Simmons Sports Centre Arena & Pool Replacement

City of Charlottetown
Specifications

TENDER PACKAGE #7

Specialized Rink Mechanical System

February 2023

File # 2023-009

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1 General

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1 General

1.1 SUMMARY OF WORK

.1 The work of this Contract is as described below for Tender Package 7 – Specialized Rink Mechanical System. The proposed work includes but not limited to:

- .1 Provide a heating, ventilation, and air-conditioning system.
- .2 Install a refrigeration plant for ice making, including providing new mechanical equipment and controls.
- .3 Provide automation equipment, sensors, and controls.
- .4 Provide a dasher-board system, connected to the rink concrete floor.
- .5 Provide electrical wiring, conduit, equipment, and labour from panels to mechanical equipment and sensors.
- .6 Provide a new rink concrete floor, which consists of multiple layers and both cold and warm floor piping.

1.2 ENQUIRIES

.1 Direct all enquiries during the tender period to:

City of Charlottetown
Attention: Finance Department
E-mail: tenders@charlottetown.ca

.2 All enquiries must be directed in writing via email no less than five (5) business days prior to tender close.

1.3 TENDERING PROCEDURE

.1 General Contractors: Submit their tender for the entire work of this Contract, INCLUDING the work of all subcontractors, directly to the Owner in accordance with the requirements of the Invitation to Tender and this specification.

.2 Tenders shall be submitted by completing the Bid Form and placing it in a sealed envelope, clearly marked on the outside, "Tender for Simmons Sports Centre Replacement – Specialized Rink Mechanical System; Attention Finance Department; 3rd Floor City Hall", and must be delivered to the 3rd Floor of City Hall, 199 Queen Street, Charlottetown PE, C1A 4B7, and received by the Finance Department before **2:00:00 pm local time on February 27, 2023**. The City of Charlottetown will not be obligated in any way by the Proponent's response to the Request for Tender. The Proponent's submission and all supporting documents will remain with the City and will not be returned. Proponent costs related to preparing and issuing the Tender response are entirely the responsibility of the Proponent. All such documentation may be reproduced by the City, provided that such reproduction is made solely for internal use or for any purpose required by law. This Tender creates no obligation on the part of the City of Charlottetown to award the contract or to reimburse proponents for tender preparation expenses. The City of Charlottetown reserves the right to accept or reject any and all submissions, in whole or in part, received as a result of this request, and to negotiate in any manner necessary to best service the interest of the project.

.3 Any addenda will be posted on the City of Charlottetown website: www.charlottetown.ca/tenders
Bidders are responsible for checking the website for proposal/quote/tender notices, documents, and addenda. The City is not responsible for ensuring bidders have obtained addenda.

.4 No fax, email or electronic documents will be accepted as the sole method of submission although an electronic copy (PDF or Microsoft WORD) of the proposal is required to be included in the envelope noted above or e-mailed by the closing date and time.

1.4 SPECIFICATION EXPLANATION

.1 Whenever the words "as shown," "as noted," "as called for," "indicated," or similar phrases are used, they shall be understood to refer to this specification and/or the accompanying drawings and addenda.

.2 The words "provided", "install" or similar words shall mean the work described shall be completely supplied, and erected or installed by the Contractor, unless otherwise noted.

.3 All materials are to be new unless noted otherwise.

1.5 EXAMINATION OF SITE

.1 All bidders submitting tenders for this work shall first examine the site and all conditions thereon and/or therein.

.1 No formal site visit will be provided. Bidders can attend site at any time.

.2 All tenders shall take into consideration all such conditions as may affect the work under this Contract.

.3 No extra payment will be made to the Contractor, above the Contract Price, for costs resultant from failure to determine the conditions that affect the Work.

1.6 EXISTING CONDITIONS

.1 Not Used

1.7 DOCUMENT INTERPRETATION

.1 The Consultant's interpretation of Contract Documents shall be final.

.2 Should the Bidder find discrepancies in, or omissions from the drawings, specifications or other tender documents, or be in doubt as to their meaning or interpretation, the Bidder should at once notify the Consultant in writing for clarification.

.3 Any instructions or clarifications to Bidders issued during the period of bidding will be in the form of Addenda and are to be included in the tender. Addenda will form part of the Contract Documents.

.4 The Owner or Consultant will not be responsible for verbal instructions.

.5 Every effort will be made to issue addenda not less than three (3) days prior to the time for the closing of tenders, at the Owner’s discretion.

1.8 PREPARATION AND SUBMISSION OF BIDS

.1 Contractors shall submit their bids on the Tender Form provided, which will be received at the time and place indicated on the Invitation to Tender. Late tenders will not be accepted and will be returned unopened to the bidder.

.2 Bidders shall fill in all information requested on the Tender Form.

.1 This form must be completely filled out in ink or be typewritten with the signature in longhand. The completed forms shall be without interlineation, alteration, or erasure.

.2 Failure to fill in the Tender Form, as provided, in its entirety may result in the rejection of the bid; however, bidders are not obligated to provide alternative prices to products listed on the Appendix provided for that specific purpose, as part of the tender form.

.3 Tender amount shall be stated both in writing and in figures.

.4 Signatures shall be without alteration or erasure.

.5 Receipt of addenda for the project shall be acknowledged by filling in the addendum number and date of issue for each addendum on the appropriate line on the Tender Form. These lines shall be initialed by the person signing the tender after they have been filled in.

.3 Each tender submitted will be accepted on the understanding that it covers all the Work called for in the specifications and on the drawings, regardless of any notations by Bidder that certain parts of the required Work are omitted from their proposal.

.4 Each bid must:

.1 Give the full business address of the Bidder and be signed by him with his usual signature.

.2 Bids by partnerships must furnish the full name of all partners and must be signed in the partnership name of one of the members of the partnership or by some authorized representative, followed by the signature and designation of the person signing.

.3 Bids by corporations must be signed with the legal name of the corporation, followed by the name of the Province of incorporation, and by the signature designation of the president, secretary, or other person authorized to bind it in the matter. The name of each person signed shall also be typed or printed below the signature.

.4 A bid by a person who affixes to his signature the word "president," "secretary," or "agent," or other designation, without disclosing his principal, may be held to be the bid of the individual signing on behalf of the corporation.

.5 A bid of any individual or any group of individuals operating as co-partners or the bid of any corporation which may be submitted shall be executed and authorized so that it shall be and it will constitute a legal binding act of the persons, copartners, or corporate entity making the bid.

.5 Bidders shall include with their tender, in the space designated in Section 00 41 13, Appendix A, the name of each Subcontractor and/or Supplier, as designated, whose price has been included in their tender and who will perform the trade work. Substitution for another Subcontractor in the event that the listed Subcontractor is unable to do the work shall be subject to the approval of the Owner and contingent on evidence satisfactory to the Owner that the original Subcontractor's price was legitimately carried in the Tender, and that the original Subcontractor is now incapable of carrying out the work required under the subcontract, or that he refuses to carry out the work and provides documented reasons for such incapacity or refusal.

.6 The term "Own Forces," as a subcontractor, may be used by a Bidder where the Bidder is equipped to and in fact normally carries out the trade work using employees in the direct employment of the Contractor or a wholly owned subsidiary company. Other designations such as "Own Estimate" are unacceptable and may be cause for rejection of the tender by the Owner.

.7 When a Bidder indicates "Own Forces" as a subcontractor, the Bidder may be required to demonstrate to the Owner that he has the resources, experience, and employees necessary, available and qualified to perform the trade work in a manner and quality satisfactory to fulfill the obligations of the Contract Documents and that the trade work is a normal and continual part of his business operation.

.8 A Bidder, whose tender is accepted, that included "Own Forces" for a subcontract will if requested, provide the Owner with payroll records verifying that the employees carrying out the "Own Forces" subcontract work are direct employees of the Contractor or of a wholly owned subsidiary company of the Contractor.

.9 Each bidder shall be prepared, if so, requested by the Owner, prior to the award of the Contract to present evidence of his experience, qualifications, and financial ability to carry out the terms of the Contract.

.10 The Owner will evaluate Tenders submitted for this project. The criteria to be considered by the Owner in awarding the Contract will include a combination of:
- .1 Bid price;
- .2 Scheduling;
- .3 Compliance;
- .4 Expertise;
- .5 Qualifications of the Contractor and named Subcontractors / Suppliers and
- .6 Any other such conditions as may be determined by the Owner to be in the best interests of the Owner. A decision on the acceptance of a Tender will be made by the Owner based on the results of the Owner's evaluation. The Owner may request a follow up interview with bidders to verify parts of their bid.

.11 Bidders may, at their own discretion, submit Alternatives to items identified as "Acceptable Material".
- .1 All proposed Alternatives shall be listed in Appendix "B", ALTERNATIVE PRICES and be identified by name and model number where applicable and each Alternative shall have an associated tender price change "INCREASED BY" $ _____ or "DECREASED BY" $_____ or "N/A," as compared with the "Acceptable Material" item carried in the tender amount.
- .2 Alternate prices will include ALL related costs associated with charges from Accepted Material. No additional costs will be accepted for failure of the Contractor to identify the full impact of using alternate systems.
- .3 Alternate prices will NOT be used in determining the tender price or as the basis for awarding the tender.

.12 Bidders are to complete any other appendices forming part of the Tender Form as directed under Section 00 41 13 - Bid Form.

.13 Tender Forms and accompanying documents shall be enclosed in a sealed envelope marked "TENDER" and bearing the following identification.
- .1 Name of project.
- .2 Name of Contractor submitting tender.

.14 Envelope to be addressed to the recipient of tenders indicated in the Invitation to Tender and delivered by hand, registered mail or courier.

.15 Submit one (1) only signed copy of Tender Form.

.16 Accompanying the Tender Form shall be:
- .1 One (1) copy of Bid Guarantee, together with Surety's Letter of Consent, as specified.
- .2 One (1) copy of a preliminary schedule demonstrating the full scope of work to be completed within the identified time for the completion of the contract work.
- .3 One (1) copy of a letter from Bidder's insurance provider identifying a list of any claims made against the Bidder within the last five (5) years.

.17 Tender forms and securities must bear original signatures.

.18 Where the bid amount is shown in both written words and number and the two are in conflict, written words will take precedence.

1.9 BID GUARANTEES

.1 Each tender submitted shall be accompanied by the following Security:

.1 For a General Contract Tender less than One Million Dollars ($1,000,000.00), including Civil, Mechanical, Sprinkler and Electrical Subcontract values:

.1 A Security Deposit in the form of a Certified Cheque or Bank Draft, in an amount not less than ten per cent (10%) of the Bid Amount;
OR

.2 A Bid Bond as identified below.

.2 For a General Contract Tender One Million Dollars ($1,000,000.00) or more, including Civil, Mechanical, Sprinkler and Electrical Subcontract values:

.1 A Bid Bond only issued by a recognized bonding company, in an amount not less than ten per cent (10%) of the Bid Amount.

.3 The Certified Cheque, Bank Draft or Bid Bond shall be made payable to the Owner.

.4 The Certified Cheque, Bank Draft or Bid Bond will guarantee that:

.1 The Bidder will not withdraw the bid for the period indicated on the Tender Form, following the schedule closing time of the receipt of bids, and

.2 The Bidder will enter into a formal agreement with the Owner in accordance with the agreement included as part of the Contract Documents, and

.3 The required Certified Cheque, Bank Draft or Bid Bond as Contract Security will be provided to the Owner, and

.4 In the event of withdrawal of said bid within said period, or the failure to enter into said Agreement and give said contract security within ten (10) days after notice of the acceptance of the bid, the Bidder shall be liable to the Owner for the full amount of the bid guarantee as representing the liquidating damages to the Owner on account of the default of the Bidder in any particular hereof and shall not be construed as a penalty.

.5 Bid Bonds or Security Deposits will be returned to all except the three (3) lowest Bidders within three (3) days after the opening of tenders. The remaining non-successful Bid Bonds or Security Deposits will be mailed to Bidders within forty-eight (48) hours after the Owner and the successful Contractor have executed the Contract and the duty executed Bonds or Certified Cheque representing the Contract Security have been received and accepted by the Owner from the successful Contractor.

.6 Bonds and Letters of Surety, provided by General Contractors to the Owner shall be from a recognized Surety Company.

.7 Only Bid Bonds issued by insurers, licensed in Canada and authorized to do business in the Province of Prince Edward Island, will be accepted.

.8 Security Deposits provided by General Contractors:

.1 Must be in the form of a Certified Cheque or Canadian Bank Draft drawn on a bank to which the Bank Act applies or a Credit Union, payable to the Owner, OR

.2 Bonds of the Government of Canada, unconditionally guaranteed, as to the principal and interest by the Government of Canada if such Bonds are:

.1 Payable to the Bearer, or

.2 Accompanied by a duly executed Instrument of Transfer to the Owner in the form prescribed by the Domestic Bonds of Canada Regulations, or

.3 Negotiated as to principal or as to principal and interest in the name of the Owner, pursuant to the Domestic Bonds of Canada Regulations.

.3 Security Deposits submitted by Subcontractors to General Contractors, shall be in a form satisfactory to the General Contractor.

.4 No interest will be paid to either the successful or unsuccessful bidders for any form of Bid Guarantee.

1.10 CONTRACT SECURITY

.1 Upon award of a Contract, the Contractor shall provide the following Contract Security:
  .1 For a General Contract Tender less than One Million Dollars ($1,000,000.00), including Civil, Mechanical, Sprinkler, and Electrical Subcontract values:
    .1 A Performance Bond and a Labour and Materials Bond, each in the amount of fifty per cent (50%) of the total Contract Amount, or
    .2 A Security Deposit in the form of a Certified Cheque or Bank Draft, in an amount not less than ten per cent (10%) of the total Contract Amount.
  .2 For a General Contract Tender One Million Dollars ($1,000,000.00) or more, including Civil, Mechanical, Sprinkler and Electrical Subcontract values:
    .1 A Performance Bond and a Labour and Materials Bond, each in the amount of fifty per cent (50%) of the total Contract Amount.

.2 All Bonds provided by General Contractors, are to be made payable to the Owner.

.3 Bonds shall be from a recognized Surety Company, licensed in Canada and authorized to do business in the Province of Prince Edward Island.

.4 If a Performance Bond is utilized, it shall be maintained in force for a period of not less than twelve (12) months after the issuance of the Total Performance Certificate.

.5 Security Deposits, provided by the General Contractor:
  .1 Must be in the form of a Certified Cheque or Bank Draft drawn on a bank to which the Canadian Bank Act applies, or a Credit Union, payable to the Owner, OR
  .2 Bonds of the Government of Canada, unconditionally guaranteed, as to the principal and interest by the Government of Canada if such Bonds are:
    .1 Payable to the Bearer, or
    .2 Accompanied by a duly executed Instrument of Transfer to the Owner, in the form prescribed by the Domestic Bonds of Canada Regulations, or
    .3 Negotiated as to principle or as to principal and interest in the name of the Owner pursuant to the Domestic Bonds of Canada Regulations.

.6 Contract Security shall be provided at the expense of the General Contractor. Cheques or Bank Drafts shall be drawn on an account with recognized Financial Institutions.

.7 Contract Security submitted by Subcontractors to General Contractors, shall be in a form acceptable to the General Contractor.

.8 No interest will be paid to the successful Contractor on any form of Contract Security.

.9 If in accordance with the Contract Security requirements the successful Contractor has used a Certified Cheque or Bank Draft as Contract Security, the Certified Cheque or Bank Draft will be deposited in a safety deposit box in a bank until the date of Substantial Performance for the Contract as defined under Definition 19 of CCDC2-2008. Subject to the Work being acceptable to the Owner and Consultant it will be returned to the Contractor, without interest. The Certified Cheque or Bank Draft used as contract Security used through the construction period will be replaced with a Certified Cheque or Bank Draft in the amount of 20% of the original Contract Security during the Warranty Period. Subject to Warranty issues being addressed during the 1-year Warranty Period to the satisfaction of the Owner and Consultant it will be returned to the Contractor, without interest.

1.11 RECEIPT AND OPENING OF BIDS

.1 Bids will be opened publicly at the time and place stated in the Invitation to Tender. The officer whose duty it is to open them will decide when the specified time has arrived. No responsibility will attach to any officer for the premature opening of a bid not properly addressed and identified.

.2 Facsimile transmitted bids will not be considered.

1.12 ADJUSTMENT AND WITHDRAWAL OF BIDS

.1 A Bidder who has already submitted a bid may submit a further bid at any time up to the official closing time. The last submission received shall supersede and invalidate all submissions previously submitted by that bidder for this tender. Any bidder may withdraw or qualify his/her submission at any time up to the official closing time by re-submitting a new bid to the City. The time and date of receipt will be marked thereon, and the new submission will be placed in the tender box. The new submission shall be marked on the sealed envelope by the Bidder as "Resubmission #" along with the name of the tender and to the attention of the Finance Department, as noted above in the tender. Bids may be withdrawn at any time prior to opening upon written request from the bidder. Negligence on the part of the bidder in preparing his/her bid shall not constitute a right to withdraw a bid subsequent to the bid opening.

1.13 AWARD OF CONTRACT

.1 The Contract, if awarded, will be awarded as promptly after the opening of bids as is possible, and at the discretion of the Owner. The award date will not extend beyond the period indicated on the Tender Form following the scheduled time of tender closing, without first obtaining permission of the three (3) low bidders, or low bidder only, at the discretion of the Owner.

.2 The Form of Agreement, (Contract) which the successful Bidder will be required to enter into with the Owner, may be seen on application to the Consultant. The drawings, specifications and any addenda issued during the tender period, will be suitably marked for identification at the time the Form of Agreement is signed by both parties, shall be considered as being included in the Contract, together with the completed Tender form and are hereinafter referred to as the "Contract Documents." All of these documents shall be read together and construed as one document. Following execution of the Contract, the Contractor shall receive from the Owner one (1) complete signed set of Contract Documents.

.3 Final award of Contract shall be subject to approval of all agencies having direct interest in the project.

.4 Where identical bids are received, the low bidder will be selected on the basis of a coin toss by the Owner in the presence of the identical bidders.

1.14 REJECTION OF BIDS

.1 The Owner reserves the right to reject any and all bids.

.2 The lowest of any bid will not necessarily be accepted.

.3 Bids submitted which indicate "own forces" for subcontract work, that in the opinion of the Owner cannot be successfully completed by the Contractor's employees will not be accepted.

.4 Bids not submitted on the required form will be rejected.

.5 Bids which are incomplete or qualified will be rejected.

.6 All Bidders acknowledge that they shall have no claim against, or entitlement to damages from the Owner or Consultant by reason of the Owner's rejection of their individual bids or all bids.

.7 At the election of the Owner, whether or not a bid or bidder otherwise satisfies the requirements of a tender, the Owner may reject summarily any bid received from a corporation or other person which has been anywise involved in litigation, arbitration or alternative dispute resolution with the Owner within the five (5) year period immediately preceding the date on which the request for tender was published.

.8 Submissions will not be evaluated if the Bidder's current or past corporate or other interests may, in the City's opinion, give rise to a conflict in connection with this project.

.9 The Owner's evaluation may include information provided by the bidder's references and may also consider the proponent's past performance on previous contracts with the Owner or other institutions.

.10 The Owner may prohibit a bidder from participating in a procurement process based on past performance or based on inappropriate conduct in a prior procurement process, and such inappropriate conduct shall include but not be limited to the following: (a) the submission of bids containing misrepresentations or any other inaccurate, misleading or incomplete information; (b) the refusal of the bidder to honour its pricing or other commitments made in its bid; or (c) any other conduct, situation or circumstance, as solely determined by the Owner.

.11 The Owner may, by written notice to a bidder, reject any submission if it is found by the Owner that gratuities, in the form of entertainment, gifts, or otherwise, were offered or given by the bidder, or the agent or representative of the bidder, to any employee or agent of the project that in the Owner's opinion have been offered or provided with a view toward securing favorable treatment with respect to the awarding or amending, or making any determinations with respect to being selected as the successful bidder. Bidders must declare to the Owner where there is a potential or real conflict of interest. The Owner will take whatever steps it deems necessary to manage the potential or real conflict of interest up to and including rejection of a bid. If, during the term of the Contract, a conflict or risk of conflict of interest arises, the Contractor will notify the City immediately in writing of that conflict or risk and take any steps that the City reasonably requires to resolve the conflict or deal with the risk.

.12 The Owner specifically reserves the right to reject all tenders if none is considered to be satisfactory and, in that event, at its option, to call for additional tenders. No term or condition shall be implied, based upon any industry or trade practice or custom, any practice or policy of the Owner or otherwise, which is inconsistent or conflicts with the provisions contained in these conditions.

1.15 SUBCONTRACT WORK

.1 Contractor is to ensure that all Subcontractors understand the full extent of their responsibilities in order to complete the entire work of the project. Subcontract work may appear in various Sections of Specifications and on various Drawings.

.2 Contractors and their Subcontractors are advised to become familiar with all specifications and drawings.

1.16 CONDITIONS OF WORK AND EMPLOYMENT IN PEI

.1 All Construction Companies and Contractors and subcontractors submitting tenders for this work, or a portion thereof, are advised, in their own interest, to contact the Construction Association of Prince Edward Island, the accredited association for commercial and industrial sectors of the construction industry, to inquire and determine the terms and conditions of work and employment in the Province of Prince Edward Island.

1.17 LABOUR

.1 No prospective employee in the Province of Prince Edward Island shall, with relation to his employment or eligibility for employment, be discriminated against or favored by reason of sex, racial origin, religious views, or political affiliations.

.2 Contractors, to the extent possible, are encouraged to maximize the employment of the local labour force for the Work of this Contract.

1.18 HARMONIZED SALES TAX REQUIREMENTS

.1 The Owner for this project must account for the Harmonized Sales Tax (HST).

.2 All tenders submitted for the work of this Contract shall be calculated on the basis that the Owner is not exempt from HST. The bid will exclude HST but will show it as a separate line item.

1.19 ACCEPTABLE PRODUCTS

.1 The Bidder shall carry in his tender the base bid product(s) identified in the specifications as "Acceptable Material", or Approved Equals as they are identified throughout the tender period.

.2 The Bidder is also encouraged to carry the products of other manufacturers, that are not considered equals, as "Alternatives Prices," listing them by name on the Appendix provided for that specific purpose, as part of the Tender Form, together with the price difference compared to the specified products, when such Appendix is identified under Section 00 41 13 - Bid Form.

1.20 APPROVED EQUALS

.1 Submission for an Approved Equal is to contain literature and descriptive information with full specification data. Where the requested item is contained on a printed document with other items, it is to be clearly identified.

.2 The Consultant will not search catalogs, e-mails or websites or contact suppliers to obtain the necessary information for proper evaluation.

.3 Submission by Bidders for evaluation of products requested to be considered as equal must be submitted to Consultant no less than 5 working days prior to closing of tenders. No consideration will be given to approving equals after the close of tenders, except when the specified product is found to have been discontinued by the manufacturer.

.4 The consideration of a product(s) for Approved Equal status and the acceptance of individual products as approved equals is entirely at the discretion of the Consultant.

.5 When products are given Approved Equal status these products may, at the discretion of bidders, be carried in their tender price, provided that ALL costs related to changes to the contract work required to incorporate the Approved Equal product are included in the tender price.

.6 The acceptance of a product by the Consultant as an "Approved Equal," even where not specifically indicated on the Approved Equals listing in the Addendum, is to be understood as being contingent upon the provision of the particular series, model and/or type, complete with all options to meet the specified requirements of the Acceptable Material product.

.7 Products given approved status that are found, during construction period, to not have all specified options available, or to have discontinued production of same, or to have made other design changes since the time of approval, will not be accepted for use on this project, except when financial compensation has been mutually agreed upon between the Contractor and the Owner and deemed acceptable by the Consultant. Compensation will not be paid to the Contractor for products acknowledged by the Consultant to be superior to the specified products.

1.21 ALTERNATIVES

.1 Alternative products, when requested under Section 00 41 13 - Bid Form, must be listed in Appendix "B" provided as part of the Tender Form, and are to be understood as being offered only for the Owner's consideration as substitutes for the specified Acceptable Material products, at the amount of increase or decrease in the tender amount indicated in the Appendix. These products and related prices are not to be included in the tender amount.

.2 Alternative products and their related increase or decrease in the base bid amount are not used as the basis for awarding tenders.

.3 When alternative products are listed in Appendix "B", ALL costs related to changes to the contract work required to incorporate the alternative product into the work are to be included in the amount stated in Appendix "B".

.4 Alternative products may or may not be accepted at the discretion of the Owner at the price difference quoted, without any other monetary consideration. If requested, bidders shall promptly supply full details of any or all Alternatives listed. Specific written direction from the Consultant must be given to the Contractor to substitute an alternative product.

.5 Alternative prices shall include all fees, taxes and markups.

1.22 UNIT PRICES

.1 Unit Prices, when requested under Section 00 41 13 - Bid Form, must be listed in Appendix "C", as part of the Tender Form and are to be understood as being offered only for the Owner's consideration; to be accepted or not accepted, at the Owner's discretion in a timely manner during the Work of the Contract, ONLY as a method of adjustment to the Contract Work for changes in the Work, should the Owner opt for the Unit Price Method.

.2 Unit prices shall include all fees, taxes and markups.

1.23 SEPARATE PRICES

.1 Separate Prices, when requested under Section 00 41 13 - Bid Form, must be listed in Appendix "D", as part of the Tender Form and are to be understood as being offered only for the Owner's consideration; to be accepted or, not accepted, in whole or in part, at the Owner's discretion. If used the Separate Prices may be incorporated into the Contract Work either at the time of Award of Contract or in a timely manner during the Work of the Contract, at the Owner's discretion.

.2 Separate Prices shall include all fees, taxes (excluding HST) and markups.

1.24 GUARANTEES

.1 The Contractor will be required to guarantee the work of this Contract in accordance with the requirements of GC12.3 of the Agreement.

.2 Notwithstanding the above, the bidder's attention is directed to the fact that certain individual items on this project may be required to be guaranteed by the manufacturer for periods in excess of twelve months. These specific requirements are to be found in various Sections of the specifications for this project.

1.25 PAYMENT OF WORKERS

.1 The Contractor shall, in addition to any fringe benefits, pay the workers employed by the Contractor on the work at wage rates, not less than those established by the Minimum Wage Order, issued under authority of the Labour Act, which is in effect. The Contractor shall pay workers employed on the work at intervals of not less than twice per month.

.2 The Contractor shall require each Subcontractor, or person doing any part of the work, to covenant with the Owner that workers are employed at the wage rates and in the manner required by this provision.

.3 Where any person employed by the Contractor or any Subcontractor, or other person engaged on the Work of this Contract, is paid less than the amount required to be paid under the provisions of this Contract, the Owner may deduct from any monies payable to the Contractor, under this or any other Contract, and pay to such person, a sum sufficient to bring the person's wages up to the amount required to be paid under this Contract.

.4 No claim for extra payment from the Contractor will be considered by the Owner concerning any change in the Minimum Wage Order which may occur during prosecution of the Contract.

1.26 TIMING REQUIREMENTS

.1 This project will require the achievement of the following project milestones.

.1	Tender Call	10 FEB 2023
.2	Deadline for Questions	20 FEB 2023
.3	Last Day for Addendums	23 FEB 2023
.4	Tender Closing	27 FEB 2023
.5	Expected Contract Award	13 MAR 2023
.6	Expected Start Date	TBD
.7	Substantial Completion	29 MAR 2024

END OF SECTION

1 General

1.1 TENDER

.1 SUBMITTED BY:

_____ (Name)

_____(Address)

_____(Contact)

DATE: _____

FOR: SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT – SPECIALIZED RINK MECHANICAL SYSTEM

TO: CITY OF CHARLOTTETOWN
199 QUEEN STREET, CHARLOTTETOWN, PE

Having examined ALL the drawings and specifications for this project, as well as any addenda issued, as prepared by I.B. Storey Inc. and/or their consultants; WE HEREBY OFFER to furnish all materials, plant and labour necessary for the full and proper completion of the Contract work for:

SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT - TP #7 – SPECIALIZED RINK MECHANICAL SYSTEM

INCLUDING all prime cost allowances and Government sales or other taxes in force at this date, EXCLUDING Harmonized Sales Tax (HST) but not any other additional or deductible allowances or taxes which may be applicable subsequent to this date, and which shall be payable by or to the Owner, in accordance with the above-mentioned Documents, for the bid amount of:

_____(Dollars)
($)

in lawful money of Canada.

The following is the total amount of Harmonized Sales Tax (HST) applicable to our bid amount:

_____(Dollars)
($)

In submitting this Tender we recognize the necessity to complete the information requested by any appendices, as well as, the right of the Owner to reject all Tenders or to accept any Tender at the price submitted, on the condition that revised Tenders will not be called for if minor changes are made.
In the event of this Tender being accepted within thirty (30) days of the time stated for the closing of Tenders, and our failing or declining to enter into a Contract, then our Bid Guarantee, submitted with our Tender shall be forfeited to the Owner in lieu of any damages which the Owner may suffer by reason of our failure or refusal to enter into such Contract.

In the event of our Tender not being accepted with thirty (30) days of the time stated for the closing of Tenders, our Bid Guarantee, submitted with our Tender will be returned to us forthwith, unless a satisfactory arrangement is made with us covering its retention for a further stated period.

If we are notified of the acceptance of this Tender within the above specified time, we will:

.1 Enter into a formal Contract Agreement with the Owner.
.2 Furnish the Performance Bond and Labour and Materials Payment Bonds, or other form of Contract Security, when specifically permitted, as Contract Security in accordance with the requirements of the specifications.
.3 Furnish a cost breakdown of the Contract sum, the total aggregating the amount of our Tender, in accordance with the requirements of the specifications.
.4 Furnish a certified copy of all insurance policies.
.5 Furnish a certified copy of all insurance policies carried by the named subtrades.
.6 Complete the entire work on or before the dates stated.
.7 Provide and update as required a Construction Schedule which clearly shows the state of progress required to complete the work on the date specified.
.8 Enter into subcontract agreements where applicable.

1.2 ACKNOWLEDGEMENT OF RECEIPT OF ADDENDA

.1 Addendum No._____ Issued: _____ initial _____

Addendum No._____ Issued: _____ initial _____

Addendum No._____ Issued: _____ initial _____

Addendum No._____ Issued: _____ initial _____

Addendum No._____ Issued: _____ initial _____

1.3 FORM OF TENDER APPENDICES

.1 Appendix 'A' must be completed by bidders.
.2 Appendix 'B' (only the items indicated) may be completed by bidders, any other items are at the bidder's discretion.
.3 Appendix 'C' must be completed by bidders.
.4 Appendix 'D' must be completed by bidders.

1.4 DOCUMENTS ACCOMPANYING BID FORM

.1 As per Section 00 21 13, Par 1.8.16

.1 One (1) copy of Bid Guarantee, together with Surety's letter of consent. _____initial

.2 One (1) copy of preliminary schedule. _____initial

.3 One (1) copy of letter from Bidders Insurance Provider identifying list of claims made against Bidder within last five (5) years. _____initial

1.5 SUPERINTENDENT

.1 Name of Superintendent _____ .
.2 Years of Experience with Contractor _____ .

1.6 CONFLICT OF INTEREST

.1 The Contractor warrants that as at the date of this Agreement, no conflict of interest, or any circumstance that might interfere with independent and objective exercise of judgment, exists or is likely to arise in relation to execution of this Agreement or its subject matter. The Contractor shall immediately notify CAA, in writing, if any such actual or potential conflict of interest should arise at any time during the Term. In the event CAA discovers or is notified by the Contractor of an actual or potential conflict of interest, CAA, in its sole discretion, may either:

.1 Allow the Contractor to resolve the actual or potential conflict to the satisfaction of CAA;
OR

.2 Terminate the Agreement in accordance with the Termination section of this Agreement.

1.7 CONTRACTOR'S SIGNATURE

.1 Signed sealed and submitted for and on behalf of:

_____
(Company Name)

_____

_____
(Address)

_____ _____
(Authorized Signature) (Witness)

_____ _____
(Name and Title) (Name and Title)

_____
(Date)

1.8 APPENDIX 'A'

.1 Herewith are identified the Subcontractors we propose to use on this project. Carrying Sub-Contractor options next to identified work, is not acceptable and may be cause for rejection of the Tender by the Owner.

Mechanical: _____

Plumbing: _____

Electrical: _____

Refrigeration Piping: _____

General Labour: _____

Concrete: _____

Welder: _____

COMPANY: _____

AUTHORIZED SIGNATURE:

1.9 APPENDIX 'B'

.1 ALTERNATIVE PRICES

We herewith submit for consideration by the Owner the following systems or products as Alternatives to the Base Bid items indicated below and identify the increase or decrease, as applicable, in our tender price, for each item should it be selected by the Owner for installation in lieu of the Base Bid item. The change in tender price includes for all necessary modifications to the base bid systems.

Alternative prices shall include all fees, taxes and markups.

SECTION ITEM BASE BID ALTERNATIVE:	TENDER PRICE INCREASED BY:	TENDER PRICE DECREASED BY:
_____	$ _____	$ _____
_____	$ _____	$ _____
_____	$ _____	$ _____
_____	$ _____	$ _____
_____	$ _____	$ _____
_____	$ _____	$ _____
_____	$ _____	$ _____
_____	$ _____	$ _____
_____	$ _____	$ _____
_____	$ _____	$ _____

COMPANY: _____

AUTHORIZED SIGNATURE:

1.10 APPENDIX 'C'

.1 UNIT PRICE COMPONENT

We submit herewith our Unit Prices for the additions or deletions to the work listed below. The Unit Prices listed apply to performing the Units of Work, in accordance with the requirements of the appropriate specifications herein, only during the time scheduled for such work in the project work schedule.

Unit prices shall include all fees, taxes, and markups.

	UNIT OF WORK	UNIT OF MEASURE	ONE (1) UNIT PRICE ONLY FOR EITHER ADDITION OR DELETION
.1			$
.2			$
.3			$
.4			$
.5			$

COMPANY: _____

AUTHORIZED SIGNATURE:

1.11 APPENDIX 'D'

.1 SEPARATE PRICES

We submit herewith our Separate Price for the work listed below and amounts ARE included in our Stipulated Price. Due to available funding, the Owner has the right to delete this work from the total bid price. In accordance with the requirements of the appropriate specifications herein, only during the time scheduled for such work in the project work schedule.

Separate prices shall include all fees, taxes and markups.

UNIT OF WORK	BASE PRICE	HST
.1	$	$
.2	$	$
.3	$	$
.4	$	$

COMPANY: _____

AUTHORIZED SIGNATURE:

END OF SECTION

1 General

1.1 FORM OF AGREEMENT

.1 The Form of Agreement between Contractor and Owner shall be Canadian Construction Documents Committee CCDC2-2008, "Stipulated Price Contract", including the Definitions and General Conditions therein dated 2008 including items GC1.1 inclusive to GC12.3, and the modifications to items GC1.1 to GC12.3 incorporated into Section 00 73 00 - Supplementary Conditions of this Specification.

.2 Document CCDC2-2008 may be examined at the Construction Association office in Charlottetown, PEI.

.3 The contractor will be required to enter into the above noted formal agreement with the City following receipt of a written letter of acceptance from the City, or upon receipt of a purchase order issued by the City.

END OF SECTION

1 General

1.1 GENERAL

.1 The Definitions and General Conditions governing the Work shall be those specified in the following amendments and supplements to those provisions and shall apply to all Sections of this Specification.

.2 Where any Article or portion of Article conflicts with the Laws of the Province concerned, such Article or portion of the Article is hereby stricken.

.3 The following amendments shall apply to the Definitions of CCDC2 Stipulated Price Contract 2008.

1.2 DEFINITIONS

.1 Paragraph 4 Consultant, add the following:

.1 The Consultant shall be the Owner's Prime Consultant, I.B. Storey Inc., 98 Fitzroy Street, Suite 800, Charlottetown, PE.

.2 Paragraph 12 Owner, add the following:

.1 The Owner shall be the City of Charlottetown.

.3 Paragraph 19 Subcontractor, add the following:

.1 All dealings with the Subcontractor shall be through the medium of the Contractor, who will be responsible for the proper coordination and execution of the Sub-contractor's work.

.4 New Paragraph 27 Engineer:

.1 This shall mean the designated engineering representative(s) of the Consultant.

1.3 ARTICLE GC1.1 CONTRACT DOCUMENTS

.1 Paragraph 1.1.8 - Delete as written and substitute:
1.1.8 The Contractor shall receive up to two (2) sets of drawings and specifications at no cost from the Owner. Additional sets of drawings will be supplied at cost of reproduction. The above covers the requirements for all trades.

.2 Paragraph 1.1.11 - Add new Paragraph as follows:
1.1.11 The Contract Documents are prepared solely for use by the party with whom the Consultant has entered into a Contract and there are no representations of any kind made by the Consultant to any party with whom the Consultant has not entered into a Contract.

.3 Paragraph 1.1.12 - Add new Paragraph as follows:
1.1.12 Electronic documents are and shall remain the Consultant's property. Copies of electronic documents may be made available for the preparations of shop drawings at the Consultant's sole discretion and for a fee.

1.4 ARTICLE GC3.1 CONTROL OF THE WORK

.1 Paragraph 3.1.1 - add new Sub-Clause 3.1.1.1 as follows:

.1 The Contractor shall co-ordinate his own work and the work of all Subcontractors so as to facilitate and expedite the progress of the work.

.2 Paragraph 3.1.1 Add new Sub-Clause 3.1.1.2 as follows:

.1 It is the responsibility of the Contractor to immediately notify the Consultant of any signs of distress or any other indications of actual or potential damage to the contract work, without regard to his awareness of any errors, inconsistencies or omissions in the Contract Documents.

.3 Add new Paragraph 3.1.3 as follows:

.1 Before ordering any materials or doing any Work, Contractor shall verify all compensation has been allowed on account of differences between actual site dimensions and the measurements indicated on the drawings. Any difference,

which may be found, shall be submitted to the Consultant for consideration before proceeding with the work.

.4 Add new Paragraph 3.1.4 as follows:

.1 The Contractor will be responsible for effecting the removal from the site of any trade, firm, group, or person who is delaying the Work, or whose Work is unsatisfactory. The Contractor will arrange for other competent trades people to complete the Work at no expense to the Owner.

1.5 ARTICLE GC3.6 SUPERVISOR

.1 Add new Paragraph 3.6.3 as follows:

.1 The Consultant may require the Contractor to inform him, in writing, of the name and experience of the supervisory personnel he intends to use on the project.

1.6 ARTICLE GC3.8 LABOUR AND PRODUCTS

.1 Add new Paragraph 3.8.4 as follows:

.1 All manufactured articles, materials and equipment shall be installed, applied, connected, erected, used, cleaned, conditioned and commissioned as directed by the manufacturer unless specified to the contrary.

1.7 ARTICLE GC3.9 DOCUMENTS AT THE SITE

.1 Add new Paragraph 3.9.2 as follows:

.1 Maintain at job site, one copy each document as follows:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Notice of Change.
.7 Change Orders.
.8 Other Modifications to Contract.
.9 Field Test Reports.
.10 Approved Work Schedule.
.11 Health and Safety Plan and Other Safety Related Documents.
.12 CSA Z317.13-07 - Infection Control Guidelines.
.13 Other documents as specified.

1.8 ARTICLE GC4.1 CASH ALLOWANCES

.1 Article GC4.1 - Delete this article.

1.9 ARTICLE GC4.2 CONTINGENCY ALLOWANCE

.1 Article GC4.2 - Delete this article.

1.10 ARTICLE GC5.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Paragraph 5.2.2 - add two new Sentences as follows:

.1 Payment shall be less any holdback release, which may have been made in accordance with the specific terms of this Agreement as dictated by GC 5.6. Any such holdback release by the Owner to the Contractor shall be a payment to the Contractor in trust for the specific Subcontractor in respect of whose work the release is made.

.2 Payments shall be less 15% Mechanics' Lien Holdback amount claimed against each progress claim.

.2 Add new paragraph 5.2.6 as follows:

.1 Authorized Change Orders shall be listed on the application for payment indicating the amount claimed against each to date of claim.

.3 Paragraph 5.2.7 - Add new sentences as follows:

.1 Payment for materials will be considered only if such materials are properly stored on site in a secure enclosure acceptable to the Consultant. Security of materials so stored is the responsibility of the Contractor.

.4 Add new Paragraph 5.2.8 as follows:

.1 With the second and all subsequent applications for payment the Contractor shall include a statutory declaration form CCDC 9B, or other similar form acceptable to the Consultant, declaring that all labour and materials entering into the work, including Subcontractors, covered by the previous application, have been paid. With application for release of lien holdback, the Contractor shall include a statutory declaration form CCDC 9A, or other similar form acceptable to the Consultant.

.2 With the second and all subsequent applications for payment the Contractor shall include a Letter of Clearance from the PEI Workers Compensation Board.

1.11 ARTICLE GC5.3 PROGRESS PAYMENT

.1 Paragraph 5.3.1 - Add new Sentence as follows:

.1 When any claim for payment during the course of construction includes for completed or partially completed Work, which in the opinion of the Consultant is defective or otherwise unacceptable, a sum of monies determined by the Consultant to be two (2) times the value of the defective or unacceptable Work, or two (2) times the value of the Work required to correct the defect or an amount solely at the Consultants discretion, will be withheld from the claim.

.2 Paragraph 5.3.1 - Add 3 new Sentences as follows:

.1 Deficiency monies may be held back at any time during the course of the project for Work deemed incomplete or unacceptable.

.2 It remains the Contractor's responsibility to undertake his own deficiency reviews and ensure the entire Work conforms to the Contract including quality, completeness and commissioning.

.3 Two final deficiency reviews will be conducted by the Consultant. The first review with the Owner and Contractor will identify any minor items which may remain outstanding, and the second review will confirm that these items have been completed. All other deficiency reviews where deficiencies are incomplete or not ready for requested inspections, will be charged at cost to the Contractor. The invoice for the additional reviews will be submitted to the Owner with a corresponding amount deducted from the Contractor's progress payment.

1.12 ARTICLE GC5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

.1 Paragraph 5.5.1, Add new Sub-Clause .3 as follows:

.1 5.5.1.3 Submit with application for payment letter of clearance from The Workers Compensation Board to the Owner stating that the Contractor is in good standing with the Board.

1.13 ARTICLE GC5.7 FINAL PAYMENT

.1 Paragraph 5.7.2 - Add new Sentence as follows:

.1 Any delay in delivering the required Project Record Drawings (As-Builts) as described in Section 01 78 00 - Closeout Submittals will have the effect of delaying the final payment to the Contractor until the Consultant has received them complete and in good condition.

1.14 ARTICLE GC6.2 CHANGE ORDER

.1 Delete Paragraph 6.2.1 and replace with a new paragraph as follows:

.1 6.2.1 When a change in Work is proposed or required, the Consultant will provide the Contractor with a written description of the proposed change in the Work. The Contractor shall promptly present, in forms acceptable to the Consultant, a detailed breakdown of the costs associated with the change, if any; and the adjustment in the Contract Time, if any. The breakdown shall include:

.1 Actual (not list) costs of material, as well as Subtrade and Supplier costs.

.2 Labour costs, including fringe benefits and wage levies.

.3 Equipment rental (excluding hand and small power tool).

.2 Change Orders calling for normal changes or additions to the Work will be priced in detail giving actual material trade prices (not list prices) and actual labour costs and wage levies (including Employment Insurance, Worker's Compensation, Holiday Pay) and actual equipment rental.

.3 Each Change Order will be considered as a whole to complete the work, inclusive of all Sub-Contract and/or General Contract work.

.4 To these prices, the Contractor will add:

.1 For all extra work, involving the General Contractor and a Subcontractor, the Subcontractor adds 15% to his cost, submits this price to the General Contractor who adds 5%; to this amount the General Contractor adds the cost of his own Work plus 15% of the cost of his own Work only. The General Contractor does NOT add a further 5% to the cost of his own Work.

.5 Note: Costs related to management, supervision, estimating, scheduling, bonding, insurance, as built drawings, copying, courier, safety, cleaning, site overhead, site vehicle, hand and small power tools etc. are covered by the mark up indicated in Paragraph 6.2.1.4 and shall not be included on Change Orders.

1.15 ARTICLE GC6.3 CHANGE DIRECTIVE

.1 Delete Paragraphs 6.3.6.1, 6.3.6.2 and 6.3.6.3 and replace with the following.

.2 The Owner or the Consultant, without invalidating the contract, may make changes by altering, adding to, or deducting from the work, the contract sum being adjusted accordingly. All such work shall be executed under the conditions of the Contract.

.3 Where work is required to proceed immediately, work may proceed under a Change Directive. The Contractor will be instructed to proceed on a time and materials basis and maintain accurate accounting records for the cost of the change.

.4 Change Directives calling for changes to the Work will be priced in detail giving actual material trade prices (not list prices) and actual labour costs and wage levies (including Employment Insurance, Worker's Compensation, Holiday Pay) and actual equipment rental.

.5 Each Change Directive will be considered as a whole to complete the work, inclusive of all Sub-Contract and/or General Contract work.

.6 To these prices, the Contractor will add:

.1 For all extra work, involving the General Contractor and a Subcontractor, the Subcontractor adds 15% to his cost, submits this price to the General Contractor who adds 5%; to this amount the General Contractor adds the cost of his own Work plus 15% of the cost of his own Work only. The General Contractor does NOT add a further 5% to the cost of his own Work.

.2 Deletions to Contract: A mark-up by either Sub-Contractor or General Contractor shall not be charged or credited on credit Change Orders

.3 Supervision related to Change Orders shall be considered as included in the allowable mark-up and shall not be included in the labour changes for a Change order.

1.16 ARTICLE GC9.1 PROTECTION OF WORK AND PROPERTY

.1 Add new Paragraph 9.1.5 as follows:

.1 The Contractor shall be responsible for implementing all necessary security measures required to protect the areas of Work under his control and shall be responsible for damage which may arise from the failure of, or the failure to implement such security measures.

1.17 ARTICLE GC10.1 TAXES AND DUTIES

.1 Paragraph G.C. 10.1.1 - Revise as follows:

.1 Delete the words ..."at the time of closing except for Value Added Taxes"...and replace with the words ..."at the time of closing including Value Added Taxes"...

1.18 ARTICLE GC11.1 INSURANCE

.1 Paragraph 11.1.1.4: Delete and replace with Contractor Insurance Requirements included in Appendix A of these Specifications.

1.19 ARTICLE GC12.3 WARRANTY

.1 Add new Paragraph 12.3.7 as follows:

.1 When a part of the work is occupied by the Owner, directly or for the use intended prior to Substantial Performance, the warranty for the Work directly related to the construction and normal operation of that part of the Work, shall start on the date of occupancy.

.2 Add new paragraph 12.3.8 as follows:

.1 The Contractor shall ensure that his subcontractors are bound to the requirements of GC12.3 insofar as their work is concerned.

END OF SECTION

Appendix E

Specifications

PART 1 – ICE RINK
GENERAL

1.1 Scope of Work

.1 The objectives of this project encompass the following:
- .1 Provide the supply and installation of ice rink equipment, mechanical, heating, water heating, ventilation, heat recovery infrastructure, piping, ducting, ice rink concrete floor, ice hockey boards and glass, and controls for the new Simmons Sports Centre located at 170 North River Road, Charlottetown, PE C1A 3L3.
- .2 Execute work using the most effective use of time and resources.
- .3 Minimize disruption of arena operation, and co-ordinate any required service disruption with the Owner and the Owner's Engineer.
- .4 Work may commence, at the earliest, by July 31st, 2023.
- .5 All work is to be substantially completed by March 29th, 2024.
- .6 If the work is not substantially completed by the substantial completion date, the contractor shall be required to provide and connect a temporary refrigeration plant to the system, at no additional cost to the Owner.

1.2 Definitions

.1 Specialized Rink Mechanical Systems: This project consists of rink engineering components for an integrated thermal plant for the new ice rink being constructed in Charlottetown. It comprises all fully operational and functional elements, including equipment, software, and programming interfaced to the associated work of other related trades. This includes packaged thermal plants, water heating equipment, pumps, field piping, ducting, ventilation equipment, valves, a dasher board system, concrete work for the cold and warm floor, piping, electrical work, automation equipment, automation programming, and instrumentation.

.2 Contractor: The single Contractor to provide the work of this Bid Document. This Contractor shall be the supplier, installer, and commissioner. This party shall be the contractor signatory to the contract, and shall take on all responsibilities therein. The Contractor shall supply all materials, labour, and equipment required to complete all work and provide all fully functional deliverables.

.3 The Owner: For the specifications herein the City of Charlottetown shall be referred to as The Owner.

.4 The Owner's Engineer: For the specifications herein I.B. Storey Inc., shall be referred to as the Owner's Engineer.

1.3 Specialized Rink Mechanical Systems Description

.1 The work shall consist of the provision of all labor, materials, tools, equipment, testing, commissioning, training services, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, removal, installation, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in this document which is required for the complete, fully functional and commissioned rink mechanical system.

1.4 Drawings Package

.1 Drawings packages have been issued with this specifications document and are referred to as 21010 PKG01 City of Charlottetown Simmons Arena IFT Drawing Package.

.2 In the event of discrepancy between the drawings package and this specifications document, the specifications document shall prevail unless otherwise noted. Any discrepancies should be brought to the Owner's attention prior to proceeding.

1.5 Quality Assurance

.1 General

.1 The Contractor shall be regularly engaged in the installation and service of mechanical, refrigeration, heating, and ventilation systems in Prince Edward Island.

.2 The system components included in this project shall consist of the products from manufacturers regularly engaged in the production of refrigeration and mechanical equipment, and shall be the manufacturer's latest standard of design at the time of bid.

.2 Workplace Safety and Hazardous Materials

.1 Provide a safety program in compliance with the Contract Documents.

.2 Contractor shall have a corporately certified comprehensive Safety Manual and a designated Safety Supervisor for the Project.

.3 The Contractor and its employees and subtrades comply with local, provincial, and federal safety regulations.

.4 The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the Occupational Health & Safety Act for

the Province of Prince Edward Island for at least each topic listed.

.5 Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.

.6 Hazards observed but not created by the Contractor or its subcontractors shall be reported to the Owner's Engineer and the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.

.7 The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.

.8 The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the Authorities Having Jurisdiction at the Project site.

.9 The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

.3 Quality Management Program

.1 Designate a competent and experienced employee to provide Project Management. The designated Project Manager shall be empowered to make technical, scheduling and related decisions on behalf of the Contractor. At minimum, the Project Manager shall:

.1 Manage the scheduling of the work to ensure that adequate materials, labour and other resources are available as needed

.2 Manage the financial aspects of the Contract, with respect to the budget and payment applications.

.2 Be responsible for the work and actions of the workforce on site

1.6 References

.1 The Contractor shall fully comply with all codes and standards applicable to this type of work, including;

.1 Occupational Health and Safety (OHS) Act & Regulations for Prince Edward Island

.2 The National Electrical Code

.3 National Fire Code

.4 CSA B52-05 Mechanical Refrigeration Code

.5 CSA B51-19 Boiler, Pressure Vessel, and Pressure Piping Code

.6 ASME Boiler and Pressure Vessel Code (BPVC)
.7 Underwriters Laboratories (UL) listing and labels
.8 American National Standards Institute (ANSI)
.9 American Society for Testing and Materials (ASTM)
.10 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
.11 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Standards:
.1 ASHRAE Standard 15 - Safety Standard for Refrigeration System
.2 ASHRAE Standard 34 – Designation and Safety Classification of Refrigerants.

.2 In the case of conflicts or discrepancies, the more stringent regulation shall apply

.3 All work shall meet the approval of the Authorities Having Jurisdiction at the project site

1.7 Shop Drawings

.1 Manufacturer's data sheets must be used for each product included as part of the scope of work. The submittal package must include:
.1 Install preparation instructions, methods, and recommendations.
.2 Safety requirements and details.
.3 Operating and design parameters such as temperatures, pressures, RPM, and physical size.
.4 Performance and equipment specifications.
.5 Storage and handling requirements and recommendations.

.2 All specifications for equivalents being offered must be received electronically by the Owner's Engineer for review no later than the question deadline during the bidding process.
.1 For maintenance purposes, equivalents for equipment will only be approved if all equipment of a similar type meet the specifications (such as pumps).

.3 Shop drawings must also contain complete wiring and schematic diagrams, sequences of operation, control system bus layouts, and any other details required to demonstrate that the system has been coordinated and will properly function as a system.

1.8 Record Documentation

.1 Provide two (2) paper copies and one (1) USB digital copy of operating and maintenance manuals for all installed equipment pertaining to this contract, including as-built drawings

.2 After completion of all tests and adjustments, the contractor shall provide a copy of all as-built information and product data.

.3 On Site documents: Maintain at job site, one copy each of the following (but is not limited to):
- .1 Contract drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed shop drawings.
- .5 List of outstanding shop drawings.
- .6 Change orders.
- .7 Other modifications to Contract.
- .8 Copy of approved Work schedule.
- .9 Health and Safety Plan and other Safety related documents.
- .10 Manufacturers' installation and application instructions.
- .11 Labour conditions and wage schedules.
- .12 Other documents as specified.

.4 Manual shall be bound in three (3) ring binders and contain, as a minimum, the following:
- .1 System operation and maintenance instructions, trouble shooting guidelines and operating log.
- .2 Safety bulletins and material safety data sheets.
- .3 Reviewed and approved (stamped) shop drawings
- .4 Completed and approved Application for water connection form (As Required). Contractor to comply with all local and provincial backflow prevention requirements, where applicable
- .5 Approvals by all Authorities having jurisdiction.
- .6 Equipment operation and maintenance instructions

.5 As-built drawings must contain, as a minimum, the following;
- .1 Refrigeration equipment layout and schedule
- .2 Mechanical System equipment layout and schedule
- .3 Control Sequences of Operation
- .4 Structural Drawings and Plans
- .5 Electrical Wiring Diagrams, Layouts and Schematics
- .6 All flow schematics

.6 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.
- .1 For electrical, communication, and structural design, as required in this scope of work, the Owner’s Engineer will coordinate the review of these with respective engineers of record for this project.

.7 The contractor shall correct any errors or omissions noted in the first review.

.8 Within two (2) weeks of contract award the contractor shall provide a schedule, in a Gantt Chart to the Owner and the Owner's Engineer, which summarizes all construction timelines and milestone dates. Including, but not limited to:
- .1 Shop drawing submittal and review time;
- .2 Equipment order dates;
- .3 Lead time;
- .4 Site construction milestones (demolition, package placement, etc.)
- .5 On-site completion;
- .6 System start-up;
- .7 Substantial completion;
- .8 Training and owner turnover.

1.9 Commissioning

.1 Upon completion of the work, the contractor shall start up and calibrate the system to ensure all installed components start, and are installed properly.

.2 The contractor shall provide the Owner's Engineer with a Start Up checklist four (4) weeks prior to project completion for review and approval. The checklist shall include, but is not limited to, the following elements:
- .1 Equipment status
- .2 Time of day
- .3 Inlet temperatures
- .4 Outlet temperatures
- .5 Suction pressures
- .6 Discharge pressures
- .7 Liquid flow rates
- .8 Valve positions
- .9 Power reading including: power draw, voltage, current, power factor
- .10 Air Balancing

.3 An initial equipment check shall occur three (3) days prior to start up to ensure functionality of all components. Prior to this check, all equipment shall be visually inspected.

.4 Once start-up has occurred, the Start-Up Checklist shall be completed. The checklist shall be completed when the system is under load and at steady state to ensure all equipment is running. The contractor shall be immediately available in the hours following

start up to provide start up services and to rectify issues immediately as they arise.

.5 After substantial completion independent performance commissioning shall be completed by I.B. Storey and a deficiency list shall be provided to the contractor. Following receipt of the deficiency list the contractor shall provide weekly updates in writing of the completion status of the deficiencies, including proof of completion. After completion of all deficiencies the Owner's Engineer shall perform one final inspection, any requisite subsequent inspections shall be at the cost of the contractor ($1,200 per inspector per occurrence.)

1.10 Training

.1 The contractor shall provide the owner's staff with two (2) up to eight (8) hour training sessions in coordination with the Owner's staff and the packaged refrigeration system manufacturer.
  .1 First Session – to occur at plant start-up, with training specifically geared toward plant start-up
  .2 Second Session – to occur at a later time for other arena staff in the event they are unable to attend, and to address any operational issues that arise during regular operation

.2 The date and time of the training sessions shall be at the option of the Owner, and shall be coordinated by the contractor.

1.11 Warranty

.1 Standard Material and Labour Warranty:
  .1 Provide a one-year labour and material warranty on the refrigeration system following substantial completion.
  .2 If within twelve (12) months from the date of acceptance of a product, upon written notice from the Owner, it is found to be defective in operation, workmanship, or materials, it shall be replaced, repaired, or adjusted at the option of the Contractor at the cost of the Contractor.

PART 2 – REFRIGERATION PLANT

2.1 Refrigeration Plant Definition

.1 Refrigeration Plant Installation: This consists of the installation of the refrigeration system for the ice rink. It comprises all fully operational and functional elements, including equipment, software, and programming interfaced to the associated work of other related trades. This includes packaged refrigeration systems, pumps, sump tanks, refrigeration field piping, water field piping, automation equipment, automation programming, and instrumentation.

2.2 Refrigeration Plant Description

.1 The supply and installation of equipment, testing, start-up and warranty of an ice rink refrigeration system as outlined.

.2 Electrical and structural work is by other Owner direct contract. The Contractor of this scope is required to coordinate site activities and work.

.3 This contractor must be able to demonstrate to the Owner that a proper plan be implemented such that the allotted time for installation is satisfied.

- .1 If the start-up date for the refrigeration plant does not occur by the substantial completion date, the Contractor will be responsible for supplying and installing a rental refrigeration system at no cost to the Owner. The Contractor is responsible for all equipment selection and functionality in this scenario.
- .2 At the option of the Contractor, a rental refrigeration system may be provided in lieu of meeting the substantial completion date. This must be noted at the time of bidding and include all costs relating to switching-over the plant from the rental refrigeration system to the permanent system. This must be approved by the Owner. The Contractor is responsible for all equipment selection and functionality within this option.

.4 Provide a complete, neat and workmanlike installation. Use only employees who are certified Red Seal journeyman or registered apprentices (under the supervision of a journeyman). The labour used to carry out the work shall be skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project. Contractors must

submit registration numbers for key personnel that are certified journeyman.

.5 Manage and coordinate the work in a timely manner in consideration of the Project schedule.

2.3 Refrigeration Plant Scope of Work

.1 Supply and install on site three (3) magnetic bearing oil-less compressor packaged rink system (IRP-1, IRP-2, IRP-3). The following performance requirements are for each package.
- .1 Refrigerant: R513a
- .2 Evaporator Side:
  - .1 Total Capacity: 45 TR (per packaged system, 135 TR total)
  - .2 Fluid: 40% Ethylene Glycol
  - .3 Flow rate: 467 USGPM
  - .4 EFT: 13°F
  - .5 LFT: 10°F
  - .6 Pressure Drop: 33 ft.
- .3 Condenser Side:
  - .1 Fluid: 40% Ethylene Glycol
  - .2 Flow rate: 220 USGPM
  - .3 EFT: 93°F
  - .4 LFT: 103°F
  - .5 Pressure Drop: 25 ft.
- .4 Power: 63 kW
- .5 Electrical Requirements: 460/3/60
- .6 Must include Danfoss frictionless, magnetic bearing, oil-less compressors.
- .7 Compressor must be of high lift design.
- .8 Manufacturer must have fifteen (15) years experience in integrating Danfoss Turbocor compressor internal protection software for stall and surge situations at various operating conditions.
- .9 Include a five (5) year warranty on the magnetic bearing compressors only (priced separately on the Bid Forms).
- .10 Use only hybrid condenser/evaporator vessels set with hybrid film design.
- .11 Pressure relief valves are to be included on both evaporator and condenser as provided by the manufacturer.
- .12 Package must include a PLC controller with colour touchscreen.
- .13 IIOT (Industrial Internet of Things) 4.0 control system capable of controlling multiple independent units.
- .14 C-UL 508a standard control panel.

.15 Controller must be BACnet compatible.
.16 Condenser water regulating valve must be included on the package.
.17 Wholly independent, standalone packaged units
.18 Package manufacturer must be:
.19 Nationally recognized supplier of OEM parts
.20 Experienced in building units with Danfoss magnetic bearing compressors
.21 Package must be able to unload with constant entering water temperature.
.22 Packaged System Dimensions:
.1 Length: 144.1" (inches)
.2 Width: 33.3" (inches)
.3 Height: 74.15" (inches)
.23 Any deviation from the Standard of Acceptance must maintain the walking path in the room and allow for serviceability of the unit. This must be demonstrated in a Clearances and Interfaces Drawing.
.24 Supplier must provide, and comply with the manufacturer's instructions for, rigging, loading, transporting, and un-loading.
.25 Testing data demonstrating performance must be available upon request.
.26 Contractor is to ensure direct ethernet connection is provided to the packages with a Port 80 access as required by the Manufacturer for remote diagnosis.
.27 The unit must be protected from physical damage at all times.
.28 Standard of Acceptance: Thermalcare TCFW375, or approved equivalent

.2 Supply and install one (1) Adiabatic Fluid Cooler complete with pre-cooling pads (AFC-1).
.1 Capacity: 2,986 MBH
.2 WBT: 73.7°F
.3 Fluid: 40% Ethylene Glycol
.4 Flow Rate: 660 USGPM
.5 EGT: 105°F
.6 LGT: 95°F
.7 Maximum Coil Pressure Drop: 4.98 psi
.8 Maximum Sound Pressure: 76 dB(A) at 3' (feet).
.9 Eight (8) Fan Motors: 36.6 HP (total), premium efficiency.
.1 Contractor to provide new contactors, fuse blocks, starters, and wiring for the installed fan motor.
.2 Motor must be electrically commutated.

.10 Contractor must adhere to all manufacturer's recommended maintenance and operation clearances
.11 Contractor to include a drain and manual isolation valve to drain the water connection in the winter.
.12 Must include the manufacturer handrail and ladder.
.13 Must include an on-board controller.
.1 Controller must be BACnet open standard communication protocol compatible. Controller must be capable of variable speed control of the fan motors.
.2 Controller as a minimum must be able to maintain the leaving glycol setpoint.
.14 Standard of Acceptance: Guntner GFD 090.2A2x4/6AA-E371H/02P.M, or approved equivalent.

.3 Supply and install two (2) Cold Floor Pumps complete with VFD's (CP-1, CP-2).
.1 Flow rate: 700 USGPM
.2 Pumping head: 91 ft. H_2O
.3 Pump speed: 1,739 RPM
.4 Working fluid: 40% Ethylene Glycol
.5 Motor: 25 HP, premium efficiency
.6 Butterfly-style isolation valves shall be installed on the inlet and outlet of each pump.
.7 Include manufacturer suction guide for each pump.
.1 Body: Cast Iron
.2 Cover Gasket: Synthetic fibre
.3 Strainer: Stainless Steel, 0.125" Perf.
.4 Standard of Acceptance: Armstrong SG-65, or approved equivalent.
.8 Include non-slam check valve with manual isolation for each pump.
.1 Valve Style: Silent check valve
.2 Valve size: 6"
.3 Body Style: Globe
.4 End Connection: Flanged
.5 Body Material: Cast Iron
.6 Plug & Seat Material: EPDM
.7 Seating Surface: Acrylonitrile-Butadiene
.8 Standard of Acceptance: Armstrong Flo-Trex, or approved equivalent.
.9 Dial type pressure gauges shall be **supplied and installed** on the inlet and outlet of the cold floor pumps.
.1 Refer to specifications below for pressure gauge requirements.

.10 Contractor to coordinate pump electrical with Owner's electrical contractor to provide power.

.11 A side stream glycol filter shall be installed across the connections of the pump (discharge to suction). The filter shall be sized sufficiently in accordance with the floor charge to provide a minimum of 4 glycol charge filtrations per day.

.1 Standard of Acceptance: Axiom SFP-20

.12 Standard of Acceptance: Armstrong 4030 5x4x10

.13 Two (2) Variable frequency drives:

.1 Power: 575/3/60

.2 Refer to electrical specifications for VFD coordination.

.4 Supply and install two (2) Condenser Pumps complete with VFD's (HP-1, HP-2)

.1 Flow rate: 330 USGPM

.2 Pumping head: 96 ft. H_2O

.3 Pump speed: 1,851 RPM

.4 Working fluid: 40% Ethylene Glycol

.5 Motor: 15 HP, premium efficiency

.6 Butterfly-style isolation valves shall be installed on the inlet and outlet of each pump.

.7 Include manufacturer suction guide for each pump.

.1 Body: Cast Iron

.2 Cover Gasket: Synthetic fibre

.3 Strainer: Stainless Steel, 0.125" Perf.

.4 Standard of Acceptance: Armstrong SG-63, or approved equivalent.

.8 Include non-slam check valve with manual isolation for each pump.

.1 Valve Style: Silent check valve

.2 Valve size: 4"

.3 Body Style: Globe

.4 End Connection: Flanged

.5 Body Material: Cast Iron

.6 Plug & Seat Material: EPDM

.7 Seating Surface: Acrylonitrile-Butadiene

.8 Standard of Acceptance: Armstrong Flo-Trex, or approved equivalent.

.9 Dial type pressure gauges shall be **supplied and installed** on the inlet and outlet of the condenser pumps.

.1 Refer to specifications below for pressure gauge requirements.

.10 Contractor to coordinate pump electrical with Owner's electrical contractor to provide power.

.11 A side stream glycol filter shall be installed across the connections of the pump (discharge to suction). The filter shall be sized sufficiently in accordance with the floor charge to provide a minimum of 4 glycol charge filtrations per day.
  .1 Standard of Acceptance: Axiom SFP-10
.12 Standard of Acceptance: Armstrong 4030 3x2.5x10.
.13 One (1) Variable frequency drive:
  .1 Power: 575/3/60
  .2 Refer to VFD specifications for requirements.

.5 Supply and install two (2) Warm Floor Pumps (WFP-1, WFP-2)
  .1 Flow rate: 30 USGPM
  .2 Pumping head: 23 ft. H_2O
  .3 Pump speed: 1,760 RPM
  .4 Working fluid: 40% Ethylene Glycol
  .5 Motor: 0.75 HP, premium efficiency
  .6 Butterfly-style isolation valves shall be installed on the inlet and outlet of each pump.
  .7 Include manufacturer suction guide for each pump.
    .1 Body: Cast Iron
    .2 Cover Gasket: Synthetic fibre
    .3 Strainer: Stainless Steel, 0.125” Perf.
    .4 Standard of Acceptance: Armstrong SG-215TF, or approved equivalent.
  .8 Include non-slam check valve with manual isolation for each pump.
    .1 Valve Style: Silent check valve
    .2 Valve size: 2”
    .3 Body Style: Globe
    .4 End Connection: Flanged
    .5 Body Material: Cast Iron
    .6 Plug & Seat Material: EPDM
    .7 Seating Surface: Acrylonitrile-Butadiene
    .8 Standard of Acceptance: Armstrong Flo-Trex, or approved equivalent.
  .9 Dial type pressure gauges shall be **supplied and installed** on the inlet and outlet of the warm floor pumps.
    .1 Refer to specifications below for pressure gauge requirements.
  .10 Contractor to coordinate pump electrical with Owner’s electrical contractor to provide power.
  .11 Standard of Acceptance: Armstrong 4030 1.5x1x6.
  .12 Power: 575/3/60

.6 Supply and install two (2) AC Loop Pumps complete with VFD's (ACP-1, ACP-2)
  .1 Flow rate: 160 USGPM
  .2 Pumping head: 63.2 ft. H_2O
  .3 Pump speed: 1,727 RPM
  .4 Working fluid: 40% Ethylene Glycol
  .5 Motor: 5 HP, premium efficiency
  .6 Butterfly-style isolation valves shall be installed on the inlet and outlet of each pump.
  .7 Include manufacturer suction guide for each pump.
    .1 Body: Cast Iron
    .2 Cover Gasket: Synthetic fibre
    .3 Strainer: Stainless Steel, 0.125" Perf.
    .4 Standard of Acceptance: Armstrong SG-43, or approved equivalent.
  .8 Include non-slam check valve with manual isolation for each pump.
    .1 Valve Style: Silent check valve
    .2 Valve size: 4"
    .3 Body Style: Globe
    .4 End Connection: Flanged
    .5 Body Material: Cast Iron
    .6 Plug & Seat Material: EPDM
    .7 Seating Surface: Acrylonitrile-Butadiene
    .8 Standard of Acceptance: Armstrong Flo-Trex, or approved equivalent.
  .9 Dial type pressure gauges shall be **supplied and installed** on the inlet and outlet of the AC loop pumps.
    .1 Refer to specifications below for pressure gauge requirements.
  .10 Contractor to coordinate pump electrical with Owner's electrical contractor to provide power.
  .11 Standard of Acceptance: Armstrong 4030 3x2x10.
  .12 Power: 575/3/60

.7 Supply and install one (1) Hydraulic Separator (HS-1)
  .1 Size: 2"
  .2 Capacity: 60 GPM
  .3 Fluid: 40% Ethylene Glycol
  .4 Standard of Acceptance: Caleffi 548052A

.8 Supply and install one (1) Automatic Cold Loop Feeder
  .1 Size: 100 Gallons
  .2 Tank Material: Plastic

.3 Include pump with automatic pressure controls
.4 Must include a diverting valve.
.5 Must include a fluid level switch to automatically shut the pump off at a low tank level.
.6 Standard of Acceptance: Axiom SF-100L, or approved equivalent.

.9 Supply and install one (1) Automatic Cold Loop Feeder
.1 Size: 100 Gallons
.2 Tank Material: Plastic
.3 Include pump with automatic pressure controls
.4 Must include a diverting valve.
.5 Must include a fluid level switch to automatically shut the pump off at a low tank level.
.6 Standard of Acceptance: Axiom SF-100L, or approved equivalent.

.10 Supply and install one (1) Cold Loop Air Separator
.1 Shell Material: Fabricated Steel
.2 Maximum Working Pressure: 165 PSI
.3 Connections to be 150# flanged ANSI raised face.
.4 Design and built with the latest ASME pressure vessel code, section VIII, Division 1.
.5 Must include a blowdown connection for cleaning.
.6 Standard of Acceptance: Armstrong VA-10-U, or approved equivalent.

.11 Supply and install one (1) Warm Loop Air Separator
.1 Shell Material: Fabricated Steel
.2 Maximum Working Pressure: 165 PSI
.3 Connections to be 150# flanged ANSI raised face.
.4 Design and built with the latest ASME pressure vessel code, section VIII, Division 1.
.5 Must include a blowdown connection for cleaning.
.6 Standard of Acceptance: Armstrong VA-8-U, or approved equivalent.

.12 Supply and install one (1) Cold Loop Expansion Tank
.1 Acceptance Volume: 73 USGAL
.2 Total Volume: 90 USGAL
.3 Type: Pre-charged heavy-duty butyl diaphragm.
.4 Include tank saddles to install horizontally.
.5 Shell Material: Carbon Steel
.6 Head Material: Carbon Steel
.7 Working Temperature: 250°F

.8 Working Pressure: 125 PSI
.9 ASME Certified Construction
.10 Standard of Acceptance: Armstrong AX-180V, or approved equivalent

.13 Supply and install one (1) Warm Loop Expansion Tank
.1 Acceptance Volume: 60 USGAL
.2 Total Volume: 48.5 USGAL
.3 Type: Pre-charged heavy-duty butyl diaphragm.
.4 Include tank saddles to install horizontally.
.5 Shell Material: Carbon Steel
.6 Head Material: Carbon Steel
.7 Working Temperature: 240°F
.8 Working Pressure: 125 PSI
.9 ASME Certified Construction
.10 Standard of Acceptance: Armstrong AX-100V, or approved equivalent

.14 Supply and install one (1) Glycol Relief High Capacity Air Vent
.1 Install one on the cold floor loop above the air separator.
.2 Provide manual isolation valves before the high capacity air vents.
.3 Pressure Range: 30-150 PSI
.4 Pressure Setting:
.5 Maximum Temperature: 250°F
.6 Standard of Acceptance: Watts 174A, or approved equivalent.

.15 Where noted in the specifications or the drawings, pressure gauges must meet the following requirements:
.1 Pressure Range: 0 – 100 PSI
.2 Standard of Acceptance: Kodiak Controls Inc. KC201 D25 100

.16 Where noted in the specifications or the drawings, analog thermometers must meet the following requirements:
.1 Type: Adjustable angle liquid-in-glass thermometer.
.2 Range: 0°F to 160°F
.3 Contractor to include all thermowells as required.
.4 Standard of Acceptance: Trerice, or approved equivalent.

.17 Housekeeping pads
.1 Refer to structural design.
.2 The contractor is to form and pour new concrete housekeeping pads with steel reinforcing as required, for all new base/floor mounted equipment, including heat exchangers, vessels, pumps, tanks, etc.

.3 Concrete pads are to be constructed in accordance with the structural drawings.
.4 Concrete pads are to be a minimum of 6" tall, unless otherwise noted.
.5 Steel bases of the equipment are to be grouted and/or filled with concrete as required to limit noise and vibration. The foundation should be sufficiently substantial to absorb any excessive vibration and permanently support the base at all times.
.6 Concrete pads are to be finished level.
.7 The foundation must be poured well in advance of the installation to allow proper time for drying and curing.
.8 The elevations of all concrete pads are to be painted high visibility safety yellow, using one coat of primer and two coats of paint.

.18 Where noted in the specifications or the drawings, variable frequency drives (VFD's) must meet the following requirements:
.1 The VFD shall provide microprocessor-based control for three-phase induction motors. The controller's full load output current rating shall be based on 77°F ambient. Installed with internal reactors
.2 The VFD shall have selectable switching frequency between 8kHz and 12kHz to reduce motor noise and avoid increased motor losses as standard.
.3 The VFD shall maintain the power factor at no less than 0.98 at nominal load.
.4 The VFD shall have a one (1) minute overload current rating of 110% and a two (2) second starting current of at least 130%.
.5 The VFD shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VFD.
.6 Humidity: 5% to 95% (non-condensing and non-corrosive).
.7 Ambient Temperature: 5°F to 104°F (VT) with de-ratings up to 122°F.
.8 Diagnostic Features must include fault history. The VFD will record and log faults and indicate the most recent first. The system will log up to three faults.
.9 Must include a forced bypass contact and line-side reactors.
.10 Functionally, automatic disconnection of the supply must occur in the event of a loss of continuity of the projective conductor.
.11 Auto-bypass functionality must be provided. Bypass contactors to be IEC rated.

.12 Standard of Acceptance: ABB ACH580 series, or approved equivalent.

2.4 Additional Refrigeration Plant Items

.1 Provide rental refrigeration system connections as detailed on the design drawings.

.2 Supply and install a new charge of glycol for the new rink cold floor system.

.1 Contractor to carry all procurement, transportation, testing, and labour required to provide the glycol charge.

.2 Fluid: 40% Ethylene Glycol, including all required additives and inhibitors

.3 After charging of the system, the Contractor is required to adjust the concentration to the desired amount. Testing must be completed demonstrating that the required concentration has been achieved. Provide all testing reports to the Owner's Engineer.

.3 Any electrical or fire alarm shutdowns required by the Contractor for the scope of work must be approved by the Owner two (2) weeks prior to being performed for coordination purposes.

.4 The contractor it to provide one (1) cold floor testing report for the following charge after the system has been installed and prior to start-up. This is to verify the fluid properties and concentration.

.5 Contractor to coordinate all required new electrical equipment with Owner's electrical contractor. Reconfiguration is required to provide adequate power to the new equipment.

.1 Refer to electrical design.

.2 All MCC's, VFD's, and starters are to be clearly labelled detailing:

.1 Equipment name

.2 Source of electrical

.3 Voltage and amps

.6 All valves and controls should be located at ergonomic heights unless technically unfeasible.

.7 Contractor to supply and install a refrigeration room as-built refrigeration system schematic and valve chart detailing all new equipment relevant to the installation.

.8 Contractor to supply and install a permanent sign with all relevant refrigeration plant information, but not limited to, plant size,

prime-mover horsepower, contractor contact information, local emergency service information, and plant refrigerant charge.

.9 The contractor shall install digital thermometers on the inlets and outlets of all heat exchangers, the refrigeration packages, and pressure gauges on all pumps. Pressure gauges are to be dial type and temperature gauges are analog type as specified.

.10 Contractor to provide structural steel support members as required for hanging equipment, fans, pipes, and ductwork.

.11 Cutting, patching, sleeving, sealing, and fireproofing of floor, wall and ceiling necessary for all delivery and installation of refrigeration system shall be provided by the contractor.

.12 The contractor shall install dust enclosures while performing work in occupied facility zones, which generates large amounts of particulates.

.13 The contractor shall carry the cost of all piping, valves, fittings, and adaptors required to make a fully functional system as outlined in the specification herein, even if not specifically mentioned.

.14 Site cleanup and removal of construction/demolition debris is the responsibility of the contractor.

.15 Equipment layout shall allow adequate clearances for cleaning and maintenance purposes. The proposed clearances must be documented on a Clearance and Interface drawing and submitted to the Owner and the Owner's Engineer for comment, prior to commencing work.

.16 All installed equipment shall be labelled with placards, and shall be labelled by equipment type in sequential order (Pumps, Heat Exchangers, etc.).

.17 All inlets and outlets to heat exchangers shall be labelled with placards indicating flow medium and whether the connection is an inlet or outlet.

.18 Contractor shall seal all building penetrations created/modified under the scope of this contract with a watertight sealant; the penetration shall be painted to match the surrounding building finishes.

.19 The contractor shall furnish, supply and install all required refrigerant isolation and control valves in accordance with all applicable codes and standards.

.20 The contractor shall provide all required fluids required for a fully functional and operational system including:

.1 Glycol Charge

.21 All equipment installations must be constructed in conformance with all local, provincial, and national codes. Any additional requirements from the latest codes and standards supersede any requirements as written in this document.

.22 All equipment shall be installed such that it meets or exceeds the manufacturer's recommended installation practices and requirements.

.23 Prior to commencing work the contractor shall determine the location of any utility entrances (power, water, sewer), which may interfere with carrying out this work. This shall be done in conjunction with the utility companies, and shall be at the cost of the contractor.

.24 The contractor shall provide a new log book ("Ice Rink Log Book") for the facility at turnover, for logging pressures and temperatures.

.1 Work with the Owner's Engineer for content.

.25 Contractor must pay for all local inspections, approvals, and permits as required for the refrigeration plant replacement project.

.26 Supply and install a glycol drain/charge valve on each pump and heat exchanger in the system.

PART 3 – AUTOMATION

3.1 System Functional Intents

.1 Automation system functional intents:

1. R513A Packages
    a. The R513A packages are intended to operate to provide refrigeration to the cold slab, arena dehumidifier, HRV-1, HRV-2, and AHU-1. The three packages are to be staged to operate based on cooling demands from the loads with the lead package rotating between the three units.
    b. When the ice sheet is in operation the supply temperature commanded to the R513A packages are to be set to the rink temperature. When the ice sheet is not in operation the supply temperature commanded to the R513A packages are to be set to the A/C temperature.
    c. The R513A packages are to have multiple modes of operation depending on ice conditions, building heating, building cooling, and dehumidification requirements.
    d. A minimum condenser flow rate of 100 GPM per unit in operation is to be maintained by the condenser pumps.
    e. A minimum evaporator flow rate of 268 GPM per unit in operation is to be maintained by the cold floor pumps and bypass valve.
2. Adiabatic Fluid Cooler
    a. The adiabatic fluid cooler is to provide cooling to the heat rejection loop when the refrigeration plant is running and the building heat loads are satisfied. The unit will have multiple modes of operation based on the building heating loads required to adequately cool the heat rejection loop. The fluid cooler is to fluctuate its setpoint based on outdoor weather when a fixed heating setpoint is not required.
    b. a field commissioned minimum glycol leaving temperature must be maintained. If the temperature falls below the commissioned value the unit is to cycle off.
    c. When the outdoor dewpoint is above 60°F the water feed valve (402) is to open to allow the water pads on

the unit to be soaked, leveraging additional capacity through water evaporation and drain valve (401) is to close.

d. When the outdoor dewpoint is below 42°F the water feed valve (402) is to close and the drain valve (401) is to open to allow the system to be automatically drained to prevent freezing on the unit.

3. Cold Floor Pump
    a. The cold floor pumps are intended to operate to distribute the cold glycol to the ice sheet, the dehumidifier, and A/C loads from the R513A packages.
    b. The pumps are to stage in operation with the R513A packages and operate at the same speed to maintain the minimum flow required for the R513A packages. The pumps are to minimize energy use by maintaining a fixed temperature differential.
    c. Cold bypass valve (101) is intended to operate to ensure the minimum flowrate through the R513A packages is maintained when the required cooling flows are small.
4. Condenser Pumps
    a. The condenser pumps are intended to operate to distribute the heating provided by the R513A packages to the DHW preheat, the snow melt pit, the warm floor, dehum-1, HRV-1, HRV-2, AHU-1, the distributed fan coils, the AC defrost, and the adiabatic fluid cooler.
    b. The pumps are to stage in operation with the R513A packages and operate at the same speed to maintain the minimum flow required for the R513A packages. The pumps are to minimize energy use by matching the required warm glycol flow rates based on what loads are calling for heating.
    c. Heat loads are to be prioritized based on load characteristics. Heat is to be distributed based on the priority of the load.
5. Warm Floor Pump
    a. The warm floor pump is intended to provide heating to the warm rink floor to prevent frost below the ice rink floor. It is to keep the floor above 40°F and cycle off when the warm floor temperatures is at setpoint.
6. A/C Pump
    a. The A/C pumps are intended to operate to distribute the tempered cold glycol provided by the cold floor

pumps to the air conditioning for HRV-1, HRV-2, and AHU-1.

b. The pumps are to stage based on the require cooling loads from the HRVs and the AHU and operate at the same speed when both pumps are in operation. The pumps are to minimize energy use by matching the required AC loads by maintaining a fixed differential pressure.
c. A/C tempering valve (110) is to mixed the cold glycol supply from the R513A packages with the return A/C line to provide A/C suitable temperature to the A/C loop.
d. A/C provision valve (502) is intended to operate when the fan coils are to be switched over to cooling operation as a back-up space cooling system during the summer months.
e. A/C defrost valve (501) is intended to operate when the A/C loop is too cold and the A/C coils require defrost to prevent freezing in the connected air handling units.

7. Domestic Hot Water Heater
    a. The domestic hot water heaters (WH-1,2) are to stage to maintain the domestic hot water tank at the acceptable temperature. Each water has an independent tank circulation pump (WHP-1,WHP-2) that are to be cycle on before the water heater is commended to operate and to cycle off when a water heater is cycled off.
    b. The lead hot water heater is to be able to be switched.
    c. The heaters will maintain an internal tank temperature of 140°F for a minimum of 1 hour each day.
8. Zamboni Water Heater
    a. The Zamboni water heater is to maintain the Zamboni water at the required temperature for Zamboni fill operation.
    b. The heater will maintain an internal tank temperature of 140°F for a minimum of 1 hour each day.
9. HRV-1 & HRV-2
    a. HRV-1 and HRV-2 are intended to provide first pass heating and cooling to all of the air class 2 and 3 zones and ensure proper O/A ventilation is provided.

b. The fans are to operated based on the O/A requirements of the connected zones and on the cooling or heating required in its supplied spaces.
c. The HRV bypass is to operate to leverage advantageous outdoor air conditions to lower the cooling and heating requirements in the building.
d. The cooling coil valves (107, 108) are to modulated based on the required dewpoint for dehumidification or the supply air temperature if the incoming air requires no dehumidification.
e. The heating coil valves (205, 206) are to modulated based on the required supply air temperature to ensure proper air heating for the building.

10. AHU-1
    a. AHU-1 is intended to provide heating and cooling to all of the air class 1 zones and ensure that proper O/A ventilation is provided.
    b. The fans are to operate based on the O/A requirements of the connected zones and on the cooling or heating required in its supplied spaces.
    c. The mixed air economizer is to operate to leverage advantageous return or outdoor air conditions to lower the cooling and heating requirements in the building. The economizer is to ensure proper O/A ventilation to all zones.
    d. The cooling coil valve (109) is to modulated based on the required dewpoint for dehumidification or the supply air temperature if the incoming air requires no dehumidification.
    e. The heating coil valve (207) is to modulate based on the required supply air temperature to ensure proper air heating for the building.
11. Dehum-1
    a. The arena dehumidifier is intended to ensure proper ventilation in the arena space as well as provide the dehumidification for the ice surface air.
    b. The fans are to operate based on the O/A requirements of the ice surface air as well as the dehumidification, cooling, and/or heating requirement of that zone.
    c. The mixed air economizer is to operate to leverage advantageous return air or outdoor air conditions to lower the cooling and heating requirements in the

building. The economizer is to ensure proper O/A ventilation to the ice surfacer air.

d. The cooling coil valve (103) is to modulate based on the required dewpoint for dehumidification or the supply air temperature if the incoming air requires no dehumidification.
e. The heating coil valve (204) is to modulate based on the required supply air temperature to ensure proper air heating for the ice surface air.

12. Fancoil
    a. The fancoils are intended to operate as the secondary heating for their supplied zones cycling on to provide heating when the space is off from setpoint to ensure its zone is properly heated.
    b. The fancoils are intended to operate as the secondary cooling units for their supplied zones when out of the heating season by a switch over from heating to cooling. Cycling on to provide cooling when the space is off from setpoint to ensure its zone is properly cooled.
    c. The individual fan coil valves are to open when its fancoil is in operation.
13. Snow Melt Valve (202)
    a. The snow melt valve (202) is intended to operate to maintain the snow melt pit temperature above freezing to ensure proper snow melt when the Zamboni dumps snow into the pit.
14. Exhaust fans
    a. The exhaust fan for the plant room (EF-1) is intended to operate based on the required ventilation for Carbon Monoxide (CO) and temperature required for the space. In addition, the fan will be operated by the refrigerant detector controller to ensure refrigerant levels are below the allowable PPM in the event of a leak.
    b. The exhaust fan for the ice resurfacer room (EF-2) is intended to operate based on the required ventilation for CO and temperature required for the space.
    c. The exhaust fan for the electrical room (EF-3) is intended to operate based on the required ventilation for CO and temperature required for the space.
    d. The exhaust fan for the pool mechanical room (EF-4) is intended to operate based on the required ventilation for CO and temperature required for the space.

e. The exhaust fan for the elevator (EF-5) is intended to operate based on the required ventilation for temperature required for the space.

15. Heating and Cooling Prioritization
    a. The contractor is to provide a method of prioritizing heating and cooling loads to ensure critical systems are served over less critical ones. This method must be submitted and approved by the Owner's Engineer.

3.2 Automation Scope of Work

.1 Plant Control System
  .1 The Contractor is to supply and install all equipment including controllers for a secondary or back-up control system for the ice rink refrigeration plant.

.2 Back-up Control System
  .1 The mechanical contractor is to supply and install all equipment including controllers for a secondary or back-up control system for the ice rink refrigeration plant.
  .2 The back-up controller is to operate the equipment in the event of a primary control system failure to ensure a fully functional system. This back-up control system will only activate when the manual selector switch is activated.
  .3 Provide a labelled selector switch that will activate the back-up control system in the event the primary rink Building Management System (BMS) is offline. This switch can then be used to revert back to the BMS once it is functional. Equipment must not turn-off when the switch-over occurs.
  .4 The control system must be installed and functioning prior to start-up.
  .5 Standard of Acceptance: Honeywell T775, or approved equivalent.

.3 Power Meters
  .1 Real Power and Energy Accuracy: ± 0.2% from 1% to 100% of rated load.
  .2 Must be BACnet compatible.
  .3 Must be able to measure voltages from 120 to 600 Vac and currents from 5 to 6,000 amps in delta (phase to phase) and wye (phase to neutral) configurations.
  .4 Standard of Acceptance: Honeywell E-mon Class 5000, or approved equivalent.

.4 Supply and install fluid flow meters
  .1 Temperature Range: up to 320°F
  .2 Flow range: 0.01 to 272,225 GPM

.3 Accuracy: ±0.2 %
.4 Standard of Acceptance: Badger M-2000 Series, or approved equivalent.

.5 Supply and install fluid flow sensors
.1 Sleeve and hex adapter to be series 300 stainless steel.
.2 Temperature Rating: 221°F
.3 Accuracy: ± 1.0% of full scale over recommended design flow range.
.4 Design Flow Range: 0.5 to 30 ft/sec.
.5 Standard of Acceptance: Badger Series 200 Insertion Flow Sensor, or approved equivalent.

.6 Supply propane fuel meters
.1 Fuel meters are to be supplied by the automation contractor and provided to the propane piping contractor. Note that the contractor is still responsible for wiring, integration to the automation system, testing, and calibration.
.2 Accuracy: 1% of reading, 0.2% of full scale.
.3 Temperature: -40°F to 250°F, 1.8% accuracy.
.4 Must be BACnet compatible.
.5 Maximum Pressure Rating: 300 psig
.6 Material of Construction: 316 stainless steel.
.7 Standard of Acceptance: Fox Thermal FT2A Series, or approved equivalent.

.7 Supply and install Weather Stations
.1 Temperature: -40°F to 240°F, 0.4°F at 77°F accuracy
.2 Must include a selectable output signal of 4-20 mA or 0-10 Vdc.
.3 Humidity: 0 to 95% R.H., 3% accuracy
.4 Standard of Acceptance: Honeywell H7635C2015, or approved equivalent.

.8 Supply and install slab temperature sensors
.1 Installed on top of the slab.
.2 Sensor Type: PT1000 1097 Ohms at 77°F PTC
.3 Temperature sensor is to have a working range of -40°F to 40°F.
.4 Standard of acceptance: Honeywell T775-SENS-WT, or approved equivalent.

.9 Supply and install Wall CO2 Sensors
.1 Capable of 4-20 mA or 0-10 VDC signals.
.2 Range of 0 – 2,000 PPM
.3 Operating Conditions: -4°F to 122°F, 15 to 90% RH

.4 Accuracy: ± 50 ppm + 3% of reading.
.5 Response Time: 90 seconds
.6 Transmitter Accuracy: ± 0.25% of span.
.7 Standard of Acceptance: Greystone CDD4A101, or approved equivalent.

.10 Supply and Install Wall CO Sensors
.1 Capable of 4-20 mA or 0-10 VDC signals.
.2 Range of 0 – 300 PPM
.3 Operating Conditions: -4°F to 122°F, 15 to 90% RH
.4 Accuracy: ± 5 ppm or 5% of reading.
.5 Response Time: < 35 seconds for 90% step change
.6 Standard of Acceptance: Greystone CMD5B1000, or approved equivalent.

