REVISED BRIDGING DOCUMENTS – NOT FOR CONSTRUCTION

PROJECT MANUAL

CDB #822-010-127
CAMPUS BOILER REPLACEMENTS
NORTHERN ILLINOIS UNIVERSITY
DEKALB (DEKALB), ILLINOIS
CDB BUILDING INV. NOS. 051 AND 001A
CONTRACT: GENERAL
PLUMBING
HEATING
VENTILATION
ELECTRICAL

State of Illinois

CAPITAL DEVELOPMENT BOARD

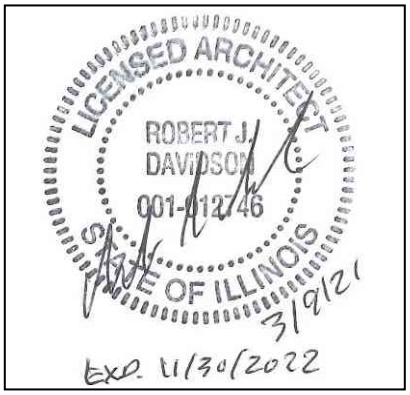
USING AGENCY: NORTHERN ILLINOIS UNIVERSITY

BY: MIDDOUGH INC.
700 COMMERCE DRIVE, SUITE 200
OAK BROOK, IL 60523

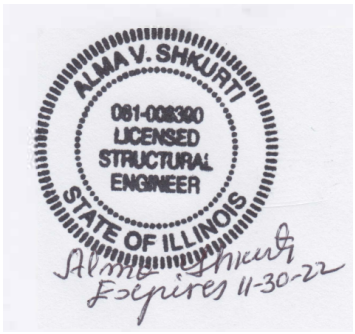
DATE: MARCH 9, 2021

REVISED BRIDGING DOCUMENTS – NOT FOR CONSTRUCTION

CIVIL



ARCHITECTURAL



STRUCTURAL

PLUMBING

HEATING -VENTILATION

ELECTRICAL

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State of Illinois
CAPITAL DEVELOPMENT BOARD

Middough Inc.
700 Commerce Drive, Suite 200
Oak Brook, Illinois 60523

PROJECT MANUAL FOR

CDB Project Number 822-010-127

NIU Campus Boiler Replacements
DeKalb, DeKalb County, Illinois

DATE: March 9, 2021

DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

A. Drawings: Listed on the Table of Contents page of the drawing set.

B. List of Drawings:

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H-1	WHP Gas Piping Schematic Diagram
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H-2	WHP HP Steam/Condensate Schematic Diagram
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H-13	WHP New Deaerator, Tanks, and Pumps Schem Diag
H-14	WHP Chemical Additives Schematic Diagram
H-15	WHP Boilers 5 & 6 Schematic Diagram
H-16	WHP Instrumentation Air Schematic Diagram
H-17	WHP PFD & Material Balance
H-18	North WHP Pipe Routing Schematic
H-19	South WHP Pipe Routing Schematic
H-20	EHP Pipe Routing Schematic
H-21	Symbols, Abbreviations, and General Notes
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V-2	First Floor Ventilation Plan
V-3	Roof Ventilation Plan
V-4	Mezzanine Ventilation Plan and Equipment Schedules
Electrical Drawings	
E-1	One Line Diagram

END OF DOCUMENT 000115

DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document and its referenced attachments are for information and are not part of the Contract Documents.

B. A geotechnical investigation report, prepared by Testing Service Corporation, dated August 27, 2019, is appended to this Document.

END OF DOCUMENT 003132

SECTION 011000 - SUMMARY

1.1 PROJECT INFORMATION

A. Project Identification: Campus Boiler Replacements, CDB Project Number 822-010-127.

1. Project Location: Northern Illinois University, DeKalb, Illinois.

B. Owner: Illinois Capital Development Board (CDB).

1. Owner's Representative: Dan Bielski, Senior Project Manager, 815-885-3317, Dan.Bielski@Illinois.gov

C. Using Agency: Northern Illinois University, Physical Plant Building, 1425 Lincoln Highway, DeKalb, Illinois 60115.

1. Using Agency's Representative: James Fitzjarrell, PE, 815-753-2061, jfitzjarrell@niu.edu.

D. Architect: Middough Inc, 700 Commerce Drive, Oakbrook, IL 60523.

1. Architect's Representative: Sean P. Carney Project Manager.

E. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Heating / Ventilation / Plumbing: Melvin Cohen & Associates Engineering.

a. Representative: John Nowakowski, PE

2. Heating: General Energy Corporation.

a. Representative: Prem Mehrotra, PE

F. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project: The current project will remove existing boilers (2 located in the West Heating Plant) and to install 2 new steam boilers in a new building addition to the West Heating Plant including new piping and systems to support the new boilers and interconnection with existing systems. The layout of the new building addition will be designed to accommodate a total of 3 boilers. As the East Heating Plant will ultimately be retired, the new building addition will also house offices and employee support areas.

B. Type of Contract:

1. Design-Build Entity

C. Work Under Owner's Separate Contracts:

1. Preceding Work: Completion and submission of air permit to the Illinois Environmental Protection Agency; Middough, Inc. Design-Build entity and their Engineer of Record will confirm the application and amend as required for purchased equipment.

D. Use of Site: Limited to work in areas indicated.

1. Limits of Site Disturbance: 40 feet beyond building; 10 feet beyond surface paving and utilities; 15 feet beyond roadway and main utility branch trenches.
2. Owner occupancy will occur during Work of this Contract.
3. Refer to Civil Sheet No. C-1 for Limits of Construction.

E. Owner's Occupancy Requirements: Full Owner Occupancy: Owner will occupy Project site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

F. Work Restrictions: Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Owner not less than five days in advance of proposed utility interruptions.

END OF SECTION 011000

SECTION 012300 - ALTERNATE BIDS

1. GENERAL

1.1 REQUIREMENTS INCLUDE:

A. Design-Build Contractor: Provide Alternate Bid prices in Bid Form for specified alternate work.

B. Each Contractor coordinate all related and required work necessary to perform work specified in alternate bids, when accepted and awarded.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Standard Documents for Construction, Article 00 43 23
B. Bid Forms Document, 00 41 00

2. DESCRIPTION OF ALTERNATE BIDS

2.1 General Contract

A. Alternate Bid No. 1: C-1 Provide additional pavement area denoted on Sheets C-2, C-3 and C-4 including site clearing, earth moving, asphalt paving, parking bumpers, pavement markings, and turf and grass. Pavement area will be designed by Design-Build entity.

1. Pertinent work specified elsewhere

a. 311000 Site Clearing
b. 312000 Earth Moving
c. 321216 Asphalt Paving
d. 321713 Parking Bumpers
e. 321723 Pavement Markings
f. 329200 Turf and Grasses

B. Alternate Bid No. 2: C-2 Provide storm water detention denoted on Sheets C-2, C-3 and C-4 including site clearing, earth moving, and turf and grasses. Detention system will be designed by Design-Build entity.

1. Pertinent work specified elsewhere

a. 311000 Site Clearing
b. 312000 Earth Moving

C. Alternate Bid No. 3: S-1 Provide concrete foundation system at future building area indicated on Sheet S-1 including footings, foundation wall and related work. Foundation system will be designed by Design-Build entity.

1. Pertinent work specified elsewhere

a. 031000 Concrete Forming and Accessories
b. 032000 Concrete Reinforcing

c. 033000 Cast-In-Place Concrete

D. Alternate Bid No. 4: H-1 Include the removal of existing boiler #5E located in the East Heating Plant and associated work. Concrete equipment pad to remain. Refer to Sheets D-2 and Basis of Design dated 03/09/2021.

E. Alternate Bid No. 5: H-2 Reroute the new chilled water supply and chilled water return piping systems at the south side of the existing underground tunnel structure indicated on Sheet C-3. Install the new CHWS and CHWR pipes below the existing tunnel structure at crossing points. Refer to Reference Drawing E-203-2295 Sheet S-5.

1. Pertinent work specified elsewhere

a. 232113 Hydronic Piping

F. Alternate Bid No. 6: A-1 Provide new glazed aluminum curtain wall and aluminum window units indicated on Sheet A-6. New units will match adjacent window unit dimensions.

1. Pertinent work specified elsewhere

a. 084413 Glazed Aluminum Curtain Walls
b. 085113 Aluminum Windows

G. Alternate Bid No. 7: E-1 Provide natural gas stand-by generator in lieu of a diesel fueled generator. Refer to Sheet C-3 for location of generator unit.

1. Pertinent work specified elsewhere

a. 263213.16 Gaseous Stand-By Engine Generator.

H. Alternate Bid No. 8: G-1 Provide future building area indicated on Sheets A-2, A-3, A-4, A-5, S-2 and S-3. Building construction and components will match the adjacent Boiler Room N-100 area. Include concrete floor slab, structural steel columns and framing, structural steel roof framing, exterior wall system, roofing system, 4 glazed curtain wall window units, 1 unit heater and interior lighting.

1. Pertinent work specified elsewhere

a. 031000 Concrete Forming and Accessories
b. 032000 Concrete Reinforcing
c. 033000 Cast-In-Place Concrete
d. 074213.19 Insulated Metal Wall Panels
e. 075216 Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
f. 076200 Sheet Metal Flashing and Trim
g. 084413 Glazed Aluminum Curtain Walls
h. 092216 Non-Structural Metal Framing
i. 238239-16 Propeller Unit Heaters
j. 260529 Hangers and Supports for Electrical Systems
k. 260533 Raceways and Boxes for Electrical Systems
l. 265100 Interior Lighting

END 01 23 00

SECTION 012300.01 - BETTERMENTS

1.1 SCHEDULE OF BETTERMENTS

A. Betterment No. 1: Boiler Feed Water (BFW) System.

1. Base Bid: The existing steam requirements on campus are:

a. 185,000lb/h Peak Winter Day:

i. 200,000lb/h Absolute Peak (recover from a 15min boiler outage on a peak day).

ii. Condensate Storage is required when a boiler outage occurs during the Absolute Peak scenario. It takes an hour before pressure is restored in the system after an outage. The condensate pumps throughout campus use steam pressure to pump the condensate back to the heating plants. Two 10,500gal Condensate Tanks are required to supply water for BFW until the steam pressure in the campus is restored. Once the steam pressure is restored, these now empty tanks will hold the last hour of condensate that accumulated across campus and is returned in a short time.

b. To accommodate future expansion, the Deaerator is being increased from 200,000lb/h to 300,000lb/h.

i. It would be prohibitively difficult to turn a 200,000lb/h Deaerator into a 300,000lb/h Deaerator in the future.

ii. Also adding spots for future BFW pumps.

c. Change natural gas fuel line from 8” to 10” to accommodate 300,000lb/h.

d. 6” BFW line is sufficient for both cases.

2. Betterment No. 1: Increase the capacity of all components of the Boiler Feed Water (BFW) system to support 300,000lb/hr of steam production.

a. Water Softener:

i. One bed is being added to the existing system for the base case.

1. Going from 3 to 4 beds to add 109gpm capacity to feed RO.

ii. For 300,000lb/h an additional 54gpm of soft water would be required.

b. Carbon Filters for Dechlorination:

i. Add more to go from 106gpm to 160gpm.

c. Additional bank of RO membranes and supporting equipment:

i. Add more to go from 80gpm to 120gpm.

d. Condensate Storage:

i. For the 300,000lb/h requirement an additional 10,500gal tank and accompanying pumps will be required.

ii. These three tanks will not fit in the location proposed for the 200,000lb/h scenario (where boiler 3 that is being removed from) and therefore will need to be located where boiler 4 is being removed from.

B. Betterment No. 2: Dechlorination System.

1. Base Bid: Carbon filter system for dechlorination.

2. Betterment No. 2: Change to a sodium bisulfite system for dechlorination:

a. The water going to the Reverse Osmosis (RO) needs to be softened (so calcium salts don't plug the membranes) and dechlorinated (so the residual chlorine from the city water doesn't damage the membranes). Two common methods of Dechlorination are Sodium Bisulfite or Carbon Filters.
b. Carbon Filters last for a long time only requiring periodic back flushes to fluff up the beds.
c. Sodium Bisulfite reacts with the chlorine but it is considered a hazardous chemical.

END OF SECTION 012300.01

SECTION 024119 - SELECTIVE DEMOLITION

1.1 FIELD CONDITIONS

A. Owner will occupy portions of building adjacent to selective demolition area.

B. Hazardous Materials: Removed by Owner prior to start of the Work.

1.2 WARRANTY

A. Existing Warranties: Not applicable.

1.3 EXAMINATION

A. Perform an engineering survey of condition of building.

1.4 PREPARATION

A. Refrigerant: Remove according to 40 CFR 82.

1.5 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Utility Shut Off: By Owner.

1.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Dispose of in an EPA-approved landfill.

1.7 SELECTIVE DEMOLITION SCHEDULE

A. Existing generator unit will be removed and relocated by Owner. Associated control panels shall be removed and salvaged. Return all components to owner.

B. Contractor will remove existing concrete pad and foundation system.

C. Contractor will disconnect existing gas piping at service point.

END OF SECTION 024119

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

1.1 QUALITY ASSURANCE

A. Mockups of formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1.2 PRODUCTS

A. Form-facing materials.

B. Insulating concrete forms.

C. Waterstops.

1.3 INSTALLATION

A. Formed Finishes: Surface Finish 3.0.

1.4 FIELD QUALITY CONTROL

A. Testing and Inspections: By Contractor-engaged agency.

B. Special Inspections: By Contractor-engaged special inspector.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

1.1 QUALITY ASSURANCE

A. Mockups of slab-on-grade and formed-surface panels to demonstrate tolerances and standard of workmanship.

1.2 PRODUCTS

A. Steel Reinforcement:

1. Reinforcing Bars: Deformed.
2. Welded-Wire Reinforcement: Plain Deformed.

1.3 INSTALLATION

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

1.4 FIELD QUALITY CONTROL

A. Testing and Inspections: By Contractor-engaged agency.

B. Special Inspections: By Contractor-engaged special inspector.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

1.1 PRODUCTS

A. Concrete General: ACI 301 and ACI 117.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type I.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Silica fume.
5. Aggregate: Normal weight.
6. Water.

C. Mixing: Project site.

1.2 CONCRETE MIXTURES

A. Compressive Strength (28 Days):

1. Footings and Grade Beams: 4500 psi.
2. Foundation Walls: 4500 psi.
3. Slabs-on-Ground: 4500 psi.
4. Building Walls: 4500 psi.

1.3 INSTALLATION

A. Formed Finishes: Surface Finish 3.0.

B. Floor and Slab Finishes:

1. Scratch Finish: Surfaces to receive concrete floor toppings.
2. Float Finish: Surfaces to receive trowel finish and surfaces to be covered with fluid-applied or sheet waterproofing.
3. Trowel and Fine-Broom Finish: Surfaces to be covered with ceramic or quarry tile to be installed by either thickset or thinset method.
4. Broom Finish: Exterior concrete ramps.
5. Slip-Resistive Finish: Concrete stair treads, ramps.

1.4 FIELD QUALITY CONTROL

A. Testing: By Contractor-engaged agency.

B. Special Inspections: By Contractor-engaged special inspector.

END OF SECTION 033000

SECTION 034100 – PRESTRESSED HOLLOW CORE SLABS

1.1 QUALITY ASSURANCE

A. Fabricator: PCI-certified plant.

B. Installer Qualifications: PCI Certificate of Compliance Erectors' Post Audit Declaration.

C. Quality-Control Standard: PCI MNL 116.

D. Sample panels.

E. Mockups.

1.2 PERFORMANCE REQUIREMENTS

A. Design Standards: ACI 318 and PCI MNL 120, PCI Design Handbook – Precast and Prestressed Concrete.

B. Structural Performance: Fabricator to design precast structural concrete units.

1. Dead Loads: As indicated on drawings.
2. Concrete Topping Load: As indicated on drawings.
3. Live Loads: As indicated on drawings.
4. Member deflections shall meet the limits of ACI 318.
5. Fire Resistant Rating: Provide components to meet the following ratings:
    a) Floors: 2 hour.

1.3 MATERIALS

A. Form liners.

B. Reinforcing Materials:

1. Reinforcing Bars: ASTM A 615, Grade 60 or Grade 40, deformed.
2. Steel Bar Mats: Steel.
3. Welded Wire Reinforcement: Plain galvanized steel.

C. Prestressing tendons: ASTM A 416, Grade 250 or Grade 270, uncoated, 7-wire, low relaxation strand.

D. Concrete Materials:

1. Portland Cement: ASTM C150, Type I or Type III.
2. Normal-Weight Aggregates: Except by PCI MNL 116, ASTM C33, with coarse aggregates complying with Class 4S.
3. Water: Potable; free from deleterious material that may affect setting or strength of concrete and complying with chemical limits of PCI MNL 116.
4. Admixtures containing calcium chloride, chloride ions, or other salts are not permitted.

E. Steel Connections:

1. Carbon-Steel Shapes and Plates: ASTM A 36.
2. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020.
3. Carbon-Steel Plate: ASTM A 283.
4. High-Strength, Low-Alloy Structural Steel: ASTM A 572.

F. Bearing Pads: High-Density plastic.

G. Grout: Sand cement, ASTM C 150, Type I.

1.4 CONCRETE MIXTURES

A. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at structural precast concrete fabricator's option.

B Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested in accordance with ASTM C 1218.

C. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): minimum 6000 psi.
   2. Release Strength: as required by design

1.5 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware.

B. Furnish loose steel plates, clip angles, anchors, dowels, hangers, and other hardware shapes for securing precast concrete units to supporting and adjacent construction.

C. Cast-in slots, holes, and other accessories in structural precast concrete units as indicated on contract drawings.

D. Reinforcement: Comply with recommendations in PCI MNL 116 for fabrication, placing, and supporting reinforcement.

E. Reinforce structural precast concrete units to resist handling, transportation, and erection stresses.

F. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.

1.6 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor engaged to evaluate fabricator's quality-control and testing methods.

1.7 FIELD QUALITY CONTROL

A. Special Inspections: Contractor engaged.

B. Testing Agency: Contractor engaged.

END OF SECTION 034100

SECTION 042200 - CONCRETE UNIT MASONRY

1.1 PERFORMANCE REQUIREMENTS

A. Net-Area Compressive Strengths of Unit Masonry: 2,800 psi.

B. Determine net-area compressive strength of masonry by testing masonry prisms.

1.2 MATERIALS

A. Concrete Masonry Units (CMUs):

1. CMUs: Normal weight.

B. Reinforcing Steel: Uncoated-steel reinforcing bars.

C. Masonry-Joint Reinforcement:

1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.

D. Ties and Anchors: Galvanized steel. Mill galvanized in interior walls.

1. Adjustable anchors for connecting to structural steel framing.
2. Adjustable anchors for connecting to concrete.
3. Partition top anchors.
4. Rigid anchors.

E. Embedded Flashing:

1. All Flashing: Stainless steel.
2. Partially Exposed Flashing: Stainless steel.
3. Concealed (Flexible) Flashing: Asphalt-coated copper.

a. Used with copper drip edge.

4. Single-Wythe CMU Flashing System: Polyethylene flashing pans and interlocking web covers.

F. Reinforcing bar positioners.

G. Mortar:

1. Portland cement-lime or mortar cement mortar unless otherwise indicated.
2. Portland cement-lime or mortar cement for exterior masonry.
3. Portland cement-lime or mortar cement for reinforced masonry.

