NORTHERN MICHIGAN UNIVERSITY

NORTHERN MICHIGAN UNIVERSITY
SPECIFICATIONS

UNIVERSITY BID # 7693
BERRY EVENT CENTER
INFRASTRUCTURE UPGRADES
BID PACK 1

Date of Issue for Bidding:
September 13, 2022

PURCHASING DEPARTMENT

136 SERVICES BUILDING

NORTHERN MICHIGAN UNIVERSITY • 1401 PRESQUE ISLE AVE. • MARQUETIE, MICHIGAN 49855-5312

PHONE: 906/227-2360 • FAX: 906/227-1114

SECTION 00005
TABLE OF CONTENTS

TITLE PAGE

TABLE OF CONTENTS

LIST OF DRAWINGS

DIVISION 0 - BID REQUIREMENTS

Sections	
00011	Invitation to Bid
00110	Instructions to Bidders
00310	Bid Proposal Form
00500	Agreement Forms
00811A	Supplementary Conditions
00812	Supplemental Conditions
00813	Sidewalk Service Vehicle Permit

DIVISION 1 – GENERAL REQUIREMENTS

Sections	
01010	Summary of Work
01015	Contractor's Use of Premises
01027	Applications for Payment
01045	Cutting & Patching
01050	Field Engineering
01153	Change Order Procedures
01200	Project Meetings
01300	Submittals
01325	Construction Progress Schedule
01370	Schedule of Values
01400	Quality Control
01630	Substitutions, Product Acceptance
01700	Contract Close-out
01710	Cleaning
01720	Project Record Documents
01740	Warranties and Bonds
01800	Potential Environmental Concerns
01900	Prohibition of Asbestos Containing Materials
01900b1	Statement of Non-Inclusion of Asbestos Containing Material
01900bb2	Statement of Non-Inclusion of Asbestos Containing Material
02070	Selective Demolition

DIVISION 13 – EQUIPMENT

Sections	
13 1811	Ice Rink General Requirements
13 1812	Ice Rink Refrigeration System
13 1813	Ice Rink Floor System
13 1814	Ice Rink Piping, Valves and Accessories
13 1815	Ice Rink Waste Heat Recovery System
13 1817	Ice Rink Central Control System

CAMPUS MAP

END OF SECTION

LIST OF DRAWINGS

Drawing No.	Drawing Description
SHEET NO.	SHEET TITLE
Cover	
R001	Ice Rink Legend, Symbols and Abbreviations
RD100	Ice Rink Floor Demo Plan
RD200	Refrigeration Room Demo Plan
RD500	Ice Rink Demolition Details
R100	Ice Rink Subfloor Plan
R101	Ice Rink Floor Plan
R200	Refrigeration Room Plan
R500	Ice Rink Sections and Details
R501	Ice Rink Sections and Details
R502	Ice Rink Sections and Details
R503	Ice Rink Sections and Details
R600	Refrigeration Flow Diagram
R601	Refrigeration Flow Diagram

SECTION 00011
INVITATION TO BID

PART 1 – GENERAL

1.01 PROJECT IDENTIFICATION

A. Project: Bid No. 7693
Berry Event Center Infrastructure Upgrades Bid Pack 1

B. Owner: Northern Michigan University
Marquette, MI 49855

C. Architect/
Engineer: Peter Basso Associates Inc
5145 Livernois, Suite 100
Troy, Michigan 48098-3276
Tel: 248-879-5666

D. Site: Northern Michigan University
Marquette, MI 49855

1.02 GENERAL DESCRIPTION OF CONSTRUCTION SEQUENCE

A. Sequences and dates specified herein are for information only and indicate the intent of the Owner and the Contractor. Exact dates shall be as established in the Agreement.

B. Sequence of operations shall be established by the Contractor within the guidelines established by the Owner as required to meet construction schedules. Schedule of work for individual subcontract trades shall be as directed by the Contractor.

1.03 TYPES OF PROPOSALS

A. Bids shall be submitted in one single lump sum category which shall include all portions of the work. Proposals shall be made on unaltered proposal forms furnished by the Engineer. The Bidder shall fill in all blank spaces and the proposal shall be signed by a legal officer or agent who is authorized to bind the bidder to a contract.

1.04 PRE-BID CONFERENCE

A. A pre-bid conference will be held at **11 a.m. EST, Wednesday, September 21, 2022**, via Zoom Conference.

Join Zoom Meeting
https://nmu.zoom.us/j/91500273986?pwd=dTVSSnh0cW5QakY5bFNQcnp2NXlvZz09

Meeting ID: 915 0027 3986
Passcode: 280499
One tap mobile
+16469313860,,91500273986#,,,,*280499# US

SECTION 00011
INVITATION TO BID

1.05 TIME AND PLACE OF BID RECEPTION

A. Sealed proposals for Bid No. **7693** should be emailed only to purchase@nmu.edu. No in-person or mailed bids accepted. Emailed bids are due **Thursday, October 6, 2022**, **2 p.m. EST**.

1.06 EXAMINATION AND PROCUREMENT OF DOCUMENTS

A. Drawings and Specifications may be examined at the office of the Owner or at the Engineer's office. Contractors may obtain access electronically to the Drawings and Specifications from NMU Purchasing Department, 1401 Presque Isle Avenue, Marquette, Michigan 49855-5317 by calling 906-227-2292 OR 906-227-2360.

1.07 BID SECURITY

A. Bid security equal to 5% of the bid amount must accompany each bid in accordance with the Instruction to Bidders.

B. Bid security shall be either a Bid Bond issued by a company licensed in the State of Michigan to furnish bid security or Certified Check made payable to Northern Michigan University.

1.08 BIDDERS' QUALIFICATION

A. The Contractor will be required to provide a performance bond and payment bond in an amount equal to 100% of the total contract amount. Such bonds shall be issued by surety licensed in the State of Michigan.

1.09 OWNER'S RIGHT TO REJECT PROPOSALS

A. The Owner reserves the right to reject any and/or all proposals. The Owner reserves the right to contract within sixty calendar days following the bid opening. No bids may be withdrawn during this time without the Owner's approval.

1.10 DEFINITIONS

A. For purposes of this project, the term Architect, Engineer, and “Architect-Engineer,” are used synonymously.

END OF SECTION

SECTION 00110
INSTRUCTIONS TO BIDDERS

1.0 PART 1 - GENERAL

A. PROCUREMENT OF DOCUMENTS

The Drawings and Specifications are on file in the following plan rooms:

Delta County Builders Exchange
230 Ludington Street
Escanaba, Michigan 49829

Iron Mountain-Kingsford Builders Exchange
600 Stephenson Avenue
Iron Mountain, Michigan 49801

Marquette Builders Exchange
1229 West Washington Street
Marquette, Michigan 49855

2.0 PART 2 - MATERIALS

(Not Applicable B This Section Only)

3.0 PART 3 - EXECUTION

A. EXAMINATION OF DOCUMENTS AND SITE

1. Bidders shall carefully examine the Contract Documents and the construction site to obtain first-hand knowledge of existing conditions. Contractor will not be given extra payments for conditions which can be determined by visually examining the site and Contract Documents.

B. QUESTIONS, INTERPRETATIONS, AND ADDENDA

1. Should any bidder find discrepancies between the Drawings and Specifications, or should he be in doubt as to their exact meaning, he should notify the Architect-Engineer at once; NMU Engineering and Planning. The Architect-Engineer may then, at his option, issue Addenda clarifying same. The Architect-Engineer will not be responsible for oral instructions or for the Contractor's misinterpretations of Drawings and Specifications.

2. The University reserves the right to issue Addenda at any time prior to the bid opening. All such addenda shall become, upon issuance, an inseparable part of the Contractor Documents. Each bidder shall incorporate within his bid proposal all costs for items listed in the Addenda; and shall acknowledge receipt and the identifying number of each Addendum on the Bid Proposal Form and on the outside of the sealed bid envelope.

C. BID SECURITY, BONDS, AND INSURANCE

1. Bid Security, Performance, and Payment Bonds will be required on this project.

   a. A Bid Bond is required in the amount of 5% of total Bid, minimum.

   b. Performance Bond and Payment Bond Requirements are described in the General and Supplementary Conditions, equal to 100% of total Bid.

   c. Insurance Requirements are described in the General and Supplementary Conditions.

D. MODIFICATION AND WITHDRAWAL

1. Proposals may be withdrawn and/or changed any time prior to the bid opening. Proposals may not be withdrawn or changed after the bid opening time; and shall be deemed a firm offer continuing for sixty (60) calendar days. Bids received after the time and date of the bid opening will be returned unopened to the proposer.

E. SUBSTITUTION OF SPECIFIED PRODUCTS

1. Coordinate substitution Requirements with Section 01630.

F. CODES, ORDINANCES, REGULATIONS, ETC.

1. All labor and materials shall be furnished and installed in strict accordance with the latest applicable codes, ordinances, and regulations of any governing body that has jurisdiction over this project.

2. If the quality of the labor and materials required by the Drawings and Specifications exceeds the requirements of the applicable codes, ordinances, and regulations, the Drawings and Specifications shall take precedence.

3. If the quality of the labor and materials required by the applicable codes, ordinances, and regulations exceed the requirements of the Drawings and Specifications, the applicable codes, ordinances, regulations, etc., shall take precedence.

G. COVID-19 EXPOSURE PREVENTION, PREPAREDNESS AND RESPONSE

1. All Contractors are to follow current State of Michigan, Occupational Safety and Health Administration (OSHA) and U.S. Center for Disease Control and Prevention (CDC) guidelines with respect to the virus and construction related activities.

H. SUB-CONTRACTOR AND MATERIAL SUPPLIER

1. The successful Bidder shall submit to the University, a complete list of all sub-contractors, all materials suppliers, and all superintendents (General Construction and principal sub-contractors) he proposes to engage on the work. Sub-contracts shall not be awarded until after they have been approved by the Architect-Engineer and Owner. Superintendents (General Construction and Principal Sub-Contractors) shall not be changed during the Construction on this project without prior approval in writing from the University.

2. The successful bidder will be required to submit the list of sub-contractors within 24 hours after bid opening.

3. Names of principal sub-contractors must be listed on the Proposal Form.

I. AWARD OF CONTRACT

1. The material proposed to be used for the completion of work, and the competency, solvency, and responsibility of the bidders will receive due considerations before the awarding of this contract. In the reception of proposals for the work, the Owner incurs no obligation to accept the lowest or any proposal submitted. The right to accept or reject any and all bids is reserved by the Owner. Award will be made by section or lot, whichever is most advantageous to the University. The Owner reserves the right to require testimonial or legal documents pertaining to the solvency of a Contractor.

J. TIME OF COMPLETION

1. The Bidder will be required to agree, if awarded a Contract, to complete the work on or before the contract completion date stated in the Proposal Form.

K. CONTRACTS WITH SUBCONTRACTORS

1. All contracts made by the successful Bidder with Subcontractors shall be covered by the terms and conditions of the Contract. The successful Bidder shall see to it that his Sub-contractors are fully informed in regard to these terms and conditions.

L. CHANGES IN THE WORK

1. The Bidder shall state in the space provided in the Proposal Form the changes, expressed as a percentage of the cost, for changes in the work, when done by his own organization and when done by Subcontractors under his Contract.

END OF SECTION

BID PROPOSAL FORM

NAME OF
BIDDER_____

To: NORTHERN MICHIGAN UNIVERSITY

PROPOSAL FOR: GENERAL CONSTRUCTION including the work of all trades, for the construction and completion of:

Bid No. 7693 BERRY EVENTS CENTER INFRASTRUCTURE UPGRADES BID PACK 1

The undersigned having examined the Bidding Documents, including the Advertisement for Bids, Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, General Conditions, Supplementary Conditions, Supplementary Special Conditions Technical Specifications, Plans, Drawings and other exhibits, on file at the Office of the Engineer, for all classifications of the Work for this Project, and being familiar with all conditions affecting this proposed Project, including the site and the availability of labor and material, hereby proposes to furnish all labor, material, tools, equipment, utilities, transportation or other facilities and services necessary to perform and complete the construction of the proposed Project in accordance with the Bidding Documents, as modified, augmented or supplemented by Addenda, for the sums and under the conditions as follows:

ADDENDA - The undersigned acknowledges:

Addendum Number_____ Dated_____ Addendum Number_____ Dated_____

Addendum Number_____ Dated_____ Addendum Number_____ Dated_____

(If none, so state and add additional Addenda as required.)

BASE BID - The undersigned agrees to the performance of the Work as stated for the Base Bid Sum of

_____Dollars ($_____)

Cost of Labor and Material Payment Bond to be added to Base Bid.

Amount_____ Dollars ($_____)

(For the above and all following sums, the amount shall be in both words and figures with the amount in figures governing in the event of discrepancy.)

SUBCONTRACTORS - (Note - Listing of the following subcontractors is mandatory and omission may cause rejection of the bid.) The undersigned submits for the Owner's and Architect's approval, the following list of subcontractors, with their subcontract bids, who shall perform the indicated portions of

the Work. The subcontract sum is included in the Base Bid Sum. The undersigned agrees to be responsible for the work, material, equipment and supplies furnished by each of the subcontractors listed.

	Firm Name	Subcontract Sum
ELECTRICAL	_____	$_____
MECHANICAL	_____	$_____
CONCRETE	_____	$_____

FEES FOR AUTHORIZED CHANGES - For changes in the work involving additions to or deductions from the Contract Sum, the undersigned agrees to perform or omit (or to cause to be performed or omitted by his subcontractors) such work at net cost to him, plus the following percentages to be added to the net cost or credited to the Owner.
The net cost shall include the following:

LABOR COST
- Base labor rate
- Labor fringe
- Workers Compensation Insurance
- Retirement benefits paid by the contractor
- Health Insurance paid by the contractor
- Union dues
- Unemployment costs (FUTA, FICA)

OVERHEAD COST
- Superintendent/Project manager time
- Builders' Risk insurance
- General Liability Insurance- Property and Personal Protection
- Field and Home office expense
- Small Tool expense
- Cost of shop drawing and as-built drawings to document the change.

PROFIT MARKUP
- Cost markup for the General Contractor

Profit markup cost in addition to Labor and overhead cost.

	ADDITIONS
Contractor work not under subcontract	_____%
Contractor work under subcontract	_____%

The undersigned further agrees that he shall bind his subcontractors not to charge a higher fee for authorized changes than he agrees to, as follows, in accordance with paragraph 5.3.1 of the General Conditions.

TIME OF COMPLETION - The undersigned agrees to commence work on a date specified in a written "Notice of Award of Contract" by the Owner and to fully complete the total project by **Friday, September 1, 2023.**

WITHDRAWAL OF BID - The undersigned agrees that this bid may not be withdrawn for a period of sixty (60) days after the opening date for receipt thereof. The undersigned further agrees that in the event a biddable addendum is issued to reduce the construction cost to be within budget, this bid may not be withdrawn for ninety (90) days after the date of opening bids for this Addendum.
See 00011-2, 1.09 and 00110-2, 3.04.

BID SECURITY - Accompanying this Proposal is a Bid Bond/Certified Check (cross out non-applicable term) in the amount of

_____Dollars ($_____)

which represents five percent (5%) of the Base Bid Sum amount which, it is agreed, shall be retained as liquidated damages by the Owner if the undersigned fails to execute the Agreement or furnish Bonds or Certificate of Insurance as specified within ten (10) days after notification of the award of Contract.

REJECTION OF BID - The undersigned understands that the Owner reserves the right to reject any or all bids and to waive any informality(s) in the bidding.

LEGAL STATUS OF BIDDER - The undersigned does hereby declare that the Bidder has the following legal status:

l. A Corporation organized and existing under the laws of the State of

_____ for whom, _____,

whose signature is affixed hereto is duly authorized to execute contracts.

2. A Partnership, all the partners of which, with addresses are:

_____

_____

_____

3. An individual, whose signature is affixed hereto;

FIRM NAME AND ADDRESS OF BIDDERS - This bid is submitted in the name of:

FIRM NAME

_____

BUSINESS ADDRESS

_____

_____

TELEPHONE NUMBER

_____

SIGNED BY

_____
(Signature)

TITLE

_____

SIGNED AND SEALED THIS _____DAY OF _____, 20___

END OF SECTION

SECTION 00500
AGREEMENT FORMS

The Contract Form of Agreement between the Owner and Contractor shall be:

THE STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR (A.I.A. DOCUMENT A101, 2017 EDITION).

THE GENERAL CONDITIONS . . . (A.I.A. DOCUMENT A201, 2017 EDITION) both modified as indicated.

Copies of the Contract are on file in the Architect-Engineer's office and the office of the Owner for the review of any interested parties.

END OF SECTION

SECTION 00811A
SUPPLEMENTARY CONDITIONS

Where any article of the American Institute of Architects General Conditions of the Contract for Construction (AIA 201, 2017) is supplemented in these Supplementary Conditions, provisions of such article shall remain in effect, and all supplementary provisions shall be considered as added thereto. Where any such article is modified, superseded or deleted herein, provisions of such article not so specifically modified, superseded or deleted shall remain in effect.

ARTICLE 1 – GENERAL PROVISIONS

1.1.6 Add the following subparagraph:

Wherever in the specification reference is made to specifications standards, directions or other published documents of governmental agencies, trade associations, manufacturers or other societies and organizations, unless otherwise specified, the reference shall mean and intend the latest edition of such document adopted and published prior to first date of invitation to submit proposals, and such document shall be a part of this specification with the same effect as if written herein in full.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1 Add the following subparagraphs:

The Contractor shall not be allowed any extra compensation by reason or any matter, or thing, concerning which he might have fully informed himself, because of his failure to have so informed himself prior to executing the Contract.

1.2.1.2 The drawings are intended to show the general arrangement, design and extent of the work and are partly diagrammatic. They are not intended to be scaled for roughing-in measurements or to serve as shop drawings.

1.2.1.3 In the case of an inconsistency between Drawings and Specifications or within either Document is not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

1.2.4 Add the following subparagraphs:

The Contract Documents contemplate a finished piece of work of such character and quality as is described therein and is reasonably inferable from them.

1.2.4.1

Conflict and Omissions: The intent of the contract documents is to provide everything necessary for the proper execution of the work. In case of conflict, the work shall not proceed until a decision has been agreed upon by all parties concerned.

ARTICLE 2 – OWNER

2.4.1 Add the following subparagraph:

Written notice shall be deemed to have been duly served if delivered in person or sent electronically with proper receipt notification, to the individual, or to a member of the firm or to an officer of the corporation or company for whom it is intended or if delivered at or sent by registered

mail to the last business address known to him who gives the notice.

ARTICLE 3 - CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS and FIELD CONDITIONS BYTHE CONTRACTOR

Add the following subparagraph:

3.2.3 The Contractor shall consult the Architect regarding any item which is insufficiently identified or described. In the absence of any definite instructions from the Architect, however, such items shall be furnished to correspond with similar items for which information is given.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Add the following subparagraph:

3.3.1.1 The Contractor shall establish all grades, lines, levels, and elevations required for his work.

3.7 PERMITS, FEES AND NOTICES

Add the following subparagraphs:

3.7.1.1 Contractor to verify with the Owner the permits customarily required and the appropriate jurisdiction having authority for work on campus prior to obtaining permits.

3.7.3.1 Where the Contract Documents require the work or parts of the work to be above the standard required by laws, ordinances, rules and regulations, such work shall be completed according to the requirements of the Contract Documents.

3.13 USE OF SITE

Add the following subparagraph:

3.13.1 The work at the project shall be confined to those areas within the contract limits as set forth by the Contract Documents as well as any additional areas for storage, fabricating, etc., as so designated by the Architect or Owner.

ARTICLE 7 - CHANGES IN THE WORK

Add the following subparagraphs:

7.1.1.1 Changes: The Contractor shall make changes in the contracted work only as ordered in writing by the Architect or Owner’s Representative, quoted by Contractor and upon issuance of an AIA Contract Change Order or Construction Change Directive (CCD), and confirmed by a Northern Michigan University Purchase Change Order. All such work shall be executed under the conditions of the original contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change.

In giving instructions, the Owner or Architect shall have authority to make minor changes in the work, not involving extra cost, and not inconsistent with the purpose of the building. Except in an

emergency endangering life or property, no changes or extra work of any kind shall be made except on written authority of the Owner or Architect by means of an AIA Contract Change Order or Construction Change Directive (CCD).

Upon the parties reaching an agreement on one of the Contract Sum adjustment methods outlined in 7.3.3, the Contractor, provided he receives an order as indicated above, shall proceed with the work. In such case he shall keep and present in such form as the Owner may direct, a correct account of the cost, including an itemized labor and material breakdown, together with vouchers. In any case, the Architect shall certify to the amount, including allowance for overhead and profit due to the Contractor as included in the Standard Form of Agreement Between owner and Contractor (A101). Pending final determination of value, payments on account of changes shall be made on the Owner's certificate. The Owner reserves the right to audit the contractor's accounting and payroll records as they relate to this project for the sole purpose of determining the validity of a contractor or subcontractor's basis for computation of cost.

Should conditions encountered below the surface of the ground be at variance with the conditions indicated by the drawings and specifications the contract sum shall be equitably adjusted upon claim by either party made within a reasonable time and in accordance with Article 15.1.

7.1.1.2 Claims for extra cost: If the Contractor claims that any instructions by drawings or otherwise involve extra cost under this contract, he shall give the Owner written notice thereof not later than five (5) days after the receipt of such instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property, and the procedure shall then be as provided for changes in the work. No such claims shall be valid unless so made.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Add the following subparagraphs:

9.2.1 The Architect will furnish Application for Payment forms upon request by the Contractor. All Applications for Payment shall include the following Sworn Statement:

To: (Owner's Name as used in the Agreement)

State of

County of

The undersigned Contractor certifies that the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by him for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that the current payment shown herein is now due.

Contractor: (Name and address as used in Agreement)

Signed:_____ Date:_____

Subscribed and sworn to before me this_____ day of_____, 20___.

Notary Public:

My Commission Expires:

9.2.2 No Progress Payment shall be due until the Bonds, Certificates of Insurance, Schedule of Values and List of Subcontractors required under Article 5, Paragraph 5.2, are approved.

9.4 CERTIFICATES FOR PAYMENT

Add the following subparagraph:

9.4.3 Application for Payment: The contractor shall submit to the Architect an application for each payment before the thirtieth (30th) of each month. The Contractor shall also submit with each payment application the necessary receipts, and/or vouchers showing his payment for materials and labor, including payments to subcontractors as required. Application for payment shall be submitted using AIA documents G702 and G703, and shall be accompanied by appropriate sworn statements and waivers of lien. Immediately after signing of the contract and before the first partial payment is made, the Contractor shall furnish the Architect and Owner a schedule of quantities, prices, and the amount included in the estimate for each general item of work in place, including with the cost of each item its' due proportion for expense and profit, the total equaling the contract price. The distribution of the amounts must be such as the Owner shall consider reasonable and be subject to his approval, and when satisfactory shall become the basis for all payments on account during the progress of work, and for fixing the valuation of extras and credits involved in modification. Payment terms will be net 30 after receipt of the Architect's approved pay request.

9.8 SUBSTANTIAL COMPLETION

Add the following subparagraph:

9.8.6 Payment: Up to 90% of the payment for the work will be made based on an estimated percentage of completion of the contract. Request for same will be supported by a schedule of costs and quantities of the various parts of the work aggregating the total contract sum. Requests for payment shall not exceed "one (1) payment per month." After completion and after final inspection, the final 10% will be paid. The Contract will not be considered complete until the work has been finally accepted by the Owner and Architect and the Owner has received (a) the required guarantee and (b) satisfactory evidence that all payrolls, material bills, and other indebtedness connected with the work have been paid, including required sworn statements and waivers of lien and all other closeout documents stipulated in the Project Manual.

9.10 FINAL COMPLETION AND FINAL PAYMENT

Add the following to subparagraphs:

9.10.2.1 The Contractor shall submit to the Owner, a written guarantee, which shall be in accordance with Article 3, Subparagraph 3.5 and Article 12, P12.2 of the General Conditions, and such additional guarantees, in writing, as are required by the Specifications.

9.10.2.2 The Contractor shall submit, in duplicate unless stated otherwise, complete instruction for the care and maintenance of all finish materials under the contract, including, but not limited to floor finishes and coverings, wainscot and wall finishes, acoustical treatment, metal finishes, painted surfaces, flooring, hardware, and finishes on mechanical and electrical equipment. Instructions

shall contain the manufacturer's or supplier's recommendations on cleaning agents, preservative treatment and such other instructions as beneficial to the maintenance, usage, appearance and durability of the product. The recommendations shall further contain cautions on the use of certain cleaners and coatings which may be detrimental to the product.

9.10.2.3 The Contractor shall prepare and submit in duplicate, unless stated otherwise, all operating and maintenance instructions and shop drawings for all mechanical and electrical equipment, and other special items, as called for in the specifications.

9.10.2.4 The Contractor shall submit an affidavit stating that no asbestos containing materials were incorporated into the work of this project by the contractor, by any sub-contractor or any supplier of materials.

9.10.2.5 All of the above described documents shall be checked for conformance with the specifications and they shall be submitted in uniform size, bound and indexed for co-reference.

9.10.2.6 The Contractor shall also submit at this time, record drawings as specified in these Supplementary Conditions, Article 3, and Subparagraph 3.11.

9.10.2.7 Delivery(s) of the above documents to the Architect for delivery to the Owner shall be completed before final payment or any part of the retained percentage shall become due.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.2 SAFETY OF PERSONS AND PROPERTY

Add the following subparagraph:

10.2.4.1 The Contractor shall give the Owner ample advance notice of intent to use explosives or hazardous materials or equipment so to permit NMU and contractor to make all necessary arrangements and take all precautions for the health and safety of all who may be impacted. Explosives are inherently dangerous and require the highest standards of care from the contractor(s). Contactor shall be responsible for obtaining all permits required for use of same, and further, shall be responsible for any and all damage caused by use of same.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

Add the following subparagraphs:

11.1.1.1 Insurance Submission

The Contractor shall not commence work until all insurance required by the Contract Documents has been obtained and approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until any insurance required of the Subcontractor has been obtained and approved.

11.1.1.2 Worker's Compensation Insurance

The Contractor shall procure and shall maintain, during the life of the contract, Worker's Compensation Insurance for all of his employees to be engaged in work on the project under this

contract; and, in case any such work is sublet, the Contractor shall require the Subcontractor similarly to provide Worker's Compensation Insurance for all of the latter's employees to be engaged in such work unless such employees are covered by the protection afforded by the Contractor's Worker's Compensation Insurance. In case any class of employees engaged in hazardous work on the project under this contract is not protected under the Worker's Compensation statute, the Contractor shall provide and shall cause each Subcontractor to provide Employer's Liability Insurance for the protection of such of his employees not otherwise protected.

The policy shall be written for limits no less than:

1. Workers Compensation - Statutory Limits
2. Employer‘s Liability
    a. $1,000,000 bodily injury for each accident
    b. $1,000,000 bodily injury by disease for each employee
    c. $1,000,000 bodily injury/disease aggregate

11.1.1.3 Commercial General Liability Insurance

The Contractor and each Subcontractor shall procure and shall maintain, during the life of this contract and for such additional time as may be required by the contract, commercial general liability insurance which shall be on an occurrence basis and shall use the ISO Commercial General Liability form (1986 or later). Such insurance shall include coverage for the contractor’s and Subcontractor’s operations, personal injury, XCU (explosion, collapse and underground), blanket contractual liability, and products and completed operations.

Such insurance shall be endorsed to state that its insurance is primary to the Owner’s insurance/self-insurance program and include the Owner as additional insured.

The policy (including any Excess/Umbrella insurance) shall be written for limits of not less than the following:

$5,000,000	Each Occurrence Limit
$5,000,000	General Aggregate

Products and Completed Operations liability must be maintained for not less than one year after acceptance of completion of your work.

11.1.1.4 Motor Vehicle Liability Insurance

The Contractor and each Subcontractor shall procure and shall maintain, during the life of this contract, motor vehicle liability insurance, which shall cover all owned, hired, and non-owned motor vehicles used in performing services under this contract. The limits for such coverage shall be $1,000,000 per occurrence.

11.1.1.5 Umbrella/Excess Liability Insurance

The Contractor and each Subcontractor may purchase Umbrella/Excess Insurance to obtain the limits required in section 11.1.1.1. Such insurance shall be on an occurrence basis and shall be at least as broad as each and every one of the underlying policies and shall include Owner as additional insured.

11.1.1.6 Certificates of Insurance

11.1.1.6.1 Before any work is begun under this contract, Contractor shall furnish to the Owner, Certificates of Insurance showing evidence of Contractor's insurance coverage required herein. In addition, Contractor shall file new certificates should original or renewed policies expire prior to completion of job or such additional time as required by the contract. These Certificates of Insurance shall:

.1 indicate the Carrier will endeavor to provide thirty (30) days notice to the Owner for any termination of coverage afforded under the policies before termination of the Contract.

.2 indicate that all insurance coverage as specified in section 11.1 Contractor's Liability Insurance are provided.

.3 provide that Owner shall be named as additional insured on the Commercial General Liability policy.

11.4 LOSS OF USE, BUSINESS INTERRUPTION, AND DELAY IN COMPLETION INSURANCE

Add the following subparagraph:

11.4.1 The Owner's Builder's Risk Policy carries a $100,000 per loss deductible. The Contractor shall cover this deductible under his/her own insurance or self-insurance provisions with regard to losses caused by Contractor.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

Add the following subparagraph:

14.2.3.1 Termination for Breach: The Owner may terminate this contract when violations are not stopped immediately and corrected within five (5) working days after notification by the Owner. In the event of such termination, the Owner may complete the contracted work and the Contractor will be liable for any excess cost occasioned by the Owner thereby, and in such case, the Owner may take possession of and utilize in completing the work such materials and equipment as may be on the site and necessary therefore to the extent Contractor has received payment for the same.

ARTICLE 15 CLAIMS AND DISPUTES

15.2 Initial Decisions

Add the following subparagraph:

Anything to the contrary notwithstanding and provided only should the parties voluntarily later agree to a mediation in writing, the parties may participate in a mediation.

15.4 Arbitration: Delete entire section.

ADD THE FOLLOWING SECTION:

ARTICLE 16 NON DISCRIMINATION CLAUSE

For all State contracts for goods or services in connection with the performance of work under this contract, the Contractor agrees as follows:

A. The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, national origin, ethnicity, age, or sex. The Contractor will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, national origin, ethnicity, age, or sex. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation and selection for training, including apprenticeship.

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, region, color, national origin, ethnicity, age, or sex.

C. The Contractor or his collective bargaining representatives will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the said labor union or worker's representative of the Contractor's commitments under this section.

D. The Contractor will comply with all published rules, regulations, directives, and orders of the Michigan Civil Rights Commission relevant to Section 209 of the Elliott-Larsen Civil Rights Act, (MCL 37.2209), prior to the taking of bids for any individual State project.

E. The Contractor will furnish and file compliance reports within such time and upon such forms as provided by the Michigan Civil Rights Commission; said forms may also elicit information as to the practices, policies, program and employment statistics of each Subcontractor as well as to the Contractor himself or herself, and said Contractor will permit access to his or her books, records, and accounts by the Michigan Civil Rights Commission, and/or its agent, for purposes of investigation to ascertain compliance with this contract and with rules, regulations and orders of the Michigan Civil Rights Commission relevant to Section 209 of the Elliott-Larsen Civil Rights Act (MCL 37.2209.)

F. If in the event that the Civil Rights Commission finds, after a hearing held pursuant to its rules, that a Contractor has not complied with the contractual obligations under this agreement, the Civil Rights Commission may, as part of its order based upon such findings, certify said findings to the Administrative Board of the State of Michigan, which Administrative Board may order the cancellation of the contract found to have been violated, and/or declare the Contractor ineligible for future contracts with the State of its political and civil subdivisions, departments, and officers, and including the governing boards of institutions of high education, until the Contractor complies with said order of the Civil Rights Commission. Notice of said declaration of future ineligibility may be given to any or all of the persons with whom the Contractor is declared ineligible to contract as a contracting party in future contracts. In any case before the Civil Rights Commission in which cancellation of an existing contract is a possibility, the contracting agency shall be notified of such possible remedy and shall be given the option by the Civil Rights Commission to participate in such proceedings.

G. The Contractor will include, or incorporate by reference, the provisions of the foregoing paragraphs (A) through (F) in every subcontract or purchase order unless exempted by the rules, regulations or orders of the Michigan Civil Rights Commission, and will provide in every subcontract or purchase order that said provisions will be binding upon each subcontractor or seller.

For all state contracts for goods or services. The Contractor, pursuant to the requirements of the

Elliott-Larsen Civil Rights Act, Section 209 (MCL 37.2209), agrees not to discriminate against any employee or applicant for employment, to be employed in the performance of the contract, with respect to hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height, weight, or marital status. The Contractor further agrees that every subcontract entered into for the performance of this contract will contain a provision requiring nondiscrimination in employment, as herein specified, binding upon each Subcontractor. Breach of this covenant may be regarded as a material breach of the contract.

Furthermore, for all state contracts for goods or services, the Contractor, pursuant to the requirements of the Persons With Disabilities Civil Rights Act, Section 209 (MCL 37.1209), agrees not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of a disability that is unrelated to the individual's ability to perform the duties of a particular job or position. The Contractor further agrees that every subcontract entered into for the performance of this contract will contain a provision requiring nondiscrimination in employment, as herein specified, binding upon each Subcontractor. Breach of this covenant shall be regarded as a material breach of the contract.

To the extent required by applicable law, the Contractor and any subcontractors shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

Contractor and any subcontractors shall comply with all applicable federal, state and local laws, rules, regulations, ordinances and executive orders. Contract clauses required by law are incorporated herein by reference.

END OF SECTION

SECTION 00811A
SUPPLEMENTARY CONDITIONS

SECTON 00812
NMU SPECIAL CONDITIONS

1. SCOPE

1.01 Information given in the SUPPLEMENTARY SPECIAL CONDITIONS are peculiar to this project, necessary for the progress of the work, and shall be provided as described herein.

2. LAYOUT OF WORK:

2.01 Verification: The initial layout shall include a verification by each prime contractor and subcontractor of the overall and critical dimensions and elevations of the Work of the Project to which the work relates, at the time of commencing this Contract. Each subcontractor shall submit a written statement to the General Contractor of the acceptance of the Work as it relates to the Work.

2.02 The Contractor shall be responsible to take such field measurements as may be required to determine the size of ordered material. In the event "Guaranteed Dimensions" are required, the Contractor shall advise other contractors by use of drawings, templates or mock-ups of the required conditions.

2.03 All Work and in particular piping, ducts, conduit and similar items shall be neatly and carefully laid out to provide the most useful space utilization and the most orderly appearance. Except as otherwise indicated or directed, piping and similar work shall be installed as close to ceilings and walls as conditions reasonably permit, located to prevent interference with other work or with the use of the spaces in the manner required by the functions of the space and the Owner. The Contractor shall carefully plan the layout and review any questionable installations with the Engineer.