.11 Supply and install Duct Temperature and Humidity Sensors
.1 Accuracy: 3%
.2 Mounting: Duct
.3 Temperature Sensor: 20K ohm at 77°F
.4 Standard of Acceptance: Honeywell H7635B2018, or approved equivalent.

.12 Supply and install Duct Differential Pressure Sensors
.1 Mounting Type: Duct
.2 Output: selectable 0-10 VDC, 0-5 VDC, 4-20 mA
.3 A display to be included.
.4 Must include a selected pressure range and uni or bi-directional modes.
.5 Range: 0 to 1 in. W.C. (0 to 250 Pa)
.6 Pressure Mode Accuracy: ±1% F.S.
.7 Acceptable Temperature Range: 32°F to 122°F
.8 Standard of Acceptance: Honeywell P7650B1008, or approved equivalent.

.13 Supply and Install Duct Velocity Sensors
.1 Ranges: 0 – 2,000 FPM (field selectable).
.2 Accuracy: < 100 FPM + 5% of reading (at 0 - 2,000 FPM)
.3 Thermal Shift: ± 0.8%FS/°C
.4 Temperature Range: 32 to 122°F
.5 Output Signal: 0 – 10 VDC or 4 – 20 mA
.6 Include optional display.
.7 Mounting: Flange
.8 Standard of Acceptance: Greystone AVDTIX, or approved equivalent.

.14 Supply and Install Duct Airflow Stations

.1 Installed Airflow Accuracy: +/- 3% of reading
.2 Probe Temperature Limits: -20°F to 160°F
.3 Power: 24 VAC
.4 Standard of Acceptance: Ebtron GTC116e-P+, or approved equivalent.

.15 Supply and install immersion water/glycol temperature sensors.
.1 Temperature sensor is to have a working range of -40°F to 250°F.
.2 Contractor to include well.
.3 Standard of acceptance: Honeywell C7041D, or approved equivalent.

.16 Supply and install one (1) refrigerant alarm system in the refrigeration room.
.1 Refrigerant Type: R-513A
.2 Enclosure: NEMA 1, steel and epoxy painted black
.3 Mounting Height: 4-5 ft above finished floor
.4 Operating Temperature: -4°F to 122°F
.5 Humidity: continuous 15 to 90% RH, non-condensing and intermittent 0 to 99% RH, non-condensing.
.6 Relay Contacts: Three (3) DPDT 5A @ 240 VAC Res.
.7 Indicators: RED LED (Alarm), Yellow LED (Warning), Green LED (Status)
.8 Include Concentration Display
.9 Include Modbus RTU connection.
.10 Sensor:
.1 Detectable Gas: R-513A
.2 Sensor Type: Infra-Red Temperature Controlled
.3 Enclosure: Polycarbonate/ABS blend
.4 Supply Voltage: 24 VDC, nominal range
.5 Operating Temperature: -49°F to 149°F
.6 Accuracy: ±3% of reading
.7 Repeatability: ±3% of full scale
.8 Response Time: less than 30 seconds for 90% of step change
.9 Standard of Acceptance: QEL QIRF-513X-0, or approved equivalent.
.11 System to be connected to the refrigeration room exhaust fan for automatic ventilation activation.
.12 Provide one (1) switch for the manual fan switch located outside the refrigeration room and connected to the controller and exhaust fan.
.1 Standard of Acceptance: QEL M-Switch, or approved equivalent.

.13 Provide one (1) switch for the reset fan switch located inside the refrigeration room and connected to the controller and exhaust fan.
  .1 Standard of Acceptance: QEL M-Reset, or approved equivalent.
.14 Alarm system must include a strobe light inside and outside the refrigeration room.
  .1 Standard of Acceptance: QEL M-Strobe, or approved equivalent.
.15 Must be ready for integration into a Building Automation System (BMS).
.16 Standard of Acceptance: QEL M-Controller, or approved equivalent.

.17 Supply and install current transformers
  .1 Frequency Range: 50/60 HZ.
  .2 UL/ULC, CE listed
  .3 Multiple selectable range split-cores
  .4 Insulation class: 600V RMS
  .5 Standard of Acceptance: Honeywell Senva Inc Current Transducers, or approved equivalent.

.18 Supply and install current transducers
  .1 Accuracy: 2% of F.S. above 80A
  .2 Range 0A-800A
  .3 Type: Current Transducer, AC
  .4 Output: 4-20 mA
  .5 Standard of Acceptance: Veris H321, or approved equivalent.

.19 Supply and install power relays
  .1 Poles: single pole per relay
  .2 Coil volts: 24 VAC/DC
  .3 Both AC and DC rated
  .4 Amps: 6 A
  .5 CSA/UL Approved only
  .6 Standard of Acceptance: Allen-Bradley ALB700HLT1U24, or approved equivalent.

.20 All control systems are to include an Uninterruptable Power Supply (UPS) to prevent the control system shutting down in the event of a building power outage or fluctuations.
  .1 Use only an industrial-grade power supply sized to provide power to all control components.
  .2 Capacity: 300 Watts (500 VA).
  .3 Recharge time: 8 hours to 90% capacity after full discharge.

.4 Typical Back-up Time: 4 minutes.
.5 Suitable Temperature Range: 0 – 50°C
.6 Standard of Acceptance: Sola SDU 500, or approved equivalent.

.21 Automation contractor is to supply all power wiring and control valves per this contract. 24V wiring is required for automation components.

.22 The Contractor of this division is required to install all noted control valves.

.23 Contractor is to supply and install all necessary transformers and relays.

.24 All control wiring shall have a minimum FT-4 rating.

.25 Contractor to coordinate the installation of all equipment with the Automation Contractor. Any required testing and commissioning of the automation system (on top of the back-up or secondary control system) must also be coordinated by the Contractor in this scope.

3.3 Automation System Scope of Work

.1 General
.1 Contractor to provide a new automation system for additional control points with the specifications mentioned herein.
.2 Control system to be standalone.
.3 The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a network area controller, graphics and programming and other control devices for a complete system as specified herein.
.4 The installed system shall provide secure password access to all features, functions and data contained in the overall BMS.
.5 Controls contractor to provide a data connection from the BMS to the I.B. Storey secure Niagara supervisory system, as well as all accessories required to provide that data connection.
.1 This will be coordinated with Owner's IT and Owner's Engineer.
.6 Standard of acceptance for Controller Vendors:
.1 Tridium's "JACE-8000 Niagara 4 Platform"
.2 Honeywell International's "WEB-8000 Niagara 4 Platform"
.3 Johnson Controls' "FX80 Niagara 4 Platform"

.2 Open, Interoperable, Integrated Architecture
.1 The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing Open protocols in one open, interoperable system.

.2 The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. Physical connection of any BACnet control equipment, such as chillers, shall be via Ethernet or IP.

.3 All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data will not be acceptable.

.4 The supplied system shall incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on the Operating System Server located in the Facilities Office on the LAN. Systems requiring proprietary database and user interface programs shall not be acceptable.

.5 A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

.1 Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.

.2 Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

.3 BAS SERVER HARDWARE

.1 Minimum Computer Configuration (Hardware Independent).

.2 Central Server. Contractor shall provide a dedicated BAS server with configuration that includes the following components as a minimum:

.1 Processor: Intel Xeon CPU E5-2640 x64 (or better), compatible with dual- and quad-core processors.

.2 Memory: 2 GB or more recommended for large systems, 8 GB or more recommended for the Windows 64-bit version.

.3 Hard Drive: 4 GB minimum, more recommended depending on archiving requirements.

.4 Display: Video card and monitor capable of displaying 1024 x 768 pixel resolution or greater.

.5 Network Support: Ethernet adapter (10/100 Mb with RJ-45 connector).

.6 Connectivity: Full-time high-speed ISP connection recommended for remote site access (i.e. T1, ADSL, cable modem).

.3 Standard Client: The thin-client Web Browser BAS GUI shall be Microsoft Internet Explorer (10.0 or later) running on Microsoft 7+. No special software shall be required to be installed on the PCs used to access the BAS via a web browser.

.4 BAS MOBILE ACCESS HMI

.1 Contractor is to supply and install one (1) BAS Mobile Access HMI embedded into the exterior of the control panel for full control access in the form of a commercially standard tablet with the following specifications:

.1 A 12” touch screen

.2 Run on the latest Android OS

.5 SYSTEM NETWORK CONTROLLER (SNC)

.1 These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC) and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.

.2 The controllers shall be fully programmable to meet the unique requirements of the facility it shall control.

.3 The controllers shall be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.

.4 The communication protocols utilized for peer-to-peer communications between SNC's will be Niagara 4 Fox, BACnet TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.

.5 The SNC shall employ a device count capacity license model that supports expansion capabilities.

.6 The SNC shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default:

.1 BACnet

.2 Lon

.3 MODBUS
.4 SNMP
.5 KNX

.7 The SNC shall be capable of executing application control programs to provide:
.1 Calendar functions.
.2 Scheduling.
.3 Trending.
.4 Alarm monitoring and routing.
.5 Time synchronization.
.6 Integration of LonWorks, BACnet, and MODBUS controller data.
.7 Network management functions for all SNC, PEC and ASC based devices.

.8 The SNC shall provide the following hardware features as a minimum:
.1 Two 10/100 Mbps Ethernet ports.
.2 Two Isolated RS-485 ports with biasing switches.
.3 1 GB RAM
.4 4 GB Flash Total Storage / 2 GB User Storage
.5 Wi-Fi (Client or WAP)
.6 USB Flash Drive
.7 High Speed Field Bus Expansion
.8 -20-60°C Ambient Operating Temperature
.9 Integrated 24 VAC/DC Global Power Supply
.10 MicroSD Memory Card Employing Encrypted Safe Boot Technology

.9 The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

.10 The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.

.11 The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via cellular modem, or wide-area network.
.1 Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
.1 Alarm.
.2 Return to normal.
.3 To default.

.2 Alarms shall be annunciated in any of the following manners as defined by the user:
.1 Screen message text.
.2 Email of complete alarm message to multiple recipients.
.3 Pagers via paging services that initiate a page on receipt of email message.
.4 Graphics with flashing alarm object(s).
.3 The following shall be recorded by the SNC for each alarm (at a minimum):
.1 Time and date.
.2 Equipment (air handler #, access way, etc.).
.3 Acknowledge time, date, and user who issued acknowledgement.

.12 Programming software and all controller "Setup Wizards" shall be embedded into the SNC.

.13 The SNC shall support the following security functions.
.1 Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
.2 Role-Based Access Control (RBAC) for managing user roles and permissions.
.3 Require users to use strong credentials.
.4 Data in Motion and Sensitive Data at Rest be encrypted.

.14 LDAP and Kerberos integration of access management. The SNC shall support the following data modeling structures to utilize Search; Hierarchy; Template; and Permission functionality:
.1 Metadata: Descriptive tags to define the structure of properties.
.2 Tagging: Process to apply metadata to components
.3 Tag Dictionary

.15 The SNC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms... that are set to be deployed as a unit based upon manufacturer's controller and relationships. All lower level communicating controllers (PEC, AUC, AVAV, VFD…) shall have an associated template file for reuse on future project additions.

.16 The SNC shall be provided with a 5 Year Software Maintenance license. Labour to implement not included.

.6 Programmable Equipment Controller (PEC)
.1 Equipment control shall be accomplished using LonMark or BACnet based devices where the application has a LonMark

profile or BTL Listed PICS defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier shall provide an XIF file for the device. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

.2 All PECs shall be application programmable and shall at all times maintain their certification. All control sequences within or programmed into the PEC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.

.3 The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.

.4 The PEC shall not require any external configuration tool or programming tool. All configuration and programming tasks shall be accomplished and accessible from within the Niagara 4 environment.

.5 The following integral and remote Inputs/Outputs shall be supported per each PEC:

.1 Eight integral dry contact digital inputs.

.2 Any two digital inputs may be configured as pulse counters with a maximum pulse read rate of 15 Hz.

.3 Eight integral analog inputs (configurable as 0-10V, 0-10,000 Ohm or, 20K NTC).

.4 Six integral 4-20 mA analog outputs.

.5 Eight integral 24 Vac Triac digital outputs, configurable as maintained or floating motor control outputs.

.6 One integral 20 Vdc, 65-mA power supply for auxiliary devices.

.7 If a 20 Vdc 65-mA power supply terminal is not integral to the PEC, provide at each PEC a separate, fully isolated, enclosed, current limited and regulated UL listed auxiliary power supply for power to auxiliary devices.

.6 Each PEC shall have expansion ability to support additional I/O requirements through the use of remote input/output modules.

.7 PEC Controllers shall support at minimum the following control techniques:

.1 General-purpose control loops that can incorporate Demand Limit Control strategies, Set point reset, adaptive intelligent recovery, and time of day bypass.
.2 General-purpose, non-linear control loops.
.3 Start/stop Loops.
.4 If/Then/Else logic loops.
.5 Math Function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV, ENTHALPY)

.7 BAS Server & Web Browser GUI - System Overview
.1 The BAS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.
.2 The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. Microsoft, Firefox, and Chrome browsers (current released versions), and Windows as well as non-Window operating systems.
.3 The BAS server software shall support at least the following server platforms (Windows 7, 8.1, Server 12). The BAS server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.
.4 The web browser GUI shall provide a completely interactive user interface and shall provide a HTML5 experience that supports the following features as a minimum:
.1 Trending.
.2 Scheduling.
.3 Electrical demand limiting.
.4 Duty Cycling.
.5 Downloading Memory to field devices.
.6 Real time 'live' Graphic Programs.
.7 Tree Navigation.
.8 Parameter change of properties.
.9 Set point adjustments.
.10 Alarm / event information.
.11 Configuration of operators.

.12 Execution of global commands.
.13 Add, delete, and modify graphics and displayed data.

.5 Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project. BAS software components shall include:
.1 Server Software, Database and Web Browser Graphical User Interface.
.2 5 Year Software Maintenance license. Labour to implement not included.
.3 Embedded System Configuration Utilities for future modifications to the system and controllers.
.4 Embedded Graphical Programming Tools.
.5 Embedded Direct Digital Control software.
.6 Embedded Application Software.

.6 BAS Server Database: The BAS server software shall utilize a Java Database Connectivity (JDBC) compatible database such as: MS SQL 8.0, Oracle 8i or IBM DB2. BAS systems written to Non -Standard and/or Proprietary databases are NOT acceptable.

.7 Thin Client - Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:
.1 Web Browser's for PC's: Only the current released browser (Explorer/Firefox/Chrome) will be required as the GUI and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.
.2 Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall offer encryption using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol (HTTP).

.8 Web Browser Graphical User Interface
.1 Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic

programs, active graphic set point controls, configuration menus for operator access, reports and reporting actions for events.

.2 Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control privileges.

.3 Navigation: Navigation through the GUI shall be accomplished by clicking on the appropriate level of a navigation tree (consisting of an expandable and collapsible tree control like Microsoft's Explorer program) and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.

.1 Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and objects.

.2 Groups View shall display Scheduled Groups and custom reports.

.3 Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

.4 Action Pane: The Action Pane shall provide several functional views for each subsystem specified. A functional view shall be accessed by clicking on the corresponding button:

.1 Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic set point controls, web content and other valid HTML elements. The data on each graphic page shall automatically refresh.

.2 Dashboards: User customizable data using drag and drop HTML5 elements. Shall include Web Charts, Gauges, and other custom developed widgets for web browser. User shall have ability to save custom dashboards.

.3 Search: User shall have multiple options for searching data based upon Tags. Associated equipment, real time data, Properties, and Trends shall be available in result.

.4 Properties: Shall include graphic controls and text for the following: Locking or overriding objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an 'accept/cancel' button.

.5 Schedules: Shall be used to create, modify/edit and view schedules based on the systems hierarchy (using the navigation tree).

.6 Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.

.7 Charting: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling. User shall have ability to create HTML charts through web browser without utilizing chart builder. User shall be able to drag and drop single or multiple data points, including schedules, and apply status colors for analysis.

.8 Logic - Live Graphic Programs: Shall be used to display' live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.

.9 Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.

.5 Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to set points and comfort. Animated .gifs or .jpg, vector scalable, active set point graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:

.1 Display Size: The GUI workstation software shall graphically display in a minimum of 1024 by 768 pixels 24 bit True Color.

.2 General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.

.3 Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective set points. The colors shall be updated dynamically as a zone's actual comfort condition changes.

.4 Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving

any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.

.5 Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
  .1 Each piece of equipment monitored or controlled including each terminal unit.
  .2 Each building.
  .3 Each floor and zone controlled.

.6 Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with proper access credentials) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day ' Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the ' Independence Day' Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
  .1 Schedules: Schedules shall comply with the LonWorks and BACnet standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
    .1 Types of schedule shall be Normal, Holiday or Override.
    .2 A specific date.
    .3 A range of dates.
    .4 Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any).
    .5 Wildcard (example, allow combinations like second Tuesday of every month).
  .2 Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of "things" to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.

.3 Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ' individual tenant' group - who may occupy different areas within a building or buildings. Schedules applied to the ' tenant group' shall automatically be downloaded to control modules affecting spaces occupied by the ' tenant group'.

.4 Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.

.5 Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).

.6 Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

.7 Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ' Alarms' view. Alarms, and reporting actions shall have the following capabilities:

.8 Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event

templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.

.9 Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.

.10 Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.

.11 Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.

.12 Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.

.13 Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A ' network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.

.14 Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement and total number of Alarms in the BAS Server database.

.15 Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.

.16 Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BAS server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:

.1 Print: Alarm information shall be printed to the BAS server's PC or a networked printer.

.2 Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.

.3 File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).

.4 Write Property: The write property reporting action updates a property value in a hardware module.

.5 SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.

.6 Run External Program: The Run External Program reporting action launches specified program in response to an event.

.7 Trends: As system is engineered, all points shall be enabled to trend. Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.

.1 Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.

.2 Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-

volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.

.3 Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.

.4 Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.

.5 Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and ' pan through' historical data by simply scrolling the mouse.

.6 Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.

.7 Copy/Paste. The operator shall have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).

.8 Security Access: Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Strong Password. Access to different areas of the BAS system shall be defined in terms of Role-Based Access Control privileges as specified:

.1 Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of 'easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.

.1 View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.

.2 Edit Privileges shall comprise: Set point, Tuning and Logic, Manual Override, and Point Assignment Parameters.

.3 Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.

.2 Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

.9 Graphical Programming

.1 The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.

.2 Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

.3 Graphic Sequence: The clarity of the graphic sequence shall be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming shall be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

.4 GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:

.1 Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.

.2 Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.

.3 Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a

specified sequence. A library of microblocks shall be submitted with the control contractors bid.

.4 Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.

.5 Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.

.6 Parameter: A parameter shall be a value that may be tied to the input of a microblock.

.7 Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.

.8 Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.

.9 Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.

.10 Live Graphical Programs: The Graphic Programming software shall support a ' live' mode, where all input/output data, calculated data and set points shall be displayed in a ' live' real-time mode.

.10 LONWORKS Network Management

.1 Systems requiring the use of third-party LonWorks network management tools shall not be accepted.

.2 Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

.3 The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices and to view health and status counters within devices.

.4 These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

.5 The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times and within the control system shall not be accepted

3.4 Additional Automation Items

.1 Any electrical or fire alarm shutdowns required by the Contractor for the scope of work must be approved by the Owner two (2) weeks prior to being performed for coordination purposes.

.2 All valves and controls should be located at ergonomic heights unless technically unfeasible.

.3 All equipment installations must be constructed in conformance with all local, provincial, and national codes. Any additional requirements from the latest codes and standards supersede any requirements as written in this document.

.4 All equipment shall be installed such that it meets or exceeds the manufacturer's recommended installation practices and requirements.

.5 There will be a $5,000 cash allowance for IT Infrastructure to be coordinated with the Owner's Engineer.

.6 The automation contractor must have a service staff member with spare components available no more than a 4-hour transport distance from the facility for emergency repairs or adjustments.

.7 The automation contractor must provide the Owner's Engineer with remote user access to the automation system. The remote user access must include control functionality such that changes may be made to setpoints or schedules as needed.

.8 Power and control wiring as much as possible is to be run through the building in non-accessible locations to the buildings occupants in the most aesthetically pleasing method as reasonable.

.1 Power and control wiring shall be run in conduit as much as possible.

.2 Power and control wiring shall be firmly secured to surfaces, walls, cable trays, or other.

.3 Power and control wiring is to be run parallel along walls at a minimum elevation of 7 ft in occupied corridors or along the ceiling of these zones to prevent interference with building occupants.

PART 4 – ICE RINK FLOOR

4.1 Ice Rink Floor Description

.1 The supply and installation of floor materials and piping systems as outlined.

.2 Coordinate installation of the Dasher Board System anchors with the Dasher Board System installer.

.3 The intent of this upgrade is to install an ice surface with NHL regulation playing surface size of 200 ft. x 85 ft. with corner radii of 28 ft.

.4 Provide a complete, neat and workmanlike installation. Use only employees who are skilled, experienced, trained, and familiar with the specific equipment, standards, and configurations to be provided for this project. The scope of work is to be carried out by red seal journeyman or registered apprentices under the supervision of a red seal journeymen.

.5 Manage and coordinate the work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

4.2 Ice Rink Floor Submittals

.1 No material orders or work will begin on any segment of this Division until submittals have been successfully reviewed and approved for conformity with these specifications and the design intent.

.2 Submit data for each accessory, admixtures, and curing material for the work.

.3 Concrete Design Data:
  .1 Prior to the Work, the Contractor must submit the mix design and batch plans for review and approval.
  .2 Submit test results of proposed mix design, performed locally, two (2) months prior to use for approval by the Owner's Engineer.
  .3 Submit all certificates for cement, fly ash, and all aggregates.

.4 Shop Drawings:
  .1 Contractor must submit shop drawings for all products including, but not limited to: piping, pipe chairs, pipe bends, concrete, rebar, wire mesh, insulation, and expansion joints.

.2 Shop drawing documents must indicate procedures, schedules, equipment, and all components required for the rink floor.
.3 Contractor to include specifications of the anti-freeze mixtures.
.4 Test results of the concrete mixture to be installed.

4.3 Ice Rink Floor Codes and Standards

.1 The Contractor shall fully comply with all codes and standards applicable to the Work undertaken, including but not limited to:
.1 Occupational Health and Safety (OHS) Act & Regulations for Prince Edward Island
.2 ACI 311-4R-09 Guide for Concrete Inspection.
.3 ACI 302.1R-15
.4 CAN/CSA-A23.1-14 Concrete Materials and Methods of Concrete Construction.
.5 CAN/CSA-A23.2-14 Standard Test Method for Determining Average Elevation, Slope, and Waviness.
.6 CAN/CSA-A23.3-14 Design of Concrete Structures.
.7 CAN/CSA-A3001 Supplementary Cementitious Materials.
.8 CAN/CSA G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
.9 CAN/CSA G30.14-M1983.14-M1983 (R1998), Deformed Steel Wire for Concrete Reinforcement.
.10 CAN/CSA G30.15-M1983 (R1998), Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
.11 CAN/CGSB-51.34-M86 Vapor Barriers, Polyethylene Sheet for Use in Building Construction.
.12 CAN/ULS S701-17 Thermal Insulation, Polystyrene, Boards and Pipe Covering. In all instances, the most recently revised version of the applicable codes shall apply.
.13 ATSM E1155M Standard Test Method for Determining F_F Floor Flatness and F_L Floor levelness Numbers

.2 In the case of conflicts or discrepancies, the more stringent regulation shall apply.

.3 All Work shall meet the approval of the Authorities Having Jurisdiction at the project site.

4.4 Ice Rink Floor Scope of Work

.1 The new ice surface must encompass a playing area 200' x 85, with 28' corner radii.
  .1 Finished rink floor slab surface to be flush with perimeter finished slab, on parallel planes.
  .2 All assemblies are to be rigidly secured and incapable of movement during operation.
  .3 Floor is to be entirely free from debris before and after the concrete pour. This includes construction waste including, but not limited to, discarded sections of pipe, extra/broken/cut cable ties or tie wires, cut sections of wire mesh or rebar, and other building materials.

.2 Buried Mains:
  .1 Excavate or leave open the header path in the rink zone for installation then bury the header mains after installation.
  .2 Run slab sensor conduit along the buried mains path, next to pipe runs.
  .3 Cold Floor Mains:
    .1 Supply and install two (2) pipes for the cold floor mains, supply and return, from the buried header piping to the refrigeration plant room and connecting inside the plant room to the existing pipes.
    .2 Provide 2" Armacell insulation and PVC jacketing for cold floor mains outside the rink slab, including the cold floor pump, up to the chiller.
    .3 Pipe Specification: 8" HDPE SDR 11, fusion welded.
  .4 Warm Floor Mains
    .1 Supply and install two (2) pipes for the warm floor mains, supply and return, from the buried header piping to the refrigeration plant room and connecting inside the plant room to the existing pipes.
    .2 Pipe Specification: 3" HDPE SDR 11, fusion welded.

.3 Buried Header Pipes:
  .1 Cold Floor Header:
    .1 Supply and install new HDPE cold floor headers for the ice surface.
      .1 Provide cold fluid supply and return headers
      .2 Pipe size: 8" SDR 11
      .3 Pipe material: HDPE
      .4 Floor pipe connections:
        .1 To be 1" IPS Fusion service saddle.
        .2 All saddles to be fusion welded to headers.

.2 Cold floor piping to be fusion welded to the cold floor saddles.

.3 Contractor to supply and install two (2) drains, complete with valves, and two (2) purge valves (vent) with connections, one (1) per header.

.1 Provide 1" purge valves at both ends of supply and return headers.

.2 Connect purge valves to headers using 1" SDR 13.5 HDPE pipe. Saddles are also an approved equivalent.

.3 Purge valve piping must not slope downwards to ensure air is not trapped in the line, and the valves must be installed in the access box.

.4 Supply and install deck board and Unistrut assembly support for the cold floor headers.

.1 Assembly to consist of 5/4" (1.25") x 6" deckboard and 1 5/8" Unistrut.

.2 Space every 4'

.3 Provide pipe clamps to clamp headers to support assembly at every other support.

.4 Grout down support assembly before pour.

.2 Warm Floor Stubby Header:

.1 Supply and install two (2) 3'' HDPE supply and return header pipes, circulating warmed fluid to prevent frost heaving in the rink floor. Header pipes shall be run from the refrigeration room.

.2 Includes thirteen (13) sets of fusion service saddle connections fusion welded to each of the stubby headers.

.3 Contractor to supply and install two (2) drains, complete with valves, and two (2) purge valves (vent) with connections, one (1) per header.

.1 Provide 1" purge valves at both ends of supply and return headers.

.2 Connect purge valves to headers using 1" SDR 13.5 HDPE pipe. Saddles are also an approved equivalent.

.3 Purge valve piping must not slope downwards to ensure air is not trapped in the line, and the valves must be installed in the access box.

.4 All valves to be of steel bodies and be fitted with hand wheels (grips).

.3 Supply and install Pipe Saddles.
  .1 To be installed to connect the floor piping to the header pipes below grade.
  .2 Saddle: 1" IPS Fusion Service Saddles.
  .3 Fuse 7" on center.
.4 Provide pipe supports for the buried headers along the width of the rink.
  .1 Supports to consist of welded uni-strut assemblies secured with channel nuts to header support assembly.
  .2 Support frame to be provided every 4' at every header support assembly.
  .3 Cable tie each chair to horizontal strut support two pipe chairs before chair ends. No overlapping of pipe chairs is required at the buried header sections.
  .4 Alternative Support Assemblies may be submitted for approval by the Owner's Engineer.

.4 Cold Floor Piping
  .1 Supply and install cold floor piping, both supply and return running parallel to each other and connected to each header saddle. To run along entire length and width of the rink.
  .2 Piping Size: 1" SDR 13.5
  .3 Material: HDPE
  .4 Spaced 3 ½" on center.
  .5 Header connections: All joints to be fully fusion welded to header saddles.
  .6 Perimeter chill ring to be secured to the rebar reinforcements with cable ties.
    .1 The chill ring will conform to all specifications noted above and be connected to the headers.
    .2 Cable ties to be provided as required to ensure no movement of the chill rings, maximum 24" apart.
  .7 Return bends: Pre-manufactured 1" IPS Socket Fusion 180° (degree) U-bend (one-piece).
    .1 Joints to be fully fusion welded.
    .2 U-bend to meet SDR 13.5 dimensional requirements at minimum.
    .3 Tension the return bends using cable ties to the perimeter rebar at rink ends to prevent sagging.
  .8 To prevent wear, piping and bends, with exception to the chill ring, are not permitted to be in contact with the reinforcing rebar at any point.

.5 Warm Floor Piping
  .1 Supply and install warm floor piping, both supply and return piping running parallel to each other and connected to each header nipple. Piping must extend the entire length and width of the new ice slab structure. Fusion service saddles may also be used.
  .2 Pipe Size: 1" SDR 13.5
  .3 Material: HDPE
  .4 Spaced 24" on center.
  .5 Provide rigid insulation to warm floor piping only located in the access box.
  .6 Header connections: All joints to be fully fusion welded to stubby header in the access box.

.6 Supply and install the new Rink Floor, from base up as described below. Note the specifications for each point are described in this document.
  .1 Clean Sand.
  .2 Warm floor piping.
  .3 Vapour Barrier.
  .4 Two layers of Rigid Extruded Insulation.
  .5 Vapour Barrier.
  .6 Pipe Chairs (Supports).
  .7 Bottom Lower Layer of Reinforcing Bar (Rebar)
    .1 Installed perpendicular to cold floor piping.
  .8 Bottom Upper Layer of Reinforcing Bar (Rebar)
    .1 Installed parallel to cold floor piping.
  .9 Cold Floor Piping.
  .10 Top Layer of Reinforcing Wire Mesh.
  .11 Concrete Slab.
    .1 Encapsulating the pipe chairs, pipes, and reinforcement.

.7 Supply and install a Clean Sand Layer
  .1 7" total of clean sand, levelled to a ±3/16" tolerance.
  .2 Warm floor piping to be placed on 2" of compacted sand, then buried under a layer of 5" of sand (for a total of 7" of the sand layer).
  .3 Sand to be free from clay, shale, and organic matter.

.8 Supply and install Vapour Barrier Layers
  .1 To consist of (2) layers of 10 MIL polyethylene vapour barriers, one (1) above the clean sand level and one (1) above the rigid extruded insulation.

.2 Overlap the edges by minimum 12". All joints to be sealed by taping as per manufacturer's requirements.

.9 Supply and install Rigid Extruded Insulation.
- .1 Provide two (2) layers of insulation between the vapour barriers.
- .2 Thickness: 2" per layer to a total of 4"
- .3 Compressive Strength: Minimum 30 PSI in conformance to ATSM D1621.
- .4 Material: Thick rigid extruded insulation levelled to ± 3/16" tolerance.
  - .1 Edges of the top layer shall be staggered from the bottom layer's edges.
- .5 Minimum Thermal Resistance: R5.
- .6 All sheets must be laid flush.
- .7 Standard of Acceptance: Styrofoam Brand SM Extruded Polystyrene Foam Insulation, or approved equivalent.

.10 Supply and install new Pipe Chairs:
- .1 "M" style chairs with slots for tubing and supports for rebar (parallel to rink pipe) with continuous metal base.
- .2 Material: Cold rolled steel.
- .3 Pipe Size: 1" SDR 13.5, with 1 3/8" OD.
- .4 Pipe centers: 3 1/2"
- .5 20 tube slots per support.
- .6 Total Height: 3 1/2"
- .7 Pipe lift: 2.00"
- .8 Rebar lift: 1.50"
- .9 Base plates: 3" x 24 gauge spaced 36" on center.
- .10 Cold floor pipes to be secured to the pipe chairs at every second joint using nylon cable ties to sufficiently fasten the pipes to the chairs. Piping must lay snug in the chairs.
- .11 Space pipe chairs, in parallel, at most 36" along the length of the rink.
  - .1 Provide a row of pipe chairs at each edge.
- .12 Cut loose cable tie ends and dispose prior to pour.
- .13 Overlap pipe chair ends by two (2) pipe spaces.

.11 Supply and install Bottom Layer Reinforcing Rebar:
- .1 Rebar type: 10M rebar.
- .2 Install lower rebar first parallel to pipe chairs (perpendicular with floor piping) with 12" on center spacing.

.3 Install upper rebar second parallel to cold floor pipes with 10 1/2" on center spacing. Upper rebar to sit in pipe chairs.
.4 Rebar to be tied, using high-visibility tie wires, at every intersection along the diagonal, starting at every third rebar intersection along the length of the rebar.
.5 Secure rebar to radius rebar at the radius ends using tie wires.
.6 Secure rebar to pipe chairs using tie wires at every three intersections, staggering ties at every chair.

.12 Supply and install Top Layer Reinforcing Wire Grid:
.1 To be installed on top of rink piping.
.2 6x6x6/6 (inches, inches, & gauge) welded wire mesh placed on top of rink piping supports (chairs) across whole area of rink slab.
.3 Any cut portions must be secured. 6x6 grid reinforced structure must be maintained.
.4 Top reinforcing must be laid and lapped to not exceed two (2) layers, and securely tied to pipe chair supports using tie wires.
.1 Wires must have loose ends cut and be turned away from and not on top of piping to avoid damage.
.2 Tie mesh to pipe chairs a minimum of every 12" along the pipe chairs and around the perimeter of each mesh sheet.
.3 Overlaps must be tied together with loop-type wires at a minimum of 12" spaces in two directions.
.5 Install continuous wire mesh above the rink pipes with 6" overlaps. Tie overlaps as noted above.
.6 Trimmed corners to maintain two (2) layers overlap max.
.7 Use flat sheets only. Rolled will not be approved.
.8 Under no circumstances shall wire mesh be tied to the rebar.

.13 Supply and install Perimeter Rebar Anchors.
.1 Provide concrete anchors and stainless steel eyebolts. Secure to the perimeter concrete along the ends and radii.
.2 To be space at 18" on center at rink radius and ends.
.3 Minimum 600 lbs working load limit.
.4 Install pre-curved 10M rebar in eyelets at radius ends and straight rebar at straight ends.

.14 Supply and install new Rink Slab Concrete:

.1 Provide a 5” concrete slab, finished level.
.2 Maximum 1 3/4” concrete coverage over rink pipes.
.3 Floor slab tolerance:
  .1 Cold slab tolerance must be measured using f-number system.
  .2 Classification D, Extremely Flat
  .3 Floor Flatness (FF) and Floor Levelness (FL) to be measured in accordance with ASTM E1155M
  .4 Specified Overall Values (SOV)
    .1 Flatness: FF 45
    .2 Levelness: FL 35
  .5 Minimum Local Values (MLV)
    .1 Flatness: FF 30
    .2 Levelness: FL 25
  .6 Inspection and floor tolerance measurements shall be made within 72 hours of completing floor slab. The Contractor of this scope is responsible for all testing requirements to demonstrate to the Owner’s Engineer that the floor flatness and levelness meets these specifications in reference to ASTM E1155M.
    .1 Use a D-Meter or approved equivalent for all measurements on floor flatness and levelness. Provide results in a report to the Owner’s Engineer.
    .2 Note that ASTM E1155M, Part 8 Procedure, lays out the steps the Contractor must take for compliant measurements including griding the floor area in 300 mm sections.
  .7 Specified floor tolerances that fall below the MLV shall be corrected by grinding. Any work of this nature must be approved by the Owner’s Engineer prior to commencement.
.4 Material Properties:
  .1 Strength: 32 MPa at 28 days. Minimum average of strength test must exceed specified strength.
    .1 Provide certification that mix proportions selected will produce concrete of specified quality and yield strength will comply with CAN3-A23.1.
  .2 Air Content: Maximum of 2% non-entrained air.
  .3 Maximum Water to Cementitious Material (W/CM): 0.45
  .4 Fly Ash:
    .1 Supplementary Cementing Materials (SCM): Maximum 15% total cementitious content.

.2 Type C or F.
.3 Loss of Ignition (LOI) not to exceed 1%
.4 Use fly ash from one source.
.5 Maximum Aggregate: 14 mm graded as per CSA A23.1 Group 1 14-5
.6 Water reducing and high range water reducing (superplasticizer) admixtures shall be included in concrete mix in compliance with CSA A23.5 as required to maintain max W/CM ratio while ensuring required flowability.

.5 Include a Shrink-Reducing Admixture
.1 Must reduce capillary tension of pore water in cementitious mixtures.
.2 Provide moderate to significant reductions in the drying shrinkage of cementitious mixtures.
.3 Reduce stresses induced from one-dimensional surface drying in concrete slabs.
.4 Must be mixed at the factory. Mixing on-site will not be permitted.
.5 Standard of Acceptance: MasterLife SRA-035, or approved equivalent.

.6 Slump range before plasticizer: 70 mm ± 20 mm.
.7 Slump range at discharge: 130 mm ± 30 mm.
.8 Use approved set retarding admixture at the manufacturers required dosage when concrete is placed at ambient temperature above 30°C (86°F).
.9 Use approved accelerating admixture at the manufacturers required dosage when concrete is placed in ambient temperatures below 10°C (50°F).
.10 Calcium chloride admixtures are not permitted for use.

.15 Supply and install a water-tight expansion joint with pre-compressed expansion joint system and sealant cover along the rink perimeter.
.1 Expansion joint to extend along the rink perimeter, between the rink concrete slab and the perimeter slab.
.2 Joint specifications:
.1 Use a preformed elastomeric joint seal only.
.2 Material: neoprene (synthetic rubber).
.3 Total Movement: 0.800”.
.4 Minimum Install Width: 1.000”.
.5 Nominal Height: 2.000”.
.6 Tensile Strength: 2,000 psi.
.7 Hardness, Shore A: 55 ± 5.

.8 Materials must comply with ATSM D3542 and AASHTO M297.

.9 Standard of Acceptance: WABO WA-175, or approved equivalent.

.16 Pouring

.1 Pour to be carried out using laser levelling devices.

.2 The concrete pour is to be completed in one continuous pour, beginning from the lobby-end of the rink slab and concluding on the refrigeration room end.

.3 Continuous supervision of the pour by the Contractor is required for the total duration of the pour.

.1 Contractor to adjust concrete hoses and clamps as required during the pour to avoid damage.

.4 Concrete pumping equipment must be kept out of direct contact with the floor structure.

.1 To avoid the concrete hose clamps from dragging and damaging the floor structure (mesh, pipes, etc.) the Contractor is to place wooden support blocks beneath each clamp in contact with the structure. Alternative methods are acceptable to avoid damage.

.5 No concrete vibrators are to be used.

.6 Finishing to be performed to provide specified flatness and levelness numbers. Advanced mechanical screeding and ride-on power trowels required. Finish per class D CSA-A23.1 or Class 9 ACI 302.1.

.1 Ensure the screeding machine or trowels is placed on plywood while finishing the floor. Alternate approaches, procedures, or devices may be used if submitted to the Owner's Engineer for approval.

.17 The Contractor must submit a Pour Plan in advanced of the concrete pour. A minimum of two (2) months if required for submitting the pour plan to allow for sufficient time for comments and to coordinate site activity with the Owner and Owner's Engineer. This plan must include information such as:

.1 Details of which companies and who will be on-site during the day of the pour. This can include Owner and Owner's Engineer representatives, Contractor representatives, concrete subcontractors, mechanical subcontractors, testing subcontractors, general labour, etc.

.2 The approval authority for the batches/trucks as they arrive on-site.

.3 An outlined of a schedule of events throughout the day. This should include start time, when trucks will arrive, the frequency of trucks, and the expected completion time.
.4 Specific equipment data sheets that will be used.
.5 Calibration certificates for any leveling devices.
.6 Testing plan, including a reporting procedure.
.7 Method of screeding.
.8 Concrete plant information.
.9 Plan for alternate mix or a back-up plant in the event the concrete fails testing.
.10 Site details outlining the method of our, truck, and pump locations including the site entrance.
.11 A space ventilation plan to monitor and reduce CO levels.
.12 A contingency plan in the event of a piping failure.
.13 Curing and protection plan post-pour.

.18 Testing:

.1 Upon completion of the warm floor piping system, the header and floor tubing shall be tested at 100 PSIG with air over a continuous 24-hour period, 48 hours prior to the sand fill. Pressure shall be reduced to and held at 50 PSIG for the duration of the sand fill and compacting. Report all findings to the Owner's Engineer in writing upon completion of the sand fill.
.2 Upon completion of the cold floor piping system, the header and floor tubing shall be tested at 100 PSIG with air over a continuous 24-hour period, 48 hours prior to the concrete pour. Following approval of the testing by the Owner's Engineer, the pressure of the cold floor piping systems shall be maintained at 50 PSIG with air until the concrete floor is poured and one 24-hour period has passed upon completion of the floor to verify that the floor piping is not damaged.
.3 A failed test includes the following: loss of pressure, damage to the pipes, failures of seals (including welds at joints).
.4 The Owner's Engineer shall be present to witness the testing and concrete pour. The Contractor shall notify the Owner's Engineer no less than one (1) month in advance of the testing date.
.5 If, during the inspection, any defects are found in the installed material, equipment, or workmanship the pressure testing procedure must be repeated.

.1 This includes the both the 100 PSIG and 50 PSIG cold floor piping tests.

.6 Upon completion of each layer, for the durations noted above, with a specified level tolerance, the Contractor is to provide a report detailing the findings of a laser leveling test to the Owner's Engineer. The test results must be acknowledged by the Owner's Engineer prior to proceeding with the installation of the next layer.
   .1 If the required tolerance is not met this must be rectified immediately be the Contractor. No allowance for extra time or compensation will be approved.
   .2 The report must list the layers, as installed, and provide documentation and testing results for each layer.

.7 Contractor to provide concrete test results no later than 24 hours after the test.

.8 All tests must be completed no later than 72 hours after the pour.

.19 Concrete Pour Site Logistics:

.1 The Contractor is solely responsible for all site logistics on the day of the pour. This includes coordination

.2 As the rink floor is required to be done in one continuous pour, the Contractor must consider the timing of the pour itself including:
   .1 Testing capacity for the concrete, especially in relation to the testing of concrete in the trucks prior to when they can be used for the pour.
   .2 Number of trucks when they arrive and how many are on-site at a given instance.
   .3 How often trucks show up from the plant.
   .4 The logistics around the job site, including where concrete will be poured and where testing is going to take place.
   .5 Concrete batch expiry time.

.20 Curing and Protection:

.1 Refrigerated slab must be cured for a minimum of 28 days.

.2 Protect and guard the finished concrete surface at all times from abrasion, concentrated construction point loads, and impact damage for 28 days after the concrete pour.
   .1 Using blankets specifically designed and manufactured to protect the concrete during curing.

.3 No construction equipment including lifts, fork trucks, and pallet jacks should be placed on the surface for the first 28 days after the pour.
.4 Prevent construction traffic over edges to protect exposed concrete from chipping for 28 days after the concrete pour.
.5 Any defects, abrasions, or construction waste on the floor must be rectified.
.6 Cover the ice surface using plyboard and tarps to prevent dust or construction debris from settling on the ice surface. Remove prior to ice making.
.7 Prior to ice making, the floor must be swept then washed with a trisodium phosphate style cleaner and rinsed with fresh water by the Contractor. Cleaners with soap or lanolin are not acceptable.

.21 Provide an Access Box.
.1 The purpose of the box is to access the purge valves and warm floor stubby headers.
.2 Supply and install:
.1 Two (2) vent valves for the underfloor warm glycol.
.2 Four (4) vent valves for the cold glycol.
.3 Two (2) drain valves for the underfloor warm glycol.
.3 Location is noted in the drawings package.
.4 To be a steel box with removable lid.
.5 Formed area to be 144” long x 72” wide.
.6 Access box dimensions are to be 60” long x 30” wide x 24” deep.
.7 Do not pour until poly pipe is connected to headers and access box is located in coordination with other Divisions.
.8 Contractor to supply and install one (1) steel access box lid suitable for patrons to stand on.
.1 Lid must be flush with the building floor and secure to prevent tampering.
.2 After installation is completed, the lid is painted by others.

.22 All cable ties mentioned in this Division will conform to the following:
.1 Material: Nylon
.2 Colour: High Visibility Yellow
.3 All cable ties must bend down and away from rink pipes.
.4 Cut all loose ends after installation and prior to the concrete pour.

.23 All tie wires mentioned in this Division will conform to the following:
- .1 Material: Hot dipped galvanized.
- .2 Colour: High-visibility green
- .3 Manufactured from soft annealed wire.
- .4 All tie wires must bend down and away from rink pipes.
- .5 Cut all loose ends after installation and prior to the concrete pour.
  - .1 Under no circumstances must loose-ends be long enough to reach or potentially puncture the vapour barrier.
- .6 To be used to secure all joints of interfacing meshes and rebar.

.24 The cold and warm floor system shall be charged with new 40% Ethylene Glycol with all required additives and inhibitors.
- .1 Submit all data sheets for approval and test results after charging for the mixture as installed.
- .2 Complete all testing prior to start-up.

.25 Supply and install pipe sleeves for all pipes penetrating perimeter concrete.
- .1 Use only PVC pipe sleeves.

.26 Reinforcing rods, rebar, and mesh edges must not lie closely above or below pipes to avoid pipe puncture.

.27 Under no circumstances must any materials protrude above the finished concrete floor.

.28 All pipe joints to be fusion welded only.

.29 Piping for the system must not be tied to any rebar unless otherwise noted.

.30 Any loose rebar or other supporting structure will not be approved during the floor inspection and must be rectified prior to the concrete pour.

.31 Contractor to connect to drainage as required.

.32 A licensed journeyman mechanic must be present during the concrete pour.

.33 Contractor is responsible for all required coordination of details and construction logistics with other Contractors.

.34 In-floor temperature sensors are to be supplied for the floor by the automation contractor, the contractor of this division is to place and install these.
- .1 Refer to the Drawings Package for positioning details.
- .2 Cold floor sensors affixed to undersize of conduit body cover plate.
- .3 Use 1" Type C aluminum conduit fitting with neoprene gasket and steel flat top cover plate. Wiring from sensors to plant room using 3/4" PVC electrical conduit.
- .4 Cut sections in top layer of concrete reinforcing wire mesh to position conduit box and install one complete 6x6 mesh centered around the box for structural reinforcement.

4.5 Ice Rink Floor Concrete Quality Control

.1 The contractor shall adhere to the quality control requirements outlined in this section. A representative from the contractor shall confirm all on-site testing.

.2 A representative of the concrete inspection company must be present at the time of pour. The concrete engineer is able to reject concrete batches that do not meet specifications.

.3 Cold floor concrete shall be placed as one monolithic slab, completed as one continuous operation to be completed within 8 hours of commencement.

.4 The use of pencil vibrators, or any such equipment, which may damage the cold floor pipes is not permitted.

.5 The concrete supplier shall be no more than a 120-minute transport distance from the job-site. If the vendor is outside of this distance, the concrete supplier is to carry the cost of set-retarders under the direction of a concrete engineer. This may only be considered acceptable if the supplier demonstrates that all mechanical requirements are still met.

.6 Provide batch tickets (Certificate of Compliance sheets) for every truck. Tickets must include:
- .1 Plant name;
- .2 Truck Number;
- .3 Date and Batch time;
- .4 Slump;
- .5 Temperature;
- .6 Cylinders cast;
- .7 Time truck poured;

.7 Water is not allowed on-site without approval by the concrete engineer.

.8 The contractor must provide a back-up pump onsite such that in the event of failure of the primary pump, work may continue uninterrupted.

.9 Concrete installers and finishers to be alert for pipe leaks. If any leaks are found, repair and retest piping system immediately.

.10 All debris must be removed from pour area before pour begins and no debris shall be deposited in the concrete during pour.

.11 On-site testing shall comply with CSA A23.2 specifications for concrete quality assurance, the tests to be performed are as follows and each test must pass.

Concrete Quality Assurance Tests			
Test	Frequency	No. of Repetitions	Note(s)
Slump	Per Truckload	3 - Successful	All three tests must be successful.
Air Content	Per Truckload	3 - Successful	At the point of deposition
Compression	Per 50 cuyd.	Set of four cylinders per sampling for 7, 14, 21, and 28-day interval compression tests	Dependant on amount of concrete used during the floor pour.

.12 The Slump testing shall be performed on each truckload of concrete received. Before pouring, the Contractor Representative shall meet the delivery driver (supplier representative). A sample of the concrete shall be taken and tested. The slump testing shall be repeated until the test yields a successful result.

.1 If the slump tests yield results which are not within the acceptable range, the Contractor must reject the batch. At this time the Contractor must contact the concrete engineer at the ready-mix facility to see if the slump can be improved without compromising the batch integrity.

.13 Air content testing shall be performed at the time of concrete delivery, at the point of deposition (i.e. through all concrete pumping systems). The air content test shall be performed a minimum of three times; the results shall be recorded and be signed by the on-site foreman.

.14 Compression test samples, the size shall be compliant with CSA A23.2, shall be taken at every 50 yd^3 of concrete delivered. The compression tests shall be completed by the contractor, or by a third party testing lab at the cost of the contractor, at 7-day, 14-day, 21-day, and 28-day intervals.

.15 Pour one truck at a time unless testing capacity and site logistics permit additional trucks. The Contractor is to ensure there are three (3) testers per pouring truck.

4.6 Ice Rink Floor Concrete Reporting and Test Results

.1 Electronic copy of test reports and log must be transmitted to the Owner's Engineer as soon as the tests are completed and results are available.

.2 The Owner's Engineer shall document and evaluate all test results as they become available. The overall project test results shall meet or exceed specification and the results shall be precise with a pre-set acceptable standard deviation.

.3 For each test category there shall be an acceptable maximum standard deviation comprised of all test results taken over the project duration, and there shall be a 'Global' testing minimum or maximum (whichever is the limiting factor). These values are summarized for all regularly measured quantities in the table below:

Concrete Quality Assurance Tests		
Test Category	Max. Standard Deviation	Global Testing
28-Day Compressive Strength	4 MPA	32 MPA [Minimum]

On-Site Air Content	1%	2% Non-Entrained [Maximum]
On-Site Concrete Slump	30 mm	130 mm [Maximum]

.4 If during the project duration the data exceeds the allowable standard deviation in any of the testing categories, the Owner's Engineer shall notify, in writing, the contractor. The contractor shall investigate the source of the deficiency, and implement corrective action such that the concrete meets specification.
  .1 If the corrective action fails to increase the concrete consistency, the Owner's Engineer shall notify the client, contractor, and concrete supplier, in writing informing them of the deficiency. At this time the Owner's Engineer reserves the right to suspend work on behalf of the client until the contractor can return the concrete to specification.

.5 If a series of concrete compressive tests fail to meet global minimums after curing, the Owner's Engineer reserves the right to enforce any of the following remedial actions
  .1 The Owner's Engineer may request, at the option of the client, that concrete samples be retrieved from the site for third party testing. If the concrete samples pass the mandated test, the cost of additional testing shall be carried by the client. If the concrete fails the testing, the cost shall be carried by the contractor.
  .2 The Owner's Engineer may, at the option of the client, instruct the full or partial demolition of the arena floor. The demolished section shall be carried by the contractor.

4.7 Ice Rink Floor Specific Requirements

.1 The proponent is responsible for:
  .1 Completion the Work in conjunction with the Owner and the Dasher Board installer.
  .2 Removal and disposal of construction waste.
  .3 All permits where applicable.
  .4 Supply and install all required building materials.

.2 Work to be coordinated with the Owner, as well as the other Contractors working in parallel at the facility.

.3 The Owner's Engineer shall be present to witness the pressure testing of the warm and cold floor piping systems, and shall be notified by the Contractor at least one-month in advance of the testing date. The Owner's Engineer shall also be present to review the completed floor assembly. Any modifications to the assembly deemed necessary at the Owner's Engineer's sole discretion must be rectified prior to the concrete pour.

.4 Contractor to ensure proper site conditions prior to pouring and during the pour, this includes but is not limited to:
   .1 Ensuring all workers, of the contractor or subcontractor, are using CO chest sensors or actively monitoring CO throughout the pour zone. Should CO levels rise above the safe limit, the Contractor is to inform the Owner and Owner's Engineer while taking immediate corrective action.
   .2 Contractor is solely responsible for actively maintaining the zone temperature during the pour within a range of 15°C to 20°C to ensure proper pouring and curing.

.5 Contractor to connect to the existing sub-floor drain. All required pipes, fittings, and connectors are to be included.

.6 Dasher board anchors shall be installed prior to concrete pour by others, to be coordinated by the Contractor.
   .1 Dasher board installer must provide all mount and goal post hole locations.

.7 Any deficiencies in the installation, prior to pour and testing, noted by the Contractor shall be reported to the Owner and Owner's Engineer prior to the inspection. After these items have been rectified, the Owner's Engineer will perform an inspection of the ice rink floor system work prior to the concrete pour and testing as part of an independent performance commissioning.
   .1 Any subsequent inspections required as a result of incomplete or deficient work shall be at the cost of the Contractor ($950 per Owner's Engineer inspector).

.8 The Contractor is responsible for all preparations required for the installation of the rink floor and cold slab assembly as specified, including but not limited to:
   .1 All geotechnical and concrete engineering work. Reports to be provided to the consultant withing 5 working days of inspections.
   .2 Sub-base inspection.
   .3 Sand sub-floor compaction inspection.
   .4 Rink floor concrete mix design, including required admixtures.

.5 Overlay concrete for curved section of floor at header trench.

.6 All structural work and inspections, including:

.1 Header trench wall, interface with new slab, and header trench cover supports.

.7 All excavation required to install the cold slab system. The top of the cold slab is to be 1-1/4” below the existing perimeter slab and the total cold slab system cross-section is 16”. Cap all drainage holes in the header trench during construction. Remove caps upon completion.

PART 5 – ICE RINK DASHER BOARDS

5.1 Ice Rink Dasher Boards Description

.1 Supply and install a panelized dasher board system. This system must consist of factory pre-fabricated sections having aluminum framing and HDPE facing. 5" deep profile is required throughout the entire system. All gates, hardware, shielding, shielding supports, glass, boxes and anchor bolts necessary to provide a complete and functional dasher board system are required.
  .1 System must be suitable for an 85' x 200' ice rink with 28' corner radii.
    .1 Arena Survey (Section 5.5) to confirm final dimensions.
  .2 Standard of Acceptance: Athletica Sport Systems Pro Series Dasher Board System, or approved equivalent.

.2 The Work shall consist of the provision of all labor, materials, tools, equipment, testing, commissioning, 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 documents which are required for the complete, fully functional and commissioned dasher board system.

.3 Manage and coordinate the work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

5.2 Ice Rink Dasher Boards Quality Assurance

.1 Experience
  .1 Arena dasher board systems must be provided by a manufacturing firm that has experience in supplying and installing ice rink hockey dasher board systems. Examples of at least ten (10) similar dasher board system installations in the last five (5) years must be provided, at the request of the Owner and the Owner's Engineer, after the bid has closed.

5.3 Ice Rink Dasher Boards Submittals

.1 No material orders or work will begin on any segment of this Division until submittals have been successfully reviewed and approved for conformity with these specifications and the design intent.

.2 Shop Drawings:
  .1 Contractor must submit shop drawings for all products.

.2 Shop drawing documents must indicate procedures, schedules, equipment, and all components required for the dasher board system.

.3 Appropriate scale, dimensions, details of arena board systems including a layout, assemblies, glass type, installation instructions, and anchor details must be shown in the shop drawing package.

.1 This must include layouts of the board anchors.

.4 Contractor must provide a dimensioned layout and placement drawing, with a noted appropriate scale, for installation of the floor anchors.

5.4 Ice Rink Dasher Boards Record Documentation

.1 Provide two (2) paper copies, in binders, and one (1) electronic copy of the as-built dasher board schematics and layouts for all installed panels and products covered under the scope of work.

.2 Manual must be bound in 3-ring binders and contain, as a minimum, the following:

.1 System operating and maintenance instructions.

.2 Final as-built drawings of the system.

.3 Approved shop drawings of all supplied equipment and materials.

5.5 Ice Rink Dasher Boards Arena Survey

.1 Perform a survey of the rink zone.

.1 Work to be completed by a professional survey engineer licensed in the Province of Prince Edward Island.

.2 The intent is to confirm exact dimensions for the mounting locations of the anchors and dasher board system dimensions.

5.6 Ice Rink Dasher Boards Materials

.1 All aluminum extrusions will be ATSM B221-14 and 6005-T5 or T6 alloy and temper. Aluminum to be clear anodized.

.1 Contractor to provide certification for anodization, demonstrating conformance to Aluminum Association designation AA M12C22A31.

.2 Thickness: 0.0002 in. minimum coating thickness.

.2 Impact panels are to be polycarbonate.

.3 All other plastic to be High Density Polyethylene (HDPE), high impact.

5.7 Ice Rink Dasher Boards Arena Panels

.1 Arena panels shall be prefabricated, 42” in height, above the refrigerated floor surface, and not more than 8’ in length per section with two (2) vertical posts. Each panel is to be assembled using high strength fasteners.

.1 Connect frames with heavy duty, 5/8” zinc-plated steel bolts.

.2 Framing to be aluminum with clear anodized finish.
  .1 Frames must allow for fastening of the HDPE facing and anchoring at base. Ensure flush mating of the HDPE facing at arena panel joints.

.3 Supply and install impact absorbing cap rail system around the perimeter of the ice hockey rink, on the ice-side of the shielding, in lieu of standard HDPE. Spectator side of glazing and return and backwalls at the boxes to remain HDPE. Panels shall be clad with 3/4" coloured cap rail. Edges of the cap rail must be smooth and radiused.
  .1 Cap Rail Material on ice side: Extruded thermoplastic with built-in voids.
  .2 HDPE is to be used inside the boxes and on the spectator sides.
  .3 The impact absorbing system must meet or exceed the following performance standards:
    .1 Durometer reading must be rated 70A or less.
    .2 ASTM D638 Standard Test Method for Tensile Properties of Plastics:
      .1 Average Peak Load: 60 lbf
      .2 Average Peak Stress: 800 psi
      .3 Average Strain at Break: 500%
    .3 ASTM D695 Standard Test Method for Compressive Properties of Rigid Plastics:
      .1 Average Peak Load: 115 lbf
      .2 Average Peak Stress: 70 psi
      .3 Modulus: 850 psi
    .4 ASTM D790 Standard Test Method for Flexural Properties:
      .1 Peak Load: 12 lbf
      .2 Peak Stress: 165 psi
      .3 Modulus: 6800 psi
  .4 Standard of Acceptance: Athletica Sports Systems SoftCap®, or approved equivalent.
    .1 All bidders are advised to respect any installation and design configuration patents which apply to providing a dasher board cap rail made of extruded thermoplastic elastomer (polyurethane) with built-in voids. If a conflict exists the bidder is required to obtain written permission to install this product, or use an alternate system that is deemed equivalent by the Owner's Engineer.

.1 The bidder is required to provide all detailed design and equipment selections for an alternative system. This alternative system must be submitted to the Owner's Engineer for approval.

.4 7 7/8" HDPE kick-plates shall be mounted to the bottom of the panels. Top of the kickplate must have a radiused edge. Each kickplate must be 1/2" thick and inlaid to the panel face.

.5 Accurately fit together all joints, corners, and intersections. The Contractor must match components to products to ensure the system is level and flush.

.6 Supply and install full height backer plastic, 3/8" white HDPE backers at the rink perimeter with Gap Closure. Backer panel must be securely attached to the arena board framing.
.1 On the rink-side panels for the player's boxes, then inside of that panel must be half-height backers to allow for placing water bottles.
.2 Backer heights are to be confirmed with the Owner.

5.8 Ice Rink Dasher Boards Player's, Penalty, and Official's Boxes/Benches

.1 Boxes and framing must be constructed similarly to the arena panels. Interior finishes of boxes must be 3/8" thick HDPE to the height of mid-stringer on the front side to provide a shelf. Include full-height HDPE on all other sides.

.2 Boxes shall consist of two player's boxes, two penalty boxes, and one official's box.

.3 Player's boxes shall be 30'-1" in length and 5'-8" deep and located as indicated in the associated drawings package. Three player gates shall be installed in each of the player's boxes.

.4 Penalty boxes shall be 8'-2" in length and 5'-8" deep and located as indicated on the drawings package, with one player gate onto the ice and one player gate into the official's box per penalty box.

.5 Official's box shall be 6'-2" long and 5'-8" deep and located as indicated in the associated drawings package.

.6 Official's box shall include a full-width table with pencil holder, electrical outlet, and chairs.

.7 Player's and penalty boxes shall include benches mounted to the concrete floor. Benches must be a nominal 9 1/2" deep and mounted on pedestals 22" above the floor.

.8 Provide a coach's walkway, in each of the player's boxes.
.1 Height: 8"
.2 Depth: 3/8"

.3 Exposed sides covered with 3/8" white HDPE.

.9 Provide wood framed floors in all boxes.
- .1 Height: 6-3/4"
- .2 Material: 3/4" CSA 0121 Douglas Fir plywood, exterior waterproof type, Grade G/Solid (Canadian Standard).

.10 All box floors and coach's walkway are to be covered with 1/2" rubber matting and laid loose.
- .1 Use only non-absorbent rubber matting.
- .2 Hardness: ATSM D2240 75 +/- 5
- .3 Material: Vulcanized rubber.
- .4 Standard of Acceptance: NWR Sport SportFloor Stamina, or approved equivalent.
- .5 Cut 1/2" thick rubber flooring and matting to neatly fit in all boxes.

5.9 Ice Rink Dasher Boards Spectator Shielding

.1 1/2" thick clear tempered glass to be installed on the sides and boxes at a height of 72" above the dasher boards and cap rail.

.2 5/8" thick clear tempered glass to be installed on the corners and ends of the rink, at a height of 72" above the cap rail.

.3 Only tempered safety glass, heat tempered and fully toughened is to be used.
- .1 Glass must be clear and colourless.
- .2 Roll-wave distortion must not exceed 0.005" from peak to valley.
- .3 Glass must meet:
  - .1 ANSI Z97.1-2009 Class A
  - .2 CPSC 16 CFR 1201 Category II
  - .3 CAN/CGSB 12.1-M90
  - .4 ASTM C1048
  - .5 CAN/CGSB-12.1, Type 2
- .4 Each piece of glass must bear an approval stamp from a certified testing facility. This is to ensure that the glass meets the requirements of Section 1.6 References. Stamp must be clearly visible and legible.

.4 Spectator shielding shall be installed along side and back of, but not in front of the player's boxes.

.5 Provide one (1) speaker holes shall be 3 1/4" and incorporated in the official's box, for communication between the official and the referee's on ice, and between the official and the players in the penalty boxes.

5.10 Ice Rink Dasher Boards Spectator Shielding Supports

.1 Aluminum vertical supports shall keep the spectator shielding in place. Aluminum support must run continuously to within 12” of the top of the glazing. Use only plastic U-shaped gaskets to protect the glass edges.

.2 At the gates, the supports are secured with a screw-applied aluminum face plate.

.3 The design shall allow for easy replacement of shielding from the ice-side without requiring additional support or securing adjacent shields.

5.11 Ice Rink Dasher Boards Gates

.1 Supply and install gates in locations as indicted on the associated drawings package, including replaceable HDPE thresholds.
- .1 Six (3) Access Gates 36”.
- .2 Six (10) Player Gates, 30”.
- .3 One (1) Machine Gate, 120”.

.2 Gates must be single latch type. All gate hinges and latch to be heavy duty stainless steel.

.3 Provide gate thresholds 1” white HDPE on 1 1/2” aluminum extrusion.

.4 Provide a flush mounted push-button latch release in the cap rail on the ice entrance gates where shields would otherwise prevent latch operation. The push-button shall be designed to be simple to operate from the ice side of the shielding (suitable for opening gates with hockey glove on hand), yet prevent accidental opening.
- .1 On rink side of single access gates.

.5 One (1) 120” machine access double-gate beside the Ice Resurfacer room.
- .1 Machine gate must be double gates.
- .2 Include all gate locks and door hardware required. Gates must swing away from the rink to allow an Ice Resurfacer to pass.
- .3 Provide HDPE machine gate thresholds to be flush with the perimeter slab.
- .4 Doors must not be able to open into the ice surface.

.6 Materials:
- .1 All gate hardware to be heavy duty stainless steel.
- .2 All nuts, washers and bolts to be zinc plated.

5.12 Ice Rink Dasher Boards Anchors

.1 Board anchors shall be mounted in the perimeter concrete.
- .1 Coordination and placement of the anchors is the responsibility of the Contractor within this Division.

.2 Anchors are to be minimum 5/8" threaded rods installed with epoxy anchors drilled into perimeter concrete.
.3 Minimum drill depth: 4"
.4 Anchors must be galvanized steel or zinc plated.

.2 Goal-post anchors are to be drilled into the existing rink floor concrete. Work with the Owner's staff to sweat the rink to locate suitable positions.

.3 Use zinc plates bolts or threaded rods and nuts for tightly fastening the anchors to the perimeter concrete.

5.13 Ice Rink Dasher Boards Protective Netting

.1 The netting is to be installed by the Contractor and attached to the new dasher board system.
.1 Supply and install clear Protective Netting, where indicated on drawings. Mesh that is 1-1/2" x 2mm in sizing is used for spectator safety and visibility.
.2 Netting must be fastened to the shielding supports to prevent pucks from leaving the ice rink zone. Eyebolts are an acceptable fastening method.
.3 Install the netting system so it matches the curvature of the dasher board system.
.4 All hardware required for a complete protective netting system is to be included. This includes, but is not limited to, beam clamps and cables.

5.14 Ice Rink Dasher Boards Colour

.1 Contractor to match existing shade and type of colours in coordination with the Owner and Owner's Engineer. Specific colour ID to be confirmed and approved prior to ordering. Guidelines are below:
.1 All panels, including gates, to be white.
.2 All kick-plates to be yellow on the inside of the rink.
.3 All netting is to be clear.
.4 All cap rail to be blue.

5.15 Ice Rink Dasher Boards Curved Acrylic Termination Assembly

.1 At players boxes, where perimeter shielding terminates its continuous run, in lieu of an aluminum post that supports both the shielding that runs along the sides of the box and the perimeter shielding at a right angle, install a curved acrylic panel mounted on impact absorbing sleeves. Each of the four locations for these panels must be identical, allowing for a spare to replace any of the panels as required.
.1 Product to be NHL approved.
.2 Durometer reading must be rated 70A or less.

.3 Provide a list of ten (10) arenas currently using this product for verification with contact information. The Owner and the Owner's Engineer reserve the right to visit the sites provided and view the installation.
.4 Include one spare curved acrylic termination.

5.16 Ice Rink Dasher Boards Specific Requirements

.1 The proponent is responsible for:
  .1 Completion of the Work in conjunction with the Owner.
  .2 Removal and disposal of construction waste.
  .3 All permits where applicable.
  .4 Supply and install all required building materials.

.2 Work to be coordinated with the Owner, as well as the other contractors working in parallel at the facility.

.3 Contractor is responsible for cleaning and remove debris from the site related to the work outlined in this Division.

.4 All permits and local approvals as required are the responsibility of the Contractor.

.5 Any deficiencies in the installation noted by the Contractor shall be reported to the Owner and Owner's Engineer prior to an inspection. After these items have been rectified, the Owner's Engineer will perform an inspection of the ice rink dasher board system work testing as part of an independent performance commissioning.
  .1 Any subsequent inspections required as a result of incomplete or deficient work shall be at the cost of the Contractor ($1,200 per Owner's Engineer inspector).

.6 Remove six (6) 6" lengths of frame floor plate and matching 2" high by 6" sections of facing for rink drainage.
  .1 Install removable kickplates at front and back.

.7 Extra hardware, cap rails, and two spare pieces of each size of tempered glass to be provided. These are required to be left with the Owner following commissioning of the dasher boards system. This shall consist of:
  .1 Fifty (50) additional painted screws of each colour required for fastening of HDPE facings.
  .2 Two (2) extra pieces of facing, cap rail (straight and curved) and kickplate.
  .3 Two (2) extra pieces of each standard size piece of tempered glass for the ends and sides.

.4 Two (2) extra pieces of 72” x 96” nominal 1/2“ acrylic to handle all special sizes of glass.

PART 6 – DOMESTIC WATER SYSTEM

6.1 Domestic Water System Scope of Work

.1 Supply and install two (2) domestic hot water heaters (WH-1, WH-2)
- .1 Fuel: Propane
- .2 Input Capacity: 800 MBH (per unit)
- .3 Output Capacity: 784 MBH (per unit)
- .4 Efficiency: 98%
- .5 Must include one (1) stainless steel circulating pump per unit.
  - .1 Flowrate: 61 USGPM
- .6 Fluid Side Flowrate: 950 GPH at 100°F Rise
  - .1 Inlet Water Temperature: 40°F
  - .2 Outlet Water Temperature: 140°F
- .7 Shipping Weight: 433 lbs.
- .8 Must include a stainless steel, welded heat exchanger of gasketless design.
- .9 Include a manufacturer supplied condensate neutralization kit.
- .10 Must include 5-year limited warranty on all parts.
- .11 Must include touch display control system with colour screen.
  - .1 Control system must be BACnet compatible
- .12 Standard of Acceptance: Lochinvar Armor AWH0800LPM, or approved equivalent.

.2 Supply and install one (1) ice resurfacer water heater (WH-3)
- .1 Fuel: Propane
- .2 Total Capacity: 285 MBH (per unit)
- .3 Efficiency: 95%
- .4 Shipping Weight: 800 lbs.
- .5 Must include a glass-lined steel tank and stainless steel heat exchanger.
- .6 Must include 5-year limited warranty on all parts.
- .7 Must include touch display control system with colour screen.
  - .1 Control system must be BACnet compatible
- .8 Standard of Acceptance: Lochinvar SWR285P, or approved equivalent.

.3 Supply and install one (1) hot water storage tank (DHWT-1, DHWT-2)
  .1 Fluid: Potable Water
  .2 Capacity: 650 US Gal
  .3 Tank to be cement lined
    .1 Minimum Thickness: 5/8”
  .4 Insulation Value: R-13
  .5 Constructed in Accordance with ASME Section IV standard.
  .6 Maximum Pressure: 125 PSI
  .7 Shipping Weight: 1,817 lbs.
  .8 Standard of Acceptance: Lochinvar RCA0650, or approved equivalent.

.4 Supply and install a water treatment system for ice rink water.
  .1 Must include the following:
    .1 One (1) stainless steel distribution pump with variable speed drive.
    .2 A twin alternating 14” automatic water softener.
    .3 Duplex 14” carbon filters and assemblies complete with eight (8) cubic feet of Jet Ice Grade Carbon.
    .4 One (1) CT-700 IMP/850 US gallon storage tank complete with liquid level auto control.
  .2 Contractor is required to carry staff training and start-up of the demineralizer directly from the manufacturer.
  .3 Electrical Requirements:
    .1 Pre-treatment with 4 plugs: 110V/1/60 at 15 Amps.
    .2 RO Unit: 208V, 60 Hz at 30 Amps
  .4 Dimensions of storage tank: 48” x 48” x 120”

.5 Supply and install one (1) DHW Preheat Heat Exchanger (HX-1)
  .1 Capacity: 962 MBH
  .2 Side 1:
    .1 Fluid: Water
    .2 EWT: 50°F
    .3 LWT: 93°F
    .4 Flow Rate: 45 USGPM
    .5 Pressure Drop: 1.32 ft.
  .3 Side 2:
    .1 Fluid: 40% Ethylene Glycol
    .2 EGT: 105°F
    .3 LGT: 95°F
    .4 Flow Rate: 215 USGPM
    .5 Max Pressure Drop: 22.64 ft.

.4 Materials: Stainless Steel Grade 316
.5 Standard of Acceptance: SEC Heat Exchangers SEC-521-28, or approved equivalent

.6 Supply and install one (1) Back-Up Heating Heat Exchanger (HX-2)
.1 Capacity: 1,371 MBH
.2 Side 1:
.1 Fluid: Water
.2 EWT: 145°F
.3 LWT: 107°F
.4 Flow Rate: 73 USGPM
.5 Pressure Drop: 1.25 ft.
.3 Side 2:
.1 Fluid: 40% Ethylene Glycol
.2 EGT: 95°F
.3 LGT: 105°F
.4 Flow Rate: 306 USGPM
.5 Max Pressure Drop: 20.06 ft.
.4 Materials: Stainless Steel Grade 316
.5 Standard of Acceptance: SEC Heat Exchangers SEC-522-36, or approved equivalent

.7 Supply and install one (1) Backup Heat Exchanger Water Pump (WP-1)
.1 Flow rate: 68 USGPM
.2 Pumping head: 35.1 ft. H_2O
.3 Pump speed: 3,480 RPM
.4 Working fluid: Domestic Hot Water
.5 Motor: 1.5 HP, premium efficiency
.6 Butterfly-style isolation valves shall be installed on the inlet and outlet of the pump.
.7 Dial type pressure gauges shall be **supplied and installed** on the inlet and outlet of the backup heat exchanger water pump.
.1 Refer to specifications below for pressure gauge requirements.
.8 Contractor to coordinate pump electrical with Owner's electrical contractor to provide power.
.9 Standard of Acceptance: Grundfos CME 10-1 A-R-I-E-AVBE U-A-D-N
.10 Power: 240/1/60

PART 7 – HVAC

7.1 HVAC Scope of Work

.1 Supply and install one (1) air-handling unit (AHU-1)
  .1 Must include the following:
    .1 Mixing air box section
    .2 Variable Frequency Drives (VFD's) on the supply and return fan motors.
    .3 Filter section with space for a dual sensor to be included.
      .1 Filters to be MERV 8 and MERV 13.
  .2 Airflow: 4,986 CFM
  .3 Rated Supply Fan Motor: 7.5 HP, TEFC premium efficiency and inverter duty
  .4 Rated Return Fan Motor: 5 HP, TEFC premium efficiency and inverter duty
  .5 External Static Pressure for fans: 2 in. W.G.
  .6 Power: 575/3/60
  .7 Heating Section:
    .1 Include one (1) heating coil with the following conditions
    .2 Heating Capacity: 390 MBH
    .3 Entering Air Dry Bulb Temperature: -0.4°F
    .4 Leaving Air Dry Bulb Temperature: 72.0°F
    .5 Coil Air Pressure Drop: 0.54 in. W.G.
    .6 Fluid: 40% Ethylene Glycol
    .7 Entering Glycol Temperature: 103°F
    .8 Leaving Glycol Temperature: 92.9°F
    .9 Coil Glycol Flow: 86.0 GPM
    .10 Coil Glycol Pressure Drop: 10.6 ft.
  .8 Cooling
    .1 Include one (1) cooling coil with the following conditions
    .2 Total Capacity: 238 MBH
    .3 Sensible Capacity: 123 MBH
    .4 Entering Air Dry Bulb Temperature: 73.4°F
    .5 Entering Air Wet Bulb Temperature: 67.1°F
    .6 Leaving Air Dry Bulb Temperature: 51.4°F
    .7 Leaving Air Wet Bulb Temperature: 51.4°F
    .8 Coil Air Pressure Drop: 1.26 in. W.C.
    .9 Fluid: 40% Ethylene Glycol

.10 Entering Glycol Temperature: 40°F
.11 Leaving Glycol Temperature: 45.0°F
.12 Coil Glycol Flow: 107.5 GPM
.13 Coil Glycol Pressure Drop: 8.2 ft.

.9 The unit must include access hatches or doors for maintenance on the coils, fan motors, dampers, and coils.
.10 Panels must be insulated with 2" foam injected R-13 with thermal break.
.11 Dimensions:
.1 Length: 130"
.2 Width: 66"
.3 Height: 33"
.12 Note the automation contractor is to supply and install controllers for the air handling units. The manufacturer is to provide a BACNet card ready for connections.
.13 Standard of Acceptance: York Solution XTI-33x66, or approved equivalent.

.2 Supply and install one (1) air-handling unit (HRV-1)
.1 Must include the following:
.1 An HRV section.
.2 Variable Frequency Drives (VFD's) on the supply and return fan motors.
.3 Filter section with space for a dual sensor to be included.
.1 Filters to be MERV 13 followed by MERV 8.
.2 Airflow: 2,942 CFM
.3 Rated Supply Fan Motor: 5 HP, TEFC premium efficiency and inverter duty
.4 Rated Return Fan Motor: 5 HP, TEFC premium efficiency and inverter duty
.5 External Static Pressure for fans: 2 in. W.G.
.6 Power: 575/3/60
.7 Heating:
.1 Include one (1) heating coil with the following conditions
.2 Heating Capacity: 218 MBH
.3 Entering Air Dry Bulb Temperature: -0.4 °F
.4 Leaving Air Dry Bulb Temperature: 69.2°F
.5 Coil Air Pressure Drop: 0.18 in. W.C.
.6 Fluid: 40% Ethylene Glycol
.7 Entering Glycol Temperature: 103°F
.8 Leaving Glycol Temperature: 93°F
.9 Coil Glycol Flow: 49.1 GPM

.10 Coil Glycol Pressure Drop: 11.3 ft.

.8 Cooling
- .1 Include one (1) cooling coil with the following conditions
- .2 Total Capacity: 194 MBH
- .3 Sensible Capacity: 96 MBH
- .4 Entering Air Dry Bulb Temperature: 73.0°F
- .5 Entering Air Wet Bulb Temperature: 67.1°F
- .6 Leaving Air Dry Bulb Temperature: 43.7°F
- .7 Leaving Air Wet Bulb Temperature: 43.7°F
- .8 Coil Air Pressure Drop: 1.55 in. W.C.
- .9 Fluid: 40% Ethylene Glycol
- .10 Entering Glycol Temperature: 40.0°F
- .11 Leaving Glycol Temperature: 45.0°F
- .12 Coil Glycol Flow: 87.1 GPM
- .13 Coil Glycol Pressure Drop: 14.2 ft.

.9 The unit must include access hatches or doors for maintenance on the coils, fan motors, dampers, and coils.

.10 Panels must be insulated with 2” foam injected R-13 with thermal break.

.11 Dimensions:
- .1 Length: 249”
- .2 Width: 57”
- .3 Height: 33”

.12 Note the automation contractor is to supply and install controllers for the air handling units. The manufacturer is to provide a BACNet card ready for connections.

.13 Standard of Acceptance: York Solution XTI-33x57, or approved equivalent.

.3 Supply and install one (1) air-handling unit (HRV-2)

.1 Must include the following:
- .1 An HRV section.
- .2 Variable Frequency Drives (VFD’s) on the supply and return fan motors.
- .3 Filter section with space for a dual sensor to be included.
  - .1 Filters to be MERV 13 followed by MERV 8.

.2 Airflow: 4,829 CFM

.3 Rated Supply Fan Motor: 10 HP, TEFC premium efficiency and inverter duty

.4 Rated Return Fan Motor: 10 HP, TEFC premium efficiency and inverter duty

.5 External Static Pressure for fans: 2 in. W.G.

.6 Power: 575/3/60
.7 Heating:
  .1 Include one (1) heating coil with the following conditions
  .2 Heating Capacity: 327 MBH
  .3 Entering Air Dry Bulb Temperature: -0.4°F
  .4 Leaving Air Dry Bulb Temperature: 62.3°F
  .5 Coil Air Pressure Drop: 0.41 in. W.C.
  .6 Fluid: 40% Ethylene Glycol
  .7 Entering Glycol Temperature: 103°F
  .8 Leaving Glycol Temperature: 93.1°F
  .9 Coil Glycol Flow: 73.2 GPM
  .10 Coil Glycol Pressure Drop: 6.8 ft.
.8 Cooling
  .1 Include one (1) cooling coil with the following conditions
  .2 Total Capacity: 281 MBH
  .3 Sensible Capacity: 140 MBH
  .4 Entering Air Dry Bulb Temperature: 73.0°F
  .5 Entering Air Wet Bulb Temperature: 67.1°F
  .6 Leaving Air Dry Bulb Temperature: 47.2°F
  .7 Leaving Air Wet Bulb Temperature: 47.0°F
  .8 Coil Air Pressure Drop: 1.46 in. W.C.
  .9 Fluid: 40% Ethylene Glycol
  .10 Entering Glycol Temperature: 40.0°F
  .11 Leaving Glycol Temperature: 45.1°F
  .12 Coil Glycol Flow: 125.4 GPM
  .13 Coil Glycol Pressure Drop: 15.1 ft.
.9 The unit must include access hatches or doors for maintenance on the coils, fan motors, dampers, and coils.
.10 Panels must be insulated with 2” foam injected R-13 with thermal break.
.11 Dimensions:
  .1 Length: 266”
  .2 Width: 69”
  .3 Height: 39”
.12 Note the automation contractor is to supply and install controllers for the air handling units. The manufacturer is to provide a BACNet card ready for connections.
.13 Standard of Acceptance: York Solution XTI-39x69, or approved equivalent.

.4 Supply and install one (1) built-up air handling unit to dehumidify the rink zone (DH-1)

.1 Must include the following:
  .1 Mixing air box
  .2 Supply and install one (1) dehumidifier supply fan (DF-1)
    .1 Airflow: 11,679 CFM
    .2 Total Static Pressure: 7 in. W.G.
    .3 Motor: 25 HP, 2,622 RPM, premium efficiency and inverter duty.
    .4 Power: 575/3/60
    .5 Total Weight: 92 lbs.
    .6 Must include:
      .1 Flanged inlet and outlet
      .2 Bolt-on motor base
      .3 Inlets cones
      .4 2” deflection isolators
      .5 OSHA belt guard
      .6 Shaft seal
      .7 Extended lube lines
      .8 Acoustic Sound Insulation
    .7 Include one (1) variable speed drive for the supply fan.
      .1 Refer to automation specifications for requirements.
    .8 Standard of Acceptance: Twin City Fan TSL 222 Class III, or approved equivalent.
  .3 Supply and install one (1) dehumidifier return fan (DF-2)
    .1 Airflow: 11,679 CFM
    .2 Total Static Pressure: 2 in. W.G.
    .3 Motor: 15 HP, 2,175 RPM, premium efficiency and inverter duty
    .4 Power: 575/3/60
    .5 Weight: 62 lbs.
    .6 Must include:
      .1 Flanged inlet and outlet
      .2 Bolt-on motor base
      .3 Inlets cones
      .4 2” deflection isolators
      .5 OSHA belt guard
      .6 Shaft seal
      .7 Extended lube lines
      .8 Acoustic Sound Insulation

.7 Include one (1) variable speed drive for the return fan.
.1 Refer to automation specifications for requirements.
.8 Standard of Acceptance: Twin City TSL 222 Class II, or approved equivalent.

.2 Supply and install the following filters located after the mixing box.
.1 Provide filter racks with mullions as required.
.2 To be assembled in two by three grids.
.3 Six (6) MERV-13 filters
.1 Airflow per filter: 1,962 CFM
.2 Face Velocity: 490.4 FPM
.3 Size: 24” x 24” x 2”
.4 Initial Resistance: 0.37” WG
.5 Final Resistance: 1” WG
.6 Standard of Acceptance: DAFO Green Pleat, or approved equivalent.
.4 Six (6) MERV-8
.1 Airflow per filter: 1,962 CFM
.2 Face Velocity: 490.4 FPM
.3 Size: 24” x 24” x 2”
.4 Initial Resistance: 0.20” WG
.5 Final Resistance: 1” WG
.6 Standard of Acceptance: DAFO Series 400 Pleat, or approved equivalent.

.3 Supply and install five (5) dehumidifier dampers
.1 One (1) for the dehumidifier intake
.1 Note this is included in the rink dehumidifier louver (IL-3).
.2 One (1) for the dehumidifier exhaust
.1 Note this is included in the rink exhaust louver (EL-3).
.3 One (1) for the dehumidifier mixing box.
.1 Width: 48”
.2 Height: 48”
.3 Blade Action: Opposed Blade
.4 Frame Material: Aluminum
.5 Standard of Acceptance: Greenheck VCD-40, or approved equivalent.
.4 One (1) for the dehumidifier supply plenum
.1 Width: 52”
.2 Height: 48”

.3 Blade Action: Opposed Blade
.4 Standard of Acceptance: Greenheck VCD-33, or approved equivalent

.5 One (1) for the dehumidifier heat pump exhaust plenum
.1 Width: 22”
.2 Height: 54”
.3 Blade Action: Opposed Blade
.4 Frame Material: Galvanized Steel
.5 Standard of Acceptance: Greenheck VCD-23, or approved equivalent

.4 Heating:
.1 Include one (1) heating coil (DHC-1) with the following conditions
.2 Total Heating Capacity: 582.48 MBH
.3 Entering Air Dry Bulb Temperature: -0.4°F
.4 Leaving Air Dry Bulb Temperature: 47.5°F
.5 Air Pressure Drop: 0.21 in W.G. (active)
.6 Entering Glycol Temperature: 103°F
.7 Leaving Glycol Temperature: 93.86°F
.8 Flow: 142.6 GPM
.9 Fluid: 40% Ethylene Glycol
.10 Maximum Pressure Drop: 15 ft.
.11 Casing Material: 16 Ga. Galvanized Steel
.12 Tube Stock: 5/8 x 0.025 Cu C12200
.13 Standard of Acceptance: Colmac Coil BWL-54x54.0-2R-8.5F-WR-R, or approved equivalent.

.5 Cooling
.1 Include one (1) dehumidifier coil (DCC-1) with the following conditions
.2 Total Capacity: 913.62 MBH
.3 Sensible Capacity: 421.13 MBH
.4 Entering Air Dry Bulb Temperature: 73.4°F
.5 Entering Air Wet Bulb Temperature: 69.0°F
.6 Leaving Air Dry Bulb Temperature: 37.8°F
.7 Leaving Air Wet Bulb Temperature: 37.8F
.8 Air Pressure Drop: 1.11 in. W.G. (active)
.9 Fluid: 40% Ethylene Glycol
.10 Entering Glycol Temperature: 15°F
.11 Leaving Glycol Temperature: 23.7°F
.12 Coil Glycol Flow: 242.0 USGPM
.13 Maximum Coil Pressure Drop: 15.0 ft.
.14 Casing Material: 14 Ga. Galvanized Steel

.15 Tube Stock: 5/8 x 0.025 Cu C12200
.16 Standard of Acceptance: Colmac Coil BWL-54x54.0-9R-5.34F-WR-R, or approved equivalent.

.6 Supply and install one (1) wrap-around heat pipe.
.1 Heat Recovered: 185,690.0 BTUH
.2 Sensible Effectiveness: 23.4%
.3 Fin Material: Aluminum 1100
.4 Casing: 14 Ga. Galvanized Steel
.5 Refrigerant: R134A
.6 Expected Dimensions:
.1 Width: 56”
.2 Length: 64.75”
.7 Pre-Cool Performance:
.1 Entering Air Temperature Dry Bulb: 73.4°F
.2 Entering Air Temperature Wet Bulb: 69.0°F
.3 Entering Air Relative Humidity: 80.4%
.4 Leaving Air Temperature Dry Bulb: 64.5°F
.5 Leaving Air Temperature Wet Bulb: 64.0°F
.6 Leaving Air Relative Humidity: 97.4%
.7 Air Pressure Drop: 0.442 in. W.G.
.8 Re-Heat Performance:
.1 Entering Air Temperature Dry Bulb: 35.5°F
.2 Entering Air Temperature Wet Bulb: 35.5°F
.3 Entering Air Relative Humidity 100%
.4 Leaving Air Temperature Dry Bulb: 51.2°F
.5 Leaving Air Temperature Wet Bulb: 43.8°F
.6 Leaving Air Relative Humidity: 54.7%
.9 Standard of Acceptance: Colmac Coil HPC-54-54.0-4R-8.5F-WR-54.0-8.5F-WR-U, or approved equivalent.

.7 Supply and install ducting as shown on drawing M-601.
.8 The unit must include two (2) Duct Airflow Stations.
.9 The unit must include access hatches or doors for maintenance on the coils, fan motors, dampers, and coils.
.10 A controller and other automation equipment for all dampers, sensors, and motors is to be provided by the Automation contractor.
.11 Supply and install a drip pan beneath the unit’s cooling coil and connect it to the drain.

.5 Supply and install one (1) Rooftop Intake Louver for HRV-1 (IL-1)
.1 Width: 56.25”
.2 Height: 56.25”

.3 Depth: 33.25”
.4 Pressure Drop: 0.04 in. WG
.5 Max Velocity: 1,000 ft/min
.6 Must include VCD-23 volume control damper.
.7 Must include integral bird screen.
.8 Standard of Acceptance: Greenheck GRSI-36, or approved equivalent.

.6 Supply and install one (1) Rooftop Intake Louver for AHU-1 (IL-2)
.1 Width: 63.25”
.2 Height: 63.25”
.3 Depth: 36.25”
.4 Pressure Drop: 0.065 in. WG
.5 Max Velocity: 1,000 ft/min
.6 Must include VCD-23 volume control damper.
.7 Must include integral bird screen.
.8 Standard of Acceptance: Greenheck GRSI-42, or approved equivalent.

.7 Supply and install one (1) Intake Louver for HRV-2 and DH-1 (IL-3)
.1 Width: 84”
.2 Height: 84”
.3 Depth: 6”
.4 Pressure Drop: 0.04 in. WG
.5 Free Area: 31.3 SQFT
.6 Max Velocity: 511 ft/min
.7 Include an extended sill, shipped loose.
.8 Must include VCD-40 volume control damper.
.9 Flanged Frame, front.
.10 Bird screen, 1/2” x 0.063” aluminum mesh, internally mounted.
.11 Standard of Acceptance: Greenheck ESD-635-84x84, or approved equivalent.

.8 Supply and install one (1) Intake Louver for the plant room (IL-5)
.1 Width: 48”
.2 Height: 48”
.3 Depth: 6”
.4 Pressure Drop: 0.03 in. WG

.5 Free Area: 9.4 SQFT
.6 Max Velocity: 439 ft/min
.7 Include an extended sill, shipped loose.
.8 Flanged Frame, front.
.9 Bird screen, 1/2" x 0.063" aluminum mesh, internally mounted.
.10 Include a motorized VCD-23 damper, interlocked to fan.
.11 Standard of Acceptance: Greenheck ESD-635-48x48, or approved equivalent.

.9 Supply and install one (1) Intake Louver for the Ice Resurfacer room (IL-6)
.1 Width: 16"
.2 Height: 16"
.3 Depth: 6"
.4 Pressure Drop: 0.04 in. WG
.5 Free Area: 0.6 SQFT
.6 Max Velocity: 491 ft/min
.7 Include an extended sill, shipped loose.
.8 Flanged Frame, front.
.9 Bird screen, 1/2" x 0.063" aluminum mesh, internally mounted.
.10 Include a motorized VCD-23 damper, interlocked to fan.
.11 Standard of Acceptance: Greenheck EDS-635-16x16, or approved equivalent.