1.3 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

B. Inspections: Special inspections according to Level B C in TMS 402/ACI 530/ASCE 5.

C. Testing: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area.

END OF SECTION 042200

SECTION 051200 - STRUCTURAL STEEL FRAMING

1.1 SUMMARY

A. Structural steel as classified by ANSI/AISC 303.

1.2 QUALITY ASSURANCE

A. Fabricator Qualifications: AISC-Certified Plant, Category BU or IAS Fabricator Inspection Program for Structural Steel.

B. Installer Qualifications: AISC-Certified Erector, Category ACSE.

C. Shop-Painting Applicator Qualifications: AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3.

D. Quality Standards: ANSI/AISC 303, ANSI/AISC 341, and ANSI/AISC 360.

1.3 PERFORMANCE REQUIREMENTS

A. Connection Design: ANSI/AISC 303, Sections 3.1.1 and 3.1.2, Option 3 and 3B.

1.4 MATERIALS

A. Structural-Steel Shapes: W-shapes channels angles M-shapes S-shapes Plate and bar Cold-formed hollow structural sections and steel pipe.

B. Steel castings.

C. Steel forgings.

D. Bolts, Nuts, and Washers: Tension control, high strength.

E. Anchor Rods: Headed rods, nuts, plate washers, and washers.

F. Connectors: Shear stud connectors Threaded rods and sleeve nuts.

G. Structural slide bearings.

H. Primer: Comply with painting Sections.

I. Shrinkage-Resistant Grout: Nonmetallic, shrinkage resistant.

1.5 FABRICATION

A. Shop Connections:

1. High-Strength Bolts: Pretensioned and Slip critical as indicated on design drawings.
2. Welded connections.

B. Surface Preparation of Steel: SSPC-SP 6/NACE No. 3.

C. Surface Preparation of Galvanized Steel: SSPC-SP 16.

1. Galvanize: Exterior structural steel and lintels, shelf angles, and welded door frames located in exterior walls.

1.6 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor engaged.

1.7 INSTALLATION

A. Field Connections:

1. High-Strength Bolts: Pretensioned, Slip critical as indicated on design drawings.
2. Welded connections.

1.8 FIELD QUALITY CONTROL

A. Special Inspector: Contractor engaged.

B. Testing Agency: Contractor engaged.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

1.1 PERFORMANCE REQUIREMENTS

A. Engineering design of special joists and connections by Contractor.

1.2 MATERIALS

A. LH-series steel joists.

1. End Arrangement: Square.
2. Top-Chord Arrangement: Parallel.

B. Primer: SSPC-Paint 15.

1.3 INSTALLATION

A. Connections: Field welded, Bolted.

1.4 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

1.1 QUALITY ASSURANCE

A. Electrical Raceway Units: UL labeled.

B. FM Global Listing: Steel roof deck.

1.2 MATERIALS

A. Roof Deck: Prime-painted Galvanized- steel sheet.

1. Profile Depth: 1-1/2 inches.

1.3 INSTALLATION

A. Roof Deck: Mechanically fastened.

1.4 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

1.1 QUALITY ASSURANCE

A. Code-compliance certification of studs and tracks by the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: For cold-formed steel framing.

1.3 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, with G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90) or equivalent metallic coating.

B. Exterior Non-Load-Bearing Wall Framing: Standard C-shaped, punched steel studs and U-shaped, unpunched track.

1. Minimum Steel Thickness: 68 mils (14 gauge).
2. Vertical deflection clips, Single deflection track, Double deflection track, and Drift clips.

C. Framing Accessories: Bracing, bridging, and solid blocking, Web stiffeners, Anchor clips, End clips, Foundation clips, Stud kickers and knee braces, Hole reinforcing plates, and backer plates.

1.4 INSTALLATION

A. Fasten framing by welding or screw fastening.

1. Exterior Non-Load-Bearing Wall Stud Spacing: 16 inches (406 mm).

1.5 FIELD QUALITY CONTROL

A. Testing: By Contractor-engaged agency.

END OF SECTION 054000

SECTION 055113 - METAL PAN STAIRS

1.1 SUMMARY

A. Preassembled steel stairs with concrete-filled treads.

B. Steel railings and guards attached to metal stairs.

C. Steel handrails attached to walls adjacent to metal stairs.

1.2 PERFORMANCE REQUIREMENTS

A. Engineering design of steel stairs, railings, and guards by Contractor.

1.3 STEEL-FRAMED STAIRS

A. Stair Standard: NAAMM AMP 510, "Metal Stairs Manual," Architectural Commercial Class.

B. Stringers: Steel channels.

C. Metal Pan Stairs: Galvanized-steel sheet.

D. Steel Tube Railings and Guards:

1. Rails and Posts: 1-5/8-inch- (41-mm-) diameter.
2. Picket Infill: 1/2-inch- (13-mm-) round pickets spaced to prohibit the passage of a 4-inch (100-mm) diameter sphere.
3. Expanded-Metal Infill: Expanded-metal panels edged with U-shaped channels made from steel sheet.
4. Mesh Infill: Woven-wire mesh crimped into steel channel frames.

END OF SECTION 055113

SECTION 055213 - PIPE AND TUBE RAILINGS

1.1 SUMMARY

A. Steel pipe railings.

B. Refer to NIU Design and Construction Standard 055213.

1.2 PERFORMANCE REQUIREMENTS

A. Engineering design of railings by Contractor.

1.3 FABRICATION

A. Changes in Direction of Members: By bending.

B. Connections: Welded.

C. Infill Panels: Expanded metal.

D. Toe boards.

1.4 FINISHES

A. Steel and Iron: Galvanized after fabrication, shop painted.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

1.1 MATERIALS

A. Wood Products, General:

1. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness.

B. Wood-Preservative-Treated Lumber:

1. Preservative Treatment: AWPA U1; Use Category UC2 - but Use Category UC3b for exterior construction and Use Category UC4a for items in contact with ground.

a. Preservative Chemicals: Containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

2. Application: All rough carpentry.

C. Fire-Retardant-Treated Materials:

1. Exterior type for exterior locations and where indicated.
2. Interior Type A, High Temperature (HT) for enclosed roof framing, and where indicated.
3. Interior Type A unless otherwise indicated.
4. Application: Items indicated and as follows:

a. Concealed blocking.
b. Roof construction.
c. Plywood backing panels.

D. Miscellaneous Lumber:

1. Dimension Lumber: Construction or No. 2 grade any species.
2. Utility Shelving: 15 percent maximum moisture content.

a. White, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling).

3. Concealed Boards: 15 percent maximum moisture content.

a. Mixed southern pine, No. 2.
b. Hem-fir, Construction or No. 2 Common.
c. Spruce-pine-fir, Construction or No. 2 Common.
d. Eastern softwoods, No. 2 Common.
e. Northern species, No. 2 Common.
f. Western woods, Construction or No. 2 Common.

E. Plywood Backing Panels: Exterior, AC.

F. Fasteners: Hot-dip galvanized steel where exposed to weather, in ground contact, in contact with treated wood, or in area of high relative humidity.

G. Metal Framing Anchors:

1. Hot-dip galvanized steel for interior locations.
2. Hot-dip, heavy-galvanized steel for treated lumber and where indicated.
3. Stainless steel for exterior and where indicated.

H. Miscellaneous Materials:

1. Sill-Sealer Gaskets: Neoprene foam.
2. Flexible flashing.
3. Water-repellent preservative.

END OF SECTION 061000

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

1.1 QUALITY ASSURANCE

A. Manufacturer's Qualifications: AWI's Quality Certification Program licensed participant.

B. Mockups for typical plastic-laminate cabinets.

1.2 PLASTIC LAMINATE-CLAD CABINETS

A. Architectural Woodwork Standards Grade: Premium.

B. Type of Construction: Face frame.

C. Door and Drawer-Front Style: Flush overlay.

D. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Post-formed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.

E. Materials for Semi-exposed Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade VGS.

1.3 MATERIALS

A. Cabinet Hardware:

1. Hinges: Butt, semi-concealed.
2. Pulls: Wire.
3. Adjustable shelf supports.
4. Locks: Not used.
5. Exposed Hardware Finishes: Satin stainless steel.

END OF SECTION 064116

SECTION 072100 - THERMAL INSULATION

1.1 MATERIALS

A. Insulation:

1. Glass-Fiber Board, Faced: 2.25 lb/cu. ft. (36 kg/cu. m).

B. Auxiliary Insulating Materials:

1. Insulation fasteners.
2. Adhesive.

END OF SECTION 072100

SECTION 074213.19 - INSULATED METAL WALL PANELS

1.1 QUALITY ASSURANCE

A. Mockups.

1.2 WARRANTY

A. Special Warranty: Two years.

B. Finishes: 20 years.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: ASTM E72.

1. Wind Loads: 115 MPH.
2. Deflection Limits: 1/360.

B. Air Infiltration: ASTM E283.

C. Water Penetration: ASTM E331.

1.4 PRODUCTS

A. Concealed-Fastener, Foam-Insulation-Core Metal Wall Panels:

1. Facing Material: Metallic-coated steel sheet. Steel coil material shall be in accordance with ASTM A755: AZ50 Galvalume / Zincalume (55% aluminum, 45% zinc) in accordance with ASTM A792.

B. Laminated-Insulation-Core Metal Wall Panels:

1. Edge: Wrapped.
2. Facing Material: Metallic-coated steel sheet.
3. Core Material: Polyisocyanurate insulation.
4. Exterior Finish: 1.5 mil. Fluropolymer (PVDF) Three Coat System: 0.2 mil primer with 0.8 mil Kynar 500 (70%) metallic color coat and 0.5 mil clear coat.
5. Interior Finish: PVDF Finish, dry film thickness of 1.0 mil including primer.
6. Thermal-Resistance Value (R-Value): Nominal R-Value of 7.0 (hours/square foot – degrees F / BTU) per inch thickness when tested in accordance with ASTM C 517 at 75 deg F mean temperature.

C. Accessories:

1. Backer board.
2. Flashing and trim.
3. Fasteners:
4. Perimeter Trim:
5. Sealants:

6. Butyl Tape:

1.5 FIELD QUALITY CONTROL

A. Testing: By Contractor-engaged agency.

END OF SECTION 074213.19

SECTION 075216 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

1.1 PREINSTALLATION MEETINGS

A. Preliminary roofing and preinstallation roofing conference.

1.2 WARRANTY

A. Manufacturer's Materials and Workmanship Warranty: 20 years.

B. Installer's Warranty: Two years.

1.3 PERFORMANCE REQUIREMENTS

A. Wind Uplift Resistance:

1. Administration / Office Building Roof: Low Roof +/- 14 feet above finish grade elevation. Top of parapet wall coping +/- 18 feet above grade elevation.
    a) Zone 1 (Roof Area field) Uplift Pressure: -18.3 psf.
    b) Zone 2 (Roof Area perimeter) Uplift Pressure: -30.8 psf.
    c) Zone 3 (Roof Area corner) Uplift Pressure: -46.3 psf.
2. Boiler Room Building: High Roof +/- 32 feet above finish grade elevation. Top of parapet wall coping +/- 36 feet above grade elevation.
    a) Zone 1 (Roof Area field) Uplift Pressure: -20 psf.
    b) Zone 2 (Roof Area perimeter) Uplift Pressure: -33.5 psf.
    c) Zone 3 (Roof Area corner) Uplift Pressure: -50.4 psf.

B. FM Approvals' RoofNav Listing: Class 1A-90.

C. SPRI's Directory of Roof Assemblies Wind Uplift Load Capacity Listing: 90 psf.

D. Cool-Roof Performance: LEED v4.

E. Exterior Fire-Test Exposure: Class A.

1.4 MATERIALS

A. Low-emitting adhesives and sealants.

B. Sheathing paper.

C. Base Sheet: ASTM D6164/D6164M, Type I, Grade S.

D. Base Sheet: ASTM D6164/D6164M, Type II, Grade S.

E. Base Sheet: ASTM D6163/D6163M, Type I, Grade S.

F. Base Sheet: ASTM D6163/D6163M, Type II, Grade S.

G. Base Sheet: ASTM D6162/D6162M, Type I, Grade S.

H. Base Sheet: ASTM D6162/D6162M, Type III, Grade S.

I. Base Sheet: ASTM D4601/D4601M, Type II.

J. Base Sheet: ASTM D4897/D4897M, Type II, vented.

K. Interply Sheet: ASTM D2178/D2178M, Type IV.

L. Cap Sheet: ASTM D6164/D6164M, Type I, Grade S.

M. Cap Sheet: ASTM D6164/D6164M, Type II, Grade S.

N. Cap Sheet: ASTM D6162/D6162M, Type I, Grade S.

O. Cap Sheet: ASTM D6164/D6164M, Type I, Grade G.

P. Cap Sheet: ASTM D6164/D6164M, Type II, Grade G.

Q. Cap Sheet: ASTM D6163/D6163M, Type I, Grade G.

R. Cap Sheet: ASTM D6163/D6163M, Type II, Grade G.

S. Cap Sheet: ASTM D6163/D6163M, Type III, Grade G.

T. Cap Sheet: ASTM D6162/D6162M, Type I, Grade G.

U. Cap Sheet: ASTM D6162/D6162M, Type III, Grade G.

V. Cap Sheet: ASTM D6298, metal-foil-surfaced.

W. Base Flashing Sheet:

1. Backer Sheet: SBS-modified asphalt sheet, reinforced with glass fibers; smooth surface.
2. Flashing Sheet: SBS-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; granule surfaced.

X. Aggregate Surfacing: Gravel.

Y. Substrate Board: Glass-mat, water-resistant gypsum substrate.

Z. Vapor Retarder: Glass-fiber felt.

AA. Roof Insulation: Polyisocyanurate board.

1. Tapered Insulation at Cricket Areas: 1/4 inch per 12 inches (1:48).

BB. Insulation cant strips.

CC. Tapered edge strips.

DD. Cover Board: Fiber-reinforced cementitious board.

EE. Walkways:

1. Pads: Reinforced asphaltic composition pads with mineral-granule surface.

1.5 INSTALLATION

A. Roof Insulation: Mechanically fastened.

B. Roofing System:

1. Base Sheet: One.
2. Base Sheet Adhering Method: Mopped.
3. Number of Interply Sheets: One.
4. Cap Sheet Adhering Method: Mopped.

1.6 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

1. Flood testing.
2. Infrared thermography testing.
3. Electrical capacitance/impedance testing.
4. Low-voltage electrical conductance testing.
5. High-voltage spark testing.

END OF SECTION 075216

SECTION 076200 - SHEET METAL FLASHING AND TRIM

1.1 QUALITY ASSURANCE

A. Mockups of fascia.

1.2 PERFORMANCE REQUIREMENTS

A. Sheet Metal Standard for Flashing and Trim: NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual".

B. FM Approvals Listing: For copings for windstorm classification, Class 1-90.

C. SPRI Wind Design Standard: For copings according to ANSI/SPRI/FM 4435/ES-1 for design pressure.

1.3 MATERIALS

A. Sheet Metals:

1. Aluminum Sheet: Color anodic Three-coat fluoropolymer.

B. Underlayment: With rosin-sized slip sheet.

1.4 PRODUCTS

A. Manufactured reglets with counterflashing.

B. Formed Roof-Drainage Fabrications: Not Used.

C. Formed Low-Slope Roof Fabrications: Including copings, roof expansion-joint covers, base flashing, counterflashing, flashing receivers, roof-penetration flashing, and roof-drain flashing.

D. Formed Wall Fabrications: Including wall expansion-joint cover.

E. Miscellaneous Formed Fabrications: Including equipment support flashing and overhead-piping safety pans.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

1.1 QUALITY ASSURANCE

A. Mockups of typical roof edge.

1.2 WARRANTY

A. Roofing-System Warranty: Roof specialties included in warranty provisions of roofing Section.

B. Special Warranty on Painted Finishes: 20 years.

1.3 PERFORMANCE REQUIREMENTS

A. Copings: FM Approvals listed.

1. FM Windstorm Classification: Class 1-90.

1.4 PRODUCTS

A. Copings: Extruded aluminum.

B. Reglets and Counterflashings:

1. Reglets, Surface Mounted: Formed aluminum.
2. Counterflashings: Formed aluminum.

C. Finishes:

1. Aluminum: Three-coat metallic fluoropolymer.

END OF SECTION 077100

SECTION 077129 - MANUFACTURED ROOF EXPANSION JOINTS

1.1 WARRANTY

A. Materials and Workmanship: Two years.

B. Painted Finishes: 20 years.

1.2 PRODUCTS

A. Aluminum Roof Expansion Joint:

1. Joint Movement Capability: Plus and minus 25 percent of joint size.
2. Frame Members: Configured with integral 5-1/2-inch tall aluminum curb.
3. Cover: Formed or extruded aluminum.

    a. Aluminum Finish: Color anodic.

4. Corner, Intersection, and Transition Units: Factory fabricated.
5. Secondary seal with thermal insulation.

END OF SECTION 077129

SECTION 077200 - ROOF ACCESSORIES

1.1 WARRANTY

A. Painted Finishes: 20 years.

1.2 PRODUCTS

A. Roof Curbs: Insulated with interior metal liner.

1. Height: Minimum 18 inches (457 mm).
2. Material: Aluminum.
3. Finish: Clear anodic aluminum.

B. Roof Hatches: Insulated with single-walled curbs.

1. Height: Minimum 18 inches (457 mm).
2. Hatch Lid: Solid.
3. Material: Aluminum-zinc alloy-coated steel.
4. Finish: Clear anodic aluminum.
5. Accessories: Safety railing system.

C. Pipe Portals: Insulated, curb-mounted type with EPDM caps.

D. Preformed Flashing Sleeves: Vent stack flashing fabricated from aluminum sheet.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

1.1 QUALITY ASSURANCE

A. Installer Qualifications: FM Approval approved or UL qualified.

1.2 PENETRATION FIRESTOPPING

A. Penetrations in Fire-Resistance-Rated Walls: F-ratings per ASTM E814 or UL 1479.

B. Penetrations in Horizontal Assemblies: F-, T-, and W-ratings per ASTM E814 or UL 1479.

1.3 INSTALLATION

A. Identification: Walls and penetrations.

1.4 FIELD QUALITY CONTROL

A. Inspection of Installed Firestopping: By Contractor-engaged agency according to ASTM E2174.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

1.1 QUALITY ASSURANCE

A. Installer Qualifications: FM Approvals approved or UL qualified.

1.2 FIRE-RESISTIVE JOINT SYSTEMS

A. Joints in or between Fire-Resistance-Rated Construction: ASTM E1966 or UL 2079.

B. Joints at Exterior Curtain-Wall/Floor Intersections: ASTM E119 or ASTM E 2307.

1.3 FIELD QUALITY CONTROL

A. Inspection of Installed Firestopping: By Contractor-engaged agency according to ASTM E2393.

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

1.1 PRECONSTRUCTION TESTING

A. Preconstruction laboratory testing.

B. Preconstruction field-adhesion testing.

1.2 WARRANTY

A. Installer Warranty: Two years.

B. Special Manufacturer's Warranty: Five years.

1.3 JOINT SEALANTS

A. Silicone joint sealants.

B. Nonstaining silicone joint sealants.

C. Urethane joint sealants.

D. Immersible joint sealants.

E. Silyl-terminated polyether joint sealants.

F. Mildew-resistant joint sealants.

G. Polysulfide joint sealants.

H. Butyl joint sealants.

I. Latex joint sealants.

J. Joint-sealant backing.

1.4 FIELD QUALITY CONTROL

A. Field-adhesion testing.

END OF SECTION 079200

SECTION 079513.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

1.1 FLOOR EXPANSION JOINT COVERS

A. Metal-plate floor joint cover.

B. Dual-elastomeric-seal floor joint cover.

1.2 WALL EXPANSION JOINT COVERS

A. Metal-plate wall joint cover.

B. Dual-elastomeric-seal wall joint cover.

1.3 ACCESSORIES

A. Moisture barriers.

END OF SECTION 079513.13

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

1.1 PERFORMANCE REQUIREMENTS

A. Fire-rated assemblies.

B. Windborne-debris-impact-resistant doors and frames.

C. Refer to NIU Design and Construction Standard 081100.

1.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2.