3. SCAFFOLDING:

3.01 Each prime contractor and subcontractor shall be responsible to provide and maintain his own scaffolding.

4. TEMPORARY STAIRS, LADDER, RAMPS, RUNWAYS, AND BARRICADES:

4.01 Each Prime Contractor and subcontractor is to provide and maintain all necessary temporary stairs, ladders, ramps, and runways to facilitate conveyance of men, materials, tools, and equipment for proper execution of the work. All protection and safety barricades, devices, covers, etc., shall be provided by each Contractor as it relates to the safe conduct of his work in accordance with OSHA requirements.

5. CUTTING AND PATCHING OF WORK:

5.01 Each Contractor and Subcontractor shall be responsible for the cutting and patching of all holes and openings through existing walls, floors, ceilings, and roofs necessary for the installation of his work as specified in the contract documents. All patching shall be done in a neat and conscientious manner by mechanics of the trade involved, with material and finish to match adjacent surfaces and defective work shall

be corrected at no cost to the Owner.

6. CONSTRUCTION SEQUENCE:

6.01 All work shall be scheduled in a sequence to minimize the disruption of Owners operations. This Work Schedule shall be reviewed in advance with the Owner. A tentative schedule is included herewith for your reference. This is not to be confused as the project schedule; it is only offered as an outline of the Owner's interpretation of project sequencing.

6.02 Contractor may be requested to work split shifts, weekends, off peak Owner loading periods, etc., to accommodate Owner's utility and service requirements, such as, but not limited to, electrical power, HVAC systems, storm and sanitary lines. Contractor shall be entitled to seek a change in schedule and price to account for such Owner requests

6.03 Contractor is responsible to provide any temporary alternate supply and/or return conditions to maintain services to the facility while work is being performed. Place safety tags or markers to indicate location of disconnected services.

6.04 No interruptions to Owner's power, lighting, signal, or alarm circuits will be permitted without the express permission of the Owner. Arrangements for proposed interruptions shall be made with the Owner and shall be made at such time and duration as authorized by them. Temporary feeders, transformer jumpers, connections, circuits, etc., shall be used as required to accomplish the above and at no additional cost to the Owner.

7. COOPERATION - DISPUTES:

7.01 The completion of the project within the prescribed time is dependent upon the close and active cooperation of all those engaged therein, therefore, it is expressly understood and agreed that the Contractor shall layout and install his work at such time and in such manner as not to delay or interfere with the completion by the agreed upon date.

7.02 In the event of any dispute arising from the possible or alleged interference between the various subcontractors, which may retard the progress of the work, the same shall be adjusted by the General Contractor whose decision as to the part or parties at fault and as to the manner in which the matter may be adjusted, shall be binding and conclusive on all Parties subject to the dispute resolution provisions set forth herein.

8. EXAMINATION OF PREMISES:

8.01 Contractor shall familiarize himself with local conditions affecting the Job. He shall take his own measurements and be responsible for the correctness of same. Contractor shall be held to have made such examinations and no allowances will be made in his behalf by reason of error or omission on his part. If any part of the work of another Contractor hinders the work of this Contract, the Contractor shall notify the

University's representative before commencing work of any defects that will affect the results. Failure to notify will constitute his acceptance of the conditions.

9. WORKING CONDITIONS:

9.01 All work shall be done in accordance with all regulations governing the University, and is to be performed with minimum possible interference with the functioning of the University activities. Materials, tools, etc., shall be confined so as not to unduly encumber the premises.

10. MOVING:

10.01 If at any time it becomes necessary to move materials temporarily located which are to enter into the final construction, the Contractor furnishing the material shall, when so directed, move them to another location at his own expense.

11. OTHER CONTRACTS:

11.01 The University may let other contracts in connection with the work, and the Contractor shall properly connect and coordinate his work with the work of such other contractors.

12. SUBCONTRACTORS:

12.01 The successful Bidder is required to submit list of subcontractors if any, that they intend to use in the course of the subject work. Northern Michigan University must approve all subcontractors prior to the beginning of construction.

13. KEY CONTROL PARKING/ACCESS TO WORK SITE:

13.01 Contractors requiring keys to enter the University premises are to obtain those keys from University Public Safety and Police Services Department instructions and permits for legal parking and access to work site while they and their employees are engaged in construction on the NMU campus. A key request form follows this section. Upon closeout of the work, the Contractor shall return all keys to the NMU owner’s representative. Lost keys and/or failure to return keys will subject the contractor to costs for re-keying the entire building. Such costs shall be deducted from the amount due the contractor, or collected through the contractor’s surety.

14. SCHEDULING WORK:

14.01 The Contractor is to meet with the University Representative prior to starting work to schedule any proposed interruption of University service.

15. SAFETY DATA SHEETS:

15.01 The Contractor shall provide copies of Safety Data Sheets (SDS), along with a copy of their safety program to the Engineer. The Contractor shall not be permitted to begin work until this process is complete.

16. WITHDRAWAL OR REVISION OF BID PROPOSALS:

16.01 Any bid proposal may be withdrawn or revised in writing prior to the scheduled time for opening of bid proposals.

16.02 A bid may not be modified, withdrawn or canceled by the bidder for sixty (60) days following the time and date designated for the receipt of bids, and bidder so agrees in submitting his bid.

17. USE OF PREMISES:

17.01 The Contractor shall confine all storage of materials, equipment and apparatus to the area adjacent to the subject building as directed by the Owner, unless otherwise specifically mentioned in the Special Conditions which form a part of the Contract.

17.02 All work shall be done in accordance with all regulations governing the institution and with minimum possible interference with the proper functioning of the activities of same. The Contractor will be held to have visited the site and checked the working conditions with institutional authorities and determined the methods of carrying out the work and to have included all costs for meeting such working conditions.

17.03 The Contractor shall not load, permit any part of the structure to be loaded, or undermine/underpin the existing buildings and cause a weight that will endanger its safety.

18. ASBESTOS:

18.01 The Contractor shall not start any work in any area that has not been inspected for asbestos by the Owner's Facilities Operation Department which shall authorize the Contractor to commence the work. If asbestos is found, safety measures are recommended by the Owner's Facilities Operation Department of its qualified asbestos consultant shall be implemented before work is started. Costs associated with correction of asbestos conditions are the responsibility of Northern Michigan University.

19. LEAD AND CADMIUM CONTAINING MATERIALS

19.01 For contractors undertaking demolition or disturbing lead/cadmium-painted surfaces during demolition activities, development of a “Negative Exposure Assessment” should be completed, as detailed in the Part 603 and Part 309 rules. Employers (Each contractor) are required to ensure that all employees who may be exposed to lead and/or cadmium are provided with appropriate training and protection pursuant

to Parts 603 and 309. This includes designating a “competent person” to determine the applicability of the rules by determining whether lead or cadmium is present in the workplace and the possibility that employee exposures will be at or above the action level (30 micrograms per cubic meter of air for lead, 2.5 micrograms per cubic meter of air for cadmium). In addition, the employer must provide a medical surveillance program, provide interim protection, complete an exposure assessment, and establish a written compliance/training program for employees working where lead and cadmium are present.

Surfaces exhibiting lead concentrations above 100 ppm or cadmium concentrations above 20 ppm may warrant further evaluation prior to disposal of painted debris to determine if debris must be disposed separately as a hazardous waste.

20. VEHICLE SIDEWALK SERVICE PERMIT:

20.01 The Contractor shall not commence with the work until a traffic pattern has been identified and approved by the Office of Manager, Buildings and Grounds. All entry and egress from the job site will have to take place in accordance with the approved plan. Any damage to turf and plantings will be corrected at the cost of the Contractor. Approval of replacement turf and plantings will be by a representative of the Manager, Buildings and Grounds.

20.02 The approved traffic pattern, including entry and egress at the job site will be adhered to by the Contractor throughout the life of the contract. Changes in the pattern must be approved in writing by the Manager of Buildings and Grounds. Violations to the approved traffic pattern can result in additional costs to the Contractor to repair turf and plantings damaged due to the violation.

20.03 Additional costs to the Contractor due to violations of the approved traffic pattern will be identified as part of the formal Punch List and final acceptance of completion. The contract retainer will be withheld until a representative of the Office of Manager, Buildings and Grounds "has signed off on the formal Punch List.

21. PARKING PERMIT

21.01 A parking permit form is attached for your use.

22. OWNER'S REPRESENTATIVE STATUS:

22.01 The Architect-Engineer shall have general observation and administration of the work. He is the agent of the Owner only to the extent provided by the Contract documents and when in special instances he is authorized by the Owner so to act, and in such instances he shall, upon request, show the Contractor written authority. He has authority to stop the work whenever such stoppage may be necessary to insure the proper execution of the Contract at no additional cost to said Contract. Representatives for this project are: **For NMU: Kathy Richards, 906-227-1237**.

22.02 In case of the termination of the employment of the Owner's Representative, the Owner shall appoint a capable and reputable Representative, against whom the

Contractor makes no reasonable objection, whose status under the contract shall be that of the former Representative; any dispute in connection with such appointment to be subject to arbitration.

23. DISPOSAL OF SURPLUS AND UNSUITABLE MATERIALS

23.01 The Contractor shall dispose of surplus and unsuitable material outside of the Owner's property and Construction Area. Prior to the disposal of surplus material, the contractor shall check with the Owner concerning need for the material. Surplus and unsuitable material shall not be disposed in any areas defined as wetlands or flood plains, without obtaining permits from the regulatory agencies having jurisdiction over such land use. The Contractor shall be responsible for and obtain any necessary permits pertaining to compliance with the Soil Erosion and Sedimentation Control Act. All costs for obtaining any and all permits relating to the disposal and disposal sites shall be included in the base bid amount. All surplus topsoil shall be retained by the Owner and hauled to the Owner's storage yard by the Contractor.

23.02 The Contractor shall be held responsible for any cleanup efforts required along the haul route, and shall provide equipment and manpower for same.

24. HOT WORK PROCEDURES

24.01 Hot work is the responsibility of the Contractor. Contractor is responsible for ensuring the hot work is done safely with the appropriate fire extinguishers available in the work area. A fire watch must be established for a minimum of thirty minutes after the hot work is completed.

The procedure for any work involving welding, torch cutting, soldering or any procedure that makes dust will require existing smoke/heat detection systems be protected from damage and nuisance alarms.

Prior to any of the above work activities the contractor must notify Public Safety at 227-2151. This notification must be made for each work activity with the following information provided: a) The name of the person making the call and a return telephone number b) where the work is being completed and c) how long it is estimated the work will continue. Public Safety will then notify Energy Management and request the required smoke/heat detection be shut down, if applicable. Once Energy Management has notified Public Safety that the system has been shut down; Public Safety will notify the requesting individual that the system is off line.

Upon completion of work activity Public Safety must be notified. Public Safety will then contact Energy Management to have the system energized.

24.02 Any construction work involving "DUST" will require all smoke/heat sensors be protected (i.e. bagged). Representatives of the NMU Energy Management and/or Engineering and Planning Departments are available to advise where the devices are located. It is the contactors responsibility to remove the "bags" at the end of the workday.

State law requires a fire watch for any activity that requires smoke/heat sensors or fire suppression systems Shut off for more than 4 hours per day. For assistance in establishing the fire watch contact Public Safety.

25. TREE AND PLANT PROTECTION

25.01 Trees shall be protected from traffic of vehicles and equipment on their root systems by erecting protective fencing a minimum of 10' from the trunk. Branches shall not be damaged by equipment use. Tree foliage must be protected from any liquid or dry materials that are injurious. All plant material shall be protected from breakage or any other damage to the foliage or roots caused by injurious materials. The contractor shall be liable for replacement of equal size all plant material that is over 40% damaged. The Owner shall be fully compensated for trees destroyed including those that have over 40% structural damage. The value of the tree shall be determined by a registered tree appraiser using the manual published by the Council of Tree and Landscape Appraisers.

26. DAMAGE CAUSED BY WORK OPERATIONS

26.01 The contractor shall be responsible for any and all damage to the existing facilities including but not limited to roads, drives, walks, parking areas, irrigation systems, turf, shrubbery, trees, drainage structures, signs, which is caused either by the installation of his work or in the delivery of materials and equipment or the storage of materials. The cost of repairing or replacing all such damage to the facilities shall be borne by the contractor. The repair or replacement work will be done in such a manner as to leave the facilities in the same condition as it was before the contract work began and to the complete satisfaction of the Owner's representative.

.1 TURF

Severely compacted soil in turf area caused by vehicles or equipment shall be thoroughly loosened to a depth of not less than six inches by tilling. After tilling the area shall be graded and covered with Class A sod cut one inch thick. Sod shall be thoroughly watered and tamped after which the final grade shall be smooth with variations not to exceed 1/2" in three feet, and at the same elevation prior to damage. Edges of the existing turf must be neatly cut so that the new sod will be laid to form a tight joint at the exact same elevation. All sod joints must be tight and staggered. The cost of any additional topsoil needed will be the responsibility of the contractor.

.2 BITUMINOUS ASPHALT PAVEMENT REPLACEMENT

Any damaged or distorted pavement shall be removed by first cutting the pavement to the full depth in straight lines in a square or rectangular shape. If the gravel base material requires replacement, it shall be 6" of Michigan

Department of Transportation Spec 22A compacted to 98% density. Bituminous pavement shall consist of 3" of hot M.D.O.T. Bituminous asphalt laid and compacted in two equal layers. Joints shall be tight and elevation shall meet the existing pavement.

.3 SIDEWALK REPLACEMENT (CONCRETE)

Cracked or otherwise damaged concrete sidewalks shall be repaired by full depth saw cutting at the nearest joint and removing the damaged portion of walk. If fill material is needed, it shall be compacted to 95% density. Walk replacement shall be 6" thick, reinforced with #6-6x6 welded steel wire fabric mesh. Concrete mix shall contain not less than six sacks of air entraining Portland cement per cubic yard. Compressive strength shall not be less than 4,000 P.S.I. in 28 days. Slump shall not exceed three inches and the air entrainment shall be 1.5%. All concrete shall be ready mix. All paving must receive an application of white membrane curing compound at the rate of one gallon to 200 sq. ft. immediately after the concrete has set.

27. CLEANUP

27.01 Each contractor and subcontractor shall keep the areas involved free from all work related debris including spillage from hauling materials on streets, parking lots, or walks. Final cleanup shall be thorough and complete.

END OF SECTION

NORTHERN MICHIGAN UNIVERSITY

POLICE DEPARTMENT
SPECIAL PARKING PERMIT APPLICATION

NAME:_____

COMPANY NAME:_____
(IF APPLICABLE)

ADDRESS:_____

CITY:_____STATE_____ZIP_____

PHONE NUMBER:_____

JOB SITE:_____

_____

DAYS AND TIMES NEEDED:

MONDAY_____
TUESDAY_____
WEDNESDAY_____
THURSDAY_____
FRIDAY_____
SATURDAY_____
SUNDAY_____

VEHICLE INFORMATION

LICENSE PLATE #_____VEHICLE MAKE:_____VEHICLE MODEL:_____

VEHICLE YEAR: _____ VEHICLE COLOR:_____VEHICLE STYLE: FOUR DOOR TWO DOOR VAN SUV
(CIRCLE ONE)

LICENSE PLATE #_____VEHICLE MAKE:_____VEHICLE MODEL:_____

VEHICLE YEAR: _____ VEHICLE COLOR:_____VEHICLE STYLE: FOUR DOOR TWO DOOR VAN SUV
(CIRCLE ONE)

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.01 PROJECT

A. Project Name: NMU Bid # 7693
Berry Events Center Infrastructure Upgrades Bid Pack 1

B. Owner's Name: Northern Michigan University

C. Architect's Name: Peter Basso Associates Inc
5145 Livernois, Suite 100
Troy, Michigan 48098-3276
Tel: 248-879-5666

D. The Project consists of:

1. This project will include ice making system replacement at the Berry Events Center.

In general, work consists of demolition of the existing concrete ice rink floor and direct R-22 refrigeration system and the construction of a new indirect concrete ice rink floor and industrial grade ammonia refrigeration system. Work includes: demolition, saw cutting, excavation, concrete, refrigeration equipment and piping, painting, electrical, mechanical, controls, and other related items.

All as detailed and described in the Plans and Specifications.

Construction start date will be at the end of the hockey season either at the earliest date of February 24, 2023 and at the latest date of April 4, 2023.

A second bid package will be issued shortly for additional infrastructure improvements to support the new ice making system. This contractor shall coordinate their work with the bid package 2 contractor.

Bid package 2 will include select demolition of building systems, finishes, mechanical/plumbing systems, and electrical/lighting systems, as detailed on bid package 2 drawings.

New work will include; new mechanical room ventilation system equipment and ductwork, sealing and re-insulation of existing ductwork within mechanical room, relocation of HVAC piping as required to accommodate new duct and plenum installation, new AHU-3 rooftop desiccant dehumidification unit equipment, ductwork, high pressure steam piping reconnection, roof curb, and structural reinforcement. New AHU-9 rooftop desiccant dehumidification unit equipment, ductwork, and high-pressure steam piping extension, roof curb, and structural reinforcement (Alternate 1). New AHU-6 and AHU-7 rooftop heating and ventilating unit equipment, ductwork, and high-pressure steam piping reconnection and curb adaptors (Alternate 2).

New roof mounted relief air hoods and insulated blank-off panels for existing wall louvers. Also required is cutting and reinforcing of precast panels as required for new louver and door installation, coring of precast panels for piping penetrations, miscellaneous masonry patching, new insulated metal doors and door hardware.

New work will include; new mechanical room ventilation system equipment and ductwork, sealing and re-insulation of existing ductwork within mechanical room, relocation of HVAC piping as required to accommodate new duct and plenum installation, new AHU-3 rooftop desiccant dehumidification unit equipment, ductwork, high pressure steam piping reconnection, roof curb, and structural reinforcement. New AHU-9 rooftop desiccant dehumidification unit equipment, ductwork, and high-pressure steam piping extension, roof curb, and structural reinforcement (Alternate 1). New AHU-6 and AHU-7 rooftop heating and ventilating unit equipment, ductwork, and high-pressure steam piping reconnection and curb adaptors (Alternate 2). Electrical systems include; replacement of fluorescent lighting with LED lighting in the mechanical room and Zamboni room, relocation of 30kVA transformer and panelboard, new feeders and duct detectors for new mechanical equipment, feeders for (2) new MCC's (MCC's provided by others), and reworking the electrical systems in the Telecommunication Room to accommodate a new wall.

Structural work will include reinforcement of roof as required for new rooftop equipment, cutting and reinforcing of existing precast panels as required for new louvers and doors, new support structure for new cooling tower, new concrete pads for exhaust fan and door pad.

All as detailed and described in the Plans and Specifications for Bid Package 2.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a stipulated price as described in the Bid Documents and Proposal Forms.

1.03 WORK BY OWNER—At a minimum, the Owner will perform the following work: None.

1.04 OWNER OCCUPANCY

A. The Owner does intend to continue to occupy adjacent portions of the existing building during the construction period.

B. The Owner intends to occupy the Project upon Substantial Completion.

C. Cooperate with Owner to minimize conflict and to facilitate the Owner's operations.

E. Schedule the Work to accommodate Owner occupancy.

SECTION 01010
SUMMARY OF WORK

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to Areas Noted at Pre-construction Meeting.

B. Arrange use of site and premises to allow Owner occupancy upon substantial completion and for the delivery and storage of materials.

C. Emergency Building Exits During Construction: Keep all exits required by code open during construction period.

1.06 PROJECT SCHEDULE

A. See proposed Project Schedule in Section 00310.

1.07 WORK SEQUENCE

A. Construct Work as scheduled during the construction period.

B. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01015
CONTRACTOR'S USE OF THE PREMISES

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: This Section applies to situations in which the Contractor or his representatives including, but not necessarily limited to, suppliers, subcontractors, employees, and field engineers, enter upon the Owner's property.

B. Related Work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division I of these Specifications.

1.02 QUALITY ASSURANCE

A. Promptly upon award of the Contract, notify all pertinent personnel regarding requirements of this Section.

B. Require that all personnel who will enter upon the Owner's property certify their awareness of and familiarity with the requirements of this Section.

1.03 TRANSPORTATION

A. Truck and equipment access:

1. To avoid traffic conflict with vehicles of the staff and others using the building, and to avoid overloading of streets and driveways elsewhere on the Owner's property, limit the access of trucks and equipment to the designated area.

2. Provide adequate protection for curbs and sidewalks over which trucks and equipment pass to reach the job site.
3. Comply with NMU requirements for Service vehicle access to buildings.

1.04 PERFORMANCE

A. The Contractor and his Sub-contractors shall conduct their operations in a manner so as to not cause any undue inconvenience or hazard to occupants and clients of the building. Areas other than that of the project limits shall not be used for storage of material and shall be kept clean at all times at the Contractor's expense. Any damage to those areas shall be repaired or replaced at Contractor's expense. The Architect/Engineer shall make the determination as to the acceptability of the proposed repair or replacement.

1.05 SECURITY

A. Restrict the access of all persons entering upon the Owner's property in connection with the Work to the actual site of the Work.

1.06 EGRESS

A. Do not block existing exit doors. Maintain a clear path of egress from within building to the exterior.

1.07 USE OF BUILDING ELEVATOR

A. Contractor use of the building elevator during construction may be permitted. If permission is granted the following conditions apply:
   1. An inspection is performed by NMU Engineering staff, the general contractor and a representative of the current elevator maintenance contractor.
   2. A list of any defects or items in need of repair, including a video tape of existing conditions is prepared and agreed to by both NMU and the contractor.
   3. The contractor provides interior cab, door and hoistway entrance protection.
   4. The contractor is responsible for the monthly maintenance charge from the Elevator maintenance contractor. NMU will not pay for elevator maintenance during the construction.
   5. Upon completion of the work, the elevator, hoistway and equipment are inspected by the elevator maintenance contractor, the general contractor and NMU Engineering staff.
   6. Any damage resulting from the contractor’s use of the elevator, including cleaning of the hoistway, if necessary, will be the responsibility of the general contractor.
   7. If elevator is used by the Contractor any time during the execution of the contract the Contractor shall adhere and comply with the State of Michigan Elevator code and any other applicable codes.

END OF SECTION

SECTION 01027
APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Comply with procedures described in this Section when applying for progress payment and final payment under the Contract.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. The contract Sum and the schedule for payments are described in the form of agreement.

3. Payments upon Substantial Completion and Completion of the Work are described in the General Conditions and in Section 01700 of these Specifications.

1.02 QUALITY ASSURANCE

A. Prior to start of construction, secure the Architect/Engineer's approval of the schedule of values required to be submitted under Paragraph 9.2 of the General Conditions, and further described in Section 01370 of these Specifications.

B. During progress of the Work, modify the schedule of values as approved by the Architect/Engineer to reflect changes in the Contract Sum due to Change Orders or other modifications of the Contract.

C. Base requests for payment on the approved schedule of values.

1.03 SUBMITTALS

A. Formal submittal: Unless otherwise directed by the Architect/Engineer:

1. Make formal submittal of request for payment by filling in the agreed data, by typewriter or neat lettering in ink, on AIA Document G702, "Application and Certificate for Payment," plus continuation sheet or sheets G703.

2. Sign and notarize the Application and Certificate for Payment.

3. Submit the original of the Application and Certificate for Payment, plus three identical copies to the Architect/Engineer.

4. The Architect/Engineer will review the formal submittal and when approved, will sign the Application Certificate for Payment, and will distribute:

a. One copy to Contractor;
b. One copy to Owner; and
c. Two copies to Architect/Engineer's file.

5. The Owner will, upon approval of the Architect/Engineer, disburse directly to the Contractor in accordance with Article 9 of the agreement between Owner and Contractor.

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: This Section establishes general requirements pertaining to cutting, fitting, and patching of the Work required to:

1. Make the several parts fit properly;

2. Uncover work to provide for installing, inspection, or both, of ill-timed work;

3. Remove and replace work not conforming to requirements of the Contract Documents; and

4. Remove and replace defective work.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Technical Sections of this Specifications.

2. In addition to other requirements specified, upon the Architect/Engineer's request uncover work to provide for inspection by the Architect/Engineer of covered work, and remove samples of installed materials for testing.

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

A. Request for Architect/Engineer's consent:

1. Prior to cutting which effects structural safety, submit written request to the Architect/Engineer for permission to proceed with cutting.

2. Should conditions of the Work, or schedule, indicate a required change of materials or methods for cutting and patching, so notify the Architect/Engineer and secure his written permission and the required Change Order prior to proceeding.

B. Notices to the Architect/Engineer:

1. Prior to cutting and patching performed pursuant to the Architect/Engineer's instructions, submit cost estimate to the Architect/Engineer. Secure the Architect/Engineer's approval of cost estimates and type of reimbursement before proceeding with cutting and patching.

2. Submit written notice to the Architect/Engineer designating the time the Work will be uncovered, to provide for the Architect/Engineer's observation.

3. Cutting and patching is required under some of the Sections of these Documents. The cost for that work is to be included in the base bid.

PART 2 PRODUCTS

2.01 MATERIALS

A. For replacement of items removed, use materials complying with pertinent Sections of these Specifications. When no section covers the replacement of items removed, use materials identical to those removed.

2.02 PAYMENT FOR COSTS

A. The Owner will reimburse the Contractor for cutting and patching performed pursuant to any written Change Order, after claim for such reimbursement is submitted by the Contractor, and approved by the Architect/Engineer and Owner prior to execution of the work. Perform other cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Inspect existing conditions, including elements subject to movement or damage during cutting, and patching.

2. After uncovering the work, inspect conditions affecting installation of new work.

B. Discrepancies:

1. If uncovered conditions are not as anticipated, immediately notify the Architect/Engineer and/or owner and secure needed directions.

2. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION PRIOR TO CUTTING

A. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.

3.03 PERFORMANCE

A. Perform work required under pertinent other Sections of these Specifications.

1. Perform cutting and demolition by methods which will prevent damage to other portions of the Work and provide proper surfaces to receive installation of repair and new work.

2. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

END OF SECTION

SECTION 01050
FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Scope
1. The Contractor will provide control points which shall be used, to lay out his work.

1.02 RELATED SECTIONS - NOT USED

1.03 QUALITY CONTROL

A. The Contractor shall be responsible for accuracy of layout.

1.04 SUBMITTALS - NOT USED

1.05 PROJECT RECORD DOCUMENTS

A. The Contractor shall identify control points on the “as built” drawings.

1.06 EXAMINATION

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect/Engineer of any discrepancies discovered.

1.07 SURVEY REFERENCE POINTS

A. The Contractor shall protect control points.

1.08 SURVEY REQUIREMENTS

A. The Contractor shall provide all horizontal and vertical control points.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01153
CHANGE ORDER PROCEDURE

PART I GENERAL

1.01 DESCRIPTION

A. Work included: Make such changes in the Work, in the Contract Sum, in the Contract Time of Completion, or any combination thereof, as are described in written Change Orders signed by the Owner and the Architect/Engineer and issued after execution of the Contract, in accordance with the provisions of this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Changes in the Work are described further in Article 7 of the General Conditions.

1.02 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such measures as are needed to assure familiarity of the Contractor's staff and employees with these procedures for processing Change Order data.

1.03 SUBMITTALS

A. Make submittals directly to the Architect/Engineer at the address shown in the Project Manual.

B. Submit the number of copies called for under the various items listed in this Section.

1.04 PRODUCT HANDLING

A. Maintain a "Register of Bulletins and Change Orders" at the job site, accurately reflecting current status of all pertinent data.

B. Make the Register available to the Architect/Engineer for review at his request.

1.05 PROCESSING CHANGES INITIATED BY THE OWNER

A. Should the Owner contemplate making a change in the Work or a change in the Contract Time of Completion, the Architect/Engineer will issue a "Bulletin" to the Contractor.

1. Bulletins will be dated and will be numbered in sequence.

2. The Bulletins will describe the contemplated change, and will carry one of the following instructions to the Contractor.

    a. Make the described change in the Work at no change in the Contract Sum and no change in the Contract Time of Completion;
    b. Make the described change in the Work, credit or cost for which will be determined in accordance with Article 7 of the General Conditions;

    c. Promptly advise the Architect/Engineer (within 10 days) as to credit or cost proposed for the described change. This is not an authorization to proceed with the change.

B. If the Contractor has been directed by the Architect/Engineer to make the described change in the Work at no change in the Contract Sum and no change in the Contract Time of Completion, but the Contractor wishes to make a claim for one or both of such changes, the Contractor shall proceed with the change and shall notify the Architect/Engineer as provided for under Paragraph 4.3.7 of the General Conditions.

C. If the Contractor has been directed by the Architect/Engineer to make the described change subject to later determination of cost or credit in accordance with Article 7.3.6 of the General Conditions, the Contractor shall:

1. Take such measures as needed to make the change;

2. Consult with the Architect/Engineer and reach agreement on the most appropriate method for determining credit or cost for the change.

D. If the Contractor has been directed by the Architect/Engineer to promptly advise him as to credit or cost proposed for the described change, the Contractor shall:

1. Analyze the described change and its impact on cost and time;

2. Secure the required information and forward it to the Architect/Engineer for review;

3. Meet with the Architect/Engineer as required to explain costs and, when appropriate, determine other acceptable ways to achieve the desired objective;

4. Alert pertinent personnel and subcontractors as to the impending change and, to the maximum extent possible, avoid such work as would increase the Owner's cost for making the change, advising the Architect/Engineer in writing when such avoidance is no longer practicable.

1.06 PROCESSING CHANGES INITIATED BY THE CONTRACTOR

A. Should the Contractor discover a discrepancy among the contract Documents, a concealed condition as described in Paragraph 4.3.6 of the General Conditions, or other cause for suggesting a change in the Work, a change in the Contract Sum, or a change in the Contract Time of Completion, he shall notify the Architect/Engineer as required by pertinent provisions of the Contract Documents.

B. Upon agreement by the Architect/Engineer that there is reasonable cause to consider the Contractor's proposed change, the Architect/Engineer will issue a Bulletin in accordance with the provisions described in Article 1.05 above.

1.07 BULLETIN RESPONSE PROCEDURE

A. Make written reply to the Architect/Engineer in response to each bulletin within 10 days of receipt.

1. State proposed change in the Contract Sum, if any.

2. State proposed change in the Contract Time of Completion, if any.

3. Clearly describe other changes in the Work required by the proposed change, or desirable therewith, if any.

4. Include full backup data such as subcontractor's letter of proposal or similar information. The Owner reserves the right to audit accounting records of the Contractor to determine the accuracy of the claim.

5. Submit this response in single copy.

B. When cost or credit for the change has been agreed upon by the Owner and the Contractor, or the Owner has directed that cost or credit be determined in accordance with provisions of Paragraph 12.3.1 of the General Conditions, the Architect/Engineer will issue a "Change Order" to the Contractor. The Owner will, in turn, issue a formal modification to the Purchase Order. Until the Purchase Order modification is received, the work cannot be invoiced to the Owner.

1.08 PROCESSING CHANGE ORDERS

A. Change Orders will be dated and will be numbered in sequence.

B. The Change Order will describe the change or changes, will refer to the Bulletin or Bulletins involved, and will be signed by the Owner and the Architect/Engineer.

C. The Architect/Engineer will issue three copies of each Change Order to the Contractor.

1. The Contractor promptly shall sign all three copies and return them to the Architect/Engineer.

2. The Architect/Engineer will submit all copies to the Owner for signature, retain one signed copy in his file, will forward one signed copy to the Contractor, and one copy to the Owner.

D. Should the Contractor disagree with the stipulated change in Contract Sum or change in Contract Time of Completion, or both:

1. The Contractor promptly shall return two copies of the Change Order, unsigned by him, to the Architect/Engineer with a letter signed by the Contractor stating the reason or reasons for the Contractor's disagreement. In no case shall the Contractor proceed with a change until a signed order is issued to him.

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Contractor will conduct weekly project meetings with its sub-contractors and monthly progress meetings with the owner and architect throughout the construction period.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and normally are not part of the project meetings content.

1.02 QUALITY ASSURANCE

A. For those persons designated by each Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.03 SUBMITTALS

A. Agenda items: To the maximum extent practicable, advise the Architect/Engineer at least 24 hours in advance of project meetings regarding items to be added to the agenda.

B. Minutes:

1. The Contractor will compile minutes of each project meeting, and will furnish one copy to each Contractor, Subcontractor, Architect and Owner.

2. Recipients of copies may make and distribute such other copies as they wish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 MEETING SCHEDULE

A. Except as noted below for the Preconstruction Meeting, progress meetings will be held twice per month.

B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.02 MEETING LOCATION

A. To the maximum extend practicable, meetings will be held at the job site.

3.03 PRECONSTRUCTION MEETING - TO BE CHAIRED BY THE ARCHITECT

A. The Preconstruction Meeting will be scheduled to be held within 15 working days after the Owner has issued the Notice to Proceed.

1. Attendance is required by authorized representatives of each Contractor and major subcontractors working on the Project.

2. The Architect/Engineer will advise other interested parties, including the Owner, and request their attendance.

B. Minimum agenda: Data will be distributed and discussed on at least the following items:

1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers, and Construction Manager.

2. Channels and procedures for communication.

3. Construction schedule, including sequence of critical work.

4. Contract Documents, including distribution of required copies of original Documents and revisions.

5. Processing of Shop Drawings and other data submitted to the Architect/Engineer for review.

6. Processing of bulletins, field decisions, and Change Orders.

7. Rules and regulations governing performance of the Work; and

8. Procedures for security, quality control, housekeeping and related matters.

3.04 PROGRESS MEETINGS

A. Attendance:

1. To the maximum extend practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.

2. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

B. Minimum agenda:

1. Review, revise as necessary, and approve minutes of previous meetings.

2. Review progress of the Work since last meeting, including status of submittals for approval.

3. Identify problems which impede planned progress.

4. Develop corrective measures and procedures to regain planned schedule.

5. Complete other current business.

C. Revisions to minutes:

1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.

2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.

3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Daily construction reports.
4. Shop Drawings.
5. Product Data.
6. Samples.
7. Quality assurance submittals.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of subcontractors.

1.03 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

3. Processing: To avoid the need to delay installation as a result of the time

required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

a. Allow 2 weeks for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.
b. If an intermediate submittal is necessary, process the same as the initial submittal.
c. Allow 2 weeks for reprocessing each submittal.
d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
2. Include the following information on the label for processing and recording action taken.

a. Project name/Bid No.----
b. Date.
c. Name and address of the Engineer.
d. Name and address of the Contractor.
e. Name and address of the subcontractor.
f. Name and address of the supplier.
g. Name of the manufacturer.
h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect or Engineer using a transmittal form. The Engineer will not accept submittals received from sources other than the Contractor, nor review submittals which have not been reviewed and approved by the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
2. Transmittal Form: Use AIA Document G810.

D. Submittal Format: Shop drawings shall be submitted as an electronic image (Portable Document Format or similar file type). Submittals shall either be emailed or posted to a shared drive or cloud based construction management software system managed by the Contractor. Owner, Architect and Engineer shall all be permitted to

view, post and download submittal information from the management system.