.10 Supply and install one (1) Intake Louver for the electrical room (IL-7)
.1 Width: 18"
.2 Height: 18"
.3 Depth: 4"
.4 Pressure Drop: 0.04 in. WG
.5 Free Area: 0.9 SQFT
.6 Max Velocity: 478 ft/min
.7 Include an extended sill, shipped loose.
.8 Flanged Frame, front.
.9 Bird screen, 1/2" x 0.063" aluminum mesh, internally mounted.
.10 Include a motorized VCD-23 damper, interlocked to fan.
.11 Standard of Acceptance: Greenheck ESD-435-18x18, or approved equivalent.

.11 Supply and install one (1) Rooftop Intake Louver for the pool mechanical room (IL-8)
- .1 Width: 38.25”
- .2 Height: 38.25”
- .3 Depth: 23”
- .4 Pressure Drop: 0.033 in. WG
- .5 Max Velocity: 1,000 ft/min
- .6 Must include VCD-23 volume control damper.
- .7 Must include integral bird screen.
- .8 Standard of Acceptance: Greenheck GRSI-24, or approved equivalent.

.12 Supply and install one (1) Rooftop Exhaust Louver for HRV-1 (EL-1)
- .1 Width: 48”
- .2 Height: 48”
- .3 Depth: 30.75”
- .4 Pressure Drop: 0.067 in. WG
- .5 Must include integral bird screen.
- .6 Include a motorized VCD-23 damper, interlocked to fan.
- .7 Standard of Acceptance: Greenheck GRSR-30, or approved equivalent.

.13 Supply and install one (1) Rooftop Exhaust Louver for AHU-1 (EL-2)
- .1 Width: 56.25”
- .2 Height: 56.25”
- .3 Depth: 33.25”
- .4 Pressure Drop: 0.093 in. WG
- .5 Must include integral bird screen.
- .6 Include a motorized VCD-23 damper, interlocked to fan.
- .7 Standard of Acceptance: Greenheck GRSR-36, or approved equivalent.

.14 Supply and install one (1) Exhaust Louver for HRV-2 and DH-1 (EL-3)
- .1 Width: 84”
- .2 Height: 84”
- .3 Depth: 6”
- .4 Pressure Drop: 0.03 in. WG
- .5 Free Area: 31.3 SQFT
- .6 Include an extended sill, shipped loose.
- .7 Flanged Frame, front.

.8 Bird screen, 1/2" x 0.063" aluminum mesh, internally mounted.
.9 Include a motorized VCD-40 damper, interlocked to fan.
.10 Standard of Acceptance: Greenheck ESD-635-84x84, or approved equivalent.

.15 Supply and install one (1) Exhaust Louver for the plant room (EL-5)
.1 Width: 48"
.2 Height: 48"
.3 Depth: 4"
.4 Pressure Drop: 0.03 in. WG
.5 Free Area: 8.9 SQFT
.6 Include an extended sill, shipped loose.
.7 Flanged Frame, front.
.8 Bird screen, 1/2" x 0.063" aluminum mesh, internally mounted.
.9 Include a motorized VCD-23 damper, interlocked to fan.
.10 Standard of Acceptance: Greenheck ESD-435-48x48, or approved equivalent.

.16 Supply and install one (1) Exhaust Louver for the ice resurfacer room (EL-6)
.1 Width: 16"
.2 Height: 16"
.3 Depth: 2"
.4 Pressure Drop: 0.04 in. WG
.5 Free Area: 0.5 SQFT
.6 Include an extended sill, shipped loose.
.7 Flanged Frame, front.
.8 Bird screen, 1/2" x 0.063" aluminum mesh, internally mounted.
.9 Include a motorized VCD-23 damper, interlocked to fan.
.10 Standard of Acceptance: Greenheck ESD-202-16x16, or approved equivalent.

.17 Supply and install one (1) Exhaust Louver for the electrical room (EL-7)
.1 Width: 18"
.2 Height: 18"
.3 Depth: 6"
.4 Pressure Drop: 0.04 in. WG

.5 Free Area: 0.8 SQFT
.6 Max Velocity: 537 ft/min
.7 Include an extended sill, shipped loose.
.8 Flanged Frame, front.
.9 Bird screen, 1/2" x 0.063" aluminum mesh, internally mounted.
.10 Include a motorized VCD-23 damper, interlocked to fan.
.11 Standard of Acceptance: Greenheck ESD-635-18x18, or approved equivalent.

.18 Supply and install one (1) plant room exhaust fan (EF-1)
.1 Drive Type: Belt
.2 CFM: 4,129
.3 Total External SP: 0.32
.4 Motor: 3/4 HP, ECM motor type.
.1 Include solid state speed control, factory mounted.
.2 Tie fan control the refrigerant alarm located in the plant and provide a disconnect switch inside the plant room.
.5 Power: 115/60/1
.6 Sones (inlet): 22
.7 Include a disconnect switch, factory mounted.
.8 Include a backdraft damper, gravity operated.
.9 Standard of Acceptance: Greenheck SBE-2H24, or approved equivalent

.19 Supply and install one (1) Ice Resurfacer room exhaust fan (EF-2)
.1 Drive Type: Direct
.2 CFM: 280
.3 Total External SP: 0.14
.4 Motor: 1/4 HP, ECM motor type.
.5 Power: 115/60/1
.6 Sones (Inlet): 3.2
.7 Include a disconnect switch, factory mounted.
.8 Include a backdraft damper, gravity operated.
.9 Standard of Acceptance: Greenheck SE1-12-432-VG, or approved equivalent.

.20 Supply and install one (1) electrical room exhaust fan (EF-3)
.1 Drive Type: Direct
.2 CFM: 423

.3 Total External SP: 0.16
.4 Motor: 1/4 HP, ECM motor type.
.5 Power: 115/60/1
.6 Sones (Inlet): 4.1
.7 Include a disconnect switch, factory mounted.
.8 Include a backdraft damper, gravity operated.
.9 Include solid state speed control, factory mounted.
.10 Standard of Acceptance: Greenheck SE1-12-432-VG, or approved equivalent.

.21 Supply and install one (1) pool mechanical room exhaust fan (EF-4)
.1 Drive Type: Belt
.2 CFM: 1423
.3 Total External SP: 0.375
.4 Motor: 1/4 HP, ECM motor type.
.5 Power: 115/60/1
.6 Sones (Inlet): 17.6
.7 Include a disconnect switch, factory mounted.
.8 Include a backdraft damper, gravity operated.
.9 Include solid state speed control, factory mounted.
.10 Standard of Acceptance: Twin City Fan 14WA3B, or approved equivalent.

.22 Supply and install one (1) electrical room exhaust fan (EF-3)
.1 Drive Type: Direct
.2 CFM: 636
.3 Total External SP: 0.1
.4 Motor: 1/4 HP, ECM motor type.
.5 Power: 115/60/1
.6 Sones (Inlet): 3.4
.7 Include a disconnect switch, factory mounted.
.8 Include a backdraft damper, gravity operated.
.9 Include solid state speed control, factory mounted.
.10 Standard of Acceptance: Greenheck SE1-12-436-VG, or approved equivalent.

.23 Supply and install four (4) Type 1 fire dampers
.1 Internal Diameter: 14”
.2 Type: Static 1.5-hour fire rated
.3 Closure Device: Fusible Link
.4 Closure Temperature: 165°F

.5 Standard of Acceptance: Greenheck FDR-510, or approved equivalent.

.24 Supply and install two (2) Type 1 fire dampers
- .1 Internal Diameter: 5”
- .2 Type: Static 1.5-hour fire rated
- .3 Closure Device: Fusible Link
- .4 Closure Temperature: 165°F
- .5 Standard of Acceptance: Greenheck FDR-510, or approved equivalent.

.25 Supply and install four (4) Type 1 fire dampers
- .1 Dimensions: 10” x 10”
- .2 Type: Static 3-hour fire rated
- .3 Closure Device: Fusible Link
- .4 Closure Temperature: 165°F
- .5 Standard of Acceptance: Greenheck FD-350, or approved equivalent.

.26 Supply and install four (4) Type 1 fire dampers
- .1 Dimensions: 5” x 5”
- .2 Type: Static 3-hour fire rated
- .3 Closure Device: Fusible Link
- .4 Closure Temperature: 165°F
- .5 Standard of Acceptance: Greenheck FD-350, or approved equivalent.

.27 Supply and install three (3) Type 1 fire dampers
- .1 Dimensions: 48” x 48”
- .2 Type: Static 1.5-hour fire rated
- .3 Closure Device: Fusible Link
- .4 Closure Temperature: 165°F
- .5 Standard of Acceptance: Greenheck FD-150, or approved equivalent.

.28 Supply and install two (2) Type 1 fire dampers
- .1 Internal Diameter: 7”
- .2 Type: Static 1.5-hour fire rated
- .3 Closure Device: Fusible Link
- .4 Closure Temperature: 165°F
- .5 Standard of Acceptance: Greenheck FDR-510, or approved equivalent.

.29 Supply and install six (6) Type 1 fire dampers
- .1 Dimensions: 20” x 20”
- .2 Type: Static 3-hour fire rated
- .3 Closure Device: Fusible Link

.4 Closure Temperature: 165°F
.5 Standard of Acceptance: Greenheck FD-350, or approved equivalent.

.30 Supply and install two (2) Type 1 fire dampers
.1 Dimensions: 8” x 8”
.2 Type: Static 3-hour fire rated
.3 Closure Device: Fusible Link
.4 Closure Temperature: 165°F
.5 Standard of Acceptance: Greenheck FD-350, or approved equivalent.

.31 Supply and install two (2) Type 1 fire dampers
.1 Internal Diameter: 16”
.2 Type: Static 1.5-hour fire rated
.3 Closure Device: Fusible Link
.4 Closure Temperature: 165°F
.5 Standard of Acceptance: Greenheck FDR-510, or approved equivalent.

.32 Supply and install two (2) Type 1 fire dampers
.1 Internal Diameter: 8”
.2 Type: Static 1.5-hour fire rated
.3 Closure Device: Fusible Link
.4 Closure Temperature: 165°F
.5 Standard of Acceptance: Greenheck FDR-510, or approved equivalent.

.33 Supply and install two (2) Type 1 fire dampers
.1 Internal Diameter: 18”
.2 Type: Static 1.5-hour fire rated
.3 Closure Device: Fusible Link
.4 Closure Temperature: 165°F
.5 Standard of Acceptance: Greenheck FDR-510, or approved equivalent.

.34 Supply and install two (2) Type 1 fire dampers
.1 Internal Diameter: 9”
.2 Type: Static 1.5-hour fire rated
.3 Closure Device: Fusible Link
.4 Closure Temperature: 165°F
.5 Standard of Acceptance: Greenheck FDR-510, or approved equivalent.

.35 Supply and install two (2) Type 1 fire dampers
.1 Dimensions: 15” x 15”
.2 Type: Static 3-hour fire rated

.3 Closure Device: Fusible Link
.4 Closure Temperature: 165°F
.5 Standard of Acceptance: Greenheck FD-350, or approved equivalent.

.36 Where noted in the specifications or the drawings, pressure gauges must meet the following requirements:
.1 Standard of Acceptance: Kodiak Controls Inc. KC201 D25 100, or approved equivalent.

.37 Where noted in the specifications or the drawings, analog thermometers must meet the following requirements:
.1 Type: Adjustable angle liquid-in-glass thermometer.
.2 Cold Side Range: -40°F to 110°F
.3 Hot Side Range: 30°F to 240°F
.4 Contractor to include all thermowells as required.
.5 Standard of Acceptance: Trerice, or approved equivalent.

.38 All metal ducting is to be provided by the Contractor and must conform to the following requirements:
.1 All ducts are to be a minimum 22 gauge galvanized sheet metal ducts
.2 All round ducts, where noted, are to be spiral ducts.
.3 90° duct turns and elbow fittings must have minimum of 1.5D center radius except where space constraints do not allow. Radii to be as large as possible.
.4 Run all ducts level unless otherwise noted.
.5 Duct sizes shown on drawings are clear inside dimensions. Installed dimensions must not be less than 1/16” smaller. Internal liners, where used, shall not reduce the clear interior dimensions.
.6 Run out ducts to air devices must be the same size as the air device neck unless otherwise noted. Balance dampers are required for all devices.
.7 Balance dampers must be located at origin of the associated branch/runout
.8 Flexible runouts to diffusers and grilles to be maximum of 6 feet in length. Flex must be stretched straight without bends or sags. Provide elbow support at 90° bends.
.9 Offset duct into joist space for clearance where space above ceiling is not sufficient for ducts to cross other ducts or work of other trades.
.10 Maintain minimum distances between outdoor air intakes, exhaust outlets, and plumbing vents as outlined in the

drawings. Any deviations must be reported prior to commencing work on the inlet/outlet.

.11 Install insulation and vapour barrier for all outdoor air ducts and plenums.

.12 Horizontal louvers of supply grilles in lobby and warm viewing areas interfacing with rink zone must be angled down to supply air towards glazing.

.13 All outdoor intake ducts must be insulated with minimum R-12.

.14 Outdoor air plenums must be insulated with minimum of R-13 insulation or the requirements of the building envelope, whichever is greater.

.15 Refer to schedule for all grilles and requirements.

.16 Refer to schedule for all diffusers and requirements.

.17 Coordinate final finish of grilles, louvers, and diffusers with architectural.

.39 Supply and install porous fabric ducting over the rink zone.

.1 Tensioning System:

.1 System must cylindrically tension textile along the entire length of textile duct including all fittings.

.2 Tensioning system must include a full 360 degree tensioning and intermediate rings with quick connection spacer tubes concealed inside the fabric system.

.3 Interior structure to include multiple mechanically adjustable tension devices. To provide proper textile tensioning, structural and textile system must be configured in segments of no more than 45 feet.

.4 Textile must be supported solely by metal cylindrical rings.

.5 Each cylindrical ring must require a vertical metal to metal cable safety attachments. Use galvanized steel rings.

.2 Textile Fabric Duct:

.1 Size: 24”

.2 Include seventy-nine (79) 3” orifices @ 64 CFM/ft. dispersion.

.3 Textile Construction: Filament/filament twill polyester treated with a machine washable anti-microbial agent by the fabric manufacturer, fire retardant in accordance with UL 2518. Non-linting filament yarn to meet the requirements of ISO Class 3 environment. Weight: 6.8 oz/yd2 per ASTM D3776.

.4 Air Permeability: Air Permeability: 2 (+2/-1) CFM/ft2 per ASTM D737, Frazier Measuring Device.
.5 Warranty: 10 years with standard inlet velocity.
.6 Textile Colour: Off-white.
.7 Holes to point away from the area above the ice sheet, parallel to the rink floor.
.8 Include an end-cap and both zippers at each hand must run in the same direction (two left-handed zippers or two right-handed zippers).

.3 Standard of Acceptance: DuctSox Sedona-XM with SkeleCore Fabric Tensioning System, or approved equivalent.

.40 Supply and install five (5) plate coils inside the snow melt pit.
.1 Connect the coils to the warm fluid system using a flanged connection type.
.2 Type: Platecoil
.3 Material: 316L Stainless Steel
.4 Plate Length: 47”
.5 Plate Height: 36”
.6 Capacity: 398 MBH
.7 Side 1:
.1 Fluid: Water
.8 Side 2:
.1 Fluid: 40% Ethylene Glycol
.2 EWT: 105°F
.3 LWT: 95°F
.4 Flow Rate: 16 USGPM (per coil)
.5 Max Pressure Drop: 11.5 ft.
.9 Provide flanges for connection to 2 1/2” warm glycol loop.
.10 Provide lifting handles.
.11 Provide a drain valve with shield to protect valve from snow and debris impact. To be located at the bottom of the coil.
.12 Standard of Acceptance: Tranter PLATECOIL Double Embossed 47” x 36”, or approved equivalent.

.41 Supply and install one (1) Circulation Pump for the Snow Melt System.
.1 Flow: 115 USGPM
.2 Head: 50 ft.
.3 Electrical Requirements: 115V, single phase, 13.8A

.4 Standard of Acceptance: Meyers WHR5H-11, or approved equivalent.

.42 Supply and install one (1) Large Particle Suction Strainer on the suction side of the snow melt circulation pump.
- .1 Material: Zinc-Plated Steel
- .2 Use 1.5” NPT female attachment.
- .3 Standard of Acceptance: McMaster-Carr Product Number - 4413K41, or approved equivalent.

.43 Supply and install three (3) wall brackets to mount the spray system
- .1 Use medium duty steel with a rod holder
- .2 Dimensions: 10 3/4” x 9 3/8”
- .3 Max Load: 300 lbs/pair
- .4 Standard of Acceptance: McMaster-Carr Product Number - 47055T28, or approved equivalent.

.44 Supply and install flexible tubing for the snow melt spray system
- .1 Estimated Length: 8’
- .2 Use only high pressure PVC tubing
- .3 Tube Size: 1.5” diameter, 1/4" wall thickness
- .4 Compatible fittings: Barbed
- .5 Standard of Acceptance: McMaster Carr Part Number – 5238K788, or approved equivalent.

.45 Supply and install four (4) Anti-Clog Nozzles
- .1 Material: 316 stainless steel
- .2 Narrow distribution - 60° full cone
- .3 ¾” threaded attachment
- .4 Standard of Acceptance: Bete MP312-N, or approved equivalent.

.46 Supply and install one (1) Spring-Loaded Wall Timer
- .1 To control the spray system and circulation pump.
- .2 Rating: 20A, 125VAC, 50/60Hz; 10A 250VAC, 50/60Hz; 10A, 277VAC, 50/60HP
- .3 Motor Sizes: 1HP, 125VAC, 50/60Hz; 2HP 250VAC, 50/60Hz
- .4 Standard of Acceptance: Intermatic FF30MH with SPST Switch, or approved equivalent.

.47 Supply and install one (1) basket strainer for the snow melt circulation system
- .1 Material: PVC

.2 Use 1.5” threaded fitting connections
.3 Material: Plastic 1/8” perforated strainer basket.
.4 EDPM O-ring seals.
.5 Standard of Acceptance: Hayward SB1150STE, or approved equivalent.

.48 Supply and install one (1) Pool Heat Exchanger (HX-3)
.1 Capacity: 2,439 MBH
.2 Side 1:
.1 Fluid: Water
.2 EWT: 65°F
.3 LWT: 82°F
.4 Flow Rate: 289 USGPM
.5 Max Pressure Drop: 3.36 ft.
.3 Side 2:
.1 Fluid: 40% Ethylene Glycol
.2 EGT: 105°F
.3 LGT: 95°F
.4 Flow Rate: 515 USGPM
.5 Max Pressure Drop: 11.5/12.59 ft.
.4 Materials: Titanium
.5 Standard of Acceptance: SEC Heat Exchangers SEC-522-63, or approved equivalent

7.2 HVAC Additional Contractors Items

.1 All louver colours are to be confirmed with the Owner’s Engineer prior to ordering.

.2 All power wiring from the MCC and starter panel to equipment is the responsibility of the Contractor.

.3 Contractor to connect to drainage, the provision of drains in rooms is by others.

.4 All valves and controls should be located at ergonomic heights unless technically unfeasible.

.5 Contractor to supply and install HVAC room as-built system schematics and valve charts detailing all equipment relevant to the project. This include H-diagrams for air handling units.

.6 The contractor shall install dust enclosures while performing work in occupied facility zones, which generates large amounts of particulates.

.7 The contractor shall carry the cost of all piping, valves, fittings, and adaptors required to make a fully functional system as

outlined in the specification herein, even if not specifically mentioned.

.8 Site cleanup and removal of construction/demolition debris is the responsibility of the contractor.

.9 Equipment layout shall allow adequate clearances for cleaning and maintenance purposes. The proposed clearances must be documented on a Clearance and Interface drawing and submitted to the Owner and the Owner's Engineer for comment, prior to commencing work.

.10 All installed equipment shall be labelled with placards, and shall be labelled by equipment type in sequential order.

.11 Contractor shall seal all building penetrations created/modified under the scope of this contract with a watertight sealant; the penetration shall be painted to match the surrounding building finishes.

.12 The contractor shall furnish, supply and install all required control valves in accordance with all applicable codes and standards.

.13 All equipment installations must be constructed in conformance with the all local, provincial, and national code. Any additional requirements from the latest codes and standards supersede any requirements as written in this document.

.14 All equipment shall be installed such that it meets or exceeds the manufacturer's recommended installation practices and requirements.

.15 Contractor must pay for all local inspections, approvals, and permits as required for the project.

.16 Supply and install a glycol drain/charge valve on each fan coil, heating coil, and cooling coil in the system. This includes each coil in the air handling units.

PART 8 – FAN COILS

8.1 Fan Coils Scope of Work

.1 Supply and install three (3) Type 1 Fan Coil Units
  .1 Heating Capacity: 35.8 MBH
  .2 Design Airflow: 1,550 CFM
  .3 Type: horizontal with return plenum, disconnect, and speed control.
  .4 Include MERV 8 filters.
  .5 MCA: 1.58
  .6 Voltage: 115/60/1
  .7 Motors to be electrically commutated (ECM).
    .1 Modulating is 0-10 VDC
  .8 Heating Fluid Details:
    .1 Fluid: 40% Ethylene Glycol
    .2 Flow: 8.1 GPM
    .3 Fluid Pressure Drop: 0.85 ft.
  .9 Temperature controls and control valve are by the Automation contractor.
  .10 Refer to schedule for installation locations.
  .11 Include a drip pan beneath the hydronic coil inside the fan coil.
  .12 Standard of Acceptance: Daikin FUHH108, or approved equivalent.

.2 Supply and install one (1) Type 2 Fan Coil Units
  .1 Heating Capacity: 3.664 MBH
  .2 Design Airflow: 318 CFM
  .3 Type: horizontal cabinet with bottom supply/return, disconnect, and 3 speed manual speed switch.
  .4 Include MERV 8 filters.
  .5 MCA: 1.5
  .6 Voltage: 115/60/1
  .7 Motors to be electrically commutated (ECM).
    .1 Modulating is 0-10 VDC
  .8 Heating Fluid Details:
    .1 Fluid: 40% Ethylene Glycol
    .2 Flow: 0.4 GPM
    .3 Fluid Pressure Drop: 0.1 ft.
  .9 Temperature controls and control valve are by the Automation contractor.

.10 Refer to schedule for installation locations.
.11 Include a drip pan beneath the hydronic coil inside the fan coil.
.12 Standard of Acceptance: Daikin FHHC202, or approved equivalent.

.3 Supply and install one (1) Type 3 Fan Coil Units
.1 Heating Capacity: 3.611 MBH
.2 Design Airflow: 295.5 CFM
.3 Type: horizontal hideaway with disconnect and 3 speed manual speed switch.
.4 Include MERV 8 filters.
.5 MCA: 1.5
.6 Voltage: 115/60/1
.7 Motors to be electrically commutated (ECM).
.1 Modulating is 0-10 VDC
.8 Heating Fluid Details:
.1 Fluid: 40% Ethylene Glycol
.2 Flow: 0.4 GPM
.3 Fluid Pressure Drop: 0.1 ft.
.9 Temperature controls and control valve are by the Automation contractor.
.10 Refer to schedule for installation locations.
.11 Include a drip pan beneath the hydronic coil inside the fan coil.
.12 Standard of Acceptance: Daikin FHHH202, or approved equivalent.

.4 Supply and install eleven (11) Type 4 Fan Coil Units
.1 Heating Capacity: 3.664 MBH
.2 Design Airflow: 318 CFM
.3 Type: horizontal recessed with bottom supply/return, disconnect, and 3 speed manual speed switch.
.4 Include MERV 8 filters.
.5 MCA: 1.5
.6 Voltage: 115/60/1
.7 Motors to be electrically commutated (ECM).
.1 Modulating is 0-10 VDC
.8 Heating Fluid Details:
.1 Fluid: 40% Ethylene Glycol
.2 Flow: 0.4 GPM
.3 Fluid Pressure Drop: 0.1 ft.
.9 Temperature controls and control valve are by the Automation contractor.

.10 Refer to schedule for installation locations.
.11 Include a drip pan beneath the hydronic coil inside the fan coil.
.12 Standard of Acceptance: Daikin FHHR202, or approved equivalent.

.5 Supply and install nine (9) Type 5 Fan Coil Units
.1 Heating Capacity: 8.576 MBH
.2 Design Airflow: 683.2 CFM
.3 Type: horizontal recessed with bottom supply/return, disconnect, and 3 speed manual speed switch.
.4 Include MERV 8 filters.
.5 MCA: 1.8
.6 Voltage: 115/60/1
.7 Motors to be electrically commutated (ECM).
.1 Modulating is 0-10 VDC
.8 Heating Fluid Details:
.1 Fluid: 40% Ethylene Glycol
.2 Flow: 1.1 GPM
.3 Fluid Pressure Drop: 0.38 ft.
.9 Temperature controls and control valve are by the Automation contractor.
.10 Refer to schedule for installation locations.
.11 Include a drip pan beneath the hydronic coil inside the fan coil.
.12 Standard of Acceptance: Daikin FHHR206, or approved equivalent.

.6 Supply and install two (2) Type 6 Fan Coil Units
.1 Heating Capacity: 35.8 MBH
.2 Design Airflow: 1,550 CFM
.3 Type: horizontal with return plenum, disconnect, and speed control.
.4 Must include corrosion and chlorine resistant coating.
.5 Include MERV 8 filters.
.6 MCA: 1.58
.7 Voltage: 115/60/1
.8 Motors to be electrically commutated (ECM).
.1 Modulating is 0-10 VDC
.9 Heating Fluid Details:
.1 Fluid: 40% Ethylene Glycol
.2 Flow: 8.1 GPM
.3 Fluid Pressure Drop: 0.85 ft.

.10 Temperature controls and control valve are by the Automation contractor.
.11 Refer to schedule for installation locations.
.12 Include a drip pan beneath the hydronic coil inside the fan coil.
.13 Standard of Acceptance: Daikin FUHH108, or approved equivalent.

PART 9 – WATER PIPING

9.1 Water Piping General Comments

.1 All work of this Division shall be coordinated and provided by the Mechanical Contractor.

.2 All materials shall be first class and new.

.3 The Mechanical Contractor shall work with the facility, and the Owner's Engineer to provide completed hydronic piping in a timely manner.

.4 The work of this Division shall be as required by the Specifications and Schematic.

.5 If the Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the Owner's Engineer.

9.2 Water Piping Definitions

.1 Water Piping: Piping which contains water (or a glycol mixture) for the purpose of distribution to loads.

.2 Mechanical Contractor (or Contractor): The Contractor responsible for supply and installation of all water piping components and requirements as specified.

9.3 Water Piping Description

.1 The supply and installation of piping, labeling, identification and insulation as outlined.

.2 The work shall consist of the provision of all labour, materials, tools, equipment, testing, commissioning, training services, 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 this documents which are required for the complete, fully functional and commissioned water piping system.

.3 Provide a complete, neat and workmanlike installation. Use only manufacturers and employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

.4 Manage and coordinate the work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of

other trades so as to not impede or delay the work of associated trades.

9.4 Water Piping Quality Assurance

.1 General

.1 The Contractor shall be a recognized national supplier, installer and service provider for water piping.

.2 As part of Risk Management and evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the Contractor must have been in the business for at least the last ten (10) years and have successfully completed a total of ten (10) piping systems in the preceding five (5) years.

.2 Workplace Safety and Hazardous Materials

.1 Provide a safety program in compliance with the Contract Documents.

.2 The Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.

.3 The Contractor and its employees and subtrades comply with federal, provincial, and local safety regulations.

.4 The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the Health and Safety Commission in the jurisdiction for at least each topic listed in the Safety Certification Manual.

.5 Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.

.6 Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the Owner's Engineer or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.

.7 The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.

.8 The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the Authorities Having Jurisdiction at the Project site.

.9 The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

.3 Quality Management Program

.1 Designate a competent and experienced employee to provide Project Management. The designated Project Manager shall be empowered to make technical, scheduling and related decisions on behalf of the Contractor. At minimum, the Project Manager shall:

.1 Manage the scheduling of the work to ensure that adequate materials, labour and other resources are available as needed.

.2 Manage the financial aspects of the Contract.

.3 Coordinate as necessary with other trades.

.4 Be responsible for the work and actions of the workforce on site.

9.5 Water Piping Codes and Standards

.1 Contractor to comply with all codes and standards applicable to this type of work, including;

.1 ASME B31.9 Building Service Piping

.2 In the case of conflicts or discrepancies, the more stringent regulation shall apply.

.3 All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

9.6 Water Piping Record Documentation

.1 Provide two (2) paper copies and one (1) electronic copy of as-built water piping schematics and layouts for all installed piping covered under this contract.

.2 Manual shall be bound in 3 ring binders and contain, as a minimum, the following:

.1 System operation and maintenance instructions, trouble shooting guidelines and operating log.

.2 Safety bulletins and material safety data sheets.

.3 Equipment operation and maintenance instructions.

.4 Signed Dept. of Labour (or equivalent) Pressure Tests Data Reports

.5 Shop drawings of all supplied equipment

.3 As-built drawings shall contain, typical piping layout, material details, piping connection details, and any additional pertinent details regarding the piping.

9.7 Water Piping Warranty

.1 Standard Material and Labour Warranty:
  .1 The Contractor shall provide a one-year labour and material warranty from the date of substantial completion on the water piping system including all valves and fittings.
  .2 If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, any portion of the Water Piping system is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the Contractor and at the cost of the Contractor.

9.8 Water Piping Scope of Work

.1 Piping shall conform to ASME B31.9 Building Service Piping.

.2 Piping shall be as follows
  .1 All Glycol and Water Piping
    .1 Up to 1 1/2" IPS
      .1 Schedule 40 ERW OR
      .2 Schedule 40 Seamless Black Steel Pipe With 150 LB Threaded, OR
      .3 Schedule 40 3M Socket Weld
    .2 2" IPS and up
      .1 Schedule 40 ERW Black Steel Pipe with Standard Butt Weld Fittings,

.3 Pipe fittings shall be as follows
  .1 Steel Piping
    .1 Flanges ANSI & RF
      .1 ASTM A105
      .2 Pressure Rating to Match Design Working Pressure
    .2 Up to 1 1/2" IPS
      .1 Threaded – Forged Steel, ASTM A105, 3000 LBS
      .2 Socket Weld – Forged Steel, ASTM A105, 3000 LBS
      .3 Butt Weld – Carbon Steel, ASTM SA-234-WPB E.H.
    .3 2" and Up
      .1 Socket Weld – Forged Steel, ASTM A105, 3000 LBS
      .2 Butt Weld – Carbon Steel, ASTM SA-234-WPB STD
  .2 Copper Piping
    .1 Up to 4"
      .1 Join using lead free solder suitable for domestic water system in conformance with ASTM B52 Gr 50A.
      .2 ATSM B88.
      .3 Any connections to dissimilar metals to include dielectric union.

.4 Piping shall be identified as per Owner's Current Labeling Standards. In the event that no standard is currently in place, labeling shall be as follows.

.1 Labeling body shall be Black on Safety Yellow

.2 Labeling shall indicate flow of water

.3 Label Size, text height and placement should conform to ASME A13.1

.1 Labels shall be adjacent to all valves and flanges

.2 Adjacent to all changes of direction

.3 On both sides of a wall or floor penetration

.4 At regular intervals on straight runs (maximum 50 feet spacing)

.4 Label Size, and Letter Size

Outside Pipe Diameter, including insulation (in.)	Minimum Label Length (in.)	Minimum Letter Height (in.)
< 1.25	8	0.5
1.5 – 2	8	0.75
2.5 – 6	12	1.25
8 – 10	24	2.5
> 10	32	3.5

.5 To further protect the piping system, the piping shall be painted.

.1 All insulated field fabricated steel piping shall be painted with a rust resistant primer prior to insulation.

.2 Colors shall match existing color scheme currently utilized at the facility. If no color scheme is present, the following shall be used

.1 Light Blue Cold Glycol

.2 Dark Blue Warm Glycol

.3 Green Domestic Hot and Cold Water

.6 Piping shall be supported as follows

Nominal Diameter Pipe NPS (in.)	Recommended Spacing Between Hangers (ft.)	Minimum Rod Size (in.)
1/2	7	3/8
3/4	7	3/8
1	7	3/8
1-1/2	9	3/8
2	10	3/8
2-1/2	11	1/2
3	12	1/2

4	14	5/8
6	17	3/4
8	19	3/4
10	22	7/8
12	23	7/8
14	25	1
16	27	1
18	28	1
20	30	1-1/4
24	32	1-1/4

.7 Pipe hangars must include rubber lining on the inside of the clamp to prevent pipe wear, unless the pipe is insulated.

.8 Mechanical system shut-off valves :

.1 All hand shutoff valves shall be ball valves or butterfly valves.

.2 Valve type used:

.1 ¼" to 2", threaded full port ball valves

.2 2 ½" to 8", full lug type butterfly valves

.3 Ball valves to be two (2) piece construction with bronze or steel body, stainless steel ball and manual lever actuator with stem extension. Ball valves to have a rated working pressure or 600 PSIG.

.4 Butterfly valves to be full lug style and constructed with ductile iron body, ductile iron nickel plated disc, stainless steel shaft, and BUNA-N seat. Butterfly valve to have rated working pressure of 225 PSIG.

.8 Valve flow coefficient shall be, at minimum, as per the following. Pressure drop across any fully open valve shall be at maximum 1.5 psi.

Pipe Size (in.)	CV
1-1/2	45
2	75
2-1/2	140
3	240
4	400
5	700
6	1000
8	2100
10	3100
12	4500

.9 Glycol Piping Insulation
- .1 Temperature range: Any
- .2 Insulation Type: Polyiso
- .3 Thickness: 2”
- .4 Jacket Type: PVC
  - .1 Single piece, pre-curled for insulation thickness

.10 Water Piping Insulation
- .1 Temperature range: Any
- .2 Insulation Type: Polyiso
- .3 Thickness: 1”
- .4 Jacket Type: PVC
  - .1 Single piece, pre-curled for insulation thickness

.11 Unless otherwise indicated, all materials must be new, first quality and approved by at least one of the following organizations: ULC, ARI, AMCA, ASME or any other body with jurisdiction in the area concerned.

.12 Piping system test pressures:
- .1 All new piping to be pressure tested. Provide all test results to Owner upon completion.
- .2 Type of test: Hydronic
- .3 Cold Glycol System: 80 PSI.
- .4 Warm Glycol System: 100 PSI.

9.9 Water Piping Specific Requirements

.1 The proponent is responsible for:
- .1 All pipe, valves and fittings shall be installed as per Local, Provincial, and National Code.
- .2 Construction is to be completed in conjunction with owner.

9.10 Water Piping Installation Practices

.1 All piping shall be installed as per manufacturer’s specifications in accordance with ASME B31.9 as required.

.2 All piping shall be installed straight and true, and parallel to all walls.

.3 All valves and controls should be located at ergonomic heights unless technically unfeasible.

.4 All valves shall be tagged with identification tags, and a reference key identifying each valve shall be provided with the as-built drawings.

.5 Piping shall be installed as per the drawings.

PART 10 – REFRIGERANT PIPING

10.1 Refrigerant Piping General Comments

.1 All work of this Division shall be coordinated and provided by the Mechanical Contractor.

.2 All materials shall be first class and new.

.3 The Refrigeration Contractor shall work with the facility, and the Owner's Engineer to provide completed refrigeration piping in a timely manner.

.4 The work of this Division shall be as required by the Specifications and Schematic.

.5 If the Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

.6 The following specification is for the refrigerant relief piping from the new refrigeration package(s).

10.2 Refrigerant Piping Definitions

.1 Refrigerant Piping: Piping which contains refrigerant as any stage within the refrigeration cycle.

.2 Refrigerant Relief Piping: Piping specifically used to vent refrigerant to atmosphere, in the event of an emergency or for testing purposes.

.3 Refrigeration Contractor (or Contractor): The Contractor responsible for supply and installation of all refrigerant piping components and requirements as specified.

10.3 Refrigerant Piping Description

.1 The supply and installation of refrigerant piping, labeling, identification and insulation as outlined.

.2 The work shall consist of the provision of all labour, materials, tools, equipment, testing, commissioning, training services, 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 this documents which are required for the complete, fully functional and commissioned refrigerant piping system.

.3 Provide a complete, neat and workmanlike installation. Use only manufacturers and employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

.4 Manage and coordinate the work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

10.4 Refrigerant Piping Quality Assurance

.1 General

.1 The Refrigeration Contractor shall be a recognized national supplier, installer and service provider for refrigerant piping.

.2 As part of Risk Management and evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the Contractor must have been in the business for at least the last ten (10) years and have successfully completed a total of ten (10) refrigerant piping systems in the preceding five (5) years.

.2 Workplace Safety and Hazardous Materials

.1 Provide a safety program in compliance with the Contract Documents.

.2 The Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.

.3 The Contractor and its employees and subtrades comply with federal, provincial, and local safety regulations.

.4 The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the Health and Safety Commission in the jurisdiction for at least each topic listed in the Safety Certification Manual.

.5 Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.

.6 Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the Owner's Engineer or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.

.7 The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.

.8 The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the Authorities Having Jurisdiction at the Project site.

.9 The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

.3 Quality Management Program

.1 Designate a competent and experienced employee to provide Project Management. The designated Project Manager shall be empowered to make technical, scheduling and related decisions on behalf of the Contractor. At minimum, the Project Manager shall:

.2 Manage the scheduling of the work to ensure that adequate materials, labour and other resources are available as needed.

.3 Manage the financial aspects of the Contract.

.4 Coordinate as necessary with other trades.

.5 Be responsible for the work and actions of the workforce on site.

10.5 Refrigerant Piping Codes and Standards

.1 Contractor to comply with all codes and standards applicable to this type of work, including;

.1 ASME B31.9 Building Service Piping

.2 In the case of conflicts or discrepancies, the more stringent regulation shall apply.

.3 All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

10.6 Refrigerant Piping Record Documentation

.1 Provide two (2) paper copies and one (1) electronic copy of as-built refrigerant piping schematics and layouts for all installed piping covered under this contract.

.2 Manual shall be bound in 3 ring binders and contain, as a minimum, the following:

.1 System operation and maintenance instructions, trouble shooting guidelines and operating log.
.2 Safety bulletins and material safety data sheets.
.3 Equipment operation and maintenance instructions.
.4 Signed Dept. of Labour (or equivalent) Pressure Tests Data Reports
.5 Shop drawings of all supplied equipment

.3 As-built drawings shall contain, typical piping layout, material details, piping connection details, and any additional pertinent details regarding the piping.

10.7 Refrigerant Piping Warranty

.1 Standard Material and Labour Warranty:

.1 The Contractor shall provide a one-year labour and material warranty from the date of substantial completion on the refrigerant piping system including all valves and fittings.

.2 If within twelve (12) months from the date of acceptance of product, upon written notice from the Owner, any portion of the Refrigerant Piping system is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the Contractor and at the cost of the Contractor.

10.8 Refrigerant Piping Scope of Work

.1 Refrigerant piping shall conform to ASME B31.5 Refrigeration piping code.

.2 Refrigerant piping shall be as follows
.2 Up to 1 1/2" IPS
.1 Schedule 80 ASTM A53 Grade A or B Seamless, OR
.2 Schedule 80 ASTM A106 Grade A or B Seamless, OR
.3 Schedule 80 ASTM A333 Grade 1 or 6 Seamless
.3 2" IPS and up
.1 Schedule 40 ASTM A53 Grade A or B ERW, OR
.2 Schedule 40 ASTM A106 Grade A or B Seamless, OR
.3 Schedule 40 ASTM A333 Grade 1 or 6 Seamless
.4 All piping shall bear the manufacturers identification and conform to the pervious specifications.

.3 Refrigerant pipe fittings shall be as follows
.2 Flanges ANSI & RF
.1 ASTM A105
.3 Pressure Rating to Match Design Working Pressure

.4 Up to 1 1/2" IPS
  .1 Threaded – Forged Steel, ASTM A105, 3000 LBS
  .2 Socket Weld – Forged Steel, ASTM A105, 3000 LBS
  .3 Butt Weld – Carbon Steel, ASTM SA-234-WPB E.H.
.5 2" and Up
  .1 Socket Weld – Forged Steel, ASTM A105, 3000 LBS
  .2 Butt Weld – Carbon Steel, ASTM SA-234-WPB STD

.4 Piping shall be identified as per the Refrigeration Pipe Labeling Guide:
  .1 Labeling body shall be Black on Safety Yellow
  .2 Labeling shall indicate flow of refrigerant and arrows shall be present on both sides of the label, with arrows wrapping around the entire circumference of the pipe
  .3 Labeling shall have an abbreviation legend
  .4 Labeling shall identify the system component as per the table listed below
  .5 Labeling shall identify refrigerant physical state (Liquid or Vapour)
    .1 Liquid shall be abbreviated as LIQ and set upon an Orange background
    .2 Vapour shall be abbreviated as VAP and set upon a Blue background
  .6 Labeling shall identify the working fluid as refrigerant
  .7 Labeling shall identify pressure level
    .1 LOW shall be any pressure below 70 psig and set upon a green background
    .2 HIGH shall be any pressure above 70 psig and set upon a red background
  .8 Label Size, text height and placement should conform to ASME A13.1
    .1 Labels shall be adjacent to all valves and flanges
    .2 Adjacent to all changes of direction
    .3 On both sides of a wall or floor penetration
    .4 At regular intervals on straight runs (maximum 50 feet spacing)
      .1 BD Booster Discharge
      .2 CD Condenser
      .3 DS Defrost Condensate
      .4 ES Economizer Suction
      .5 HGD Hot Gas Defrost
      .6 HPL High Pressure Liquid
      .7 HSD High Stage Discharge
      .8 HSS High Stage Suction

.9 HTRL High Temperature Recirculated Liquid
.10 HTRS High Temperature Recirculated Suction
.11 LTRL Low Temperature Recirculated Liquid
.12 LTRS Low Temperature Recirculated Suction
.13 LIC Liquid Injection Cooling
.14 LSS Low Stage Suction
.15 RV Relief Vent
.16 TSR Thermosiphon Return
.17 TSS Thermosiphon Supply

.5 Label Size, and Letter Size

Outside Pipe Diameter, including insulation (in)	Minimum Label Length (in)	Minimum Letter Height (in)
< 1.25	8	0.5
1.5 – 2	8	0.75
2.5 – 6	12	1.25
8 – 10	24	2.5
> 10	32	3.5

.5 To further protect the refrigerant piping, the piping shall be painted.

.1 All insulated field fabricated steel piping shall be painted with a rust resistant primer prior to insulation.

.2 Colors shall match existing color scheme currently utilized at the facility. If no color scheme is present, the following shall be used

.1 Red Compressor High Vapour
.2 Yellow Intermediate Pressure
.3 Orange High Pressure Liquid
.4 Blue Low Pressure Liquid or Vapour
.5 Green Water

.6 Refrigerant piping shall be supported as follows

Nominal Diameter Pipe NPS (in)	Recommended Spacing Between Hangers (ft.)	Recommended Rod Size (in)
1/2	7	3/8
3/4	7	3/8
1	7	3/8
1-1/2	9	3/8
2	10	3/8
2-1/2	11	1/2
3	12	1/2
4	14	5/8
6	17	3/4
8	19	3/4
10	22	7/8
12	23	7/8
14	25	1
16	27	1
18	28	1
20	30	1-1/4
24	32	1-1/4

.7 Refrigerant isolation valves to be Angle or Globe type only.

.1 Supply and Return refrigerant valves to compressors shall be Angle type

.2 Supply and Return refrigerant valves to Plate and Frames shall be Globe type

.3 Supply and Return refrigerant valves to Condenser shall be Globe type

.4 Inline refrigerant valves shall be Globe type

.8 All refrigerant valves to be equipped with seal caps; however, handwheels shall also be provided.

.9 Refrigerant Valve flow coefficient shall be, at minimum, as per the following

Pipe Size (in)	CV	Equivalent Pipe Length (ft.)

1-1/2	45	11
2	75	26
2-1/2	115	22
3	180	31
4	280	54
5	550	47
6	775	65
8	1300	85
10	2250	97
12	3000	116
14	4000	143
16	5500	155

.10 Refrigerant systems shall be equipped with Pressure Relief valves. The Relief Valves shall start to function at a pressure not exceeding the design pressure of the system being protected.

.1 Stop Valves shall not be located between pressure relief valve and the system, unless when pressure relief valves are installed in parallel.

.2 The discharge to atmosphere shall be not less than 15 ft. above ground, and not less than 25 ft. from any window, ventilation opening or exit.

.11 Unless otherwise indicated, all materials must be new, first quality and approved by at least one of the following organizations: ULC, ARI, AMCA, ASME or any other body with jurisdiction in the area concerned.

.12 All refrigerant piping and fittings shall conform to the latest edition of the ASME B31.5 Refrigeration Piping and Heat Transfer Components.

10.9 Refrigerant Piping Specific Requirements

.1 The contractor shall provide a new refrigerant relief stack, which extends a minimum of 15ft above the accessible roof level and is 25ft from any building opening or ventilation louver.

.1 A diffusor and goose-neck must be included on the relief stack to prevent direct spray of refrigerant on personnel in the vicinity and prevent foreign material or debris from entering the discharge piping.

.2 The proponent is responsible for:
.1 All pipe, valves and fittings shall be installed as per code. The pipe sizes and valve equipment list are provided in drawings package.
.2 Construction is to be completed in conjunction with the Owner.

10.10 Refrigerant Piping Installation Practices

.1 All piping shall be installed as per manufacturer's specification.

.2 Where refrigerant piping must cross an open space that provides a passageway, piping shall be installed no less than 7.5 feet above floor, unless it is against the ceiling of such a space.

.3 All valves and controls should be located at ergonomic heights unless technically unfeasible.

.4 All piping shall be installed straight and true, and parallel to all walls.

.5 Refrigerant piping shall not be installed in an enclosed stairway, stair landing or exit. Piping shall not be installed in an elevator, dumb waiter, or shaft containing a moveable object.

.6 All refrigerant piping, valves, and fittings shall be free of copper, zinc and its specific alloys.

.7 All refrigerant valves shall be tagged with identification tags, and a reference key identifying each valve shall be located within the mechanical room.

.8 Piping and valves shall be installed as per the drawings.

Appendix F

Drawings

CHARLOTTETOWN PE
VAUGHAN ON
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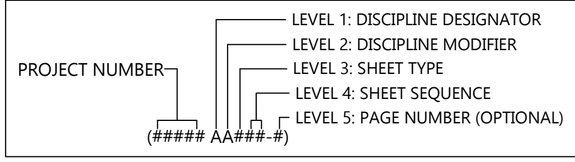
IBS DRAWING SHEET DEFINITION



LEVEL 1 DISCIPLINE DESIGNATOR	
A	ARCHITECTURAL
B	GEOTECHNICAL
C	CIVIL
D	PROCESS
E	ELECTRICAL
F	FIRE PROTECTION
H	HAZARDOUS MATERIALS
I	INTERIORS
L	LANDSCAPE
M	MECHANICAL
O	OPERATIONS
P	PLUMBING
Q	EQUIPMENT
R	RESOURCE
S	STRUCTURAL
T	TELECOMMUNICATIONS
V	SURVEY/MAPPING
W	DISTRIBUTED ENERGY
X	OTHER DISCIPLINES
Z	CONTRACTOR/SHOP DRAWINGS

LEVEL 2 DISCIPLINE MODIFIER		
	-	MODIFIER NOT USED
M	B	BOARDS & GLASS
	D	DEMOLITION
	H	HVAC
	I	INSTRUMENTATION
	P	PIPING
	R	RINK FLOOR

LEVEL 3 SHEET TYPE	
0	GENERAL
1	PLANS
2	ELEVATIONS
3	SECTIONS
4	LARGE-SCALE VIEWS
5	DETAILS
6	SCHEDULES & DIAGRAMS
7	COORDINATION
8	DESIGN STANDARD
9	3D REPRESENTATIONS

LEVEL 4 SHEET SEQUENCE	
01-99	SEQUENTIAL VALUE
ODD	DISTINCT DRAWINGS
EVEN	MIRROR DRAWINGS

REVISION LOG

MECHANICAL EQUIPMENT				
21010 M-101	BUILDING LAYOUT	VER: 1.0	ISSUED FOR TENDER	25-NOV-22
21010 M-403	MECHANICAL LAYOUTS	VER: 2.0	ISSUED FOR TENDER	11-JAN-23
21010 M-601	REFRIGERATION SCHEMATIC PACKAGE	VER: 4.0	ISSUED FOR TENDER	08-FEB-23
21010 M-615	BACKUP CONTROLLER	VER: 1.0	ISSUED FOR TENDER	25-NOV-22
PIPING				
21010 MP101	SIMMONS PIPING DISTRIBUTION	VER: 4.0	ISSUED FOR TENDER	11-JAN-23
21010 MP401	PIPING ENLARGED PLAN	VER: 2.0	ISSUED FOR TENDER	11-JAN-23
21010 MP403	SNOWMELT PIT ENLARGED PLAN	VER: 1.0	ISSUED FOR TENDER	11-JAN-23
DUCTING				
21010 MH101	DUCTING DISTRIBUTION	VER: 4.0	ISSUED FOR TENDER	11-JAN-23
21010 MH401	DUCTING ENLARGED PLANS	VER: 2.0	ISSUED FOR TENDER	09-DEC-22
RINK FLOOR				
21010 MR101	RINK FLOOR PLAN	VER: 1.0	ISSUED FOR TENDER	25-NOV-22
21010 MR501	RINK FLOOR DETAILS	VER: 1.0	ISSUED FOR TENDER	25-NOV-22
BOARDS AND GLASS				
21010 MB101	BOARDS AND GLASS PLAN	VER: 2.0	ISSUED FOR TENDER	08-FEB-23
21010 MB501	BOARDS AND GLASS DETAILS	VER: 2.0	ISSUED FOR TENDER	08-FEB-23
ISOMETRIC VISUALIZATIONS				
21010 M-901	ISOMETRIC VISUALIZATION PIPING & DUCTING	VER: 4.0	ISSUED FOR TENDER	06-FEB-23
21010 M-903	ISOMETRIC VISUALIZATION EQUIPMENT	VER: 4.0	ISSUED FOR TENDER	06-FEB-23
21010 MP901	ISOMETRIC VISUALIZATION PIPING	VER: 4.0	ISSUED FOR TENDER	06-FEB-23
21010 MH901	ISOMETRIC VISUALIZATION DUCTING	VER: 4.0	ISSUED FOR TENDER	06-FEB-23
IBSDS				
IBSDS M801	GLYCOL RELIEF VALVES	VER: 7.0	ISSUED FOR TENDER	08-FEB-21
IBSDS M805	AIR SEPARATOR	VER: 8.0	ISSUED FOR TENDER	05-MAY-21
IBSDS M809	GLYCOL FEEDER	VER: 7.0	ISSUED FOR TENDER	08-FEB-21
IBSDS M811	EXPANSION TANK	VER: 8.0	ISSUED FOR TENDER	03-MAY-21
IBSDS M815	RENTAL CHILLER	VER: 2.0	ISSUED FOR TENDER	08-FEB-21
IBSDS M827	SNOWMELT PIT CIRCULATION	VER: 2.0	ISSUED FOR TENDER	11-JAN-23

NOTES

21010 PKG04

REFERENCE DEFINITION

SHEET COLUMN
SHEET NUMBER
SHEET ROW
(#, X#)

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VER #	REVISIONS	DATE	BY
6.0	EO #682	08-FEB-23	H.A.
5.0	EO #679	06-FEB-23	Z.M.
4.0	EO #668	11-JAN-23	Z.M.
3.0	EO #665	15-DEC-22	Z.M.
2.0	EO #658	09-DEC-22	Z.M.
1.0	ISSUED FOR TENDER	25-NOV-22	H.A.

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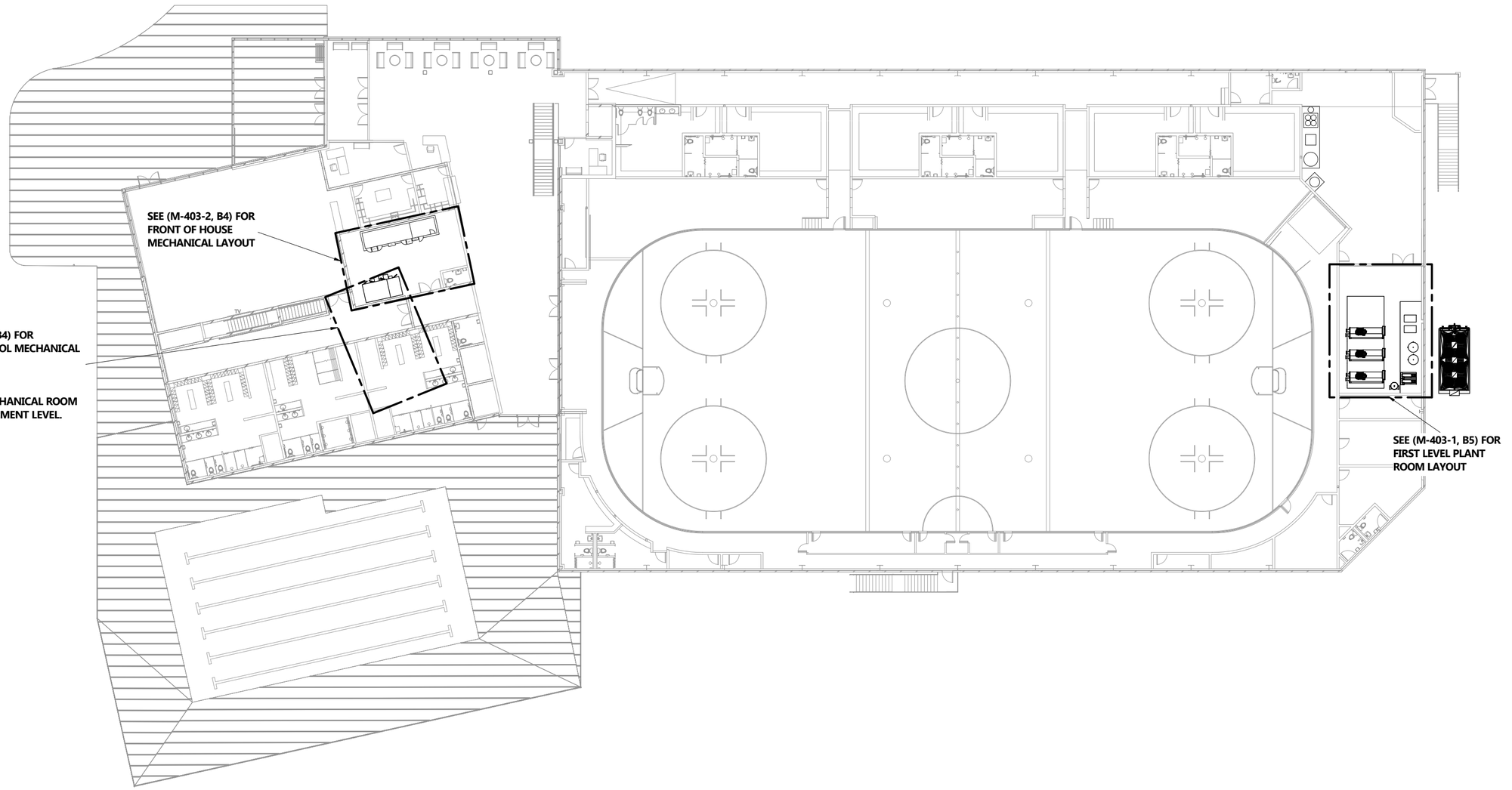
STAMP

DRAWING NUMBER 21010 PKG04
DRAWING NAME REVISION LOG
CLIENT CITY OF CHARLOTTETOWN
PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY H. AKAR
CHECKED BY J. RITCHIE
DATE 08-FEB-23
REVISION 6.0
SHEET SIZE C
SHEET NO. 1 OF 1



FIRST LEVEL LAYOUT
SCALE 1:300

FIRST LEVEL LAYOUT

NOTES

———	NEW
———	FOR REFERENCE

21010 M-101

REFERENCE DEFINITION

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(#, X#)

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DRAWING NAME	BUILDING LAYOUT
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	25-NOV-22
REVISION	1.0
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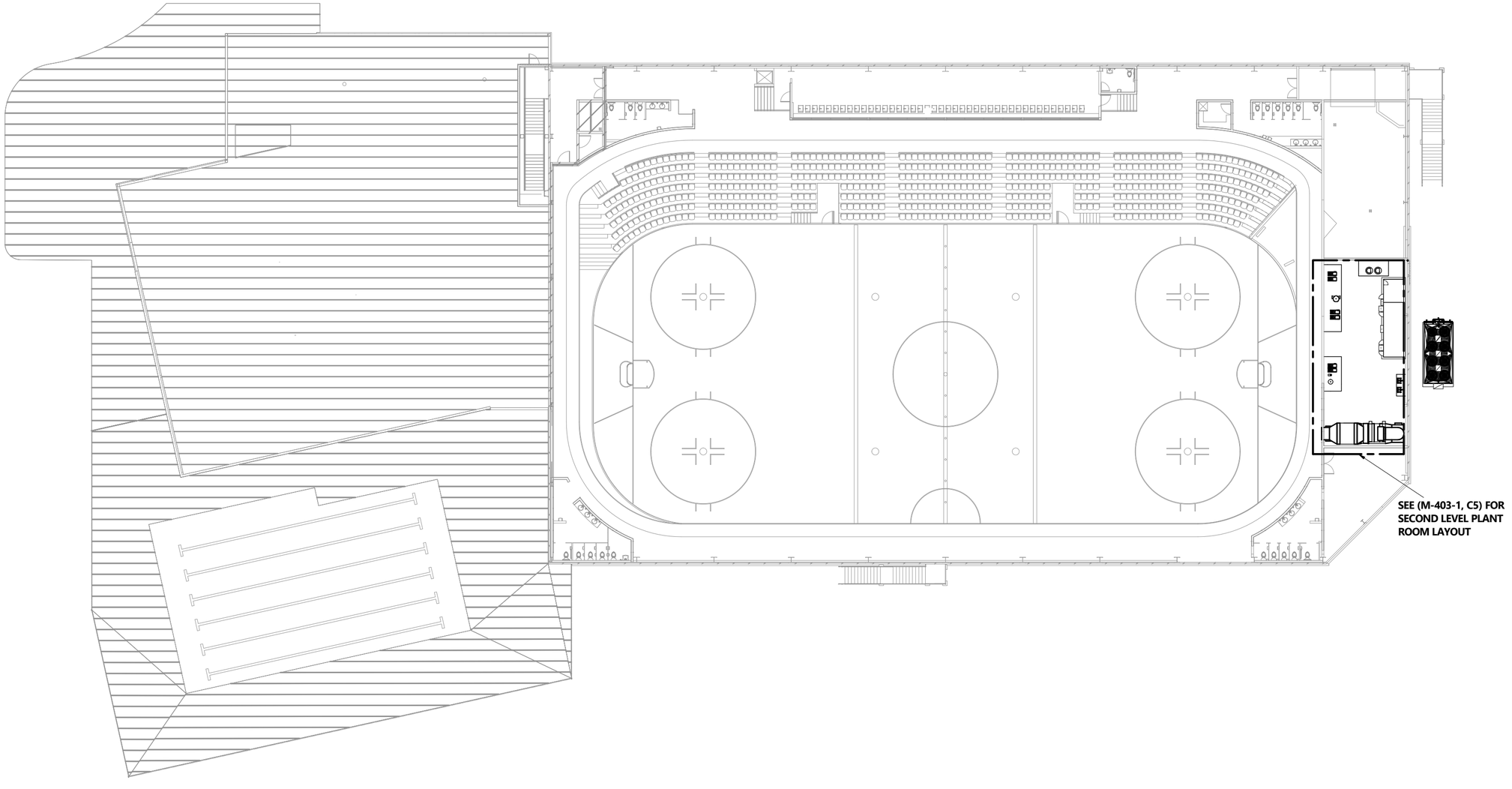

SECOND LEVEL LAYOUT
SCALE 1:300

SECOND LEVEL LAYOUT

NOTES

———	NEW
———	FOR REFERENCE

21010 M-101

REFERENCE DEFINITION

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SHEET NUMBER — (#, X#)

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DRAWING NUMBER
21010 M-101

DRAWING NAME
BUILDING LAYOUT

CLIENT
CITY OF CHARLOTTETOWN

PROJECT
SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
H. AKAR	J. RITCHIE
DATE	**REVISION**
25-NOV-22	1.0
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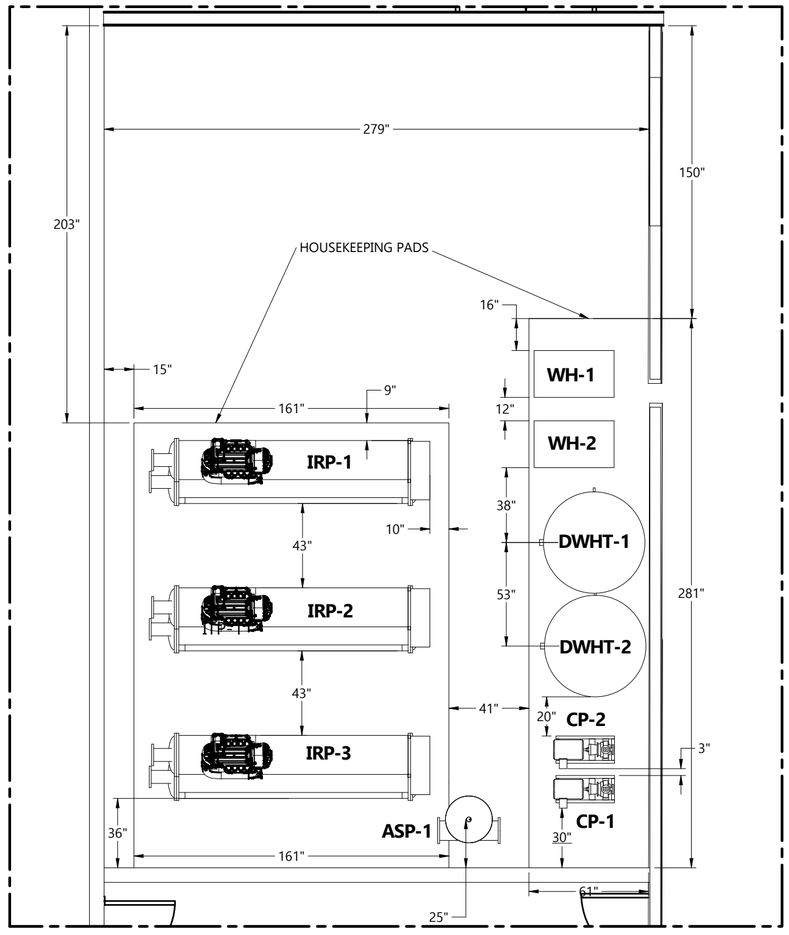
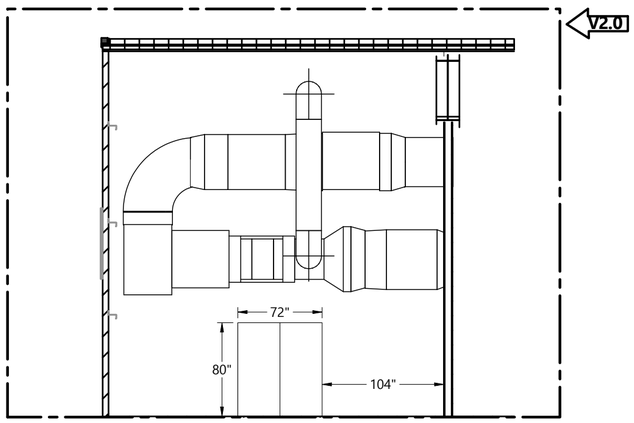


FIRST LEVEL PLANT ROOM
SCALE 1:60



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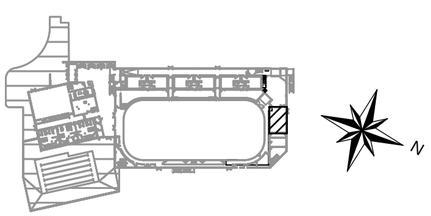

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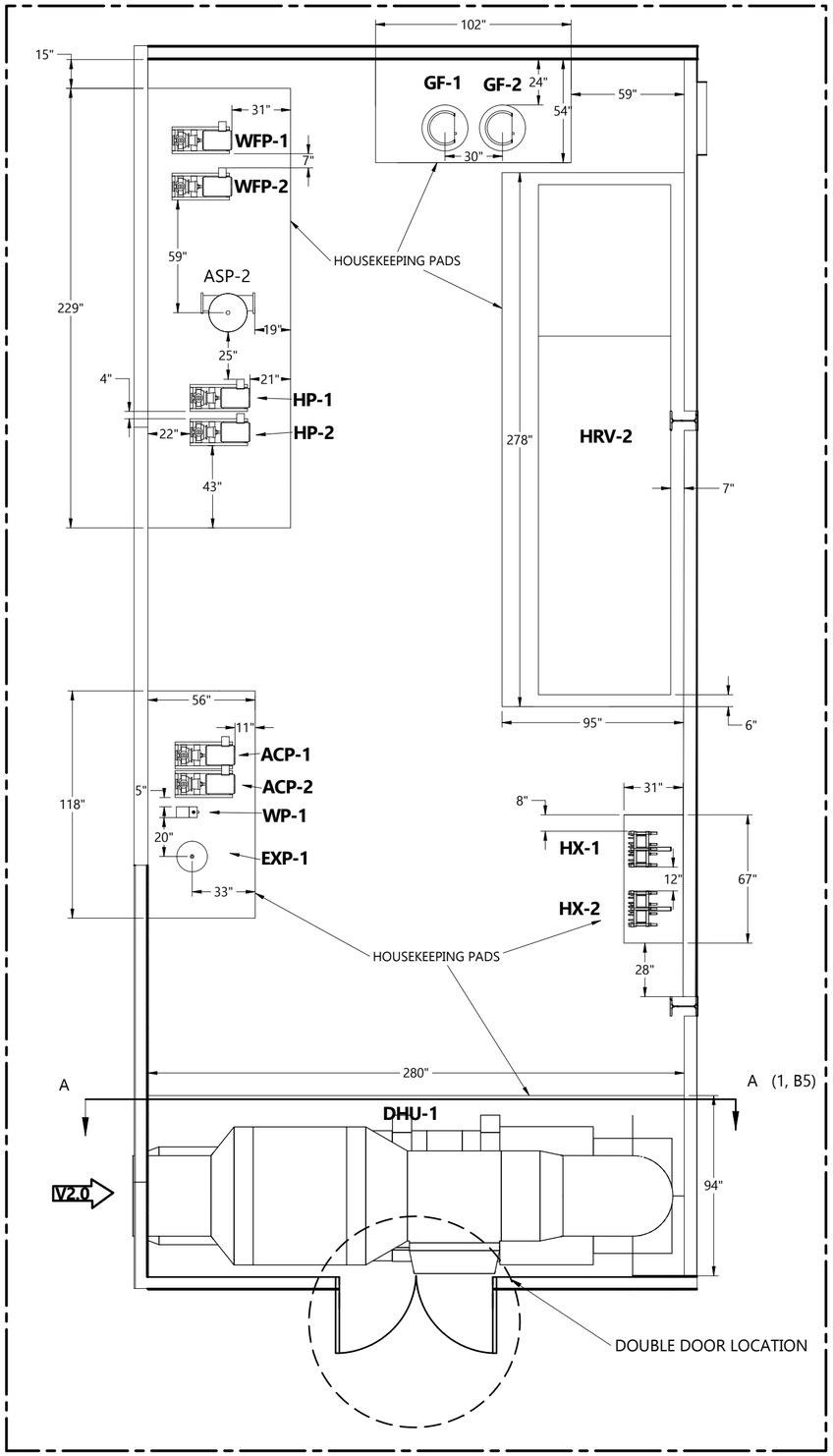

SECOND LEVEL PLANT ROOM
SCALE 1:60

NOTE:
- ALL HOUSEKEEPING PADS ARE TO BE 6" DEEP.
- PIPING REMOVED FOR CLARITY.

PLANT ROOM LAYOUT

NOTES

	NEW
	EXISTING

21010 M-403

REFERENCE DEFINITION
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VER #	REVISIONS	DATE	BY
2.0	EO #668	11-JAN-23	Z.M.
1.0	ISSUED FOR TENDER	25-NOV-22	H.A.

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VAUGHAN ON
REDINGTON SHORES FL

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STAMP

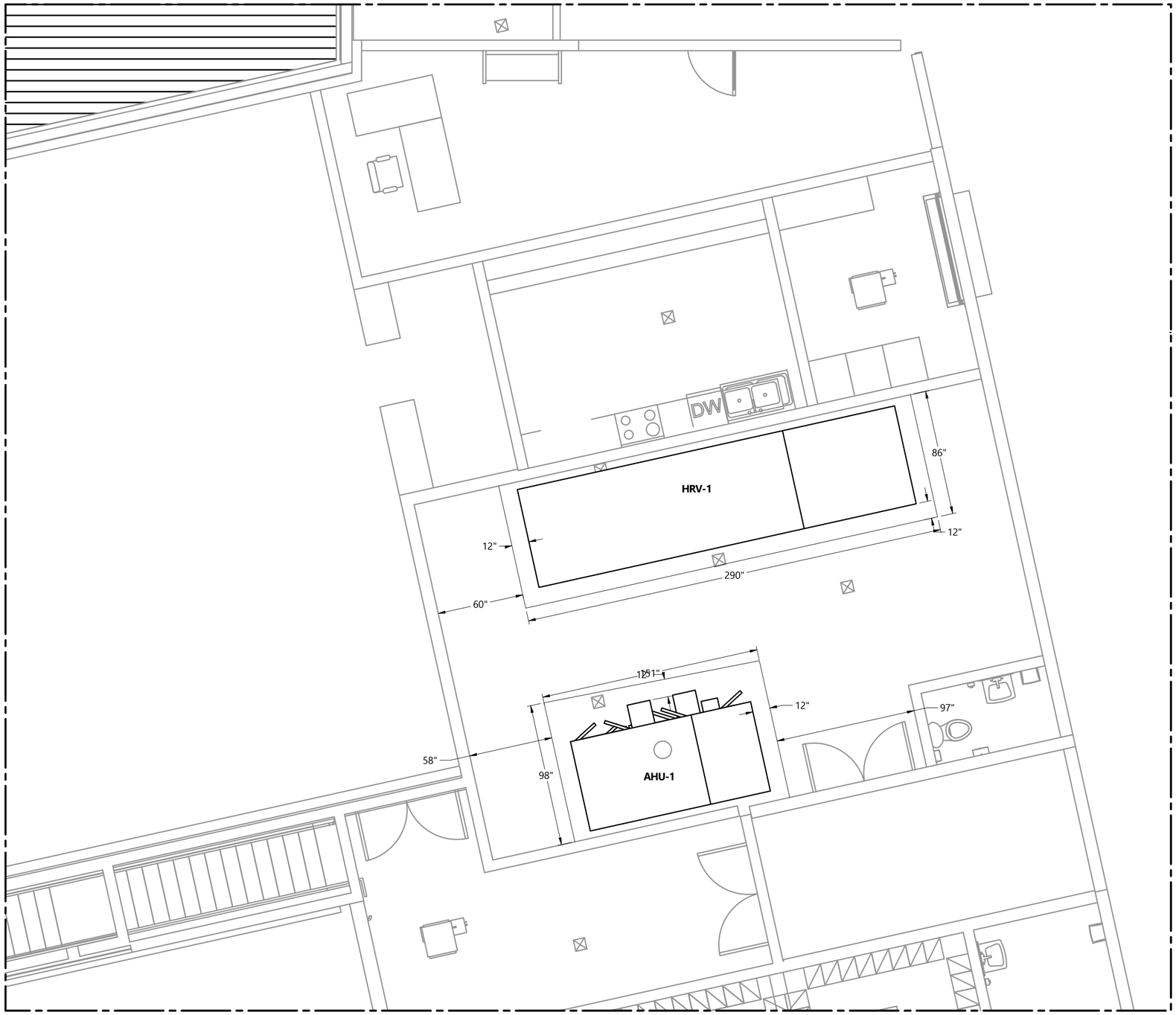
DRAWING NUMBER
21010 M-403

DRAWING NAME
PLANT ROOM LAYOUT

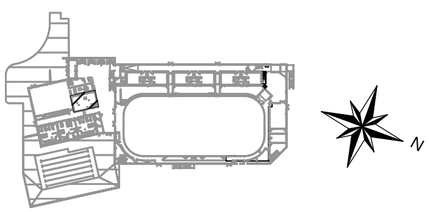
CLIENT
CITY OF CHARLOTTETOWN

PROJECT
SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
H. AKAR	J. RITCHIE
DATE	**REVISION**
11-JAN-23	2.0
SHEET SIZE	**SHEET NO.**
C	1 of 4



FRONT OF HOUSE MECHANICAL LAYOUT
SCALE 1:60



SITE KEY
SCALE 1:2000

FRONT OF HOUSE MECHANICAL LAYOUT

NOTE:
- ALL HOUSEKEEPING PADS ARE TO BE 6" DEEP.
- PIPING AND DUCTING REMOVED FOR CLARITY.

NOTES

	NEW
	EXISTING

21010 M-403

REFERENCE DEFINITION
SHEET COLUMN / SHEET ROW
SHEET NUMBER
(#, X#)

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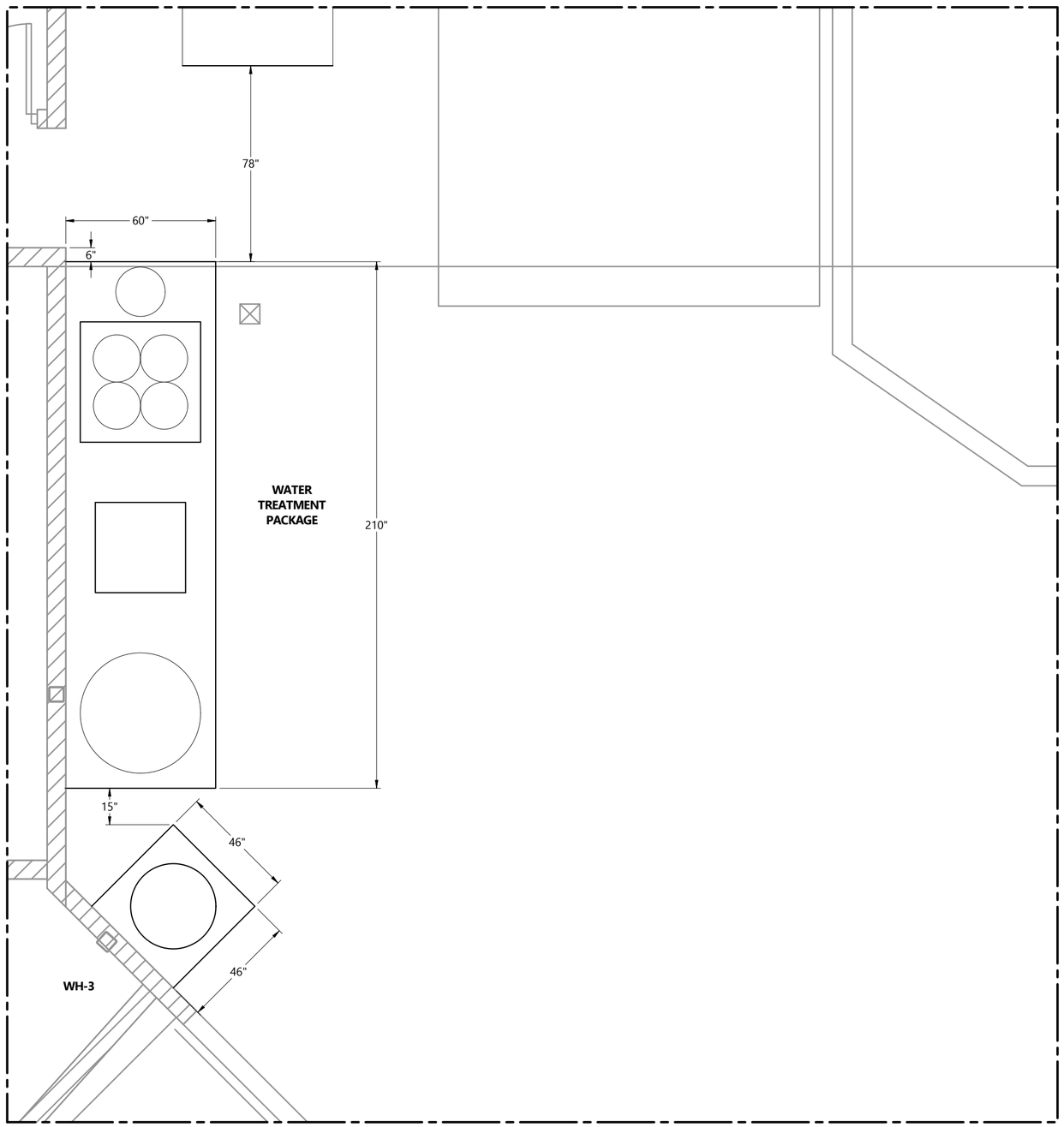
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	11-JAN-23
REVISION	2.0
SHEET SIZE	C
SHEET NO.	2 of 4



ICE RESURFACER ROOM
SCALE 1:40

ICE RESURFACER ROOM LAYOUT

NOTE:
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NOTES

———	NEW
———	EXISTING

21010 M-403

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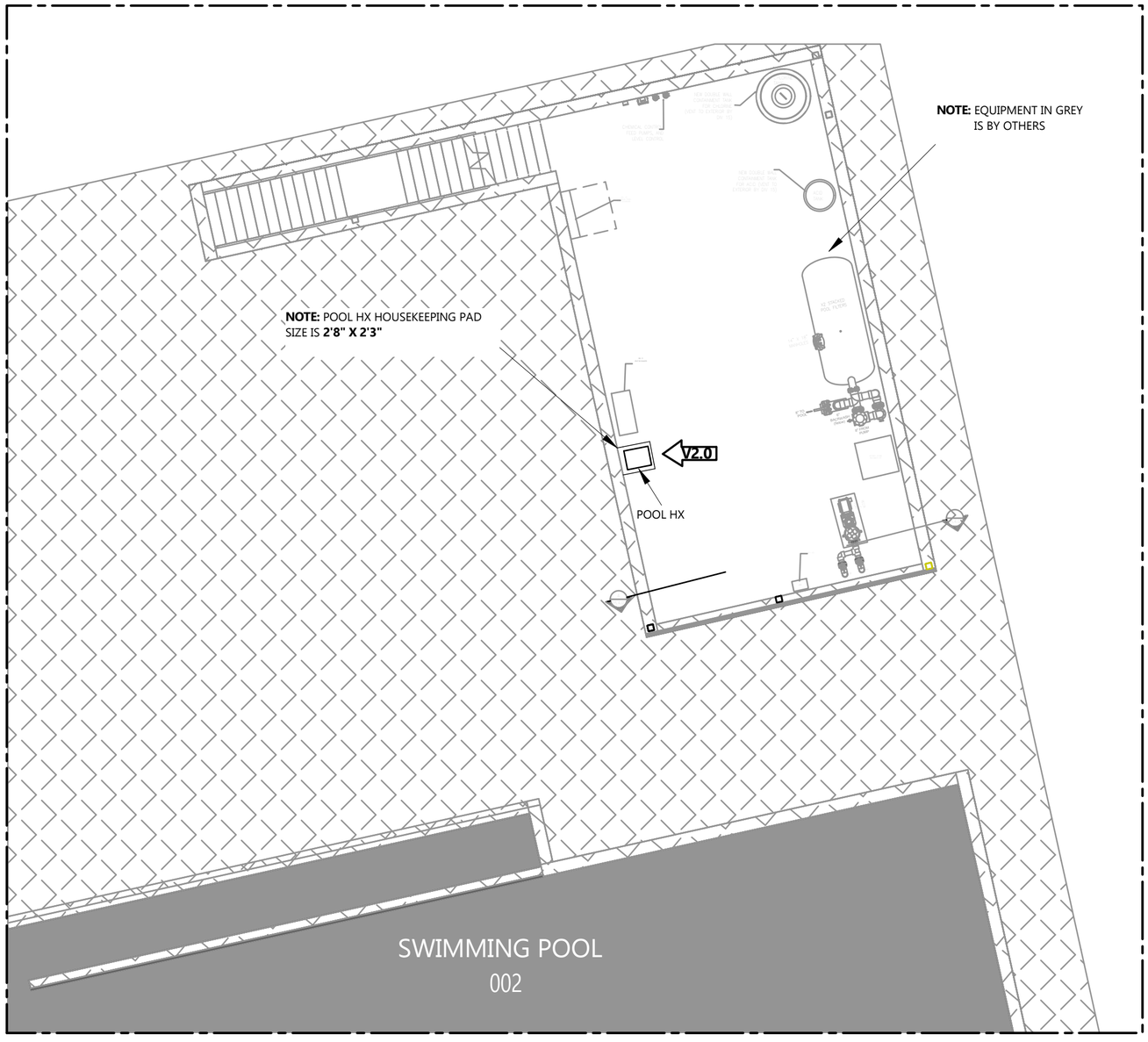
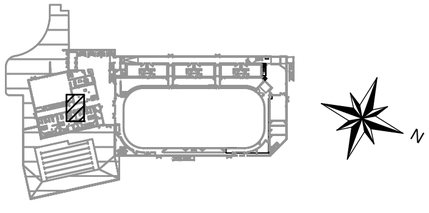
SHEET NO.	3 of 4



SWIMMING POOL MECHANICAL ROOM
SCALE 1:100



SITE KEY
SCALE 1:2000

SWIMMING POOL PLANT ROOM LAYOUT

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NOTES

———	NEW
———	EXISTING

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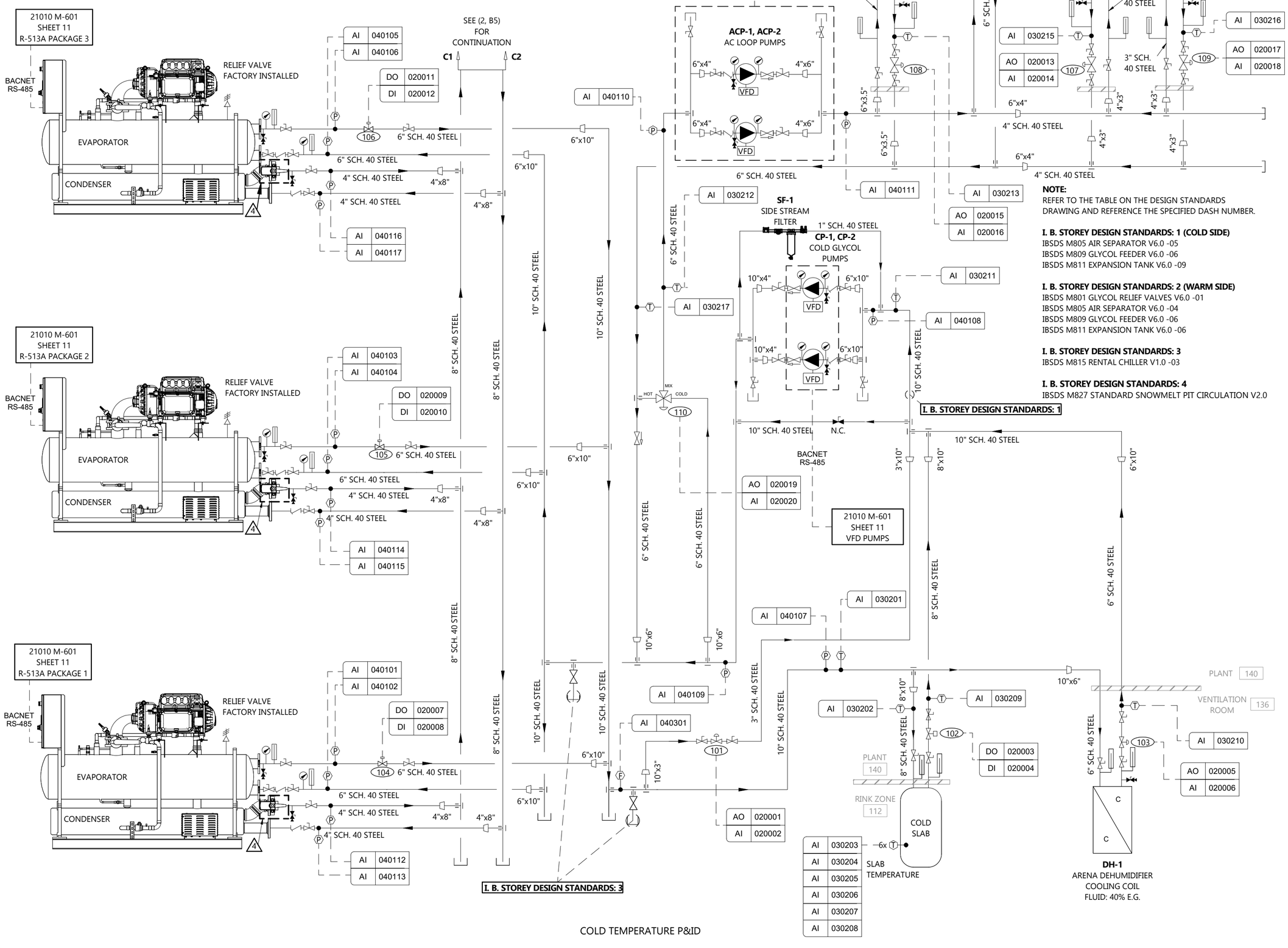
REVISION	2.0
SHEET SIZE	C
SHEET NO.	4 of 4

1. STRUCTURAL SUPPORT, CONCRETE PAD, AND PLUMBING TO DRAIN BY OTHERS.
2. COLD GLYCOL PIPING TO BE INSULATED AS PER TENDER SPECIFICATIONS.
3. OUTDOOR PRD DISCHARGE TO BE UNSTALLED IN LOCATION AWAY FROM PERSONNEL, 25 FT. FROM WINDOWS, BUILDING EXITS AND VENTILATION OPENINGS AND 15 FT. ABOVE GRADE OR ROOF LEVEL
4. MODULATING CONDENSER VALVE (FACTORY INSTALLED)
6. WATER CONNECTIONS BY OTHERS.



COLD TEMPERATURE P&ID

NOTE:
REFER TO THE TABLE ON THE DESIGN STANDARDS DRAWING AND REFERENCE THE SPECIFIED DASH NUMBER.

I. B. STOREY DESIGN STANDARDS: 1 (COLD SIDE)
IBSDS M805 AIR SEPARATOR V6.0 -05
IBSDS M809 GLYCOL FEEDER V6.0 -06
IBSDS M811 EXPANSION TANK V6.0 -09

I. B. STOREY DESIGN STANDARDS: 2 (WARM SIDE)
IBSDS M801 GLYCOL RELIEF VALVES V6.0 -01
IBSDS M805 AIR SEPARATOR V6.0 -04
IBSDS M809 GLYCOL FEEDER V6.0 -06
IBSDS M811 EXPANSION TANK V6.0 -06

I. B. STOREY DESIGN STANDARDS: 3
IBSDS M815 RENTAL CHILLER V1.0 -03

I. B. STOREY DESIGN STANDARDS: 4
IBSDS M827 STANDARD SNOWMELT PIT CIRCULATION V2.0

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR
F	FLOW METER
LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION
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2.0	EO #665	15-DEC-22	Z.M
1.0	ISSUED FOR TENDER	25-NOV-22	T.VW.

