H. Upon request, submit sample products for inspection. Provide luminaires identical with approved samples; retain approved samples at site for comparison until after all other luminaires have been shipped to site and installed. Transportation charges for samples shall be paid by Contractor. Unapproved samples will be returned at Contractor's expense. Upon notification of disapproval, immediately submit new samples that meet contract requirements.
- I. Upon request by Engineer, provide computerized illumination calculation data for specified interior or exterior areas in digital or isofootcandle format and in such detail as requested.
- J. Operating and Maintenance Instructions: Provide maintenance and operating instructions for battery powered lighting units. Include technical data sheets and parts ordering information for components used in all luminaires.

1.4 QUALITY ASSURANCE

- A. Warrant all lighting and components for one year after acceptance of the work and at no additional cost to the Owner, promptly provide and install replacements for luminaires or components which are defective in materials or workmanship; or repair installed equipment at the job site as necessary to restore first class operating condition. For any time during the warranty period that luminaires are not fully functional due to defects in materials or workmanship, provide, install, and remove suitable temporary lighting. Warrant replacement luminaires in a similar manner for a period of one year following replacement including replacement of defective replacements.
- B. Warrant drivers, batteries, and occupancy sensors as further specified herein.
- C. Provide products of firms regularly engaged in the manufacture of interior luminaires or components of similar types and ratings to those required. Such products shall have been in satisfactory use in similar applications for not less than two years.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver luminaires and their components to job site, factory assembled and wired to the greatest extent practical, in strict accordance with approved shop drawings, samples, certificates and catalog cuts.
- B. Protect exposed finishes during manufacture, transport, storage and handling; replace damaged materials.
- C. Luminaires shall be stored under cover, above the ground, in clean, dry areas, and be tagged and/or marked as to type and site destination.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide lighting fixtures as listed on the Lighting, Lamping, and Fixture Schedule on the drawings and as specified herein that meet the physical, performance and quality standard exhibited by that fixture. Substitutes shall be equal in all respects including mechanical, electrical, physical, performance, photometric, and quality characteristics except minor variances in construction details which do not affect overall quality or performance are permitted.

- B. Accessories: Provide required accessories for mounting and operation of each luminaire as indicated.
 - 1. Recessed Luminaires: Provide trim type suitable for ceiling system in which luminaire is installed; design fixtures to operate in a 140° F environment.
 - 2. Thermal Protection: Provide thermal protection devices to meet NFPA 70 requirements.
 - 3. Disconnecting Means: Provide disconnecting means in fluorescent luminaires that utilize double-ended lamps and contain ballast(s) that can be serviced in place.
 - 4. Surface Luminaires: Provide spacers and brackets required for mounting; design for a minimum ambient temperature of 92° F.
 - 5. Pendant Luminaires: Provide swivel hangers, pendant rods, tubes, chains, and other hardware as required and/or indicated to install luminaire at appropriate height.

2.2 LED LUMINAIRES

- A. Exterior Housing: Diecast aluminum with five stage polyester powder paint finish, electrical components solidly heat-sink mounted to housing, type as described on the drawings.
- B. Shall be approved by DesignLights Consortium, if not, shall have LM-79 and LM-80 testing or shall have 5 year warranty that cover the product if light levels drop below 70% of the initial light output.
- C. Power Supply: 0 - 10v dimming capabilities.
- D. Reflector: Precision injection molded, high specular reflector, minimum photometric performance in accordance with fixtures listed on Lighting Fixture Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine adjacent surfaces to determine that surfaces are ready to receive work.
- B. Install wiring in accordance with Section 26 00 10.
- C. Install luminaires and accessories in accordance with manufacturer's instructions, as indicated, with equipment, materials, parts, attachments, devices, hardware, hangers, cables, supports, channels, frames and brackets necessary to make a safe, complete, and fully operative installation.
- D. Install luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent luminaires, and secure in accordance with manufacturers' directions and approved shop drawings. Conform to the requirements of National Electrical Code ANSI/NFPA 70.
 - 1. Specified or indicated mounting heights are to be to the bottom of each luminaire for suspended and ceiling mounted luminaires, and to the center of each luminaire for wall mounted luminaires. Obtain approval of exact mounting for luminaires on the job before installation is commenced and, where applicable, after coordinating with type, style, and pattern of ceiling being installed.
 - 2. Support surface mounted luminaires from ceiling grid tee structure; provide auxiliary support laid across top of ceiling tees and fasten to prohibit movement.
 - 3. Install recessed luminaires to permit removal from below and install earthquake clips.
 - 4. For lighting fixtures mounted in or on suspended ceilings, provide two support hangers per fixture so that each is independently supported from the building structure.

