

**PROJECT MANUAL
BIDDING SPECIFICATION**

VOLUME 1

FOR

**RIVERLAND ENERGY COOPERATIVE
ALMA CITY HALL REMODEL – PHASE 1**

1225 South Main Street
Alma, WI 54610

Project # 25020

DECEMBER 16, 2025

ARCHITECTURAL

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Eau Claire, WI 54701
(715) 835 7500

PLUMBING / MECHANICAL / ELECTRICAL

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ALMA CITY HALL REMODEL

TABLE OF CONTENTS

Division	Section Title.....	Pages

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

	Project Title Page.....	1
	Table Of Contents	2
00 01 15	List Of Drawing Sheets.....	1
00 11 16	Invitation To Bid.....	2
00 21 00	Instructions To Bidders.....	4
00 26 00	Procurement Substitution Procedures	2
00 31 26	Existing Hazardous Material Information	1
	Hazardous Material Report by Legend Technical Services	33
00 31 43	Permit Application.....	1
00 41 13	Bid Form - Stipulated Sum (single-prime Contract).....	2
00 43 13	Bid Security Forms	1
00 43 93	Bid Submittal Checklist	1
00 60 00	Project Forms.....	1

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00	Summary	2
01 25 00	Substitution Procedures	3
01 26 00	Contract Modification Procedures	2
01 29 00	Payment Procedures.....	3
01 31 00	Project Management And Coordination	5
01 33 00	Submittal Procedures	5
01 35 16	Alteration Project Procedures	4
01 60 00	Product Requirements.....	4
01 73 00	Execution	7
01 74 19	Construction Waste Management And Disposal	4
01 77 00	Closeout Procedures	4
01 78 23	Operation And Maintenance Data	4
01 78 39	Project Record Documents	2
01 79 00	Demonstration And Training	1

DIVISION 02 - EXISTING CONDITIONS

02 41 19	Selective Demolition.....	4

DIVISION 03 - CONCRETE

03 30 53	Miscellaneous Cast-in-place Concrete.....	5

DIVISION 04 - MASONRY

04 20 00	Unit Masonry	4

DIVISION 05 - METALS

05 50 00	Metal Fabrications	3

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 53	Miscellaneous Rough Carpentry	3
06 46 00	Wood Trim.....	2
06 48 00	Wood Frames.....	2

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 01 50.19	Preparation For Reroofing	3
07 26 00	Vapor Retarders	1
07 53 23	Ethylene-propylene-diene-monomer (EPDM) Roofing.....	8
07 71 00	Roof Specialties	4
07 72 00	Roof Accessories	3
07 92 00	Joint Sealants	3

DIVISION 08 - OPENINGS

08 14 16	Flush Wood Doors	2
08 41 13	Aluminum-framed Storefronts.....	4
08 56 53	Security Windows.....	3
08 71 00	Door Hardware	3
08 80 00	Glazing.....	5
08 88 53	Security Glazing	4

DIVISION 09 - FINISHES

09 01 90.52	Maintenance Repainting	3
09 29 00	Gypsum Board	3
09 30 13	Ceramic Tiling.....	4
09 51 23	Acoustical Tile Ceilings.....	2
09 65 13	Resilient Base And Accessories.....	2
09 65 19	Resilient Tile Flooring	2
09 68 13	Tile Carpeting	3
09 91 23	Interior Painting	2

DIVISION 10 - SPECIALTIES

10 14 23.16	Room-identification Panel Signage	2
10 28 00	Toilet, Bath, And Laundry Accessories.....	2
10 44 13	Fire Protection Cabinets.....	2
10 44 16	Fire Extinguishers	1

DIVISION 22 - PLUMBING

22 05 00	Common Work Results For Plumbing.....	17
22 05 19	Meters And Gauges For Plumbing Piping	3
22 05 53	Identification For Plumbing Piping And Equipment	4
22 07 19	Plumbing Piping Insulation	7
22 10 05	Plumbing Piping	19
22 10 06	Plumbing Piping Specialties	6
22 30 00	Plumbing Equipment	6
22 40 00	Plumbing Fixtures.....	10

DIVISION 23 – HEATING, VENTILATING, & AIR CONDITIONING

23 05 00	Common Work Results For HVAC.....	11
23 05 13	Common Motor Requirements For HVAC Equipment.....	3
23 05 29	Hangers And Supports For HVAC Piping And Equipment	4
23 05 93	Testing, Adjusting, And Balancing For HVAC.....	6
23 07 00	HVAC Insulation.....	8
23 23 00	Refrigerant Piping.....	4
23 31 00	HVAC Ducts and Casings	6
23 33 00	Air Duct Accessories	6
23 34 00	HVAC Fans	4
23 37 13	Diffusers, Registers & Grilles.....	4
23 41 00	Particulate Air Filtration	3
23 54 00	Gas Fired Furnaces	3
23 62 13	Packaged Air-Cooled Refrigerant Compressor And Condensing Units.....	5

DIVISION 26 - ELECTRICAL

26 01 00	Basic Electrical Requirements.....	9
26 01 10	Basic Electrical Materials And Methods	7
26 01 15	Temporary Service.....	2
26 05 01	Minor Electrical Demolition.....	3
26 05 19	Low-Voltage Electrical Power Conductors And Cables	6
26 05 23	Control-Voltage Electrical Power Cables.....	3
26 05 26	Grounding And Bonding For Electrical Systems	4
26 05 29	Hangers And Supports For Electrical Systems.....	2
26 05 33	Raceway And Boxes For Electrical Systems.....	12
26 05 34	Conduit	6
26 05 35	Surface Raceways.....	2
26 05 37	Boxes	4
26 05 53	Identification For Electrical Systems.....	3
26 22 00	Low-Voltage Transformers.....	4
26 24 16	Panelboards.....	4
26 27 17	Equipment Wiring.....	3
26 27 26	Wiring Devices	5
26 28 18	Enclosed Switches	2
26 51 00	Interior Lighting.....	9
26 56 00	Exterior Lighting.....	3

END OF TABLE OF CONTENTS

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SECTION 00 01 15
LIST OF DRAWING SHEETS

LIST OF DRAWINGS

Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Riverland Energy Cooperative: Alma City Hall Remodel – Phase 1, dated December 16, 2025, as modified by subsequent Addenda and Contract modifications.

List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

GENERAL

Title Sheet, Sheet Index, Project Location Maps	G101
Phase 1 – Egress Plan, Code Analysis, FFE Plans	G102
Building Components.....	G103

CIVIL

Site Plan	C201

ARCHITECTURAL

Phase 1 North – Demolition Floor Plan.....	A201
Phase 1 South – Demolition Floor Plan.....	A202
Phase 1 – Demolition Roof Plan	A203
Phase 1 North – Remodel Floor Plan	A301
Phase 1 South – Remodel Floor Plan, Enlarged Plan.....	A302
Phase 1 – Proposed Roof Plan.....	A303
Phase 1 – Wall Types, Door Types, Window Types, Schedules.....	A304
Phase 1 – Exterior and Interior Elevations	A401
Phase 1 – Door and Window Details.....	A501
Phase 1 – Reflected Ceiling Plan.....	A701

PLUMBING

General Information Sheet, Schedules, and Details	P100
Demolition Floor Plan.....	P101
Demolition Roof Plan.....	P102
Remodel Floor Plan and Schematics	P201

MECHANICAL

Demolition Plans	M101
Remodel Plans.....	M201
Schedules, Notes, and Details	M301

ELECTRICAL

Demolition Floor Plan.....	E101
Remodel Floor Plan Lighting	E201
Remodel Floor Plan Power.....	E301

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Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.

This remodel project will include new public toilet rooms, reworked office areas, reworked break room, and a new city meeting space. In addition, the windows on the North and East elevations and EPDM roof system will be replaced. All associated plumbing, electrical, and mechanical rework will be necessary, see plans.

General Contract (all trades).

Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

Bids will be thereafter publicly opened and read aloud.

Bid security shall be submitted with each bid in the amount of 5 percent of the bid amount. No bids may be withdrawn for a period of 60 days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

A prebid conference for all bidders will be held at 1225 South Main Street, Alma, WI 54610 on February 4, 2026 at 10:00 a.m., local time. Prospective bidders are requested to attend, but not required.

Printed Procurement and Contracting Documents: Obtain after January 22, 2026 on our website at www.lienandpetersonarchitects.com and at the following builders exchanges, Northwest Regional Builders Exchange, La Crosse Builders Exchange, and Minnesota Builders Exchange.

The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within 180 calendar days.

1 **BIDDER'S QUALIFICATIONS**

2 Bidders must be properly licensed under the laws governing their respective trades and be able to obtain
3 insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment
4 Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

5
6 **INTERPRETATION**

7 No verbal explanation or instructions will be given in regard to the meaning of the drawings or
8 specifications during the bid period. Bidders shall bring inadequacies, omissions, or conflicts to the
9 Architect/Engineer's attention at least nine (9) business days before the date set for bid opening. Prompt
10 clarification will be supplied to all bidders of record by addendum.

11
12 Failure to so request clarification or interpretation of the drawings and specifications will not relieve the
13 successful Bidder of responsibility. Signing of the contract will be considered as implicitly denoting that
14 the Contractor has thorough understanding of the scope of work and comprehension of the contract
15 documents.

16
17 The Architect/Engineer will be responsible for verbal instructions.

18
19 **END OF DOCUMENT**

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Project Identification: Alma City Hall Remodel – Phase One
Project Number: 25020
Project Location: 1225 South Main Street, Alma, WI 54610
Owner's Representative: Mayor Rick Champeny
Architect: Lien & Peterson Architects, Inc.
Supervising Professional: William Boettcher, PE

Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the invitation to bid, Instructions to Bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, and all Addenda.

A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

The terms, Architect and A/E shall mean Lien & Peterson Architects, Inc.

Each bidder by making his bid represents that he has read and understands the bidding documents and that he has visited the site and familiarized himself with the local conditions under which the Work is to be performed.

All bids must be prepared on the form provided in this Project Manual and submitted in accordance with the Instructions to Bidders. **REMOVE FORM FROM PROJECT MANUAL.** Do not submit entire project manual. Submit only one Bid Form. Bid shall be completed in accordance with the requirements stated in this section. Place bid in an opaque envelope and seal. No other information shall be included with the Bid Form except any required bond or information requested herein or by Addendum. Mark the exterior of the envelope as follows:

(Give Project Name)
(State Portion of the Work Bid Upon)
(Contractor's Name and Address)

A bid is invalid if it has not been deposited at the designated location prior to the Bid Deadline. Such a bid will not be opened and will be returned to the bidder.

1 Bids will be received for contracts as provided in the Bid/Proposal form.

3 **ADDENDA**

4 Addenda will be made available through the same online platform as the Bid Documents. Questions
5 regarding plans and specifications are due by February 10, 2026. An addendum will be issued on February
6 12, 2026.

8 **BIDDING DOCUMENTS**

9 Contracting Documents: Obtain digital copies after January 22, 2026 on our website at
10 www.lienandpetersonarchitects.com and at the following builders exchanges; Northwest Regional Builders
11 Exchange, La Crosse Builders Exchange, and Minnesota Builders Exchange.

12
13 Refer to section 00 43 93 "Bid Submittal Checklist" to ensure all documents are submitted with bid.

14
15 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect
16 assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding
17 Documents.

18
19 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or
20 grant of use is conferred by distribution of the Bidding Documents.

22 **EXAMINATION OF BIDDING DOCUMENTS**

23 The Bidder shall carefully study the Bidding Documents, shall examine the site and local
24 conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and
25 request clarification or interpretation.

26
27 No verbal explanation or instructions will be given in regard to the meaning of the drawings or
28 specifications during the bid period. Bidders shall bring inadequacies, omissions, or conflicts to the
29 Architect/Engineer's attention, in writing, at least nine (9) days prior to the bid date.

30
31 Modifications and interpretations of the Bidding Documents shall be made by Addendum.

32 Modifications and interpretations of the Bidding Documents made in any other manner shall not
33 be binding, and Bidders shall not rely upon them.

34
35 Failure to so request clarification or interpretation of the drawings and specifications will not relieve the
36 successful Bidder of responsibility. Signing of the contract will be considered as implicitly denoting that
37 the Contractor has thorough understanding of the scope of work and comprehension of the contract
38 documents.

40 **INSURANCE REQUIREMENTS**

41 The Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full
42 insurable value thereof. This insurance shall include the interests of the Owner, the Contractor,
43 Subcontractors and Sub-subcontractors in the Work and shall insure against the perils of fire and extended
44 coverage and shall include "all risk" insurance for physical loss or damage including, without duplication
45 coverage, theft, vandalism and malicious mischief.

47 **SUBSTITUTIONS**

48 Each bidder represents that his bid is based upon the materials and equipment described in the bidding
49 documents.

50
51 No substitution will be considered unless written request has been submitted to the A/E for approval at least
52 ten (10) days prior to the date for receipt of bids. Each such request shall include a complete description of
53 the proposed substituted, drawings, cuts, performance and test data and any other data or information
54 necessary for a complete evaluation. Approval of substitutions will be set forth by Addendum.

1 Approval by the A/E of a manufacturer for specified items shall not be deemed as approval of all products
2 or models that the manufacturer can furnish but only the single product which most closely duplicates the
3 item originally specified.

4
5 The responsibility for all revisions to the work required by substitutions shall be borne solely by the
6 Contractor who utilizes the substitution, including the following:

7
8 Additional work by other Contractors.

9 Changes to the building structure or room sizes.

10 Additional associated devices, connections, wiring, etc.

11 Properly notifying other contractors as to the effect of such substitutions on their contract.

12 13 **PRODUCT OR MATERIAL AVAILABILITY**

14 Prior to the receipt of bids, verify that all specified items, products, materials, etc., will be available for
15 timely inclusion in the work. Should any item not be available, notify the A/E. Extra costs resulting from
16 delays caused by failure to determine availability of specified items shall be borne by the Contractor.

17 18 **QUALIFICATION OF BIDDERS**

19 Before the award of any contract, the owner shall be satisfied that the bidder, (1) maintains a permanent
20 place of business, (2) has adequate equipment to do the work properly, (3) has a suitable financial status to
21 meet obligations incident to the work, (4) has appropriate technical experience, and (5) has satisfactorily
22 completed contracts of similar nature and magnitude.

23 24 **SUBMISSION OF BIDS**

25 All bids shall be submitted on the standard Bid Forms enclosed in the specifications and only bids that are
26 made on the Bid Forms will be considered. The entire Bid Form including the Addendum
27 Receipt/Signature page, the Bid Bond Form, and other supporting documents (if any), shall be filled out
28 and submitted in the manner specified hereinafter. SPECIFICATIONS SHALL NOT ACCOMPANY BID.

29
30 Bidders shall submit a Single Base Bid for all the work. No bids for any subdivision or any sub-
31 classification of this work will be accepted. Any conditional bid, amendment to the Bid Form or appendant
32 thereto, the inclusion of any correspondence, written or printed matter, unsolicited material or data, or
33 details of any nature other than the information specifically called for, will disqualify the Bid.
34 Telecommunication alterations to the bid will not be accepted.

35
36 Any addendum issued during the time of bidding shall become a part of the Contract Documents. Bidders
37 shall acknowledge receipt of such addendum in the appropriate space provided on the Bid Form. Bid will
38 be rejected if receipt of an addendum applicable to the award of contract has not been acknowledged on the
39 Bid Form.

40
41 Bidder shall be responsible for the sealed bid being delivered to the place designated for the bid opening
42 before the time specified. Bids received after the time indicated in the Advertisement for Bids will be
43 rejected.

44
45 Bid will be considered invalid and will be rejected if it has not been signed by the Bidder.

46 47 **AWARD OR REJECTION OF BIDS**

48 Review the Bid Form for procedures to be followed should the bid be accepted by the Owner. Notice that
49 prompt delivery of the required documents is required. The bidder acknowledges the right of the Owner to
50 reject any or all bids and to waive any informality or irregularity in any bid received. In addition, the
51 bidder recognizes the right of the Owner to reject a bid if the bidder failed to furnish any required bid
52 security, or to submit the data required by the bidding documents, or if the bid is in any way incomplete or
53 irregular.

1 **SUBMISSION OF POST-BID INFORMATION**

2 Upon request by the A/E, the selected bidder shall within seven (7) days thereafter submit the following:

3
4 A statement of costs for each major item of Work included in the bid.

5
6 A designation of the Work to be performed by the bidder with his own forces.

7
8 A list of names of the Subcontractors or other persons or organizations (including those who are to
9 furnish materials or equipment fabricated to a special design) proposed for the principal portions
10 of the Work.
11

12 **PERFORMANCE BOND AND PAYMENT BOND**

13 The Bidder who is awarded the work shall furnish and pay for bonds covering the faithful performance of
14 the Contract and the payment of all obligations arising thereunder in such form as the Owner may prescribe
15 and with such sureties secured through the bidder's usual sources as may be agreeable to the parties. The
16 amount of each bond shall be 100% of the Contract Amount. Bonds shall be dated not later than the date of
17 execution of the Contract. The attorney-in-fact who executes the required bonds on behalf of the surety
18 shall affix thereto a certified and current copy of his power-of-attorney indicating the limit of such power.
19

20 Bond form shall be AIA Document WIS. A311, latest edition, "Private Improvement Performance Bond"
21 and "Private Improvement Labor and Material Payment Bond."
22

23 **RETAINAGE**

24 Retainage will be accumulated at 10% of the amount due until 50% completion. Upon substantial
25 completion, payments shall be increased to 98% of the amount due, less allowance for incomplete and
26 unsatisfactory work.
27

28 **END OF SECTION**

SECTION 00 26 00
PROCUREMENT SUBSTITUTION PROCEDURES

DEFINITIONS

Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 01 25 00 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

QUALITY ASSURANCE

Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PROCUREMENT SUBSTITUTIONS

Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:

Extensive revisions to the Contract Documents are not required.

Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.

The request is fully documented and properly submitted.

SUBMITTALS

Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:

Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.

Submittal Format: Submit copies of each written Procurement Substitution Request, using CSI Substitution Request Form 1.5C.

Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.

Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

Architect's Action:

Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

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This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

Related Requirements:

Section 02 41 19 "Selective Demolition" for notification requirements if materials suspected of containing hazardous materials are encountered.

Alma City Hall Remodel – Phase 1
00 31 26 - 1

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May 19, 2025

City of Alma
Attn: Rick Champeny
314 N Main Street
Alma, WI 54610

RE: Final Report- Asbestos Services
LEGEND No. 25WI065

1.0 INTRODUCTION

This report presents the results of a partial non-destructive pre-renovation inspection of the building located at 1225 South Main Street in Alma, WI conducted by LEGEND Technical Services, Inc. (LEGEND) representatives Lucas Sokol, WI Asbestos Inspector #AII-267101, and Jack Brown, WI Asbestos Inspector #AII-293770 on April 29, 2025. LEGEND's services were requested and authorized by Rick Champeny with the City of Alma.

The building was constructed in the 1950s. It consisted of an office space and large connected garage/warehouse. Both the office space and the garage were included in the pre-renovation inspection. Interior floor finishes included concrete, terrazzo, floor tile, linoleum and carpet; interior wall finishes included concrete block, ceramic tile, drywall and plaster; interior ceiling finishes included plaster and ceiling tile. At the time of the inspection the building was unoccupied, and electrical systems were energized.

2.0 SIGNIFICANT LIMITATIONS AND ASSUMPTIONS

LEGEND's scope of work for this pre-renovation inspection was limited to an asbestos containing materials (ACM) inspection which included the following significant limitations and assumptions:

<i>Limitation</i>	<i>Discussion</i>
Scope of Inspection	This inspection was limited to a non-destructive inspection of the interior and exterior, excluding the roof. Roofing materials were not included in this inspection and should be assumed to contain asbestos until proven otherwise. If any suspect materials are discovered that are not identified in the sample bulk table, assume them to be asbestos and treat them as such until proven otherwise.
Electrical System	Until the electrical systems are de-energized, safe inspection is not possible. Most electrical components contain other hazardous materials which require proper disposal. If suspect asbestos insulators are identified, assume them to contain asbestos and treated them as such.
Non-Destructive	LEGEND was authorized to conduct this inspection using non-destructive methods. Therefore, reasonable attempts were made to inspect concealed areas, including mechanical equipment interiors, electrical equipment interiors, paneling adhesives, CMU cavities, ceramic materials, chimney interiors, mirror adhesives, and interstitial wall/ceiling cavities, etc.

	Any concealed materials that are discovered that are not identified in the attached bulk sampling table should be assumed to be asbestos containing materials and be treated as such, until proven otherwise. Notably, this includes wall/ceiling cavities and fire doors.

3.0 ACM INSPECTION

The US EPA, US OSHA, WI DHS, and WI DNR definitions of ACM states any building material containing greater than 1% asbestos by volume is classified as an ACM. The US EPA, WI DHS, and WI DNR definitions also require that any material determined to contain less than or equal to 1% asbestos by visual estimate be considered an ACM unless the result is confirmed by point counting methods. For materials in which multiple samples have been collected, only one sample needs to result as an ACM to consider all of that material an ACM.

A total of One Hundred Thirty-Eight (138) bulk samples were collected from suspect ACMs. Laboratory analysis indicates **Seventeen (17) of these samples resulted >1% for asbestos**. The results are summarized in the table below for the upcoming renovation areas:

<i>Sample #</i>	<i>Asbestos Containing Material</i>	<i>Location</i>	<i>Estimated Quantity</i>	<i>ACM Category</i>
429- <i>Assumed</i>	Fire Door Insulation	North Side Entry to Garage; Vault	2 Ea.	RACM
	The vault door and door to garage are assumed to contain asbestos.			
89, 90	Adhesive on wall	RCI Sales Room Wall South Side	<1ft ²	CAT II
	The ACM brown adhesive is found on the south side wall of the RCI sales room, next to the door. The adhesive is applied in a rectangle to mount a wall board.			
80, 81	HVAC Insulation	Equipment Room	30 ft ²	RACM
	The ACM HVAC insulation is on the east side of the equipment room wrapping the hvac ducts.			
73, 74, 76, 78,	Pipe Insulation	Throughout Structure	210 LF	RACM
	The ACM pipe insulation includes hard fittings on elbows and T's (amosite) and a black tar paper lining around the straight pipe lagging (acm black layer is below non-acm brown layers of pipe insulation.)			
	The ACM pipe insulation is visible in the garage, storage room, and equipment room, as well as visible above ceiling tiles in the lobby and break room. ACM pipe insulation is assumed to be present above the hard plaster ceiling and in wall cavities throughout the rest of the building- the exact location of the remaining ACM pipe insulation is unknown without removing plaster ceilings/opening wall cavities. The estimated quantity represents the visible, accessible pipe insulation shown on the diagram only.			
50, 52, 55, 57	Floor Tile	Throughout Structure	1,685 ft ²	CAT I
	The ACM 9" Tan Floor Tile can be found throughout the structure in rooms and hallway closets. The associated black and yellow mastics do not contain asbestos.			

	The ACM floor tile is the top visible layer in several areas. The ACM tile is below carpet in Member's Service Rep and closet, Load Meter Tech, RCI Sales. In the East Storage room the ACM tile is below multiple layers of non-ACM linoleum.			
83, 84, 85, 86, 88	Window/Door Glaze	Throughout Structure	13 Ea.	CAT II/ RACM
	The ACM window and door glaze is found throughout the structure on 2 styles of doors with large windows. On the north side of the lobby there is ACM glazing on the set of windows in the door frame.			

RACM (Regulated Asbestos Containing Material)- friable ACM, Category I non-friable ACM that has become friable, Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

CAT I (Category I)- nonfriable ACM packings, gaskets, resilient floor covering, and asphalt roofing products.

CAT II (Category II)- nonfriable ACM, excluding Category I non-friable ACM.

The following building materials were found to be non-asbestos containing:

- Drywall & Joint Compound
- 2'x2 White Ceiling Tile
- Plaster Skimcoat & Basecoat
- Linoleum and Underlayment Paper (Tan, Tan/Gray, Brown Pebble Pattern)
- Carpet Glue
- 12" Gray Floor Tile
- Yellow and Black Mastic
- Terrazzo
- Baseboards and associated adhesives
- Sink Undercoat
- Wall Patch
- Tan Adhesive
- Ceramic Tile, Adhesives and Grout (White, Blue, Tan, Gray)
- Clay Block Wall and Mortar
- Window Caulk
- Concrete
- Brick and Mortar
- Stucco
- Brown Caulk (Exterior)
- White Caulk (Exterior)

4.0 SAMPLING STRATEGIES/METHODOLOGIES

An ACM inspection within the scope of work was conducted; suspect asbestos containing materials were sampled and shipped to LEGEND's laboratory located at 88 Empire Drive in Saint Paul, MN 55103. Our laboratory is accredited by the National Institute for Standards and Technology (NIST), an agency of the US Department of Commerce. Our National Voluntary Laboratory Accreditation Program (NVLAP) number is 102081. The laboratory proficiency records, certifications, and quality assurance manual are available upon request.

Analysis for the presence of asbestos fibers in bulk samples was performed using polarized light microscopy (PLM) and dispersion staining techniques with an Olympus BHSP microscope at 40-200X magnification in with current U.S. Environmental Protection Agency (USEPA) protocols, 40 CFR Appendix E to Subpart E of Part 763, "Interim Method of the Determination of Asbestos in Bulk Insulation Samples" and "Method for the Determination of Asbestos in Bulk Building Materials," 1993 (EPA 600/R-93-116).

5.0 REMARKS

If any suspect ACMs not identified in the attached tables are discovered or are added to the scope of the renovations, work should be halted, and a State of Wisconsin Certified Asbestos Inspector should be contacted to determine the asbestos content of the materials.

WI DNR publishes WA-651, "Planning Your Demolition or Renovation Project: A Guide to Hazard Evaluation, Recycling, and Waste Disposal". This document provides guidance for the proper identification of the common harmful materials found on project sites; including asbestos, chlorofluorocarbons and halons, lead, mercury, polychlorinated biphenyls, and others. This document is accessible at.

WI DNR provides guidance for the proper handling of building debris from renovation or demolition activities at <https://dnr.wi.gov/topic/demo/structures.html>. This guidance includes the statements: "you could face fines and penalties if you burn a structure" and "in general, it is illegal to bury waste on your property".

Prior to the project, notification to WI DNR and/or WI DHS may be made through the Asbestos Renovation/Demolition Notification System, accessible at <https://dnr.wi.gov/topic/Switchboard>.

6.0 RECOMMENDATIONS

For renovation activities, the ACMs should be removed by a Wisconsin State Certified Asbestos Contractor employing trained and Wisconsin State Certified Asbestos Workers and Supervisors, prior to any disturbance. Alternatively, if an ACM will not be disturbed by the renovations, removal may not be required.

Until removal, all maintenance staff and outside contractors should be made aware of the ACMs in the structure and be provided a complete copy of this report.

Any disturbance to known or assumed ACMs in the structures should be performed in accordance with the various asbestos regulations including, but not limited to: WI DHS 159; WI DNR 447; US OSHA 29 CFR 1926.1101; US EPA 40 CFR 61 Subpart M; et al.

7.0 STANDARD OF CARE

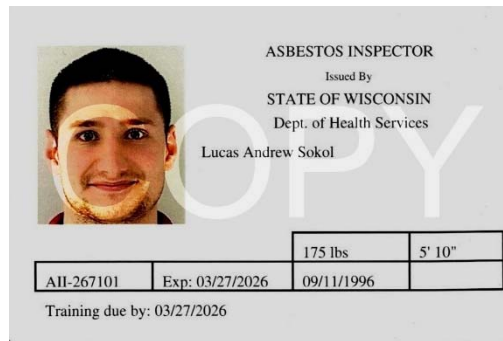
The recommendations in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted industrial hygiene consulting practices at this time and location. Other than this, no warranty is implied or intended.

Any unconsumed portion of analyzed samples will be retained in our laboratory for a period of seven days from the date of this report unless prior instructions are received from the client.

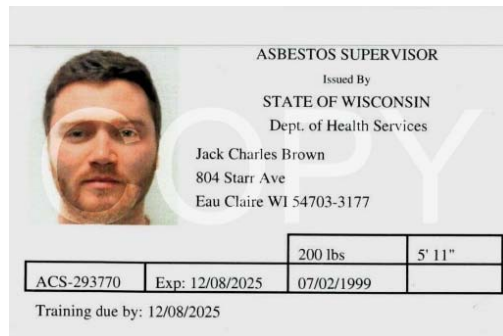
Submitted By:
LEGEND TECHNICAL SERVICES, INC.

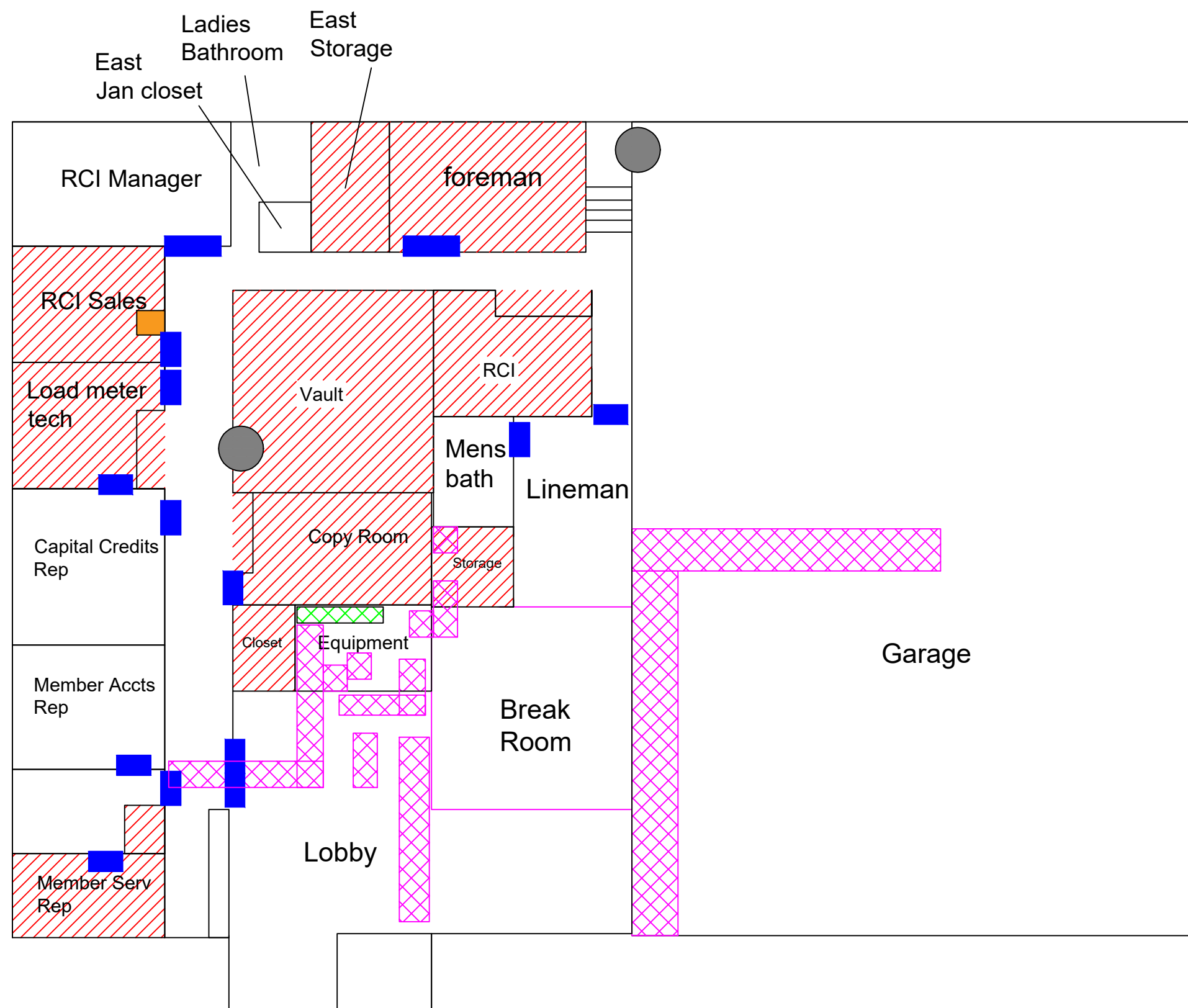


Lucas Sokol
Wisconsin Regional Manager
WI Asbestos Inspector #All-267101



Jack Brown
WI Asbestos Inspector #All-293770





Notes

- ACM Floor Tile
- ACM Door / Window Glaze
- ACM Adhesive on wall
- ACM Pipe insulation (visible only)
- ACM insulation on hvac
- Assumed fire door

Concealed ACM pipe insulation is assumed to be above the plaster ceiling and in wall cavities throughout the structure- this is not shown on the diagram.

Refer to the narrative report for further information.

LEGEND

1225 South Main Street
Alma, WI 54610
Asbestos Diagram

Project: 25WI065

Date: 5/19/2025

Scale: None

PLAN NORTH



ACM 9 in floor tile-hallway closets-typical



ACM 9 in floor tile-typical



ACM 9 inch floor tile-typical



ACM Brown adhesive on wall-RCI Sales, ACM glazing in door



ACM glazing in door and window-lobby



ACM Glazing in door-typical style 1



ACM glazing in door-typical style 2



ACM glazing in door-typical



ACM insulation around hvac-equipment room east side



ACM pipe insulation above plaster ceiling-typical



ACM pipe insulation in ceiling- Equipment room



ACM pipe insulation in wall cavities



ACM pipe insulation in wall cavities



ACM pipe insulation-above ceiling tile-above plaster ceiling-typical



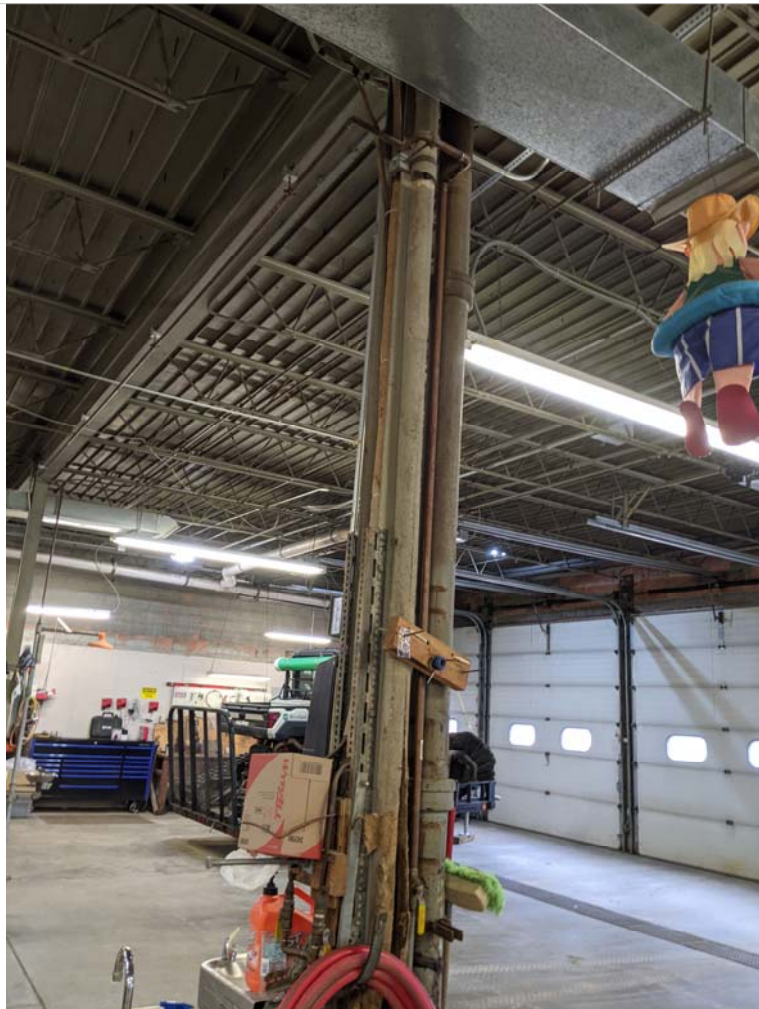
ACM pipe insulation-above ceiling tile-above plaster ceiling-typical



ACM pipe insulation-garage-typical



ACM pipe insulation-garage-typical



ACM pipe insulation-garage-typical



ACM pipe insulation-inner black paper layer-typical



ACM pipe insulation-typical



Assumed fire door-Garage



Exterior of Building

LEGEND TECHNICAL SERVICES, INC.

LEGEND No. 25WI065
PLM BULK ASBESTOS RESULTS TABLE
Sampled: 4/29/2025 by Jack Brown & Lucas Sokol
Analyzed: 5/15/2025 by Todd Giorgi

SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-1	25WI065-1	Lobby Break Room Wall	Joint Compound White, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-2	25WI065-2	Men's Bath West Wall	Joint Compound White, Cementitious Homogeneous	None Detected	<1% Cellulose 98% Nonfibrous <1% Fiberglass
429-3	25WI065-3	Lobby Break Room Wall	Drywall White, Cementitious Homogeneous	None Detected	5% Cellulose 92% Nonfibrous 3% Fiberglass
429-4	25WI065-4	Break Room	Drywall White, Cementitious Homogeneous	None Detected	5% Cellulose 92% Nonfibrous 3% Fiberglass
429-5	25WI065-5	Men's Bath	Drywall Gray, Fibrous Homogeneous	None Detected	70% Cellulose 20% Nonfibrous 10% Fiberglass
429-6	25WI065-6	Break Room	2'x2' White Ceiling Tile Gray, Fibrous Homogeneous	None Detected	70% Cellulose 20% Nonfibrous 10% Fiberglass
429-8	25WI065-8	Hall by RCI manager Ceiling	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-9	25WI065-9	Hall by RCI manager Ceiling	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-10	25WI065-10	Equipment Ceiling	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-11	25WI065-11	Equipment Ceiling	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-12	25WI065-12	Equipment Ceiling	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-13	25WI065-13	Equipment Ceiling	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-14	25WI065-14	Lobby Above Ceiling Tile	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-15	25WI065-15	Lobby Above Ceiling Tile	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-16	25WI065-16	Lobby Above Ceiling Tile	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-17	25WI065-17	Lobby Above Ceiling Tile	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-18	25WI065-18	Lobby Wall	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-19	25WI065-19	Lobby Wall	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-20	25WI065-20	Lobby Wall	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-21	25WI065-21	Lobby Wall	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-22	25WI065-22	RCI Manager Wall	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-23	25WI065-23	RCI Manager Wall	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-24	25WI065-24	RCI Manager Wall	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-25	25WI065-25	RCI Manager Wall	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-26	25WI065-26	Hall by East Exit Wall	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-27	25WI065-27	Hall by East Exit Wall	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-28	25WI065-28	Meter Tech East Wall	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	100% Nonfibrous

LEGEND TECHNICAL SERVICES, INC.

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-29	25WI065-29	Meter Tech East Wall	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-30	25WI065-30	RCI Sales Wall	Plaster Skimcoat White, Cementitious Homogeneous	None Detected	99% Nonfibrous <1% Fiberglass
429-31	25WI065-31	RCI Sales Wall	Plaster Basecoat Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-32	25WI065-32	East Storage Top Layer	Tan/Gray Linoleum Tan/Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-33	25WI065-33	East Storage Top Layer	Underlayment Paper for Sample #429-32 Gray, Fibrous Homogeneous	None Detected	90% Cellulose 10% Fiberglass
429-34	25WI065-34	East Storage Top Layer	Tan/Gray Linoleum Tan/Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-35	25WI065-35	East Storage Top Layer	Underlayment Paper for Sample #429-32 Gray, Fibrous Homogeneous	None Detected	90% Cellulose 10% Fiberglass
429-36	25WI065-36	East Storage Middle Layer	Brown Pebble Linoleum Brown, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-37	25WI065-37	East Storage Middle Layer	Underlayment Paper for Sample #429-36 Gray, Fibrous Homogeneous	None Detected	40% Cellulose 40% Synthetic 20% Fiberglass

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-38	25WI065-38	East Storage Middle Layer	Brown Pebble Linoleum Brown, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-39	25WI065-39	East Storage Middle Layer	Underlayment Paper for Sample #429-38 Gray, Fibrous Homogeneous	None Detected	50% Cellulose 30% Synthetic 20% Fiberglass
429-40	25WI065-40	RCI Manager	Carpet Glue Brown, Cementitious Homogeneous	None Detected	<1% Cellulose 97% Nonfibrous 2% Synthetic
429-41	25WI065-41	Lobby By Break Room	Carpet Glue Brown, Cementitious Homogeneous	None Detected	98% Nonfibrous 2% Synthetic
429-42	25WI065-42	Lobby Near Center	12" Gray Floor tile Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-43	25WI065-43	Lobby Near Center	Clear Glue for Sample #429-42 Clear, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-44	25WI065-44	Lobby Near Center	12" Gray Floor tile Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-45	25WI065-45	Lobby Near Center	Clear Glue for Sample #429-44 Clear, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-46	25WI065-46	Storage Center/Linemen	12" White Floor Tile White, Cementitious Homogeneous	None Detected	100% Nonfibrous

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-47	25WI065-47	Storage Center/Linemen	Yellow Mastic for Sample #429-46 Yellow, Cementitious Homogeneous	None Detected	99% Nonfibrous <1% Synthetic
429-48	25WI065-48	Storage Center/Linemen	12" White Floor Tile White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-49	25WI065-49	Storage Center/Linemen	Yellow Mastic for Sample #429-48 Yellow, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-50	25WI065-50	Closet North of Equipment	9" Tan Floor Tile Tan, Cementitious Homogeneous	2% Chrysotile	98% Nonfibrous
429-51	25WI065-51	Closet North of Equipment	Black mastic for Sample #429-50 Black, Cementitious Homogeneous	None Detected	2% Cellulose 96% Nonfibrous 2% Synthetic
429-52	25WI065-52	Closet North of Equipment	9" Tan Floor Tile Tan, Cementitious Homogeneous	2% Chrysotile	98% Cellulose
429-53	25WI065-53	Closet North of Equipment	Black mastic for Sample #429-52 Black, Cementitious Homogeneous	None Detected	2% Cellulose 95% Nonfibrous 3% Synthetic
429-54	25WI065-54	Hall by Closet By Copy	Yellow Mastic for 9" Tan Floor Tile Yellow, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-55	25WI065-55	Storage Center	9" Tan Floor Tile Tan, Cementitious Homogeneous	2% Chrysotile	98% Nonfibrous

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-56	25WI065-56	Storage Center	Yellow Mastic for Sample #429-55 Yellow, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-57	25WI065-57	Storage East Bottom Layer	9" Tan Floor Tile Tan, Cementitious Homogeneous	2% Chrysotile	98% Nonfibrous
429-58	25WI065-58	Storage East Bottom Layer	Yellow Mastic for Sample #429-57 Yellow, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-59	25WI065-59	East Closet by Women's Bath On Shelf	Tan Linoleum Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-60	25WI065-60	East Closet by Women's Bath On Shelf	Underlayment Paper for Sample #59 Tan, Fibrous Homogeneous	None Detected	50% Cellulose 30% Synthetic 20% Fiberglass
429-61	25WI065-61	East Closet by Women's Bath On Shelf	Tan Linoleum Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-62	25WI065-62	East Closet by Women's Bath On Shelf	Underlayment Paper for Sample #61 Tan, Fibrous Homogeneous	None Detected	50% Cellulose 30% Synthetic 20% Fiberglass
429-63	25WI065-63	Hall by East Exit	White Terrazzo Floor White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-64	25WI065-64	Hall by East Exit	White Terrazzo Floor White/Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-65	25WI065-65	Storage Center/Linoleum	Black Baseboard Black, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-66	25WI065-66	Storage Center/Linoleum	Tan Adhesive for Sample #429-65 Brown, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-67	25WI065-67	Lobby North Side By Counter	Tan Baseboard Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-68	25WI065-68	Lobby North Side By Counter	Tan Adhesive for Sample #429-67 Tan, Cementitious Homogeneous	None Detected	3% Cellulose 97% Nonfibrous
429-69	25WI065-69	Lobby North Side By Counter	Tan Baseboard Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-70	25WI065-70	Lobby North Side By Counter	Tan Adhesive for Sample #429-69 Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-71	25WI065-71	Break Room East Side	Sink Undercoat White, Cementitious Homogeneous	None Detected	10% Cellulose 90% Nonfibrous
429-72	25WI065-72	Break Room East Side	Sink Undercoat White, Cementitious Homogeneous	None Detected	15% Cellulose 85% Nonfibrous
429-73	25WI065-73	Garage Northwest By Water Heater	Hard Fitting on Metal Beam Gray, Cementitious/Fibrous Homogeneous	50% Amosite	5% Cellulose 45% Nonfibrous

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-74	25WI065-74	Garage Northwest By Water Heater	Pipe Insulation (Inner Black Paper) Black, Fibrous Homogeneous	50% Chrysotile	50% Cellulose
429-75	25WI065-75	Garage Northwest By Water Heater	Pipe Insulation Outer Brown Layer Brown, Fibrous Homogeneous	None Detected	97% Cellulose 3% Hair
429-76	25WI065-76	Garage Center Beam	Pipe Insulation (Inner Black Paper) Black, Fibrous Homogeneous	50% Chrysotile	50% Cellulose
429-77	25WI065-77	Garage Center Beam	Pipe Insulation Outer Brown Layer Brown, Fibrous Homogeneous	None Detected	100% Cellulose
429-78	25WI065-78	Lobby East Side Above Ceiling Tile	Pipe Insulation (Inner Black Paper) Black, Fibrous Homogeneous	50% Chrysotile	50% Cellulose
429-79	25WI065-79	Lobby East Side Above Ceiling Tile	Pipe Insulation Outer Brown Layer Brown, Fibrous Homogeneous	None Detected	98% Cellulose 2% Hair
429-80	25WI065-80	Equipment East Wall On HVAC edges	Insulation on HVAC Gray, Cementitious/ Fibrous Homogeneous	10% Chrysotile	3% Cellulose 37% Nonfibrous 50% Fiberglass
429-81	25WI065-81	Equipment East Wall On HVAC edges	Insulation on HVAC Gray, Cementitious/ Fibrous Homogeneous	10% Chrysotile	50% Nonfibrous 40% Fiberglass
429-82	25WI065-82	Equipment South Wall Around Pipes	Wall Patch Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-83	25WI065-83	RCI Manage Brown Wood Door	Door Glaze White, Cementitious Homogeneous	2% Chrysotile	95% Nonfibrous 3% Fiberglass
429-84	25WI065-84	Member Accounting Rep.	Door Glaze White, Cementitious Homogeneous	2% Chrysotile	2% Cellulose 94% Nonfibrous 2% Fiberglass
429-85	25WI065-85	Foreman Office Tan door	Door Glaze White, Cementitious Homogeneous	3% Chrysotile	95% Nonfibrous 2% Fiberglass
429-86	25WI065-86	Copy Room	Door Glaze White, Cementitious Homogeneous	2% Chrysotile	<1% Cellulose 95% Nonfibrous 2% Fiberglass
429-87	25WI065-87	Members Service Rep. South Side	Door Glaze White, Cementitious Homogeneous	None Detected	3% Cellulose 97% Nonfibrous
429-88	25WI065-88	Lobby North Side Hall door/Window	Door/Window Glaze White, Cementitious Homogeneous	2% Chrysotile	98% Nonfibrous
429-89	25WI065-89	RCI Sales South Side Hall by Door Brown Glue	Brown Adhesive Brown, Cementitious Homogeneous	2% Chrysotile	<1% Cellulose 97% Nonfibrous
429-90	25WI065-90	RCI Sales South Side Hall by Door Brown Glue	Brown Adhesive Brown, Cementitious Homogeneous	2% Chrysotile	98% Nonfibrous
429-91	25WI065-91	Copy Room West Wall For Wood Panel	Tan Adhesive Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-92	25WI065-92	Copy Room West Wall For Wood Panel	Tan Adhesive Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-93	25WI065-93	RCI Manager Below Wood Shelf Top	Tan Adhesive Tan, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-94	25WI065-94	RCI Manager for Wood Wall Panel	Tan Adhesive Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-95	25WI065-95	RCI Manager for Wood Wall Panel	Tan Adhesive Tan, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-96	25WI065-96	Ladies Bath for Wood	Tan Adhesive Tan, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-97	25WI065-97	Ladies Bath Wall	White Ceramic Tile White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-98	25WI065-98	Ladies Bath Wall	White Ceramic Tile White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-99	25WI065-99	Ladies Bath Wall	Adhesive for Wall Tile Tan, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-100	25WI065-100	Ladies Bathroom Wall	Grout for Wall Tile White, Cementitious Homogeneous	None Detected	98% Nonfibrous 2% Fiberglass

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SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-101	25WI065-101	Ladies Bathroom Wall	Grout for Wall Tile White, Cementitious Homogeneous	None Detected	<1% Cellulose 98% Nonfibrous <1% Fiberglass
429-102	25WI065-102	Ladies Bathroom Wall	Blue Ceramic Tile Blue/White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-103	25WI065-103	Ladies Bathroom Wall	Adhesive for Wall Tile Tan, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-104	25WI065-104	Ladies Bathroom Wall On Wood Counter	White Patch/Joint Compound White, Cementitious Homogeneous	None Detected	<1% Cellulose 98% Nonfibrous <1% Fiberglass
429-105	25WI065-105	Equipment West Wall	Clay Black Wall Brown, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-106	25WI065-106	Equipment West Wall	Mortar for Black Wall Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-107	25WI065-107	Hall East Exit Wall	Clay Black Wall Brown, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-108	25WI065-108	Hall East Exit Wall	Mortar for Black Wall Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-109	25WI065-109	Foreman Office East Side	Window Caulk Black, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous

LEGEND TECHNICAL SERVICES, INC.

LEGEND No. 25WI065
PLM BULK ASBESTOS RESULTS TABLE
Sampled: 4/29/2025 by Jack Brown & Lucas Sokol
Analyzed: 5/15/2025 by Todd Giorgi

SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-110	25WI065-110	RCI Sales North Side	Window Caulk Black, Cementitious Homogeneous	None Detected	3% Cellulose 96% Nonfibrous <1% Fiberglass
429-111	25WI065-111	Garage Southwest	Door Glaze Black, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-112	25WI065-112	Hall East Exit Window Above Door	Window Glaze Gray, Cementitious Homogeneous	None Detected	3% Cellulose 97% Nonfibrous
429-113	25WI065-113	Exterior East Side East Exit	Door Caulk Gray, Cementitious Homogeneous	None Detected	3% Cellulose 96% Nonfibrous 1% Fiberglass
429-114	25WI065-114	Exterior East Side East Exit	Door Caulk Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-115	25WI065-115	Men's Bathroom	Tan Ceramic Tile Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-116	25WI065-116	Men's Bathroom	Gray Thinset Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-117	25WI065-117	Men's Bathroom	Grout for Tan Tile White, Cementitious Homogeneous	None Detected	98% Nonfibrous 2% Fiberglass
429-118	25WI065-118	Men's Bath	Tan Ceramic Tile Tan, Cementitious Homogeneous	None Detected	100% Nonfibrous

LEGEND TECHNICAL SERVICES, INC.

LEGEND No. 25WI065
PLM BULK ASBESTOS RESULTS TABLE
Sampled: 4/29/2025 by Jack Brown & Lucas Sokol
Analyzed: 5/15/2025 by Todd Giorgi

SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-119	25WI065-119	Men's Bath	Gray Thinset Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-120	25WI065-120	Men's Bath	Grout for Tan Tile White, Cementitious Homogeneous	None Detected	<1% Cellulose 98% Nonfibrous <1% Fiberglass
429-121	25WI065-121	Men's Bath Floor	Gray Ceramic Tile Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-122	25WI065-122	Men's Bath	Gray Ceramic Tile Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-123	25WI065-123	Men's Bath	Grout for Gray Ceramic Tile Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-124	25WI065-124	Men's Bath	Grout for Gray Ceramic Tile Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-125	25WI065-125	Hall East Exit	Mortar for Block/Brick Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-126	25WI065-126	Garage South Side	Concrete Floor Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-127	25WI065-127	Exterior Southeast Corner	Brick Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous

LEGEND TECHNICAL SERVICES, INC.

LEGEND No. 25WI065
PLM BULK ASBESTOS RESULTS TABLE
Sampled: 4/29/2025 by Jack Brown & Lucas Sokol
Analyzed: 5/15/2025 by Todd Giorgi

SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-128	25WI065-128	Exterior Southeast Corner	Brick Mortar Gray, Cementitious Homogeneous	None Detected	2% Cellulose 98% Nonfibrous
429-129	25WI065-129	Exterior North Side	Brick Mortar Gray, Cementitious Homogeneous	None Detected	<1% Cellulose 99% Nonfibrous
429-130	25WI065-130	Exterior North Side	Brick Gray, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-131	25WI065-131	Exterior West Side	Stucco Gray, Cementitious Homogeneous	None Detected	98% Nonfibrous 2% Fiberglass
429-132	25WI065-132	Exterior West Side	Stucco Gray, Cementitious Homogeneous	None Detected	98% Nonfibrous <1% Fiberglass <1% Hair
429-133	25WI065-133	Exterior West Side	Stucco Gray, Cementitious Homogeneous	None Detected	99% Nonfibrous <1% Fiberglass
429-134	25WI065-134	Exterior RCI Manager	Brown Caulk Brown, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-135	25WI065-135	Exterior RCI Manager	Brown Caulk Brown, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-136	25WI065-136	Exterior RCI Manager	Window Caulk Brown, Cementitious Homogeneous	None Detected	100% Nonfibrous

LEGEND TECHNICAL SERVICES, INC.

LEGEND No. 25WI065
PLM BULK ASBESTOS RESULTS TABLE
Sampled: 4/29/2025 by Jack Brown & Lucas Sokol
Analyzed: 5/15/2025 by Todd Giorgi

SAMPLE NO.	LAB NO.	LOCATION	MATERIAL/ PHYSICAL DESCRIPTION	ASBESTOS CONTENT	BALANCE OF MATERIAL
429-137	25WI065-137	Exterior RCI Manager	Window Caulk Brown, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-138	25WI065-138	Exterior RCI Manager	White Caulk White, Cementitious Homogeneous	None Detected	100% Nonfibrous
429-139	25WI065-139	Exterior RCI Manager	White Caulk White, Cementitious Homogeneous	None Detected	100% Nonfibrous

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1 **SECTION 00 31 43**
2 **PERMIT APPLICATION**

3
4 **PERMIT APPLICATION INFORMATION**

5 This Document with its referenced attachments is part of the Procurement and Contracting Requirements
6 for Project. They provide Owner's information for Bidders' convenience and are intended to supplement
7 rather than serve in lieu of the Bidders' own investigations. This Document and its attachments are not part
8 of the Contract Documents.

9
10 Permit Application: Complete building permit application and file with authorities having jurisdiction
11 within five days of the date of execution of the Contract.

12
13 **END OF DOCUMENT**

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SECTION 00 41 13
BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

BID INFORMATION

Bidder: _____.
Project Name: Alma City Hall Remodel – Phase One
Project Location: 1225 South Main Street, Alma, WI 54610
Owner: City of Alma
Architect: Lien & Peterson Architects, Inc.
Architect Project Number: 25020

CERTIFICATIONS AND BASE BID

Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Lien & Peterson Architects, Inc. and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

_____ Dollars (\$_____).

The above amount may be modified by amounts indicated by the Bidder on the attached Document 004322 "Unit Prices Form" and Document 004323 "Alternates Form."

BID GUARANTEE

The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

_____ Dollars (\$_____).

In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

SUBCONTRACTORS AND SUPPLIERS

The following companies shall execute subcontracts for the portions of the Work indicated:

Roofing Work: _____.