I.B. STOREY Rink Engineering Experts
151 GREAT GEORGE ST., SUITE 302
CHARLOTTETOWN, PEI, C1A 4K8

400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3

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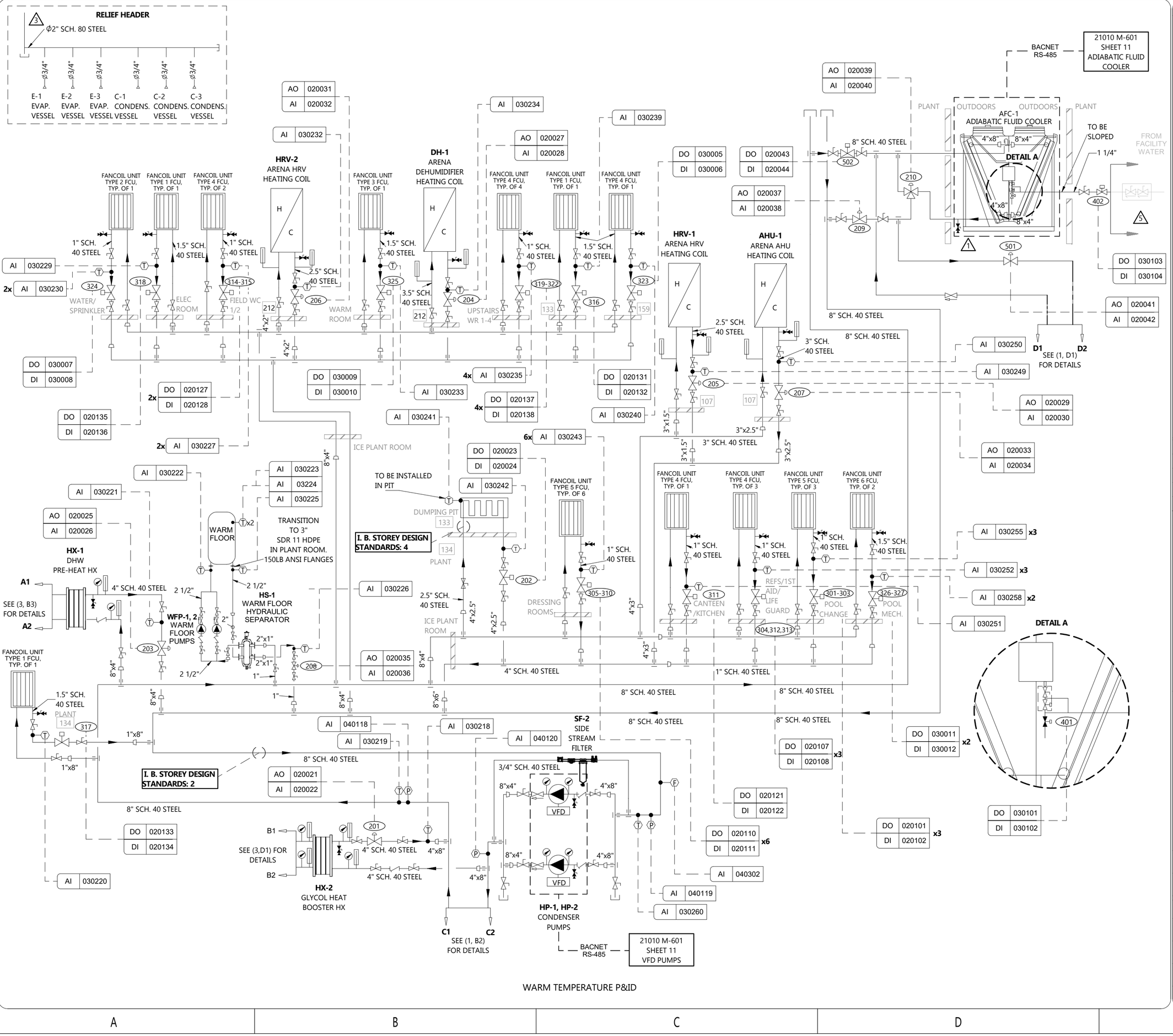
STAMP

DRAWING NUMBER	21010 M-601
DRAWING NAME	REFRIGERATION SCHEMATIC PACKAGE
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY: T.VANWINKLE	CHECKED BY: J.RITCHIE
DATE: 08-FEB-23	REVISION: 4.0
SHEET SIZE: C	SHEET NO.: 1 OF 14

21010 M-601



WARM TEMPERATURE P&ID

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR
F	FLOW METER
LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW

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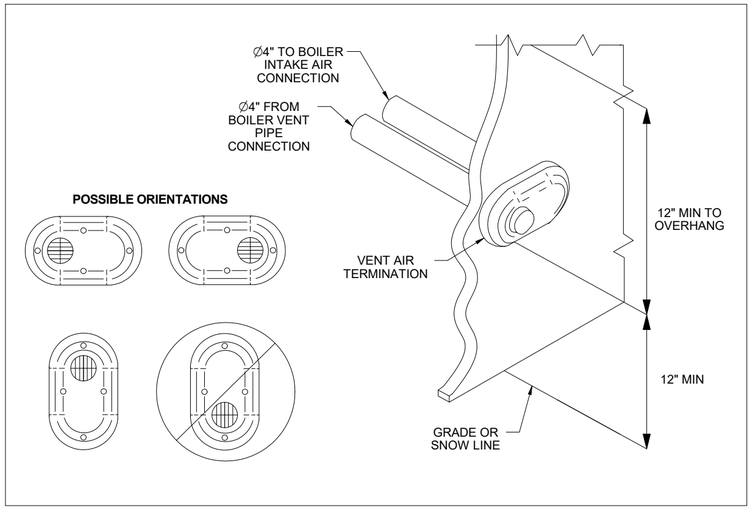
DATE	08-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	2 OF 14

21010 M-601

SIDEWALL TERMINATION OF AIR AND VENT



NOTE:
MINIMUM CLEARANCE TO WINDOW OR DOOR THAT MAY BE OPENED IS 36"

MINIMUM CLEARANCE TO SERVICE REGULATOR VENT OUTLET ABOVE A REGULATOR WITHIN 3 FT HORIZONTALLY OF THE VERTICAL CENTER LINE OF THE REGULATOR VENT OUTLET TO A MAXIMUM VERTICAL DISTANCE OF 15 FT

MINIMUM CLEARANCE TO NONMECHANICAL AIR SUPPLY INLET TO BUILDING OR THE COMBUSTION AIR INLET TO ANY OTHER APPLIANCE IS 36"

MINIMUM CLEARANCE TO A MECHANICAL AIR SUPPLY INLET IS 6 FT

MINIMUM CLEARANCE ABOVE PAVED SIDEWALK OR PAVED DRIVEWAY LOCATED ON PUBLIC PROPERTY IS 7 FT

MINIMUM CLEARANCE UNDER VERANDA, PORCH, DECK, OR BALCONY IS 12"

NOTE:
1. THE TOTAL LENGTH OF PIPING FOR VENT OR AIR MUST NOT BE LESS THAN 12 EQ. FT OR EXCEED 100 EQ. FT
2. THE SURROUNDINGS WHEN TERMINATING THE VENT AND AIR MUST BE CONSIDERED:
A. POSITION THE VENT TERMINATION WHERE VAPORS WILL NOT DAMAGE NEARBY SHRUBS, PLANTS OR AIR CONDITIONING EQUIPMENT OR BE OBJECTIONABLE.
B. THE FLUE PRODUCTS WILL FORM A NOTICEABLE PLUME AS THEY CONDENSE IN COLD AIR. AREAS WHERE THE PLUME COULD OBSTRUCT WINDOW VIEWS MUST BE AVOIDED.
C. PREVAILING WINDS COULD CAUSE FREEZING OF CONDENSATE AND WATER/ICE BUILDUP WHERE FLUE PRODUCTS IMPINGE ON BUILDING SURFACES OR PLANTS.
D. POSSIBILITY OF ACCIDENTAL CONTACT OF FLUE PRODUCTS WITH PEOPLE OR PETS MUST BE AVOIDED.
E. DO NOT LOCATE THE TERMINATIONS WHERE WIND EDDIES COULD AFFECT PERFORMANCE OR CAUSE RECIRCULATION, SUCH AS INSIDE BUILDING CORNERS, NEAR ADJACENT BUILDINGS OR SURFACES, WINDOW WELLS, STAIRWELLS, ALCOVES, COURTYARDS, OR OTHER RECESSED AREAS.
F. DO NOT TERMINATE ABOVE ANY DOOR OR WINDOW. CONDENSATE CAN FREEZE, CAUSING ICE FORMATIONS.
G. LOCATE OR GUARD VENT TO PREVENT CONDENSATE DAMAGE TO EXTERIOR FINISHES.
H. DO NOT LOCATE THE TERMINATIONS OVER PUBLIC WALKWAYS.
I. DO NOT LOCATE THE TERMINATIONS NEAR SOFFIT VENTS, CRAWL SPACE VENTS, OR OTHER AREAS WHERE CONDENSATE OR VAPOR COULD CREATE A NUISANCE, HAZARD, OR CAUSE PROPERTY DAMAGE.
J. DO NOT LOCATE THE TERMINATIONS WHERE CONDENSATE VAPOR COULD CAUSE DAMAGE OR COULD BE DETRIMENTAL TO THE OPERATION OF REGULATORS, RELIEF VALVES, OR OTHER EQUIPMENT.
K. TERMINATIONS MUST BE LOCATED A MINUMUM OF 12" ABOVE GRADE OR MAXIMUM SNOW LINE.

VENT MUST TERMINATE:
• AT LEAST 6 FEET FROM ADJACENT WALLS.
• NO CLOSER THAN 12 INCHES BELOW ROOF OVERHANG.

AIR INLET MUST TERMINATE AT LEAST 12 INCHES ABOVE GRADE OR SNOW LINE; AT LEAST 12 INCHES BELOW THE VENT TERMINATION;

DO NOT TERMINATE CLOSER THAN 4 FEET HORIZONTALLY FROM ANY ELECTRIC METER, GAS METER, REGULATOR, RELIEF VALVE, OR OTHER EQUIPMENT. NEVER TERMINATE ABOVE OR BELOW ANY OF THESE WITHIN 4 FEET HORIZONTALLY.

WATER HEATING

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR
F	FLOW METER
LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION
SHEET COLUMN / SHEET NUMBER — SHEET ROW
(#, X#)

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400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3

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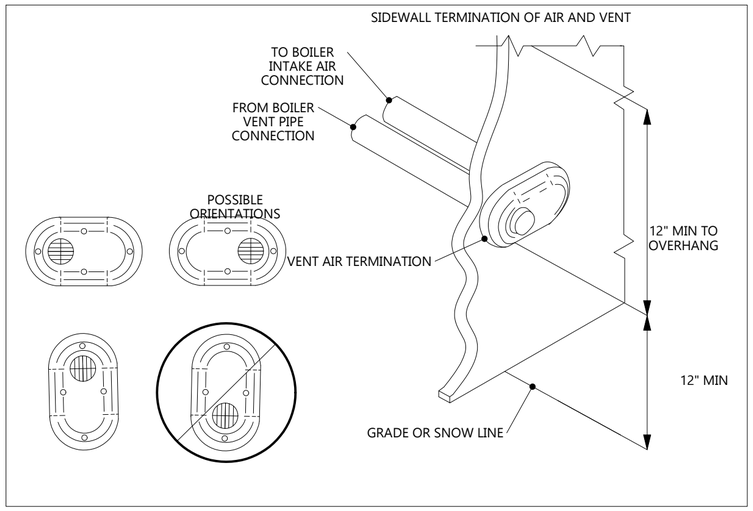
STAMP

DRAWING NUMBER	21010 M-601
DRAWING NAME	REFRIGERATION SCHEMATIC PACKAGE
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	T.VANWINKLE
CHECKED BY	J.RITCHIE
DATE	08-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	3 OF 14

21010 M-601



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F. DO NOT TERMINATE ABOVE ANY DOOR OR WINDOW. CONDENSATE CAN FREEZE, CAUSING ICE FORMATIONS.
G. LOCATE OR GUARD VENT TO PREVENT CONDENSATE DAMAGE TO EXTERIOR FINISHES.
H. DO NOT LOCATE THE TERMINATIONS OVER PUBLIC WALKWAYS.
I. DO NOT LOCATE THE TERMINATIONS NEAR SOFFIT VENTS, CRAWL SPACE VENTS, OR OTHER AREAS WHERE CONDENSATE OR VAPOR COULD CREATE A NUISANCE, HAZARD, OR CAUSE PROPERTY DAMAGE.
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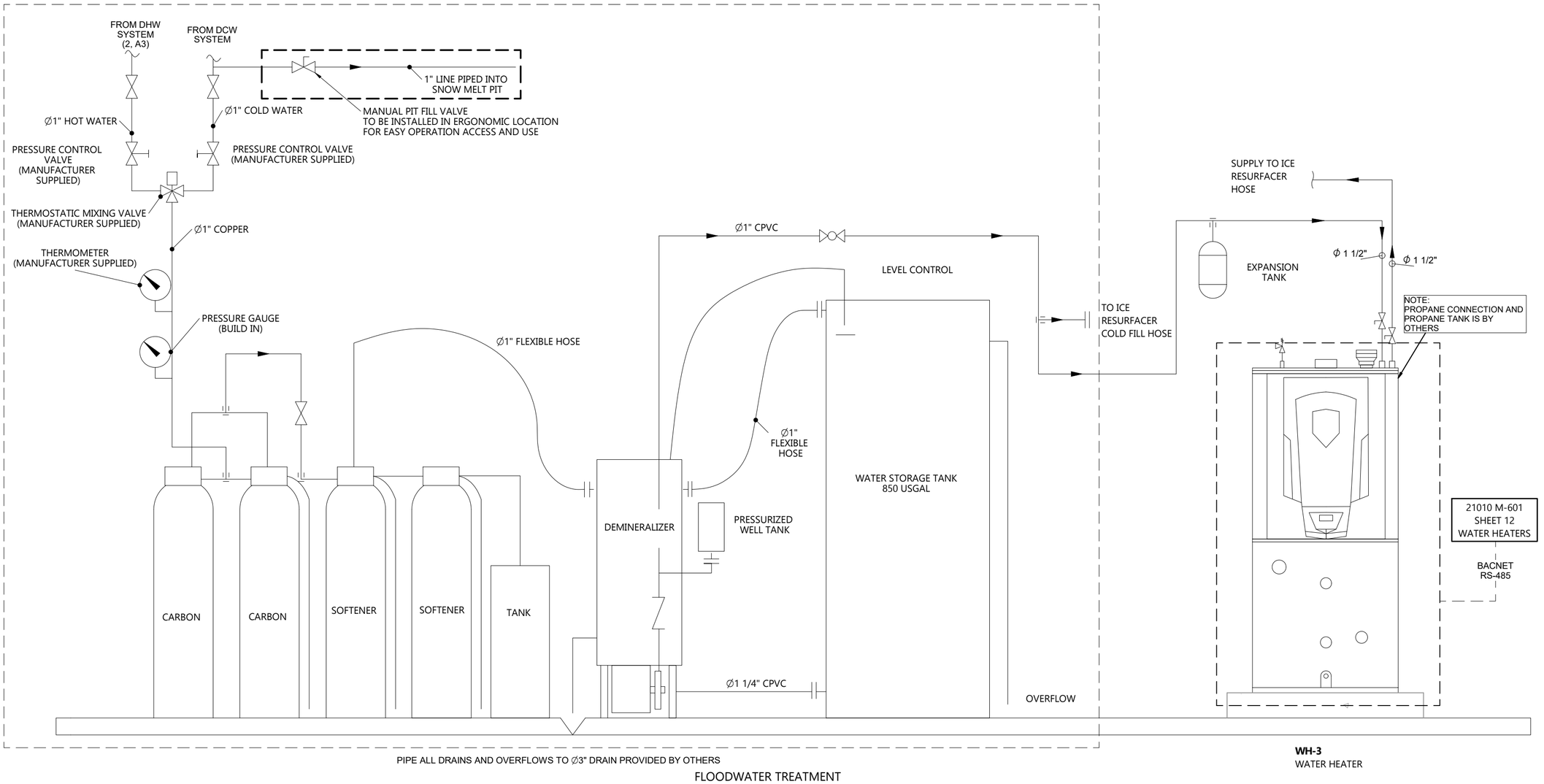
ICE RESURFACER WATER TREATMENT PACKAGE



FLOODWATER TREATMENT

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR
F	FLOW METER
LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

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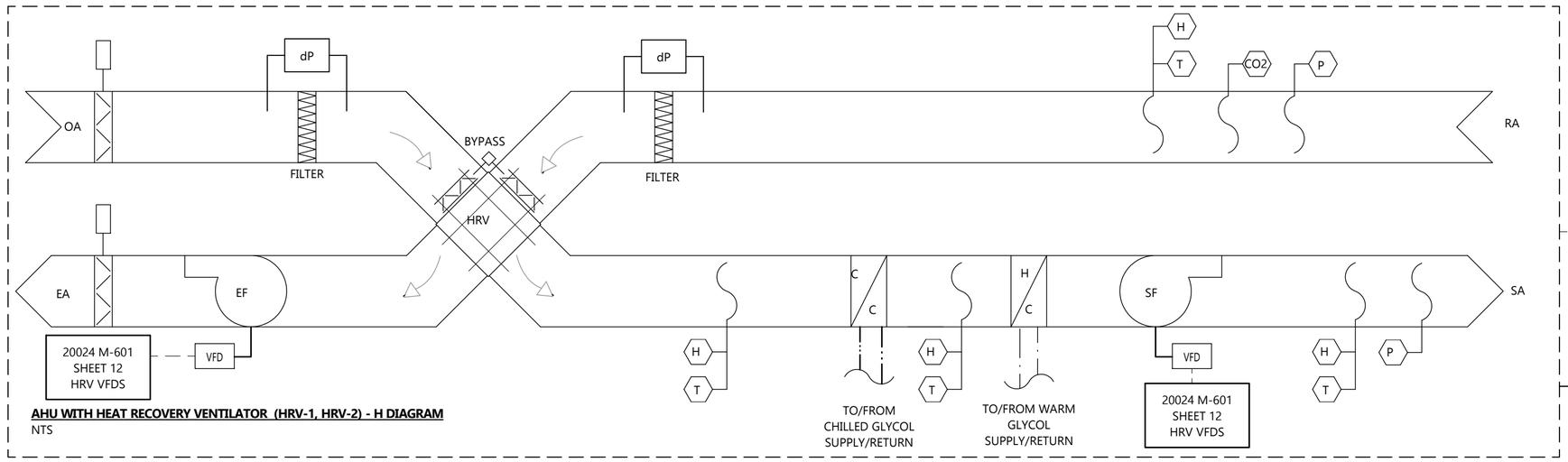
CLIENT CITY OF CHARLOTTETOWN

PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
T.VANWINKLE	J.RITCHIE
DATE 08-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 4 OF 14

21010 M-601



AHU WITH HEAT RECOVERY VENTILATOR (HRV-1, HRV-2) - H DIAGRAM
NTS

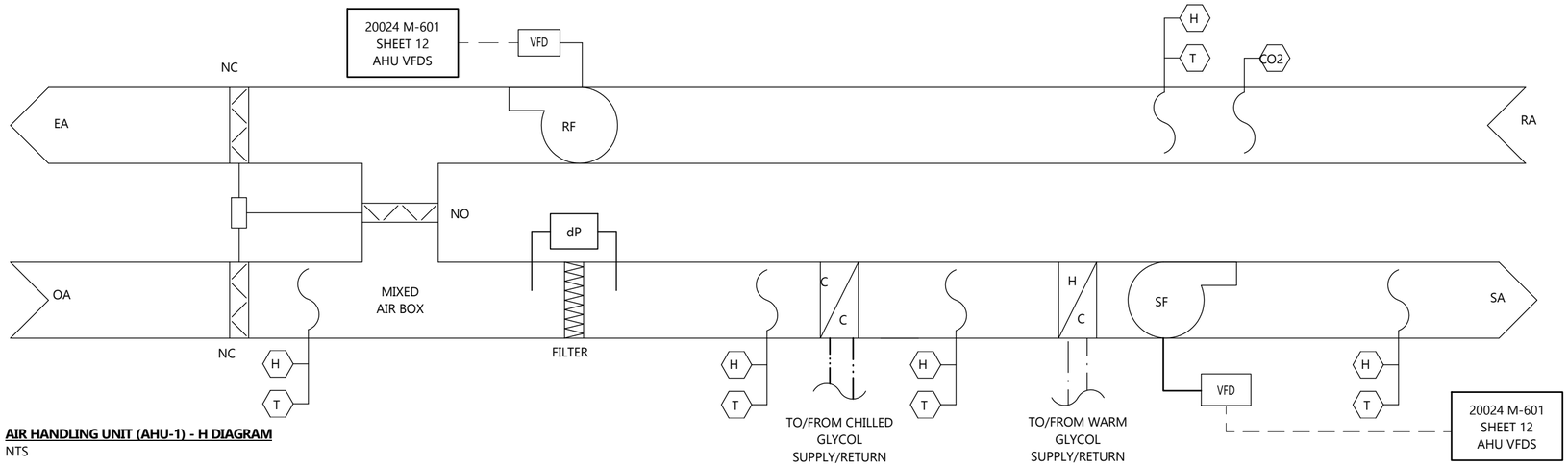
20024 M-601
SHEET 14
HRV-1

20024 M-601
SHEET 14
HRV-2

BACNET
RS-485

A

SINGLE POINT OF POWER
ENTERANCE



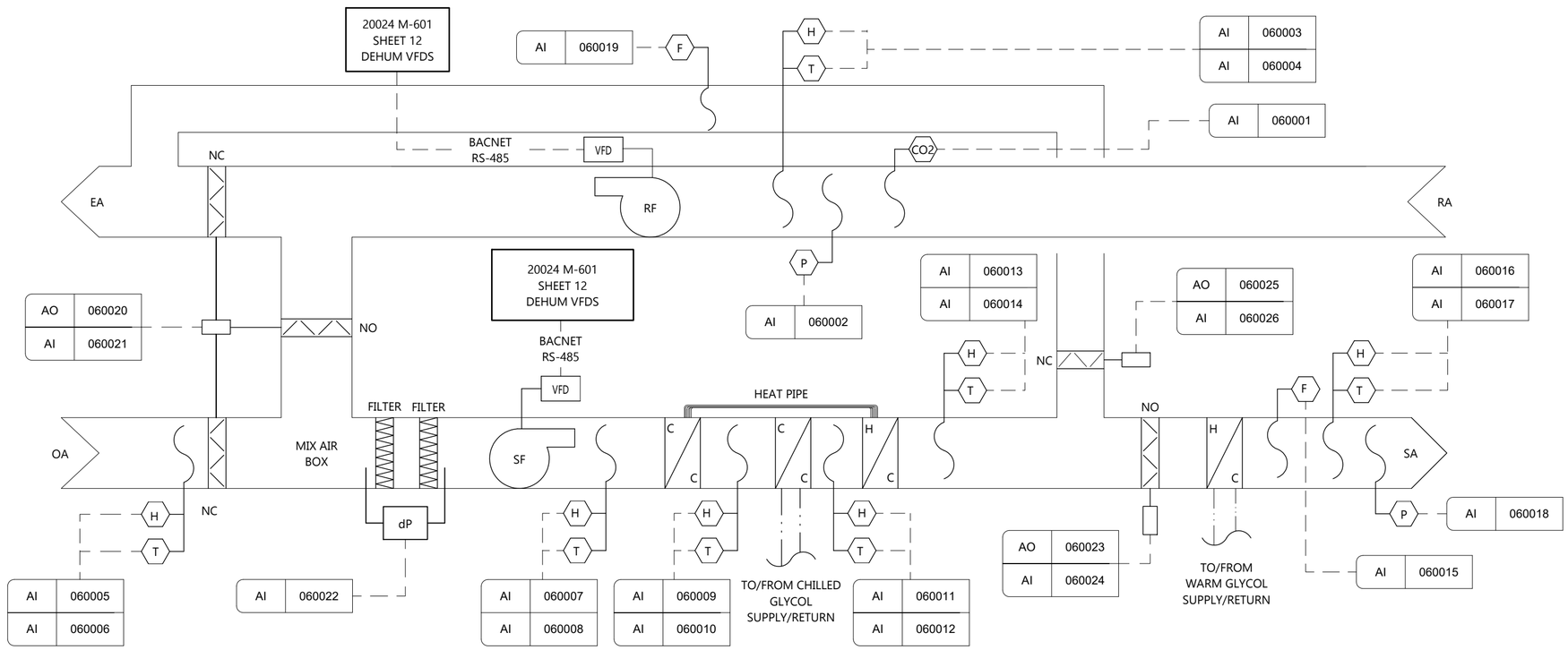
AIR HANDLING UNIT (AHU-1) - H DIAGRAM
NTS

20024 M-601
SHEET 14
AHU-1

BACNET
RS-485

A

SINGLE POINT OF POWER
ENTERANCE



V3.0 **DEHUMIDIFIER (DH-1) - H DIAGRAM**
NTS

VENTILATION H DIAGRAMS

NOTES

	NEW
	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
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LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

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CLIENT
CITY OF CHARLOTTETOWN

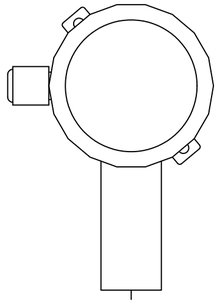
PROJECT
SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
T.VANWINKLE	J.RITCHIE
DATE	**REVISION**
08-FEB-23	4.0
SHEET SIZE	**SHEET NO.**
C	5 OF 14

21010 M-601

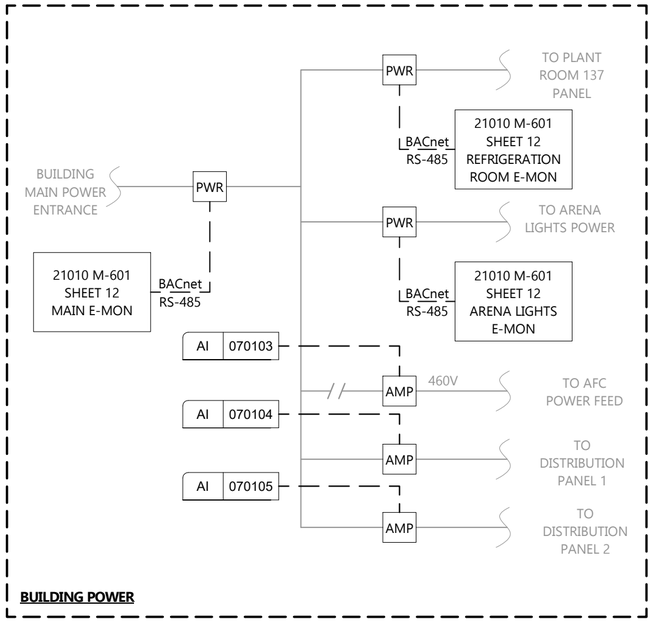
INSTALLATION NOTES:

1) INSTALLED ON EXTERIOR OUT OF DIRECT SUNLIGHT.

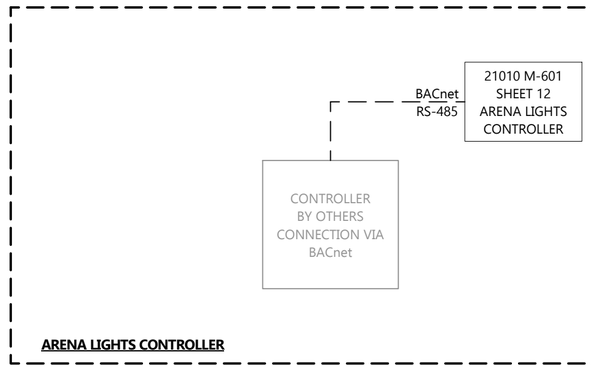


AI	070101
AI	070102

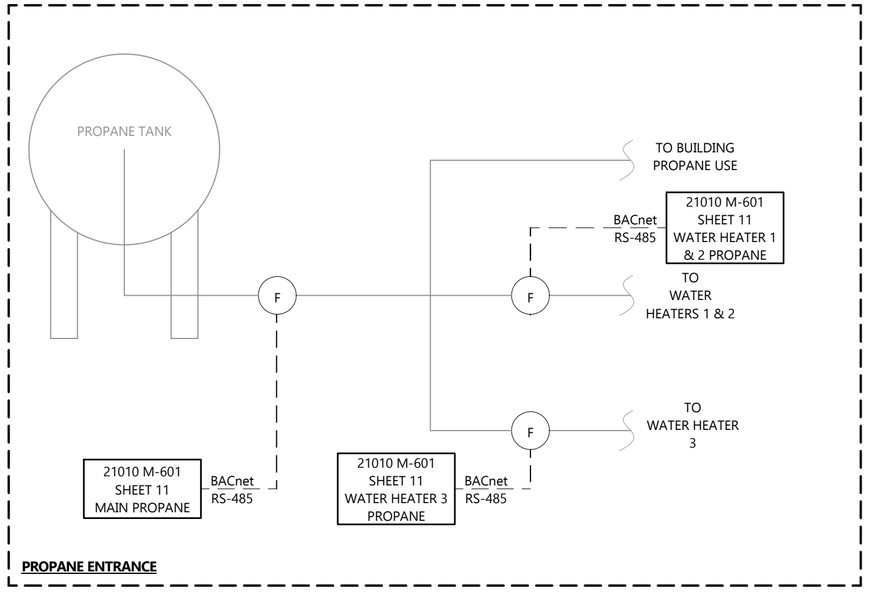
OUTDOOR SENSOR



BUILDING POWER



ARENA LIGHTS CONTROLLER



PROPANE ENTRANCE

MISC. ITEMS

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR
F	FLOW METER
LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW — (#, X#)

- NOT FOR CONSTRUCTION -

CONFIDENTIAL & PROPRIETARY

VER #	REVISIONS	DATE	BY
4.0	EO #682	08-FEB-23	T.VW.
3.0	EO #668	11-JAN-23	T.VW.
2.0	EO #665	15-DEC-22	Z.M
1.0	ISSUED FOR TENDER	25-NOV-22	T.VW.

I.B. STOREY Rink Engineering Experts
151 GREAT GEORGE ST., SUITE 302
CHARLOTTETOWN, PEI, C1A 4K8

400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3

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STAMP

DRAWING NUMBER
21010 M-601

DRAWING NAME
REFRIGERATION SCHEMATIC PACKAGE

CLIENT
CITY OF CHARLOTTETOWN

PROJECT
SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

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C	6 OF 14

21010 M-601

ICE REFRIGERATION PACKAGE SCHEDULE

UNIT NO.	SERVICE	REFRIGERANT	COMPRESSOR DATA		CAPACITY, TR	EVAPORATOR DATA					CONDENSER DATA				POWER (KW)	VOLT/PHASE /HZ	MCA	MOP	EST. OPERATING WEIGHT, LB	LxWxH, IN	MANUFACTURER AND MODEL NO.
			NO. COMPRESSORS	NO. CIRCUITS		GPM	FLUID	EGT, F	LGT, F	FT. H20	GPM	FLUID	LGT, F	FT. H20							
IRP-1	ICE REFRIGERATION PKG	R513A	1	1	50	467	40% E. GLYCOL	13	10	33	220	40% E. GLYCOL	93	25	64.1	460/3/60	230	250	5,587	144.1 x 33.3 x 74.15	THERMAL CARE TCFW375
IRP-2	ICE REFRIGERATION PKG	R513A	1	1	50	467	40% E. GLYCOL	13	10	33	220	40% E. GLYCOL	93	25	64.1	460/3/60	230	250	5,587	144.1 x 33.3 x 74.15	THERMAL CARE TCFW375
IRP-3	ICE REFRIGERATION PKG	R513A	1	1	50	467	40% E. GLYCOL	13	10	33	220	40% E. GLYCOL	93	25	64.1	460/3/60	230	250	5,587	144.1 x 33.3 x 74.15	THERMAL CARE TCFW375

FLUID COOLER SCHEDULE

UNIT NO.	SERVICE	TOWER FLOW, GPM	MBH	DB, F	WB, F	FLUID	EGT, F	LGT, F	FT. H20	POWER (KW)	VOLT/PHASE/HZ	EST. OPERATING WEIGHT, LB	LxWxH, IN	MANUFACTURER AND MODEL NO.
AFC-1	FLUID COOLER	660	2,986	79.5	73.7	40% E. GLYCOL	105	95	11.5	29.7	575/3/60	9,410	243 13/16 x 101 5/8 x 111 1/16	GUNTNER GFD 090.2A2x4/6AA-E371H/02P.M

V3.0

PUMP SCHEDULE

UNIT NO.	SERVICE	FLUID	FLOW, GPM	FT. H20	MOTOR HP	RPM	VOLT/PHASE/HZ	VFD	EST. WEIGHT, LB	LxWxH, IN	MANUFACTURER AND MODEL NO.	SUCTION GUIDE	TDV
CP-1	COLD GLYCOL PUMP	40% E. GLYCOL	700	91	25	1,739	575/3/60	YES	604	48X19X26.5	ARMSTRONG 4030 -5x4x10	SG-65	FTV-6FA
CP-2	COLD GLYCOL PUMP	40% E. GLYCOL	700	91	25	1,739	575/3/60	YES	604	48X19X26.5	ARMSTRONG 4030 -5x4x10	SG-65	FTV-6FA
HP-1	CONDENSER PUMP	40% E. GLYCOL	330	96	15	1,851	575/3/60	YES	445	45x16x20.75	ARMSTRONG 4030 - 3x2.5x10	SG-63	FTV-4FA
HP-2	CONDENSER PUMP	40% E. GLYCOL	330	96	15	1,851	575/3/60	YES	445	45x16x20.75	ARMSTRONG 4030 - 3x2.5x10	SG-63	FTV-4FA
WFP-1	WARM FLOOR PUMP	40% E. GLYCOL	30	23	0.75	1,760	575/3/60	NO	109	30x14x14.75	ARMSTRONG 4030 - 1.5x1x6	SG-215TF	FTV-2GS
WFP-2	WARM FLOOR PUMP	40% E. GLYCOL	30	23	0.75	1,760	575/3/60	NO	109	30x14x14.75	ARMSTRONG 4030 - 1.5x1x6	SG-215TF	FTV-2GS
ACP-1	AC LOOP PUMP	40% E. GLYCOL	160	63.2	5	1,727	575/3/60	YES	270	30x14x20.75	ARMSTRONG 4030 - 3x2x10	SG-43	FTV-4FS
ACP-2	AC LOOP PUMP	40% E. GLYCOL	160	63.2	5	1,727	575/3/60	YES	270	30x14x20.75	ARMSTRONG 4030 - 3x2x10	SG-43	FTV-4FS
WP-1	BACK-UP HX WATER PUMP	DOMESTIC HOT WATER	68	35.1	1.5	3,480	240/1/60	NO	21	15x8.35x10.2	GRUNDFOS CME 10-1 A-R-I-E-AVBE U-A-D-N	-	-

I.B. STOREY DESIGN STANDARDS SCHEDULE

UNIT NO.	QTY.	SERVICE	MAX FLOW, USGPM	MANUFACTURERS AND MODEL NO.	ACCEPTANCE VOLUME, USGAL	VOLUME, USGAL	SHIPPING WEIGHT, LB
AIR SEPARATOR	1	COLD SIDE	1401	VASASME VA-10-U	-	-	237
AIR SEPARATOR	1	WARM SIDE	660	VASASME VA-8-U	-	-	228
EXPANSION TANK	1	COLD SIDE	-	ARMSTRONG AX-180V	73	90	283
EXPANSION TANK	1	WARM SIDE	-	ARMSTRONG AX-100V	48.5	60	175
GLYCOL FEEDER	1	COLD SIDE	-	AXIOM SF-100L	-	100	50
GLYCOL FEEDER	1	WARM SIDE	-	AXIOM SF-100L	-	100	50

WATER HEATER SCHEDULE

UNIT NO.	FLUID	QTY	INPUT MBH	FUEL	EFFICIENCY	MANUFACTURER AND MODEL NO.
WH-1	POTABLE WATER	1	800	PROPANE	98%	LOCHINVAR AWH0800LPM
WH-2	POTABLE WATER	1	800	PROPANE	98%	LOCHINVAR AWH0800LPM
WH-3	POTABLE WATER	1	285	PROPANE	95%	LOCHINVAR SWR285P

WATER TANK SCHEDULE

UNIT NO.	FLUID	QTY	CAPACITY (USGAL)	MANUFACTURER AND MODEL NO.
DHWT-1	POTABLE WATER	1	650	LOCHINVAR RCA0650
DHWT-2	POTABLE WATER	1	650	LOCHINVAR RCA0650

HEAT EXCHANGER SCHEDULE

V4.0

UNIT NO.	SERVICE	CAPACITY, MBH	SIDE 1					SIDE 2					MANUFACTURER AND MODEL NO.
			USGPM	FLUID	EWT (°F)	LWT (°F)	FT. H20	USGPM	FLUID	EFT (°F)	LFT (°F)	FT. H20	
HX-1	DHW PREHEAT	962	45	WATER	50	93	1.3	214	40% E. GLYCOL	105	95	22.6	SEC HEAT EXCHANGERS SEC-521-28
HX-2	BACK-UP HEATING	1,371	73	WATER	145	107	1.2	306	40% E. GLYCOL	95	105	20.1	SEC HEAT EXCHANGERS SEC-522-36
HX-3	POOL HEATING	2,439	290	WATER	65.12	82	3.4	515	40% E. GLYCOL	105	95	12.6	SEC HEAT EXCHANGERS SEC-522-63

ROOFTOP LOUVER SCHEDULE

V3.0

V2.0

TAG	AREA SERVED	MANUFACTURER	MODEL	APPLICATION	THROAT WIDTH	LxWxH (IN)	VOLUME (CFM)	PRESSURE DROP (IN. WG)	THROAT VELOCITY (FT/MIN)
IL-1	HRV-1	GREENHECK	GRSI-36	INTAKE	36	56.25x56.25x33.25	2,942	0.04	401
IL-2	AHU-1	GREENHECK	GRSI-42	INTAKE	42	63.25x63.25x36.25	4,986	0.06	490
IL-8	POOL MECH ROOM	GREENHECK	GRSI-24	INTAKE	24	38.25x38.25x23	1,406	0.033	434
EL-1	HRV-1	GREENHECK	GRSR-30	RELIEF	30	48x48x30.75	2,942	0.067	589
EL-2	AHU-1	GREENHECK	GRSR-36	RELIEF	36	56.25x56.25x33.25	4,986	0.085	657

LOUVER SCHEDULE

V2.0

V2.0

TAG	AREA SERVED	MANUFACTURER	MODEL	APPLICATION	LxWxH (IN)	VOLUME (CFM)	PRESSURE DROP (IN. WG)	FREE AREA VELOCITY (FT/MIN)	FREE AREA (SQ. FT.)
IL-3	HRV-2/DH-1	GREENHECK	ESD-635-84x84	INTAKE	84x84x6	15,989	0.03	511	31.3
IL-5	ICE PLANT ROOM	GREENHECK	ESD-635-48x48	INTAKE	48x48x6	4,129	0.03	439	9.4
IL-6	ICE RESURFACE ROOM	GREENHECK	ESD-635-16x16	INTAKE	16x16x6	280	0.04	491	0.6
IL-7	ELECTRICAL ROOM	GREENHECK	ESD-435-18x18	INTAKE	18x18x4	423	0.04	478	0.9
EL-3	HRV-2/DH-1	GREENHECK	ESD-635-84x84	EXHAUST	84x84x6	15,989	0.03	511	31.3
EL-5	ICE PLANT ROOM	GREENHECK	ESD-635-48x48	EXHAUST	48x48x4	4,129	0.03	463	8.9
EL-6	ICE RESURFACE ROOM	GREENHECK	ESD-635-16x16	EXHAUST	16x16x2	280	0.04	550	0.5
EL-7	ELECTRICAL ROOM	GREENHECK	ESD-635-18x18	EXHAUST	18x18x6	423	0.04	537	0.8

EQUIPMENT SCHEDULES - 1

NOTES

———	NEW
———	EXISTING

21010 M-601

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
(P)	PRESSURE SENSOR
(T)	TEMPERATURE SENSOR
(F)	FLOW METER
(LS)	LEVEL SWITCH
(R)	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW

(#, X#)

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DRAWING NAME REFRIGERATION SCHEMATIC PACKAGE

CLIENT CITY OF CHARLOTTETOWN

PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
T.VANWINKLE	J.RITCHIE
DATE 08-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 7 OF 14

EXHAUST FAN SCHEDULE

TAG	AREA SERVED	MANUFACTURER	MODEL	DRIVE TYPE	AIRFLOW (CFM)	TOTAL EXTERNAL SP (IN. WG)	FAN RPM	BHP	VOLT/PHASE/HZ	SONES (INLET)	dBA
EF-1	ICE PLANT ROOM	GREENHECK	SBE-2H24	BELT	4,129	0.32	1,056	0.53	115/1/60	22	73
EF-2	ICE RESURFACER ROOM	GREENHECK	SE1-12-432-VG	DIRECT	280	0.14	783	0.02	115/1/60	3.2	43
EF-3	ELECTRICAL ROOM	GREENHECK	SE1-12-432-VG	DIRECT	423	0.16	423	0.04	115/1/60	4.1	45
EF-4	POOL MECH ROOM	TWIN CITY FAN	14WA3B	BELT	1423	0.375	1418	0.25	115/1/60	17.6	81
EF-5	ELEVATOR	GREENHECK	SE1-12-436-VG	DIRECT	636	0.1	1021	0.02	115/1/60	3.4	43

V3.0

V2.0

HYDRAULIC SEPARATOR SCHEDULE

TAG	FLUID	QTY.	SIZE, IN	CAPACITY, GPM	MANUFACTURER AND MODEL NO.
HS-1	40% E. GLYCOL	1	2	60	CALEFFI 548052A

V3.0 CABINIT UNIT HEATER SCHEDULE

QTY	MANUFACTURER/MODEL NO.	TYPE	EGT (°F)	GLYCOL FLOW (GPM)	GLYCOL PD (FT. H20)	ENTERING AIR (°F)	HEATING OUTPUT (MBH)	ELECTRIC MOTOR			AIRFLOW (CFM)	E.S.P (IN. WG)	MCA	MROPD	COMMENTS
								HP	VOLT/HZ	QTY					
3	DAIKIN FUHH108	TYPE 1	103	8.1	0.85	41	35.8	1/8	115/60	1	1550	0	1.58	15	-
1	DAIKIN FHHC202	TYPE 2	105	0.4	0.1	61	3.664	1/20	115/60	1	318	0	1.5	15	HORIZONTAL CABINET WITH BOTTOM SUPPLY/RETURN, DISCONNECT, 3 SPEED MANUAL SPEED SWITCH
1	DAIKIN FHHH202	TYPE 3	105	0.4	0.1	61	3.611	1/20	115/60	1	295.5	0.1	1.5	15	HORIZONTAL HIDEAWAY, DISCONNECT, 3 SPEED MANUAL SPEED SWITCH
11	DAIKIN FHHR202	TYPE 4	105	0.4	0.1	61	3.664	1/20	115/60	1	318	0.1	1.5	15	HORIZONTAL RECESSED WITH BOTTOM SUPPLY/RETURN, DISCONNECT, 3 SPEED MANUAL SPEED SWITCH
9	DAIKIN FHHR206	TYPE 5	105	1.1	0.38	61	8.576	1/12	115/60	1	683.2	0	1.8	15	HORIZONTAL RECESSED WITH BOTTOM SUPPLY/RETURN, DISCONNECT, 3 SPEED MANUAL SPEED SWITCH
2	DAIKIN FUHH108	TYPE 6	103	8.1	0.85	41	35.8	1/8	115/60	1	1550	0	1.58	15	CORROSION (CHLORINE) RESISTANT COATING

NOTE: SEE FANCOIL VALVE SCHEDULE FOR SERVICE/LOCATION ID

COLD GLYCOL VALVE SCHEDULE

TAG	DESCRIPTION	QTY.	FLOW, GPM	PIPE SIZE, IN	VALVE SIZE, IN	VALVE PATTERN	VALVE CV	FAIL STATE	CONTROL TYPE
101	COLD BY-PASS	1	100	3	1	2-WAY	54	OPEN	MODULATING
102	COLD FLOOR	1	750	8	6	2-WAY	1202	OPEN	OPEN/CLOSE
103	DH-1	1	242	6	3	2-WAY	116	CLOSED	MODULATING
104	EVAP	1	467	6	6	2-WAY	605	OPEN	OPEN/CLOSE
105	EVAP	1	467	6	6	2-WAY	605	OPEN	OPEN/CLOSE
106	EVAP	1	467	6	6	2-WAY	605	OPEN	OPEN/CLOSE
107	HRV-1	1	88.9	3	2	2-WAY	52	CLOSED	MODULATING
108	HRV-2	1	126.2	3.5	2.5	2-WAY	72	CLOSED	MODULATING
109	AHU-1	1	106.4	3	2	2-WAY	52	CLOSED	MODULATING
110	AC MIXING VALVE	1	321.6	6	4	3-WAY	152	A-AB	MODULATING

WARM GLYCOL VALVE SCHEDULE

TAG	DESCRIPTION	QTY.	FLOW, GPM	PIPE SIZE, IN	VALVE SIZE, IN	VALVE PATTERN	VALVE CV	FAIL STATE	CONTROL TYPE
201	HX-2	1	299	4	2.5	2-WAY	162	CLOSED	MODULATING
202	SNOWMELT	1	79	2.5	2	2-WAY	91	OPEN	OPEN/CLOSE
203	HX-1	1	214	3	2	2-WAY	100	CLOSED	MODULATING
204	DH-1	1	143	3	1.5	2-WAY	74	CLOSED	MODULATING
205	HRV-1	1	49.1	1.5	0.75	2-WAY	25	CLOSED	MODULATING
206	HRV-2	1	73.2	2	1.25	2-WAY	37	CLOSED	MODULATING
207	AHU-1	1	75.2	2.5	1.25	2-WAY	37	CLOSED	MODULATING
208	WARM FLOOR	1	6.02	1	0.75	2-WAY	7.4	OPEN	OPEN/CLOSE
209	FLUID COOLER	1	660	6	6	2-WAY	392	OPEN	MODULATING
210	FLUID COOLER BY-PASS	1	660	6	5	3-WAY	392	A-B	MODULATING

FANCOIL VALVE SCHEDULE

TAG	FC TAG	DESCRIPTION	QTY.	FLOW, GPM	PIPE SIZE, IN	VALVE SIZE, IN	VALVE PATTERN	VALVE CV	FAIL STATE	CONTROL TYPE
301	FC-1	MALE CHANGE	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
302	FC-2	COMMON CHANGE	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
303	FC-3	CHANGE ROOM	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
304	FC-4	LIFE GUARD	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
305	FC-5	CHANGE ROOM 1	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
306	FC-6	CHANGE ROOM 2	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
307	FC-7	CHANGE ROOM 3	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
308	FC-8	CHANGE ROOM 4	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
309	FC-9	CHANGE ROOM 5	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
310	FC-10	CHANGE ROOM 6	1	1.1	1	0.5	2-WAY	1.3	CLOSED	OPEN/CLOSED
311	FC-11	CANTEEN	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
312	FC-12	REFS CHANGE 1	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
313	FC-13	REFS CHANGE 2	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
314	FC-14	FIELD WC 1	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
315	FC-15	FIELD WC 2	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
316	FC-16	ICE RESURFACER	1	8.1	1	0.75	2-WAY	4.3	CLOSED	OPEN/CLOSED
317	FC-17	ICE PLANT	1	8.1	1	0.75	2-WAY	4.3	CLOSED	OPEN/CLOSED
318	FC-18	ELEC.	1	8.1	1	0.75	2-WAY	4.3	CLOSED	OPEN/CLOSED
319	FC-19	WR (NE)	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
320	FC-20	WR (NW)	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
321	FC-21	WR (SE)	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
322	FC-22	WR (SW)	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
323	FC-23	RESURFACER WR	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
324	FC-24	WATER & SPRINKLER	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
325	FC-25	WARM ROOM	1	0.4	1	0.5	2-WAY	0.38	CLOSED	OPEN/CLOSED
326	FC-27	POOL MECH. ROOM	1	8.1	1	0.75	2-WAY	4.3	CLOSED	OPEN/CLOSED
327	FC-28	POOL MECH. ROOM	1	8.1	1	0.75	2-WAY	4.3	CLOSED	OPEN/CLOSED

WATER VALVE SCHEDULE

TAG	DESCRIPTION	QTY.	FLOW, GPM	PIPE SIZE, IN	VALVE SIZE	VALVE PATTERN	VALVE CV	FAIL STATE	CONTROL TYPE
401	FLUID COOLER WATER DRAIN	1	8.6	1 1/4	3/4	2-WAY	7.4	OPEN	OPEN/CLOSE
402	FLUID COOLER WATER SUPPLY	1	8.6	1 1/4	3/4	2-WAY	7.4	CLOSED	OPEN/CLOSE

WARM GLYCOL VALVE SCHEDULE

TAG	DESCRIPTION	QTY.	FLOW, GPM	PIPE SIZE, IN	VALVE SIZE, IN	VALVE PATTERN	VALVE CV	FAIL STATE	CONTROL TYPE
501	AC FREE COOLING RETURN	1	322	6	2 1/2	2-WAY	162	CLOSED	MODULATING
502	FREE COOLING ISOLATION	1	660	6	6	2-WAY	605	OPEN	OPEN/CLOSE

SIDE STREAM FILTER

TAG	MODEL	SIZE, IN	SIDE STREAM FLOW RATE, GPM	FILTER SIZE	VESSEL VOLUME, USGAL
SF-1	SFP-20	1	10-20	20" DOE COTTON WOUND	0.8
SF-2	SFP-10	3/4	1-10	10" DOE COTTON WOUND	0.4

SNOW MELT PIT COIL

V4.0

TAG	QTY.	FLOW RATE (USGPM)	EGT (°F)	LGT (°F)	MAX PD (PSIG)	LxW, IN	MANUFACTURER AND MODEL NO.
SMC-1	5	16	105	95	5	47x36	TRANTER PLATECOIL DOUBLE EMBOSSED

EQUIPMENT SCHEDULES - 2

NOTES

	NEW
	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR
F	FLOW METER
LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

SHEET COLUMN / SHEET ROW
SHEET NUMBER
(#, X#)

- NOT FOR CONSTRUCTION -
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VER #	REVISIONS	DATE	BY
4.0	EO #682	08-FEB-23	T.VW.
3.0	EO #668	11-JAN-23	T.VW.
2.0	EO #665	15-DEC-22	Z.M
1.0	ISSUED FOR TENDER	25-NOV-22	T.VW.

I.B. STOREY
Rink Engineering Experts
151 GREAT GEORGE ST., SUITE 302
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400 APPLEWOOD CRES., SUITE 100
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DRAWING NUMBER 21010 M-601
DRAWING NAME REFRIGERATION SCHEMATIC PACKAGE
CLIENT CITY OF CHARLOTTETOWN
PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
T.VANWINKLE	J.RITCHIE
DATE 08-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 8 OF 14

21010 M-601

VENTILATION UNIT SCHEDULE

UNIT NO.	MODEL NO.	CONSTRUCTION	AIRFLOW (CFM)	OPERATING WEIGHT (LBS)	VOLT/PHASE/HZ
AHU-1	XTI-33x66	INDOOR	4,467	3,605	575/3/60
HRV-1	XTI-33x57	INDOOR	2,942	5,485	575/3/60
HRV-2	XTI-39-69	INDOOR	4,829	6,990	575/3/60

DEHUMIDIFIER FAN SCHEUDLE

FAN NO.	SERVICE	CFM	TOTAL SP (IN. WG)	FAN RPM	OPER. BHP	HP	MOTOR RPM	VOLTS/PHASE/HZ	TOTAL WEIGHT	VFD	MANUFACTURER & MODEL NO.
DF-1	RINK ZONE	11679	7	2622	21.93	25	1800	575/3/60	92	YES	TWIN CITY 222 TSL
DF-2	RINK ZONE	11679	2	2175	10.92	15	1800	575/3/60	62	YES	TWIN CITY 222 TSL

AHU-1 FAN DATA

FUNCTION	AIRFLOW (CFM)	T.S.P (IN. WG)	E.S.P (IN. WG)	TYPE	WHEEL (TYPE)	CLASS	SIZE	DRIVE	FAN (RPM)	FAN QTY	MOTOR TYPE	MOTOR (HP)	MOTOR (RPM)	MOTOR (FLA)
SUPPLY FAN	4,986	5.52	2	TEFC/WEG	SWSI	II	150-9	DIRECT DRIVE	3,389	1	TEFC PREMIUM EFFICIENCY	7.5	3,600	6.94
RETURN FAN	4,986	2.64	2	TEFC/WEG	SWSI	II	135-9	DIRECT DRIVE	3,811	1	TEFC PREMIUM EFFICIENCY	5	3,600	4.72

HRV-1 FAN DATA

FUNCTION	AIRFLOW (CFM)	T.S.P (IN. WG)	E.S.P (IN. WG)	TYPE	WHEEL (TYPE)	CLASS	SIZE	DRIVE	FAN (RPM)	FAN QTY	MOTOR TYPE	MOTOR (HP)	MOTOR (RPM)	MOTOR (FLA)
SUPPLY FAN	2,942	6.71	2	TEFC/WEG	SWSI	II	135-9	DIRECT DRIVE	4,005	1	TEFC PREMIUM EFFICIENCY	5	3,600	4.72
RETURN FAN	2,942	4.26	2	TEFC/BALDOR	SWSI	II	122-9	DIRECT DRIVE	4,016	1	TEFC PREMIUM EFFICIENCY	5	3,600	4.7

HRV-2 FAN DATA

FUNCTION	AIRFLOW (CFM)	T.S.P (IN. WG)	E.S.P (IN. WG)	TYPE	WHEEL (TYPE)	CLASS	SIZE	DRIVE	FAN (RPM)	FAN QTY	MOTOR TYPE	MOTOR (HP)	MOTOR (RPM)	MOTOR (FLA)
SUPPLY FAN	4,829	6.79	2	TEFC/WEG	SWSI	II	165-9	DIRECT DRIVE	3,124	1	TEFC PREMIUM EFFICIENCY	10	3,600	9.2
RETURN FAN	4,829	3.9	2	TEFC/BALDOR	SWSI	II	165-9	DIRECT DRIVE	2,692	1	TEFC PREMIUM EFFICIENCY	10	1,800	9.6

AHU-1 FILTER DATA

TYPE	MERV	1ST FILTER SIZE, HxW (IN)	1ST QTY	2ND FILTER SIZE, HxW (IN)	2ND QTY	RANGE (IN. WG)
RF PRE-FILTER	8	24x12	3	24x20	1	0 - 0.5
RF PRIMARY FILTER	13	24x12	3	24x20	1	0 - 1

AHU-1 COIL DATA

FUNCTION	AIRFLOW	FACE VELOCITY (FT/MIN)	A.P.D (IN. WG)	EAT-DB (°F)	EAT-WB (°F)	LAT-DB (°F)	LAT-WB (°F)	TMBH	SMBH	FLOW RATE (GPM)	EWT (°F)	LWT (°F)	WPD	ROWS	FPI	FLUID
COOLING COIL	4,986	560	1.26	73.4	67.1	51.4	51.4	238	123	107.5	40	45	8.2	8	8	40% E. GLYCOL
HEATING COIL	4,986	560	0.54	-0.4	-	72	-	390	390	86	103	92.9	10.6	4	10	40% E. GLYCOL

HRV-1 FILTER DATA

TYPE	MERV	1ST FILTER SIZE, HxW (IN)	1ST QTY	2ND FILTER SIZE, HxW (IN)	2ND QTY	RANGE (IN. WG)
FF PRIMARY FILTER	8	24x24	2	-	-	0 - 0.5
RF PRE-FILTER	8	24x24	2	-	-	0 - 0.5
RF PRIMARY FILTER	13	24x24	2	-	-	0 - 1

HRV-1 COIL DATA

FUNCTION	AIRFLOW	FACE VELOCITY (FT/MIN)	A.P.D (IN. WG)	EAT-DB (°F)	EAT-WB (°F)	LAT-DB (°F)	LAT-WB (°F)	TMBH	SMBH	FLOW RATE (GPM)	EWT (°F)	LWT (°F)	WPD	ROWS	FPI	FLUID
COOLING COIL	2,942	420	1.55	73	67.1	43.7	43.7	194	96	87.1	40	45	14.2	10	14	40% E. GLYCOL
HEATING COIL	2,942	420	0.18	-0.4	-	69.2	-	218	218	49.1	103	93	11.3	3	12	40% E. GLYCOL

HRV-2 FILTER DATA

TYPE	MERV	1ST FILTER SIZE, HxW (IN)	1ST QTY	2ND FILTER SIZE, HxW (IN)	2ND QTY	RANGE (IN. WG)
FF PRIMARY FILTER	8	24x20	3	-	-	0 - 0.5
RF PRE-FILTER	8	24x20	3	-	-	0 - 0.5
RF PRIMARY FILTER	13	24x20	3	-	-	0 - 1

HRV-2 COIL DATA

FUNCTION	AIRFLOW	FACE VELOCITY (FT/MIN)	A.P.D (IN. WG)	EAT-DB (°F)	EAT-WB (°F)	LAT-DB (°F)	LAT-WB (°F)	TMBH	SMBH	FLOW RATE (GPM)	EWT (°F)	LWT (°F)	WPD	ROWS	FPI	FLUID
COOLING COIL	4,829	543	1.46	73	67.1	47.2	47	281	140	125.4	40	45.1	15.1	8	12	40% E. GLYCOL
HEATING COIL	4,829	543	0.41	-0.4	-	62.3	-	327	327	73.2	103	93.1	6.8	4	14	40% E. GLYCOL

DEHUMIDIFIER COIL DATA

TAG	QTY	AIRFLOW (CFM)	AIRSIDE					TOTAL MBH	SENSIBLE MBH	FLUID SIDE					COIL FIN LENGTH (IN)	COIL FIN HEIGHT (IN)	COIL FACE LENGTH (IN)	COIL FACE HEIGHT (IN)	MANUFACTURER & MODEL NO.
			EADB (°F)	EAWB (°F)	LADB (°F)	LAWB (°F)	DP (IN. WG)			FLUID	GPM	EGT (°F)	LGT (°F)	DP (FT. H20)					
DCC-1	1	10,769	73.4	69	37.8	37.8	1.11	914	421	40% E. GLYCOL	242	15	23.7	13	54	54	67 1/8	57	COLMAC COIL BWL-54x54.0-12R-4.0F-WR-R
DHC-1	1	10,769	-0.4	-	47.5	-	0.21	582	582	40% E. GLYCOL	142.6	103	93.86	3.7	54	54	66 5/8	57	COLMAC COIL BWL-54x54.0-2R-8.5F-WR-R

DEHUMIDIFIER HEAT PIPE DATA

TAG	QTY	AIRFLOW (CFM)	REFRIGERANT	FPM	PRE-COOL PERFORMANCE						RE-HEAT PERFORMANCE					DIMENSIONS	MANUFACTURER & MODEL NO.
					EADB (°F)	EAWB (°F)	LADB (°F)	LAWB (°F)	DP (IN. WG)	TOTAL MBH	EADB (°F)	EAWB (°F)	LADB (°F)	LAWB (°F)	DP (IN. WG)	SPACE BETWEEN COILS (IN)	
DHPC-1	1	10,769	513A	531.8	73.4	69	64.5	64	0.442	185.69	35.5	35.5	51.2	43.8	0.352	36	COLMAC COIL HPC-54-54.0-4R-8.5F-WR-54.0-8.5F-WR-U

DEHUMIDIFIER DAMPER SCHEDULE

TAG	QTY.	LOCATION	WIDTH (IN)	HEIGHT (IN)	BLADE ACTION	MANUFACTURER	MODEL	FRAME MATERIAL	BLADE MATERIAL
D-1	1	DEHUM INTAKE LOUVER	84	84	OPPOSED BLADE	GREENHECK	VCD-40	ALUMINUM	EXTRUDED ALUMINUM
D-2	1	DEHUM MIXING BOX	48	48	OPPOSED BLADE	GREENHECK	VCD-40	ALUMINUM	EXTRUDED ALUMINUM
D-3	1	DEHUM EXHAUST LOUVER	84	84	OPPOSED BLADE	GREENHECK	VCD-40	ALUMINUM	EXTRUDED ALUMINUM
D-4	1	DEHUM SUPPLY PLENUM	52	48	OPPOSED BLADE	GREENHECK	VCD-33	GALVANIZED STEEL	GALVANIZED STEEL
D-5	1	HEAT PUMP EXHAUST PLENUM	22	54	OPPOSED BLADE	GREENHECK	VCD-23	GALVANIZED STEEL	GALVANIZED STEEL

EQUIPMENT SCHEDULES - 3

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
(P)	PRESSURE SENSOR
(T)	TEMPERATURE SENSOR
(F)	FLOW METER
(LS)	LEVEL SWITCH
(R)	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

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SHEET SIZE C	**SHEET NO.** 9 OF 14

21010 M-601

AHU-1 GRILLE SCHEDULE						
ROOM ID	QTY	LOCATION	MANUFACTURER	MODEL	WIDTH (IN)	HEIGHT (IN)
155	1	CORRIDOR (FRONT OF HOUSE)	PRICE	80	6"	5"
154	1	REF OFFICE	PRICE	80	6"	5"
102 / 101	5	ATRIUM + LOBBY	PRICE	80	24"	5"
117	1	OFFICE	PRICE	80	6"	5"
123	1	PLAYERS CORRIDOR	PRICE	80	6"	5"
206	1	WARM ROOM	PRICE	80	12"	5"
V2.0 106	6	MULTI-PURPOSE	PRICE	SDR100	48" x 2 SLOTS	
105	1	FRONT OFFICE	PRICE	80	6"	5"
100	1	VESTIBULE	PRICE	80	6"	5"

AHU-1 DIFFUSER SCHEDULE						
ROOM ID	QTY	LOCATION	MANUFACTURER	MODEL	WIDTH (IN)	HEIGHT (IN)
155	2	CORRIDOR (FRONT OF HOUSE)	PRICE	SPD	12" x 12" - 4	
154	1	REF OFFICE	PRICE	SPD	12" x 12" - 4	
102 / 101	5	ATRIUM + LOBBY	PRICE	RPD	10	
117	1	OFFICE	PRICE	SPD	12" x 12" - 4	
123	5	PLAYERS CORRIDOR	PRICE	RPD	6	
206	5	WARM ROOM	PRICE	SPD	12" x 12" - 4	
106	6	MULTI-PURPOSE	PRICE	SDS100 W/ SDA PLENUM	48" x 2 SLOTS	
105	1	FRONT OFFICE	PRICE	SPD	12" x 12" - 4	
100	1	VESTIBULE	PRICE	SDP	12" x 12" - 4	

HRV-1 GRILLE SCHEDULE						
ROOM ID	QTY	LOCATION	MANUFACTURER	MODEL	WIDTH (IN)	HEIGHT (IN)
109	1	WASHROOM	PRICE	80	12"	4"
108	1	WASHROOM	PRICE	80	12"	4"
110	1	FIRST AID	PRICE	80	6"	5"
111	1	LIFE GUARD	PRICE	80	6"	5"
113	1	CHANGE ROOM	PRICE	80	48"	4"
114	1	COMMUN CHANGE	PRICE	80	48"	4"
115	1	MALE CHANGE	PRICE	80	48"	4"
151	1	REFS CHANGE 2	PRICE	80	12"	5"
215	1	WR (SE)	PRICE	80	12"	6"
150	1	REFS CHANGE 1	PRICE	80	12"	5"
103	1	CANTEEN	PRICE	80	6"	6"
104	1	KITCHEN	PRICE	80	6"	6"

HRV-1 DIFFUSER SCHEDULE						
ROOM ID	QTY	LOCATION	MANUFACTURER	MODEL	WIDTH (IN)	HEIGHT (IN)
109	1	WASHROOM	PRICE	SPD	24" x 24" - 6	
108	1	WASHROOM	PRICE	SPD	24" x 24" - 6	
110	1	FIRST AID	PRICE	SPD	12" x 12" - 4	
111	1	LIFE GUARD	PRICE	SPD	12" x 12" - 4	
113	1	CHANGE ROOM	PRICE	SPD	24" x 24" - 12	
114	1	COMMUN CHANGE	PRICE	SPD	24" x 24" - 14	
115	1	MALE CHANGE	PRICE	SPD	24" x 24" - 12	
151	1	REFS CHANGE 2	PRICE	SPD	24" x 24" - 8	
215	1	WR (SE)	PRICE	SPD	24" x 24" - 8	
150	1	REFS CHANGE 1	PRICE	SPD	24" x 24" - 6	
103	1	CANTEEN	PRICE	SPD	24" x 24" - 6	
104	1	KITCHEN	PRICE	SPD	24" x 24" - 6	

HRV-2 GRILLE SCHEDULE						
ROOM ID	QTY	LOCATION	MANUFACTURER	MODEL	WIDTH (IN)	HEIGHT (IN)
208	1	WR (NW)	PRICE	80	24"	4"
159	1	RESURFACER WR	PRICE	80	12"	4"
132/162	1	CHANGE ROOM 6	PRICE	80	24"	5"
207	1	WARM ROOM WR	PRICE	80	12"	4"
131/161	1	CHANGE ROOM 5	PRICE	80	24"	5"
126/125	1	CHANGE ROOM 4	PRICE	80	24"	5"
122/124	1	CHANGE ROOM 3	PRICE	80	24"	5"
129/121	1	CHANGE ROOM 2	PRICE	80	24"	5"
119/120	1	CHANGE ROOM 1	PRICE	80	24"	5"
205	1	WR (SW)	PRICE	80	12"	5"
217	1	WR (NE)	PRICE	80	12"	6"
138	1	FIELD WASHROOM	PRICE	80	12"	4"
139	1	FIELD WASHROOM	PRICE	80	12"	4"

HRV-2 DIFFUSER SCHEDULE						
ROOM ID	QTY	LOCATION	MANUFACTURER	MODEL	WIDTH (IN)	HEIGHT (IN)
208	1	WR (NW)	PRICE	SDP	24" x 24" - 10	
159	1	RESURFACER WR	PRICE	SDP	24" x 24" - 6	
132/162	1	CHANGE ROOM 6	PRICE	SDP	24" x 24" - 10	
207	1	WARM ROOM WR	PRICE	SDP	24" x 24" - 6	
131/161	1	CHANGE ROOM 5	PRICE	SDP	24" x 24" - 10	
126/125	1	CHANGE ROOM 4	PRICE	SDP	24" x 24" - 10	
122/124	1	CHANGE ROOM 3	PRICE	SDP	24" x 24" - 10	
129/121	1	CHANGE ROOM 2	PRICE	SDP	24" x 24" - 10	
119/120	1	CHANGE ROOM 1	PRICE	SDP	24" x 24" - 10	
205	1	WR (SW)	PRICE	SDP	24" x 24" - 8	
217	1	WR (NE)	PRICE	SDP	24" x 24" - 10	
138	1	FIELD WASHROOM	PRICE	SDP	24" x 24" - 6	
139	1	FIELD WASHROOM	PRICE	SDP	24" x 24" - 6	

POOL MECHANICAL GRILLE SCHEDULE						
ROOM ID	QTY	LOCATION	MANUFACTURER	MODEL	WIDTH (IN)	HEIGHT (IN)
001	1	POOL MECH ROOM	PRICE	80	18"	18"

POOL MECHANICAL DIFFUSER SCHEDULE						
ROOM ID	QTY	LOCATION	MANUFACTURER	MODEL	WIDTH (IN)	HEIGHT (IN)
001	1	POOL MECH ROOM	PRICE	RPD	14" DIA	

EQUIPMENT SCHEDULES - 4

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR
F	FLOW METER
LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

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DATE 08-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 10 OF 14

21010 M-601

BACNET CONNECTION TO ICE REFRIGERATION PACKAGE 1					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
010001	IRP-1 START/STOP				X
010002	IRP-1 STATUS			X	
010003	COLD WATER SETPOINT		X		
010004	HOT WATER SETPOINT		X		
010005	IRP-1 POWER CONSUMP.	X			
010006	IRP-1 CAPACITY (%)	X			
010007	COND. IN TEMP	X			
010008	COND. OUT TEMP	X			
010009	EVAP IN TEMP	X			
010010	EVAP OUT TEMP	X			
010011	RUNTIME	X			
010012	STARTS	X			
010013	AMPS	X			
010014	POWER FACTOR	X			
010015	VOLTAGE	X			
010016	POWER (KW)	X			
010017	IRP-1 ALARM STATE			X	
010018	IRP-1 CONDENSER VALVE COMMAND		X		
010019	IRP-1 CONDENSER VALVE FEEDBACK	X			

BACNET CONNECTION TO RINK REFRIGERATION PACKAGE 2					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
010101	IRP-2 START/STOP				X
010102	IRP-2 STATUS			X	
010103	COLD WATER SETPOINT		X		
010104	HOT WATER SETPOINT		X		
010105	IRP-2 POWER CONSUMP.	X			
010106	IRP-2 CAPACITY (%)	X			
010107	COND. IN TEMP	X			
010108	COND. OUT TEMP	X			
010109	EVAP IN TEMP	X			
010110	EVAP OUT TEMP	X			
010111	RUNTIME	X			
010112	STARTS	X			
010113	AMPS	X			
010114	POWER FACTOR	X			
010115	VOLTAGE	X			
010116	POWER (KW)	X			
010117	IRP-2 ALARM STATE			X	
010118	IRP-2 CONDENSER VALVE COMMAND		X		
010119	IRP-2 CONDENSER VALVE FEEDBACK	X			

BACNET CONNECTION TO RINK REFRIGERATION PACKAGE 2					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
010201	IRP-3 START/STOP				X
010202	IRP-3 STATUS			X	
010203	COLD WATER SETPOINT		X		
010204	HOT WATER SETPOINT		X		
010205	IRP-3 POWER CONSUMP.	X			
010206	IRP-3 CAPACITY (%)	X			
010207	COND. IN TEMP	X			
010208	COND. OUT TEMP	X			
010209	EVAP IN TEMP	X			
010210	EVAP OUT TEMP	X			
010211	RUNTIME	X			
010212	STARTS	X			
010213	AMPS	X			
010214	POWER FACTOR	X			
010215	VOLTAGE	X			
010216	POWER (KW)	X			
010217	IRP-3 ALARM STATE			X	
010218	IRP-3 CONDENSER VALVE COMMAND		X		
010219	IRP-3 CONDENSER VALVE FEEDBACK	X			

BACNET CONNECTION TO VFD PUMPS					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
010301	CP-1 START/STOP				X
010302	CP-1 STATUS			X	
010303	CP-1 VFD SPEED COMMAND		X		
010304	CP-1 VFD SPEED FEEDBACK	X			
010305	CP-1 VFD AMPS	X			
010306	CP-1 VFD VOLTAGE	X			
010307	CP-1 VFD POWER FACTOR	X			
010308	CP-1 VFD POWER (KW)	X			
010401	CP-2 START/STOP				X
010402	CP-2 STATUS			X	
010403	CP-2 VFD SPEED COMMAND		X		
010404	CP-2 VFD SPEED FEEDBACK	X			
010405	CP-2 VFD AMPS	X			
010406	CP-2 VFD VOLTAGE	X			
010407	CP-2 VFD POWER FACTOR	X			
010408	CP-2 VFD POWER (KW)	X			
010501	ACP-1 START/STOP				X
010502	ACP-1 STATUS			X	
010503	ACP-1 VFD SPEED COMMAND		X		
010504	ACP-1 VFD SPEED FEEDBACK	X			
010505	ACP-1 VFD AMPS	X			
010506	ACP-1 VFD VOLTAGE	X			
010507	ACP-1 VFD POWER FACTOR	X			
010508	ACP-1 VFD POWER (KW)	X			
010601	ACP-2 START/STOP				X
010602	ACP-2 STATUS			X	
010603	ACP-2 VFD SPEED COMMAND		X		
010604	ACP-2 VFD SPEED FEEDBACK	X			
010605	ACP-2 VFD AMPS	X			
010606	ACP-2 VFD VOLTAGE	X			
010607	ACP-2 VFD POWER FACTOR	X			
010608	ACP-2 VFD POWER (KW)	X			
010701	HP-1 START/STOP				X
010702	HP-1 STATUS			X	
010703	HP-1 VFD SPEED COMMAND		X		
010704	HP-1 VFD SPEED FEEDBACK	X			
010705	HP-1 VFD AMPS	X			
010706	HP-1 VFD VOLTAGE	X			
010707	HP-1 VFD POWER FACTOR	X			
010708	HP-1 VFD POWER (KW)	X			
010801	HP-2 START/STOP				X
010802	HP-2 STATUS			X	
010803	HP-2 VFD SPEED COMMAND		X		
010804	HP-2 VFD SPEED FEEDBACK	X			
010805	HP-2 VFD AMPS	X			
010806	HP-2 VFD VOLTAGE	X			
010807	HP-2 VFD POWER FACTOR	X			
010808	HP-2 VFD POWER (KW)	X			

BACNET CONNECTION TO R513A REFRIGERANT DETECTOR					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
010901	REFRIGERANT PPM	X			
010902	REFRIGERANT ALARM	X			

BACNET CONNECTION TO ADIABATIC FLUID COOLER					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
011001	FAN 1 START/STOP				X
011002	FAN 1 STATUS			X	
011003	FAN 1 SPEED COMMAND		X		
011004	FAN 1 SPEED FEEDBACK	X			
011005	FAN 2 START/STOP				X
011006	FAN 2 STATUS			X	
011007	FAN 2 SPEED COMMAND		X		
011008	FAN 2 SPEED FEEDBACK	X			
011009	FAN 3 START/STOP				X
011010	FAN 3 STATUS			X	
011011	FAN 3 SPEED COMMAND		X		
011012	FAN 3 SPEED FEEDBACK	X			
011013	FAN 4 START/STOP				X
011014	FAN 4 STATUS			X	
011015	FAN 4 SPEED COMMAND		X		
011016	FAN 4 SPEED FEEDBACK	X			
011017	FAN 5 START/STOP				X
011018	FAN 5 STATUS			X	
011019	FAN 5 SPEED COMMAND		X		
011020	FAN 5 SPEED FEEDBACK	X			
011021	FAN 6 START/STOP				X
011022	FAN 6 STATUS			X	
011023	FAN 6 SPEED COMMAND		X		
011024	FAN 6 SPEED FEEDBACK	X			
011025	FAN 7 START/STOP				X
011026	FAN 7 STATUS			X	
011027	FAN 7 SPEED COMMAND		X		
011028	FAN 7 SPEED FEEDBACK	X			
011029	FAN 8 START/STOP				X
011030	FAN 8 STATUS			X	
011031	FAN 8 SPEED COMMAND		X		
011032	FAN 8 SPEED FEEDBACK	X			
011033	MODE CONTROL		X		
011034	LEAVING GLYCOL SETPOINT		X		

BACNET CONNECTION TO MAIN PROPANE METER					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
011101	FLOW RATE	X			
011102	TEMPERATURE	X			

BACNET CONNECTION TO WATER HEATER 1 & 2 PROPANE METER					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
011201	FLOW RATE	X			
011202	TEMPERATURE	X			

BACNET CONNECTION TO WATER HEATER 3 PROPANE METER					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
011301	FLOW RATE	X			
011302	TEMPERATURE	X			

AUTOMATION POINTS LIST - 1

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
(P)	PRESSURE SENSOR
(T)	TEMPERATURE SENSOR
(F)	FLOW METER
(LS)	LEVEL SWITCH
(R)	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW

(#, X#)

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VER #	REVISIONS	DATE	BY
4.0	EO #682	08-FEB-23	T.VW.
3.0	EO #668	11-JAN-23	T.VW.
2.0	EO #665	15-DEC-22	Z.M
1.0	ISSUED FOR TENDER	25-NOV-22	T.VW.

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DRAWING NUMBER 21010 M-601

DRAWING NAME REFRIGERATION SCHEMATIC PACKAGE

CLIENT CITY OF CHARLOTTETOWN

PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
T.VANWINKLE	J.RITCHIE
DATE 08-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 11 OF 14

21010 M-601

BACNET CONNECTION TO WATER HEATERS					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
011401	WH-1 BOILER START/STOP				X
011402	WH-1 BOILER AMPS	X			
011403	WH-1 FLOW SWITCH			X	
011404	WH-1 GAS PRESSURE SWITCH			X	
011405	WH-1 LOUVER PROVING SWITCH			X	
011406	WH-1 AIR PRESSURE SWITCH			X	
011407	WH-1 ALARM CONTACTS			X	
011408	WH-1 BOILER PUMP STATUS			X	
011409	WH-1 CASCADE CURRENT POWER	X			
011410	WH-1 OUTLET SETPOINT	X			
011411	WH-1 OUTLET TEMPERATURE	X			
011412	WH-1 INLET TEMPERATURE	X			
011413	WH-1 TANK SETPOINT		X		
011414	WH-1 SYSTEM SUPPLY TEMPERATURE		X		
011501	WH-2 BOILER START/STOP				X
011502	WH-2 BOILER AMPS	X			
011503	WH-2 FLOW SWITCH			X	
011504	WH-2 GAS PRESSURE SWITCH			X	
011505	WH-2 LOUVER PROVING SWITCH			X	
011506	WH-2 AIR PRESSURE SWITCH			X	
011507	WH-2 ALARM CONTACTS			X	
011508	WH-2 BOILER PUMP STATUS			X	
011509	WH-2 CASCADE CURRENT POWER	X			
011510	WH-2 OUTLET SETPOINT	X			
011511	WH-2 OUTLET TEMPERATURE	X			
011512	WH-2 INLET TEMPERATURE	X			
011513	WH-2 TANK SETPOINT		X		
011514	WH-2 SYSTEM SUPPLY TEMPERATURE		X		
011601	WH-3 BOILER START/STOP				X
011602	WH-3 BOILER AMPS	X			
011603	WH-3 FLOW SWITCH			X	
011604	WH-3 GAS PRESSURE SWITCH			X	
011605	WH-3 LOUVER PROVING SWITCH			X	
011606	WH-3 AIR PRESSURE SWITCH			X	
011607	WH-3 ALARM CONTACTS			X	
011608	WH-3 BOILER PUMP STATUS			X	
011609	WH-3 CASCADE CURRENT POWER	X			
011610	WH-3 OUTLET SETPOINT	X			
011611	WH-3 OUTLET TEMPERATURE	X			
011612	WH-3 INLET TEMPERATURE	X			
011613	WH-3 TANK SETPOINT		X		
011614	WH-3 SYSTEM SUPPLY TEMPERATURE		X		

BACNET CONNECTION TO POWER METER					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
011701	ENERGY SUM - KWH	X			
011702	POWER SUM W	X			
011703	POWER A W	X			
011704	POWER B W	X			
011705	POWER C W	X			
011706	VOLT AVG LN V	X			
011707	VOLT A V	X			
011708	VOLT B V	X			
011709	VOLT C V	X			
011710	VOLT AVG LL V	X			
011711	FREQ HZ	X			
011712	CURRENT A AMP	X			
011713	CURRENT B AMP	X			
011714	CURRENT C AMP	X			
011715	POWER FACTOR AVG	X			
011716	POWER FACTOR A	X			
011717	POWER FACTOR B	X			
011718	POWER FACTOR C	X			
011719	DEMAND SUM W	X			
011720	DEMAND A	X			
011721	DEMAND B	X			
011722	DEMAND C	X			

BACNET CONNECTION TO REFRIGERATION ROOM POWER METER					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
011801	ENERGY SUM - KWH	X			
011802	POWER SUM W	X			
011803	POWER A W	X			
011804	POWER B W	X			
011805	POWER C W	X			
011806	VOLT AVG LN V	X			
011807	VOLT A V	X			
011808	VOLT B V	X			
011809	VOLT C V	X			
011810	VOLT AVG LL V	X			
011811	FREQ HZ	X			
011812	CURRENT A AMP	X			
011813	CURRENT B AMP	X			
011814	CURRENT C AMP	X			
011815	POWER FACTOR AVG	X			
011816	POWER FACTOR A	X			
011817	POWER FACTOR B	X			
011818	POWER FACTOR C	X			
011819	DEMAND SUM W	X			
011820	DEMAND A	X			
011821	DEMAND B	X			
011822	DEMAND C	X			

BACNET CONNECTION TO ARENA LIGHT POWER METER					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
011901	ENERGY SUM - KWH	X			
011902	POWER SUM W	X			
011903	POWER A W	X			
011904	POWER B W	X			
011905	POWER C W	X			
011906	VOLT AVG LN V	X			
011907	VOLT A V	X			
011908	VOLT B V	X			
011909	VOLT C V	X			
011910	VOLT AVG LL V	X			
011911	FREQ HZ	X			
011912	CURRENT A AMP	X			
011913	CURRENT B AMP	X			
011914	CURRENT C AMP	X			
011915	POWER FACTOR AVG	X			
011916	POWER FACTOR A	X			
011917	POWER FACTOR B	X			
011918	POWER FACTOR C	X			
011919	DEMAND SUM W	X			
011920	DEMAND A	X			
011921	DEMAND B	X			
011922	DEMAND C	X			

BACNET CONNECTION TO ARENA LIGHT CONTROLLER (TO BE COORDINATED)					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
012001	BANK 1 ON/OFF				X
012002	BANK 1 STATUS	X			
012003	BANK 1 DIMMER		X		
012004	BANK 2 ON/OFF				X
012005	BANK 2 STATUS	X			
012006	BANK 2 DIMMER		X		
012007	BANK 3 ON/OFF				X
012008	BANK 3 STATUS	X			
012009	BANK 3 DIMMER		X		
012010	BANK 4 ON/OFF				X
012011	BANK 4 STATUS	X			
012012	BANK 4 DIMMER		X		

BACNET CONNECTION TO AHU VFDS					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
012101	AHU-1 SF START/STOP				X
012102	AHU-1 SF STATUS			X	
012103	AHU-1 SF VFD SPEED COMMAND		X		
012104	AHU-1 SF VFD SPEED FEEDBACK	X			
012105	AHU-1 SF VFD AMPS	X			
012106	AHU-1 SF VFD VOLTAGE	X			
012107	AHU-1 SF VFD POWER FACTOR	X			
012108	AHU-1 SF VFD POWER (KW)	X			
012109	AHU-1 RF START/STOP				X
012110	AHU-1 RF STATUS			X	
012111	AHU-1 RF VFD SPEED COMMAND		X		
012112	AHU-1 RF VFD SPEED FEEDBACK	X			
012113	AHU-1 RF VFD AMPS	X			
012114	AHU-1 RF VFD VOLTAGE	X			
012115	AHU-1 RF VFD POWER FACTOR	X			
012116	AHU-1 RF VFD POWER (KW)	X			
012101	HRV-1 SF START/STOP				X
012102	HRV-1 SF STATUS			X	
012103	HRV-1 SF VFD SPEED COMMAND		X		
012104	HRV-1 SF VFD SPEED FEEDBACK	X			
012105	HRV-1 SF VFD AMPS	X			
012106	HRV-1 SF VFD VOLTAGE	X			
012107	HRV-1 SF VFD POWER FACTOR	X			
012108	HRV-1 SF VFD POWER (KW)	X			
012109	HRV-1 RF START/STOP				X
012110	HRV-1 RF STATUS			X	
012111	HRV-1 RF VFD SPEED COMMAND		X		
012112	HRV-1 RF VFD SPEED FEEDBACK	X			
012113	HRV-1 RF VFD AMPS	X			
012114	HRV-1 RF VFD VOLTAGE	X			
012115	HRV-1 RF VFD POWER FACTOR	X			
012116	HRV-1 RF VFD POWER (KW)	X			
012301	HRV-2 SF START/STOP				X
012302	HRV-2 SF STATUS			X	
012303	HRV-2 SF VFD SPEED COMMAND		X		
012304	HRV-2 SF VFD SPEED FEEDBACK	X			
012305	HRV-2 SF VFD AMPS	X			
012306	HRV-2 SF VFD VOLTAGE	X			
012307	HRV-2 SF VFD POWER FACTOR	X			
012308	HRV-2 SF VFD POWER (KW)	X			
012309	HRV-2 RF START/STOP				X
012310	HRV-2 RF STATUS			X	
012311	HRV-2 RF VFD SPEED COMMAND		X		
012312	HRV-2 RF VFD SPEED FEEDBACK	X			
012313	HRV-2 RF VFD AMPS	X			
012314	HRV-2 RF VFD VOLTAGE	X			
012315	HRV-2 RF VFD POWER FACTOR	X			
012316	HRV-2 RF VFD POWER (KW)	X			

BACNET CONNECTION TO ARENA DEHUMIDIFIER					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
012401	DEHUM-1 SF START/STOP				X
012402	DEHUM-1 SF STATUS			X	
012403	DEHUM-1 SF VFD SPEED COMMAND		X		
012404	DEHUM-1 SF VFD SPEED FEEDBACK	X			
012405	DEHUM-1 SF VFD AMPS	X			
012406	DEHUM-1 SF VFD VOLTAGE	X			
012407	DEHUM-1 SF VFD POWER FACTOR	X			
012408	DEHUM-1 SF VFD POWER (KW)	X			
012409	DEHUM-1 RF START/STOP				X
012410	DEHUM-1 RF STATUS			X	
012411	DEHUM-1 RF VFD SPEED COMMAND		X		
012412	DEHUM-1 RF VFD SPEED FEEDBACK	X			
012413	DEHUM-1 RF VFD AMPS	X			
012414	DEHUM-1 RF VFD VOLTAGE	X			
012415	DEHUM-1 RF VFD POWER FACTOR	X			
012416	DEHUM-1 RF VFD POWER (KW)	X			

AUTOMATION POINTS LIST - 2

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
(P)	PRESSURE SENSOR
(T)	TEMPERATURE SENSOR
(F)	FLOW METER
(LS)	LEVEL SWITCH
(R)	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

SHEET COLUMN / SHEET ROW
SHEET NUMBER
(#, X#)

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DRAWING NUMBER 21010 M-601
DRAWING NAME REFRIGERATION SCHEMATIC PACKAGE
CLIENT CITY OF CHARLOTTETOWN
PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
T.VANWINKLE	J.RITCHIE
DATE	**REVISION**
08-FEB-23	4.0
SHEET SIZE	**SHEET NO.**
C	12 OF 14

21010 M-601

IO-CONTROLLER 1					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
020001	CG BY-PASS VALVE 101 OPEN/CLOSE		X		
020002	CG BY-PASS VALVE 101 FEEDBACK	X			
020003	COLD FLOOR VALVE 102 OPEN/CLOSE				X
020004	COLD FLOOR VALVE 102 FEEDBACK			X	
020005	DH-1 COOLING COIL VALVE 103 OPEN/CLOSE		X		
020006	DH-1 COOLING COIL VALVE 103 FEEDBACK	X			
020007	IRP-1 EVAP. VALVE 104 OPEN/CLOSE				X
020008	IRP-1 EVAP. VALVE 104 FEEDBACK			X	
020009	IRP-2 EVAP. VALVE 105 OPEN/CLOSE				X
020010	IRP-2 EVAP. VALVE 105 FEEDBACK			X	
020011	IRP-3 EVAP. VALVE 106 OPEN/CLOSE				X
020012	IRP-3 EVAP. VALVE 106 FEEDBACK			X	
020013	HRV-1 COOLING COIL VALVE 107 OPEN/CLOSE		X		
020014	HRV-1 COOLING COIL VALVE 107 FEEDBACK	X			
020015	HRV-2 COOLING COIL VALVE 108 OPEN/CLOSE		X		
020016	HRV-2 COOLING COIL VALVE 108 FEEDBACK	X			
020017	AHU-1 COOLING COIL VALVE 109 OPEN/CLOSE		X		
020018	AHU-1 COOLING COIL VALVE 109 FEEDBACK	X			
020019	AC MIXING VALVE 110 OPEN/CLOSE		X		
020020	AC MIXING VALVE 110 FEEDBACK	X			
020021	HX-2 GLYCOL HEAT BOOSTER VALVE 201 OPEN/CLOSE		X		
020022	HX-2 GLYCOL HEAT BOOSTER VALVE VALVE 201 FEEDBACK	X			
020023	SNOW MELT PIT VALVE 202 OPEN/CLOSE				X
020024	SNOW MELT PIT VALVE 202 FEEDBACK			X	
020025	HX-1 DHW PRE-HEAT VALVE 203 OPEN/CLOSE		X		
020026	HX-1 DHW PRE-HEAT VALVE 203 FEEDBACK	X			
020027	DH-1 HEATING COIL VALVE 204 OPEN/CLOSE		X		
020028	DH-1 HEATING COIL VALVE 204 FEEDBACK	X			
020029	HRV-1 HEATING COIL VALVE 205 OPEN/CLOSE		X		
020030	HRV-1 HEATING COIL VALVE 205 FEEDBACK	X			
020031	HRV-2 HEATING COIL VALVE 206 OPEN/CLOSE		X		
020032	HRV-2 HEATING COIL VALVE 206 FEEDBACK	X			
020033	AHU-1 HEATING COIL VALVE 207 OPEN/CLOSE		X		
020034	AHU-1 HEATING COIL VALVE 207 FEEDBACK	X			
020035	WARM FLOOR VALVE 208 OPEN/CLOSED		X		
020036	WARM FLOOR VALVE 208 FEEDBACK	X			
020037	AFC-1 VALVE 209 OPEN/CLOSED		X		
020038	AFC-1 VALVE 209 FEEDBACK	X			
020039	FLUID COOLER BY-PASS VALVE 210 OPEN/CLOSE		X		
020040	FLUID COOLER BY-PASS VALVE 210 FEEDBACK	X			
020041	AC FREE COOLING RETURN VALVE 501 OPEN/CLOSE		X		
020042	AC FREE COOLING RETURN VALVE 501 FEEDBACK	X			
020043	FREE COOLING ISOLATION VALVE 502 OPEN/CLOSE				X
020044	FREE COOLING ISOLATION VALVE 502 FEEDBACK			X	
020101	FANCOIL 1 VALVE 301 OPEN/CLOSE				X
020102	FANCOIL 1 VALVE 301 FEEDBACK			X	
020103	FANCOIL 2 VALVE 302 OPEN/CLOSE				X
020104	FANCOIL 2 VALVE 302 FEEDBACK			X	
020105	FANCOIL 3 VALVE 303 OPEN/CLOSE				X
020106	FANCOIL 3 VALVE 303 FEEDBACK			X	
020107	FANCOIL 4 VALVE 304 OPEN/CLOSE				X
020108	FANCOIL 4 VALVE 304 FEEDBACK			X	
020109	FANCOIL 5 VALVE 305 OPEN/CLOSE				X
020110	FANCOIL 5 VALVE 305 FEEDBACK			X	
020111	FANCOIL 6 VALVE 306 OPEN/CLOSE				X
020112	FANCOIL 6 VALVE 306 FEEDBACK			X	
020113	FANCOIL 7 VALVE 307 OPEN/CLOSE				X
020114	FANCOIL 7 VALVE 307 FEEDBACK			X	
020115	FANCOIL 8 VALVE 308 OPEN/CLOSE				X
020116	FANCOIL 8 VALVE 308 FEEDBACK			X	
020117	FANCOIL 9 VALVE 309 OPEN/CLOSE				X
020118	FANCOIL 9 VALVE 309 FEEDBACK			X	
020119	FANCOIL 10 VALVE 310 OPEN/CLOSE				X
020120	FANCOIL 10 VALVE 310 FEEDBACK			X	
020121	FANCOIL 11 VALVE 311 OPEN/CLOSE				X
020122	FANCOIL 11 VALVE 311 OPEN/CLOSE			X	
020123	FANCOIL 12 VALVE 312 OPEN/CLOSE				X
020124	FANCOIL 12 VALVE 312 FEEDBACK			X	

IO-CONTROLLER 1 (PART 2)					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
020125	FANCOIL 13 VALVE 313 OPEN/CLOSE				X
020126	FANCOIL 13 VALVE 313 FEEDBACK			X	
020127	FANCOIL 14 VALVE 314 OPEN/CLOSE				X
020128	FANCOIL 14 VALVE 314 FEEDBACK			X	
020129	FANCOIL 15 VALVE 315 OPEN/CLOSE				X
020130	FANCOIL 15 VALVE 315 FEEDBACK			X	
020131	FANCOIL 16 VALVE 316 OPEN/CLOSE				X
020132	FANCOIL 16 VALVE 316 FEEDBACK			X	
020133	FANCOIL 17 VALVE 317 OPEN/CLOSE				X
020134	FANCOIL 17 VALVE 317 FEEDBACK			X	
020135	FANCOIL 18 VALVE 318 OPEN/CLOSE				X
020136	FANCOIL 18 VALVE 318 FEEDBACK			X	
020137	FANCOIL 19 VALVE 319 OPEN/CLOSE				X
020138	FANCOIL 19 VALVE 319 FEEDBACK			X	
020139	FANCOIL 20 VALVE 320 OPEN/CLOSE				X
020140	FANCOIL 20 VALVE 320 FEEDBACK			X	

IO-CONTROLLER 2					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
030001	FANCOIL 21 VALVE 321 OPEN/CLOSE				X
030002	FANCOIL 21 VALVE 321 FEEDBACK			X	
030003	FANCOIL 22 VALVE 322 OPEN/CLOSE				X
030004	FANCOIL 22 VALVE 322 FEEDBACK			X	
030005	FANCOIL 23 VALVE 323 OPEN/CLOSE				X
030006	FANCOIL 23 VALVE 323 FEEDBACK			X	
030007	FANCOIL 24 VALVE 324 OPEN/CLOSE				X
030008	FANCOIL 24 VALVE 324 FEEDBACK			X	
030009	FANCOIL 25 VALVE 325 OPEN/CLOSE				X
030010	FANCOIL 25 VALVE 325 FEEDBACK			X	
030011	FANCOIL 27 VALVE 326 OPEN/CLOSE				X
030012	FANCOIL 27 VALVE 326 FEEDBACK			X	
030013	FANCOIL 28 VALVE 327 OPEN/CLOSE				X
030014	FANCOIL 28 VALVE 327 FEEDBACK			X	
030101	AFC-1 WATER DRAIN VALVE 401 OPEN/CLOSE				X
030102	AFC-1 WATER DRAIN VALVE 401 FEEDBACK			X	
030103	AFC-1 WATER SUPPLY VALVE 402 OPEN/CLOSE				X
030104	AFC-1 WATER SUPPLY VALVE 402 FEEDBACK			X	
030201	COLD GLYCOL SUPPLY TEMPERATURE	X			
030202	RINK COLD FLOOR SUPPLY TEMPERATURE	X			
030203	RINK COLD FLOOR TEMPERATURE SENSOR	X			
030204	RINK COLD FLOOR TEMPERATURE SENSOR	X			
030205	RINK COLD FLOOR TEMPERATURE SENSOR	X			
030206	RINK COLD FLOOR TEMPERATURE SENSOR	X			
030207	RINK COLD FLOOR TEMPERATURE SENSOR	X			
030208	RINK COLD FLOOR TEMPERATURE SENSOR	X			
030209	RINK COLD GLYCOL RETURN TEMPERATURE	X			
030210	DH-1 COLD GLYCOL RETURN TEMPERATURE	X			
030211	COLD GLYCOL PUMP INLET TEMPERATURE	X			
030212	AC LOOP SUPPLY TEMPERATURE	X			
030213	HRV-2 COOLING COIL RETURN TEMPERATURE	X			
030214	AC FREE COOLING RETURN TEMPERATURE	X			
030215	HRV-1 COOLING COIL RETURN TEMPERATURE	X			
030216	AHU-1 COOLING COIL RETURN TEMPERATURE	X			
030217	AC LOOP RETURN TEMPERATURE	X			
030218	HX-2 RETURN GLYCOL TEMPERATURE	X			
030219	WARM GLYCOL SUPPLY TEMPERATURE	X			
030220	FANCOIL 17 RETURN TEMPERATURE	X			
030221	HX-1 RETURN GLYCOL TEMPERATURE	X			
030222	WARM FLOOR SUPPLY TEMPERATURE	X			
030223	WARM FLOOR TEMPERATURE SENSOR	X			
030224	WARM FLOOR TEMPERATURE SENSOR	X			
030225	WARM FLOOR RETURN TEMPERATURE	X			
030226	HYDRAULIC SEPARATOR RETURN TEMPERATURE	X			

IO-CONTROLLER 2 (PART 2)					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
030227	FANCOIL 14 RETURN TEMPERATURE	X			
030228	FANCOIL 15 RETURN TEMPERATURE	X			
030229	FANCOIL 18 RETURN TEMPERATURE	X			
030230	FANCOIL 24 RETURN TEMPERATURE	X			
030231	FANCOIL 25 RETURN TEMPERATURE	X			
030232	HRV-2 HEATING COIL RETURN TEMPERATURE	X			
030233	FANCOIL 26 RETURN TEMPERATURE	X			
030234	DH-1 HEATING COIL RETURN TEMPERATURE	X			
030235	FANCOIL 19 RETURN TEMPERATURE	X			
030236	FANCOIL 20 RETURN TEMPERATURE	X			
030237	FANCOIL 21 RETURN TEMPERATURE	X			
030238	FANCOIL 22 RETURN TEMPERATURE	X			
030239	FANCOIL 16 RETURN TEMPERATURE	X			
030240	FANCOIL 23 RETURN TEMPERATURE	X			
030241	SNOWMELT PIT TEMPERATURE SENSOR	X			
030242	SNOWMELT PIT RETURN TEMPERATURE	X			
030243	FANCOIL 5 RETURN TEMPERATURE	X			
030244	FANCOIL 6 RETURN TEMPERATURE	X			
030245	FANCOIL 7 RETURN TEMPERATURE	X			
030246	FANCOIL 8 RETURN TEMPERATURE	X			
030247	FANCOIL 9 RETURN TEMPERATURE	X			
030248	FANCOIL 10 RETURN TEMPERATURE	X			
030249	HRV-1 HEATING COIL RETURN TEMPERATURE	X			
030250	AHU-1 HEATING COIL RETURN TEMPERATURE	X			
030251	FANCOIL 11 RETURN TEMPERATURE	X			
030252	FANCOIL 4 RETURN TEMPERATURE	X			
030253	FANCOIL 12 RETURN TEMPERATURE	X			
030254	FANCOIL 13 RETURN TEMPERATURE	X			
030255	FANCOIL 1 RETURN TEMPERATURE	X			
030256	FANCOIL 2 RETURN TEMPERATURE	X			
030257	FANCOIL 3 RETURN TEMPERATURE	X			
030258	FANCOIL 27 RETURN TEMPERATURE	X			
030259	FANCOIL 28 RETURN TEMPERATURE	X			
030260	CONDENSER PUMP INLET TEMPERATURE	X			

IO-CONTROLLER 3					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
040001	HX-2 SUPPLY WATER TEMPERATURE	X			
040002	DHW CIRCULATION RETURN TEMPERATURE	X			
040003	WT-1 TEMPERATURE SENSOR	X			
040004	WT-2 TEMPERATURE SENSOR	X			
040005	WATER HEATER RETURN TEMPERATURE	X			
040006	HX-2 RETURN WATER TEMPERATURE	X			
040007	HX-1 RETURN WATER TEMPERATURE	X			
040008	HX-1 SUPPLY WATER TEMPERATURE	X			
040101	IRP-1 EVAP INLET PRESSURE	X			
040102	IRP-1 EVAP OUTLET PRESSURE	X			
040103	IRP-2 EVAP INLET PRESSURE	X			
040104	IRP-2 EVAP OUTLET PRESSURE	X			
040105	IRP-3 EVAP INLET PRESSURE	X			
040106	IRP-3 EVAP OUTLET PRESSURE	X			
040107	COLD GLYCOL SUPPLY PRESSURE	X			
040108	COLD GLYCOL PUMP INLET PRESSURE	X			
040109	COLD GLYCOL RETURN PRESSURE	X			
040110	AC LOOP PUMP INLET PRESSURE	X			
040111	AC LOOP PUMP OUTLET PRESSURE	X			
040112	IRP-1 COND OUTLET PRESSURE	X			
040113	IRP-1 COND INLET PRESSURE	X			
040114	IRP-2 COND OUTLET PRESSURE	X			
040115	IRP-2 COND INLET PRESSURE	X			
040116	IRP-3 COND OUTLET PRESSURE	X			
040117	IRP-3 COND INLET PRESSURE	X			
040118	WARM GLYCOL SUPPLY PRESSURE	X			
040119	CONDENSER PUMP INLET PRESSURE	X			
040120	CONDENSER PUMP OUTLET PRESSURE	X			

V3.0 AUTOMATION POINTS LIST - 3

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR
F	FLOW METER
LS	LEVEL SWITCH
R	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW

(#, X#)

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VER #	REVISIONS	DATE	BY
4.0	EO #682	08-FEB-23	T.VW.
3.0	EO #668	11-JAN-23	T.VW.
2.0	EO #665	15-DEC-22	Z.M
1.0	ISSUED FOR TENDER	25-NOV-22	T.VW.