1. Face: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
2. Edge Construction: Model 1, Full Flush.
3. Core: Polystyrene Vertical steel stiffener.
4. Frames: Full profile welded; uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
5. Exposed Finish: Prime.

1.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2.

1. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
2. Edge Construction: Model 1, Full Flush.
3. Core: Polystyrene Vertical steel stiffener.
4. Frames Full profile welded; metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
5. Exposed Finish: Prime.

1.4 INSTALLATION

A. Metal-Stud Partitions and Concrete Masonry Walls: Frames filled with insulation or grout.

END OF SECTION 081113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

1.1 PRECONSTRUCTION LABORATORY MOCKUPS

A. Preconstruction Testing Service: Contractor engaged.

1.2 WARRANTY

A. Materials and Workmanship: 10 years.

B. Finish: 20 years.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Contractor to design aluminum-framed systems.

B. Windborne-Debris-Impact Resistance: Wind Zone 4, basic protection.

1.4 SYSTEM COMPONENTS

A. Storefront:

1. Exterior Construction: Thermally broken.
2. Interior Vestibule Construction: Thermally broken.
3. Glazing System: Gaskets on four sides.
4. Glazing Plane: Front.

B. Glazing: Section 088000 "Glazing."

C. Entrance Doors:
1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness.
2. Door Design: Wide stile.
3. Glazing stops and gaskets.

D. Entrance Door Hardware: Refer to NIU Design and Construction Standards.

1.5 ALUMINUM FINISHES

A. Aluminum Finishes: Class II, color anodic.

1.6 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor engaged.

1.7 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

1.8 MAINTENANCE SERVICE

A. Entrance Door Hardware: Six months.

END OF SECTION 084113

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

1.1 PRECONSTRUCTION LABORATORY MOCKUPS

A. Preconstruction Testing Service: Contractor engaged.

1.2 WARRANTY

A. Materials and Workmanship: 10 years.

B. Finish: 20 years.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Contractor to design glazed aluminum curtain walls.

B. Boiler Room Area: ASTM 1886 and ASTM 1996 standards and the TAS 201, 202 and 203 test protocols to meet Florida Building Code (FBC) and Miami-Dade's Notice of Acceptance (NOA) criteria. Structural-Uniform Wind Load: ASTM E330: TAS 202. Windborne Debris-Impact Resistance: ASTM E1886. Blast Mitigation: ASTM F1642.

1.4 SYSTEM COMPONENTS

A. Framing Members:

1. Construction: Thermally broken.
2. Glazing System: Gaskets on four sides.
3. Glazing Plane: Front.

B. Insulated Spandrel Panels:

1. Section 074213.19 "Insulated Metal Wall Panels.
2. Laminated, metal-faced flat panels as follows:

    a. Overall Panel Thickness: 1 inch (25.4 mm).
    b. Exterior Skin: Aluminum.
    c. Interior Skin: Aluminum.

C. Glazing: Section 088000 "Glazing."

1.5 ALUMINUM FINISHES

A. Aluminum Finishes: Class II, color anodic.

1.6 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor engaged.

1.7 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

END OF SECTION 084413

SECTION 085113 - ALUMINUM WINDOWS

1.1 QUALITY ASSURANCE

A. Mockups for each form of construction.

1.2 WARRANTY

A. Windows: 10 years from date of Substantial Completion.

B. Glazing Units: 10 years from date of Substantial Completion.

C. Aluminum Finish: 20 years from date of Substantial Completion.

1.3 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: AAMA/WDMA/CSA 101/I.S.2/A440.

1. Minimum Performance Class: CW.
2. Minimum Performance Grade: 35.

B. Thermal Transmittance: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) maximum.

C. Solar Heat-Gain Coefficient: 0.27 maximum.

D. Condensation-Resistance Factor: 52 minimum.

E. Sound Transmission Class: 30 minimum.

F. Outside-Inside Transmission Class: 30 minimum.

G. Windborne-Debris Resistance: Passing ASTM E1886 and requirements of authorities having jurisdiction.

1.4 ALUMINUM WINDOWS

A. Frames and Sashes: Thermally improved aluminum extrusions.

B. Glazing:

1. Glass: Clear, insulating, argon filled, with low-E coating.
2. Glazing System: Manufacturer's standard.

C. Accessories: Subsills, Interior trim, Panning trim and Receptor system.

D. Insect Screens: At each operable exterior sash, with aluminum frames and without wickets.

E. Aluminum Finish: Class II, color anodic.

1.5 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

END OF SECTION 085113

SECTION 087100 - DOOR HARDWARE

1.1 WARRANTY

A. Materials and Workmanship: Three years.

1.2 MAINTENANCE SERVICE

A. Full-Maintenance Service: 12 months.

1.3 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Contractor engaged.

B. Occupancy Adjustment: After six months.

1.4 DOOR HARDWARE SCHEDULE

A. Refer to NIU Design and Construction Standards.

B. Vertical rod devices are not permitted in/on exterior doors.

END OF SECTION 087100

SECTION 088000 - GLAZING

1.1 SUMMARY

A. Glass for windows, doors, interior borrowed lites, storefront framing, and glazed curtain walls.

1.2 WARRANTY

A. Coated-Glass Products: 10 years.

B. Laminated Glass: 10 years.

C. Insulating Glass: 10 years.

1.3 PERFORMANCE REQUIREMENTS

A. Engineering design of glass by Contractor.

B. Administrative/Office Area: Windborne-Debris-Impact Resistance Performance of Exterior Glazing: Wind Zone 4.

C. Boiler Room Area: Windborne-Debris-Impact-Resistance Performance of Exterior Glazing: Shall be tested in accordance with ASTM E 1886 and information in ASTM E 1996 and/or AAMA 506. Large-Missile Impact for exterior glazing located within 30 feet of grade.

1.4 MATERIALS

A. Silicone Glazing Sealants: Neutral curing, Class 100/50.

B. Glazing Tapes: Expanded-cellular type.

1.5 INSULATING GLASS SCHEDULE

A. Glass Type GL-1: Low-E-coated, clear and tinted insulating glass.

1. Outdoor Lite: Fully tempered float glass.
2. Indoor Lite: Fully tempered float glass.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS

1.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Contractor to design louvers.

B. Wind Loads: 30 lbf/sq. ft. (1436 Pa).

C. Windborne-Debris-Impact Resistance: Louvers located within 30 feet (9.1 m) of grade pass basic protection, when tested according to AMCA 540.

1.2 PRODUCTS

A. Fixed Extruded-Aluminum Louvers:

1. Horizontal, Drainable-Blade, Windborne-Debris-Impact-Resistant Louver: 4 inches (100 mm) deep.

B. Blank-Off Panels: Insulated.

C. Finishes:

1. Aluminum: Three-coat fluoropolymer.
2. Galvanized Steel: Baked enamel or powder coat.

D. Louver Screens:

1. Provided at each exterior louver.
2. Screening Type: Bird and / or Insect Screening.

END OF SECTION 089119

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

1.1 QUALITY ASSURANCE

A. Code-compliance certification of studs and tracks.

1.2 MATERIALS

A. Steel Framing:

1. Steel studs and tracks.
2. Slip-Type Head Joints:
    a. Single long-leg track.
    b. Double tracks.
    c. Deflection track.
3. Firestop track.
4. Flat strap and backing plate.
5. Cold-rolled channel bridging.
6. Hat-shaped, rigid furring channels.
7. Resilient furring channels.
8. Cold-rolled furring channels.
9. Z-shaped furring.

B. Suspension Systems:

1. Wire hangers.
2. Flat hangers.
3. Carrying channels (main runners).
4. Furring channels.
5. Grid suspension systems for ceilings.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

1.1 QUALITY ASSURANCE

A. Mockups for the following:

1. Levels of exposed gypsum board finish.
2. Texture finishes.

1.2 MATERIALS

A. Interior Gypsum Board:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Gypsum ceiling board.
4. Foil-backed gypsum board.
5. Abuse-resistant gypsum board.
6. Impact-resistant gypsum board.
7. Mold-resistant gypsum board.

B. Tile-Backing Panels:

1. Glass-mat, water-resistant backing board.
2. Cementitious backer units.
3. Water-resistant gypsum backing board.

C. Trim Accessories:

1. Interior.
2. Aluminum: Extruded profiles.

D. Auxiliary Materials:

1. Laminating Adhesive.
2. Acoustical Sealant.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

1.1 QUALITY ASSURANCE

A. Mockup for each type of floor tile installation.

B. Mockup for each type of wall tile installation.

1.2 TILE PRODUCTS

A. Tile Type CT-1: Unglazed ceramic tile.

1. Composition: Vitreous or impervious natural clay or porcelain.
2. Size: 12 by 12 inches minimum.
3. Trim Shapes: Base cove, Surface bullnose base cap, Bead (bullnose) wainscot cap, Surface bullnose external corner, Coved internal corner, and Tapered transition.

B. Tile Type CT-2: Glazed wall tile.

1. Size: 4-1/4 by 4-1/4 inches.
2. Face Size Variation: Rectified.
3. Trim Shapes: Straight base, Bullnose wainscot cap, Surface bullnose wainscot cap, Bullnose external corner, and Surface bullnose external corner.

1.3 ACCESSORY MATERIALS

A. Thresholds: Granite.

B. Tile Backing Panels: Cementitious backer units.

C. Waterproof Membrane: Urethane waterproofing and tile-setting adhesive.

D. Crack Isolation Membrane: Urethane crack isolation membrane and tile-setting adhesive.

E. Metal edge strips.

1.4 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floors on Concrete:

1. TCNA F125A: Thinset mortar on crack isolation membrane. High-performance grout.

B. Interior Walls, Wood or Metal Studs or Furring:

1. TCNA W245 or TCNA W248: Thinset mortar on glass-mat, water-resistant gypsum backer board. High-performance. Water-cleanable epoxy grout.

C. Shower Walls, Wood or Metal Studs or Furring:

1. TCNA B419: Thinset mortar on coated glass-mat, water-resistant backer board. High-performance, Water-cleanable epoxy grout.

END OF SECTION 093013

SECTION 095123 - ACOUSTICAL TILE CEILINGS

1.1 QUALITY ASSURANCE

A. Mockups for each form of construction.

1.2 PERFORMANCE REQUIREMENTS

A. Engineering design of seismic restraints by Contractor.

B. Flame-Spread Index: Class A.

C. Smoke-Developed Index: 50.

1.3 PRODUCTS

A. Acoustical Tiles:

1. Type III: Mineral base with painted finish.
2. Pattern: CE (perforated, small holes and lightly textured).
3. LR: Not less than 0.90.
4. CAC: Not less than 35.
5. NRC: Not less than 0.75.
6. Thickness: 3/4 inch (19 mm).
7. Modular Size: 24 x 24 inches (610 mm x 610mm).

B. Metal Suspension System:

1. High-humidity finish.
2. Direct Hung, Double Web: Heavy duty.
3. Access: Upward and end pivoted or side pivoted.
4. Attachment Devices: Postinstalled expansion.
5. Seismic perimeter stabilizer bars, struts, and clips.

C. Metal Edge Moldings and Trim: Roll-formed sheet metal and Extruded aluminum.

1.4 ERECTION TOLERANCES

A. Main and Cross Runners: Level to within 1/8 inch in 12 feet (3 mm in 3.6 m).

B. Moldings and Trim: Level to within 1/8 inch in 12 feet (3 mm in 3.6 m).

C. Ceiling grid shall be laid out such that no tiles will be smaller than 6-inches in length or width.

1.5 FIELD QUALITY CONTROL

A. Special Inspection: Contractor-engaged special inspector for seismic design.

B. Testing Agency: Contractor engaged.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

1.1 PRODUCTS

A. Resilient Base: Thermoplastic rubber.

1. Style and Location:

a. Straight: In areas with carpet.
b. Cove: In areas with resilient flooring.
c. Butt to: In areas indicated.

2. Minimum Thickness: 0.125 inch (3.2 mm).
3. Height: 4 inches (102 mm).
4. Outside Corners: Job formed.
5. Inside Corners: Job formed.

B. Resilient Accessories: Rubber.

1. Cap for cove carpet.
2. Cap for cove resilient flooring.
3. Carpet bar for tackless installations.
4. Carpet edge for glue-down applications.
5. Nosing for carpet.
6. Nosing for resilient flooring.
7. Reducer strip for resilient flooring.
8. Joiner for tile and carpet.
9. Transition strips.

C. Installation Materials:

1. Trowelable leveling and patching compounds.
2. Adhesives.
3. Metal edge strips.
4. Floor polish.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

1.1 PRODUCTS

A. Vinyl Composition Floor Tile: Through-pattern tile.

1. Wearing Surface: Smooth.
2. Thickness: 0.125 inch (3.2 mm).
3. Size: 12 by 12 inches (305 by 305 mm).

B. Installation Materials:

1. Trowelable leveling and patching compounds.
2. Adhesives.
3. Floor polish.

1.2 REFERENCE

A. NIU Design and Construction Standard 096500.

END OF SECTION 096519

SECTION 096723 - RESINOUS FLOORING

1.1 QUALITY ASSURANCE

A. Mockups: For each resinous flooring system.

1.2 PRODUCTS

A. Resinous Flooring and Integral Cove Base:

1. System Characteristics:

a. Color and Pattern: As selected by Owner from manufacturer's full range.
b. Wearing Surface: Textured for slip resistance Manufacturer's standard wearing surface.
c. Overall System Thickness: 1/8 inch (3.2 mm).

2. System Components:

a. Primer: 100 percent solids.
b. Waterproofing Membrane: 100 percent solids.
c. Reinforcing Membrane with Fiberglass Scrim: 100 percent solids.
d. Body Coat(s):

1) Resin: Epoxy.
2) Formulation Description: 100 percent solids.
3) Application Method: Self-leveling slurry with broadcast aggregates.
4) Number of Coats: Two.
5) Thickness of Coats: 1/8 inch (3.2 mm).
6) Aggregates: Manufacturer's standard.

e. Grout Coat:

1) Resin: Epoxy.
2) Formulation Description: 100 percent solids.
3) Thickness of Coat: 1/8 inch (3.2 mm).

f. Topcoat: Sealing or finish coats.

1) Resin: Epoxy.
2) Formulation Description: 100 percent solids.
3) Number of Coats: Two.
4) Thickness of Coats: 1/16 inch (1.6 mm).
5) Finish: Matte.

3. System Chemical Resistance: Tested according to ASTM D1308 for 50 percent immersion in the following reagents for no fewer than seven days:

a. NIU to provide list of reagents at later date.

1.3 FIELD QUALITY CONTROL

A. Core sampling by Contractor.

END OF SECTION 096723

SECTION 096813 - TILE CARPETING

1.1 QUALITY ASSURANCE

A. Mockups for each type of carpet tile installation.

1.2 WARRANTY

A. Materials and Workmanship for Carpet Tile: 10 years.

1.3 PRODUCTS

A. Carpet Tile CT-1: Carpet Tile

1. Fiber Type: 100 percent nylon 6, 6
2. Pile Characteristic: Level-loop pile
3. Density: Average density = 6,406; Weight density = 134,542
4. Pile Thickness: 0.118 inches
5. Size: 24 by 24 inches
6. Applied Treatments: Soil resistant

B. Carpet Tile CT-3: Modular Walk-Off

1. Fiber Type: 100 percent nylon 6, 6
2. Tufted Pile Weight: 38.0 oz. per sq. yd.
3. Density: 9,500
4. Weight Density = 361,000
5. Finished Pile Thickness: 0.144 inches
6. Dye Method: Solution Dyed
7. Backing Material: EcoFlex ICT
8. Stain Release Technology: Permanent, Built into Fiber
9. Size: 24 by 24 inches
10. Soil Release Technology: Soil Protection

END OF SECTION 096813

SECTION 099123 - INTERIOR PAINTING

1.1 QUALITY ASSURANCE

A. Mockups for each color and finish.

B. Refer to NIU Design and Construction Standard 099100.

1.2 PAINT, GENERAL

A. MPI-listed products.

1.3 SOURCE QUALITY CONTROL

A. Testing: Contractor engaged.

1.4 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Institutional low-odor/VOC latex system.
2. Water based light industrial coating system.
3. Alkyd system.
4. Concrete stain system.

B. Concrete Substrates, Traffic Surfaces:

1. Solvent-based concrete floor sealer system.

C. Cement Board Substrates:

1. Institutional low-odor/VOC latex system.
2. Alkyd system.

D. CMU Substrates:

1. Institutional low-odor/VOC latex system.
2. High-performance architectural latex system.
3. Alkyd system.

E. Steel Substrates:

1. Institutional low-odor/VOC latex system.
2. High-performance architectural latex system.
3. Alkyd dry-fall over shop-applied quick-drying shop primer system.

F. Gypsum Board Substrates:

1. Latex over latex sealer system.
2. Latex over alkyd primer system (for plaster only).
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Water-based light industrial coating system.
6. Alkyd over latex sealer system.

END OF SECTION 099123

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

1.1 SUMMARY

A. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

1. Toilet-Enclosure Style: Overhead braced, Floor anchored.
2. Urinal-Screen Style: Wall hung, flat panel.

1.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: ASTM E84.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

1.3 COMPONENTS

A. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides, with no-sightline system.

B. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

C. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room.
2. Color and Pattern: As selected by Owner from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.
3. Edge Color: Through-color matching facing sheet color.

1.4 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Stainless steel finish.

B. Hardware and Accessories: Manufacturer's heavy-duty stainless steel operating hardware and accessories.

END OF SECTION 102113.17

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

1.1 WARRANTY

A. Silver Spoilage for Mirrors: 15 years.

1.2 PRODUCTS

A. Public-Use Washroom Accessories:

1. Toilet tissue (roll) dispenser.
2. Combination toilet tissue dispenser.
3. Combination towel (folded) dispenser/waste receptacle.
4. Grab bar.
5. Sanitary-napkin disposal unit.
6. Mirror unit.
7. Coat hook.
8. Shower rod and curtain.

B. Underlavatory guards.

C. Custodial Accessories:

1. Utility shelf.
2. Mop and broom holder.
3. Paper towel (roll) dispenser.

1.3 REFERENCE

A. Refer to NIU Design and Construction Standard 102800.

END OF SECTION 102800

SECTION 105113 - METAL LOCKERS

1.1 PRODUCTS

A. Welded Athletic Lockers:

1. Doors: Perforated steel sheet.
2. Sides: Unperforated.
3. Bottoms: Standard.
4. Hinges: Continuous.
5. Door Handle and Latch: Integral pull and padlock loop (box lockers).
6. Locks: Combination padlocks.
7. Base: Continuous zee type.
8. Tops: Flat (not sloping).
9. Ends: Finished end panels.
10. Material: Steel sheet, metallic coated.