Plumbing Work: _____.

HVAC Work: _____.

Electrical Work: _____.

TIME OF COMPLETION

The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within 180 calendar days.

1
2 **ACKNOWLEDGMENT OF ADDENDA**

3 The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of
4 this Bid:

5
6 Addendum No. 1, dated _____.

7
8 Addendum No. 2, dated _____.

9
10 Addendum No. 3, dated _____.

11
12 Addendum No. 4, dated _____.

13
14 **BID SUPPLEMENTS**

15 The following supplements are a part of this Bid Form and are attached hereto.

16
17 Bid Form Supplement - Bid Bond Form (AIA Document A310-2010).

18
19 **CONTRACTOR'S LICENSE**

20 The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the
21 State of Wisconsin, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in
22 full.

23
24 **SUBMISSION OF BID**

25
26 Respectfully submitted this ____ day of _____, 2026.

27
28 Submitted By: _____ (Name of bidding firm or corporation).

29
30 Authorized Signature: _____ (Handwritten signature).

31
32 Signed By: _____ (Type or print name).

33
34 Title: _____ (Owner/Partner/President/Vice President).

35
36 Witnessed By: _____ (Handwritten signature).

37
38 Attest: _____ (Handwritten signature).

39
40 By: _____ (Type or print name).

41
42 Title: _____ (Corporate Secretary or Assistant Secretary).

43
44 Street Address: _____.

45
46 City, State, Zip: _____.

47
48 Phone: _____.

49
50 License No.: _____.

51
52 Federal ID No.: _____ (Affix Corporate Seal Here).

53
54 **END OF DOCUMENT**

1 **SECTION 00 43 13**
2 **BID SECURITY FORMS**

3
4 **BID FORM SUPPLEMENT**

5 A completed bid bond form is required to be attached to the Bid Form.

6
7 **BID BOND FORM**

8 AIA Document A312-2010 "Bid Bond" is the recommended form for a bid bond. A bid bond acceptable to
9 Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid
10 Form as a supplement.

11
12 Copies of AIA standard forms may be obtained from The American Institute of Architects;
13 <https://www.aiacontracts.org/>; email: docspurchases@aia.org; (800) 942-7732.

14
15 **END OF DOCUMENT**

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- 34

Bidder: _____

Prime Contract: _____.

Project Location: 1225 South Main Street, Alma, WI 54610

Architect: Lien & Peterson Architects, Inc.

Architect Project Number: 25020

In an effort to assist the Bidder in properly completing all documentation required, the following checklist is provided for the Bidder's convenience. The Bidder is solely responsible for verifying compliance with bid submittal requirements.

Attach this completed checklist to the outside of the Submittal envelope.

- Used the Bid Form provided in the Project Manual.
Prepared the Bid Form as required by the Instructions to Bidders.
Indicated on the Bid Form the Addenda received.
Attached to the Bid Form: Bid Bond OR a certified check for the amount required.
Bid envelope shows name and address of the Bidder.
Bid envelope shows the Bidder's Contractor's License Number.
Bid envelope shows name of Project being bid.
Bid envelope shows name of Prime Contract being bid, if applicable.
Bid envelope shows time and day of Bid Opening.
Verified that the Bidder can provide executed Performance Bond and Labor and Material Bond.
Verified that the Bidder can provide Certificates of Insurance in the amounts indicated.

Alma City Hall Remodel – Phase 1
00 43 93 - 1

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The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:

The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."

ADMINISTRATIVE FORMS

Copies of AIA standard forms may be obtained from the American Institute of Architects; www.aiacontractdocsaiacontracts.org; (800) 942-7732.

Form of Performance Bond and Labor and Material Bond: AIA Document A312-2010 "Performance Bond and Payment Bond."

Information and Modification Forms:

Form of Request for Proposal: AIA Document G709-2018 "Proposal Request."

Change Order Form: AIA Document G701-2017 "Change Order."

Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-2017
"Architect's Supplemental Instructions."

Payment Forms:

Schedule of Values Form: AIA Document G703-1992 "Continuation Sheet."

Payment Application: AIA Document G702-1992/703-1992 "Application and Certificate for Payment and Continuation Sheet."

Form of Contractor's Affidavit: AIA Document G706-1994 "Contractor's Affidavit of Payment of Debts and Claims."

Form of Affidavit of Release of Liens: AIA Document G706A-1994 "Contractor's Affidavit of Payment of Release of Liens."

Form of Consent of Surety: AIA Document G707-1994 "Consent of Surety to Final Payment."

Alma City Hall Remodel – Phase 1
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1 **SECTION 01 10 00**
2 **SUMMARY**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes:

- 8 Project information.
9 Work covered by Contract Documents.
10 Contractor's use of site and premises.
11 Coordination with occupants.
12 Work restrictions.
13

14 **PROJECT INFORMATION**

- 15 Project Identification: Alma City Hall Remodel – Phase One
16 Project Location: 1225 South Main Street, Alma, WI 54610
17 Owner's Representative: Mayor Rick Champeny
18

19 Consultants: The following design professionals have prepared designated portions of the Contract Documents:
20

21
22 Architect: Lien & Peterson Architects, Inc.
23

24 Designer: Apex Engineering
25 Address: 110 E Grand Avenue, Eau Claire, WI 54701
26 Plumbing Designer: Adam Flogel
27 Mechanical Designer: Todd Armstrong
28 Electrical Designer: Paul Kuchta
29

30 **WORK COVERED BY CONTRACT DOCUMENTS**

31 The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
32
33

34 This remodel project will include new public toilet rooms, reworked office areas, reworked break room, and a new city meeting space. In addition, the windows on the North and East elevations and EPDM roof system will be replaced. All associated plumbing, electrical, and mechanical rework will be necessary, see plans.
35
36
37
38

39 Type of Contract:

40
41 Project will be constructed under a single prime contract.
42

43 **CONTRACTOR'S USE OF SITE AND PREMISES**

44 Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
45
46
47

48 Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
49
50

51 Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
52
53

54 Limits on Use of Site: Confine construction operations to area of work.

1 Driveways, Walkways, and Entrances: Keep driveways and entrances serving premises clear and
2 available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas
3 for parking or for storage of materials.
4

5 Condition of Existing Building: Maintain portions of existing building affected by construction operations
6 in a weathertight condition throughout construction period. Repair damage caused by construction
7 operations.
8

9 Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping
10 affected by construction operations throughout construction period. Repair damage caused by construction
11 operations.
12

13 **COORDINATION WITH OCCUPANTS**

14 Full Owner Occupancy: Owner will occupy site and existing building during entire construction period.
15 Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage.
16 Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless
17 otherwise indicated.
18

19 **WORK RESTRICTIONS**

20 Comply with restrictions on construction operations.
21

22 Comply with limitations on use of public streets, work on public streets, rights of way, and other
23 requirements of authorities having jurisdiction.
24

25 Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others
26 unless permitted under the following conditions and then only after providing temporary utility services
27 according to requirements indicated:
28

29 Notify Architect and Owner not less than seven days in advance of proposed utility interruptions.
30 Obtain Architect's written permission before proceeding with utility interruptions.
31

32 Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and
33 vibration, dust, odors, or other disruption to Owner occupancy with Owner.
34

35 Notify Architect and Owner not less than three days in advance of proposed disruptive operations.
36 Obtain Architect's written permission before proceeding with disruptive operations.
37

38 Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other
39 controlled substances on Owner's property is not permitted.
40

41 **PART 2 - PRODUCTS (Not Used)**

42 **PART 3 - EXECUTION (Not Used)**

43 **END OF SECTION**

SECTION 01 25 00
SUBSTITUTION PROCEDURES

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements for substitutions.

Related Requirements:

Document 00 26 00 "Contract Modification Procedures" for requirements for substitution requests prior to award of Contract.

Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

DEFINITIONS

Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

ACTION SUBMITTALS

Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

Substitution Request Form: Use form acceptable to Architect.

Documentation: Show compliance with requirements for substitutions and the following, as applicable:

Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.

Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

Product Data, including drawings and descriptions of products and fabrication and installation procedures.

Samples, where applicable or requested.

Certificates and qualification data, where applicable or requested.

List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.

Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.

Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter

1 from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack
2 of availability, or delays in delivery.
3 Cost information, including a proposal of change, if any, in the Contract Sum.
4 Contractor's certification that proposed substitution complies with requirements in the Contract
5 Documents, except as indicated in substitution request, is compatible with related materials and
6 is appropriate for applications indicated.
7 Contractor's waiver of rights to additional payment or time that may subsequently become
8 necessary because of failure of proposed substitution to produce indicated results.
9

10 Architect's Action: If necessary, Architect will request additional information or documentation for
11 evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor
12 of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven
13 days of receipt of additional information or documentation, whichever is later.
14

15 Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental
16 Instructions for minor changes in the Work.
17 Use product specified if Architect does not issue a decision on use of a proposed substitution
18 within time allocated.
19

20 **QUALITY ASSURANCE**

21 Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with
22 related products and materials. Engage a qualified testing agency to perform compatibility tests
23 recommended by manufacturers.
24

25 **PROCEDURES**

26 Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.
27

28 **SUBSTITUTIONS**

29 Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but
30 not later than 15 days prior to time required for preparation and review of related submittals.
31

32 Conditions: Architect will consider Contractor's request for substitution when the following conditions
33 are satisfied. If the following conditions are not satisfied, Architect will return requests without
34 action, except to record noncompliance with these requirements:
35

36 Requested substitution is consistent with the Contract Documents and will produce indicated
37 results.

38 Substitution request is fully documented and properly submitted.

39 Requested substitution will not adversely affect Contractor's construction schedule.

40 Requested substitution has received necessary approvals of authorities having jurisdiction.

41 Requested substitution is compatible with other portions of the Work.

42 Requested substitution has been coordinated with other portions of the Work.

43 Requested substitution provides specified warranty.

44 If requested substitution involves more than one contractor, requested substitution has been
45 coordinated with other portions of the Work, is uniform and consistent, is compatible with other
46 products, and is acceptable to all contractors involved.
47

48 Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days
49 after commencement of the Work. Requests received after that time may be considered or rejected at
50 discretion of Architect.
51

52 Conditions: Architect will consider Contractor's request for substitution when the following conditions
53 are satisfied. If the following conditions are not satisfied, Architect will return requests without
54 action, except to record noncompliance with these requirements:
55

1 Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or
2 other considerations, after deducting additional responsibilities Owner must assume. Owner's
3 additional responsibilities may include compensation to Architect for redesign and evaluation
4 services, increased cost of other construction by Owner, and similar considerations.
5 Requested substitution does not require extensive revisions to the Contract Documents.
6 Requested substitution is consistent with the Contract Documents and will produce indicated
7 results.
8 Substitution request is fully documented and properly submitted.
9 Requested substitution will not adversely affect Contractor's construction schedule.
10 Requested substitution has received necessary approvals of authorities having jurisdiction.
11 Requested substitution is compatible with other portions of the Work.
12 Requested substitution has been coordinated with other portions of the Work.
13 Requested substitution provides specified warranty.
14 If requested substitution involves more than one contractor, requested substitution has been
15 coordinated with other portions of the Work, is uniform and consistent, is compatible with other
16 products, and is acceptable to all contractors involved.

17 **PART 2 - PRODUCTS (Not Used)**

18 **PART 3 - EXECUTION (Not Used)**

19 **END OF SECTION**

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SUMMARY

MINOR CHANGES IN THE WORK

PROPOSAL REQUESTS

CHANGE ORDER PROCEDURES

Alma City Hall Remodel – Phase 1
01 26 00 - 1

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5

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

1 **SECTION 01 29 00**
2 **PAYMENT PROCEDURES**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section includes administrative and procedural requirements necessary to prepare and process Applications
8 for Payment.

9
10 **SCHEDULE OF VALUES**

11 Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's
12 construction schedule.

13
14 Coordinate line items in the schedule of values with items required to be indicated as separate activities
15 in Contractor's construction schedule.

16 Submit the schedule of values to Architect at earliest possible date, but no later than seven days before
17 the date scheduled for submittal of initial Applications for Payment.

18
19 Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule
20 of values. Provide at least one line item for each Specification Section.

21
22 Arrange schedule of values consistent with format of AIA Document G703.

23 Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of
24 Applications for Payment and progress reports. Provide multiple line items for principal subcontract
25 amounts in excess of five percent of the Contract Sum.

26 Provide a separate line item in the schedule of values for each part of the Work where Applications for
27 Payment may include materials or equipment purchased or fabricated and stored, but not yet
28 installed.

29 Differentiate between items stored on-site and items stored off-site.

30 Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item
31 value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use
32 information indicated in the Contract Documents to determine quantities.

33 Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line
34 item.

35 Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of
36 actual work-in-place as separate line items.

37 Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project
38 closeout requirements in an amount totaling five percent of the Contract Sum and subcontract
39 amount.

40 Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction
41 Change Directives result in a change in the Contract Sum. Include at least one separate line item for
42 each Change Order and Construction Change Directive.

43
44 **APPLICATIONS FOR PAYMENT**

45 Each Application for Payment following the initial Application for Payment shall be consistent with
46 previous applications and payments as certified by Architect and paid for by Owner.

47
48 Payment Application Times: Submit Application for Payment to Architect by the first day of the month.
49 The period covered by each Application for Payment is one month, ending on the last day of the month.

50
51 Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for
52 Applications for Payment.

53
54 Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to
55 sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1
2 Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated
3 schedules if revisions were made.
4 Include amounts for work completed following previous Application for Payment, whether or not
5 payment has been received. Include only amounts for work completed at time of Application for
6 Payment.
7 Include amounts of Change Orders and Construction Change Directives issued before last day of
8 construction period covered by application.
9
10 Transmittal: Submit one signed and notarized copies of each Application for Payment to Architect via
11 email. This copy shall include waivers of lien and similar attachments if required.
12
13 Transmit each copy with a transmittal form listing attachments and recording appropriate information
14 about application.
15
16 Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from
17 subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous
18 application.
19
20 Submit partial waivers on each item for amount requested in previous application, after deduction for
21 retainage, on each item.
22 When an application shows completion of an item, submit conditional final or full waivers.
23 Owner reserves the right to designate which entities involved in the Work must submit waivers.
24 Submit final Application for Payment with or preceded by conditional final waivers from every entity
25 involved with performance of the Work covered by the application who is lawfully entitled to a lien.
26 Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
27
28 Initial Application for Payment: Administrative actions and submittals that must precede or coincide with
29 submittal of first Application for Payment include the following:
30
31 List of subcontractors.
32 Schedule of values.
33 Contractor's construction schedule (preliminary if not final).
34 Submittal schedule (preliminary if not final).
35 Copies of building permits.
36 Certificates of insurance and insurance policies.
37 Performance and payment bonds.
38 Data needed to acquire Owner's insurance.
39
40 Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial
41 Completion, submit an Application for Payment showing 100 percent completion for portion of the Work
42 claimed as substantially complete.
43
44 Include documentation supporting claim that the Work is substantially complete and a statement
45 showing an accounting of changes to the Contract Sum.
46 This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner
47 occupancy of designated portions of the Work.
48
49 Final Payment Application: After completing Project closeout requirements, submit final Application for
50 Payment with releases and supporting documentation not previously submitted and accepted, including, but
51 not limited, to the following:
52
53 Evidence of completion of Project closeout requirements.
54 Insurance certificates for products and completed operations where required and proof that taxes, fees,
55 and similar obligations were paid.
56 Updated final statement, accounting for final changes to the Contract Sum.

1 Evidence that claims have been settled.

2

3

PART 2 - PRODUCTS (Not Used)

4

5

PART 3 - EXECUTION (Not Used)

6

7

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SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

SUMMARY

Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

- General coordination procedures.
Coordination drawings.
RFIs.

Related Requirements:

Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

INFORMATIONAL SUBMITTALS

Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

- Name, address, telephone number, and email address of entity performing subcontract or supplying products.
- Number and title of related Specification Section(s) covered by subcontract.
- Drawing number and detail references, as appropriate, covered by subcontract.

GENERAL COORDINATION PROCEDURES

Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

- Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
- Make adequate provisions to accommodate items scheduled for later installation.

Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

- Preparation of Contractor's construction schedule.
- Preparation of the schedule of values.
- Installation and removal of temporary facilities and controls.
- Delivery and processing of submittals.
- Progress meetings.
- Project closeout activities.
- Startup and adjustment of systems.

COORDINATION DRAWINGS

Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

Coordination Drawing Organization: Organize coordination drawings as follows:

Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

Structural Penetrations: Indicate penetrations and openings required for all disciplines.

Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

REQUEST FOR INFORMATION (RFI)

General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.

Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

Owner name.

Owner's Project number.

Name of Architect.

Architect's Project number.

Date.

Name of Contractor.

RFI number, numbered sequentially.

RFI subject.

Specification Section number and title and related paragraphs, as appropriate.

Drawing number and detail references, as appropriate.

1 Field dimensions and conditions, as appropriate.
2 Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or
3 the Contract Sum, Contractor shall state impact in the RFI.
4 Contractor's signature.
5 Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings,
6 coordination drawings, and other information necessary to fully describe items needing
7 interpretation.
8
9 RFI Forms: AIA Document G716.
10
11 Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven
12 days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as
13 received the following working day.
14
15 The following Contractor-generated RFIs will be returned without action:
16
17 Requests for approval of submittals.
18 Requests for approval of Contractor's means and methods.
19 Requests for coordination information already indicated in the Contract Documents.
20 Requests for adjustments in the Contract Time or the Contract Sum.
21 Requests for interpretation of Architect's actions on submittals.
22 Incomplete RFIs or inaccurately prepared RFIs.
23
24 Architect's action may include a request for additional information, in which case Architect's time for
25 response will date from time of receipt by Architect of additional information.
26 Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may
27 be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract
28 Modification Procedures."
29
30 If Contractor believes the RFI response warrants change in the Contract Time or the Contract
31 Sum, notify Architect in writing within five days of receipt of the RFI response.
32
33 RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log
34 weekly.
35
36 Project name.
37 Name and address of Contractor.
38 Name and address of Architect.
39 RFI number including RFIs that were returned without action or withdrawn.
40 RFI description.
41 Date the RFI was submitted.
42 Date Architect's response was received.
43
44 On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected
45 parties. Review response and notify Architect within seven days if Contractor disagrees with response.
46
47 **PROJECT MEETINGS**
48 General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
49
50 Preconstruction Conference: Schedule and conduct a preconstruction conference before starting
51 construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the
52 Agreement.
53
54 Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its
55 superintendent; major subcontractors; suppliers; and other concerned parties shall attend the

conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

Agenda: Discuss items of significance that could affect progress, including the following:

- Responsibilities and personnel assignments.
- Tentative construction schedule.
- Phasing.
- Critical work sequencing and long lead items.
- Designation of key personnel and their duties.
- Lines of communications.
- Procedures for processing field decisions and Change Orders.
- Procedures for RFIs.
- Procedures for testing and inspecting.
- Procedures for processing Applications for Payment.
- Distribution of the Contract Documents.
- Submittal procedures.
- Sustainable design requirements.
- Preparation of Record Documents.
- Use of the premises and existing building.
- Work restrictions.
- Working hours.
- Owner's occupancy requirements.
- Responsibility for temporary facilities and controls.
- Procedures for moisture and mold control.
- Procedures for disruptions and shutdowns.
- Construction waste management and recycling.
- Parking availability.
- Office, work, and storage areas.
- Equipment deliveries and priorities.
- First aid.
- Security.
- Progress cleaning.

Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

Progress Meetings: Conduct progress meetings at biweekly intervals.

Coordinate dates of meetings with preparation of payment requests.

Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

Review schedule for next period.

Review present and future needs of each entity present, including the following:

- 1 Interface requirements.
- 2 Sequence of operations.
- 3 Status of submittals.
- 4 Status of sustainable design documentation.
- 5 Deliveries.
- 6 Off-site fabrication.
- 7 Access.
- 8 Site use.
- 9 Temporary facilities and controls.
- 10 Progress cleaning.
- 11 Quality and work standards.
- 12 Status of correction of deficient items.
- 13 Field observations.
- 14 Status of RFIs.
- 15 Status of Proposal Requests.
- 16 Pending changes.
- 17 Status of Change Orders.
- 18 Pending claims and disputes.
- 19 Documentation of information for payment requests.
- 20
- 21 Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes
- 22 to each party present and to parties requiring information.
- 23
- 24 Schedule Updating: Revise Contractor's construction schedule after each progress meeting where
- 25 revisions to the schedule have been made or recognized. Issue revised schedule concurrently
- 26 with the report of each meeting.
- 27
- 28 **PART 2 - PRODUCTS (Not Used)**
- 29
- 30 **PART 3 - EXECUTION (Not Used)**
- 31
- 32 **END OF SECTION**

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Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number. Email to admin@2dlp.com

SUBMITTAL PROCEDURES

Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

Resubmittal Review: Allow 15 days for review of each resubmittal.

Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

SUBMITTAL REQUIREMENTS

Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.

Mark each copy of each submittal to show which products and options are applicable.

Include the following information, as applicable:

Manufacturer's catalog cuts.

Manufacturer's product specifications.

Standard color charts.

Statement of compliance with specified referenced standards.

Testing by recognized testing agency.

Application of testing agency labels and seals.

Notation of coordination requirements.

Availability and delivery time information.

For equipment, include the following in addition to the above, as applicable:

- Wiring diagrams that show factory-installed wiring.
- Printed performance curves.
- Operational range diagrams.
- Clearances required to other construction, if not indicated on accompanying Shop Drawings.

Submit Product Data before Shop Drawings, and before or concurrent with Samples.

Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

- Identification of products.
- Schedules.
- Compliance with specified standards.
- Notation of coordination requirements.
- Notation of dimensions established by field measurement.
- Relationship and attachment to adjoining construction clearly indicated.
- Seal and signature of professional engineer if specified.

Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

Identification: Permanently attach label on unexposed side of Samples that includes the following:

- Project name and submittal number.
- Generic description of Sample.
- Product name and name of manufacturer.
- Sample source.
- Number and title of applicable Specification Section.
- Specification paragraph number and generic name of each item.

Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.

- Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
- Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

- Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

1 Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same
2 material to be used for the Work, cured and finished in manner specified, and physically identical
3 with material or product proposed for use, and that show full range of color and texture variations
4 expected. Samples include, but are not limited to, the following: partial sections of manufactured or
5 fabricated components; small cuts or containers of materials; complete units of repetitively used
6 materials; swatches showing color, texture, and pattern; color range sets; and components used for
7 independent testing and inspection.

8
9 Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets;
10 remainder will be returned.

11 Submit a single Sample where assembly details, workmanship, fabrication techniques,
12 connections, operation, and other similar characteristics are to be demonstrated.

13 If variation in color, pattern, texture, or other characteristic is inherent in material or product
14 represented by a Sample, submit at least three sets of paired units that show approximate
15 limits of variations.

16
17 Product Schedule: As required in individual Specification Sections, prepare a written summary indicating
18 types of products required for the Work and their intended location. Include the following information in
19 tabular form:

20
21 Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or
22 person. Include lists of completed projects with project names and addresses, contact information of
23 architects and owners, and other information specified.

24
25 Design Data: Prepare and submit written and graphic information indicating compliance with indicated
26 performance and design criteria in individual Specification Sections. Include list of assumptions and
27 summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used
28 for calculations. Number each page of submittal.

29
30 Certificates:

31
32 Certificates and Certifications Submittals: Submit a statement that includes signature of entity
33 responsible for preparing certification. Certificates and certifications shall be signed by an officer or
34 other individual authorized to sign documents on behalf of that entity. Provide a notarized signature
35 where indicated.

36 Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer
37 complies with requirements in the Contract Documents and, where required, is authorized by
38 manufacturer for this specific Project.

39 Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that
40 manufacturer complies with requirements in the Contract Documents. Include evidence of
41 manufacturing experience where required.

42 Material Certificates: Submit written statements on manufacturer's letterhead certifying that material
43 complies with requirements in the Contract Documents.

44 Product Certificates: Submit written statements on manufacturer's letterhead certifying that product
45 complies with requirements in the Contract Documents.

46 Welding Certificates: Prepare written certification that welding procedures and personnel comply with
47 requirements in the Contract Documents. Submit record of Welding Procedure Specification and
48 Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

49 50 **CONTRACTOR'S REVIEW**

51 Action Submittals and Informational Submittals: Review each submittal and check for coordination with
52 other Work of the Contract and for compliance with the Contract Documents. Note corrections and field
53 dimensions. Mark with approval stamp before submitting to Architect.

1 **ARCHITECT'S REVIEW**
2 Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and
3 return it.
4
5 PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
6 Paper Submittals: Architect will stamp each submittal with an action stamp and will mark stamp
7 appropriately to indicate action.
8
9 Informational Submittals: Architect will review each submittal and will not return it, or will return it if it
10 does not comply with requirements. Architect will forward each submittal to appropriate party.
11
12 Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has
13 received prior approval from Architect.
14
15 Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for
16 resubmittal without review.
17
18 Architect will discard submittals received from sources other than Contractor.
19
20 Submittals not required by the Contract Documents will be returned by Architect without action.
21
22 **PART 2 - PRODUCTS (Not Used)**
23
24 **PART 3 - EXECUTION (Not Used)**
25
26 **END OF SECTION**

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1 Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of
2 fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process.
3 Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's
4 training, duties, and authority to enforce fire safety.

5
6 Safety and Health Standard: Comply with ANSI/ASSP A10.6.

7 8 **STORAGE AND HANDLING OF SALVAGED MATERIALS**

9 Salvaged Materials:

- 10
11 Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
12 Pack or crate items after cleaning; cushion against damage during handling. Label contents of
13 containers.
14 Store items in a secure area until delivery to Owner.
15 Transport items to Owner's storage area designated by Owner.
16 Protect items from damage during transport and storage.

17
18 Salvaged Materials for Reinstallation:

- 19
20 Repair and clean items for reuse as indicated.
21 Pack or crate items after cleaning and repairing; cushion against damage during handling. Label
22 contents of containers.
23 Protect items from damage during transport and storage.
24 Reinstall items in locations indicated. Comply with installation requirements for new materials and
25 equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to
26 make items functional for use indicated.

27
28 Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from
29 construction work. Where permitted by Architect, items may be dismantled and taken to a suitable,
30 protected storage location during construction work and reinstalled in their original locations after
31 alteration and other construction work in the vicinity is complete.

32
33 Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture,
34 weather, condensation, and freezing temperatures.

- 35
36 Identify each item for reinstallation with a nonpermanent mark to document its original location.
37 Indicate original locations on plans, elevations, sections, or photographs by annotating the
38 identifying marks.
39 Secure stored materials to protect from theft.
40 Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above
41 the dew point.

42 43 **PART 2 - PRODUCTS - (Not Used)**

44 45 **PART 3 - EXECUTION**

46 47 **PROTECTION**

48 Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding
49 buildings from harm resulting from alteration work.

- 50
51 Use only proven protection methods, appropriate to each area and surface being protected.
52 Provide temporary barricades, barriers, and directional signage to exclude the public from areas where
53 alteration work is being performed.
54 Erect temporary barriers to form and maintain fire-egress routes.
55 Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance
56 and exit that must remain in service during alteration work.

1 Contain dust and debris generated by alteration work, and prevent it from reaching the public or
2 adjacent surfaces.
3 Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
4 Protect floors and other surfaces along hauling routes from damage, wear, and staining.
5 Provide supplemental sound-control treatment to isolate demolition work from other areas of the
6 building.
7
8 Temporary Protection of Materials to Remain:
9
10 Protect existing materials with temporary protections and construction. Do not remove existing
11 materials unless otherwise indicated.
12 Do not attach temporary protection to existing surfaces except as indicated as part of the alteration
13 work program.
14
15 Comply with each product manufacturer's written instructions for protections and precautions. Protect
16 against adverse effects of products and procedures on people and adjacent materials, components, and
17 vegetation.
18
19 Utility and Communications Services:
20
21 Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires,
22 conduits, pipes, and other services affected by alteration work before commencing operations.
23 Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for
24 alteration work.
25 Maintain existing services unless otherwise indicated; keep in service, and protect against damage
26 during operations. Provide temporary services during interruptions to existing utilities.
27
28 Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning
29 properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area
30 until the drainage system is functioning properly.
31
32 Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system.
33 Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting
34 from alteration work.
35 Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
36
37 Existing Roofing: Prior to the start of work in an area, install roofing protection as needed.
38
39 **PROTECTION FROM FIRE**
40 General: Follow fire-prevention plan and the following:
41
42 Comply with NFPA 241 requirements unless otherwise indicated.
43 Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless
44 necessary for the immediate work.
45 If combustible material cannot be removed, provide fire blankets to cover such materials.
46
47 **PROTECTION DURING APPLICATION OF CHEMICALS**
48 Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings
49 from harm or spillage resulting from applications of chemicals and adhesives.
50
51 Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project
52 unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use
53 covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave
54 residue on surfaces to which they are applied. Apply protective materials according to manufacturer's
55 written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When
56 no longer needed, promptly remove protective materials.

1
2 Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
3

4 Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
5

6 Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil
7 contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water
8 penetration into building interior.
9

10 **GENERAL ALTERATION WORK**

11 Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.
12

13 Notify Architect of visible changes in the integrity of material or components whether from environmental
14 causes including biological attack, UV degradation, freezing, or thawing or from structural defects
15 including cracks, movement, or distortion.
16

17 Do not proceed with the work in question until directed by Architect.
18

19 **END OF SECTION**

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- 55

SUMMARY

Related Requirements:

DEFINITIONS

Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

QUALITY ASSURANCE

Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

PRODUCT DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

PRODUCT WARRANTIES

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

Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.

Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.

Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.

See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

PRODUCT SELECTION PROCEDURES

General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.

Where products are accompanied by the term "as selected," Architect will make selection.

Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.

Product Selection Procedures:

Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

1 Sole manufacturer/source may be indicated by the phrase "Subject to compliance with
2 requirements, provide products by the following."
3 Limited List of Products: Where Specifications include a list of names of both manufacturers and
4 products, provide one of the products listed that complies with requirements. Comparable products
5 or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
6 Limited list of products may be indicated by the phrase "Subject to compliance with requirements,
7 provide one of the following."
8 Non-Limited List of Products: Where Specifications include a list of names of both available
9 manufacturers and products, provide one of the products listed or an unnamed product that complies
10 with requirements.
11 Non-limited list of products is indicated by the phrase "Subject to compliance with requirements,
12 available products that may be incorporated in the Work include, but are not limited to, the
13 following."
14 Provision of an unnamed product is not considered a substitution, if the product complies with
15 requirements.
16 Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a
17 product by one of the manufacturers listed that complies with requirements. Comparable products or
18 substitutions for Contractor's convenience will not be considered unless otherwise indicated.
19 Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements,
20 provide products by one of the following."
21 Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers,
22 provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that
23 complies with requirements.
24 Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with
25 requirements, available manufacturers whose products may be incorporated in the Work
26 include, but are not limited to, the following."
27 Provision of products of an unnamed manufacturer is not considered a substitution, if the product
28 complies with requirements.
29 Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on
30 Drawings, and include a list of manufacturers, provide the specified or indicated product or a
31 comparable product by one of the other named manufacturers. Drawings and Specifications may
32 additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the
33 product named. Comply with requirements in "Comparable Products" Article for consideration of an
34 unnamed product by one of the other named manufacturers.
35 For approval of products by unnamed manufacturers, comply with requirements in
36 Section 01 25 00 "Substitution Procedures" for substitutions for convenience.
37
38 Visual Matching Specification: Where Specifications require the phrase "match Architect's sample,"
39 provide a product that complies with requirements and matches Architect's sample. Architect's decision will
40 be final on whether a proposed product matches.
41 If no product available within specified category matches and complies with other specified
42 requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal
43 of product.
44
45 Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from
46 manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect
47 will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both
48 standard and premium items.
49
50 **COMPARABLE PRODUCTS**
51 Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for
52 comparable product when the following conditions are satisfied. If the following conditions are not
53 satisfied, Architect may return requests without action, except to record noncompliance with the following
54 requirements:

1 Evidence that proposed product does not require revisions to the Contract Documents, is consistent
2 with the Contract Documents, will produce the indicated results, and is compatible with other
3 portions of the Work.

4 Detailed comparison of significant qualities of proposed product with those of the named basis-of-
5 design product. Significant product qualities include attributes, such as type, function, in-service
6 performance and physical properties, weight, dimension, durability, visual characteristics, and other
7 specific features and requirements.

8 Evidence that proposed product provides specified warranty.

9 List of similar installations for completed projects, with project names and addresses and names and
10 addresses of architects and owners, if requested.

11 Samples, if requested.
12

13 Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional
14 information or documentation for evaluation within seven days of receipt of a request for a comparable
15 product. Architect will notify Contractor of approval or rejection of proposed comparable product within 15
16 days of receipt of request, or seven days of receipt of additional information or documentation, whichever
17 is later.

18 Architect's Approval of Submittal: Marked with approval notation from Architect's action stamp. See
19 Section 01 33 00 "Submittal Procedures."

20 Use product specified if Architect does not issue a decision on use of a comparable product request
21 within time allocated.
22

23 Submittal Requirements, Two-Step Process: Approval by Architect of Contractor's request for use of
24 comparable product is not intended to satisfy other submittal requirements. Comply with specified
25 submittal requirements.
26

27 Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified
28 submittal requirements of individual Specification Section in combined submittal for comparable products.
29 Approval by Architect of Contractor's request for use of comparable product and of individual submittal
30 requirements will also satisfy other submittal requirements.
31

32 **PART 3 - EXECUTION (Not Used)**

33 **END OF SECTION** 34

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PART 2 - PRODUCTS

MATERIALS

Comply with requirements specified in other Sections.

For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

EXAMINATION

Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.

Furnish location data for work related to Project that must be performed by public utilities serving Project site.

Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.

List of detrimental conditions, including substrates.

List of unacceptable installation tolerances.

Recommended corrections.

1 Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the
2 Work indicates acceptance of surfaces and conditions.

4 **PREPARATION**

5 Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust,
6 move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances
7 located in or affected by construction. Coordinate with authorities having jurisdiction.

9 Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements
10 before installing each product. Where portions of the Work are indicated to fit to other construction, verify
11 dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule
12 with construction progress to avoid delaying the Work.

14 Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on
15 Drawings.

17 Review of Contract Documents and Field Conditions: Immediately on discovery of the need for
18 clarification of the Contract Documents, submit a request for information to Architect in accordance with
19 requirements in Section 01 31 00 "Project Management and Coordination."

21 **CONSTRUCTION LAYOUT**

22 Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in
23 relation to the property survey and existing benchmarks and existing conditions. If discrepancies are
24 discovered, notify Architect and Construction Manager promptly.

26 Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations,
27 column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey
28 markings and elevations for use with control lines and levels. Level foundations and piers from two or
29 more locations.

31 Record Log: Maintain a log of layout control work. Record deviations from required lines and levels.
32 Include beginning and ending dates and times of surveys, weather conditions, name and duty of each
33 survey party member, and types of instruments and tapes used. Make the log available for reference by
34 Architect.

36 **INSTALLATION**

37 Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

39 Comply with manufacturer's written instructions and recommendations for installing products in
40 applications indicated.

42 Install products at the time and under conditions that will ensure satisfactory results as judged by Architect.
43 Maintain conditions required for product performance until Substantial Completion.

45 Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in
46 excess of that expected during normal conditions of occupancy of type expected for Project.

48 Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site
49 and placement in permanent locations.

51 Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

53 Templates: Obtain and distribute to the parties involved templates for Work specified to be factory
54 prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate
55 provisions are made for locating and installing products to comply with indicated requirements.

Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

Allow for building movement, including thermal expansion and contraction.

Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

Repair or remove and replace damaged, defective, or nonconforming Work.

Comply with section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

CUTTING AND PATCHING

General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

Temporary Support: Provide temporary support of Work to be cut.

Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 10 00 "Summary."

Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize and prevent interruption to occupied areas.

Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

1 Excavating and Backfilling: Comply with requirements in applicable Sections where required by
2 cutting and patching operations.
3 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap,
4 valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other
5 foreign matter after cutting.
6 Proceed with patching after construction operations requiring cutting are complete.
7
8 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following
9 performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by
10 Architect. Provide materials and comply with installation requirements specified in other Sections, where
11 applicable.
12
13 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical
14 integrity of installation.
15 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained
16 adjoining construction in a manner that will eliminate evidence of patching and refinishing.
17
18 Clean piping, conduit, and similar features before applying paint or other finishing materials.
19 Restore damaged pipe covering to its original condition.
20
21 Floors and Walls: Where walls or partitions that are removed extend one finished area into another,
22 patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish,
23 color, texture, and appearance. Remove in-place floor and wall coverings and replace with new
24 materials, if necessary, to achieve uniform color and appearance.
25
26 Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate
27 paint coats appropriate for substrate over the patch, and apply final paint coat over entire
28 unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling.
29 Provide additional coats until patch blends with adjacent surfaces.
30
31 Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of
32 uniform appearance.
33 Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight
34 condition and ensures thermal and moisture integrity of building enclosure.
35
36 Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils,
37 putty, and similar materials from adjacent finished surfaces.
38
39 **PROGRESS CLEANING**
40 Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of
41 materials lawfully.
42
43 Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
44 Do not hold waste materials more than seven days during normal weather or three days if the
45 temperature is expected to rise above 80 deg F.
46 Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers
47 appropriately and dispose of legally, in accordance with regulations.
48
49 Use containers intended for holding waste materials of type to be stored.
50
51 Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working
52 concurrently.
53
54 Site: Maintain Project site free of waste materials and debris.
55

1 Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper
2 execution of the Work.

3
4 Remove liquid spills promptly.

5 Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area,
6 as appropriate.

7
8 Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions
9 of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended.
10 If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health
11 or property and that will not damage exposed surfaces.

12
13 Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

14
15 Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and
16 deterioration at time of Substantial Completion.

17
18 Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or
19 into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste
20 Management and Disposal."

21
22 During handling and installation, clean and protect construction in progress and adjoining materials already
23 in place. Apply protective covering where required to ensure protection from damage or deterioration at
24 Substantial Completion.

25
26 Clean and provide maintenance on completed construction as frequently as necessary through the
27 remainder of the construction period. Adjust and lubricate operable components to ensure operability
28 without damaging effects.

29
30 Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed
31 or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the
32 construction period.

33 34 **STARTING AND ADJUSTING**

35 Start equipment and operating components to confirm proper operation. Remove malfunctioning units,
36 replace with new units, and retest.

37
38 Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

39
40 Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace
41 damaged and malfunctioning controls and equipment.

42 43 **PROTECTION OF INSTALLED CONSTRUCTION**

44 Provide final protection and maintain conditions that ensure installed Work is without damage or
45 deterioration at time of Substantial Completion.

46
47 Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by
48 construction are maintained in condition that existed at commencement of the Work.

49
50 Comply with manufacturer's written instructions for temperature and relative humidity.

51 52 **CORRECTION OF THE WORK**

53 Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates
54 and finishes.

- 1 Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching
2 materials, and properly adjusting operating equipment.
3
- 4 Repair Work previously completed and subsequently damaged during construction period. Repair to like-
5 new condition.
6
- 7 Restore permanent facilities used during construction to their specified condition.
8
- 9 Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without
10 visible evidence of repair.
11
- 12 Repair components that do not operate properly. Remove and replace operating components that cannot be
13 repaired.
14
- 15 Remove and replace chipped, scratched, and broken glass or reflective surfaces.
16
17
- END OF SECTION**

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements for the following:

- Salvaging nonhazardous demolition and construction waste.
Recycling nonhazardous demolition and construction waste.
Disposing of nonhazardous demolition and construction waste.

Related Requirements:

Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.

DEFINITIONS

Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

ACTION SUBMITTALS

Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

WASTE MANAGEMENT PLAN

General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.

Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.

1 Recycled Materials: Include list of local receivers and processors and type of recycled materials each
2 will accept. Include names, addresses, and telephone numbers.
3 Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and
4 telephone number of each landfill and incinerator facility.
5 Handling and Transportation Procedures: Include method that will be used for separating recyclable
6 waste including sizes of containers, container labeling, and designated location where materials
7 separation will be performed.

8 9 **PART 2 - PRODUCTS**

10 11 **PERFORMANCE REQUIREMENTS**

12 General: Achieve end-of-Project rates for salvage/recycling of 25 percent by weight of total nonhazardous
13 solid waste generated by the Work. Facilitate recycling and salvage of materials.

14 15 **PART 3 - EXECUTION**

16 17 **PLAN IMPLEMENTATION**

18 General: Implement approved waste management plan. Provide handling, containers, storage, signage,
19 transportation, and other items as required to implement waste management plan during the entire duration
20 of the Contract.

21
22 Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as
23 appropriate for the Work.

24
25 Distribute waste management plan to entities when they first begin work on-site. Review plan
26 procedures and locations established for salvage, recycling, and disposal.

27
28 Site Access and Temporary Controls: Conduct waste management operations to ensure minimum
29 interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

30
31 Designate and label specific areas on Project site necessary for separating materials that are to be
32 salvaged and recycled.

33 34 **SALVAGING DEMOLITION WASTE**

35 Comply with requirements in Section 02 41 19 "Selective Demolition" for salvaging demolition waste.

36 37 **Salvaged Items for Reuse in the Work:**

38
39 Clean salvaged items.

40 Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date
41 of removal, quantity, and location where removed.

42 Store items in a secure area until installation.

43 Protect items from damage during transport and storage.

44 Install salvaged items to comply with installation requirements for new materials and equipment.

45 Provide connections, supports, and miscellaneous materials necessary to make items functional for
46 use indicated.

47
48 Salvaged Items for Sale and Donation: Not permitted on Project site.

49 50 **Salvaged Items for Owner's Use:**

51
52 Clean salvaged items.

53 Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date
54 of removal, quantity, and location where removed.

55 Store items in a secure area until delivery to Owner.

56 Transport items to Owner's storage area designated by Owner.

1 Protect items from damage during transport and storage.
2
3 **RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL**
4 Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling
5 waste materials shall accrue to Contractor.
6
7 Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse
8 facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and
9 other substances deleterious to the recycling process.
10
11 Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable
12 waste by type at Project site to the maximum extent practical according to approved construction waste
13 management plan.
14
15 Provide appropriately marked containers or bins for controlling recyclable waste until removed from
16 Project site. Include list of acceptable and unacceptable materials at each container and bin.
17 Inspect containers and bins for contamination and remove contaminated materials if found.
18 Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape
19 stockpiles to drain surface water. Cover to prevent windblown dust.
20 Stockpile materials away from construction area. Do not store within drip line of remaining trees.
21 Store components off the ground and protect from the weather.
22 Remove recyclable waste from Owner's property and transport to recycling receiver or processor as
23 often as required to prevent overfilling bins.
24
25 **RECYCLING DEMOLITION WASTE**
26 Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
27
28 Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
29
30 Metals: Separate metals by type.
31
32 Structural Steel: Stack members according to size, type of member, and length.
33 Remove and dispose of bolts, nuts, washers, and other rough hardware.
34
35 **RECYCLING CONSTRUCTION WASTE**
36 Packaging:
37
38 Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
39 Polystyrene Packaging: Separate and bag materials.
40 Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For
41 pallets that remain on-site, break down pallets into component wood pieces and comply with
42 requirements for recycling wood.
43 Crates: Break down crates into component wood pieces and comply with requirements for recycling
44 wood.
45
46 Wood Materials:
47
48 Clean Cut-Offs of Lumber: Grind or chip into small pieces.
49 Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
50
51 **DISPOSAL OF WASTE**
52 General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site
53 and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
54
55 Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-
56 site.

1 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

2
3 General: Except for items or materials to be salvaged or recycled, remove waste materials and legally
4 dispose of at designated spoil areas on Owner's property.

5
6 Burning: Do not burn waste materials.

7
8 Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided
9 required permits are obtained. Provide full-time monitoring for burning materials until fires are
10 extinguished.

11
12 **END OF SECTION**

1 **SECTION 01 77 00**
2 **CLOSEOUT PROCEDURES**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section includes administrative and procedural requirements for Contract closeout, including, but not
8 limited to, the following:

- 9
10 Substantial Completion procedures.
11 Final Completion procedures.
12 List of incomplete items.
13 Submittal of Project warranties.
14 Final cleaning.

15
16 Related Requirements:

- 17
18 Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual
19 requirements.
20 Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications,
21 and Record Product Data.
22 Section 01 79 00 "Demonstration and Training" for requirements to train Owner's maintenance
23 personnel to adjust, operate, and maintain products, equipment, and systems.
24

25 **ACTION SUBMITTALS**

- 26 Product Data: For each type of cleaning agent.
27 Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
28 Certified List of Incomplete Items: Final submittal at Final Completion.
29

30 **CLOSEOUT SUBMITTALS**

- 31 Certificates of Release: From authorities having jurisdiction.
32 Certificate of Insurance: For continuing coverage.
33 Field Report: For pest-control inspection.
34

35 **SUBSTANTIAL COMPLETION PROCEDURES**

36 Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected
37 (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is
38 incomplete.
39

40 Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to
41 requesting inspection for determining date of Substantial Completion. List items below that are incomplete
42 at time of request.

- 43
44 Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting
45 Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits,
46 operating certificates, and similar releases.
47 Submit closeout submittals specified in other Division 01 Sections, including Project Record
48 Documents, operation and maintenance manuals, damage or settlement surveys, property surveys,
49 and similar final record information.
50 Submit closeout submittals specified in individual Sections, including specific warranties,
51 workmanship bonds, maintenance service agreements, final certifications, and similar documents.
52 Submit maintenance material submittals specified in individual Sections, including tools, spare parts,
53 extra materials, and similar items, and deliver to location designated by Architect. Label with
54 manufacturer's name and model number.
55 Submit testing, adjusting, and balancing records.

1 Submit sustainable design submittals not previously submitted.

2 Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

3
4 Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to
5 requesting inspection for determining date of Substantial Completion. List items below that are incomplete
6 at time of request.

7
8 Advise Owner of pending insurance changeover requirements.

9 Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of
10 changeover in security provisions.

11 Complete startup and testing of systems and equipment.

12 Perform preventive maintenance on equipment used prior to Substantial Completion.

13 Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and
14 systems. Submit demonstration and training video recordings specified in Section 01 79 00
15 "Demonstration and Training."

16 Advise Owner of changeover in utility services.

17 Participate with Owner in conducting inspection and walkthrough with local emergency responders.

18 Terminate and remove temporary facilities from Project site, along with mockups, construction tools,
19 and similar elements.

20 Complete final cleaning requirements.

21 Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

22
23 Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10
24 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of
25 request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.
26 Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of
27 items, either on Contractor's list or additional items identified by Architect, that must be completed or
28 corrected before certificate will be issued.

29 30 **FINAL COMPLETION PROCEDURES**

31 Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion,
32 complete the following:

33
34 Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."

35 Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion
36 inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect.

37 Certified copy of the list will state that each item has been completed or otherwise resolved for
38 acceptance.

39 Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with
40 insurance requirements.

41
42 Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days
43 prior to date the Work will be completed and ready for final inspection and tests. On receipt of request,
44 Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will
45 prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must
46 be completed or corrected before certificate will be issued.

47 48 **LIST OF INCOMPLETE ITEMS**

49 Organization of List: Include name and identification of each space and area affected by construction
50 operations for incomplete items and items needing correction including, if necessary, areas disturbed by
51 Contractor that are outside the limits of construction.

52
53 Organize list of spaces in sequential order, starting with exterior areas first, listed by room or space
54 number.

55 Organize items applying to each space by major element, including categories for ceilings, individual
56 walls, floors, equipment, and building systems.

1 Include the following information at the top of each page:

- 2
3 Project name.
4 Date.
5 Name of Architect.
6 Name of Contractor.
7 Page number.
8

9 Submit list of incomplete items in the following format:

10
11 PDF Electronic File: Architect will return annotated file.
12

13 **SUBMITTAL OF PROJECT WARRANTIES**

14 Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work
15 where warranties are indicated to commence on dates other than date of Substantial Completion, or when
16 delay in submittal of warranties might limit Owner's rights under warranty.
17

18 Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
19

20 Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and
21 bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item.
22 Provide bookmarked table of contents at beginning of document.
23

24 Submit by email to Architect.
25

26 Warranties in Paper Form:
27

28 Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as
29 necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
30

31 Provide additional copies of each warranty to include in operation and maintenance manuals.
32

33 **PART 2 - PRODUCTS**

34 **MATERIALS**

35 Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the
36 surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that
37 might damage finished surfaces.
38
39

40 Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products
41 that comply with the California Code of Regulations maximum allowable VOC levels.
42

43 **PART 3 - EXECUTION**

44 **FINAL CLEANING**

45 Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and
46 ordinances and Federal and local environmental and antipollution regulations.
47
48

49 Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or
50 unit to condition expected in an average commercial building cleaning and maintenance program. Comply
51 with manufacturer's written instructions.
52

53 Complete the following cleaning operations before requesting inspection for certification of
54 Substantial Completion for entire Project or for a designated portion of Project:
55

56 Clean Project site of rubbish, waste material, litter, and other foreign substances.

1 Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains,
2 films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces.
3 Restore reflective surfaces to their original condition.
4 Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts,
5 trenches, equipment vaults, manholes, attics, and similar spaces.
6 Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's
7 instructions.
8 Vacuum and mop concrete.
9 Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance
10 with manufacturer's instructions if visible soil or stains remain.
11 Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing
12 compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking
13 care not to scratch surfaces.
14 Remove labels that are not permanent.
15 Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess
16 lubrication, paint and mortar droppings, and other foreign substances.
17 Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from
18 water exposure.
19 Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers,
20 registers, and grills.
21 Clean ducts, blowers, and coils if units were operated without filters during construction or that
22 display contamination with particulate matter on inspection.
23 Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
24 Clean strainers.
25 Leave Project clean and ready for occupancy.
26

27 Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 74 19 "Construction
28 Waste Management and Disposal."
29

30 **CORRECTION OF THE WORK**

31 Complete repair and restoration operations required by "Correction of the Work" Article in
32 Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.
33

34 **END OF SECTION**

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

SUMMARY

Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

- Operation and maintenance documentation directory manuals.
- Systems and equipment operation manuals.
- Systems and equipment maintenance manuals.
- Product maintenance manuals.

CLOSEOUT SUBMITTALS

Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

Architect will comment on whether content of operation and maintenance submittals is acceptable.

Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

Format: Submit operation and maintenance manuals in the following format:

Submit by email to Architect. Enable reviewer comments on draft submittals.

Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

FORMAT OF OPERATION AND MAINTENANCE MANUALS

Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

If oversized drawings are necessary, fold drawings to same size as text pages and use as foldouts.

If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual to contain the following materials, in the order listed:

Title page.

Table of contents.

Manual contents.

Title Page: Include the following information:

Subject matter included in manual.

Name and address of Project.

Name and address of Owner.

Date of submittal.

Name and contact information for Contractor.

Name and contact information for Architect.

Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.

Cross-reference to related systems in other operation and maintenance manuals.

Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

SYSTEMS AND EQUIPMENT OPERATION MANUALS

Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.

Performance and design criteria if Contractor has delegated design responsibility.

Operating standards.

Operating procedures.

Operating logs.

Wiring diagrams.

Control diagrams.

Piped system diagrams.

Precautions against improper use.

License requirements including inspection and renewal dates.

Descriptions: Include the following:

Product name and model number. Use designations for products indicated on Contract Documents.

Manufacturer's name.

Equipment identification with serial number of each component.

Equipment function.

- 1 Operating characteristics.
- 2 Limiting conditions.
- 3 Performance curves.
- 4 Engineering data and tests.
- 5 Complete nomenclature and number of replacement parts.
- 6
- 7 Operating Procedures: Include the following, as applicable:
 - 8 Startup procedures.
 - 9 Equipment or system break-in procedures.
 - 10 Routine and normal operating instructions.
 - 11 Regulation and control procedures.
 - 12 Instructions on stopping.
 - 13 Normal shutdown instructions.
 - 14 Seasonal and weekend operating instructions.
 - 15 Required sequences for electric or electronic systems.
 - 16 Special operating instructions and procedures.
- 17
- 18 Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- 19
- 20 Piped Systems: Diagram piping as installed, and identify color coding where required for identification.
- 21
- 22 **SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**
- 23 Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of
- 24 each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance
- 25 documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems
- 26 diagrams, lists of spare parts, and warranty information.
- 27
- 28 Content: For each system, subsystem, and piece of equipment not part of a system, include source
- 29 information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service
- 30 schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds,
- 31 as described below.
- 32
- 33 Manufacturers' Maintenance Documentation: Include the following information for each component part or
- 34 piece of equipment:
 - 35 Standard maintenance instructions and bulletins; include only sheets pertinent to product or component
 - 36 installed. Mark each sheet to identify each product or component incorporated into the Work. If data
 - 37 include more than one item in a tabular format, identify each item using appropriate references from
 - 38 the Contract Documents. Identify data applicable to the Work and delete references to information
 - 39 not applicable.
 - 40 Prepare supplementary text if manufacturers' standard printed data are not available and where the
 - 41 information is necessary for proper operation and maintenance of equipment or systems.
 - 42 Drawings, diagrams, and instructions required for maintenance, including disassembly and component
 - 43 removal, replacement, and assembly.
 - 44 Identification and nomenclature of parts and components.
 - 45 List of items recommended to be stocked as spare parts.
- 46
- 47 Maintenance Procedures: Include the following information and items that detail essential maintenance
- 48 procedures:
 - 49 Test and inspection instructions.
 - 50 Troubleshooting guide.
 - 51 Precautions against improper maintenance.
 - 52 Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 53 Aligning, adjusting, and checking instructions.
 - 54 Demonstration and training video recording, if available.
- 55

1 Maintenance and Service Schedules: Include service and lubrication requirements, list of required
2 lubricants for equipment, and separate schedules for preventive and routine maintenance and service with
3 standard time allotment.

5 Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified
6 and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance
7 materials and related services.

9 Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions
10 that would affect validity of warranties or bonds.

11 Include procedures to follow and required notifications for warranty claims.

13 Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of
14 component parts of equipment and systems and to illustrate control sequence and flow diagrams.
15 Coordinate these drawings with information contained in record Drawings to ensure correct illustration of
16 completed installation.

18 **PRODUCT MAINTENANCE MANUALS**

19 Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and
20 maintenance of each product, material, and finish incorporated into the Work.

22 Content: Organize manual into a separate section for each product, material, and finish. Include source
23 information, product information, maintenance procedures, repair materials and sources, and warranties and
24 bonds, as described below.

26 Product Information: Include the following, as applicable:

27 Product name and model number.

28 Manufacturer's name.

29 Color, pattern, and texture.

30 Material and chemical composition.

31 Reordering information for specially manufactured products.

33 Maintenance Procedures: Include manufacturer's written recommendations and the following:

34 Inspection procedures.

35 Types of cleaning agents to be used and methods of cleaning.

36 List of cleaning agents and methods of cleaning detrimental to product.

37 Schedule for routine cleaning and maintenance.

38 Repair instructions.

40 Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

42 Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions
43 that would affect validity of warranties or bonds.

44 Include procedures to follow and required notifications for warranty claims.

46 **PART 2 - PRODUCTS (Not Used)**

48 **PART 3 - EXECUTION (Not Used)**

50 **END OF SECTION**

1
2 Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient
3 at recording graphic information in production of marked-up record prints.

4 Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes
5 for different categories of the Work at same location.

6 Mark important additional information that was either shown schematically or omitted from original
7 Drawings.

8 Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar
9 identification, where applicable.

10
11 Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD
12 DRAWING" in a prominent location.

13
14 Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover
15 sheets. Include identification on cover sheets.

16 Identification: As follows:

17
18 Project name.