I.B. STOREY Rink Engineering Experts
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400 APPLEWOOD CRES., SUITE 100
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STAMP

DRAWING NUMBER 21010 M-601

DRAWING NAME REFRIGERATION SCHEMATIC PACKAGE

CLIENT CITY OF CHARLOTTETOWN

PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
T.VANWINKLE	J.RITCHIE
DATE 08-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 13 OF 14

21010 M-601

IO-CONTROLLER 3 (PART 2)					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
040201	HX-2 SUPPLY WATER PRESSURE	X			
040202	HX-2 RETURN WATER PRESSURE	X			
040203	HX-1 RETURN WATER PRESSURE	X			
040204	HX-1 SUPPLY WATER PRESSURE	X			
040301	COLD GLYCOL SUPPLY FLOWRATE	X			
040302	WARM GLYCOL RETURN FLOW SENSOR	X			
040303	DCW SUPPLY FLOW SENSOR	X			

IO-CONTROLLER 4					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
050001	HRV-1 SUPPLY DUCT PRESSURE	X			
050002	HRV-1 RETURN DUCT PRESSURE	X			
050003	HRV-1 EXHAUST FAN DAMPER OPEN/CLOSE				X
050004	HRV-1 EXHAUST FAN DAMPER FEEDBACK			X	
050005	HRV-1 OA DAMPER OPEN/CLOSE				X
050006	HRV-1 OA DAMPER FEEDBACK			X	
050007	HRV-1 BYPASS DAMPER OPEN/CLOSE				X
050008	HRV-1 BYPASS DAMPER FEEDBACK			X	
050009	HRV-1 OA FILTER DIFF. PRESSURE	X			
050010	HRV-1 RA FILTER DIFF. PRESSURE	X			
050011	HRV-1 POST HRV TEMPERATURE	X			
050012	HRV-1 POST HRV HUMIDITY	X			
050013	HRV-1 POST C/C TEMPERATURE	X			
050014	HRV-1 POST C/C HUMIDITY	X			
050015	HRV-1 SUPPLY TEMPERATURE	X			
050016	HRV-1 SUPPLY HUMIDITY	X			
050017	HRV-1 RETURN CO2 PPM	X			
050018	HRV-1 RETURN TEMPERATURE	X			
050019	HRV-1 RETURN HUMIDITY	X			
050020	HRV-1 SINGLE POINT AMPS	X			
050021	HRV-2 SUPPLY DUCT PRESSURE	X			
050022	HRV-2 RETURN DUCT PRESSURE	X			
050023	HRV-2 EXHAUST FAN DAMPER OPEN/CLOSE				X
050024	HRV-2 EXHAUST FAN DAMPER FEEDBACK			X	
050025	HRV-2 OA DAMPER OPEN/CLOSE				X
050026	HRV-2 OA DAMPER FEEDBACK			X	
050027	HRV-2 BYPASS DAMPER OPEN/CLOSE				X
050028	HRV-2 BYPASS DAMPER FEEDBACK			X	
050109	HRV-2 OA FILTER DIFF. PRESSURE	X			
050110	HRV-2 RA FILTER DIFF. PRESSURE	X			
050111	HRV-2 POST HRV TEMPERATURE	X			
050112	HRV-2 POST HRV HUMIDITY	X			
050113	HRV-2 POST C/C TEMPERATURE	X			
050114	HRV-2 POST C/C HUMIDITY	X			
050115	HRV-2 SUPPLY TEMPERATURE	X			
050116	HRV-2 SUPPLY HUMIDITY	X			
050117	HRV-2 RETURN CO2 PPM	X			
050118	HRV-2 RETURN TEMPERATURE	X			
050119	HRV-2 RETURN HUMIDITY	X			
050120	HRV-2 SINGLE POINT AMPS	X			
050121	AHU-1 MIXED AIR DAMPER COMMAND		X		
050122	AHU-1 MIXED AIR DAMPER FEEDBACK	X			
050123	AHU-1 OA TEMPERATURE	X			
050124	AHU-1 OA HUMIDITY	X			
050125	AHU-1 MIXED AIR TEMPERATURE	X			
050126	AHU-1 MIXED AIR HUMIDITY	X			
050127	AHU-1 POST C/C TEMPERATURE	X			
050128	AHU-1 POST C/C HUMIDITY	X			
050209	AHU-1 SUPPLY TEMPERATURE	X			
050210	AHU-1 SUPPLY HUMIDITY	X			
050211	AHU-1 RETURN CO2	X			
050212	AHU-1 RETURN TEMPERATURE	X			
050213	AHU-1 RETURN HUMIDITY	X			
050214	AHU-1 FILTER DIFF. PRESSURE	X			
050215	AHU-1 SINGLE POINT AMPS	X			

IO-CONTROLLER 5					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
060001	DH-1 RETURN CO2 PPM	X			
060002	DH-1 RETURN PRESSURE	X			
060003	DH-1 RETURN HUMIDITY	X			
060004	DH-1 RETURN TEMPERATURE	X			
060005	DH-1 OA HUMIDITY	X			
060006	DH-1 OA TEMPERATURE	X			
060007	DH-1 MIXED AIR TEMPERATURE	X			
060008	DH-1 MIXED AIR HUMIDITY	X			
060009	DH-1 PRE C/C TEMPERATURE	X			
060010	DH-1 PRE C/C HUMIDITY	X			
060011	DH-1 POST C/C TEMPERATURE	X			
060012	DH-1 POST C/C HUMIDITY	X			
060013	DH-1 PRE H/C TEMPERATURE	X			
060014	DH-1 PRE H/C HUMIDITY	X			
060015	DH-1 SUPPLY FLOWMETER	X			
060016	DH-1 SUPPLY HUMIDITY	X			
060017	DH-1 SUPPLY TEMPERATURE	X			
060018	DH-1 SUPPLY PRESSURE	X			
060019	DH-1 RECIRC FLOWMETER	X			
060020	DH-1 MIXED AIR DAMPER COMMAND		X		
060021	DH-1 MIXED AIR DAMPER FEEDBACK	X			
060022	DH-1 FILTER DIFF. PRESSURE	X			
060023	DH-1 SUPPLY AIR DAMPER COMMAND		X		
060024	DH-1 SUPPLY AIR DAMPER FEEDBACK	X			
060025	DH-1 RECIRC AIR DAMPER COMMAND		X		
060026	DH-1 RECIRC AIR DAMPER FEEDBACK	X			
060101	FC-1 START/STOP				X
060102	FC-1 STATUS (AMPS)	X			
060103	FC-2 START/STOP				X
060104	FC-2 STATUS (AMPS)	X			
060105	FC-3 START/STOP				X
060106	FC-3 STATUS (AMPS)	X			
060107	FC-4 START/STOP				X
060108	FC-4 STATUS (AMPS)	X			
060109	FC-5 START/STOP				X
060110	FC-5 STATUS (AMPS)	X			
060111	FC-6 START/STOP				X
060112	FC-6 STATUS (AMPS)	X			
060113	FC-7 START/STOP				X
060114	FC-7 STATUS (AMPS)	X			
060115	FC-8 START/STOP				X
060116	FC-8 STATUS (AMPS)	X			
060117	FC-9 START/STOP				X
060118	FC-9 STATUS (AMPS)	X			
060119	FC-10 START/STOP				X
060120	FC-10 STATUS (AMPS)	X			
060121	FC-11 START/STOP				X
060122	FC-11 STATUS (AMPS)	X			
060123	FC-12 START/STOP				X
060124	FC-12 STATUS (AMPS)	X			
060125	FC-13 START/STOP				X
060126	FC-13 STATUS (AMPS)	X			
060127	FC-14 START/STOP				X
060128	FC-14 STATUS (AMPS)	X			
060129	FC-15 START/STOP				X
060130	FC-15 STATUS (AMPS)	X			
060131	FC-16 START/STOP				X
060132	FC-16 STATUS (AMPS)	X			
060133	FC-17 START/STOP				X
060134	FC-17 STATUS (AMPS)	X			
060135	FC-18 START/STOP				X
060136	FC-18 STATUS (AMPS)	X			
060137	FC-19 START/STOP				X
060138	FC-19 STATUS (AMPS)	X			
060139	FC-20 START/STOP				X
060140	FC-20 STATUS (AMPS)	X			
060141	FC-21 START/STOP				X
060142	FC-21 STATUS (AMPS)	X			

IO-CONTROLLER 5 (PART 2)					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
060143	FC-22 START/STOP				X
060144	FC-22 STATUS (AMPS)	X			
060145	FC-23 START/STOP				X
060146	FC-23 STATUS (AMPS)	X			
060147	FC-24 START/STOP				X
060148	FC-24 STATUS (AMPS)	X			
060149	FC-25 START/STOP				X
060150	FC-25 STATUS (AMPS)	X			
060151	FC-26 START/STOP				X
060152	FC-26 STATUS (AMPS)	X			

IO-CONTROLLER 6					
POINT NUMBER	POINT DESCRIPTION	INTEGRATED HARDWARE			
		POINT TYPE			
		ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT
070001	FC-27 START/STOP				X
070002	FC-27 STATUS (AMPS)	X			
070003	FC-28 START/STOP				X
070004	FC-28 STATUS (AMPS)	X			
070101	OUTDOOR WEATHER TEMPERATURE	X			
070102	OUTDOOR WEATHER HUMIDITY	X			
070103	AFC CURRENT (AMPS)	X			
070104	DP-1 CURRENT (AMPS)	X			
070105	DP-2 CURRENT (AMPS)	X			

NOTES

———	NEW
———	EXISTING

	ISOLATING VALVE
	MODULATING VALVE
	SOLENOID VALVE
	EXPANSION VALVE
	RELIEF VALVE
	SAND FILTER
	STRAINER
	CHECK VALVE
	BALANCING VALVE
(P)	PRESSURE SENSOR
(T)	TEMPERATURE SENSOR
(F)	FLOW METER
(LS)	LEVEL SWITCH
(R)	RELIEF LINE
	DRAIN VALVE

REFERENCE DEFINITION

SHEET COLUMN / SHEET ROW
SHEET NUMBER
(#, X#)

- NOT FOR CONSTRUCTION -
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VER #	REVISIONS	DATE	BY
4.0	EO #682	08-FEB-23	T.VW.
3.0	EO #668	11-JAN-23	T.VW.
2.0	EO #665	15-DEC-22	Z.M
1.0	ISSUED FOR TENDER	25-NOV-22	T.VW.

I.B. STOREY Rink Engineering Experts
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400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3

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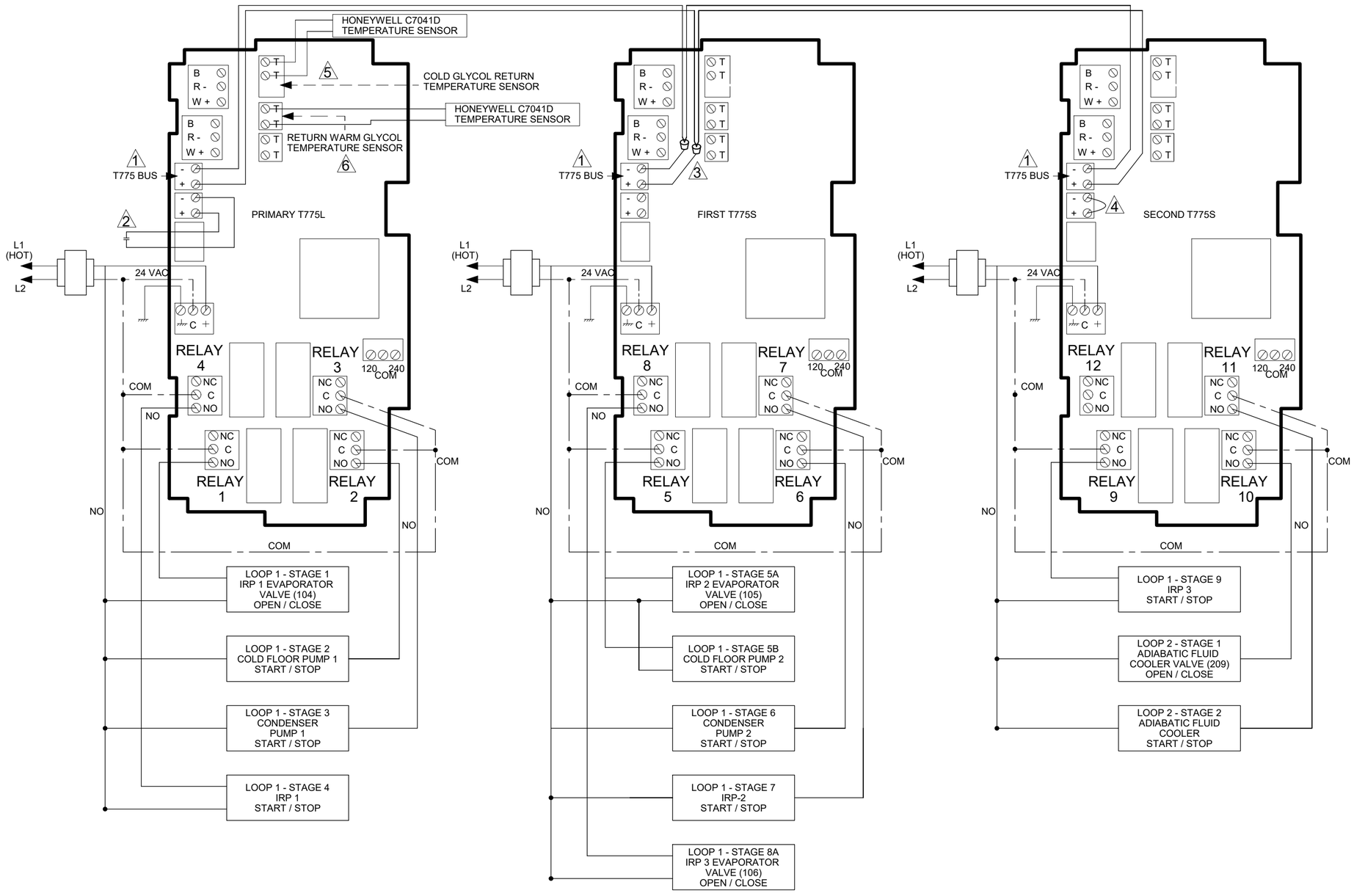
STAMP

DRAWING NUMBER 21010 M-601
DRAWING NAME REFRIGERATION SCHEMATIC PACKAGE
CLIENT CITY OF CHARLOTTETOWN
PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
T.VANWINKLE	J.RITCHIE
DATE 08-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 14 OF 14

21010 M-601



1. T775 BUS TERMINALS PROVIDE WIRING CONNECTIONS TO/FROM T775L AND T775S
2. DIGITAL INPUT FROM SELECTOR SWITCH (DRY CONTACT)
3. USE PIGTAIL CONNECTIONS TO WIRE THE T775 BUS TERMINALS ON THE FIRST T775S
4. LAST T775S MUST HAVE A JUMPER INSTALLED AS SHOWN AT THE JUMPER TERMINAL
5. LOOP 1 CONTROLLED ON RETURN COLD GLYCOL TEMPERATURE
6. LOOP 2 CONTROLLED ON RETURN WARM GLYCOL TEMPERATURE

BACKUP CONTROLLER

NOTES

21010 M-615

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW — (#, X#)

VER #	REVISIONS	DATE	BY
2.0	EO#668	11-JAN-23	T.VW.
1.0	ISSUED FOR TENDER	25-NOV-22	H.A.

I.B. STOREY
Rink Engineering Experts
151 GREAT GEORGE ST., SUITE 302
CHARLOTTETOWN, PEI, C1A 4K8

400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3

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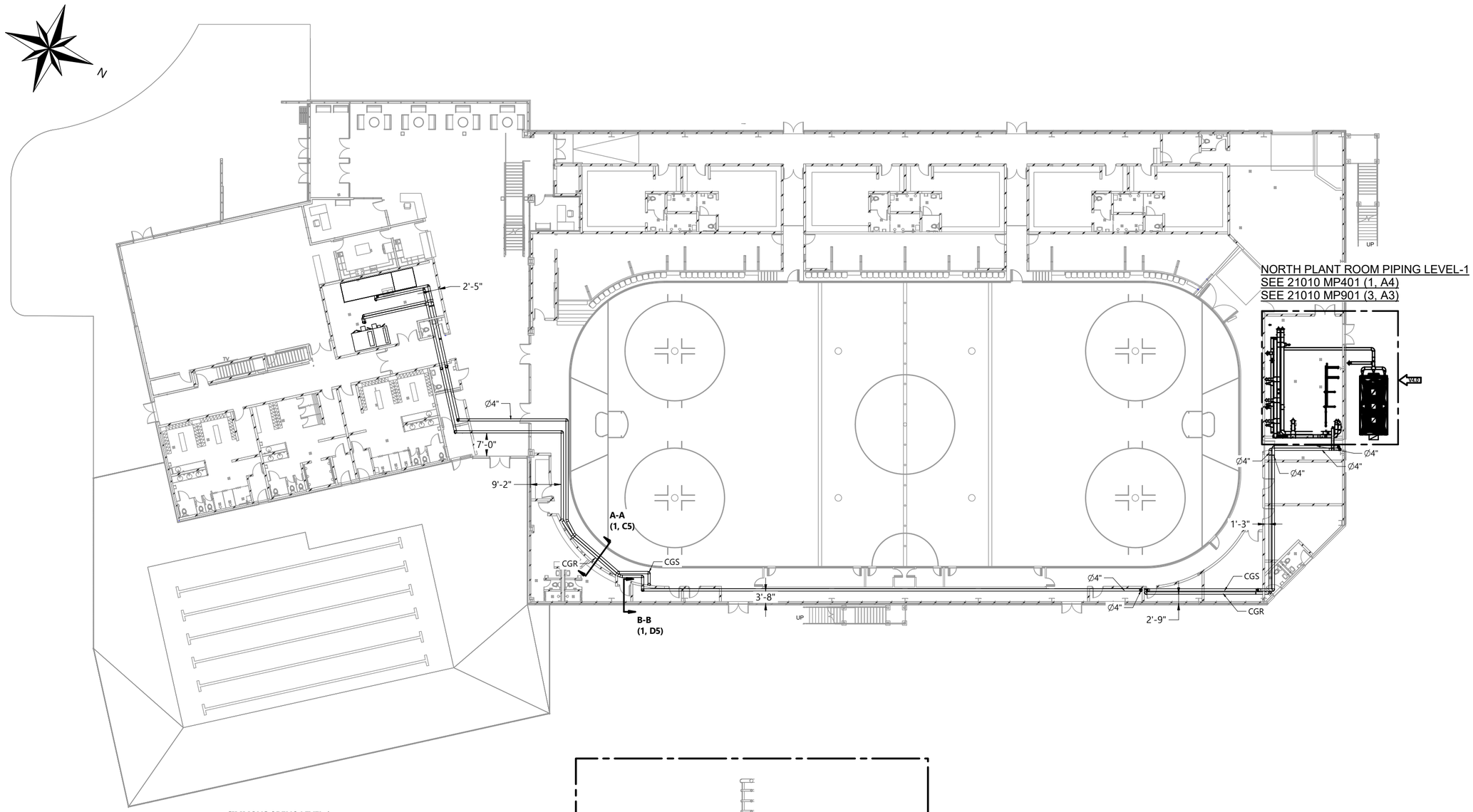
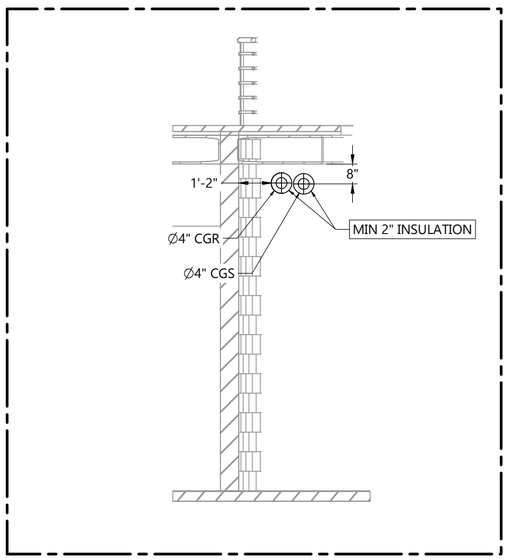
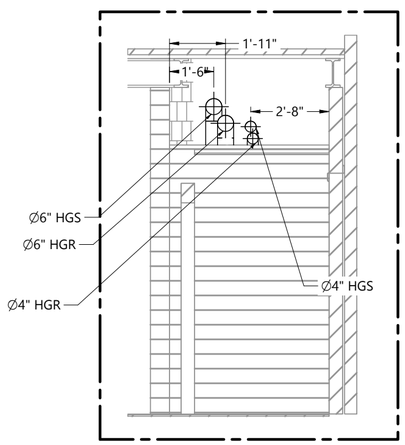
DRAWING NUMBER	21010 M-615
DRAWING NAME	BACKUP CONTROLLER SCHEMATIC
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	11-JAN-23
REVISION	2.0
SHEET SIZE	C
SHEET NO.	1 OF 1



SIMMONS ARENA LEVEL 1
SCALE 1:300



SECTION CUT A-A (1, B3): 45° WALKING TRACK RINK AREA
SCALE 1 : 48



SECTION CUT B-B(1, B3): 90° WALL SECTION AT WALKING TRACK
SCALE 1 : 48

NOTE:

- INDOOR CHILLED GLYCOL PIPING TO BE INSULATED WITH MIN 2" EXTRUDED POLYSTYRENE. PVC JACKETING.

COLD GLYCOL PIPING - LEVEL 1

NOTES

———	NEW
———	EXISTING

21010 MP101

REFERENCE DEFINITION

SHEET COLUMN / SHEET ROW
SHEET NUMBER
(#, X#)

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4.0	EO #668	11-JAN-23	Z.M.
3.0	EO #665	15-DEC-22	Z.M.
2.0	EO #658	09-DEC-22	Z.M.
1.0	RELEASED FOR TENDER	25-NOV-22	Z.M.
VER #	REVISIONS	DATE	BY

I.B. STOREY Rink Engineering Experts

CHARLOTTETOWN PE
VAUGHAN ON
REDINGTON SHORES FL

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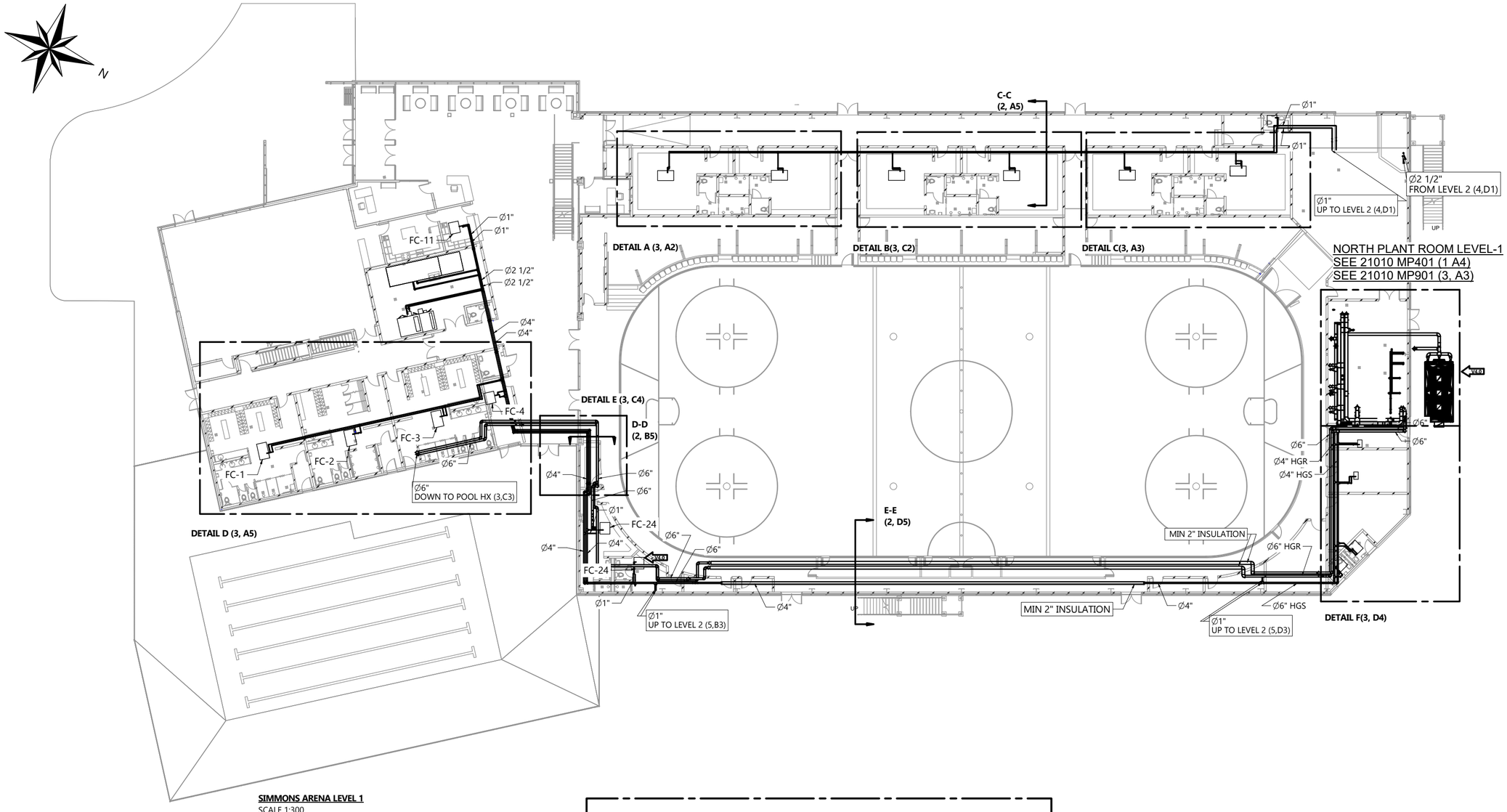
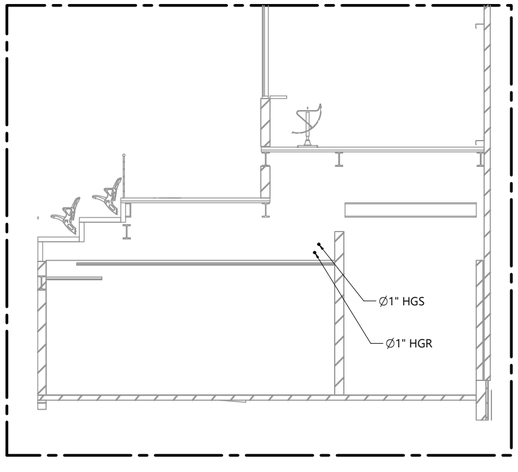
STAMP

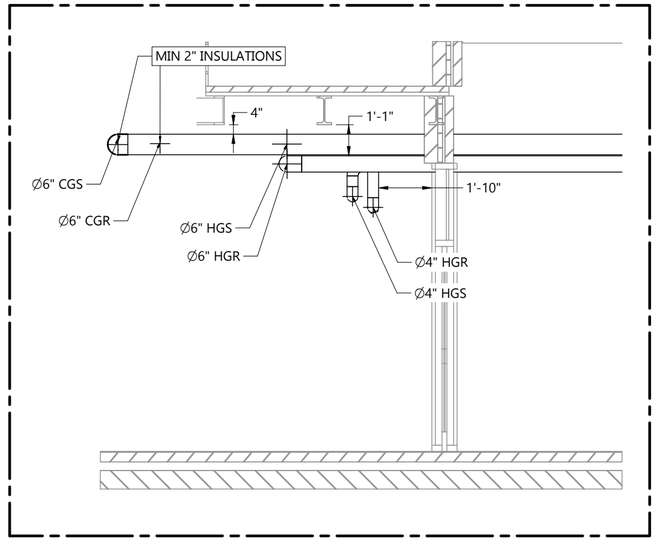
DRAWING NUMBER	21010 MP101
DRAWING NAME	SIMMONS PIPING DISTRIBUTION
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	11-JAN-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	1 OF 6



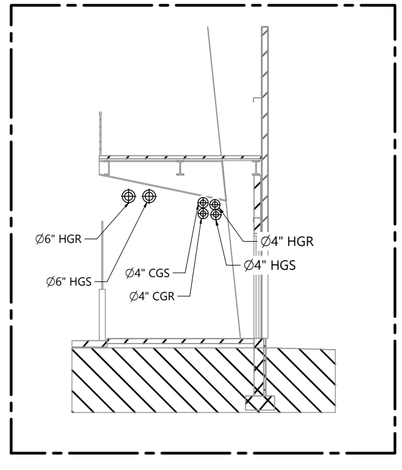
SIMMONS ARENA LEVEL 1
SCALE 1:300



SECTION CUT C-C (2, C1): ⌒90· WALL SECTION AT WARM ROOM
SCALE 1 : 96



SECTION CUT D-D (2, B2): WALL SECTION AT WALKING TRACK
SCALE 1 : 48



SECTION CUT E-E(2, C3): ⌒90· WALL SECTION AT WALKING TRACK
SCALE 1 : 96

NOTE:

- ALL PIPING IN RINK ZONE TO BE INSULATED AND JACKETED. MIN 2" EXTRUDED POLYSTYRENE WITH PVC JACKETING.

WARM GLYCOL PIPING - LEVEL 1

21010 MP101

NOTES

	NEW
	EXISTING

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CLIENT CITY OF CHARLOTTETOWN
PROJECT SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

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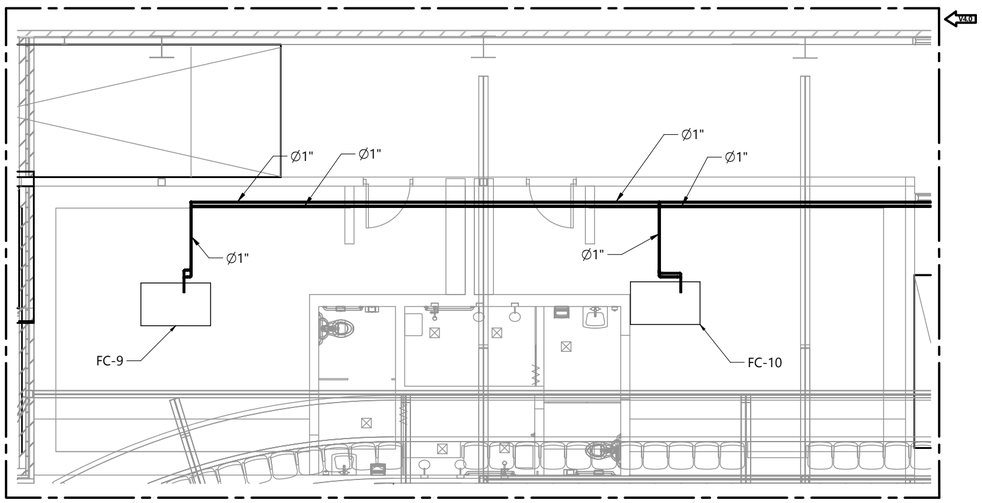
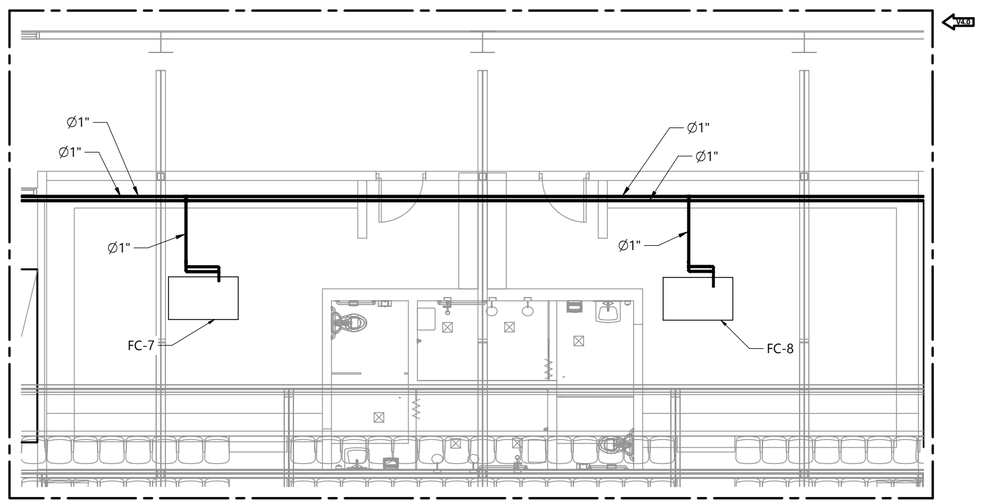
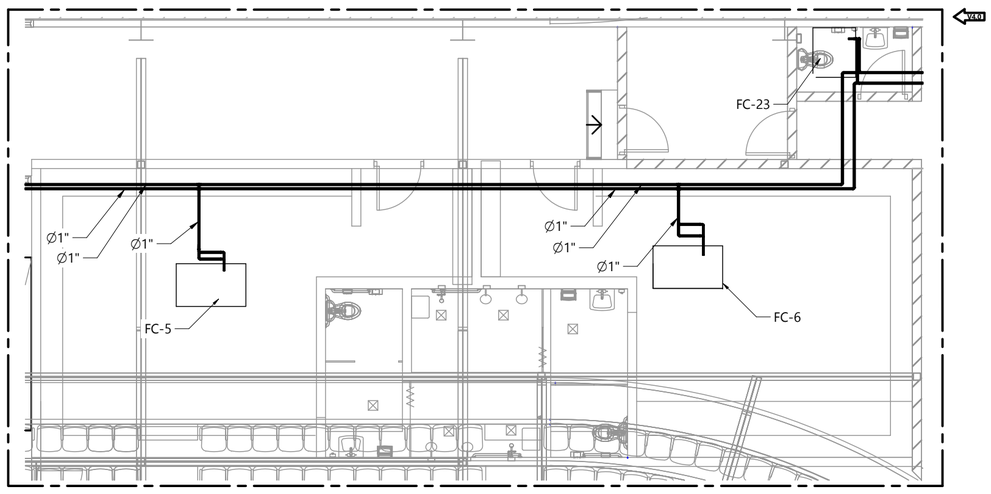
Z.MBADDER	J.RITCHIE
DATE	**REVISION**
11-JAN-23	4.0
SHEET SIZE	**SHEET NO.**
C	2 OF 6



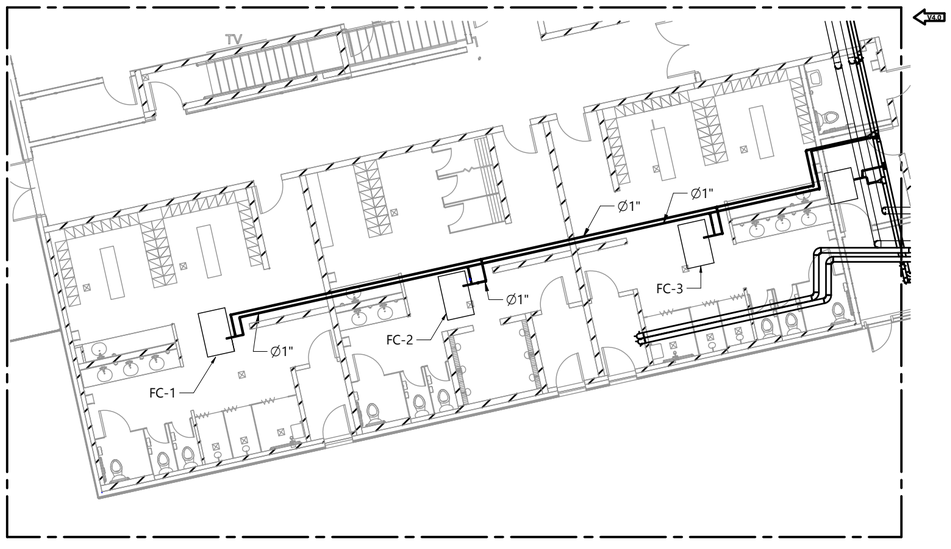
DETAIL A (2, B2): WARM PIPING FC-9 & FC-10
SCALE 1 : 96



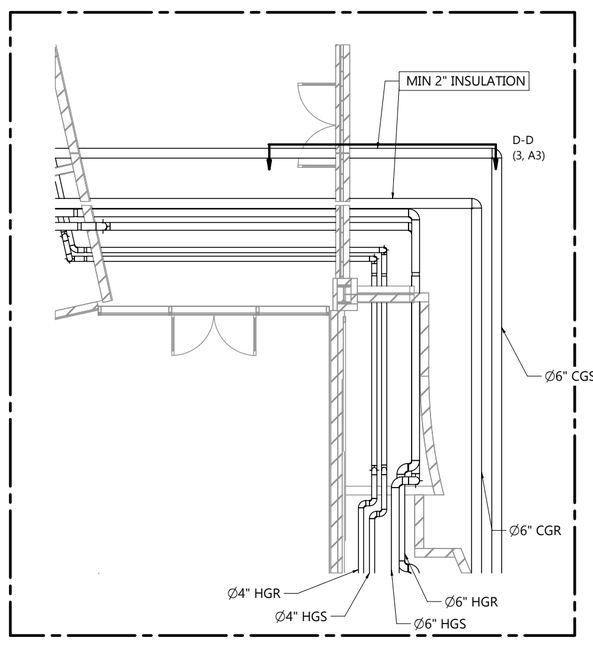
DETAIL B (2, C2): WARM PIPING FC-7 & FC-8
SCALE 1 : 96



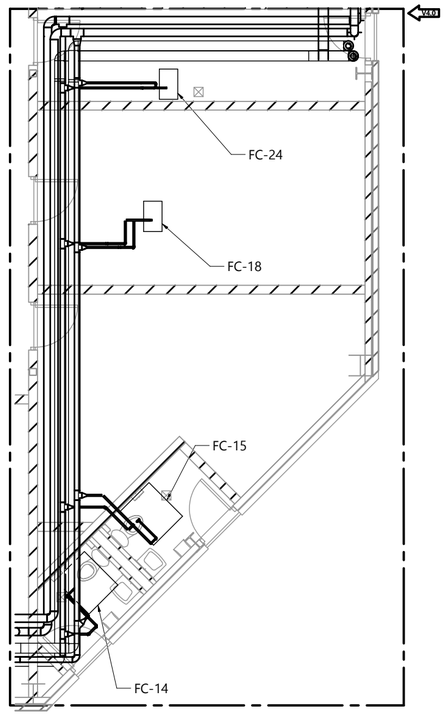
DETAIL C (2, D2): WARM PIPING FC-5 & FC-6
SCALE 1 : 96



DETAIL D (2, A3): WARM PIPING FC-5 & FC-6
SCALE 1 : 150



DETAIL E (2, B2): WARM & COLD PIPING-LEVEL 1
SCALE 1 : 96



DETAIL F (2, D3): WARM & COLD PIPING
SCALE 1 : 96

FAN COIL DETAILS

NOTES

	NEW
	EXISTING

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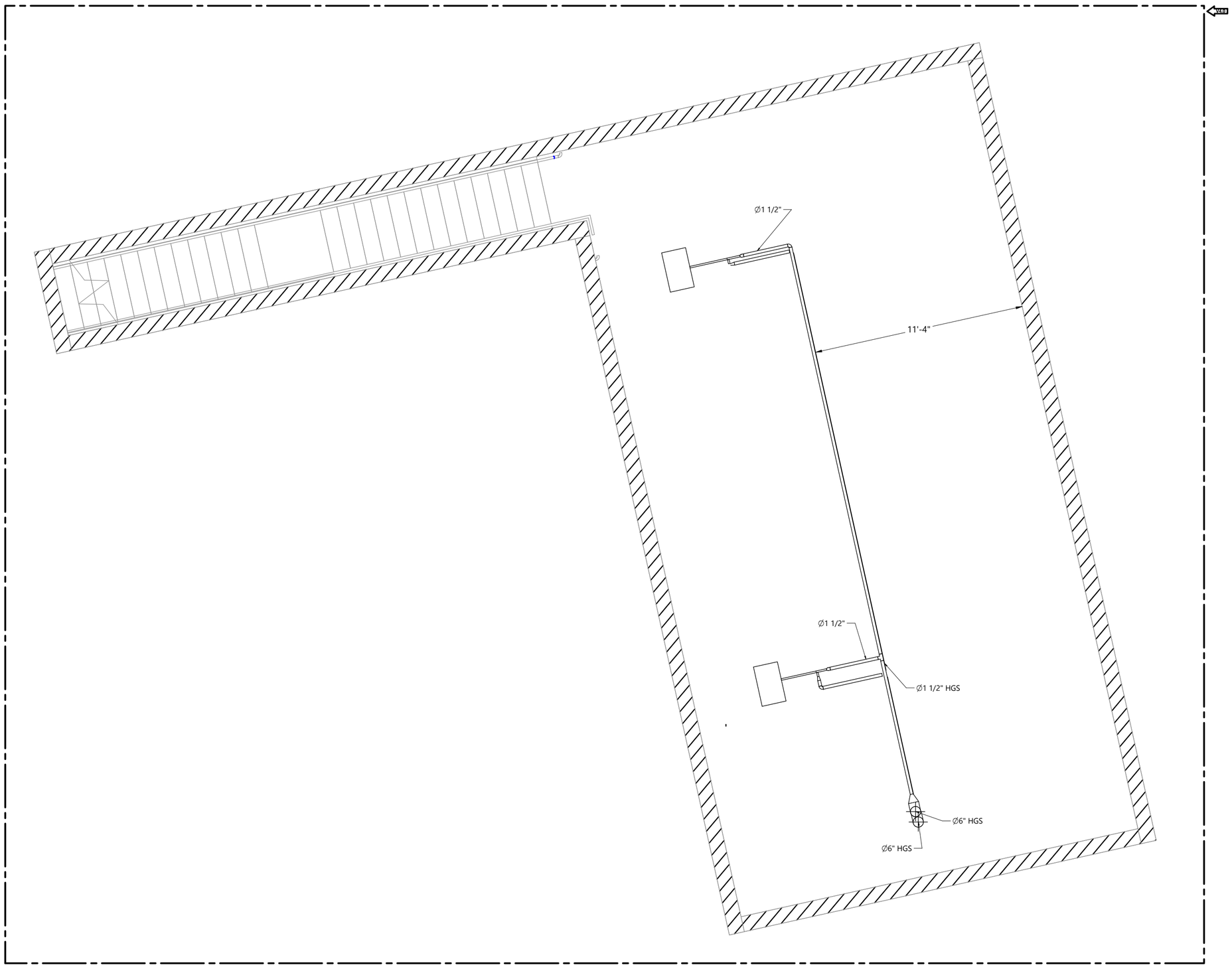

SIMMONS ARENA ROOM MECH POOL BASEMENT
SCALE 1:50

NOTE:

- ALL PIPING IN RINK ZONE TO BE INSULATED AND JACKETED. MIN 2" EXTRUDED POLYSTYRENE WITH PVC JACKETING.
- INDOOR CHILLED GLYCOL PIPING TO BE INSULATED WITH MIN 2" EXTRUDED POLYSTYRENE. PVC JACKETING.

WARM GLYCOL PIPING - MECHANICAL POOL

NOTES

———	NEW
———	EXISTING

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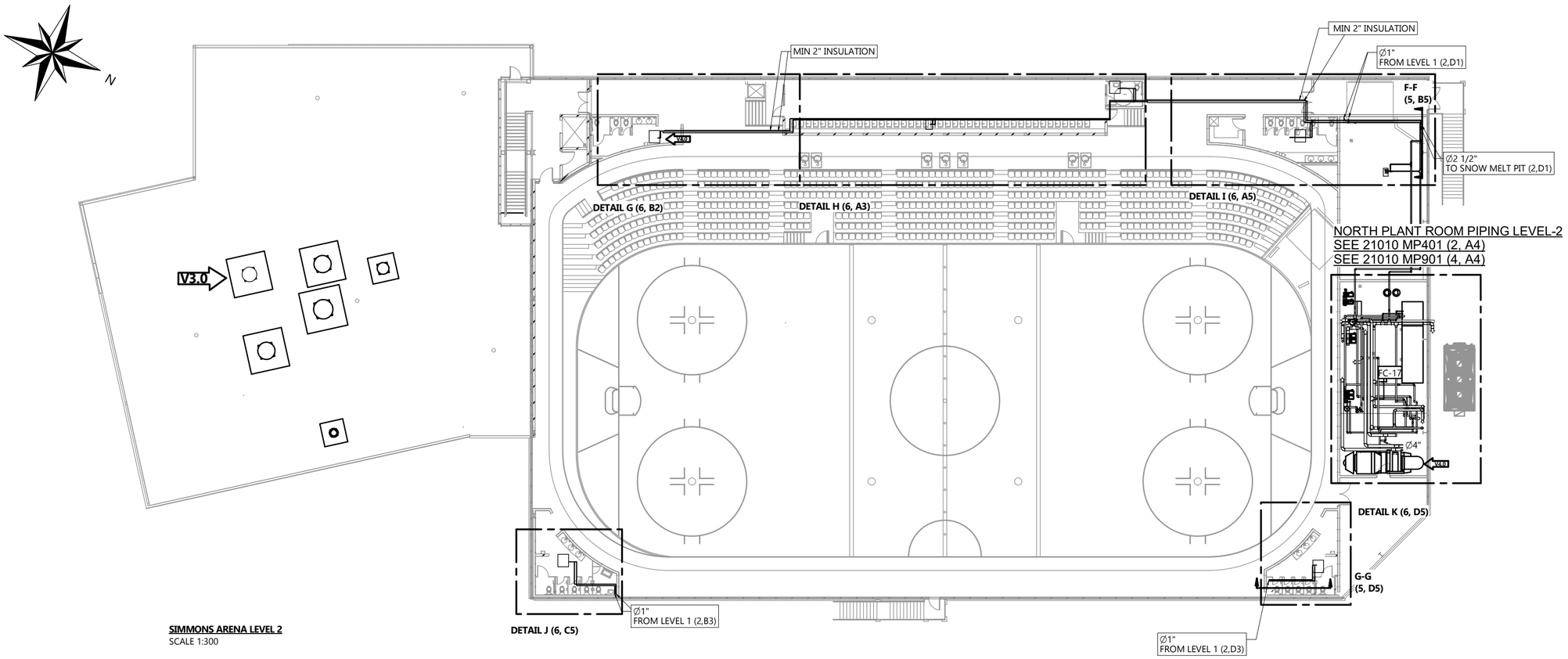
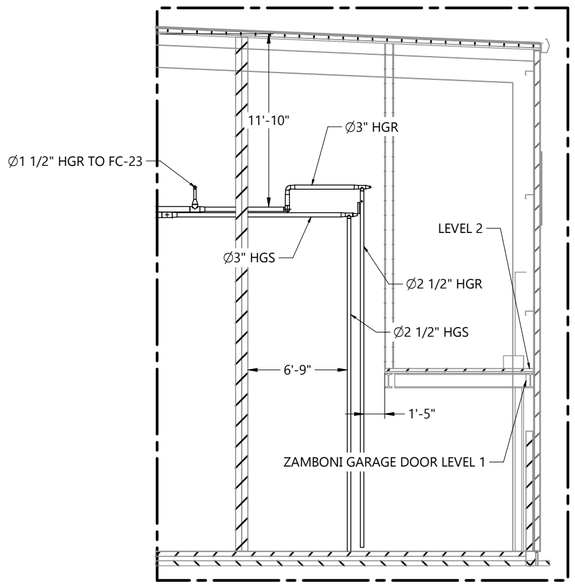
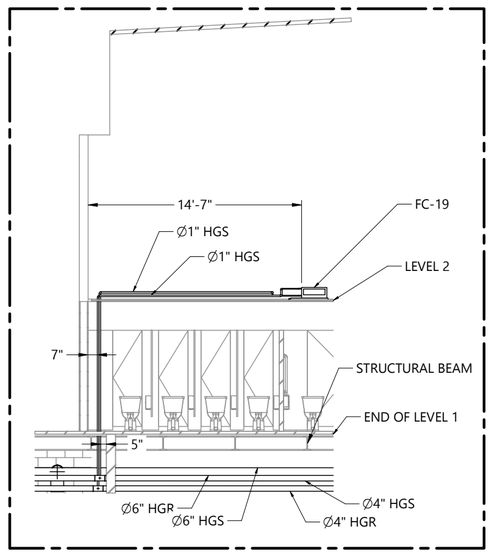


SIMMONS ARENA LEVEL 2
SCALE 1:300



SECTION CUT F-F (5, D1)◠90°: WALL SECTION AT SNOW MELT PIT
SCALE 1 : 96



SECTION CUT G-G (5, D3): WARM PIPING TO LEVEL 2
SCALE 1 : 96

NOTE:

- ALL PIPING IN RINK ZONE TO BE INSULATED AND JACKETED. MIN 2" EXTRUDED POLYSTYRENE WITH PVC JACKETING.

WARM GLYGOL PIPING - LEVEL 2

NOTES

———	NEW
———	EXISTING

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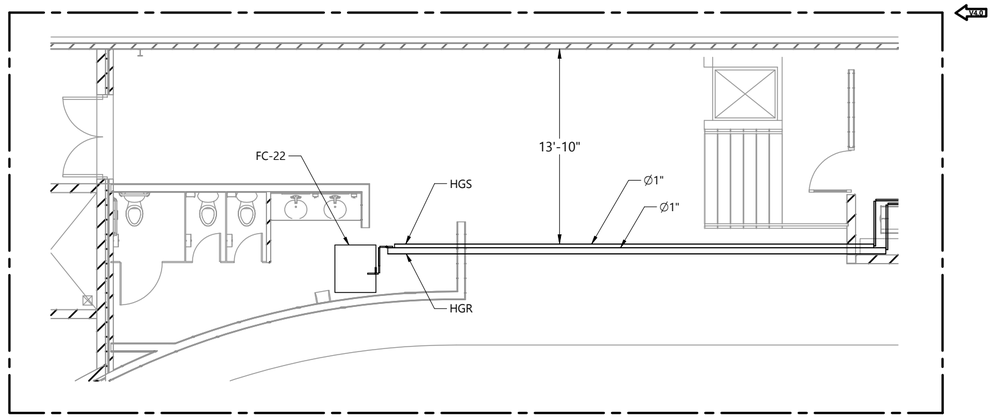
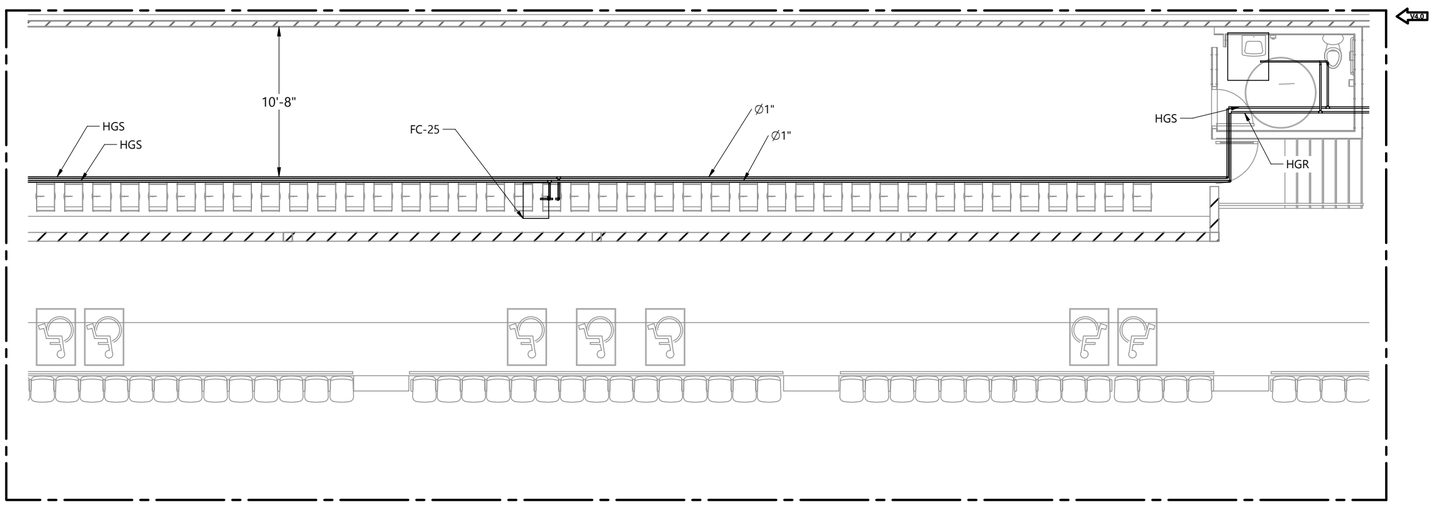
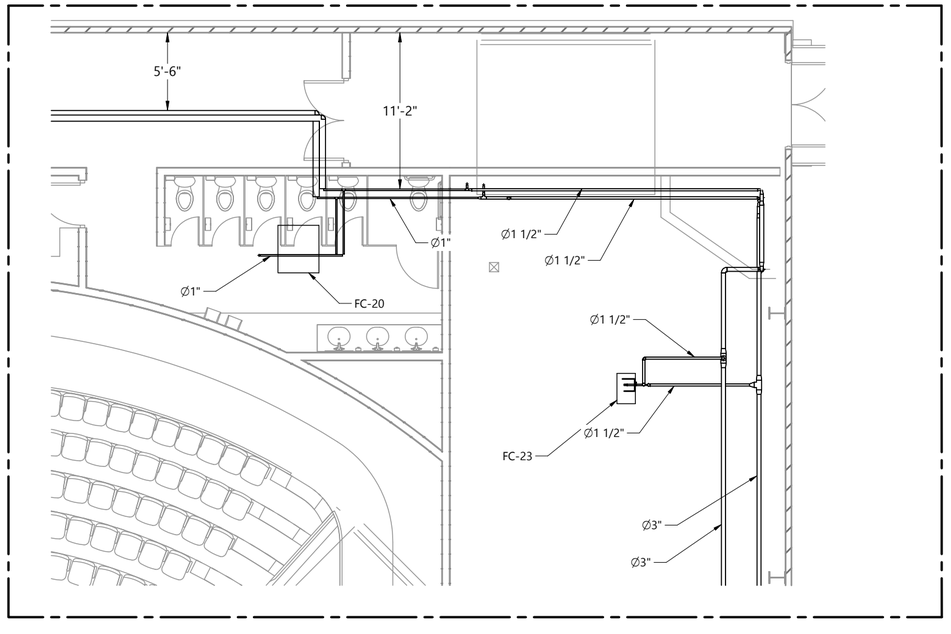
SHEET NO.	5 OF 6



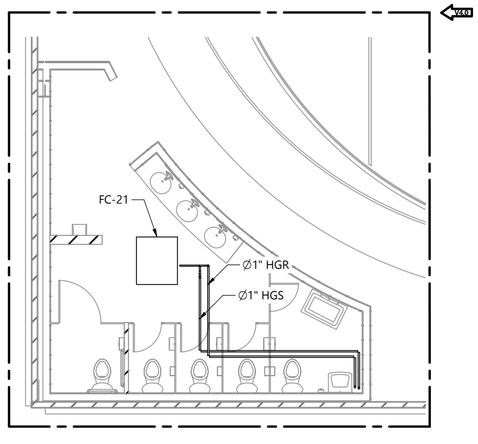
DETAIL G (5, B1): WARM PIPING FC-22
SCALE 1 : 96



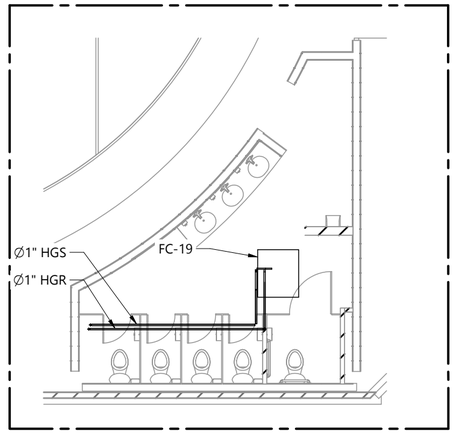
DETAIL H (5, C1): WARM ROOM PIPING
SCALE 1 : 96



DETAIL I (5, D1): WARM PIPING FC-20 & FC-23
SCALE 1 : 96



DETAIL J(5, B3): WARM PIPING FC-21
SCALE 1 : 96



DETAIL K (5, D3): WARM PIPING FC-19
SCALE 1 : 96

FAN COIL DETAILS - LEVEL 2

NOTES

	NEW
	EXISTING

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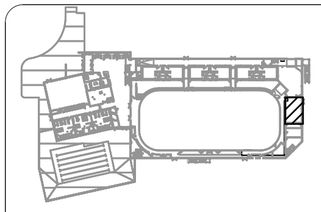
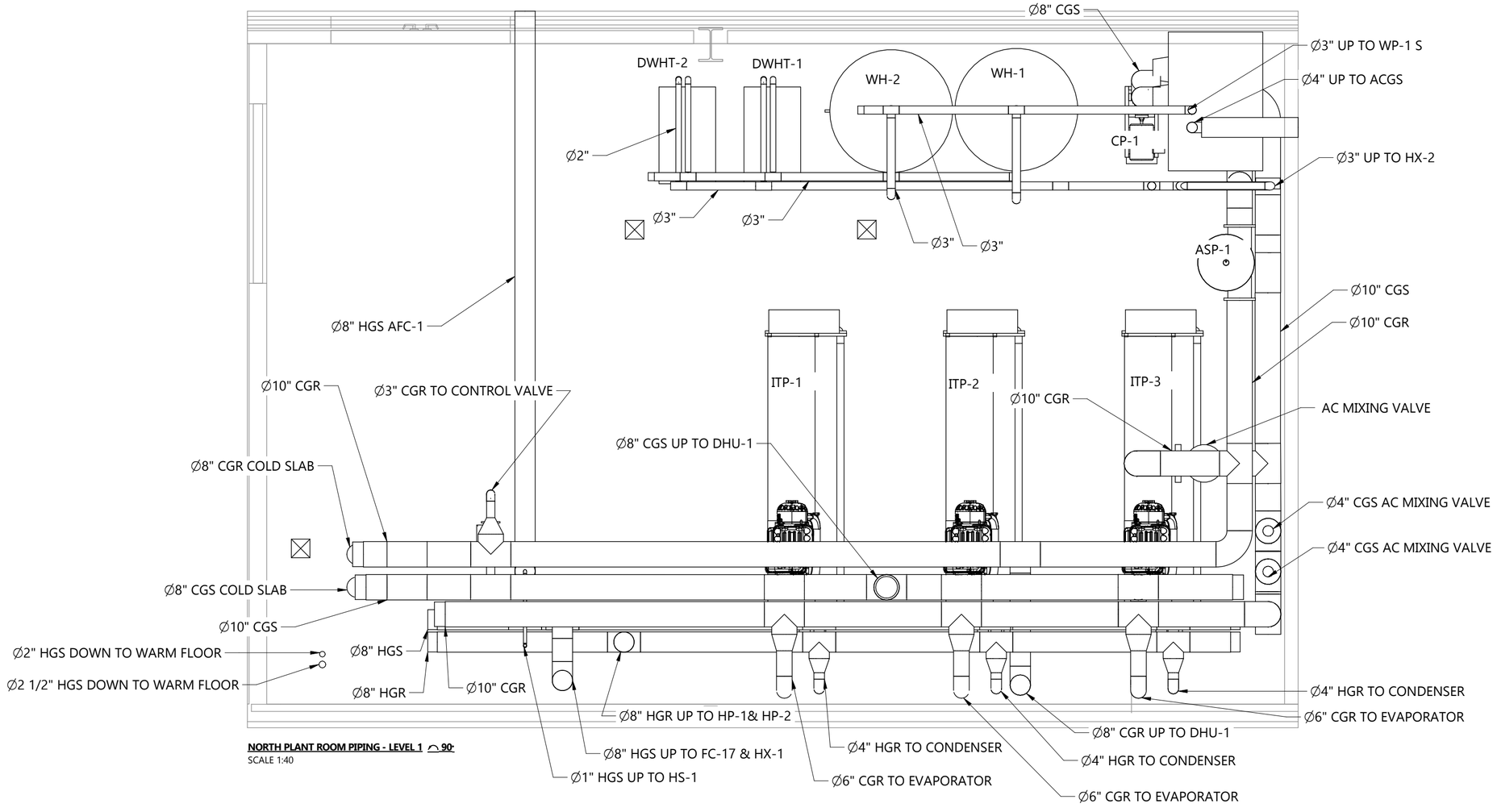


SITE KEY
SCALE 1:2000



NORTH PLANT ROOM PIPING - LEVEL 1 ⌒ 90·
SCALE 1:40

NORTH PLANT ROOM ENLARGED - LEVEL 1

NOTES

21010 MP401

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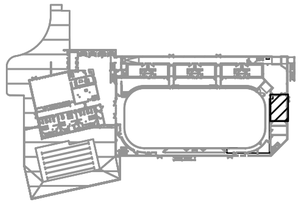
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY Z.MBADDER	**CHECKED BY** J.RITCHIE
DATE 11-JAN-23	**REVISION** 2.0
SHEET SIZE C	**SHEET NO.** 1 OF 2



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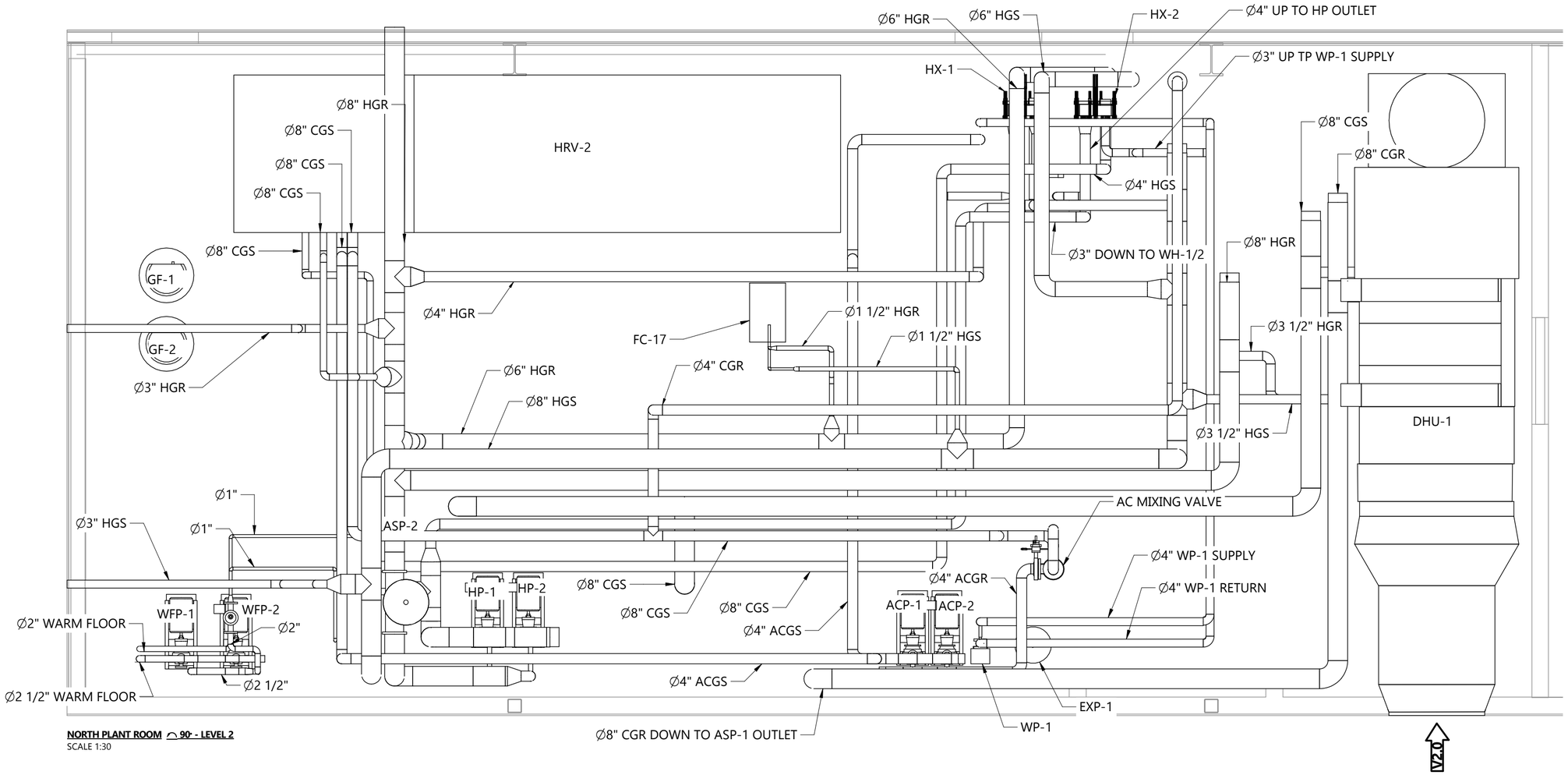

NORTH PLANT ROOM **90' - LEVEL 2**
SCALE 1:30

NORTH PLANT ROOM ENLARGED - LEVEL 2

NOTES

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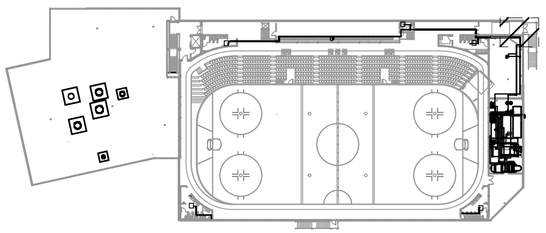
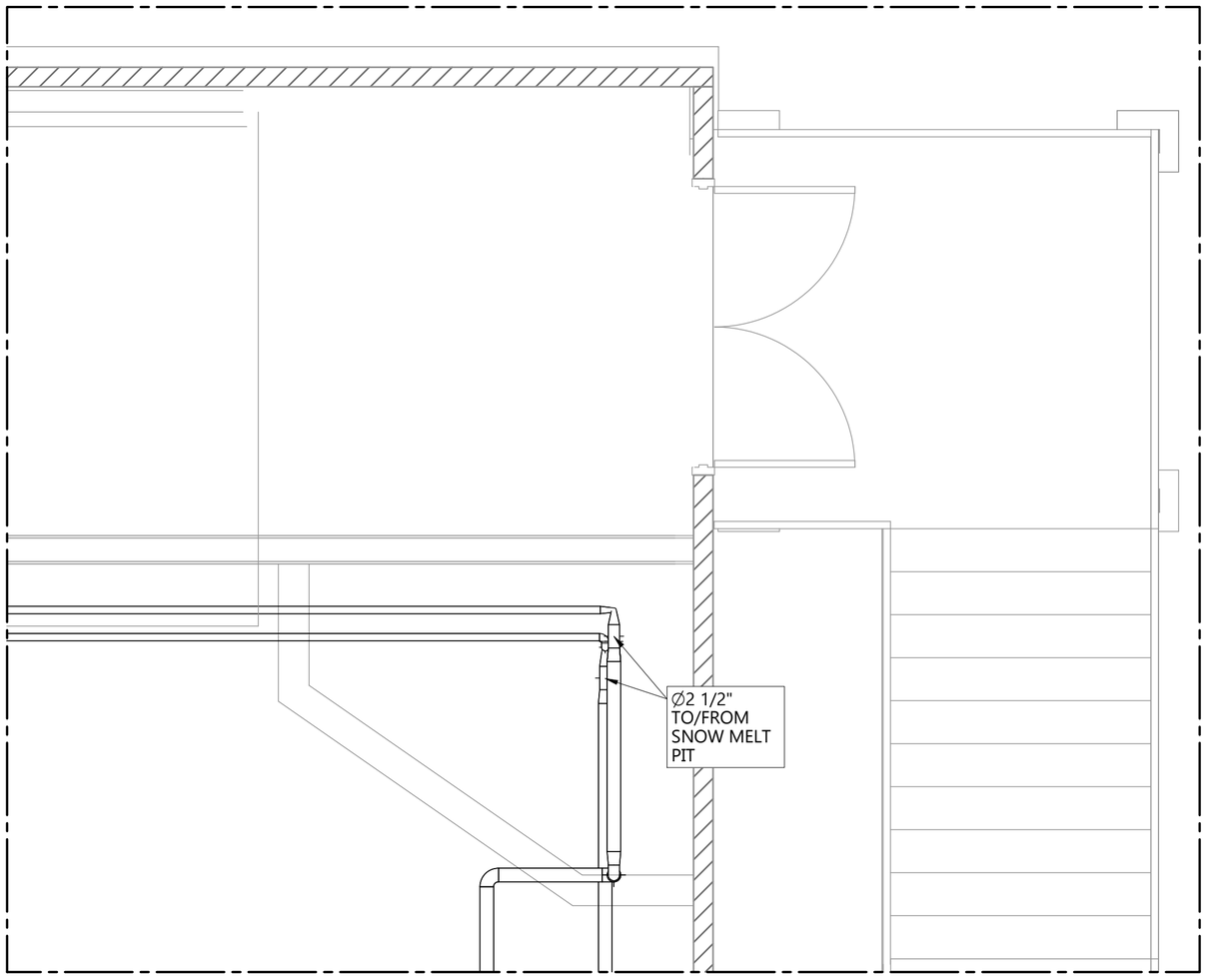
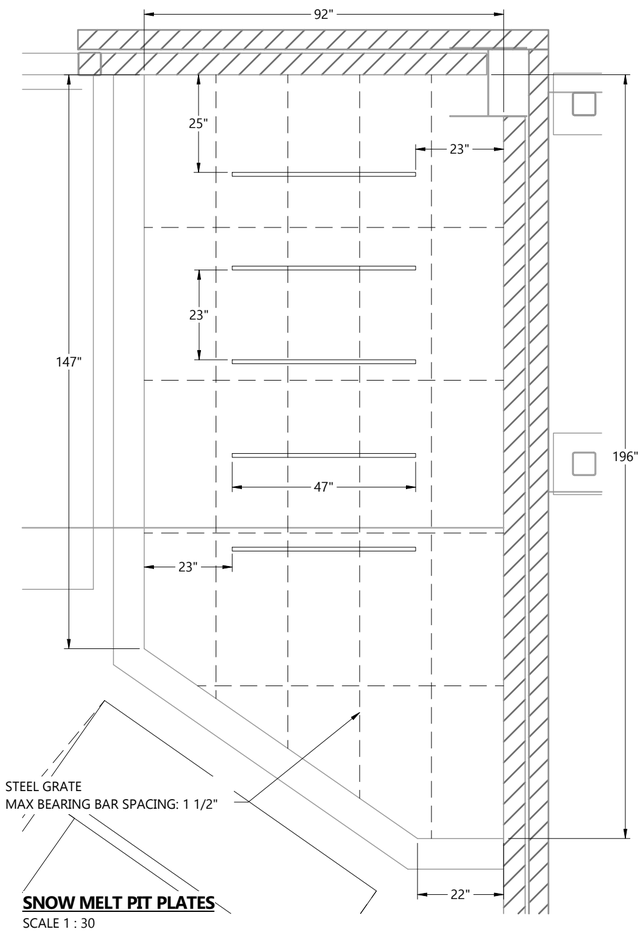


SITE KEY
SCALE 1 : 1000



SNOW MELT PIT HOT GLYCOL PIPING CONNECTIONS
SCALE 1 : 30



SNOW MELT PIT PLATES
SCALE 1 : 30

NOTE:

- PLATES MUST BE SECURED TO EACH OTHER AND TO THE WALLS FOR STABILITY.
- PLATE LENGTH: 47 IN
- PLATE DEPTH: 37 IN

SNOW MELT PIT DETAILS

NOTES

	NEW
	EXISTING

21010 MP403

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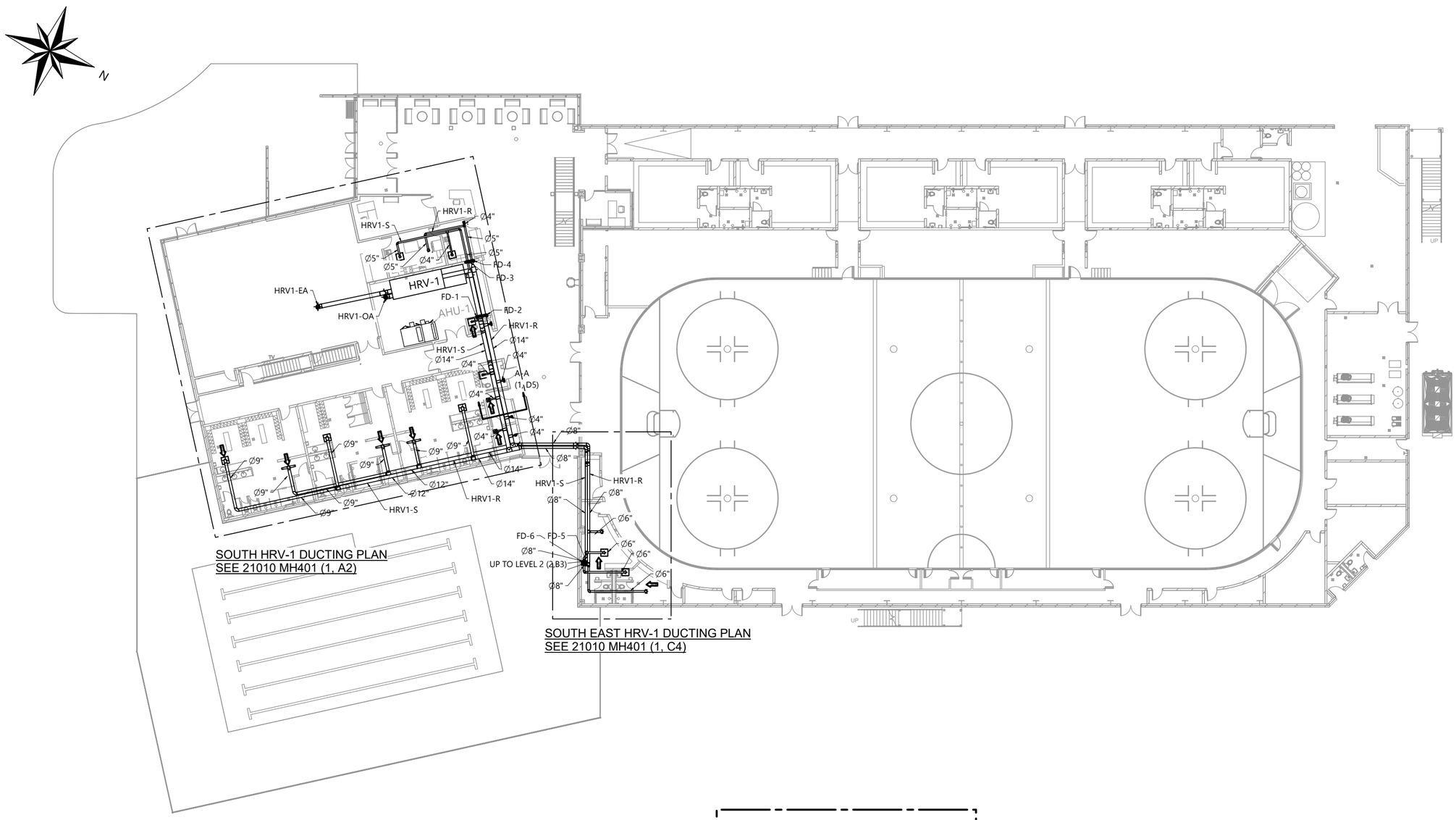
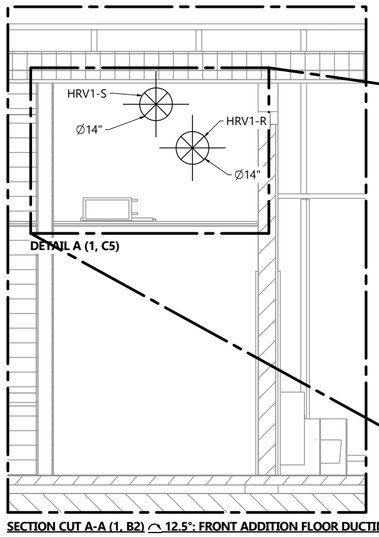


SOUTH HRV-1 DUCTING PLAN
SEE 21010 MH401 (1, A2)

SOUTH EAST HRV-1 DUCTING PLAN
SEE 21010 MH401 (1, C4)

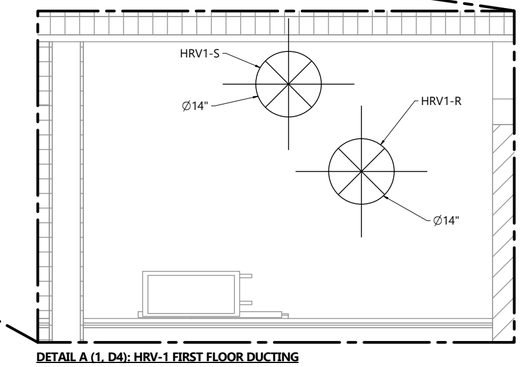
SIMMONS ARENA LEVEL 1
SCALE: 1:300

HRV-1 LEVEL 1 - FIRE DAMPER SCHEDULE				
UNIT TAG	**DUCT SIZE**	**FIRE RATING**	**DIMENSIONS**	**DAMPER MODEL**
FD-1	14"	1.5 HOUR	14"	FDR-510
FD-2	14"	1.5 HOUR	14"	FDR-510
FD-3	5"	1.5 HOUR	5"	FDR-510
FD-4	5"	1.5 HOUR	5"	FDR-510
FD-5	8"	3 HOUR	10"X10"	FD-350
FD-6	8"	3 HOUR	10"X10"	FD-350
FD-7	14"	1.5 HOUR	14"	FDR-510



DETAIL A (1, C5)

SECTION CUT A-A (1, B2) ⌒ 12.5°: FRONT ADDITION FLOOR DUCTING PATH
SCALE 1 : 50



DETAIL A (1, D4): HRV-1 FIRST FLOOR DUCTING
SCALE 1 : 25

NOTE:
- DUCTING IN THE RINK ZONE IS TO BE INSULATED
- SDA PLENUMS MUST BE FIELD MODIFIED TO ALLOW DIFFUSERS TO PENETRATE ARCHITECTURAL CEILING

LEVEL 1 - HRV1

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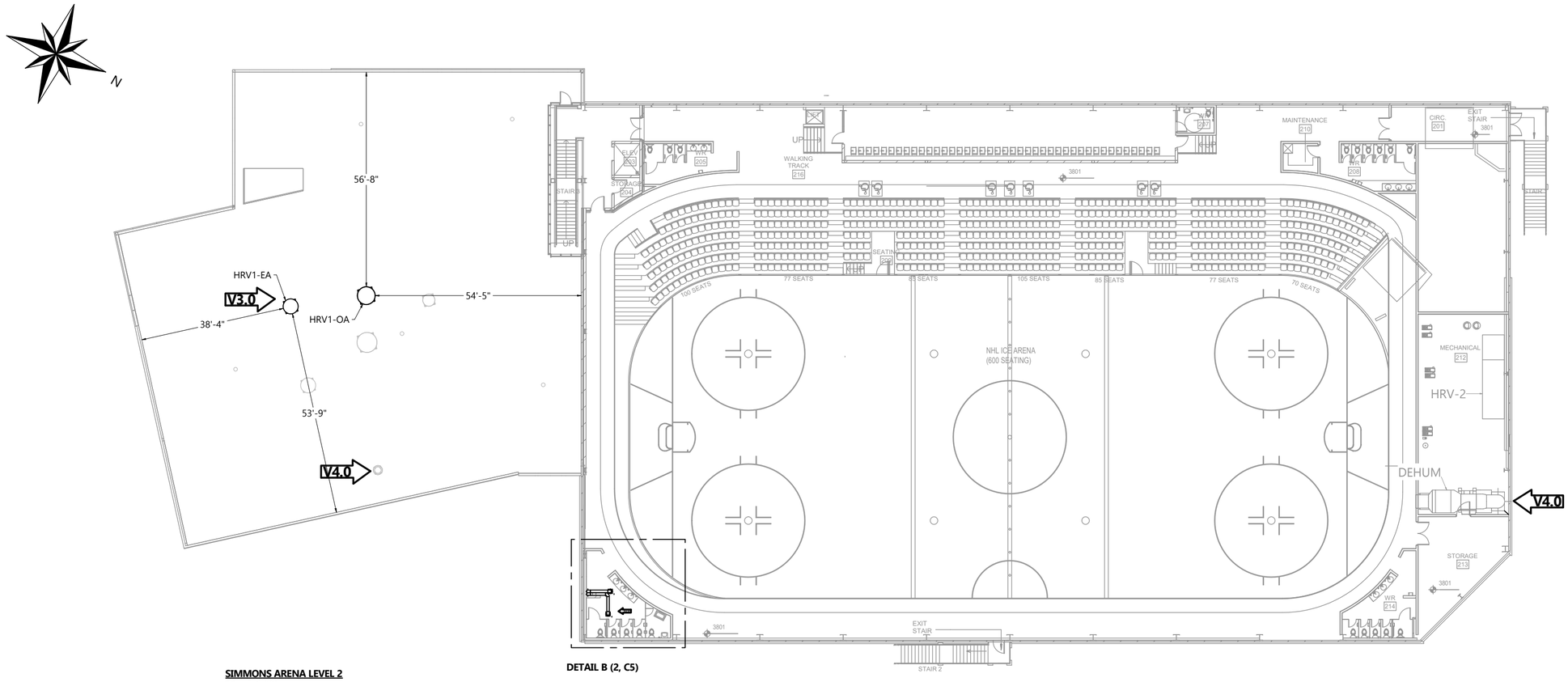
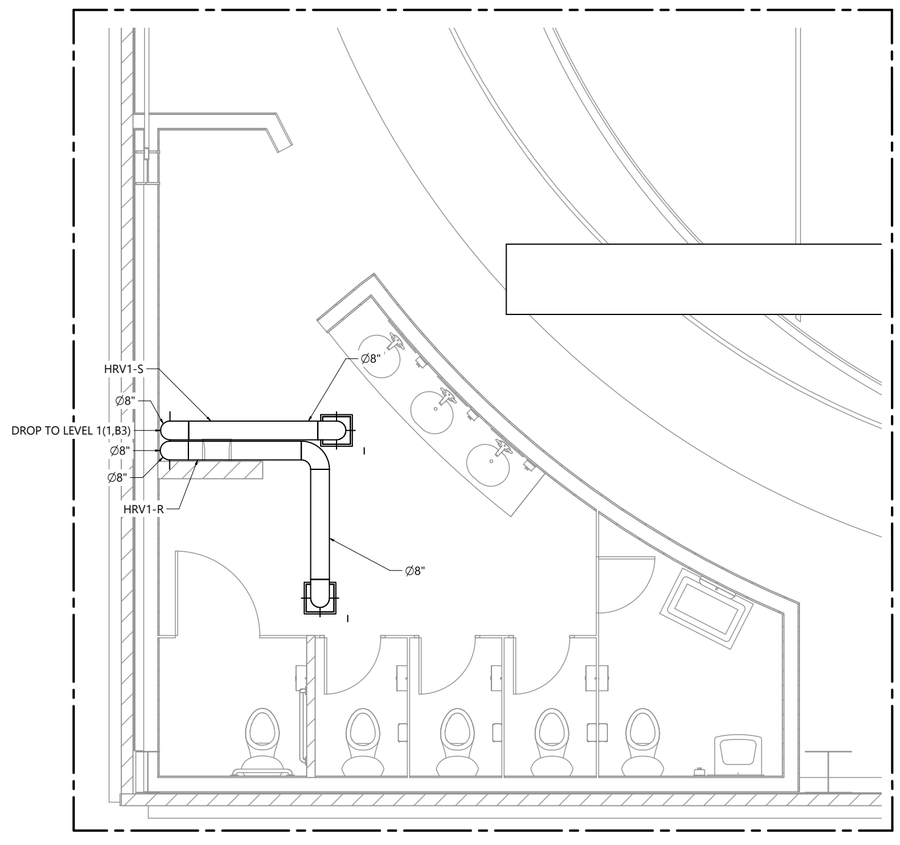