B. Locker Benches:

1. Tops: Laminated hardwood.
2. Pedestals: Fixed, tubular steel.

C. Knocked-Down Construction: Preassembled.

END OF SECTION 105113

SECTION 123553.13 - METAL LABORATORY CASEWORK

1.1 PERFORMANCE REQUIREMENTS

A. Contractor to design laboratory casework installation.

1.2 CASEWORK, GENERAL

A. Product Standard: SEFA 8 M, "Laboratory Grade Metal Casework."

B. Flammable Liquid Storage Cabinets: NFPA 30.

1.3 MATERIALS

A. Metal Cabinet Doors:

1. Flush metal.
2. Glazed with clear laminated glass.

B. Utility-Space Framing: Steel framing units consisting of two slotted channels connected at top and bottom by U-shaped brackets.

C. Laboratory Casework System: Integrated system that includes support framing, suspended modular cabinets, filler and closure panels, countertops, and fittings needed to assemble system.

D. Drawer and Door Locks: Not used.

E. Countertops:

1. Epoxy: 3/4 inch (19 mm) thick.

a. Configuration: Flat with backsplash.
b. Construction: Solid 1/4-inch- (6-mm-) thick epoxy, laminated to backing.

F. Shelves:

1. Phenolic Composite: 3/4 inch (19 mm) thick.

G. Sinks:

1. Epoxy.

H. Accessories:

1. Reagent shelves.
2. Pegboards.

I. Electrical Service Fittings:

1. Receptacles: General grade.
2. GFCI Receptacles: General grade.

3. TVSS Receptacles: General grade.
4. Voice and Data Communication Outlets: RJ-45 jacks.
5. Cover Plates: Stainless steel.
6. Fitting Type: Pedestal.

END OF SECTION 123553.13

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

1.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or ductile iron, with plain ends and integral waterstop collar.

B. Steel Pipe Sleeves: Anticorrosion coated, with plain ends and integral waterstop collar.

C. Galvanized-Steel Sheet Pipe Sleeves: Round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: Schedule 40.

E. Molded-PVC Sleeves: With nailing flange.

F. Molded-PE or -PP Sleeves: Removable, with nailing flange.

1.2 STACK SLEEVE FITTINGS

A. Manufactured, Galvanized cast-iron sleeve with integral cast flashing flange, with underdeck clamp.

1.3 SLEEVE-SEAL SYSTEMS

A. Field-assembled, modular sealing-element unit for filling annular space between piping and sleeve.

1. Sealing Elements: High-temperature silicone.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating.

1.4 SLEEVE-SEAL FITTINGS

A. Manufactured, sleeve-type, plastic or rubber waterstop assembly made for imbedding in concrete slab or wall.

1.5 GROUT

A. Nonshrink, factory packaged.

1.6 SILICONE SEALANTS

A. Silicone Sealant: Type S, Grade NS, Class 25, Use NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.

B. Silicone Sealant: Type S, Grade P, Class 25, Use NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

1.7 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Exterior Concrete Walls above Grade:

1. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves.
2. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves.

B. Exterior Concrete Walls below Grade:

1. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves with sleeve-seal system.
2. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves with sleeve-seal system.

C. Concrete Slabs-on-Grade:

1. Piping Smaller Than NPS 6 (DN 150): Cast-iron pipe sleeves with sleeve-seal system.
2. Piping NPS 6 (DN 150) and Larger: Cast-iron pipe sleeves with sleeve-seal system.

D. Concrete Slabs above Grade:

1. Piping Smaller Than NPS 6 (DN 150): Stack-sleeve fittings.
2. Piping NPS 6 (DN 150) and Larger: Stack-sleeve fittings.

E. Interior Partitions:

1. Piping Smaller Than NPS 6 (DN 150): Steel pipe sleeves.
2. Piping NPS 6 (DN 150) and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

1.1 SUMMARY

A. Section includes:

1. Escutcheons.
2. Floor plates.

1.2 PRODUCTS

A. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece deep pattern.
2. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
3. Insulated Piping: One-piece steel with polished, chrome-plated finish.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
6. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
7. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.

B. Escutcheons for Existing Piping to Remain:

1. Chrome-Plated Piping: Split-plate, stamped steel with exposed hinge, with polished, chrome-plated finish.
2. Insulated Piping: Split-plate, stamped steel with exposed hinge, with polished, chrome-plated finish.
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with exposed hinge, with polished chrome-plated finish.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with exposed hinge, with polished chrome-plated finish.
5. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with exposed hinge, with polished chrome-plated finish.
6. Bare Piping in Equipment Rooms: Split-plate, stamped steel with exposed hinge, with polished, chrome-plated finish.
7. Bare Piping in Equipment Rooms: Split-plate, stamped steel with exposed hinge, with polished, chrome-plated finish.

C. Floor Plates: Split-plate, stamped steel with concealed hinge.

END OF SECTION 220518

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

1.1 DOMESTIC HOT- AND COLD-WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Brass ball valve, one piece.
2. Bronze ball valve, one piece with stainless steel trim.
3. Brass ball valves, two-piece with full port and stainless steel trim.
4. Bronze ball valves, two-piece with full port and stainless steel trim.
5. Brass ball valves, three-piece with full port and stainless steel trim.
6. Bronze ball valves, three-piece with full port and stainless steel trim.
7. Bronze ball valves, two-piece with regular port and stainless steel trim.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Iron ball valves, Class 150.

END OF SECTION 220523.12

SECTION 220523.13 - BUTTERFLY VALVES FOR PLUMBING PIPING

1.1 DOMESTIC HOT- AND COLD-WATER VALVES

A. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, ductile-iron disc.
2. Ductile-Iron, Grooved-End Butterfly Valves: 175 CWP.

END OF SECTION 220523.13

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

1.1 DOMESTIC HOT- AND COLD-WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze swing check valves, Class 150, bronze disc with soldered or threaded end connections.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves, Class 125, metal seats with flanged end connections.
2. Iron swing check valves with closure control, Class 125, lever and spring with flanged end connections.
3. Iron, grooved-end swing check valves, 300 CWP.
4. Iron, center-guided check valves, Class 125, compact wafer.
5. Iron, center-guided check valves, Class 125, metal seat with flanged end connections.
6. Iron, single-plate check valves, Class 125, resilient seat with flanged end connections.

END OF SECTION 220523.14

SECTION 220523.15 - GATE VALVES FOR PLUMBING PIPING

1.1 DOMESTIC HOT- AND COLD-WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze gate valves, NRS, Class 125 with threaded ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger: Iron gate valves, NRS, Class 125 with flanged ends.

END OF SECTION 220523.15

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

1.1 PERFORMANCE REQUIREMENTS

A. Pipe hangers and equipment supports designed by Contractor.

B. Seismic-restraint hangers and supports designed by Contractor.

1.2 SUBMITTALS

A. Shop Drawings**:** Signed and sealed by a professional engineer.

1.3 QUALITY ASSURANCE

A. AWS D1.1/D1.1M.

B. 2015 ASME Boiler and Pressure Vessel Code, Section IX.

1.4 COMPONENTS

A. Metal Pipe Hangers and Supports: Carbon steel.

B. Trapeze pipe hangers.

C. Fiberglass pipe hangers.

D. Metal Framing Systems: MFMA manufacturer.

E. Fiberglass strut systems.

F. Thermal hanger-shield inserts.

G. Fastener Systems: Powder-actuated fasteners.

H. Pipe Stands: Compact.

I. Pipe-positioning systems.

J. Equipment supports.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

1.1 PRODUCTS

A. Equipment Labels: Plastic.

B. Warning Signs and Labels: 1/8 inch (3.2 mm) thick with adhesive.

C. Pipe Labels: Self-adhesive.

D. Stencils: Aluminum.

E. Valve Tags: Aluminum, 0.032-inch (0.8-mm) minimum thickness.

F. Warning Tags: 3 by 5-1/4 inches (75 by 133 mm) minimum Approximately 4 by 7 inches (100 by 178 mm); brass grommet and wire fasteners.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

1.1 QUALITY ASSURANCE

A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors, according to ASTM E 84.

B. Mockup of each type of pipe insulation and finish.

1.2 FIELD QUALITY CONTROL

A. Field Inspections: By Contractor-engaged agency.

1.3 PIPING INSULATION SCHEDULE, GENERAL

A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

1.4 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water: Cellular glass.

B. Domestic Hot and Recirculated Hot Water: Cellular glass.

C. Storm water and Overflow: Cellular glass.

D. Roof Drain and Overflow Drain Bodies: Cellular glass.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: mineral-fiber, preformed pipe insulation, Type I.

1.5 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Piping, Concealed: PVC.

B. Piping, Exposed: PVC.

1.6 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

1.1 SUMMARY

A. Water service outside the building.

1.2 SUBMITTALS

A. Coordination Drawings.

1.3 QUALITY ASSURANCE

A. Quality Standard for Water-Service Piping and Specialties for Domestic Water: NSF 61 Annex G.

1.4 MATERIALS

A. Underground Water-Service Piping NPS 4 to NPS 8:

1. Ductile-iron, push-on-joint pipe and fittings.

B. Aboveground and Vault Water-Service Piping NPS 4 to NPS 8:

1. Ductile-iron, grooved-end pipe and ductile-iron grooved-end appurtenances.

C. Piping Specialties:

1. Transition fittings.
2. Split-sleeve pipe couplings.

D. Corrosion-Protection Piping Encasement: Required.

1.5 MANUFACTURED UNITS

A. Gate Valves:

1. Cast Iron: Nonrising stem, C500.

B. Check Valves: AWWA.

C. Butterfly Valves: AWWA.

D. Concrete Vaults: Not required.

END OF SECTION 221113

SECTION 221116 - DOMESTIC WATER PIPING

1.1 QUALITY ASSURANCE

A. Refer to NIU Construction Standards 221116 for additional requirements.

1.2 UNDER-BUILDING-SLAB, DOMESTIC WATER, BUILDING SERVICE PIPING

A. Pipe NPS 3 (DN 80) and Smaller:

1. Soft copper tube; wrought-copper, solder-joint fittings; and brazed joints.

B. Pipe NPS 4 to NPS 8 (DN 100 to DN 200) and Larger:

1. Mechanical-joint, ductile-iron pipe; standard pattern, mechanical-joint fittings; and mechanical joints.
2. Push-on-joint, ductile-iron pipe; standard pattern, push-on-joint fittings; and gasketed joints.

1.3 UNDER-BUILDING SLAB, COMBINED DOMESTIC WATER, BUILDING-SERVICE, AND FIRE-SERVICE-MAIN PIPING

A. Pipe NPS 6 to NPS 12 (DN 150 to DN 300):

1. Mechanical-joint, ductile-iron pipe; standard pattern, mechanical-joint fittings; and mechanical joints.
2. Push-on-joint, ductile-iron pipe; standard pattern, push-on-joint fittings; and gasketed joints.

1.4 UNDER-BUILDING-SLAB, DOMESTIC WATER PIPING

A. Pipe NPS 2 (DN 50) and Smaller:

1. [Hard] [or] [soft] copper tube; [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal-joint fittings; and pressure-sealed] joints.
2. PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

1.5 ABOVEGROUND DOMESTIC WATER PIPING

A. Pipe NPS 2 1/2 (DN 63.5) and Smaller:

1. Hard copper tube; cast or wrought copper, solder-joint fittings; and soldered joints.

B. Pipe NPS 3 or more (DN 65 or more):

1. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

1.6 ABOVEGROUND, COMBINED DOMESTIC-WATER-SERVICE AND FIRE-SERVICE-MAIN PIPING

A. Pipe NPS 6 to NPS 12 (DN 150 to DN300):

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
2. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

1.7 MANUFACTURED UNITS

A. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.

B. Flexible Connectors: Bronze hose.

1.8 PRODUCTS

A. Wall Penetrations below Grade: Wall penetration system.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

1.1 QUALITY ASSURANCE

A. Quality Standards: NSF 14, NSF 61, and NSF 372.

1.2 PRODUCTS

A. Vacuum Breakers:

1. Hose-Connection Vacuum Breakers: Rough-bronze finish.

B. Backflow Preventers:

1. Intermediate Atmospheric-Vent Backflow Preventers:

   a. End Connections: Union, solder joint.
   b. Finish: Rough bronze.

2. Reduced-Pressure-Principle Backflow Preventers:

   a. Body: Bronze for NPS 2 (DN 50) and smaller; stainless steel for NPS 2-1/2 (DN 65) and larger.
   b. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
   c. Configuration: Horizontal, straight through.

3. Double-Check Backflow-Prevention Assemblies:

   a. Body: Bronze for NPS 2 (DN 50) and smaller; stainless steel for NPS 2-1/2 (DN 65) and larger.
   b. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
   c. Configuration: Horizontal, straight through.

4. Reduced-Pressure-Detector, Fire-Protection Backflow-Preventer Assemblies:

   a. Body: Cast iron with interior lining.
   b. Configuration: Horizontal, straight through.

5. Hose-connection backflow preventers.
6. Backflow-preventer test kits.

C. Automatic Water Shutoff Valves:

1. Shutoff Control Ball Valve:

   a. Size: NPS 2 (DN 50) and smaller.
   b. Control Valve: Two-piece, full-port brass ball valve, MSS SP-110.
   c. End Connections: Threaded, female.
   d. CWP Rating: 600 psig (4140 kPa).

2. Shutoff Control Butterfly Valve:

    a. Size: NPS 2-1/2 to NPS 4 (DN 65 to DN 100).
    b. Compliance: MSS SP-67.
    c. Full-port, epoxy-coated, ductile-iron lug body.
    d. Face-to-Face Flange: API 609.

3. Clothes Washer Shutoff Control Valve: Two-way, four-port, low-zinc bronze alloy valve.

    a. End Connections: Male hose connections, NPS 3/4 (DN 20).
    b. Pressure Rating: ANSI 250, 400 psi (2758 kPa) at 32 to 150 deg F (0 to 65.6 deg C).
    c. Actuator: Two position, drive closed, spring open.

4. Water Main Shutoff Valve Actuator: Motor operated, with or without gears, electric and electronic. Capable of closing valve against inlet pressure. Direct mount, two way; fails open/open or closed/closed.
5. Domestic Water Heater Shutoff Valve Actuator: Motor operated, with or without gears, electric and electronic. Capable of closing valve against inlet pressure. Direct mount, two way; fails open/open or close/close.

D. Balancing Valves:

1. Copper-Alloy Calibrated Balancing Valves: Ball valve.
2. Accessories: Meter kit.
3. Memory-stop balancing valves.

E. Temperature-Actuated Water Mixing Valves:

1. Water-Temperature Limiting Devices:

    a. Connections: Threaded inlets and outlet.
    b. Finish: Rough bronze.

F. Strainers for Domestic Water Piping:

1. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining and epoxy coating for NPS 2-1/2 (DN 65) and larger.
2. Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
3. Screen: Stainless steel with round perforations unless otherwise indicated.
4. Drain: Factory-installed, hose-end drain valve.

G. Outlet Boxes:

1. Clothes Washer Outlet Boxes:

    a. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
    b. Inlet Hoses: Two, 60 inches (1500 mm) long.
    c. Drain Hose: One, 48 inches (1200 mm) long.

2. Icemaker Outlet Boxes: Enameled-steel or epoxy-painted-steel box and faceplate.

H. Hose Stations:

1. Single-Temperature-Water Hose Stations:

a. Body: Bronze.
b. Finish: Rough bronze.
c. Mounting:[Wall, with reinforcement.
d. Hose: 50 feet (15 m) long.

I. Hose Bibbs:

1. Vacuum Breaker: Integral.
2. Finish for Service Areas: Rough bronze.
3. Operation for Service Areas: Wheel handle.
4. Operation for Finished Rooms: Wheel handle.

J. Wall Hydrants:

1. Nonfreeze Wall Hydrants:

a. Outlet: Exposed.
b. Finish: Polished nickel bronze.

K. Drain Valves: Stop-and-waste type.

L. Water Hammer Arresters: Copper tube with piston.

M. Air Vents: Bolted construction.

N. Trap-Seal Primer Valves: Supply type.

1.3 MANUFACTURED UNITS

A. Trap-Seal Primer Systems:

1. Cabinet: Surface-mounted steel box with stainless-steel cover.
2. Number Outlets: Four.

B. Water Meters: Compound type with remote registration system.

END OF SECTION 221119

SECTION 221313 - FACILITY SANITARY SEWERS

1.1 PIPING

A. PVC Pipe and Fittings:

1. PVC gravity sewer piping.
2. PVC pressure piping.

B. Nonpressure-Type Transition Couplings:

1. Nonpressure-type, rigid.

C. Pressure-Type Pipe Couplings: 150-psig minimum pressure rating.

D. Expansion Joints and Deflection Fittings: Ductile-iron, expansion joints.

1.2 COMPONENTS

A. Cleanouts:

1. PVC.

B. Manholes: Standard precast concrete.

1. Resilient pipe connectors.
2. Reinforced-concrete grade rings.
3. Manhole frames and covers.
4. Manhole-cover inserts.

END OF SECTION 221313

SECTION 221316 - SANITARY WASTE AND VENT PIPING

1.1 QUALITY ASSURANCE

A. Refer to NIU Construction Standards 221316 for additional requirements.

1.2 MATERIALS

A. Hub-and-spigot, service and extra-heavy-class, cast-iron soil pipe and fittings.

B. Hubless, cast-iron soil pipe and CISPI, heavy-duty, cast-iron, hubless piping couplings.

1. Sovent stack fittings.

C. Standard weight, galvanized pipe, with cast-iron drainage fittings, cast-iron flanges and grooved-joint, galvanized-steel-pipe appurtenances.

D. Type DWV copper tube with solder-joint drainage fittings.

E. Hard copper tube with copper pressure fittings.

F. Soft copper tube with copper pressure fittings.

G. Solid-wall PVC pipe with PVC socket fittings.

H. Unshielded, nonpressure transition couplings.

I. Union, Flange insulating kit, Nipple dielectric fittings.

J. PE-film encasement for underground metal piping.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

1.1 QUALITY ASSURANCE

A. Quality Standard for Plastic Piping: NSF 14.

1.2 PRODUCTS

A. Backwater Valves: Horizontal, cast iron.

B. Cleanouts: Cast iron exposed.

C. Miscellaneous Sanitary Drainage Piping Specialties:

1. Open drains, shop or field fabricated from Service Class, hub-and-spigot, cast-iron, soil-pipe fittings.
2. Cast-iron or bronze deep-seal traps.
3. Floor-drain, trap-seal primer fittings.
4. Air-gap fittings.
5. Sleeve flashing devices.
6. Stack flashing fittings.
7. Expansion joints.

END OF SECTION 221319

SECTION 221413 - FACILITY STORM DRAINAGE PIPING

1.1 MATERIALS

A. Hub-and-spigot, Service and Extra Heavy class, cast-iron soil pipe and fittings.

B. Hubless, cast-iron soil pipe and CISPI, heavy-duty, cast-iron, hubless piping couplings.

C. Copper Type DWV tube with solder-joint drainage fittings.

D. Hard copper tube with copper pressure fittings.

E. Soft copper tube with copper pressure fittings.

F. Solid-wall PVC pipe with PVC socket fittings.

G. Unshielded, nonpressure transition couplings.

H. Union, Flange, Flange insulating kit, Nipple dielectric fittings.

I. High-density, crosslaminated PE-film or Linear low-density PE film encasement for underground metal piping.

END OF SECTION 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

1.1 PRODUCTS

A. Metal Roof Drains:

1. Cast-Iron Roof Drains:

a. Sump: Small.
b. Combination Flashing Ring and Gravel Stop: Not required.
c. Flow-Control Weirs: Not required.
d. Outlet: Bottom.
e. Outlet Type: No hub, Inside caulk.
f. Extension Collars: Required.
g. Underdeck Clamp: Required.
h. Expansion Joint: Required.
i. Sump Receiver Plate: Not required.
j. Dome Material: Cast iron.
k. Perforated Gravel Guard: Not required.
l. Vandal-Proof Dome: Not required.
m. Water Dam: Not required.