19 Date.

20 Designation "PROJECT RECORD DRAWINGS."

21 Name of Architect.

22 Name of Contractor.

23 24 **MAINTENANCE OF RECORD DOCUMENTS**

25 Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract
26 Documents used for construction. Do not use Project Record Documents for construction purposes.
27 Maintain Record Documents in good order and in a clean, dry, legible condition, protected from
28 deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal
29 working hours.

30 31 **PART 2 - PRODUCTS (Not Used)**

32 33 **PART 3 - EXECUTION (Not Used)**

34 35 **END OF SECTION**

1 **SECTION 01 79 00**
2 **DEMONSTRATION AND TRAINING**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section includes administrative and procedural requirements for instructing Owner's personnel, including
8 the following:

9
10 Instruction in operation and maintenance of systems, subsystems, and equipment.

11
12 **QUALITY ASSURANCE**

13 Preinstruction Conference: Conduct conference at Project site to comply with requirements in
14 Section 01 31 00 "Project Management and Coordination."

15
16 **COORDINATION**

17 Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize
18 disrupting Owner's operations and to ensure availability of Owner's personnel.

19
20 **INSTRUCTION PROGRAM**

21 Program Structure: Develop an instruction program that includes individual training modules for each
22 system and for equipment not part of a system, as required by individual Specification Sections.

23
24 **INSTRUCTION**

25 Training Location and Reference Material: Conduct training on-site in the completed and fully operational
26 facility using the actual equipment in-place. Conduct training using final Operation and Maintenance
27 Manual.

28
29 **PART 2 - PRODUCTS (Not Used)**

30
31 **PART 3 - EXECUTION (Not Used)**

32
33 **END OF SECTION**

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1 **SECTION 02 41 19**
2 **SELECTIVE DEMOLITION**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 The Work of this Section Includes:

8 Demolition and removal of selected portions of exterior or interior of building or structure and site
9 elements.

10 Removal and salvage of existing items for delivery to Owner and removal of existing items for
11 reinstallation.

12
13 Related Requirements:

14 Section 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements,
15 and phasing requirements.

16 Section 01 73 00 "Execution" for cutting and patching procedures.

17 Section 01 35 16 "Alteration Project Procedures" for general protection and work procedures for
18 alteration projects.

19
20 **MATERIALS OWNERSHIP**

21 Unless otherwise indicated, demolition waste becomes property of Contractor.

22
23 Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their
24 contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be
25 uncovered during demolition remain the property of Owner.

26
27 Carefully salvage in a manner to prevent damage and promptly return to Owner.

28
29 **INFORMATIONAL SUBMITTALS**

30 Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed
31 for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations
32 and construction of barriers.

33
34 Schedule of selective demolition activities with starting and ending dates for each activity.

35
36 **CLOSEOUT SUBMITTALS**

37 Inventory: Submit a list of items that have been removed and salvaged.

38
39 **FIELD CONDITIONS**

40 Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct
41 selective demolition so Owner's operations will not be disrupted.

42
43 Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as
44 practical.

45
46 Notify Architect of discrepancies between existing conditions and Drawings before proceeding with
47 selective demolition.

48
49 Hazardous Materials:

50 Hazardous materials are present in building to be selectively demolished. A report on the presence of
51 hazardous materials is included in Section 00 31 26 "Existing Hazardous Material Information" for
52 review and use. Examine report to become aware of locations where hazardous materials are present.

53
54 On-site sale of removed items or materials is not permitted.

1
2 **WARRANTY**

3 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during
4 selective demolition, by methods and with materials and using approved contractors so as not to void
5 existing warranties.

6
7 **PART 2 - PRODUCTS**

8
9 **PERFORMANCE REQUIREMENTS**

10 Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective
11 demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

12
13 Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

14
15 **PART 3 - EXECUTION**

16
17 **EXAMINATION**

18 Verify that utilities have been disconnected and capped before starting selective demolition operations.

19
20 Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

21 Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or
22 video conditions that might be misconstrued as damage caused by removal.

23 Photograph or video existing conditions of adjoining construction including finish surfaces, that might
24 be misconstrued as damage caused by selective demolition operations or removal of items for
25 salvage or reinstallation.

26
27 **PREPARATION**

28 Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to
29 preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and
30 to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

31
32 Temporary Protection: Provide temporary barricades and other protection required to prevent injury to
33 people and damage to adjacent buildings and facilities to remain.

34
35 Existing Items to Remain: Protect construction indicated to remain against damage and soiling during
36 selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage
37 location and reinstalled in their original locations after selective demolition operations are complete.

38
39 **UTILITY SERVICES AND BUILDING SYSTEMS**

40 Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and
41 protect against damage during selective demolition operations.

42
43 Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal
44 or cap off utilities and building systems serving areas to be selectively demolished.

45 Owner will arrange to shut off indicated utilities when requested by Contractor.

46 Arrange to shut off utilities with utility companies.

47 If disconnection of utilities and building systems will affect adjacent occupied parts of the building,
48 provide temporary services/systems that bypass area of selective demolition and that maintain
49 continuity of services/systems to those parts of the building.

50 Demolish and remove existing building systems, equipment, and components indicated on Drawings to
51 be removed.

52 Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug
53 remaining piping with same or compatible piping material.

54 Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts
55 with same or compatible ductwork material.

56 Equipment to Be Removed: Disconnect and cap services and remove equipment and components.

- 1 Abandon existing building systems, equipment, and components indicated on Drawings to be
2 abandoned in place.
3 Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible
4 piping material and leave in place.
5 Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material
6 and leave in place.
7 Remove and reinstall/salvage existing building systems, equipment, and components indicated on
8 drawings to be removed and reinstalled or removed and salvaged:
9 Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and
10 store equipment and components; when appropriate, reinstall, reconnect, and make equipment
11 operational.
12 Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and
13 components and deliver to Owner.
14

15 **SALVAGE/REINSTALL**

- 16 Removed and Salvaged Items:
17 Clean salvaged items.
18 Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date
19 of removal, quantity, and location where removed.
20 Store items in a secure area until delivery to Owner.
21 Transport items to Owner's storage area designated by Owner.
22 Protect items from damage during transport and storage.
23

24 **Removed and Reinstalled Items:**

- 25 Clean and repair items to functional condition adequate for intended reuse.
26 Pack or crate items after cleaning and repairing. Identify contents of containers.
27 Protect items from damage during transport and storage.
28 Reinstall items in locations indicated. Comply with installation requirements for new materials and
29 equipment. Provide connections, supports, and miscellaneous materials necessary to make item
30 functional for use indicated.
31

32 **SELECTIVE DEMOLITION, GENERAL**

- 33 General: Demolish and remove existing construction only to extent required by new construction and as
34 indicated. Use methods required to complete the Work within limitations of governing regulations and as
35 follows:

- 36 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods
37 least likely to damage construction to remain or adjoining construction. Use hand tools or small
38 power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover
39 openings to remain.
40 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing
41 finished surfaces.
42 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such
43 as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting
44 operations. Maintain portable fire-suppression devices during flame-cutting operations.
45 Maintain fire watch during and for at least 2 hours after flame-cutting operations.
46 Locate selective demolition equipment and remove debris and materials so as not to impose excessive
47 loads on supporting walls, floors, or framing.
48

- 49 Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to
50 ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used
51 facilities.
52

53 **DISPOSAL OF DEMOLISHED MATERIALS**

- 54 Remove demolition waste materials from Project site and recycle or dispose of them in accordance with
55 Section 01 74 19 "Construction Waste Management and Disposal."
56 Do not allow demolished materials to accumulate on-site.

1 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
2 Remove debris from elevated portions of building by chute, hoist, or other device that will convey
3 debris to grade level in a controlled descent.
4 Comply with requirements specified in Section 01 74 19 "Construction Waste Management and
5 Disposal."

6
7 Burning: Do not burn demolished materials.
8

9 **CLEANING**

10 Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition
11 operations. Return adjacent areas to condition existing before selective demolition operations began.
12

13 **END OF SECTION**

SECTION 03 30 53
MISCELLANEOUS CAST-IN-PLACE CONCRETE

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

SUMMARY

Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

ACTION SUBMITTALS

Product Data: For each type of product.

Design Mixtures: For each concrete mixture.

QUALITY ASSURANCE

Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

PART 2 - PRODUCTS

CONCRETE, GENERAL

Comply with ACI 301.

Comply with ACI 117.

STEEL REINFORCEMENT

Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

CONCRETE MATERIALS

Cementitious Materials:

Portland Cement: ASTM C 150/C 150M, Type I.

Fly Ash: ASTM C 618, Class C or F.

Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag cement.

Normal-Weight Aggregate: ASTM C 33/C 33M, 1-1/2-inch nominal maximum aggregate size.

Air-Entraining Admixture: ASTM C 260/C 260M.

Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

Retarding Admixture: ASTM C 494/C 494M, Type B.

Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

Water: ASTM C 94/C 94M.

RELATED MATERIALS

Vapor Retarder: Plastic sheet, ASTM E 1745, Class A or B.

Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick; or plastic sheet, ASTM E 1745, Class C.

Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

CURING MATERIALS

Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.

Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

Water: Potable.

Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

CONCRETE MIXTURES

Normal-Weight Concrete:

Minimum Compressive Strength: 4000 psi at 28 days.

Maximum W/C Ratio: 0.45.

Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

Slump Limit: 5 inches, plus or minus 1 inch.

Air Content: Maintain within range permitted by ACI 301. Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

CONCRETE MIXING

Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

FORMWORK INSTALLATION

Design, construct, erect, brace, and maintain formwork according to ACI 301.

EMBEDDED ITEM INSTALLATION

Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1
2 **VAPOR-RETARDER INSTALLATION**

3 Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest
4 dimension parallel with direction of pour.

5
6 Lap joints 6 inches and seal with manufacturer's recommended adhesive or joint tape.

7
8 **STEEL REINFORCEMENT INSTALLATION**

9 Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

10
11 Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing
12 concrete.

13
14 **JOINTS**

15 General: Construct joints true to line with faces perpendicular to surface plane of concrete.

16
17 Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into
18 areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness

19
20 Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with
21 vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as
22 indicated.

23
24 Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface
25 unless otherwise indicated.

26
27 **CONCRETE PLACEMENT**

28 Before test sampling and placing concrete, water may be added at Project site, subject to limitations of
29 ACI 301.

30
31 Do not add water to concrete during delivery, at Project site, or during placement.

32
33 Consolidate concrete with mechanical vibrating equipment according to ACI 301.

34
35 **FINISHING FORMED SURFACES**

36 Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects
37 repaired and patched. Remove fins and other projections exceeding 1/2 inch.

38
39 Apply to concrete surfaces not exposed to public view.

40
41 Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly
42 and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove
43 fins and other projections exceeding 1/8 inch.

44
45 Apply to concrete surfaces exposed to public view.

46
47 Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed-finished as-cast
48 concrete where indicated:

49
50 Smooth-rubbed finish.

51 Grout-cleaned finish.

52 Cork-floated finish.

53
54 Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to
55 formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue

1 final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise
2 indicated.

3 4 **FINISHING UNFORMED SURFACES**

5 General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete
6 surfaces. Do not wet concrete surfaces.

7
8 Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form
9 a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.

10
11 Do not further disturb surfaces before starting finishing operations.

12
13 Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or
14 mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious
15 floor finishes unless otherwise indicated.

16
17 Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and
18 slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-
19 applied membrane roofing, or sand-bed terrazzo.

20
21 Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to
22 view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane,
23 paint, or another thin film-finish coating system.

24
25 Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces
26 indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset
27 methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface
28 with a fine broom.

29
30 Slip-Resistive Broom Finish: Apply a slip-resistive finish to surfaces indicated and to exterior concrete
31 platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by
32 brooming with fiber-bristle broom perpendicular to main traffic route.

33 34 **CONCRETE PROTECTING AND CURING**

35 General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
36 Comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during
37 curing.

38
39 Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions
40 cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according
41 to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but
42 before float finishing.

43
44 Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

45
46 Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of
47 the following methods:

48
49 Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following
50 materials:

51
52 Water.

53 Continuous water-fog spray.

54 Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges
55 with 12-inch lap over adjacent absorptive covers.

Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

FIELD QUALITY CONTROL

Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

Tests: Perform according to ACI 301.

Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

END OF SECTION

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1 **SECTION 04 20 00**
2 **UNIT MASONRY**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes:

- 8 Concrete masonry units.
9 Lintels.
10 Mortar materials.
11 Reinforcement.
12 Mortar mixes.
13

14 **ACTION SUBMITTALS**

15 Product Data: For each type of product.

16
17 Shop Drawings: For reinforcing steel: Indicate bending, lap lengths, and placement of unit masonry
18 reinforcing bars. Comply with ACI 315R.
19

20 **INFORMATIONAL SUBMITTALS**

21 Material Certificates: For each type and size of product and for masonry units, include data on material
22 properties.
23

24 Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

- 25
26 Include test reports for mortar mixes required to comply with property specification. Test in
27 accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention,
28 and ASTM C91/C91M for air content.
29

30 **FIELD CONDITIONS**

31 Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do
32 not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing
33 conditions. Comply with cold-weather construction requirements contained in TMS 602.
34

35 Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.
36

37 **PART 2 - PRODUCTS**

38
39 **UNIT MASONRY, GENERAL**

40 Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract
41 Documents.
42

43 Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain
44 chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in
45 the completed Work.
46

47 Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

- 48
49 Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified
50 testing agency acceptable to authorities having jurisdiction.
51

52 **CONCRETE MASONRY UNITS**

53 Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent
54 units unless otherwise indicated.
55

1 Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other
2 special conditions.

3
4 CMUs: ASTM C90, normal weight.

5
6 Unit Compressive Strength: Provide units with minimum average net-area compressive strength of
7 2500 psi.

8 9 **LINTELS**

10 Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching
11 adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and
12 filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-
13 place lintels until cured.

14 15 **MORTAR MATERIALS**

16 Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather
17 construction. Provide natural color or white cement as required to produce mortar color indicated.

18 Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

19
20 Hydrated Lime: ASTM C207, Type S.

21 Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other
22 ingredients.

23 Masonry Cement: ASTM C91/C91M.

24
25 Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar
26 mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory
27 performance in masonry mortar.

28
29 Aggregate for Mortar: ASTM C144.

30 For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

31 For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

32 White-Mortar Aggregates: Natural white sand or crushed white stone.

33
34 Water: Potable.

35 36 **REINFORCEMENT**

37 Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

38 39 **MORTAR MIXES**

40 General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-
41 repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

42
43 Do not use calcium chloride in mortar.

44 Use portland cement-lime or masonry cement mortar unless otherwise indicated.

45
46 Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure
47 quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to
48 Project site.

49
50 Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types
51 of mortar for applications stated unless another type is indicated or needed to provide required compressive
52 strength of masonry.

53
54 For reinforced masonry, use Type M or Type N.

55 For interior nonload-bearing partitions, Type O may be used instead of Type N.

1
2
3 **PART 3 - EXECUTION**

4 **INSTALLATION, GENERAL**

5 Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit
6 adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow
7 units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where
8 possible, cut edges concealed.

9 Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix
10 units from several pallets or cubes as they are placed.

11
12 **TOLERANCES**

13 Dimensions and Locations of Elements:

- 14
15 For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
16 For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
17 For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4
18 inch in a story height or 1/2 inch total.

19
20 Lines and Levels:

- 21
22 For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft.,
23 or 1/2-inch maximum.
24 For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by
25 more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
26 For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20
27 ft., or 1/2-inch maximum.
28 For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control
29 joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch
30 maximum.
31 For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or
32 1/2-inch maximum.
33 For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft.
34 or 1/2-inch maximum.

35
36 Joints:

- 37
38 For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a
39 maximum thickness limited to 1/2 inch.
40 For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus
41 1/4 inch.
42 For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do
43 not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

44
45 **LAYING MASONRY WALLS**

46 Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and
47 for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-
48 size units, particularly at corners, jambs, and, where possible, at other locations.

49
50 Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do
51 not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

52
53 Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly
54 with masonry around built-in items.

55
56 Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

MORTAR BEDDING AND JOINTING

Lay CMUs as follows:

- Bed face shells in mortar and make head joints of depth equal to bed joints.
- Bed webs in mortar in all courses of piers, columns, and pilasters.
- Bed webs in mortar in grouted masonry, including starting course on footings.
- Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

CLEANING

In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

- Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
- Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
- Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
- Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
- Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
- Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
- Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

MASONRY WASTE DISPOSAL

Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

Do not dispose of masonry waste as fill within 18 inches of finished grade.

Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

1 **SECTION 05 50 00**
2 **METAL FABRICATIONS**

3
4 **PART 1 – GENERAL**

5
6 **SUMMARY**

7 Section Includes:
8 Miscellaneous framing and supports.

9
10 **PART 2 – PRODUCTS**

11 **METALS**

12 Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal
13 fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks,
14 rolled trade names, or blemishes.

15
16 Steel Plates, Shapes, and Bars: ASTM A36/A36M.

17
18 Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or
19 ASTM A283/A283M, Grade C or D.

20 Rolled-Stainless Steel Floor Plate: ASTM A793.

21
22 Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

23
24 Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

25
26 **MISCELLANEOUS MATERIALS**

27 Shop Primers: Provide primers that comply with Section 09 91 23 "Interior Painting."

28
29 Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying
30 with MPI#79 and compatible with topcoat.

31 Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.

32
33 **FABRICATION, GENERAL**

34 Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as
35 necessary for shipping and handling limitations. Use connections that maintain structural value of joined
36 pieces. Clearly mark units for reassembly and coordinated installation.

37
38 Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of
39 approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

40
41 Form bent-metal corners to smallest radius possible without causing grain separation or otherwise
42 impairing work.

43
44 Form exposed work with accurate angles and surfaces and straight edges.

45
46 Weld corners and seams continuously to comply with the following:

47 Use materials and methods that minimize distortion and develop strength and corrosion resistance of
48 base metals.

49 Obtain fusion without undercut or overlap.

50 Remove welding flux immediately.

51 At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness
52 shows after finishing and contour of welded surface matches that of adjacent surface.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

MISCELLANEOUS FRAMING AND SUPPORTS

General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

Field Welding: Comply with the following requirements:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove welding flux immediately.

At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

1 Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor
2 bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
3

4 **REPAIRS**

5 Touchup Painting:

6 Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated
7 and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for
8 touching up shop-painted surfaces.
9

10 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to
11 comply with ASTM A780/A780M.
12

13 **END OF SECTION**

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SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

SUMMARY

Section Includes: Framing with dimension lumber, rooftop equipment bases and support curbs, wood blocking and nailers, wood furring and grounds, wood sleepers, plywood backing panels.

ACTION SUBMITTALS

Product Data: For each type of process and factory-fabricated product.

INFORMATIONAL SUBMITTALS

Evaluation Reports: For the following, from ICC-ES:

Preservative-treated wood.

Power-driven fasteners.

PART 2 - PRODUCTS

WOOD PRODUCTS, GENERAL

Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

Factory mark each piece of lumber with grade stamp of grading agency.

For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.

Dress lumber, S4S, unless otherwise indicated.

Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

WOOD-PRESERVATIVE-TREATED MATERIALS

Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

Mark lumber with treatment quality mark of an inspection agency approved by the ALSB Board of Review.

Application: Treat items indicated on Drawings, and the following:

Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

Wood floor plates that are installed over concrete slabs-on-grade.

1
2 **DIMENSION LUMBER FRAMING**

3 Non-Load-Bearing Interior Partitions: Construction or No. 2 grade of any species.

4
5 Other Framing: No. 2 grade of any of the following species:

- 6
7 Hem-fir (north); NLGA.
8 Southern pine; SPIB.
9 Douglas fir-larch; WCLIB or WWPB.
10 Southern pine or mixed southern pine; SPIB.
11 Spruce-pine-fir; NLGA.
12 Douglas fir-south; WWPB.
13 Hem-fir; WCLIB or WWPB.
14 Douglas fir-larch (north); NLGA.
15 Spruce-pine-fir (south); NeLMA, WCLIB, or WWPB.

16
17 **MISCELLANEOUS LUMBER**

18 General: Provide miscellaneous lumber indicated and lumber for support or attachment of other
19 construction, including the following:

- 20
21 Blocking.
22 Nailers.
23 Rooftop equipment bases and support curbs.
24 Cants.
25 Furring.
26 Grounds.
27 Utility shelving.

28
29 Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

30
31 Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:

- 32
33 Mixed southern pine or southern pine, No. 2 grade; SPIB.
34 Eastern softwoods, No. 2 Common grade; NELMA.
35 Northern species, No. 2 Common grade; NLGA.
36 Western woods, Construction or No. 2 Common grade; WCLIB or WWPB.

37
38 **PLYWOOD BACKING PANELS**

39 Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, in thickness indicated or, if not indicated,
40 not less than 3/4-inch nominal thickness.

41
42 **FASTENERS**

43 General: Provide fasteners of size and type indicated that comply with requirements specified in this article
44 for material and manufacture.

45
46 Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of
47 high relative humidity, provide fasteners with hot-dip zinc coating complying with
48 ASTM A153/A153M.

49
50 **MISCELLANEOUS MATERIALS**

51 Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is
52 approved for use indicated by adhesive manufacturer.

53
54 Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt
55 compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to
56 produce an overall thickness of not less than 0.025 inch.

1
2 **PART 3 - EXECUTION**
3

4 **INSTALLATION**

5 Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction,"
6 unless otherwise indicated.
7

8 Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry
9 accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with
10 requirements for attaching other construction.
11

12 Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing
13 panels.
14

15 Do not splice structural members between supports unless otherwise indicated.
16

17 Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
18

19 Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the
20 following:
21

22 Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

23 Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate
24 Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

25 ICC-ES evaluation report for fastener.
26

27 **PROTECTION**

28 Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection,
29 inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution
30 by spraying to comply with EPA-registered label.
31

32 **END OF SECTION**

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1 Assemble casings in shop except where shipping limitations require field assembly.

2 3 **SHOP PRIMING**

4 Interior Wood Trim for Opaque Finish: Shop prime with one coat of wood primer specified in
5 Section 09 91 23 "Interior Painting."

6
7 Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk
8 fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to
9 each unit of work.

10
11 Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces
12 of wood trim.

13 14 **SHOP FINISHING**

15 General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup,
16 cleaning, and polishing until after installation.

17
18 General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication
19 shop as specified in this Section. Refer to Section 09 91 23 "Interior Painting" for field finishing wood trim
20 not indicated to be shop finished.

21
22 Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk
23 fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to
24 each unit of work.

25
26 Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces
27 of wood trim. Apply two coats to end-grain surfaces.

28 29 **PART 3 - EXECUTION**

30 31 **PREPARATION**

32 Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

33 34 **INSTALLATION**

35 Grade: Install wood trim to comply with same grade as item to be installed.

36
37 Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and
38 plumb to a tolerance of 1/8 inch in 96 inches.

39
40 Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

41
42 Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with
43 countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed
44 fastening, countersunk and filled flush with woodwork.

45
46 For shop-finished items, use filler matching finish of items being installed.

47
48 Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from
49 maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches long
50 except where shorter single-length pieces are necessary.

51
52 Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

53 54 **END OF SECTION**

1 **SECTION 06 48 00**
2 **WOOD FRAMES**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Interior frames and jambs.
8

9 **ACTION SUBMITTALS**

10 Product Data: For each type of product, including factory-finishing specifications.
11

12 Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details,
13 attachment devices, and other components.
14

15 Samples:

16 Lumber for transparent finish, for each species and cut, finished on one side and one edge.

17 Lumber with shop-applied opaque finish, for each finish system and color, with exposed surface
18 finished.
19

20 **PART 2 - PRODUCTS**

21
22 **WOOD FRAMES, GENERAL**

23 Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for
24 grades of wood frames indicated for construction, finishes, installation, and other requirements.
25

26 **WOOD MATERIALS**

27 Wood Products: Provide materials that comply with requirements of referenced quality standard for each
28 type of wood frame and quality grade specified unless otherwise indicated.
29

30 Wood Moisture Content for Interior Materials: 5 to 10 percent.
31

32 **MISCELLANEOUS MATERIALS**

33 Interior Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln dried to less than 15 percent
34 moisture content.
35

36 Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide
37 metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip
38 galvanized anchors and inserts at inside face of exterior walls and at floors.
39

40 **FABRICATION**

41 Fabricate wood frames to dimensions, profiles, and details indicated. Ease edges to radius indicated for the
42 following:
43

44 Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
45

46 **SHOP PRIMING**

47 Interior Wood Frames for Opaque Finish: Shop prime with one coat of wood primer specified in
48 Section 09 91 23 "Interior Painting."
49

50 Interior Wood Frames for Transparent Finish: Shop seal with stain (if required), other required
51 pretreatments, and first coat of finish as specified in Section 09 93 00 "Staining and Transparent Finishing."
52

53 Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk
54 fasteners, sealing concealed surfaces, and similar preparations for finishing wood frames, as applicable to
55 each unit of work.

Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim.

SHOP FINISHING

General: Finish wood frames at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Section 09 91 23 "Interior Painting" for field finishing wood frames not indicated to be shop finished.

Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood frames, as applicable to each unit of work.

Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood frames. Apply two coats to end-grain surfaces.

PART 3 - EXECUTION

PREPARATION

Before installation, condition wood frames to average prevailing humidity conditions in installation areas.

INSTALLATION

Grade: Install wood frames to comply with same grade as item to be installed.

Install wood frames level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

Scribe and cut wood frames to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

Anchor wood frames to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

For shop-finished items, use filler matching finish of items being installed.

END OF SECTION

1 **PART 2 - PRODUCTS**

2
3 **AUXILIARY REROOFING MATERIALS**

4 General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for
5 intended use and compatible with components of existing and new roofing system.

6
7 **PART 3 - EXECUTION**

8
9 **PREPARATION**

10 Seal or isolate windows that may be exposed to airborne substances created in removal of existing
11 materials.

12
13 Shut off rooftop utilities and service piping before beginning the Work.

14
15 Test existing roof drains to verify that they are not blocked or restricted.

16
17 Immediately notify Architect of any blockages or restrictions.

18
19 Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.

20
21 Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or
22 activate smoke detectors in the ductwork.

23
24 During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of
25 temporary protection in the event of unexpected rain.

26
27 Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.

28
29 Prevent debris from entering or blocking roof drains and conductors.

30
31 Use roof-drain plugs specifically designed for this purpose.

32 Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is
33 forecast.

34 If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial
35 installation of new roofing system, provide alternative drainage method to remove water and
36 eliminate ponding.

37
38 Do not permit water to enter into or under existing roofing system components that are to remain.

39
40 **ROOF TEAR-OFF**

41 Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.

42
43 Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other
44 acceptable means of removing materials from roof areas.

45
46 Remove accessories from roofing.

47
48 Full Roof Tear-off: Where indicated on Drawings, remove existing roofing and other roofing system
49 components down to the existing roof deck .

50
51 Remove substrate board vapor retarder roof insulation and cover board.

52 Remove base flashings and counter flashings.

53 Remove perimeter edge flashing and gravel stops.

54 Remove copings.

55 Remove expansion-joint covers.

56 Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.

1 Remove wood blocking, curbs, and nailers.
2
3 Remove fasteners from deck.
4
5 **DECK PREPARATION**
6 Inspect deck after tear-off of roofing system.
7
8 If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck
9 appears or feels inadequately attached, immediately notify Architect.
10
11 Do not proceed with installation until directed by Architect.
12
13 If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect,
14 immediately notify Architect.
15
16 Do not proceed with installation until directed by Architect.
17
18 Provide additional deck securement as indicated on Drawings.
19
20 Replace steel deck as indicated on Drawings.
21
22 Replace steel deck as directed by Architect.
23
24 Replace plywood roof sheathing as indicated on Drawings.
25
26 Replace plywood roof sheathing as directed by Architect.
27
28 Deck replacement will be paid for by adjusting the Contract Sum according to unit prices included in
29 the Contract Documents.
30
31 **ROOF RE-COVER PREPARATION**
32 Remove blisters, ridges, buckles, and other substrate irregularities from existing roofing that inhibit new
33 recover boards from conforming to substrate.
34 Broom clean existing substrate.
35 Coordinate with Owner's inspector to schedule times for tests and inspections.
36 Verify that existing substrate is dry.
37
38 Spot check substrates with an electrical capacitance moisture-detection meter.
39
40 Remove materials that are wet or damp.
41
42 Removal will be paid for by adjusting the Contract Sum according to unit prices included in the
43 Contract Documents.
44
45 **BASE FLASHING REMOVAL**
46 Remove existing base flashings.
47
48 Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
49
50 Do not damage metal counterflashings that are to remain.
51
52 Replace metal counterflashings damaged during removal with counterflashings of same metal, weight
53 or thickness, and finish as existing.
54
55 **END OF SECTION**

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1 **SECTION 07 26 00**
2 **VAPOR RETARDERS**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes:

8 Polyethylene vapor retarders.

9
10 **ACTION SUBMITTALS**

11 Product Data: For each type of product.

12
13 **INFORMATIONAL SUBMITTALS**

14 Product test reports.

15
16 **PART 2 - PRODUCTS**

17
18 **POLYETHYLENE VAPOR RETARDERS**

19 Polyethylene Vapor Retarders: ASTM D4397, 6-mil- thick sheet, with maximum permeance rating of 0.1 perm.

20
21
22 **PART 3 - EXECUTION**

23
24 **INSTALLATION OF VAPOR RETARDERS ON FRAMING**

25 Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

26
27
28
29
30 Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

31
32
33
34 Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

35
36
37 Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

38
39
40 **END OF SECTION**

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SECTION 07 53 23
ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 – GENERAL

SUMMARY

Section Includes:

- Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
Accessory roofing materials.
Roof insulation.
Insulation accessories and cover board.
Asphalt materials.
Walkways.

ACTION SUBMITTALS

Product Data: For each type of product.

- For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

- Layout and thickness if insulation.
- Base flashings and membrane terminations.
- Flashing details at penetrations.
- Tapered insulation, thickness, and slopes.
- Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
- Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- Tie-in with air barrier.

Samples: For the following products:

- Roof membrane and flashings of color required.
Walkway pads or rolls, of color required.

Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

INFORMATIONAL SUBMITTALS

Manufacturer Certificates:

- Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

- Submit evidence of complying with performance requirements.

Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

Sample warranties.

CLOSEOUT SUBMITTALS

Maintenance data.

- Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

QUALITY ASSURANCE

Qualifications:

Manufacturers: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.

Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

WARRANTY

Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

Warranty Period: 20 years from Date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.

Impact Resistance: Roof membrane to resist impact damage when tested in accordance with ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

Fire/Windstorm Classification: Class 1A-90.

Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.

Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class C; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

EPDM Sheet: ASTM D4637/D4637M, Type I, nonreinforced, EPDM sheet with factory-applied seam tape.

Thickness: 60 mils, nominal.

Exposed Face Color: Black.

ACCESSORY ROOFING MATERIALS

General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55 to 60 mils thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

1
2 Slip Sheet: Manufacturer's standard, of thickness required for application.

3
4 Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

5
6 Bonding Adhesive: Manufacturer's standard.

7
8 Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified
9 asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed
10 membrane roofing.

11
12 Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based,
13 cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

14
15 Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-
16 applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-
17 backed membrane roofing.

18
19 Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum,
20 butyl splice tape with release film.

21
22 Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

23
24 Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

25
26 Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars,
27 approximately 1 by 1/8 inch thick; with anchors.

28
29 Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance
30 provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to
31 roofing system manufacturer.

32
33 Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded
34 pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement
35 strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

36
37 Provide white flashing accessories for white EPDM membrane roofing.

38 39 **ROOF INSULATION**

40
41 Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.45-lb/cu. ft. minimum density, 25 psi
42 minimum compressive strength square edged.

43
44 Thermal Resistance: R-value of 5.0 per 1 inch.

45
46 Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2 coated glass-fiber facer on both major
47 surfaces.

48
49 Tapered Insulation: Provide factory-tapered insulation boards.

50 Material: Match roof insulation.

51 Minimum Thickness: 1/4 inch.

52 Slope:

53
54 Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.

55 Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

INSULATION ACCESSORIES AND COVER BOARD

Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

- Modified asphaltic, asbestos-free, cold-applied adhesive.
- Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
- Full-spread, spray-applied, low-rise, two-component urethane adhesive.

Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch thick, with a minimum compressive strength of 80 psi.

Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.

ASPHALT MATERIALS

Roofing Asphalt: ASTM D312/D312M, Type III or Type IV.

Asphalt Primer: ASTM D41/D41M.

WALKWAYS

Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

- Size: Approximately 36 by 60 inches.
- Color: Contrasting with roof membrane.

PART 3 - EXECUTION

EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

PREPARATION

Perform fastener-pullout tests in accordance with roof system manufacturer's written instructions.

Submit test result within 24 hours of performing tests.

Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

INSTALLATION OF ROOFING, GENERAL

Install roofing system in accordance with roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

INSTALLATION OF INSULATION

Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

1 Comply with roofing system and insulation manufacturer's written instructions for installing roof
2 insulation.

3
4 Installation Over Metal Decking:

5
6 Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
7 Locate end joints over crests of decking.

8
9 Where installing composite and noncomposite insulation in two or more layers, install
10 noncomposite board insulation for bottom layer and intermediate layers, if applicable, and
11 install composite board insulation for top layer.

12 Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting
13 sloping roof decks.

14 Make joints between adjacent insulation boards not more than 1/4 inch in width.

15 At internal roof drains, slope insulation to create a square drain sump with each side equal to the
16 diameter of the drain bowl plus 24 inches.

17
18 Trim insulation so that water flow is unrestricted.

19
20 Fill gaps exceeding 1/4 inch with insulation.

21 Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

22 Loosely lay base layer of insulation units over substrate.

23 Mechanically attach base layer of insulation using mechanical fasteners specifically designed and
24 sized for fastening specified board-type roof insulation to metal decks.

25
26 Fasten insulation in accordance with requirements in FM Approvals' RoofNav for specified
27 Windstorm Resistance Classification.

28 Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

29
30 Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12
31 inches from previous layer of insulation.

32
33 Staggered end joints within each layer not less than 24 inches in adjacent rows.

34 Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent
35 rows.

36 Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting
37 sloping roof decks.

38 Make joints between adjacent insulation boards not more than 1/4 inch in width.

39 At internal roof drains, slope insulation to create a square drain sump with each side equal to the
40 diameter of the drain bowl plus 24 inches.

41 Trim insulation so that water flow is unrestricted.

42 Fill gaps exceeding 1/4 inch with insulation.

43 Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

44 Loosely lay each layer of insulation units over substrate.

45 Adhere each layer of insulation to substrate using adhesive in accordance with FM Approvals'
46 RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification
47 and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

48
49 Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or
50 minus 25 deg F of equiviscous temperature.

51 Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing
52 and maintaining insulation in place.

53 Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly
54 pressing and maintaining insulation in place.
55

INSTALLATION OF COVER BOARDS

Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

At internal roof drains, conform to slope of drain sump.

Trim cover board so that water flow is unrestricted.

Cut and fit cover board tight to nailers, projections, and penetrations.

Loosely lay cover board over substrate.

Adhere cover board to substrate using adhesive in accordance with FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.

Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

Install slip sheet over cover board and immediately beneath roofing.

ADHERED ROOFING INSTALLATION

Adhere roof membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.

Unroll membrane roof membrane and allow to relax before installing.

Start installation of roofing in presence of roofing system manufacturer's technical personnel.

Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roof membrane.

Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.

Apply roof membrane with side laps shingled with slope of roof deck where possible.

Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.

Apply lap sealant and seal exposed edges of roofing terminations.

Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

1
2 Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

3
4 Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
5 Apply lap sealant and seal exposed edges of roofing terminations.

6
7 Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

8
9 Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
10 Apply lap sealant and seal exposed edges of roofing terminations.

11
12 Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in
13 place with clamping ring.

14
15 Adhere protection sheet over roof membrane at locations indicated.

16
17 **MECHANICALLY FASTENED MEMBRANE ROOFING INSTALLATION**

18 Mechanically fasten roof membrane over area to receive roofing in accordance with roofing system
19 manufacturer's written instructions.

20
21 Unroll roofing membrane and allow to relax before installing.

22
23 For in-splice attachment, install roof membrane with long dimension perpendicular to steel roof deck flutes.

24
25 Start installation of roofing in presence of roofing system manufacturer's technical personnel.

26
27 Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required
28 by manufacturer. Stagger end laps.

29
30 Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of
31 roofing.

32
33 Apply roof membrane with side laps shingled with slope of roof deck where possible.

34
35 Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

36
37 Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
38 Apply lap sealant and seal exposed edges of roofing terminations.

39 Apply a continuous bead of in-seam sealant before closing splice if required by roofing system
40 manufacturer.

41
42 Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

43
44 Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
45 Apply lap sealant and seal exposed edges of roofing terminations.

46
47 Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

48
49 Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
50 Apply lap sealant and seal exposed edges of roofing terminations.

51
52 Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in
53 place with clamping ring.

54
55 In-Splice Attachment: Secure one edge of roof membrane using fastening plates or metal battens centered
56 within splice, and mechanically fasten roof membrane to roof deck. Field splice seam.

Through-Membrane Attachment: Secure roofing using fastening plates or metal battens, and mechanically fasten roof membrane to roof deck. Cover battens and fasteners with a continuous cover strip.

Adhere protection sheet over roof membrane at locations indicated.

INSTALLATION OF WALKWAYS

Flexible Walkways: Install walkway products in accordance with manufacturer's written instructions.

Install flexible walkways at the following locations:

- Perimeter of each rooftop unit.

- Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

- Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.

- Top and bottom of each roof access ladder.

- Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.

- Locations indicated on Drawings.

- As required by roof membrane manufacturer's warranty requirements.

Provide 6-inch clearance between adjoining pads.

Adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

PROTECTING AND CLEANING

Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

1 **SECTION 07 71 00**
2 **ROOF SPECIALTIES**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes:

8 Roof-edge specialties.

9 Roof-edge drainage systems.

10
11 **ACTION SUBMITTALS**

12 Product Data: For each type of product.

13
14 Shop Drawings: For roof specialties.

15
16 Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work.
17 Distinguish between plant- and field-assembled work.

18
19 **INFORMATIONAL SUBMITTALS**

20 Sample warranty.

21
22 **CLOSEOUT SUBMITTALS**

23 Maintenance Data: For roofing specialties to include in maintenance manuals.

24
25 **QUALITY ASSURANCE**

26 Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM
27 Approvals listed for specified class.

28
29 **WARRANTY**

30 Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 00 71 00 "Roof
31 Specialties."

32
33 Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that
34 show evidence of deterioration of factory-applied finishes within specified warranty period.

35
36 Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

37
38 Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.

39 Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.

40 Cracking, checking, peeling, or failure of paint to adhere to bare metal.

41
42 Finish Warranty Period: 10 years from date of Substantial Completion.

43
44 **PART 2 - PRODUCTS**

45
46 **PERFORMANCE REQUIREMENTS**

47 FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals'
48 "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals'
49 markings.

50
51 SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested in accordance with
52 SPRI ES-1 and capable of resisting the following design pressures:

53
54 Design Pressure: 45 PSF.

Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

ROOF-EDGE SPECIALTIES

Gravel Stop: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

Formed Aluminum Sheet Fascia Covers: Aluminum sheet, thickness as required to meet performance requirements.

Surface: Smooth, flat finish.

Finish: Two-coat fluoropolymer.

Color: As selected by Architect from manufacturer's full range.

Corners: Factory mitered and mechanically clinched and sealed watertight.

Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover. Provide matching corner units.

Formed Aluminum Sheet Fascia Covers: Aluminum sheet, thickness as required to meet performance requirements.

Surface: Smooth, flat finish.

Finish: Two-coat fluoropolymer.

Color: As selected by Architect from manufacturer's full range.

Corners: Factory mitered and mechanically clinched and sealed watertight.

Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

Receiver: Manufacturer's standard material and thickness.

MATERIALS

Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

MISCELLANEOUS MATERIALS

Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.

Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329.

Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

FINISHES

Coil-Coated Aluminum Sheet Finishes:

High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.

Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat.

Two-Coat Mica Fluoropolymer: AAMA 2605. Fluoropolymer finish with suspended mica flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.

Three-Coat Metallic Fluoropolymer: AAMA 2605. Fluoropolymer finish with suspended metallic flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.

Provide uniform, neat seams with minimum exposure of solder and sealant.

Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

Torch cutting of roof specialties is not permitted.

Do not use graphite pencils to mark metal surfaces.

Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.

When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

1 Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener
2 manufacturer to achieve maximum pull-out resistance.

3
4 Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

5
6 Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do
7 not install sealants at temperatures below 40 deg F.

8
9 **INSTALLATION OF ROOF-EDGE SPECIALITIES**

10 Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

11
12 Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet
13 performance requirements.

14
15 **CLEANING AND PROTECTION**

16 Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

17
18 Clean and neutralize flux materials. Clean off excess solder and sealants.

19
20 Remove temporary protective coverings and strippable films as roof specialties are installed.

21
22 **END OF SECTION**

1 **SECTION 07 72 00**
2 **ROOF ACCESSORIES**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Manufactured units for the following applications:

- 8 Roof curbs.
9 Heat and smoke vents.
10 Miscellaneous materials.

11
12 **ACTION SUBMITTALS**

13 Product data.

14
15 Shop Drawings: For roof accessories.

16 Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings,
17 and special conditions. Distinguish between plant- and field-assembled work.

18
19 **INFORMATIONAL SUBMITTALS**

20 Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items.
21 Qualification statements.

22
23 **CLOSEOUT SUBMITTALS**

24 Operation and maintenance data.

25
26 **PART 2 - PRODUCTS**

27
28 **PERFORMANCE REQUIREMENTS**

29 General Performance: Roof accessories to withstand exposure to weather and resist thermally induced
30 movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture,
31 fabrication, installation, or other defects in construction.

32
33 Wind-Restraint Performance: 115 MPH Exposure C.

34
35 **ROOF CURBS**

36 Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including
37 equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and
38 capable of meeting performance requirements; with welded or mechanically fastened and sealed corner
39 joints, and integrally formed deck-mounting flange at perimeter bottom.

40
41 Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be
42 supported.

43
44 Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to
45 be supported.

46
47 Construction:

48 Curb Profile: Manufacturer's standard compatible with roofing system.

49 On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof
50 profile.

51 Sloping Roofs: Where roof slope exceeds 1/4 inch per 12 inches, fabricate curb with perimeter curb
52 height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit
53 with water diverter or cricket on side that obstructs water flow.

54 Liner: Same material as curb, of manufacturer's standard thickness and finish.

MISCELLANEOUS MATERIALS

Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, and complying with AWPA C2; not less than 1-1/2 inches thick.

Fasteners: Roof accessory manufacturer's recommended fasteners, designed to comply with performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

GENERAL FINISH REQUIREMENTS

Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Install roof accessories in accordance with manufacturer's written instructions.

Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.

Anchor roof accessories securely in place so they are capable of resisting indicated loads.

Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.

Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.

Coat concealed side of uncoated aluminum and stainless steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

1
2 **INSTALLATION OF ROOF ACCESSORIES**
3 Roof Curb: Install each roof curb so top surface is level.
4
5 Seal joints with elastomeric sealant as required by roof accessory manufacturer.
6
7 **CLEANING AND PROTECTION**
8 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing in
9 accordance with ASTM A780/A780M.
10
11 On completion of installation, clean exposed surfaces in according with manufacturer's written instructions.
12 Clean off excess sealants.
13
14 Remove temporary protective coverings and strippable films as roof accessories are installed. On
15 completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop
16 rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.
17
18 Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup
19 or similar minor repair procedures, as determined by Architect.
20
21 **END OF SECTION**

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1 **SECTION 07 92 00**
2 **JOINT SEALANTS**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes:
8 Urethane joint sealants.

9
10 **ACTION SUBMITTALS**

11 Product data.
12 Samples: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range
13 of colors available for each product exposed to view.

14
15 **INFORMATIONAL SUBMITTALS**

16 Sample warranties.

17
18 **CLOSEOUT SUBMITTALS**

19 Warranty Documentation.

20
21 **PART 2 - PRODUCTS**

22
23 **JOINT SEALANTS, GENERAL**

24 Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one
25 another and with joint substrates under conditions of service and application, as demonstrated by joint-
26 sealant manufacturer, based on testing and field experience.

27
28 Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

29
30 **URETHANE JOINT SEALANTS**

31 Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent
32 movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS,
33 Class 100/50, Uses T and NT.

34
35 **JOINT-SEALANT BACKING**

36 Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and
37 other joint fillers; and approved for applications indicated by sealant manufacturer based on field
38 experience and laboratory testing.

39
40 Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size
41 and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

42
43 Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for
44 preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.
45 Provide self-adhesive tape where applicable.

46
47 **MISCELLANEOUS MATERIALS**

48 Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to
49 joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

50
51 Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant
52 backing materials, free of oily residues or other substances capable of staining or harming joint substrates
53 and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to
54 joint substrates.

Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

PREPARATION

Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

Concrete.

Masonry.

Remove laitance and form-release agents from concrete.

Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

Metal.

Glass.

Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

INSTALLATION OF JOINT SEALANTS

General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

Do not leave gaps between ends of sealant backings.

Do not stretch, twist, puncture, or tear sealant backings.

Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1
2 Place sealants so they directly contact and fully wet joint substrates.
3 Completely fill recesses in each joint configuration.
4 Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant
5 movement capability.
6
7 Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins,
8 tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform
9 beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant
10 with sides of joint.
11
12 Remove excess sealant from surfaces adjacent to joints.
13 Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor
14 sealants or adjacent surfaces.
15 Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise
16 indicated.
17
18 Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with
19 cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints
20 occur.
21
22 Protect joint sealants during and after curing period from contact with contaminating substances and from
23 damage resulting from construction operations or other causes so sealants are without deterioration or
24 damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut
25 out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired
26 areas are indistinguishable from original work.
27
28 **END OF SECTION**

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1 **SECTION 08 14 16**
2 **FLUSH WOOD DOORS**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Solid-core, Pre-Hung doors with wood-veneer.

8
9 **ACTION SUBMITTALS**

10 Product Data: For each type of product, including factory-finishing specifications.

11
12 Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction
13 details not covered in Product Data; and the following:

14 Door schedule indicating door and frame location, type, size, and swing.

15 Door elevations, dimension and locations of hardware and glazing thicknesses.

16 Details of frame for each frame type, including dimensions and profile.

17 Dimensions and locations of blocking for hardware attachment.

18 Clearances and undercuts.

19
20 **PART 2 - PRODUCTS**

21
22 **FLUSH WOOD DOORS AND FRAMES, GENERAL**

23 Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

24
25 **LIGHT FRAMES AND LOUVERS**

26 Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless
27 otherwise indicated.

28
29 **FABRICATION**

30 Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced
31 quality standard for fitting unless otherwise indicated.

32
33 Factory machine doors for hardware that is not surface applied.

34
35 Openings: Factory cut and trim openings through doors.

36
37 Light Openings: Trim openings with moldings of material and profile indicated.

38 Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable
39 requirements in Section 08 80 00 "Glazing."

40
41 **FACTORY FINISHING**

42 Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors
43 for openings and machining for hardware that is not surface applied, before finishing.

44
45 Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom
46 edges, edges of cutouts, and mortises.

47
48 Factory finish doors.

49
50 **PART 3 - EXECUTION**

51
52 **INSTALLATION**

53 Hardware: For installation, see Section 08 71 00 "Door Hardware."

1 Install doors and frames to comply with manufacturer's written instructions and referenced quality standard,
2 and as indicated.

3
4 Install frames level, plumb, true, and straight.

5
6 Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
7 Anchor frames to anchors or blocking built in or directly attached to substrates.

8
9 Secure with countersunk, concealed fasteners and blind nailing.

10 Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush
11 with woodwork.

12
13 For factory-finished items, use filler matching finish of items being installed.

14
15 **END OF SECTION**

SECTION 08 41 13
ALUMINUM-FRAMED STOREFRONTS

SECTION 08 41 13

ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

SUMMARY

Section Includes: Aluminum-framed storefront systems.

ACTION SUBMITTALS

Product data.

Shop Drawings: For aluminum-framed storefront systems. Include plans, elevations, sections, full-size details, and attachments to other work.

Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

Point-to-point wiring diagrams.

Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

INFORMATIONAL SUBMITTALS

Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

Product test reports.

Sample warranties.

CLOSEOUT SUBMITTALS

Operation and maintenance data.

QUALITY ASSURANCE

Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

WARRANTY

Special Warranty: Manufacturer and Installer agree to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.

Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

Failure also includes the following:

- Thermal stresses transferring to building structure.

- Glass breakage.

- Noise or vibration created by wind and thermal and structural movements.

- Loosening or weakening of fasteners, attachments, and other components.

- Failure of operating units.

Structural Loads:

- Wind Loads: 115 MPH Exposure C

Deflection of Framing Members Supporting Glass: At design wind load, as follows:

- Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.

- Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

- Cantilever Deflection: Limited to $2L/175$ at unsupported cantilevers.

Structural: Test in accordance with ASTM E330/E330M as follows:

- When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.

- When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.

- Test Durations: As required by design wind velocity, but not less than 10 seconds.

Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

- No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

- Thermal Transmittance (U-factor):

- Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

- Solar Heat-Gain Coefficient (SHGC):

- Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.45 as determined in accordance with NFRC 200.

- Air Leakage:

- Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.

Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.

Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

- Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

ALUMINUM-FRAMED STOREFRONT SYSTEMS

1 Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required
2 and reinforced as required to support imposed loads.

3
4 Exterior Framing Construction: Thermally broken.

5 Glazing System: Retained mechanically with gaskets on four sides.

6 Finish: Baked-enamel or powder-coat finish.

7 Fabrication Method: Field-fabricated stick system.

8 Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

9 Steel Reinforcement: As required by manufacturer.

10
11 Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral,
12 where framing abuts adjacent construction.

13
14 Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining,
15 nonferrous shims for aligning system components.

16 17 **GLAZING**

18 Glazing: Comply with Section 08 80 00 "Glazing."

19
20 Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient
21 elastomeric glazing gaskets, setting blocks, and shims or spacers.

22
23 Glazing Sealants: As recommended by manufacturer.

24 25 **MATERIALS**

26 Sheet and Plate: ASTM B209.

27
28 Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

29
30 Structural Profiles: ASTM B308/B308M.

31
32 Steel Reinforcement:

33 Structural Shapes, Plates, and Bars: ASTM A36/A36M.

34 Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.

35 Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

36
37 Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with
38 SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface
39 preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in
40 accordance with applicable SSPC standard.

41 42 **FABRICATION**

43 Form or extrude aluminum shapes before finishing.

44
45 Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish.
46 Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

47
48 Fabricate components that, when assembled, have the following characteristics:

49 Profiles that are sharp, straight, and free of defects or deformations.

50 Accurately fitted joints with ends coped or mitered.

51 Physical and thermal isolation of glazing from framing members.

52 Accommodations for thermal and mechanical movements of glazing and framing to maintain required
53 glazing edge clearances.

54 Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel
55 glazing or metal panels.

56 Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

1
2 Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

3
4 After fabrication, clearly mark components to identify their locations in Project in accordance with Shop
5 Drawings.

6 **PART 3 - EXECUTION**

7
8 **INSTALLATION OF ALUMINUM-FRAMED STOREFRONT SYSTEMS**

9 Comply with manufacturer's written instructions.

10
11 Do not install damaged components.

12
13 Fit joints to produce hairline joints free of burrs and distortion.

14
15 Rigidly secure nonmovement joints.

16
17 Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to
18 prevent impeding movement of moving joints.

19
20 Seal perimeter and other joints watertight unless otherwise indicated.

21
22 **Metal Protection:**

23 Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting
24 contact surfaces with materials recommended by manufacturer for this purpose or by installing
25 nonconductive spacers.

26 Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact
27 surfaces with bituminous paint.

28
29 Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint
30 Sealants," to produce weathertight installation.

31
32 Install joint filler behind sealant as recommended by sealant manufacturer.

33
34 Install components plumb and true in alignment with established lines and grades.

35
36 Install glazing as specified in Section 08 80 00 "Glazing."

37
38 **END OF SECTION**

To Attach to Existing Transaction Countertop

Glazing Meeting Edges: Polished glazing.

FABRICATION

General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.

Provide units that are reglazable from the secure side without dismantling the attack side of framing.

Prepare security windows for field glazing unless preglazing at the factory is indicated.

Framing: Miter or cope corners the full depth of framing; weld and dress smooth.

Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.

Glazing Stops: Finish glazing stops to match security window framing.

Attack-Side (Exterior) Glazing Stops: Welded or integral to framing.

Secure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.

Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

Factory-cut openings in glazing for speaking apertures.

Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated. Installation orientation of glazing to meet performance requirements. Comply with requirements in Section 08 88 53 "Security Glazing."

STEEL FINISHES

Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.

Baked-Enamel or Power-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish.

Color and Gloss: As selected by Architect from manufacturer's full range.

ACCESSORIES

Speaking Apertures: Fabricate from stainless steel, designed to allow passage of speech at normal speaking volume without distortion.

Shape: Circular.

Ballistics Resistance: Same as security window.

Listed and labeled as bullet resisting in accordance with UL 752.

Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.

Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

Glazing Strips and Weather Stripping: Manufacturer's standard replaceable components.

Compression Type: Molded EPDM or neoprene gaskets complying with ASTM D2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C509, Grade 4.

1
2 Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass
3 manufacturers and with a proven record of compatibility with surfaces contacted in installation.
4

5 Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with
6 ASTM B633; provide sufficient strength to withstand design pressures indicated.
7

8 **PART 3 - EXECUTION** 9

10 **EXAMINATION**

11 Examine roughing-in for embedded and built-in anchors to verify actual locations of security window
12 connections before security window installation.
13

14 Inspect built-in and cast-in anchor installations, before installing security windows, to verify that anchor
15 installations comply with requirements. Prepare inspection reports.
16

17 **INSTALLATION**

18 Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing
19 security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and
20 other connectors.
21

22 Glazed Framing: Provide gasket-glazed framing. Comply with installation requirements in
23 Section 08 88 53 "Security Glazing."
24

25 Removable Glazing Stops and Trim: Fasten components with security fasteners.
26

27 Fasteners: Install security windows using fasteners recommended by manufacturer with head style
28 appropriate for installation requirements, strength, and finish of adjacent materials.
29

30 Sealants: Comply with requirements in Section 07 92 00 "Joint Sealants" for installing sealants, fillers, and
31 gaskets.
32

33 **FIELD QUALITY CONTROL**

34 Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate
35 compliance with and deviations from the Contract Documents.
36

37 Prepare field quality-control certification that states installed products and their installation comply with
38 requirements in the Contract Documents.
39

40 **CLEANING AND PROTECTION**

41 Lubricate sliding security window hardware.

42 Lubricate transaction drawer hardware.
43

44 **END OF SECTION**

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1 **SECTION 08 71 00**
2 **DOOR HARDWARE**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Door hardware for interior doors.
8

9 **ACTION SUBMITTALS**

10 Product data.

11 Samples: For each exposed product in each finish specified.

12 Door hardware schedule.

13 Keying schedule.
14

15 **CLOSEOUT SUBMITTALS**

16 Maintenance data.
17

18 **QUALITY ASSURANCE**

19 Installer Qualifications: Worker trained and experienced in hardware installation.
20

21 **WARRANTY**

22 Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in
23 materials or workmanship within specified warranty period.

24 Warranty Period: Three years from date of Substantial Completion.
25

26 **PART 2 - PRODUCTS**
27

28 **SOURCE LIMITATIONS**

29 Obtain each type of door hardware from single manufacturer.
30

31 **PERFORMANCE REQUIREMENTS**

32 Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require
33 use of a key, tool, or special knowledge for operation.
34

35 Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.
36

37 **HINGES**

38 Hinges: ANSI/BHMA A156.1.
39

40 **MECHANICAL LOCKS AND LATCHES**

41 Lock Functions: As indicated in door hardware schedule.
42

43 Lock Backset: 2-3/4 inches unless otherwise indicated.
44

45 Lock Trim:

46 Levers: Forged.

47 Dummy Trim: Match lever lock trim and escutcheons.
48

49 Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements
50 indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished
51 to match lock or latch.