SIMMONS ARENA LEVEL 2
SCALE: 1:300

DETAIL B (2, C5)



DETAIL B (2, B3):HRV-1 DUCTING WR SE
SCALE 1 : 50

NOTE:

- DUCTING IN THE RINK ZONE IS TO BE INSULATED
- SDA PLENUMS MUST BE FIELD MODIFIED TO ALLOW DIFFUSERS TO PENETRATE ARCHITECTURAL CEILING

LEVEL 2 - HRV1

21010 MH101

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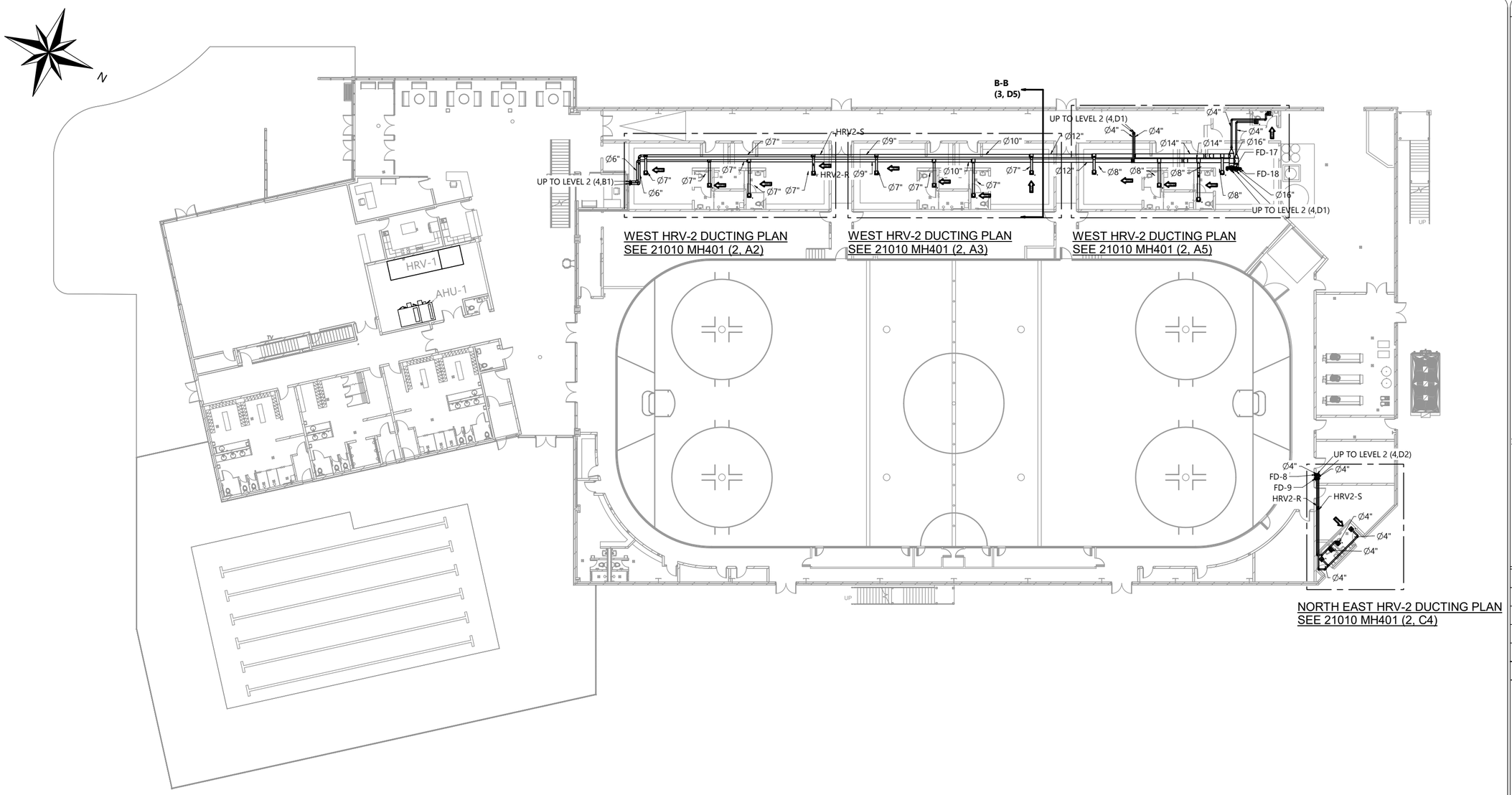
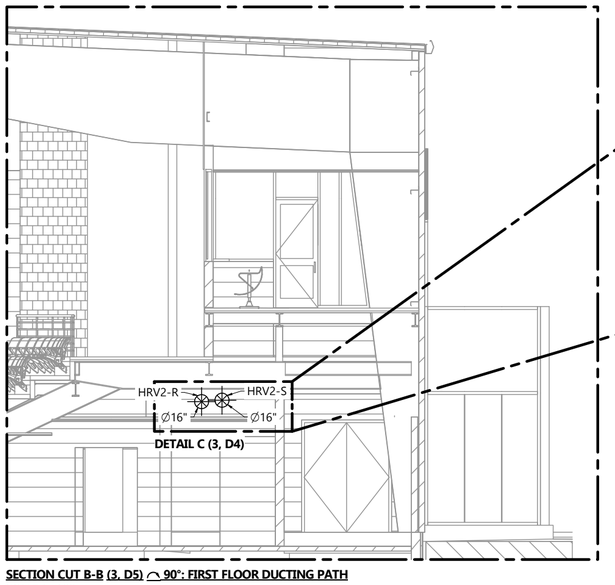
PROJECT
SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
M.HILANEH	J.RITCHIE
DATE	**REVISION**
11-JAN-23	4.0
SHEET SIZE	**SHEET NO.**
C	2 OF 8

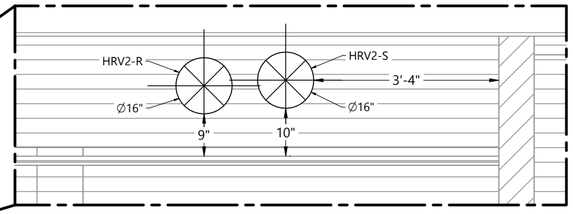


SIMMONS ARENA LEVEL 1
SCALE: 1:300

HRV-2 LEVEL 1 - FIRE DAMPER SCHEDULE				
UNIT TAG	**DUCT SIZE**	**FIRE RATING**	**DIMENSIONS**	**DAMPER MODEL**
FD-8	4"	3 HOUR	5"X5"	FD-350
FD-9	4"	3 HOUR	5"X5"	FD-350
FD-17	16"	3 HOUR	20"X20"	FD-350
FD-18	16"	3 HOUR	20"X20"	FD-350



SECTION CUT B-B (3, D5) ⌒ 90°: FIRST FLOOR DUCTING PATH
SCALE 1 : 100



DETAIL C (3, C5): HRV-1 FIRST FLOOR DUCTING
SCALE 1 : 25

NOTE:
- DUCTING IN THE RINK ZONE IS TO BE INSULATED
- SDA PLENUMS MUST BE FIELD MODIFIED TO ALLOW DIFFUSERS TO PENETRATE ARCHITECTURAL CEILING

LEVEL 1 - HRV2

21010 MH101

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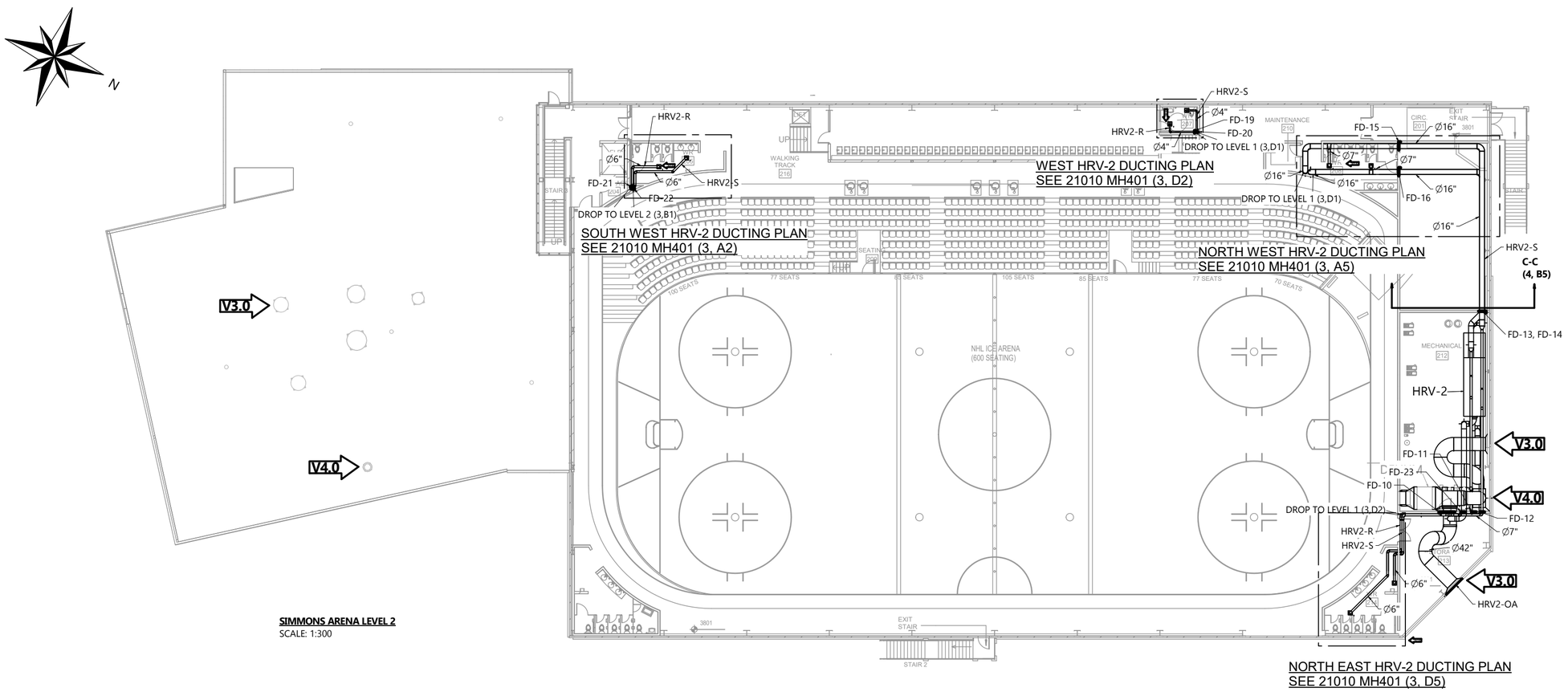
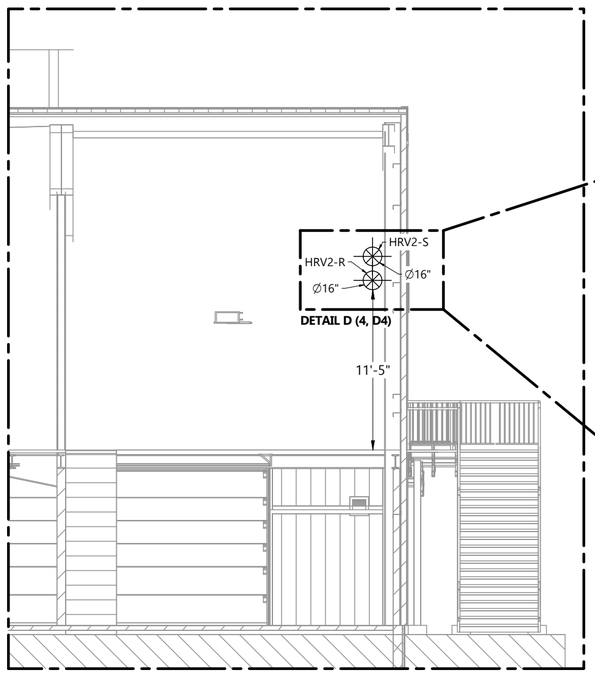
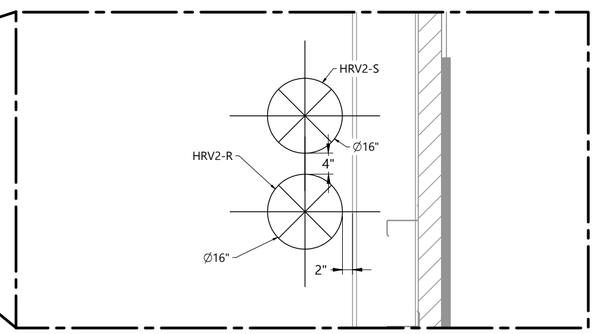


SIMMONS ARENA LEVEL 2
SCALE: 1:300

HRV-2 LEVEL 2 - FIRE DAMPER SCHEDULE				
UNIT TAG	**DUCT SIZE**	**FIRE RATING**	**DIMENSIONS**	**DAMPER MODEL**
FD-10	42"	1.5 HOUR	48"X48"	FD-150
FD-11	7"	1.5 HOUR	7"	FDR-510
FD-12	7"	1.5 HOUR	7"	FDR-510
FD-13	16"	3 HOUR	20"X20"	FD-350
FD-14	16"	3 HOUR	20"X20"	FD-350
FD-15	16"	3 HOUR	20"X20"	FD-350
FD-16	16"	3 HOUR	20"X20"	FD-350
FD-19	4"	3 HOUR	5"X5"	FD-350
FD-20	4"	3 HOUR	5"X5"	FD-350
FD-21	6"	3 HOUR	8"X8"	FD-350
FD-22	6"	3 HOUR	8"X8"	FD-350
FD-23	16"	1.5 HOUR	16"	FDR-510



SECTION CUT C-C (4, D2): SECOND FLOOR DUCTING PATH
SCALE 1 : 100



DETAIL D (4, C4): HRV-2 SECOND FLOOR DUCTING
SCALE 1 : 25

NOTE:
- DUCTING IN THE RINK ZONE IS TO BE INSULATED
- SDA PLENUMS MUST BE FIELD MODIFIED TO ALLOW DIFFUSERS TO PENETRATE ARCHITECTURAL CEILING

LEVEL 2 - HRV2

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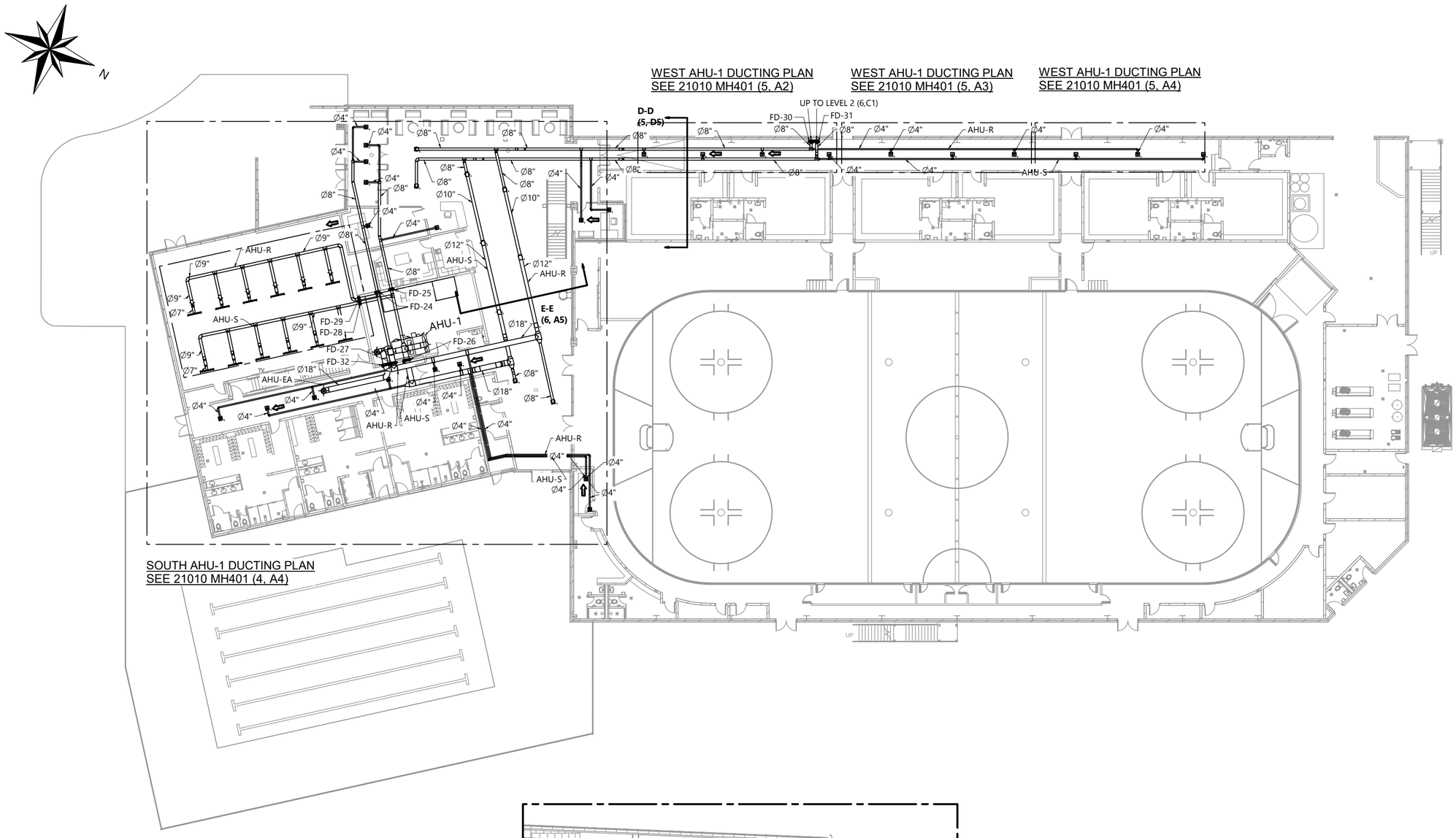
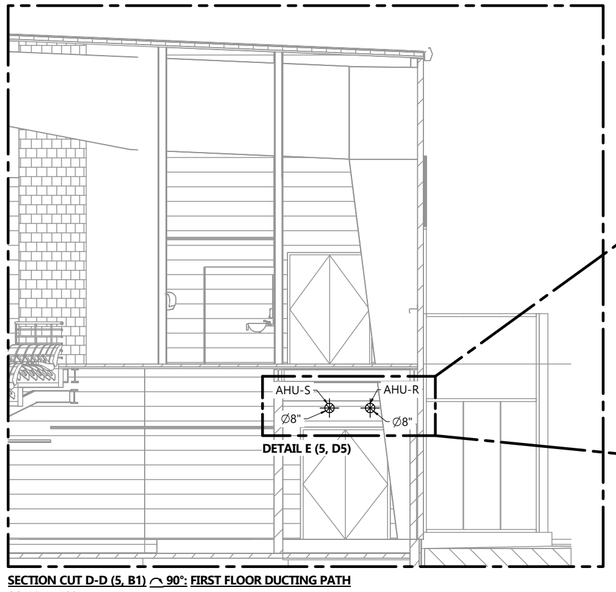
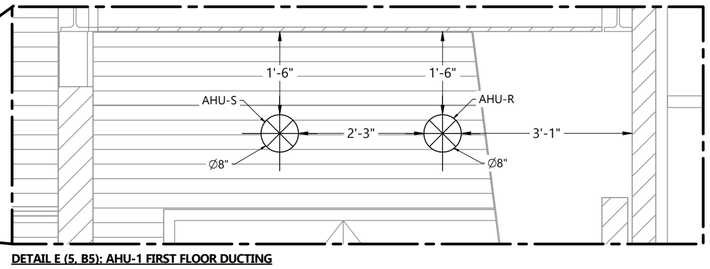


SIMMONS ARENA LEVEL 1
SCALE: 1:300

AHU-1 LEVEL 1 - FIRE DAMPER SCHEDULE				
UNIT TAG	**DUCT SIZE**	**FIRE RATING**	**DIMENSIONS**	**DAMPER MODEL**
FD-24	8"	1.5 HOUR	8"	FDR-510
FD-25	8"	1.5 HOUR	8"	FDR-510
FD-26	18"	1.5 HOUR	18"	FDR-510
FD-27	18"	1.5 HOUR	18"	FDR-510
FD-28	9"	1.5 HOUR	9"	FDR-510
FD-29	9"	1.5 HOUR	9"	FDR-510
FD-30	8"	3 HOUR	10"X10"	FD-350
FD-31	8"	3 HOUR	10"X10"	FD-350
FD-32	14"	1.5 HOUR	14"	FDR-510



DETAIL E (5, D5)



DETAIL E (5, B5): AHU-1 FIRST FLOOR DUCTING
SCALE 1 : 25

SECTION CUT D-D (5, B1) ⌒ 90°: FIRST FLOOR DUCTING PATH
SCALE 1 : 100

NOTE:

- DUCTING IN THE RINK ZONE IS TO BE INSULATED
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LEVEL 1 - AHU1

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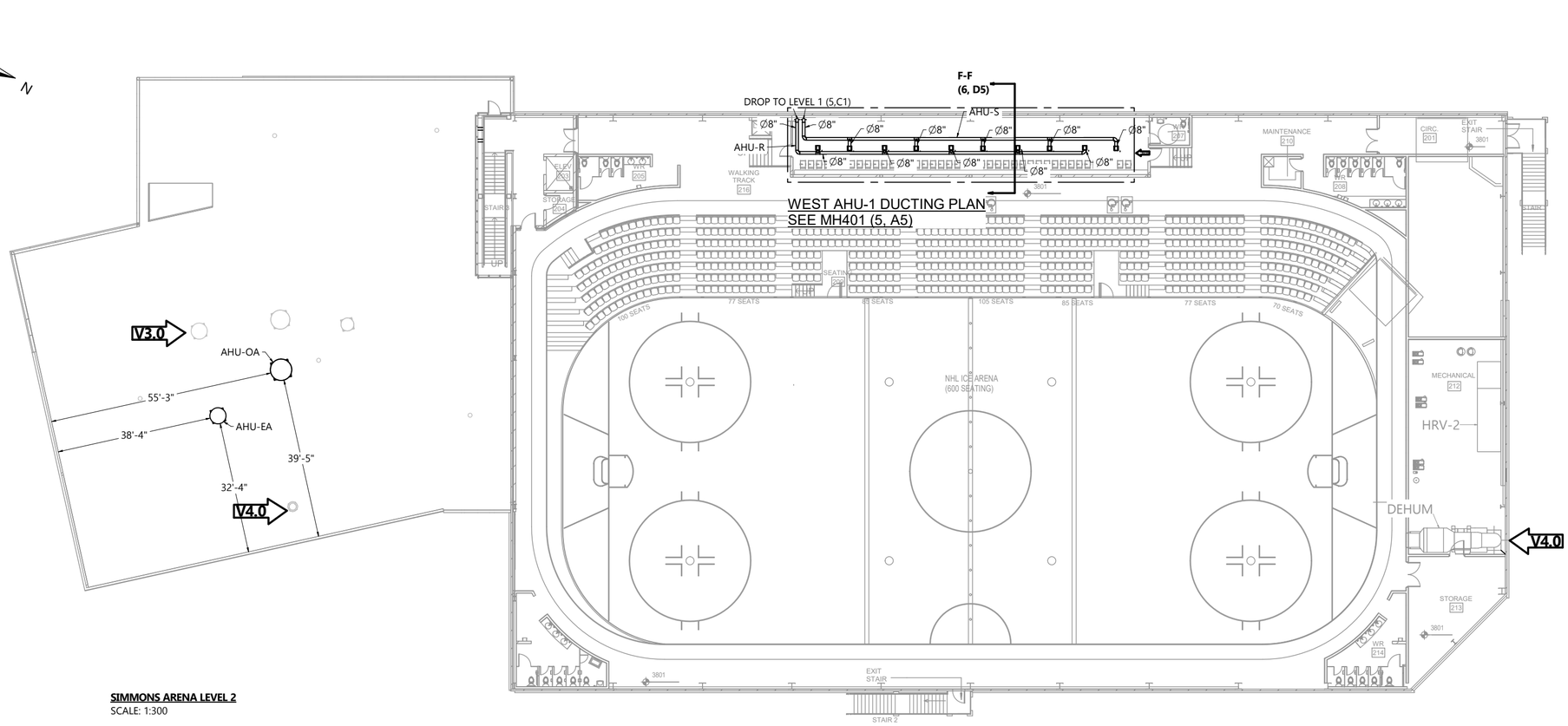
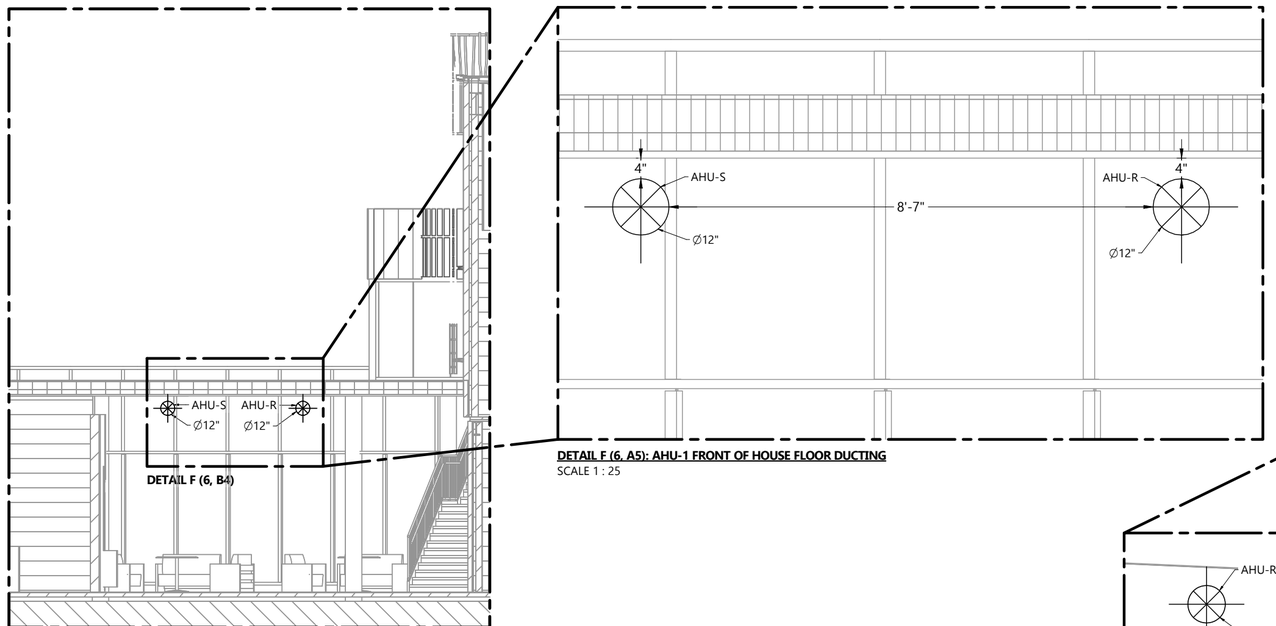
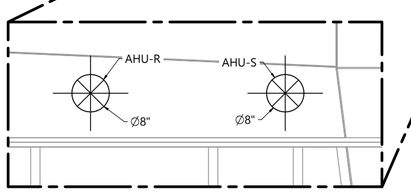


SIMMONS ARENA LEVEL 2
SCALE: 1:300

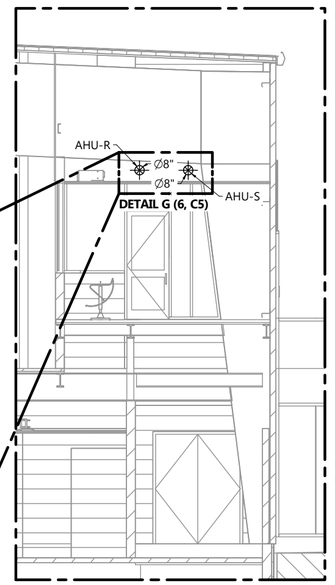


SECTION CUT E-E (5, B1) ⌒ 12.5°: FRONT OF HOUSE FLOOR DUCTING PATH
SCALE 1 : 100

DETAIL F (6, A5): AHU-1 FRONT OF HOUSE FLOOR DUCTING
SCALE 1 : 25



DETAIL G (6, D5): AHU-1 SECOND FLOOR DUCTING
SCALE 1 : 25



SECTION CUT F-F (6, C1) ⌒ 90°: SECOND FLOOR DUCTING PATH
SCALE 1 : 100

NOTE:
- DUCTING IN THE RINK ZONE IS TO BE INSULATED
- SDA PLENUMS MUST BE FIELD MODIFIED TO ALLOW DIFFUSERS TO PENETRATE ARCHITECTURAL CEILING

LEVEL 2 - AHU1

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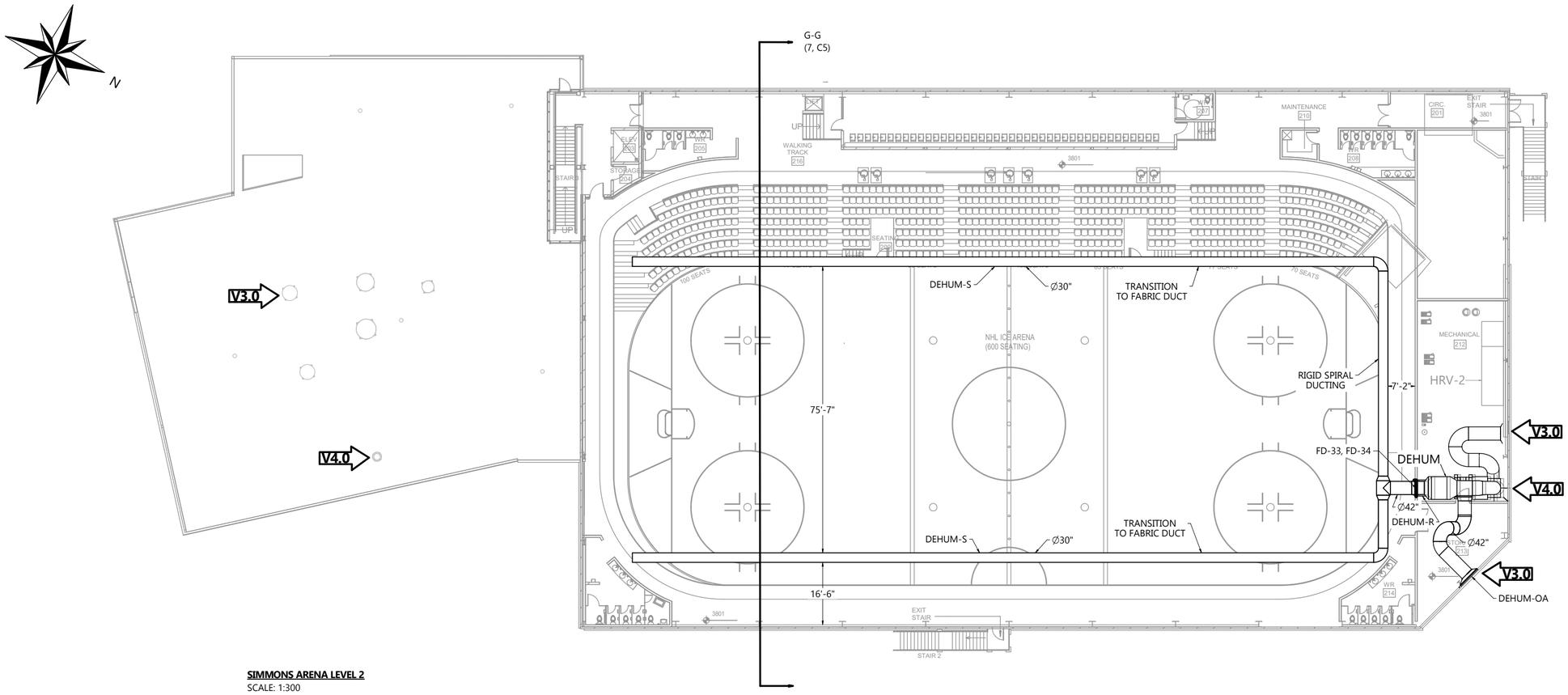
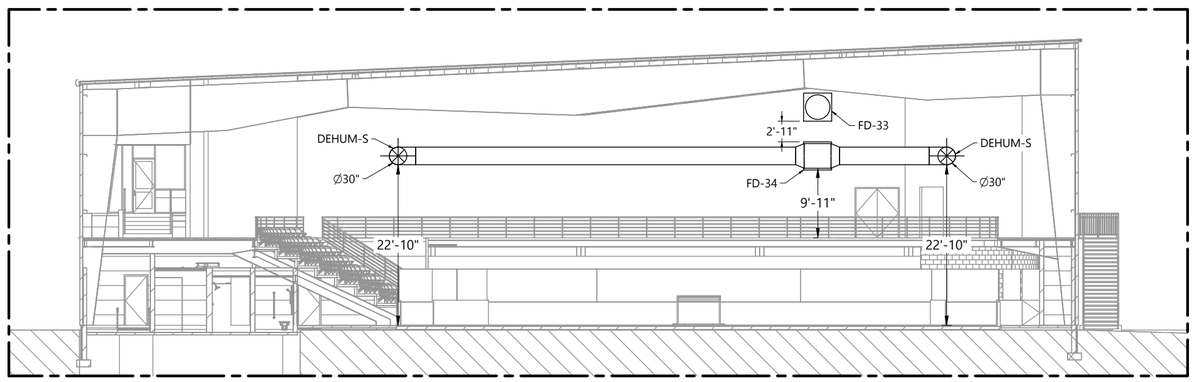


SIMMONS ARENA LEVEL 2
SCALE: 1:300

DEHUM LEVEL 2 - FIRE DAMPER SCHEDULE				
UNIT TAG	**DUCT SIZE**	**FIRE RATING**	**DIMENSIONS**	**DAMPER MODEL**
FD-33	42"	1.5 HOUR	48"X48"	FD-150
FD-34	42"	1.5 HOUR	48"X48"	FD-150



SECTION CUT G-G (7, C1) ⌒ 90°: ABOVE ARENA DUCTING PATH
SCALE 1 : 200

NOTE:
- DUCTING IN THE RINK ZONE IS TO BE INSULATED
- SDA PLENUMS MUST BE FIELD MODIFIED TO ALLOW DIFFUSERS TO PENETRATE ARCHITECTURAL CEILING

LEVEL 2 - DEHUM

NOTES

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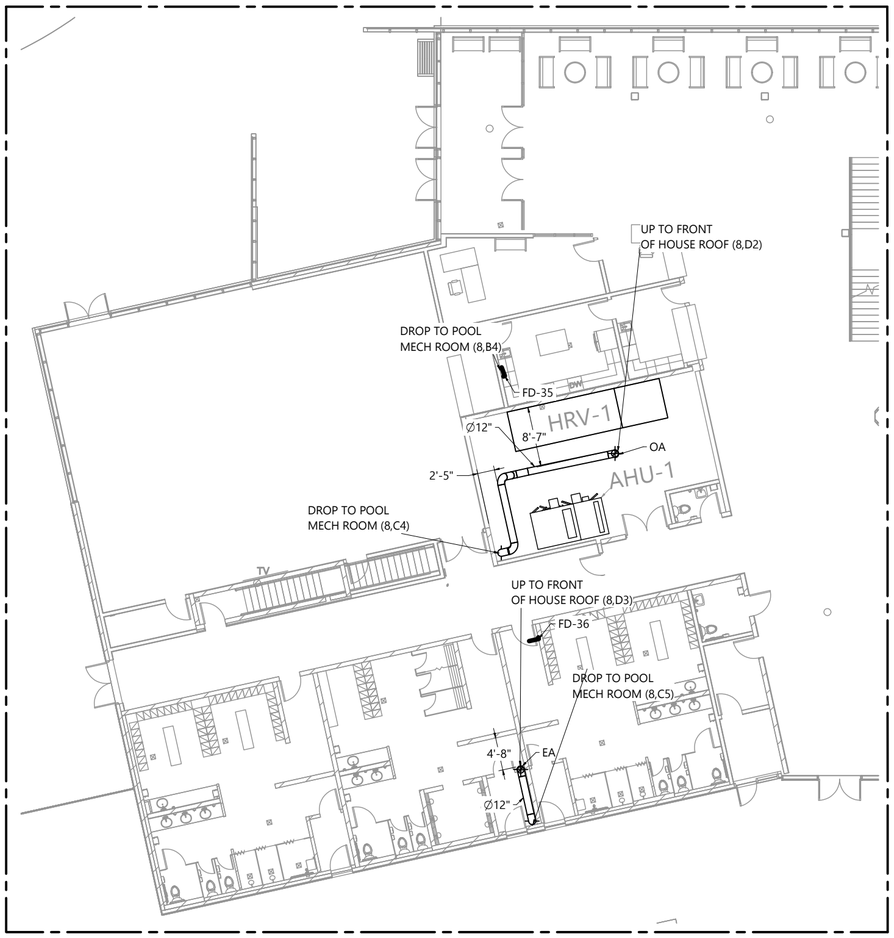


SIMMONS ARENA LEVEL 1
SCALE: 1:200

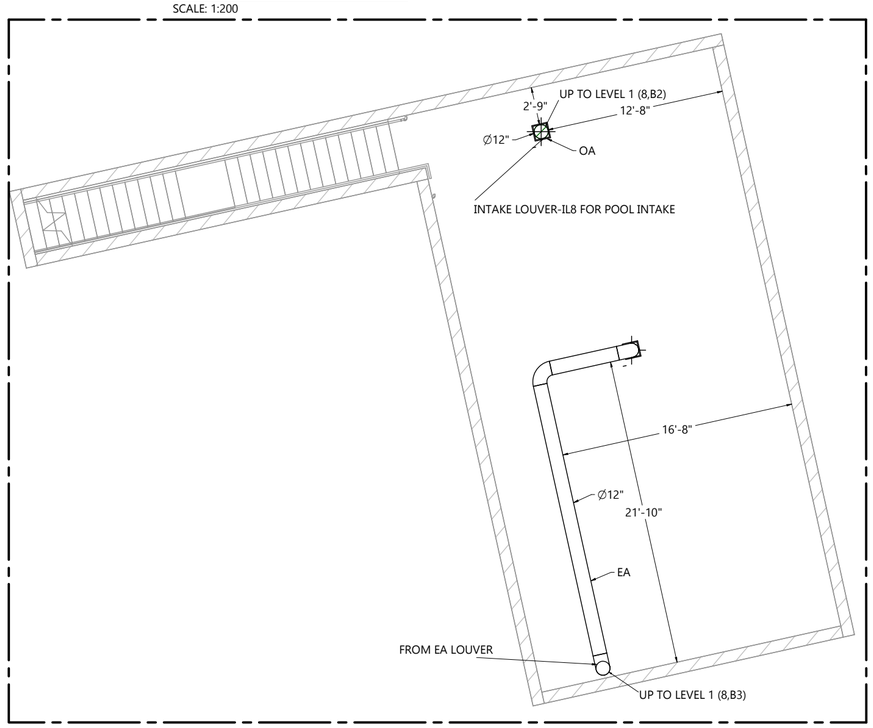
SIMMONS ARENA FRONT OF HOUSE ROOF
SCALE: 1:200

POOL MECH HVAC - FIRE DAMPER SCHEDULE				
UNIT TAG	**DUCT SIZE**	**FIRE RATING**	**DIMENSIONS**	**DAMPER MODEL**
FD-35	12"	3 HOUR	15"X15"	FD-350
FD-36	12"	3 HOUR	15"X15"	FD-350

NOTE:

- DUCTING IN THE RINK ZONE IS TO BE INSULATED
- SDA PLENUMS MUST BE FIELD MODIFIED TO ALLOW DIFFUSERS TO PENETRATE ARCHITECTURAL CEILING

SIMMONS ARENA BASEMENT POOL MECH ROOM
SCALE: 1:100



POOL MECH ROOM

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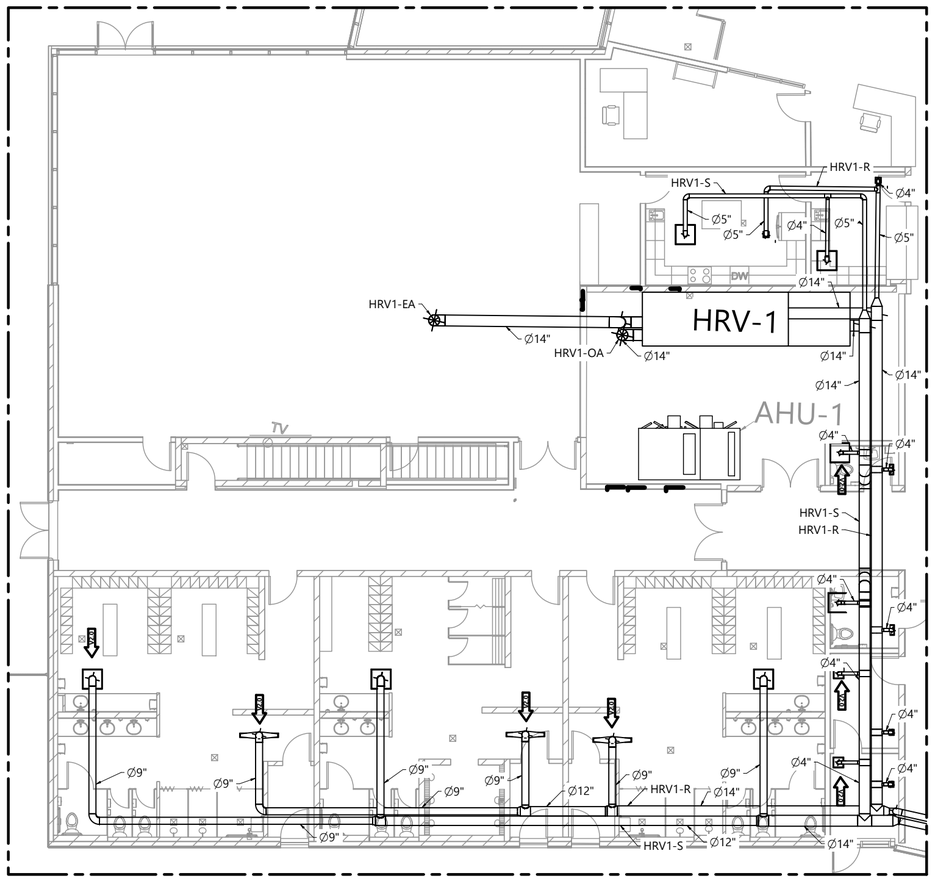
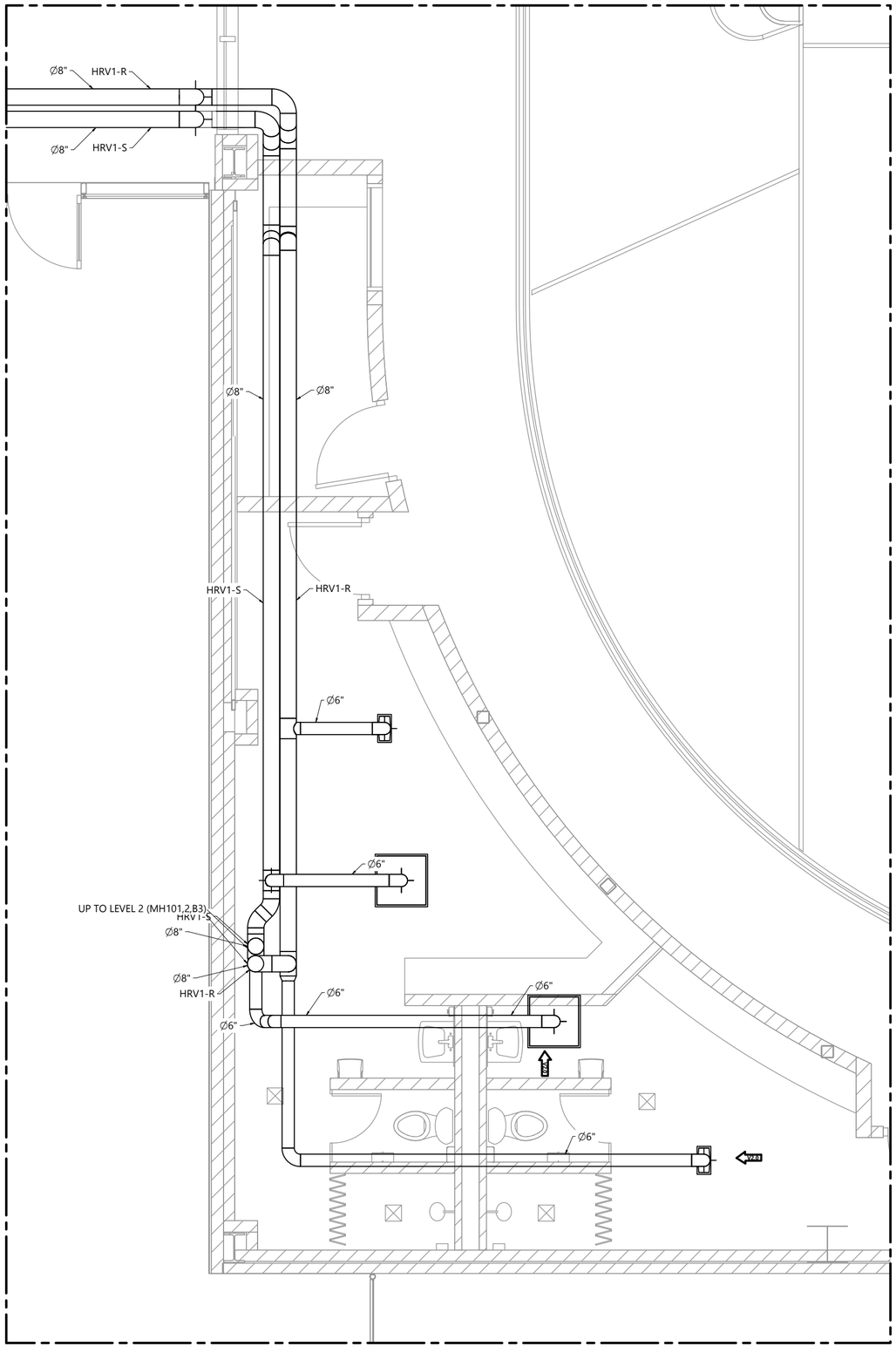


SOUTH HRV-1 DUCTING PLAN - LEVEL 1 ◠ 12: [SEE 21010 MH101 (1, 3A)]
SCALE 1:150



SOUTH EAST HRV-1 DUCTING PLAN REFS ROOM - LEVEL 1 [SEE 21010 MH101 (1, 3B)]
SCALE 1:50

NOTE:

- DUCTING IN THE RINK ZONE IS TO BE INSULATED

LEVEL 1 - HRV1 ENLARGED

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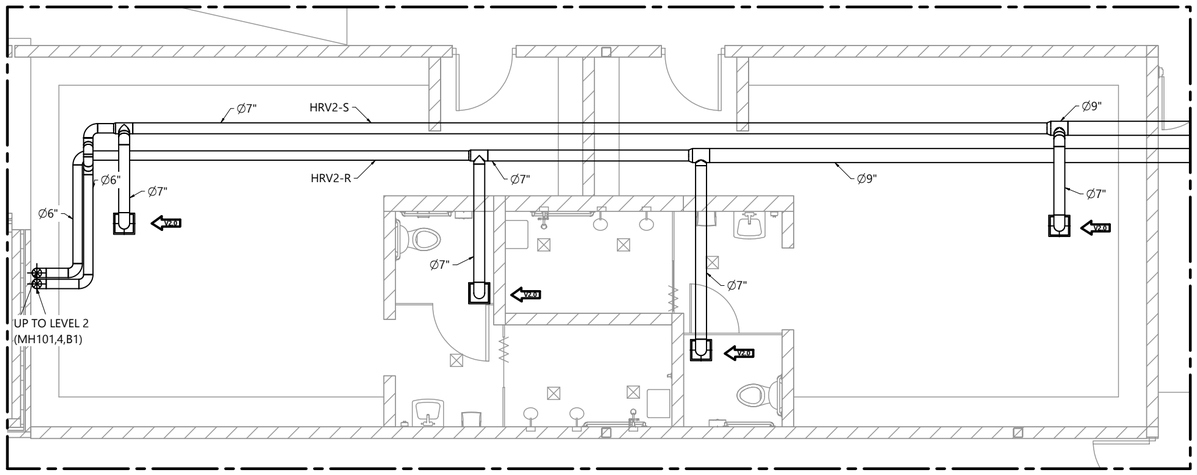
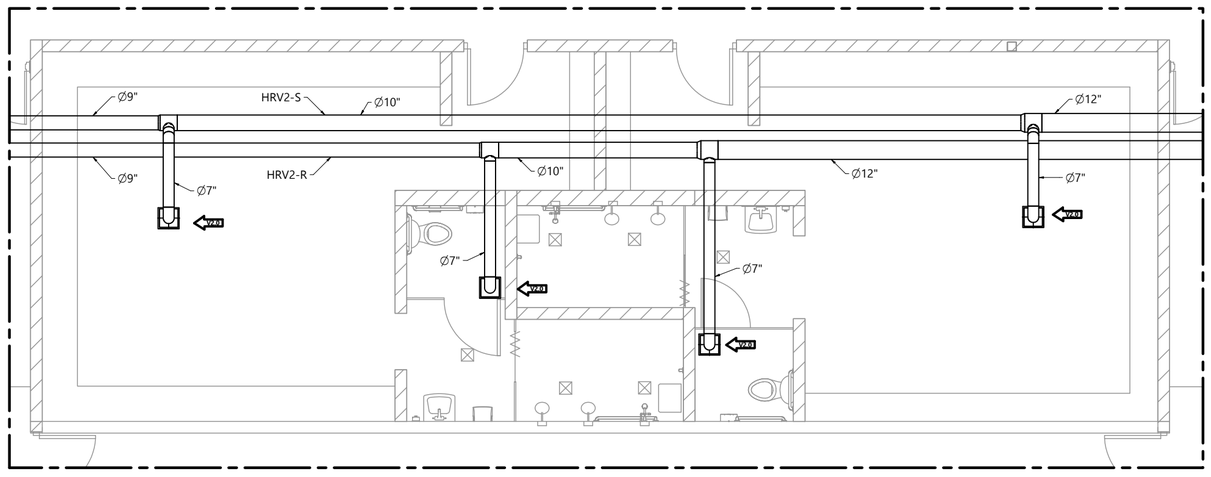
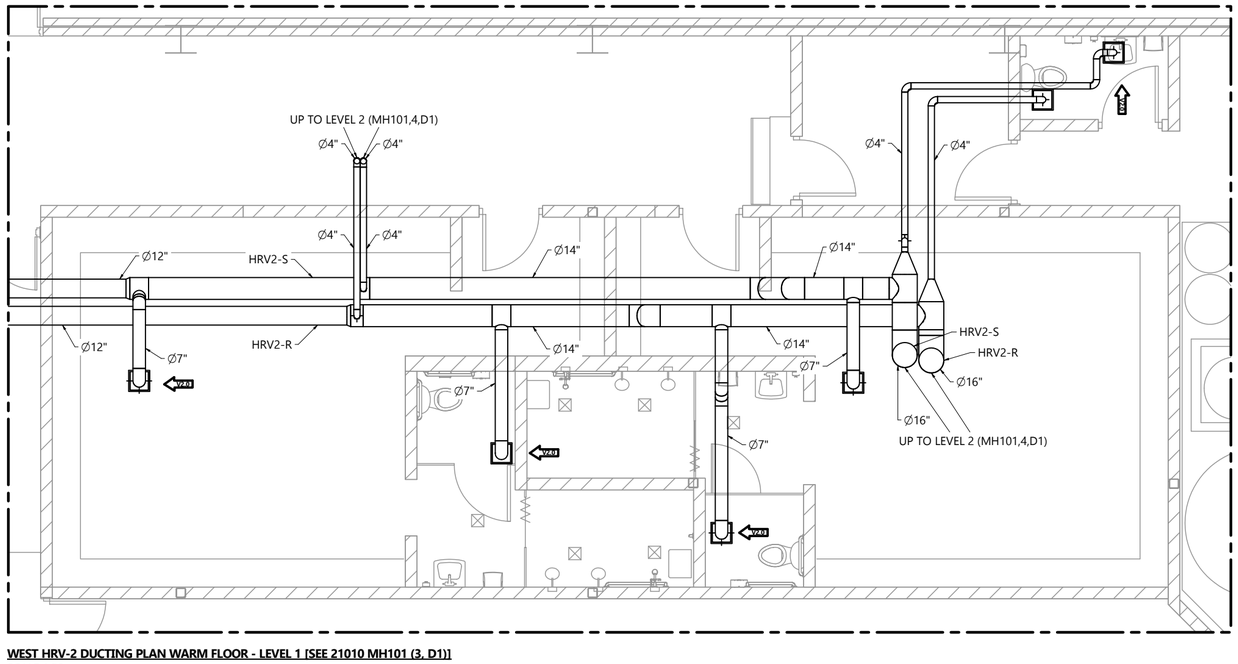


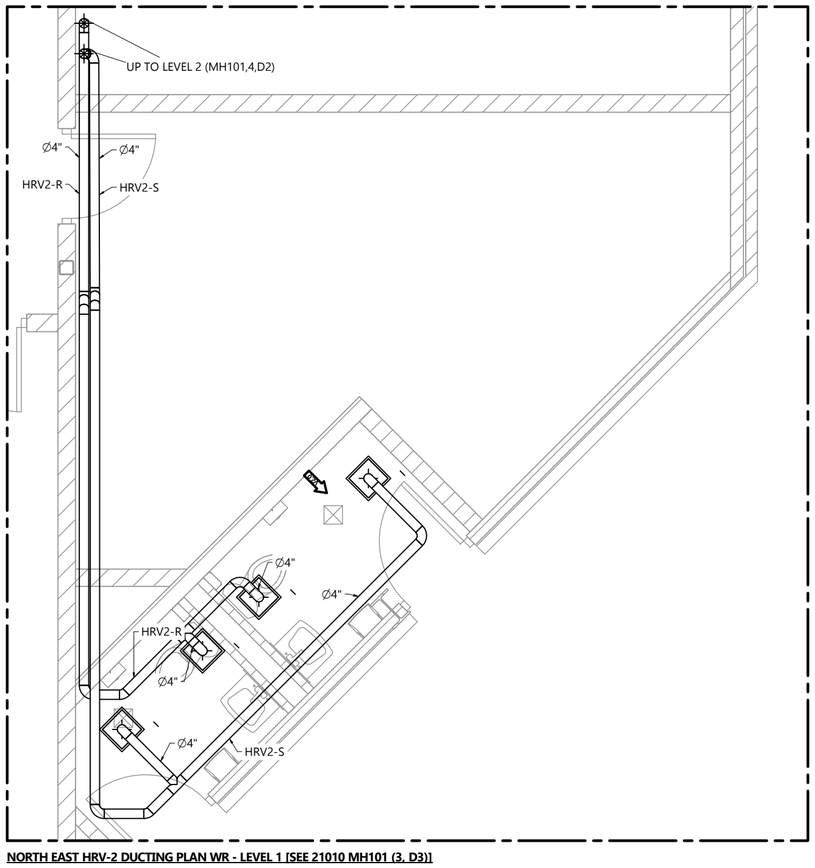
WEST HRV-2 DUCTING PLAN WARM FLOOR - LEVEL 1 [SEE 21010 MH101 (3, C1)]
SCALE 1:50



WEST HRV-2 DUCTING PLAN WARM FLOOR- LEVEL 1 [SEE 21010 MH101 (3, C1)]
SCALE 1:50



WEST HRV-2 DUCTING PLAN WARM FLOOR - LEVEL 1 [SEE 21010 MH101 (3, D1)]
SCALE 1:50



NORTH EAST HRV-2 DUCTING PLAN WR - LEVEL 1 [SEE 21010 MH101 (3, D3)]
SCALE 1:50

NOTE:

- DUCTING IN THE RINK ZONE IS TO BE INSULATED

LEVEL 1 - HRV2 ENLARGED

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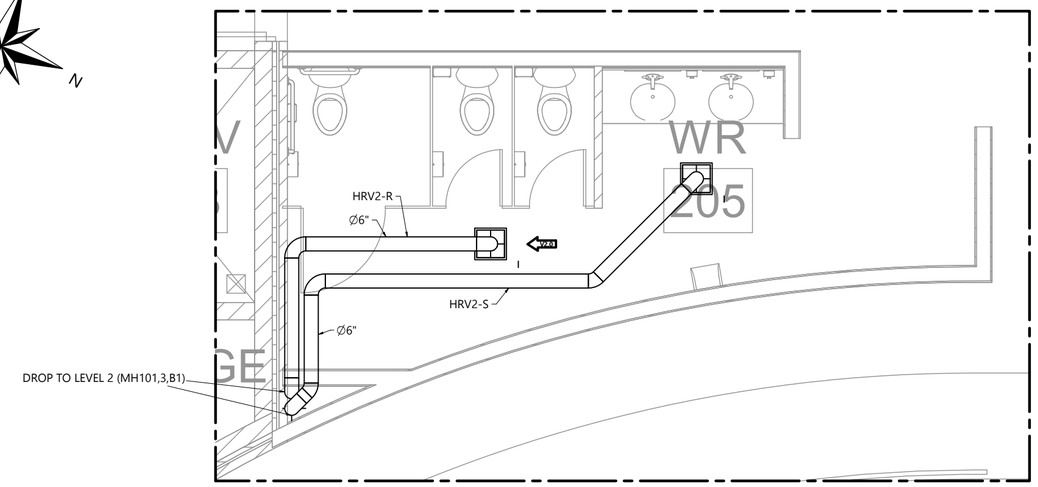
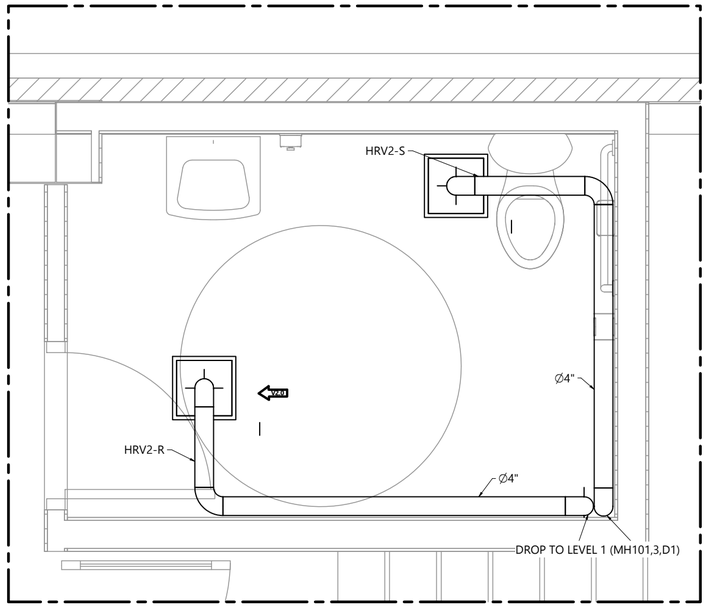
SHEET SIZE	C
SHEET NO.	2 OF 5



SOUTH WEST HRV-2 DUCTING PLAN WR - LEVEL 2 [SEE 21010 MH101 (4, B1)]
SCALE 1:50



WEST HRV-2 DUCTING PLAN WR - LEVEL 2 [SEE 21010 MH101 (4, D1)]
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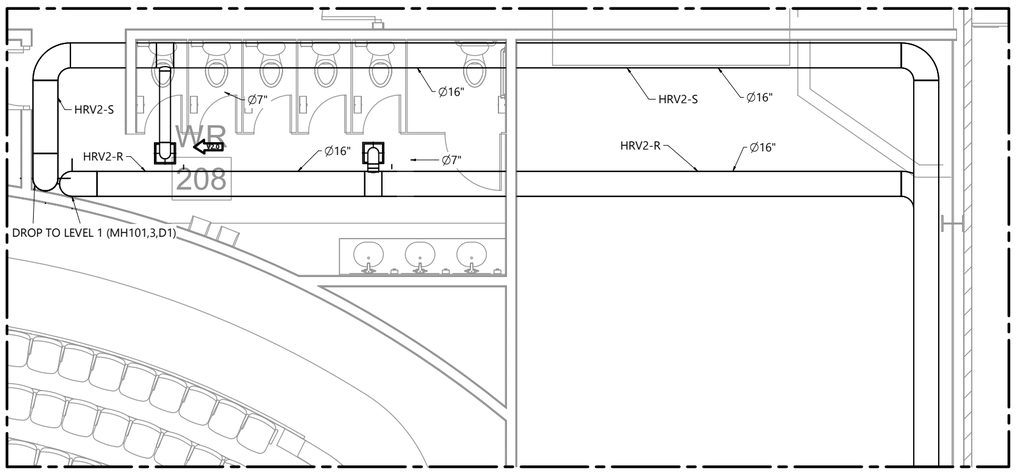
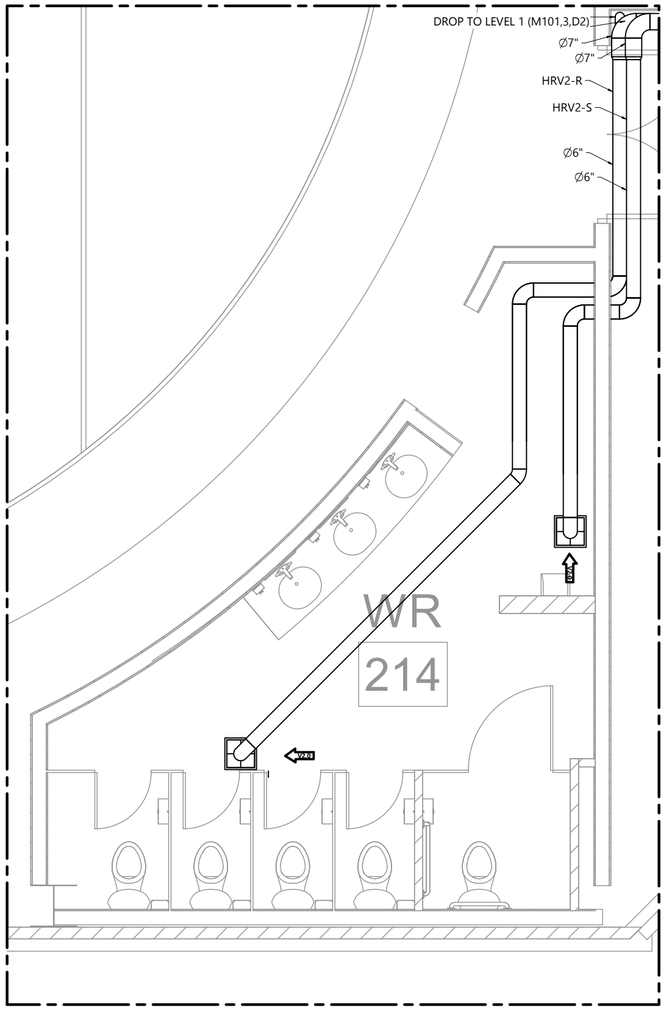


NORTH WEST HRV-2 DUCTING PLAN MAINTENANCE ROOM- LEVEL 2 [SEE 21010 MH101 (4, D1)]
SCALE 1:50



NORTH EAST HRV-2 DUCTING PLAN WR - LEVEL 2 [SEE 21010 MH101 (4, D3)]
SCALE 1:50

NOTE:

- DUCTING IN THE RINK ZONE IS TO BE INSULATED

LEVEL 2 - HRV2 ENLARGED

21010 MH401

NOTES

REFERENCE DEFINITION
SHEET COLUMN / SHEET NUMBER — SHEET ROW
(#, X#)

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2.0	EO #658	09-DEC-22	Z.M.
1.0	RELEASED FOR TENDER	25-NOV-22	Z.M.

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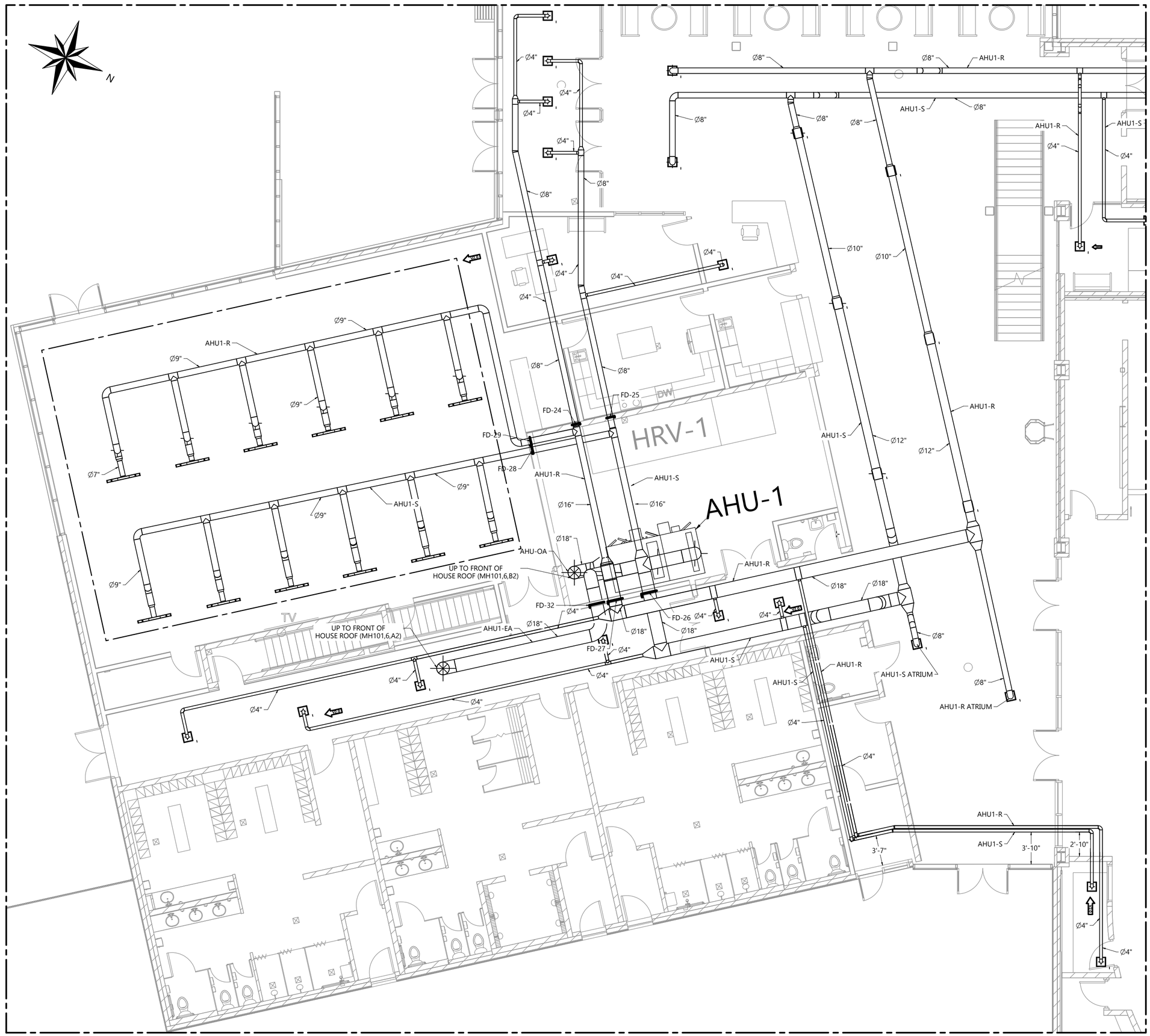
DRAWING NUMBER	21010 MH401
DRAWING NAME	DUCTING ENLARGED PLANS
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY M.HILANEH	**CHECKED BY** J.RITCHIE
DATE 09-DEC-22	**REVISION** 2.0
SHEET SIZE C	**SHEET NO.** 3 OF 5



SOUTH AHU-1 DUCTING PLAN - LEVEL 1 (SEE 21010 MH101 (5, A3))
SCALE 1:100

NOTE:

- DUCTING IN THE RINK ZONE IS TO BE INSULATED

LEVEL 1 - AHU1 ENLARGED

21010 MH401

NOTES

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DATE 09-DEC-22	**REVISION** 2.0
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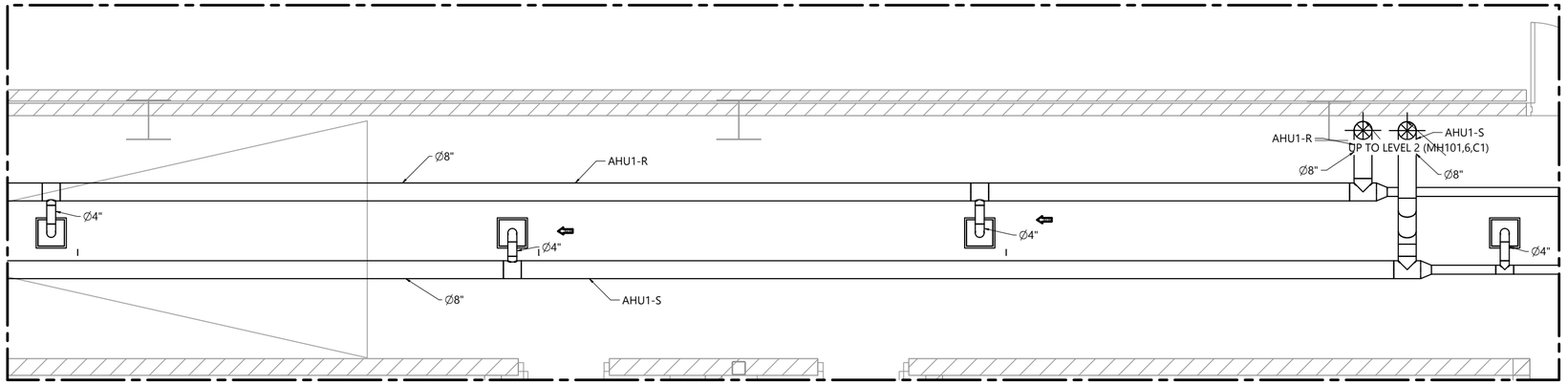
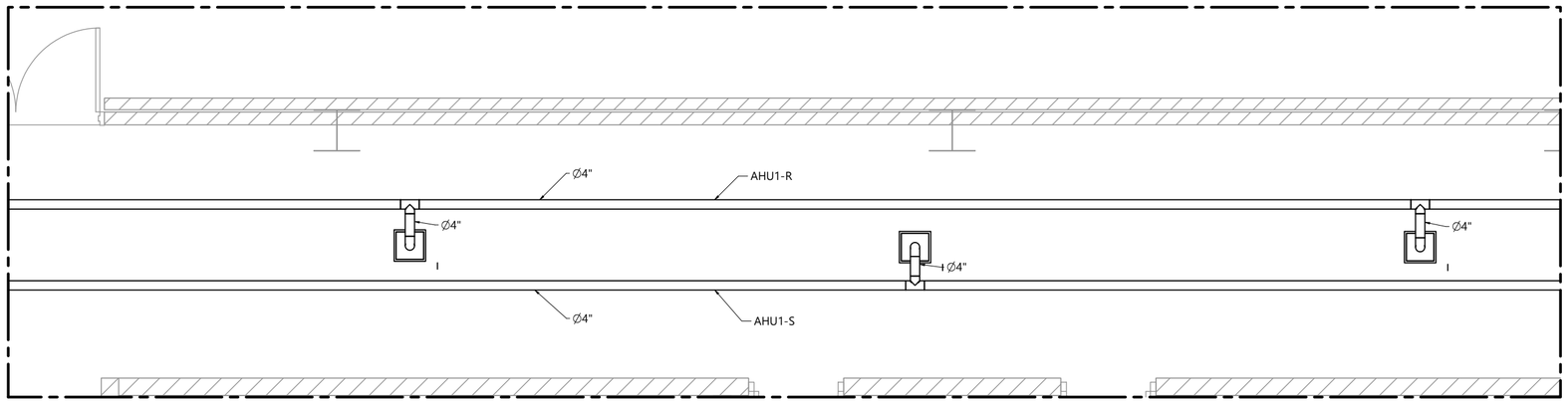
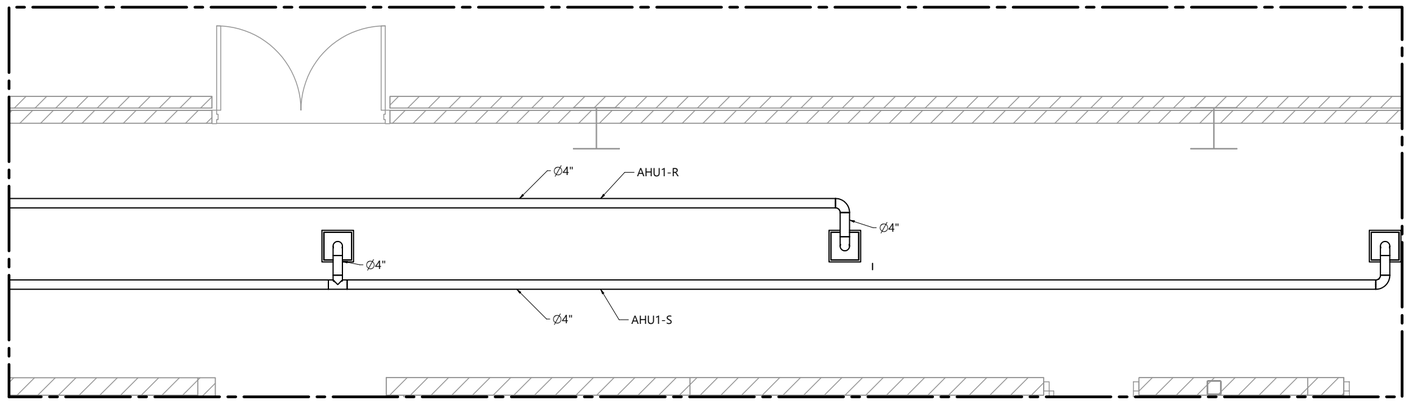


WEST AHU-1 DUCTING PLAN - LEVEL 1 [SEE 21010 MH101 (5, B1)]
SCALE 1:75



WEST AHU-1 DUCTING PLAN - LEVEL 1 [SEE 21010 MH101 (5 C1)]
SCALE 1:75



WEST AHU-1 DUCTING PLAN - LEVEL 1 [SEE 21010 MH101 (5, D1)]
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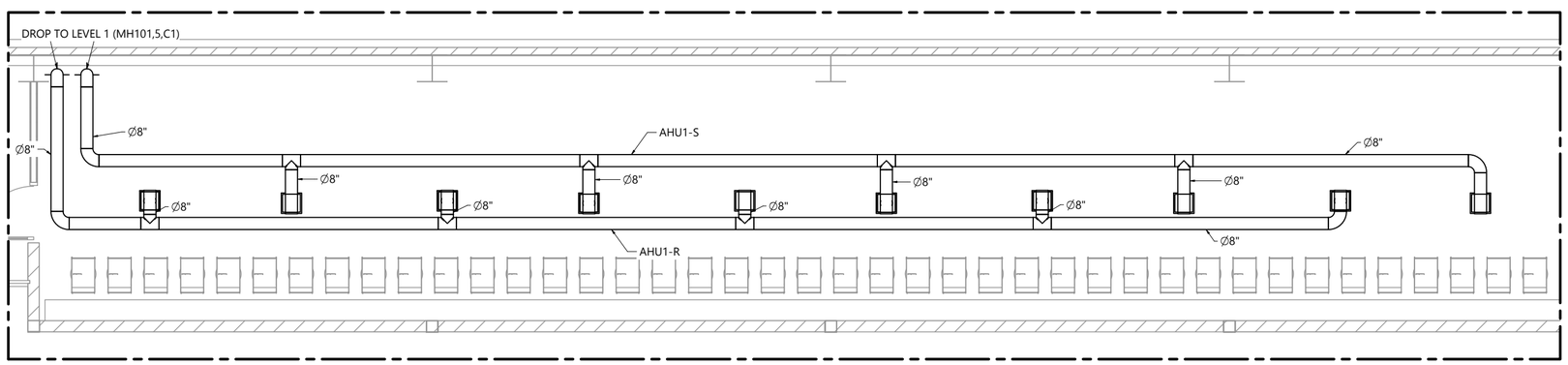

WEST AHU-1 DUCTING PLAN - LEVEL 2 [SEE 21010 MH101 (6, C1)]
SCALE 1:75

NOTE:

- DUCTING IN THE RINK ZONE IS TO BE INSULATED

AHU1 DUCTING ENLARGED

NOTES

21010 MH401

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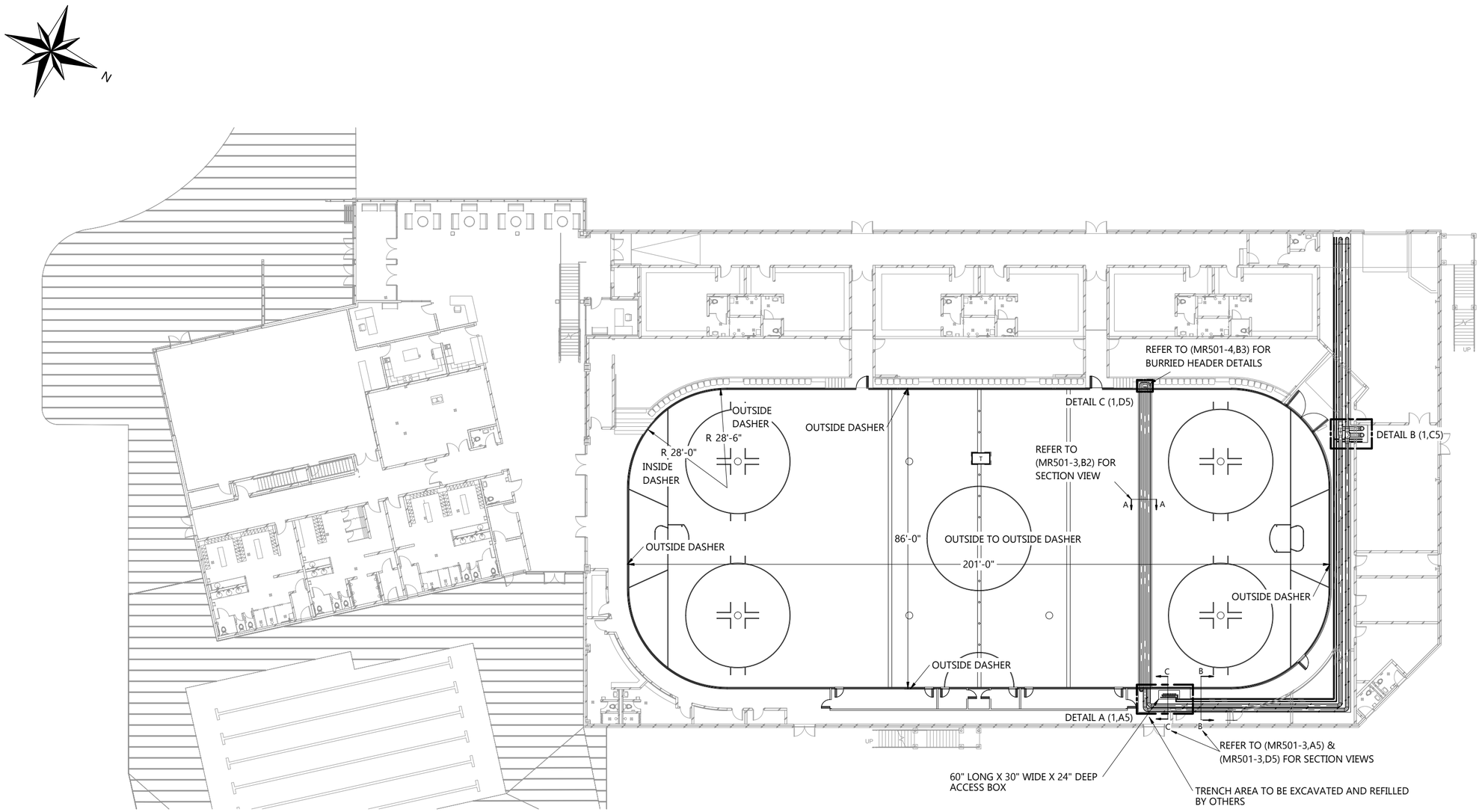
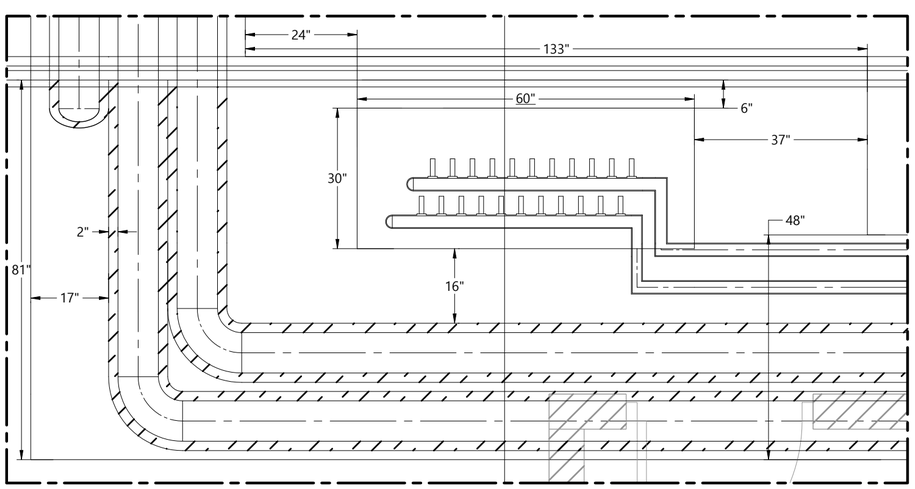
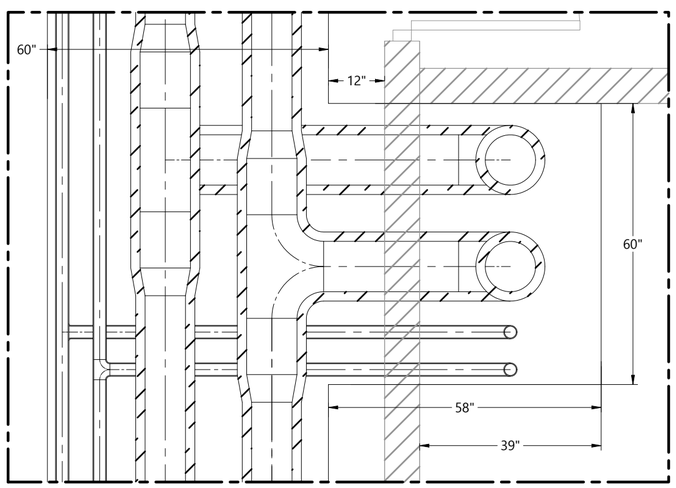
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	M.HILANEH
CHECKED BY	J.RITCHIE
DATE	09-DEC-22
REVISION	2.0
SHEET SIZE	C
SHEET NO.	5 OF 5



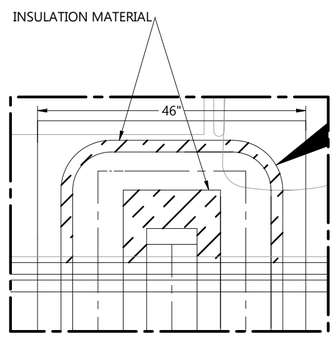
RINK FLOOR LAYOUT
SCALE 1:300



DETAIL A (1, D3): TRENCH PATH
SCALE 1:40



DETAIL B (1, D2): TRENCH PATH
SCALE 1:40



DETAIL C (1, C2): PIPING U-BEND
SCALE 1:20

RINK FLOOR PLAN

NOTES

	NEW
	EXISTING

21010 MR101

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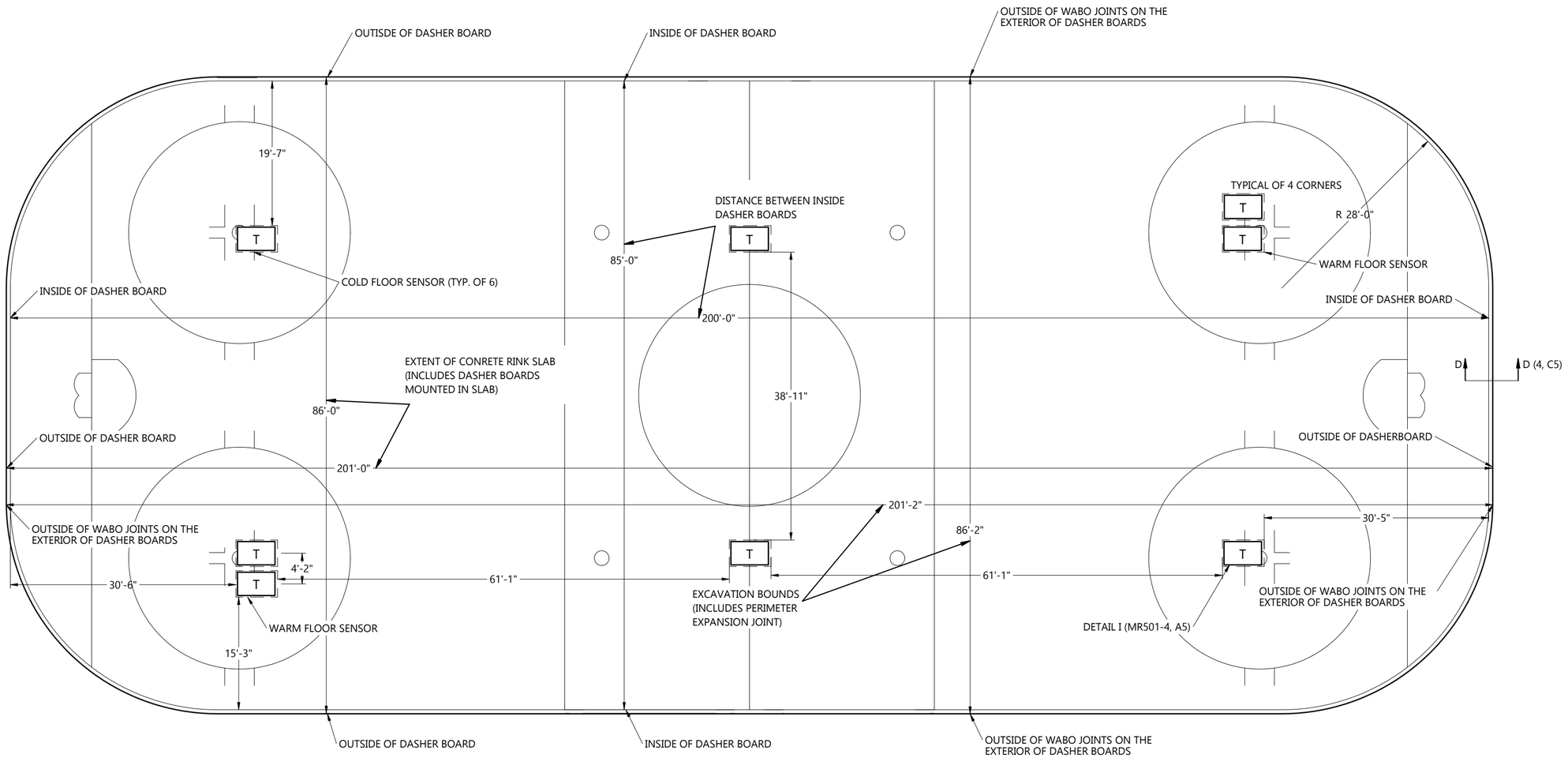
DRAWING NAME	RINK FLOOR PLAN
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	25-NOV-22
REVISION	1.0
SHEET SIZE	C
SHEET NO.	1 OF 1

NOTES:

- PIPING, REBAR, AND MESH REMOVED FOR CLARITY.



DETAIL A: RINK FLOOR DETAIL

CONCRETE QUALITY ASSURANCE TESTS			
TEST	**FREQUENCY**	**NO. OF REPITIONS**	**NOTE(S)**
SLUMP	PER TRUCKLOAD	3 - SUCCESSFUL	ALL THREE TESTS MUST BE SUCCESSFUL
AIR CONTENT	PER TRUCKLOAD	3 - SUCCESSFUL	AT THE POINT OF DEPOSITION
COMPRESSION	PER 50 CUYD.	SET OF FOUR CYLINDERS PER SAMPLING FOR 7, 14, 21, AND 28-DAY INTERVAL COMPRESSION TESTS	DEPENDANT ON AMOUNT OF CONCRETE USED DURING THE FLOOR POUR

RINK FLOOR CONSTRUCTION:

.1 FINISHED ICE SLAB SURFACE TO BE FLUSH WITH PERIMETER SURFACE.
.2 INSULATE COLD FLOOR SUPPLY AND RETURN MAINS BETWEEN MECHANICAL ROOM CONNECTION AND BURIED HEADERS WITH 2" FOAMGLASS INSULATION AND PROTECTIVE WRAP.
.3 INSTALL FLOOR INSULATION AFTER COMPLETION OF THE SUB-SOIL. INSULATION PROPERLY LEVELLED +/- 3/16" OVERLAPPED WITH STAGGERED JOINTS.
.4 INSTALL SLIP SHEET ON TOP OF FLOOR INSULATION, OVERLAP EDGES 12".
.5 ON NO ACCOUNT SHALL ANY REINFORCING RODS & EDGES OF MESH LIE IMMEDIATELY ABOVE OR BELOW PIPES TO AVOID PIPE PUNCTURE.
.6 ALL JOINTS TO BE COMPLETELY FUSION WELDED.