E. Owner reserves the right to request select shop drawings be submitted in paper form. In the event that the request is for construction/CAD drawings the submittals shall be prepared and provided as scalable drawings. Paper size to be determined by owner.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 3 days after the date established for "Commencement of the Work."

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
3. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
4. Coordinate the Contractor's Construction Schedule with the list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
5. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.

B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner affect the sequence of Work.

C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Distribution: Following response to the initial submittal distribute electronic copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed

their assigned portion of the Work and are no longer involved in construction activities.

F. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.05 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
2. Prepare the schedule in chronological order. Provide the following information:

a. Scheduled date for the first submittal.
b. Related Section number.
c. Submittal category (Shop Drawings, Product Data, or Samples).
d. Name of the subcontractor.
e. Description of the part of the Work covered.
f. Scheduled date for resubmittal.
g. Scheduled date for the Engineer's final release or approval.

B. Distribution: Following response to the initial submittal distribute electronic copies to the Engineer, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.06 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit electronic copies to the Engineer at weekly intervals:

1. List of subcontractors at the site.
2. Approximate count of personnel at the site.
3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.

5. Meetings and significant decisions.
6. Stoppages, delays, shortages, and losses.
7. Meter readings and similar recordings.
8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

1.07 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included by sheet and detail number.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Nation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings formatted to print at scale on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm).

1.08 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
   a. Manufacturer's printed recommendations.
   b. Compliance with trade association standards.
   c. Compliance with recognized testing agency standards.
   d. Application of testing agency labels and seals.
   e. Notation of dimensions verified by field measurement.

f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
4. Submittals: Shall be made electronically.
   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

   a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
   b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Engineer's sample. Include the following:

   a. Specification Section number and reference.
   b. Generic description of the Sample.
   c. Sample source.
   d. Product name or name of the manufacturer.
   e. Compliance with recognized standards.
   f. Availability and delivery time.

2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

   a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
   b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.

a. The Engineer will review and return preliminary submittals with the Engineer's notation, indicating selection and other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Engineer will return one set marked with the action taken.

5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or

other individual authorized to sign documents on behalf of the company.

1.11 ARCHITECT/ENGINEER'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Engineer will stamp each submittal with a uniform, action stamp. The Engineer will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When the Engineer marks a submittal "Reviewed or No Exception Noted" the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. Final-But-Restricted Release: When the Engineer marks a submittal "Reviewed with Comments," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
3. Returned for Resubmittal: When the Engineer marks a submittal “Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

a. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit” at the Project Site or elsewhere where Work is in progress.

4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Engineer will return the submittal marked "Record” or “Action Not Required."

C. Unsolicited Submittals: The Engineer will return unsolicited submittals to the sender without action.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 01325
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 01000 Proposed Project Schedule

1.03 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Sheet Size: Multiples of 8-1/2 x 11 inches.

C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS B NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.03 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate changes required to maintain Date of Substantial Completion.

3.04 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor=s project site file, to Subcontractors, suppliers, Architect, Owner, and other concerned parties.

END OF SECTION

SECTION 01370
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the Work, as specified herein and in other provisions of the Contract Documents.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Paragraph 9.2 of the General Conditions.

3. Schedule of values is required to be compatible with the "continuation sheet" AIA Form G703 Accompanying Applications for Payment

1.02 QUALITY ASSURANCE

A. Use required means to assure arithmetical accuracy of the sums described.

B. When so required by the Architect/Engineer, provide copies of the subcontracts or other data acceptable to the Architect/Engineer, substantiating the sums described.

1.03 SUBMITTALS

A. Prior to first application for payment, submit a proposed schedule of values to the Architect/Engineer.

1. Meet with the Architect/Engineer and determine additional data, if any, required to be submitted.

2. Secure the Architect/Engineer's approval of the schedule of values prior to submitting first application for payment

END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control of installation.

B. Testing and inspection and Testing Services.

C. Manufacturers′ field services.

1.02 REFERENCES

A. ASTM C 1077 B Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 1998.

B. ASTM C 1093 B Standard Practice for Accreditation of Testing Agencies for Unit Masonry; 1995.

C. ASTM D 3740 B Standard Practice for Minimum Requirements for Agencies Engaged in the testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

D. ASTM E 329 B Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction; 1998a.

E. ASTME E 543 B Standard Practice for Agencies Performing Nondestructive Testing; 1999.

F. ASTM E 548 B Standard Guide for General Criteria used for Evaluating Laboratory Competence; 1994.

1.03 SUBMITTALS

A. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer. Include list of certified technicians and certificate numbers with specialty.

B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date Issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by Architect, provide interpretation of results
   2. Test reports are submitted for Architect=s knowledge as contract administrator or for the Owner, for information for the limited purposes of assessing conformance with information given and the design concept expressed in the contract documents.

1.04 TESTING AND INSPECTION AGENCIES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing.
   1. Owner provided testing shall include: soils, concrete, masonry and fireproofing.

B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing and inspection.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS B NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Have Work performed by persons qualified to produce required and specified quality.

3.02 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities.
   6. Perform additional tests and inspections required by Architect.
   7. Attend pre-construction meetings and progress meetings.
   8. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers= facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at the source of Products to be tested/inspected.
      c. To facilitate tests/inspections.

d. To provide storage and curing of test samples for operations requiring testing/inspection services.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner=s agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.03 MANUFACTURERS / FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and other services as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers= written instructions.

3.04 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect and Owner will direct an appropriate remedy or adjustment payment.

3.05 TESTING AGENCY QUALIFICATION

A. NAME:

B. ADDRESS:

C. TELEPHONE: (906)

D. FAX: (906)

3.06 CERTIFIED TECHNICIANS

A. NAMES SPECIALTY CERTIFICATE

307 RESIDENT PROFESSIONAL ENGINEER IN DIRECT SUPERVISION OF TESTING SERVICE

A. NAME MICHIGAN P.E.

END OF SECTION

SECTION 01630
SUBSTITUTIONS, PRODUCT ACCEPTANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. DRAWINGS AND GENERAL PROVISIONS of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.02 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if presented to the Architect at least 10 days in advance of bid due date.

1. Identify the product, or the fabrication to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

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

b. Samples, where applicable or requested.

c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

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

e. A Statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

f. Cost information, including all related costs under this Contract and excluding Architect's redesign costs, net change, if any, in the Contract Sum, and waiving all claims for additional costs related to the substitution which subsequently became apparent.

g. Certification by the Contractor that the substitution proposed is appropriate in every significant respect to that required by the Contract Documents, and that it will perform adequately in the

application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

B. Product Presentation: Conduct a presentation at the Architect's office if required by the Architect to prove appropriateness to the specified product.

C. Architect's Action: Within one week of receipt of Bids, the Architect may request additional information or documentation necessary for evaluation of the request. Within 2 week of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute is not made or obtained within the time allocated, use the product specified by name. If acceptance is made prior to award, it will be included in the Contract Amount. If acceptance is made after Award, it will be in the form of a Change Order.

1.03 GENERAL REQUIREMENTS FOR SUBSTITUTIONS

A. Substitutions during Bidding:

1. Substitutions shall be included in the proposal under the following conditions only and shall follow all requirements of "Acceptance of Substitutions".

a. When the Contractor is unable to obtain competitive prices from more than one of the specified manufacturers.

b. When the Contractor knows of another product of equal or better quality and performance.

c. When the Contractor has had unsatisfactory experience with one or more of the specified products or has reason to believe that the specified Manufacturer will not provide the necessary guarantees or assume responsibility for performance.

B. Substitutions After Contract:

1. Substitutions proposed after Award of the contract will only be considered for the following reasons.

2. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

C. Acceptance of Substitutions:

1. Substitutions will be considered for any manufacturer except those followed by the words "No Substitutions" in the Specifications.

2. In all cases where substitutions are proposed by the Contractor, it shall be the sole responsibility of the Contractor to provide adequate data and samples as required by the Architect to evaluate the substitution.

3. The Architect shall not be obliged to justify his reason for rejecting a proposed substitution.

4. In the event that a substitution is accepted conditionally on the Contractor's agreement to assume full responsibility for equality and performance, the Contract shall provide a full value warranty and agree to make good all damages resulting from the failure of the substitute product.

1.04 ACCEPTANCE OF MATERIALS AND MANUFACTURERS

A. Standard Materials:

1. Architect's acceptance applies to the Manufacturer only and shall not act to permit any deviation from other requirements of the Specifications.

2. Acceptance will be based on the Manufacturer's specifications at time of issuance of Bidding Documents. Deviations from such specifications shall be considered as a substitution.

3. Requests for acceptance shall be in tabular form stating Specification paragraph and material selected, except as otherwise provided.

4. Shop Drawings shall not indicate any material for which acceptance has not been received, unless accompanied by a separate request for approval. In no case shall Architect's review and return of Shop Drawings constitute and acceptance of either specified or substitute manufacturers or materials.

B. Materials Involving Supplementary Warranty of Maintenance Contract:

1. These materials shall be submitted as a request for acceptance over the signature of a qualified technical representative in the direct employ of the Manufacturer of such other person as the manufacturer may authorize in writing. Request for acceptance shall contain the following information.

a. Name of project.

b. Name of Contractor, Subcontractor or other party to whom material is furnished.

c. Reference to Specification Section and Article where material is specified and other Contract Documents necessary for identification.

d. Statement of acceptance of documents, conditions, and performance requirements:

1. Statement that documents as issued are in accordance with manufacturer's recommendations for use of specified materials, or

2. Recommended modification of detail, use, application or for substitution of different product by same manufacturer as being more suitable for the performance requirements of the warranty.

e. Statement that detailed installation instructions will be provided.

f. Extent of job site technical services, consultants or instructors proposed, if any.

g. Statement that warranty will be provided.

h. Special provisions required to keep warranty in force.

2. Requests for acceptance may be in the form of a letter including the above items and addressed to the subcontractor responsible for installation of the material, or may be according to a sample form of Material Proposal, provided by the Architect.

3. Upon receipt of the manufacturer's proposal, the subcontractor shall add his own statement agreeing to comply with the manufacturer's requirements and warranting his own workmanship.

4. The Contractor shall submit letter of endorsement of copies of all documents, including letters of comment, to the Architect for approval. In the event that the request for approval recommends a change in the work, modification of detail, or substitution of material, the Contractor shall indicate his concurrence with the change as being within the scope of the Contract or indicate the change in the Contract Sum for making such change, or state his objections to the change.

END OF SECTION

SECTION 001700 CONTRACT CLOSE-OUT

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide an orderly and efficient transfer of the completed Work to the Owner.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Activities relative to Contract close-out are described in, but not necessarily limited to the General Conditions and Sections in Division 1 of these Specifications.

3. "Substantial Completion" is defined in Paragraph 9.8 of the General Conditions.

1.02 QUALITY ASSURANCE

A. Prior to requesting inspection by the Architect/Engineer, use adequate means to assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection (punch list).

1.03 PROCEDURES

A. Substantial Completion:

1. Prepare and submit the list required by the first sentence of Paragraph 9.8.2 of the General Conditions.

2. Within a reasonable time after receipt of the list, the Architect/Engineer will inspect to determine status of completion.

3. Should the Architect/Engineer determine that the Work is not substantially complete:

a. The Architect/Engineer promptly will so notify the Contractor, in writing, giving the reasons therefore.

b. Remedy the deficiencies and notify the Engineer when ready for inspection.

c. The Architect/Engineer will re-inspect the Work.

4. When the Architect/Engineer concurs that the Work is substantially complete:

a. The Architect/Engineer will prepare a "Certificate of Substantial Completion" on AIA form G704, accompanied by the Contractor's list of items to be completed or corrected, as verified by the Architect/Engineer.

b. The Architect/Engineer will submit the certificate to the Owner and to the Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

B. Final Completion:

1. Prepare and submit the notice required by the first sentence of Paragraph 9.8.2 of the General Conditions.

2. Verify that the Work is complete including, but not necessarily limited to, the items mentioned in Paragraph 9.8.2 of the General Conditions.

3. Certify that:

a. Contract Documents have been reviewed;

b. Work has been inspected for compliance with the Contract Documents;

c. Work has been completed in accordance with the Contract Documents;

d. Equipment and systems have been tested as required, and are operation; and

e. Work is completed and ready for final inspection.

4. The Architect/Engineer will make an inspection to verify status of completion (final punch list).

5. Should the Architect/Engineer determine that the Work is incomplete or defective:

a. The Architect/Engineer promptly will so notify the Contractor, in writing, listing the incomplete or defective work.

b. Remedy the deficiencies promptly, and notify the Architect/Engineer when ready for re-inspection.

6. When the Architect/Engineer determines that the work is acceptable under the Contract Documents, he will request the Contractor to make close-out submittals.

C. Close-out submittals include, but are not necessarily limited to:

1. Operation and maintenance data (O&Ms) for items so listed in pertinent

sections of the Contract Documents, and for other items when so directed by the Architect/Engineer. O & M data shall include both manufactures prepared manuals, where appropriate, and approved shop drawings for finishes and MEP systems. Two sets of printed and an electronic version of O&Ms shall be provided. Printed copies shall be bound in a 3 ring binders;

2. Contractor 1 year written warranty, manufacturer's warranties and bonds;

3. Manufacturers Technical Representative Report;

4. Spare parts and materials extra stock;

5. Evidence of compliance with requirements of governmental agencies having jurisdiction including, but not necessarily limited to:

   a. Certificates of Inspection and Occupancy;

6. Certificates of Insurance for products and completed operations.

7. Evidence of payment and release of liens;

8. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.

D. Final adjustment of accounts:

1. Submit a final statement of accounting to the Architect/Engineer, showing all adjustments to the Contract Sum.

2. If so required, the Architect/Engineer will prepare a final Change Order showing adjustment to the Contract Sum which were not made previously by Change Orders.

1.04 INSTRUCTION

A. Instruct the Owner's personnel in proper operation and maintenance of systems, equipment, and similar items which were provided as part of the work.

END OF SECTION

SECTION 01710
CLEANING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Each Contractor shall, throughout the construction period, maintain the buildings and site in a standard of cleanliness as described in this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. In addition to standards described in this Section, comply with requirements for cleaning as described in pertinent other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Conduct daily inspection, and more often if necessary, to verify that requirements for cleanliness are being met.

B. In addition to standards described in this Section comply with pertinent requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Each Contractor shall provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

B. The Contractor shall pay for the cleanup and removal of debris accumulated at the end of each working day, including that which accumulates on the Owner's existing roads as a result of their use by construction traffic access to the site.

2.02 COMPATIBILITY

A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

PART 3 EXECUTION

3.01 PROGRESS CLEANING (BY EACH CONTRACTOR)

SECTION 01710
CLEANING

A. General; Each Contractor shall:

1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing protection of materials from weather.

2. Not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.

3. At least once a week, and more often if necessary, completely remove all scrap, debris, and waste material from the building and place in a dumpster.

4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pickup all scrap, debris, and waste material. Remove such items to the place designated for their storage.

2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service arrangements to meet the requirements of subparagraph 3.01-A-1 above.

3. Maintain the site in a neat and orderly condition at all times.

C. Structures:

1. Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.

2. Weekly, and more often if necessary, sweep interior spaces clean.

a. "Clean," for the purposes of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a hand-held broom.

3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

4. Protect existing finish floor materials, clean the finish floor daily (and more

often if necessary) at all times while work is being performed in the space in which finish materials are installed. Any damage caused by a Contractor shall be repaired or replaced by him as directed by the Architect/Engineer at no cost to the Owner.

a. "Clean," for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material which, in the opinion of the Architect/Engineer, may be injurious to the finish floor material.

3.02 FINAL CLEANING

A. "Clean," for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

B. Where surface treatment, washing or polishing is specified, the Contractor shall see that such areas are completed before occupancy by Owner.

C. Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Clean and wax all vinyl floors. Clean and seal all ceramic tile floors, vacuum carpeted areas, dust all surfaces and wash all glass surfaces.

D. Site:

1. Unless otherwise specifically directed by the Architect/Engineer, broom clean paved areas on the site and public paved areas adjacent to the site.

2. Completely remove resultant debris.

E. Structures:

1. Exterior:

a. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.

b. Remove all traces of splashed materials from adjacent surfaces.

c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.

d. In the event of stubborn stains not removable with water, the Architect/Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

F. Broom all exterior areas occupied by the Contractor during the course of the work.

G. Schedule final cleaning as approved by the Architect/Engineer to enable the Owner to accept a completely clean Project.

END OF SECTION

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included:

1. Throughout progress of the work, maintain an accurate record of changes in the Contract Documents, as described in Article 3.01 below.

2. Upon completion of the work, transfer the recorded changes to a single sheet of Record Documents, as described in Article 3.02 below.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Other requirements affecting Project Record Documents may appear in pertinent other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff. Record the work of all subcontractors on a single sheet.

B. Accuracy of records:

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other Documents where such entry is required to show the change properly.

2. Accuracy of records shall be such that future search for items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

C. Make entries within 24 hours after receipt of information that the change has occurred.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. The Architect/Engineer's approval of the current status of Project Record Documents may be a prerequisite to the Architect/Engineer's approval of requests for progress payment and request for final payment under the Contract.

C. Prior to submitting each request for progress payment, secure the Architect/Engineer's approval of the current status of the Project Record Documents.

D. Prior to submitting the request for final payment, submit the final Project Record Documents to the Architect/Engineer and secure his approval.

1.04 PRODUCT HANDLING

A. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

B. In the event of loss of recorded data, use means necessary to again secure the data to the Architect/Engineer's approval.

1. Such means shall include, if necessary in the opinion of the Architect/Engineer, removal and replacement of the concealing materials, at no cost to the Owner.

2. In such case, provide replacements to the standards originally required by the Contract Documents, at no cost to the Owner.

PART 2 PRODUCTS

2.01 RECORD DOCUMENTS

A. Job Set: Promptly following receipt of the Owner's Notice to Proceed, secure one complete set of all documents comprising the Contract.

PART 3 EXECUTION

3.01 MAINTENANCE OF JOB SET

A. Immediately upon receipt of the job set described in Paragraph 2.01-A above, identify each of the Documents with the title "RECORD DOCUMENTS - JOB SET."

B. Preservation:

1. Considering the contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set.

2. Do not use the job set for any purpose except entry of new data and for review by the Architect/Engineer.

C. Making entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required. Use a separate color for each trade.

2. Date all entries.

3. Call attention to the entry by a "cloud" drawn around the area(s) affected.

4. In the event of overlapping changes, use different colors for the overlapping changes.

D. Make entries in the pertinent other documents as approved by the Architect/Engineer.

3.02 FINAL PROJECT RECORD DOCUMENTS

A. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of the work to proceed without lengthy and expensive site measurement, investigation, and examination.

B. Transfer of data to other documents:

1. If the documents other than Drawings have been kept clean during progress of the work, and if entries thereon have been orderly to the approval of the Architect/Engineer, the job set of those Documents other than Drawings will be accepted as final Record Documents.

2. If any such document is not so approved by the Architect/Engineer, secure a new copy of that document from the Architect/Engineer at the Architect/Engineer's usual charge for reproduction and handling, and carefully transfer the change data to the new copy to the approval of the Architect/Engineer.

C. Review and submittal:

1. Submit the completed set of Project Record Documents to the Architect/Engineer as described in Paragraph 1.03-D above.

2. Participate in review meetings as required.

3. Make required changes and promptly deliver the final Project Record Documents to the Architect/Engineer.

3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility of recording changes in the work subsequent to final completion, except for change resulting from work performed under warranty.

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparation and submittal.

B. Time and schedule of submittals.

1.2 RELATED SECTIONS

A. Invitation to Bid.

B. General Conditions, Form of Agreement, Performance Bond and Labor and Material Payment Bonds, Warranty and Correction of Work.

C. Section 01700 - Contract Closeout: Contract closeout procedures.

D. Individual Specifications Sections: Warranties required for specific Products of Work.

1.3 FORM OF SUBMITTALS

A. Bind in commercial quality, 8-1/2 x 11 inch three-ring side binders with hardback, cleanable, plastic covers.

B. Label cover of each binder with type or printed title WARRANTIES AND BONDS, with title of project, name, address and telephone number of Contractor and equipment supplier and name of responsible principal.

C. Table of Contents: Neatly type, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of the product or work item.

D. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate type sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address and telephone number of responsible principal.

1.4 PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item or work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty blank until the Date of Substantial Completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

1.5 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

B. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.

C. For items of Work when acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01800
POTENTIAL ENVIRONMENTAL CONCERNS

PART 1 GENERAL

1.01 DESCRIPTION

A. Based on the anticipated scope of work, several potential environmental hazards have been identified within the project areas. Environmental hazards identified include asbestos and the potential for lead containing paint and other hazardous building materials. The Contractor and all Sub-contractors are responsible for conducting activities on the project site in accordance with all applicable environmental, health and safety regulations.

1.02 LEAD

A. Project Implementation - Painted surfaces throughout the project area are assumed to contain lead paint based on their date of construction (prior to 1978). During construction activities, specifically core drilling activities, lead exposure risks may be present. Typical routes of lead exposure include inhalation, ingestion, and adsorption. Appropriate work practices, employee training, and personal protective equipment shall be utilized by the Contractor.

1. The Contractor shall control lead dust inside and outside of the work area to less than 30µg/m^3 at all times, and shall perform sufficient monitoring to confirm that this level of control is maintained. Contractor shall provide copies of monitoring results to Owner.

2. In accordance with the “Lead Exposure in Construction Standard,” Part 603 of R325.51997 of the Michigan Administrative Code, the Contractor is required to conduct an Initial Exposure Assessment to determine of concentrations if airborne lead exceed the Action Level of 30µg/m^3.

3. The Contractor shall make every attempt to keep occupational exposure to lead on this project below the action level of 30µg/m^3 defined in 29 CFR 1926 (.62). If it is not possible, and if occupational exposures could possibly exceed the action level for 30 or more days per year, the Contractor shall institute a medical surveillance program. The program shall meet the examination frequency and content requirements specified in paragraph (j)(1), (j)(2), and (j) (3) of 29 CFR 1926 (.62). Medical removal as specified in paragraph (k) of 29 CFR 1926 (.62), if necessary, shall be at the Contractor’s expense.

B. Occupational Exposure Assessment - Sampling and analytical procedures to determine compliance with the occupational exposure monitoring requirements of this section shall be described in the lead hazard control plan appendix of the Contractor’s *Accident Prevention Plan*. Monitoring for the initial determination may be omitted if the Contractor has sufficient proof from previous operations as specified in 29 CFR 1926 (.62) (d) (3) (iii) and (iv) that workers will not be exposed over the Action Level. The following occupational exposure monitoring

requirements apply and shall be implemented if the requirements of 29 CFR 1926 (.62) (d) (3) (iii) and (iv) cannot be demonstrated.

1. During Initial Monitoring the Contractor shall representatively sample employees with the greatest potential for exposure to aerosolized lead.
2. Continued/Additional Monitoring shall meet applicable paragraphs in 29 CFR 1926 (.62) (d) (6), Frequency, after the initial determination has been made.

1.03 Hazardous Materials

Suspect lead containing materials; mercury containing lamps, thermostats, and equipment gauges; polychlorinated bi-phenyl (PCB) containing light ballasts, transformers, and capacitors; fire/smoke detectors containing radio active sources, and other hazardous materials identified in the *Hazardous Building Evaluation* conducted by U.P. Engineers & Architects, Inc. in the Appendix shall be segregated during project implementation and staged in an appropriate manner preventing potential contamination of the staging area.

1. Waste Management - The Contractor has sole responsibility for gaining acceptance for disposal of any lead containing debris generated during construction activities. This includes debris sampling and analyses to satisfy Marquette County Solid Waste Management Authority *Waste Acceptance Criteria* for debris disposal. It is the Contractors responsibility to cover the cost of all required sampling and analysis of debris slated for disposal as part of its Bid.

1.04 ASBESTOS

A. Asbestos containing building materials were present in buildings included in the demolition project. The Owner will manage asbestos containing material abatement under a separate contract. If during the course of demolition activities suspect asbestos containing materials are encountered, halt all demolition activities and notify the owner who will address the asbestos materials.

B. The Contractor is responsible for complying with all requirements regulating work conducted in an area potentially containing asbestos. This includes providing all employees and Subcontractors with appropriate hazard awareness training as required in Michigan Occupational Health Standards for Construction Chapter VI, Part VI—General Workplace Requirements, Rule 6601 General Requirements Section (1) Part (b).

NORTHERN MICHIGAN UNIVERSITY

STATEMENT OF NON-INCLUSION OF ASBESTOS CONTAINING MATERIAL

STATE OF MICHIGAN
COUNTY OF MARQUETTE

ENGINEER/ARCHITECT AFTER DESIGN

"My name is _____, hereinafter known as Authorized Representative.

I am the _____ of _____ hereinafter known as ENGINEER/ARCHITECT.

"I am fully competent to make this statement. I have personal knowledge of the facts set forth below and they are all true and correct.

"WHEREAS ENGINEER/ARCHITECT has been selected to provide designs, to prepare the bid and construction documents, and to assist

Northern Michigan University, hereinafter known as OWNER, during the construction of _____

_____, located at _____

_____ Marquette, MI,

hereinafter known as Project, and

"WHEREAS asbestos in a dust form is a recognized health hazard, and

"WHEREAS the OWNER desires not to have any asbestos containing materials used or incorporated into the construction of the Project;

"THEREFORE the ENGINEER/ARCHITECT affirms that to the best of its knowledge and belief:

1. The ENGINEER/ARCHITECT, any person, firm or organization representing or represented by the ENGINEER/ARCHITECT, shall not knowingly specify, request, or approve for use in conjunction with the Project, any asbestos containing materials or any other materials defined as containing asbestos by any laws, rules or regulations promulgated by the United States Government, the State of Michigan or any governmental organization or agency operating under the authority of either of those entities.

. The ENGINEER/ARCHITECT states its understanding that if any asbestos containing materials not approved by the OWNER for inclusion into the Project, are determined, as a result of any inspection and sample analysis performed by an individual(s) and/or firm(s) certified and/or licensed to perform such inspection by the United States Government and/or the State of Michigan, to have been specified, requested and/or approved by the ENGINEER/ARCHITECT for inclusion in the Project, the OWNER shall look to the ENGINEER/ARCHITECT for reimbursement of any and all costs incurred in the removal and/or other abatement of said asbestos containing materials.

. ENGINEER/ARCHITECT further understands that OWNER shall also look to the ENGINEER/ARCHITECT for any and all damages to OWNER which result from the inability of the OWNER to use any portion or all of the Project due to the incorporation of asbestos containing materials that have been specified, requested and/or approved by the ENGINEER/ARCHITECT.

. ENGINEER/ARCHITECT further understands that OWNER will pursue reimbursement of any said cost and compensation for any said damages from the ENGINEER/ARCHITECT by any and every means within OWNER's right and power.

Signature of Authorized Representative: _____

STATE OF MICHIGAN
COUNTY OF MARQUETTE

ON _____, 20___, personally appeared _____

_____ and been duly sworn by me, subscribed to the foregoing statement and has stated that the facts stated therein are true and correct.

Notary Public, State of Michigan _____

Printed Name of Notary _____

My Commission Expires: _____

01605B/110392

NORTHERN MICHIGAN UNIVERSITY

STATEMENT OF NON-INCLUSION OF ASBESTOS CONTAINING MATERIAL

STATE OF MICHIGAN
COUNTY OF MARQUETTE

GENERAL CONTRACTOR AFTER CONSTRUCTION

"My name is _____, hereinafter known as Authorized Representative.

I am the _____ of _____ hereinafter known as GENERAL CONTRACTOR.

"I am fully competent to make this statement. I have personal knowledge of the facts set forth below and they are all true and correct.

"WHEREAS GENERAL CONTRACTOR has been selected to provide labor and all materials for construction, and to assist

Northern Michigan University, hereinafter known as OWNER, during the construction of _____

_____, located at

_____ Marquette, MI, hereinafter known as Project, and

"WHEREAS asbestos in a dust form is a recognized health hazard, and

"WHEREAS the OWNER desires not to have any asbestos containing materials used or incorporated into the construction of the Project;

"THEREFORE the GENERAL CONTRACTOR affirms that to the best of its knowledge and belief:

1. The GENERAL CONTRACTOR, any person, firm or organization representing or represented by the GENERAL CONTRACTOR, shall not knowingly specify, request, or utilize in conjunction with the Project, any asbestos containing materials or any other materials defined as containing asbestos by any laws, rules or regulations promulgated by the United States Government, the State of Michigan or any governmental organization or agency operating under the authority of either of those entities.
2. The GENERAL CONTRACTOR states its understanding that if any asbestos containing materials not approved by the OWNER for inclusion into the Project, are determined, as a result of any inspection and sample analysis performed by an individual(s) and/or firm(s) certified and/or licensed to perform such inspection by the United States Government and/or the State of Michigan, to have been specified, requested and/or approved by the GENERAL CONTRACTOR for inclusion in the Project, the OWNER shall look to the GENERAL CONTRACTOR for reimbursement of any and all costs incurred in the removal and/or other abatement of said asbestos containing materials.
3. GENERAL CONTRACTOR further understands that OWNER shall also look to the GENERAL CONTRACTOR for any and all damages to OWNER which result from the inability of the OWNER to use any portion or all of the Project due to the incorporation of asbestos containing materials that have been specified, requested, installed and/or approved by the GENERAL CONTRACTOR.
4. GENERAL CONTRACTOR further understands that OWNER will pursue reimbursement of any said cost and compensation for any said damages from the GENERAL CONTRACTOR by any and every means within OWNER's right and power.

Signature of Authorized Representative: _____

STATE OF MICHIGAN
COUNTY OF MARQUETTE

ON _____, 20___, personally appeared _____

_____ and been duly sworn by me, subscribed to the foregoing statement and has stated that the facts stated therein are true and correct.

Notary Public, State of Michigan _____

Printed Name of Notary _____

My Commission Expires: _____

01605B/110392

SECTION 01900
PROHIBITION OF ASBESTOS CONTAINING MATERIALS

ARTICLE 1 - GENERAL

1.1 RELATED DOCUMENTS

The following documents are a part of this section:

All documents in Bidding Requirements, Contract Forms and Conditions of the Contract.

Other sections of Division 1 - General Requirements apply to this section.

1.2 DESCRIPTION AND INTENT OF THE WORK

No asbestos containing material (ACM) shall be brought onto the Project site, and/or incorporated into the Project construction without the written consent of the OWNER. Any asbestos containing material found at any time including after contract completion, to have been brought onto the site or incorporated into the Project construction by the CONTRACTOR, or any Subcontractors, Sub-Subcontractors or Suppliers, shall be removed and disposed of in accordance with the then current governmental regulatory standards.

All costs associated with the inspection, sampling, testing, removal and disposal of ACM as described above shall be paid by the CONTRACTOR.

1.3 DEFINITIONS

ASBESTOS: The asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite) cummingtonite-grunerite (amosite), anthophyllite, actinolite and tremolite.

ASBESTOS CONTAINING MATERIAL (ACM): Any material containing more than one percent (1%) by weight of asbestos of any type or mixture of types.

ASBESTOS CONTAINING BUILDING MATERIAL (ACBM): Any material used in the construction of, or incorporated into the construction of, any building that contains more than one percent (1%) by weight of asbestos of any type or mixture of types.

The A/E has been instructed to not permit any asbestos containing materials to be specified, requested or approved for use in conjunction with this Project.

1.4 QUALITY ASSURANCE

PROHIBITION OF ASBESTOS CONTAINING MATERIALS

The E/A has signed the following:

A. Statement of Non-Inclusion of Asbestos Containing Material (Engineer/Architect, After Design): stating that E/A has not specified, requested or approved any ACM in this Project without the prior written approval of the OWNER, and that any ACM allowed in this Project is identified in the Statements.

A Copy of this Statement is attached at the end of this section.

ASBESTOS CONTAINING MATERIALS PROHIBITED FROM SITE

No asbestos containing materials will be permitted as part of the Project construction. The following list is intended to be used as a general guide to show which types of materials are suspected to contain asbestos:

- Cement Pipes
- Cement Wallboard
- Cement Siding
- Asphalt Floor Tile
- Vinyl Floor Tile
- Vinyl Sheet Flooring
- Flooring Backing
- Construction Mastics (floor tile, carpet, ceiling tile, etc.)
- Acoustical Plaster
- Decorative Plaster
- Textured Paintings/Coatings
- Ceiling Tiles and Lay-in Panels
- Spray-Applied Insulation
- Blown-in Insulation
- Fireproofing Materials
- Taping Compounds (thermal)
- Packing Materials (for wall/floor penetrations)
- High Temperature Gaskets
- Laboratory Gloves
- Fire Blankets
- Fire Curtains
- Elevator Equipment Panels
- Elevator Brake Shoes
- HVAC Duct Insulation
- Boiler Insulation
- Breeching Insulation
- Ductwork Flexible Fabric Connections
- Cooling Towers
- Pipe Insulation (corrugated air-cell, block, etc.)
- Heating and Electrical Ducts
- Electrical Panel Partitions
- Electric Cloth
- Electric Wiring Insulation
- Chalkboards
- Roofing Shingles
- Roofing Felt
- Roof Coatings
- Base Flashing
- Thermal Paper Products
- Fire Doors
- Caulking/Putties
- Adhesives
- Wallboard
- Joint Compounds
- Spackling Compounds

If any of these suspect materials are specified for use on the Project, and if they do not have specific labeling identifying them as asbestos free, then the CONTRACTOR shall notify the OWNER immediately. Laboratory analysis of the material by an OWNER-approved laboratory shall be performed at CONTRACTOR's expense in order to warrant that the material does not contain asbestos. A copy of the package labeling or results of laboratory testing must be provided to the OWNER prior to inclusion of the specified material during construction.

1.5 SUBMITTALS

NON-USE OF ASBESTOS AFFIDAVIT

At the time of Substantial Completion, the CONTRACTOR will provide to the OWNER a Non-Use of Asbestos Affidavit (Contractor after Construction, Form 01605B). This Affidavit certifies that the CONTRACTOR did not allow asbestos containing materials to be incorporated into the construction or allowed any asbestos containing building materials on the site for which the OWNER of the Project did not give prior written approval.

Final payment and/or retainage reduction may be withheld until the above described Affidavit and/or information are received and approved.

SECTION 02070
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Remove designated building equipment.
B. Partial demolition and removal of structures.
C. Disconnecting, capping or sealing, and abandoning utilities in place.
D. Disconnecting, capping or sealing, and removing utilities.
E. Hazardous material removal, Appendix ‘A’.
F. Remove designated components.
G. Disposal of demolished materials as identified in the scope of work and plan set.
H. Submit the required notification with the Department of Environmental Quality (DEQ) see Appendix ‘A’.
I. DEQ Guidelines – Demolition Projects – Appendix ‘B’.