52 Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
53

54 Bored Locks: ANSI/BHMA A156.2, Grade 1, Series 4000.

1
2 **AUXILIARY LOCKS**

3 Bored Auxiliary Locks: ANSI/BHMA A156.36, Grade 1; with strike that suits frame.
4

5 **EXIT DEVICES AND AUXILIARY ITEMS**

6 Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

7 **LOCK CYLINDERS**

8 Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide
9 cylinder from same manufacturer of locking devices.

10
11 Standard Lock Cylinders: ANSI/BHMA A156.5, Grade 1 permanent cores; face finished to match lockset.
12 Core Type: Interchangeable.
13

14 **KEYING**

15 Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix.
16 Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

17 No Master Key System: Only change keys operate cylinders.

18 Provide three cylinder change keys.

19 Existing System: Owner may have an existing master key or grand master key system.
20

21 Keys: Nickel silver.

22 Stamping: Permanently inscribe each key with a visual key control number and include the following
23 notation:

24 Notation: Information to be furnished by Owner.
25

26 **OPERATING TRIM**

27 Operating Trim: ANSI/BHMA A156.6; aluminum or stainless steel unless otherwise indicated.
28

29 **SURFACE CLOSERS**

30 Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch
31 speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written
32 instructions for size of door closers depending on size of door, exposure to weather, and anticipated
33 frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for
34 opening force.
35

36 **MECHANICAL STOPS AND HOLDERS**

37 Wall Mounted Stops: ANSI/BHMA A156.16.
38

39 **METAL PROTECTIVE TRIM UNITS**

40 Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch-thick aluminum; with
41 manufacturer's standard machine or self-tapping screw fasteners.
42

43 **AUXILIARY DOOR HARDWARE**

44 Auxiliary Door Hardware: ANSI/BHMA A156.16.
45

46 **FINISHES**

47 Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.
48

49 **PART 3 - EXECUTION**
50

51 **INSTALLATION**

52 Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise
53 indicated or required to comply with governing regulations.

54 Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
55

1 Install each door hardware item to comply with manufacturer's written instructions. Where cutting and
2 fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in
3 another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing
4 work. Do not install surface-mounted items until finishes have been completed on substrates involved.
5

6 Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number
7 recommended by manufacturer for application indicated or one hinge for every 30 inches of door height,
8 whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or
9 pivots, are provided.
10

11 Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in
12 quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door
13 and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
14

15 Stops: Provide wall stops as indicated in door hardware schedule.
16

17 **ADJUSTING**

18 Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper
19 operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust
20 door control devices to compensate for final operation of heating and ventilating equipment and to comply
21 with referenced accessibility requirements.
22

23 **DOOR HARDWARE SCHEDULE**

24 See Plan Set
25
26

END OF SECTION

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GLASS PRODUCTS, GENERAL

Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

NGA Publications: "Glazing Manual."

AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."

IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."

IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

Thickness: Where glass thickness is indicated, it is a minimum.

Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

INSULATED METAL PANELS, GENERAL

Transoms: Provide manufacturer's standard fixed metal skin panel transoms held within the same existing hollow metal frames as existing door panels in all existing integral air openings; fabricated and finished to match existing door frame and panels.

Size: Match existing integral air opening width, height, and depth.

GLASS PRODUCTS

Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

Reflective- and Low-E-Coated Spandrel Glass: ASTM C1376, Kind CS.

INSULATING GLASS

Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

Perimeter Spacer: Manufacturer's standard spacer material and construction .

Desiccant: Molecular sieve or silica gel, or a blend of both.

GLAZING SEALANTS

General:

Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.

GLAZING TAPES

Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

AAMA 804.3 tape, where indicated.

AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.

AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

MISCELLANEOUS GLAZING MATERIALS

Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

PART 3 - EXECUTION

GLAZING, GENERAL

Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

Provide spacers for glass lites where length plus width is larger than 50 inches.

Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

TAPE GLAZING

Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

1 Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in
2 tapes with compatible sealant approved by tape manufacturer.

3
4 Apply heel bead of elastomeric sealant.

5
6 Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense
7 compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket
8 applications at corners and work toward centers of openings.

9
10 Apply cap bead of elastomeric sealant over exposed edge of tape.

11 12 **GASKET GLAZING (DRY)**

13 Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with
14 allowance for stretch during installation.

15
16 Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints
17 miter cut and bonded together at corners.

18
19 Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly
20 against soft compression gasket by inserting dense compression gaskets formed and installed to lock in
21 place against faces of removable stops. Start gasket applications at corners and work toward centers of
22 openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass.
23 Seal gasket joints with sealant recommended in writing by gasket manufacturer.

24
25 Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly
26 against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying
27 pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without
28 developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket
29 manufacturer.

30
31 Install gaskets so they protrude past face of glazing stops.

32 33 **SEALANT GLAZING (WET)**

34 Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and
35 glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and
36 blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position
37 to control depth of installed sealant relative to edge clearance for optimum sealant performance.

38
39 Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to
40 glass and channel surfaces.

41
42 Tool exposed surfaces of sealants to provide a substantial wash away from glass.

43 44 **CLEANING AND PROTECTION**

45 Immediately after installation, remove nonpermanent labels and clean surfaces.

46
47 Protect glass from contact with contaminating substances resulting from construction operations. Examine
48 glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals
49 during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

50
51 If, despite such protection, contaminating substances do contact with glass, remove substances
52 immediately as recommended in writing by glass manufacturer. Remove and replace glass that
53 cannot be cleaned without damage to coatings.

54
55 Remove and replace glass that is damaged during construction period.

1
2

END OF SECTION

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1 **SECTION 08 88 53**
2 **SECURITY GLAZING**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section includes: Laminated-glass security glazing
8

9 **COORDINATION**

10 Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and
11 face clearances, and adequate sealant thicknesses, with reasonable tolerances.
12

13 **ACTION SUBMITTALS**

14 Product data.
15

16 Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of glass
17 tint.
18

19 Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location.
20 Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and
21 construction that receives security glazing, including clearances and glazing channel dimensions.
22

23 **INFORMATIONAL SUBMITTALS**

24 Test and Evaluation Reports:

25 Product test reports.

26 Preconstruction test reports.

27 Delegated design engineer qualifications.

28 Sample warranties.
29

30 **QUALITY ASSURANCE**

31 Qualifications:

32 Installers: Authorized representative who is trained and approved by manufacturer.
33

34 **WARRANTY**

35 Special Warranty, Laminated-Glass Security Glazing: Manufacturer agrees to replace laminated-glass
36 security glazing that fails in materials or workmanship within specified warranty period.

37 Warranty Period: Five years from date of Substantial Completion.
38

39 **PART 2 - PRODUCTS**

40
41 **PERFORMANCE REQUIREMENTS**

42 General:

43
44 Structural Performance: Glazing will withstand the following design loads within limits and under
45 conditions indicated.

46
47 Design Procedure for Glass: ASTM E1300 and the IBC.
48

49 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
50

51 Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201,
52 Category II.

SECURITY GLAZING, GENERAL

Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

AAMA Publications: AAMA GDSG-1 and AAMA TIR-A7.

IGMA Publication for Sloped Glazing: IGMA TB-3001.

IGMA Publication for Insulating Glass: SIGMA TM-3000.

NGA Publications: "GANA Glazing Manual."

Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of manufacturer. Label will indicate manufacturer's name, type of glazing, glass thickness, and safety glazing standard with which glazing complies.

GLASS PRODUCTS

Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

LAMINATED-GLASS SECURITY GLAZING

Laminated-Glass Security Glazing: ASTM C1172. Two or more glass lites bonded with interlayer. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

Interlayer Color: Clear unless otherwise indicated.

SPALL-RESISTANT FILM

Composite of clear polyvinyl butyral film and clear abrasion-resistant polyester film.

Laminating Process: Factory laminate spall-resistant film to glazing assemblies to produce laminated lites free of foreign substances, air, and glass pockets.

GLAZING SEALANTS

General:

Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of Industry colors.

GLAZING TAPES

Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and security glazing manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

MISCELLANEOUS GLAZING MATERIALS

Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

FABRICATION OF SECURITY GLAZING

Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

GLAZING, GENERAL

Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of it off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.

Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

Provide spacers for security glazing lites where the length plus width is larger than 50 inches.

Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and in accordance with requirements in referenced glazing publications.

TAPE GLAZING

Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.

Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

Do not remove release paper from tape until just before each glazing unit is installed.

Apply heel bead of elastomeric sealant.

Center security glazing in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

Apply cap bead of elastomeric sealant over exposed edge of tape.

GASKET GLAZING (DRY)

Cut compression gaskets to lengths recommended in writing by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

Insert soft compression gasket between glazing unit and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

Installation with Drive-in Wedge Gaskets: Center security glazing in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

Installation with Pressure-Glazing Stops: Center security glazing in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

Install gaskets so they protrude past face of glazing stops.

SEALANT GLAZING (WET)

Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers, or spacers and backings, in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.

Tool exposed surfaces of sealants to provide a substantial wash away from security glazing.

CLEANING AND PROTECTION

Immediately after installation remove nonpermanent labels and clean surfaces.

Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter.

If, despite such protection, contaminating substances do contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.

END OF SECTION

SECTION 09 01 90.52
MAINTENANCE REPAINTING
PART 1 - GENERAL

SUMMARY

Section includes maintenance repainting as follows: Patching substrates, and Repainting.

Related Requirements:

Section 01 35 16 "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.

ACTION SUBMITTALS

Product Data: For each type of product.

Samples: For each type of paint system and each pattern, color, and gloss.

For each painted color being matched to a standardized color-coding system, include the color chips from the color-coding-system company with Samples.

Label each Sample for location and application.

Product List: Printout of current "MPI Approved Products List" for each MPI-product category specified in paint systems, with the proposed product highlighted.

INFORMATIONAL SUBMITTALS

Color Matching Certificate: For computer-matched colors.

PART 2 - PRODUCTS

PREPARATORY CLEANING MATERIALS

Water: Potable.

Hot Water: Water heated to a temperature of 140 to 160 deg F.

Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for every 5 gal. of solution required.

Mildewcide: Commercial proprietary mildewcide or a job-mixed solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

PAINT, GENERAL

Material Compatibility:

Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

Colors: As selected by Architect from full range of industry colors.

PAINT MATERIALS, GENERAL

MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

Transition Coat: Paint manufacturer's recommended coating for use where a residual existing coating is incompatible with the paint system.

PATCHING MATERIALS

Gypsum-Plaster Patching Compound: Finish coat plaster and bonding compound according to ASTM C 842 and manufacturer's written instructions.

PART 3 - EXECUTION

MAINTENANCE REPAINTING, GENERAL

Execution of the Work: In repainting surfaces, disturb them as minimally as possible and as follows:

- Remove failed coatings and corrosion and repaint.
- Verify that substrate surface conditions are suitable for repainting.
- Allow other trades to repair items in place before repainting.

Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail.

Heat Processes: Do not use torches, heat guns, or heat plates.

EXAMINATION

Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of painting work. Comply with paint manufacturer's written instructions for inspection.

PREPARATORY CLEANING

General: Use the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.

Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.

Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine, that leave residue.

SUBSTRATE REPAIR

General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.

Gypsum-Plaster and Gypsum-Board Substrates:

- Repair defects including dents and chips more than 1/8 inch in size and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners.
- Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.

PAINT APPLICATION, GENERAL

Prepare surfaces to be painted according to the Surface-Preparation Schedule and with manufacturer's written instructions for each substrate condition.

1
2 Apply a transition coat over incompatible existing coatings.
3

4 Blending Painted Surfaces: When painting new substrates patched into existing surfaces or touching up
5 missing or damaged finishes, apply coating system specified for the specific substrate. Apply final finish
6 coat over entire surface from edge to edge and corner to corner.
7

8 **FIELD QUALITY CONTROL**

9 Manufacturer's Field Service: Engage paint-remover manufacturer's factory-authorized service
10 representative for consultation and Project-site inspection and to provide on-site assistance when requested
11 by Architect.
12

13 **CLEANING AND PROTECTION**

14 At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
15

16 Protect work of other trades against damage from paint application. Correct damage to work of other trades
17 by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged
18 condition.
19

20 At completion of construction activities of other trades, touch up and restore damaged or defaced painted
21 surfaces.
22

23 **SURFACE-PREPARATION SCHEDULE**

24 General: Before painting, prepare surfaces for painting according to applicable requirements specified in
25 this schedule.
26

27 Examine surfaces to evaluate each surface condition according to paragraphs below.

28 Where existing degree of soiling prevents examination, preclean surface and allow it to dry before
29 making an evaluation.

30 Repair substrate defects according to "Substrate Repair" Article.
31

32 **END OF SECTION**

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1 **SECTION 09 29 00**
2 **GYPSUM BOARD**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Interior gypsum board.
8

9 **ACTION SUBMITTALS**

10 Product data.
11

12 Shop Drawings: Show locations and installation of control and expansion joints, including plans,
13 elevations, sections, details of components, and attachments to other work.
14

15 Samples: For each texture finish indicated on same backing indicated for Work.
16

17 **PART 2 - PRODUCTS**

18
19 **PERFORMANCE REQUIREMENTS**

20 Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction
21 identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing
22 agency.
23

24 STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those
25 tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413
26 by an independent testing agency.
27

28 **GYPSUM BOARD, GENERAL**

29 Size: Provide maximum lengths and widths available that will minimize joints in each area and that
30 correspond with support system indicated.
31

32 **INTERIOR GYPSUM BOARD**

33 Gypsum Wallboard: ASTM C1396/C1396M.

34 Thickness: 5/8 inch.

35 Long Edges: Tapered.
36

37 Gypsum Board, Type X: ASTM C1396/C1396M.

38 Thickness: 5/8 inch.

39 Long Edges: Tapered.
40

41 Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper
42 surfaces.

43 Core: 5/8 inch, Type X.

44 Long Edges: Tapered.

45 Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.
46

47 **TRIM ACCESSORIES**

48 Interior Trim: ASTM C1047.

49 Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-
50 steel sheet.

51 Shapes:

52 Cornerbead.

53 Bullnose bead.

54 LC-Bead: J-shaped; exposed long flange receives joint compound.

55 L-Bead: L-shaped; exposed long flange receives joint compound.

U-Bead: J-shaped; exposed short flange does not receive joint compound.
Expansion (control) joint.

JOINT TREATMENT MATERIALS

General: Comply with ASTM C475/C475M.

Joint Tape: Paper.

Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

Prefilling: At open joints and damaged surface areas, use setting-type taping compound.

Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

Use setting-type compound for installing paper-faced metal trim accessories.

Fill Coat: For second coat, use drying-type, all-purpose compound.

Finish Coat: For third coat, use drying-type, all-purpose compound.

Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

AUXILIARY MATERIALS

Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

Steel Drill Screws: ASTM C1002 unless otherwise indicated.

Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

PART 3 - EXECUTION

INSTALLATION OF PANELS

Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

Comply with ASTM C840.

Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

FINISHING OF GYPSUM BOARD

Prefill open joints and damaged surface areas.

Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

Level 1: Ceiling plenum areas, concealed areas, and where indicated.

1 Level 4 or better: At panel surfaces that will be exposed to view unless otherwise indicated.
2 Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

4 PROTECTION

5 Protect installed products from damage from weather, condensation, direct sunlight, construction, and other
6 causes during remainder of the construction period.

8 Remove and replace panels that are wet, moisture damaged, and mold damaged.

10 **END OF SECTION**

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1 **SECTION 09 30 13**
2 **CERAMIC TILING**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes:

- 8 Porcelain tile.
9 Setting material.
10 Grout materials.

11
12 **ACTION SUBMITTALS**

13 Product Data:

- 14 Porcelain tile.
15 Setting material.
16 Grout materials.

17
18 Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths,
19 details, and locations of movement joints in tile substrates and finished tile surfaces.

20
21 Samples:

- 22 Full-size units of each type and composition of tile and for each color and finish required.
23 Full-size units of each type of trim and accessory for each color and finish required.

24
25 **INFORMATIONAL SUBMITTALS**

26 Qualification Data: For Installer.

27
28 **MAINTENANCE MATERIAL SUBMITTALS**

29 Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products
30 installed and that are packaged with protective covering for storage and identified with labels describing
31 contents.

- 32 Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each
33 type, composition, color, pattern, and size indicated.

34
35 **PART 2 - PRODUCTS**

36
37 **PRODUCTS, GENERAL**

38 ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and
39 other characteristics indicated.

40
41 ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI
42 standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods
43 specified in tile installation schedules, and other requirements specified.

44
45 **PORCELAIN TILE**

46 Porcelain Tile Type: Unglazed.

47 Certification: Tile certified by the Porcelain Tile Certification Agency.

48 Face Size: 4 by 4 inches.

49 Face Size Variation: Rectified.

50 Thickness: 1/4 inch or 3/8 inch.

51 Product Use Classification: Interior, Wet (IW).

52 Physical Properties: Chemical resistant when tested with indicated chemicals in accordance with
53 ASTM C650.

54 Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.

55 Grout Color: As selected by Architect from manufacturer's full range.

Precoat with temporary protective coating.

TILE BACKING PANELS

Water-Resistant Gypsum Backing Board: ASTM C1396/C1396M, with manufacturer's standard edges.

Core: As indicated on Drawings.

SETTING MATERIALS

Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

Cleavage Membrane: Installer's option of material that complies with ANSI A108.02, paragraph 3.8.

Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A1064/A1064M except for minimum wire size.

Expanded Metal Lath: Diamond-mesh lath complying with ASTM C847.

Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

GROUT MATERIALS

Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

Standard Cement Grout: ANSI A118.6.

MISCELLANEOUS MATERIALS

Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.

Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.

Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.

Description: L-shaped or Square.

Material and Finish: Metallic or combination of metal and PVC or neoprene base; color-coated aluminum exposed-edge material.

Color: As selected by Architect from manufacturer's full range.

Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.

Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

EXAMINATION

Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

Verify that concrete substrates for tile floors installed with bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.

1
2 Proceed with installation only after unsatisfactory conditions have been corrected.
3

4 **PREPARATION**

5 Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting
6 materials.
7

8 Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset
9 mortar with trowelable leveling and patching compound specifically recommended by tile-setting material
10 manufacturer.
11

12 Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed
13 that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.
14

15 Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile
16 units taken from one package show same range of colors as those taken from other packages and match
17 approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before
18 installing.
19

20 **Substrate Flatness:**

21 For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of
22 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured
23 from tile surface high points.

24 For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate
25 is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when
26 measured from tile surface high points.
27

28 Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from
29 staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective
30 coating, taking care not to coat unexposed tile surfaces.
31

32 **INSTALLATION OF CERAMIC TILE SYSTEM**

33 Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written
34 instructions for type of application indicated.
35

36 Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for
37 TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series
38 that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to
39 types of setting and grouting materials used.
40

41 Extend tile work into recesses and under or behind equipment and fixtures to form complete covering
42 without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners
43 without disrupting pattern or joint alignments.
44

45 Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible
46 surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints.
47 Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers
48 overlap tile.
49

50 Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges. (Provide
51 metal edge at top of base tile on wall).
52

53 Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
54

1 Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields
2 in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are
3 less than half of a tile. Provide uniform joint widths unless otherwise indicated.

4
5 Metal Flooring Transitions: Install where exposed edge of tile flooring meets carpet, wood, or other
6 flooring that finishes flush with top of tile.

7
8 Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with
9 manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and
10 sealer from tile faces by wiping with soft cloth.

11
12 **END OF SECTION**

SECTION 09 51 23
ACOUSTICAL TILE CEILINGS

SECTION 09 51 23

ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

SUMMARY

Section Includes: Acoustical tiles, Metal suspension system, and Accessories.

ACTION SUBMITTALS

Product Data: For each type of product.

Samples: For each exposed product and for each color and texture specified.

INFORMATIONAL SUBMITTALS

Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

Product test reports.

Research reports.

CLOSEOUT SUBMITTALS

Maintenance data.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: Class C in accordance with ASTM E1264.

Smoke-Developed Index: 450 or less.

ACOUSTICAL TILES

Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.

Color: White.

Light Reflectance (LR): 0.83.

Ceiling Attenuation Class (CAC): 33.

Noise Reduction Coefficient (NRC): 0.55.

Edge/Joint Detail: Tegular edge.

Thickness: 5/8 inch.

Modular Size: 24 by 24 inches.

METAL SUSPENSION SYSTEM

Metal Suspension-System Standard: Manufacturer's standard, direct-hung, fully concealed, metal suspension system that complies with applicable requirements in ASTM C635/C635M.

Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.

Structural Classification: Intermediate-duty system.

Access: Upward, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

Initial Access Opening: In each module, 24 by 24 inches.

1
2 **ACCESSORIES**

3 Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct
4 Hung," unless otherwise indicated. Comply with seismic design requirements.
5

6 **METAL EDGE MOLDINGS AND TRIM**

7 Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated,
8 manufacturer's standard moldings for edges and penetrations complying with seismic design requirements;
9 formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.
10

11 **PART 3 - EXECUTION**

12
13 **PREPARATION**

14 Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges
15 of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated.
16

17 Layout openings for penetrations centered on the penetrating items.
18

19 **INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS**

20 Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M and manufacturer's
21 written instructions.
22

23 Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary
24 to conceal edges of acoustical tiles.

25 Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before
26 they are installed.

27 Do not use exposed fasteners, including pop rivets, on moldings and trim.
28

29 Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.
30

31 **END OF SECTION**

1 **SECTION 09 65 13**
2 **RESILIENT BASE AND ACCESSORIES**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Vinyl base.

8
9 **ACTION SUBMITTALS**

10 Product Data: For each type of product.

11
12 Samples: For each exposed product and for each color and texture specified.

13
14 **PART 2 - PRODUCTS**

15
16 **VINYL BASE**

17 Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).

18
19 Group: I (solid, homogeneous) or II (layered).

20 Style and Location:

21 Style B, Cove: Provide in areas with resilient floor coverings.

22
23 Minimum Thickness: 0.125 inch.

24 Height: 4 inches.

25 Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

26 Outside Corners: Job formed or preformed.

27 Inside Corners: Job formed or preformed.

28 Colors and Patterns: As selected by Architect from manufacturer's full range.

29
30 **INSTALLATION MATERIALS**

31 Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended
32 hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for
33 applications indicated.

34
35 Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and
36 substrate conditions indicated.

37
38 Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread
39 manufacturer.

40
41 **PART 3 - EXECUTION**

42
43 **PREPARATION**

44 Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

45
46 Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove
47 bumps and ridges to produce a uniform and smooth substrate.

48
49 Do not install resilient products until materials are the same temperature as space where they are to be
50 installed.

51
52 Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

53
54 **RESILIENT BASE INSTALLATION**

55 Comply with manufacturer's written instructions for installing resilient base.

1
2 Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent
3 fixtures in rooms and areas where base is required.

4
5 Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces
6 aligned.

7
8 Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact
9 with horizontal and vertical substrates.

10
11 Do not stretch resilient base during installation.

12
13 On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with
14 manufacturer's recommended adhesive filler material.

15
16 Preformed Corners: Install preformed corners before installing straight pieces.

17
18 Job-Formed Corners:

19
20 Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than
21 3 inches in length.

22
23 Form without producing discoloration (whitening) at bends.

24
25 Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3
26 inches in length.

27
28 Miter or cope corners to minimize open joints.

29
30 **RESILIENT ACCESSORY INSTALLATION**

31 Comply with manufacturer's written instructions for installing resilient accessories.

32
33 Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length
34 of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

35
36 **CLEANING AND PROTECTION**

37 Comply with manufacturer's written instructions for cleaning and protecting resilient products.

38
39 Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor
40 polish.

41
42 Apply two coat(s).

43
44 Cover resilient products subject to wear and foot traffic until Substantial Completion.

45
46 **END OF SECTION**

1 **SECTION 09 65 19**
2 **RESILIENT TILE FLOORING**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Solid vinyl floor tile.

8
9 **ACTION SUBMITTALS**

10 Product Data: For each type of product.

11 Samples: For each exposed product and for each color and pattern specified.

12
13 **CLOSEOUT SUBMITTALS**

14 Maintenance data.

15
16 **QUALITY ASSURANCE**

17 Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques
18 required by manufacturer for floor tile installation.

19
20 **PART 2 - PRODUCTS**

21
22 **SOLID VINYL FLOOR TILE (LVT)**

23 Tile Standard: ASTM F 1700.

24 Class: Class III, Printed Film Vinyl Tile.

25 Type: B, Embossed Surface.

26
27 Thickness: 0.180 inch minimum.

28 Size: 12 by 24 inches or plank style.

29 Colors and Patterns: As selected by Architect from manufacturer's full range.

30
31 **INSTALLATION MATERIALS**

32 Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended
33 hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications
34 indicated.

35
36 Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile
37 and substrate conditions indicated.

38
39 Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

40
41 **PART 3 - EXECUTION**

42
43 **PREPARATION**

44 Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient
45 products.

46
47 Concrete Substrates: Prepare according to ASTM F 710.

48
49 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

50 Remove substrate coatings and other substances that are incompatible with adhesives and that contain
51 soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do
52 not use solvents.

53 Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with
54 installation only after substrate alkalinity falls within range on pH scale recommended by
55 manufacturer in writing, but not less than 5 or more than 10 pH.

Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

Do not install floor tiles until materials are the same temperature as space where they are to be installed.

At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

FLOOR TILE INSTALLATION

Comply with manufacturer's written instructions for installing floor tile.

Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

Lay tiles in pattern indicated by Owner.

Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

Lay tiles in pattern of colors and sizes indicated by Owner.

Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

Apply two coat(s).

END OF SECTION

1 **SECTION 09 68 13**
2 **TILE CARPETING**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Modular carpet tile.

8
9 **ACTION SUBMITTALS**

10 Product data.

11
12 Shop Drawings: For carpet tile installation.

13
14 **INFORMATIONAL SUBMITTALS**

15 Product test reports.

16 Sample warranties.

17
18 **CLOSEOUT SUBMITTALS**

19 Maintenance data.

20
21 **WARRANTY**

22 Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile
23 installation that fail in materials or workmanship within specified warranty period.

24 Warranty Period: 10 years from date of Substantial Completion.

25
26
27 **PART 2 - PRODUCTS**

28
29 **CARPET TILE**

30 Color: As selected by Architect from manufacturer's full range.

31 Pattern: As selected by Architect from manufacturer's full range.

32
33 Fiber Content: nylon

34 Pile Characteristic: Level-loop pile.

35 Density: 3,500 oz./cu. yd..

36 Primary Backing/Backcoating: Manufacturer's standard composite materials.

37 Secondary Backing: Manufacturer's standard material.

38 Size: 24 by 24 inches.

39 Soil-Resistance Treatment: Manufacturer's standard treatment.

40
41 Performance Characteristics:

42 Texture Appearance Retention Rating (TARR): Moderate traffic, 2.5 minimum in accordance with
43 ASTM D7330.

44 Dry Breaking Strength: Not less than 100 lbf in accordance with ASTM D2646.

45 Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical
46 measurement.

47 Electrostatic Propensity: Less than 3.5 kV in accordance with AATCC 134.

48
49 **INSTALLATION ACCESSORIES**

50 Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation
51 provided or recommended in writing by carpet tile manufacturer.

52
53 Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and
54 subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that
55 are recommended in writing by carpet tile manufacturer for releasable installation.

1
2 **PART 3 - EXECUTION**
3

4 **EXAMINATION**

5 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for
6 maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet
7 tile performance.

8
9 Examine carpet tile for type, color, pattern, and potential defects.

10
11 Concrete Slabs: Verify that finishes comply with requirements and that surfaces are free of cracks, ridges,
12 depressions, scale, and foreign deposits.

13 Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer
14 than three tests in each installation area and with test areas evenly spaced in installation areas.
15

16 **PREPARATION**

17 General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for
18 preparing substrates.
19

20 Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions,
21 to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions
22 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are
23 required by manufacturer's written instructions.
24

25 Concrete Substrates: Remove coatings, including curing compounds, and other substances that are
26 incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use
27 mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
28

29 Broom and vacuum clean substrates to be covered immediately before installing carpet tile.
30

31 **INSTALLATION**

32 General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written
33 installation instructions.
34

35 Installation Method: As recommended in writing by carpet tile manufacturer.
36

37 Maintain dye-lot integrity. Do not mix dye lots in same area.
38

39 Maintain pile-direction patterns recommended in writing by carpet tile manufacturer, confirm with Owner.
40

41 Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including
42 cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing
43 by carpet tile manufacturer.
44

45 Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges,
46 alcoves, and similar openings.
47

48 Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating
49 on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
50

51 Install pattern parallel to walls and borders.
52

53 Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid.
54 Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

1 **CLEANING AND PROTECTION**

2 Protect carpet tile against damage from construction operations and placement of equipment and fixtures
3 during the remainder of construction period. Use protection methods indicated or recommended in writing
4 by carpet tile manufacturer.

5

6

END OF SECTION

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1 **SECTION 09 91 23**
2 **INTERIOR PAINTING**
3 **PART 1 - GENERAL**
4

5
6 **SUMMARY**

7 Section Includes:

8 Primers.

9 Water-based finish coatings.
10

11 **ACTION SUBMITTALS**

12 Product Data: For each type of product.

13
14 Samples: For each type of topcoat product.

15
16 Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to
17 cross-reference paint systems specified in this Section. Include color designations.
18

19 **QUALITY ASSURANCE**

20 Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify
21 preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality
22 standards for materials and execution.
23

24 **PART 2 - PRODUCTS**

25 **MANUFACTURERS**

26 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that
27 may be incorporated into the Work include, but are not limited to the following:
28

29 Sherwin-Williams Paints
30

31 Products: Subject to compliance with requirements, available products that may be incorporated into the
32 Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category
33 indicated.
34

35 **PRIMERS**

36 Alkali-Resistant, Water-Based Primer: Water-based primer formulated for use on alkaline surfaces, such as
37 plaster, vertical concrete, and masonry.
38

39 Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum
40 wallboard surfaces.
41

42 **WATER-BASED FINISH COATS**

43 Interior, Latex, Satin: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum
44 board, and on primed wood and metals.
45

46 Interior, Pro Industrial Pre-Catalyzed Water Based Epoxy, Eggshell: Pro Industrial Pre-Catalyzed Water
47 Based Epoxy offers the adhesion, durability and resistance to stains and most cleaning solvents usually
48 characteristic of two-component water-borne acrylic epoxy products.
49

50 **PART 3 - EXECUTION**
51

52 **EXAMINATION**

53 Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and
54 primers.
55

1 Proceed with coating application only after unsatisfactory conditions have been corrected.

2
3 Application of coating indicates acceptance of surfaces and conditions.

4 5 **PREPARATION**

6 Comply with manufacturer's written instructions and recommendations applicable to substrates and paint
7 systems indicated.

8
9 Remove hardware, covers, plates, and similar items already in place that are removable and are not to be
10 painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied
11 protection before surface preparation and painting.

12
13 After completing painting operations, use workers skilled in the trades involved to reinstall items that were
14 removed. Remove surface-applied protection if any.

15 16 **INSTALLATION**

17 Apply paints according to manufacturer's written instructions.

18
19 Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller
20 tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

21 22 **CLEANING AND PROTECTION**

23 After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping,
24 or other methods. Do not scratch or damage adjacent finished surfaces.

25
26 Protect work of other trades against damage from paint application. Correct damage to work of other trades
27 by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged
28 condition.

29
30 At completion of construction activities of other trades, touch up and restore damaged or defaced painted
31 surfaces.

32
33 **END OF SECTION**

SECTION 10 14 23.16

ROOM-IDENTIFICATION PANEL SIGNAGE

SECTION 10 14 23.16

ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

SUMMARY

Section includes room-identification signs that are directly attached to the building.

ACTION SUBMITTALS

Product Data: For each type of product.

Shop Drawings: For room-identification signs.

Include fabrication and installation details and attachments to other work.

Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories as required.

Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

Samples: For each exposed product and for each color and texture specified.

INFORMATIONAL SUBMITTALS

Sample warranty.

CLOSEOUT SUBMITTALS

Maintenance data.

WARRANTY

Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Accessibility Standard: Comply with applicable provisions in ICC A117.1.

ROOM-IDENTIFICATION SIGNS

Room-Identification Sign Insert drawing designation: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

Composite- Face Sheet Thickness: Manufacturer's standard for size of sign.

Surface-Applied Graphics: Applied vinyl film.

Color(s): As selected by Architect from manufacturer's full range.

Sign-Panel Perimeter: Finish edges smooth.

Edge Condition: Beveled.

Corner Condition in Elevation: Rounded.

Mounting: Manufacturer's standard method for substrates indicated for a surface mounted to wall type.

1
2 **SIGN MATERIALS**

3 Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV
4 filtering).

5
6 **ACCESSORIES**

7 Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive
8 and compatible with each material joined, and complying with the following:

9
10 Use concealed fasteners and anchors unless indicated to be exposed.

11
12 Adhesive: As recommended by sign manufacturer.

13
14 Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on
15 both sides.

16
17 **FABRICATION**

18 General: Provide manufacturer's standard sign assemblies according to requirements indicated. Conceal
19 connections if possible; otherwise, locate connections where they are inconspicuous.

20
21 **PART 3 - EXECUTION**

22
23 **INSTALLATION**

24 General: Install signs using mounting methods indicated and according to manufacturer's written
25 instructions.

26
27 Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of
28 distortion and other defects in appearance.

29 Install signs so they do not protrude or obstruct according to the accessibility standard.

30 Before installation, verify that sign surfaces are clean and free of materials or debris that would impair
31 installation.

32
33 **END OF SECTION**

1 **SECTION 10 28 00**
2 **TOILET, BATH, AND LAUNDRY ACCESSORIES**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Private-use washroom and under-lavatory guards.
8

9 **ACTION SUBMITTALS**

10 Product Data: For each type of product.
11

12 Samples: For each exposed product and for each finish specified, full size.

13 Approved full-size Samples will be returned and may be used in the Work.
14

15 Delegated Design Submittals: For grab bars.

16 Include structural design calculations indicating compliance with specified structural-performance
17 requirements.
18

19 **INFORMATIONAL SUBMITTALS**

20 Sample warranties.
21

22 **CLOSEOUT SUBMITTALS**

23 Maintenance data.
24

25 **WARRANTY**

26 Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in
27 materials or workmanship within specified warranty period.
28

29 Warranty Period: 10 years from date of Substantial Completion.
30

31 **PART 2 - PRODUCTS**
32

33 **PERFORMANCE REQUIREMENTS**

34 Structural Performance: Design accessories and fasteners to comply with the following requirements:
35

36 Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at
37 any point.
38

39 **PUBLIC-USE WASHROOM ACCESSORIES**

40 Toilet Tissue (Roll) Dispenser:

41 Description: Single-roll dispenser.

42 Mounting: Surface mounted.

43 Operation: Noncontrol delivery with standard spindle.

44 Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.

45 Material and Finish: Satin-finish aluminum bracket with plastic spindle.
46

47 Paper Towel (Folded) Dispenser:

48 Mounting: Surface mounted.

49 Minimum Capacity: 400 C-fold or 525 multifold towels.

50 Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

51 Lockset: None.

52 Refill Indicator: Pierced slots at sides or front.
53

54 Soap Dispenser:

55 Description: Designed for manual operation and dispensing soap in liquid or lotion form.

1 Mounting: Vertically oriented, surface mounted.
2 Capacity: 34 oz.
3 Materials: ABS Plastic and Polystyrene.
4 Lockset: None.
5 Refill Indicator: Window type.
6
7

8 **Grab Bar:**

9 Mounting: Flanges with concealed fasteners.
10 Material: Stainless steel, 0.05 inch thick.
11 Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
12 Outside Diameter: 1-1/2 inches.
13 Configuration and Length: As indicated on Drawings G103.
14

15 **Mirror Unit:**

16 Frame: Stainless steel channel.
17 Corners: Manufacturer's standard.
18 Size: As indicated on Drawings.
19 Hangers: Manufacturer's standard rigid, tamper and theft resistant.
20

21 **UNDERLAVATORY GUARDS**

22 **Underlavatory Guard:**

23 Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct
24 contact with and burns from piping; allow service access without removing coverings.
25 Material and Finish: Antimicrobial, molded plastic, white.
26

27 **PART 3 - EXECUTION**
28

29 **INSTALLATION**

30 Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to
31 substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored
32 in locations and at heights indicated.
33

34 Remove temporary labels and protective coatings.
35

36 Grab Bars: Install to comply with specified structural-performance requirements.
37

38 **END OF SECTION**

1 **SECTION 10 44 13**
2 **FIRE PROTECTION CABINETS**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section Includes: Fire-protection cabinets for portable fire extinguishers.

8
9 **ACTION SUBMITTALS**

10 Product Data: For each type of product.

11 Shop Drawings: For fire-protection cabinets.

12
13 **CLOSEOUT SUBMITTALS**

14 Maintenance data.

15
16 **COORDINATION**

17 Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated
18 are accommodated.

19
20 Coordinate sizes and locations of fire-protection cabinets with wall depths.

21
22 **PART 2 - PRODUCTS**

23
24 **PERFORMANCE REQUIREMENTS**

25 Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for
26 fire-resistance rating of walls where they are installed.

27
28 **FIRE-PROTECTION CABINET**

29 Fire-Protection Cabinet Type: Suitable for fire extinguisher.

30
31 Cabinet Construction: Nonrated.

32
33 Cabinet Material: Cold-rolled steel sheet.

34
35 Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall
36 surface, with exposed trim face and wall return at outer edge (backbend).

37
38 Rolled-Edge Trim: 2-1/2-inch backbend depth.

39
40 Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

41
42 Cabinet Trim Material: Steel sheet.

43
44 Door Material: Steel sheet.

45
46 Door Style: Fully glazed panel with frame.

47
48 Door Glazing: Clear float glass.

49
50 Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim
51 style, and door material and style indicated.

Accessories:

Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

Location: Applied to cabinet door.

Application Process: Decals.

Lettering Color: Red.

Materials:

Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

Finish: Baked enamel or powder coat.

Color: As selected by Architect from full range of industry colors and color densities.

Clear Float Glass: ASTM C1036, Type I, Class 1, Quality q3, 3 mm thick.

FABRICATION

Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

INSTALLATION OF FIRE-PROTECTION CABINETS

Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

Identification: Apply decals at locations indicated.

Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION

1 **SECTION 10 44 16**
2 **FIRE EXTINGUISHERS**

3
4 **PART 1 - GENERAL**

5
6 **SUMMARY**

7 Section includes: Portable, hand-carried fire extinguishers.

8
9 **ACTION SUBMITTALS**

10 Product Data: For each type of product.

11
12 **INFORMATIONAL SUBMITTALS**

13 Warranty: Sample of special warranty.

14
15 **CLOSEOUT SUBMITTALS**

16 Operation and maintenance data.

17
18 **COORDINATION**

19 Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

20
21 **WARRANTY**

22 Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire
23 extinguishers that fail in materials or workmanship within specified warranty period.

24
25 Warranty Period: Six years from date of Substantial Completion.

26
27 **PART 2 - PRODUCTS**

28
29 **PERFORMANCE REQUIREMENTS**

30 NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire
31 Extinguishers."

32
33 Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency
34 acceptable to authorities having jurisdiction.

35
36 **PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS**

37 Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

38
39 Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar
40 coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

41
42 Regular Dry-Chemical Type: UL-rated 4-A nominal capacity, with sodium bicarbonate-based dry chemical
43 in manufacturer's standard enameled container.

44
45 Multipurpose Dry-Chemical Type: UL-rated 4-A nominal capacity, with monoammonium phosphate-based
46 dry chemical in manufacturer's standard enameled container.

47
48 **PART 3 - EXECUTION**

49
50 **INSTALLATION**

51 Examine fire extinguishers for proper charging and tagging.

52
53 Remove and replace damaged, defective, or undercharged fire extinguishers.

54
55 **END OF SECTION**

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SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SCOPE

- A. Applicable provisions of Division 1 shall govern work under this section. The contractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on the drawings and/or herein specified, including all materials, equipment, and incidentals necessary to produce a complete and operating system.

1.02 INDEX

A. General

1. Scope
2. Index
3. System Description
4. Related Sections
5. Submittals

B. General Provisions

1. Codes and Standards
2. Permits
3. Drawings, Coordination, Existing Conditions
4. Materials
5. Substitution
6. Execution
7. Sleeves and Inserts
8. Mounting Pads
9. Escutcheons
10. Horizontal Sanitary Lines
11. Traps
12. Safing
13. Penetrations of Fire Resistive Assemblies
14. Requirements for Substantial Completion
15. Tests and Adjustments
16. Certification of Tests and Adjustments - Plumbing
17. Guarantee

1.03 SYSTEM DESCRIPTION

- A. Demolition. Disconnect existing fixtures and related piping as indicated on documents. Remove all unnecessary piping above ceiling and below floor as necessary to complete new work.
- B. Provide and install fixtures, specialties, equipment, and all related piping as shown on floor plans, scheduled, and/or specified for a complete working system.
- C. Provide and install all necessary sanitary waste, vent, water piping, and gas piping as shown on floor plans, scheduled, and/or specified for a complete working system.
- D. Provide and install electric water heater as shown on floor plans, scheduled, and/or specified. Coordinate power with Electrical Contractor.
- E. Provide and install thermal expansion tank at water heater/storage tanks as shown on plans, scheduled, and/or specified. Provide check valve in cold water supply piping to fixture.
- F. Furnish and install hot return piping system with return pump, check valve, expansion tank thermometer and balancing valves as shown on floor plans, scheduled, and/or specified. Coordinate power with Electrical Contractor.
- G. Plumbing Contractor to furnish and install LP gas piping from vaporizer unit location, which is supplied by LP gas supplier to all equipment, new and existing requiring gas to operate as shown on floor plans, scheduled, and/or specified for a complete system. Provide regulators with vent limiters or vent to outside atmosphere if required. LP tanks and vaporizer and first stage regulators and valves at tanks supplied and installed by LP gas supplier.
- H. Refer to architectural plans and specifications for project construction phasing.
- I. See specification front end and plans for Alternate Bid work.

1.04 RELATED SECTIONS

- A. Applicable provisions of Division 1 govern work under this section.
 - 1. Division 3 - Concrete.
 - 2. Division 6 - Rough Carpentry.
 - 3. Division 21 - Fire Suppression.
 - 4. Division 23 - Mechanical.
 - 5. Division 26 - Electrical.
 - 6. Division 31 - Earthwork.
 - 7. Division 33 - Utilities.
- B. This section applies to all Division 22 00 00 Sections of Plumbing.

1.05 SUBMITTALS

- A. The Plumbing Contractor shall review all shop drawings and mark each item with their approval before submitting them to Architect/Engineer.
- B. The Plumbing Contractor shall provide shop drawings for review in accordance with the requirements of the General Conditions.
- C. Shop drawings shall contain complete dimensional, operational, material quality and manufacturer information on all fixtures, specialty, and equipment items. Drawings shall also include title sheet with plumbing contractor's and supplier's name, address, phone number, and email address.
- D. Shop drawings shall have each piece of equipment, fixture, and specialty items identified in correlation with drawings and specifications, all accessories shall be checked or identified as being provided, index sheets alone are not acceptable. Shop drawings shall be submitted electronically in pdf format, or in booklet form. Each fixture, specialty, and equipment along with accessories are grouped together. Failure to do so, will result in shop drawings being returned to the sender marked "Incomplete" or "Revise and Resubmit."
- E. The Plumbing Contractor shall be responsible for transmitting copies of the reviewed shop drawings to all affected trades, such as the Electrical Contractor for wiring connections, Heating Contractor for piping connections and General Contractor for supports, drains and equipment bases, etc. If submitting in booklet form, provide sufficient copies for all trades listed above along with contractors' own needs and a copy to be retained by Architect and Engineer.
- F. Shop drawings are required on the following items:
 - 1. Fixtures and Trim
 - 2. Drains and Cleanouts
 - 3. Gas and Electric Water Heater
 - 4. Expansion Tank
 - 5. Domestic Water Circulation Pump
 - 6. Thermometers and Pressure Gauges
 - 7. Backflow Preventers
 - 8. Valves
 - 9. Pipe Insulation
 - 10. LP Piping

PART 2 GENERAL PROVISIONS

2.01 CODES AND STANDARDS

- A. All work specified in this section and applicable provisions of Division 1 shall conform to all applicable codes and to the standards for materials and workmanship of the nationally recognized approval agencies and trade associations such as the American Society of Mechanical Engineers, the American Society for Testing and Materials, The American Standards Association, National Fire Protection Association.
- B. Comply with requirements of Wisconsin Administrative Code.
- C. Standards. Abbreviations of standards organizations referenced in this, and other sections are as follows:
 - 1. ABMA - American Boiler Manufacturers' Association
 - 2. ACPA - American Concrete Pipe Association
 - 3. AGA - American Gas Association
 - 4. AMCA - Air Movement and Control Association
 - 5. ANSI - American National Standards Institute
 - 6. ARI - Air Conditioning and Refrigeration Institute
 - 7. ASME - American Society of Mechanical Engineers
 - 8. ASPE - American society of Plumbing Engineers
 - 9. ASSE - American Society of Sanitary Engineering
 - 10. ASTM - American Society for Testing and Materials
 - 11. AWWA - American Water Works Association
 - 12. AWS - American Welding Society
 - 13. CISPI - Cast Iron Soil Pipe Institute
 - 14. CGA - Compressed Gas Association
 - 15. CS - Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
 - 16. EPA - Environmental Protection Agency
 - 17. FS - Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
 - 18. GAMA - Gas Appliance Manufacturers Association
 - 19. IAPMO - International Association of Plumbing & Mechanical Officials
 - 20. IEEE - Institute of Electrical and Electronics Engineers
 - 21. ISA - Instrument Society of America
 - 22. MCA - Mechanical Contractors Association
 - 23. MICA - Midwest Insulation Contractors Association
 - 24. MSS - Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
 - 25. NBS - National Bureau of Standards
 - 26. NEC - National Electric Code
 - 27. NEMA - National Electrical Manufacturers Association
 - 28. NFPA - National Fire Protection Association
 - 29. NSF - National Sanitation Foundation
 - 30. PDI - Plumbing and Drainage Institute
 - 31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association. Inc.
 - 32. STI - Steel Tank Institute
 - 33. UL - Underwriters Laboratories Inc.

D. Standards referenced in this section:

1. ACI 614 - Recommended Practice for Measuring, Mixing and Placing of Concrete
2. ASTM D1557 - Standard Test Method for Moisture-Density Relations of Soils
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
5. D.O.T. - Standard Specifications for Road and Bridge Construction, State of Wisconsin, Dept. of Transportation
6. UL1479 - Fire Tests of Through-Penetration Firestops
7. UL723 - Surface Burning Characteristics of Building Materials

2.02 PERMITS

- A. All permits and fees required by regulatory agencies or utilities for plumbing work shall be secured and paid for by the Plumbing Contractor.

2.03 DRAWINGS, COORDINATION, EXISTING CONDITIONS

- A. Plans of piping and fixtures shown on scale drawings are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction and approximate general arrangement of one phase of work to another, but not to the exact detail or arrangement of construction. Plans are based on equipment scheduled. Plumbing Contractor shall be responsible for changes resulting from equipment other than scheduled.
- B. If it is found before installation, that a more convenient, suitable or workable arrangement for any or all phases of the project would result by varying or altering the arrangement indicated on the drawings, the Plumbing Contractor may change the location or arrangement of their work without additional cost to the owner but only after obtaining a written approval by the Architect/Engineer.
- C. Mechanical systems are shown on drawings that were closely coordinated with the Architectural drawings; however, minor variations may occur. Plumbing Contractor shall verify dimensions, heights, door swings, window locations, and any other information critical to the placement of devices, with the architectural drawings to ensure proper installation. Field measurements shall take precedence over drawing dimensions and shall be verified. Plans shall not be scaled to locate equipment.
- D. All piping installations shall closely match the drawings as approved by the Department of Safety and Professional Services. Any variation from or additions to the piping arrangement will require revision or be resubmitted to the Department of Safety and Professional Services at the Plumbing Contractor's expense.

- E. It shall be the contractor's responsibility to visit the existing project site, become acquainted with all existing conditions, and ascertain the extent of work involved. The contractor shall provide all labor, materials, etc., required for the complete, new installation required for the completion of the project. By submitting a price; or in the case of time and material project, begin work, the contractor shall be deemed to have performed such an examination, to have accepted such conditions, and to have made allowances therefore preparing their price and resolving questions regarding work required.
- F. The contractor installing material and equipment shall coordinate the installation with all other trades prior to installation. Additional project cost is not justified due to lack of coordination or due to material fabrication without field measurements. Any coordination problems shall be brought to the attention of the engineer before installation or fabrication. Any work installed that is not coordinated and that interferes with other contractors' work shall be removed or relocated at installing contractor's expense.
- G. All project conditions shall be verified prior to performing any work. All accessible elevations and inverts shall be immediately verified. Hidden or inaccessible elevations or inverts important to the installation of plumbing systems shall be investigated after obtaining approval from the owner to excavate or demolish surfaces or structure required for such investigation, but prior to performing any related work. Promptly report findings to the engineer who shall assist the contractor in determining if revisions, if any, are required to the scope of the contractor's work.
- H. It is the Plumbing Contractor's responsibility to become acquainted with fixtures/equipment installation manuals before proceeding with the installation of that fixture/equipment. Any variation from drawing conditions and manufacturer's installation instructions shall be reported to the engineer before installing equipment.

2.04 MATERIALS

- A. Each major component of the equipment shall have the manufacturer's name, address, catalog, and serial number permanently attached in a conspicuous place.
- B. The same brand or manufacturer shall be used for each specific application of fixtures, pumps, valves, fittings, controls, and other equipment.
- C. All materials shall be new and of the quality specified and meet approval as per SPS 384.10 (2).
- D. All products must be lead free as required by the lead-free law "Federal Safe Drinking Water Act."
- E. All equipment shall be listed, approved, or rated by a nationally recognized testing and rating bureau or the recognized manufacturers association responsible for setting industry standards. All electrical equipment and apparatus shall be U.L. listed. Examples of recognized associations are:
 - 1. American Gas Association
 - 3. American Pipe Fitting Institute
 - 4. American Water Works Association
 - 5. Plastic Pipe Institute
 - 6. Thermal Insulation Manufacturers Association

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

2.05 SUBSTITUTIONS

- A. It is the intent of this specification to permit the use of the materials of any nationally recognized manufacturer so long as they are fully equal to the quality and performance of the named item in the opinion of the engineer. Materials or equipment of other manufacturers may be used under the following conditions:
1. The proposed substitute is equal in design, materials, construction, and performance in the opinion of the engineer. No compromise in quality level will be allowed.
 2. The service capabilities, availability of service parts and stability of the manufacturer are adequate in the opinion of the engineer.
 3. The Plumbing Contractor assumes responsibility for any modifications required for the installation of substitute equipment and for the accommodation of such substitution by work of other contractors. Any additional expense on the part of other contractors or to the owner due to substitution of equipment shall be borne by the Plumbing Contractor making such substitution.
 4. Substitute equipment/products shall fit into the space provided with adequate provisions for service and maintenance and must meet product approval as per SPS 384.10 (2). Any substitute equipment that causes variation of or deviation from original piping arrangement may require a revision to be submitted to the Department of Safety and Professional Services at the Plumbing Contractor's expense.
- B. The Plumbing Contractor may submit catalog data on material proposed for substitution to the engineer for evaluation up to 10 days prior to the date for opening bids. The engineer will render an opinion on whether the material can be bid as a substitute based on the information received. Final approval for the use of substitute equipment will not be given until complete shop drawings, samples or other information deemed necessary by the engineer has been submitted.
- C. Where several manufacturers' names are specified for a given item the product of these manufacturers will only be accepted. Requests for substitutions will not be granted. Materials by the first manufacturer named are used in design and scheduled. Materials by the other name manufacturers shall be of equal quality, capacity, design, and function and shall be adaptable into the system without alteration to the system.

2.06 EXECUTION

- A. Workmanship. All work shall be done by qualified licensed plumbers that are knowledgeable and experienced in the operations they are performing. Fabrications and installation methods, procedures and materials shall be in accordance with accepted industry practice and with the standard of manufacturing and contracting associations applicable to the work. All work shall be neatly done with special emphasis on the appearance of work exposed to view. All piping shall be run plumb and square unless otherwise required for a functional reason. Gradients of pitched lines shall be continuous.
- B. Painting. Furnish all equipment completely finished unless specifically noted otherwise. Touch up all abrasions, nicks, scratches, or other paint defects to restore equipment to its original condition. Severely marred equipment shall be factory refinished if so desired by Architect/Engineer. All surfaces shall be clean, rust free, and suitable for painting, on all piping and equipment furnished which are to be painted. All roof and/or wall piping penetrations that are visible shall be primed and painted. All painting of plumbing related items is responsibility of Plumbing Contractor, who may use project Painting Contractor as their subcontractor for this work. Coordinate color with Architect.
- C. Excavation and Backfill
 - 1. The Plumbing Contractor shall perform all excavation required for related underground piping inside building and for all exterior underground piping. Include all necessary clearing of excavated area, and all trenching, tunneling, sheet piling, shoring, underpinning, pumping, bailing, transportation of earth, fill and backfilling.
 - 2. Reference is made to the Working Drawings for subsurface soil data, contours, site conditions, etc.
 - 3. Excavate whatever material is encountered to depth required. Excavation shall extend one foot out from each side of pipe. Bottom of trench or excavation shall be level and solidly compacted to assure firm foundation.
 - 4. All excavated materials shall be removed from site or deposited as directed by the General Construction Contractor.
 - 5. Protect excavation from caving or washing and erect necessary barricades, complying with regulations set forth in General Orders on "Safety in Construction" and Tunneling, Caisson and Trench Construction", issued by the State Department of Safety and Professional Services or other governing authority.
 - 6. Lay all piping in open trenches unless Architect/Engineer gives written approval for tunneling.

7. Trenches:
 - a. Trenches for sewers and water shall have a minimum of 8ft of space between each service.
 - b. Water and sewer lines may be laid in the same trench as per SPS 382.40 (8) (b).
 - c. Gas lines shall always be placed in separate trenches.
 - d. All underground piping shall be supported on a bedding of sand or granular material at least 4" thick.
 8. Backfill with sand to one foot above top of piping and thoroughly compacted with earth free of cinders, stones, and debris. Remove forms, shoring, etc., as backfill is placed. All backfilling under footings must be compacted within 8ft of all footings.
 9. When running a pipe below a footing and parallel to it, same shall in all cases be at least one foot greater in distance away from footing than below its bottom. Where possible, run lines at center point between two parallel footings and maintain above-mentioned distances at minimum. When running under a footing, disturb as little of the soil under footing as possible. Provide concrete fill under all footings where excavations wider than 18" are required.
 10. Backfilling shall not be placed until the work has been inspected, tested and approved.
 11. Concrete, asphalt or gravel paved areas, sidewalks, curbs, gutters, and lawn areas which are disturbed shall be replaced and restored to original condition by Plumbing Contractor unless specifically stated to the contrary.
- D. Cutting and Patching. Skilled tradesmen shall be employed to do cutting and patching. Each Contractor shall be responsible for cutting and patching new openings for their use, in existing or previously constructed walls, ceilings, floors, roofs, etc., unless otherwise designated. Provide personnel protection under coring operations in occupied areas. Submit methods of supporting and sealing floor sleeves for approval. Holes cut in roof and exterior wall shall be weatherproofed immediately. Provide temporary dust barriers for cutting operations in occupied spaces. Refer to Architectural drawings for lintels provided by General Contractor. When lintels are not indicated in other divisions of the work, they shall be provided by the contractor requiring the opening. All piping penetrations through masonry structure shall be drilled or core drilled. All penetrations for access panels, etc. shall be saw-cut before removal. Jack hammering without saw cutting is prohibited.
- E. Access. All plumbing fixtures and/or equipment shall be located so that parts requiring service and/or adjustment, fixture traps and valves shall be readily accessible. Provide access doors or panels to make service convenient. Doors by Acudor, Milcor or as per architectural specifications. Provide by Plumbing Contractor unless designated otherwise.