B. Cleanouts: Cast-iron floor cleanouts, Cast-iron wall cleanouts.

C. Backwater Valves: Cast iron, horizontal.

END OF SECTION 221423

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

1.1 QUALITY ASSURANCE

A. Performance Efficiency: ASHRAE/IES 90.1.

B. ASME Compliance: ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. NSF Compliance: NSF 61 and NSF 372.

1.2 WARRANTY

A. Commercial, Electric, Domestic-Water Heaters: Three years.

B. Compression Tanks: Five years.

1.3 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Tank: ASME-code, steel.
2. Vertical arrangement.
3. Pressure Rating: 150 psig (1035 kPa).

B. Capacity and Characteristics - refer to drawings for information.

1.4 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks: Steel tank with welded joints and butyl-rubber diaphragm; 150-psig (1035-kPa) pressure rating.

B. Drain Pans: Corrosion-resistant metal with raised edge.

C. Piping-type heat traps.

D. Manifold kits.

E. Combination temperature-and-pressure relief valves.

F. Vacuum relief valves.

G. Domestic-water heater stands.

H. Domestic-water heater mounting brackets.

END OF SECTION 223300

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

1.1 QUALITY ASSURANCE

A. Refer to NIU Construction Standards 224000 for additional requirements.

1.2 WALL-MOUNTED WATER CLOSETS

A. Water Closets: Wall mounted, top spud, accessible.

1. Material: Vitreous china.
2. Type: Siphon jet.
3. Style: Flushometer valve.
4. Water Consumption: 1.28 gal. (4.8 L)/1.6 gal. (6 L)] per flush.
5. Support: Waste-fitting assembly.

1.3 FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Style: Exposed.
2. Consumption: 1.28 gal. (4.8 L)/1.6 gal. (6 L) per flush.

1.4 TOILET SEATS

A. Toilet Seats:

1. Type: Commercial (Standard).
2. Shape: Elongated rim, open front.
3. Hinge: Self-sustaining, check.
4. Seat Cover: Not required.

END OF SECTION 224213.13

SECTION 224213.16 - COMMERCIAL URINALS

1.1 QUALITY ASSURANCE

A. Refer to NIU Construction Standards 224000 for additional requirements.

1.2 WALL-HUNG URINALS

A. Urinals : Wall hung, back outlet, washout, accessible.

1. Material: Vitreous china.
2. Type: Washout with extended shields.
3. Water Consumption: Water saving.

1.3 FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Style: Exposed.
2. Consumption: 0.125 gal. (1.9 L)÷1.0 gal. (3.8 L) per flush.

END OF SECTION 224213.16

SECTION 224216.13 - COMMERCIAL LAVATORIES

1.1 QUALITY ASSURANCE

A. Refer to NIU Construction Standards 224000 for additional requirements.

1.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Ledge back, vitreous china, wall mounted.

1. Type: For wall hanging.
2. Nominal Size: Oval, 20 by 18 inches (508 by 457 mm).
3. Faucet-Hole Punching: One hole.
4. Faucet-Hole Location: Top.

1.3 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. Lavatory Faucets: Automatic-type, battery-powered, electronic-sensor-operated, mixing, solid-brass valve.

1. Body Type: Single hole.
2. Body Material: General-duty, solid brass.
3. Finish: Polished chrome plate.
4. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
5. Mounting Type: Deck, concealed.
6. Spout: Rigid type.
7. Spout Outlet: Aerator.
8. Drain: Not part of faucet.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

1.1 SERVICE BASINS

A. Service Basins: Terrazzo, floor mounted.

1. Shape: Square.
2. Nominal Size: 24 by 24 inches (610 by 610 mm).
3. Height: 12 inches (305 mm) with dropped front.
4. Tiling Flange: On three sides.
5. Drain: Grid with NPS 3 (DN 80) outlet.
6. Mounting: On floor and flush to wall.
7. Faucet: Manual type.

1.2 SINK FAUCETS

A. NSF Standard: NSF 372 for faucet-spout materials in contact with potable water.

B. Sink Faucets: Manual type, two-lever-handle mixing valve.

1. Standard: ASME A112.18.1/CSA B125.1.
2. Body Type: Widespread.
3. Body Material: Commercial, solid brass.
4. Finish: Chrome plated.
5. Maximum Flow Rate: 4.0 gpm (15 L/min.).
6. Handle(s): Cross, four arm.
7. Mounting Type: Back/wall, exposed.
8. Spout Type: Swing, round tubular.
9. Vacuum Breaker: Required for hose outlet.
10. Spout Outlet: Hose thread.

END OF SECTION 224216.16

SECTION 224223 - COMMERCIAL SHOWERS

1.1 SHOWER FAUCETS

A. Shower Faucets: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.

1. Body Material: Polished chrome plate, solid brass.
2. Maximum Flow Rate: 2.5 gpm (9.5 L/min.).
3. Mounting: Concealed.
4. Operation: Single-handle, rotate control.
5. Antiscald Device: Integral with mixing valve.
6. Shower Head: Ball joint with arm and flange .
7. Shower-Arm, Flow-Control Fitting: Not required.

1.2 SHOWER BASINS

A. Shower Basins: Precast terrazzo, cast-polymer, or solid surface.

1. Type: Handicapped/wheelchair.
2. Nominal Size and Shape: 36 by 36 inches (915 by 915 mm) square.

END OF SECTION 224223

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

1.1 QUALITY ASSURANCE

A. Quality Standard: ANSI Z358.1, NSF 61, and NSF 372.

1.2 MANUFACTURED UNITS

A. Eye/Face Wash Equipment: Accessible, wall mounted, plumbed.

B. Water-Tempering Equipment: Hot and cold water.

END OF SECTION 224500

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

1.1 PRODUCTS

A. Liquid-in-Glass Thermometers:

1. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

a. Case: Cast aluminum; 7-inch (178-mm) size unless otherwise indicated.
b. Case Form: Adjustable angle unless otherwise indicated.
c. Tube: Glass with magnifying lens and blue or red organic liquid.
d. Tube Background: Nonreflective aluminum with etched scale in deg F (deg C).
e. Window: Glass.
f. Stem: Aluminum.

B. Thermowells:

1. Material for Use with Copper Tubing: CNR or CUNI.
2. Material for Use with Steel Piping: CSA.
3. Type: Stepped shank unless straight or tapered shank is indicated.
4. Heat-Transfer Medium: Mixture of graphite and glycerin.

C. Pressure Gages:

1. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

a. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) diameter.
b. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
c. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
d. Dial: Nonreflective aluminum with etched scale in psi (kPa).
e. Window: Glass.
f. Ring: Metal.
g. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

D. Gage Attachments:

1. Snubbers: Brass; with NPS 1/4 (DN 8), and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
2. Siphons: Loop-shaped section of brass pipe with NPS 1/4 (DN 8) pipe threads.
3. Valves: Brass ball, with NPS 1/4 (DN 8) pipe threads.

E. Test Plugs: Test-station fitting made for insertion in piping tee fitting.

END OF SECTION 230519

SECTION 230523.12 - BALL VALVES FOR HVAC PIPING

1.1 CHILLED-WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball Valves: Brass or bronze, two piece, with brass trim, and full port.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 125.
2. Steel Ball Valves: Class 150.

1.2 HEATING-WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

B. Brass or bronze, two piece with brass trim, and full port.

C. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 125.
2. Steel Ball Valves: Class 150.

1.3 LOW-PRESSURE STEAM VALVES (15 PSIG (104 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball Valves: Brass or bronze, two piece, with brass trim, and full port.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 125.
2. Steel Ball Valves: Class 150.

1.4 HIGH-PRESSURE STEAM VALVES (MORE THAN 15 PSIG (104 kPa)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball Valves: Brass or bronze, two piece, with brass trim, and full port.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Steel Ball Valves: Class 300.

1.5 STEAM-CONDENSATE VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball Valves: Brass or bronze, two piece, with brass trim, and full port.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 125.
2. Steel Ball Valves: Class 300.

END OF SECTION 230523.12

SECTION 230523.14 - CHECK VALVES FOR HVAC PIPING

1.1 CHILLED-WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze swing check valves with nonmetallic disc, Class 125.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 125.

1.2 HEATING-WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze swing check valves with nonmetallic disc, Class 125.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 125.

1.3 LOW-PRESSURE STEAM VALVES (15 PSIG (104 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze swing check valves with nonmetallic disc, Class 125.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 125.

1.4 HIGH-PRESSURE STEAM VALVES (MORE THAN 15 PSIG (104 kPa)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze swing check valves with nonmetallic disc, Class 150.

B. Pipe Sizes NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 250.

1.5 STEAM-CONDENSATE VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze swing check valves with nonmetallic disc, Class 125.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 125.

END OF SECTION 230523.14

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.1 PERFORMANCE REQUIREMENTS

A. Pipe hangers and equipment supports designed by Contractor.

1.2 QUALITY ASSURANCE

A. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. ASME Boiler and Pressure Vessel Code, Section IX.

1.3 COMPONENTS

A. Metal Pipe Hangers and Supports: Carbon steel and copper.

B. Trapeze pipe hangers.

C. Metal Framing Systems:

1. Manufacturer: MFMA.
2. Material: Carbon steel.
3. Coating: Epoxy Paint.

D. Thermal-Hanger Shield Inserts:

1. For Cold Piping: Cellular glass or Polyisocyanurate.
2. For Hot Piping: Calcium silicate or Cellular glass.

E. Fastener Systems: Powder-actuated fasteners and mechanical-expansion anchors.

F. Equipment supports.

END OF SECTION 230529

SECTION 230548.13 - VIBRATION CONTROLS FOR HVAC

1.1 COMPONENTS

A. Vibration Isolators:

1. Elastomeric Isolation Pads: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area. Material to be oil and water resistant with elastomeric properties.

    a. Surface Pattern: Waffle pattern.
    b. Infused nonwoven cotton or synthetic fibers.
    c. Load-bearing metal plates adhered to pads.

2. Spring Hangers: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression and with vertical-limit stop.

END OF SECTION 230548.13

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

1.1 QUALITY ASSURANCE

A. Quality Standard for Piping Identification: ASME A13.1.

1.2 PRODUCTS

A. Equipment Labels: Plastic.

B. Warning Signs and Labels: 1/16 inch (1.6 mm) thick with fasteners.

C. Pipe Labels: Self-adhesive.

D. Duct Labels: Self-adhesive.

E. Stencils: Fiberboard or metal.

F. Valve Tags: Brass, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.1 SUMMARY

A. Testing, Adjusting and Balancing (TAB) for the following:

1. Balancing Air Systems:

    a. Constant-volume air systems.
    b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:
    a. Variable-flow hydronic systems.

3. TAB Equipment:

    a. Heat exchangers.
    b. Pumps.
    c. Motors.
    d. Heat-transfer coils.
    e. Air Handling Units.
    f. Fans.
    g. Air Terminal Units.
    h. Air Inlets and Outlets.
4. Vibration tests.
5. Duct leakage tests.
6. Control system verification.

1.2 QUALITY ASSURANCE

A. TAB Agent Qualifications: AABC, NEBB or TABB certified.

1.3 EXECUTION

A. Tolerances: Plus or minus 10 percent of design values.

B. Inspections: Random checks by TAB firm to verify final TAB report.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

1.1 QUALITY ASSURANCE

A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors; according to ASTM E84.

B. Refer to NIU Construction Standards 230713 for additional requirements.

1.2 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, mixed air and outdoor air.
2. Indoor, exposed supply, mixed air and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

1.3 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Duct Insulation: Mineral-fiber board with FSK (Foil-Scrim-Kraft) Facing or ASJ (All Service Jacket).

END OF SECTION 230713

SECTION 230716 - HVAC EQUIPMENT INSULATION

1.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors; in accordance with ASTM E84.

B. Mockup of each type of equipment insulation and finish.

1.2 EQUIPMENT INSULATION SCHEDULE

A. Steam-to-Hot-Water Converter Insulation: Mineral-fiber board or mineral-fiber pipe and tank.

B. Heating-Hot-Water Air-Separator Insulation: Mineral-fiber board or mineral-fiber pipe and tank.

END OF SECTION 230716

SECTION 230719 - HVAC PIPING INSULATION

1.1 QUALITY ASSURANCE

A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors, according to ASTM E 84.

B. Mockup of each type of pipe insulation and finish.

C. Refer to NIU Construction Standards 230719 for additional requirements.

1.2 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C): Flexible elastomeric.

B. Chilled Water above 40 Deg F (5 Deg C): Flexible elastomeric.

C. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and Below: Mineral-fiber, preformed pipe, Type I.

D. Steam and Steam Condensate, 15 psig and Below: Mineral-fiber pipe insulation, Type I or II.

E. Steam and Steam Condensate, Above 15 psig: Calcium silicate or mineral-fiber, preformed pipe, Type I or II.

1.3 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Piping, Exposed below 8'-0" above floor: Aluminum.

B. Removable insulated jackets for all steam and condensate valves. Provide jackets insulating material encapsulated by a silicone coated fiberglass cloth jacket. Jacket to be secured with adjustable lacing or straps with rings.

END OF SECTION 230719

SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

1.1 SYSTEM DESCRIPTION

A. System Description: Microprocessor-based monitoring and control including analog/digital conversion and program logic. Provide components that use native BACNet MS/TP, BACNet TCP/IP architecture and be in strict accordance with Ashrae Standard 135. Provide components that are compatible with the existing Schneider Electric I/Net and Eco Structure campus control system.

B. Delegated Design: Engage a qualified professional to design DDC system.

C. DDC System Speed:

1. Response Time of Connected I/O: Two seconds.

2. Display of Connected I/O:

   a. Point COV: 10 seconds.
   b. Alarms of Analog and Digital Points: 45 seconds.
   c. Graphic Display Refresh: Eight seconds.
   d. Point Change of Values and Alarms Displayed from Workstation to Workstation: Graphic refresh rate indicated.

D. Input Point Displayed Accuracy:

1. Flow:
   a. Air (Terminal Units): Within 10 percent of design flow rate.

2. Gas:

   a. Carbon Dioxide: Within 50 ppm.

3. Moisture (Relative Humidity):

   a. Air: Within 5 percent RH.

4. Pressure:
   a. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
   b. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).

5. Temperature, Dry Bulb:

   a. Air: Within 1 deg F (0.5 deg C).
   b. Space: Within 1 deg F (0.5 deg C).
   c. Outdoor: Within 2 deg F (1 deg C).
   d. Heating Hot Water: Within 1 deg F (0.5 deg C).
   e. Temperature Difference: Within 0.25 deg F (0.15 deg C).

E. Control Stability:

1. Temperature, Dry Bulb:
   a. Space: Within 0.5 deg F (0.2 deg C).

b. Heating Hot Water: Within 2 deg F (1 deg C).

F. Electric Power Quality:

1. Power-Line Surges:

a. Protect DDC system products connected to ac power circuits from power-line surges.
b. No fuses for surge protection.
c. Two waveforms:

1) 10-by-1000-mic.sec. waveform with a peak voltage of 1500 V and a peak current of 60 A.
2) 8-by-20-mic.sec. waveform with a peak voltage of 1000 V and a peak current of 500 A.

2. Power Conditioning: Susceptible DDC system products.
3. Ground Fault: Protect products.

G. Backup power source.

H. Continuity of operation after electric power interruption for applications with systems and equipment connected to backup power systems.

1.2 SYSTEM ARCHITECTURE

A. Perform modifications without having to remove and replace existing network equipment.

B. Number of LANs and associated communication transparent to operator.

C. Independence of any single device for system alarm reporting and control execution.

1.3 NETWORK COMMUNICATION PROTCOL

A. Industry Standard Protocols:

1. ASHRAE 135.

1.4 ASHRAE 135 (BACnet) GATEWAYS

A. Gateway Minimum Requirements:

1. Read and view all readable object properties on non-BACnet network to BACnet network and vice versa where applicable.
2. Write to all writeable object properties on non-BACnet network from BACnet network and vice versa where applicable.
3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet and vice versa.
4. Includes data sharing read property, data sharing write property, device management dynamic device binding, and device management communication control.
5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.

6. Backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

1.5 ASHRAE 135 (BACnet) PROTOCOL ANALYZER

A. Analyzer minimum capabilities:

1. Capture and store to a file data traffic on all network levels.
2. Measure bandwidth usage.
3. Filtering options with ability to ignore select traffic.

1.6 NETWORK CONTROLLERS

A. Communication: Communicate with other devices on DDC system network.

B. Operator Interface: Equipped with a service communications port for connection to a portable operator's workstation or mobile device.

1.7 PROGRAMMABLE APPLICATION CONTROLLERS

A. Communication: Communicate with other devices on network.

B. Operator Interface: Equipped with a service communications port for connection to a portable operator's workstation or mobile device.

1.8 APPLICATION-SPECIFIC CONTROLLERS

A. Microprocessor-based controllers.

B. Operator interface with a service communications port for connection to a portable operator's workstation.

1.9 CONTROLLER SOFTWARE

A. General Controller Software Requirements: I/O points shall be identified by up to 30-character point name and up to 16-character point descriptor. Same names shall be used at operator workstations.

B. Security: Individual security passwords and user names.

C. Scheduling:

1. Weekly Schedule: Include separate schedules for each day of week.
2. Exception Schedules: Operator able to designate any day of the year as an exception schedule.
3. Holiday Schedules: Operator able to define up to 99 special or holiday schedules.

D. System Coordination: Operator able to group equipment based on function and location.

E. Binary Alarms: Alarm based on operator-specified state.

F. Analog Alarms: Both high and low alarm limits and able to be automatically and manually disabled.

G. Alarm Reporting: Able to determine action to be taken in event of an alarm, routed to appropriate operator workstations based on time and other conditions, and able to start programs, print, be logged in event log, generate custom messages, and display graphics.

H. Maintenance Management: Monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits.

I. Sequencing: Application software to properly sequence applicable HVAC equipment.

J. Control Loops

1. Support Control Loops:

a. Two-position (on/off, open/close, slow/fast) control.
b. Proportional control.
c. Proportional plus integral (PI) control.
d. Proportional plus integral plus derivative (PID) control.
e. Adaptive (automatic tuning).