1.2 RELATED WORK

A. Section 01010 - Summary of Work.
B. Section 01700 - Contract Close-Out: Construction Cleanup.
C. Other technical sections of the project manual.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
B. Remove and Salvage: Items indicated to be removed and salvaged and to remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.
C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.
B. Historical items indicated remain the Owner's property. Carefully remove and salvage each item in a manner to prevent damage and deliver promptly to the Owner.
C. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered during selective demolition,

remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.
B. Schedule of selective demolition activities indicating the following:

0. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
1. Interruption of utility services.
2. Coordination for shutoff, capping, and continuation of utility services.
3. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
5. Locations of temporary partitions and means of egress.

C. Inventory of items to be removed and salvaged.
D. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.
E. Record drawings at Project closeout according to Division 1.

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

F. Landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.
B. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
C. Pre-demolition Conference: Conduct conference at Project site to comply with pre-installation conference requirements of Division 1.

1.7 PROJECT CONDITIONS

A. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
B. Storage or sale of removed items or materials on-site will not be permitted.

1.8 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.
B. Submit Notification of Intent to Renovate/Demolish a minimum of 10 working days prior to starting any work. A form is included herein for use by the contractor.

1.9 WARRANTY

A. Existing Special Warranty: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.
B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.
E. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.
F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to

Owner and to governing authorities.

a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

C. Utility Requirements: Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

A. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.

3.4 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.5 SELECTIVE DEMOLITION

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

1. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
2. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Break up and remove concrete slabs on grade, unless otherwise shown to remain.

3.6 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.
B. Patching is specified in Division 1.
C. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

D. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
B. Burning: Do not burn demolished materials.
C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Remove and/or remove and salvage items as indicated in the drawing set or further identified in the technical portions of the project manual.

END OF SECTION

SECTION 13 18 11 – ICE RINK GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality assurance - prequalification criteria.

B. General description of ice system requirements including ice rink floor, refrigeration system, and waste heat recovery systems.

C. Reinspection.

D. Submittal and project closeout requirements.

E. Electrical requirements.

F. General concrete requirements.

G. Floor drain containment systems.

H. Start-up and shutdown procedures.

I. Demolition work.

J. Emergency Preparedness Planning Assistance (ammonia systems).

1.2 QUALITY ASSURANCE

A. Contractors wishing to bid/quote on this project must submit, with their bid, the following prequalification criteria.

To demonstrate the qualifications to perform the Work, the Ice Rink Contractor shall submit the information requested below with their Bid. Ice Rink Contractor is defined as the contractor responsible for completing all Division 13 work and all work shown on the “R” drawings. Subcontractors performing the work identified below shall also meet the qualifications. Qualification document submitted by the low bidder will be evaluated after the bid opening to determine if the Ice Rink Contractor meets these qualifications.

1. As evidence and assurance of the contractor’s ability to construct the project and support the Owner’s system with service the contractor installing and constructing the primary and secondary refrigeration systems must have successfully installed and constructed **ammonia stick built or built on site refrigeration systems** and ice rink floors for seven (7) ice rink construction projects that are similar to this project and completed within the past five (5) years. Submit information on each project. Submittal shall be on company letterhead, signed by an authorized representative of the company and include project description, portion of project completed by the company, location, construction cost, completion date, owner's name, owner's representative, phone number and completion date of work.

2. As evidence and assurance of the contractor’s concrete subcontractor’s ability to construct the project the contractor placing and finishing the concrete must have successfully completed the placement and finishing of concrete on eight (8) concrete ice rink floor construction projects within the past five (5) years. Submit information on each project. Submittal shall be on company

letterhead, signed by an authorized representative of the company and include project description, portion of project completed by the company, location, construction cost, completion date, owner's name, owner's representative, phone number and completion date of work.

3. As evidence and assurance of the contractor's controls subcontractor's ability to construct the project the control subcontractor must have successfully completed the programming and installation of two (2) ice rink construction projects that are similar to this project that were completed within the past five (5) years. Submit information on each project. Submittal shall be on company letterhead, signed by an authorized representative of the company and include project description, portion of project completed by the company, location, construction cost, completion date, owner's name, owner's representative, phone number and completion date of work.

4. As evidence and assurance of the contractor's expansion joint subcontractor's ability to construct the project the ice rink floor expansion joint subcontractor must have successfully completed twenty (20) construction projects that use the same type of joint. Submit information on each project. Submittal shall be on company letterhead, signed by an authorized representative of the company and include project description, portion of project completed by the company, location, construction cost, completion date, owner's name, owner's representative, phone number and completion date of work.

5. Submit the name of at least one (1) person employed by the company that will supervisor the fusion welding process along with their certifications, training and qualifications for performing the fusion welding process for high density polyethylene pipe (HDPE).

B. Contractors wishing to bid on this project shall perform an on-site investigation prior to submitting a bid for the project. Contractor shall field verify all equipment and materials that will be affected by the work of this project and report any concerns to the Engineer at least ten (10) business days prior to the bid opening date.

1.3 GENERAL PROJECT DESCRIPTION

A. The following is a general description of the project and may not include all materials and labor required or covered elsewhere in the contract documents.

1. Furnish and install a complete ice system including refrigeration system, ice rink floor, and waste heat recovery systems for sub-floor heating and snow melting.
2. Furnish and install an indirect refrigeration system including equipment, piping, insulation, valves, refrigerant, glycol, gas monitoring system, controls, motor control center, electrical, accessories and all other necessary materials and labor required for a complete operating system.
3. Furnish and install a concrete ice rink floor including floor insulation, vapor barrier, pipe supports, piping, reinforcement, concrete, expansion joint, accessories and all other necessary materials and labors required for a complete operating system.
4. Furnish and install waste heat recovery systems for sub-floor heating and snow melting including sand, piping, coil for pit, heat exchanger, pumps, valves, glycol, controls, electrical, accessories and all other necessary materials and labor required for complete operating systems.
5. Schedule and pay for all testing and start up services required by the contract documents pertaining to the ice system.

1.4 REINSPECTION

A. In addition to the Engineer's standard site visits throughout the project, the Engineer will be on-site at the end of the project to generate a list of uncompleted, or unsatisfactorily completed items, (i.e., punch list) after the project is reported complete by the Contractor and prior to the project's required completion date. If the items are not satisfactorily completed and should additional site visits be required to follow up on uncompleted items, the Engineer shall be compensated at the typically hourly rate for each person involved in the re-inspection. The Contractor will be back charged the amount of the additional inspections.

1.5 RELATED SECTIONS

A. Division 0, Division 1, General and Supplementary Conditions.

B. Section 131812 - Ice Rink Refrigeration System.

C. Section 131813 - Ice Rink Floor System.

D. Section 131814 - Ice Rink Piping, Valves and Accessories.

E. Section 131815 - Ice Rink Waste Heat Recovery Systems.

F. Section 131817 – Ice Rink Central Control System.

1.6 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 305 - Hot Weather Concreting.

C. ACI 306 - Cold Weather Concreting.

D. ACI 309 - Recommended Practices for Consolidation of Concrete.

E. ASHRAE/ANSI - 15 Safety Code for Mechanical Refrigeration.

F. ASME B31.5 - Refrigeration Pressure Piping Code.

G. IEEE Standard 112 - Standard Test Procedure for Polyphase Induction Motors and Generators (Method B).

H. NECA - Standard of Installation.

I. NEMA ICS2 - Industrial Control Devices, Controllers and Assemblies.

J. NEMA -MG - Motor and Generators.

K. NEMA TC2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

L. NEMA-WC5 - Thermoplastic Insulated Wire and Cable.

M. NEMA -WC7 - Cross Linked Thermosetting Poly Insulated Wire and Cable.

N. NEMA 250 - Enclosures for Electrical Equipment.

O. NFPA 70 - National Electrical Code.

P. UL-83 - Thermoplastic - Insulated Wires and Cables.

Q. UL 360 - Liquid-Tight Flexible Steel Conduit.

R. UL 508 - Industrial Control Equipment.

S. UL 651 - Schedule 40 and 80 PVC Conduit.

T. UL 797 - Electrical Metallic Tubing.

U. UL 810 – Capacitors.

V. UL 845 - Control Panels.

W. International Fire Code.

X. International Building Code.

Y. International Mechanical Code.

1.7 CODES AND STANDARDS

A. All parts of the project shall be performed in accordance with the most recent version of the following codes and standards and all amendments:

1. State Building Codes.
2. State Electrical Codes.
3. State Mechanical Codes.
4. National Fire Protection Association Codes.
5. ANSI/ASHRAE 15 -Safety Code for Mechanical Refrigeration.
6. ASHRAE 34-Number Designations and Safety Classification of Refrigerants .
7. OSHA.
8. American Standard Code for Pressure Piping ASA B31.1.
9. American Standard Code for Refrigeration Piping ASA B31.
10. American Standard Code for Pressure Vessels.
11. ANSI/IIAR Standard.

1.8 SUBMITTALS

A. See General Conditions, Division 0 and additional requirements below.

B. The Contractor's approval stamp is required on all submittals and indicates that the Contractor has reviewed all materials and has a completed understanding of the specifications and requirements. Contractor shall clearly mark all deviations from the contract documents on all submittals.

C. Progress Schedule. Submit progress schedule before project begins.

D. Shop Drawings. All submittals shall conform to the requirements the General Conditions and these specifications.

E. Test Reports. Submit one (1) electronic copy of test reports to the Engineer when specified.

F. Certifications. Submit one (1) electronic copy of certifications to the Engineer when specified.

G. Operation and Maintenance Manuals.

1. Submit one (1) electronic copy for initial review. After reviewed by the Engineer and all changes are made, submit one (1) final electronic copy and two (2) final printed copies for the Owners use.
2. Prepare manuals, instructions and data by personnel experienced in maintenance and operation of described products.
3. Prepare data in form of an instructional manual.

4. Binders: Commercial quality, 8 ½ x 11-inch text pages, three D size, 3 ring binders with durable plastic covers, 2-inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
5. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
6. Sheets: Printed sheets in Part 1 shall have page protectors for each sheet. Printed sheets at the start and end of each additional section of the manual shall have page protectors.
7. Drawings: Provide with reinforced edges.
8. Manual covers to have printed title “OPERATION AND MAINTENANCE INSTRUCTIONS”, title of project, and subject matter of manual when multiple manuals are required.
9. Contents of Manuals:

    a. Table of Contents: Provide for each volume with each product or system identified, typed on white paper.

    b. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, subcontractors, and major equipment suppliers for each product or system.

    c. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

        1) Provide logical sequence of instructions for each procedure, incorporating manufacturer’s instructions.

        2) Description of each unit, equipment or system.

        3) Significant design criteria, normal operating characteristics and limiting conditions for each equipment and system. Include performance curves, engineering data and tests.

        4) Operating Procedures: Include start-up, break-in, routine normal operating instructions, sequences, and shutdown of the system including, but not limited to, system checks, controls, stopping, valve number references, typical fluid levels in all vessels, emergency instructions, etc. Include winter, summer, and any other special operating instructions.

        5) Start-up and shut-down procedure description including a step by step written description of how to start up and shutdown the system including, but not limited to, system checks, safety device checks, valves number references, typical levels in vessels, etc.

        6) Instructions of care and maintenance instructions for equipment and systems including, but not limited to, manufacturer’s recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

        7) Maintenance Requirements: Include routine maintenance procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

        8) Detailed description of control system including a step-by-step written description of how to operate the control system. See Section 131817 - Ice Rink Control System for additional requirements.

        9) List of equipment.

        10) Parts list for each component.

        11) Valve list that includes valve number, description, manufacturer, operation (normal closed or open, etc.). Provide schematic drawing of refrigeration system that shows locations of each valve.

        12) Servicing and lubrication schedule, list of lubricants required.

        13) Troubleshooting information.

    d. Part 3: Project documents and certificates, including the following:

        1) Approved shop drawings and product data.

2) Manufacturer's printed operation and maintenance instructions.

3) Detailed wiring diagrams of all electrical and control systems and all other electrical and control information.

4) Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

5) Air and water balance reports.

6) Test records

   a) Material and fluid tests for concrete, sand, glycol, CaCl2, etc.

   b) Pipe pressure tests for refrigeration system piping, rink floor piping, and transmission mains.

7) Certifications of inspections by regulatory agencies.

8) Warranties. Including project warranty and all equipment and material warranties.

9) Maintenance Drawings – Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

10) Record Drawings including pipe routing, joint locations on all underground transmission mains, wiring diagrams, equipment layout, valve locations, etc. Reduce to half size and insert into back of manual

11) Training and reporting forms.

   a) Provide daily checklist form for recording operation of refrigeration system.

1.9 WARRANTY/GUARANTY

A. In addition to the standard manufacturer's warranty on all equipment and materials, the contractor shall provide a standard one-year materials and labor warranty on all work performed for this project.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

A. Transport, handle, store and protect products in accordance with manufacturer's recommendations. Secure products at all times.

B. Store products with seals and labels intact and legible.

C. Store products in a secure environment at all times.

D. Provide adequate labor to handle products and prevent damage.

E. All damaged materials and equipment will be rejected.

PART 2 - PRODUCTS

2.1 ELECTRICAL

A. See requirements in Section 131812 - Ice Rink Refrigeration Systems.

2.2 GENERAL CONCRETE REQUIREMENTS

A. This section refers to all concrete work outside the ice rink floor unless otherwise noted. For concrete ice rink floor see Section 131813 - Ice Rink Floor.

B. Concrete Mix:

1. Submit mix design fourteen (14) business days prior to placement.
2. Concrete shall be produced by a Ready-Mix Plant approved by the Engineer. Concrete shall meet the requirement of ASTM C94 - Standard Specifications for Ready Mix Concrete.
3. Mix Design Requirements

Minimum 28-day compressive strength	4000 psi
Coarse aggregate size	3/4 inch to #44 (ASTM C33 No. 67)
Maximum water to cement ratio	0.45
Maximum pozzolan content	25% of cement content
Minimum cement plus pozzolan content	564 lbs/cy
Slump	3 inches +/- 1 inch
Entrained air content	6% +/- 1.5%

C. Material Requirements

1. Cement: Shall meet ASTM C150, Type 1
2. Aggregates: Shall meet ASTM C33
3. Water: Shall be clean, potable water.
4. Admixtures:
   a. Air Entrainment: Shall meet ASTM C260
   b. Water Reducing Agent: Shall meet ASTM C494, Type A
   c. Fly Ash: Shall meet ASTM C618 class C or F.

D. Reinforcement and Formwork

1. Formwork shall meet ACI 347 - Recommended Practice for Concrete Formwork.
2. Reinforcement shall be tagged and conform to ASTM A615 Grade 60. Installation shall meet ACI 315.
3. Tire wire: Shall be 16-gauge black annealed wire or heavier.

E. Related General Materials

1. Polyethylene Sheeting: Shall conform to ASTM C171.
2. Finishing Compound: Thoroseal by Thoro System Products or equal.
3. Expansion Joint: Bituminous fiber type meeting ASTM D1751.
4. Joint Sealant: Two part - self leveling, polyurethane sealant. MasterSeal SL2 by BASF or equal.
5. Anchor Adhesive: For anchoring dowels. Hilti HIT Doweling Adhesive C-100 by Hilti Fastening Systems, Powers Pure 110+, or equal.

2.3 FLOOR DRAIN CONTAINMENT SYSTEMS

A. Floor Drain Covers

1. Approved manufacturers: CPLabSafety (California Small Business #58199) or equal.

2. Provide one Drain Seal product for each of the floor drains in the ammonia refrigeration room.
3. Size: shall be 6” larger than the outside of the drain grate or as required by the manufacturer.
4. Material: The Drain Seal system shall be water-tight, Ultra-Tech flexible, 2-hour rated, non-absorbing urethane material, shall resist oil and ammonia, and maid with reinforced and tear resistant mesh. System shall seal using either side of material the material.
5. Color: orange

PART 3 - EXECUTION

3.1 CONSTRUCTION UTILITIES AND FACILITIES

A. Unless specified elsewhere, all temporary utilities and facilities required to complete the project shall be the responsibility of the contractor and costs for these utilities and facilities shall be incidental to the project costs.

3.2 INSPECTION

A. The Contractor shall notify the Engineer a minimum of seven (7) business days prior to the following phases of the work:

1. Completion of subgrade preparation.
2. Start of sub-floor heating system piping.
3. Completion of transmission main installation
4. Start of floor insulation.
5. Completion of floor insulation.
6. Start of rink piping and header piping.
7. Completion of rink piping and header piping.
8. Final flushing of all piping systems.
9. Start of concrete placement.
10. Start of refrigeration piping insulation installation.
11. Start and completion of all pressure tests.
12. Start up and Training

B. See Section 1.04 of this section for requirements regarding re-inspection of uncompleted or unsatisfactorily completed items.

3.3 DEMOLITION

A. The Contractor is responsible for all demolition and disposal of the entire existing ice system (and all related piping, valves, supports, electrical, control systems) including but not limited to the following:

1. Ice rink floor.
2. Refrigeration system.
3. Waste heat recovery systems.
4. Other related systems or areas as noted on the Drawings.

B. The following items shall be salvaged, protected and stored:

1. None.

C. Drain fluids from all systems prior to starting demolition.

1. Primary refrigerant.

a. The reclamation and recovery of all refrigerants must meet the requirements outlined in Section 608 of the Clean Air Act of 1990. Contractors who recover systems containing refrigerant are required to carry a Pollution Liability Insurance Policy. The following project documentation is required. Copies of the documentation shall be submitted to the Owner.

1) Approved reclamation contractors include Rapid Recovery (952.297.2011), Reclamation Technologies (763.785.0686), or equal.
2) Recovery technicians EPA certification
3) Recovery equipment certification
4) Date of service
5) Location of service (site name & address)
6) Make, model and serial number of systems
7) Type and quantity of refrigerant
8) Comments or concerns about condition of existing system or parts of systems.
9) Signed certificate of abatement certifying the following:
10) An EPA certified technician was used to perform the service and complete EPA documentation as required by the EPA - Clean Air Act.
11) EPA Certified and ARI Certified equipment was used to recover the refrigerant.
12) The systems were recovered to EPA required levels.
13) Recovered refrigerants were transported to an EPA certified reclamation facility.

b. Dispose of all refrigerants off-site in accordance with all local, state and federal codes.

2. Secondary refrigerant solutions.

a. Remove all fluids in ice rink floor, refrigeration system, waste heat recovery systems, headers, transmission mains and all related piping systems and equipment. Dispose of in accordance with all local and state codes.

D. Disconnect all electrical systems prior to starting demolition. Coordinate utility service outages with the Owner, Engineer and utility company since the main facility may still be in use. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations. In particular, all security and safety systems must be maintained in operation at all times as required by the Owner and local officials. This includes security and safety lighting.

E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Cut all buried piping, that is indicated to be abandoned, flush with finished floor unless otherwise noted. Fill all buried piping indicated to abandon in place with flowable grout. Finish floor to match existing adjacent floors.

G. Remove and dispose of existing two concrete ice rink floors, piping, supports, transmission mains, insulation, vapor barrier, expansions joints and all associated materials. Remove and dispose of all materials off-site.

H. Contractor shall saw cut all concrete full depth to the size specified using water to minimize dust. Remove and dispose of concrete off site. Care shall be taken by the Contractor not to damage perimeter or adjacent concrete where indicated to remain.

I. Excavate sub-soils as require for installation of new systems. Remove and dispose of all existing sub-soil heating system piping, headers, mains and all related materials. Stockpile soils outside at the designated area. Re-use soils where approved placing within 0.05’ of specified or required elevation. All extra material shall be removed and disposed of off-site.

J. All mechanical equipment, piping, valves, electrical systems and other items related to the refrigeration or ice system resulting from required demolition shall be removed and disposed of off-site by the unless specifically designated to be salvaged.

K. All disposals shall occur off-site and shall be performed in accordance with applicable authorities having jurisdiction.

L. PROTECTION: The Contractor shall be responsible for covering all electrical systems, control systems, sensitive equipment, scoreboards, bleacher system, doorways, HVAC intakes, and other areas adjacent to areas where demolition will take place with polyethylene sheeting prior to the start of demolition.

M. VENTILATION: The Contractor shall be responsible for providing proper ventilation in the arena during construction of the project and to prevent unwanted vapors or odors from reaching other parts of the facility.

3.4 CLEANING, PAINTING AND RESTORATION

A. Contractor shall be responsible for cleaning the immediate construction area including the rink floor, perimeter concrete where work or demolition is conducted and the mechanical rooms where work is being performed.

B. Patch and paint all holes caused or left by construction and demolition work. Match adjacent textures and colors.

C. Clean all equipment and piping to original condition after project has been completed.

D. Touch up all equipment paint, using paint provided by the manufacturer, after the installation is complete.

E. All piping, valves, and other items related to the ice system resulting from required demolition shall be removed and disposed of off-site by the contractor unless specifically designated to be salvaged.

F. Clean out snow melt pit.

3.5 CONCRETE WORK

A. Reinforcement shall be installed with a minimum of 2" of cover. Adequately support reinforcement with concrete blocks or wire/plastic chairs. Splices shall be installed with minimum lapping distances shown on the plans and bars wired tightly together.

B. Concrete Placement: shall conform to ACI 309 - Consolidation, ACI 306 - Cold Weather Placement, ACI 307 - Hot Weather Placement.

C. All new concrete adjacent to the ice rink floor shall be placed at the same tolerance as specified for the ice rink floor and shall use the same benchmark, unless otherwise noted.

D. Finishing: Apply float finish and uniform textured surface to all interior slabs. Apply broom finish to exterior slabs. Edge or chamfered the edge of all concrete that is adjacent an expansion or construction joint.

E. Joints: Install control and construction joints as follows unless otherwise stated elsewhere:

1. Install control joints every 10 feet o.c. in each direction.
2. Install construction joints with expansion material and caulk at any new cold joints.

F. Curing: Cover with burlap-polyethylene and damp cure for a minimum of 7 days.

G. Testing: Contractor shall hire a testing agency to perform the following tests and shall pay for all testing and laboratory costs. Tests shall include air content (ASTM C 231), slump (ASTM C143) and compressive strength (ASTM C31, C39) for all concrete placed. Three (3) copies of the results shall be submitted to the Engineer.

3.6 START-UP AND FOLLOW UP SERVICES

A. The refrigeration system shall not be started until all local and state governing authorities have inspected and provided written approval for all systems related to, and including the refrigeration, piping, controls, ventilation, ice equipment room and building and all other related systems; and all alarms and controls have been thoroughly tested for all conditions and modes of operations.

B. Provide documentation of all piping pressures tests and vacuum tests on systems. All tests shall be witnessed by Owner or Owner's representatives.

C. After all piping systems have been tested according to the specifications and current codes and have been thoroughly cleaned, fill all piping systems with a complete charge of the specified primary and secondary refrigerants. Remove all free air from the systems. The contractor shall be responsible for removing air from the system throughout the warranty period of the project. The contractor shall take every precaution to fill the piping system in such a manner that results in maximum air removal and avoids trapping air in the system (for example, the ice rink floor). If air becomes trapped in the piping system, the contractor shall remove the fluid and refill the system as many times as required until the air is removed. Provide field report for each site visit where air is removed, or systems checked clearly detailing processes and observations.

D. Provide all additional primary and secondary refrigerants necessary to maintain fully charged systems throughout the warranty period of the project. Test all refrigerants at frequency specified in Section 131812 – Ice Rink Refrigeration System and provide final test reports of each refrigerant (including moisture content, inhibitor concentration, solids, refrigerant content, etc.).

E. Provide a factory trained technician for a minimum of 30 hours to completely check the operation of the refrigeration system and equipment and all associated systems and equipment during start up. Provide documentation and certification from trained technician with completed, detailed, check list.

F. Concrete ice rink floors shall cure a minimum of 28 days prior to lowering the temperature of the ice rink floor. After the 28-day cure, lower the temperature of the ice rink floor at a maximum rate of 1-degree F per hour until a slab temperature of 34 degrees F and then 1-degree F every 2 hours until a slab temperature of 16-18 degrees F or as desired by the Owner. Apply water only after the desired operating temperature is reached. Provide documentation that procedure was witnessed by Owner or Owner representative.

G. Provide the Owner's operating staff with fourteen (14) hours of hands-on instructions on the safe operation of the entire ice system. This shall be provided in a minimum of two (2) separate days. Include detailed instructions on how to build the first ice sheet. Operation and Maintenance Manuals must be completed and approved at by this time so they can be reviewed during the training sessions. Provide a minimum of fourteen (14) days' notice for all training sessions. Training sessions shall be coordinated with Owner's schedule.

H. Demonstrate that all control and alarm systems are working as required by code and specified in the contract documents. All necessary adjustments, additions, and electrical modifications shall be made to provide these systems. Provide documentation that procedure was witnessed by Owner or Owner representative.

I. The Contractor shall provide the following follow-up services, at minimum. The cost of these services shall be incidental.

1. Forty-Eight (48) hours after the system has been operating, shutdown the system and remove the construction bags from the compressor and clean strainers and screens on the compressor and

rink pump that has been operating throughout this period. Clean strainers and screens on all other valves and equipment. Start operation of second compressor and rink pump.

2. Forty-Eight (48) hours after the second compressor and rink pump start up, shutdown the system and remove the construction bags from the compressor and clean the screens on the compressor and rink pump that has been operating throughout this period. Repeat this step for additional equipment. Provide field report and documentation of all work performed and observations.

3. Provide one complete oil change of compressors at runtime recommended by manufacturer. Provide documentation of work.

4. Site visits during the warranty period as required to make adjustments to control settings, equipment functions, and any other parts of the system as required to optimize the operation of the ice system.

J. Variable Frequency Drives: Provide start up services by a certified manufacturer's representative to provide an additional 1-year warranty. Provide field report and documentation of all work performed and observations.

K. Provide on-site monitoring for first two (2) hockey games. The contractor's representative shall be on-site during 10 hours before the start of the game and for the duration of the game to monitor system operations.

L. Assist the Owner in preparing an Emergency Preparedness Plan, Process Hazard Assessment, or related documents by providing the Owner's planning consultant with the required information on the ice system as requested and take part in a planning session with the Owner via teleconference.

3.7 SHUTDOWN SERVICES

A. Provide the Owner's operating staff with eight (8) hours of hands-on instructions on the shutdown procedures of the system after the first ice season has finished. Provide a minimum of fourteen (14) days' notice for all training sessions. Training sessions shall be coordinated with Owner's schedule.

3.8 COORDINATION OF WORK

A. The contractor shall be responsible for coordinating all work in Division 13 – Ice Rink. The contractor shall also work closely with the other subcontractors on the project and help coordinate all associated structural, electrical and mechanical systems.

3.9 PERMITS

A. The contractor shall apply for and obtain all permits required to construct the project at no additional cost to the Owner unless specified otherwise.

END OF SECTION 131811

SECTION 13 18 12 – ICE RINK REFRIGERATION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General system description, design criteria and control criteria.

B. Motor Control Center

C. Motor Starters.

D. Motors.

E. Other Electrical Components (enclosures, emergency switch, dialer, meter, etc.).

F. Compressors.

G. Chiller and Surge Drum.

H. Rink Pumps.

I. Adiabatic Condenser

J. Gas Monitoring System.

K. Primary Refrigerant.

L. Secondary Refrigerant.

M. Storage Receiver System.

1.2 RELATED SECTIONS

A. Division 0, Division 1, General and Supplementary Conditions.

B. Section 131811 - Ice Rink General Requirements.

C. Section 131813 - Ice Rink Floor System.

D. Section 131814 - Ice Rink Piping, Valves and Accessories.

E. Section 131815 - Ice Rink Waste Heat Recovery Systems.

F. Section 131817 – Ice Rink Central Control System.

1.3 GENERAL REQUIREMENTS

A. General Refrigeration System Description:

1. Furnish and install a complete ice rink refrigeration system including but not limited to chiller, compressors, pumps, condenser system, piping, valves, controls, motor control center, and all related electrical components and connections necessary for a completely automatic refrigeration system with alarms, operating at the conditions described in, and meeting the requirements of, the contract documents.

B. Refrigeration System Design Criteria:

1. Design Parameters: See Ice Equipment Schedule on drawings.
2. All primary refrigeration piping shall be sized by the Contractor unless otherwise specified or indicated on the drawings. The piping shall be sized for the full capacity of the system except where manufacturer recommends a different size to optimize operation of the system.
3. Furnish and install all isolation valves and unions required for servicing equipment and system components whether or not they are shown on the drawings.
4. The cost of all piping, electrical, equipment, controls, or other changes required for the proper installation of all equipment shall be included in the Contractors bid. If equipment substitutions require revisions in the design of the systems or facility, the Contractor shall reimburse the Owner for the cost of the redesign services.
5. The Contractor shall provide all electrical work, design, materials and equipment necessary for a complete, operational ice system. All work, materials and equipment shall meet the required electrical codes for the Project's location. A licensed electrician shall perform all electrical work. The main electrical feed for each piece of equipment shall be routed beneath the floor slab, not overhead. Provide all low voltage wiring required for alarms, controls and other related system for a complete operating system.

1.4 SUBMITTALS

A. Shop Drawings. All submittals shall conform to the requirements of the General Conditions and these specifications.

1.5 WARRANTY/GUARANTY

A. As required in Section 131811 - Ice Rink General Requirements and as follows:

1. Manufacturer’s standard warranties that exceed the specified warranty.
2. Evaporative Condenser: In addition to the standard 1-year warranty, provide 5-year warranty on corrosion protection system, welded 304 stainless steel, and all major mechanical components, including fans, fan shafts, bearings, sleeves, supports and fan motor.
3. Motors and Variable Frequency Drives: In addition to the standard 1-year warranty, provide start-up services from a certified manufacturer’s representative to provide an additional 1-year warranty.
4. Test and maintain chemical balance of all refrigerants in all systems including inhibitors in all solutions during warranty period.
5. Diffusion tank. 3-year warranty for defects in materials and workmanship and 1-year for fittings and accessories.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

A. As required in Section 131811 - Ice Rink General Requirements.

PART 2 - PRODUCTS

2.1 MOTOR CONTROL CENTER

A. Approved Manufacturers: Eaton/Cutler Hammer Westinghouse, Allen Bradley, General Electric, Siemens, Square D, Rockwell Automation or equal.

B. Panels designed and manufactured by custom panel shops will not be approved.

C. Provide two separate motor control centers to allow for two separate electrical feeders to be used. See equipment chart on drawings for MCC loads. Extension of feeders to the MCC's will be by others under a separate bid package. Coordinate exact loads and requirements with other bid package electrical contractor.

D. Provide a Motor Control Center (MCC) to house and including all starters, breakers, controls, running lights, contacts, relays, switches, fuses, safety switches, alarms, overload relays, resets, and all other electrical devices required for a fully operational ice system. The MCC shall include but not limited to, the following:

1. Starters for compressors, and pumps.
2. Variable frequency drives for rink floor pumps.
3. Running lights and HOA switches for all pumps, compressors, and condenser fan.
4. 120/240V, 1PH panel board for refrigeration equipment requiring 120V power for control circuits, etc.
5. 440-480V / 120-240V, 1PH transformer.
6. Pressure controllers for condenser fan and pump cycling as manufactured by Johnson Controls or equal.
7. Safety cutout controller for low brine temperature.
8. Adjustable alarm contact for high return brine temperature.
9. Hour run time meters for each compressor.
10. Ice System Controls. See description in this section.

E. Shall be installed on a 4" high concrete pad and away from the refrigeration equipment to avoid vibration concerns.

F. The MCCs shall be a dead-front, free standing unit, Type 1 enclosure in accordance with UL 508, UL845 and shall be NEMA rated. Shall include individual buckets for each piece of equipment, each bucket containing a combination starter (motor starter, breaker device, and power disconnect), disconnects with means of padlocking in lock out position, copper ground bus, fault current rating of 42,000 amps, non-insulated equipment ground bus, and rated for 480 volts, 3 phase, 3 wire, 60 hertz electrical service. Provide plastic laminated identification nameplates on the front of the MCC panel. Finish shall be gray primer over a phosphatized surface.

G. The Motor Control Center and Ice System Control System shall fit in the spaces shown on the drawings. The contractor is responsible for all changes and modifications to these systems as required.

H. Electrical feeders (with phase loss protection) will be brought into the refrigeration room by the Division 26 electrical subcontractor under a separate bid package and connection made to the MCC panels. Verify the size of the electrical feeders with electrical subcontractor prior to ordering equipment. Verify that size of electrical feeders are adequate for ice system equipment. All electrical requirements inside the MCC, including the design of the electrical system, and to the ice system equipment are the responsibility of the Ice Rink Contractor.

2.2 ICE RINK CONTROL SYSTEM AND COMPONENTS:

1. Furnish and install Ice Rink Control System as specified in Section 131817 – Ice Rink Central Control System.
2. Furnish and install all necessary controls, electrical, wiring, lights, housings, relays and other electrical devices and systems required for a complete automatically controlled ice system. Provide all low voltage wiring and connections required for alarms, controls and all other related devices for complete operating systems.
3. The refrigeration system shall have sufficient manual controls to allow the system to operate without the computer control system if the computer control system fails.

2.3 MOTOR STARTERS AND VARIABLE FREQUENCY DRIVES

A. Approved Manufacturers: Cutler Hammer Westinghouse, Allen Bradley, General Electric, Siemens, Square D.

B. Each motor shall have its own dedicated starter device.

C. Across-the-Line Starters: For motors smaller than 75-HP.

1. NEMA ICS 2, Class A, magnetic, full voltage, non-reversing.
2. Overload and phase failure protection.
3. Integral control transformer for required control power voltage.
4. Hand-Off-Auto selector switch and red indicator light on cover.

D. Solid State Starters (Soft Starts): Required for motors 75-HP and greater. Shall be UL listed and include isolation contacts, current limiting fuses, capacitors for noise protection, microprocessors and all other circuitry required to function properly, overload protection, LED indicators, auxiliary contacts, heat sink, integral cooling fan, phase loss and stall protection, soft stop, adjustable starting and stopping times, and adjustable initial voltage level to adjust torque for motor starts. Shall have standard handle with four positions; ON, OFF, TRIPPED, and RESET. Part winding or wye-delta starters will not be accepted.

E. All motors for use with Variable Frequency Drives shall be listed suitable for use with VFD equipment to prevent premature bearing failure as specified in the VFD section.

F. Variable Frequency Drive (VFD):

1. Approved Manufacturers: ABB, Allen Bradley, Bell & Gossett, Cutler Hammer or equal.
2. Materials and Construction: NEMA 1 Enclosure, pad lockable input disconnect switch, electronic overload protection, input fuses, HOA switch, selectable operating modes, protection circuits, UL/CSA Approved.
3. Display: Output frequency and voltage, motor current, kwh meter, fault indication with text, % torque, % power (kW), and speed (RPM).
4. Voltage Tolerance: +/- 10%.
5. Options: Manual bypass (2 contactors).
6. All motors for use with Variable Frequency Drives shall be listed suitable for use with VFD equipment to prevent premature bearing failure. This includes, but is not limited to, providing NDE and DE bearings and shaft grounding rings or system, etc. Shall be installed prior to start-up.