- F. Plumbing piping and equipment located between finish floor and 7'-6" shall have a resilient material (foam rubber, etc.) attached to all potentially dangerous edges.
- G. Blocking. Plumbing Contractor is responsible for any additional blocking materials required for the attachment or suspending of plumbing related piping, components, fixtures, and equipment related to plumbing work. Reference Division 06 - Rough Carpentry.

2.07 SLEEVES AND INSERTS

- A. At all fire rated penetrations only use UL listed, tested, and approved materials and methods that meet Department of Safety and Professional Services Plumbing Approval. (Division 07 - Fire stopping.)
- B. All pipes passing through masonry walls, floors, ceilings, or partitions shall be provided with sleeves having internal diameters at least 1/4" greater than the outside diameter of un-insulated pipes and/or outside diameter of the insulation of insulated piping. Sleeves for pipes passing through fire rated floor slabs and fire rated walls shall be schedule 40 steel pipes extending 1" above the finished slab and sealed. If holes must be cut through finished construction, they must be core drilled to avoid damage to construction. Exterior wall sleeves shall be caulked weathertight. Sleeves through equipment room also shall be filled with glass fiber insulation. Where chases are formed for passage of several pipes, they shall have a 1" high curb above finished slab and sealed. Whenever sleeves occur as penetrations of rated construction, the void space shall be sealed with U.L. rated sealant similar to Bio Fireshield Firestop Products; Chase Foam, CTC PR855; 3M Fire Barrier Caulk CP25 and putty 303; Dow Corning Fire Stop 2000 or Specified Technologies, Inc. Spec Seal Firestop Products installed in strict accordance with the manufacturer's instructions. Use sealant thickness as required to provide the full fire protection rating of the structure. Insulation shall not pass through rated assemblies. Insulation shall be tight against the rated assembly after the sealant is installed and inspected. Refer to section SPS 351.049 (1)(3) of the Wisconsin Building Heating, Ventilating and Air Conditioning Code.
- C. Inserts in floor slabs shall be galvanized individual type with accommodation for removable nuts and threaded rods up to 3/4" diameter, permitting lateral adjustment. Any fastener in a beam shall be midway above the bottom of the beam.
- D. Piping that passes through outside walls below grade and above grade shall be permanently sealed with watertight rubber compression seal between the pipe and the sleeve equal to Link-Seal modular wall and casing seal as manufacturer by Thunderline Corporation. The pipe sleeve and seal must meet UL listed, tested, and approved materials and methods that meet Department of Safety and Professional Services Plumbing Approval.
- E. Sleeves through equipment room walls shall be filled with pre-compressed, self-expanding, polyurethane acoustic foam equal to Illbruck insulation.

2.08 MOUNTING PADS

- A. Floor mounted plumbing equipment shall be set on reinforced concrete pads 4" high and extending 4" beyond the equipment base on all sides. Mounting pads to be installed by the General Contractor unless otherwise specified. See drawings for specific requirements. Plumbing Contractor shall coordinate size and location with General Contractor.

2.09 ESCUTCHEONS

- A. Escutcheons shall be installed on all exposed pipes wherever they pass through floors, ceilings, walls, or partitions.
- B. Escutcheons for pipes passing through floors in unfinished areas shall be split hinged type designed to fit the pipe and to cover the projecting pipe sleeve. Escutcheons for pipes exposed to view in finished areas shall be chrome-plated brass.
- C. Escutcheons shall be properly sized to fit snugly around the pipe and shall be sized to completely cover the wall or floor opening.

2.10 HORIZONTAL SANITARY PIPING

- A. Lines shall pitch down a minimum of 1/8" per foot in the direction of flow, or as indicated on the drawings. Soil and waste branch piping shall pitch down 1/4" per foot. All vent piping shall drip back into waste piping. Stacks shall be run vertically. Changes of direction 45° or more from vertical to horizontal shall be made with long sweep elbows. Horizontal changes in direction shall be made with "Y" or "Y" and 1/8 bend combination fitting.

2.11 TRAPS

- A. Every fixture and floor drain shall be provided with a proper trap placed near the outlet and properly vented. Traps shall be cast iron hub and spigot when used in soil pipe or no hub with approved stainless-steel couplings. Traps for threaded pipes shall be screwed drainage pattern cast iron "P" traps. Where approved, PVC traps with adjustable compression fittings may be used. All exposed traps for sinks, lavatories and similar fixtures shall be chrome plated "P" traps, or as specified with the fixture trim. All traps shall have a minimum seal of 2".

2.12 SAFING

- A. Provide and install floor drains where shown and size indicated on the drawings of the type listed below. Floor drains shall be set level and at the proper elevation to drain the surrounding floor area. All floor drains set in floors above habitable space shall be equipped with 4# per square foot sheet lead safing or approved vinyl type extending a minimum of 18" beyond rim of floor drain in all directions. Based on product by Zurn.
- B. Where it is impossible to use safing - use a Portland cement type of latex patching compound to seal between floor and drain body. The patching compound to be equal to the following manufacturers and material shall meet SPS Product Approval Requirements:
 - 1. Ventonite, Inc. - Atlanta, Georgia.
 - 2. ACD Pourable Underlayment, International, Inc. - Pittsburgh, PA
 - 3. Ardex V-800, Levelcrete by Ardex, Inc. - Pittsburgh, PA
 - 4. Latex Cement by Master Builders/Martin Marretta - Cleveland, OH

2.13 PENETRATIONS OF FIRE RESISTIVE ASSEMBLIES

- A. Plumbing piping systems that penetrate fire-rated assemblies shall be installed in accordance with SPS 351.049 or current acceptable methods. Also refer to requirements for sleeves.
- B. SPS 351.049 Miscellaneous Openings in Fire-rated Construction.
 - 1. Service Openings. Openings around plumbing pipes, sleeves, conduit or other service installations penetrating required fire-resistive rated floor, wall and roof assemblies shall be protected by an approved penetration fire stop system installed as tested in accordance with ASTM E814 and shall have F rating of not less than the required fire resistance rating of the construction assembly. The system shall be tested and listed for the specific application regarding the size of the opening, the size and type of the penetrating objects and the type of assembly penetrated, and the size of the annular space to be fire stopped.
 - 2. Plastic Piping and Electrical System Components. Penetration of required fire-resistive rated floor, wall, ceiling and roof assemblies by plastic piping and electrical system components shall be in accordance with one of the following:
 - a. A device or system tested and listed by an approved testing laboratory.
 - b. For plastic piping, conduits, or raceways, substitute a steel or cast-iron pipe or conduit in the penetration of the fire-rated assembly to a distance of at least 10ft beyond both faces of the assembly.
 - 3. Plumbing contractor shall verify all fire rated areas, walls, and floors on architectural plans and with general contractor.

2.14 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

A. Cleaning Equipment and Premises

1. Thoroughly clean all parts of the piping, valves, and fixtures. Exposed parts which are to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease spots removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.
2. Remove all construction debris, excess materials, and equipment.
3. Caulk around all plumbing fixtures at walls and around base of water closets, service sinks, etc.

B. Operating and Maintenance Manuals

1. The Plumbing Contractor shall furnish to the Engineer two operating manuals of furnished plumbing equipment. Information sheets shall be bound in standard 3-ring binders labeled to show the contractor's name, address, regular business phone number, emergency phone number, email address, and date. Operating manuals shall be submitted prior to completion of the work to allow time for review.
2. The manual shall contain the following information:
 - a. Provide a warranty letter on the plumbing contractor's letterhead stating that, *"All material and workmanship shall be guaranteed for a period of one year after substantial completion."*
 - b. The Certification of Tests and Adjustments completed and signed.
 - c. Completed and signed plumbing punch lists.
 - d. A list (keyed with identification numbers used) of each item of equipment, which requires service, giving the name of the item, model number, manufacturer's name and address and the name address and phone number of the nearest representative or authorized service organization.
 - e. A copy of the stamped reviewed shop drawings for each fixture, equipment and plumbing specialties installed.
 - f. Provide installation and service manuals for all plumbing specialties, equipment, and fixtures, with all model numbers and options highlighted.
 - g. A complete operating and maintenance manual with parts listed, wiring diagrams, lubrication requirements, and service instructions for each major item including faucet and mixing valve repair.

- h. Complete control diagrams with description of all operating sequences and control devices.
- i. Properly executed and registered manufacturers' warranties for all products installed.
- j. A copy of valve chart.
- k. Provide a signed letter by plumbing contractor and owner maintenance staff on contractor's letter head stating completion of a minimum of two hours training on operating and maintenance of major equipment.
- l. Provide a signed letter by plumbing contractor and owner maintenance staff on contractor's letter head stating completion of training on the proper methods of winterizing a seasonal building.
- m. Provide Record Drawings: Accurately record locations of field changes on a set of drawings and deliver to Architect/Engineer upon substantial completion. State approved plumbing plans are not to be used for Record Drawings!

2.15 TESTS AND ADJUSTMENTS

- A. The Plumbing Contractor shall conduct tests of systems as required by codes, regulatory agencies, and this specification. Tests shall be made with the medium and under pressure as stated in the test requirements. Notify the Engineer and/or regulatory agencies prior to conducting tests. The Plumbing Contractor shall complete the attached certification form and submit it to the Engineer when tests have been completed and include in O&M Manuals.
- B. Testing Requirements:
 - 1. Building sanitary piping system.
 - a. Water test – Minimum of 10-foot head on each joint for a minimum of 15 minutes with no head loss.
 - b. Air test – Uniform gauge pressure of 3 psig for a minimum of 15 minutes without adding air.
 - 2. Water Service and Building Distribution Piping.
 - a. Water test – 100 psi gauge pressure for a two-hour period.
 - 3. Propane Gas Piping.
 - a. Air test – Maintain 25 psi for a two-hour period.

4. The pressure in pounds per square inch, or inches of vacuum, gauge, are given as an initial pressure to be applied to lines being tested, together with test medium. Tests are to be applied for a minimum period of four (4) hours and until tests are complete. Final pressures at the end of test period may vary only by that caused by expansion of the test medium due to temperature changes.
5. Check of systems during application of test pressures should include visual check for water medium leakage, soap bubble or similar for air and nitrogen medium.
6. Start-Up of Piping Systems. Potable water system shall be cleaned and disinfected in accordance with state and local codes or in the absence of such codes shall be treated by accepted methods to provide a system free of harmful contaminants and acceptance to regulatory agencies. All lines shall be thoroughly flushed to remove dirt and construction debris. See SPS 382.40(8) (I).

2.16 CERTIFICATION OF TESTS AND ADJUSTMENTS - PLUMBING

- A. Project Name: _____
- B. Project Number: _____
- C. Plumbing Contractor Name: _____

The Plumbing Contractor named above certifies that the tests and adjustments indicated below have been completed in accordance with the specifications on the date indicated. Also include attachments of all test reports.

TESTS	DATE
D. Building Sanitary Sewers, Branches, Drains, Stacks and Vent Piping.	_____
E. Building Water Distribution Piping.	_____
F. Propane Fuel Gas Piping.	_____
G. Flushing and Disinfection of Potable Water System.	_____
H. Start-up of Piping System and Pumps.	_____
I. Start-up of Domestic Water Circulation Pump and Balancing of Hot Water Return Piping System.	_____

Contract _____

Signed By Plumbing Contractor _____

Date _____

Signed By Project Manager _____

Date _____

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

2.17 GUARANTEE

- A. All material and workmanship shall be guaranteed for a period of one year after substantial completion. Where warranties are required, they shall be provided by the manufacturer or contractor as specified.

END OF SECTION

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SECTION 22 05 19

METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges.
- B. Thermometers.

1.02 RELATED SECTIONS

- A. Section 22 05 00 - Common Work Results for Plumbing.
- B. Section 22 10 05 - Plumbing Piping.

1.03 REFERENCES

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.
- B. ASTM E 1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2005.
- C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 1998 (Reapproved 2003).

1.04 SUBMITTALS

- A. See Section 22 05 00 - Submittals.
- B. Product Data: Provide list that indicates use, operating range, total range, and location for manufactured components.

1.05 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

1.06 EXTRA MATERIALS

- A. See Section 01 60 00 - Product Requirements. for additional provisions.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

- A. Manufacturers:
 - 1. H.O. Trerice Co.: www.trerice.com.
 - 2. WIKA Instrument Corp.: www.wika.com.
 - 3. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 4. Moeller Instrument Co., Inc: www.moellerinstrument.com.
 - 5. Omega Engineering, Inc: www.omega.com.
 - 6. Winters Instruments: www.wekslerglass.com.
 - 7. Substitutions: See Section 22 05 00 - Substitutions.
- B. Pressure Gauges: ASME B40.100, drawn steel case, phosphor bronze bourdon tube, rotary brass movement with 1% - 2% accuracy, 1/4" brass socket, 2-1/2" diameter case with black PSI scale on white background.
 - 1. Trerice 800B
 - 2. WIKA 11.10.
 - 3. Winters PEM214

2.02 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. H.O. Trerice Co.: www.trerice.com.
 - 2. WIKA Instrument Corp.: www.wika.com.
 - 3. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 4. Omega Engineering, Inc: www.omega.com.
 - 5. Weksler Glass Thermometer Corp: www.wekslerglass.com.
 - 6. Winters Instrumente: www.wekslerglass.com.
 - 7. Substitutions: See Section 22 05 00 - Substitutions.
- B. Thermometers - Adjustable Angle: 9" scale, black Fahrenheit scale on white background with blue or red - appearing non-toxic liquid with 2% accuracy per ASTM E 77, in clear glass or acrylic; ASTM E 1; lens front tube, cast aluminum case with epoxy finish, 3-1/2" aluminum stem, cast aluminum adjustable joint with positive locking device; adjustable 360° in horizontal plane, 180° in vertical plane.
 - 1. Trerice BX9-1403-06-SPB.
 - 2. WIKA TI.901
 - 3. Winters TIM104A

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide one pressure gauge at the water service meter.
- C. Provide one pressure gauge down stream of pressure reducing valve.

- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2" for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45° off vertical.
- G. Adjust gauges and thermometers to final angle, clean windows, and lenses, and calibrate to zero.

3.02 SCHEDULES

- A. Pressure Gauges, Location and Scale Range:
 - 1. Water service meter, 0 to 150 psi.
 - 2. Expansion tanks, 0 to 100 psi.
 - 3. Pressure reducing valves, 0 to 100 psi.
- B. Stem Type Thermometers, Location and Scale Range:
 - 1. Water heaters hot outlet, 30° to 180° F.
 - 2. Hot water return pumps, 30° to 180° F.

END OF SECTION

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SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

1.02 RELATED SECTIONS

- A. Section 09 90 00 - Painting and Coating: Identification painting.

1.03 REFERENCES

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.04 SUBMITTALS

- A. See Section 22 05 00 - Submittals.
- B. List: Submit list of wording, symbols, letter size, and color-coding for plumbing identification.
- C. Product Data: Provide manufacturer's catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Brady Inc: www.bradyid.com.
- B. Brimar Inc: www.brimar.com.
- C. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
- D. Marking Services, Inc.: www.markerv.com.
- E. Seton Identification Products: www.seton.com/aec.
- F. Substitutions: See Section 22 05 00 Substitutions.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/2".
 - 3. Background Color: Black.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2" diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2" diameter with smooth edges.
- C. Chart: Typewritten letter size list in anodized aluminum frame.
- D. Chart: Copy of valve chart included in O&M manuals.

2.04 PIPE MARKERS

- A. Comply with ASME A13.1. and ASME Pipe Marker Guidelines for proper identification including, but not limited to, letter heights, marker size, color, wording legend, flow direction arrows, and proper placement.
- B. Snap-on Plastic Pipe Markers: Factory fabricated, flexible, cylindrical self-coiling semi-rigid plastic, pre-formed to fit around pipe or pipe covering held tightly in place without the use of adhesive, tape, or straps; information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6" wide by 4 mil thick, manufactured for direct burial service.

2.05 CEILING TACKS

- A. Description: Steel pushpin with color-coded head.
- B. Color code as follows:
 - 1. Green - Plumbing valves
 - 2. Silver - Plumbing equipment
 - 3. Yellow - HVAC equipment
 - 4. Red - Fire dampers/smoke dampers
 - 5. Blue - Heating/cooling valves

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners in lieu of adhesive whenever possible. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain and/or S-hook.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6" to 8" below finished grade, directly above buried pipe.
- F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify thermostats relating to terminal boxes or valves with nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Valve tags shall state valve number, valve location, and describe valve function.
- K. Tag automatic controls, instruments, and relays. Key to control schematic.
- L. Identify piping, concealed, or exposed, with pipe markers. Identify service, flow direction, and, if required, pressure. Install in clear view and align with axis of piping. Locate identification in each room, or open area, not to exceed 20ft on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Installation of pipe identification shall be after piping is clean or required painting is performed, and before installation of finish ceiling.
- M. Domestic hot water with a hot water return system shall be marked with directional arrows to indicate flow.
- N. Label Gas Piping Systems with gas type and gas pressure.
- O. Abandoned Piping: Provide Snap-On pipe markers for abandoned piping. Marker to be white with black lettering and include a black border. If abandoned piping is pressurized, or contains hazardous materials, the legend should indicate such.
- P. Valve tag chart shall be mounted in mechanical room in a place as directed by Architect.
- Q. Provide ceiling tacks to locate valves and plumbing equipment above T-bar type panel ceilings. Locate in corner of panel closest to valves and equipment.

- R. Coordinate with owner on use and location of ceiling tacks.
- S. Coordinate equipment and piping labels, and valve tag types with existing piping identifications. Valve tags shall be coordinated with existing tag numbers, and the numbering shall be of continuation.

3.03 SCHEDULES

- A. Identification Symbols:
 - 1. Condensate drain
 - 2. Domestic Cold Water
 - 3. Domestic Hard Cold Water
 - 4. Domestic Hot Water
 - 5. Domestic Hot Water Recirculation
 - 6. Sanitary Sewer
 - 7. Sanitary Vent
 - 8. Propane Gas, with Pressure.
 - 9. Abandoned Piping

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 RELATED SECTIONS

- A. Section 07 84 00 - Firestopping.
- B. Section 09 90 00 - Painting and Coating: Painting insulation jacket.
- C. Section 22 05 00 - Common Work Results for Plumbing
- D. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCES

- A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.
- B. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2000.
- C. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2000.
- D. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.
- E. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2007.
- F. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2005.
- G. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2006.
- H. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation; 2003.
- I. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2006.
- J. ASTM C 585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 1990 (Reapproved 2004).

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- K. ASTM C 591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2005.
- L. ASTM C 610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2005.
- M. ASTM C 795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2003.
- N. ASTM D 1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2000.
- O. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2006.
- P. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2007.
- Q. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.
- R. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- S. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

1.04 SUBMITTALS

- A. See Section 22 05 00 - Submittals.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of documented experience.
- C. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Project Engineer.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.
- B. General Requirements. The work covered by this specification consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of all insulation for the plumbing piping systems in strict accordance with the insulation for the plumbing piping systems in strict accordance with the insulation section of this specification and applicable drawings, subject to the terms and conditions of the contract. All insulation shall be installed in a skillful manner by skilled workers regularly engaged in this type of work.
 - 1. All insulation shall have composite (insulation, jacket, or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E84, NFPA 255, and UL 723 not exceeding: Flame spread 25; Smoke developed 50; fuel contributed 50; UL fire hazard classification 1. Accessories, such as adhesives, plastics, cements, taps or glass fabric for fittings shall be the same component ratings as listed above.
 - 2. Insulation thickness specified herein is based on a conductivity of .22 BTU/SQ.Ft>/Deg. F/HR. at 75° F. mean temperature. If insulating materials with substantially different thermal properties are used the thickness of insulation shall be adjusted to provide the overall insulating efficiency of the material specified.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. Knauf Fiber Glass: www.knaufusa.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation: www.certainteed.com.
 - 5. Substitutions: See Section 22 05 00 Substitutions.
- B. Insulation: ASTM C 547; rigid molded, noncombustible.
 - 1. 'K' value: ASTM C 177, 0.24 at 75° F.
 - 2. Maximum service temperature: 850° F.
 - 3. Maximum moisture absorption: 0.2% by volume.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- C. Insulation: ASTM C 547; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. 'K' value: ASTM C 177, 0.24 at 75° F.
 - 2. Maximum service temperature: 650° F.
 - 3. Maximum moisture absorption: 0.2% by volume.
 - 4. Preformed pipe insulation shall be two-piece or one-piece fiberglass composite with vinyl coated embossed vapor barrier laminate and pressure sealing lap. The insulation systems shall be suitable for piping operating between 50°F to 450°F. The insulation system shall be vermin-proof, rot-free, non-shrinking with a moisture absorption not exceeding .2% by volume after 96 hours at 120°F and 95% RH. Jacket permanence shall not exceed .2% perms and shall have a Beach puncture rating of at least 50 units.
 - 5. Fittings, valve bodies, and flanges for pipe sizes 6" and smaller shall be finished with fiberglass inserts and PVC fitting covers. One (1) insert to be used for pipe insulation of 1" thickness. An additional insert to be used for each additional 1" or fraction thereof for pipe insulation above 1" thickness.
- D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96/E 96M of 0.02 perm-inches.
- E. Tie Wire: 0.048" stainless steel with twisted ends on maximum 12" centers.
- F. Vapor Barrier Lap Adhesive:
 - 1. Compatible with insulation.
- G. Fibrous Glass Fabric:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Blanket: 1.0 lb/cu ft density.
 - 3. Weave: 5x5.
- H. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 - 1. Armacell International: www.armacell.com.
 - 2. Aeroflex: www.aeroflexusa.com.
 - 3. Substitutions: See Section 22 05 00 Substitutions.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: -40° F.
 - 2. Maximum Service Temperature: 220° F.
 - 3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETS

- A. PVC Plastic.
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com.
 - b. Sproule Mfg. Co.: www.sroule-mfg.com.
 - c. Substitutions: See Section 22 05 00 Substitutions.
 - 2. Jacket: One-piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0° F.
 - b. Maximum Service Temperature: 150° F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96/E 96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
 - 3. Covering Adhesive Mastic:
 - a. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140° F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC covers.
- H. Inserts and Shields:
1. Application: Piping 1" diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hangers, rolls, and inserts.
 3. Insert location: Between support shield and piping and under the finish jacket.
 4. Insert configuration: Minimum 6" long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10ft above finished floor): Finish with PVC jacket covers.
- K. Insulation on all cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchor, etc. that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.
- L. All insulation shall be continuous through walls and ceiling openings and sleeves where applicable.
- M. Make adequate provisions for expansion of piping. Unions to be left uncovered and clean. Finished surfaces of insulation are to be suitable for painting.
- N. At no point taping of joints with duct tape, electrical tape, or other materials not designed for the insulation system are an acceptable method of attaching insulation; only use proper adhesives rated for that system's type of insulation material.
- O. All exposed insulation shall be clean and free of tears, holes, dirt, oil, grease, fingerprints, etc. at time of completion of project.
- P. Pipe insulation shall be protected with insulation saddles at pipe hangers or similar supports.

3.03 SCHEDULES

- A. Insulation Protection
 - 1. Insulation exposed to high moisture of interior areas shall be encased with 15 mil. vinyl film.
 - 2. Insulation exposed above food processing areas shall be protected with 30 mil. vinyl film.
 - 3. Insulation exposed to weather shall be encased with 20 mil. vinyl film.
 - 4. All joints sealed as recommended by manufacturer.
- B. Domestic Water Piping
 - 1. Cold water above ground shall be insulated with 1" thick fiberglass insulation with ASJ jacket.
 - 2. Hot water above ground shall be insulated with 1" thick fiberglass for sizes through 3" pipe and 1-1/2" thick fiberglass for sizes greater than 3" and with ASJ jacket.
 - 3. Hot water return above ground shall be insulated with 1" thick fiberglass for sizes through 2" pipe with ASJ jacket.
 - 4. Hot and cold-water branch piping concealed in walls or pipe chases may be insulated with 1/2" thick plastic foam.
 - 5. Circulated hot water and hot water return piping concealed in walls or pipe chase shall be insulated with 1" fiberglass or 1" foam insulation.

END OF SECTION

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SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary and vent.
- B. Domestic water.
- C. Gas piping.
- D. Condensate drain piping.
- E. Flanges, unions, and couplings.
- F. Pipe hangers and supports.
- G. Valves.
- H. Strainers.

1.02 RELATED SECTIONS

- A. Section 31 23 16 – Excavation.
- B. Section 31 23 23 – Fill.
- C. Section 31 23 16.13 – Trenching.
- D. Section 33 13 00 – Disinfecting of Water Utility Distribution.
- E. Section 07 84 00 – Firestopping.
- F. Section 08 31 00 – Access Doors and Panels.
- G. Section 09 90 00 – Painting and Coating.
- H. Section 22 05 00 – Common Work Results for Plumbing.
- I. Section 22 05 53 – Identification for Plumbing Piping and Equipment.
- J. Section 22 07 19 – Plumbing Piping Insulation.
- K. Section 26 27 17 – Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

- A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).
- B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005) (ANSI B16.18).
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
- E. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.1).
- F. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.
- G. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).
- H. ASME (BPV IV) - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; The American Society of Mechanical Engineers; 2004.
- I. ASTM A 47/A 47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2004).
- J. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2006a.
- K. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; Latest Revision.
- L. ASTM A 888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings, Latest Revision.
- M. ASTM A 234/A 234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2006a.
- N. ASTM A 536 – Standard Specification for Ductile Iron Castings; 2009.
- O. ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2002.
- P. ASTM B 68 - Standard Specification for Seamless Copper Tube, Bright Annealed; 2002.
- Q. ASTM B 75 - Standard Specification for Seamless Copper Tube; 2002.
- R. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.
- S. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; Latest Revision.

- T. ASTM C 1277 -Standard Specification for Standard Shielded Couplings Joining Hubless Pipe and Fittings, Latest Revision.
- U. ASTM C 1460 - Standard Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe & Ftg, Latest Revision.
- V. ASTM C 1540 -Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Pipe & Fittings, Latest Revision.
- W. ASTM D1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- X. ASTM D 1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.
- Y. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.
- Z. ASTM D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2004.
- AA. ASTM D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2007.
- AB. ASTM D 2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2003.
- AC. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2002).
- AD. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2002.
- AE. ASTM F 708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2004).
- AF. ASTM F 1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe; 2005.
- AG. ASTM F-1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007.
- AH. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing
- AI. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems
- AJ. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing

- AK. ASTM F1970 - 12e1 - Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems
- AL. AWWA C606 – Grooved and Shouldered Joints; 2011.
- AM. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).
- AN. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; Latest Revision.
- AO. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute; Latest Revision.
- AP. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2002.
- AQ. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- AR. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- AS. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- AT. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.
- AU. NFPA 58 - Liquefied Petroleum Gas Code; National Fire Protection Association; 2004.

1.04 SUBMITTALS

- A. See Section 22 05 00 - Submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer's catalog information. Indicate valve data and ratings.
 - 1. Grooved joint couplings and fittings shall be referred to on drawings and product submittals and shall be identified by the manufacturer's style or series designation. Trade names and abbreviations are not acceptable.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Wisconsin plumbing codes.
 - 1. Maintain one copy of approved plumbing plans on project site.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- C. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.
- D. Welders Certification: In accordance with ASME (BPV IX).
- E. All grooved joint couplings, fittings, valves, and specialties shall be of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 1. All castings used for fittings, couplings, valve bodies, etc., shall include a cast date stamp for quality assurance and traceability.
- F. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
- G. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 REGULATORY REQUIREMENTS

- A. Perform work in accordance with State of Wisconsin plumbing code.
- B. Conform to Wisconsin plumbing code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

1.09 EXTRA MATERIALS

- A. See Section 01 60 00 - Project Requirements for additional provisions.
- B. Provide two repacking kits for each size valve.

PART 2 PRODUCTS

2.01 SANITARY SEWER AND VENT PIPING, BURIED INTERIOR

- A. Cast Iron Pipe and Fittings: ASTM A74, ASTM A888, CISPI 301, Cast iron Waste and Vent lines service weight. Pipe and fittings shall be marked with the above listings and listed by NSF. Acceptable: AB&I, Charlotte, Tyler Pipe.
 - 1. Hub and Spigot Compression Gaskets ASTM C564, ASTM C1563, one piece compression neoprene elastomeric gasket.
 - a. AB&I, Charlotte, Tyler Pipe.
 - 2. Joint Seals: ASTM C-564, ASTM C1540, Heavy duty neoprene sleeve gasket with 316 stainless steel shield minimum thickness of 0.015 and a minimum of four screw 316 stainless steel bands. Bands to be torqued to 80-inch pounds.
 - a. Husky CR 7000 series.
- B. Epoxy Cast Iron Pipe and Fittings: ASTM A74, ASTM A888, CISPI 301, Cast iron Waste and Vent lines shall be corrosion protective coating lined with a suitable epoxy inside and out. Pipe and fittings shall be marked with the above listings and listed by NSF. Acceptable: AB&I, Tyler Pipe.
 - 1. Joint Seals: ASTM C-564, ASTM C1540, Heavy duty neoprene sleeve gasket with 316 stainless steel shield minimum thickness of 0.015 and a minimum of four screw 316 stainless steel bands. Bands to be torqued to 80-inch pounds.
 - a. Husky CR 7000 series.
- C. Cast Iron to PVC piping transitions: ASTM C1460, ASTM C654, Heavy duty neoprene sleeve gasket with 316 stainless steel shield minimum thickness of 0.015 and a minimum of four screw 304 stainless steel bands. Bands to be torqued to 80-inch pounds.
 - 1. Husky SD 4200
- D. PVC solid wall plastic pipe, Schedule 40, Class 12454, per ASTM D1784, iron pipe size (IPS) conforming to NSF 14, ASTM D1785; PVC plastic drain, waste and vent pipe and fittings ASTM D2665; socket fitting patterns, ASTM D3311 and ASTM F1866; primer ASTM F656; solvent cement ASTM D2564. Acceptable Charlotte, Crestline, Spears.
- E. PVC Pipe: ASTM D 2665 schedule 40, or ASTM F 679.
 - 1. Fittings: PVC.
 - 2. Joints: Push-on, using ASTM F 477 elastomeric gaskets.
- F. Fittings required shall meet specifications for respective piping.
- G. Provide cleanouts as required per SPS 382.35.

2.02 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

- A. Cast Iron Pipe and Fittings: ASTM A74, ASTM A888, CISPI 301, Cast iron Waste and Vent lines service weight. Pipe and fittings shall be marked with the above listings and listed by NSF. Acceptable: AB&I, Charlotte, Tyler Pipe.
 - 1. Hub and Spigot Compression Gaskets ASTM C564, ASTM C1563, one piece compression neoprene elastomeric gasket.
 - a. AB&I, Charlotte, Tyler Pipe.
 - 2. Joint Seals: ASTM C-564, ASTM C1540, Heavy duty neoprene sleeve gasket with 316 stainless steel shield minimum thickness of 0.015 and a minimum of four screw 316 stainless steel bands. Bands to be torqued to 80-inch pounds.
 - a. Husky CR 7000 series.
- B. Epoxy Cast Iron Pipe and Fittings: ASTM A74, ASTM A888, CISPI 301, Cast iron Waste and Vent lines shall be corrosion protective coating lined with a suitable epoxy inside and out. Pipe and fittings shall be marked with the above listings and listed by NSF. Acceptable: AB&I, Tyler Pipe.
 - 1. Joint Seals: ASTM C-564, ASTM C1540, Heavy duty neoprene sleeve gasket with 316 stainless steel shield minimum thickness of 0.015 and a minimum of four screw 316 stainless steel bands. Bands to be torqued to 80-inch pounds.
 - a. Husky CR 7000 series.
- C. Cast Iron to PVC piping transitions: ASTM C1460, ASTM C654, Heavy duty neoprene sleeve gasket with 316 stainless steel shield minimum thickness of 0.015 and a minimum of four screw 304 stainless steel bands. Bands to be torqued to 80-inch pounds.
 - 1. Husky SD 4200
- D. PVC solid wall plastic pipe, Schedule 40, Class 12454, per ASTM D1784, iron pipe size (IPS) conforming to NSF 14, ASTM D1785; PVC plastic drain, waste and vent pipe and fittings ASTM D2665; socket fitting patterns, ASTM D3311 and ASTM F1866; primer ASTM F656; solvent cement ASTM D2564. Acceptable Charlotte, Crestline, Spears.

2.03 WATER PIPING, ABOVE GRADE

- A. Copper seamless water tube H (drawn) temper, type 'L' copper in accordance with ASTM B88 and ANSI/NSF 61. Acceptable: Cerrotube, JMF, Mueller Streamline, Wheatland tube.
 - 1. Wrought copper pressure fittings in accordance with ANSI B16.22 and ANSI/NSF 61.
 - a. Lead free flux in accordance ASTM B813, and lead free solder with less than 0.2% lead in accordance ASTM B32.
 - 2. Lead free copper and copper alloy press fittings with EPDM seal element in accordance with ASME 16.51, NSF 61, UPC, NSF/ANSI 372. Acceptable: Apollo Press, Nibco Presssystem, Viega ProPress.
 - 3. Copper mechanical grooved fittings and couplings on roll grooved pipe NSF/ANSI 61. Ductile iron couplings with copper colored alkyd enamel with offsetting angle-pattern bold pads ASTM A-536 Grade 65-45-12, and EPDM coupling gasket. Acceptable: Victaulic.

- B. Crosslinked Polyethylene (PEX-a Engel Method) plastic pipe and fittings, 1/2" to 2" sizes, in accordance with ASTM F876, ASTM F877, cold expansion fittings, rated for a temperature of 180° F at 100 psi, copper tube size (CTS) in accordance with ASTM F1960. PEXa pipe 1" to 2" shall be provided in straight lengths, coil stock may be used for 1/2" and 3/4" sizes. Piping shall be color coded blue for cold water, and red for hot and hot water return water. Acceptable: Uponor,
 - 1. Fittings for PEXa-to-PEXa connection to be Brass or Polyphenylsulfone (PPSU) plastic for cold expansion, accordance with ASTM F1960.
 - 2. Transition fittings PEXa to Metal, one-piece lead free, brass threaded or sweat adapter, with PEX-a reinforcing cold expansion ring, accordance with ASTM F1960.
 - 3. Multiport manifold with valve to be Brass or Polyphenylsulfone (PPSU) plastic for cold expansion, accordance with ASTM F1960. Install with appropriate manifold cabinet constructed of steel with frame and door.
- C. UL classified in accordance with NSF-61 for potable water service. The system shall meet the low-lead requirements of NSF-372.

2.04 PROPANE GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53 / A53M Schedule 40 black, type E or S, Grade B, Schedule 40 standard weight black steel pipe. Joints meeting ASME B31.1 for threaded, welding or press fittings following NFPA 54. Acceptable: Wheatland Tube,
 - 1. Fittings: ASTM A197/ANSI B16.3 class 150, black malleable iron threaded fittings for sizes 1/2" - 2" or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.
 - 2. Press Fittings: Carbon Press designed to be used with schedule 10 – 40 steel pipe (black iron, epoxy coated and galvanized) 1/2" – 2" fittings and valves. Acceptable: Apollo Power Press, Viega ProPressG and MegaPressG.
- B. Corrugated Stainless Steel Tubing: ASTM A240, (TMH 1042) type 300 with a minimum wall thickness of .010 for 3/8" through 1-1/4" diameter size, with pressure rating of 125 psig.
 - 1. Fittings: SAE CA360, mechanical tube fitting, yellow brass incorporating double wall flare for sealing and jacket capturing for steel tubing protection.
 - 2. Jacket: ASTM E84 polyethylene jacket resistant to flame spread and smoke density and resistant to UV.
 - 3. Gastite, Tracpipe CounterStrike.

2.05 CONDENSATE DRAIN PIPING

- A. PVC Pipe: ASTM D 1785 Schedule 40, or ASTM D 2241 SDR 26 for not less than 150 psi pressure rating.
 - 1. Fittings: ASTM D 2466, PVC.
 - 2. Joints: Solvent welded, with ASTM D 2564 Solvent cement.
- B. Discharge to floor drain or properly vented open site drain.

2.06 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3" and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
 - 3. PVC/CPVC pipe: ½ through 4-inch 235psi 6-inch 150psi @ 73° F with socket connections.
- B. Flanges for Pipe Size Over 1" :
 - 1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper tube and pipe: Class 150 slip-on bronze flanges; pre-formed neoprene gaskets.
 - 3. PVC/CPVC Pipe: Class 150 socket welded flanges; 1/8" thick 70 durometer full-face neoprene gaskets.
- C. Grooved and Shouldered Pipe End Couplings:
 - 1. Housing: Two ductile iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion where required; ASTM A449 electroplated steel bolts, nuts; galvanized for galvanized pipe.
 - 2. Sealing gasket: "C" shape composition sealing gasket.
 - 3. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, and B31.9. Victaulic Style 107H/107N (Quick-Vic™) or equal. Installation ready rigid coupling for direct stab installation without field disassembly.
 - 4. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Installation-Ready Style 177 or Style 77 or equal.
 - 5. Copper Tubing: Coupling housings with offsetting, angle-pattern bolt pads at copper-tube dimensions. Victaulic Style 607H (Quick-Vic™) or equal. Installation ready rigid coupling for direct stab installation without field disassembly.
 - 6. UL classified in accordance with NSF-61 for potable water service and shall meet the low-lead requirements of NSF-372.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
 - 1. Dielectric Waterway: Copper silicon casting conforming to UNS C87850 with grooved and/or threaded ends. Basis of Design: Victaulic Series 647 or equal.
 - 2. UL classified in accordance with NSF-61 for potable water service and shall meet the low-lead requirements of NSF-372.

2.07 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Anvil International: www.anvilintl.com.
 - 2. Champion Fiberglass : www.championfiberglass.com.
 - 3. Cooper B-Line: www.cooperblinc.com.
 - 4. Elite Components: www.elitecomponents.com.
 - 5. Mason Industries: www.mason-ind.com.
 - 6. Substitutions: See Section 22 05 00 Substitutions.

B. Pipe Hangers - General

1. Furnish and install suitable hangers and supports for all horizontal lines. Pipe sizes of 3" and larger shall be carried by pipe hangers supported by rods secured to structure. No piping shall be hung from other piping or ductwork. In no case shall hangers be supported by means of vertical expansion bolts. At no point should hangers and pipe clamps break the insulation vapor barrier. Always provide proper saddle support and hanger/clamp support system for insulation materials.
2. Support Spacing. Piping shall be supported at distances not to exceed those specified:
 - a. Cast Iron: Horizontal Max - 5ft (a); Vertical Max - 15ft.
 - b. Copper or Copper-Alloy Pipe: Horizontal Max: 12ft; Vertical Max - 10ft.
 - c. Copper or Copper-Alloy Tubing
 - 1) Less than or equal to 1-1/4" diameter: Horizontal Max - 6ft; Min - 10ft.
 - 2) Greater than or equal to 1-1/2" diameter: Horizontal Max - 10ft; Min - 10ft.
 - d. Crosslinked Polyethylene (PEX): Horizontal Max - 2-2/3ft; Vertical Max - 4ft unless using a tested support system such as Uponor PEX A Pipe Support. See Hanger Schedule.
 - e. Polyvinyl Chloride: Horizontal Max - 4ft; Vertical Max - 10ft.

NOTES: (a) is the maximum horizontal spacing for supports may be increased to 10ft when 10-foot lengths of pipe are employed. (b) is mid-story guide to be employed.

C. Plumbing Piping - Drain, Waste, and Vent:

1. Conform to ASME B31.9 or MSS SP-69.
2. Hangers for Pipe Sizes 1/2" to 1-1/2": Malleable iron, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2" and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3": Cast iron hook.
6. Wall Support for Pipe Sizes 4" and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

D. Plumbing Piping - Water:

1. Conform to ASME B31.9 or MSS SP-69.
2. Hangers for Pipe Sizes 1/2" to 1-1/2": Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2" and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

5. Wall Support for Pipe Sizes to 3": Cast iron hook.
6. Vertical Support: Steel riser clamp.
7. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Floor Support for Hot Pipe Sizes to 4": Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
10. Use epoxy coated style riser clamps with PEX.

2.08 VALVES - GENERAL

- A. Manufacturers:
 1. Apollo Valve: www.apollovalves.com.
 2. Jomar International: www.jomar.com.
 3. Kitz Valves: www.kitzus-kca.com.
 4. Nibco, Inc: www.nibco.com.
 5. Milwaukee Valve Company: www.milwaukeevalve.com.
 6. Red-White Valve Corp. (RWV): www.redwhitevalvecorp.com.
 7. Shurjoint: www.shurjoint.com.
 8. Smith Cooper Valves: www.smithcooper.com.
 9. Victaulic Company: www.victaulic.com.
 10. Watts Water Technologies Inc.: www.watts.com.
 11. Uponor Inc: www.uponorpro.com.
 12. Spears Manufacturing Company: www.spearsmfg.com.
 13. Substitutions: See Section 22 05 00 Substitutions.
- B. Valves shall be suitable for 125 PSIG working pressure unless otherwise specified.
- C. A control valve for water supply piping 3/4" through 4" in diameter which serves 2 or more plumbing fixtures shall have a nominal diameter at least equal to the piping.
- D. Valves for water supplies shall be lead free, as required by the Lead-Free Law.

2.09 BALL VALVES

- A. Water Systems
 1. MSS SP-110, 3" and smaller: Two-piece bronze body; sweat, threaded, press or ASTM F1960 joint connection ends, full port stainless steel ball, and stem; glass filled Teflon seat; Teflon packing and threaded packing nut; blowout-proof stem; 600 psig CWP, WOG. Provide valve stem extensions for valves installed in all piping with insulation.
 - a. Apollo 70LF-100 series
 - b. Jomar T-200 series
 - c. Milwaukee UPBA-100S series
 2. MSS SP-110, 2" and Smaller: 400 psi CWP, stainless-steel, three-piece body, stainless steel ball, full port, PTFE seats, blow-out proof stainless steel stem, lever handle.
 - a. Jomar SS-1000N-4B Series
 - b. Victaulic P569 Series.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

3. Construction, 8" and smaller: All thermoplastic ball valves shall be True Union type manufactured to ASTM F 1970 and constructed from PVC Type I, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447. All O- rings shall be EPDM or FKM. All valves shall have Safe-T-Shear® stem with double O-ring stem seals. All valve handles shall be polypropylene with built-in lockout mechanism. All valve union nuts shall have Butress threads. All seal carriers shall be Safe-T-Blocked®. All valve components shall be replaceable. All valves with EPDM Elastomers shall be certified by NSF International for use in potable water service. All 1/2" through 4" valves shall be pressure rated to 235 psi, all 6", and 8" venturied valves and all flanged valves shall be pressure rated to 150 psi for water at 73° F.
 4. Construction, 2" and smaller: Full-port ball valve: two-piece, ASTM F1960 cold-expansion ends, with PEX-a reinforcing cold-expansion ring shall be by the same manufacturer as the piping system. In compliance with: 250 CWP, ANSI/NSF 359, ANSI/NSF 14/61, cNSF-us-pw_G lead free 0.25% Lead max., ASTM F1960, ASTM F 877.
- B. Propane Gas Systems
1. 4" and smaller: Ball or eccentric plug valve, bronze or cast-iron body, 2" and under threaded ends, 2-1/2" and over flanged ends, chrome plated bronze ball, bronze or nickel plated cast iron plug, TFE or Hycar seats and seals, lever handle, 175 psi W.O.G., U.L listed for use as natural gas shut-off.
 - a. Apollo 80-100 series
 - b. Milwaukee BA-475B

2.10 SWING CHECK VALVES

- A. Up to 2":
1. MSS SP-80, Class 125, lead free bronze body and cap, bronze swing disc with rubber seat, solder, or threaded ends.
 - a. Apollo 161S-LF/161T-LF.
 - b. Jomar S-511G
 - c. Milwaukee Valve UP509
 - d. RWV 236BT

2.11 SPRING LOADED CHECK VALVES

- A. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.
1. Apollo 61/61LF series.
- B. 300-psig, ductile iron body, stainless steel spring, and shaft, suitable for vertical or horizontal installation.
1. Apollo 910WB series.

2.12 BALANCE VALVES

- A. Manufacturers:
 - 1. ThermOmegaTech: www.thermomegatech.com.
 - 2. Substitutions: See Section 22 05 00 Substitutions.
- B. ANSI/AWWA C800; Thermostatically controlled recirculation valve will regulate the flow of recirculated domestic hot water based on water temperature entering the valve without additional piping or control mechanisms. Valves shall be set for 120° hot water return. Valve shall be equal to pipe size with 0.2 gpm minimum flow when 90% closed and rated to 200 PSIG maximum working pressure. Type 303 Stainless steel construction.
 - 1. Circuit solver CSUA-3/4 – 120 – CV1

2.13 RELIEF VALVES

- A. Pressure Relief:
 - 1. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com
 - b. Cla-Val Co: www.cla-val.com.
 - c. Henry Technologies: www.henrytech.com.
 - d. Watts Regulator Company: www.wattsregulator.com.
 - e. Substitutions: See Section 22 05 00 Substitutions.
 - 2. AGA Z21.22 certified, bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure Relief:
 - 1. Manufacturers:
 - a. Apollo Valves: www.apollovalves.com
 - b. Cla-Val Co: www.cla-val.com.
 - c. Henry Technologies: www.henrytech.com.
 - d. Watts Regulator Company: www.wattsregulator.com.
 - e. Substitutions: See Section 22 05 00 Substitutions.
 - 2. AGA Z21.22 certified, lead free, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210° F, capacity ASME (BPV IV) certified and labeled.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burs.
- B. Remove scale and dirt, inside and outside, before assembly.

- C. Prepare piping connections to equipment with flanges or unions.
- D. Unions and flanges for servicing or disconnect are not required on installations using grooved joint couplings. The couplings should serve as disconnect points.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. All sanitary waste and storm piping that are located over offices, conference rooms etc. where sound needs to be at a minimum, all piping shall be cast iron or insulated PVC piping. Coordinate with General Contractor.
- C. All sanitary waste piping serving mop sink or similar fixtures shall be epoxy coated cast iron or PVC piping.
- D. Provide non-conducting dielectric connections wherever they join dissimilar metals.
- E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- F. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- G. Group piping whenever practical at common elevations.
- H. Install piping to allow for expansion and contraction without stressing pipes, joints, or connected equipment.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- J. Provide access where valves and fittings are not exposed.
- K. Establish elevations of buried piping outside the building to ensure not less than 5 ft of cover.
- L. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- N. Provide support for utility meters in accordance with requirements of utility companies.
- O. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 22 05 00 - Execution.
- P. Install bell and spigot pipe with bell end upstream.
- Q. Install valves with stems upright or horizontal, not inverted.
- R. Pipe vents from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

- S. Install water piping to ASME B31.9.
- T. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.
- U. Sleeve pipes passing through partitions, walls, and floors.
- V. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4".
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
- W. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F 708; and MSS SP-89.
 - 2. Support horizontal piping as scheduled.
 - 3. Install hangers to provide minimum 1/2" space between finished covering and adjacent work.
 - 4. Place hangers within 12" of each horizontal elbow.
 - 5. Use hangers with 1-1/2" minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
 - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - 10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 05 48.
 - 11. Support cast iron drainage piping at every joint.

3.04 APPLICATION

- A. Use grooved mechanical couplings and fasteners in accessible locations.
 - 1. Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Provide spring loaded check valves on discharge of water pumps.
- F. Provide plug valves in propane gas systems for shut-off service.
- G. Provide balance valve in water recirculation systems where indicated.

3.05 ERECTION TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2" vertically of location indicated and slope to drain at minimum of 1/8" per foot slope.
- B. Water Piping: Slope at minimum of 1/32" per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 33 13 00.
- B. Prior to starting work, verify system is complete, flushed, and clean.
- C. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form, throughout system to obtain 50 to 80 mg/L residual.
- E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15% of outlets.
- F. Maintain disinfectant in system for 24 hours.

- G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- I. Take samples no sooner than 24 hours after flushing, from 10% of outlets and from water entry, and analyze in accordance with AWWA C651.
- J. Disinfect AquaPEX in accordance with AWWA C651-86. Disinfection solutions should not stand in the system longer than 24 hours. Use a chlorine solution of 50 ppm for no longer than 24 hours and 200 ppm for 3 hours for disinfection.

3.07 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe size: 1/2" to 1-1/4":
 - 1) Maximum hanger spacing: 6.5 ft.
 - 2) Hanger rod diameter: 3/8".
 - b. Pipe size: 1-1/2" to 2":
 - 1) Maximum hanger spacing: 10 ft.
 - 2) Hanger rod diameter: 3/8".
 - c. Pipe size: 2-1/2" to 3":
 - 1) Maximum hanger spacing: 10 ft.
 - 2) Hanger rod diameter: 1/2".
 - d. Pipe size: 4" to 6":
 - 1) Maximum hanger spacing: 10 ft.
 - 2) Hanger rod diameter: 5/8".
 - 2. Plastic Piping:
 - a. All Sizes:
 - 1) Maximum hanger spacing: 6 ft.
 - 2) Hanger rod diameter: 3/8".
 - b. Uponor PEX A with Pipe Support 1" and smaller
 - 1) Maximum hanger spacing: 6 ft
 - 2) Hanger rod diameter: 3/8".
 - 3) Pipe support to be used with same manufacturer of pipe only
 - c. Uponor PEX A with Pipe Support 1-1/4 – 3"
 - 1) Maximum hanger spacing: 8 ft
 - 2) Hanger rod diameter: 3/8".
 - 3) Pipe support to be used with same manufacturer of pipe only

3.08 GAS PIPING EXECUTION

- A. General: Design, materials, methods, and installation as per NFPA-54 for natural gas piping and NFPA-58 for liquefied petroleum gases.
- B. Unions shall be equal to Stockham 592-T Teflon O-ring type. Insulating union shall be provided at gas service entrance on service side of meter.

- C. Gas Pressure Regulator. All gas regulators must be installed in the horizontal position. Provide and install where shown on drawings and/or details, regulators sized per loads of equipment being served. Regulators shall be of diaphragm, spring operation type with cast iron body, aluminum diaphragm case, and vent valve with threaded connection for atmosphere disposal. Regulators sized within load requirements which are equipped with leak limiter venting may be used in lieu of the atmosphere venting type. Regulators by Maxitrol, Rockford or Fisher are acceptable. Follow gas regulator requirements and installation with gas fired equipment being served by the regulator. Provide and install lock-up style regulator on all boilers per manufacturer's requirements.
1. Gas regulators on Aerco Boilers: Install lock-up style Jeavons #J-48, shipped loose with boiler. Turn second Maxtrol RV-81 or Maxtrol RV-91 shipped loose with boiler, over to Owner. Coordinate work with Mechanical Contractor (see detail).
- D. Gas regulator relief vents shall be extended to outside of building, thru wall or roof and provide weather cap. Each regulator shall be vented independently of each other, no group venting permitted. Size vent piping as per gas regulator manufacturer specifications.
- E. Provide shut-off valve, dirt leg and union at each piece of equipment and appliances that are furnished by others..
- F. Purge with gas to remove all air from distribution piping to make ready for service.
- G. Gas piping may be installed in or above accessible ceiling spaces. Gas regulators and valves shall not be located in such spaces.
- H. Gas piping shall be installed with swing joints to relieve the thrust on the pipe at point where it pierces building wall. The annular space between the pipe and sleeve, where pipe pierces building walls, shall be grouted airtight with an elastomeric compound.
- I. Doormont. Gas-fired appliance connector.
1. The connector shall be stainless steel and A.G.A approved.
- J. LP Gas: Pitch horizontal piping down 1" in 60ft in the direction of flow. All branch connections to the main shall be from the top or side of the main.
- K. Corrugated Stainless Steel Tubing Gas Piping: The tubing, fittings and strike-protection are to be by same manufacturer as tubing materials. Strike protection is to be used as required and proper manufacturer installation training obtained prior to installation. System to be installed and pressure tested in accordance with all requirements of NFPA-54 or NFPA-58 code, ANSI/IAS LC-1 and the most current edition of manufacturer's design and installation guide. Grounding and Bonding shall be in accordance with the National Electrical Code NFPA 70.

- L. All gas piping, related valves, regulators, unions, and flexible connectors are supplied and installed by Plumbing Contractor. All final connections of gas piping to equipment are by Plumbing Contractor.
- M. Gas regulators shall be installed at each piece of equipment. Install gas regulators along with vent limiters or regulator vent piping as per manufacturer specifications of the gas regulator and the gas fire equipment. Gas regulator shall be installed to allow for ease of access and not installed above finish ceilings. Regulators should be installed in gas piping located in same room as equipment being served by the regulator. Provide a minimum of 12-inches gas piping between regulator and equipment or as directed per manufacturer specifications.

END OF SECTION

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SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cleanouts.
- B. Drains.
- C. Trap guards.
- D. Backflow preventers.
- E. Double check valve assemblies.
- F. Vacuum relief valves.
- G. Access panels.

1.02 RELATED SECTIONS

- A. Section 22 05 00 - Common Work Results for Plumbing.
- B. Section 22 10 05 - Plumbing Piping.
- C. Section 22 40 00 - Plumbing Fixtures.
- D. Section 22 30 00 - Plumbing Equipment.
- E. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

- A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).
- B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; The American Society of Mechanical Engineers; 2003.
- C. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2005 (ANSI/ASSE 1011).
- D. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2002 (ANSI/ASSE 1012).

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.04 SUBMITTALS

- A. See Section 22 05 00 - Submittals.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- E. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.
- F. Operation Data: Indicate frequency of treatment required for interceptors.
- G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Accept specialties on site in original factory packaging. Inspect for damage.

1.07 EXTRA MATERIALS

- A. See Section 22 05 00 – Extra Materials, for additional provisions.

PART 2 PRODUCTS

2.01 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jrsmith.com.
 - 2. Josam Company: www.josam.com.
 - 3. Wade: www.wadedrains.com.
 - 4. Watts: www.watts.com.
 - 5. Mifab: www.mifab.com.
 - 6. Sioux Chief: www.siouxchief.com.
 - 7. Zurn Industries, Inc: www.zurn.com.
 - 8. Substitutions: See Section 22 05 00 Substitutions.