5. Provide two support hangers for the minimum security fixtures so that each is independently supported from the building structure.
 6. Ground non current carrying parts of electrical equipment in accordance with UL and NEC provisions.
- E. Install lighting fixtures where indicated on the plans; plans may be scaled for approximate locations; minor adjustments are permitted to avoid conflicts. Fixture placement that does not conform to the layout indicated shall be corrected; if in doubt about correct placement consult Engineer prior to roughing in. Install all lighting so that it is securely fastened, rows are uniformly spaced and in alignment, and fixture rests flat on mounting surface.
 - F. Perform insulation resistance and ground continuity test.
- 3.2 ADJUSTING AND CLEANING
- A. Align luminaires and clean lenses and diffusers at completion of work.
 - B. Aim adjustable luminaires as indicated or as directed.
 - C. Adjust directional arrows on exit signs to meet approval of authority having jurisdiction.
 - D. Clean paint splatters, dirt, and debris from installed luminaires.
 - E. Touch up luminaire and pole finish at completion of work.
- 3.3 OWNER INSTRUCTION
- A. Provide on-site training of Owner's personnel in operation of controls systems by a factory trained manufacturer's representative. Include instruction in programming time controls to obtain required control functions. Provide one follow-up visit if necessary.

END OF SECTION

SECTION 27 10 00 – TELEPHONE AND DATA WIRING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes, but is not limited to, the following:
 - 1. Coordinate backer board provided under Sections 06100 and 09900.
 - 2. Furnish underground duct from riser pole to backer board.
 - 3. Furnish a system of conduits and pull boxes for trunk cables.
 - 4. Furnish outlets and wiring for telephone and data distribution outlets.
 - 5. Test outlet wiring for circuit integrity.
 - 6. Cooperate with Owner's telephone equipment supplier.
- B. Related Documents:
 - 1. Drawings, Division 00, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
 - 2. Section 06 10 00, Rough Carpentry.
 - 3. Section 09 91 00, Painting.
 - 4. Section 26 00 10, Basic Electrical Requirements.
- C. Work Not Included:
 - 1. Telephone equipment and its installation.
 - 2. Telephone service entrance cables.

1.2 REFERENCES

- A. Comply with the latest revisions of the following:
 - 1. ANSI/NFPA 70, National Electrical Code.
 - 2. ANSI/TIA/EIA-568-B, Commercial Building Telecommunications Standard.
 - 3. TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - 4. BICSI Telecommunications Distribution Methods Manual.

1.3 SUBMITTALS

- A. Submit catalog cuts in accordance with Section 26 00 10 for the following:
 - 1. Telephone and Data Cable
 - 2. Fiber Optic Cable
 - 3. Telephone/Data Outlet and Cover Plate
 - 4. Patch Panels
 - 5. Relay Rack
- B. Submit factory certification that cable has been tested and meets the specified standards.
- C. Submit test report for installed cables and terminations.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Telephone backer boards shall be 3/4 inch AB grade fir plywood with two coats black enamel paint. Backer board shall be minimum 48" x 96", or as indicated, install 6'-6" AFF to top of board.