K. Anti-short cycling.

L. On and off control with differential.

M. Run-time totalization.

1.10 RELAYS

A. General-purpose relays.

B. Multifunction time-delay relays.

C. Latching relays.

D. Current sensing relay.

E. Combination on-off status sensor and on-off relay.

1.11 ELECTRICAL POWER DEVICES

A. Transformers.

B. Power-line conditioner.

C. Transient voltage suppression and high-frequency noise filter unit.

D. DC power supply.

1.12 CONTROL WIRE AND CABLE

A. Wire: Single conductor control wiring above 24 V.

B. Single Twisted Shielded Instrumentation Cable above 24 V.

C. Single Twisted Shielded Instrumentation Cable 24 V and Less.

D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

1.13 ACCESSORIES

A. Damper blade limit switches.

B. Instrument enclosures.

1.14 IDENTIFICATION

A. Control Equipment, Instruments, and Control Devices: Engraved tags.

B. Valve tags: Brass tags and brass chains attached to valve.

C. Raceway and Boxes: Painted labels on cover plates.

D. Equipment Warning Labels: Acrylic label with pressure-sensitive adhesive back and peel-off protective jacket.

END OF SECTION 230923

SECTION 230923.11 - CONTROL VALVES

1.1 BALL-STYLE CONTROL VALVES (HYDRONIC)

A. Pressure-Independent Ball Valves NPS 2 (DN 50) and Smaller:

1. Body: Forged brass, nickel plated, and with threaded ends.
2. Ball: Chrome-plated brass.
3. Stem and Stem Extension: Chrome-plated brass, blowout-proof design.
4. Flow Characteristic: Equal percentage. Externally adjustable maximum flow setting.

1.2 GLOBE-STYLE CONTROL VALVES (HYDRONIC)

A. Pressure-Independent Globe Valves NPS 2-1/2 to NPS 6 (DN 65 to DN 150):

1. Body: Ductile iron with flanged ends.
2. Valve Flow Setting Element: Brass.
3. Differential Pressure Regulator: Stainless Steel.
4. Externally adjustable maximum flow setting.

1.3 GLOBE-STYLE CONTROL VALVES (STEAM)

A. Two-Way Globe Valves NPS 2 (DN 50) and Smaller:

1. Globe Style: Single port.
2. Body: Cast bronze or forged brass.
3. End Connections: Threaded.
4. Bonnet: Screwed.
5. Plug, Seat, and Stem: Stainless steel.
6. Equal percentage flow characteristic.

B. Two-Way Globe Valves NPS 2-1/2 to NPS 6 (DN 65 to DN 150):

1. Globe Style: Single port.
2. Body: Cast iron.
3. End Connections: Flanged.
4. Bonnet: Bolted.
5. Modified linear flow characteristic.

1.4 ELECTRIC AND ELECTRONIC CONTROL VALVE ACTUATORS

A. Manufacturer: Belimo (Basis of Design), Honeywell, or Johnson Controls.

B. Type: Motor operated, with or without gears, electric and electronic.

C. Voltage: 24-V ac.

D. Field adjustable.

E. Two-Position Actuators: Single direction, spring return or reversing type.

F. Modulating Actuators:

1. Operation: Capable of stopping at all points across full range, and starting in either direction from any point in range.
2. Control Input Signal:

a. Three point, tristate, or floating point.
b. Proportional.
c. Pulse width modulation (PWM).
d. Programmable multi-function.

G. Fail-safe.

H. Integral overload protection.

I. Valve attachment.

END OF SECTION 230923.11

SECTION 232113 - HYDRONIC PIPING

1.1 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressures and Temperatures:

1. Hot-Water Heating Piping: 125 psig (860 kPa) at 200 deg F (93 deg C.
2. Chilled-Water Piping: 125 psig (860 kPa) at 200 deg F (93 deg C.
3. Makeup-Water Piping: 125 psig (860 kPa) at 200 deg F (93 deg C.
4. Condensate-Drain Piping: 150 deg F (66 deg C).
5. Air-Vent Piping: 200 deg F (93 deg C).
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.2 QUALITY ASSURANCE

A. Quality Standard: ASME B31.9.

1.3 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:

1. Copper tubing and soldered or pressure-seal joints.
2. Steel pipe, cast-iron fittings, and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
1. Steel pipe and welded and flanged joints.
2. Steel pipe and grooved, mechanical-coupled joints.

C. Chilled-water piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:

1. Copper tubing and soldered or pressure-seal joints.
2. Steel pipe, cast-iron fittings, and threaded joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
1. Steel pipe and welded and flanged joints.
2. Steel pipe and grooved, mechanical-coupled joints.

E. Makeup-water piping installed aboveground shall be the following:

1. Copper tubing, wrought-copper fittings, and soldered joints.

F. Condensate-Drain Piping: Copper tubing, wrought-copper fittings, and soldered joints.

G. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

H. Air-Vent Piping:

1. Inlet: Same as service where installed.

2. Outlet: Copper tubing with soldered or flared joints.

I. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

J. Diaphragm or Bladder-Type Expansion Tanks.

K. Tangential-Type Air Separators.

L. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

END OF SECTION 232113

SECTION 232123 - HYDRONIC PUMPS

1.1 PRODUCTS

A. Wet-Rotor Pump:

1. Body: Type 304 stainless steel.
2. Impeller: Polypropylene or stainless steel.
3. Pump Shaft: Stainless steel.
4. Bearings. Double-sintered carbon.
5. Motor Efficiency: Premium efficient as defined in NEMA MG 1.
6. Motor: ECM.

B. Specialty Fittings:
1. Triple-duty valves.

C. Integral Pump Motor Variable-Speed Controllers:

1. For pumps indicated to be variable speed.
2. Integrated Pump Controller: Direct BMS communication via BACnet™ MS/TP.

D. Electronically Commutated Motors (ECMs):

1. For pumps indicated.
2. Synchronous, constant torque, ECM with permanent magnet rotor.
3. Driven by frequency converter.

1.2 STARTUP SERVICE

A. Startup service by a factory-authorized service representative.

1.3 DEMONSTRATION

A. By a factory-authorized service representative.

END OF SECTION 232123

SECTION 232213 - STEAM AND CONDENSATE HEATING PIPING

1.1 DEFINITIONS

A. HP Systems: High-pressure piping operating at more than 15 psig (104 kPa) as required by ASME B31.1.

B. LP Systems: Low-pressure piping operating at 15 psig (104 kPa) or less as required by ASME B31.9.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum working pressures and temperatures:

1. HP Steam Piping: 300 psig.
2. LP Steam Piping: 125 psig.
3. Condensate Piping: 125 psig.
4. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
5. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

1.3 QUALITY ASSURANCE

A. Quality Standard: ASME B31.1, "Power Piping," and ASME B31.9, "Building Services Piping."

1.4 PIPING APPLICATIONS

A. LP Steam Piping Applications:

1. LP Steam Piping, NPS 2 (DN 50) and Smaller: Steel pipe, cast-iron fittings, and threaded joints.
2. LP Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
3. Condensate Piping above Grade, NPS 2 (DN 50) and Smaller:

    a. Steel pipe, cast-iron fittings, and threaded joints.

4. Condensate Piping above Grade, NPS 2-1/2 (DN 65) and Larger:

    a. Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

B. HP Steam Piping Applications:

1. HP Steam Piping, NPS 2 (DN 50) and Smaller: Steel pipe, cast-iron fittings, and threaded joints.
2. HP Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

3. Condensate Piping above Grade, NPS 2 (DN 50) and Smaller:

    a. Steel pipe, cast-iron fittings, and threaded joints.

4. Condensate Piping above Grade, NPS 2-1/2 (DN 65) and Larger:

    a. Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

END OF SECTION 232213

SECTION 232223 - STEAM CONDENSATE PUMPS

1.1 PRODUCTS

A. Single-Stage, Centrifugal Pumps:

1. Configuration: Duplex floor-mounted pumps; rated to pump 210 deg F steam condensate.
2. Variable Frequency Drives (VFD) in accordance with NIU Design and Construction Standards.
    a. All VFDs installed on individual projects shall be from the same manufacturer.
        1) Toshiba, ABB or Allen Bradley.
3. All motors to include grounding bushings.

B. Condensate Pumps to Move Condensate from EHP to WHP:

1. Located under existing Condensate Receiver in EHP. This configuration will provide required suction head for pumps.
2. Level controller for pumps will tie into existing level bridle for receiver.
3. Pumps are approximately 210 gpm at 70 psi ΔP

END OF SECTION 232223

SECTION 232500 - HVAC WATER TREATMENT

1.1 PERFORMANCE REQUIREMENTS

A. Quality Parameters for Closed Hydronic Systems:

1. pH: Maintain a value within 8.5 to 10.2.
2. "P" Alkalinity: Maintain a value within 30 to 500 ppm.
3. Hardness as CaCO3 within 30 to 500 ppm.
4. Total Iron / Copper less than 5 ppm.
5. Chloride less than 200 ppm.
6. Total Dissolved Solids (TDS) less than 1000 ppm.
7. Sulfates less than 200 ppm.

1.2 PRODUCTS

A. Bypass Feeders: Steel, with corrosion-resistant exterior coating.

1. Capacity: 5 gal. (19 L).
2. Minimum Working Pressure: 125 psig (860 kPa).

B. Chemical Treatment Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet.

C. Chemicals recommended by water-treatment system manufacturer.

D. Multimedia Filters: Simplex, multimedia filter system of filter tank, media, strainer, circulating pump, piping, and controls.

E. Centrifugal Separators: Simplex separator housing with baffles and chambers.

END OF SECTION 232500

SECTION 232519 - WATER TREATMENT FOR STEAM SYSTEM FEEDWATER

1.1 PRODUCTS

A. Overview:

1. The water treatment system is to provide the required demineralized water and chemicals to the Deaerator to supply required Boiler Feed Water (BFW) to the Boilers.
2. Flow rates of water to the Deaerator average about 41 to 82 gpm in the Summer and 163 to 245 gpm in the Winter. A Peak Winter day is about 377 gpm and an Absolute Peak flow is 408 gpm.
3. There will be two sets of Deaerators with BFW pumps; the existing one and the one being installed with this project. Piping and controls will be set up to enable lining the water and chemicals to the new or old system.

B. Water Softener:

1. Manufacturer Basis of Design: Bridging documents are based on equipment manufactured by Marlo.
2. Existing water softener shall be modified to accommodate required additional soft water for the additional boiler feed water makeup.

    a. The existing system has three large softener vessels and two smaller ones.
    b. The two smaller vessels shall be removed and saved for use elsewhere on campus.
    c. A new larger vessel will be added to increase the soft water capacity to meet the needs of the new boiler feed water requirements while maintaining the capacity required for the existing soft water users.
    d. A new control system will be added to enable all four of the water softener vessels to function together and enable individual softeners to be taken out of service for maintenance leaving the three remaining softener function to provide soft water.

C. Water De-chlorination:

1. Manufacturer Basis of Design: Bridging documents are based on equipment manufactured by Marlo.
2. A set of carbon filters will be installed to dechlorinate the soft water going to the RO systems.
3. It will also be connected to supply dechlorinated soft water for the existing RO system.
4. Since the new RO is sized to meet the entire RO water requirement, the dechlorinated soft water doesn't need to be sized for both new and old RO systems simultaneously, it just needs to be sized for the larger new RO system.
5. The carbon filters need to have sufficient capacity / redundancy to enable one of the carbon filters to be taken offline for backwash or other maintenance while still supplying full rate of dechlorinated soft water for the new RO system.
6. Betterment No.2 uses Sodium Bisulfite in lieu of carbon filters for De-chlorination.

D. Reverse Osmosis (RO):

1. Manufacturer Basis of Design: Bridging documents are based on equipment manufactured by Marlo.
2. A RO system will be used to remove dissolved solids from the water. The system needs to be able to produce 80gpm of Boiler Feed Water make-up.

E. Water Storage:

1. Twenty-One Thousand (21,000) gallons of water storage is required.
2. The water is supplying the deaerator / boilers with BFW running at maximum rates (200,000 lb/h of steam) for one hour without any condensate being returned.
3. The tank(s) needs to be compatible with hot condensate (212°F) as well as RO water that has not been to the deaerator; likely stainless steel or carbon steel with compatible liner.

F. Condensate Pumps:

1. Condensate pumps will be located below the condensate tanks to ensure amble suction head.
2. The pumps will have Variable Frequency Drives (VFD) in accordance with NIU Design and Construction Standards to control the flow rate to maintain the desired level in the Deaerator.

    a. All VFDs installed on individual projects shall be from the same manufacturer.

        1) Toshiba, ABB or Allen Bradley.

3. All motors to include grounding bushings.
4. To provide the required redundancy and flexibility over the range of flows there will be four (4) Condensate Pumps.

    a. Two (2) x 50%, approximately 204 gpm @ 35 psi ΔP.
    b. Two (2) x 25%, approximately 102 gpm @ 35 psi ΔP.

G. Chemical additives system:

1. There are four (4) different chemical additives being used.

    a. Oxygen Scavenger will be injected into the Deaerator.
    b. Scale Inhibitor will be injected into BFW going to the Deaerator.
    c. BFW pH Control will be injected into BFW going to the Deaerator.
    d. Steam pH Control will be injected into the steam header.
    e. Alt 2 would add a 5th, Sodium Bisulfite, see section C.

2. The chemicals will be supplied by totes or drums that will have secondary containment.
3. All chemicals will ha provisions for truck fill included to limit plant personnel exposure to chemical hazards.
4. An oxidation reduction potential analyzer on the outlet of the deaerator will be used to control oxygen scavenger addition.
5. Metering pumps will send a controlled flow of additive to their respective injection points and will have a system (e.g. PLC) that will automatically adjust rates based on operating parameters including but not limited to BFW flow and oxidation reduction potential.
6. Details on chemical additive system to be coordinated with the NIU water chemistry consultant Pete Wesley of Essential Water Technologies.

END OF SECTION 232519

SECTION 233113 - METAL DUCTS

1.1 MATERIALS

A. Single-wall rectangular ducts and fittings.

B. Single-wall round ducts and fittings.

C. Sheet Metal Materials:

1. Galvanized sheet steel.

D. Duct Liner:

1. Fibrous glass, Type I, flexible.

a. With antimicrobial erosion-resistant coating.

E. Sealant Materials:

1. Two-part tape sealing system.
2. Water-based joint and seam sealant.
3. Flanged joint sealant.
4. Flange gaskets.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

1.1 QUALITY ASSURANCE

A. Installation Standards: NFPA 90A, NFPA 90B, and SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1.2 PRODUCTS

A. Backdraft and Pressure Relief Dampers: Multiple blade, parallel action, gravity balanced with return springs.

B. Barometric Relief Dampers: Horizontal or vertical mounting; multiple blade, parallel action, gravity balanced with return springs.

C. Manual Volume Dampers: Multiple and single blade.

1. Standard, steel, manual volume dampers.

D. Control Dampers: Parallel and Opposed-blade design; galvanized-steel or aluminum frame and blades. For all outside air intake or exhaust control dampers that provide isolation to outdoors provide dampers with thermally isolated damper blades.

E. Fire Dampers: Dynamic, replaceable heat-responsive device.

F. Flange connectors.

G. Duct Silencers: Factory fabricated and tested, round or rectangular.

H. Turning Vanes: Galvanized sheet steel.

I. Remote damper operators.

J. Duct-Mounted Access Doors: Double wall, rectangular, galvanized sheet steel with insulation.

K. Pressure Relief Access Doors: Double wall with insulation fill.

L. Flexible Connectors.

M. Duct accessory hardware.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

1.1 QUALITY ASSURANCE

A. AMCA-Certified Ratings Seal.

1.2 CEILING-MOUNTED VENTILATORS

A. Housing: Steel with acoustical insulation.

B. Backdraft Damper: Integral.

C. Grille: Plastic, louvered.

1.3 CENTRIFUGAL VENTILATORS - ROOF DOWNBLAST

A. Direct-driven or belt-driven centrifugal type, with spun-aluminum dome top and outlet baffle; square, one-piece aluminum base with venturi inlet cone.

B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades
   1. Sparkproof construction where scheduled.

C. Accessories:

   1. Variable-speed motor controller.
   2. Disconnect switch.
   3. Bird screens.
   4. Backdraft dampers.
   5. Galvanized-steel roof curbs manufactured to accommodate roof slope.

END OF SECTION 233423

SECTION 233600 - AIR TERMINAL UNITS

1.1 PRODUCTS

A. Modulating, Single-Duct Air Terminal Units:

1. Configuration: Volume-damper assembly inside unit casing.
2. Casing: Galvanized steel, single wall.

a. Lining: 1/2-inch- (13-mm-) thick, fibrous-glass duct liner.

3. Volume Damper: Galvanized steel with maximum damper leakage of 2 percent at 3-inch wg (750 Pa) inlet static pressure.
4. Velocity sensors.
5. Hydronic Heating Coils: Copper tube and aluminum fins.
6. Factory-mounted and -wired, DDC controls.

B. Parallel Fan-Powered Air Terminal Units:

1. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing.
2. Casing: Galvanized steel, single wall.

a. Lining: 1/2-inch- (13-mm-) thick, fibrous-glass duct liner.

3. Volume Damper: Galvanized steel with maximum damper leakage of 2 percent at 3-inch wg (750 Pa) inlet static pressure.
4. Velocity sensors.
5. Motor:

a. Type: Electronically commutated motor.

6. Filters: Pleated cotton-polyester media, 1 inch (25 mm) thick.
7. Hydronic Heating Coils: Copper tube and aluminum fins.
8. Factory-mounted and wired, DDC controls.

C. Hangers and supports.

1.2 SOURCE QUALITY CONTROL

A. Factory test assembled air terminal units.

END OF SECTION 233600

SECTION 233713.13 - AIR DIFFUSERS

1.1 PRODUCTS

A. Square, flat faced, architectural ceiling diffusers.

B. Linear slot diffusers.

END OF SECTION 233713.13

SECTION 233713.23 - REGISTERS AND GRILLES

1.1 PRODUCTS

A. Grilles: Adjustable for supply air applications and fixed for return and exhaust air applications.
   1. Adjustable opposed-blade dampers.

END OF SECTION 233713.23

SECTION 233723 - HVAC GRAVITY VENTILATORS

1.1 PRODUCTS

A. Louvered-Penthouse Ventilators: 4-inch- (100-mm-) deep louvers and aluminum sheet roof.

1. Frame and Blade Material: Extruded aluminum with mitered corners.

a. AMCA seal.
b. Exterior Corners: Mitered blades with concealed close-fitting splices and fully recessed mullions at corners.

2. Roof Curbs: Galvanized steel, with built in mounting flange.

a. Overall Height: 18 inches (450 mm).

3. Insulation: Mineral-fiber insulation and vapor barrier.
4. Bird Screening: Galvanized steel, square mesh.

END OF SECTION 233723

SECTION 235233 - WATER-TUBE BOILERS

1.1 WARRANTY

A. Materials and Workmanship for Package Boilers: 12 months operation or 18 months from shipping.

1.2 PERFORMANCE REQUIREMENTS

A. Quality Standard: ASME Boiler Code and others as applicable.

1. ASME Code Stamp and National Board number.

B. Minimum Efficiency: ASHRAE/IESNA 90.1 HHV Efficiency of ≥ 83% at ≥ 50% firing rate.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70.

1.3 “D” type welded wall gas fired boilers, with single gas burner

A. Manufacturer Basis of Design: Bridging documents are based on boilers as manufactured by Rentech. Other acceptable manufacturers include the following:

1. Indeck
2. Victory Energy
3. Foster Wheeler
4. Babcock & Wilcox

B. 75,000 lb/h each of saturated steam at 140 psig at the steam outlet.

1. Boiler Feed Water: 227°F.

C. Rated for at least 200 psig.

D. Forced draft fan motor with 480V Variable Frequency Drives (VFD) in accordance with NIU Design and Construction Standards.

1. All VFDs installed on individual projects shall be from the same manufacturer.

a. Toshiba, ABB or Allen Bradley.