2.4 MOTORS

A. Motors shall be 460 volts, 3 phase, 60 Hz, squirrel cage induction motors with a service factor of 1.15. Shall have adequate torque to accelerate the load at operating conditions without exceeding the nameplate rating, not including the service factor. Motors shall be designed, constructed and tested in accordance with ANSI/NEMA Publication No.MG-1 and meet NEMA specifications. Shall be premium

efficiency design as determined by IEEE Standard 112, Method B. Minimum motor efficiencies shall meet the following.

Table for Premium Efficiency Motors (ODP type)

Motor HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	77.0
1.5	86.5	86.5	84.0
2	87.5	86.5	85.5
3	88.5	89.5	85.5
5	89.5	89.5	86.5
7.5	90.2	91.0	88.5
10	91.7	91.7	89.5
15	91.7	93.0	90.2
20	92.4	93.0	91.0
25	93.0	93.6	91.7
30	93.6	94.1	91.7
40	94.1	94.1	92.4
50	94.1	94.5	93.0
60	94.5	95.0	93.6
75	94.5	95.0	93.6
100	95.0	95.4	93.6
125	95.0	95.4	94.1
150	95.4	95.8	95.0
200	95.4	95.8	95.0

B. Motor enclosures shall be open drip proof (ODP). Bearings shall be shielded and regreasable steel ball bearings. Stator windings shall be copper. Insulation shall be Class F non-hygroscopic materials.

C. Motor shall be factory aligned and if necessary, shall be realigned by the Contractor after installation and prior to start-up.

D. Motors shall be inverter duty where VFDs are being used.

2.5 OTHER ELECTRICAL COMPONENTS

A. All electrical components if not specified elsewhere shall be UL listed where possible, meet all code requirements and approved for specific application.

B. Enclosures: Enclosures shall be NEMA 1 rated for indoor applications and NEMA 3R for outdoor applications.

C. Disconnects: Approved Manufacturers for disconnects: Cutler Hammer, General Electric, Square D, Westinghouse or equal. Enclosure shall be NEMA rated for environment where it will be located.

D. Fuses: Provide one spare fuse for each type and size used on the project.

E. Emergency Devices

1. Furnish and install an emergency remote control push/pull button (off-only control) and all associated electrical for a complete system to stop the operation of all electrically energized equipment related to the refrigeration system as required by the current state and local mechanical codes.
2. For interior devices and locations, furnish and install a clear Plexiglass protective, lockable, wall mounted case for devices.
3. For exterior devices and locations, furnish and install NEMA Type 3R, continuous hinge, lockable enclosure (Weigmann RHC121206 or equal). Emergency ventilation remote switch provided by others will also be installed by others in this enclosure. Verify enclosure space needs with ventilation contractor.
4. See Gas Monitoring section for additional requirements.
5. Provide all low voltage wiring and connections required for alarms, controls and all other related devices for complete operating systems.

F. Customer Monitoring Panel: Furnish and install a microprocessor-based monitor panel to provide the following readings: voltage, amperage, power, power factor, and energy consumption. The panel shall conform to the following:

1. Approved Manufacturers: Esterline Angus Panel Master 1000-288-4-RS2A4, Rockwell Automation (Allen Bradley) PowerMonitor 5000 or equal.
2. Current transformers, 5A secondary.
3. Four (4) protection functions shall be provided which shall include the following: overvoltage and undervoltage. Protective functions shall be field settable for alarm and/or trip outputs.
4. One alarm relay shall be programmable for KWH pulse output.
5. A serial port for data transmission to remote location shall be provided.
6. Provide monitoring software for multiple computers as required by Engineer/Owner. Connect unit to Ice Rink Center Control System for data collection and manipulation.

G. Automatic Alarm Dialer.

1. Furnish and install a complete automatic alarm dialer system, compatible with the Owner's telephone system, that will monitor the following alarm conditions and points. This system is required by IIAR 6.14.7.4 "A monitored location shall be notified upon loss of power to or failure of the emergency mechanical ventilation system".
2. Before ordering the dialer system, the contractor shall verify with the Owner the type of phone system that is being used (standard dial type telephone system, Voice over Internet Protocol (VoIP) system, etc.). The contractor shall select the correct dialer system for their application. If VoIP is available, that system shall be selected.
3. Monitor the following alarm conditions and points:
    a. Power loss to refrigerant leak detection dedicated circuit branch (per IIAR).
    b. Power loss to emergency mechanical ventilation system's dedicated circuit branch (per IIAR).
    c. Start/Fail for the emergency ventilation system's fan (per IIAR).
    d. High brine temperatures from compressor microprocessor.
    e. Alarm conditions from compressor microprocessor to be named later by Owner.
    f. Power failure to refrigeration system.
4. Manufacturer: Sensaphone 800 system, Sensaphone Sentinel Monitoring System with Cellular Modem or equal.
5. Unit to provide up to 12 different status conditions.
6. Dial a minimum of eight (8) different phone numbers.
7. Uninterrupted Power Supply (UPS) for 20 minutes.
8. Additional requirements for standard telephone system:
    a. Operate with standard dial telephone line.
    b. Respond to status interrogation from any touch-tone telephone.
9. Additional requirements for VoIP system:

a. Include 12-month subscription to cellular dialer system for time of startup. Coordinate with City on selection of service provider.

b. Shall instantly sends alerts via phone, text or email over cellular connection.

c. Shall deliver event reports, and audit logs.

d. Shall store all data in the cloud, with unlimited information storage and allows multiple devices to be managed from one account. No software shall be required.

e. Shall be accessible by any web-enabled device.

H. Power Factor Correction Capacitors:

1. Approved Manufacturers: Square D, Cutler Hammer or equal.

2. Furnish and install power factor correction capacitors to increase the power factor to a minimum of 0.90 or minimum recommended by the local power company, whichever is higher. A capacitor shall be provided on each motor, for the following equipment:

a. Each compressor motor (including motors with soft starts)

b. All other motors of 3 horsepower or greater.

c. Capacitors are not required on motors with variable frequency drives.

3. Materials and Construction:

a. Type: self-healing, internally protected capacitor elements, dry design.

b. Dielectric: metalized polypropylene film, no liquid dielectrics

c. Internal connection: 3 phase, delta.

d. Tolerance on capacitors: -5%/+10%

e. Discharge mechanism: polycarbonate resistor, 1 per phase.

f. Losses: <0.5W/kVAR, including discharge resistors.

g. Rated voltage/frequency: 480V/60 Hz

h. Dielectrics withstand: 4kV/60 Hz for 1 minute

i. Interrupting rating: unfused-10kA I.C. symmetrical; fused-200kA.

j. Continuous overvoltage: 1.1 x Vn (8 hours over 24 hours)

k. Continuous overcurrent: 1.30 In

l. Maximum harmonic current: 1.05 x In

m. Maximum harmonic voltage: 1.05 x V

n. Temperature range: 14 F to +104 F

o. Approvals: CSA and CSA-US certified

p. Painted finish: NEMA Type 1 and Type 3R

q. Enclosure: 14-gauge steel.

r. Other: wall mount brackets

I. Phase Loss Protection:

1. Approved Manufactures: Zelio by Telemecanique (Schneider Electric), Macromatic, or equal.
2. Furnish and install phase loss protection at each motor. Devices shall monitor 3-Phase supplies and sequence of phases L1, L2, and L3 and total loss of one or more phases.
3. Function:

a. Phase sequence

b. Phase failure

c. Asymmetry

4. Materials and Construction:

a. Product certifications: UL, CSA

b. Conforming standards: NF EN 60255-6 and IEC 60255-6

c. Vibration resistance: 0.035 mm from 10-150 Hz.

d. Degree of protection: Casing IP 30, Terminals IP 20.

e. Overvoltage category: III

f. Insulation resistance: >500 mega ohms, 500 Vdc.

g. Rated insulation voltage: 400 V

h. Insulation test voltage: Dielectric = 2kV, 50 Hz, 1 min. on VAC

i. Wire: Solid cable range one 14-20 AWG.

j. Housing material: Self-extinguishing plastic.

k. Rated supply voltage: 208-480 Vac.

l. Operating range: 183-528 Vac.

m. Voltage limits (of power supply circuit): -12%, +10%

n. Frequency: 50/60 Hz +/- 10%

o. Maximum power consumption: 1.8 VA on VAC

p. Output type: 1 or 2 C/O contacts.

q. Contact type: Cadmium-free

r. maximum switching voltage: 250 Vac/Vdc

s. Rated breaking capacity: 1250 VA

t. Minimum breaking current: 10/5 Vdc mA.

u. Maximum operating rate: 360 operations/hour under full load

v. Maximum response time (fault event): 100 ms

w. Delay on pick-up: 500 ms

x. Relay status and fault signaling shall be indicated by LEDs.

2.6 COMPRESSORS (RECIP)

A. Approved manufacturers: Vilter Manufacturing Corporation 450 series, Mycom W-series, or equal.

B. Design Parameters: Compressors shall be direct drive. See Ice Equipment Schedule on drawings.

C. Material Construction: Each compressor unit to include compressor, motor oil separator, and should be factory mounted on steel frame. Removable high grade, cast iron, cylinder sleeve liners, heavy duty ductile iron crankshaft with insert type connection rods including replaceable steel bearing shells, spring loaded safety heads, rifle drilled aluminum connection rods, aluminum heat-treated pistons with two compression rings and one oil ring, piston operated suction valve lifters to unload compressor for starting and internally piped oil lubricating system.

D. Accessories: suction strainer with screen bag, internal safety relief valve, high discharge/low suction pressure switch, oil failure switch, capacity reduction switches, Tri-Micro oil filter, suction and discharge valves, initial crankcase heater and well, 150 watt crankcase heater and well, direct drive coupling, steel base and coupling guard, refrigerant oil cooler system, refrigerant head cooling system, suction and discharge gauges with Steady-Mounts and liquid filled oil pressure gauges, oil thermometers, suction and discharge thermometers, safety relief valves, and all other required materials for complete installation.

E. Capacity Reduction: Provide capacity reduction for each compressor based on the following table.

No. of Cylinders	Capacity Reduction
6	33% and 66%

F. Oil Separator: Shall meet ASME code requirements for 300 psig design working pressure. Separator shall be sized for the full flow rate of the compressor and have a full line size check valve and stop valve on the outlet piping. Separator shall be complete with a coalescing element capable of removing 99.9% of all particles larger than 1 micron; a full line size check valve and stop valve on the outlet piping, a safety relief valve, a service cover, pipe stud connections, an oil return system connected back to crankcase of compressors including float valve assembly and piping, and all other required materials for complete installation. Shall be ASME coded.

1. Provide controls for the compressor system through the computer control system as specified in Section 131817.

G. Provide complete charge of oil for the compressors as recommended by the manufacturer. Provide an additional 10 gallons of oil to be used by the Owner during the first 1-2 years of operation. Provide one (1) Vilter Model A40894A 60 Hz Oil Charging Pump with MTG Hose and adapter oil charge fittings model KT009B.

2.7 CHILLER AND SURGE DRUM

A. Approved Manufacturers: Chil-con or Henry Technologies, Standard Refrigeration Company, Cimco or equal.

B. Design Parameters: See Ice Equipment Schedule on drawings.

C. Shell and Head Construction: Steel pipe construction conforming to ASME Specifications AS-53 Grade B, seamless or resistance welded; or rolled steel plate conforming to ASME SA-516 Grade 70 with electric fusion welds conforming to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

Minimum design ratings on flooded vessels shall be as follows:

Refrig.	Shell Side Pressure	Tube Side Pressure	Temperature Range
R-717	250 PSIG	250 PSIG	-20 F to 200 F

D. Tube Construction:

Item	Flooded System	DX System
Design Pressure & Temp	See table above	See table above
Tube Material	Plain Steel	Copper
Outside Diameter	0.750 inches	0.625 inches
Minimum Wall Thickness	0.065 inches	0.025 inches
Fouling Resistance	0.0005 hr x sf x F/BTU	0.0005 hr x sf x F/BTU

E. Surge Drum: Design conditions and material construction equal to the chiller. Surge drum shall be sized to provide adequate separation of the refrigerant vapors from the refrigerant liquid and shall provide adequate surge space. Risers shall be sized to allow adequate separation of the refrigerant vapors from the refrigerant liquid and shall be close coupled to the chiller vessel. Number of risers shall be as recommended by the manufacturer.

F. Accessories:

1. Dual relief valve assembly as specified and per code requirements.
2. Name plate shall clearly display code compliance and capacity of vessel.
3. Site glasses on chiller vessel for monitoring refrigerant level.
4. System shall include all floats, valves, gauges, piping and other related materials and accessories as necessary for a fully operational system.
5. Adjustable level controller, column and float system: Provide an external column with a float switch for liquid make-up and a float switch for high level compressor shutdown. See specifications in Section 131814 – Ice Rink Piping Valves and Accessories.

G. Oil Pot System:

1. Provide an oil storage system including, but not limited to, oil receiver vessel, relief valves, stop valves, piping, designed for 300 psig working pressure and site glass. Oil pot shall have a design working pressure of 400 PSIG @ -20F to 400 F constructed in accordance with A.S.M.E. Section VIII Division 1, current edition and addenda, UW-12(e) & CSA B-51 codes.
2. Provide Owner with operation and maintenance procedure of oil return system and heater in the Operation and Maintenance manual.

H. Vessels shall be mounted on a factory constructed steel frame system. The steel frame and vessels shall be shop painted with one coat of primer and one coat of alkyd egg-shell enamel.

I. All vessels must meet state requirements for national board registration.

J. Finish: Prepare exterior surface of all vessels in accordance with SSPC-SP3 Power Tool Cleaning or SSPC-SP10/NACE 2 Near-White Blast Cleaning. Paint with one coat of primer and one coat of alkyd egg-shell enamel for exterior use.

K. Drip Pan: Provide a stainless steel drip pan under oil pot with integral drain.

2.8 RINK PUMPS

A. Approved Manufacturers: Aurora Series 340/360, Xylem Inc. Bell and Gossett Series e1510, Armstrong or equal.

B. Design Parameters: See Ice Equipment Schedule on drawings. Motor size is based on the pump manufacturer listed in the schedule on the drawings. If the motor size increases due to the use of pump another manufacturer, the contractor is responsible for all changes associated with the motor size change at no additional cost to the Owner.

C. Pump Construction and Materials

1. Centrifugal, end suction design, base mounted, single stage. Shall be serviceable without disconnecting to piping system. Pumps shall be capable of continuous operation without fault. Pump shall be rated at 175 psi.
2. Volute: Heavy-duty cast-iron conforming to ASTM A48, Class 30, integrally cast pedestal support. Provide drain and vent plugs. When calcium chloride (CaCl2) is specified as the secondary refrigerant or brine all surfaces in contact with the liquid shall have an epoxy coating.
3. Impellers: Enclosed type, cast bronze conforming to ASTM B584 (for glycol use only), vacuum cast, keyed to shaft with non-corrosive fasteners, statically and dynamically balanced. When calcium chloride (CaCl2) is specified as the secondary refrigerant or brine the impeller material shall be cast iron conforming to ASTM A48, Class 30 or stainless-steel conforming to AISI 316.
4. Shafts: Carbon steel conforming to AISI C1045 machined and polished. Replaceable bronze sleeve conforming to ASTM B62. Maximum deflection of 0.002 inches at the seal face under a maximum load condition. Provide ANSI/OSHA-compliant coupling guard with slotted viewing window. When calcium chloride (CaCl2) is specified as the secondary refrigerant or brine the sleeve shall be stainless steel conforming to AISI 316 when using calcium chloride.

5. Bearings: Heavy duty, grease lubricated, regreasable, ball bearings with B10 minimum bearing life of 50,000 hours per AFBMA test procedures. Shall be replaceable without disconnecting pump from pipe system.
6. Seal Assembly:

Material	Glycol Systems
Elastomer	EPR (Ethylene Propylene Rubber)
Rotating Face	Silicon Carbide
Stationary Face	Silicon Carbide
Hardware	Stainless Steel
Spring	18-8-Stainless Steel
Other	Internal flushing capabilities
Other	Easily Inspected
Other	Replaceable

7. Wearing Ring:

Material	Glycol Systems	CaCl2 Systems
Material	Bronze	Cast Iron
ASTM Specification	B62	A48
Type	Replaceable	Replaceable

8. Motor: Shall conform to the requirements of this Section.
9. Energy Rating. After January 27, 2020, all pump and motor assemblies shall be in compliance with the pump energy efficiency regulations by the U.S. Department of Energy. Provide all documents with the shop drawing submittal and as required for the Owner to apply for a rebate through the electrical utility.
10. Accessories: See Section on Ice Rink Piping, Valves, and Accessories and other requirements herein.

2.9 ADIABATIC CONDENSER

A. The unit must be provided with a full controls package that provides modes to optimize water and energy savings and eliminates any potential for distribution water system freezing in cold weather climates. The controls will be integral to unit operation with single point power connection.

B. Manufacturers: Subject to compliance with requirements, provide adiabatic condensers manufactured by one of the following:Baltimore Aircoil Company (BAC): TrilliumSeriesTM Adiabatic Products or equal

C. THERMAL PERFORMANCE

1. See project schedule and notes.

D. RIGGING AND INSTALLATION

1. The unit and controls are to be shipped fully assembled to allow for a single lift installation by the rigger.

E. MATERIALS OF CONSTRUCTION

1. Casing and Frame: Unless otherwise noted in this specification, provide all steel panels and structural members protected with a thermosetting hybrid polymer (THP) coating system. Type 304 stainless steel is considered an acceptable alternative. Uncoated or painted G-235 galvanized steel is not acceptable. The THP system will consist of G-235 (Z700 metric) hot-dip galvanized steel prepared in a four-step (clean, pre-treat, rinse, dry) process. The coating will be electrostatically applied with the THP fuse-bonded to the substrate during a thermally activated curing stage. Quality will be monitored by a 23-step quality assurance program. Other coatings must be submitted to the engineer for pre-approval. Approved equals must have undergone testing, with the criteria specified below as a minimum:

a. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of 5% salt spray per ASTM B117 without blistering, chipping, or loss of adhesion.

b. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of exposure to acidic (pH=4.0) and alkaline (pH=11.0) water solutions at 95ºF (35°C) without signs of chemical attack;

c. Withstand impact of 160 in-lbs. per ASTM D2794 without fracture or delamination of the polymer layer.

d. Withstand 6000 hours of ultraviolet radiation equivalent to 120,000 hours of noontime sun exposure without loss of functional properties;

e. Withstand 200 thermal shock cycles between -25ºF and +180ºF (-32°C and 82°C) without loss of adhesion or other deterioration;

f. Withstand 6000 hours of exposure to 60 psi (42,184 kg/m2) water jet without signs of wear or erosion.

g. Fasteners shall be protected by a GM7114M coating.

2. Coils:

a. The coil will be constructed of 304 stainless steel tubes with pre-coated aluminum fins.

b. Provide coil with a maximum allowable working pressure of 400 psi.

c. For tube/fin condenser coils, the coils shall have a fin density of 10 fins per inch or less, to limit fouling, and comply with Title 24. Louvered fins will not be acceptable. For fluid cooler coils, fin density shall be no greater than 12 fpi.

d. Provide coil design tested according to UL 207.

e. Prior to shipment, coils will be charged with nitrogen to 15 psi to provide assurance of coil integrity upon customer receipt of product.

3. Water-System:

a. Products that do not conserve water by collecting and reusing water are not acceptable.

b. All components that collect water must be constructed of Type 304 stainless steel or higher grade.

c. All wetted components, except Pre-Cooler media, must be constructed of Type 304 stainless steel or of PVC.

d. The collection basin will allow no water to be exposed to sunlight.

e. Provide a factory-installed strainer in the pan, with holes smaller than those of the distribution system above the pads, so that any debris from the supply water or from the environment that enters the water system is caught and is prevented from clogging the water distribution.

4. Make-Up Water Valves:

a. Provide solenoid actuated, slow-closing make-up valve to maintain proper water level in the unit, and to prevent water hammer in the building.

b. Electronically operated make-up and drain line allow for periodic draining of the basin to control water quality.

c. Make-up Water Strainer: To protect downstream components, an in-line Y strainer must be supplied on make-up water supply. Strainer will have a brass body and 304 stainless steel strainer.

5. Drain Valve:

a. Provide a normally open drain valve that ensures, in case of power failure, no water is contained in the unit.

6. Auto-Discrete System:

a. Provide a system that automatically provides backup water supply for the adiabatic cooling in case of component or signal failure. The system will sense if the pump, make-up valve, or float switch fails, and if so, disable the pump and trigger a backup supply of water to trickle

over the pads. The system also sends an alarm signal. The system has an automatic reset feature whereby it periodically rechecks the components to identify if the fault has cleared and if so, returns the unit to normal operation. The system can also be manually reset.

7. Adiabatic Pre-Cooler Pads:
    a. Pads must have at least 90% efficiency when unit is operating with fans at full speed, to deliver the lowest condensing temperature (refrigerant) / leaving gas temperature (CO2) / leaving fluid temperature (fluid).
    b. Pads will be removable without the use of any tools, for easy coil inspection. Pad removal must be facilitated by including steel partitions between one section of media to avoid friction and premature failure of pad.
    c. Pads will be made of recycled material with cross-fluted design to prevent biological degradation and clogging. Media will be easily removed and easy to clean. Media will have edge-coating for UV-protection.
8. Cleansing Circulation Pump:
    a. Unit must have a factory-wired submersible water pump rated for continuous duty. For optimum water savings, products that do not reuse water are not acceptable.
    b. The pump will be installed in a vertical position so that water will drain from the pump when the system is emptied.
    c. Pump motor is to be totally enclosed with protective canopy for outdoor operation.
    d. The pump must have Class F insulation, UL labeling, and a minimum ingress protection of IP68.
    e. Construct exterior pump casing of Type 304 stainless steel.
    f. The water pump shall have an automatic reset with thermal overload protection.
9. Fan(s):
    a. Fan(s) must be constructed of an aluminum alloy designed to meet or exceed standard DIN EN 485-2, protected with an epoxy coating.
    b. Fan(s) must be both statically and dynamically balanced to provide for vibration-free performance.
    c. Fan(s) must be provided with a wire-mesh screens complying with OSHA and UL regulations.
    d. Balancing: Fans will have maximum residual balance as per DIN ISO 1940.
10. Fan Motor(s):
    a. Fan motor(s) shall be factory installed and wired and shall be electronically commutated (EC) with UL and CE markings.
    b. FAN AND VSCFan motor efficiency at full load: 92%
    c. Motors shall have space heaters or trickle current provision to prevent condensation inside the motor. The heater shall operate automatically from the factory and require no extra wiring.
    d. Fan motor(s) will have a minimum ingress protection of IP55 or better.
    e. Fan motor(s) will have maintenance-free, permanently lubricated, sealed ball bearings.
    f. Fan motor(s) will operate with integrated commutation electronics offering high efficiency across the entire speed range and optimal acoustic performance at minimal installation expenditure.
    g. Fan Motor(s) will have an integrated VSC.
    h. Fan motor(s) will be thermal overload protected (TOP).
    i. Fan motor(s) will have integrated PFC filter which complies with IEC 61000-3-2.
    j. Fan motor(s) will have integrated phase loss protection.

k. Fan motor(s) are to be UL listed to UL1004 and/or UL2111, CSA C22.2 No. 77 and/or No.100. 9.

l. Fan motors will have a minimum service factor of 1.0.

m. Motor Insulation is Type F.

n. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."

o. Fan Motor Speed Controller: The fan controller shall allow the user to control the fan speed the following ways:

p. RS485 ModBus communication port with both read and write capabilities (Default).

q. Analog Input (0-10VDC, 10-0VDC or 4-20mA)

11. Fan System Protection

a. Provide factory-wired integral electronics within the motors that will detect upset conditions, prompting the factory-provided controls to shut down the fan motor(s) in that specific module and issue an alarm warning to alert the Operator to check the fan.

F. WATER AND ENERGY CONSERVATION CONTROL SYSTEM FOR THE ADIABATIC CONDENSER / COOLER

1. Scope: The Adiabatic condenser/cooler manufacturer shall furnish an industrial control panel for use with the specified unit. The panel must be integral to the unit's operation.
2. Terminology

a. UI – User Interface

b. PLC – Programmable Logic Controller

c. BAS – Building Automation System

d. NCDC – National Climatic Data Center

e. VFD – Variable Frequency Drive

f. VSC – Variable Speed Controller

g. I/O – Input(s)/Output(s)

h. SCCR – Short Circuit Current Rating

3. Device Description

a. The integral control system will control all motor driven and optional electrically operated equipment including (but not limited to) the fan motor(s), pump motor(s), make-up and drain valve(s), and manufacturer supplied water level switches. The operation of all driven components must be manually overridden for equipment startup or troubleshooting. The status of all equipment must be available to be displayed on a panel mounted user interface.

4. Submittals and Operations Manuals

a. Submittals shall include the following as a minimum:

b. System design information sheet.

c. Description of system operation.

d. Control panel drawing with list of operator interfaces.

e. Electrical power and control-wiring diagrams for customer connections.

f. Submittals, which are not job specific and designed to meet the requirements of this section, will not be acceptable.

g. Provide an electronic copy of the submittal to the consulting engineer for approval.

h. Provide an electronic copy of the Operation and Maintenance Manual prior to system start-up.

5. Electrical

   a. Design Requirements : The control panel manufacturer shall be listed by Underwriters Laboratories as an approved manufacturer of industrial control panels. Use of commercial grade controllers from the building automation contractor shall not be acceptable.

   b. The control panel enclosure shall meet NEMA 4 requirements.

   c. The closed-circuit cooler control system shall have a Short Circuit Current Rating (SCCR) of a minimum of 65 kA at 460 VAC.

   d. Control Panel will include the following equipment:

      1) Programmable Logic Controller (PLC)

      2) Ambient Dry Bulb Sensor(s) [1 per unit.] Refer to contract documents for quantity and location.

      3) Cleansing Circulation Pump Motor Starter(s)

      4) Main Circuit Breaker Disconnect

      5) Control Power Transformer

      6) Basin water level float switch

      7) Relays, Fuses and Circuit Breakers for All Unit Equipment

      8) User Interface Screen

      9) Modbus or BACnet capabilities with 2-wire connection for Building Automation System (BAS).

   e. Circuit Breaker Disconnect: Molded case circuit breaker disconnect shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics and shall be adequately sized for all loads present in the panel enclosure. Circuit breaker shall be UL 489 Listed, CSA, IEC certified/rated, and CE marked for global acceptance.

   f. Relays shall be of the plug-in base or terminal block type. Relays shall be rated for continuous duty operation.

   g. User Interface (UI) Provide operator display as a stand-alone component with a separate programmable logic controller. Use of a computer for the process control will not be acceptable. Unit must have the ability to be adjusted while in operation without cutting power. The UI must be provided either within or directly on a weather-tight cover mounted door of a NEMA 4 enclosure such that it will maintain the enclosure's NEMA 4 rating. The UI must be accessible while the unit is in operation, without shutting off the unit. The UI shall be industrially rated and certified for the following conditions: Relative Humidity: 5 to 95% (Non-condensing) UI shall be rated for 50,000 hours of life The UI shall be industrially rated and certified for UL/ULC.

6. Operation

   a. The controls will allow for three modes of operation to allow optimization of water and energy savings. For all supported modes of operation, the panel shall utilize adaptive logic to allow for automatic adjustment between unit modes of operation based on real time system load and ambient temperature conditions. Modes of Operation:

      1) Standard Mode: When a preset outside air temperature is reached, water will be used to pre-cool incoming air to increase the unit's capacity and efficiency.

      2) Water Saver Logic: The controller will optimize the unit's efficiency and only use water when the conditions require the extra cooling capacity. Pre-Cooler Mode will be initiated only when the outside air temperature is above the switch point and the fans are running at 90% or above for over 60 seconds. This mode will recheck conditions every two hours.

      3) Energy Saver Logic: The controller will optimize its sequence so that the least amount of energy is consumed to meet the present load of the unit. Pre-Cooler Mode will be initiated at 10°F (5.6°C) below the switch point and if the fan speed is above 35%.

b. On off-peak days when the water distribution is on, pads are fully wetted, and the full pad efficiency is maintained/utilized. In this way the minimum condensing temperature (or leaving fluid temperature) is achieved, delivering the maximum system efficiency.

7. Fail-safes

1) The unit will operate, by default, to have the fans 'fail on' at 100% speed in case of loss of control signal, or failure of any internal electrical components, other than the mechanical disconnect, in order to provide reliability for the refrigeration system.

2) Daily Self Clean Cycle: Once daily the fans will reverse direction to blow debris off the pads and coil. This mode will function without human intervention. The control system must drain and flush itself in such a way that the need for water treatment is eliminated, provided the incoming water is not contaminated.

3) Daily Dry Operation: One per day, regardless of climate, the unit shall force dry operation (if not otherwise already running dry), to dry the pads and maintain pad performance and longevity

G. Installation

1. All wiring to the control panel shall be installed by a licensed electrician. The National Electrical Code and all applicable state and local codes shall be followed when installing this equipment. All power, control and sensor field wiring between the control panel and the closed-circuit cooler must be provided by ice rink contractor.
2. Control panel enclosure must be mounted on the condenser/fluid cooler. Separate brackets or stands are not acceptable.

H. Testing/Commission

1. Factory Testing: All inputs and outputs to the PLC must be tested for proper function at the point of field wiring. The Control system will be tested and setup to the customer's specific project.

I. Field Wiring

1. Refer to Manufacturer's electrical drawings for all required field wiring.
2. Electrical wiring best practices shall be followed
3. All discrete control wiring shall be a minimum of #14 AWG, 600 V minimum insulation and 75°C minimum temperature rating.
4. All signal wires (i.e., 4-20 mA) shall be #18 AWG stranded copper, shielded, twisted pair unless otherwise specified.
5. All field wiring shall have the same ground reference for all connected control panels.
6. Analog and signal wires (i.e., 4-20mA) shall be shielded individually and only grounded on the panel side.

J. Field Piping

1. Proper clearance in front of the equipment shall be maintained when piping, to comply with the NEC and local ordinances

2.10 REFRIGERANT GAS MONITORING SYSTEM

A. Approved Manufacturer: Bacharach (Pat McClernon, Control House Ltd. 952-746-3485), Calibration Technologies, Inc., Cool Air Mechanical, or equal

B. Provide one (1) complete refrigerant gas monitoring system for the specified refrigerant. System shall continuously monitor for refrigerant leaks and meet ASHRAE 15 Standard current edition.

C. System shall include:

1. One (1) Main Controller Panel mounted inside ice equipment room.
2. One (1) Remote Display Panel mounted outside main door to ice equipment room.
3. Sensors, strobes and audible devices as defined herein.
4. One (1) Uninterruptable Power Supply (UPS) to provide power for 20 minutes.

D. Features:

1. Multi-zone detection with expandable capabilities.
2. Main Controllers and remote displays shall have a front panel display with backlit graphic LCD, system and alarm status indicators, and keypad.
3. Displays shall show zone specific refrigerant concentration for all sensors.
4. Four (4) SPDT relays contacts (minimum).
5. 4-20 mA analog output.
6. Sampling: Automatic and continuous or manual.
7. Automatic reboot and system alarm reset after power failure.
8. Trend / Data Logging: Graphic display of trend data, alarm log and fault log.
9. NEMA 4X, UL-listed, CSA, IEC, IP66 enclosure.
10. Unit shall not require calibration for a minimum of 10 years. Provide manufacture's verification.
11. Provide a silence and reset switch at the gas monitoring panel inside the refrigeration room as required by code.

E. Sensors and transmitters

1. Approved type of sensors:
   a. Infrared transmitters and sensors with a sensing range of 25ppm to 10,000ppm.
   b. Electrochemical transmitters and sensors
   c. Solid state
2. Accuracy of +/- 5% of value.
3. Zero Drift: Less than 0.1% of full-scale.
4. Response time: less than 20 seconds
5. Linearity: +/- 1% of full-scale
6. Ranges:
   a. Provide ranges most suitable for the ranges specified in the table below except that one sensor in the ice equipment room must have a high range of 1,000 ppm.
7. Certification: ETL listed to UL standard.
8. Sensors shall be installed in the locations shown on the plans (if indicated) and in accordance with the table below. The exact locations shall be verified during construction.

Location	Sensor Type	Quantity
Ice Equipment Room	Infrared/Electrochemical/SS	2

F. Alarm Settings

1. Alarm concentration levels shall be adjustable. Initial settings and sequences shall be in accordance with the table below.
2. Alarm Devices

Ammonia Concentration	Description or Action
25 ppm	1. Notify Ice Rink Control System a. Notification sent to facility personnel 2. Controller to initiate the following alarm sequences per IIAR: a. Strobes and audible alarm in ice equipment room, vestibule and exterior door only activated

50 ppm	1. Notify Ice Rink Control System a. Notification sent to facility personnel 2. Controller to initiate the following alarm sequences: a. All strobes and audible alarms activated. This may be the same as 25 ppm.
150 ppm	1. Notify Ice Rink Control System a. Notification sent to facility personnel. 2. Controller to initiate the following alarm sequences per IIAR: a. All strobes and audible alarms activated. b. Emergency purge ventilation system is activated. c. Send signal to fire alarm system.
250 ppm	1. Notify Ice Rink Control System a. Notification sent to facility personnel. 2. Controller to initiate the following alarm sequences per IIAR: a. All strobes and audible alarms activated. b. De-energize pumps, compressors, and normally closed automatic refrigerant valves that are not part of an emergency control system.

3. Alarm devices shall be combination strobe lights and audible alarms.
4. Strobe light single color shall be selected by Owner.
5. Furnish and install as required by current state and local mechanical codes.
6. Device locations shall be as shown on the plans and in accordance with the table below. The exact locations shall be verified during construction.

Location	Alarm Device	Quantity
Inside Refrigeration Room	Strobe & Audible	2
Outside Refrigeration Room Doors	Strobe & Audible	2

G. Provide all necessary auxiliary equipment relays as required to operate strobes / audible devices, start emergency ventilation, shut down refrigeration system, fire alarm system notification, etc.

H. Leak detector shall turn on exhaust fan even when control panel is powered off or not functioning.

I. Connection from the emergency ventilation to the auxiliary relay will be by building electrical or mechanical contractor.