FLOOR SLAB TOLERANCE:

.1 COLD SLAB TOLERANCE MUST BE MEASURED USING F-NUMBER SYSTEM.
.2 CLASSIFICATION D, EXTREMELY FLAT
.3 FLOOR FLATNESS (FF) AND FLOOR LEVELNESS (FL) TO BE MEASURED IN ACCORDANCE WITH ASTM E1155M
.4 SPECIFIED OVERALL VALUES (SOV)
  .1 FLATNESS: FF 45
  .2 LEVELNESS: FL 35
.5 MINIMUM LOCAL VALUES (MLV)
  .1 FLATNESS: FF 30
  .2 LEVELNESS: FL 25
.6 INSPECTION AND FLOOR TOLERANCE MEASUREMENTS SHALL BE MADE WITHIN 72 HOURS OF COMPLETING FLOOR SLAB. THE CONTRACTOR OF THIS SCOPE IS RESPONSIBLE FOR ALL TESTING REQUIREMENTS TO DEMONSTRATE TO THE OWNER'S ENGINEER THAT THE FLOOR FLATNESS AND LEVELNESS MEETS THESE SPECIFICATIONS IN REFERENCE TO ASTM E1155M.
  .1 USE A D-METER OR APPROVED EQUIVALENT FOR ALL MEASUREMENTS ON FLOOR FLATNESS AND LEVELNESS. PROVIDE RESULTS IN A REPORT TO THE OWNER'S ENGINEER.
  .2 NOTE THAT ASTM E1155M, PART 8 PROCEDURE, LAYS OUT THE STEPS THE CONTRACTOR MUST TAKE FOR COMPLIANT MEASUREMENTS INCLUDING GRIDING THE FLOOR AREA IN 300 MM SECTIONS.
.7 SPECIFIED FLOOR TOLERANCES THAT FALL BELOW THE MLV SHALL BE CORRECTED BY GRINDING. ANY WORK OF THIS NATURE MUST BE APPROVED BY THE OWNER'S ENGINEER PRIOR TO COMMENCEMENT.

MATERIAL PROPERTIES:

.1 STRENGTH: 32 MPA AT 28 DAYS. MINIMUM AVERAGE OF STRENGTH TEST MUST EXCEED SPECIFIED STRENGTH.
  .1 PROVIDE CERTIFICATION THAT MIX PROPORTIONS SELECTED WILL PRODUCE CONCRETE OF SPECIFIED QUALITY AND YIELD STRENGTH WILL COMPLY WITH CAN3-A23.1.
.2 AIR CONTENT: MAXIMUM OF 2% NON-ENTRAINED AIR.
.3 MAXIMUM WATER TO CEMENTITIOUS MATERIAL (W/CM): 0.45
.4 FLY ASH:
  .1 SUPPLEMENTARY CEMENTING MATERIALS (SCM): MAXIMUM 15% TOTAL CEMENTITIOUS CONTENT.
  .2 TYPE C OR F.
  .3 LOSS OF IGNITION (LOI) NOT TO EXCEED 1%
  .4 USE FLY ASH FROM ONE SOURCE.
.5 MAXIMUM AGGREGATE: 14 MM GRADED AS PER CSA A23.1 GROUP 1 14-5
.6 WATER REDUCING AND HIGH RANGE WATER REDUCING (SUPERPLASTICIZER) ADMIXTURES SHALL BE INCLUDED IN CONCRETE MIX IN COMPLIANCE WITH CSA A23.5 AS REQUIRED TO MAINTAIN MAX W/CM RATIO WHILE ENSURING REQUIRED FLOWABILITY.
.7 INCLUDE A SHRINK-REDUCING ADMIXTURE
  .1 MUST REDUCE CAPILLARY TENSION OF PORE WATER IN CEMENTITIOUS MIXTURES.
  .2 PROVIDE MODERATE TO SIGNIFICANT REDUCTIONS IN THE DRYING SHRINKAGE OF CEMENTITIOUS MIXTURES.
  .3 REDUCE STRESSES INDUCED FROM ONE-DIMENSIONAL SURFACE DRYING IN CONCRETE SLABS.
  .4 MUST BE MIXED AT THE FACTORY. MIXING ON-SITE WILL NOT BE PERMITTED.
  .5 STANDARD OF ACCEPTANCE: MASTERLIFE SRA-035, OR APPROVED EQUIVALENT.
.8 SLUMP RANGE BEFORE PLASTICIZER: 70 MM ± 20 MM.
.9 SLUMP RANGE AT DISCHARGE: 130 MM ± 30 MM.
.10 USE APPROVED SET RETARDING ADMIXTURE AT THE MANUFACTURERS REQUIRED DOSAGE WHEN CONCRETE IS PLACED AT AMBIENT TEMPERATURE ABOVE 30°C (86°F).
.11 USE APPROVED ACCELERATING ADMIXTURE AT THE MANUFACTURERS REQUIRED DOSAGE WHEN CONCRETE IS PLACED IN AMBIENT TEMPERATURES BELOW 10°C (50°F).
.12 CALCIUM CHLORIDE ADMIXTURES ARE NOT PERMITTED FOR USE.

RINK FLOOR DETAIL

NOTES

———	NEW
———	EXISTING

21010 MR501

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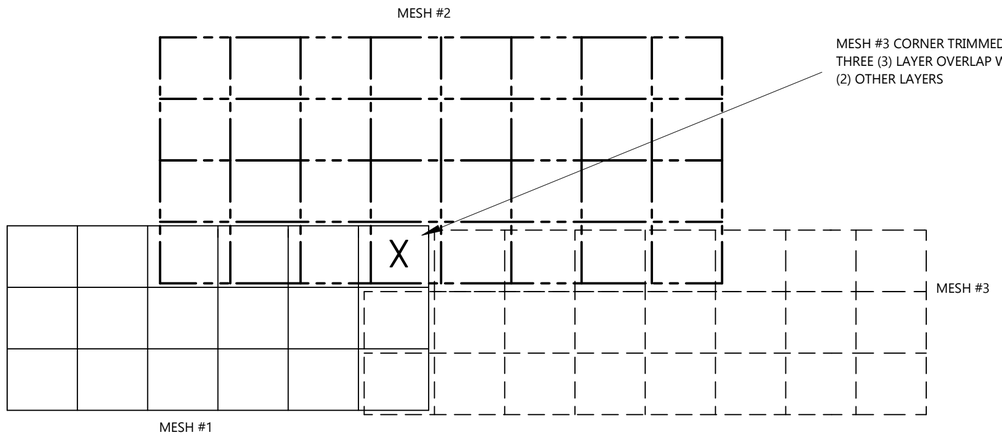
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	25-NOV-22
REVISION	1.0
SHEET SIZE	C
SHEET NO.	1 OF 7



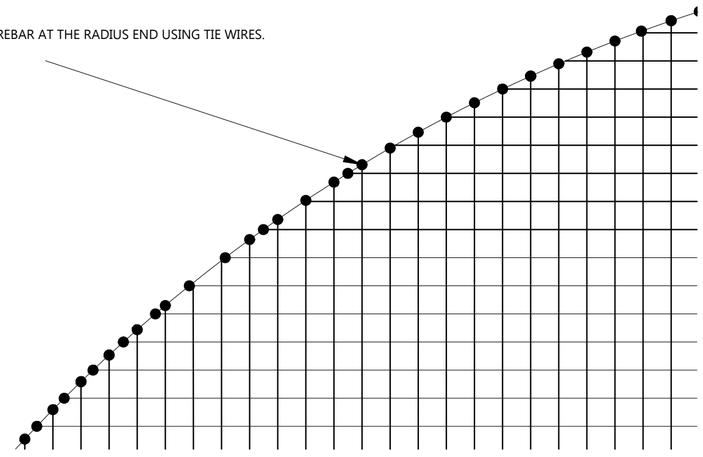
DETAIL B: WIRE MESH DETAIL
NTS

TOP LAYER REINFORCING WIRE MESH:

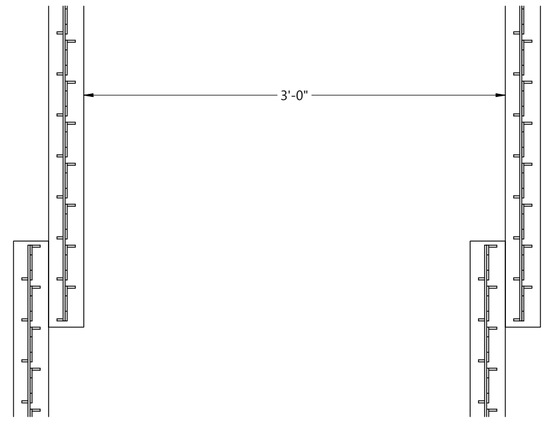
.1 TO BE INSTALLED ON TOP OF RINK PIPING.
.2 6X6X6/6 (INCHES, INCHES, & GAUGE) WELDED WIRE MESH PLACED ON TOP OF RINK PIPING SUPPORTS (CHAIRS) ACROSS WHOLE AREA OF RINK SLAB.
.3 ANY CUT PORTIONS MUST BE SECURED. 6X6 GRID REINFORCED STRUCTURE MUST BE MAINTAINED.
.4 TOP REINFORCING MUST BE LAID AND LAPPED TO NOT EXCEED TWO (2) LAYERS, AND SECURELY TIED TO PIPE CHAIR SUPPORTS USING TIE WIRES.
  .1 WIRES MUST HAVE LOOSE ENDS CUT AND BE TURNED AWAY FROM AND NOT ON TOP OF PIPING TO AVOID DAMAGE.
  .2 TIE MESH TO PIPE CHAIRS A MINIMUM OF EVERY 12" ALONG THE PIPE CHAIRS AND AROUND THE PERIMETER OF EACH MESH SHEET.
  .3 OVERLAPS MUST BE TIED TOGETHER WITH LOOP-TYPE WIRES AT A MINIMUM OF 12" SPACES IN TWO DIRECTIONS.
.5 INSTALL CONTINUOUS WIRE MESH ABOVE THE RINK PIPES WITH 6" OVERLAPS. TIE OVERLAPS AS NOTED ABOVE.
.6 TRIMMED CORNERS TO MAINTAIN TWO (2) LAYERS OVERLAP MAX.
.7 USE FLAT SHEETS ONLY. ROLLED WILL NOT BE APPROVED.
.8 UNDER NO CIRCUMSTANCES SHALL WIRE MESH BE TIED TO THE REBAR.

SECURE REBAR TO RADIUS REBAR AT THE RADIUS END USING TIE WIRES.

(TYP. OF 4 CORNERS)



DETAIL C: RADIUS REBAR DETAIL
NTS

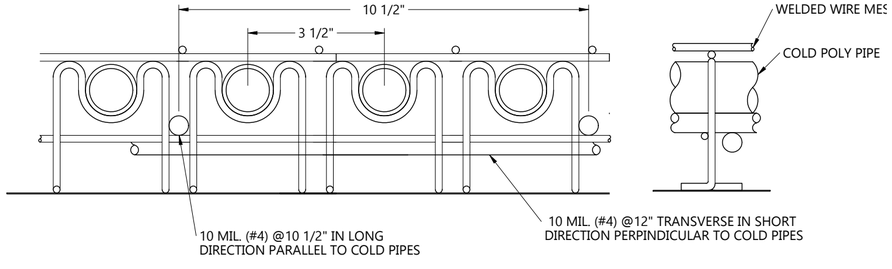


PIPE CHAIR SPECIFICATIONS:

- "M" STYLE WITH CONTINUOUS METAL BASE
- PIPE: 1" 13.5 SDR HDPE PIPE. 1 3/8" OD
- PIPE CENTERS: 3 1/2"
- 20 SPACES PER SUPPORT
- TOTAL HEIGHT: 3.4"
- PIPE LIFT: 2.00"
- TOP REBAR LIFT: 1.50"
- BASE PLATES: 3" X 24 GAUGE SPACED 36" ON CENTRE
- 36" SPACING
- TWO (2) PIPE OVERLAP

DETAIL D: PIPE CHAIR DETAIL
NTS

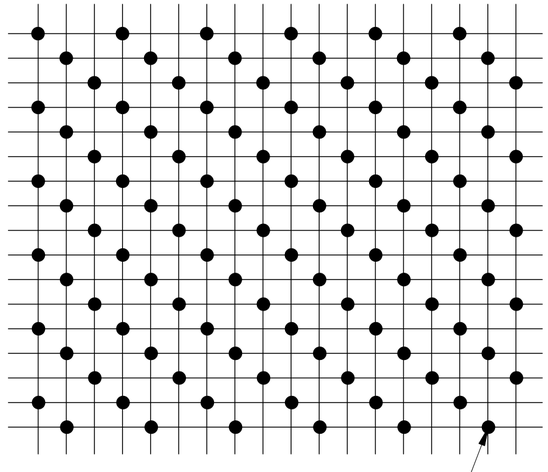
COLD FLOOR PIPES TO BE SECURED TO THE PIPE CHAIRS AT EVERY SECOND JOINT USING NYLON CABLE TIES TO SUFFICIENTLY FASTEN THE PIPES TO THE CHAIRS. PIPING MUST LAY SNUG IN THE CHAIRS.



DETAIL E: PIPE CHAIR DETAIL
NTS

SUPPLY AND INSTALL BOTTOM LAYER REINFORCING REBAR:

- REBAR TYPE: 10 MIL. (#4) REBAR.
- INSTALL LOWER REBAR FIRST PARALLEL TO PIPE CHAIRS (PERPINDICULAR WITH FLOOR PIPING) WITH 12" ON CENTER SPACING.
- INSTALL UPPER REBAR SECOND PARALLEL TO COLD FLOOR PIPES WITH 10 ½" ON CENTER SPACING. UPPER REBAR TO SIT IN PIPE CHAIRS.
- SECURE REBAR TO PIPE CHAIRS USING TIE WIRES AT EVERY THREE INTERSECTIONS, STAGGERING TIES AT EVERY CHAIR.



DETAIL F: REBAR DETAIL
NTS

REBAR TO BE TIED, USING HIGH-VISIBILITY TIE WIRES, AT EVERY INTERSECTION ALONG THE DIAGONAL, STARTING AT EVERY THIRD REBAR INTERSECTION ALONG THE DIAGONAL,

REINFORCEMENT

NOTES

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———	EXISTING

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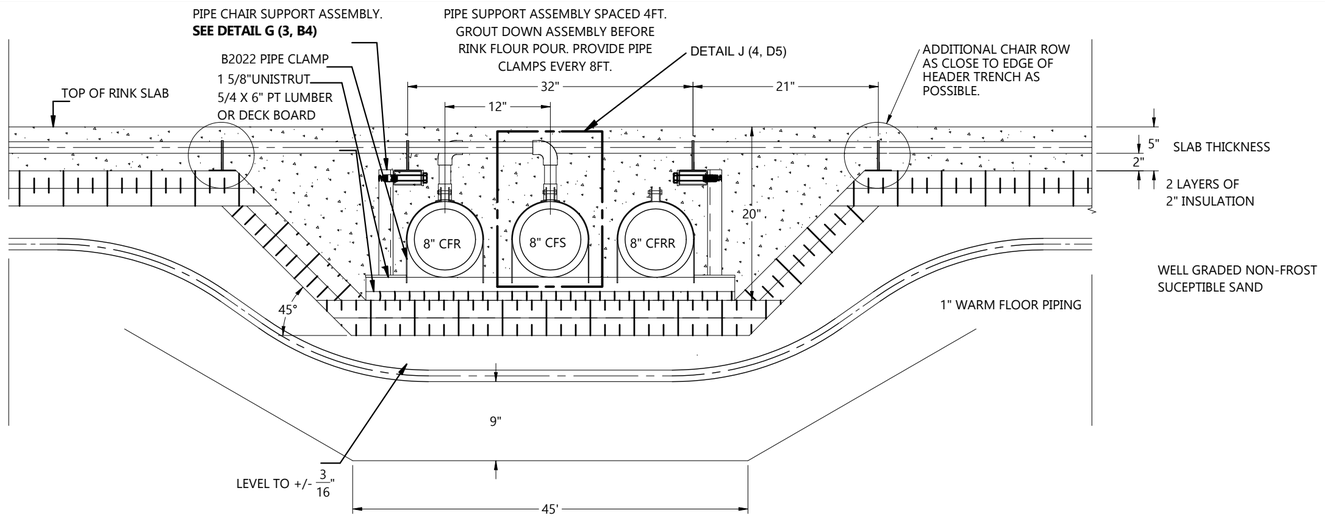
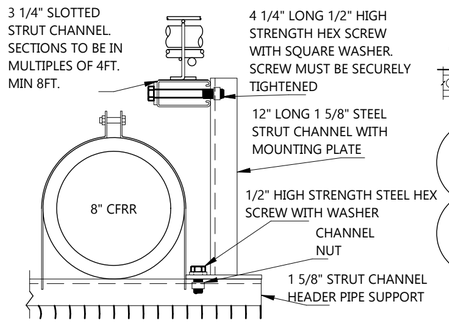


SECTION VIEW A-A (MR101-1, C2): HEADER TRENCH
NTS

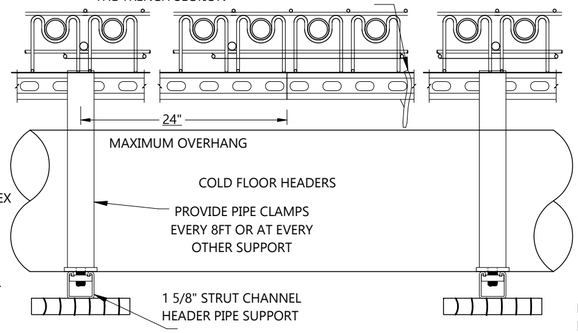
SIDE VIEW

NOTE:
PERSONNEL ARE NOT ALLOWED TO STAND DIRECTLY ON PIPE CHAIR ASSEMBLY. 8FT LONG PLYWOOD MUST BE PLACED LONGITUDINALLY



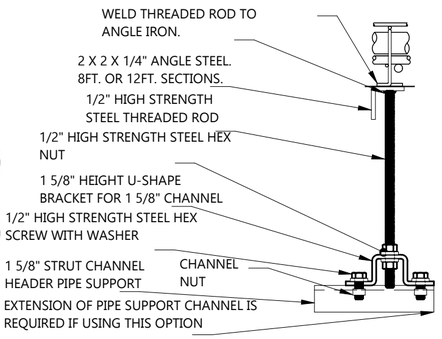
FRONT VIEW

CABLE TIE EACH CHAIR TO HORIZONTAL STRUT SUPPORT TWO PIPE CHAIRS BEFORE CHAIR ENDS. NO OVERLAPPING OF PIPE CHAIRS IS REQUIRED AT THE TRENCH SECTION

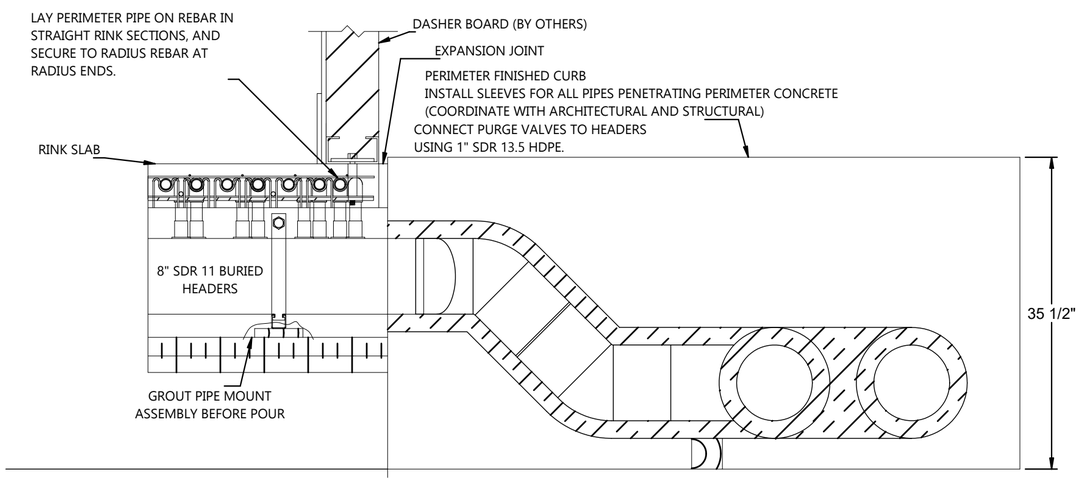


ALTERNATE SUPPORT ASSEMBLY - OR APPROVED EQUIVALENT

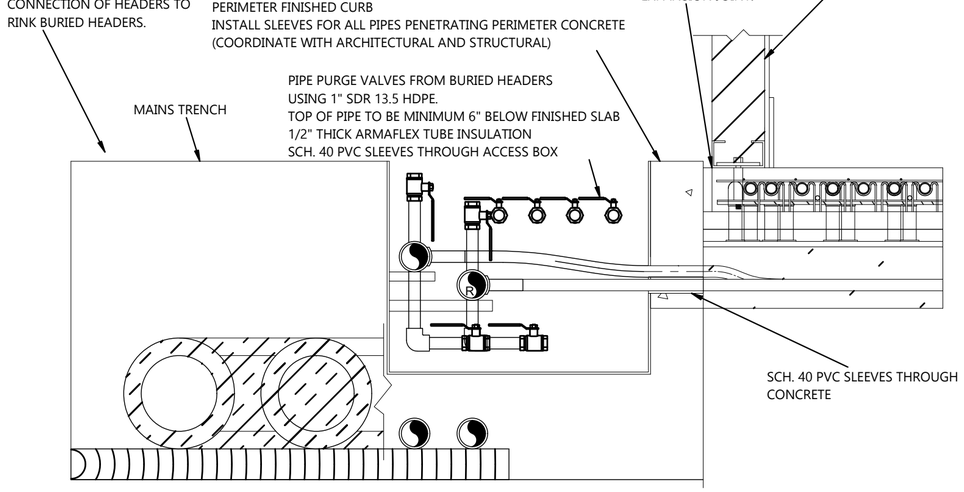
CABLE TIE EACH CHAIR TO HORIZONTAL STRUT SUPPORT TWO PIPE CHAIRS BEFORE CHAIR ENDS. NO OVERLAPPING OF PIPE CHAIRS IS REQUIRED AT THE TRENCH SECTION



DETAIL G (3, A1): TRENCH PIPE CHAIR SUPPORT FRAME
NTS



SECTION VIEW B-B ⌒ 90° (MR101-1, D3): MAINS PIPING SIDE VIEW
NTS



SECTION VIEW C-C ⌒ 90° (MR101-1, D3): WARM HEADER
NTS

FLOOR SYSTEM DETAILS

TESTING

PRESSURE TESTING

DESIGN ENGINEER SHALL WITNESS PRESSURE TESTING. PROVIDE MINIMUM ONE MONTH NOTICE OF TEST DATES.
FAILED TESTS INCLUDE

- LOSS OF PRESSURE
- PIPE DAMAGE
- ANY SEAL FAILURE (INCLUDES JOINT WELDS)

RETESTING IS REQUIRED FOLLOWING CORRECTION OF DEFECTS AFTER ANY FAILED TESTS.

WARM FLOOR CIRCUIT PRESSURE TESTING
PRESSURE: 100 PSIG, AIR
DURATION: 24-HOURS, CONTINUOUS
TEST COMPLETE CIRCUIT INCLUDING HEADERS AND FLOOR TUBES.
COMPLETE TESTING 48 HOURS PRIOR TO SAND FILLING.
AFTER PRESSURE TESTING APPROVAL BY DESIGN ENGINEER, REDUCE TO 50 PSIG AND HOLD FOR DURATION OF SAND FILL AND COMPACTING.

COLD FLOOR CIRCUIT PRESSURE TESTING
PRESSURE: 100 PSIG, AIR
DURATION: 24-HOURS, CONTINUOUS
TEST COMPLETE CIRCUIT INCLUDING HEADERS AND FLOOR TUBES.
COMPLETE TESTING 48 HOURS PRIOR TO CONCRETE POUR.
AFTER PRESSURE TESTING APPROVAL BY DESIGN ENGINEER, REDUCE TO 50 PSIG AND HOLD FOR DURATION OF CONCRETE POUR.

FLOOR TOLERANCE TESTING
COMPLETE LASER LEVELING AND TOLERANCE REPORTS FOLLOWING COMPLETION OF EACH LAYER:

- SAND LAYER
- INSULATION
- FINISHED CONCRETE

PROVIDE TEST RESULTS TO OWNER AND DESIGN ENGINEER WITHIN 24 HOURS OF ALL TESTING.
ALL FINISHED CONCRETE TESTING MUST BE COMPLETED WITHIN 72 HOURS OF POUR COMPLETION.
TEST RESULTS MUST BE ACKNOWLEDGED BY DESIGN ENGINEER PRIOR TO ADVANCING TO NEXT STAGE.
RESULTS OUTSIDE REQUIRED TOLERANCES REQUIRE CORRECTION AND RETESTING. NO COMPENSATION WILL BE APPROVED FOR DEFICIENCY CORRECTION.

NOTES

	NEW
	EXISTING

21010 MR501

REFERENCE DEFINITION
SHEET COLUMN
SHEET NUMBER
(#, X#)
SHEET ROW

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VER #	REVISIONS	DATE	BY
1.0	ISSUED FOR TENDER	25-NOV-22	H.A.

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STAMP

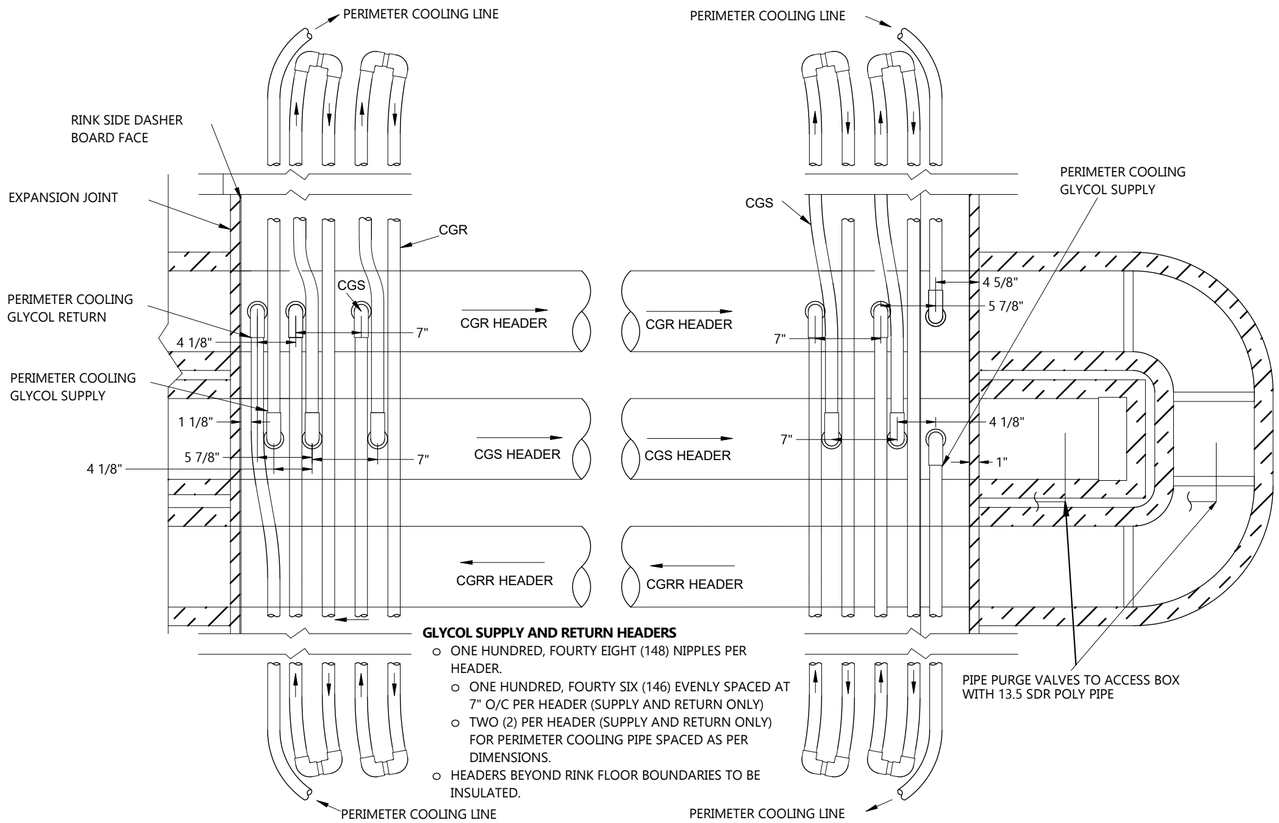
DRAWING NUMBER
21010 MR501

DRAWING NAME
RINK FLOOR DETAILS

CLIENT
CITY OF CHARLOTTETOWN

PROJECT
SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
H. AKAR	J. RITCHIE
DATE	**REVISION**
25-NOV-22	1.0
SHEET SIZE	**SHEET NO.**
C	3 OF 7



GLYCOL SUPPLY AND RETURN HEADERS

- ONE HUNDRED, FOURTY EIGHT (148) NIPPLES PER HEADER.
  - ONE HUNDRED, FOURTY SIX (146) EVENLY SPACED AT 7" O/C PER HEADER (SUPPLY AND RETURN ONLY)
  - TWO (2) PER HEADER (SUPPLY AND RETURN ONLY) FOR PERIMETER COOLING PIPE SPACED AS PER DIMENSIONS.
- HEADERS BEYOND RINK FLOOR BOUNDARIES TO BE INSULATED.

DETAIL H (MR101-1, D2): BURIED HEADER DETAILS
NTS

COLD FLOOR NOTES:

GENERAL

PIPE MATERIAL: HDPE

ALL TUBING CONNECTIONS AND INTERFACES TO BE FUSION WELDED.

HEADERS

MATERIAL: HDPE

SIZE: 8'' SDR 11

SADDLES FUSION WELDED TO HEADERS FOR CONNECTION TO FLOOR PIPES

SADDLE SPACING: 7'' O/C

SADDLE QTY. PER HEADER: 148

HEADER PIPING OUTSIDE RINK FLOOR BOUNDARY WRAPPED IN INSULATION.

VALVES

DRAINS:

- QTY: TWO X 1'' DRAIN VALVE
- FUSION WELD TO HEADER USING 1'' SDR 13.5 HDPE TUBING
- INSTALL IN ACCESS BOX TO SUPPLY AND RETURN HEADERS.

PURGE VALVES

- QTY: TWO X 1'' PURGE VALVE
- FUSION WELD TO HEADER USING 1'' SDR 13.5 HDPE TUBING
- POSITION UPRIGHT.
- INSTALL ON SUPPLY AND RETURN HEADERS IN ACCESS BOX

FLOOR TUBING

MATERIAL: HDPE

SIZE: 1'' SDR 13.5

SPACING: 3-1/2'' O/C

FUSION WELD EACH CIRCUIT TO SUPPLY/RETURN HEADERS.

SECURE TUBING TO PIPE CHAIRS USING CABLE TIES.

PERIMETER CHILL RING

FASTEN PERIMETER CHILL RING DIRECTLY TO PERIMETER REBAR ANCHORS USING CABLE TIES. CABLE TIES TO BE PROVIDED AS REQUIRED TO ENSURE NO MOVEMENT OF THE CHILL RINGS, MAXIMUM 24" APART.

RETURN BENDS

ONE-PIECE, PRE-MANUFACTURED 180° U-BEND (TYP.)

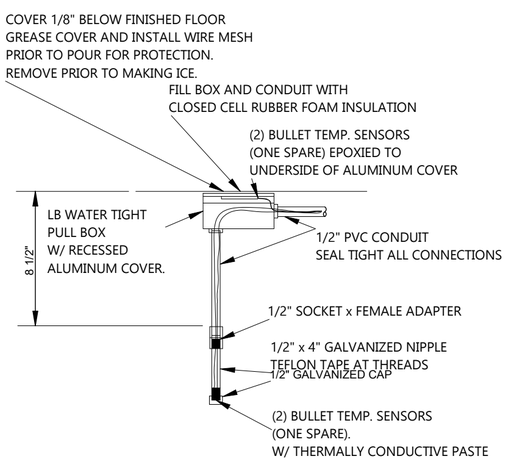
MATERIAL: HDPE

SIZE: 1'' IPS SDR 13.5

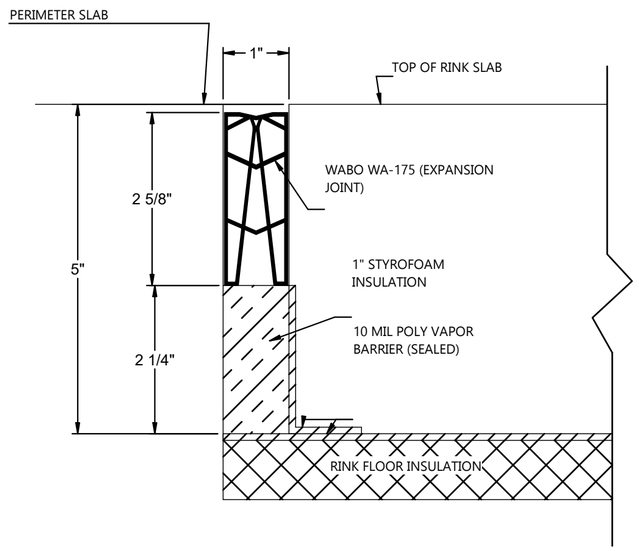
SPACING: 3-1/2'' O/C OFFSET

SOCKET FUSION WELDED TO FLOOR PIPES

CABLE TIE RETURN BENDS DIRECTLY TO PERIMETER REBAR ANCHORS TO TENSION THE SYSTEM AND MINIMIZE SAGGING.



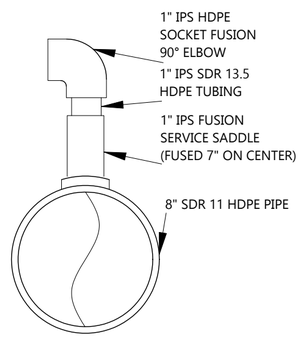
DETAIL I (1, D3): INFLOOR SENSOR DETAIL
NTS



PREPARTION

- INSTALL 1" x 5" STYROFOAM INSULATION IN ONE SCORED PIECE OR TWO PIECES, SCORE OR TOP PIECE IS 2-6/8". INSTALL VAPOR BARRIER TO TOP OF 5" HIGH INSULATION ON THE RINK SIDE OF THE EXPANSION JOINT. AFTER CONCRETE SLAB IS POURED AND CURED, REMOVE TOP PIECE OF INSULATION AND TRIM VAPOR BARRIER BACK 2-6/8".
- INSTALL WABO WA-175 AS PER LATEST MANUFACTURER INSTALLATION MANUALS AT TIME OF INSTALL.
- TOP OF SEAL 18 " BELOW FINISHED SLAB.

SECTION VEIW D-D (1, E2) ⌒ 180°: EXPANSION JOINT DETAIL
NTS



DETAIL J (3, B1): PIPE SADDLE DETAIL
NTS

FLOOR SYSTEM DETAILS

NOTES

———	NEW
———	EXISTING

21010 MR501

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW

(#, X#)

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1.0	ISSUED FOR TENDER	28-OCT-22	H.A.
1.0	ISSUED FOR TENDER	25-NOV-22	H.A.

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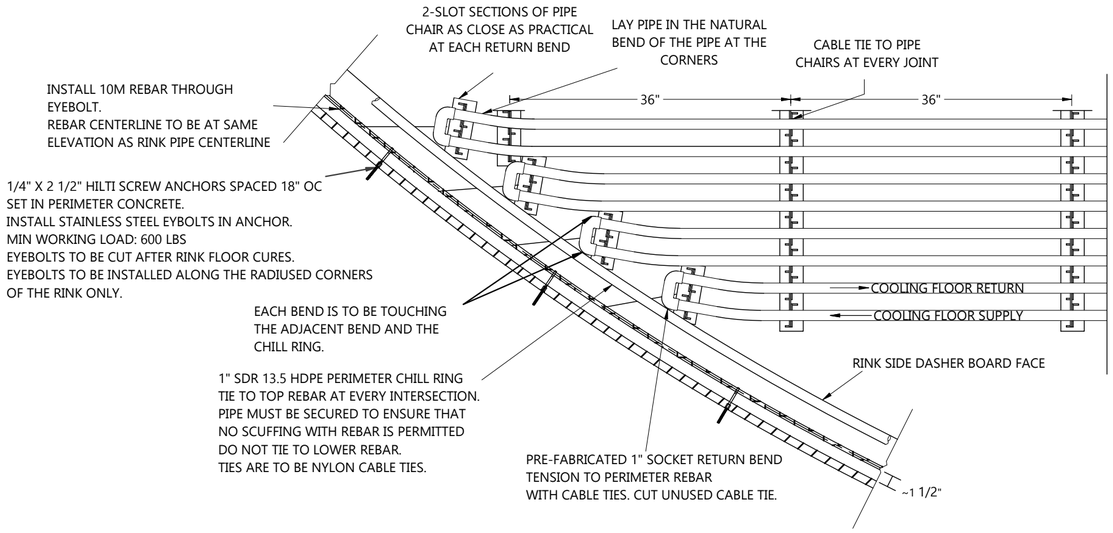
DRAWING NUMBER	21010 MR501
DRAWING NAME	RINK FLOOR DETAILS
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	25-NOV-22
REVISION	1.0
SHEET SIZE	C
SHEET NO.	4 OF 7



DETAIL G: COLD FLOOR PIPING DETAIL
NTS

COLD FLOOR PIPING

NOTES

	NEW
	EXISTING

21010 MR501

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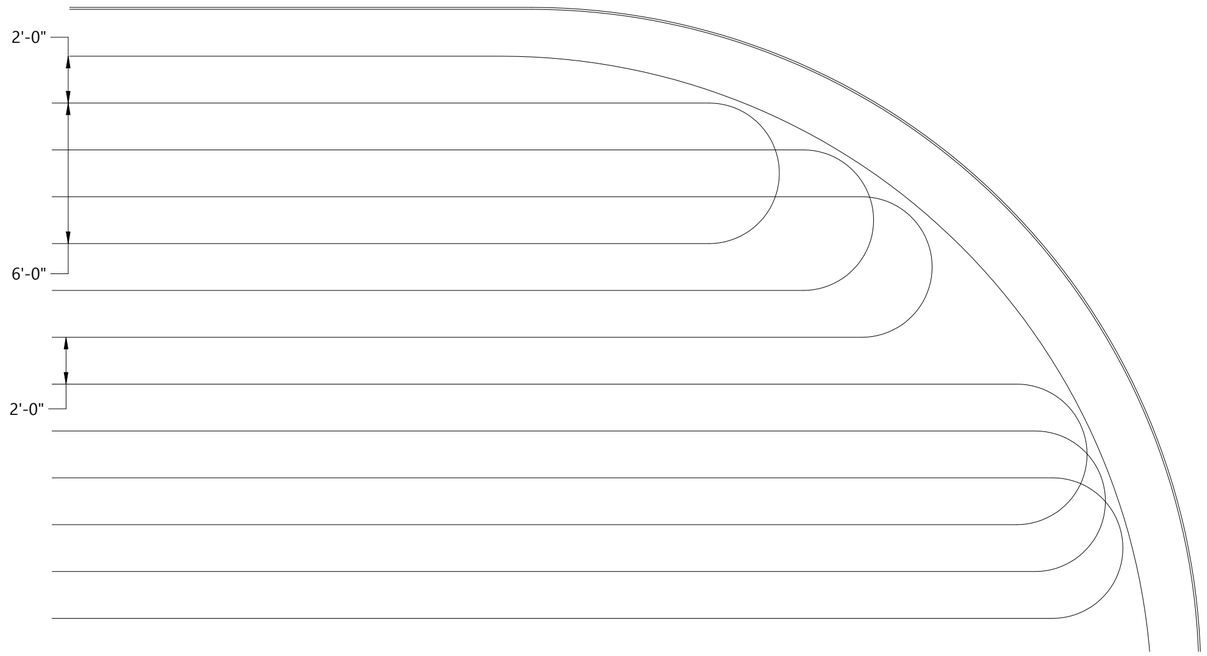
CITY OF CHARLOTTETOWN

PROJECT
SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
H. AKAR	J. RITCHIE
DATE 25-NOV-22	**REVISION** 1.0
SHEET SIZE C	**SHEET NO.** 5 OF 7



DETAIL H: WARM FLOOR PIPING DETAIL
NTS

WARM FLOOR ADDITIONAL NOTES:

GENERAL

MATERIAL: HDPE

ALL PIPE CONNECTIONS AND INTERFACES TO BE FUSION WELDED.

STUBBY HEADERS

MATERIAL: HDPE

SIZE: 3'' SDR 11

SADDLES FUSION WELDED TO SUPPLY AND RETURN HEADERS FOR CONNECTION TO FLOOR PIPES

SADDLE QTY PER HEADER: 11

WARM FLOOR PIPING

MATERIAL: HDPE

SIZE: 1'' SDR 13.5

SPACING:

TYP. 24'' O/C

18'' FROM SLAB PERIMETER

FUSION WELD EACH CIRCUIT TO SUPPLY/RETURN STUBBY HEADERS.

WARM FLOOR NOTES:

.1 WARM FLOOR MAINS

- .1 SUPPLY AND INSTALL TWO (2) PIPES FOR THE WARM FLOOR MAINS, SUPPLY AND RETURN, FROM THE BURIED HEADER PIPING TO THE REFRIGERATION PLANT ROOM AND CONNECTING INSIDE THE PLANT ROOM TO THE EXISTING PIPES.
- .2 PIPE SPECIFICATION: 3" HDPE SDR 11, FUSION WELDED.

.2 WARM FLOOR STUBBY HEADER:

- .1 SUPPLY AND INSTALL TWO (2) 3'' HDPE SUPPLY AND RETURN HEADER PIPES, CIRCULATING WARMED FLUID TO PREVENT FROST HEAVING IN THE RINK FLOOR. HEADER PIPES SHALL BE RUN FROM THE REFRIGERATION ROOM.
- .2 INCLUDES THIRTEEN (13) SETS OF FUSION SERVICE SADDLE CONNECTIONS FUSION WELDED TO EACH OF THE STUBBY HEADERS.
- .3 CONTRACTOR TO SUPPLY AND INSTALL TWO (2) DRAINS, COMPLETE WITH VALVES, AND TWO (2) PURGE VALVES (VENT) WITH CONNECTIONS, ONE (1) PER HEADER.
  - .1 PROVIDE 1" PURGE VALVES AT BOTH ENDS OF SUPPLY AND RETURN HEADERS.
  - .2 CONNECT PURGE VALVES TO HEADERS USING 1" SDR 13.5 HDPE PIPE. SADDLES ARE ALSO AN APPROVED EQUIVALENT.
  - .3 PURGE VALVE PIPING MUST NOT SLOPE DOWNWARDS TO ENSURE AIR IS NOT TRAPPED IN THE LINE, AND THE VALVES MUST BE INSTALLED IN THE ACCESS BOX.
- .4 ALL VALVES TO BE OF STEEL BODIES AND BE FITTED WITH HAND WHEELS (GRIPS).

.1 WARM FLOOR PIPING

- .1 SUPPLY AND INSTALL WARM FLOOR PIPING, BOTH SUPPLY AND RETURN PIPING RUNNING PARALLEL TO EACH OTHER AND CONNECTED TO EACH HEADER NIPPLE. PIPING MUST EXTEND THE ENTIRE LENGTH AND WIDTH OF THE NEW ICE SLAB STRUCTURE. FUSION SERVICE SADDLES MAY ALSO BE USED.
- .2 PIPE SIZE: 1" SDR 13.5
- .3 MATERIAL: HDPE
- .4 SPACED 24" ON CENTER.
- .5 PROVIDE RIGID INSULATION TO WARM FLOOR PIPING ONLY LOCATED IN THE ACCESS BOX.
- .6 HEADER CONNECTIONS: ALL JOINTS TO BE FULLY FUSION WELDED TO STUBBY HEADER IN THE ACCESS BOX.

WARM FLOOR PIPING

NOTES

———	NEW
———	EXISTING

21010 MR501

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SHEET NUMBER
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21010 MR501

DRAWING NAME
RINK FLOOR DETAILS

CLIENT
CITY OF CHARLOTTETOWN

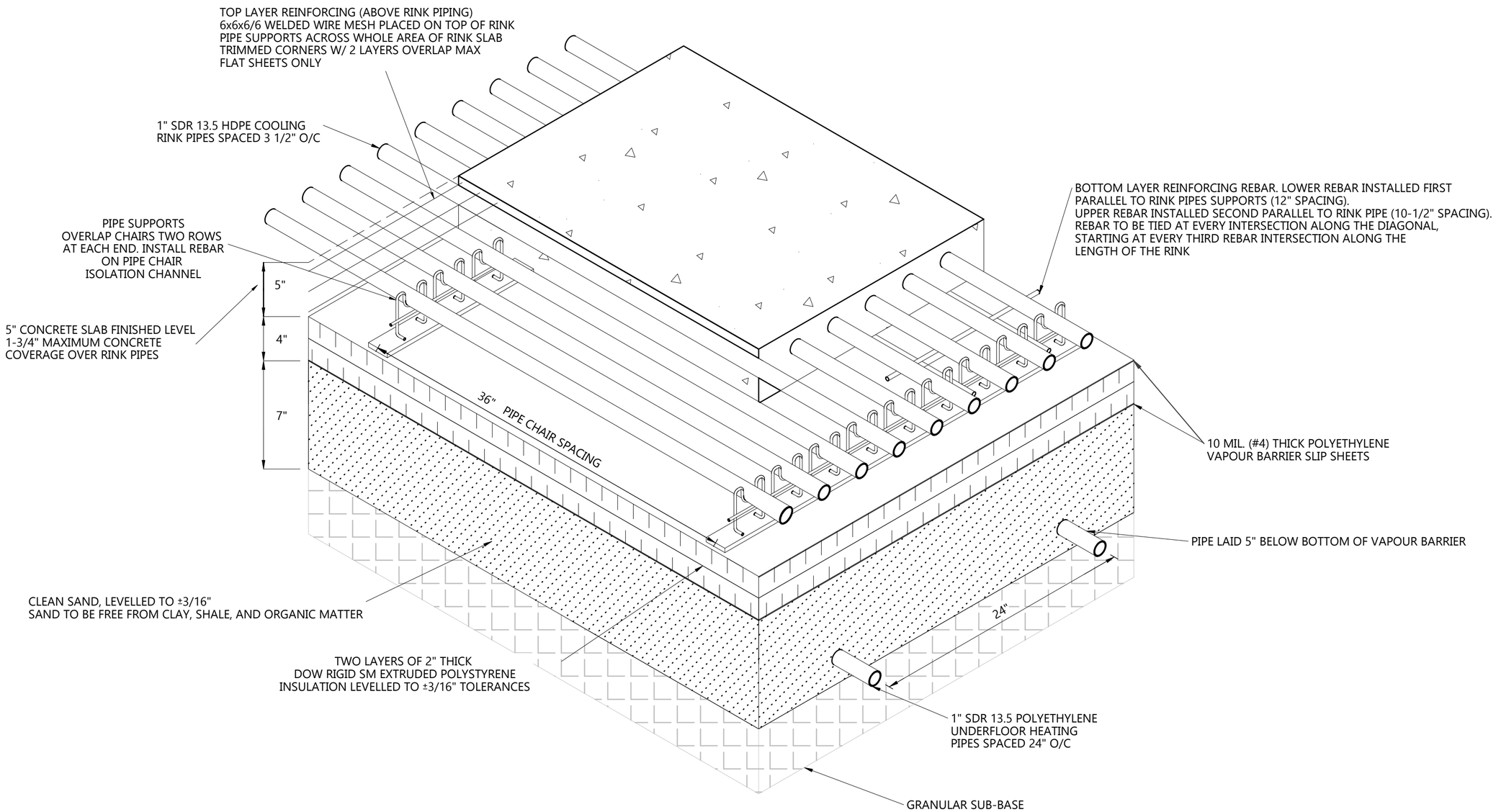
PROJECT
SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

DRAWN BY	CHECKED BY
H. AKAR	J. RITCHIE
DATE	**REVISION**
25-NOV-22	1.0
SHEET SIZE	**SHEET NO.**
C	6 OF 7

ICE RINK FLOOR SYSTEM SUMMARY

TOTAL SYSTEM DEPTH FROM PERIMETER FINISHED FLOOR: 16"

- TOP OF RINK SLAB FLUSH WITH PERIMETER SLAB
- 5" CONCRETE
  - TOP LAYER REINFORCEMENT WIREMESH
  - COLD FLOOR 1" POLY PIPING
  - M-STYLE PIPE CHAIRS
  - BOTTOM LAYER REINFORCING REBAR GRID
- VAPOR BARRIER
- 4" INSULATION (2X2" LAYERS)
- VAPOR BARRIER
- 7" SAND BASE
  - WARM FLOOR 1" POLY PIPING
- EXISTING GRANULAR SUB-BASE BELOW



SAMPLE RINK FLOOR SECTION (EXAGGERATED FOR CLARITY)

FLOOR ISOMETRIC VIEW

NOTES

———	NEW
———	EXISTING

21010 MR501

REFERENCE DEFINITION

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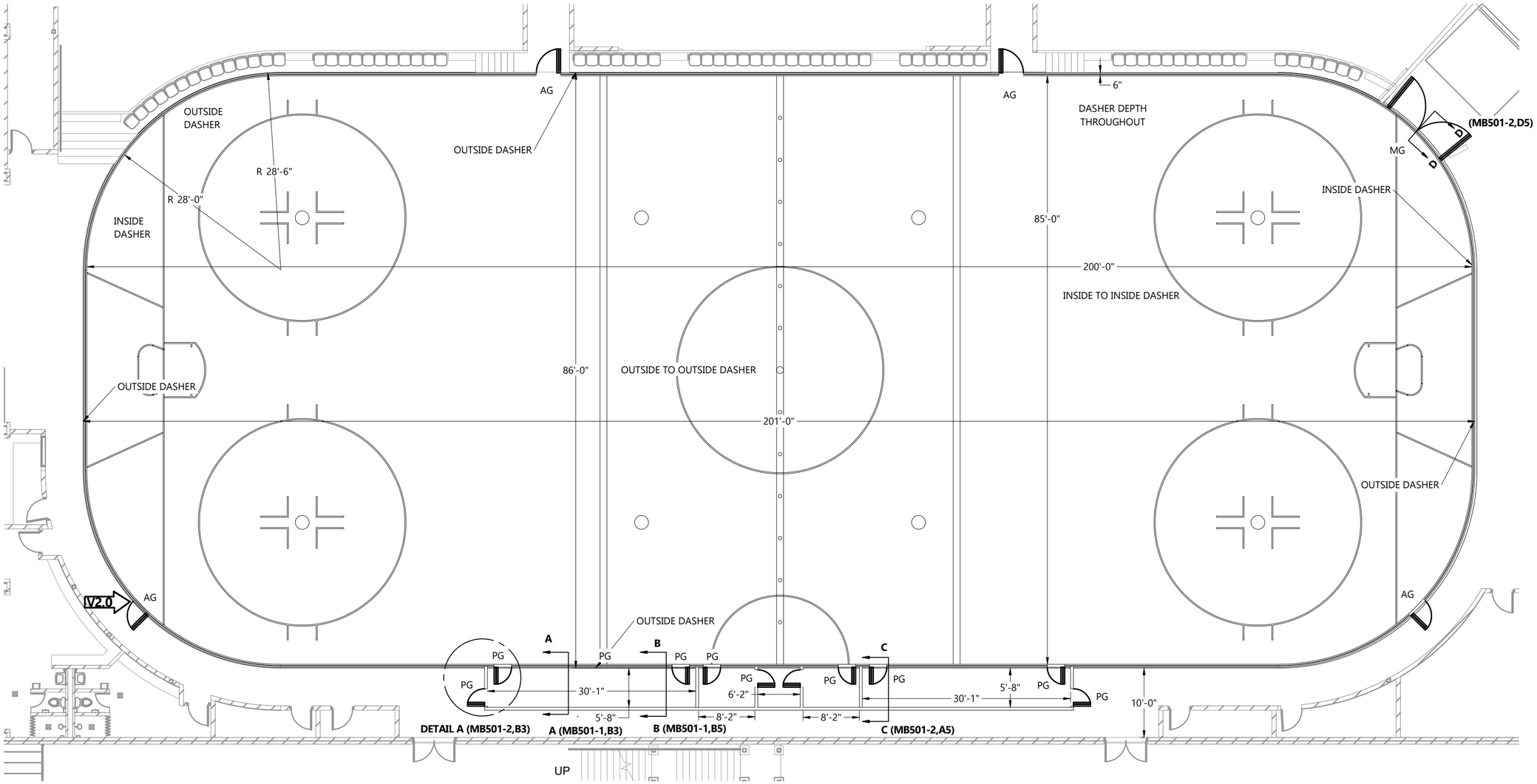
DRAWING NAME	RINK FLOOR DETAILS
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	25-NOV-22
REVISION	1.0
SHEET SIZE	C
SHEET NO.	7 OF 7



DASHER BOARD PLAN

SCALE 1 : 150

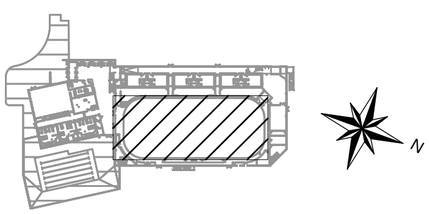
GATE DETAILS			
QTY.	CODE	ITEM	DIMENSION
10	PG	PLAYER GATE	30"
4	AG	ACCESS GATE	36"
1	MG	MACHINE GATE	120" (2 x 60")

V2.0

NOTE:

- BOARDS ARE TO BE INSTALLED ON THE NEW RINK FLOOR SLAB.

BOX INSIDE DIMENSIONS		
TYPE	LENGTH	WIDTH
PLAYER'S BOX (RIGHT)	30'-1"	5'-8"
PLAYER'S BOX (LEFT)	30'-1"	5'-8"
PENALTY BOX (RIGHT)	8'-2"	5'-8"
PENALTY BOX (LEFT)	8'-2"	5'-8"
TIMEKEEPER BOX	6'-2"	5'-8"



N

SITE KEY

SCALE 1:2000

DASHER BOARD LAYOUT

NOTES

	NEW
	EXISTING

REFERENCE DEFINITION

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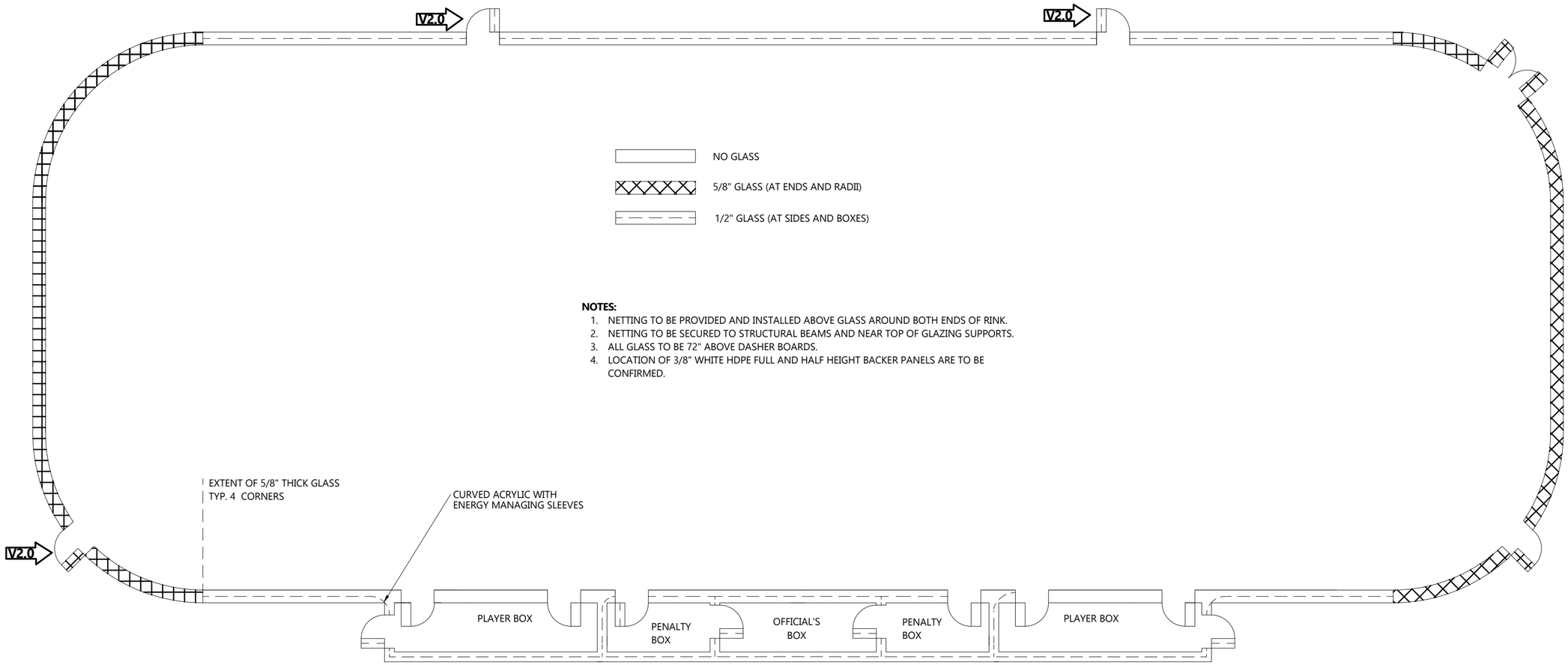
STAMP

DRAWING NUMBER	21010 MB101
DRAWING NAME	BOARDS & GLASS PLAN
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	08-FEB-23
REVISION	2.0
SHEET SIZE	C
SHEET NO.	1 OF 2

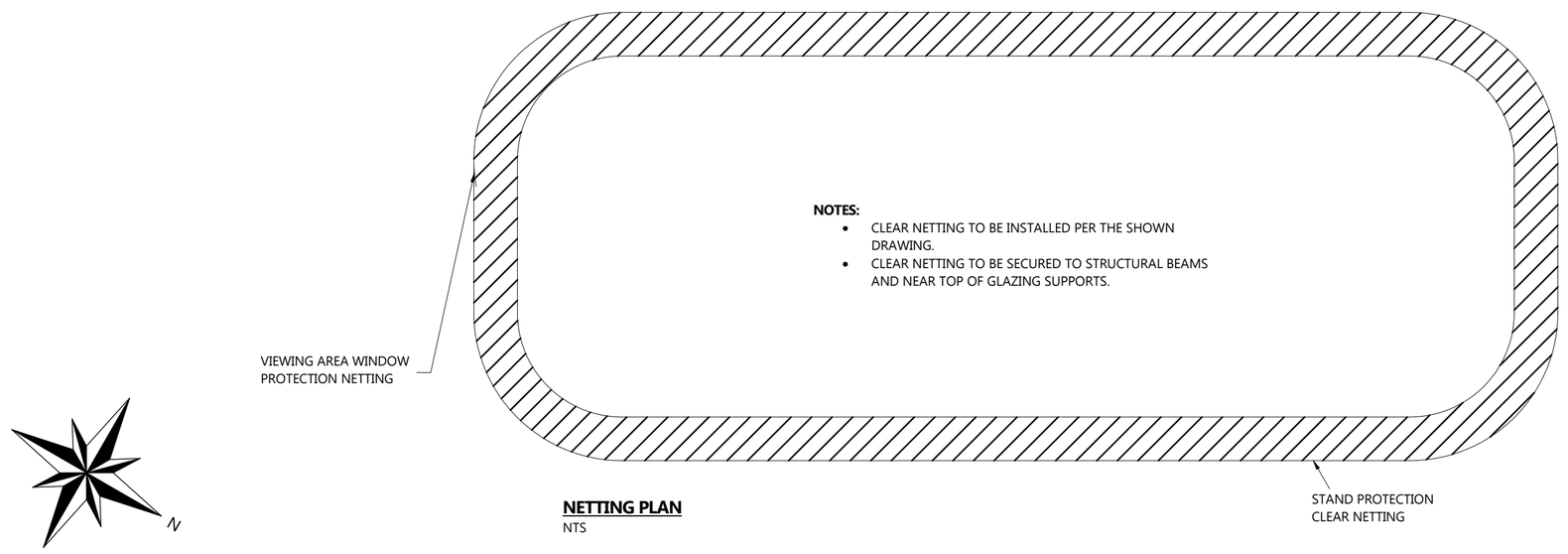
21010 MB101



NOTES:

1. NETTING TO BE PROVIDED AND INSTALLED ABOVE GLASS AROUND BOTH ENDS OF RINK.
2. NETTING TO BE SECURED TO STRUCTURAL BEAMS AND NEAR TOP OF GLAZING SUPPORTS.
3. ALL GLASS TO BE 72" ABOVE DASHER BOARDS.
4. LOCATION OF 3/8" WHITE HDPE FULL AND HALF HEIGHT BACKER PANELS ARE TO BE CONFIRMED.

GLASS, BACKER PANEL, & NETTING PLAN
NTS



NOTES:

- CLEAR NETTING TO BE INSTALLED PER THE SHOWN DRAWING.
- CLEAR NETTING TO BE SECURED TO STRUCTURAL BEAMS AND NEAR TOP OF GLAZING SUPPORTS.

NETTING PLAN
NTS

GLASS, BACKER PANEL, AND NETTING PLAN

NOTES

	NEW
	EXISTING

21010 MB101

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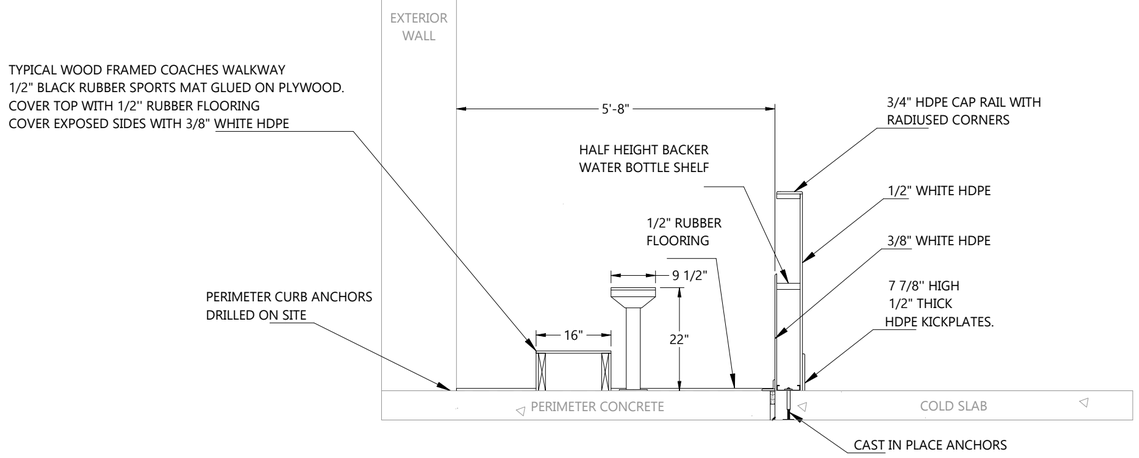
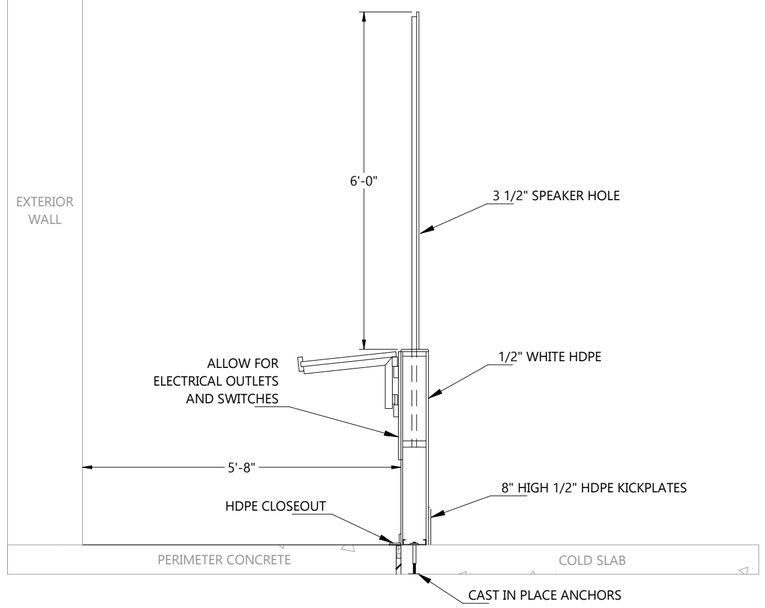
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	08-FEB-23
REVISION	2.0
SHEET SIZE	C
SHEET NO.	2 OF 2



SECTION CUT A-A (MB101-1,B3) ⌒90°: PLAYERS BENCH DETAILS
SCALE 1 : 25



SECTION CUT B-B (MB101-1, C3) ⌒90°: TIME KEEPER'S BOX DETAILS
SCALE 1 : 25

DASHER BOARD DETAILS

NOTES

———	NEW
———	EXISTING

21010 MB501

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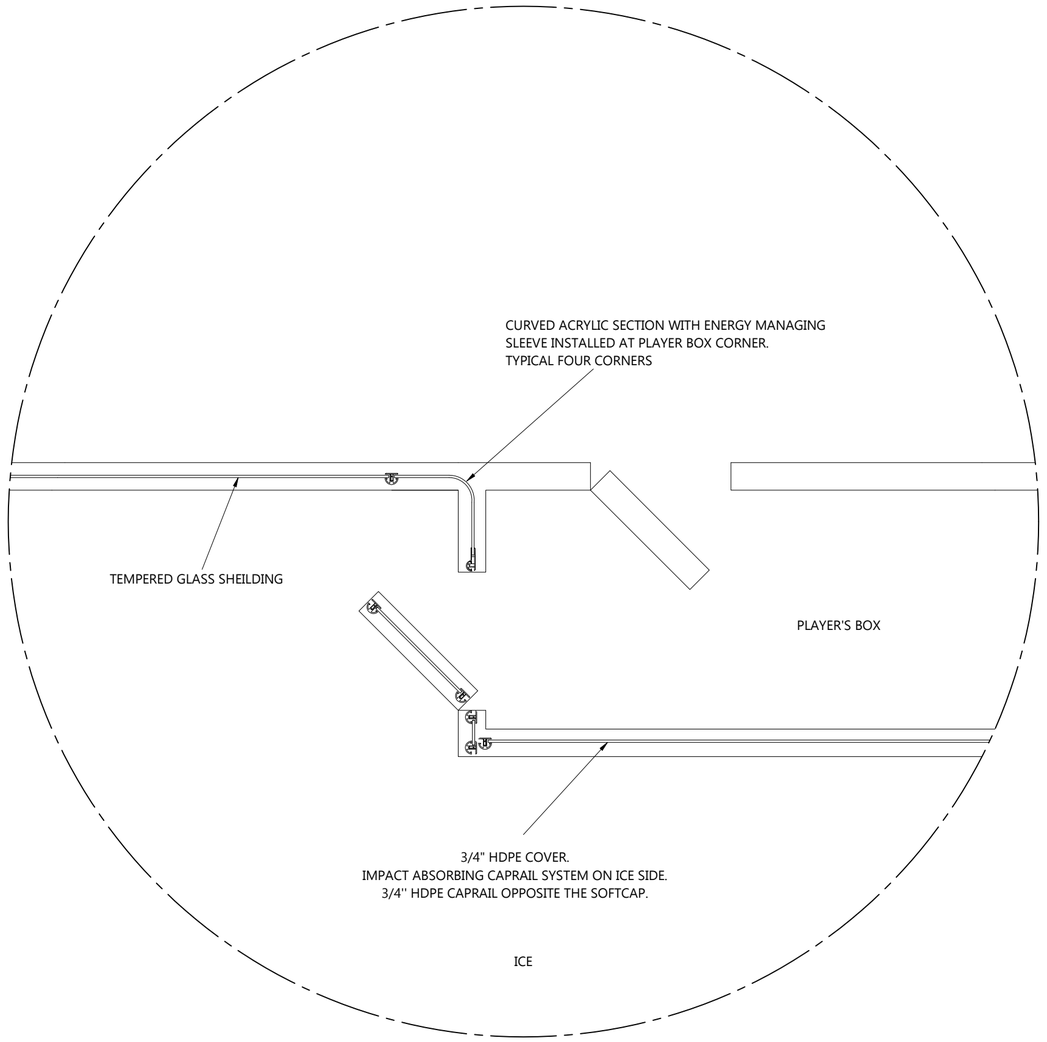
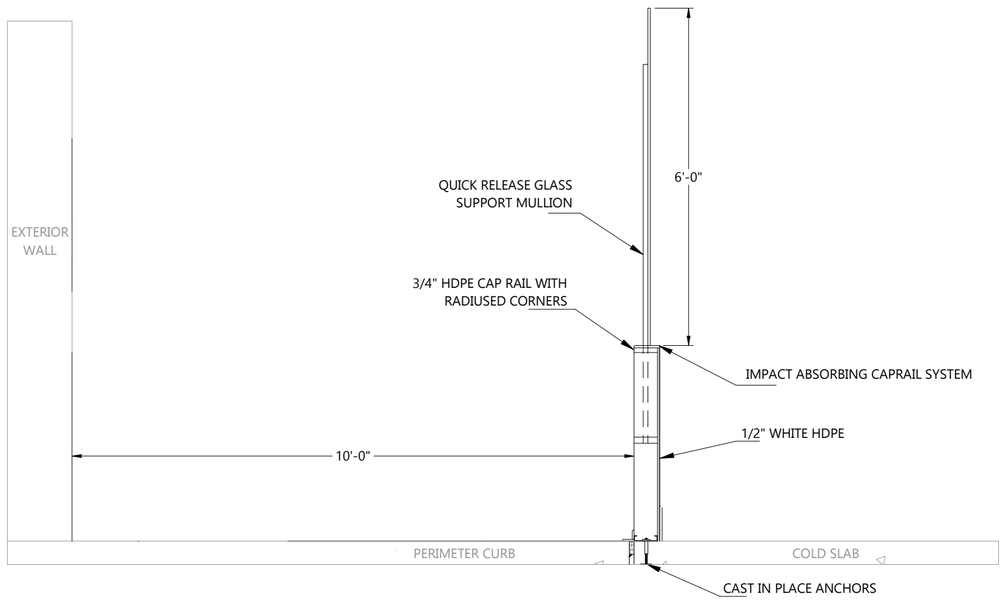
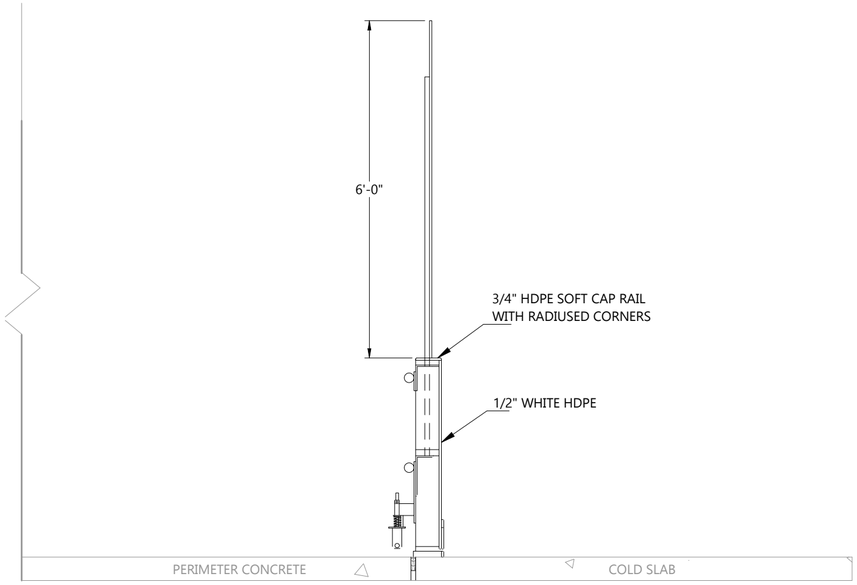
DRAWING NAME	BOARDS & GLASS DETAILS
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	08-FEB-23
REVISION	2.0
SHEET SIZE	C
SHEET NO.	1 OF 2



DETAIL A (MB101-1,B3): CURVED ACRYLIC DETAIL
SCALE 1 : 25



SECTION CUT C-C (MB101-1,C3) ⌒90°: DASHER BOARD GENERAL DETAILS
SCALE 1 : 25



SECTION CUT D-D (MB101-1,E1) ⌒ 225°: MACHINE GATE DETAILS
SCALE 1 : 25

DASHER BOARD DETAILS

NOTES

———	NEW
———	EXISTING

21010 MB501

REFERENCE DEFINITION
SHEET COLUMN / SHEET ROW
SHEET NUMBER
(#, X#)

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VER #	REVISIONS	DATE	BY
2.0	EO#682	08-FEB-23	H.A.
1.0	ISSUED FOR TENDER	25-NOV-22	H.A.

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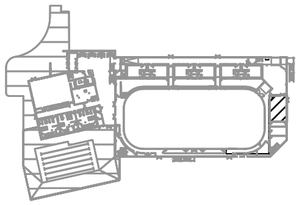
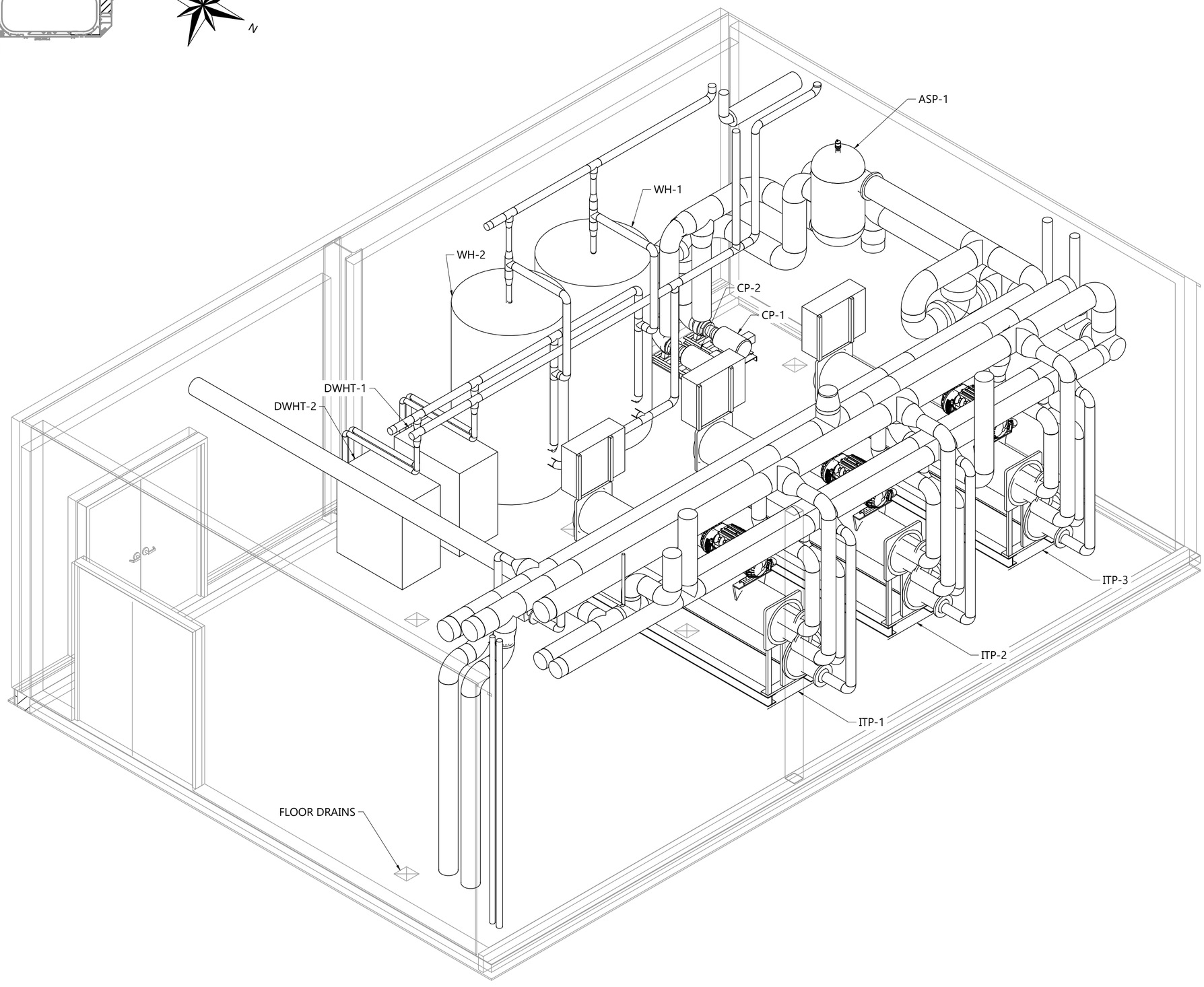
DRAWING NUMBER	21010 MB501
DRAWING NAME	BOARDS & GLASS DETAILS
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	H. AKAR
CHECKED BY	J. RITCHIE
DATE	08-FEB-23
REVISION	2.0
SHEET SIZE	C
SHEET NO.	2 OF2



SITE KEY
SCALE 1:2000



PLANT ROOM PIPING & DUCTING LEVEL 1
SCALE 1:35

PLANT ROOM PIPING & DUCTING - LEVEL 1

NOTES

	NEW
	EXISTING

21010 M-901

REFERENCE DEFINITION

SHEET COLUMN — SHEET ROW
SHEET NUMBER — (#, X#)

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VER #	REVISIONS	DATE	BY
4.0	EO #679	06-FEB-23	Z.M
3.0	EO #668	11-JAN-23	Z.M
2.0	EO #665	15-DEC-22	Z.M
1.0	RELEASED FOR TENDER	25-NOV-22	R.T

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VAUGHAN ON
REDINGTON SHORES FL

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STAMP

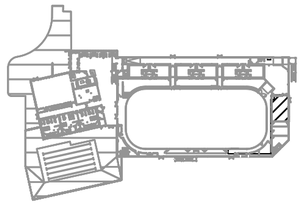
DRAWING NUMBER
21010 M-901

DRAWING NAME
ISOMETRIC VISUALIZATION PIPING & DUCTING

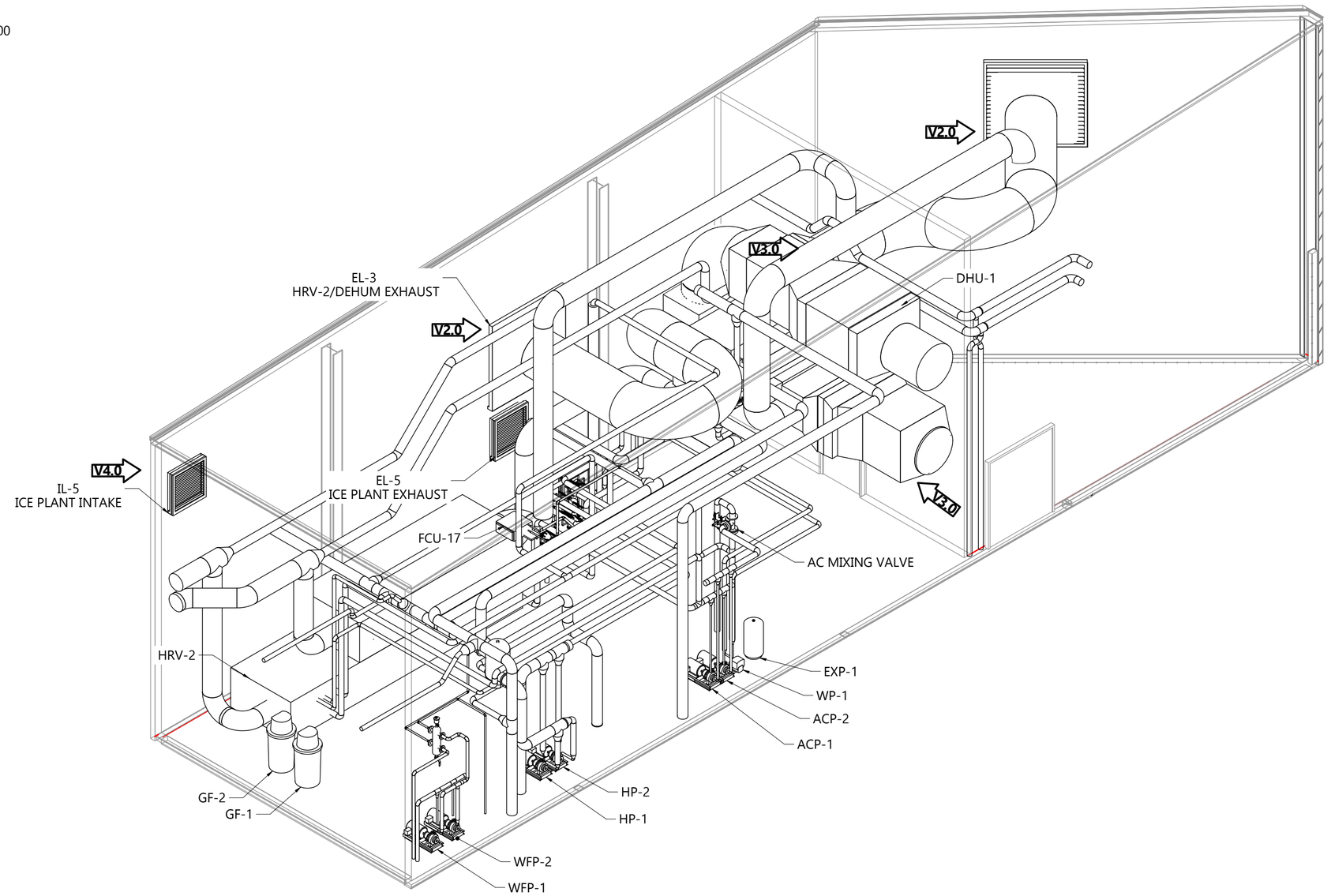
CLIENT
CITY OF CHARLOTTETOWN

PROJECT
SIMMONS SPORTS CENTRE ARENA &POOL REPLACEMENT

DRAWN BY	CHECKED BY
Z.MBADDER	J.RITCHIE
DATE 06-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 1 OF 5



SITE KEY
SCALE 1:2000



PLANT ROOM PIPING & DUCTING - LEVEL 2
SCALE 1:75

PLANT ROOM PIPING & DUCTING - LEVEL 2

NOTES

	NEW
	EXISTING

21010 M-901

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW
(#, X#)

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VER #	REVISIONS	DATE	BY
4.0	EO #679	06-FEB-23	Z.M
3.0	EO #668	11-JAN-23	Z.M
2.0	EO #665	15-DEC-22	Z.M
1.0	RELEASED FOR TENDER	25-NOV-22	R.T

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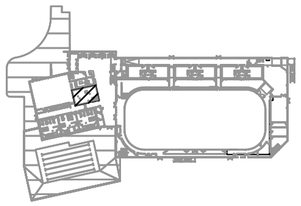
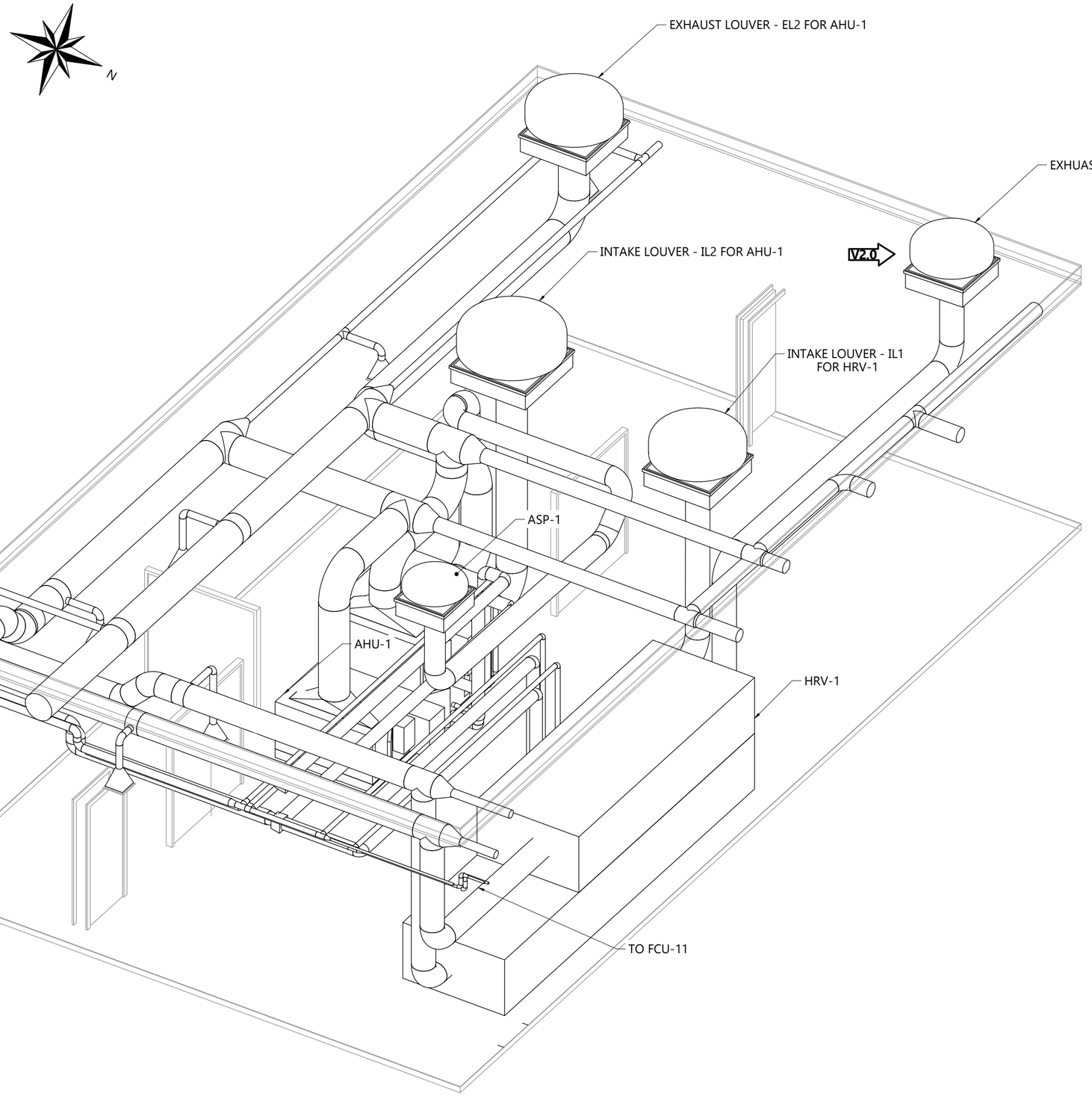
DRAWING NUMBER	21010 M-901
DRAWING NAME	ISOMETRIC VISUALIZATION PIPING & DUCTING
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA &POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	2 OF 5



SITE KEY
SCALE 1:2000



NOTE:

- CEILINGS & WALLS IN VIEW ARE REMOVED FOR CLARITY OF MECHANICAL ROOM.

SOUTH MECHANICAL ROOM PIPING & DUCTING-EAST
SCALE 1:50

SOUTH MECHANICAL ROOM PIPING & DUCTING-EAST

21010 M-901

NOTES

	NEW
	EXISTING

REFERENCE DEFINITION
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SHEET NUMBER
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2.0	EO #665	15-DEC-22	Z.M
1.0	RELEASED FOR TENDER	25-NOV-22	R.T

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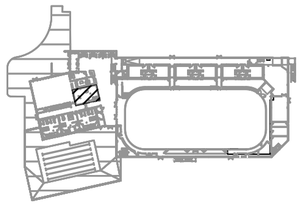
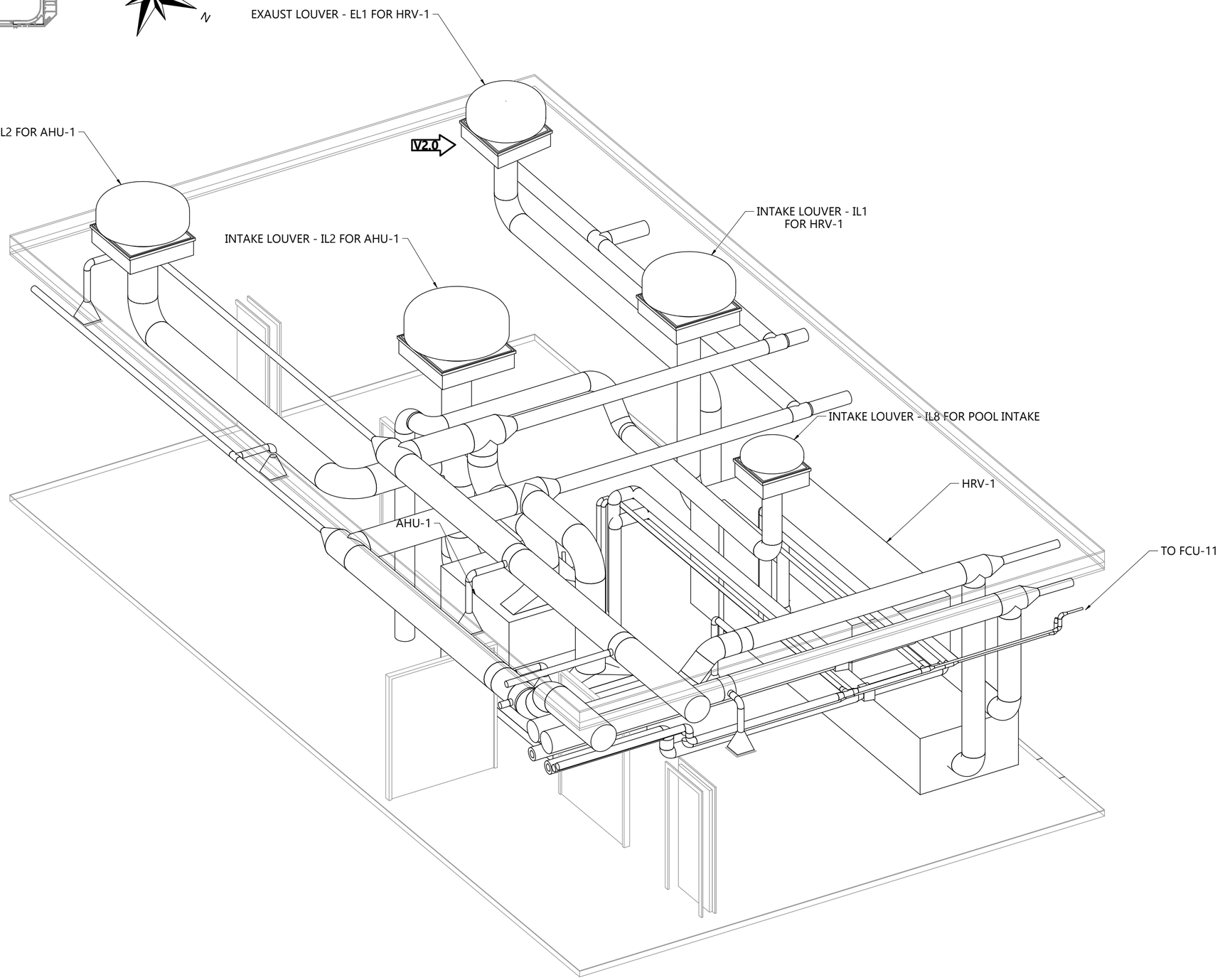
DRAWING NUMBER	21010 M-901
DRAWING NAME	ISOMETRIC VISUALIZATION PIPING & DUCTING
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA &POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	3 OF 5



SITE KEY
SCALE 1:2000



NOTE:

- CEILINGS & WALLS IN VIEW ARE REMOVED FOR CLARITY OF MECHANICAL ROOM.