2.2 TELEPHONE/DATA OUTLETS

- A. Acceptable Manufacturers:
 - 1. AT&T
 - 2. Hubbell
 - 3. Leviton
 - 4. Panduit
- B. Data Jacks: RJ-45, eight pin modular, UL verified and listed Category 6, UL 1863, meeting FCC Part 68.5, gold plating over nickel under plating (50 micro-inch) beryllium copper jack contacts, phosphor bronze (100 micro-inch) tin/lead plating over nickel under plating IDC 110 contacts, TIA/EIA-568-A configuration, Hubbell HXJ6 series, Blue color, or approved equal.
- C. Telephone Jacks: RJ-45, eight pin modular, UL verified and listed Category 6, similar to Data Jack, TIA/EIA-568-A configuration, gray color.
- D. Mounting Plate: High impact 94 V-O rated gray thermoplastic (Noryl) flush cover plate with labels stenciled by thermal ink transfer, Hubbell FPL series, or approved equal. Provide blank cover for unused openings. Note: System is sized for future expansion; do not use single or dual position plates with no blanks.

2.3 CABLE

- A. Acceptable Manufacturers:
 - 1. Alpha
 - 2. Belden
 - 3. Berk-Tek
 - 4. Commscope
 - 5. Mohawk/CDT
 - 6. West Penn
- B. Data and Telephone Horizontal Cables: Inside cable, non plenum applications, NEC Type CM, CMG; riser applications Type CMR; UL Listed Category 6, unshielded 4-twisted pair solid 24 AWG copper conductors with polyvinyl chloride or polyolefin insulation and polyvinyl chloride sheath, factory certified to conform with EIA/TIA-568-A and Addenda TSB-36 and TSB-40-A, 100 ohms characteristic impedance, designed to support Gigabit Ethernet Standard of 250 MHz with maximum insertion loss (attenuation) of 33db and NEXT minimum of 36db. For plenum applications provide cable with CMP (plenum) rating and FEP Teflon insulation for both jacket and individual conductors.

2.4 EQUIPMENT

- A. Data Patch Panels Category 6, "110" termination, Hubbell #P6XXU series, provide ports as required for installed cables, plus 10 percent spares, or approved equal. Use for terminating all Category 6 cables.
- B. Powered Data Patch Panels for POE components: Category 6, "110" termination, Hubbell #DTX24P series, provide ports as required for installed wireless ports, plus 10 percent spares, or approved equal. Provide power supply chassis Hubbell #DTXPS and Power supply Modules

Hubbell #DTXPM350, 2 per patch panel for full redundancy. Use for terminating all wireless Category 6 cables.

- C. Terminal Blocks: "66" blocks, Reliable Electric #R66MN-25DAF9, 25 and 50 pair as appropriate, with double clips and female connectors. Provide #R89-1-25 standoff bracket.
- D. Fiber Optic Terminations: Twelve port SC panel, rack mounted with swing out fiber management tray like Hubbell #FPR012SCM.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring in conduit as specified for branch circuits, Section 26 00 10, except use cable tray and underfloor raceway where indicated.
- B. All conduit installed for telephone wiring shall have no more than two 90° bends in any run unless one or more accessible, appropriately sized pull boxes are provided.
- C. Leave telephone service and feeder ducts with a pull string for use by others.
- D. Installers shall be well trained, experienced, and familiar with TIA/EIA-568-A and its application in the installation of communication wiring. Run Category 5e cables in strict compliance with TIA/EIA-568-A. Observe bending radius rules, do not staple cable, and do not exert excessive tension when installing in raceway.
- E. Fiber Optic Cable: Do not exceed cables minimum manufacturers specified bending radius and/or maximum tensile rating during installation. Install all fiber cable in inner duct, minimum 1 1/4" trade size, install duct to minimize bends and twists. Secure all exposed sections with cable ties; do not allow the cable ties to bear the cable's weight.
- F. Make up telephone jacks to cables in accordance with TIA/EIA-568-B standards and test for opens, shorts and grounds at each pin. Cooperate with Owner's telephone equipment installer, who will install trunk cables and telephone equipment, and aid in troubleshooting cable problems. Correct defects in circuits supplied under this section.