J. Connection from the fire alarm system to the auxiliary relay will be by fire alarm contractor.

K. Provide connection to ice rink control system for monitoring concentrations and alarms.

2.11 PRIMARY REFRIGERANT

A. Furnish and install a complete operating charge of anhydrous ammonia (R-717) refrigerant to fill entire refrigeration system. The refrigerant charge shall meet the following chemical properties:

1. Ammonia: 99.999% minimum
2. Moisture (as H20): 10 ppm maximum
3. Oil: 1 ppm maximum

2.12 SECONDARY REFRIGERANT

A. Ethylene Glycol Solution

1. Furnish and install a complete operating charge of 35% by volume of inhibited ethylene glycol and deionized water. The fluid shall be an industrial heat transfer fluid specifically designed for HVAC systems.
2. Approved Manufacturers: Dow Chemical Company Dowtherm SR-1, Texaco Texcool E100, or equal.
3. The solution shall have a factory mixed corrosion inhibitor or neutralizing agent and anti-foaming agent to minimize air entrainment.
4. The solution mixture shall meet the following parameters:

Parameter	35% EG
Specific Gravity @ 15F	1.064
Viscosity @15F	7.500
Freezing Point	-1.5 F
pH	8.0 to 9.2
Density @ 15F	66.37 lbs./cf
Specific Heat @15F	0.828 BTU/lb. F
Thermal Conductivity @15F	0.23 BTU/hr-SF

5. The deionized water shall conform to the following properties in maximum allowable concentrations:

Calcium Carbonate Hardness	100 ppm
Chlorides	25 ppm
Sulfates	25 ppm

B. Submit a product data sheet and MSDS sheet for the solution including the inhibitor and/or neutralizing agent.

C. Provide a weather resistant tag on the fill valve for the system that includes description of fluid, freezing and burst point, total gallons of system, Material Safety Data Sheet reference and date of original charge.

D. Provide certified test results for all solutions in systems. At minimum samples for the secondary refrigerant solution shall be drawn at the following times:

1. 3 months after start-up.
2. 11 months after start-up.

2.13 SIGNAGE

A. Furnish and install legible permanent signs on the outside of all ice rink equipment mechanical room doors as detailed on the drawings and as follows:

1. All signs informative signs, emergency signs, charts and labels shall be in accordance with NFPA 704, ANSI/IIAR, ANSI Z535.2 and the International Mechanical Code.
2. For ammonia refrigerant, the NFPA 704 or Fire Diamond numbering shall be 3-3-0-blank (blue-red-yellow-white) or per current code requirements.
3. Provide all other signs required by code even if not shown on the drawings.

B. Furnish and install signage, as detailed on the drawings, next to each strobe light and audible alarm.

C. Furnish and install signage, as detailed on the drawings, next to each refrigeration system emergency stop button and ventilation enable switch.

D. Furnish and install schematic drawing or panel giving directions for operation of the system per ASHRAE-15 paragraph 11.7.

E. If Owner requires the format (font, size, colors, etc.) of the signage to match other signage in the facility, provide the format required by the Owner unless it does not meet code requirements.

2.14 STORAGE RECEIVER

A. Approved Manufacturers: Vilter Manufacturing Corporation, Chil-con, Bitzer, Henry Technologies, Wheeler Tank, H.A. Phillips, Midwest Tank Company, Cimco, or equal.

B. Capacity: See Ice Equipment Schedule on drawings.

C. Construction: Designed for minimum design parameters outlined in table below. Vessel shall be constructed and stamped per ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 98E/99A.

D.

Refrig.	Minimum Design Pressure	Temperature Range
R-717	250 PSIG	-20 F to 250 F

E. Accessories: Provide a dual relief valve assembly as specified and per code requirements. Provide a 2" diameter external steel site glass column with: welded caps; a minimum of three (3) 1-¼"-12 SPUD with 1-1/4" sight glasses; and two ¾" NPS connections to the vessel with shut-off valves. Provide all valves, piping and other related materials and accessories as necessary for a fully operational system. Name plate shall clearly display code compliance and capacity of vessel.

F. Vessels shall be mounted on a factory constructed steel legs or frame system.

G. Finish: Prepare exterior surface in accordance with SSPC-SP3 Power Tool Cleaning or SSPC-SP10/NACE 2 Near-White Blast Cleaning. Paint with one coat of primer and one coat of alkyd egg-shell enamel for exterior use.

H. Rust inhibitor shall be used when hydro-testing system. Thoroughly dry vessel interior after hydro-testing and prior to filling system with refrigerant.

2.15 DIFFUSION TANK

A. Approved Manufacturers: Exxon Mobil (Paxon 7000 Series by Indelco 800.486.6456 ext. 335, www.indelco.com), Snyder Industries Inc., ACO Systems, Poly Processing Company, or equal.

B. Design Conditions:

1. See Ice Equipment List on drawings for capacity.
2. Provide 3-year warranty for defects in materials and workmanship and 1 year for fittings and accessories.

C. Construction:

1. Upright, single wall, flat bottom, closed top.
2. Molded one-piece seamless construction according to ASTM D 1998. Virgin polyethylene resin and shall be Type I (cross-linkable polyethylene) or Type II (linear polyethylene) and shall be FDA or NSF 61 listed.
3. Shall be designed for chemical applications and specifically ammonia refrigerant storage.
4. Submit factory test report for verification of wall thickness, impact tests, hydrostatic tests, verification of materials and visual inspection.
5. Tanks shall be manufactured with a minimum of two lift lugs integrally molded into tank.
6. Tanks shall be marked to identify the product, date (month and year) of manufacture, capacity and serial number.

D. Fittings and Accessories

1. Provide all necessary fittings and accessories required for the layout and function of the tank.
2. Double bolted 150-pound flange fittings required for fittings 2 inches and larger below liquid level.
3. Drain fitting and PVC ball valve at lowest possible point. Provide siphon tube to improve drainage capability.
4. Vents and vent line for atmosphere pressure and pressure during filling of tank for proper ventilation complying with OSHA and other requirements.
5. Ammonia sparger tube.
6. Provide flange connections and adapters as required for connecting equipment, piping, relief inlets and outlets, etc.
7. 18-inch threaded manway with 15-inch access. No vent.
8. Integrally molded gallonage marks on side of tank.
9. 1” flange connection on top of tank for make-up water connection.

PART 3 - PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. All equipment shall be installed per manufacturer's requirements.

B. All equipment bases shall be bolted down and filled with concrete unless otherwise specified or noted. Adjust level of concrete as required to provide access to anchor bolts for compressors, motors, etc.

C. All equipment shall be installed and designed such that vibration is minimal and meets acceptable limits. If the amount of vibration is in question, the Contractor shall be responsible for hiring a certified, experienced vibration company to perform the necessary test. A certified test report shall be submitted to the Engineer. If results are not satisfactory, the Contractor shall be responsible for correcting the problem and retesting for vibration as previously specified.

D. Connect cold water make-up line to remote sump. Provide drain line, valves, etc. as shown on the drawings.

E. All meters, gauges, and readouts shall be mounted at eye level.

F. All equipment, vessels, and tanks shall be fully supported with a structural steel framing system anchored to the wall and floor and not to the roof structure unless otherwise approved.

G. Tanks. If tanks (for example, sump, water, diffusion, expansion, etc.) do not fit through existing or proposed door opening, make all necessary accommodations, including removal and replacement of door(s) and wall(s) for required access.

3.2 VARIABLE FREQUENCY DRIVES (VFD)

A. Provide start-up services by a certified representative of the manufacturer.

3.3 MOTORS

A. Provide motor circuits as required by NFPA 70 including a motor grounding conductor.

B. Testing:

1. Voltage and current measurements shall be performed on all motor driven equipment to confirm that the voltage and current is within the operating range of the motor and the nameplate rating.
2. Perform an insulation resistance test or megger test on each 460-volt motor by applying 500 Vdc phase to ground on each phase for 10 minutes with readings taken at the end of one (1) minute and ten (10) minutes. Minimum acceptable reading is 5 megaohms.

3.4 CONDENSER SUPPORTS

A. By others under separate bid package. Coordinate final size, location and elevation as necessary.

3.5 ELECTRICAL

A. Provide all electrical work necessary for a complete, operational ice system. All work shall meet the required electrical codes for the Project's location. A licensed electrician shall perform all electrical work. The main electrical feed for each piece of equipment shall be routed beneath the floor slab, not overhead.

B. Locate the Emergency Remote Control button(s), protective case(s), audible alarm(s) and strobe light(s) outside the ice mechanical room at a distance from the entrance door(s) to the ice mechanical room as required by code. Locate other strobe lights and audible alarm assemblies were shown on the drawings and as required by code.

3.6 REFRIGERANT GAS MONITORING SYSTEM

A. Monitoring and display units shall be mounted at eye level.

B. Recalibrate unit at both the unit and each sensor after final completion of project. Provide verification that the unit has been calibrated. Provide calibration and test kits from the manufacturer as required to calibrate the unit per manufacturers recommendations and as specified.

3.7 PAINTING AND FINISHES

A. All structural supports and framing shall be painted with one coat of primer and one coat of alkyd egg-shell enamel.

B. Touch up paint on all equipment, vessels, supports and exposed pipes after project is complete.

C. Provide additional touch up paint for equipment and vessels for Owners use.

D. Touch up damaged galvanized coatings and corrosion protection systems on condenser and remote sump.

3.8 CLEANING

A. Clean and vacuum all debris from inside the Motor Control Center and all other electrical enclosures. Do not use compressed air to clean out panel.

B. Thoroughly clean equipment of all temporary protective coatings and foreign material prior to assembly of erection.

C. After project completion thoroughly clean all equipment and piping systems.

3.9 START UP AND SHUTDOWN SERVICES

A. See Section 131811 - Ice Rink General Requirements.

END OF SECTION 131812

SECTION 13 18 13 – ICE RINK FLOOR SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sand.

B. Insulation, jacketing and vapor barrier.

C. Pipe and reinforcement support chairs.

D. Reinforcement.

E. Pipe and fittings.

F. Expansion joint.

G. Concrete.

H. General materials.

I. Temperature sensors and monitors for sub-floor and ice rink floor.

J. Subgrade preparation.

1.2 RELATED SECTIONS

A. Division 0, Division, General and Supplementary Conditions.

B. Section 131811 - Ice Rink General Requirements.

C. Section 131815 - Ice Rink Waste Heat Recovery Systems.

D. Section 131817 – Ice Rink Central Control System.

1.3 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 304 - Concrete Placement.

C. ACI 305 - Hot Weather Concreting.

D. ACI 306 - Cold Weather Concreting.

E. ACI 309 - Recommended Practices for Consolidation of Concrete.

F. ASTM C94 - Standard Specifications for Ready Mix Concrete.

G. ASTM D 2513 - Thermoplastic Gas Pressure Pipe.

H. ASTM D 2683 - Socket Type Polyethylene Fittings.

I. ASTM D 3261 - Butt Fusion Polyethylene Fittings.

J. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings.

K. NSF Standard 61 - Plastic Piping Components and Related Materials.

L. AWWA C901 - Polyethylene Pipe.

M. The Plastic Pipe Institute Handbook of Polyethylene Pipe.

N. Pipe Manufacturer for fusion welding procedure.

1.4 SUBMITTALS

A. Shop Drawings. All submittals shall conform to the requirements of the General Conditions and Section 131811 - Ice Rink General Requirements.

B. Test Reports. Submit four (4) copies of test reports to the Engineer when specified.

C. Gradation of clean sand fill.

D. Concrete mix design. Submit fifteen (15) business days prior to placement.

E. Two (2) samples of a typical fusion welded pipe to fitting connection. Samples shall come from a demonstration performed in the field prior to placement of polyethylene pipe.

F. Rink subgrade and top of pipe surveys.

1.5 WARRANTY/GUARANTY

A. As required in Section 131811 - Ice Rink General Requirements

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

A. As required in Section 131811 - Ice Rink General Requirements.

PART 2 - PRODUCTS

2.1 SAND

A. Sub-Floor: Clean sand consisting of sound, durable particles. Material gradation shall meet 100% passing the #4 sieve and not more than 5% passing the 200 sieve. Material shall be clean, free of all debris, roots, or other foreign material or chemicals.

2.2 INSULATION, JACKETING AND VAPOR BARRIER

A. Approved manufacturers: Styrofoam brand by the Dow Chemical Company, CertainTeed, Ownes-Corning, DiversiFoam, or equal.

B. Floor Insulation: Insulation material shall meet ASTM C 578 Type VI with a minimum compressive strength of 40 psi, maximum water absorption of 0.1% by volume (ASTM C272) and an R-value per inch at 75 F of 5 Fxsfxh/Btu. Provide in sheet dimensions as indicated on the drawings.

C. Pipe Insulation System:

1. Direct Bury: As specified in Section 131814 – Ice Rink Piping, Valves and Accessories.

D. Accessories: Provide all adhesive, sealants and other products as required by the manufacturer to provide a completely sealed system. Provide vapor barrier for the piping that is non-flammable and fire resistant for all systems operating below 65 F.

E. Vapor Barrier (for Rink Floor):

1. Concrete Rink Floor: Shall conform to ASTM D-4397 for Clear Polyethylene Film except the thickness shall be 6-mil. Tensile strength shall be a minimum of 1700 psi (long direction) and Elongation shall be a minimum of 225% (long direction). The materials shall be supplied in 20’-0” x 100’-0” minimum size sheets. Provide tape manufactured for sealing the seams of poly sheeting.

2.3 PIPE AND REBAR SUPPORT CHAIR

A. Approved Manufacturers: Hunter Wire Products or equal.

B. U-type or M-type configuration designed for both supporting rink piping and reinforcement or equal. Six (6) foot long sections.

C. Material: Wire shall be a minimum of #7-gauge (0.187") steel. Base plate shall be a minimum of 20-gauge steel for sand floors and 24-gauge steel for concrete floors except that 20-gauge steel shall be used on all rink floor with steel rink piping.

D. Shims (for adjusting pipe elevation): Shims shall be plastic or steel and shall be a minimum size of 2” wide x 2” long to provide full support beneath the pipe and rebar support chair.

2.4 REINFORCEMENT

A. Reinforcement: Shall be tagged and conform to ASTM A615 Grade 60.

B. Wire Mesh: 6x6 W2.9/W2.9 (6 gauge) steel mesh conforming to ASTM 1064.

C. Tie Wire: Shall be 16-gauge yellow-coated annealed wire or heavier.

2.5 PIPE AND FITTINGS

A. Polyethylene Pipe:

1. SDR 17, pressure rating 100 psi (rink transmission pipe only)

Nominal I.D.	10"
Actual O.D.	10.75”
Wall Thickness*	-

*Minimum thickness. Wall thickness shall be within 10% of that specified.

2. SDR 11, pressure rating 200 psi (rink and subfloor piping and headers, subfloor transmission mains).

Nominal I.D.	1"	3"	10”
Actual O.D.	1.315"	3.5"	10.750”
Wall Thickness*	0.119"	0.318"	

*Minimum thickness. Wall thickness shall be within 10% of that specified.

3. Shall be high density polyethylene complying with requirements of ASTM D3350 cell classification and have a Plastic Pipe Institute (PPI) designation of PE4710. Minimum density shall be 58 lbs/cf (0.957 gm/cc).

4. Joints/Connections: Fusion welded. Welding process shall be performed by fully trained personnel in the fusion welding process.

5. Fittings:

   a. Approved manufacturers: Charter Plastics, Performance Pipe, Rahn, Georg Fisher, Polycam or equal.

   b. All fittings shall be socket type and conform to ASTM 2683. Fittings shall be manufactured and not field or shop fabricated. The inside diameter of the fittings shall be equal to the inside diameter of the pipe.

   c. Rink piping return bends: Construct as detailed on the drawings. As alternatives:

      1) POLY-CAM (763.786.6682) Series 734 polyethylene HDPE 3408 socket U-Bend fittings with I.D. of 1.310 inches at 4” o.c. <u>At this time, the new POLY-CAM bend at 3.5” o.c. is NOT APPROVED.</u>

      2) GES Geoglide 180 HDPE pre-molded socket return bend. Only the newest design and product will be approved. www.gesgeo.com

   d. Use manufacturer recommended coupling when fusion welding pipe of different gauges or wall thickness.

6. The pipe shall have product traceability by inclusion of product code on the exterior of the pipe and include the manufacturer, the date of manufacture, the lot and supplier of the raw material, the location of the manufacture, and the production shift of which the product was produced.

2.6 COMPRESSION SEAL AND EXPANSION JOINT MATERIALS

A. Compression Seals: Shall be D.S. Brown Delastic or equal.

1. D.S. Brown Delastic Catelog Numbers shall be as follows:

   a. For ½” joint (width at time of concrete placement) shall be Catalog No. E-1006.

   b. For 1” joint (width at time concrete placement) shall be Catalog No. CV-1752.

   c. Provide dimension as required for the joint width shown on the drawings.

2. Material shall be polyethylene, non-absorbent, non-staining.

3. Compression seal material shall meet the parameters for the specified D.S Brown product.

4. Color: Black

5. Expansion Joint Material: Ceramar by W.R. Meadows or extruded polystyrene insulation (thickness of expansion joint by depth of rink floor) in one piece with top scored to depth of expansion joint material or as recommended by the manufacturer.

2.7 CONCRETE

A. This section refers to concrete for the ice rink floor only. For perimeter slab concrete and other miscellaneous concrete requirements see Ice Rink General Requirements Section.

B. Concrete Mix:

1. Submit mix design fifteen (15) business days prior to placement.

2. Concrete shall be produced by a Ready-Mix Plant approved by the Engineer. Concrete shall meet the requirement of ASTM C94 - Standard Specifications for Ready Mix Concrete.

3. Mix Design Requirements. Prepare design mix for type and strength of concrete in accordance with applicable provisions of ASTM C94, Alternative #3.

Minimum 28-day compressive strength	5,000 psi
Coarse aggregate size	3/4 inches to #4 (ASTM C33 No. 67)
Maximum water to cement ratio	0.40
Minimum cement content	600 lbs/cy
Fly ash	15% of cement content max.
High Range Water Reducing Admixture	
Slump (prior to addition of HRWRA)	3 inches maximum
Slump (after addition of HRWRA)	7 inches maximum
Air content	3% maximum

4. Proportion aggregates such that the concrete mix adequately flows into all corners and around reinforcement without segregating, leaving voids or producing honeycombs. There shall be no free water in the mix.

5. The consistency of the concrete mix shall be uniform and such that the cement and other ingredients are uniformly distributed throughout the mix and such that the mortar clings to the coarse aggregate.

C. Material Requirements

1. Cement: Shall be Portland Cement that meets ASTM C150, Type I or Type I/II. Only the specified manufacturer submitted with design mix will be allowed.

2. Fine Aggregates: Shall be clean, natural sand free of loam, clay and other deleterious or foreign materials. Shall meet ASTM C33 and come from a single source.

3. Coarse Aggregates: Shall be clean, processed aggregates free of loam, clay or other deleterious or foreign materials. Shall be crushed stone or crushed gravel.

4. Water: Shall be clean, potable water. Maximum concentration of chloride ions of 0.1%.

5. Admixtures: All admixtures shall conform to ASTM C494. A representative for the HRWRA supplier shall be on-site at the start of the concrete placement until consistency in the mix has been proven by the testing agency. No changes are allowed once the design mix is approved.

a. Air Entrainment:

1) Shall meet ASTM C260.

2) Approved manufacturers:

Axim Concrete Tech. - Catexol AE 260, VR
Euclid Chem. Co. - AEA 92S, AEA 92, Air Mix 250
General Resource Tech - Polychem AE, VR
W R Grace - Darex II AEA, Daravair 1000, 1400
Grave – Airalon 300
Master Builders - MB VR standard, Micro Air, MasterAir AE 90
Sika Corporation – Sika AEA-14, Sika Multi AIR 25
Premiere – ConAir

b. Water Reducing Admixture:

1) Shall meet ASTM C494, Type A and shall not contain more chloride ions than in potable water source with a maximum of 0.1%.

2) Approved manufacturers:

Axim Concrete Tech. - Catexol 800N, 1000N, 2000N
Euclid Chem. Co. - Eucon MR, WR, WR-91
General Resource Tech - Polychem 1000, KB1000, 400NC
GCP – Applied Technologies - WRDA 82, MIRA 110
Master Builders - Pozzolith 220N, MasterPolyhead 997
Sika Corporation - Sikament HP, Plastocrete 169, 161
Premiere – OptiFlo MR

c. High Range Water Reducing Admixture (HRWRA) Superplasticizer

1) Shall meet ASTM C494, Type F or G and shall not contain more chloride ions than in potable water source with a maximum of 0.1%.

2) Approved manufacturers:

Euclid Chem. Co. - Eucon 37
GCP – Applied Technolgies - ADVA 140M, ADVA CAST 575
Sika Corporation – Sikament 686
Master Builders – MasterGlenium 7500
Premiere – OptiFlo MR

2.8 GENERAL MATERIALS

A. Nylon Ties: Shall be 3/16" wide and UL recognized. For sand rink floor ties shall have a minimum tensile strength of 100 lbs, with metal tabs. For concrete rink floor ties shall have a minimum tensile strength of 50 lbs.

B. Moisture Curing Covers: Shall be polyethylene sheeting (4 mil minimum thickness) or a curing cover such as Hydrocure by PNA Construction Technologies or equal.

2.9 TEMPERATURE SENSOR AND MONITORS

A. Provide sensors for sub-floor heating system and the rink floor. See drawings for number and location.

B. Approved Manufacturers: Omega Engineering, Thermokon, Kele, Honeywell, or equal.

C. Sensor (thermistor or RTD):

1. Accuracy: +/- 1% accuracy of measuring range.
2. Sensor pocket shall be aluminum.
3. Protection: Shall be protected against humidity, vibration and mechanical overstress.
4. Construction: Shall be suitable for temperature extremes and immune to the effects of moisture and condensation.
5. Provide wiring as required by monitor manufacturer.
6. Other control systems – provide compatible 4-20mA sensor.

D. Box: Iron or steel construction with 3/4" hub size, threaded connections, flat removable iron or steel cover with neoprene gasket.

E. Conduit: Schedule 80 PVC from box to mechanical room and from box to depth of sensor to prevent heat transfer.

F. Wire: Provide all wiring size for application and per code requirements.

2.10 FLOOR INSERTS

A. Furnish and install floor inserts as detailed on the drawings and for the quantity shown. Inserts shall be designed for 4,000-pound load in any direction.

B. Plug Materials: Furnish and install threaded plugs for each insert. The plug material for goal post inserts shall be 303 stainless steel. The material for dasher board and circus inserts shall be 360 brass.

C. Insert Materials: As shown on the drawings. If not shown, then material shall be 303 stainless steel inserts.

D. Base Plate Material: 303 Stainless steel or carbon steel.

E. Wrench: Furnish two plug wrenches. Each wrench shall have a minimum shaft length of 6”, a minimum handle length 10” and designed to fit insert plugs. Wrench shall be constructed of coated steel or equal.

F. Flexible goal post pegs will be provided by the dasher board manufacturer. Verify peg dimensions prior to manufacturing floor inserts.

2.11 FLOOR HARDENER

A. Approved manufacturer: Lapidolith by Degussa, MasterKure HD 300WB or equal.

B. Magnesium fluorosilicate concrete hardener and dustproofer, bonds chemically. Shall meet ASTM C779 for abrasion resistance, 30 minutes, 0.0025 inches with treatment.

C. Color: Clear.

2.12 RINK FLOOR PAINT/SEALER

A. Furnish and install rink floor paint on new rink floor. 1023 Concrete Rink Sealer, by T.K. Products of New Hope, Minnesota or equal. Color shall white. Install per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSPECTION

A. The Contractor shall notify the Engineer a minimum of seven (7) business days prior to the phases of work described in the Ice Rink General Requirements Section. Piping shall not be covered without notifying the Engineer.

3.2 EXCAVATION AND BACKFILL

A. The Contractor shall be responsible for verifying the location of all existing piping, electrical, and other utilities prior to excavation.

B. Benchmark: Contractor shall provide an elevation survey of the existing perimeter concrete, every 10 linear feet, to the Engineer. The Engineer will review and determine the best location for a benchmark.

C. Excavation: All excavation shall be performed in accordance with OSHA regulations, to the depths shown on the drawings, and to the tolerances specified in the table below.

Area	Tolerance
Pipe trenches and non-rink floor areas	+/- 0.03 feet (3/8”)
Rink floor subgrade for rink floor with a subfloor heating system	+/- 0.05 feet (5/8”)

D. Verification Surveys: The ice rink contractor shall provide verification surveys in the following areas. Submit surveys to Engineer for review prior to installation of new rink floor system.

1. Perimeter concrete. Survey top of perimeter concrete within 2” of the rink floor edge every 10 feet around the entire perimeter of the rink floor. This information will be used by the Engineer to establish a benchmark to construct the rink floor.
2. Subgrade. Prior to the installation of the piping systems for the subfloor heating system, survey a 10-foot x10 foot grid pattern across the entire ice rink floor subgrade and include the benchmark elevation that was established in item 1 above.
3. Top of sand layer. Prior to installation of the floor insulation, survey 10-foot x 10-foot grid pattern across the entire final and finished ice rink floor sand layer for the subfloor heating system and include the benchmark elevation that was established in item 1 above.

E. Backfilling: All excavated areas shall be backfilled as soon as possible but not before compaction tests have been taken and approved where required. Backfill materials shall be placed in lifts less than 12 inches thick, uniformly compacted and follow requirements of the geotechnical report, if report is available. Backfilled areas shall be fine graded to the tolerances specified in the table below. Care shall be taken while backfilling to protect the pipe from damage.

Area	Tolerance
Pipe trenches and non-rink floor areas	+/- 0.03 feet (3/8”)
Rink floor subgrade for rink floor with a subfloor heating system	+/- 0.05 feet (5/8”)
Rink floor subfloor heating system sand layer	+/- 0.015 feet (3/16”)

F. Compaction: Backfill material shall be uniformly compacted to the densities shown in the table below.

Area	Standard Proctor Density
Pipe trenches within building footprint and other structural areas	98%
Rink floor subgrade (below subfloor heating system)	98%
Rink floor subfloor heating system sand layers 6” thick or less	95%

3.3 INSTALLATION OF PIPE

A. No changes to pipe alignment or elevation shall be made without approval from the Engineer.

B. All pipe shall be cleaned out prior to installation. Inspect pipe for defects and damage.

C. Buried piping shall be bedded in material recommended by the pipe manufacturer.

D. Rink and header piping shall be supported as shown on the drawings.

E. Support all piping in such a manner as to prevent all vibration and vertical or horizontal movement.

F. For polyethylene pipe, butt or socket fusion welds shall be used to connect pipe and fittings. Electro fusion welded couplings should only be used where it is not possible to make a butt and socket weld due to space constraints. In addition, electro fusion welded couplings and fittings shall not be used in the following locations:

1. In or beneath the ice rink floor system. This includes, but is not limited to, the header pipe systems for both the rink floor and subfloor systems and the rink floor and subfloor piping systems.
2. Under permanent bleacher systems except where transmission mains connect to header pipe outside of the rink floor perimeter.
3. Above ground piping systems.

3.4 INSULATION, JACKETING AND VAPOR BARRIER

A. Install floor insulation with staggered joints as required on the drawings. Ends shall be tightly butted together and secured. All cuts must be performed with a sharp-edged tool.

B. Install vapor barrier over insulation with a minimum of 18" overlap at all joint. All joints shall be taped.

C. Install pipe insulation on transmission mains as specified.

3.5 PIPE AND REBAR SUPPORT CHAIR

A. Install as shown on the drawings.

B. Additional supports shall be placed as close to the ice rink piping return bends as possible.

3.6 REINFORCEMENT

A. Reinforcement shall be installed as shown on the drawings.

B. Installation shall meet ACI 315. Reinforcement shall be installed with a minimum of 2" of cover unless otherwise noted on the drawings. Adequately support reinforcement with support chair where specified and concrete blocks. Terminate rebar 2” from the rink edge.

C. Splices shall be installed with minimum lapping distances shown on the plans and bars wired tightly together. If lapping distances are not shown on the plans the following lapping distances shall apply.

Reinforcement Bar Size	Lap Splice (inches)	90° Hook End
#4	25	8
#5	31	10
#6	37	12

D. Wire mesh shall be placed over rink piping. Loose ends of the wire mesh shall be bent down. The wire mesh sheets shall be overlapped by a minimum of 6" and wired securely to the reinforcement bars at a minimum of 18" on center or as noted on drawings (whichever is the tighter spacing) in both directions and along all edges of mesh. The mesh shall be tightly wired down in all locations. Terminate mesh 2" from the rink edge. Turn all wires down. Contractor shall monitor the location of the wire mesh throughout the concrete placement and finishing processes and provide additional securing as needed.

3.7 PIPE AND FITTINGS

A. All sub-floor heating and rink piping shall be continuous. There shall be no joints, splices or additional fittings other than were indicated on the drawings. Header and transmission main piping shall be supplied in typical lengths.

B. All piping and fittings shall be connected by fusion welding. Contractor shall perform and demonstration in the field for the Engineer prior to placement of polyethylene pipe. Submit two (2) samples of a typical fusion welded joint from the demonstration.

C. All connections to the header pipe shall be at a 90-degree angle to the header pipe. No connections shall be made at an angle.

D. Contractor shall inspect the interior and exterior of all butt and socket joints wherever possible to assure there are no blockages and that joints are formed to manufacturer's specifications.

E. Fasten rink piping to chair supports with specified nylon ties as necessary to secure pipe in position. Varying temperatures may require less restrictions to allow pipe to move. End of ties shall be turned downward.

F. Placement:

1. Rink piping shall be installed within +/- 3/16" of the elevation shown on the drawings. Shims shall be used to adjust pipe elevations if necessary.

2. Pipe Survey: When rink piping installation is complete the Contractor shall provide a survey of the top of the rink pipe. The survey shall be performed by an independent surveying companying and signed by a professional engineer or registered land surveyor licensed in the state of the project. The survey equipment used must have recent documented certification of calibration and must be of the highest accuracy to document the very tight tolerances specified for this work. At minimum, the survey locations shall include the following:

   a. Top of pipe in a 10-foot x 10-foot grid pattern over the entire rink surface.

   b. In addition, top of pipe on each header pipe at a 10-foot spacing.

   c. In addition, top of pipe along radii and ends of rink at a 10-foot spacing, 1 foot from edge of perimeter concrete.

   d. In addition, top of pipe along the row of support chairs on each side of the header trench at a 10-foot spacing.

   e. In addition, perimeter concrete at edge of rink floor every 20 linear feet around entire perimeter of concrete.

   The information shall be recorded and submitted to the engineer clearly showing top of pipe elevation in reference to the top of concrete elevation and the difference between the two elevations. The survey shall be completed in adequate time for the Engineer to verify the information and the Contractor to make adjustments prior to the concrete pour.

3. Flushing: Thoroughly flush all piping systems before installation of secondary Refrigerants and remove all water or other fluids used during the testing and flushing procedures. The Engineer shall be notified to observe final flushing procedures.

G. Testing:

1. The entire sub-floor heating system including the headers and transmission mains and the entire rink piping system including the header and transmission mains shall be hydrostatically tested as two separate systems at 100 psi each for the first four (4) hours and reduced to 60 psi for an additional 20 hours with no pressure drop at either setting. While each test is being set up the Contractor will likely need to add water for the first 2 to 3 hours as the pipe may stretch slightly. Each test shall not begin until the Contractor is confident all air is removed from the system and the system is completely filled with water. An Owner’s representative shall witness and approve the test.

2. Once the initial testing is approved, the pressure shall be lowered to 50 psi and maintained until 48 hours after the sand and concrete placement is complete.

3. Gauges used for pressure tests must be designed for pressures greater than the test pressure. For example, a 100-psi gauge cannot be used for a 100-psi test. The scale on the gauge must be the next increment up from 100 psi.

H. Fill sub-floor piping system with glycol solution specified in Section 131815 - Ice Rink Waste Heat Recovery Systems. Fill rink piping system with secondary refrigerant as specified in Section 131812 - Ice Rink Refrigeration System.

3.8 COMPRESSION SEAL AND EXPANSION JOINT MATERIAL

A. Install extruded polystyrene insulation (thickness of expansion joint by depth of rink floor) in one piece with top scored to depth of expansion joint material or as recommended by the manufacturer.

B. After concrete has been placed and cured, remove top piece of insulation.

C. Clean all dirt, debris and water from space between perimeter concrete and rink floor using a brush, vacuum or compressed air and as recommended by the manufacturer.

D. Install when concrete substrate is clean, sound, dry and cured for a minimum of 14 days and as recommended by the manufacturer.

E. Install the compression seal material in longest pieces possible and as recommended by the manufacturer. A series of small sections will not be accepted.

F. Install adhesive per manufacturer’s recommendations. Do not allow to freeze prior to installation. Store all components out of direct sunlight in a clean, dry location between 50 F and 90 F.

G. Install adhesive per manufacturer’s recommendations.

H. Install compression seal per manufacturer’s recommendations.

3.9 CONCRETE WORK

A. Quality Control:

1. A prepour meeting will be scheduled with the Engineer or Owner's representative to discuss the methods of placement, equipment, and quality control procedures.
2. A benchmark shall be approved by the Engineer prior to starting the pour.
3. The survey of the rink floor piping must be approved by the Engineer prior to concrete placement.
4. Prior to placement, an inspection of the rink floor shall be conducted and all debris, soil, trash, and standing water shall be removed before placement begins.
5. Concrete shall not be placed until authorized by the Engineer or the Owner's representative.
6. At least two (2) standby concrete trucks shall be available in case of equipment failure or loads are rejected.
7. Standby pumping equipment shall be on-site in case primary pumping equipment fails. Hand pushed wheelbarrows will not be accepted.
8. An extra vibrator shall be kept on-site.
9. The concrete placement for the rink floor shall take place as one continuous pour from start to finish. Method of placement, leveling, finishing and curing shall be approved by the Engineer and the Contractor responsible for the ice rink work.
10. Quality control personnel from the ready-mix company, HRWRA admixture supplier and the Contractor shall be present during the pour.
11. All concrete not meeting the approved design mix parameters will be rejected.
12. Testing:

a. Contractor shall hire a testing agency to perform the following tests and shall pay for all testing and laboratory costs.

b. Temperature: Measure the concrete temperature for each truck.

c. Slump: Measure the slump before and after adding the High Range Water Reducing Admixture (HRWRA)/Super Plasticizer for each truck. Tests shall be performed in accordance with ASTM C143.

d. Air Content: Tests shall be taken before and after adding the High Range Water Reducing Admixture (HRWRA)/Super Plasticizer during casting of cylinders. Tests shall be performed in accordance with ASTM C231.

e. Compressive Strength:

1) Make and cure at least one (1) set of test cylinders, consisting of four (4) individual cylinders, for every 50 cubic yards of concrete placed or fraction thereof. Test specimens and testing shall be performed in accordance with ASTM C31 and ASTM C39.

2) For each set of cylinders, test one specimen at seven (7) days, two specimens at twenty-eight (28) days and one hold. Acceptance shall be based on the average of the two 28-day tests.

f. All sampling and tests shall be taken at the point of placement unless otherwise specified.

g. An electronic copy of the test results shall be submitted to the Engineer as soon as the tests are completed.

B. Placement:

1. All concrete shall be placed and consolidated in accordance with ACI 304 (measuring, mixing, transporting), 305 (hot weather) and 306 (cold weather).

2. The method and manner of placing the concrete shall be such as to minimize the possibility of segregation of the aggregate, the displacement of the reinforcement, pipe or supports and damage to the floor insulation. Place concrete as near to the final position as possible. The vibrator shall not be used to transport or to flow concrete to the extents that causes segregation.

3. The pumping equipment used for conveyance of concrete the equipment shall be suitable for this type of work and have adequate capacity for the work. The pump shall be operated such that a continuous stream of concrete without air pockets is produced.