E. Heat Release (or Liberation) Rate need to be ≤ 70,000 btu/h·ft3.

F. Ladders, stairs and platforms included as required.

G. Boilers will be located inside building addition.

1. Bottom of roof deck approximately 33’ to 34’ above floor / roof deck approximately 1’ thick
2. Stacks need to be 45’ above floor.
3. CEMS port will be accessible from the roof

a. Do not expect CEMS being required / for potential future need

b. Do not need stairs or platform for CEMS port

H. Boilers to be provided with all trim, insulation, forced draft fans with VFD, burners, PLC and controls for boiler and burner.

1. Three element BFW level control
2. Needs to be remotely viewable

a. Similar to existing Burner Management System (new / East Boilers 1 & 2, 2016)

I. Boiler sound level measured according to parameters defined in ABMA publication "Boiler 304 Measurement of Sound from Steam Generators" shall not exceed 85dBA.

J. Combustion air for the boilers will come from outside.

1. Temperature can get as low as -20°F in the winter.
2. Need to provide a duct to bring the air from the roof.
3. If combustion air preheat is required to meet emissions / performance requirements, then that the required preheat equipment must be provided.

a. Steam can be used to provide heat with steam coils and condensate being returned. Source of steam is the 140psig steam being produced.
b. Heat exchanger using flue gas can be used. Required metallurgy to avoid corrosion, if condensation of water in flues gas occurs, must be provided.
c. Preheat is not required if the boilers / burners can meet emission and performance requirements without it.
d. Preheat equipment that contains water (e.g. condensate from steam) will be located inside to avoid freezing when the boiler is not operating. Damper will be provided to isolate water containing equipment from outside air when the boiler is not running.

1.4 SOURCE QUALITY CONTROL

A. Boilers: Factory tested and inspected.

1.5 EMISSION

A. Boilers need to meet the requirements of the air permit as described in the Basis of Design, summarized in Table 9.1

	Maximum Emissions per Boiler				
	NOx	CO	PM	SO2	VOM
Maximum Emission Rates (lb/hr)	3.57	8.98	1.36	3.65	3.59
Estimated Maximum Emission Rates (ppm)	33	135	-	-	-

END OF SECTION 235233

SECTION 235313 - BOILER FEEDWATER PUMPS

1.1 SUMMARY

A. Feedwater pumps and receivers.

1.2 PERFORMANCE REQUIREMENTS

A. Quality Standard: ASME B31.1

1.3 MANUFACTURED UNITS

A. Feedwater Pumps:

1. Horizontal, multistage, radially split-case design.
2. Boiler Feedwater (BFW) pumps will be located below the Deaerator to ensure ample suction head.
3. The pump motors will be 480V with Variable Frequency Drives (VFD) in accordance with NIU Design and Construction Standards.

    a. All VFDs installed on individual projects shall be from the same manufacturer.

        1) Toshiba, ABB or Allen Bradley.

4. All motors to include grounding bushings.
5. Pumps need to be able to supply 408 gpm (203,000 lb/h) of BFW
6. To provide the required redundancy and flexibility over the range of flows there will be four (4) BFW Pumps.

    a. Two (2) x 50%, approximately 204 gpm @ 240 psi ΔP.
    b. Two (2) x 25%, approximately 102 gpm @ 240 psi ΔP.

7. Space will be left for the addition of future pumping capacity to enable 611 gpm (304,500 lb/h) of BFW.

B. Feedwater Pump Control:

1. The control system will ramp up or down / turn on or off the pumps to maintain constant BFW pressure as the boilers change the amount of BFW consumed.
2. The flow rate of BFW will be relayed to the Chemical Additive controls to ramp up or down rate of additive injections to match requirements.

END OF SECTION 235313

SECTION 235316 - DEAERATORS

1.1 PERFORMANCE REQUIREMENTS

A. ASME-fabricated and -labeled deaerators and components.

1.2 MANUFACTURED UNITS

A. Manufacturer Basis of Design: Bridging documents are based on deaerator manufactured by Sterling Deaerator Company. Other acceptable manufacturers include the following:

1. Cochrane
2. Cleaver Brooks

B. Deaerator and Storage Tank are designed to operate over the range of 304,500 lb/hr (611 gpm) to 20,000 lb/h (40 gpm)

C. Vertical Spray & Tray Deaerator with 316L SS spray valves.

1. Stainless steel required for areas that contact non-deaerated water and vented gases.

D. Deaerator mounted on Horizontal Storage Tank.

E. Deaerator and Storage Tank rated for 50 psig and Full Vacuum from -20°F to 500°F.

F. Steam available at 140psig saturated. Need to provide pressure reduction and flow control to supply required steam. Over pressure protection is required.

G. Adjustable Spray Valves: Type 316 stainless steel.

H. Instruments and connections on the Deaerator and Storage Tank shall include but are not limited to:

1. 24” Manway for access to trays
2. 24” Manway to access to storage tank
3. Pressure Gauge
4. Temperature Gauge
5. Level Bridle for Level Controller
6. Level Bridle for Gauge Glass
7. Provision for chemical injection quill.
8. Vent and drain valves on DA and storage tank.

I. Deaerator and Storage Tank:

1. Material: Welded carbon steel; with 1/16” allowance for corrosion protection.
2. Factory-applied insulation and aluminum jacket.

1.3 SOURCE QUALITY CONTROL

A. Deaerator Tanks: Tested and inspected according to ASME Boiler and Pressure Vessel Code.

END OF SECTION 235316

SECTION 235700 - HEAT EXCHANGERS FOR HVAC

1.1 QUALITY ASSURANCE

A. Quality Standard: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

1.2 PRODUCTS

A. Shell-and-Tube Heat Exchangers:

1. Configuration: U-tube with removable bundle.
2. Shell Material: Steel.
3. Head Material: Cast iron or Fabricated steel.
4. Tube Material: Seamless Copper.
5. Tubesheet Material: Steel.
6. Baffle Material: Steel.
7. Support Saddles: Fabricated of material similar to shell. Foot mount with provision for anchoring to support.

END OF SECTION 235700

SECTION 237313.16 - INDOOR, SEMI-CUSTOM AIR-HANDLING UNITS

1.1 SUMMARY

A. Insulated, double-wall-casing, indoor, semi-custom, factory-assembled, air-handling units.

1.2 QUALITY ASSURANCE

A. Quality Standards: AHRI 430, AMCA 301 or AHRI 260, AMCA 210, NFPA 70, and NFPA 90A.

B. Refer to NIU Variable Frequency Drive Standards for additional requirements.

1.3 SUSTAINABLE DESIGN REQUIREMENTS

A. Comply with ASHRAE 62.1 and ASHRAE/IES 90.1.

1.4 MANUFACTURERS

A. Trane (Basis of Design), Carrier, or Daikin.

1.5 COMPONENTS

A. Unit Casing:

1. Base Rail: Galvanized steel.
2. Outside Casing: Galvanized steel.
3. Outside Casing Finish: Manufacturer's standard.
4. Inside Casing: Galvanized steel; solid except fan section that shall be perforated.
5. Floor Plate: Galvanized steel.
6. Cabinet Insulation: 2 inches (50 mm) thick.
7. Casing Panel R-Value: Minimum R-11.
8. Static-Pressure Classifications for Unit Sections: 3-inch wg (750 Pa).
9. Inspection access panels and access doors.
10. Condensate Drain Pans: Stainless steel.

B. Supply Fan Section:

1. AHU-1

a. Type: DWDI, airfoil centrifugal.
b. Drive: V-belt.
c. Number of Fan Wheels: (1).
d. Internal vibration control.
e. Motors. Shaft grounding rings.

f. Variable-frequency motor controller.

2. AHU-2

a. Type: SWSI, airfoil unhoused centrifugal.
b. Drive: Direct.
c. Number of Fan Wheels: (4).
d. Internal vibration control.
e. Motors. Shaft grounding rings.
f. Variable-frequency motor controller serving all fans combined.

C. Coils:

1. Coil Sections: Common or individual, insulated, galvanized-steel casings.
2. Heating Coil: Hot water and Steam.
3. Cooling Coil: Chilled water.
4. Water Coils:

a. Tubes: Copper.
b. Fins: Aluminum.
c. Frames: Galvanized steel.

5. Steam Coils: Distribution header type.

a. Tubes: Copper.
b. Fins: Aluminum.
c. Frames: Galvanized steel.

D. Filters:

1. Pleated.

E. Filter Access: Side.

F. Filter gauges.

G. Dampers:

1. Leakage Rate: Not to exceed 4 cfm/sq. ft. (20 L/s per sq. m) at 1-inch wg (250 Pa) and 8 cfm/sq. ft. (40 L/s per sq. m) at 4-inch wg (1.0 MPa); AMCA 500.
2. Damper Operators: Electronic.
3. Face-and-Bypass Dampers: Opposed blade; galvanized steel.
4. Low-Leakage, Outdoor-Air Dampers: Double skin; airfoil blade; galvanized steel.
5. Outdoor- and Return-Air Dampers: Opposed or Parallel blade; galvanized steel.
6. Combination filter and mixing box.

1.6 INSTALLATION

A. Equipment Mounting: Install air-handling units on concrete bases using elastomeric pads.

END OF SECTION 237313.16

SECTION 238239.13 - CABINET UNIT HEATERS

1.1 PRODUCTS

A. Cabinet Unit Heaters: Factory-assembled and -tested unit complying with AHRI 440.

B. Coil Section Insulation Materials: Glass-fiber duct liner with aluminum-foil facing or with erosion-resistant coating.

C. Cabinet Material: Steel with standard baked-enamel finish.

1. Vertical Unit, Exposed Front Panels: Sheet steel, removable panels.
2. Horizontal Unit, Exposed Bottom Panels: Sheet steel, removable panels.

D. Filters: Glass fiber, MERV 5.

E. Coils:

1. Hot-Water Coil: Copper tube with aluminum fins. Include manual air vent and drain.

F. Controls:

1. Fan and Motor Board: Removable.
2. Basic Unit Controls:

a. Wall or Unit-mounted thermostat.

END OF SECTION 238239.13

SECTION 238239.16 - PROPELLER UNIT HEATERS

1.1 MANUFACTURED UNITS

A. Housings:

1. Finish: Standard color baked enamel.
2. Adjustable discharge louver.

B. Coils:

1. Hot-Water Coil: Copper tube with aluminum fins.
2. Steam Coils: Copper tube with aluminum fins.
3. Electric-Resistance Coils: Nickel-chromium heating wire.

C. Fan and Motor:

1. Fan: Aluminum propeller directly connected to motor.
2. Motor: Permanently lubricated.

D. Controls:
1. Wall-mounted thermostat.

END OF SECTION 238239.16

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1.1 CONDUCTORS AND CABLES

A. Copper Building Wire, Rated 600 V or Less:

1. Insulation: Type THWN-2 indoors and Type XHHW-2 outdoors.

B. Fire-Alarm Wire and Cable: Complying with NFPA 70, Article 760.

1. Signaling Line Circuits: Twisted, shielded pair.
2. Non-Power-Limited Circuits: Solid-copper conductors, 600 V, 75 deg C.

    a. Low-Voltage Circuits: No. 16 AWG, minimum.
    b. Line-Voltage Circuits: No. 12 AWG, minimum.

1.2 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Wiring Method of Fire-Alarm System: Installed in a dedicated raceway system that is not used for any other wire or cable.

1.3 FIELD QUALITY CONTROL

A. Testing Agency: Contractor.

B. Infrared Scanning: For each splice in cables and conductors No. 3 AWG and larger.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.1 QUALITY ASSURANCE

A. Quality Standard for Grounding and Bonding Materials and Equipment: UL 467.

1.2 PRODUCTS

A. Conductors:

1. Insulated Conductors: Copper wire or cable.
2. Bare Copper Conductors:

    a. Bonding cable.
    b. Bonding conductor.
    c. Bonding jumper.
    d. Tinned bonding jumper.

3. Grounding Bus: Predrilled rectangular copper bars with stand-off insulators.

B. Connectors:

1. Welded.
2. Bus-bar connectors.
3. Beam clamps.
4. Cable-to-cable connectors.
5. Conduit hubs.
6. Ground rod clamps.
7. Lay-in lug connector.
8. Straps.
9. U-bolt clamps.
10. Water pipe clamps.

C. Grounding Electrodes:

1. Ground Rods: Copper-clad.

1.3 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1.1 PRODUCTS

A. Support, Anchorage, and Attachment Components:

1. Galvanized-steel slotted support systems.
2. Raceways and cable supports.
3. Steel conduits and cable hangers, clamps, and associated accessories.
4. Structural steel for fabricated supports and restraints.
5. Mounting, Anchoring, and Attachment Components:

    a. Powder-actuated fasteners.
    b. Mechanical-expansion anchors.
    c. Concrete inserts.
    d. Clamps for attachment to steel structural elements.
    e. Steel springhead toggle bolts.
    f. Threaded hanger rods.

B. Fabricated Metal Equipment Support Assemblies: Welded or bolted steel shapes.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

1.1 MATERIALS

A. Conduit:

1. GRC.
2. IMC
3. RNC
4. EMT.
5. FMC: Zinc-coated steel.

B. Metal Wireways and Auxiliary Gutters: Sheet metal with screw covers.

C. Surface Metal Raceways: Metal, galvanized steel, with snap-on covers.

D. Boxes, Enclosures, and Cabinets:

1. Metal Outlet and Device Boxes: Ferrous alloy.
2. Metal Floor Boxes: Cast metal, fully adjustable.
3. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb.
4. Small sheet metal pull and junction boxes.
5. Cast-metal access, pull, and junction boxes.
6. Box extensions.
7. Cabinets: Galvanized steel.

E. Handholes and Boxes for Exterior Underground Wiring: Polymer concrete. frame and cover, prototype tested for compliance with SCTE 77.

1. Configuration: Closed bottom.
2. Weatherproof cover.
3. Cover Legend: "ELECTRIC."

1.2 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: GRC or IMC.
2. Underground: RNC schedule 40-PVC concrete encased.
3. Boxes and Enclosures, Aboveground: Type 3R.

B. Indoors:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Damage: GRC or IMC.
3. Concealed: EMT.
4. Connection to Vibrating Equipment: FMC.
5. Damp or Wet Locations: GRC or IMC.
6. Boxes and Enclosures: Type 1, except Type 4 in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Fittings shall be steel and compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Threaded rigid steel conduit fittings.
2. EMT: Setscrew fittings.
3. Flexible Conduit: Fittings listed for use with flexible conduit.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

1.1 MATERIALS

A. Sleeves:

1. Schedule 40 steel pipe.
2. Cast-iron pipe.
3. Galvanized-steel sheet for conduits penetrating non-fire-rated gypsum-board assemblies.
4. Schedule 40 PVC pipe.
5. Molded-PVC pipe.
6. Molded-PE or -PP pipe.
7. Galvanized-steel sheet for rectangular openings.

B. Sleeve-Seals:

1. EPDM rubber sealing elements.
2. Carbon-steel pressure plates.
3. Carbon-steel, with corrosion-resistant coating connecting bolts and nuts.

C. Hydraulic-cement grout.

D. Silicone Sealants:

1. Single-component, silicone-based, neutral-curing elastomeric sealant.
2. Multicomponent, silicone-based liquid elastomeric nonshrinking foam.

END OF SECTION 260544

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

1.1 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 PRODUCTS

A. General Transformer Requirements:

1. Coils: Aluminum or Copper, continuous windings without splices except for taps.
2. Transformers Rated 15 kVA and Larger:

    a. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
    b. Mark as compliant with DOE 2016 efficiency levels.

B. Distribution Transformers:

1. Core: One leg per phase.
2. Coils: Aluminum, continuous windings without splices except for taps.
3. Enclosure:

    a. Ventilated.

4. Taps for Transformers Smaller Than 3 kVA: None.
5. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
6. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
7. Insulation Class: 220 deg C, with maximum 80 deg C rise above 40 deg C.

1.3 SOURCE QUALITY CONTROL

A. Transformers: Factory tested and inspected.

1.4 FIELD QUALITY CONTROL

A. Testing: By Contractor.

END OF SECTION 262213

SECTION 262413 - SWITCHBOARDS

1.1 PRODUCTS

A. Quality Standards: NEMA PB 2, NFPA 70, and UL 891.

B. Manufactured Units:

1. Front-connected, front-accessible switchboards.

a. Main Devices: Panel mounted.
b. Branch Devices: Panel mounted.
c. Sections front and rear aligned.

2. Front- and side-accessible switchboards.

a. Main Devices: Fixed, individually mounted.
b. Branch Devices: Panel mounted.
c. Sections front and rear aligned.

3. Front- and rear-accessible switchboards.

a. Main Devices: Fixed, individually mounted.
b. Branch Devices: Panel mounted.
c. Sections front and rear aligned.

4. Nominal System Voltage: 480Y/277 V.
5. Main-Bus Continuous: 2000A.
6. Indoor Enclosures: Steel, Type 1.

a. Finish: Standard gray color.

7. Barriers: Between adjacent switchboard sections.
8. Insulation and Isolation: main and vertical buses of feeder sections.
9. Customer metering compartment.
10. Bus transition and incoming pull sections.
11. Removable, hinged rear doors and compartment covers.
12. Hinged front panels.
13. Buses and Connections: Three phase, four wire, plus ground; copper.
14. Future device provisions.

C. Disconnecting and Overcurrent Protective Devices:

1. Molded-case circuit breaker (MCCB), with interrupting capacity to meet available fault currents.

a. Lugs: Mechanical style.
b. Ground-Fault Protection: Integrally mounted.

D. Instrumentation:

1. Potential transformers.
2. Current transformers.

3. Control-power transformers.
4. Current transformers for neutral and ground-fault current sensing.
5. Multifunction digital-metering monitor.

E. Control Power: 120-V ac.

1.2 FIELD QUALITY CONTROL

A. Testing: By Contractor.

B. Tests: Infrared scanning, ground-fault protection, and NETA ATS.

C. Coordination Study – Contractor shall provide settings for all adjustable circuit breakers and a complete short circuit and coordination study for the switchboard and downstream panelboards.

END OF SECTION 262413

SECTION 262726 - WIRING DEVICES

1.1 PRODUCTS

A. Standard-Grade Receptacles, 125 V, 20 A:

1. Duplex receptacles.
2. Isolated-ground, duplex receptacles.
3. Tamper-resistant duplex receptacles.
4. Weather-resistant duplex receptacles.
5. Tamper- and weather-resistant duplex receptacles.

B. Standard-Grade Receptacles, 125 V, 15 A:

1. Duplex receptacles.
2. Isolated-ground, duplex receptacles.
3. Tamper-resistant duplex receptacles.
4. Weather-resistant duplex receptacles.
5. Tamper- and weather-resistant duplex receptacles.

C. USB Receptacles: USB charging receptacles.

D. GFCI Receptacles, 125V, 20A:

1. Duplex GFCI receptacles.
2. Tamper-resistant duplex GFCI receptacles.
3. Tamper- and weather-resistant GFCI receptacles.

E. Cord and plug sets.

F. Toggle Switches: 120/277 V, 15 A.

1. Switches:

a. Single pole.
b. Two poles.
c. Three way.
d. Four way.

G. Toggle Switches: 120/277 V, 20 A.

1. Switches:

a. Single pole.
b. Two poles.
c. Three way.
d. Four way.

H. Occupancy Sensors:

1. Wall switch sensor light switch, dual technology.
2. Wall switch sensor light switch, passive infrared.
3. Wall switch sensor light switch, ultrasonic.