- B. FCO-1 Finish Floor Cleanout:
 - 1. ANSI A112.36.2M; Cast iron body with threaded top assembly. No-Hub or Neo-Loc outlet connection, Bronze, or PVC plug. Round gasket scored medium traffic nickel bronze cover. Provide with anchor flange when required. Provide carpet flanges for carpeted areas.
 - a. J.R. Smith 4020-PB or 4031-PB
 - b. Josam 55000-2
 - c. Wade 8000
 - d. Watts CO-200-R
 - e. Zurn ZN1400-NH or ZN1400-NL
- C. C.O. Cleanouts at Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.02 DRAINS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jrsmith.com.
 - 2. Josam Company: www.josam.com.
 - 3. Mifab: www.mifab.com.
 - 4. Sioux Chief: www.siouxchief.com.
 - 5. Wade: www.wadedrains.com.
 - 6. Watts: www.watts.com.
 - 7. Zurn Industries, Inc: www.zurn.com.
 - 8. Substitutions: See Section 22 05 00 Substitutions.
- B. FD-1 Floor Drain:
 - 1. ASME A112.6.3; Cast iron body, drainage flange, weep holes, reversible clamping collar for high or low setting, 6" round nickel bronze adjustable heel-proof strainer.
 - a. J.R. Smith 2005-NB-A
 - b. Josam 30000-A
 - c. Sioux Chief 863- NRD
 - d. Wade 1100-A-1
 - e. Watts FD-100-A
 - f. Zurn Z415B-ZN
- C. Open Site Drains:
 - 1. ASME A112.6.3; Provide and install a vented trap with inlet 1" above finished floor where shown. Sizes shown on plan, as 2", 3", 4", etc. are sizes with an increaser of one pipe size larger opening extending above floor or as specifically noted.
 - a. OS-1: hub section up 1" minimum above floor level, with full-sized deep seal P-trap as described above.

- D. Roof Drains:
1. ASME A112.6.4. Flash roof drains to deck with .060" thick rubber membrane minimum of 30"x30" in size. Flashing shall be securely clamped to the body of the drain to make watertight, airtight, and durable connection. Provide suitable extensions for insulation as required. Roof drains shall be located according to the Architectural drawings. See plumbing drawings for rain leader layout and sizes.
 - a. RD-1: Roof Drain: Cast iron body with combined flashing collar gravel stop, dome, under deck clamp and sump receiver.
 1. J.R. Smith 1010Y-R-C
 2. Watts RD-300-D-F
 3. Zurn Z100-NH-C-R

2.03 TRAP SEAL GUARDS

- A. Manufacturers:
1. JR Smith Quad Close: www.jrsmith.com.
 2. Jones Stephens Corp.: www.jonesstephens.com.
 3. ProSet Systems Trap Guard: www.trapguard.com.
 4. Sure Seal: www.thesureseal.com.
 5. Green Drain: www.greendrains.com.
 6. Zurn Industries, Inc: www.zurn.com.
 7. Substitutions : See Section 22 05 00 Substitutions.
- B. Trap Guard: ASSE 1072, Flexible elastomeric PVC construction diaphragm trap guard prevents trap evaporation and waste backflow, shall be installed in all new and existing floor drains, open site drains, and trench drains. Exceptions are open site drains that will receive a high velocity discharge, similar to commercial dishwashers or clothes washers. Size trap guard as applicable to the drain outlet size, up to 4" size. Follow Manufacture instructions and specifications.

2.04 BACKFLOW PREVENTERS

- A. Manufacturers:
1. Apollo Valves: www.apollovalves.com
 2. Watts Regulator Company: www.wattsregulator.com.
 3. Wilkins: www.wilkins.com.
 4. Zurn Industries, Inc: www.zurn.com.
 5. Substitutions: See Section 22 05 00 Substitutions.
- B. Backflow Preventer:
1. ASSE 1056; High hazard anti-siphon, anti-spill vacuum breaker, lead free bronze body construction, silicone disc, silicone vent disc, stainless steel springs, inlet and outlet ball shut-off valves, test port, rated at 150.0 psig and 180°F maximum.
 - a. Apollo SVB 4W
 - b. Watts LF008PCQT
 - c. Zurn 460XL

2.05 DOUBLE CHECK VALVE ASSEMBLIES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com.
 - 2. Watts Regulator Company: www.wattsregulator.com.
 - 3. Wilkins: www.wilkins.com.
 - 4. Substitutions: See Section 22 05 00 Substitutions.
- B. Dual Check Valve Assemblies:
 - 1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless-steel springs; two independently operating check valves with intermediate atmospheric vent.
 - a. Apollo DCAP
 - b. Watts 9D
 - c. Wilkins 760

2.06 ACCESS DOORS

- A. Manufacturers:
 - 1. Acudor Product, Inc.: www.acudor.com.
 - 2. Elmdor/Stoneman: www.elmdorstoneman.com.
 - 3. Mifab, Inc.: www.mifab.com.
 - 4. Substitutions: See Section 22 05 00 Substitutions.
- B. AD-1 Access Door.
 - 1. Fire rated 1½ hour "B" label Underwriters Laboratories (UL) listed and tested access door in fire rated walls with stack cleanouts. Use 12" x 12" size for cleanouts up to 6" in size. Use 16" x 16" size for clean outs 8 to 12" in size.
 - a. Acudor FB-5060
 - b. Elmdor FR Series

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install equipment as shown on plan drawings and as scheduled.
- B. Install in accordance with manufacturer's instructions.
- C. Extend cleanouts to finished floor or wall surface. Clean outs shall be full size thru 6", 8" and larger shall be 6". Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- D. Install new floor cleanouts and floor drains at elevation to accommodate finished floor, coordinate finish floor elevation with General Contractor.
- E. Adjust existing floor cleanouts and floor drains to elevation to accommodate new finished floor, coordinate new finish floor elevation with General Contractor.

- F. Manufacturers of floor drains and floor clean outs that offer protective covers to allow protection of drain grates and clean out covers from damage during pouring and troweling of concrete in lieu of using duct tape or other methods are acceptable, providing they meet requirements as specified for each type drain and cleanout mentioned above.
- G. Trap Guards: Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, open site drains, and trench drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4" size. Manufacturer by: Sure Seal, JR Smith Quad Close, or approved equal.
- H. Pipe relief from backflow preventer to nearest drain.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion Tank.
- B. Domestic Water Circulator Pumps.

1.02 RELATED SECTIONS

- A. Section 22 05 00 - Common Work Results for Plumbing.
- B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

- A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.
- B. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc.; 2004.
- C. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; 2004.

1.04 SUBMITTALS

- A. See Section 22 05 00 - Submittals.
- B. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Indicate pump type, capacity, power requirements.
 - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 4. Provide electrical characteristics and connection requirements.
- C. Shop Drawings:
 - 1. Indicate heat exchanger dimensions, size of tapings, and performance data.
 - 2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, and drains.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in owners name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.
- C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation, operate within 25% of midpoint of published maximum efficiency curve.

1.06 CERTIFICATIONS

- A. Water Heaters: NSF approved.
- B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.
- C. Water Tanks: ASME labeled, to ASME (BPV VIII, 1).
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- E. Approved by state and/or local agencies.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum three-year manufacturer warranty for domestic water heaters.

1.09 EXTRA MATERIALS

- A. See Section 01 60 00 - Project Requirements, for additional provisions.
- B. Provide two pump seals.

PART 2 PRODUCTS

2.01 ELECTRIC WATER HEATER (If existing deemed unfit)

- A. Manufacturers:
 - 1. A.O. Smith Water Products Co: www.hotwater.com.
 - 2. Bradford White: www.bradfordwhite.com.
 - 3. Heat Transfer Products Inc: www.htproducts.com.
 - 4. Lochinvar: www.lochinvar.com
 - 5. PVI Industries, Inc.: www.PVI.com.
 - 6. Rheem Manufacturing Company: www.rheem.com.
 - 7. State Industries: www.statewaterheaters.com.
 - 8. Substitutions: See Section 22 05 00 Substitutions.
- B. Performance and Electrical Characteristics: See Schedule.
- C. Tank: Glass lined welded steel; 4" diameter inspection port, thermally insulated with minimum 2" glass fiber or polyurethane encased in corrosion-resistant steel jacket; baked-on enamel finish. Maximum working pressure of 150 psig.
- D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60° to 180° Fahrenheit, flanged or screw-in nichrome elements, high temperature limit thermostat.
- E. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 Watts per square inch.
- F. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve. The entire unit shall be U.L. approved and labeled as such.

2.02 EXPANSION TANK

- A. Manufacturers:
 - 1. Amtrol Inc: www.amtrol.com.
 - 2. Apollo Valves: www.apollovalves.com
 - 3. ITT Bell & Gossett: www.bellgossett.com.
 - 4. Watts: www.watts.com.
 - 5. Substitutions: See Section 22 05 00 Substitutions.
- B. Performance: See Schedule.
- C. Construction: Welded steel, tested and stamped in accordance with non-ASME; supplied with National Board Form U-1, rated for working pressure of 150 psig and operating temperature of 200°F, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- D. Accessories: Pressure gauge and air-charging fitting, tank drain; pre-charge to 40 psig, Check valve in cold water supply before tank.

2.03 IN-LINE CIRCULATOR PUMP

- A. Manufacturers:
 - 1. Armstrong Pumps Inc: www.armstrongpumps.com.
 - 2. Bell and Gossett: www.xylem.com/bellgossett
 - 3. Grundfos Pumps Corp.: www.grundfos.com/web/homeus.nsf
 - 4. Taco Inc.: www.tacocomfort.com.
 - 5. Substitutions: See Section 22 05 00 Substitutions.
- B. Performance: See Schedule
- C. Body: Horizontal, quiet operation with overload protection. Lead free bronze or stainless-steel casing, rated for maximum 150 psig working pressure, with stainless steel rotor assembly. Steel shaft supported by permanently lubricated, sealed ball bearings. Seal to be carbon on silicon carbide.
- D. Controls:
 - 1. Manufacturers:
 - a. Honeywell: www.honeywell.com.
 - b. Intermatic: www.intermatic.com.
 - c. Paragon Electrical: www.paragontimecontrols.com.
 - d. Substitutions: See Section 22 05 00 Substitutions.
 - 2. Performance:
 - a. Aquastat on hot water return line, to control circulator pump. Aquastat settings for pump on when water temperature below 110°F and pump off when water temperature reaches 120°F.
 - 1) Honeywell L4006A1017
 - b. Digital 7 Day time control to override aquastat control of circulation pump during building non-occupancy. Set time clock days/hours as directed by owner.
 - 1) Intermatic ET1700 Series
 - 2) Paragon Electrical; EC7000/120V
 - c. Building maintenance system to override aquastat control of circulation pump for building occupancy. Temperature Control Contractor to set days/hours as directed by Owner. Coordinate with Mechanical Contractor.
 - d. Control wiring by and installed by plumbing contractor. 115-volt wiring and power by electrical contractor division 26.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. All equipment startups shall be performed by factory or factory authorized representatives per manufacturer requirements. Manufacturers that do not require or include factory startups, Plumbing Contractor shall follow all required steps for startup as outlined by manufacturer specifications.
- C. Coordinate with plumbing piping and related electrical work to achieve operating system.
- D. All condensate piping from equipment to open site drain or floor drain shall be ridged PVC piping.
- E. Pumps:
 - 1. Provide air cock and drain connection on horizontal pump casings.
 - 2. Domestic Hot Water Return Pump: Provide line sized isolating valve and strainer on suction and line sized, soft seated check valve and balancing valve on discharge. Install Aquastat and adjust temperature. Adjust balancing valves through domestic hot water return piping.
 - 3. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4" and over.
 - 4. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
 - 5. Align and verify alignment of base mounted pumps prior to start-up.
- F. Water Heater/Storage Tank Safety Devices:
 - 1. Must be approved for use in the State of Wisconsin
 - 2. All pressurized storage-type water heaters and unfired hot water storage tanks should be equipped with one or more combination temperature and pressure relief valves. The temperature steam rating of a combination temperature and pressure relief valve or valves shall equal or exceed the energy input rating in BTU per hour of the water heater. No shut off valve or other restricting devices may be installed between the water heater or storage tank and the combination temperature and pressure relief valve.
 - 3. Temperature and pressure relief valves shall be installed so that the sensing element of the valve extends into the heater or tank and monitors the temperature in the top 6" of the heater or tank.

4. A vacuum relief valve shall be installed in each water heater and hot water storage tank which, when measured from the bottom of the heater or tank, is located more than 20ft above any faucet or outlet served by the heater or tank.
5. All domestic hot water storage tanks/water heaters will be equipped with a drain valve at the lowest point of unit or on cold water inlet near bottom of unit if not equipped with factory drain valve. Plumbing Contractor to install drain valve if not factory equipped. Drain valve shall meet SPS 384.20 (5) (p) water heaters section and conform to ASSE 1005.
6. Relief Valve:
 - a. Every relief valve, which is designed to discharge water or steam, shall be connected to a discharge pipe.
 - b. The discharge pipe and fittings shall have a diameter not less than the diameter of the relief valve outlet.
 - c. The discharge pipe may not be trapped.
 - d. No valve may be installed in the discharge pipe.
 - e. The discharge pipe shall be installed to drain by gravity flow to a floor served by a floor drain or to a receptor in accordance with SPS 382.33 (8). The outlet of the discharge pipe shall terminate within 6" over the floor or receptor, but not less than a distance equal to twice the diameter of the outlet pipe. The outlet of the discharge pipe may not be threaded.
 - f. The discharge pipe for a water heater shall terminate within the same room or enclosure within which the water heater or hot water storage tank is located.
7. Safety Devices:
 - a. Relief valves shall be listed by the American Gas Association, Underwriters Laboratories, Inc., or American Society of Mechanical Engineers when the heat input to a water heater is less than or equal to 200,000 BTU per hour.
 - b. Relief valves shall be listed by the American Society of Mechanical Engineers when the heat input to a water heater exceeds 200,000 BTU per hour.
 - c. Pressure relief valves shall be set to open at either the maximum allowable working pressure rating of the water heater or storage tank or 150 psig, whichever is smaller.
 - d. Temperature and pressure relief valves shall be set to open at a maximum of 210° F. and in accordance with code.
- G. Expansion Tank:
 1. Install on cold water supply at water heater.
 2. Install check valve on cold water supply upstream of expansion tank.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tank type water closets.
- B. Stall urinals.
- C. Wall hung lavatories.
- D. Laundry tubs

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Product requirements for owners furnished fixtures.
- B. Section 06 41 00 - Architectural Wood Casework: Preparation of counters for sinks; lavatory tops.
- C. Section 07 90 05 - Joint Sealers: Seal fixtures to walls and floors.
- D. Section 22 05 00 - Common Work Results for Plumbing.
- E. Section 22 10 05 - Plumbing Piping.
- F. Section 22 10 06 - Plumbing Piping Specialties.
- G. Section 22 30 00 - Plumbing Equipment.
- H. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).
- B. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.
- C. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2003.
- D. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 2005.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.04 SUBMITTALS

- A. See Section 22 05 00 - Submittals.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in owners' name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

- A. See Section 22 05 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five-year manufacturer's warranty for electric water cooler.

1.09 EXTRA MATERIALS

- A. See Section 01 60 00 - Project Requirements, for additional provisions.
- B. Supply two sets of faucet washers.

1.10 FIXTURES AND TRIM

- A. This section of the work includes plumbing fixtures furnished and installed by the Plumbing Contractor.
- B. All vitreous china fixtures shall be of the best quality conforming in all respects to classification "Regulation Selection" in accord with the uniform grading rules of "Vitreous China."

- C. All products must be lead free as required by the lead-free law "Federal Safe Drinking Water Act."
- D. All similar fixtures, faucets, and trims shall be of same manufacturer throughout project.
- E. Fixtures and trim of equal quality as listed by other manufacturers may be submitted.
- F. Fixture support. Provide and install proper supports and carriers for plumbing fixtures as scheduled or required for the application. Carriers shall be set in accordance with manufacturers' recommendations with adequate anchors and fasteners to provide required support. Wall hung water closet outlets shall be fully grouted for support in masonry walls.
- G. Faucets and flush valves that have AC powered sensors shall have all wiring run in conduit and J-Boxes. Wiring below fixture shall be installed as high as possible. Transformers shall be installed above ceiling or in accessible chase. Coordinate work with Electrical Contractor.

1.11 PLUMBING FIXTURES LIST

- A. Manufacturers: Fixture descriptions establish fixture type, quality, materials, features, and size. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted. For substitutions, see Section 22 05 00 Substitutions.
 - 1. China Water Closets, Urinals and Lavatories Fixtures
 - a. American Standard Inc: www.americanstandard.com.
 - b. Kohler Company: www.kohlerco.com.
 - c. Sloan Valve Company: www.sloanvalve.com.
 - d. Toto USA Inc.: www.totousa.com.
 - e. Zurn Industries, Inc.: www.zurn.com.
 - f. Mansfield Plumbing Products: www.mansfieldplumbing.com.
 - 2. Water Closet Seats
 - a. American Standard Inc: www.americanstandard.com.
 - b. Bemis Manufacturing Company: www.bemismfg.com.
 - c. Church Seat Company: www.churchseats.com.
 - d. Comfort Seats: www.comforttoiletseats.com.
 - e. Kohler Company: www.kohlerco.com.
 - f. Zurn Industries, Inc: www.zurn.com.
 - 3. Faucets
 - a. American Standard Inc: www.americanstandard.com.
 - b. Bradley Corporation: www.bradleycorp.com.
 - c. Chicago Faucet Company: www.chicagofaucets.com.
 - d. Elkay Manufacturing Company: www.elkay.com.
 - e. Kohler Company: www.kohlerco.com.
 - f. Sloan Valve Company: www.sloanvalve.com.
 - g. Speakman Company: www.speakmancompany.com.

- h. Symmons Industries: www.symmons.com.
 - i. T&S Brass Inc.: www.tsbrass.com.
 - j. Union Brass Manufacturing Company: www.unionbrass.com.
 - k. Zurn Industries, Inc: www.zurn.com.
 - l. Delta Faucet Company Commercial: www.specselect.com.
 - m. Moen Incorporated Commercial: www.moen.com.
4. Laundry Trays
- a. Fiat Products: www.fiat.ca.
 - b. E.L. Mustee & Sons, Inc.: www.mustee.com.
 - c. Zurn Industries, Inc: www.zurn.com.
5. Carriers and Supports
- a. Jay R. Smith Manufacturing Company: www.jrsmith.com.
 - b. Josam Company: www.josam.com.
 - c. Wade: www.wadedrains.com.
 - d. Watts Water Technologies Company: www.watts.com.
 - e. Zurn Industries, Inc: www.zurn.com.
6. Drains and Traps
- a. BrassCraft Company.: www.brasscraft.com.
 - b. Chicago Faucet Company: www.chicagofaucets.com.
 - c. Keeney Manufacturing Company: www.keeneymfg.com.
 - d. McGuire Manufacturing: www.mcguiremfg.com.
 - e. Zurn Industries, Inc: www.zurn.com.
7. Stops and Supplies
- a. BrassCraft Company.: www.brasscraft.com.
 - b. Chicago Faucet Company: www.chicagofaucets.com.
 - c. McGuire Manufacturing: www.mcguiremfg.com.
 - d. Zurn Industries, Inc: www.zurn.com.
8. Under Lav Protection
- a. McGuire Manufacturing: www.mcguiremfg.com.
 - b. Plumberex Specialty Products, Inc: www.plumberex.com.
 - c. Truebro IPS Corporation: www.truebro.com.
 - d. Zurn Industries, Inc: www.zurn.com.
9. Vacuum Breakers
- a. Apollo Valves: www.apollovalves.com.
 - b. Watts Water Technologies, Inc.: www.watts.com.
 - c. Zurn Industries, Inc: www.zurn.com.
10. Floor Grates
- a. Indelco Plastics Corp.: www.indelco.com.
 - b. Seelye Plastic Inc: www.seelyeplastics.com.

PART 2 PRODUCTS

2.01 TANK TYPE WATER CLOSETS

A. WC-1 Water Closet (ADA):

1. Fixture Tank and Bowl: ASME A112.19.2; Vitreous china, elongated bowl, close coupled 17" floor mounted, floor outlet, 1.6-gallon siphon jet water closet, tank and cover, backflow preventer water control, anti-siphon float valve, and bolt caps water guard. Left hand flush handle on tank.
 - a. American Standard 215AA.004
 - b. Kohler K-3979
 - c. Zurn Z5551-K
 - d. Mansfield 384-386-LT
2. Supplies: ½" compression chrome plated cast brass angle stop with brass stem and loose key handle, chrome plated flexible copper tube riser and chrome escutcheon.
 - a. BrassCraft SCR-1912-C
 - b. McGuire LF2166CCLK
 - c. Zurn Z8804-CR-LK
3. Seat: Extra heavy white solid plastic, open front seat with check hinge for elongated bowl.
 - a. American Standard 5901100SS
 - b. Bemis 1955SSCT
 - c. Beneke 523
 - d. Church 295CT
 - e. Kohler K-4670-C
 - f. Zurn Z5955SS-EL
4. Note: As per ADA code, flush handle must be located on accessible side of fixture.

B. WC-2 Water Closet (ADA):

1. Fixture Tank and Bowl: ASME A112.19.2; Vitreous china, elongated bowl, close coupled 17" floor mounted, floor outlet, 1.6-gallon siphon jet water closet, tank and cover, backflow preventer water control, anti-siphon float valve, and bolt caps water guard. Right hand flush handle on tank.
 - a. American Standard 215AA.005
 - b. Kohler K-3979-R
 - c. Zurn Z5551-K-RH
 - d. Mansfield 384-386-RH
2. Supplies: ½" compression chrome plated cast brass angle stop with brass stem and loose key handle, chrome plated flexible copper tube riser and chrome escutcheon.
 - a. BrassCraft SCR-1912-C
 - b. McGuire LF2166CCLK
 - c. Zurn Z8804-CR-LK

3. Seat: Extra heavy white solid plastic, open front seat with check hinge for elongated bowl.
 - a. American Standard 5901100SS
 - b. Bemis 1955SSCT
 - c. Beneke 523
 - d. Church 295CT
 - e. Kohler K-4670-C
 - f. Zurn Z5955SS-EL
4. Note: As per ADA code, flush handle must be located on accessible side of fixture.

2.02 STALL URINALS

- A. U-1 Urinal:
 1. Fixture: ASME A112.19.2; Vitreous china, one gallon per flush stall urinal with integral flushing rim and $\frac{3}{4}$ " top inlet. Fill between urinals by General Contractor.
 - a. Kohler K-25039-T
 - b. American Standard 6400.001
 2. Strainer: Chrome plated brass flat grid strainer.
 - a. McGuire 1233
 3. Flush Valve: ASME A112.18.1; $\frac{3}{4}$ " chrome plated handle operated quiet action, 0.5 gallon per flush valve with vacuum breaker, $\frac{3}{4}$ " screwdriver operated angle stop and $\frac{1}{2}$ " supply pipe to the fixture with chrome plated cast brass escutcheon.
 - a. American Standard 6145051.002
 - b. Sloan Royal 186-0.5
 - c. Zurn Z-6003AV-EWS
 - d. Delta 81T231-19

2.03 WALL HUNG LAVATORIES

- A. L-1 Lavatory:
 1. Fixture: ASME A112.19.2; White 20"x18" vitreous china wall mounted lavatory with 4" faucet centers, front overflow.
 - a. American Standard 0355.012.020
 - b. Kohler K-2032
 - c. Zurn Z5364
 - d. Mansfield 2018HB-4
 2. Faucet: ASME A112.18.1; Lead free chrome plated cast brass, ADA compliant single lever handle faucet, ceramic disc cartridge and temperature limit stop, with 4" centers and 0.5 gpm aerator, no lift rod hole.
 - a. American Standard 6114.116
 - b. Elkay LK422L4
 - c. T&S Brass B-2711-WS
 - d. Speakman S-3561-LD
 - e. Symmons S9612G
 - f. Zurn Z81000-XL
 - g. Delta 501LF-HDF

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

3. Supplies: ½" compression lead free chrome plated cast brass angle stop with brass stem and loose key handle, chrome plated flexible copper tube riser and chrome escutcheon.
 - a. BrassCraft SCR-1912AX C
 - b. McGuire LF2165CCLK
 - c. Zurn Z8804-XL-LRLK-PC
4. Drain: 17 gauge, cast brass, chrome plated offset lavatory drain with perforated strainer with 1¼" tailpiece.
 - a. Keeney 5700PC
 - b. McGuire 155WC-ECO
 - c. Zurn Z8746
5. Trap: 1¼" x 1½", 17 gauge, cast brass chrome plated, adjustable ground joint 'P' trap with cleanout plug and chrome plated escutcheon.
 - a. Keeney 5311XPC
 - b. McGuire 8912CBECO
 - c. Zurn Z8701-9B
6. Under Lav Protection: Handicap lavatory P-trap and angle valve assemblies shall be insulated with white color fully molded insulation kit.
 - a. Truebro 103 E-Z
 - b. McGuire PW 2000 WC
 - c. Plumberex X4444
 - d. Zurn Z-8946-3-NT
7. Carrier: ASME A112.6.1M; Cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.
 - a. J.R. Smith 700 for masonry, 700-M31 for metal stud walls
 - b. Josam 17100
 - c. Watts TCA-411
 - d. Zurn Z-1231-EZ
8. Note: Refer to architectural plans for mounting height.

2.04 LAUNDRY TUBS

A. LT-1 Laundry Tub:

1. Fixture: ANSI Z124.6; Floor mounted, single compartment 23" x 23½" x 13" deep, molded stone and polyester resin sink, 1½" molded drain assembly, faucet holes to match selected faucet. Adjustable leg levelers.
 - a. Fiat FL-1
 - b. Mustee 17F
 - c. Zurn MS-2620-F
2. Faucet: ASME A112.18.1; Lead free, polished chrome plated brass 4" deck faucet with 6" low profile spout with ¾ garden hose thread. Vandal resistant 2½" color coded metal lever handles.
 - a. Symmons S-249 BL-109
 - b. T&S Brass B-1110
 - c. Zurn Z812F1-XL-10F
 - d. Delta 27C4363
3. Vacuum Breaker: ANSI A112.1.3, ASSE 1011; Lead free, polished chrome-plated brass vacuum breaker with stainless steel working parts, rubber diaphragm, and disc. Non-removal design for permanent installation. Maximum pressure 125 psig garden hose thread on outlet.
 - a. Apollo HBV2 LF CS
 - b. Watts 8AC
 - c. Woodford 50H-CH
 - d. Zurn Z1399-VB-PC
4. Supplies: ½" compression lead free chrome plated cast brass angle stop with brass stem and loose key handle, chrome plated flexible copper tube riser and chrome escutcheon.
 - a. BrassCraft SCR-1912AX C
 - b. McGuire LF2165CCLK
 - c. Zurn Z8804-XL-LRLK-PC
5. Trap: 1½" x 1½", 17 gauge, cast brass chrome plated, adjustable ground joint 'P' trap with cleanout plug and chrome plated escutcheon.
 - a. Keeney 5307XPC
 - b. McGuire 8912CBECO
 - c. Zurn Z8702-9B

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of countertop lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes and locations indicated in fixture rough-in drawings.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome-plated rigid supplies where exposed or flexible supplies in cabinets to fixtures with loose key or wheel handle stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.
- E. Seal fixtures to wall and floor surfaces with sealant as specified in Architectural specifications, color to match fixture.
- F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.
- G. Equipment shall be suitably protected against damage before and after installation. Any damaged plumbing fixture or piece of equipment shall be replaced at the expense of the plumbing contractor. All fixtures to be acceptable for final inspection shall be free of chips, flaws, scratches, abrasions, discolorations, or any defect, which, in the opinion of the Engineer, would classify the fixture as unsuitable for use intended.
- H. All exposed trim including pipe nipples to plumbing fixtures shall be chromium plated and shall be completely free of tool marks, abrasions, or flattening of tubing, etc. All fixtures included in this specification and shown on the drawings shall be completed by the plumbing contractor together with all necessary hangers, bolts, anchors, and brackets.
- I. All fixture heights, spacing apart and distances from walls shall be in accordance with Architectural details, floor plans, and elevation. Deviation may necessitate alteration to comply with plans. Verify dimensions with General Contractor.
- J. Repair all leaks, dripping or running fixtures, faucets, etc. Regulate flow to water closets, showers, etc., for proper operation. Provide shutoffs at all individual fixtures.
- K. All fixtures, flush valves, faucets etc. being reinstalled or relocated that were salvaged during the demolition phase of project shall be thoroughly cleaned and checked for any issues, repair as required. Flush valves and Faucets shall be checked for proper operation and replace flush valve diaphragm and faucet ceramic cartridges or install washer kit and new .5 or 1.5 gpm aerators to match existing. Upgrade washer faucets to ceramic cartridges when possible. Battery sensor flush valves and faucets shall have new batteries installed before reinstallation.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow. Repair any leaks, dripping or running fixtures.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment at end of project.

END OF SECTION

**SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Continuity of Existing Services
 - 7. Protection of Finished Surfaces
 - 8. Sleeves and Openings
 - 9. Sealing and Firestopping
 - 10. Equipment Substitutions
 - 11. Submittals
 - 12. Off-site Storage
 - 13. Certificates and Inspections
 - 14. Operating and Maintenance Data
 - 15. Training of Owner Personnel
 - 16. Record Drawings
- C. PART 2 - Products
 - 1. Access Panels and Doors
 - 2. Identification
 - 3. Sealing and Firestopping
- D. PART 3 - EXECUTION
 - 1. Demolition
 - 2. Concrete Work
 - 3. Cutting and Patching
 - 4. Building Access
 - 5. Equipment Access
 - 6. Coordination
 - 7. Identification
 - 8. Lubrication
 - 9. Sleeves and Openings
 - 10. Sealing and Firestopping
 - 11. Temperature Control
 - 12. Cleaning Equipment, Ductwork, and Premises
 - 13. Guarantee
 - 14. Certification of Tests and Adjustments

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.02 RELATED WORK

- A. Section 23 05 13 - Common Motor Requirements for HVAC
- B. Section 23 33 00 - Air Duct Accessories

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. Abbreviations of standards organizations referenced in other sections are as follows:

AABC	Associated Air Balance Council
ADC	Air Diffusion Council
AGA	American Gas Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
EPA	Environmental Protection Agency
GAMA	Gas Appliance Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
MCA	Mechanical Contractors Association
MICA	Midwest Insulation Contractors Association
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
UL	Underwriters Laboratories Inc.
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
UL1479	Fire Tests of Through-Penetration Firestops
UL723	Surface Burning Characteristics of Building Materials

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.
- B. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

1.06 CONTINUITY OF EXISTING SERVICES

- A. Do not interrupt or change existing services without prior written approval from the Owner. When interruption is required, coordinate the down time with the Owner to minimize disruption to their activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

1.07 PROTECTION OF FINISHED SURFACES

- A. Refer to Division 1, General Requirements, Protection of Finished Surfaces.
- B. Furnish one can of touch up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch up paint with other "loose and detachable parts" as covered in the General Requirements.

1.08 SLEEVES AND OPENINGS

- A. Refer to Division 1, General Requirements, Sleeves and Openings.

1.09 SEALING AND FIRESTOPPING

- A. Sealing and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations.

1.10 EQUIPMENT SUBSTITUTIONS

- A. Contractors and/or manufacturers may submit catalog data on material proposed for substitution to the engineer for evaluation up to 10 days prior to the date for opening bids. The engineer will render an opinion on whether or not the material can be bid as a substitute based on the information received. Final approval for the use of substitute equipment will not be given until complete shop drawings, samples or other information deemed necessary by the engineer has been submitted.

1.11 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.
- C. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Starters and disconnects which are not explicitly defined as the responsibility of any contractor shall be provided by the Division 23 contractor. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule are in agreement or indicate any discrepancies. See related comments in Section 23 05 13 in Part 1 under Electrical Coordination.
- D. Include wiring diagrams of electrically powered equipment.

- E. Submit sufficient quantities of shop drawings to allow the following distribution:
- Operating and Maintenance Manuals 3 copies
 - Testing, Adjusting and Balancing Contractor 1 copy
 - A/E 1 copy
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.12 OFF-SITE STORAGE

- A. Prior approval by General Contractor/Construction Manager and the A/E will be needed.
- B. Generally, ductwork, metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough in material will not be accepted for off-site storage. For material that can be stored off site, no material will be accepted for off-site storage unless shop drawings for that material have been approved.

1.13 CERTIFICATES AND INSPECTIONS

- A. Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.
- B. Contractors installing heating, ventilating, and air conditioning systems or equipment in the State of Wisconsin must be licensed. The contractor must provide proof of current and valid license upon request and maintain license through project completion.
- C. Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer in accordance with Wis Adm Code SPS 302. Deliver originals of these certificates to the A/E. Include copies of the certificates in the Operating and Maintenance Instructions.
- D. All utility connection fees shall be paid by the respective contractor.

1.14 OPERATING AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.
- B. Assemble material in three ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
- Copies of all approved shop drawings
 - Manufacturer's wiring diagrams for electrically powered equipment
 - Records of tests performed to certify compliance with system requirements
 - Certificates of inspection by regulatory agencies
 - Temperature control record drawings and control sequences
 - Parts lists for manufactured equipment
 - Lubrication instructions, including list/frequency of lubrication done during construction
 - Warranties
 - Additional information as indicated in the technical specification sections
 - A copy of signed Certification of Tests and Adjustments Form
 - Final Testing, Adjusting, and Balance Report

1.15 TRAINING OF OWNER PERSONNEL

- A. Instruct Owner personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include not less than 2 hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

1.16 RECORD DRAWINGS

- A. Refer to Division 1, General Requirements, Record Drawings.
- B. In addition to the data indicated in the General Requirements, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

PART 2 - PRODUCTS

2.01 ACCESS PANELS AND DOORS

- A. LAY IN CEILINGS: Removable lay in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are sufficient; no additional access provisions are required unless specifically indicated.
- B. PLASTER WALLS AND CEILINGS: 16-gauge frame with not less than a 20-gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.02 IDENTIFICATION

- A. STENCILS: Not less than 1 inch high letters/numbers for marking pipe and equipment.
- B. ENGRAVED NAME PLATES: White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.

2.03 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:

1. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with UL & ASTM.
2. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

B. NON-RATED PENETRATIONS:

1. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.
2. Duct Penetrations: Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.
3. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 - EXECUTION

3.01 DEMOLITION

- A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.
- B. All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. All piping and ductwork specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the Owner. All designated equipment is to be turned over to the Owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.
- C. Mechanical systems are shown on drawings that were coordinated with the existing conditions; however, variations may occur. Contractor shall verify dimensions, heights, door swings and any other information critical to the placement of devices with the drawings and existing conditions to assure proper installation. Field measurements shall take precedence over drawing dimensions and shall be verified. Plans shall not be scaled to locate equipment.

- D. It shall be the contractor's responsibility to visit the existing project site, become acquainted with all existing conditions, and ascertain the extent of work involved in installing equipment, ductwork, air distribution devices, piping, controls and all other appurtenances pertaining to the above. The contractor shall provide all labor, materials, etc., required for the complete, new installation required for the completion of the project. By the act of submitting a price; or in the case of time and material project, begin work, the contractor shall be deemed to have performed such an examination, to have accepted such conditions, and to have made allowances therefore preparing his price and resolving questions regarding work required.

3.02 CONCRETE WORK

- A. All cast in place concrete will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support of mechanical equipment.

3.03 CUTTING AND PATCHING

- A. Refer to Division 1, General Requirements, Cutting and Patching.
- B. Skilled tradesmen shall be employed to do cutting and patching. Each Contractor shall be responsible for cutting and patching new openings for their use, in existing or previously constructed walls, ceilings, floors, roofs, etc., unless otherwise designated. Use core drills or saws to cut all openings. Air, jack or manual hammers shall not be used unless approved by the Architect/Engineer. Provide personnel protection under coring operations in occupied areas. Submit methods of supporting and sealing floor sleeves for approval. Holes cut in roof and exterior wall shall be weatherproofed immediately. Provide temporary dust barriers for cutting operations in occupied spaces. Where openings require lintels, they shall be provided by the trade requiring the opening unless specifically indicated on the drawings as being provided in another trade. Each contractor shall be responsible for sealing finished openings, for their use, water and air tight, unless otherwise designated.

3.04 BUILDING ACCESS

- A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.05 EQUIPMENT ACCESS

- A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.
- B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels. See 'Identification'.
- C. Ductwork, equipment, and piping below 7'-6" above finished floor shall have a resilient material (foam rubber, etc.) attached to all potentially dangerous edges.

3.06 COORDINATION

- A. Mechanical systems are shown on drawings that were coordinated with the architectural drawings; however, variations may occur. Contractor shall verify all information critical to the placement of devices with the architectural drawings to assure proper installation. Field measurements shall take precedence over drawing dimensions and shall be verified. Plans shall not be scaled to locate equipment. It shall be the contractor's responsibility to become acquainted with all conditions, and ascertain the extent of work involved in installing equipment, ductwork, air distribution devices, piping, controls and all other appurtenances pertaining to the above. The contractor shall provide all labor, materials, etc., required for the complete, new installation required for the completion of the project. By the act of submitting a price; or in the case of time and material project, begin work, the contractor shall be deemed to have performed such an examination, to have accepted such conditions, and to have made allowances therefore preparing his price and resolving questions regarding work required.
- B. Plans of piping and ductwork shown on scale drawings are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction and approximate general arrangement of one phase of work to another, but not the exact detail or arrangement of construction. Plans are based on equipment scheduled. Contractor shall be responsible for changes resulting from equipment other than scheduled.
- C. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi recessed heating and/or cooling terminal units installed in/on architectural surfaces.
- D. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
- E. Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify system completion to the test and balance agency (clean filters, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

3.07 IDENTIFICATION

- A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.
- B. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.
- C. All valves, coils, controls, and other equipment requiring service located above ceilings, shall have the ceiling tile directly below identified with a colored tack inserted into the tile.
- D. Use engraved name plates to identify control equipment.

3.08 LUBRICATION

- A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.09 SLEEVES AND OPENINGS

A. DUCT SLEEVES:

- 1. Duct sleeves are not required in non-rated partitions or floors.

3.10 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:

- 1. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with UL & ASTM.

B. NON-RATED PARTITIONS:

- 1. At all interior walls and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.
- 2. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include janitor closets, toilet rooms, mechanical rooms, conference rooms, offices, private consultation rooms, where ducts are exposed and where noted on drawings elsewhere.

3.11 TEMPERATURE CONTROL

- A. All wall mounted temperature control devices such as thermostats, fan switches, etc. shall be installed in or on flush outlet boxes with all terminations made within junction or device box. Devices shall be located at a maximum of 48" above the finished floor.
- B. All temperature control conductors shall be supported by metallic hanger straps secured to the building structure, intervals not exceeding 5 feet on center. Above accessible ceilings, conductors shall be secured not less than 8" above ceiling tiles to allow for tile removal, and conductors shall not be allowed to lie directly on ceiling tiles. All control wiring in all areas below finished ceiling shall be in conduit.
- C. All line voltage conductors shall be installed in raceways. All raceways shall comply in all aspects to the provision of Division 26, including materials and installation.
- D. All line voltage terminations made by this contractor shall be made in complete compliance with the requirements of Division 26 specifications, the National Electrical Code, and all local codes having jurisdiction. Where installed in raceway, all splices, fittings, and terminations in temperature control conductors shall be made within the device or in junction boxes. Boxes shall be accessible from the finished surface of the facility.

3.12 CLEANING EQUIPMENT, DUCTWORK AND PREMISES

- A. Thoroughly clean all parts of the piping, valves, ductwork, grilles and equipment. Exposed parts which are to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.
- B. Clean filters shall be installed in all equipment specified with filters.
- C. Remove all construction debris, excess materials and equipment.

3.13 GUARANTEE

- A. All materials and workmanship shall be guaranteed for a period of one year after substantial completion. Where extended warranties are required, they shall be provided by the manufacturer or contractor as specified, in the equipment specification.

3.14 CERTIFICATION OF TESTS AND ADJUSTMENTS

A. Contractor _____

B. Division of Work _____

C. Project Name _____

D. Project Number _____

E. The Contractor named above certifies that the tests and adjustments indicated below have been completed in accordance with the specifications on the date indicated. Start-up of all HVAC equipment installed in this project is the responsibility of this Contractor unless otherwise indicated.

F. Tests:	Date
1. Fuel Gas	_____
2. Furnace Start-up	_____
3. Refrigeration Piping	_____
4. Condensing Unit Start-up	_____

G. Contact _____

H. Signed By _____

I. Date _____

END OF SECTION

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SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes requirements for single phase motors that are used with equipment specified in other sections. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Off-site Storage
 - 7. Operating and Maintenance Data
 - 8. Electrical Coordination
 - 9. Product Criteria
- C. PART 2 - Products
 - 1. Single Phase, Single Speed Motors
- D. PART 3 - EXECUTION
 - 1. Installation

1.02 RELATED WORK

- A. Division 26 - Electrical

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators
- B. ANSI/NEMA MG-1 Motors and Generators
- C. ANSI/NFPA 70 National Electrical Code

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Include with the equipment which the motor drives the following motor information: motor manufacturer, horsepower, voltage, phase, hertz, rpm, full load efficiency. Include project wiring diagrams prepared by the contractor specifically for this work.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.07 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.
- B. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:
 - 1. Lubrication instructions, including list/frequency of lubrication.
 - 2. Table noting full load power factor, service factor, NEMA design designation, insulation class and frame type for each motor provided.

1.08 ELECTRICAL COORDINATION

- A. All starters, overload relay heater coils, disconnect switches and fuses, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are furnished and installed by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.
- B. Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor. See related comments in Section 23 05 00 - Common Work Results for HVAC, under Shop Drawings.
- C. Electrical Contractor will provide all power wiring and control wiring, except temperature control wiring.
- D. Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

1.09 PRODUCT CRITERIA

- A. Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.
- B. Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.
- C. Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 - PRODUCTS

2.01 SINGLE PHASE, SINGLE SPEED MOTORS

- A. Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 3/4 HP and smaller.
- B. Use electronically commutated motor, permanent split capacitor or capacitor start, induction run motors, as indicated, equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.
- B. Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use. Include this information in the maintenance manuals.

END OF SECTION

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SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Description
 - 7. Submittals
 - 8. Design Criteria
- C. PART 2 - Products
 - 1. Pipe Hanger and Support Manufacturers
 - 2. Structural Supports
 - 3. Pipe Hangers and Supports
 - 4. Wood Structure Supports
 - 5. Corrosive Atmosphere Coatings
- D. PART 3 - EXECUTION
 - 1. Installation
 - 2. Hanger and Support Spacing

1.02 RELATED WORK

- A. Section 23 07 00 - HVAC Insulation

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.
- B. MSS SP-59 Pipe Hangers and Supports - Selection and Application.

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 DESCRIPTION

- A. Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.
- B. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.
- C. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.
- D. Protect insulation at all hanger points; see Related Work above.

1.07 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service. Reference section 23 05 00.

1.08 DESIGN CRITERIA

- A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.
- B. Piping supported by lying on the bottom chord of joists or trusses will not be accepted.
- C. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.
- D. Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

PART 2 - PRODUCTS

2.01 PIPE HANGER AND SUPPORT MANUFACTURERS

- A. Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

2.02 STRUCTURAL SUPPORTS

- A. Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.

2.03 PIPE HANGERS AND SUPPORTS

- A. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods if calculations are submitted.
- B. Wall Support:
 - 1. Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.
 - 2. Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.
- C. Vertical Riser Support: Carbon steel riser clamp, copper plated when used with copper pipe. Anvil figure 261 for steel pipe, figure CT121 for copper pipe.
- D. Copper Pipe Support: Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.
- E. Steel Hanger Rods:
 - 1. Threaded both ends, threaded one end, or continuous threaded, black finish.
 - 2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
 - 3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2

- 4. Provide rods complete with adjusting and lock nuts.

2.04 WOOD STRUCTURE SUPPORTS

- A. Carbon steel pipe short strap for piping ½" through 2". Fastened with two No. 24 x 2 (minimum size) wood screws. Anvil Figure 262.
- B. Carbon steel coach screw rods machine threaded on opposite ends, minimum 3/8" diameter. Anvil Figure 142.
- C. Carbon steel side beam bracket with minimum 3/8" rod size and fastened with minimum ½" x 3" lag screws. Anvil Figure 207.

2.05 CORROSIVE ATMOSPHERE COATINGS

- A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface, each side. Mechanical galvanize threaded products, ASTM B695 Class 150, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.
- B. Corrosive atmospheres include the following locations:
 - Exterior locations

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install supports to provide for free expansion of the piping and duct system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.
- B. Piping shall be supported independently from ductwork and all other trades.
- C. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.

3.02 HANGER AND SUPPORT SPACING

- A. Place a hanger within 12" of each horizontal elbow, valve, strainer, or similar piping specialty item.
- B. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
- C. Support riser piping independently of connected horizontal piping.
- D. Adjust hangers to obtain the slope specified in the piping section of this specification.
- E. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Horizontal Max. Spacing	Vertical Max Spacing
Steel	1/2" through 1-1/4"	6'-6"	15'-0"
Thermoplastic	All sizes	4'-0"	10'-0"
Copper	1/2" through 1-1/4"	5'-0"	10'-0"

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes air testing, adjusting and balancing for the entire project. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Description
 - 6. Quality Assurance (Qualifications)
 - 7. Pre-Installation Meeting and Scheduling
 - 8. Pre-Balance Conference
 - 9. Submittals
- C. PART 2 - Products
 - 1. Instrumentation
- D. PART 3 - EXECUTION
 - 1. Daily Reports
 - 2. Preliminary Procedures
 - 3. Performing Testing, Adjusting, and Balancing
 - 4. Deficiencies

1.02 RELATED WORK

- A. Section 23 05 00 Common Work Results for HVAC
- B. Section 23 07 00 HVAC Insulation

1.03 REFERENCE

- A. Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. AABC National Standards for Total System Balance, Sixth Edition, 2002.
- B. ASHRAE ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.
- C. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.
- D. TABB Tab Procedural Guide, First Edition, 2003.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.05 DESCRIPTION

- A. The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.
- B. Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC, NEBB, or TABB.
- C. Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.
- D. Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.
- E. Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

1.06 QUALITY ASSURANCE (QUALIFICATIONS)

- A. An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 5 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.
- B. A certified member of AABC or certified by NEBB or TABB in the specific area of work performed. Maintain certification for the entire duration of the project.
- C. Technicians on this project must have satisfactorily completed work on a minimum of (5) five projects of at least 50% in size, and of similar complexity. Size is defined as the quantity of each specific individual item requiring testing and balancing such as, but not limited to, equipment, devices, terminal devices, and grilles/diffusers.
- D. Submit Qualifications of firm and project staff to A/E upon request.

1.07 PRE-INSTALLATION MEETING AND SCHEDULING

- A. The test and balance agency is required to attend a pre-installation meeting with all other project contractors before the construction process is started. The test and balance agency shall give the Lead Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule.

1.08 PRE-BALANCE CONFERENCE

- A. 90 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the Architect/Engineer, Owner's Project Representative and the mechanical system and temperature control system installing Contractors. Provide A/E with a complete copy of the TAB plan for the project. The objective is final coordination and verification of system operation and readiness for testing, adjusting and balancing procedures and scheduling procedures with the above-mentioned parties. Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party responsible for completion of that work.

1.09 SUBMITTALS

- A. See also Related Work in this section.
- B. Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB, AABC, or TABB Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.
 1. Submission:
 - a. Distribute electronic copies of the Report to the Mechanical Contractor and the Prime A/E.
 - b. Provide three (3) hard copies of Final Report to be included in O&M Manuals.
 2. Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:
 - General Information
 - Summary
 - Air Systems
 - Special Systems
 3. Contents: Provide the following minimum information, forms and data:
 - a. General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.
 - b. Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.
 - c. The remainder of the report to contain the appropriate standard NEBB, AABC, or TABB forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

- A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB, AABC, or TABB Standards and instrument manufacturer's specifications.
- B. All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by A/E upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB, AABC, or TABB Standards.

PART 3 - EXECUTION

3.01 DAILY REPORTS

- A. Submit to Owner's Project Representative daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

3.02 PRELIMINARY PROCEDURES

- A. Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.
- B. Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.
- C. Notify Owner's Project Representative on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

3.03 PERFORMING TESTING, ADJUSTING, AND BALANCING

- A. Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.
- B. Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday.
- C. In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the owner's project representative.

- D. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.
- E. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.
- F. Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.
- G. Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.
- H. Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.
- I. Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.
- J. Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the owner's project representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to owner's project representative. Prior authorization is needed before this work is started.
- K. Final air system measurements to be within the following range of specified cfm:

Fans	0% to +10%
Supply grilles, registers, diffusers	0% to +10%
Return/exhaust grilles, registers	0% to -10%
- L. Contact the Mechanical Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.
- M. Permanently mark equipment settings, including damper positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.
- N. Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

3.04 DEFICIENCIES

- A. Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the Owner's Project Representative of these items and instructions will be issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done at no cost to the Owner. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

**SECTION 23 07 00
HVAC INSULATION**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Description
 - 7. Definitions
 - 8. Submittals
 - 9. Operation and Maintenance Data
 - 10. Environmental Requirements
- C. PART 2 - Products
 - 1. Materials
 - 2. Insulation Types
 - 3. Adhesives, Mastics, Sealants, and Reinforcing Materials
 - 4. Jackets
 - 5. Accessories
- D. PART 3 - EXECUTION
 - 1. Examination
 - 2. Installation
 - 3. Protective Jacket Installation
 - 4. Piping, Valve and Fitting Insulation
 - 5. Piping Protective Jackets
 - 6. Pipe Insulation Schedule
 - 7. Duct Insulation
 - 8. Duct Insulation Schedule

1.02 RELATED WORK

- A. Section 23 05 00 - Common Work Results for HVAC
- B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
- C. Section 23 31 00 - HVAC Ducts and Casings

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
ASTM D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics
ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM E84	Surface Burning Characteristics of Building Materials
ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
MICA	National Commercial & Industrial Insulation Standards
NFPA 225	Surface Burning Characteristics of Building Materials
UL 723	Surface Burning Characteristics of Building Materials

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.
- B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.
- C. Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the contractor shall be able to document the successful completion of a minimum of five (5) projects of at least 50% of the size and similar scope of the work specified in this section.

1.06 DESCRIPTION

- A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
 - Pipe Insulation
 - Duct Insulation
- B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications.

1.07 DEFINITIONS

- A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.08 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.09 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.
- B. Protect installed insulation work with plastic sheeting to prevent water damage.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Manufacturers: Armacell, CertainTeed, Manson, Childers, Dow, Extol, Fibrex, Halstead, Foster, Imcoa, ITW, Johns Manville, Knauf Insulation, Owens-Corning, Pittsburgh Corning, VentureTape or approved equal.
- B. Materials or accessories containing asbestos will not be accepted.
- C. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exception:
 - 1. Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 450 when tested in accordance with UL 723 and ASTM E84.

2.02 INSULATION TYPES

- A. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.
- B. Flexible Fiberglass Insulation: Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.
- C. Elastomeric Insulation: Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75°F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor permeability of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20°F to 220°F on piping and 180°F where adhered to equipment.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

2.03 ADHESIVES, MASTICS, SEALANTS, AND REINFORCING MATERIALS

- A. Products shall be compatible with surfaces and materials on which they are applied and shall be suitable for use at operating temperatures of systems to which they are applied.
- B. Fiberglass Insulation Adhesive: Must comply with ASTM C916, Type II: Foster 85-60, Childers CP-127, Duro Dyne SSG.
- C. Vapor Retarding Mastic: For below ambient equipment/piping use a water-based mastic with a water vapor permeance of less than 0.04 perms at 40 mils dry film thickness per ASTM E 96: Childers CP-34, Foster 30-65 Vapor-Fas, Knauf Insulation, KI-900 or KI-905, Vimasco 749.
- D. For below ambient equipment/piping use water-based, anti-fungal mastic that meets ASTM D 5590 with a 0 growth rating (AF) and a water vapor permeance that is less than 0.013 perms at 43 mils dry film thickness per ASTM E 96 Procedure B: Foster 30-80AF Vapor Safe Mastic or equal.
- E. Insulation Joint Sealant: Joint sealants to be non-shrinking and permanently flexible.
 - Used on all below ambient piping to prevent moisture ingress.
 - For Elastomeric use Armaflex 520 or equal.

2.04 JACKETS

- A. PVC Fitting Covers and Jackets (PFJ): White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be minimum 30 mil unless otherwise noted.
- B. Foil Scrim All Service Jackets (FSJ): Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

2.05 ACCESSORIES

- A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.
- B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.
- C. Insulation bands to be 3/4" wide, constructed of aluminum or stainless steel. Minimum thickness to be .015" for aluminum and .010" for stainless steel.
- D. Tack fasteners to be stainless steel ring grooved shank tacks.
- E. Staples to be clinch style.
- F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.
- G. Finishing cement to be ASTM C449.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.
- B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.02 INSTALLATION

- A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.
- B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.
- C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.
- D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2".
- E. Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.
- F. All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.
- G. Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.
- H. Provide a complete vapor barrier for insulation on the following systems:
 - Refrigerant
 - Insulated Duct
 - Ductwork or piping with a surface temperature below 65°F

3.03 PROTECTIVE JACKET INSTALLATION

- A. PVC Fitting Covers and Jackets (PFJ): Lap seams and joints a minimum of 2" and continuously seal PVC with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems requiring a vapor barrier, apply a 1-1/2" band of mastic over ends, throat, seams and penetrations.
- B. All Service Jackets (ASJ) and Foil Scrim Kraft Jackets (FSK): Install according to manufacturer's recommendations using factory supplied lap seals and butt strip seals. In addition to factory adhesive, secure lap seals and tape with clinch type staples

3.04 PIPING, VALVE, AND FITTING INSULATION

A. General:

- 1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 3" tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally, secure with clinch style staples along seams and butt joints.
- 2. On systems requiring a vapor retarding jacket, seal off all raw ends of insulation and butt joints with vapor retarding mastic at intervals of not more than 20 feet on piping to create a vapor dam. Also provide a vapor dam on each side of valves, unions, and tees. Coat staples, longitudinal and transverse seams with vapor retarding mastic and on systems requiring vapor retarding jacket, coat insulated elbows, fittings, and valves with vapor retarding mastic.
- 3. Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.
- 4. On low temperature systems, use premanufactured insulated pipe riser clamps such as Pipe Shields E1000 and E 2000 series.
- 5. Fully insulate all reheat coil piping, fittings and valves (except for unions) up to coil connection to prevent condensation when coil is inactive during cooling season. Provide a vapor proof seal between the pipe insulation and the insulated coil casing.

B. Insulation Inserts and Pipe Shields:

- 1. Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions, however the inserts shall be no less than 12" in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.
- 2. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

- C. Elastomeric: Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. Apply full bed of adhesive to both surfaces.

3.05 PIPING PROTECTIVE JACKETS

- A. In addition to the jackets specified in the pipe insulation schedule below the following protective jackets are required:
- B. Provide a protective PVC (PFJ) for the following insulated piping:
- Exterior installed refrigeration piping.

3.06 PIPE INSULATION SCHEDULE

- A. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	Insulation	Jacket	Insulation Thickness by Pipe Size				
			< 1"	1" < 2"	2" - <4"	4" < 8"	8" >
Refrig. Suction >40°F	Elastomeric	None	0.5"	1"	1.5"	1.5"	1.5"
Cooling Coil Condensate Drain	Rigid Fiberglass	ASJ	0.5"	0.5"	1"	1"	1"

3.07 DUCT INSULATION

- A. General:
- Secure flexible blanket duct insulation on sides and bottom of ductwork over 24" wide with weld pins. Space fasteners 18" on center or less as required to prevent sagging. Compress insulation no more than 25%.
 - Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed with vapor retarding mastic.
 - Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.
 - External supply duct insulation is not required where ductwork contains continuous 1" acoustical liner, unless otherwise indicated. Provide 4" overlap of external insulation over ends of acoustically lined sections.
 - Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.

6. Where insulated low temperature (below 45°F) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.
7. Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation and vapor barrier jacketing to encapsulate the support channels.