4. Proper precautions shall be taken to prevent the polyethylene headers from floating up during the pour.

5. Concrete shall be placed in maximum 12" layers in the header trench. Each layer shall be adequately consolidated before the next layer is placed.

6. Mechanical vibration shall be used to consolidate the concrete. Provide and use two (2) vibrators during the pour. Vibrators shall be capable of operating at frequencies sufficient to achieve thorough and uniform consolidation, but not less than 7000 impulses per minute. Methods such as spading shall be used to consolidate concrete in locations where it's impossible to reach with a vibrator. Vibration shall not be applied directly to the reinforcement or piping. Placement and duration of the vibration shall be such to thoroughly consolidate the concrete without causing segregation or localized areas of grout.

7. Bridge screeds or super screeds shall not be used.

8. Concrete that has been contaminated by foreign materials shall not be deposited or shall be removed from the rink area. Concrete that has been partially hardened shall not be reworked or re-tempered and shall be removed from the rink area.

C. Finishing:

1. Immediately after placement and consolidation, the concrete shall be struck off, screeded, and leveled to the required elevation. Begin floating when the surface is ready and bleed water is no

longer visible. Floating may be conducted either by hand or with a machine. Check for levelness, fill or cut as necessary, and refloat surface to a smooth, uniform, granular texture.

2. Chemical finishing aids or fogging system shall be used at the Contractor's discretion to prevent rapid surface moisture loss. Water shall not be added to the concrete at any time.

3. After floating, apply a trowel finish using a power-driven trowel. The Contractor shall determine the time to start troweling. Perform final troweling by a combination of hand and power-driven trowels, leaving the surface free of marks, and uniform in appearance and texture. Provide a smooth surface.

4. Tolerance: The top of slab elevation for the rink shall be continuously checked by the Contractor throughout the finishing operation with survey equipment and final elevation shall be within +/- 3/16" from a true level plane.

5. The perimeter edge of the rink floor, adjacent to the expansion joint, shall be edged or chamfered to 1/4" radius.

D. Concrete Surface Survey: When concrete placement installation for the rink floor is complete the Contractor shall provide a survey of the concrete surface. The survey shall be performed by an independent surveying companying and signed by a professional engineer or registered land surveyor licensed in the state of the project. At minimum, the survey locations shall include the following:

1. Top of concrete rink floor in a 10-foot x 10-foot grid pattern over the entire rink surface.

2. In addition, survey along radii and ends of rink at a 10-foot spacing, 1 foot from edge of perimeter concrete.

The information shall be recorded and submitted to the engineer clearly showing top of concrete elevation in reference to the benchmark used to build the rink floor and the difference between the two elevations. The survey shall be completed the same day of the rink pour and according to ASTM and ACI standards.

Curing: After finishing and as soon as possible provide a wet cure for a minimum of 14 days by covering the entire surface with curing blankets. The curing blankets shall be installed to prevent air pockets and discoloration in the concrete surface. The Contractor is responsible for maintaining the wet condition for the entire 14 days. The curling blankets shall be removed all at one time to avoid potential damage due to differential shrinkage. Approved manufacturers: Ultra Cure by McTech Group or equal. Polyethylene sheeting is not approved.

E. The concrete floor shall not be refrigerated or open to equipment traffic for 28 days from time of pour. See startup procedures in the Ice Rink General Requirements Section.

F. Liquid Hardener:

1. A liquid hardener shall be uniformly applied to the surface of the ice rink floor and as recommended by the manufacturer.

3.10 TEMPERATURE SENSORS

A. Install temperature sensors in accordance with manufacturer's recommendations. For each sensor, the top of the box cover shall be even with the top of the ice rink slab for easy access and sensor replacement.

3.11 HEADER VENT ASSEMBLIES

A. Connect vent pipes to supply and return header pipes using fusion welded saddle.

B. Vent boxes shall be installed in perimeter concrete or landscaped area so that the top of the removable cover is level with the top of the concrete or finished grade.

C. Insulate 1" HDPE vent pipe between the vent box and the rink floor to allow a slip surface and prevent pipe damage as concrete cures.

3.12 FLOOR INSERTS

A. Install inserts at the locations shown on the drawings. Inserts shall be carefully lined and leveled with transit before placing concrete for the rink floor.

B. Brass plugs should be installed prior to concrete placement. Grease top of plug.

3.13 CONCRETE PATCHING AND REPAIR MORTAR

A. Clean area: Flush area with clean water to remove all dust. Apply a pH indicator to prepared surface to test for carbonation. Air blast with oil-free compressed air to remove all water.

B. Prepare, mix and apply per manufacturers requirements.

C. Prevent moisture loss during the first 3 hours after placement by using plastic sheeting.

D. Grind patch flush with existing floor.

3.14 CLEANING

A. The ice rink floor shall be completely cleaned of all debris, spills, stains, etc. If requested by the Engineer, the contractor shall wash and mop the entire floor to assure floor is clean.

B. Clean all other material, equipment, and debris from other areas of the building on a daily basis and thoroughly clean at the end of the project.

END OF SECTION 131813

SECTION 13 18 14 – ICE RINK PIPING, VALVES AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Fittings.

B. Valves and Accessories.

C. Pipe Hangers.

D. Pipe and Equipment Markers.

E. Expansion Tank.

F. Pressure Gauges.

G. Thermometers.

H. Insulation.

I. Sealing and Firestopping.

1.2 RELATED SECTIONS

A. Division 0, Division 1, General and Supplementary Conditions.

B. Section 131811 - Ice Rink General Requirements.

C. Section 131812 - Ice Rink Refrigeration System.

D. Section 131813 - Ice Rink Floor.

E. Section 131815 - Ice Rink Waste Heat Recovery Systems.

F. Section 131817 – Ice Rink Central Control System.

1.3 SUBMITTALS

A. Shop Drawings. All submittals shall conform to the requirements of the General Conditions and Section 131811 - Ice Rink General Requirements.

1.4 WARRANTY/GUARANTY

A. As required in Section 131811 - Ice Rink General Requirements.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

A. As required in Section 131811 - Ice Rink General Requirements.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Polyethylene.

1. Rink pipe and transmission mains. As specified in Section 131813 – Ice Rink Floor.

B. Steel.

1. Primary and secondary refrigerant piping.
2. Material shall be carbon steel and meet the following:
    a. 1 3/4 inch to 12 inches diameter shall conform to ASTM A53, Grade B Schedule 40.
    b. Larger than 12 inches diameter shall conform to ASTM A53, Grade B Schedule 40.
    c. Type F steel shall not be used for refrigerant lines except when discharging to atmosphere.
3. Joints shall be welded end type. No threaded joints.
4. Fittings shall be carbon steel with welded end type and shall meet ANSI B16.9. Fittings shall be manufactured and not shop or field fabricated.
5. Flanges shall be of the same material as the pipe and shall be rated for a minimum of 150 psi. Shall meet ANSI B16.5

2.2 VALVES AND ACCESSORIES

A. Primary Refrigerant Valves and Accessories

1. Approved Manufacturers: Hansen Technologies, Henry, Refrigeration Specialties, Cyrus Shank Company, Parker, Danfoss, or equal.
2. Minimum working pressure rating: 400 psig.
3. Body: Heavy duty ductile iron, cast steel.
4. Internal parts: Stainless steel.
5. Gaskets and Seats: Neoprene O-rings or flat composite gaskets, Teflon seats.
6. Packing nut and hand wheel: Zinc chromate plated steel.
7. Pressure relief valves to meet requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Maximum release pressure should match vessel pressure rating. Provide discharge indicator such as Pop Eye by Hanson Technologies or equal. Secondary side (glycol/brine) should be set at 150 psi unless otherwise stated.
8. Refrigerant Strainers: Shall include stainless steel screen and body. Shall be easily serviceable in-line.
9. Filter Dryer: Steel shell with corrosion resistant finish, aluminum cover plate with 1/8" FPT connection for valve, and copper fittings.
10. All hand expansion valves, solenoid valves, and regulators shall be supplied with seal caps on the adjusting stem.
11. Check valves: Shall be Hanson HCK4 LR Gravity Drain check valves for low pressure drop applications of 0.25 psid, Danfoss, or equal.

12. Solenoid Valves: Shall be Hansen Model HS4A, Danfoss or equal. Piston and spring mechanism shall be pressure operated. Valves using plunger-needle type assemblies shall not be used."
13. Pressure Regulating Valve(s): Shall be Hansen Standard Regulator HA4A, Danfoss, or equal. The pressure regulating valve for the compressor discharge line(s) shall include a high range (up to 185 psi) spring assembly.
14. Liquid Level Float Switch (High Level):
    a. Approved Manufacturers: Phillips Refrigeration, Parker, Danfoss, or equal
    b. Operating temperature: -50F to +150 F.
    c. Float chamber: zinc plated
    d. 10-amp Single pole, double throw switch, hermetically sealed, magnetically actuated.
    e. Standard DIN connector with 15' cable.
    f. Housing interchangeable with RS LL float switch.
15. Adjustable Level Controllers and External Level Column Systems: Shall be Hansen Vari-Level or equal. System shall include, but not limited to; adjustable control unit with Teflon encased stainless steel sensing principle and control cable, level column with site glasses (minimum of 4 positioned at 6" on center), probe, valve position indicator, isolation valves. Probes shall be full length of the columns.

B. Secondary Refrigerant Valves and Accessories

1. Approved Manufacturers: Apollo, Aurora, Bell & Gossett, Crane, Flowseal, Milwaukee, Mueller, Nibco, Stockham or equal.
2. Minimum working pressure rating: 125 psig
3. Provide valve neck extensions where needed.
4. Butterfly Valves: Cast iron body with stainless steel shaft; Teflon (PTFE), nylatron, or acetal bearings; EPDM resilient seat.
5. Check Valves: Non-slam design; cast iron body, bonnet, disc plate, and disc cage meeting ASTM A-126 Class B.
6. Combination Valves: Operates as a non-slam check valve, shutoff valve and throttling valve. Cast iron body, brass seat, and bronze disc with EDPM seat insert, stainless steel stem and spring, Teflon-graphite packing.
7. Ball Valves: Bronze body, 316 stainless-steel ball, Teflon seats.
8. Air Release Valves: Cast iron or bronze body. Provide ball valve and drain line to floor. Include 1/2" FPT and 3/4" MPT connections.
9. 3-Way Mixing Valves: Cast iron body, flanged. Controls to operate valve based on fluid temperature.
10. Poly to Steel Transition Fittings:
    a. Approved manufacturers: Krausz USA (Hymax Cplg), Polycam
11. Suction Diffuser/Strainer:
    a. Body and Cover:Cast iron, ASTM A48, flanged.
    b. Vanes & Orifice Cyl: Steel for glycol systems

       Stainless steel for calcium chloride systems.
    c. Strainer:5/32" perforated, 304 stainless steel.
    d. Start-up Screen:20 mesh, 304 stainless steel.
    e. O-ring:Buna-N
    f. Purge/Drain Plug:Wrought steel

g. Cap Screws: Wrought steel, SAE Grade 5

h. Pipe Supports: Steel, adjustable

12. Flexible Connectors: 150 lb plate or carbon steel - flat face type, flexible stainless-steel hose and braid material, and stainless-steel braid collar.

13. Flow Switch or Differential Pressure Switch:

a. Approved manufacturers: Johnson Controls, United Electric Controls, Hansen, or equal.

b. Must be compatible with the system fluid.

c. Gold-plated contacts for improved electrical performance.

d. Stainless steel paddle or opposing metal bellows (seal bellows) to detect pressure differences between two sources

e. Adjustable set points.

f. Epoxy coated enclosure.

14. Resistance Temperature Detectors (RTD) Assemblies:

a. Approved manufactures: Omega, JW Instruments (763.784.5708) or equal.

b. RTD: Single Element, platinum, 3 wire, Tolerance Class A, 316 stainless steel sheath. Length to be at approximately 10% longer than radius of pipe.

c. Temperature Ranges:

1) Return brine/glycol: 0-50F

2) Others: As required.

d. Spring loaded.

e. NPT stainless steel hex nipple.

f. Aluminum screw cover head – NEMA 4X rated.

g. Signal: 4 to 20 mA programmable temperature transmitter, upscale burnout, temperature range to match RTD.

h. Thermowell: Shall be standard duty threaded (NPT), 304 stainless steel, NPT size as required to accommodate RTD.

i. Shall coordinate type of RTD and transmitter with controls, VFD or other device that is being connected to RTD Assembly.

C. Water Line

1. Backflow Preventers: Watts No. 909 or equal. Provide one (1) reduced pressure zone backflow preventer with strainer on waterline to remote condenser sump. Provide gate valves on both sides of unit.

D. Valve Tags

1. Provide non-ferrous metal or plastic laminated tags on each valve with non-ferrous or corrosion proof fasteners. Numbering system shall be referenced in the Operation and Maintenance Manual.

2.3 PIPE HANGERS

A. Approved Manufacturers: Anvil International, Crane, Red Head, or equal.

B. Provide a complete pipe support system including hangers, supports, brackets, guides and anchors even if not specifically shown on the drawings. All supports shall conform to the latest requirements of ASME Code for Pressure Piping B31.1 and MSS Standard Practice SP-58, SP-69, SP-89 and SP-90.

C. Pipe hangers shall be capable of supporting the pipe in all conditions of operation without transferring excessive stress to the pipe.

D. Supports shall fit adequately over insulation. Provide 12 gage pipe saddles and inserts of high-density block insulation.

E. Exterior pipe supports shall be galvanized steel.

2.4 PIPE AND EQUIPMENT MARKERS

A. All pipe and equipment markers shall conform to IIAR Bulletin No. 114 (most recent edition): Guidelines for Identification of Ammonia Refrigeration Piping and System Components.

2.5 EXPANSION TANK (FOR RINK FLOOR PIPING)

A. Approved Manufacturers: Aurora, ITT Bell & Gossett, John Wood Company, H.A. Phillips, Armstrong, or equal.

B. Capacity: Horizontal compression tank. See capacity in Ice Equipment Schedule on drawings.

C. Materials: Pressure rating of 125 psig in accordance with Section VIII, Division 1, of the ASME Boiler Pressure Vessel Code, and registered with the National Board of Boiler Pressure Vessel Inspectors.

D. Accessories: Liquid level gauge assembly by Apollo Valve or equal and shall include gauge glass, drain valve, glass protector and shut off valves. Air control fitting equal to ITT Bell & Gossett tank fitting and ATFL including brass vent tube plug and stainless-steel ball check.

E. Tank shall be painted with one coat of primer and one coat of enamel.

2.6 PRESSURE GAUGES

A. Approved Manufacturers: McDaniel, Ashcroft or equal.

B. Materials and Accessories: Shall have stainless steel case, minimum 4" diameter, bourdon tube type, liquid filled, 1% scale accuracy over entire range of gauge, 1/2" minimum diameter stainless steel sockets. Provide ball valve and snubber for each gauge. Provide 1/2” minimum diameter steel pipe extension to extend ball valve outside of pipe insulation. Steel pipe and ball valve specified elsewhere in the specifications.

C. Sizes: Scaled from 0 to 50 psi for snowmelt, sub-floor, and water systems. Scaled from 0 to 100 psi for all other systems

2.7 THERMOMETERS

A. Approved Manufacturers: Weksler, Trerice or equal.

B. Materials. Round, bimetal thermometer style using bimetallic sensing element, sensing element consisting of two dissimilar metals, stainless steel stem, highly polished type 300 stainless 4” diameter steel case, adjustable angle, silicone dampened coil, dial pointer, stainless steel stems, non-breakable double strength glass window, accuracy to +/- 1.0% full scale ASME B40.3 Grade A, external reset.

C. B. Materials: Adjustable base, plastic case, non-breakable window, accuracy of one scale division. Temperature wells to have copper bulbs.

D. Size: 9" long, scale ranging from -40 F to 110 F.

2.8 INSULATION

A. Pipe and equipment insulation system.

B. See Insulation Schedule on drawings for required thickness, type and location.

C. Insulation and Jacket Type:

1. Materials: Shall be composite insulation system including insulation, jacket (as specified for specific application), and all sealants and shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less. Shall be puncture resistant based on ASTM D-781, moisture and mildew resistant and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

2. Type 3 Insulation (exposed, interior of building) - Flexible Elastomeric Thermal Pipe Insulation by Armaflex or equal.

   a. Jacketing: None.

3. Type 5 Insulation (exposed, interior and exterior of building) – Dow XPS Styrofoam, Certainteed, Ownes-Corning, Pittsburgh Corning, Extrol, Fibrex, H.B. Fuller, or equal.

   a. Insulation shall meet the following properties:

Properties	Value
Density, ASTM D1622, minimum	1.6 lbs/cf
Compressive Strength ASTM D1621, minimum	20 lb/sq. in
K-factor, ASTM C518	0.259 btu-in/hr-cf-F
Water Absorption, % by volume ASTM C272/D2842, max.	0.5/1.0 %
Water Vapor Permeability, ASTM E96, max.	1.5 perm-inch

   b. Jacketing (exposed, interior of building):

      1) PVC material with thickness of 20 mils, gloss finish on one side, semi-gloss on other side, FS LP-535D. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation or installed outdoors. Jackets shall be rated for 0 F to 150 F with maximum flame spread rating of 25 meeting ASTM E-84 and maximum smoke development rating of 50 meeting ASTM E-84.

      2) Type: Composition A, Type II, Grade GU, jacketing shall meet above requirements. Type 3 jacketing shall meet ASTM D-1784, Grade 1, and high impact in addition to the above requirements.

   c. Jacketing (exposed, exterior of building and vertical pipe chase applications):

      1) Aluminum material alloy 3003, 1100, or 3105 meeting ASTM B-209 with H-14 temper, 20 mil, smooth finish, white painted aluminum. UV protected. Jacketing shall have no paper to retain moisture.

      2) Provide Polysurlyn moisture barrier with a minimum thickness of 2.5 mil. Dupont, Dow Saran or equal.

      3) Banding shall be 0.020” thick by ½” wide, 300 series, stainless steel.

      4) Aluminum jacketing for fittings, tees, elbows, valves, caps, etc. shall be sectional, factory contoured, to fit closely around insulation.

4. Type 5A (direct bury interior and exterior applications) – FoamGlas by Owens Corning or equal.

   a. Insulation shall meet the following properties:

Properties	Value
Density, ASTM C303, minimum	7.18 lbs/cf
Compressive Strength C165/C240/C552, minimum	90 lb/sq. in

K-factor, ASTM C518, C177 at 0F	0.250 btu-in/hr-cf-F
Water Absorption, % by volume ASTM C240, max.	< 0.2% by Vol
Water Vapor Permeability, ASTM E 96 West Cup, max.	0.0 perm-inch

b. Jacketing:

1) Approved manufacturers: Pittwrap SS by Pittsburgh Corning or equal. Insulrap 50-SJ-NG is not considered an equal.

2) Modified bituminous membrane

3) Self-healing material

4) Overlap shall be a minimum of 50%.

5) Apply in temperatures above 50F.

6) Properties:

Properties	Value
Thickness (mils), minimum	70
Permeability, ASTM E96 (perm-inches), max.	.002
Tensile Strength, ASTM D882 (at 78F), min.	>1150 lbs/in
Puncture Resistant, ASTM E154, min.	199 lbs

5. Type 5B (direct bury interior and exterior applications) Composite Piping System

a. This product is can only be used with composite piping systems with HDPE jacket such as Tricon Piping Systems, Inc., Energy Task Force Pre-Insulated Pipe or equal. Piping material shall meet the pipe specifications for this project. Shall use HDPE jacket as specified below.

b. Closed cell polyurethane foam insulation. Foamed in place.

c. Insulation shall meet the following properties:

Properties	Value
Density, ASTM D1622, minimum	2.0 lbs/cf
Closed Cell, minimum	90-95%
K-factor, ASTM C177	0.147 btu-in/hr-sf-F

d. Jacketing

1) Direct Bury, Interior and Exterior of Building for Composite Piping Systems:

2) Approved manufacturers: Tricon Piping Systems, Inc. or equal.

3) HDPE materials.

4) Must be applied with manufacturers recommended shrink sleeve material connecting pipe section for waterproof application. No substitutions.

5) Properties:

Properties	Value
Resin, ASTM D3350	Type III, Grade P34
Tensile Strength, ASTM D638(at 78F), min.	3300 psi
Ultimate Elongation, ASTM D638 min.	850%
Tangent Flexural Modules, ASTM D790, min.	175,000 psi

D. Insulation Inserts and Pipe Shields

1. Approved Manufacturers: B-Line, Pipe Shields, Value Engineered Products or equal.

2. Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12” and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be a minimum 180 degrees coverage on bottom supported piping and full 360 degrees coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate. On low temperature systems,

extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

3. Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thickness, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

4. Precompressed 20 lb density molded fiberglass blocks, Hamfab or equal, of the same thickness as adjacent insulation may be substituted for calcium silicate inserts with a 1" x 6" block for piping through 2 ½" and three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

5. Wood blocks will not be accepted.

E. Accessories:

1. Provide all adhesive, sealants, protective finishes, and other products as recommended by the manufacturer to provide a completely sealed system.

2. Provide vapor barrier that is non-flammable, fire resistant and polymeric resin, for all systems operating below 65 F.

3. Insulation bands shall be ¾ inches wide, constructed of aluminum or stainless steel. Minimum thickness to be 0.015 inches for aluminum and 0.010 inches for stainless steel.

4. Tack fasteners shall be stainless steel ring grooved shank tacks.

5. Staples shall be clinch style.

6. Insulating cement shall meet ANSI/ASTM C195, hydraulic setting mineral wool. Finishing cement shall meet ASTM C449.

7. Bedding compounds to be non-flammable, fire resistant, polymeric resin.

2.9 SEALANT AND FIRESTOPPING

A. Sealant and fire stopping of sleeves and openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor.

B. Fire and/or Smoke Rated Penetrations:

1. Approved Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco, or equal.

2. All fire stopping systems shall be provided by the same manufacturer.

3. Fire stop systems shall be UL listed or tested by and independent testing laboratory approved by the State.

4. Use a product that has a rating not less than the rating of the wall or floor being penetrated.

5. Contractor shall use firestop putty, caulk sealant, intumescent wrap strips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application require for this project. Provide mineral wool backing where specified in manufacturer's application detail.

C. Non-rated Penetrations:

1. Pipe Penetrations Through Below Grade Walls. In exterior wall openings below grade, use a modular mechanical-type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve.

2. Pipe Penetrations. At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve.

PART 3 - EXECUTION

3.1 EXCAVATION, INSTALLATION OF PIPE, AND BACKFILLING

A. The Contractor shall be responsible for verifying the location of all existing piping, electrical, and other utilities prior to excavation.

B. No changes to pipe alignment or elevation shall be made without approval from the Engineer.

C. All pipes shall be cleaned out prior to installation. Inspect pipe for defects and damage.

D. Decrease line size to pumps as required with long radius reducing elbows or concentric reducers/increasers in vertical piping. All valves and piping specialties must be full line size.

E. Excavate pipe trenches in accordance with OSHA regulations. All pipe trenches shall be backfilled as soon as possible. Backfill and compact materials in 12" lifts. Care shall be taken while backfilling to protect the pipe from damage. Backfill material for trenches within the building footprint or other structural areas shall be compacted to at least 100% standard moisture density relationship of soils to prevent settlement of the floor slabs.

F. Support all piping in such a manner as to prevent all vibration and vertical or horizontal movement. All pipe support systems shall be installed to meet local and state code requirements.

G. Provide all coring drilling required to install piping system through masonry or concrete walls, screen walls, roof structures and other structures as required to install piping systems. Keep holes to minimal size.

H. Provide all pipe sleeves required for core drilled penetrations.

I. Relief lines and devices shall be terminated outside of the building in accordance with all current State and Local codes including minimum distance from ground level, openings and exits unless a containment tank is specified.

J. All refrigerant piping shall be installed, tested and placed in operation per these specifications and the state and local mechanical codes.

K. All pipe joints erected on site shall be exposed for visual inspection prior to being covered.

3.2 TESTING OF PIPING SYSTEMS

A. All testing shall be witnessed by the Engineer. Provide advanced notification to the Engineer as specified in Section 131811 - Ice Rink General Requirements.

B. All piping shall be tested prior to backfilling. Isolate all equipment and any other devices that may be damaged by the pressure test. Testing procedures shall meet all code requirements.

C. Testing Requirements:

1. Polyethylene Pipe: Shall be tested as specified in Section 131813 -Ice Rink Floor.
2. Steel Brine Pipe: Shall be hydrostatically tested at 75 psig for 24 hours with no pressure drop.
3. Steel Refrigerant Pipe (Refrigeration system):
    a. Pressure Test: All refrigeration piping systems shall be pressure tested at the pressures stated in the table below with nitrogen gas for 24 hours with no pressure drop. The pressure shall then be lowered to 200 psig and maintained until system is ready to be charged. The test shall not begin until the Contractor is confident all water and contaminants are removed from the system. The Engineer shall witness the test.

Refrigerant	Pressure (psig)
Ammonia – High side	250 psi
Ammonia – Low side	250 psi

b. Vacuum Dehydration: After the piping has been tested, a vacuum pump of adequate size shall be connected to the associated piping and allowed or run continuously until a vacuum reading of at least 1000 microns (29.882 in. vacuum) or lower is obtained. This test must be maintained with the pump valved off for at least ten (10) minutes. Provide an absolute pressure gauge for monitoring and use per the manufacturer's recommendations. The Engineer shall witness the test.

4. Gauges used for pressure tests must be designed for pressures greater than the test pressure. For example, a 100-psi gauge cannot be used for a 100-psi test. The scale on the gauge must be the next increment up from 100 psi.

3.3 CHARGING OF SYSTEMS

A. Primary Refrigerant Systems: After all pressure tests and vacuum dehydration testing has passed, the system shall then be fully charged with the specified refrigerant.

B. Secondary Refrigerant Systems: After all pressure tests have passed the secondary refrigerant systems shall be fully charged with the specified solutions. Remove all air from the systems.

C. Waste Heat Recovery Systems: After all pressure tests have passed the waste heat recovery systems shall be fully charged with the specified solutions. Remove all air from the systems.

3.4 VALVES AND ACCESSORIES

A. Install valves at the locations shown on the drawings, described in the specifications as required for system operation and maintenance or as required by the manufacturer.

B. Install all valves so that they can be easily replaced in the future including installing unions and allowing adequate clearance.

C. Install all valves with adequate clearance around the valve for maintenance.

D. Install air release valves at all high points in the system whether or not shown on the drawings.

E. All pressure relief valves shall be located where ambient temperature is normally above 32 F. Pipe all pressure relief piping to within one foot of ice equipment room floor.

F. Install valves for system drainage at all exposed low points in the system whether or not shown on the drawings.

G. Provide all power and electrical systems as necessary for operation.

H. Expansion tank shall be supported from the ceiling or supported with a floor mounted frame system with adequate supports and gauge glass placed in highly visible arrangement. Location to be approved by the General Contractor.

I. Construction strainers in suction diffusers shall be removed after system start-up.

J. Install thermowells for all temperature gauges.

K. Resistance Temperature Detector (RTD) Assemblies

1. Piping system shall be drained and fluid stored for installation of threadolets to install wells and RTD probes. No hot taps allowed.
2. For new projects, installation shall be done prior to installation of insulation systems. For renovation projects, remove pipe insulation as necessary for installation of wells and sensors. Reinsulate piping system with like materials to provide a sealed insulation system.
3. Wire sensors directly to VFD's or other devices.
4. Refill piping systems. Provide additional fluid as necessary for full system charge. Remove air from system.

L. 30 days after start-up the following shall be performed on the system:

1. Replace filter dryer cores.
2. Clean screens on pumps, strainers and other equipment.

3.5 GAUGES AND THERMOMETERS

A. All gauges and thermometers shall be installed at eye level wherever possible unless specified otherwise and shall be positioned for ease of reading by operation and maintenance staff. All gauges and thermometers shall be calibrated per the manufacturer's recommendations prior to installation

3.6 HANGERS AND SUPPORTS

A. The Contractor is responsible for adequately supporting all piping systems and equipment with hangers, floor supports, framing systems and all other components required to adequately support the piping systems and equipment. If supported from the ceiling, the Contractor shall verify that the building structure can support the total weight of all piping and equipment systems where hangers and supports are installed unless otherwise noted on the drawings. If requested, the contractor shall provide calculations, by a registered engineer, to verify construction of hangers and supports is adequate including the building structure they are attached to.

B. Support all piping in such a manner as to prevent all vibration and vertical or horizontal movement.

C. Pipe hangers and supports shall be spaced no more than eight (8) feet on center. Provide additional supports by equipment for assistance with equipment maintenance and replacement. Provide sufficient supports near equipment so that temporary supports are not needed to remove and replace equipment or to service and maintain equipment.

3.7 INSULATION AND JACKETS

A. Furnish and install insulation and jacketing on equipment and piping as noted on the drawings and all other cold surfaces which are part of the system including, but not limited to, chilled water pump bodies, chilled water filter, chemical bypass feeder, etc.

B. Systems shall not be insulated until an inspection has been completed by the Engineer and pressure tests have been performed and accepted.

C. All valves, fittings, and accessories connected to pipe and equipment systems shall be insulated and jacketed. Provide handle extensions as required to allow full insulation of valves.

D. Provide vapor barrier for all systems operating below 65 F.

E. Install all insulation and jacketing per manufacturer's recommendations. Use full length materials. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers or supports maybe attached directly to piping

with insulation completely covering hanger or support and jacket sealed at support rod penetrations. Where riser clamps are required to be attached directly to piping requiring a vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

F. Install all jacketing on exposed exterior piping systems with joints at 3'oclock and 9 o'clock position and jacketing secured with specified banding and seals. Banding shall be installed at a maximum of 9" on center. End joints shall be secured with bands and seals centered directly over joint. Jacketing shall be installed in a manner to shed water and in accordance with the Midwest insulation Contractors Association (M.I.C.A) National Commercial and Industrial Standards. Jacketing shall be caulked before closing and banding and positioned in an orientation to avoid water infiltration.

G. All insulation joints shall be staggered and tight. Provide 2" minimum lap on jackets and 2" tape on butt joints, firmly and continuously cemented with lap adhesive or welding solvent as recommended by the manufacturer. Additionally, secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.

H. Provide inserts and pipe shields at all hanger and support locations. Inserts may be omitted on ¾" and smaller copper piping provided 12" long 22-gauge pipe shields are used.

I. Insulate entire piping system for a completely insulated system including all areas that will frost up during operation. This includes filling all gaps, spaces, voids, etc. completely to prevent frost or condensation build up. This also includes providing valve handle extensions and all other material to properly insulate valves and prevent condensation. Insulation shall be tightly butted and free of voids and gaps. Weather seal shall be continuous.

J. All fasteners and bands shall be neatly aligned, and overall work must be of high-quality appearance and workmanship.

K. Provide removable insulated covers for fill valves, equipment lifting hooks, access points to strainers, valves, nameplates, and all other areas that require periodic inspection, service or repair.

L. All site glasses and nameplates shall be insulated to prevent frost build-up.

M. Provide all adhesive, sealants and other products as required by the manufacturer to provide a completely sealed system. Seal all seams of the jacketing.

3.8 SEALING AND FIRESTOPPING

A. All pipes piercing interior and exterior walls, ceiling, and floor shall be tightly sealed to the walls, ceiling and floors through which they pass as specified herein.

1. Fire and/or Smoke Rated Penetrations. Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.
2. Non-Rated Penetrations. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve and cored opening and the pipe or insulation is completely blocked.

3.9 PAINTING AND FINISHES

A. All interior steel piping, equipment, fittings, supports, and accessories that are exposed to view shall be painted with one coat of primer and one coat of enamel. Ammonia piping colors per IIAR Bulletin No. 114 March 2017. Prepare steel as recommended by the paint manufacturer. Colors shall be as outlined in table below:

Area or item	Color
Ammonia high pressure liquid lines	Orange (Pantone 152 C)
Ammonia high pressure vapor lines	Yellow (Pantone 109C)
Ammonia low pressure/high temperature liq. & vapor lines (0F to +47.3F)	Light blue (Pantone 298C)
Ammonia low pressure/low temperature liq.&vapor lines	Dark blue (Pantone 3015C)
Pressure relief vent piping	Grey (Pantone 430C)
Other refrigerant piping and vessels	Color selected by Owner
Condenser water piping (refrigerant piping specified above)	Color selected by Owner
Interior supports and frames in refrigeration room	Color selected by Owner
All other areas not mentioned	Color selected by Owner

B. All exterior exposed steel piping shall be painted with one coat of primer and two coats of enamel. Prepare steel as recommend by the paint manufacturer. Owner to select color of paint.

C. Touch up paint on all equipment, vessels, supports and exposed pipes after project is complete.

D. Touch up damaged galvanized coatings and corrosion protection systems on condenser and remote sump.

END OF SECTION 131814

SECTION 13 18 15 – ICE RINK WASTE HEAT RECOVERY SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General system description and design criteria.

B. Pumps.

C. Heat Exchanger.

D. Expansion Tank.

E. Snowmelt Coil.

F. Circulation Fluid.

G. Pipe and Accessories.

1.2 GENERAL SYSTEM DESCRIPTION AND DESIGN CRITERIA

A. Provide all materials, equipment and controls necessary for a fully functional waste heat recovery system that recovers waste heat from the refrigeration system and uses it for heating the sub-floor heating system and for melting snow in the snow melt pit. The system shall be a closed piping system.

B. The snow melt pump will operate continuously circulating a glycol/water solution while the compressors are operating. The glycol temperature shall be controlled by a thermostatic solenoid valve which stops the flow of refrigerant through the heat exchanger when the desired temperature is reached. The solenoid control valve shall be capable of automatically controlling glycol temperatures over a range of 40 F to 100 F. The snowmelt pump shall automatically lock out when the compressors are not operating.

C. The sub-floor pump will be operated automatically by sensing the sub-floor temperature sensors in each rink floor as necessary to keep the soils beneath the ice rink slab between 32 F and 45 F. A temperature sensor and the ice rink controls system should monitor the temperature of the glycol going to the sub-floor system. When the glycol temperature drops below 45 F (temperature setting shall be adjustable) the three-way valve shall modulate to allow more of the warmer glycol from the snow melt piping loop into the sub-floor piping loop until the desired glycol temperature and sub-floor temperature is satisfied. The sub-floor pumps shall automatically lock out when the compressors and snowmelt pump are not operating.

1.3 RELATED SECTIONS

A. Section 007200 - General Conditions.

B. Section 007300 – Supplementary Conditions.

C. Section 131811 - Ice Rink General.

D. Section 131812 – Ice Rink Refrigeration System.

E. Section 131813 - Ice Rink Floor.

F. Section 131814 - Ice Rink Piping, Valves and Accessories.

G. Section 131817 – Ice Rink Central Control System.

1.4 SUBMITTALS

A. Shop Drawings. All submittals shall conform to the requirements of General Conditions and Section 131811 - Ice Rink General Requirements.