I. Wall-Box Dimmers:

1. Modular, full-wave, solid-state units with slider control.

a. Incandescent: Soft tap or other quiet switch; EMI/RFI filter to eliminate interference.
b. Fluorescent: Trim potentiometer for low-end dimming.
c. LED lamp dimmer switches.

J. Wall Plates:

1. Material for Finished Spaces: Steel with baked enamel.
2. Material for Unfinished Spaces: Galvanized steel.
3. Material for Damp and Wet Locations: Cast aluminum.

K. Floor Service Fittings: Modular, dual service, with power receptacle and voice and data communication outlet.

1. Type: Flush.
2. Service Plate: Round, brass.
3. Voice and Data Communication Outlet: Two modular, keyed, RJ-45 jacks.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1.1 PRODUCTS

A. Fusible Switches: Type HD, UL 98 and NEMA KS 1 rated.

B. Nonfusible Switches: Type HD, three pole, single throw,.

C. Molded Case Circuit Breakers: UL 489.

D. Molded Case Switches: UL 489.

E. Enclosures: NEMA 250 Type 1 indoors in dry location, Type 12 indoors in boiler room and Type 3R outdoors.

1.2 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor engaged.

1.3 INSTALLATION

A. Wiring Method: In raceways.

1.4 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

B. Test Procedure: NETA ATS.

END OF SECTION 262816

SECTION 262913.03 - MANUAL AND MAGNETIC MOTOR CONTROLLERS

1.1 PRODUCTS

A. Motor Starting Switches: Configuration: Nonreversing,

B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action.

1. Configuration: Nonreversing.
2. Overload Relay: Melting alloy.

C. Integral Horsepower Manual Controllers (IHPMC): "Quick-make, quick-break" toggle or push-button action.

1. Configuration: Nonreversing.
2. Overload Relay: Melting alloy.

D. Enclosed Full-Voltage Magnetic Motor Controllers: Across the line start, magnetically held, for system voltage 600-V ac or less.

1. Configuration: Standard duty; nonreversible.
2. Control Circuit: 24V ac, integral CPT, with primary and secondary fuses.
3. Overload Relay:Solid state.

E. Combination Full Voltage Magnetic Motor Controllers: Controller, SCPD and OCPD, in a single enclosure.

1. Configuration: Standard duty, nonreversible.
2. Control Circuit: 24V ac, integral CPT, with primary and secondary fuses.
3. Overload Relay: Solid state.
4. Combination Controller: Fusible disconnecting means.

F. Enclosures; NEMA ICS 6:

1. Dry and Clean Indoor Locations: Type 1, Type 12 in the boiler room.
2. Outdoor Locations: Type 3R.

G. Accessories:

1. Push Buttons: as indicated.
2. Pilot Lights: [LED type; colors as indicated.

1.2 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

END OF SECTION 262913.03

SECTION 263213.14 - DIESEL ENGINE GENERATORS

1.1 WARRANTY

A. Materials and Workmanship: Five years.

1.2 MAINTENANCE SERVICE

A. Full-Maintenance Service: 12 months.

1.3 PERFORMANCE REQUIREMENTS

A. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 2 EPSS.

B. UL Compliance: Comply with UL 2200.

C. Environmental Conditions:

1. Ambient Temperature: 5-degree F to 104-degree F (minus 15 to plus 40-degree C).
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 872 feet (266 m).

D. Unusual Service Conditions: Engine generator equipment will operate under the following conditions:

1. Outdoor location in upper Midwest.

1.4 ASSEMBLY DESCRIPTION

A. Power Rating: Industrial Standby 750 kW

B. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.

C. Service Load: 938 kVA.

D. Power Factor: 0.8 lagging.

E. Frequency: 60 Hz.

F. Voltage: 480 V ac.

1. Phase: Three-phase, four wire, wye.

G. Induction Method: Turbocharged.

H. Performance: Suitable for loads involving sensitive electronic equipment, adjustable frequency drives, or UPS systems.

I. Single engine generator with automatic power control.

1.5 ENGINE

A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15.

B. Engine Cooling System: Integral radiator.

C. Muffler/Silencer: Commercial type.

D. Air-Intake Filter: Heavy duty.

E. Starting System: 12 or 24 V electric, with negative ground.

1. Cranking Cycle: 60 seconds.
2. Battery: Lead acid; cranking cycle twice without recharging.
3. Battery Charger: Current-limiting, automatic-equalizing and float-charging type.

1.6 DIESEL FUEL-OIL SYSTEM

A. Fuel-Oil Storage:
1. Base-mounted fuel-oil tank sized for continuous 48-hour operation.
2. Optional items to include - Remote Audio/Visual fuel level alarm panel and 5 gallon spill containment.

1.7 CONTROL AND MONITORING

A. Sequence of Operations: Automatic starting; with control devices grouped on panel mounted on engine generator.

1. Minimum run time control set for 30 minutes with emergency-stop switch. Unit must be capable of running 48 hours on one tank fill.
2. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages grouped in a common control and monitoring panel mounted on engine generator.

1.8 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Insulated-case, electronic-trip type.

B. Generator disconnect switch.

C. Microprocessor-based generator protector.

D. Ground-fault trip.

E. Generator: Directly connected to engine shaft, with drip proof enclosure and solid-state voltage regulator.

1.9 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Drive: Shaft directly connected to engine shaft.

B. Electrical Insulation: Class H or Class F.

C. Enclosure: Drip proof.

D. Instrument Transformers: Mounted within generator enclosure.

E. Voltage Regulator: Solid state.

F. Strip heater.

G. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

H. Sub-transient Reactance: 12 percent, maximum.

1.10 OUTDOOR ENGINE GENERATOR ENCLOSURE

A. Vandal-resistant, sound attenuating, weatherproof painted steel housing on concrete foundation. Provide lockable access doors, externally mounted E stop, stainless steel fasteners and hardware and internally mounted exhaust silencing system. Must meet IBC 2015 certifications for site wind and seismic loads. Maintain 75 dBA Sound Pressure levels at 23 ft and 100 % load.

1.11 SOURCE QUALITY CONTROL

A. Testing and Inspection: Project specific at factory.

1.12 EMISSION

A. Diesel Generator needs to meet the requirements of the air permit as described in the Basis of Design, summarized in Table 9.1

	Maximum Emissions				
	NOx	CO	PM	SO2	VOM
Maximum Emission Rates (lb/hr)	TBD	TBD	TBD	TBD	TBD
Estimated Maximum Emission Rates (ppm)	TBD	TBD	TBD	TBD	TBD

1.13 E

IE

1.14 QUALITY CONTROL

A. Testing: By Contractor-engaged agency.

END OF SECTION 263213.14

SECTION 263213.16 - GASEOUS STANDBY ENGINE GENERATORS

1.1 WARRANTY

A. Materials and Workmanship: Five years.

1.2 MAINTENANCE SERVICE

A. Full-Maintenance Service: 12 months.

1.3 PERFORMANCE REQUIREMENTS

A. Environmental Conditions:

1. Ambient Temperature: -20°F to 105°F.
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet .

1.4 ASSEMBLY DESCRIPTION

A. Service Load: See drawings.

B. Power Factor: 0.8, lagging.

C. Frequency: 60 Hz.

D. Voltage: 480-V ac.

E. Phase: Three-phase, four-wire wye.

F. Governor: Adjustable isochronous, with speed sensing.

G. Parallel engine generator with automatic power control and load sharing.

1.5 ENGINE

A. Fuel: Natural gas.

B. Engine Cooling System: Integral.

C. Muffler/Silencer: Commercial type.

D. Air-Intake Filter: Heavy duty.

E. Starting System: 24-V electric, with negative ground.

1. Cranking Cycle: 60 seconds.
2. Battery: Lead acid, cranking cycle twice without recharging.
3. Battery Charger: Current-limiting, automatic-equalizing and float-charging type.

1.6 GASEOUS FUEL SYSTEM

A. Natural gas, vapor-withdrawal system.

1.7 CONTROL AND MONITORING

A. Sequence of Operations: Automatic starting; with control devices grouped on panel mounted on engine generator.

1. Minimum run time control set for 15 minutes with emergency-stop switch.
2. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages grouped in a common control and monitoring panel mounted on engine generator.

1.8 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type.

B. Generator disconnect switch.

C. Microprocessor-based generator protector.

D. Ground-fault trip.

E. Generator: Directly connected to engine shaft, with dripproof enclosure and solid-state voltage regulator.

1.9 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Drive: Shaft directly connected to engine shaft.

B. Electrical Insulation: Class H or Class F.

C. Instrument Transformers: Mounted within generator enclosure.

D. Voltage Regulator: Solid state.

E. Strip heater.

F. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

1.10 OUTDOOR ENGINE GENERATOR ENCLOSURE

A. Vandal-resistant, sound attenuating, weatherproof steel housing on concrete foundation.

1.11 SOURCE QUALITY CONTROL

A. Testing: Prototype at factory.

1.12 FIELD QUALITY CONTROL

A. Testing: By Contractor-engaged agency.

1.13 EMISSION

A. Generator need to meet the requirements of the air permit as described in the Basis of Design, summarized in Table 9.

Maximum Emissions from Generator			
	NOx	CO	VOM
Maximum Emission Rates (lb/hr)	2.46	4.91	1.92
Maximum Emission from 500 hr/yr (tons)	0.61	1.23	0.48

END OF SECTION 263213.16

SECTION 263600 - TRANSFER SWITCHES

1.1 QUALITY ASSURANCE

A. Quality Standards: NEMA ICS 1, NFPA 110, and UL 1008.

1.2 PRODUCTS

A. Performance Requirements:

1. Indicated Current Ratings: For continuous loading and total system transfer.
2. Fault Current Closing and Short-Circuit Ratings: Coordinated with overcurrent protective device(s).
    a. Short-time withstand capability for three cycles.
3. Transfer Switch and SPD Rating: Service rated.
4. Ground-Fault Protection: Normal bus.
5. Neutral Terminal: Solid. Fully rated.
6. Remote programming for devices.
7. General-purpose Type 1 enclosures.

B. Contactor-Type Automatic Transfer Switches:

1. Switch Characteristics: Continuous-duty repetitive transfer of full-rated current between active power sources. Double throw; mechanically held in both directions.
    a. Material: Hard-drawn copper, 98 percent conductivity.
    b. Lugs: Mechanical type.
    c. Ground bar.
2. Automatic Switching Arrangement: closed transition.
3. Nonautomatic Switching Arrangement: Under-load manual switch operation.
4. Digital communication interface.
5. Automatic transfer-switch controller.

C. Source Quality Control: Factory test and inspect components, assembled switches, and associated equipment.

1.3 FIELD QUALITY CONTROL

A. Testing: By Contractor with assistance of manufacturer's service representative.

END OF SECTION 263600

SECTION 311000 - SITE CLEARING

1.1 SUMMARY

A. Protecting existing vegetation to remain.

B. Removing existing vegetation.

C. Clearing and grubbing obstructions, trees, shrubs, and other vegetation, including grinding stumps and removing roots and debris.

1. Chipping removed tree branches and stockpiling in areas approved by Owner.

D. Stripping and stockpiling topsoil and stockpiling surplus topsoil.

E. Stripping and stockpiling rock and stockpiling surplus rock.

F. Removing existing above- and below-grade site improvements.

G. Disconnecting, capping or sealing, and removing site utilities.

H. Providing temporary erosion- and sedimentation-control measures.

1.2 REFERENCES

A. NIU Design and Construction Standards Division 31 1000 - Site Clearing

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

1.1 SUMMARY

A. Rough grading the Site.

B. Preparing subgrades for slabs-on-grade, walks, pavements, turf, and grasses.

C. Excavating and backfilling for buildings and structures.

D. Drainage course for concrete slabs-on-grade.

E. Base course for concrete walks.

F. Subbase course for asphalt paving.

G. Subsurface drainage backfill for walls and trenches.

H. Excavating and backfilling for utilities.

I. Excavation: Classified.

1.2 REFERENCES

A. NIU Design and Construction Standards Division 31 2000 - Earthwork

1.3 QUALITY ASSURANCE

A. Blasting: Seismographic monitoring provided by independent seismic survey agency.

1.4 MATERIALS

A. Soil Materials: Satisfactory and unsatisfactory soil classifications, subbase material, base course, drainage course, engineered fill, and bedding course.

B. Geotextiles: Separation geotextile.

C. Controlled Low-Strength Material: Low density concrete.

1.5 EXCAVATION

A. Explosives: Not allowed.

B. Hand-excavate in tree- and plant-protection zones.

C. Disposal of Surplus and Waste Materials: Satisfactory soil to designated storage areas on Owner's property; waste materials and unsatisfactory soil off Owner's property in a legal manner.

1.6 FIELD QUALITY CONTROL

A. Special Inspector and Testing Agency: Contractor engaged.

END OF SECTION 312000

SECTION 312319 - DEWATERING

1.1 PERFORMANCE REQUIREMENTS

A. Contractor to design dewatering system.

1.2 FIELD CONDITIONS

A. Geotechnical report is available.

B. Contractor to survey adjacent construction before and during dewatering.

1.3 INSTALLATION

A. Maintain water level 24 inches below bottom of excavation.

END OF SECTION 312319

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

1.1 PERFORMANCE REQUIREMENTS

A. Contractor to design excavation support and protection.

1.2 FIELD CONDITIONS

A. Geotechnical report is available.

B. Contractor to survey adjacent construction before and during installation of excavation support and protection.

1.3 MATERIALS

A. Structural steel.

B. Steel sheet piling.

C. Wood Lagging: Nominal rough thickness of 3 inches.

D. Shotcrete.

E. Cast-in-place concrete.

F. Tiebacks.

1.4 REMOVAL

A. Remove excavation support and protection.

B. Leave excavation support and protection in place.

END OF SECTION 315000

SECTION 321216 - ASPHALT PAVING

1.1 REFERENCES

A. NIU Construction Standards Division 32 1216 – Asphalt Paving

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Standard Specifications for Road and Bridge Construction of Illinois Department of Transportation.

1.3 MATERIALS

A. Asphalt Materials:

1. Asphalt Binder: AASHTO M 320, performance graded.
2. Asphalt Cement: ASTM D3381/D3381M, viscosity graded.
3. Prime Coat: Asphalt emulsion.
4. Tack Coat: Emulsified asphalt.
5. Fog Seal: Emulsified asphalt.

B. Auxiliary Materials:

1. Recycled Materials: Reclaimed asphalt pavement and reclaimed, unbound-aggregate base material;].
2. Herbicide.
3. Paving Geotextile: Nonwoven polypropylene.

C. Mixes:

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content no more than 50 percent by weight.

    a. Surface Course Limit: No more than 10 percent by weight.

D. Asphalt Mixes: Approved by authorities having jurisdiction .

1. Binder Course: IL-19.0.
2. Surface Course: IL-9.5.

1.4 INSTALLATION

A. Hot-Mix Asphalt Paving:

1. Subgrade proof-rolled for full-depth, hot-mix asphalt.
2. Herbicide applied.
3. Prime coat over unbound-aggregate base course.

B. Surface Treatment: Fog seal.

1.5 FIELD QUALITY CONTROL

A. Testing Agency: Contractor engaged.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

1.1 REFERENCES

A. NIU Construction Standards Division 32 1313 – Concrete Pavement

1.2 QUALITY ASSURANCE

A. Mockups to demonstrate surface finish, texture, and color; curing; and standard of workmanship.

1.3 PRODUCTS

A. Concrete, General: ACI 301.

B. Reinforcement:

1. Welded-Wire Reinforcement: Plain steel.
2. Joint Dowel Bars: Epoxy-coated plain steel.

C. Concrete:

1. Portland Cement Replacement: Use fly ash, slag cement, and silica fume to reduce portland cement by 40 percent.
2. Portland Cement: White.
3. Fly ash.
4. Slag cement.
5. Blended cement.
6. Normal-weight aggregate.
7. Air-entraining admixture.
8. Color pigment.
9. Compressive Strength: 4000 psi at 28 days.

D. Detectable Warnings: Blockouts in concrete for detectable paving units.

1.4 FINISHING AND CURING

A. Finishes: Medium-to-coarse-textured broom.

B. Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these.

1.5 FIELD QUALITY CONTROL

A. Testing: By Contractor-engaged agency.

END OF SECTION 321313

SECTION 321713 - PARKING BUMPERS

1.1 SUMMARY

A. Concrete wheel stops.

1.2 INSTALLATION

A. Wheel stops anchored with galvanized-steel hardware.

END OF SECTION 321713

SECTION 321723 - PAVEMENT MARKINGS

1.1 QUALITY ASSURANCE

A. Regulatory Requirements: Standard Specifications for Road and Bridge Construction of Illinois Department of Transportation.

1.2 MATERIALS

A. Pavement-Marking Paint: Acrylic type.

1.3 INSTALLATION

A. Asphalt paving and concrete surfaces aged 30 days before marking.

B. Graphic symbols and lettering made with stencils.

END OF SECTION 321723

SECTION 321726 - TACTILE WARNING SURFACING

1.1 QUALITY ASSURANCE

A. Mockups for each type of tactile warning surfacing.

B. Accessibility Requirements: The U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

1.2 MATERIALS

A. Cast-in-Place Detectable Warning Metal Tiles: Fiberglass.

1. Mounting: Permanently embedded, wet set.

B. Setting Bed: Mortar.

END OF SECTION 321726

SECTION 329200 - TURF AND GRASSES

1.1 QUALITY ASSURANCE

A. Installer's Personnel Certifications: Certified Lawn Care Technician.

1.2 MATERIALS

A. Seed: Field of Dreams Athletic Mixture by National Seed, McNabb Tees & Fairway Mixture, or approved equal.

B. Turfgrass Sod: IDOT Class 1 Mixture or IDOT Class 1A Salt Tolerant Mixture.

C. Mulches: Straw.

D. Pesticides.

E. Erosion-Control Materials: Blankets.

1.3 INSTALLATION

A. Seeding Method: Sow.

B. Protect seeded areas with straw mulch.

1.4 MAINTENANCE SERVICE

A. Turf: 90 days from date of Substantial Completion.

END OF SECTION 329200

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

1.1 SUMMARY

A. System Description: Piped utilities outside the building.

1.2 QUALITY ASSURANCE

A. Steel Piping Welding Qualifications: ASME Boiler and Pressure Vessel Code: Section IX.

B. Lettering and Colors of Identification Devices: ASME A13.1.

1.3 MATERIALS

A. Transition Fittings:

1. Transition couplings.
2. Transition fittings.
3. Transition unions.

B. Identification Devices:

1. Equipment nameplates.
2. Stencils.
3. Snap-on plastic pipe markers.
4. Plastic tape.
5. Valve tags.
6. Plasticized tags.

C. Grout: Nonshrink; nonmetallic.

D. Flowable Fill: Low-strength concrete, flowable-slurry mix.

END OF SECTION 330500

SECTION 334200 - STORMWATER CONVEYANCE

1.1 PIPING

A. Concrete Pipe and Fittings: Reinforced-concrete sewer pipe and fittings.

1.2 COMPONENTS

A. Manholes: Standard precast concrete.

1. Resilient pipe connectors.
2. Adjusting rings.
3. Ductile-iron manhole frames and covers.

B. Catch Basins: Standard precast concrete.

1. Ductile-iron frames and grates.

C. Stormwater Inlets: Combination type.

END OF SECTION 334200