3.2 TERMINATIONS

- A. Voice Riser (trunks): Terminate on AT&T or equivalent 110 type insulation displacement connection (IDC) termination blocks, with the shield grounded. Maintain pair twists to within 1/2" of the termination points.
- B. Data Riser: Terminate fiber strands using the appropriate ST/SC connectors.
- C. Station Outlets: Flush mounted four position faceplate with unused positions covered with blank off insert. Terminate cables on jack inserts, install voice jack in top position, data jack(s) in bottom position(s).
- D. Station Terminal Fields:
 - 1. Terminate voice station cables on AT&T, or equivalent, 110 type insulation displacement connection (IDC) termination blocks. Maintain pair twists to within 1/2" of the termination points.
 - 2. Terminate data station cables on Category 6 modular patch panels having 110 type insulation displacement connection termination for the station cable, and RJ-45 style eight (8) position jacks wired in TIA-T-568-A pin configuration. maintain pair twists to within 1/2", or less, of the termination points.

- E. Ground patch panels via a bond connection to the appropriate telecommunications grounding busbar.

3.3 LABELING REQUIREMENTS

- A. Number both ends of each cable with labels of waterproof materials and indelible ink text information, using either mechanical or waterproof adhesive attachment.
- B. Wall Plate Marking:
 - 1. Wall Plate ID = FTNN Where F= Floor Designator
T= Terminal Identifier (i.e. "A", "B")
N= Sequential station placement drop number (Keyed to room number)
 - 2. Example: G-A-1024.3-3 = Ground floor, IDF A, Room 1024.3-Outlet number 3 in this room.
 - 3. This designation must be permanently and indelibly marked on the wall plate in a clear and legible manner. The designation must also be marked on the terminal block or patch panel of the associated distribution frame location (MDF/IDF).
 - 4. Record the wall plate number on the building floor plan record diagram.
- C. Riser (Trunk) Pair Marking:
 - 1. Riser Pair ID = NNN Where NNN= Sequential riser pair number.
 - 2. Example: (Riser) 245 = Riser pair number 245.
 - 3. The designation must be marked on the termination blocks at each end of the riser cables. Riser pair counts shall not be repeated. If riser pair 1-48 terminates at the first IDF, the next riser pair count in the following IDF shall start with pair number 49.]

3.4 GROUNDING REQUIREMENTS

- A. Extend service equipment ground to service backer board using min. #6 AWG copper. In exposed locations, install ground wire in EMT. Bond all telecommunications raceway to form a continuous path to ground.
- B. Ground patch panels, equipment racks and other telecommunications' equipment via a min. #6 AWG bond connection to the appropriate telecommunications grounding busbar.
- C. Provide appropriate grounding for the protection of personnel, materials and equipment conforming to all applicable regulations, codes and standards.

3.5 FIRE STOPPING

- A. Apply UL 1479 listed cementitious fire stop materials conforming to ASTM E-814 F and T ratings, in full hours, compatible with the rating of the penetrated fire barrier.

3.6 TESTING

- A. Voice Circuits: Test for opens, shorts, grounds, and pair compliance at each pin. Correct defects and retest as necessary to obtain error free circuits. No defective pairs are permitted in station cables. A pair is defective if:
 - 1. Either or both conductors are open.
 - 2. Either or both conductors are shorted to ground or another conductor.
 - 3. Tip and ring are reversed.
 - 4. Foreign voltages are present.

- B. Data Circuits: Test and certify all Category 6 cable runs to conform to TIA/EIA-568-B and UTP Addenda TSB-36, TSB-40A, 569, and 606. Runs shall support the Gigabit Ethernet Standard for 250 Mhz with maximum insertion loss (attenuation) of 33db and NEXT minimum of 36db. Perform bi-directional test using a network analyzer, Microtest Penta scanner, or approved equal. Defective pairs are not permitted; runs which do not meet this requirement shall be replaced or suitably repaired and retested. Submit a computer generated test report listing results for each run.
- C. Fiber Optic Riser: Test each strand in accordance with ANSI/TIA/EIA-526-7, Method A.1, one reference jumper. Test in one direction at 1310 and 1550 nm wavelengths; attenuation shall not exceed 1.0db/km at both wavelengths. Connector loss shall not exceed 1.5db per connector pair. No defective fiber strands, or splices of any type, are permitted in a riser cable. Replace any cable containing defective strands. Submit test report summarizing test results.
- D. Submit a typed test report indicating test results for each circuit, including station circuits and trunk cables.

END OF SECTION