1.5 WARRANTY/GUARANTY

A. As required in Section 131811 - Ice Rink General Requirements.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

A. As required in Section 131811 - Ice Rink General Requirements.

PART 2 - PRODUCTS

2.1 PUMPS (INLINE)

A. Approved Manufacturers: Bell & Gossett Series e80 or equal.

B. Design Criteria: See Ice Equipment List on drawings.

C. Shall meet all requirements of the Rink Pumps in Section 131812 with the following exceptions:

1. Shall be horizontal, base mounted or close coupled.
2. Impellers shall be cast bronze, enclosed type.
3. Wearing rings shall be bronze construction.

D. Energy Rating. After January 27, 2020, all pump and motor assemblies shall be in compliance with the pump energy efficiency regulations by the U.S. Department of Energy. Provide all documents with the shop drawing submittal and as required for the Owner to apply for a rebate through the electrical utility.

2.2 HEAT EXCHANGER (SHELL AND TUBE)

A. Approved Manufacturers: Vilter Manufacturing Corporation, Chil-con, Henry Technologies, ITT Bell & Gossett, Cimco, or equal.

B. Design Criteria: See Ice Equipment List on drawings.

C. Shell and Head Construction: Steel pipe construction conforming to ASME Specifications AS-53 Grade B, seamless or resistance welded; or rolled steel plate conforming to ASME SA-516 Grade 70 with electric fusion welds conforming to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

D. Minimum design ratings on vessels shall be as follows:

Refrig.	Shell Side Pressure	Tube Side Pressure	Temperature Range
R-717	250 PSIG	150 PSIG	-20 F to 200 F

E. Tube Construction: Carbon steel with outer diameter of 0.75 inch and a minimum wall thickness of 0.065 inches. Fouling resistance shall be 0.0005. See table above for design pressure and temperatures.

F. Accessories: Provide a dual relief valve assembly as specified and per code requirements. Provide all valves, gauges, piping, electrical and other related materials and accessories as necessary for a fully operational system. Name plate shall clearly display code compliance and capacity of vessel.

G. Vessel shall be mounted on a steel frame system or ceiling mounted. The steel frame and vessels shall be shop painted with one coat of primer and one coat of alkyd egg-shell enamel.

H. All vessels must meet state requirements for national board registration.

2.3 EXPANSION TANK

A. Approved Manufacturers: Aurora, ITT Bell & Gossett, John Wood Company, Cimco, or equal.

B. Capacity: See Ice Equipment List on drawings.

C. Materials: Minimum pressure rating of 125 psig in accordance with Section VIII, Division 1, of the ASME Boiler Pressure Vessel Code, and registered with the National Board of Boiler Pressure Vessel Inspectors.

D. Accessories: Gauge glass equal in construction to Henry Valve Co. Type 824. Air control fitting equal to ITT Bell & Gossett tank fitting and ATFL including brass vent tube plug and stainless-steel ball check.

E. Tank shall be painted with one coat of primer and one coat of enamel.

2.4 SNOW MELT COIL

A. Fabricate coil from 2 ½" Schedule 10 304L stainless steel pipe and fittings as shown on the plans. All connections shall be welded except for the flanged connection at the pit wall.

B. Pipe supports shall be 3" high 304L stainless steel square stock, spaced at 3' on center to support the snow melt coil. If the snow melt pit is specified with a membrane liner, pipe supports shall be steel tubing, all edges shall be rounded to prevent puncturing liner and supports shall be tack welded to coil.

C. Verify size of snow melt pit and location of drain pipe prior to fabricating the coil.

2.5 SECONDARY REFRIGERANT

A. See section 131812.

2.6 PIPING AND ACCESSORIES

A. Provide all piping, thermometers, gauges, valves, insulation, controls, electric as required for a complete system, as shown on the drawings, and as specified in Section131814 - Ice Rink Piping, Valves and Accessories.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install, test and start up equipment, piping, valves, insulation, etc. as specified in Sections 131813 - Ice Rink Floor, 131812 - Ice Rink Refrigeration System, and 131814 - Ice Rink Piping, Valves and Accessories.

B. Verify with General Contractor prior to mounting piping, tanks, heat exchangers, to walls or ceiling in ice mechanical room.

C. Provide all controls and electrical work as required for a complete operating system.

3.2 START UP AND SHUTDOWN SERVICES

A. See Section 131811 - Ice Rink General Requirements.

END OF SECTION 131815

SECTION 13 18 17 – ICE RINK CENTRAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes labor, materials, equipment, skills and related services necessary to furnish and install an ice rink control system (IRCS) for the ice rink refrigeration system.

B. General Requirements

C. General System Description and Design Criteria

D. References

E. Submittals

F. Warranty

G. Products, Delivery, Storage and Handling Requirements

H. Products

I. Execution / Performance

1.2 RELATED SECTIONS

A. Division 0, Division 1, General and Supplemental Conditions

B. Section 131811 – Ice Rink General Requirements

C. Section 131812 – Ice Rink Refrigeration System

D. Section 131815 – Ice Rink Waste Heat Recovery Systems

E. Drawing Sheets show locations and quantities of equipment for the refrigeration system.

1.3 GENERAL REQUIREMENTS

A. All work of this Division shall be coordinated and provided by the single Ice Rink Control System (IRCS) Contractor.

B. The work of this Division shall be scheduled, coordinated and interfaced with the associated work of other trades. Reference the other Division 13 Sections for details.

C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

D. If the IRCS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the Engineer.

E. Provide connection points to collect and manipulate data from power monitoring device specified in Section 13 18 12 Ice Rink Refrigeration System.

F. The IRCS Contractor is responsible for the design of the control system.

G. The refrigeration system shall have sufficient manual controls to allow the system to operate without the computer control system if the computer control system fails.

1.4 GENERAL SYSTEM DESCRIPTION AND DESIGN CRITERIA

A. The Ice Rink Control System (IRCS) shall be a complete system to operate the ice rink refrigeration system and all its functions and monitoring requirements and include the following:

1. An 18" (minimum size) touch screen microprocessor control system to control and manage the refrigeration system and all its components, functions and alarms.
2. The capability of remote access through an Owner provided data/phone circuit. Contractor to supply phone line to unit. Owner will supply any data lines require for connection with building management, energy management or IT systems.
3. Provide all control and monitoring points and alarms to the Building Management System (BMS) or Energy Management System (EMS) as specified elsewhere.

B. The work of the single IRCS Contractor shall be as defined individually and collectively in all Sections of Division 13 of these specifications together with the Drawings.

C. The IRCS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned IRCS.

D. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

E. The IRCS shall be integrated with the refrigeration system's specified motor control center (MCC) and shall be located in a wall mounted, NEMA rated, steel enclosure.

1.5 REFERENCES

A. In addition to the references listed in Section 131811 - Ice Rink General, all work shall conform to the following Codes and Standards, as applicable:

1. National Fire Protection Association (NFPA) Standards.
2. National Electric Code (NEC) and applicable local Electric Code
3. Underwriters Laboratories (UL) listing and labels.
4. UL 864 UUKL Smoke Control
5. UL 268 Smoke Detectors.
6. UL 916 Energy Management
7. NFPA 70 - National Electrical Code.
8. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.

9. NFPA 92A and 92B Smoke Purge/Control Equipment. Factory Mutual (FM).
10. American National Standards Institute (ANSI).
11. National Electric Manufacturer's Association (NEMA).
12. American Society of Mechanical Engineers (ASME).
13. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) [user note: add ASHRAE 62 IAQ as applicable].
14. Air Movement and Control Association (AMCA).
15. Institute of Electrical and Electronic Engineers (IEEE).
16. American Standard Code for Information Interchange (ASCII).
17. Electronics Industries Association (EIA).
18. Occupational Safety and Health Administration (OSHA).
19. American Society for Testing and Materials (ASTM).
20. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
21. Americans Disability Act (ADA)
22. ANSI/EIA 909.1-A-1999 (LonWorks)
23. ANSI/ASHRAE Standard 195-2004 (BACnet)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the authorities having jurisdiction at the project site.

D. Definitions:

1. EMS – Energy Management System
2. BMS – Building Management System
3. DDC – Direct Digital Control
4. IRCS – Ice Rink Control System

1.6 SUBMITTALS

A. Shop Drawings. All submittals shall conform to the requirements of General Conditions and Section 131811 - Ice Rink General Requirements.

B. The IRCS contractor shall submit a list of all shop drawings with submittals dates within 45 days of contract award from City to Ice Rink Contractor.

C. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Engineer for Contract compliance.

D. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the IRCS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.

E. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.

F. The IRCS Contractor shall correct any errors or omissions noted in the first review.

G. At a minimum, submit the following:

1. IRCS network architecture diagrams including all nodes and interconnections. Include future/existing BMS/EMS connection.
2. Systems schematics, sequences and flow diagrams.
3. Points schedule for each point in the IRCS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
4. Samples of screen menus.
5. Details of all IRCS interfaces and connections.
6. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.7 RECORD DOCUMENTATION

A. Provide the following information in addition to the requirements of Section 131811 - Ice Rink General Requirements.

1. Operation and Maintenance Manuals
    a. One (1) hard copy and three (3) electronic copies on compact disc (CD) format of the entire Operation and Maintenance Manuals shall be provided to the Engineer upon completion of the Project. Include the following for the IRCS:
        1) Table of contents.
        2) As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
        3) Manufacturer's product data sheets or catalog pages for all products including software.
        4) System and Software Operator's manuals.
        5) Archive copy of all site-specific databases and sequences.
        6) IRCS and BMS network diagrams.
        7) Interfaces to all third-party products and work by other trades.
        8) Operating license for all software.
    b. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.8 WARRANTY/GUARANTY

A. As required in Section 131811 - Ice Rink General Requirements.

B. Provide as-built drawings to include a board and points list for the system.

C. The Ice Rink Control Contractor must furnish 8 hours of checkout and walk thru time at refrigeration start up with the Owners personnel.

D. Contractor shall assure all warranties and extended warranties are properly filed for all systems and equipment. A copy of all warranties shall be inserted in the Operation and Maintenance Manuals.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

A. As required in Section 131811 - Ice Rink General Requirements.

1.10 QUALIFICATIONS

A. As evidence and assurance of the contractor's controls subcontractor's ability to construct the project, the control subcontractor must have successfully completed the design, programming and installation of five (5) ice rink control systems similar to this project within the past five (5) years.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Control systems by Alerton by NAC (651.490.9869, www.nac-hvac.com),Tridium-Vykon by Total Mechanical Services, Inc. (651.768.9367, www.totalmech.com) Cimco SmartHub and Distech, WAGO, or equal manufacturer.

2.2 GENERAL

A. Furnish and install a complete ice rink control system (IRCS) including all controllers, alarm devices, enclosures, transformers, sensors, transducers, boards required for a complete monitoring system.

B. Provide an uninterruptible power supply (UPS) that provides 20-minute run time during a power failure. The purpose of this system is to allow the system to run long enough to send out alarms.

2.3 CONTROLLERS

A. Alerton Visual Logic Controller (VLC) or equal. Furnish and install all cards and boards required.

B. Provide remote monitoring capabilities.

C. All panels and devices must utilize BACnet ANSI/ASHRAE Standards 135-2004, as required to interact with the existing/future BMS/EMS, on a single building level network.

D. Provide web accessible graphic monitoring and control system. All system access shall be compatible with standard, current web browsers.

2.4 GRAPHICAL USER INTERFACE (GUI)

A. The Graphical User Interface shall allow the operator to view, configure, and edit values from multiple controllers. The GUI shall be completely programmable and shall be wall mounted.

B. Operator interface shall be via a wall mounted touch screen display with ASHRAE standard user definable graphical icons associated with any displayed variable.

C. Variables such as alarms, trends, set points, analog and digital values may be displayed and/or edited using the GUI.

D. The GUI shall be menu based displaying a minimum of 16 menus. Menus shall be arranged logically

E. The graphics shall provide a visual representation of the ice rink, refrigeration system and equipment with associated hardware point's locations displayed symbolically and monitoring inputs shown.

2.5 OTHER SYSTEMS

A. ICRS shall communicate with the refrigerant gas monitoring system, power monitoring device, ventilation system, building management system and fire alarm system. See Section 131813 – Ice Rink Refrigeration System.

2.6 ENCLOSURES

A. Furnish and install all required enclosures. Furnish and install weatherproof enclosures for exterior equipment such as the condenser. Seal all unused knockout holes with silicon sealant. Label enclosure.

2.7 SENSORS AND TRANSDUCERS

A. Approved Manufacturers: Rochester Gauges, Inc., Computer Process Controls, Inc., Ashcroft Inc., Kele Inc., Omega, JW Instruments, ACI, SETRA, or equal.

B. Furnish and install all sensors, transducers and all other devices required to control and monitor systems.

C. Scale on sensors shall be as specified in the contract drawings for monitoring devices. If not specified, shall be typical of similar systems.

D. Temperature Sensor Accuracy. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

Point Type	Accuracy
Glycol/Brine (warm or cold)	+ .5ºF
Ice/Subfloor Temperature	+ .5ºF
All Others	+ .5ºF

E. Resistance Temperature Detectors (RTD) Assemblies:

1. RTD: Single Element, platinum, 3 wire, Tolerance Class A, 316 stainless steel sheath. Length to be at approximately 10% longer than radius of pipe.
2. Temperature Ranges:
    a. Return brine/glycol: 0-50F
    b. Others: As required.
3. Spring loaded.
4. NPT stainless steel hex nipple.
5. Aluminum screw cover head – NEMA 4X rated.

F. Thermowell:

1. Shall be standard duty threaded (NPT), 304 stainless steel, NPT size as required to accommodate RTD or other devices.
2. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.

3. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.

G. Transducers

1. Replace the adjustable transducers that come with the Bitzer screw compressors and others, and replace with a valve and fixed transducer on each gauge port.

2.8 LOW VOLTAGE CABLE

A. Cable: Shall be level-4, twisted pair, stranded and shielded.

B. Wire: Shall be 22 AWG, 0.65 mm diameter.

C. Loop Resistance: 106 ohms/km

D. Capacitance: 49 nf/km

2.9 CABLE FOR SENSORS, TRANSDUCERS AND CONTROL RELAY

A. Temperature Sensors and 2 Wire Inputs Sensors: (Dry contact, 4-20 ma, and low voltage): 2-wire input sensor cable shall be 2 conductor, stranded, shielded, twisted, PVC jacketed 22 AWG, (Belden #8761 or equiv.). Cable runs over 800 feet shall be a minimum of 18 AWG.

B. Control Relays (low voltage or dry contact only): Cable shall be 2 conductors, stranded, twisted, PVC jacketed 18 AWG cable, (Belden #8461 or equiv.).

C. Pressure Transducers: Cable shall be 3 conductors, stranded, shielded, twisted, PVC jacketed 22 AWG, (Belden #8771 or equiv.). Cable runs over 800 feet shall be a minimum of 18 AWG.

2.10 CONDUIT

A. Cable: General: Conduit for all high voltage, low voltage, and communication connections must be run and connected in accordance to meet current electrical code standards.

B. High Voltage Connections:

1. Separate conduit shall be run from each refrigeration/HVAC controller, IRLDS-II panels, Input/output boards, and control boards to each respective enclosure or panel housing their source of power. Conduit will not be necessary if equipment is mounted directly to enclosure housing source of power providing electrical couplings are fitted to link enclosures permitting enough room to supply power wires to equipment.

C. Low Voltage Connections:

1. Controllers: Separate conduit will be run to connect any Alerton VLC, or equal controllers where by the units are separated from each other in different rooms. Conduit will be labeled at each end as “echelon net and/or 485 com” and to what controller opposite end of conduit leads to.

2. Input / output boards: Separate conduit will be run to connect any enclosures housing I/O and/or controller boards where communication wires are needed to link each other through an area outside of the building structure ensuring no communication wires are left exposed to outside air. Conduit will be labeled at each end as to what I/O board and/or controller the opposite end of conduit leads to.

3. Sensors: Separate conduit per island or dual-temp case shall be run in slabs from equipment enclosure housing respective I/O boards of each case to enclosed area of case. Conduit shall be labeled with case or I/O board number on each end of conduit.

2.11 LABELS

A. All components, devices and cables shall be identified with printed labels. Labels shall include name of equipment, unit numbers, identify associated equipment and devices.

B. Cables shall have labels at each end.

C. Input and Output relays, digitals controls shall be labeled with control description.

D. Alarms shall be labeled as “out alarms” or “in alarms”.

2.12 ALARM LIGHT AND STROBE

A. Furnish one (1) alarm strobe light with time delay button.

PART 3 - EXECUTION / PERFORMANCE

3.1 GENERAL INSTALLATION

A. Installation shall be in accordance with manufacturers recommendations.

3.2 SENSOR AND TRANSDUCER INSTALLATION

A. All sensors and transducers are to be mounted in an appropriate location. All pressure transducers must be mounted in an upward vertical position and accessible for adjustment. All sensors and transducers are to be properly setup through software and hardware.

3.3 WIRE INSTALLATION

A. No cable will be run in the same conduit as line voltage wiring.

B. All cables can be run exposed whenever permitted by code, and shall be secured in such a manner so that it is not visible from the floor.

C. Communications cables connecting boards shall be run from board to board in a logical daisy chained fashion with no breaks, or star configurations.

3.4 GAS MONITORING SYSTEM CONNECTIONS

A. Connect gas monitoring system unit outputs to IRCS for alarming and monitoring functions.

B. An alarm strobe light and bell with time delay button shall be mounted by the controller.

C. Furnish and install one dry contact pushbutton. Mount switches to the outside of alarm panel. Label one switch as "Sign Override".

D. Settings shall enable alarms to stay "on" if system fails.

E. Program all necessary set points, parameters, and alarm settings for proper operation.

3.5 ALARMS

A. All alarm parameters must be programmed and fine-tuned at time of product delivery.

B. Owner must be notified of all alarms through email and text messages.

C. Connect ice system controls to automatic dialer system, specified in Section 131812 – Ice Rink Refrigeration System, for alarm notifications.

D. Outside alarms must be tested in the present of Owner's representative.

E. All alarms and settings identified herein are recommended guidelines for initial system setup. These settings shall be fully adjustable.

F. The following alarms and Set Points shall be established.

1. Compressor high discharge pressure - 200 psi
2. Compressor high discharge temperature - 300ºF
3. Compressor low suction pressure - 10 psi
4. Compressor high oil temperature - 150ºF
5. Compressor low oil temperature - 90ºF
6. Compressor low oil net pressure - 15 psi (net = oil pressure – suction pressure)
7. Brine/glycol return high temperature - 24ºF
8. Heat recovery water heater high water temperature - 150ºF
9. Emergency bypass/crossover solenoid valve activation - 235psi
10. Refrigeration system power failure.

G. The following equipment shall be monitored for status/current after a start command has been given. Alarms shall be recorded and require manual user reset when the current monitoring has identified that the equipment is not operating.

1. Compressors
2. Brine/glycol pumps
3. Condenser
4. Snowmelt pump
5. Subfloor pump

H. The following alarms shall be recorded and automatically de-energize the associated compressor. When the alarms are cleared, the user must manually reset alarms through on-site access or remote access to bring associated compressors back into operation.

1. Compressor high discharge pressure.
2. Compressor low suction pressure.
3. Compressor high discharge temperature.
4. Compressor high oil temperature.
5. Compressor low oil pressure (net).
6. Start failure (MCC failure for motor overload, phase loss, etc.)

I. The following alarms shall be recorded and automatically de-energize all compressors. When the alarm condition is cleared, the compressor shall automatically reset. The alarm shall remain in a latched state for operator to identify that alarm occurred.

1. Chiller flow switch
2. Emergency stop activated
3. Refrigerant leak detection activation

3.6 CABLE FOR SENSOR, TRANSDUCERS, AND CONTROL RELAY INSTALLATION

A. No cable will be run in the same conduit as line voltage wiring.

B. All cables can be run exposed whenever permitted by code, and shall be secured in such a manner so that it is not visible from the floor.

C. Cables with multiple conductors to accommodate more than one sensor can be utilized for island and dual-temp cases only, providing all limitations are met through specifications for each sensor connected.

D. Cables for input sensors shall be run with no breaks or splices from the I/O board to sensors wires. Use wire butt connector. Do not use wire nuts.

E. Cables for control relays shall be run with no breaks or splices from the I/O board to termination on points of relay.

3.7 PENETRATIONS

A. Provide fire stopping for all penetrations used by dedicated BMS/EMS conduits and raceways.

B. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.

C. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.

D. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

3.8 GENERAL POINTS LIST

A. The IRCS shall, at minimum, monitor the following system points and points necessary for a complete control system as describe in this section.

B. Points Type Legend:

1. AI – Analog Input
2. AO – Analog Output
3. BI – Binary Input
4. BO – Binary Output

GENERAL				
Description	Function	Units	Input/ Output	Type
Outdoor Air Temperature	Monitor	Degree F	Input	AI

Outdoor Relative Humidity	Monitor	%	Input	AI
Refrigeration System Power Status	Monitor	On/Off	Input	BI
Power Usage (Electric Submeters)	Monitor/ Logging	KWH	Input	
System Enable Switch	Monitor	On/Off	Input	
Spare				
Spare				
ALARMS AND SAFETIES				
Description	Function	Units	Input/ Output	Type
Refrigeration System Emergency Stop	Control	On/Off	Input	BI
Leak Detection Refrigerant Level	Monitor	PPM	Input	AI
Leak Detection Alarm Level 1	Monitor		Input	BI
Leak Detection Alarm Level 2	Monitor		Input	BI
Leak Detection Alarm Level 3	Monitor		Input	BI
Leak Detection Alarm Level 4	Monitor		Input	BI
Chiller Flow Switch	Monitor		Input	BI
Condenser Fail to Run	Monitor		Input	BI
Spare				
SOLENOID VALVES				
Description	Function	Units	Input/ Output	Type
Chiller King Solenoid Valve	Control	Open/Closed	Output	BO
Bypass/Crossover Solenoid Valve	Control	Open/Closed	Output	BO
Compressor Only Enabled Solenoid Valves	Control	Open/Closed	Output	BO
COMPRESSORS				
Description	Function	Units	Input/ Output	Type
Compressor Common Discharge Pressure 1	Monitor	PSI	Input	AI
Compressor Common Discharge Pressure 2	Monitor	PSI	Input	AI
Compressor 1 Oil Temperature	Monitor	Degree F	Input	AI
Compressor 1 Oil Pressure	Monitor	PSI	Input	AI
Compressor 1 Discharge Pressure	Monitor	PSI	Input	AI
Compressor 1 Suction Pressure	Monitor	PSI	Input	AI
Compressor 1 Command	Control	On/Off	Output	BO
Compressor 1 Status	Monitor	Amps	Input	AI
Compressor 1 Stage 1 Loading	Control	On/Off	Output	BO
Compressor 1 Stage 2 Loading	Control	On/Off	Output	BO
Compressor 2 Oil Temperature	Monitor	Degree F	Input	AI
Compressor 2 Oil Pressure	Monitor	PSI	Input	AI
Compressor 2 Discharge Pressure	Monitor	PSI	Input	AI
Compressor 2 Suction Pressure	Monitor	PSI	Input	AI
Compressor 2 Command	Control	On/Off	Output	BO

Compressor 2 Status	Monitor	Amps	Input	AI
Compressor 2 Stage 1 Loading	Control	On/Off	Output	BO
Compressor 2 Stage 2 Loading	Control	On/Off	Output	BO
Compressor 3 Oil Temperature	Monitor	Degree F	Input	AI
Compressor 3 Oil Pressure	Monitor	PSI	Input	AI
Compressor 3 Discharge Pressure	Monitor	PSI	Input	AI
Compressor 3 Suction Pressure	Monitor	PSI	Input	AI
Compressor 3 Command	Control	On/Off	Output	BO
Compressor 3 Status	Monitor	Amps	Input	AI
Compressor 3 Stage 1 Loading	Control	On/Off	Output	BO
Compressor 3 Stage 2 Loading	Control	On/Off	Output	BO
Spare				
ADIABATIC CONDENSER				
All points necessary for monitoring/controlling Trillium Condenser Controller as recommended by manufacturer.	Control/Monitor	Varies	Input/Output	Varies
Spare				
ICE RINK				
Description	Function	Units	Input/ Output	Type
Glycol Supply Temperature	Monitor	Degrees F	Input	AI
Glycol Return Temperature	Monitor	Degrees F	Input	AI
Rink Floor Temperature 1	Monitor	Degrees F	Input	AI
Rink Floor Temperature 2	Monitor	Degrees F	Input	AI
Rink Floor Temperature 3	Monitor	Degrees F	Input	AI
Rink Floor Temperature 4	Monitor	Degrees F	Input	AI
Subfloor Temperature 1	Monitor	Degrees F	Input	AI
Subfloor Temperature 2	Monitor	Degrees F	Input	AI
Subfloor Temperature 3	Monitor	Degrees F	Input	AI
Subfloor Temperature 4	Monitor	Degrees F	Input	AI
RINK PUMPS				
Description	Function	Units	Input/ Output	Type
Rink Pump 1 Command	Control	On/Off	Output	BO
Rink Pump 1 Status	Monitor	Amps	Input	AI
Rink Pump 1 Speed Control (VFD)	Control		Output	AO
Rink Pump 2 Command	Control	On/Off	Output	BO
Rink Pump 2 Status	Monitor	Amps	Input	AI
Rink Pump 2 Speed Control (VFD)	Control		Output	AO
HEAT RECOVERY SYSTEMS				

Description	Function	Units	Input/ Output	Type
Snowmelt Pump Command	Control	On/Off	Output	BO
Snowmelt Pump Status	Monitor	Amps	Input	AI
Snowmelt Return Temperature	Monitor	Degrees F	Input	AI
Snowmelt Supply Temperature	Monitor	Degrees F	Input	AI
Subfloor Pump Command	Control	On/Off	Output	BO
Subfloor Pump Status	Monitor	Amps	Input	AI
Subfloor Supply Temperature	Monitor	Degrees F	Input	AI
Subfloor 3-Way Valve	Control		Output	AO

3.9 SEQUENCE OF OPERATION

A. The following is a general sequence of operation to familiarize the control system developer/supplier with the functions and controls of the ice system. It may not be comprehensive sequence or list and may be modified throughout the project.

B. All temperatures and pressure settings identified herein are recommended guidelines for initial system setup. These settings should be adjusted during system operation to achieve optimum system performance.

C. Compressors

1. Compressor Lead/Lag.

a. The three (3) compressors shall rotate lead / lag positions based on operator sequence selection to rotate order of operation. The following compressor sequences shall be used.

Lead Position	*Lag Position*	*Standby Position*
1	2	3
2	3	1
3	1	2

2. Compressor Operation

a. Compressor operation is controlled by secondary refrigerant temperature returning from rink floor based on operator adjustable Set Point (SP). System shall have the following pre-programmed setpoints:

1) Ice Mode: Adjustable Set Point. Initial setpoint = 14F

2) Cover Mode: Adjustable Set Point. Initial setpoint = 17F

b. Lead / Lag compressors shall be energized in accordance with the SP offsets in the table below. SP offsets shall be operator adjustable.

Compressor	*ON (ºF)*	*OFF (ºF)*
Lead	SP + 1º	SP - 1º
Lag	SP + 2º	SP - 1º

c. Lag compressors shall not be energized until the SP offset has been reached and the lead compressor has been operating fully loaded for 10-minutes.

d. If the lead compressor fails to start, the lag compressor shall be energized within 2-minutes of the failure.

3. Compressor loading shall be fully adjustable with initial settings as follows:

a. Stage 1 loading will occur 1-minute after compressor start.

b. Stage 2 loading will occur 2-minutes after compressor start.

D. Heat Reclaim System

1. Snow Melting

a. Pump on and solenoid valve open when compressors are running.

2. Subfloor Heating

a. With subsoil temperature sensors: Pump on when compressors are running and subsoil temperature is less than 40º (F). If glycol temperature is less than 55º (F), the three-way valve shall modulate warmer glycol from the snow melt piping loop into the subfloor heat loop. Pump shall turn off when subsoil temperature reaches 45º (F).

b. Without subsoil temperature sensors: Pump on when compressors are running. If glycol return temperature is less than 40º (F), the three-way valve shall modulate warmer glycol from the snow melt piping loop into the subfloor heat loop until the glycol temperature reaches 45º (F).

E. Adiabatic Condenser

1. Condenser shall be independently controlled by unit supplied controller based on discharge head pressure.

2. Control system shall automatically drain water from system when temperatures drop below 45F via a solenoid valve located on the water supply line. Coordinate connection with plumbing contractor under separate bid package.

F. Chiller

1. The level of refrigerant in the chiller vessel is controlled by:

a. A solenoid valve (king valve) as described below.

b. A high-level float switch shall be wired in series with the solenoid valve (king valve) to close the solenoid valve if the maximum set level in the chiller is reached.

G. Rink Pumps

1. Continuously running. Pump speed regulated by VFD based on operator adjustable Set Point (SP) for the ice rink floor temperature as measured by the rink floor sensors. One pump should always operate at 100%.

H. Solenoid Valves:

1. King Valve for Chiller Vessel:

a. This valve allows refrigerant to pass from the high-pressure receiver to the chiller vessel.

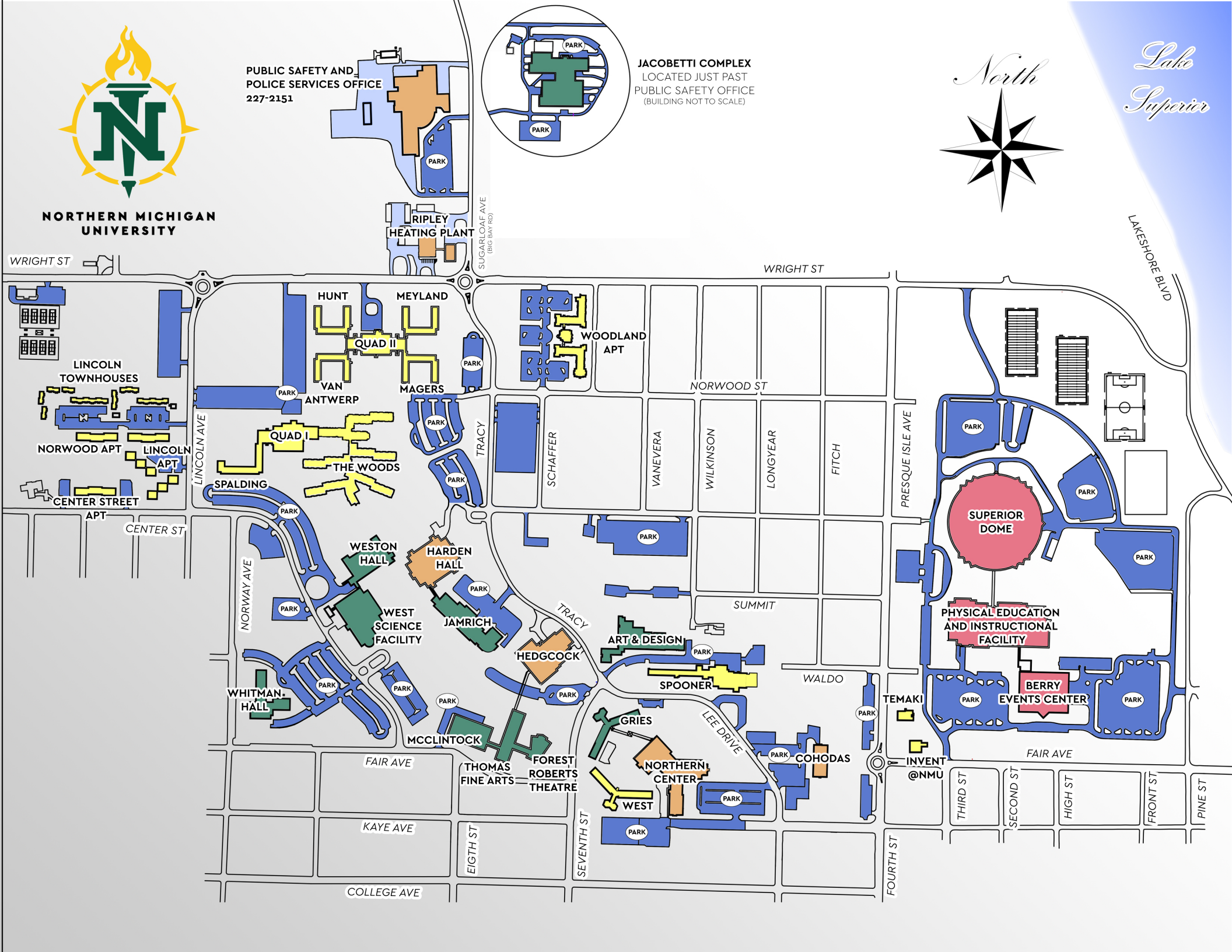
b. This valve shall be enabled with any one or more compressors are running.

c. This valve shall be opened and closed by the specified adjustable level controller that is mounted on the liquid refrigerant column.

2. Emergency Bypass/Crossover Solenoid Valve: This valve allows high and low-pressure refrigerant to equalize if high discharge pressures are reached. Valve opens if compressor discharge pressure reaches 235 psi. Compressors shall be locked out when valve is open.

3. Compressor Only Enabled Solenoid Valve: These valves control refrigerant hot gas flow to heat exchangers. Valves are open when compressors are running.

END OF SECTION 131817


NORTHERN MICHIGAN UNIVERSITY
PUBLIC SAFETY AND POLICE SERVICES OFFICE
227-2151
JACOBETTI COMPLEX
LOCATED JUST PAST PUBLIC SAFETY OFFICE
(BUILDING NOT TO SCALE)
PARK
North
Lake Superior
RIPLEY HEATING PLANT
SUGARLOAF AVE (BIG BAY RD)
WRIGHT ST
LAKESHORE BLVD
HUNT
MEYLAND
QUAD II
WOODLAND APT
LINCOLN TOWNHOUSES
VAN ANTWERP
MAGERS
NORWOOD ST
NORWOOD APT
LINCOLN APT
LINCOLN AVE
QUAD I
THE WOODS
TRACY
SCHAFFER
VANEVERA
WILKINSON
LONGYEAR
FITCH
PRESQUE ISLE AVE
SPALDING
CENTER STREET APT
CENTER ST
SUPERIOR DOME
WESTON HALL
HARDEN HALL
NORWAY AVE
WEST SCIENCE FACILITY
JAMRICH
SUMMIT
PHYSICAL EDUCATION AND INSTRUCTIONAL FACILITY
ART & DESIGN
HEDGCOCK
SPOONER
WALDO
BERRY EVENTS CENTER
WHITMAN HALL
TEMAKI
GRIES
LEE DRIVE
MCCLINTOCK
THOMAS FINE ARTS
FOREST ROBERTS THEATRE
NORTHERN CENTER
COHODAS
INVENT @NMU
FAIR AVE
WEST
KAYE AVE
EIGTH ST
SEVENTH ST
FOURTH ST
THIRD ST
SECOND ST
HIGH ST
FRONT ST
PINE ST
COLLEGE AVE