3.08 DUCT INSULATION SCHEDULE

A. Provide duct insulation on new and existing remodeled ductwork in the following schedule:

Service	Insulation Type	Jacket	Insulation Thickness
Outside air ducts	Flexible Fiberglass	FSK	2.2"
Concealed supply ducts	Flexible Fiberglass	FSK	2.2" (R6 min. installed)
Exhaust and Relief ducts downstream of backdraft dampers	Flexible Fiberglass	FSK	2.2"

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section contains specifications for all refrigerant piping and accessories for this project. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Submittals
 - 6. Quality Assurance
 - 7. Delivery, Storage, and Handling
 - 8. Design Criteria
- C. PART 2 - Products
 - 1. Refrigerant Piping
 - 2. Refrigerant Piping Accessories
- D. PART 3 - EXECUTION
 - 1. Preparation
 - 2. Erection
 - 3. Refrigerant Piping
 - 4. Refrigerant Piping Accessories

1.02 RELATED WORK

- A. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
- B. Section 23 07 00 - HVAC Insulation

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
- B. ASTM B88 Seamless Copper Water Tube
- C. ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
- D. ASHRAE 15 Safety Code for Mechanical Refrigeration

1.05 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.
- C. COPPER TUBE: Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

1.06 QUALITY ASSURANCE

- A. Order all copper refrigeration tube with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier; with soft straight lengths or coils identified with a tag indicating that the product was manufactured in accordance with ASTM B280; and with each hard temper straight length identified throughout its length by a blue colored marking not less than 3/16 inch in height and a legend at intervals of not greater than three feet that includes the designation "ACR" and pipe outside diameter.
- B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.
- B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. If end caps are not present on tube bearing the "ACR" designation, clean and re-cap in accordance with ASTM B280. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.
- C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.
- D. Storage and protection methods must allow inspection to verify products.

1.08 DESIGN CRITERIA

- A. Use only new material, free of defects and scale, and meeting the latest revision of ASTM specifications as listed in this specification.
- B. Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING

- A. It is not the intent of this specification to require a hard piped system on small air cooled condensing units that are typically provided by the manufacturer with precharged tubing. If precharged tubing is available in the proper length, it may be used. In that case, use the manufacturer's standard liquid line refrigerant specialties also. If, however, the application requires a special refrigerant piping system, use the following pipe specification.
- B. ASTM B88 type L hard drawn copper tube, cleaned and capped in accordance with ASTM B280, and marked "ACR", with ANSI B16.22 wrought copper or forged brass solder-type fittings.

2.02 REFRIGERANT PIPING ACCESSORIES

- A. Provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 450 psig and a maximum working temperature of 225°F. For systems using R-410A, provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 850 psig and a maximum working temperature of 225°F.
- B. Filter Dryers: Provide straight pattern filter dryers without replaceable core.
- C. Thermostatic Expansion Valves: Brass body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.
- D. Charging Valves: Provide ¼" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2" long copper extension sections.
- E. Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Remove all foreign material from interior and exterior of pipe and fittings.

3.02 ERECTION

- A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.
- B. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

- C. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

3.03 REFRIGERANT PIPING

- A. Refrigeration piping to be installed by firms who are experienced in installation of such piping and in accordance with the requirements of the Wisconsin Administrative Code.
- B. All solder joints to be ASTM Grade 4 or 5 and have a melting point of approximately 1250 degrees F. Solder impurities shall not exceed 0.15%. Tubing to be new and delivered to the job site with the original mill end caps in place. Clean and polish all joints before soldering. Avoid prolonged heating and burning during soldering. Purge all lines with nitrogen during soldering. Provide manual shut-off and check valves as required.
- C. No refrigerant is to be vented directly to the atmosphere except that which may escape through leaks in the system during leak testing. During evacuation procedures, use equipment designed to recover and allow recycling of the refrigerant.
- D. Leak test the system by charging the system to a pressure of 10 psig with an HFC refrigerant, with the compressor suction and discharge valves closed and with all other system valves open. Increase pressure to 300 psig with dry nitrogen. Rap all joints with a mallet and check for leaks with an electric leak detector having a certified sensitivity of at least one ounce per year. Seal any leaks that may be found and retest.
- E. After completion of the leak test, evacuate the system with a vacuum pump to an absolute pressure not exceeding 1500 microns while the system ambient temperature is above 60°F. Break the vacuum to 2 psig with the refrigerant to be used in the system. Repeat the evacuation process, again breaking the vacuum with refrigerant. Install a drier of the required size in the liquid line, open the compressor suction and discharge valves, and evacuate to an absolute pressure not exceeding 500 microns. Leave the vacuum pump running for not less than two hours without interruption. Raise the system pressure to 2 psig with refrigerant and remove the vacuum pump.
- F. Charge refrigerant directly from original drums through a combination filter-drier. Each drier may be used for a maximum of three cylinders of refrigerant and then must be replaced with a fresh drier. Charge the system by means of a charging fitting in the liquid line. Weigh the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side of the compressor, charge in vapor form only.

3.04 REFRIGERANT PIPING ACCESSORIES

- A. Install accessories in accordance with the manufacturer's written instructions and recommendations.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes specifications for all duct systems used on this project. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Submittals
 - 7. Design Criteria
 - 8. Delivery, Storage, and Handling
- C. PART 2 - Products
 - 1. General
 - 2. Ductwork Pressure Class
 - 3. Materials
 - 4. Low Pressure Ductwork (Maximum 2 inch pressure class)
 - 5. Duct Sealant
 - 6. Gaskets
- D. PART 3 - EXECUTION
 - 1. Installation
 - 2. Ductwork Support
 - 3. Low Pressure Duct (Maximum 2 inch pressure class)
 - 4. Cleaning

1.02 RELATED WORK

- A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC
- B. Section 23 33 00 - Air Duct Accessories

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. ASTM A90 Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
- B. ASTM A623 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
- C. ASTM A527 Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

D. ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
E. ASTM C 1071	Specification for Fibrous Glass Duct Lining Insulation
F. ASTM C 411	Test Method for Hot Surface Performance of High Temperature Thermal Insulation
G. ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
H. ASTM C 1338	Test Method for Determining Fungal Resistance of Insulation Materials and Facings
I. ASTM G 21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
J. ASTM C 916	Standard Specification for Adhesives for Duct Thermal Insulation
K. NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
L. UL 181	Standard for Safety for Factory Made Air Ducts and Air Connectors

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Include manufacturer's data and/or Contractor data for the following:

- Fabrication and installation drawings.
- Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.
- Duct sealant and gasket material.

1.07 DESIGN CRITERIA

A. Construct all ductwork to be free from vibration, chatter, objectionable pulsations, and leakage under specified operating conditions.

B. Use material, weight, thickness, gauge, construction, and installation methods as outlined in the following SMACNA publications, unless noted otherwise:

- HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
- HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012
- HVAC Systems - Duct Design, 4th Edition, 2006
- Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
- Round Industrial Duct Construction Standards, 2nd Edition, 1999
- Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995

C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.
- B. Protect Ductwork against damage.
- C. Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.
- D. Offsite storage agreements do not relieve the contractor from using proper storage techniques.
- E. Storage and protection methods must allow inspection to verify products.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.
- B. Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

2.02 DUCTWORK PRESSURE CLASS

- A. Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application. Duct system pressure classes are indicated on the drawings.

2.03 MATERIALS

- A. **GALVANIZED STEEL SHEET:** Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish or galvanneal sheet metal for ductwork that will be painted.

2.04 LOW PRESSURE DUCTWORK (Maximum 2 inch pressure class)

- A. Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.
- B. Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

- C. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.
- D. Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00.
- E. Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.
- F. Button punch snaplock construction will not be accepted on aluminum ductwork.
- G. Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except as permitted by the Architect/Engineer.
- H. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

2.05 DUCT SEALANT

- A. Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal, or approved equal. Silicone sealants are not allowed in any type of ductwork installation.
- B. Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

2.06 GASKETS

- A. 2" pressure class and lower: Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.
- B. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or fume exhaust ductwork.
- C. Test openings for test and balance work will be provided under Section 23 05 93.
- D. Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.
- E. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.
- F. Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.
- G. Install all motor operated dampers and connect to or install all equipment furnished by others.
- H. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.
- I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- J. Provide adequate access to ductwork for cleaning purposes.
- K. Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the ductwork.
- L. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

M. Ductwork required to be prepared for painting:

1. Surface shall be clean, dry and free from manufacturer's lubricants.
2. Remove dirt and grease from galvanized ductwork with VM&P, Naphtha, or water based commercial detergent and wipe dry with a clean cloth.
3. Surface shall be free of foreign materials that will be adversely affect adhesion or appearance of applied paint coating.

3.02 DUCTWORK SUPPORT

- A. Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.
- B. Stainless steel air-craft cable hanging systems are allowed on round ductwork under 12" diameter if installed utilizing two fasteners with two cable loops. Support with 3/32", 7 x 7, stainless steel air-craft cable, with matching serrated spring loaded wedge mechanism fasteners rated for actual load. Comply with the manufacturer's installation instructions.

3.03 LOW PRESSURE DUCT (Maximum 2 inch pressure class)

- A. Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.
- B. Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.
- C. Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheet metal screws or pop rivets. Trapeze hangers may be used at contractor's option.

3.04 CLEANING

- A. Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.
- B. Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes accessories used in the installation of duct systems. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Submittals
 - 7. Operation and Maintenance Data
- C. PART 2 - Products
 - 1. Manual Volume Dampers
 - 2. Turning Vanes
 - 3. Access Doors
 - 4. Flexible Duct
 - 5. Duct Lining
 - 6. Flashings
 - 7. Duct Flexible Connections
 - 8. Hoods for Intake and Exhaust
- D. PART 3 - EXECUTION
 - 1. Manual Volume Dampers
 - 2. Turning Vanes
 - 3. Access Doors
 - 4. Flexible Duct
 - 5. Duct Lining
 - 6. Flashings
 - 7. Duct Flexible Connections
 - 8. Hoods for Intake and Exhaust

1.02 RELATED WORK

- A. Section 23 05 29 - Hanger and Supports for HVAC Piping and Equipment
- B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
- C. Section 23 31 00 - HVAC Ducts and Casings

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems
- B. SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995
- C. UL 214
- D. UL 555(6th edition) Standard for Fire Dampers and Ceiling Dampers
- E. UL 555S (4th edition) Leakage Rated Dampers for Use in Smoke Control Systems

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.
- C. Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.
- D. Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

1.07 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 MANUAL VOLUME DAMPERS

- A. Manufacturers: Ruskin, Vent Products, Air Balance, Pottorff, or approved equal.
- B. Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.
- C. Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48". Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

2.02 TURNING VANES

- A. Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley, or approved equal.
- B. Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

2.03 ACCESS DOORS

- A. Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non hinged doors provide sufficient number of cam sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.
- B. Use insulated, 2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

2.04 FLEXIBLE DUCT

- A. Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster or approved equal.
- B. Factory fabricated, UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under in accordance with NFPA 90A.
- C. Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ± 2 " pressure class, depending on the application.
- D. Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.
- E. Where duct is specified to be insulated, provide a minimum 1" fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75°F) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

2.05 DUCT LINING

- A. Manufacturers: Manville, Owens-Corning, Knauf, or approved equal.
- B. 1" thick, flexible, mat faced insulation made from inorganic glass fibers bonded with a thermosetting resin with thermal conductivity of .25 Btu inch / hour sq.ft. deg F.

- C. Meet erosion testing per UL 181 or ASTM C 1071 for 5000 fpm maximum air velocity. ASTM C 411 maximum operating temperature rating of 250°F. ASTM E84 flame spread less than 25 and smoke developed less than 50.
- D. Meet requirements of ASTM C 1338 and ASTM G21 for fungi resistance.
- E. Install liner using adhesive conforming to ASTM C 916.

2.06 FLASHINGS

- A. Provide flashing to completely weatherproof connection of ductwork to louvers. Flashing to be constructed of material similar to louver material.
- B. Flashing and counterflashing for roof curbs will be provided by others.
- C. Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

2.07 DUCT FLEXIBLE CONNECTIONS

- A. Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.
- B. Connections to be a minimum of 3" wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.

2.08 HOODS FOR INTAKE

- A. Manufacturers: Acme, Carnes, Cook, Greenheck, Louvers and Dampers, United Enertech, or approved equal.
- B. Use low silhouette type hoods.
- C. Construct hoods of aluminum as indicated.
- D. Provide bird screen and motor operated damper (where indicated) for each hood.

PART 3 - EXECUTION

3.01 MANUAL VOLUME DAMPERS

- A. Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.02 TURNING VANES

- A. Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.
- B. Install double wall, airfoil, 2" radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2" radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

- C. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheet metal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

3.03 ACCESS DOORS

- A. Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.
- B. Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8" x 8" size for hand access, 18" x 18" size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.
- C. Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5" height lettering reading, "SMOKE DAMPER" or "FIRE DAMPER". Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

3.04 FLEXIBLE DUCT

- A. Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.
- B. Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.
- C. Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.
- D. Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.
- E. Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.
- F. Penetration of any partition, wall, or floor with flexible duct will not be accepted.

3.05 DUCT LINING

- A. Apply lining to ductwork as scheduled.
- B. Do not apply lining to the following ductwork:
 - Outside air ductwork.
 - Kitchen exhaust ductwork.
 - Dishwashing exhaust ductwork.
 - Shower exhaust ductwork.
 - Pool ventilation ductwork.
 - Supply, return and exhaust ductwork associated with shop ventilation systems where air handling units are located in the shops.
 - Fume hood exhaust ductwork.
 - Supply ductwork associated with ventilation systems serving hospital critical areas.
- C. Install liner in compliance with the latest edition of NAIMA's Fibrous Glass Duct Liner Standard. Locate longitudinal joints at the corners of duct only. Cut and fit to assure lapped, compressed joints. Coat all transverse and longitudinal joints and edges with adhesive. Provide metal nosing on leading edge where lined duct is preceded by unlined duct. Adhere liner to duct with full coverage area of adhesive. Additionally secure liner to duct using mechanical fasteners spaced as recommended by the liner manufacturer without compressing liner more than 1/8" with the fasteners.

3.06 FLASHINGS

- A. Flashing for roof curbs, equipment supports or rails located on roof will be installed by others.

3.07 DUCT FLEXIBLE CONNECTIONS

- A. Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 2-19. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

3.08 HOODS FOR INTAKE AND EXHAUST

- A. Install in locations indicated on the drawings, coordinating the roof opening location with the General Contractor. Curbs are covered in Section 23 05 29.

END OF SECTION

**SECTION 23 34 00
HVAC FANS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes specifications for fans that are not an integral part of a manufactured device. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Submittals
 - 7. Operation and Maintenance Data
 - 8. Design Criteria
- C. PART 2 - Products
 - 1. General
 - 2. Backdraft Dampers
 - 3. Power Roof Exhaust Fans
- D. PART 3 - EXECUTION
 - 1. Installation

1.02 RELATED WORK

- A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment
- B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. AMCA 203 AMCA Fan Application Manual - Troubleshooting
- B. AMCA 204 Standard Balance Quality and Vibration Levels for Fans
- C. AMCA 210 Laboratory Method of Testing Fans for Rating
- D. AMCA 211 Certified Ratings Program Product Rating Manual for Fan Air Performance
- E. AMCA 500-D Laboratory Methods for Testing Dampers for Ratings
- F. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
- G. UL 705 Standard Power Ventilators

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.06 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Include dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification and vibration isolation for all equipment. Sound power levels to be based on tests performed in accordance with AMCA Standard 300.
- C. Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Brake horsepower, recommended selection range, and limits of operation are to also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.

1.07 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 DESIGN CRITERIA

- A. Tested and certify all fans in accordance with the applicable AMCA test code.
- B. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.
- C. Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.
- D. Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to prevent uneven airflow or improve mixing.
- E. All internal insulation and other components exposed to the airstream are to meet the flame spread and smoke ratings contained in NFPA 90A.
- F. All roof mounted equipment to be provided with curbs or equipment stands in accordance with specification in Section 23 05 29.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Use fan size, class, type, arrangement, and capacity as scheduled.
- B. Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. All single-phase motors to have inherent thermal overload protection.

- C. Statically and dynamically balance all fans so they operate without objectionable noise or vibration.
- D. All direct drive fan motors shall be provided with a means for balancing fan speed. E.g., solid state speed controller, potentiometer, VFD, etc.

2.02 BACKDRAFT DAMPERS

- A. Manufacturers: Backdraft dampers shall be provided by the same manufacturer as the specified exhaust fan. Acceptable fan manufacturers are listed under each fan type. Where motorized dampers are indicated, refer to section 23 09 14 and/or 23 33 00 for requirements.
- B. Construction: 18 gauge damper frame, minimum 0.025" thick damper blades with vinyl edge seals, axle, axle bearings and internal linkage. Material and finish shall match duct material where damper is installed, unless otherwise noted.
- C. Performance: Dampers shall have an air leakage rate not greater than 20 cfm/ft² where not less than 24" in either dimension and 40 cfm/ft² where less than 24" in either dimension. The rate of air leakage shall be determined at 1.0" water gauge when tested in accordance with AMCA 500D for such purpose. The dampers shall be labeled by an approved agency.

2.03 POWER ROOF EXHAUST FANS

- A. Manufacturers: Carnes, Greenheck, Cook, CaptiveAire, or approved equal.
- B. Provide upblast or downblast units as scheduled.
- C. Construction: Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. A two-piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Aluminum bird screen at discharge.
- D. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency and minimize noise and turbulence
- E. Motor: EC motor as indicated. Motors that are single phase shall have thermal overload protection with integral disconnect switch.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install as shown on the drawings, as detailed, and according to manufacturer's installation instructions.
- B. Dampers shall be installed in accordance with manufacturer's installation instructions and be installed square and free from racking. Dampers must be accessible to allow inspection, adjustment, and replacement of components. Provide access door as specified under section 23 33 00.
- C. Contractor shall balance blade assembly of destratification fans after installation to assure stable operation.

END OF SECTION

SECTION 23 37 13
DIFFUSERS, REGISTERS & GRILLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes specifications for air terminal equipment. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Submittals
 - 7. Design Criteria
- C. PART 2 - Products
 - 1. Manufacturers
 - 2. Square Ceiling Diffusers - Plaque
 - 3. Plenum Slot Diffuser - 180° Adjustable
 - 4. Side-Wall Registers and Grilles
 - 5. Eggcrate Grille
- D. PART 3 - EXECUTION
 - 1. Installation

1.02 RELATED WORK

- A. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
- B. Section 23 31 00 - HVAC Ducts and Casings
- C. Section 23 33 00 - Air Duct Accessories

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- B. UL 181 - Factory-Made Air Ducts and Connectors.
- C. ARI-ADC Standard 880.

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Furnish submittal information including, but not limited to, the following:

- Manufacturer's name and model number
- Identification as referenced in the documents
- Capacities/ratings
- Materials of construction
- Sound ratings
- Dimensions
- Finish
- Color selection charts where applicable
- Manufacturer's installation instructions
- All other appropriate data

1.07 DESIGN CRITERIA

- A. All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturers for specific products are listed under each item.

2.02 SQUARE CEILING DIFFUSERS - PLAQUE

- A. Titus model OMNI, Carnes series SFPA/SHPA, Price model ASDP, Tuttle & Bailey series 1100, Metal Aire series 5750, Krueger series PLQ/5PLQ, and Raymon PRO-2.
- B. Aluminum unless otherwise indicated, plaque face furnished with frame type appropriate to installation.
- C. Diffuser shall have throw characteristics of a round diffuser having a 360° horizontal blow pattern.
- D. One-piece removable square face plaque with one-piece backpan.
- E. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.03 PLENUM SLOT DIFFUSER - 180° ADJUSTABLE

- A. Titus model TBD-30, Carnes model DA, Price model TBD3, Metal Aire series 6600, and Krueger series PTBA, Raymon-Donco Series SAT/XC.
- B. Steel, furnished with T-bars compatible with ceiling components. Vane air pattern and flow rate adjustment with air pattern having full 180-degree adjustment.

- C. Provide 24 gauge galvanized steel insulated plenum (Contractor to also insulate externally as scheduled for ductwork). Provide round or oval inlet collar designed to fit standard flexible duct sizes.
- D. Double metal thickness slot face.
- E. White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior.

2.04 SIDE-WALL REGISTERS AND GRILLES

- A. Titus Series 300 (supply) and Series 350 (return/exhaust), Carnes Model R Series, Price Model 520 (Supply) or 530 (return/exhaust), Metal Aire Series V4000 or H4000, Krueger Series 880, Tuttle & Bailey A54 (supply) and A70D (return/exhaust), Raymon Series RA.
- B. Aluminum unless otherwise indicated, with frame type appropriate to installation.
- C. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.
- D. Opposed blade volume control damper supply registers, operable from face.
- E. Fixed blade, 45 degree core return and exhaust registers and grilles unless otherwise indicated.
- F. Opposed blade volume control damper return registers, operable from face, where indicated.
- G. Register and grille sizes as shown on drawings and/or as scheduled.
- H. White, baked enamel finish or powder coat finish, unless otherwise indicated.
- I. Screw holes on surface counter sunk to accept recessed type screws.

2.05 EGGCRATE GRILLE

- A. Titus model 50, Carnes model RAE or RAT, Price model 80, Metal Aire model CC, Krueger model EGC, Tuttle & Bailey CRE 500, or Raymon model ECR.
- B. Aluminum construction with frame type appropriate to installation.
- C. Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1/2" deep with a minimum of 85% free area.
- D. Grille sizes and finishes as shown on drawings and/or as scheduled.
- E. White, baked enamel finish or powder coat finish, unless otherwise indicated.
- F. Screw holes on surface counter sunk to accept recessed type screws.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.
- B. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.
- C. Seal connections between ductwork drops and diffusers/grilles airtight.
- D. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

END OF SECTION

**SECTION 23 41 00
PARTICULATE AIR FILTRATION**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes specifications for air system filters. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Shop Drawings
 - 7. Operation and Maintenance Data
 - 8. Design Criteria
- C. PART 2 - PRODUCTS
 - 1. Manufacturers
 - 2. MERV 13 Filters
 - 3. Housings for MERV 13 Filters
- D. PART 3 - EXECUTION
 - 1. Installation

1.02 RELATED WORK

- A. Section 23 07 00 - HVAC Insulation
- B. Section 23 72 00 - Air-to-Air Energy Recovery Equipment

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. ASHRAE Standard 52
- B. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors
- C. UL 586 – Standard for High Efficiency Particulate Air Filter Units
- D. UL 900 – Standard for Air Filter Units

1.05 QUALITY ASSURANCE

- A. Refer to division 1, General Conditions, Equals and Substitutions.

1.06 SHOP DRAWINGS

- A. Refer to division 1, General Conditions, Submittals.
- B. Include data concerning dimensions, materials, efficiencies, installation instructions and appropriate identification.
- C. Independent test reports verifying filter performance, test procedures and ratings.
- D. Provide two (2) extra sets of filters for each unit that contains filters

1.07 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 DESIGN CRITERIA

- A. Use UL Class 1 or Class 2 filters unless noted otherwise. (Reference applicable UL standard referenced)
- B. Efficiencies indicated in this section are based on ASHRAE Standard 52.
- C. Fan motors have been selected to operate against the resistance of dirty filters as specified in this section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Trion Air Bear, American Air Filter, Cambridge, Continental, Camil-Farr, Research Products, or approved equal.

2.02 MERV 13 FILTERS

- A. Use 4" thick, pleated panels, 100% synthetic, self supported media fully bonded and sealed in cardboard frame.
- B. Media nominal rating to be 500 FPM face velocity, 0.20 inch WG initial resistance, 1.0 inches WG recommended final resistance. Average arrestance of filter media shall be 90-92%.
- C. Furnish a side access housing or holding frame as scheduled.
- D. Filter tracks shall be constructed to provide clearance between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

2.03 HOUSINGS FOR MERV 13 FILTERS

- A. Housing or holding frame to be of the same manufacturer as filter media or provided by the air handling unit manufacturer. Contractor fabricated housings or filter racks will not be accepted. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media can be readily changed. Filter tracks shall be constructed to provide clearance between the pre-filter and final-filter media to facilitate the installation of static pressure taps.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Where air handling equipment is to be used for temporary heating or ventilation of a facility, do not operate the equipment until specified filter media has been installed. Contractor shall be responsible for maintaining the cleanliness of air handling apparatus and air distribution systems during construction through regular inspection and changing of filter media throughout the construction period.
- B. Where air handling apparatus is used during the construction period, install new filter media prior to start of air balancing. Additionally, deliver one new set of media to the owner prior to substantial completion.
- C. Install units as shown on drawings and details according to manufacturer's instructions.
- D. Reinforce filter holding frames per manufacturer's instructions.
- E. Maintain necessary clearance for changing filters.

END OF SECTION

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**SECTION 23 54 00
GAS FIRED FURNACES**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes specifications for gas fired furnaces. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Energy Efficiency
 - 7. Submittals
 - 8. Operating and Maintenance Data
 - 9. Warranty
- C. PART 2 - Products
 - 1. Furnaces
- D. PART 3 - EXECUTION
 - 1. Installation
 - 2. Furnaces

1.02 RELATED WORK

- A. Section 23 05 13 - Common Motor Requirements for HVAC
- B. Section 23 33 00 - Air Duct Accessories

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. AGA American Gas Association
- B. ANSI Z21.64 Direct Vent Central Furnaces
- C. GAMA Gas Appliance Manufacturers Association
- D. NEC National Electrical Code

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 ENERGY EFFICIENCY

- A. Provide gas furnaces that bear the ENERGY STAR label and meet the ENERGY STAR specifications for energy efficiency.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.07 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

1.08 OPERATING AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.09 WARRANTY

- A. Furnace primary and secondary heat exchangers warranted for 10 years under normal use and maintenance. Remainder of furnace components warranted for 1 year from date of startup.

PART 2 - PRODUCTS

2.01 FURNACES

- A. Manufacturers: Amana, Carrier, Lennox, or York.
- B. Direct vent, sealed combustion, condensing type AGA certified for use with natural gas. Minimum annual fuel utilization efficiency (A.F.U.E.) of 96. All ratings are to be certified by GAMA. All wiring shall comply with the National Electrical Code.
- C. 22 gauge steel casing with baked enamel finish or prepainted galvanized steel. Insulate casing back and side panels with foil faced fiberglass insulation.
- D. Construct primary heat exchanger of aluminized steel. Construct secondary heat exchanger of stainless steel with aluminum fins or of polypropylene laminated steel. Aluminized steel multi-port in-shot burner with hot surface or electronic spark ignition, approved for vertical or sidewall venting.
- E. AGA listed gas controls including manual main shut off valve, double automatic gas valves for redundancy and gas pressure regulator.
- F. Centrifugal type blower fan statically and dynamically balanced with ECM, direct drive motor. Provide low energy induced draft blower for heat exchanger prepurge and combustion gas venting.
- G. Provide unit with filters and filter holding rack as scheduled.

- H. Provide solid state integral control unit with all necessary controls and relays including but not limited to:
 - 1. Pressure switch for airflow of flue products through furnace and out vent system.
 - 2. Rollout switch with manual reset to prevent overtemperature in burner area.
 - 3. Electronic flame sensor.
 - 4. Blower access safety interlock.
 - 5. Timed blower start after main burners ignite.
 - 6. Factory installed 24 v transformer for controls and thermostat.
 - 7. LED's to indicate status and to aid in troubleshooting.
- I. Provide unit with matching cased "A" configuration cooling coil for upflow units, "V" configuration cooling coil for downflow units, and vertical flat face configuration cooling coil for horizontal units. "N" configuration cooling coils are also acceptable.
- J. Minimum 1/2" OD seamless copper tubing mechanically bonded to heavy ripple edged aluminum fins with thermal expansion valve, holding charge and copper tube stubs for field piping.
- K. Non-corrosive stainless steel or polymer drain pan with 3/4" NPT drain connection.
- L. 20 gauge steel coil casing with baked enamel finish and fiberglass insulation.
- M. This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All wiring is to be in conduit in accordance with Division 26 00 00. All relays, transformers and controls are to be in enclosures.
- N. Provide a 7-day programmable thermostat with 2 occupied periods per day, automatic changeover, separate heating and cooling set points for both occupied and unoccupied modes. Provide auxiliary controls on sub-base to open minimum outside air damper during occupied mode. Equal to Honeywell model TB8220.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install units as shown on plans, as detailed and according to the manufacturer's installation instructions.
- B. Install thermostats where indicated on the drawings. Provide all wiring between thermostats and the furnace.

3.02 FURNACES

- A. Install as indicated on the drawings. Pipe condensate to floor drain or open site.
- B. Provide schedule 40 PVC, ASTM D1785 combustion air and vent piping and fittings with solvent welded joints as indicated on the drawings. Terminate as recommended by the furnace manufacturer.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

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SECTION 23 62 13
PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSING UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scope. This section includes specifications for air cooled condensing units for use with split system type air conditioning. Included are the following topics:
- B. PART 1 - GENERAL
 - 1. Scope
 - 2. Related Work
 - 3. Reference
 - 4. Reference Standards
 - 5. Quality Assurance
 - 6. Submittals
 - 7. Operation and Maintenance Data
 - 8. Delivery, Storage and Handling
 - 9. Warranty
- C. PART 2 - Products
 - 1. Units up to 5 Tons
 - 2. Refrigerant Piping Sizing
 - 3. Refrigerant Piping Accessories
- D. PART 3 - EXECUTION
 - 1. Installation
 - 2. Startup

1.02 RELATED WORK

- A. Section 23 05 00 - Common Work Results for HVAC
- B. Section 23 23 00 - Refrigerant Piping

1.03 REFERENCE

- A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

- A. ARI 210/240 Unitary Air Conditioning and Heat Pump Equipment
- B. ARI 365 Commercial and Industrial Unitary Air Conditioning Condensing Units
- C. ASHRAE 15 Safety Standard for Refrigeration Systems
- D. ASHRAE 90.1 (2004 edition) Energy Standard for Buildings except Low Rise Residential Buildings
- E. NEC National Electrical Code
- F. ASTM B117 Standard Practice for Operating Salt Spray (fog) Apparatus
- G. UL Underwriters Laboratory

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.05 QUALITY ASSURANCE

- A. Refer to Division 1, General Conditions, Equals and Substitutions.
- B. Unit Energy Efficiency Ratio (EER), Coefficient of Performance (COP) and Integrated Part Load Value (IPLV) shall meet the minimum applicable requirements of ASHRAE 90.1(2004 edition). Units that are labeled ENERGY STAR® will be acceptable.
- C. Rate unit performance in accordance with the latest edition of ARI Standard 365 or ARI Standard 210/240, whichever is applicable for the equipment.
- D. Construct units in accordance with ASHRAE 15, UL standards and the NEC. Units shall carry the UL label.
- E. Factory run test units to see that each control device operates properly. Pressure test, evacuate, charge with holding charge of refrigerant and full oil charge prior to shipping from the factory.

1.06 SUBMITTALS

- A. Refer to Division 1, General Conditions, Submittals.
- B. Submit air cooled condensing unit shop drawings including the following information: specific manufacturer and model numbers, dimensional and weight data, required clearances, materials of construction, capacities and ratings, stages of unloading capacity achievable without hot gas bypass (and with hot gas bypass if applicable), refrigerant type and charge, component information, size and location of piping connections, electrical connections, wiring diagrams and information for all specialties and accessories.
- C. Submit manufacturer's installation and start-up instructions, maintenance data, troubleshooting guide, parts lists, controls and accessories.
- D. At substantial completion, submit warranty certificate and copy of start-up report.

1.07 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturer's instructions for storing, rigging, unloading, and transporting units. Protect units from physical damage. Leave factory-shipping covers in place until installation.
- B. Ship units to jobsite fully assembled.

1.09 WARRANTY

- A. Provide a one year parts and labor warranty on the entire unit beginning upon substantial completion of project.
- B. Provide a five year parts warranty on the compressor(s) beginning upon substantial completion of project.

PART 2 - PRODUCTS

2.01 UNITS UP TO 5 TONS

- A. Manufacturers: Amana, Carrier, Lennox, or York.
- B. Provide factory assembled, outdoor mounted, air-cooled condensing unit suitable for on grade or rooftop installation. Include compressor, air cooled condenser, refrigerant, lubrication system, interconnecting wiring, safety and operating controls, motor starting components and additional features as specified herein or required for safe, automatic operation. Capacity and steps of unloading as indicated in the equipment schedule. Refrigerant is to be R-410A.
- C. Cabinet: Construct cabinet of heavy gauge, galvanized steel coated with weather resistant paint. Provide removable access panels to facilitate full access to the compressor, fan and control components.
- D. Compressor: Provide hermetic reciprocating or scroll type compressor with built in motor winding temperature and current protection, liquid and suction service valves, gage ports, sight glass and liquid line filter dryer. Provide crankcase heater with reciprocating type compressors. Mount compressors on vibration isolators.
- E. Condenser:
 - 1. Provide condenser coils with aluminum alloy plate fins mechanically fastened to seamless copper tubing with integral subcooler. Construct coils with design working pressure suitable for the refrigerant.
 - 2. Provide direct-drive statically and dynamically balanced propeller type fans with vertical or horizontal discharge as indicated on the drawings and guards constructed of heavy gage PVC coated wire or galvanized steel.
- F. Power Wiring:
 - 1. Provide factory installed 24-volt control circuit with fusing; control power transformer and all associated internal wiring. Provide a single point power connection to the unit(s). Provide factory installed magnetic contactors for compressor and condenser motors.
 - 2. Electrical characteristics shall be as indicated in the equipment schedule.

G. Controls:

1. Provide high/low refrigerant pressure cutouts with automatic reset and anti-short cycle compressor timer.
2. Unit must be capable of operating down to ambient temperature of 40°F. Provide low ambient lockout to prevent compressor from operating below 40°.

2.02 REFRIGERANT PIPING SIZING

- A. The unit manufacturer shall verify the final refrigeration pipe sizing process to ensure conformance to specific unit requirements such as max lengths, refrigerant velocities, unloading considerations and proper oil return. This contractor shall provide refrigeration piping drawings from the field which details the way the piping will actually be installed.

2.03 REFRIGERANT PIPING ACCESSORIES

- A. Provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 450 psig and a maximum working temperature of 225°F. For systems using R-410A, provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 850 psig and a maximum working temperature of 225°F.
- B. Filter Dryers: Provide straight pattern filter dryers without replaceable core.
- C. Thermostatic Expansion Valves: Brass body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.
- D. Charging Valves: Provide ¼" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2" long copper extension sections.
- E. Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install units, piping and accessories in accordance with the manufacturer's written instructions and recommendations. Mount unit(s) on a poured concrete pad on grade as indicated on the drawings.
- B. Maintain adequate service access and airflow clearances for all components as recommended by the manufacturer and as indicated on the drawings.
- C. Charge unit(s) with full oil charge and refrigerant charge based on the entire refrigeration system pipe size and length.
- D. Provide all control wiring in conduit in compliance with Section 23 09 14 and Division 26 00 00 - Electrical.
- E. Coordinate power wiring requirements with the electrical trade.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

3.02 STARTUP

- A. Adjust units for maximum operating efficiency, adjust all controls to required final settings and demonstrate that all components are functioning properly. Submit copy of a written startup report following the initial start up. Include with form provided in section 23 05 00. Include in the report: work done to the system, all readings taken, a statement certifying that the refrigeration system(s) are leak free and a statement certifying that the unit(s) have been placed in proper running condition as recommended by the manufacturer and as intended in the drawings and specifications.

END OF SECTION

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SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF PROJECT

- A. This project consists of a remodel of the office portion of an office/garage building and shall include all material to provide for the completion of all work associated with the following, but not be limited to the following:
1. Minor demolition work.
 2. Temporary services. *Tie into existing electrical service in the garage.
 3. Low voltage conduit and wire.
 4. Panelboards.
 5. Disconnects.
 6. Transformers.
 7. Wiring Devices.
 8. Interior lighting.
 9. Exterior lighting.
 10. Voice and data wiring (rough-in only).
 11. Access control (rough-in only).

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

1.03 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

- A. Equipment, fixtures, material and installation shall conform to the requirements of the local Building Department, the serving utility companies, the National Electrical Code, National Electrical Safety Code, Life Safety Code, Occupational Safety and Health Act, and applicable national, state, and local codes, ordinances, and regulations.
- B. All equipment shall be equal to, or exceed, the minimum requirements of NEMA, IEEE, and UL.
- C. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architect/Engineer prior to execution of the Work. The work shall be carried out according to the requirements of such code in accordance with the instruction of the Architect/Engineer and at no additional cost to the Owner.
- D. The provisions of Standards, Codes, Laws, Ordinances, etc., shall be considered minimum requirements. In case of conflict between their published requirements, the Owner's Representative shall determine which is to be followed and his decision shall be binding. Specific requirements of this specification or the drawings, which exceed the published requirements, shall take precedence over them.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.04 QUALITY ASSURANCE

- A. Work under this Division shall be supervised by a person who holds a certification issued by the Wisconsin Department of Safety and Professional Services as a certified electrical contractor, certified electrical contractor-restricted or certified master electrician.
- B. Work under this Division shall be executed by a person who holds a certification issued by the Wisconsin Department of Safety and Professional Services as a certified electrical contractor, certified electrical contractor-restricted, certified master electrician, certified journeyman electrician or certified beginning electrician.

1.05 FEES

- A. All local fees, permits, and services of inspection authorities shall be obtained and paid for by the Contractor. The Contractor shall cooperate fully with local utilities with respect to their services. The Owner shall pay fees, service charges, tap charges, meter charges, and special fees assessed by the local utilities.

1.06 SCOPE OF WORK

- A. Electrical Installations: This division of the specifications covers the electrical systems of the project. It includes work performed by the electrical trades as well as trades not normally considered as electrical trades.
- B. Provide all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start-up and checkout on each item and system to provide fully operable systems.
- C. Examine and compare the Electrical Drawings with these specifications, and report any discrepancies between them to the Architect/Engineer and obtain from him written instructions for changes necessary in the work. At time of bid the most stringent requirements must be included in the bid.
- D. Examine and compare the Electrical Drawings and Specifications with the Drawings and Specifications of other trades, and report any discrepancies between them to the Architect/Engineer and obtain from him written instructions for changes necessary in the work. At time of bid, the most stringent requirements must be included in said bid.
- E. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interferences in a manner approved by the Architect/Engineer. All changes required in the work of the Contractor, caused by his neglect to do so, shall be made by him at his own expense.
- F. It is the intent of the Drawings and Specifications to provide a complete workable system ready for the Owner's operation. Any item not specifically shown on the Drawings or called for in the Specifications, but normally required to conform with the intent, are to be considered a part of the Contract.

- G. All materials furnished by the Contractor shall be new and unused (temporary lighting and power products are excluded) and free from defects. All materials used shall bear the Underwriter's Laboratory, Inc. label provided a standard has been established for the material in question.
- H. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material shall be the product of one manufacturer throughout the entire project. Multiple manufacturers will not be permitted.

1.07 DEFINITIONS

- A. "PROVIDE" means to furnish, install, purchase, transport, place, erect, connect, wire, test, and turn over to Owner, complete and ready for regular operation, the particular Work referred to.
- B. "INSTALL" means to set in place, join, unite, fasten, link, attach, wire, set up, or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular Work referred to.
- C. "FURNISH" means to purchase, supply, and deliver to job site, all materials, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application for the particular Work referred to.
- D. "WIRE", "WIRING" means the inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such Work.
- E. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc
- F. "AS DIRECTED" means as directed by the Architect/Engineer, or his representative.
- G. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed above hung ceilings.

1.08 COORDINATION OF THE WORK

- A. Certain materials will be provided by other trades. Examine the Contract Documents to ascertain these requirements.
- B. Carefully check space requirements with other trades and the physical confines of the area to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings and the spaces within the existing building. Make modifications thereto as required and approved.
- C. Transmit to other trades all information required for work to be provided under their respective Sections in ample time for installation.
- D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.

- E. Coordinate, project and schedule work with other trades in accordance with the construction sequence.
- F. The Drawings show only the general run of raceways and approximate location of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Architect/Engineer and receive his approval before such alterations are made. All such modifications shall be made without additional cost to the Owner.
- G. Obtain from the Architect/Engineer in the field the location of such outlets or equipment not definitely located on the Drawings.
- H. Circuit "tags" are used to show the circuit number and the panel designation for wiring devices and luminaires. Equipment circuits are indicated on equipment connection schedule. Show the actual circuits numbers on the finished record drawings and on panel directory card. Where circuiting is not indicated, Electrical Subcontractor must provide required circuiting in accordance with the loading indicated on the drawings and/or as directed.
- I. Adjust location of conduits, panels, equipment, pull boxes, fixtures, etc. to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each raceway prior to fabrication.
 - 1. Right-of-Way
 - a. Lines that pitch have the right-of-way over those that do not pitch. For example: steam, condensate, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
 - b. Make offsets, transitions and changes in direction in raceways as required to maintain proper headroom in pitch of sloping lines whether or not indicated on the Drawings.
- J. Wherever the work is of sufficient complexity, prepare additional Detail Drawings to scale similar to that of the bidding Drawings of the same size as the Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field.
- K. Coordinate with the local Electric Utility Company and the local Telephone Company as to their requirements for service connections and provide all necessary materials, labor and testing.
- L. Coordinate with contractors for work under other Divisions of this specification for all work necessary to accomplish this contractor's work.

1.09 PROGRESS OF WORK

- A. The Contractor shall order the progress of his work to conform to the progress of the work of other trades and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from the defective or ill-timed work performed under this section shall be borne by the Contractor.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Ship and store all products and materials in a manner that will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair. Any such repairs shall be subject to review and acceptance of the manufacturer and Architect/Engineer.
- B. Deliver materials in manufacturer's unopened container fully identified with manufacturer's name, trade name, type, class, grade, size and color.
- C. Store materials suitably sheltered from the elements, but readily accessibly for inspection by the Architect/Engineer until installed. Store all items subject to moisture damage in dry, heated spaces.

1.11 EQUIPMENT ACCESSORIES

- A. Provide supports, hangers and auxiliary structural members required for support of the work.
- B. Furnish and set all sleeves for passage of raceways through structural, masonry and concrete walls of floors and elsewhere as will be required for the proper protection of each raceway passing through building surfaces.
- C. Wall mounted equipment may be directly secured to wall by means of steel bolts. Maintain at least 1" air space between equipment and supporting wall. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars. Prefabricated steel channels providing a high degree of mounting flexibility, such as those manufactured by Kindorf, Glob-Strutt and Unistrut, may be used for mounting arrays of equipment.

1.12 OPERATIONS AND MAINTENANCE MANUALS

- A. General: Provide operations & maintenance (O&M) manuals in accordance with the Contract Documents.
 - 1. Provide two (2) copies of each manual.
 - 2. Manuals shall be 8-1/2 inches X 11 inches in hard cover 3-ring loose-leaf binders.
 - 3. Manuals shall be complete and in Owner's hands prior to turning building over to Owner and at least 10 days prior to instruction to operating personnel.
- B. Provide manufacturer's literature as regularly published by the respective manufacturers for proper preventative and comprehensive maintenance.

- C. Provide O&M manuals including but not limited to the following:
1. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
 2. Operating instructions for complete system including:
 - a. Normal starting, operating, and shut-down.
 - b. Emergency procedures for fire or failure of major equipment.
 - c. Summer and winter special procedures, if any.
 - d. Day and night special procedures, if any.
 3. Maintenance instruction including:
 - a. Proper lubricants and lubricating instructions for each piece of equipment, and date when lubricated.
 - b. Necessary cleaning, replacement and/or adjustment schedule.
 4. Manufacturer's data for each piece of equipment including:
 - a. Installation instructions.
 - b. Drawings and specifications.
 - c. Parts list, including recommended items to be stocked.
 - d. Complete wiring diagrams.
 - e. Marked or changed prints locating all concealed parts and all variations from the original system design.
 - f. Test and inspection certificates.
- D. Refer to individual specification sections for additional O&M requirements.

1.13 RECORD DOCUMENTS

- A. Prepare record ("as-built") documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate installed conditions for:
1. Major raceway systems, size, and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 3. Approved substitutions, contract modifications, and actual equipment and materials installed.

1.14 GUARANTEE

- A. Guarantee all material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified elsewhere, such longer term to apply. Within 24 hours after notification, correct any deficiencies that occur during the guarantee period at no additional cost to the Owner, all to the satisfaction of the Owner and Architect/Engineer. Obtain similar guarantees from subcontractors, manufacturers, suppliers and subtrade specialists.
- B. See Division 1 – Closeout Procedures, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Applicable equipment and materials shall be listed by Underwriters' Laboratories and Manufactured in accordance with ASME, NEMA, ANSI or IEEE standards, and as approved by local authorities having jurisdiction as mentioned in Division 1.
- B. If products and materials are specified or indicated on the Drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of Shop Drawings where Shop Drawings are required or as approved in writing where Shop Drawings are not required.
- C. All equipment capacities, etc. are listed for job site operating conditions. All equipment sensitive to altitudes or ambient temperatures to be derated and method of derating shown on Shop Drawings. Where operating conditions shown differ from the laboratory test conditions, the equipment to be derated and the method of derating shown on Shop Drawings.

2.02 SUBSTITUTION OF MATERIALS OR EQUIPMENT

- A. All requests for substitution of materials or equipment shall be made in writing. The request for prior approval must be in the Engineers office not less than 10 days prior to the bid date. Samples of proposed substitute materials or equipment shall be submitted to the Engineer for review whenever they are requested. Bids shall be based only upon the specified materials and equipment, or substitutes that have received written acceptance from the Engineer prior to the bid.
- B. Wherever the words "for approval" or "approved" are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of apparatus for that specified, submit all information pertinent to the adequacy and adaptability of the proposed apparatus, and secure Architect/Engineer's acceptance before apparatus is ordered.
- C. Wherever quantities or a definite make and size of apparatus are specified, the make and size of apparatus which is proposed must conform substantially (in regard to the operating results) to that specified or implied. Same shall apply to important dimensions relating to operation of apparatus in coordination with the rest of the system, or to properly fitting it into available space conditions. Any substitution of equipment or apparatus shall include all necessary revisions, as required to complete the installation.

- D. Acceptance of substitutions, for equipment specified herein, will not be given merely upon submission of manufacturer's names and will be given only after receipt of complete and satisfactory performance data covering the complete range of operating conditions in tabular and graphical form. Furnish complete and satisfactory information relative to equipment dimensions, weight, etc. Acceptance of all equipment specified or shown on the Drawings, or substitutions submitted for that specified or shown on the Drawings, will be granted if such equipment, in the opinion of the Architect/Engineer, conforms to the performance requirements, space conditions, weight requirements and quality requirements. Any additional construction and design costs incurred as a result of any accepted substitution shall be borne by the Contractor. The opinion and judgment of the Architect/Engineer shall be final, conclusive, and binding.

2.03 SUBMITTALS

- A. Submit through General or Prime Contractor. Refer to Division 1 – Section 'Submittals'.
- B. Prepare and submit one (1) electronic copy of Shop Drawings for materials, systems, and equipment as listed herein, including locations and sizes of all openings in floor decks, walls, and floors.
- C. The Work described in any Shop Drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions, and proper coordination with all trades on the job. Each submitted Shop Drawing shall include a certification that all related job conditions have been checked and that no conflict exists.
- D. All drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking and resubmitting as may be required. All submittals shall be complete and contain all required and detailed information.
- E. Acceptance of any submitted data or Shop Drawings for material, equipment apparatus, devices, arrangements, and layout shall not relieve Contractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details, to efficiently perform the requirements and intent of the Contract. Such acceptance shall not relieve Contractor from responsibility for errors, omissions, or inadequacies of any sort on submitted data or Shop Drawings.
- F. Each Shop Drawing shall contain the following information.
1. Provide general information on each copy of the submittal.
 - a. Project title.
 - b. Reference to the applicable drawing and specification article.
 - c. Identify each device per the schedules and drawings.
 - d. Contractor and supplier identification, addresses and telephone numbers.
 - e. Submittal Date.
 - f. Tab each submittal with its specification section. Do not supply a complete submittal without breaking out each specification section.
 2. Certification that the contractor has reviewed the submittal.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

3. Refer to individual specification sections for additional information requirements.
- G. Shop Drawing submittals shall be provided for each specific material, system, or equipment as identified herein.
1. As a minimum, make submittals on the following items:
 - a. Raceways, conduit & wire
 - b. Wiring devices and plates
 - c. Transformers
 - d. Panelboards
 - e. Disconnect switches
 - f. Lighting fixtures
 2. Refer to individual specification sections for additional submittal requirements.

END OF SECTION

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SECTION 26 01 10

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements specified in Division 26 Section "Basic Electrical Requirements" apply to this Section.
- C. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:
 - 1. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
 - 2. Cutting, patching, and repairing.
 - 3. Excavation, trenching, and backfill.
 - 4. Waterproofing.
 - 5. Supports.
 - 6. Fastenings.
 - 7. Testing equipment and materials.
 - 8. Cleaning up.

1.02 DEFINITIONS

- A. The following definitions apply to excavation operations:
 - 1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
 - 2. Subbase: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
 - 3. Subgrade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.
 - 4. Unauthorized excavation: Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Engineer.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

PART 2 PRODUCTS

2.01 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Engineer from manufacturer's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
 - 1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. One-Part, Nonacid-Curing, Silicone Sealant
 - b. "Chem-Calk N-Cure 2000", Bostic Construction Products Division.
 - c. "Dow Corning 790", Dow Corning Corporation.
 - d. "Silglaze N SCS 2501", General Electric Company.
 - e. "Silpruf SCS 2000", General Electric Company.
 - f. "864", Pecora Corporation.
 - g. "Rhodorsil 5C", Rhone-Poulenc, Inc.
 - h. "Spectrum 1", Tremco, Inc.
 - i. "Spectrum 2", Tremco, Inc.
- D. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Dow Corning Fire Stop Foam", Dow Corning Corp.
 - b. "Pensil 851", General Electric Co.

2.02 INSTALLATION

- A. Examine substrates, area, and condition, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Preparation for Joint Sealers.
 - 1. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
 - 2. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.
- C. Application of Joint Sealers
 - 1. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - a. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
 - b. Comply with recommendations of ASTM C 790 for use of acrylic emulsion joint sealants.
 - 2. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops with fire- resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Follow manufacturer's instructions for installing, connecting, and adjusting all equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all special supports, connections, wiring, accessories, etc.
- B. Use mechanics skilled in their trade for all work.

- C. Rough-in:
1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 2. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.
- D. Electrical Installations: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate electrical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of electrical systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "ACCESS DOORS".
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.02 CUTTING, PATCHING, AND REPAIRING

- A. The work shall be carefully laid out in advance. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of raceway, outlets or other equipment, the work shall be carefully done. Any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc. shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.
- B. Where conduits, mounting channels, outlet, junction, or pull boxes are mounted on a painted surface, or a surface to be painted, they shall be painted to match the surface. Whenever support channels are cut, the bare metal shall be cold galvanized.
- C. Perform cutting and patching in accordance with Division 01 Section "CUTTING AND PATCHING". In addition to the requirements specified in Division 01, the following requirements apply:
 1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover work to provide for installation of ill-timed work.
 - b. Remove and replace defective work.
 - c. Remove and replace work not conforming to requirements of the Contract Documents.
 2. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- E. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- F. Patch finished surfaces and building components using new materials specified for the original installation and experienced installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.03 WATERPROOFING

- A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect/Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
- B. If Contractor penetrates any walls or surfaces after they have been waterproofed, he shall restore the waterproof integrity of that surface as directed by the Architect/Engineer at his own expense.

3.04 SUPPORTS

- A. Support work in accordance with the best industry practice and the following.
- B. Include supporting frames or racks extending from building structure for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets.
- C. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a free standing position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Nothing, (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways, or cables for support, except that threaded hub type fittings having a gross volume not in excess of 100 cubic inches may be supported from heavy wall conduit, where the conduit is securely supported from the structure within five inches of the fitting on two opposite sides.
- F. Nothing shall rest on, or depend for support on, suspended ceilings media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling).
- G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure.

3.05 FASTENINGS

- A. Fasten electric work to building structure in accordance with the best industry practice and the following.
- B. Floor or pad mounted equipment shall not be held in place solely by its own dead weight. Include anchor fastening in all cases.
- C. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging, tying to the building structural elements.

3.06 TESTING EQUIPMENT AND MATERIALS

- A. The Contractor shall provide all testing instruments, equipment and all materials, connections, labor, etc., required to perform tests.
- B. Test all circuits, fixtures, equipment, and systems for proper operation and freedom from grounds, shorts and open circuits before acceptance is requested.
- C. Measure voltage at panelboards and outlets after the building is fully occupied. Make final transformer tap adjustments based on these measurements.
- D. Perform all tests required by local authorities, such as tests of life safety systems, in addition to tests specified herein.
- E. Perform tests required by other specification sections.

3.07 CLEANING UP

- A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc., resulting from the installation of his work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean.
- B. Contractor shall clean up all fixtures and equipment at the completion of the project.
- C. All switchboards, panelboards, wireways, trench ducts, cabinets and enclosures shall be thoroughly vacuumed clean prior to energizing equipment and at the completion of the project. Equipment shall be opened for observation by the Architect/Engineer as required.

END OF SECTION

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SECTION 26 01 15
TEMPORARY SERVICE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The Electrical Contractor shall tie into the garage's electrical service for all temporary panels.
- B. Temporary lighting and circuits shall conform to all aspects of 2017 National Electrical Code Provisions. Among other provisions, code prohibits use of Romex, UF, or open wiring and requires cord connections for all work.
- C. Temporary service is required for construction areas.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 INSTALLATION

- A. The service size shall be 200 amp, 120/208 volt, 3 phase. Provide 100 amp panel in area of each addition.
- B. The Electrical Contractor shall provide, at no cost to other contractors, all lamps, wiring switches, sockets and similar equipment required for temporary system until substantial completion. Temporary system shall be installed and maintained in accordance with requirements of the safety code of the Industrial Commission and such as to prevent injury or damage to persons, equipment or construction. All facilities exposed to moisture or weather shall be weatherproof type, and electrical equipment enclosures shall be locked to prevent access.
- C. In accordance with the latest issue of the National Electrical Code, all temporary electrical circuits for construction purposes shall be equipped with combination ground fault interrupter and circuit breaker meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test button shall be provided for checking the device. The breaker mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with overcenter switching mechanism so that contact cannot be held closed.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- D. The Electrical Contractor shall provide at least one 120 volt, single phase outlet for lighting and one grounded duplex outlet for small power tools for each 1,000 sq. ft. of floor space. Circuits shall be 20 ampere, single pole, No. 12 wire. Circuit length shall not exceed 200 feet. Not less than 15 foot candles illumination shall be provided. Lighting shall be provided to maintain 15 foot candles minimum light levels.
- E. Subcontractors and other contractors shall be allowed to use the service provided for general lighting and fractional horsepower tools at no cost. Each contractor shall furnish his own extension cords and lamps other than those furnished for general lighting.
- F. Contractors requiring voltage other than basic temporary system specified, three phase power, or a special single phase run, for operation of construction equipment or testing shall make their own arrangements with the Owner for cost of energy used and with Electrical Contractor for cost of service extension, installation and removal when no longer required.
- G. Each contractor shall provide and pay for installation of temporary service for lighting, heating or cooling of their temporary offices. They shall make arrangements with the Electrical Contractor for the cost of installation and removal when no longer required.
- H. Heating and Ventilating Contractor shall expedite the work under his contract in such a manner that the permanent power wiring system and panels will be installed and connected to permanent heating and ventilating equipment in time to operate and test this equipment when the building has been closed sufficiently to permit the use of portions of the heating and ventilating system for temporary heating during construction. Permanent wiring and connections may be used at permanent equipment; however, the use of the permanent system during construction shall in no way waive any part of the guarantee period.
- I. After substantial completion of the permanent electrical system and building wiring by the Electrical Contractor, permanent receptacles may be used during finishing work. Permanent wiring for lighting fixtures, switches and receptacles shall be installed only after all masonry and plastering has been completed, but this wiring shall not be used for motors larger than fractional HP or for welding equipment. Circuits for larger motors and welding equipment may be provided with special circuits to mains of electrical panels at the expense of contractors requiring them, provided that special permission is obtained from the Architect/Engineer and the installation is made by the Electrical Contractor.
- J. Upon completion of the project, the Electrical Contractor shall remove the temporary electrical systems.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

SECTION 26 05 01

MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.

1.02 RELATED REQUIREMENTS

- A. Division 1 - Execution and Closeout Requirements: Additional requirements for alterations work.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents.
- D. Report discrepancies to Owner before disturbing existing installation.
- E. Report discrepancies to Architect before disturbing existing installation.
- F. Beginning of demolition means installer accepts existing conditions.
- G. It shall be the contractor's responsibility to visit the existing project site, become acquainted with all existing conditions, and ascertain the extent of work involved in installing equipment, conduit, devices, controls and all other appurtenances pertaining to the above. The contractor shall provide all labor, materials, etc., required for the complete, new installation required for the completion of the project. By the act of submitting a price; or in the case of time and material project, begin work, the contractor shall be deemed to have performed such an examination, to have accepted such conditions, and to have made allowances therefore preparing his price and resolving questions regarding work required.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove all abandoned wiring to source of supply. Verify with Owner.
- C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- E. Disconnect and remove abandoned panelboards and distribution equipment.
- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- K. Disconnect and remove abandoned telecom devices and cabling. Coordinate with owner.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wire and cable for 600 volts and less.
- B. Wiring connectors and connections.

1.02 RELATED REQUIREMENTS

- A. Division 31 - Earthwork.
- B. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.
- B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 01 - Submittal Procedures.
- B. Test Reports: Indicate procedures and values obtained.
- C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Use of aluminum conductors requires written approval from Engineer.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.
- E. Project Record Documents: Record actual locations of components and circuits.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WIRING REQUIREMENTS

- A. Concealed Dry Interior Locations: Use only building wire in raceway, building wire with Type THHN, THWN, XHHW insulation in raceway, armored cable, or metal clad cable. See permitted use in 3.03 Installation for AC and MC cable.
- B. Exposed Dry Interior Locations: Use only building wire in raceway, building wire with Type THHN, THWN, XHHW insulation in raceway, armored cable, or metal clad cable. See permitted use in 3.03 Installation for AC and MC cable.
- C. Above Accessible Ceilings: Use only building wire in raceway, building wire with Type THHN, THWN, or XHHW insulation in raceway, armored cable, or metal clad cable. See permitted use in 3.03 Installation for AC and MC cable.
- D. Wet or Damp Interior Locations: Use only building wire with Type THWN or XHHW insulation in raceway.
- E. Exterior Locations: Use only building wire with Type THWN or XHHW insulation in raceway, direct burial cable, service-entrance cable.
- F. Underground Installations: Use only building wire with Type THWN or XHHW insulation in raceway.
- G. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- H. Use stranded conductors for control circuits.
- I. Use conductor not smaller than 12 AWG for power and lighting circuits.
- J. Use conductor not smaller than 16 AWG for control circuits.
- K. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (25 m).
- L. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet (60 m).
- M. Conductor sizes are based on copper.

2.02 WIRE MANUFACTURERS

- A. Cerro Wire Inc.
- B. Industrial Wire & Cable, Inc.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- C. Southwire Company.
- D. Encore.
- E. Substitutions: See Division 01 - Product Requirements.

2.03 BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
 - 1. For Sizes Smaller Than 4 AWG: Copper.
 - 2. For Sizes 4 AWG and Larger: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70, Type THW, THHN, THWN, XHHW.
- E. Insulation: Thermoplastic material rated 60 degrees C.

2.04 ARMORED CABLE (See Permitted Use in 3.03 Installation)

- A. Description: NFPA 70, Type AC.
- B. Conductor: Copper.
 - 1. For Sizes Smaller Than 4 AWG: Copper.
 - 2. For Sizes 4 AWG Through 1 AWG: Copper.
- C. Insulation Voltage Rating: 300 volts.
- D. Insulation Temperature Rating: 60 degrees C.
- E. Insulation Material: Thermoplastic.
- F. Conductor Assembly Covering: Lead.

2.05 METAL CLAD CABLE (See Permitted Use in 3.03 Installation)

- A. Description: NFPA 70, Type MC.
- B. Conductor: Copper.
 - 1. For Sizes Smaller Than 4 AWG: Copper.
 - 2. For Sizes 4 AWG and Larger: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation Temperature Rating: 60 degrees C.
- E. Insulation Material: Thermoplastic.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- F. Armor Material: Steel.
- G. Armor Design: Interlocked metal tape.
- H. Jacket: PVC; use in locations indicated.

2.06 WIRING CONNECTORS

- A. Split Bolt Connectors:
 - 1. Not acceptable.
- B. Solderless Pressure Connectors:
 - 1. High copper alloy terminal. May be used only for cable termination to equipment pads or terminals.
 - 2. Substitutions: See Division 01 - Product Requirements.
- C. Spring Wire Connectors:
 - 1. Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
 - 2. Substitutions: See Division 01 - Product Requirements.
- D. Compression Connectors:
 - 1. Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.
 - 2. Substitutions: See Division 01 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.
- D. Verify that field measurements are as indicated.

3.02 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.03 INSTALLATION

- A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Route wire and cable as required to meet project conditions.
 - 1. Wire and cable routing indicated is approximate unless dimensioned.
 - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
 - 3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.
- C. Use wiring methods indicated.
- D. Pull all conductors into raceway at same time.
- E. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- F. Protect exposed cable from damage.
- G. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
- H. Use suitable cable fittings and connectors.
- I. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- J. Clean conductor surfaces before installing lugs and connectors.
- K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- L. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
- M. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- N. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- O. AC and MC cable permitted uses:
 - 1. **Flexible connections less than 4'.**
 - 2. Light fixture connections above suspended ceiling. **Length shall be 6' or less.** Not approved for fixture to fixture wiring.
 - 3. Conductor to last device on branch circuits installed in walls.
 - 4. Control and signal circuits.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Division 01.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION

SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnishing and installing cabling for remote-control, signaling and power-limited circuits.

1.02 RELATED REQUIREMENTS

- A. Applicable provisions of Division 1 govern work under this Section.
- B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
- C. Section 26 05 53 – Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code 2017.

1.04 SUBMITTALS

- A. Submit product data: Provide for each cable assembly type.
- B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency.

1.05 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 PRODUCTS

2.01 GENERAL

- A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
- B. All conductors shall be copper.
- C. Insulation shall have a 600 volt rating.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- D. All conductors shall be suitable for the application intended. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:
 - 1. All conductors terminated with crimp type devices shall be stranded.
 - 2. Stranded conductors shall be terminated with an approved ETL Listed type terminations or methods: e.g. stranded conductors shall not be wrapped around a terminal screw but shall be terminated with a crimp type device or in an approved back wired method.

2.02 REMOTE CONTROL AND SIGNALING CABLE

- A. Refer to Section 28 31 00 for requirements for cable to be used on fire alarm systems.
- B. All other systems cabling shall meet the requirements of NEC Article 725 and the following:
 - 1. Cable for Class 1 Remote-Control, Signaling and Power-Limited Circuits: 600 volt insulation, individual conductors twisted together, shielded, and covered with an overall PVC jacket. Cable shall be Listed, temperature rated, and suitable Type (general purpose, riser or plenum) for the application as required in the National Electrical Code.
 - 2. Cable for Class 2 or Class 3 Remote-Control, Signaling and Power-Limited Circuits shall be Listed, temperature rated, and suitable Type (general purpose, riser or plenum) for the application as required in the National Electrical Code.

2.03 WIRING CONNECTORS

- A. Split Bolt Connectors: Not acceptable.
- B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
- C. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

PART 3 EXECUTION

3.01 GENERAL WIRING METHODS

- A. Control-voltage cables shall be installed in conduit.
- B. Control cables for controlling HVAC and lighting equipment connected to emergency power shall be routed in raceway.
- C. Do not use wire smaller than 14 AWG for control wiring greater than 60 volts, or 18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.

- D. Splice only in junction boxes.
- E. Identify wire per section 26 05 53.
- F. Neatly train and lace wiring inside boxes, and equipment.

3.02 WIRING INSTALLATION

- A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling conditions when necessary.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

3.04 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes (except splices to low voltage occupancy sensor power packs and terminations to temperature control devices).
- B. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.
- C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
- D. Thoroughly clean wires before installing lugs and connectors.
- E. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding components.
- B. Provide all components necessary to complete the grounding system(s) consisting of:
 - 1. Existing metal underground water pipe.
 - 2. Existing metal underground gas piping system.

1.02 REFERENCE STANDARDS

- A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.
- C. NFPA 99 - Standard for Health Care Facilities; National Fire Protection Association; 2005.

1.03 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms.
- B. Communications Busbar(s): 5 ohms.

1.04 SUBMITTALS

- A. See Division 01 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide for grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations of components and grounding electrodes.
- F. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Power Systems.
- B. Framatome Connectors International.
- C. CadWeld.
- D. Substitutions: See Division 01 - Product Requirements.

2.02 CONDUCTORS

- A. Material: Stranded copper (aluminum not permitted).
- B. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used at the same facility.
- C. Conductors for Telecommunications shall be as follows:
 - 1. Telecommunications Bonding Conductor (TMGB to Service Ground): No. 3/0 minimum or as shown on drawings.
 - 2. Telecommunications Bonding Backbone (TBB; TMGB to TGB): No. 3/0 minimum or as shown on drawings.
 - 3. Telecommunications Grounding Equalizer (GE): No. 3/0 minimum or as shown on drawings.
 - 4. Bonding Conductors shall be insulated with a Green Jacket or jacket marked with Green Tape or labeled per NEC Guidelines

2.03 BUS/BUSBAR

- A. Material: Copper (aluminum not permitted).
- B. Size:
 - 1. All Power systems: 1/4" X 2", length as needed (24" minimum).
 - 2. Telecommunications Main Ground Busbar (TMGB): 1/4" x 4" x 20" long (minimum).
 - 3. Telecommunications Grounding Busbar (TGB): 1/4" x 2" x 12" long (minimum).
- C. Busbars for Telecommunications shall:
 - 1. Be pre-drilled to accommodate two-hole lugs.
 - 2. 3/8" stud hole size; hole spacing per ANSI J-STD-607-A.
 - 3. Incorporate insulators and stand-off brackets that electrically isolate busbar from mounting surface.

2.04 CONNECTORS AND ACCESSORIES

- A. Mechanical Connectors: Bronze.
 - 1. Substitutions: See Division 01 - Product Requirements.
- B. Exothermic Connections:
 - 1. Product: CadWeld
 - 2. Substitutions: See Division 01 - Product Requirements.
- C. Wire: Stranded copper.
- D. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Provide bonding to meet requirements described in Quality Assurance.
- B. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

3.03 COMMUNICATION SYSTEM GROUNDING

- A. Grounding and Bonding System for Communications shall be an isolated grounding system with a single ground point. That ground point is to be the common grounding electrode system at the building electrical service entrance (main ground bar located in electrical room).
- B. The system shall be compliant with ANSI J-STD-607-B with the exception that the ground cable shall not be bonded to building steel except at the electrical service entrance.
- C. Provide Grounding Busbar for Telecommunications at each Telecommunications Room, the Main Equipment Room and at the electrical service entrance per project drawings. Coordinate Busbar location(s) and conductor routing per drawings with Division 27 contractor.
- D. Provide Telecommunications Bonding Conductor from Telecommunications Main Grounding Busbar (TMGB) at the Communications Entrance Facility to building common grounding electrode system. Attach grounding conductor to building steel as allowed only at the main electrical service entrance.
- E. Provide Telecommunications Bonding Backbone (TBB) conductor from the TMGB to Telecommunications Grounding Busbar (TGB) at each Telecommunication Room, Telecommunications Equipment Room and Telecommunications Enclosure.
 - 1. The TBB shall be connected through Telecommunications Main Ground Busbar direct to the Telecommunications Ground Busbar (TGB).
 - 2. The TGBs may be bonded to the TBB via tap off of the TBB. Use the same conductor size for the tap as the main TBB.
 - 3. Provide 10 foot of slack in the TBB conductor at each TGB location.
 - 4. Do not bond the TBB or TGB to the building steel at the TGB location(s); bond only at the building common grounding electrode system.
- F. Provide Grounding Equalizer(s) (GE) per project drawings. Connect GE conductor directly to TGBs being interconnected.

3.04 FIELD QUALITY CONTROL

- A. Owner will provide field inspection in accordance with Division 01.
- B. Provide field inspection in accordance with Division 01.
- C. Inspect and test in accordance with NETA STD ATS except Section 4.
- D. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.03 SUBMITTALS

- A. See Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog data for fastening systems.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.

- C. Anchors and Fasteners:
1. Do not use powder-actuated anchors, spring clips, or beam clamps.
 2. Obtain permission from Architect before using powder-actuated anchors.
 3. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
 4. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
 5. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
 6. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
 7. Solid Masonry Walls: Use expansion anchors or preset inserts.
 8. Sheet Metal: Use sheet metal screws.
 9. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 2. Do not drill or cut structural members.
 3. Obtain permission from Architect before drilling or cutting structural members.
- B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- C. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
- E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section describes the products and execution requirements relating to furnishing and installing raceways and boxes and related systems as part of a raceway system for electrical, communications, and other low-voltage systems for the project.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- C. Section 26 27 02 – Equipment Wiring Systems.
- D. Section 26 27 26 – Wiring Devices.

1.03 REFERENCE STANDARDS

- A. NFPA 70 – National Electrical Code; National Fire Protection Association, 2017.
- B. ANSI/TIA-569-C-Telecommunications Pathways and Spaces.

1.04 SUBMITTALS

- A. Surface Raceway System - submit product data and catalog sheets for all components.
- B. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.
- C. Conduits in Concrete Slabs Above Grade - provide proposed conduit routing and sizing to Structural Engineer prior to approval of installation to verify structural integrity and fire rating of concrete slab.

PART 2 PRODUCTS

2.01 GENERAL

- A. All steel fittings and conduit bodies shall be galvanized.
- B. All conduit transitional fittings shall be listed for installed application.
- C. No cast metal or split-gland type fittings permitted.
- D. All conduit covers must be fastened to the conduit body with screws and be of the same manufacture.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- E. Mogul-type condulets 2 inch (50 mm) and larger, shall be permitted.
- F. C-condulets shall not be used in lieu of pull boxes.
- G. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

2.02 RIGID METAL CONDUIT (RMC) AND FITTINGS

- A. Conduit: Heavy wall threaded, galvanized steel.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.
- C. Expansion Fittings/Expansion Joints: Expansion Fittings shall be Internal Grounding type and shall not rely on external bonding jumpers to maintain grounding continuity between raceway components.

2.03 PVC COATED RIGID METAL CONDUIT

- A. PVC Externally Coated Conduit: Rigid heavy wall, schedule 40, steel conduit with external 40 mil (0.1 mm) PVC coating. Conduit must be hot dipped galvanized inside and out including threads. The PVC coating bond to the galvanized steel conduit shall be stronger than the tensile strength of the coating itself.
- B. Fittings and Conduit Bodies: Threaded type, material to match conduit. PVC coated fittings and couplings shall have specially formed sleeves to tightly seal to conduit PVC coating. The sleeves shall extend beyond the fitting or coupling a distance equal to the pipe outside steel diameter or two inches (50 mm) whichever is greater.

2.04 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

- A. Conduit: Galvanized [Steel] [Aluminum], threaded.
- B. Fittings and Conduit Bodies: Use all [Steel] [Aluminum] threaded fittings and conduit bodies.
- C. Expansion Fittings/Expansion Joints: Expansion Fittings shall be Internal Grounding type and shall not rely on external bonding jumpers to maintain grounding continuity between raceway components.

2.05 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Conduit: Steel, Unthreaded thin wall galvanized tubing.
- B. Fittings: All steel, compression or set screw type. No push-on or indenter types permitted.
- C. Transitional fitting: ½-1": All steel and malleable iron.
- D. Conduit Bodies: All steel conduit bodies.

2.06 FLEXIBLE METAL CONDUIT (FMC) AND FITTINGS

- A. Conduit: steel, galvanized, spiral strip.
- B. Fittings and Conduit Bodies: All steel, galvanized or malleable iron (except as allowed in specification 26 51 13).

2.07 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) AND FITTINGS

- A. Conduit: Rigid non-metallic conduit, Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90°C conductors. Schedule 80 for locations exposed to physical damage or as required.
- B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.08 CONDUIT SUPPORTS

- A. See specification Section 26 05 29.

2.09 SURFACE NONMETAL RACEWAY

- A. Description: Nonmetallic channel with fitted cover, suitable for use as surface raceway.
- B. Size: As shown on Drawing.
- C. Color: Ivory.
- D. Fittings: Couplings, elbows, and connectors designed for use with raceway system.
- E. Boxes and Extension Rings: Designed for use with raceway systems.

2.10 MULTI-OUTLET ASSEMBLY

- A. Description: Sheet metal channel with fitted cover, [with pre-wired receptacles,] suitable for use as a multi-outlet assembly.
- B. Size: As indicated on Drawing.
- C. Receptacles: Provide covers and accessories to accept convenience receptacles specified in Section 26 27 26.
- D. Finish: White. VERIFY COLOR WITH ARCHITECT
- E. Provide Fittings: Couplings, elbows, outlet and device boxes, and connectors.

2.11 CONDUIT WATER SEALANT

- A. Description: Conduit sealant used to prevent water from entering buildings via conduits.
- B. Sealant shall seal conduits against water and gas intrusion, such as Polywater® FST™ 250 Foam Duct Sealant, Raychem RDSS Rayplate Duct Sealing System, or approved alternate. Sealant shall be re-enterable, shall be compatible with the conduit and conductor types being used, and shall comply with NEC 225.27, 230.8, and 300.5(G).
- C. Manufacturer names and catalog numbers are used to develop quality and performance requirements only. Products manufactured by others may be acceptable provided they meet or exceed the specifications.

2.12 PULL AND JUNCTION BOXES

- A. Interior Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot-welded joints and corners.
- B. Interior Sheet Metal Boxes larger than 12 inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover. Boxes 9 square-feet or larger shall have hinged covers and a single cover shall not exceed 10 square-feet.
- C. Interior Sheet Metal Boxes connected to an exterior underground raceway, shall have a drain fitting located in the bottom.
- D. Exterior Boxes and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain-tight. [Galvanized cast iron][Aluminum][PVC] box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- E. Boxes installed in Parking Ramps shall be Type 4X, flat-flanged, surface-mounted junction box, ETL listed as rain-tight. [Stainless Steel] box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- F. Box extensions and adjacent boxes within 48 inches of each other are not allowed for the purpose of creating more wire capacity.
- G. Junction boxes 6 inch-by-6 inch or larger size shall be without stamped knock-outs.
- H. Wireways shall not be used in lieu of junction boxes.

2.13 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.
- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
- C. Concrete Ceiling Boxes: Concrete type.
- D. Cast Boxes: Cast ferroalloy or aluminum, deep type, gasketed cover, threaded hubs.

2.14 OUTLET BOX EXTENDERS

- A. Outlet Box Extenders: Non-Metallic, adjustable depth.
- B. Outlet Box Extenders may only be used in limited applications with the pre-approval of the Engineer. See Part 3 – Execution for examples of applications of where Outlet Box Extenders may be allowed.

PART 3 EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. EMT is permitted to be used in sizes 4 inch (100 mm) and smaller for power and low-voltage systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.
- B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch (16 mm) minimum except **all homerun conduits shall be 3/4 inch (21 mm)**, or as specified elsewhere. **Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.**
- C. Size communications and other low-voltage systems raceways as follows:
 - 1. Communications, including Equipment Outlet Box: 1 inch minimum. Conduit used for single device locations (e.g. Wireless Access Point, Video Surveillance Camera, and Wall mounted telephone) may be 3/4 inch minimum.
 - 2. Control, security, signal, and other low-voltage applications (not including AV): 3/4 inch minimum.
- D. Provide one raceway from each communications outlet box [to above accessible ceiling] [to cable tray].
- E. Arrange conduit to maintain 6'-8" clear headroom and present a neat appearance.
- F. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- G. Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- H. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
- I. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

- J. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
- K. Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.
- L. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.
- M. Conceal all conduits except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.
- N. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
- O. For indoor and exposed exterior conduits, no continuous conduit run shall exceed 100 feet (30 meters) without a junction box.
- P. For exterior below grade conduits, no continuous conduit run shall exceed 250 feet (75 meters) without hand hole, manhole or pull box.
- Q. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.02 CONDUIT INSTALLATION

- A. All conduit shall be run overhead unless indicated on the plans.
- B. All raceways shall be routed concealed in finished areas unless authorized by the Architect and Engineer.
- C. Cut conduit square; de-burr cut ends.
- D. Conduit shall not be fastened to the corrugated metal roof deck nor drywall or suspended ceiling grids.
- E. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- F. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.
- G. Threads cut in the field, and factory threads of conduit and nipples not coated with corrosion protection, shall be coated with an approved electrically conductive compound per NEC 300.6.
- H. Corrosion inhibitor, when used in the food service environment, shall be approved for Food Service locations.
- I. Terminate all conduit (except for terminations into conduit bodies) using conduit hubs, or connectors with one locknut, or utilize double locknuts (one each side of box wall).

- J. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 26 05 26 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.
- K. Provide insulated bushings where raceways contain 4 AWG or larger conductors.
- L. Communication and Low Voltage systems conduits shall terminate in horizontal plane.
- M. Use pendants supported from swivel hangers in exposed ceiling/ structure locations where necessary to mount boxes supporting luminaires and wiring devices. Installation method shall comply with NEC 314.23 (H).
- N. Install no more than the equivalent of the following for building:
 - 1. Three 90 degree bends between boxes for electrical systems.
 - 2. Two 90 degree bends between boxes for communications and other low voltage systems. Note: Offsets shall be considered 90 degrees.
 - 3. No single bend may exceed 90 degrees.
- O. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.
- P. Bend conduit according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bending of PVC conduit.
- Q. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
- R. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
- S. Install listed expansion-deflection fitting or other approved means shall be used where a raceway crosses a structural joint for expansion, contraction or deflection, used in buildings, bridges, parking garages or other structures.
- T. **Install expansion joints where direct-buried conduit is subject to Earth Movement by settlement or frost per NEC 300.5(J), especially where conduit exits the ground exposed and enters a box, cabinet, or enclosure attached to a building or structure.**
- U. Install expansion fitting in exterior PVC conduit runs per NEC table 352.44 utilizing a minimum temperature change of 120 degree F.
- V. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.
- W. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide conduit or box with duct seal or other means to prevent the passage of moisture and water vapor through the conduit.

- X. Route conduit through roof openings for piping and ductwork where possible.
- Y. Where communication cabling is to be installed in conduit to the wiring hub (e.g. Telecom Room), multiple conduits may be consolidated into fewer, larger conduits. Capacity of shared conduits shall equal the capacity of the individual conduits unless otherwise noted.
- A. Ground and bond conduit under provisions of Section 26 05 26.
- AA. Identify conduit under provisions of Section 26 05 53.
- AB. Clean PVC conduit with solvent, and dry before application of glue. The temperature rating of glue/cement shall match weather conditions. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturer's recommendations.

3.03 CONDUIT INSTALLATION SCHEDULE

- A. Conduit other than that specified below for specific applications shall not be used.
 - Concealed in Poured Concrete Walls: Rigid Metal Conduit, PVC conduit, or Electrical Nonmetallic Tubing (ENT).
 - Concealed in Concrete Block Walls: Electrical metallic tubing, PVC conduit. Electrical Nonmetallic Tubing (ENT).
 - Emerging from Within Concrete Slab: Rigid Metal conduit.
 - Exposed Outdoor Locations: Rigid Metal conduit, Intermediate Metal conduit.
 - Wet Interior Locations: Exposed: [Rigid metal conduit] [Schedule 80 PVC conduit] [PVC coated Rigid metal conduit].
 - Concealed Dry Interior Locations: Rigid metal conduit, Intermediate metal conduit, Electrical metallic tubing, PVC conduit (Ground conductor).
 - Interior Building Grounding Electrode Conductor: Schedule 80 PVC.
 - Exposed Dry Interior Locations: Rigid metal conduit, Intermediate metal conduit, Electrical metallic tubing.
 - Motor and equipment connections: Liquidtight flexible metal conduit (LFMC) in all locations except in Mechanical equipment plenum spaces where Flexible Metal Conduit (FMC) shall be utilized. Minimum length shall be one foot (300 mm); maximum length shall be three feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
 - Exposed Dry Interior Locations for HVAC control devices with Conduit Connections: Electrical metallic tubing, Flexible Metal Conduit (FMC). For FMC installations, Minimum length shall be one foot (300 mm), Maximum length shall be three feet (900 mm). Minimum size FMC of 3/8".

- Exposed Dry Interior Locations for HVAC control devices without Conduit Connections: Where HVAC equipment control panels or devices do not provide for the direct connection of conduits, exposed Class 2 wiring may be extended to complete the final connections in dry locations, provided it does not exceed 18 inches in length.
- Light fixtures: Refer to specification section 26 51 13.
- Plenum Spaces: Installation shall comply with requirements of NEC 300.22.

3.04 PVC COATED RIGID METAL CONDUIT INSTALLATION

- A. Installers of PVC Coated Rigid Metal Conduit shall be factory trained and certified in the proper installation methods for this type of conduit. Proof of such certification shall be kept on the project site at all times and shall be produced upon request.

3.05 HIGH DENSITY POLYETHYLENE CONDUIT (HDPE) INSTALLATION

- A. See specification Section 26 05 34 -- Underground HDPE Pathways for Electrical Systems.

3.06 NONMETALLIC SURFACE RACEWAY INSTALLATION

- A. Use flat headed screws with appropriate anchors to fasten channel to surfaces secured every twenty-four (24) inches. Mount plumb and level. All surface mounted devices shall be fastened to the wall utilizing flat head screws along with appropriate anchors. No device shall be adhered to the wall surface using two-faced tape or any means other than as described above.
- B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- C. In areas where the walls cannot be fished, the station cable serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, and conference rooms or like facilities.
- D. Non-metallic raceway shall have a screw applied base. Both the base and cover shall be manufactured of rigid PVC materials.
- E. The raceway shall originate from a surface mounted box mounted adjacent to and at the same height as existing electrical boxes in the room, be attached to the wall and terminate above the ceiling.
- F. All fittings including, but not limited to, extension boxes, elbows, tees, fixture bodies shall match the color of the raceway.
- G. The raceway and all systems devices shall be UL listed and exhibit nonflammable self-extinguishing characteristics, tested to specifications of UL94V-0.

- H. In raceway for communications and other low voltage systems, the inside bend radius minimum shall be as follows:
- Internal diameter of 2 in or less- 6 times the internal diameter.
 - Internal diameter of more than 2 in- 10 times the internal diameter.
- I. Conduit bends shall contain no kinks or other discontinuities.

3.07 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
- D. Conduit and boxes shall not be fastened to the metal roof deck. If conduit and boxes are required to be located and installed on roof decks, the conduit and boxes are required to be spaced minimum 1-5/8 inch off the lowest part of the metal roof decking material, per NEC 300.4 (E).
- E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
- F. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.
- G. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.
- H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors. Boxes must be installed within 12" from edge of the access door.
- I. Locate and install to maintain headroom and to present a neat appearance.
- J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.
- K. Boxes installed in the building envelop shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and locations per IEC 502.4.3.

3.08 PULL AND JUNCTION BOX INSTALLATION

- A. Pull boxes and junction boxes shall be minimum 4 inches square (100 mm) by 2 1/8 inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit, minimum junction box size shall be 4 11/16 inches square by 2 1/8 inches deep.
- B. Where used with raceway(s) containing conductors of 4 AWG or larger, pull box shall be sized as required unless otherwise noted on the drawings.
- C. Where used with raceway(s) containing conductors on systems over 600V, size pull box per NEC 314 Part IV unless otherwise noted as larger on the drawings.

Size pull boxes for communications per ANSI/TIA-568-C.

- D. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.
- E. Provide Pull and Junction boxes for communications and other low voltage applications (a) in any section of conduit longer than 100 feet, (b) where there are bends totaling more than 180 degrees between pull points or pull boxes and (c) wherever there is a reverse bend in run. Locate boxes on straight section of raceway (e.g. do not use boxes in place of raceway bends).
- F. Support pull and junction boxes independent of conduit.

3.09 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch (150 mm) separation, except provide minimum 24 inch (600 mm) separation in acoustic-rated walls.
- B. Power:
 - 1. Recessed (1/4 inch maximum) outlet boxes in masonry, concrete, tile construction, or drywall shall be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes. A single gang box can be used in drywall and masonry, for a single device location, when a single conduit enters box.
 - 2. Shallow 4 inch square by 1 1/2 inch deep boxes can be used as device boxes for power provided the box and plaster ring is sized for installed device and conductors.

- C. Low Voltage:
1. Recessed (1/4 inch maximum) outlet boxes in masonry, concrete, tile construction or drywall shall be minimum 4 11/16 inch square by 2 1/8 inch deep with single gang device ring (unless noted otherwise on drawings or in companion specifications). Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
 2. Provide one conduit from each communications Equipment Outlet box. Conduit runs between outlet boxes for communications are not allowed. Terminate conduit [above accessible ceiling] [above accessible ceiling in corridor] [on cable tray] [as detailed on drawings].
- D. Provide knockout closures for unused openings.
- E. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.
- F. Install boxes in walls without damaging wall insulation.
- G. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- H. Ceiling outlets shall be 4 inch square, minimum 2 1/8 inch (54 mm) deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.
- I. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches (150 mm) of recessed luminaire, to be accessible through luminaire ceiling opening.
- J. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- L. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.
- M. Surface wall outlets shall be 4 inch (100 mm) square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.
- N. Outlet Box adjustable ring and depth device applications: Provide box extenders for boxes that are set too far back in the wall due to un-anticipated wall finishes. Place the box extender over the existing box face to make the box face flush with the wall finish.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

SECTION 26 05 34

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

- A. Division 01 - Firestopping.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems.
- E. Section 26 05 37 - Boxes.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2015.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2015.
- D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.
- E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; 2013.
- F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2014.
- G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2018.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association; 2013.

- I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2016.
- J. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 01 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.
- C. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Conduit Size: Comply with NFPA 70.
 - 1. Minimum Size: 1/2 inch unless otherwise specified.
- B. Underground Installations:
 - 1. More than 5 Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, or plastic coated conduit.
 - 2. Within 5 Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, plastic coated conduit, or thickwall nonmetallic conduit.

3. In or Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit, or plastic coated conduit.
4. Minimum Size: 3/4 inch.
- C. Outdoor Locations Above Grade: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, or electrical metallic tubing.
- D. In Slab Above Grade: (All locations shall be approved by Owner and Electrical Designer.)
 1. Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing, or thickwall nonmetallic conduit.
 2. Maximum Size Conduit in Slab: 3/4 inch; 1/2 inch for conduits crossing each other.
- E. Wet and Damp Locations: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, electrical metallic tubing, thickwall nonmetallic conduit, or nonmetallic tubing.
- F. Dry Locations:
 1. Concealed: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, electrical metallic tubing.
 2. Exposed: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, electrical metallic tubing.

2.02 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.03 PVC COATED METAL CONDUIT

- A. Description: NEMA RN 1; rigid steel conduit with external PVC coating.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.04 FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction.
- B. Fittings: NEMA FB 1.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction with PVC jacket.
- B. Fittings: NEMA FB 1.

2.06 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression or set screw type.

2.07 NONMETALLIC CONDUIT (Use Only in Locations as Shown on Plans)

- A. Description: NEMA TC 2; Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.08 NONMETALLIC TUBING (Use Only in Locations Shown on Plans)

- A. Description: NEMA TC 2.
- B. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

- A. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1. **All conduit shall be run overhead unless indicated on the plans.**
- B. All raceways shall be routed concealed in finished areas unless authorized by the Architect and Engineer.
- C. Install steel conduit as specified in NECA 101.
- D. Install nonmetallic conduit in accordance with manufacturer's instructions.
- E. Arrange supports to prevent misalignment during wiring installation.

- F. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- G. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- H. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.
- I. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- J. Do not attach conduit to ceiling support wires.
- K. Arrange conduit to maintain headroom and present neat appearance.
- L. Route exposed conduit parallel and perpendicular to walls.
- M. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- N. Route conduit in and under slab from point-to-point.
- O. Do not cross conduits in slab.
- P. Maintain adequate clearance between conduit and piping.
- Q. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- R. Cut conduit square using saw or pipecutter; de-burr cut ends.
- S. Bring conduit to shoulder of fittings; fasten securely.
- T. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- U. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.
- V. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.
- W. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- X. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic.
- Y. Provide suitable pull string in each empty conduit except sleeves and nipples.
- Z. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

AA. Ground and bond conduit under provisions of Section 26 05 26.

AB. Identify conduit under provisions of Section 26 05 53.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 01.

B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified.

END OF SECTION

SECTION 26 05 35
SURFACE RACEWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface nonmetal raceways.

1.02 RELATED REQUIREMENTS

- A. Section 26 27 26 - Wiring Devices: Receptacles.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain one copy of document on site.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.
- D. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Lamson & Sessions (Carlon).
- B. Square D.
- C. Wiremold Company.
- D. Panduit
- E. Substitutions: See Division 1 - Product Requirements.

2.02 SURFACE RACEWAYS

- a. Surface Nonmetal Raceway: Plastic channel with fitted cover, suitable for use as surface raceway.
 - 1. Size: As shown on Drawings.
 - 2. Finish: verify with the architect

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install raceways securely, in a neat and workmanlike manner, as specified in NECA 1.
- C. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- D. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- E. Ground and bond raceway and wireway under provisions of Section 26 05 26.

END OF SECTION

SECTION 26 05 37

BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling outlet boxes.
- B. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

- A. Section 26 27 16 - Electrical Cabinets and Enclosures.
- B. Section 26 27 26 - Wiring Devices: Wall plates in finished areas.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.
- B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2014.
- C. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2013.
- D. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2013.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2018.
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 01 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Panduit.
- B. Legrand.
- C. Hubbell.
- D. Wiremold.
- E. Substitutions: See Division 01 - Product Requirements.

2.02 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.03 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 26 27 16.
- C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
 - 1. Material: Galvanized cast iron.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION

- A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
- C. Coordinate installation of outlet boxes for equipment connected under Section 26 27 17.
- D. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- E. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
 - 1. Adjust box locations up to 10 feet if required to accommodate intended purpose.
- F. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- G. Maintain headroom and present neat mechanical appearance.
- H. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- I. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- J. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 01.
- K. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- L. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- M. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- N. Use flush mounting outlet box in finished areas.
- O. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- P. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- Q. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

- R. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- S. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- T. Use adjustable steel channel fasteners for hung ceiling outlet box.
- U. Do not fasten boxes to ceiling support wires.
- V. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- W. Use gang box where more than one device is mounted together. Do not use sectional box.
- X. Use gang box with plaster ring for single device outlets.
- Y. Use cast outlet box in exterior locations exposed to the weather and wet locations.

3.03 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

3.04 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.
- D. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

- A. Division 01 - Painting and Coating.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 01 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide catalog data for nameplates, labels, and markers.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Brady Corporation.
- B. Seton Identification Products.
- C. HellermannTyton.
- D. Substitutions: See Division 01 - Product Requirements.

2.02 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
 - 2. Communication cabinets.
 - 3. Disconnects, starters, and relays.
- C. Letter Size:
 - 1. Use 1/8 inch letters for identifying individual equipment and loads.
 - 2. Use 1/4 inch letters for identifying grouped equipment and loads.
 - 3. Use 1 inch letters for identifying distribution and control equipment enclosures.
- D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations.

2.03 WIRE MARKERS

- A. Description: Cloth type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - 2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

2.04 CONDUIT MARKERS

- A. Description: Use tape or paint to mark conduit.
- B. Location: Furnish markers for each conduit longer than 6 feet.
- C. Spacing: 20 feet on center.
- D. Color:
 - 1. 120/208 Volt System: White.
 - 2. Data System: Blue.

2.05 WIRING DEVICE IDENTIFICATION

- A. Wall switches, receptacles, occupancy sensors, photocells, poke-through fittings, access floor boxes, and time clocks shall be identified with circuit numbers and panelboard source (ex. Panel ABC-3). In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated adhesive labels, or neatly hand-written permanent marker.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

- A. Install nameplates and labels parallel to equipment lines.
- B. Secure nameplates to equipment front using screws.
- C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Identify conduit using field painting under provisions of Division 01.
 - 1. Paint colored band on each conduit longer than 6 feet.
 - 2. Paint bands 20 feet on center.
 - 3. Colors:
 - a. 120/208 Volt System: White.
 - b. Data System: Blue.
- E. Identify underground conduits using underground warning tape. Install one tape per trench at a minimum of 12" above the underground installation.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

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SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Two-winding transformers.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 34 - Conduit: Flexible conduit connections.

1.03 REFERENCE STANDARDS

- A. NEMA ST 1 - Specialty Transformers (Except General Purpose Type); National Electrical Manufacturers Association; 1988 (R1997).
- B. NEMA ST 20 - Dry-Type Transformers for General Applications; National Electrical Manufacturers Association; 1992 (R1997).
- C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 1 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.
- C. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations of transformers.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Electrical/Cutler-Hammer.
- B. ABB.
- C. Square D.
- D. Substitutions: See Division 1 - Product Requirements.

2.02 TWO-WINDING TRANSFORMERS

- A. Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, ratings as indicated.
- B. Energy Efficient NEMA TP-1.
- C. Primary Voltage: 480 volts, 3 phase.
- D. Secondary Voltage: 208Y/120 volts, 3 phase.
- E. Insulation system and average winding temperature rise for rated kVA as follows:
 - 1. 1-15 kVA: Class 185 with 115 degrees C rise.
 - 2. 16-500 kVA: Class 220 with 115 degrees C rise.
- F. Case Temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- G. Winding Taps:
1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
 2. Transformers 15 kVA and Larger: NEMA ST 20. Two 2-1/2 percent full capacity taps above and four 2-1/2 percent full capacity taps below normal voltage on primary winding.
- H. Sound Levels: NEMA ST 20.
1. 1-9 kVA: 40 dB.
 2. 10-50 kVA: 45 dB.
 3. 51-150 kVA: 50 dB.
 4. 151-300 kVA: 55 dB.
 5. 301-500 kVA: 60 dB.
- I. Basic Impulse Level: 10 kV.
- J. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- K. Mounting:
1. 1-15 kVA: Suitable for wall mounting.
 2. 16-75 kVA: Suitable for wall, floor, or trapeze mounting.
 3. Larger than 75 kVA: Suitable for floor mounting.
- L. Coil Conductors: Continuous aluminum windings with terminations brazed or welded. The winding shall be epoxy encapsulated providing rigid construction and quieter operation. The windings shall withstand short circuit stress up to 25 times normal load current for two seconds.
- M. Transformer Enclosure: NEMA ST 20.
1. Type 1.
 2. Ventilated.
 3. Provide lifting eyes or brackets.
- N. Isolate core and coil from enclosure using vibration-absorbing mounts.
- O. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Set transformers plumb and level.
- B. Use flexible conduit, under the provisions of Section 26 05 34, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- C. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.
- D. Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- E. Mount trapeze-mounted transformers as indicated.
- F. Provide seismic restraints.
- G. Provide grounding and bonding in accordance with Section 26 05 26.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Division 1.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.2.1.1. In addition to the basic requirements of Section 7.2, include the following:
 - 1. Perform turns ratio tests at all tap positions.
 - 2. Verification that as-left tap connections are as specified.
 - 3. Perform excitation-current tests on each phase.
 - 4. Measure the resistance of each winding at each tap connection.
 - 5. Overpotential test on all high- and low-voltage windings-to-ground.

3.03 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.
- B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- D. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.
- E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2013.
- F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 1 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- D. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- E. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 MAINTENANCE MATERIALS

- A. See Division 1 - Product Requirements, for additional provisions.
- B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Electrical/Cutler-Hammer.
- B. ABB.
- C. Square D.
- D. Substitutions: See Division 1 - Product Requirements.

2.02 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.
- C. Minimum Integrated Short Circuit Rating: As indicated.
 - 1. 240 Volt Panelboards: 10,000 amperes rms symmetrical.
 - 2. 480 Volt Panelboards: 14,000 amperes rms symmetrical.

- D. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
 - 4. Do not use tandem circuit breakers.
- E. Current Limiting Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole; UL listed. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
- F. Enclosure: NEMA PB 1, Type 1.
- G. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.
- H. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
 - 1. Minimum spare conduits: 5 empty 1 inch (DN27).
- H. Ground and bond panelboard enclosure according to Section 26 05 26.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Division 1.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.03 ADJUSTING

- A. Measure steady state load currents at each panelboard feed. Re-arrange circuits to balance the phase loads to within 10 percent.

END OF SECTION

SECTION 26 27 17
EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 34 - Conduit.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).
- C. Section 26 05 37 - Boxes.
- D. Section 26 27 26 - Wiring Devices.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2016.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 1 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.06 COORDINATION

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Conform to NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
 - 4. Product:
 - 5. Substitutions: See Division 1 - Product Requirements.
- B. Disconnect Switches: As specified in Section 26 28 18 and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 27 26.
- D. Flexible Conduit: As specified in Section 26 05 34.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Boxes: As specified in Section 26 05 37.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.03 EQUIPMENT SCHEDULE

- A. Schedule on drawings.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Occupancy sensors.
- D. Receptacles.
- E. Device plates and decorative box covers.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 37 - Boxes.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.
- B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2016.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

- A. See Division 01 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Manufacturer's Installation Instructions.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 EXTRA MATERIALS

- A. See Division 01 - Product Requirements, for additional provisions.
- B. Furnish two of each style, size, and finish wall plate.
- C. Provide two protective rings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hubbell.
- B. Leviton.
- C. Pass & Seymour.
- D. Substitutions: See Division 01 - Product Requirements.

2.02 WALL SWITCHES

- A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
 - 1. Body and Handle: plastic with toggle handle. Verify color with architect.
 - 2. Ratings:
 - a. Voltage: 120 volts, AC.
 - b. Current: 20 amperes.
 - 3. Ratings: Match branch circuit and load characteristics.
- B. Switch Types: Single pole, double pole, and 3-way.

2.03 WALL DIMMERS

- A. Wall Dimmers: Specify per light fixture manufacturer's recommendations. Type as indicated on drawings, complying with NEMA WD 6 and WD 1.
 - 1. Body and Handle: plastic. (Verify color with Architect.)
 - 2. Voltage: Per fixture type.
 - 3. Power Rating: Per fixture and manufacturer's recommendations.
 - 4. Power Rating: Match load shown on drawings.
 - 5. Power Rating: As indicated in schedule.
- B. Accessory Wall Switches: Match dimmer appearance.

2.04 OCCUPANCY SENSORS

- A. Provide type as indicated on drawings.

2.05 RECEPTACLES

- A. Receptacles: Heavy duty, complying with NEMA WD 6 and WD 1.
 - 1. Configuration: NEMA WD 6, type as specified and indicated.
- B. Convenience Receptacles: NEMA 5-20R.
- C. Single Convenience Receptacles: NEMA 5-20R.
- D. Duplex Convenience Receptacles: NEMA 5-20R.
- E. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- F. Provide tamper and arc fault receptacles per NEC and Local codes.

2.06 WALL PLATES

- A. Decorative Cover Plates: smooth plastic. (Verify color with Architect/Owner.)
- B. Jumbo Cover Plates: smooth plastic. (Verify color with Architect/Owner.)
- C. Weatherproof Cover Plates: Gasketed cast metal with hinge.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.03 INSTALLATION

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on top.
- G. Connect wiring device grounding terminal to outlet box with bonding jumper.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping conductor around screw terminal.
- J. Use jumbo size plates for outlets installed in masonry walls.
- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- L. Install protective rings on active flush cover service fittings.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 37 to obtain mounting heights specified.
- B. Install wall switch 44 inches above finished floor.
- C. Install convenience receptacle 18 inches above finished floor.
- D. Install convenience receptacle 6 inches above counter.
- E. Install dimmer 44 inches above finished floor.
- F. Install telephone jack 18 inches above finished floor.
- G. Install telephone jack for side-reach wall telephone to position top of telephone at 48 inches above finished floor.
- H. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches above finished floor.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Division 01.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify that each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

- A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

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SECTION 26 28 18
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonfusible switches.

1.02 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2012.
- B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.
- C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.03 SUBMITTALS

- A. See Division 1 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide switch ratings and enclosure dimensions.
- C. Project Record Documents: Record actual locations of enclosed switches.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Electrical/Cutler-Hammer.
- B. ABB.
- C. Square D.
- D. Substitutions: See Division 1 - Product Requirements.

2.02 COMPONENTS

- A. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
 - 1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
 - 2. Handle lockable in OFF position.
- B. Manual Toggle Controller/Disconnect
 - 1. Hubbell #HBL78 Series.
- C. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install fuses in fusible disconnect switches.
- C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection in accordance with Division 1.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.2.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires, egress fixtures, and accessories.
- B. Exit signs.
- C. LED Luminaires.
- D. LED Drivers.

1.02 RELATED REQUIREMENTS

- A. Section 23 36 00 - Air Terminal Units: Air distribution accessories for air handling luminaires.

1.03 REFERENCE STANDARDS

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006 (R2015).
- B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004 (R2015).
- C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002.
- D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- F. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2016.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.
- H. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2018.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

1.04 SUBMITTALS

- A. See Division 1 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.
 - 1. Photometric Data: Submit on CD or DVD, in IESNA LM-63 standard format.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Instructions for each product.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 1 - Product Requirements, for additional provisions.
 - 2. Extra Plastic Lenses: One of type and size.
 - 3. Extra Lamps: One of each type and size.
 - 4. Extra Ballasts: One of type and size.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 LUMINAIRES

- A. Furnish products as indicated in Schedule on drawings.
- B. Substitutions: See Division 1 - Product Requirements.

2.02 EXIT SIGNS

- A. Manufacturers:
 - 1. Cooper Lighting.
 - 2. Lithonia Lighting.
 - 3. Hubbell.
 - 4. Current.
 - 5. Substitutions: See Division 1 - Product Requirements.
- B. Exit Signs: Exit sign fixture suitable for use as emergency lighting unit.
 - 1. Furnish products as indicated in schedule on drawings.

2.03 LED LUMINAIRES

- A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
 - 1. Minimum Light Output.
 - 2. Zonal Lumen Requirements.
 - 3. Minimum Luminaire Efficacy.
 - 4. Minimum CRI.
 - 5. L70 Lumen Maintenance.
 - 6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
- B. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
- C. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
- D. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
- E. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
- F. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
- G. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
- H. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
- I. Luminaire and driver shall be furnished from a single manufacturer to ensure compatibility.

- J. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
- K. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
- L. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
- M. Luminaire shall have a maximum Total Harmonic Distortion (THD) of $\leq 20\%$ at full input power and across specified voltage range.
- N. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
- O. All luminaires shall be provided with knockouts for conduit connections.
- P. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
- Q. Provide all of the following data on submittals:
 - 1. Delivered lumens
 - 2. Input watts
 - 3. Efficacy
 - 4. Color rendering index.
- R. The failure of one LED shall not affect the operation of the remaining LEDs.

2.04 LED DRIVERS

- A. General:
 - 1. Provide driver type (non-dimmed, step-dimmed, continuous-dimming, etc.) as indicated on the luminaire schedule on the drawings.
 - 2. Minimum Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
 - 3. Driver shall have a rated life of 50,000 hours, minimum.
 - 4. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
 - 5. Driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.

6. Driver shall operate normally for input voltage fluctuations of plus or minus 10 percent.
 7. Driver shall have a maximum Total Harmonic Distortion (THD) of $\leq 20\%$ at full input power and across specified voltage range.
 8. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
 9. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
 10. Provide all of the following data on submittals:
 - a. Input watts
 - b. Power Factor (pf)
 - c. Crest Factor (cf) at full input power
 - d. Total Harmonic Distortion (THD).
- B. Dimming Drivers:
1. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC), Constant Voltage, or Pulse Width Modulation (PWM) operation.
 2. Continuous Dimming Drivers: LED luminaires shall dim to (10%, 1%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or "popcorn effect". "Popcorn effect" is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire. Continuous Dimming Drivers shall use 0-10V control.

2.05 ACCESSORIES

- A. Product:
1. Substitutions: See Division 1 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).
- B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- C. Support luminaires equal to or larger than 2 x 4 foot (600 x 1200 mm) size independent of ceiling framing.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- F. Exposed Grid Ceilings: Support surface mounted luminaires in grid ceiling directly from building structure.
- G. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.
- H. Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- I. Install recessed luminaires to permit removal from below.
- J. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- K. Install clips to secure recessed grid-supported luminaires in place.
- L. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.
- M. Install accessories furnished with each luminaire.
- N. Connect luminaires and exit signs to branch circuit outlets provided under Section 26 05 34 using flexible conduit.
- O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- P. Bond products and metal accessories to branch circuit equipment grounding conductor.
- Q. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.
- R. Interface with air handling accessories furnished and installed under Section 23 36 00.
- S. 0-to-10V Dimming Control Wiring Installation:
 - 1. Zero-to-10V dimming control conductors are classified by the NEC as Class 2 conductors and shall be kept separate from line-voltage conductors per NEC 725.136(A). Matching the insulation rating of Conductors of Different Systems does not apply to Class 2 conductors per NEC 300.3(C)(1), Informational Note No.1.
 - 2. Wall box dimmers will typically have two conduits: One conduit for line-voltage power, and one conduit or conduit stub for the 0-10V control wiring.

3. At each luminaire, separate openings (either manufactured knock-outs or punched openings) shall be used for the line-voltage power and the 0-10V wiring. The EC shall use a cable connector at the opening for the 0-10V wiring. Zero-to-10V conductors entering and within a luminaire enclosure shall maintain a minimum separation of 6 mm (0.25 in.) per NEC 725.136(D).
4. Exposed 0-10V cables shall be installed in separate conduits from line-voltage conductors.
5. The 0-10V cables may be routed in free air where concealed above accessible ceilings. Cables routed in free air shall observe the following installation requirements:
 - a. The 0-10V cables may be tie-wrapped to the outside of the luminaire power raceway where allowed by NEC 300.11(B)(2). Tie-wraps shall be UL listed for UV resistance. Care should be taken in the use of cable ties to secure and anchor the cabling. Ties shall not be over tightened as to compress the cable jacket. No sharp burrs shall remain where excess length of the cable tie has been cut.
 - b. Cabling shall be neatly run at right angles and be kept clear of other trades work.
 - c. Cabling shall be secured within twelve (12) inches of direction change or termination.
 - d. Cabling shall be supported at a maximum of 5-foot intervals utilizing "J-Hook" or "Bridle Ring" supports anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12-inches, another support shall be provided. Cable supports shall be installed to maintain cable bend to larger than the minimum bend radius.
 - e. Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical or communications conduit. Do not place cable directly on the ceiling grid or attach cable in any manner to the ceiling grid wires.
 - f. All cables shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum type grips may be used to spread the strain over a longer length of cable.
 - g. Cable manufacturer's minimum bend radius shall be observed in all instances.
 - h. Use suitable cable fittings and connectors.

T. Luminaire Connections – Metal-Clad (MC) Cable:

1. Metal-Clad (MC) type cable that combines power and Class 2 circuits into a single cable may be used for the luminaire wiring where 0-10V dimming control wiring is required. Examples of such products are Encore Wire® MC-LED™ or Southwire® MC-PCS Duo™. Manufacturer's names and catalog numbers are used for quality and performance only. MC Cables manufactured by others shall be equally acceptable provided they meet or exceed in performance and quality as specified.
2. Recessed, including Master-Satellite connections:
 - a. Use a luminaire fixture whip from a J-box for recessed lay-in luminaires. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Metal Clad (MC) cable that combines power and Class 2 circuits (for 0-10V dimming control) into a single cable may be used as a whip for luminaires that are dimmed.
 - b. Cable/Conduit whips shall be 3/8" (10 mm) minimum diameter, six feet (1.8 m) maximum length.
 - c. Flexible whips or pre-wired systems between master and satellite luminaires may be supported by the ceiling grid wires.
 - d. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite units.
3. Chain or Cable Hung (unfinished spaces):
 - a. Use manufacturer's SO cord or a luminaire fixture whip from a J-box. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Metal Clad (MC) cable that combines power and Class 2 circuits (for 0-10V dimming control) into a single cable may be used as a whip for luminaires that are dimmed.
 - b. Conduit whips shall be 3/8" (10 mm) minimum diameter. Conduit whip or SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the chain/cable/luminaire, but shall not be long enough to "loop" and shall present a neat and workmanlike appearance.
 - c. Luminaire field wired flexible cord installations shall be connected per NEC 410.62.
 - d. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite units.
 - e. Conduit whip slack shall be tie-wrapped to the chain supports. Tie-wraps shall be UL listed for UV resistance.
4. Cable Hung (finished spaces):
 - a. Use manufacturer's SO cord from luminaire to a J-box.
 - b. SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the cable/luminaire, but shall not be long enough to "loop" and shall present a neat and workmanlike appearance.

- c. SO cord slack may be tie-wrapped to the cable supports. Tie-wraps shall be UL listed for UV resistance.
 - d. Luminaire field wired flexible cord installations shall be connected per NEC 410.62.
- 5. Surface Mounted (unfinished spaces): Provide direct conduit and box connection.
 - 6. Surface Mounted (finished spaces): Provide direct conduit and box connection. Use surface metal raceway where indicated on drawings. Conceal box and conduit where appropriate. Flexible metal conduit shall not be used where the conduit is exposed.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection in accordance with Division 1.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.03 ADJUSTING

- A. Aim and adjust luminaires as indicated.
- B. Position exit sign directional arrows as indicated.

3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate luminaire operation for minimum of two hours.

3.06 PROTECTION

- A. Relamp luminaires that have failed lamps at Substantial Completion.

3.07 SCHEDULE – On Drawings.

END OF SECTION

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

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SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires, egress fixtures, and accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.
- B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.
- C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- D. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2002.
- E. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002.
- F. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000(R2005) (ANSI/IES RP8).
- G. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- H. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.05 SUBMITTALS

- A. See Division 1 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

Riverland Energy Cooperative
Alma City Hall Remodel – Phase 1
Alma, WI

- C. Product Data: Provide dimensions, ratings, and performance data.
 - 1. Photometric Data: Submit on CD or DVD, in IESNA LM-63 standard format.
- D. Test Reports: Indicate measured illumination levels.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- F. Maintenance Data: For each luminaire.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 1 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 LUMINAIRES

- A. Furnish products as indicated in Schedule on drawings.
- B. Substitutions: See Division 1 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 501.
- B. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

3.02 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.03 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution indicated on Drawings.

3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.05 SCHEDULE – On Drawings.

END OF SECTION

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