SOUTH MECHANICAL ROOM PIPING & DUCTING-SOUTH
SCALE 1:50

SOUTH MECHANICAL PIPING & DUCTING-SOUTH

21010 M-901

NOTES

	NEW
	EXISTING

REFERENCE DEFINITION
SHEET COLUMN / SHEET NUMBER — SHEET ROW
(#, X#)

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2.0	EO #665	15-DEC-22	Z.M
1.0	RELEASED FOR TENDER	25-NOV-22	R.T

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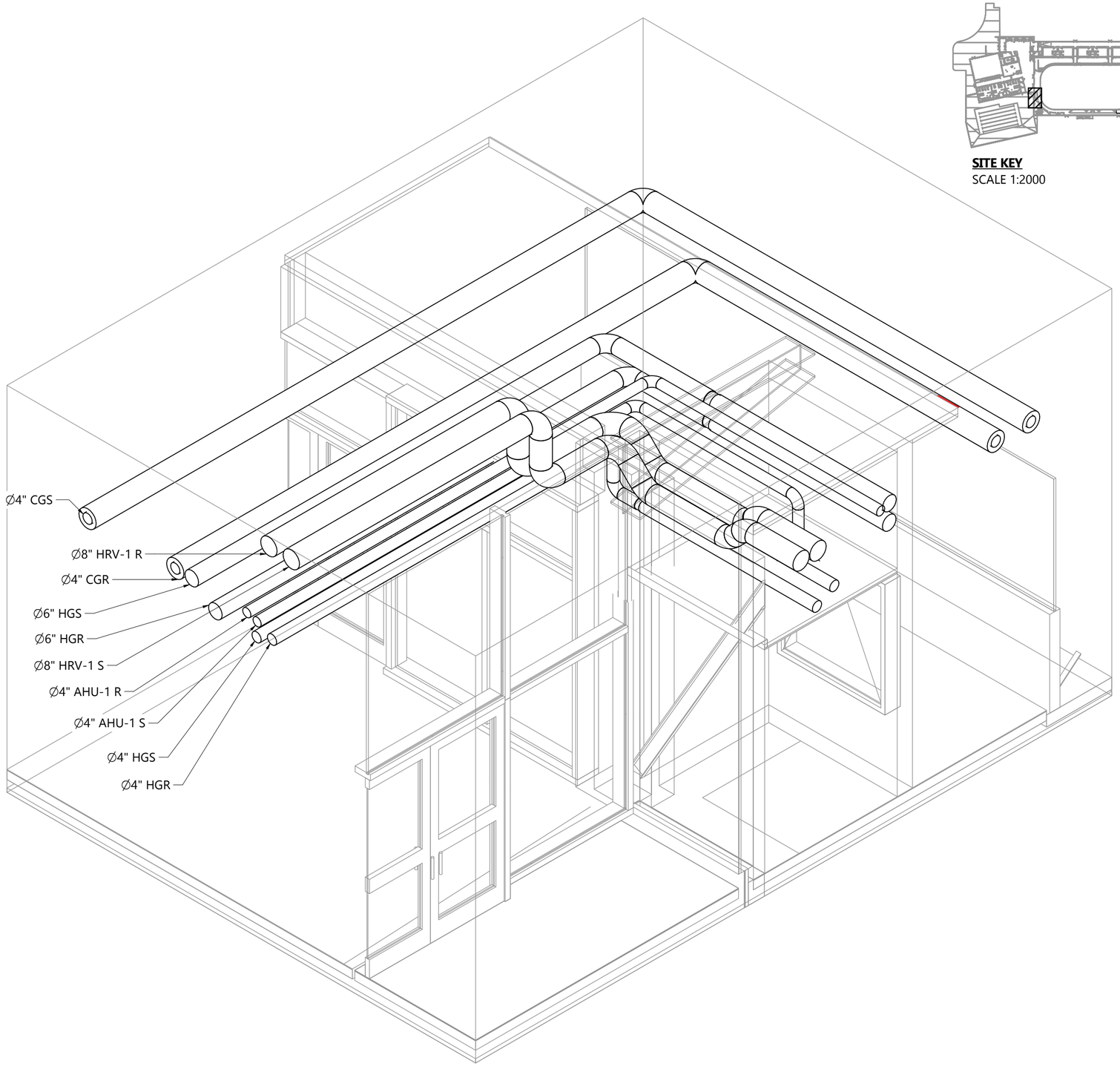
DRAWING NAME	ISOMETRIC VISUALIZATION PIPING & DUCTING
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA &POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	4 OF 5



SITE KEY
SCALE 1:2000

SOUTH EAST CORNER FROM FRONT OF THE HOUSE TO ARENA - ISOMETRIC VIEW
SCALE: 1:50

CORNER FROM FRONT OF HOUSE TO ARENA

NOTES

	NEW
	EXISTING

21010 M-901

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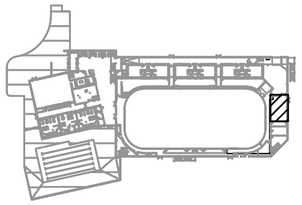
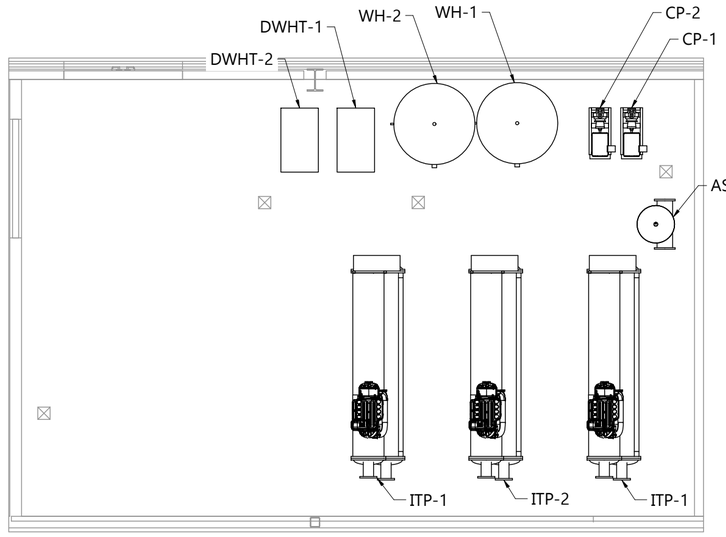
DRAWING NAME	ISOMETRIC VISUALIZATION PIPING & DUCTING
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA &POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	5 OF 5

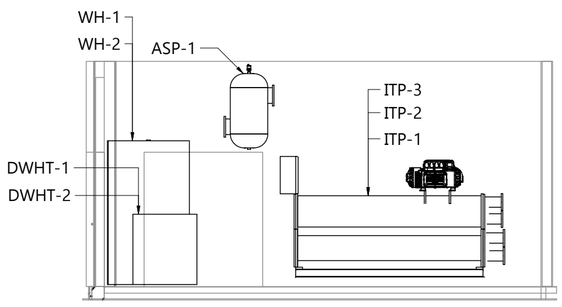


SITE KEY
SCALE 1:2000

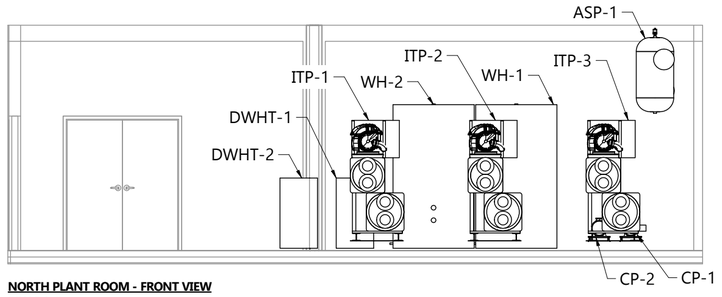
NORTH PLANT ROOM - ISOMETRIC VIEW
SCALE 1:50



NORTH PLANT ROOM-TOP VIEW
SCALE 1:75



NORTH PLANT ROOM-SIDE VIEW
SCALE 1:75



NORTH PLANT ROOM - FRONT VIEW
SCALE 1:75

EQUIPMENT LAYOUT - LEVEL 1

NOTES

	NEW
	EXISTING

21010 M-903

REFERENCE DEFINITION
SHEET COLUMN / SHEET NUMBER — SHEET ROW
(#, X#)

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VER #	REVISIONS	DATE	BY
4.0	EO #679	06-FEB-23	Z.M
3.0	EO #668	11-JAN-23	Z.M
2.0	EO #665	15-DEC-22	Z.M
1.0	RELEASED FOR TENDER	25-NOV-22	R.T

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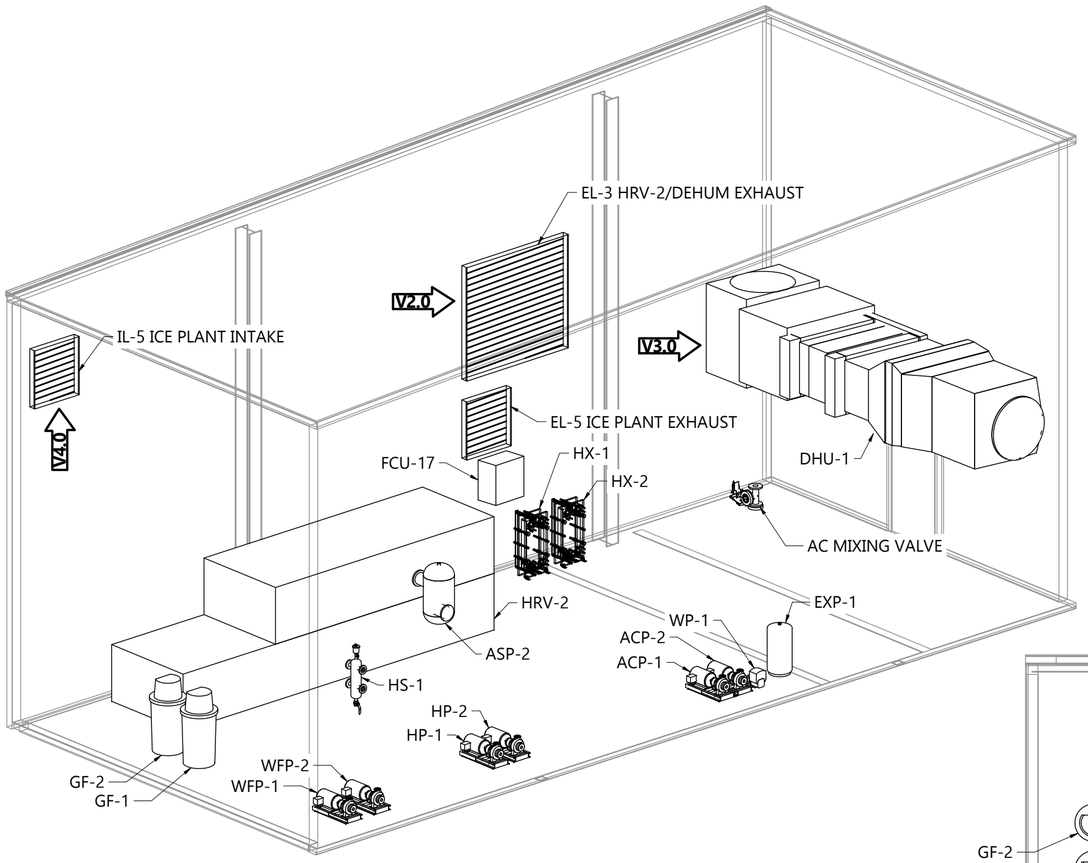
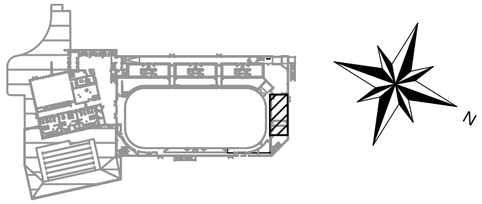
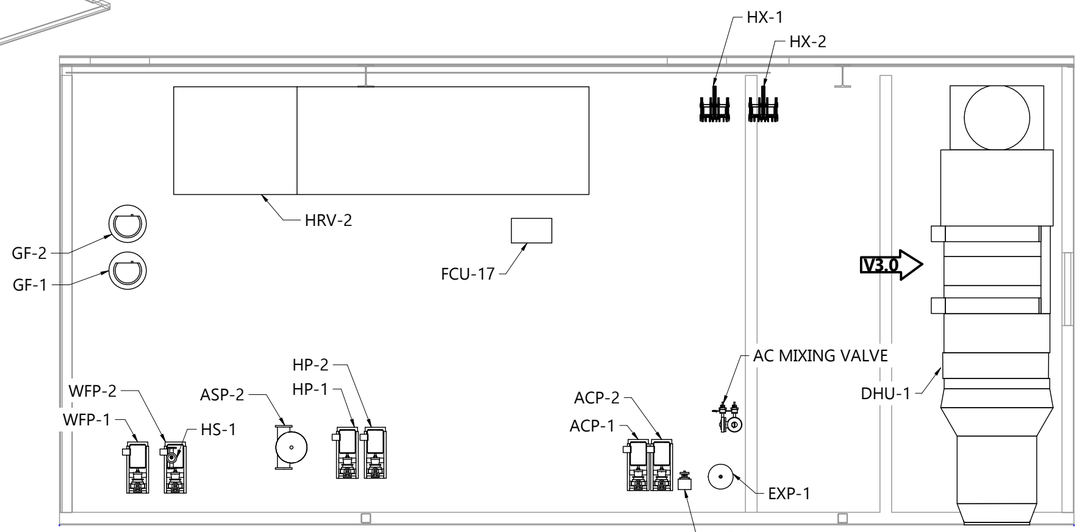
DRAWING NUMBER	21010 M-903
DRAWING NAME	ISOMETRIC VISUALIZATION EQUIPMENT LAYOUT
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	1 OF 3



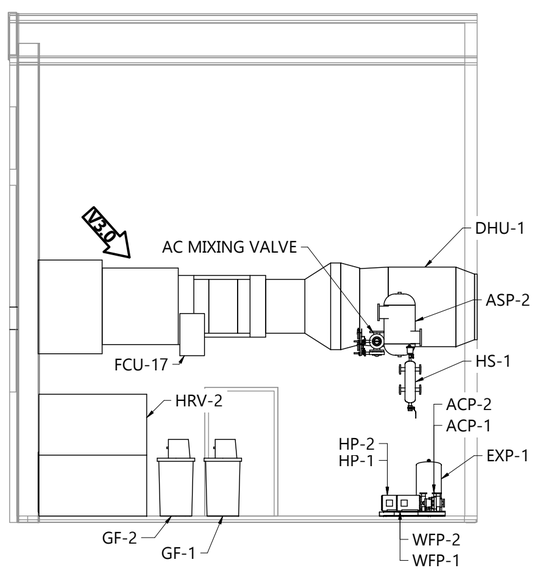
NORTH PLANT ROOM - ISOMETRIC VIEW
SCALE 1:75



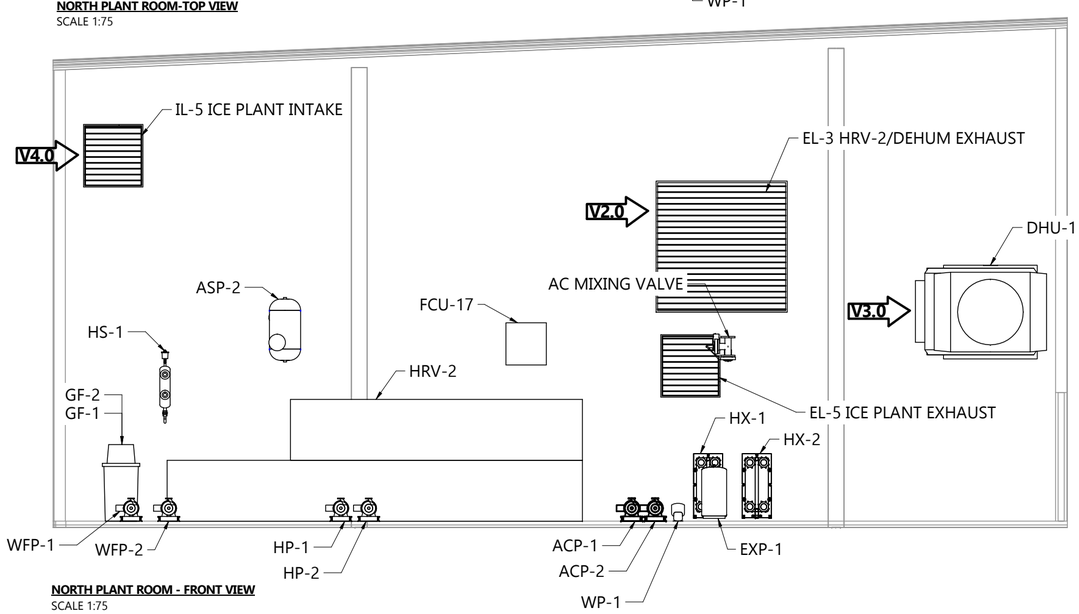
SITE KEY
SCALE 1:2000



NORTH PLANT ROOM-TOP VIEW
SCALE 1:75



NORTH PLANT ROOM-SIDE VIEW
SCALE 1:75



NORTH PLANT ROOM - FRONT VIEW
SCALE 1:75

EQUIPMENT LAYOUT - LEVEL 2

NOTES

	NEW
	EXISTING

21010 M-903

REFERENCE DEFINITION
SHEET COLUMN / SHEET NUMBER — SHEET ROW
(#, X#)

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4.0	EO #679	06-FEB-23	Z.M
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2.0	EO #665	15-DEC-22	Z.M
1.0	RELEASED FOR TENDER	25-NOV-22	R.T

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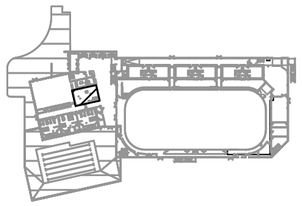
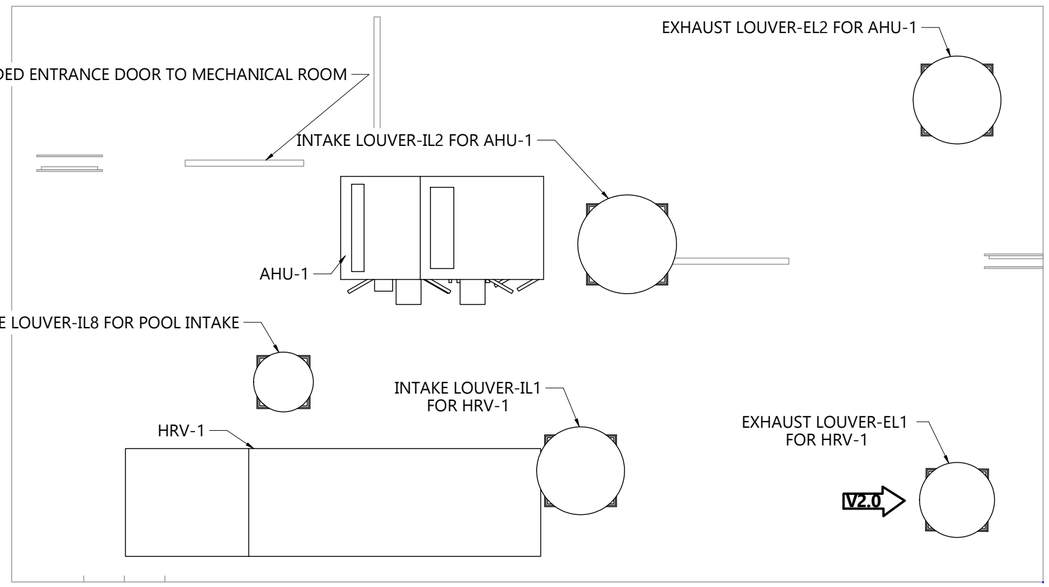
DRAWING NUMBER	21010 M-903
DRAWING NAME	ISOMETRIC VISUALIZATION EQUIPMENT LAYOUT
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	2 OF 3

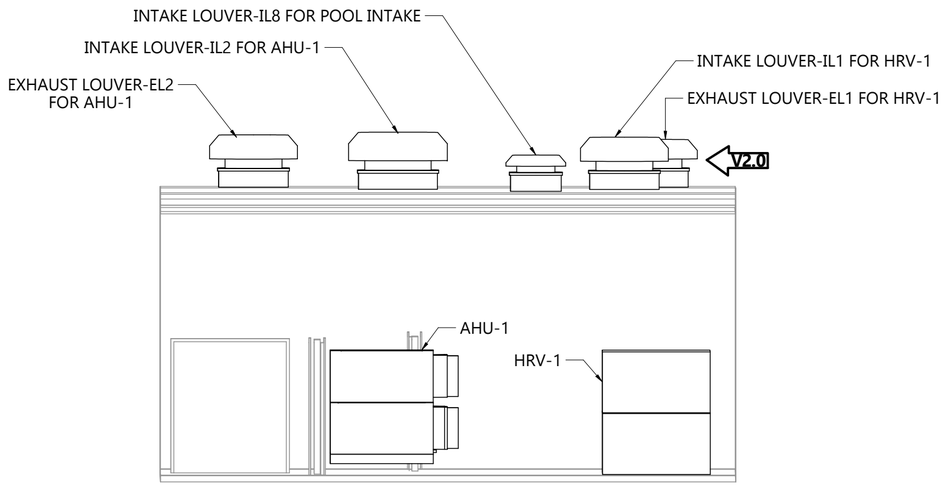


SITE KEY
SCALE 1:2000

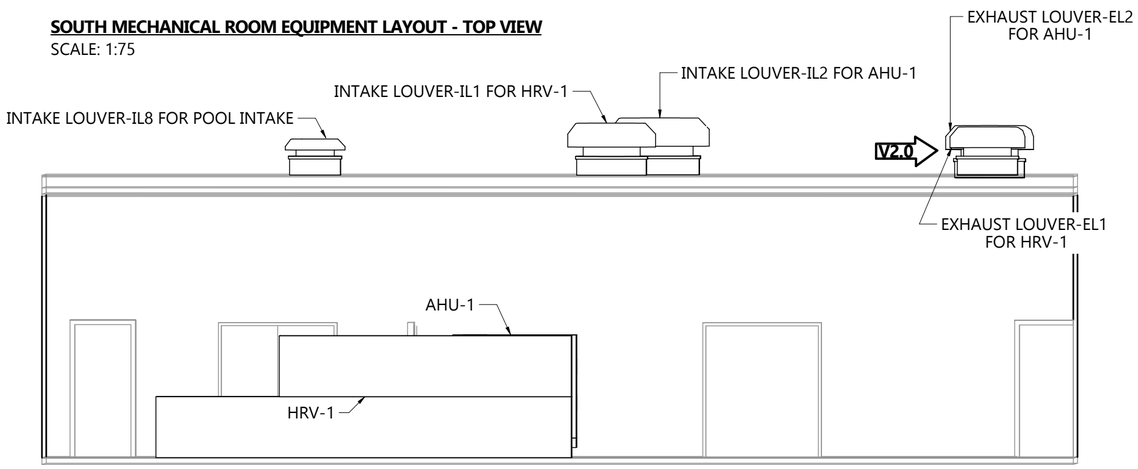
SOUTH MECHANICAL ROOM EQUIPMENT LAYOUT - ISOMETRIC VIEW
SCALE: 1:75



SOUTH MECHANICAL ROOM EQUIPMENT LAYOUT - TOP VIEW
SCALE: 1:75



SOUTH MECHANICAL ROOM EQUIPMENT LAYOUT - SIDE VIEW
SCALE: 1:75



SOUTH MECHANICAL ROOM EQUIPMENT LAYOUT - FRONT VIEW
SCALE: 1:75

NOTE:

- CEILINGS & WALLS IN VIEW ARE REMOVED FOR CLARITY OF MECHANICAL ROOM.

EQUIPMENT LAYOUT - FRONT OF HOUSE MECHANICAL

NOTES

	NEW
	EXISTING

21010 M-903

REFERENCE DEFINITION
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(#, X#)

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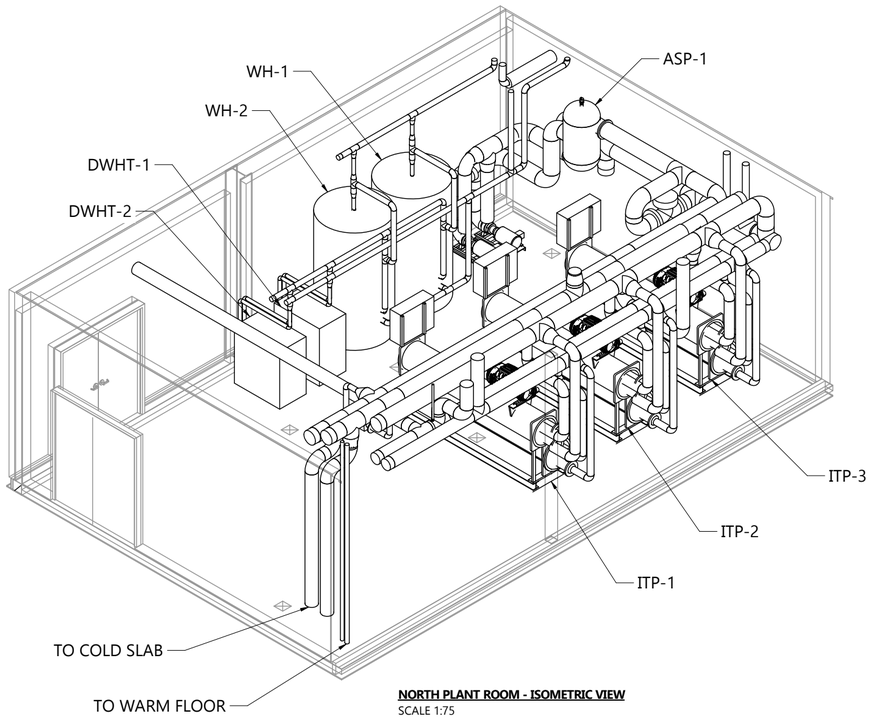
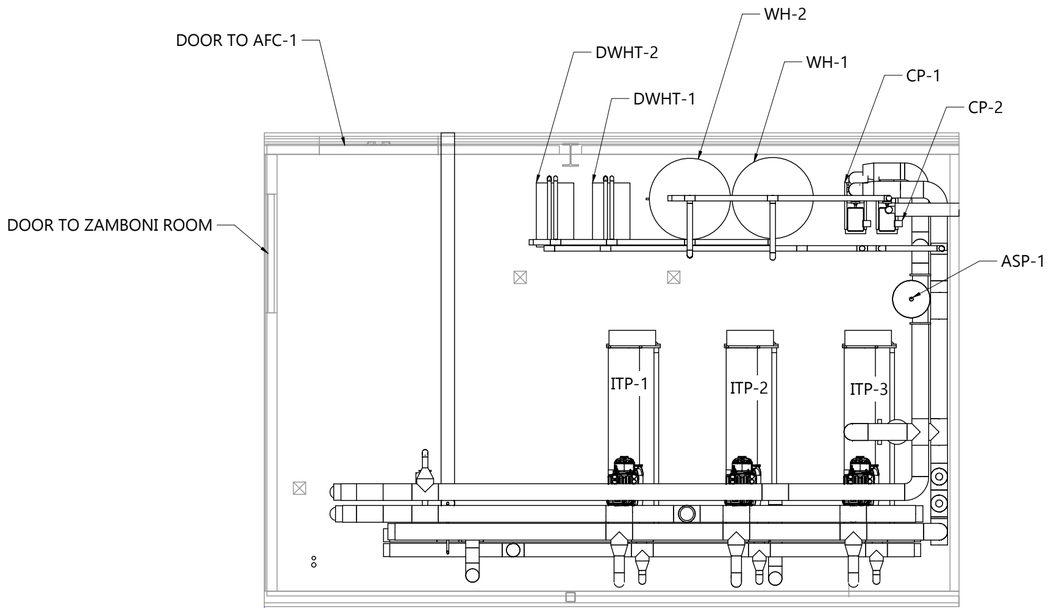
DRAWING NUMBER	21010 M-903
DRAWING NAME	ISOMETRIC VISUALIZATION EQUIPMENT LAYOUT
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	3 OF 3



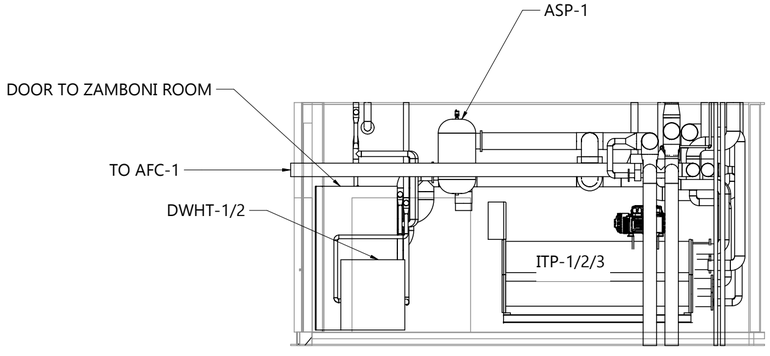
NORTH PLANT ROOM - ISOMETRIC VIEW
SCALE 1:75

NOTE:

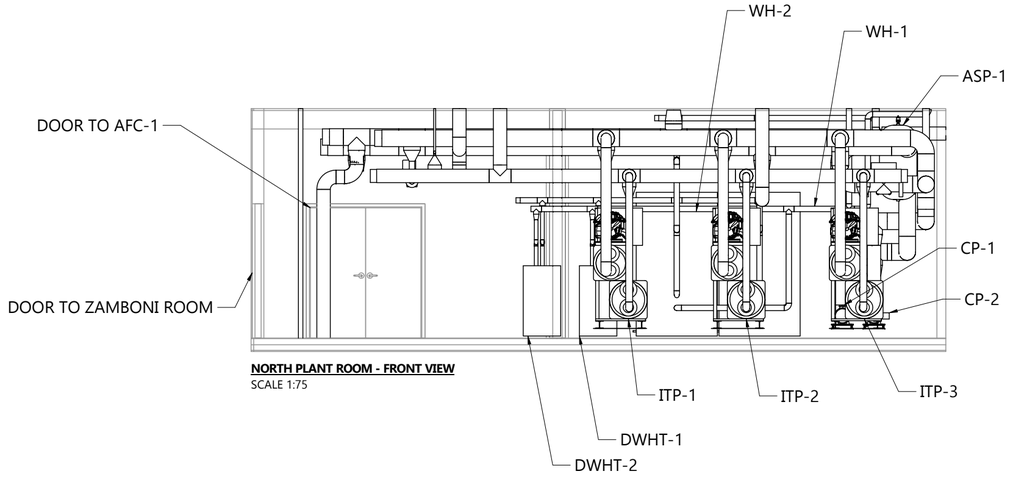
- ALL DUCTING ARE HIDDEN FOR CLARITY OF THE EQUIPMENTS & PIPING
- SEE MP-903 (1,C3) FOR EQUIIPMENT LAYOUT.



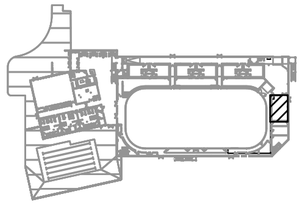
NORTH PLANT ROOM-TOP VIEW
SCALE 1:75



NORTH PLANT ROOM-SIDE VIEW
SCALE 1:75



NORTH PLANT ROOM - FRONT VIEW
SCALE 1:75



SITE KEY
SCALE 1:2000

PLANT ROOM PIPING-LEVEL 1

NOTES

	NEW
	EXISTING

21010 MP901

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(#, X#)

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2.0	EO #665	15-DEC-22	Z.M.
1.0	ISSUED FOR TENDER	25-NOV-22	Z.M.

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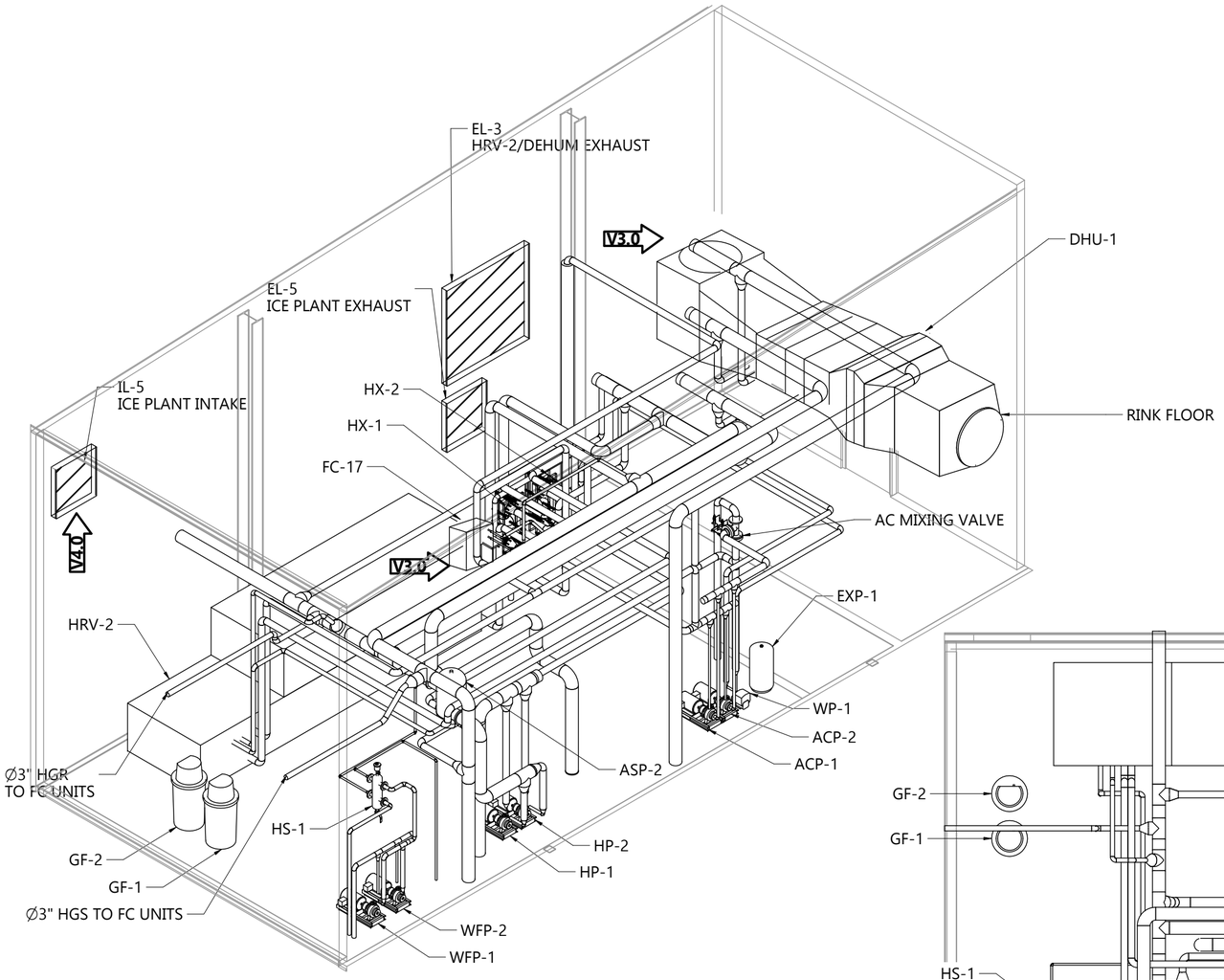
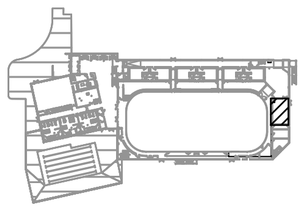
DRAWING NAME	ISOMETRIC VISUALIZATION PIPING
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA &POOL REPLACEMENT
DRAWN BY Z.MBADDER	**CHECKED BY** J.RITCHIE
DATE 06-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 1 OF 3



NORTH PLANT ROOM - ISOMETRIC VIEW
SCALE 1:75



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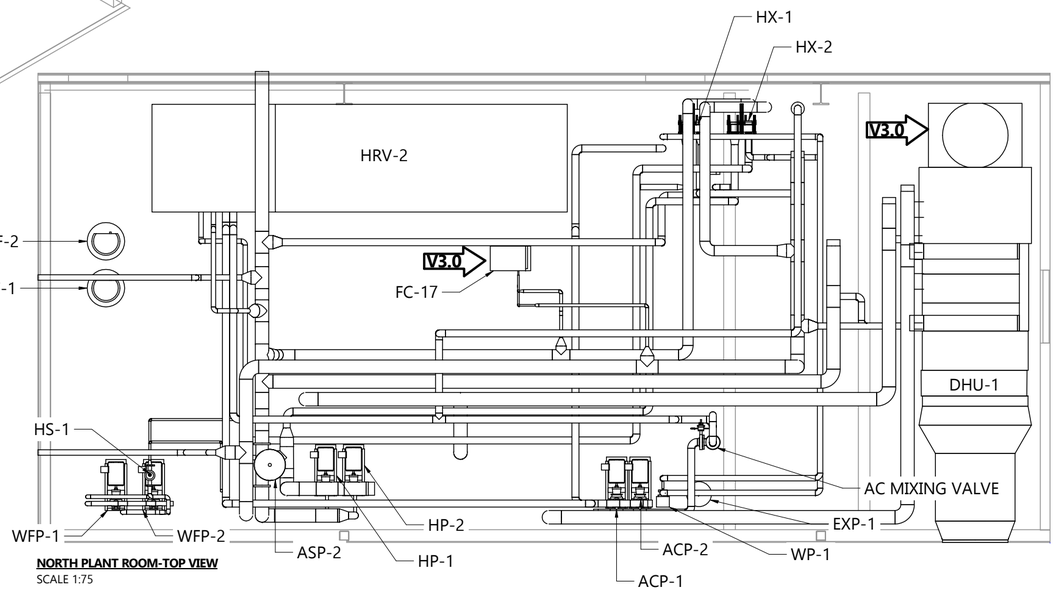
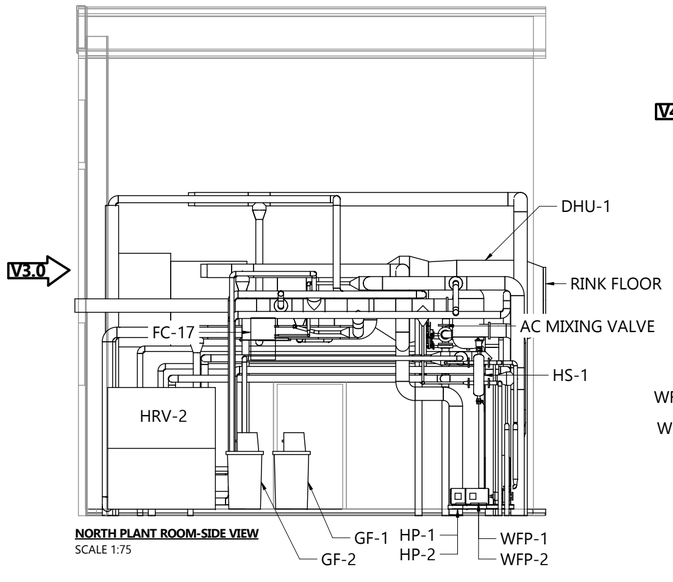
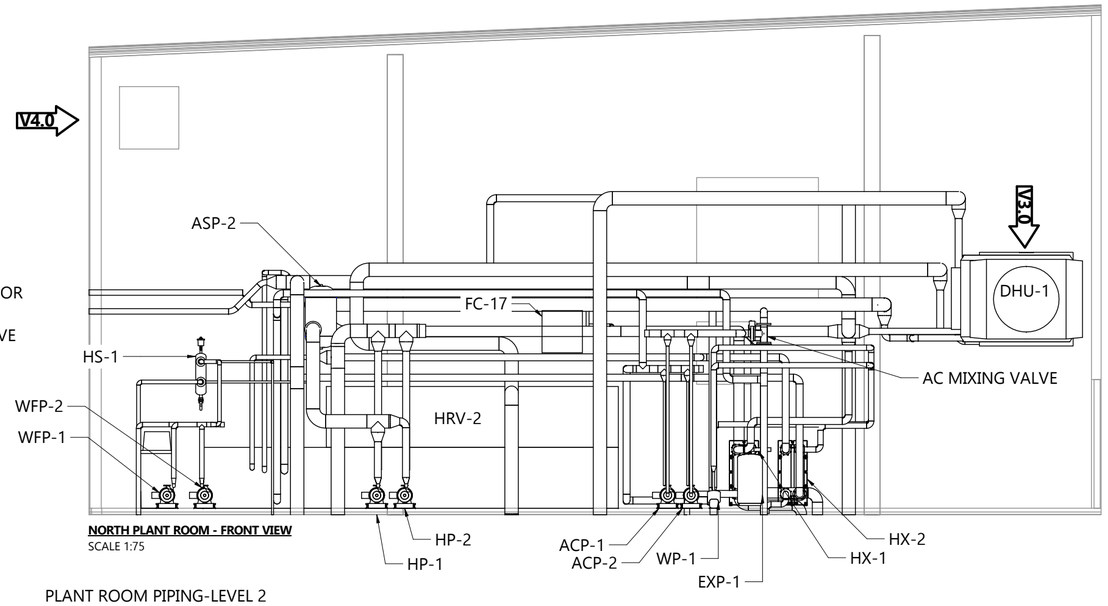
SCALE 1:2000



NORTH PLANT ROOM-TOP VIEW
SCALE 1:75



NORTH PLANT ROOM-SIDE VIEW
SCALE 1:75



NORTH PLANT ROOM - FRONT VIEW
SCALE 1:75

PLANT ROOM PIPING-LEVEL 2

NOTES

	NEW
	EXISTING

21010 MP901

REFERENCE DEFINITION

SHEET COLUMN / SHEET NUMBER — SHEET ROW
(#, X#)

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VER #	REVISIONS	DATE	BY
4.0	EO #679	06-FEB-23	Z.M.
3.0	EO #668	11-JAN-23	Z.M.
2.0	EO #665	15-DEC-22	Z.M.
1.0	ISSUED FOR TENDER	25-NOV-22	Z.M.

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CHARLOTTETOWN PE
VAUGHAN ON
REDINGTON SHORES FL

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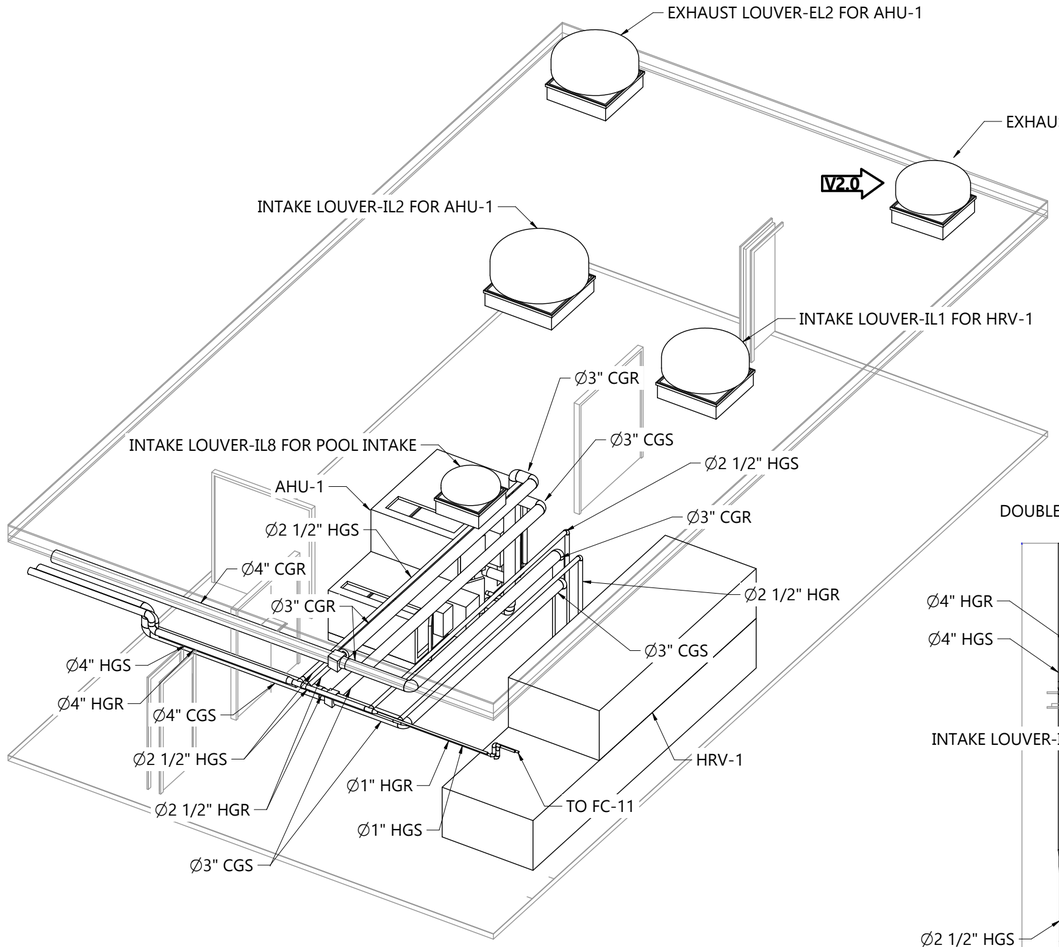
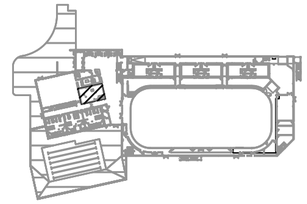
STAMP

DRAWING NUMBER	21010 MP901
DRAWING NAME	ISOMETRIC VISUALIZATION PIPING
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA &POOL REPLACEMENT
DRAWN BY	Z.MBADDER
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	2 OF 3



SOUTH MECHANICAL ROOM PIPING - ISOMETRIC VIEW
SCALE: 1:75



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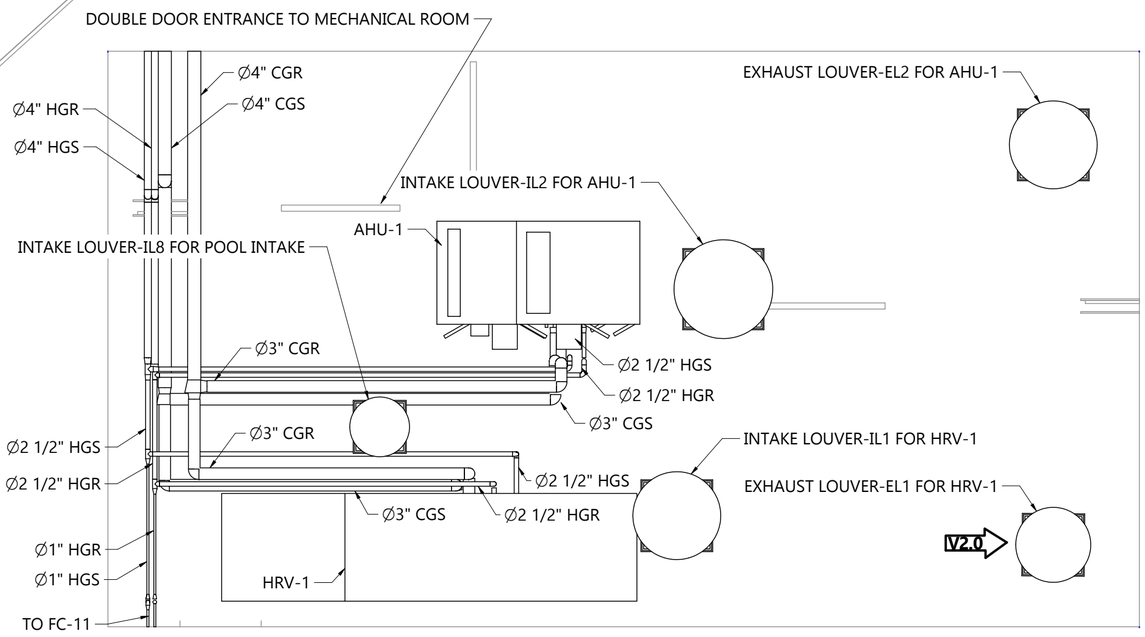
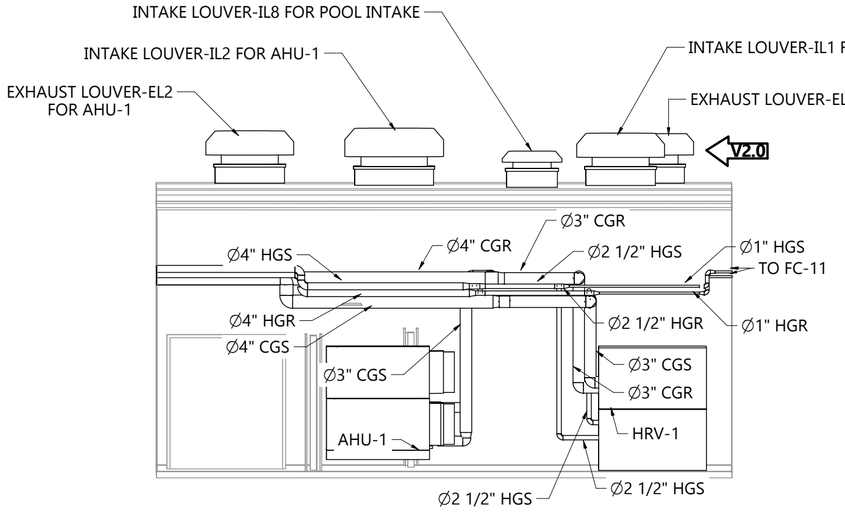
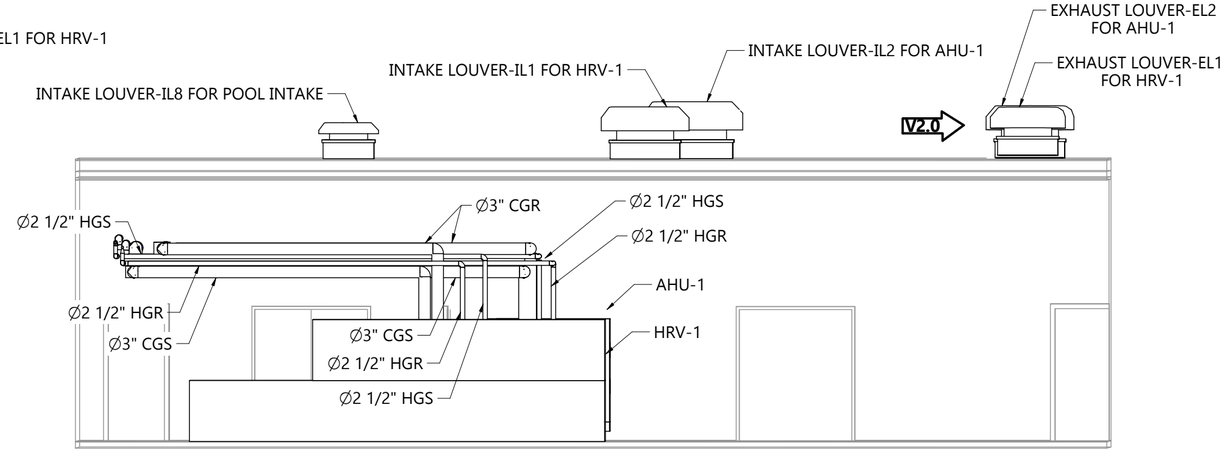


SOUTH MECHANICAL ROOM PIPING - TOP VIEW
SCALE: 1:75



SOUTH MECHANICAL ROOM PIPING - SIDE VIEW
SCALE: 1:75



SOUTH MECHANICAL ROOM PIPING - FRONT VIEW
SCALE: 1:75

NOTE:

- CEILINGS & WALLS IN VIEW ARE REMOVED FOR CLARITY OF MECHANICAL ROOM.

MECHANICAL ROOM- EAST

NOTES

	NEW
	EXISTING

21010 MP901

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STAMP

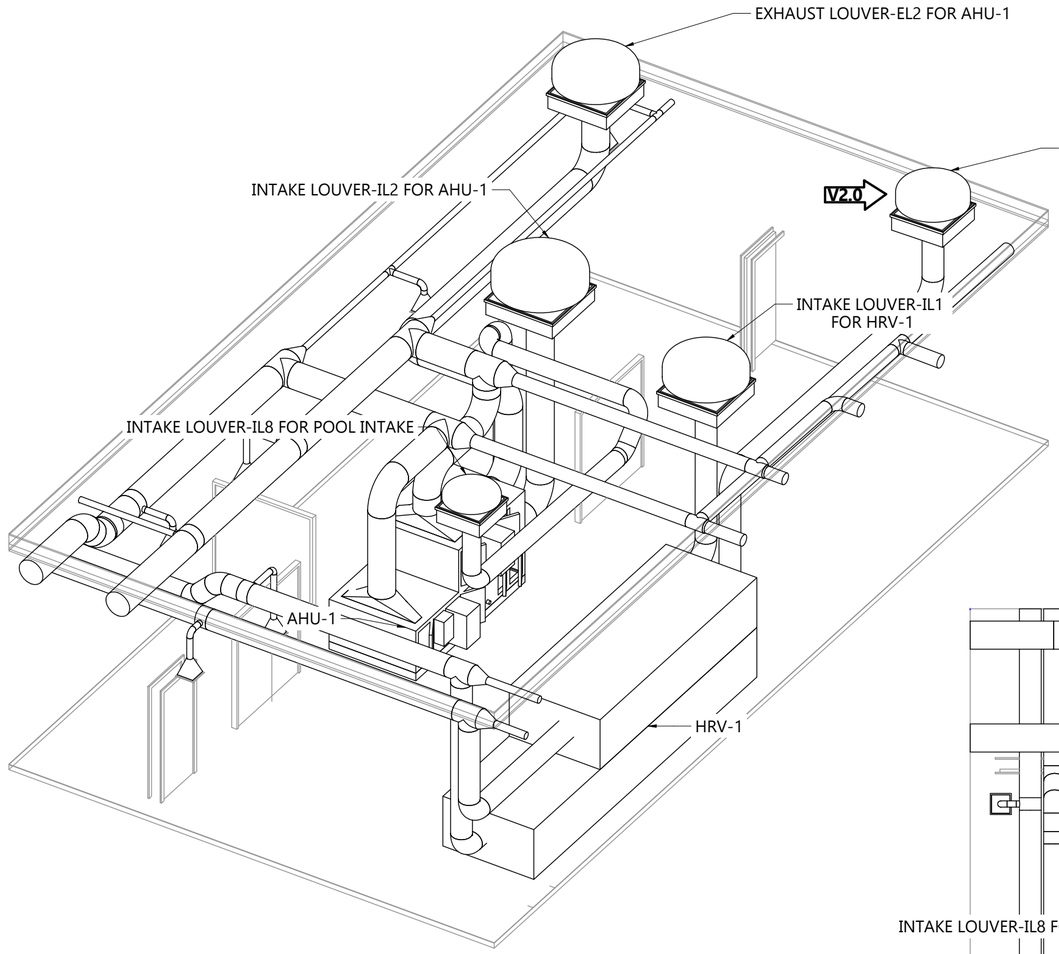
DRAWING NUMBER
21010 MP901

DRAWING NAME
ISOMETRIC VISUALIZATION PIPING

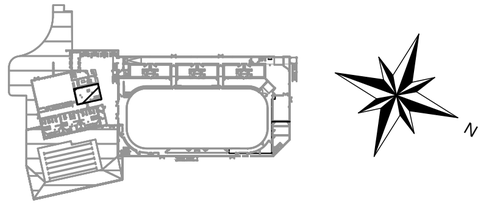
CLIENT
CITY OF CHARLOTTETOWN

PROJECT
SIMMONS SPORTS CENTRE ARENA &POOL REPLACEMENT

DRAWN BY	CHECKED BY
Z.MBADDER	J.RITCHIE
DATE	**REVISION**
06-FEB-23	4.0
SHEET SIZE	**SHEET NO.**
C	3 OF 3



SOUTH MECHANICAL ROOM DUCTING - ISOMETRIC VIEW
SCALE: 1:75



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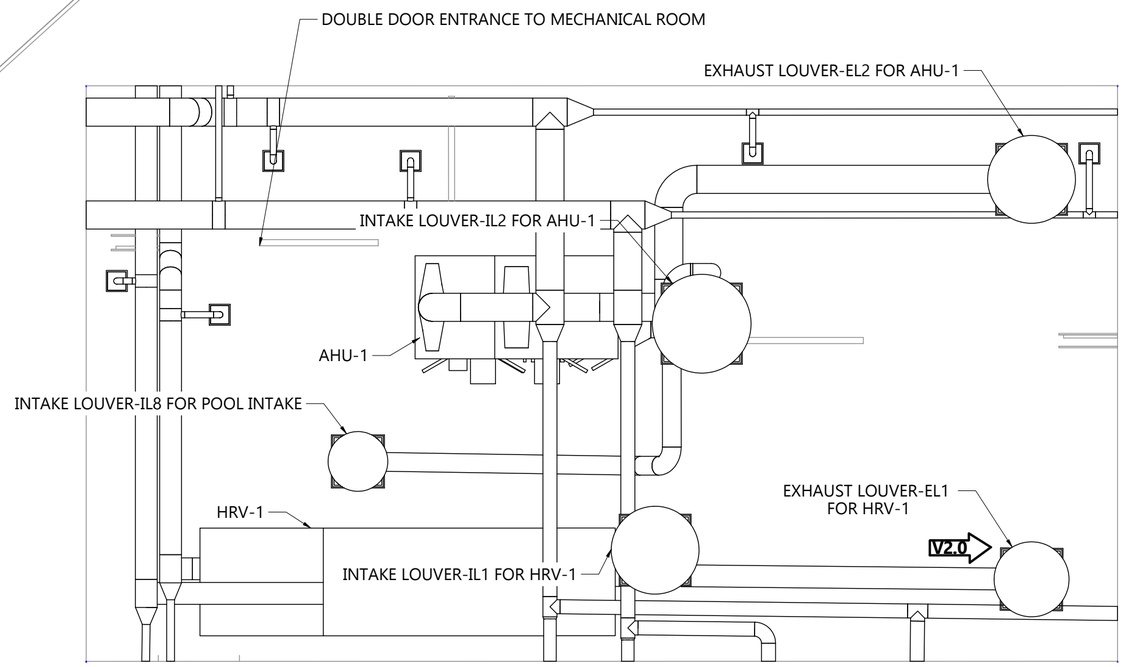
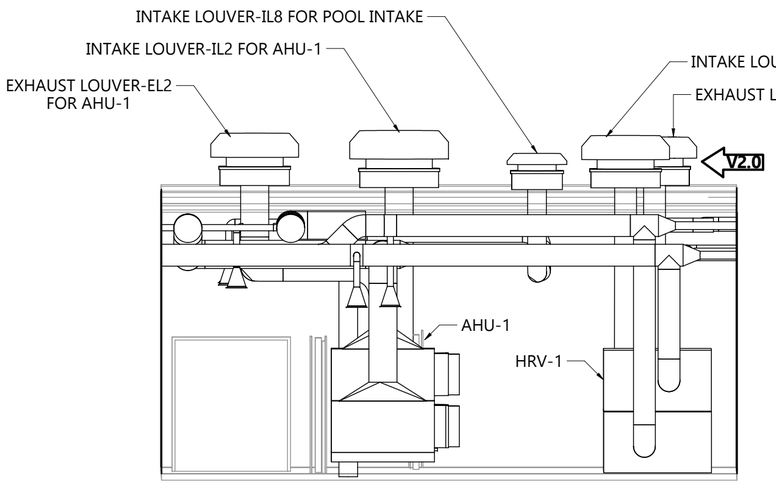
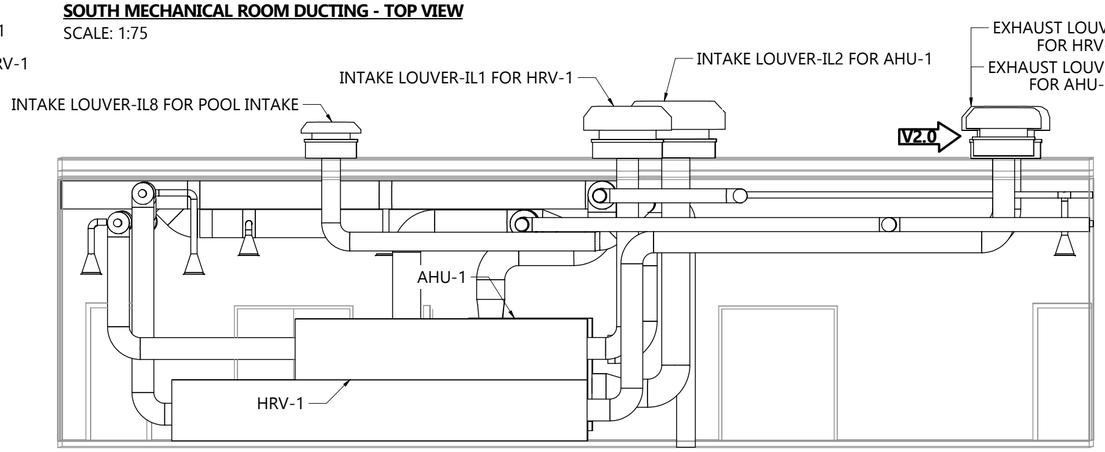
SCALE 1:2000



SOUTH MECHANICAL ROOM DUCTING - TOP VIEW
SCALE: 1:75



SOUTH MECHANICAL ROOM DUCTING - SIDE VIEW
SCALE: 1:75



SOUTH MECHANICAL ROOM DUCTING - FRONT VIEW
SCALE: 1:75

SOUTH MECH ROOM DUCTING- EAST

NOTES

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1.0	RELEASED FOR TENDER	25-NOV-22	Z.M.

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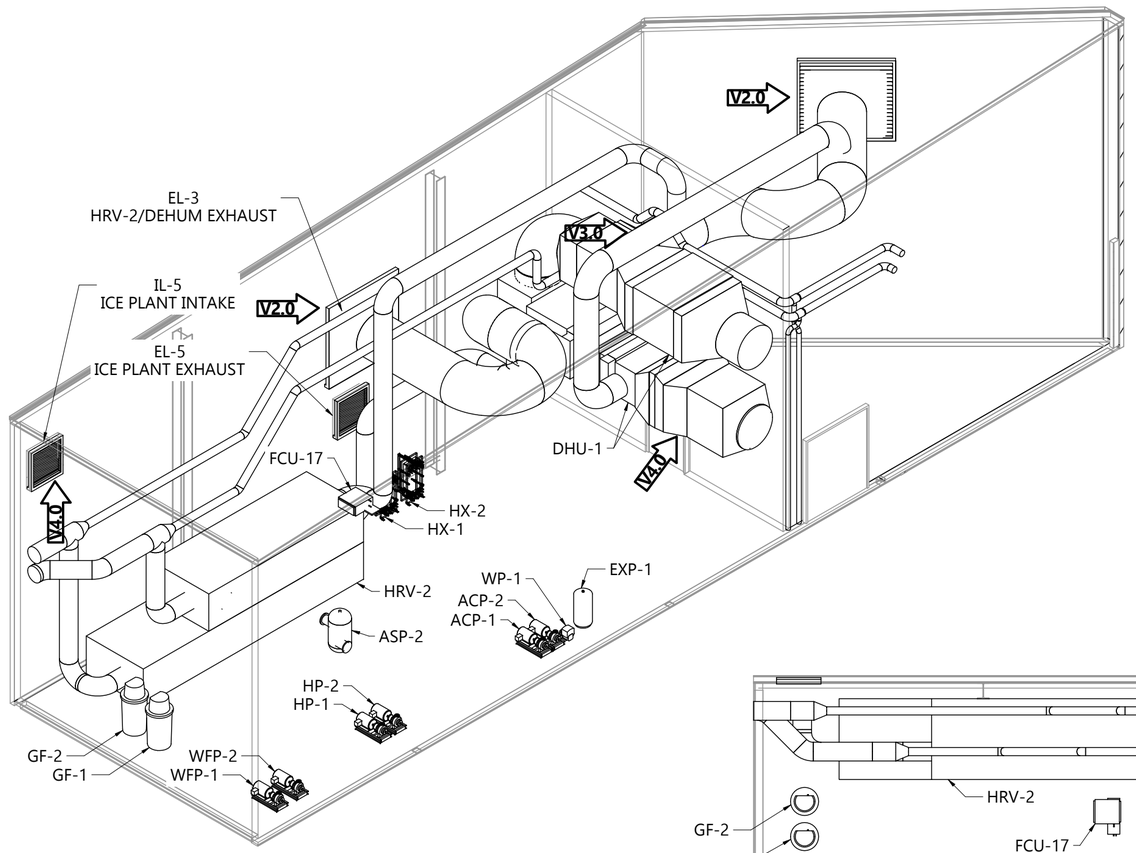
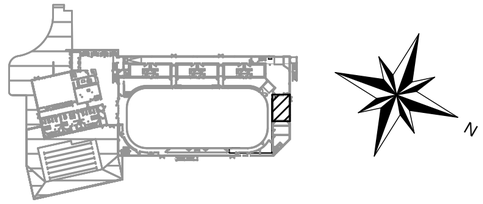
DRAWING NUMBER	21010 MH901
DRAWING NAME	ISOMETRIC VISUALIZATION DUCTING
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT

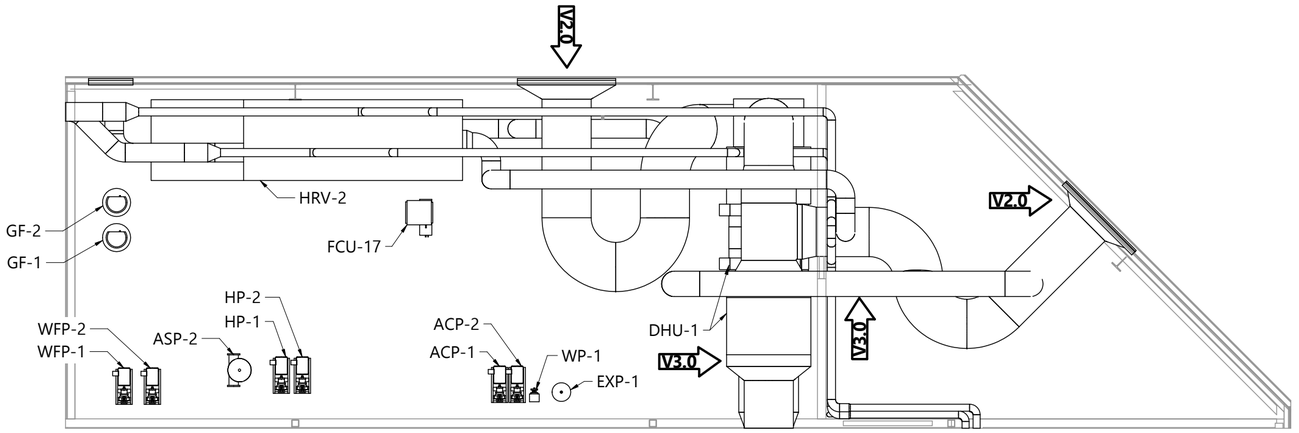
DRAWN BY M.HILANEH	**CHECKED BY** J.RITCHIE
DATE 06-FEB-23	**REVISION** 4.0
SHEET SIZE C	**SHEET NO.** 1 OF 2



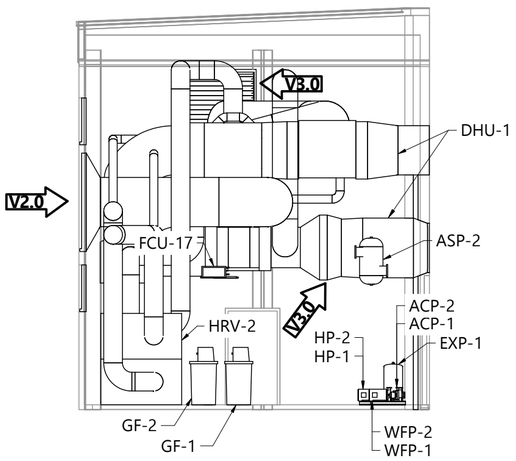
NORTH MECHANICAL ROOM DUCTING - ISOMETRIC VIEW
SCALE: 1:100



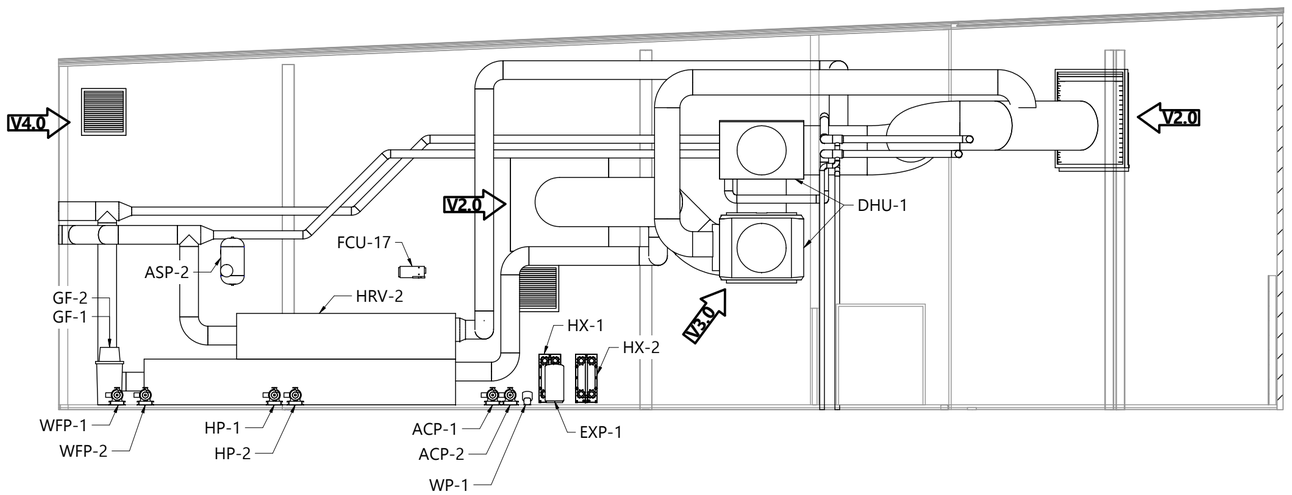
SITE KEY
SCALE 1:2000



NORTH MECHANICAL ROOM DUCTING - TOP VIEW
SCALE: 1:100



NORTH MECHANICAL ROOM DUCTING - SIDE VIEW
SCALE: 1:100



NORTH MECHANICAL ROOM DUCTING - FRONT VIEW
SCALE: 1:100

NORTH MECH ROOM DUCTING

NOTES

	NEW
	EXISTING

21010 MH901

REFERENCE DEFINITION
SHEET COLUMN — SHEET ROW
SHEET NUMBER — (#, X#)

- NOT FOR CONSTRUCTION -
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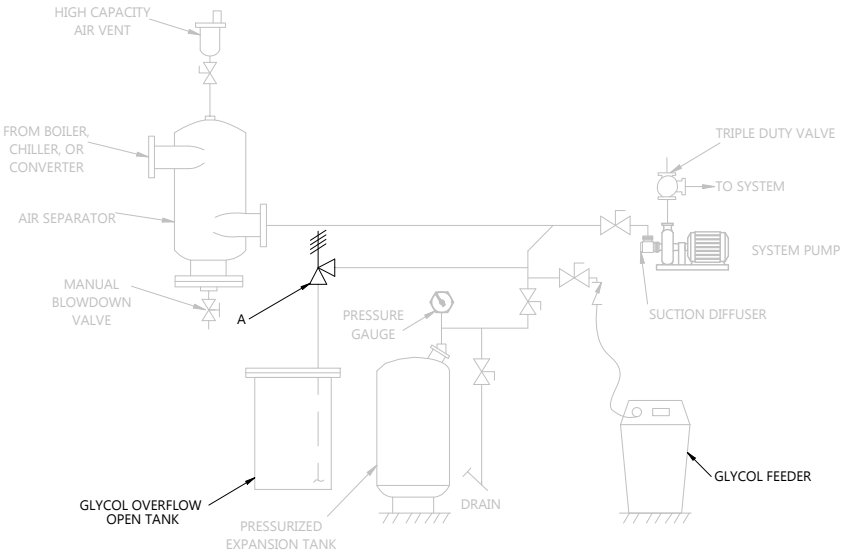
DRAWING NAME	ISOMETRIC VISUALIZATION DUCTING
CLIENT	CITY OF CHARLOTTETOWN
PROJECT	SIMMONS SPORTS CENTRE ARENA & POOL REPLACEMENT
DRAWN BY	M.HILANEH
CHECKED BY	J.RITCHIE
DATE	06-FEB-23
REVISION	4.0
SHEET SIZE	C
SHEET NO.	2 OF 2



GLYCOL RELIEF VALVE SCHEDULE					
DASH NUMBER	MODEL NUMBER	MANUFACTURER	PRESSURE RANGE, PSI	MBH, RANGE	MAX. TEMP., F
-01	174A	WATTS	30 - 150	650 - 14,370	250
-02	374A	WATTS	30	UP TO 550	-
-03	740	WATTS	30 - 75	925 - 10,700	250

NOTES:
- THE DISCHARGE LINE MUST BE THE SAME SIZE AS THE VALVE OUTLET, AND MUST PITCH DOWNWARD FROM THE VALVE TO A SAFE PLACE FOR DISPOSAL.
- VALVE LEVER MUST BE TRIPPED AT LEAST ONCE A YEAR TO ENSURE THAT WATERWAYS ARE CLEAR. THIS DEVICE IS DESIGNED FOR EMERGENCY SAFETY RELIEF AND SHALL NOT BE USED AS AN OPERATING CONTROL.

GLYCOL SYSTEM RELIEF VALVES

SHUT-OFF VALVE

CHECK VALVE

RELIEF VALVE

MANUAL VALVE

NEW EQUIPMENT

IBSDS-M801

FOR ILLUSTRATION ONLY

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VER #	DATE	BY
7.0	08-FEB-21	E.K.
6.0	25-SEP-20	S.M.
5.0	08-JUL-20	E.K.

I.B. STOREY
Rink Engineering Experts
151 GREAT GEORGE ST., SUITE 302
CHARLOTTETOWN, PEI, C1A 4K8

400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3
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STAMP

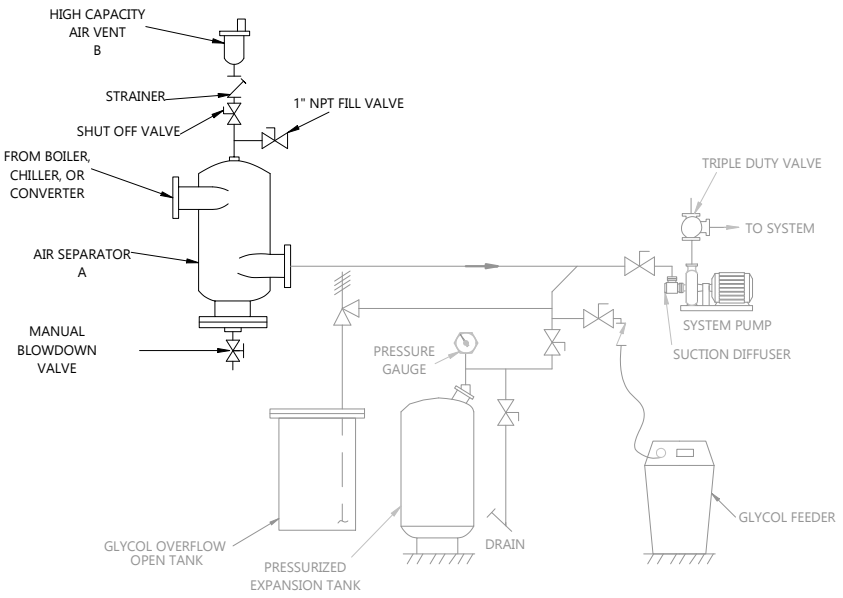
DRAWING NUMBER
IBSDS-M801

DRAWING NAME
GLYCOL SIDE DESIGN STANDARD

CLIENT
I.B. STOREY INC.

PROJECT
IB STOREY DESIGN STANDARDS

DRAWN BY	CHECKED BY
E.KADYROVA	J.RITCHIE
DATE	**REVISION**
08-FEB-21	7.0
SHEET SIZE	**SHEET NO.**
A	1 OF 1



AIR SEPARATOR AND AIR VENT SCHEDULE

DASH NUMBER	MANUFACTURER A	MODEL NUMBER A	MAX. FLOW RATE, USGPM FOR LINE VELOCITY, FT/S			MANUFACTURER B	MODEL NUMBER B
			4	6	8		
-0.1	ARMSTRONG	VA-4	160	240	320	ARMSTRONG	AAE-750
-0.2	ARMSTRONG	VA-5	250	375	500	ARMSTRONG	AAE-750
-0.3	ARMSTRONG	VA-6	360	540	720	ARMSTRONG	AAE-750
-0.4	ARMSTRONG	VA-8	630	940	1250	ARMSTRONG	AAE-750
-0.5	ARMSTRONG	VA-10	990	1500	1980	ARMSTRONG	AAE-750
-0.6	ARMSTRONG	VA-12	1400	2100	2800	ARMSTRONG	AAE-750

NOTE:
- VISUALLY INSPECT THE AIR SEPARATOR FOR DAMAGE, WHICH MAY OCCUR DURING TRANSIT.
- A MANUAL DRAIN CAN BE ADDED TO HELP FACILITATE PURGING SEDIMENT FROM THE AIR SEPARATOR.

SHUT-OFF VALVE

MANUAL VALVE

AIR VENT

MANUAL DRAIN

NEW EQUIPMENT

AIR SEPARATOR

IBSDS-M805

VER #	DATE	BY
8.0	05-MAY-21	E.K.
7.0	08-FEB-21	E.K.
6.0	25-SEP-20	S.M.

I.B. STOREY
Rink Engineering Experts
151 GREAT GEORGE ST., SUITE 302
CHARLOTTETOWN, PEI, C1A 4K8

400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3
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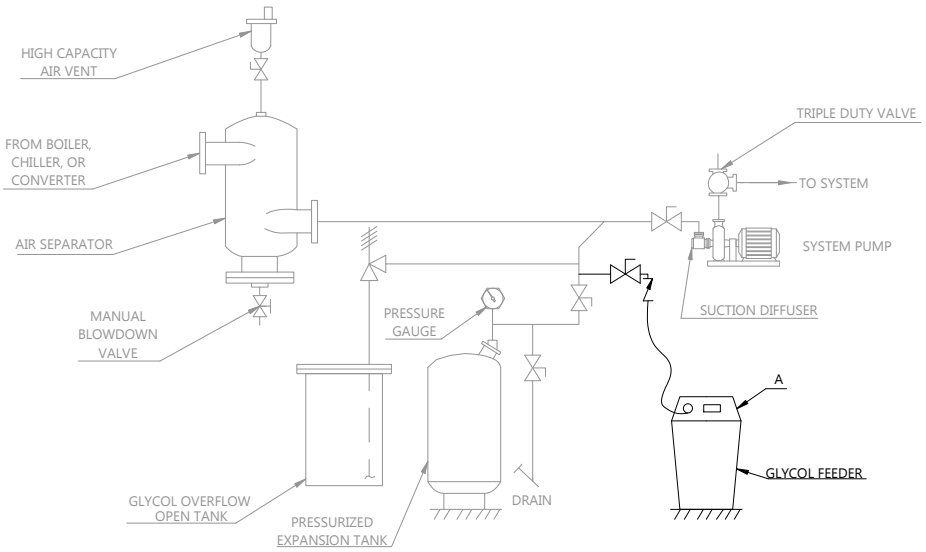
STAMP

DRAWING NUMBER	IBSDS-M805
DRAWING NAME	GLYCOL SIDE DESIGN STANDARD
CLIENT	I.B. STOREY INC.
PROJECT	IB STOREY DESIGN STANDARDS
DRAWN BY E.KADYROVA	**CHECKED BY** J.RITCHIE
DATE 05-MAY-21	**REVISION** 8.0
SHEET SIZE A	**SHEET NO.** 1 OF 1



GLYCOL FEEDER SCHEDULE							
DASH NUMBER	MANUFACTURER A	MODEL NUMBER A	VOLUME, USGAL	WEIGH WHEN FULL, LB	PUMP FLOWRATE. USGPM	POWER	V/H/PH
-0.1	AXIOM	DMF150	4.6	50	1.0	50 W	115/60/1
-0.2	AXIOM	DMF300	17	166	1.0	50 W	115/60/1
-0.3	AXIOM	MF200	6.6	60	0.7	50 W	115/60/1
-0.4	AXIOM	MF300	19	157	0.7	50 W	115/60/1
-0.5	AXIOM	SF100	55	525	1.4	0.7 A	115/60/1
-0.6	AXIOM	SF100L	100	940	1.7	0.7 A	115/60/1

DMF SERIES NOTES
- SET SYSTEM FEEDER ON A SECURE AND LEVEL BASE OR ON THE PROVIDED WALL BRACKET.
- IF MOUNTING ON THE WALL, THE CARDBOARD CUT-OUT ON THE SIDE OF THE DMF BOX MAY BE USED TO LOCATE THE SCREW HOLES FOR THE WALL BRACKET.
- ENSURE THE WALL BRACKET IS LEVEL AND FASTENED SECURELY TO THE WALL.
- HANG AND FILL TANK PRIOR TO MAKING SYSTEM CONNECTION. THIS HELPS TO ENSURE THAT THE TANK IS SECURELY SEATED ON THE MOUNTING BRACKET

MF SERIES NOTES:
- SET SYSTEM FEEDER ON A SECURE AND LEVEL BASE OR IN THE OPTIONAL TANK SHELF.
- CONNECT THE UNIT TO THE SYSTEM USING COPPER OR PLASTIC TUBING. ENSURE THAT THERE IS A SYSTEM ISOLATION VALVE INSTALLED TO ALLOW FOR ISOLATION OF THE UNIT. DO NOT INSTALL A CHECK VALVE OR PRESSURE REGULATOR BETWEEN SYSTEM FEEDER AND SYSTEM.
- MOUNT POWER SUPPLY AND SECURE WITH MOUNTING BRACKET. DO NOT POWER UP SYSTEM FEEDER UNTIL A SYSTEM CONNECTION IS MADE, ISOLATION VALVE IS CLOSED AND FEEDER VALVE IS SET TO MIX.
- TO CONNECT THE SYSTEM FEEDER TO THE RIA10-1-SAA ALARM PANEL REMOVE LOW LEVEL FLOAT SWITCH FROM CIRCUIT AND CONNECT TO AXIOM RIA10-1-SAA ALARM PANEL.
- INSTALL PROPER WATER/GLYCOL MIX IN THE TANK TO A LEVEL ABOVE MINIMUM LEVEL INDICATION ON TANK SCALE.
- CLOSE SYSTEM ISOLATION VALVE, TURN FEEDER VALVE TO VERTICAL POSITION (MIX POSITION).
- INSERT DC PLUG INTO THE SYSTEM FEEDER FIRST, AND THEN PLUG POWER SUPPLY INTO 120V OUTLET. THE RED LED IN THE POWER SUPPLY CORD SHOULD LIGHT UP. IF IT DOES NOT, CHECK THE FUSE AND POWER RECEPTACLE.
- ONCE THE PUMP IS PRIMED, TURN THE FEEDER VALVE HANDLE TO HORIZONTAL POSITION (RUN POSITION), OPEN SYSTEM ISOLATION VALVE AND ALLOW PUMP TO PRESSURIZE SYSTEM. IF SYSTEM PRESSURE IS BELOW PRESSURE SWITCH SETTING (18 PSI), THE PUMP WILL START. THE SYSTEM FEEDER WILL RUN UNTIL SYSTEM IS PRESSURIZED TO APPROXIMATELY 18 PSI. AND SHUT-OFF. IT MAY CYCLE RAPIDLY A NUMBER OF TIMES WHILE SYSTEM PRESSURE STABILIZES AND WHILE AIR IS REMOVED FROM THE SYSTEM. THE CYCLING WILL STOP ONCE SYSTEM PRESSURE RISES ABOVE 18 PSI DUE TO THERMAL EXPANSION.
- IF A HIGHER FILL PRESSURE IS REQUIRED (UP TO 25 PSI) THE INTERNAL PRESSURE SWITCH MAY BE ADJUSTED BY TURNING THE CENTER ADJUSTING SCREW COUNTER CLOCKWISE TO INCREASE PRESSURE. ACCESS TO THE PRESSURE SWITCH CAN BE GAINED BY LIFTING THE LEFT SIDE OF THE TOP COVER.

SF100, SF100-L SERIES NOTES:
- SET THE SOLUTION FEEDER ON A SECURE AND LEVEL BASE.
- CONNECT THE FLEXIBLE HOSE SUPPLIED WITH THE UNIT TO YOUR SYSTEM CONNECTION POINT - USE A UNION AND ISOLATION VALVE TO ALLOW FOR FUTURE SERVICE.
- THE CHECK VALVE SUPPLIED WITH THE UNIT MUST BE ON THE SYSTEM END OF THE FLEXIBLE HOSE.
- RELIEF AND DRAIN VALVES MAY BE PIPED TO THE SF100 TANK, BUT ANY HOLES FOR ENTRY OF THESE PIPES SHOULD BE CUT INTO THE SIDE OF THE TANK NEAR THE TOP RATHER THAN THROUGH THE COVER. THIS WILL ALLOW THE COVER AND TOP TO BE EASILY REMOVED IF NECESSARY.
- FILL THE SF100 TANK WITH FLUID.
- THE UNIT IS SUITABLE FOR WATER OR GLYCOL/WATER SOLUTIONS OF UP TO 50% GLYCOL CONCENTRATION.

GLYCOL FEEDER

SHUT-OFF VALVE
CHECK VALVE
RELIEF VALVE
MANUAL VALVE

NEW EQUIPMENT

IBSDS-M809

VER #	DATE	BY
7.0	08-FEB-21	E.K.
6.0	25-SEP-20	S.M.
5.0	08-JUL-20	E.K.

I.B. STOREY
Rink Engineering Experts
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VAUGHAN, ON, L4K 0C3
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STAMP

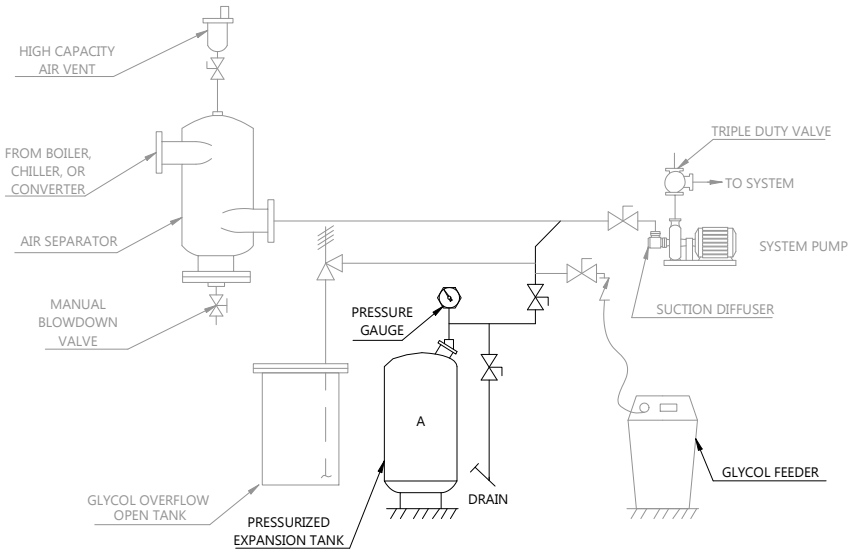
DRAWING NUMBER
IBSDS-M809

DRAWING NAME
GLYCOL SIDE DESIGN STANDARD

CLIENT
I.B. STOREY INC.

PROJECT
IB STOREY DESIGN STANDARDS

DRAWN BY	CHECKED BY
E.KADYROVA	J.RITCHIE
DATE	**REVISION**
08-FEB-21	7.0
SHEET SIZE	**SHEET NO.**
A	1 OF 1



EXPANSION TANK SCHEDULE

DASH NUMBER	TANK VOLUME, GAL	ACCEPTANCE VOLUME, GAL	MANUFACTURER	MODEL NUMBERS A	QTY.
-01	8	6.3	ARMSTRONG	AX-15	1
-02	11	8.8	ARMSTRONG	AX-20	1
-03	25	20.2	ARMSTRONG	AX-40	1
-04	35	28	ARMSTRONG	AX-60	1
-05	45	36	ARMSTRONG	AX-80	1
-06	60	48.5	ARMSTRONG	AX-100	1
-07	70	56.5	ARMSTRONG	AX-120	1
-08	80	65	ARMSTRONG	AX-144	1
-09	90	73	ARMSTRONG	AX-180	1
-10	115	93	ARMSTRONG	AX-200	1
-11	140	113.5	ARMSTRONG	AX-240	1
-12	158	128	ARMSTRONG	AX-260	1
-13	211	171	ARMSTRONG	AX-280	1
-14	53	53	ARMSTRONG	A200-L	1
-15	80	80	ARMSTRONG	A300-L	1
-16	106	106	ARMSTRONG	A400-L	1
-17	132	132	ARMSTRONG	A500-L	1
-18	158	158	ARMSTRONG	A600-L	1
-19	211	211	ARMSTRONG	A800-L	1
-20	264	264	ARMSTRONG	A1000-L	1
-21	317	317	ARMSTRONG	A1200-L	1
-22	370	370	ARMSTRONG	A1400-L	1
-23	422	422	ARMSTRONG	1600-L	1
-24	528	528	ARMSTRONG	2000-L	1
-25	660	660	ARMSTRONG	2500-L	1
-26	792	792	ARMSTRONG	3000-L	1
-27	1056	1056	ARMSTRONG	4000-L	1
-28	1320	1320	ARMSTRONG	5000-L	1

NOTES:
- VISUALLY INSPECT TANK FOR DAMAGE, WHICH MAY OCCUR DURING TRANSIT.
- FACTORY PRE-CHARGE PRESSURE MAY NOT BE CORRECT FOR THE INSTALLATION. TANK MUST BE PRE-CHARGED TO SYSTEM DESIGN FILL PRESSURE BEFORE PLACING INTO OPERATION. REMOVE PIPE PLUG COVERING THE VALVE ENCLOSURE. CHECK AND ADJUST THE CHARGE PRESSURE BY ADDING OR RELEASING AIR FOR EACH APPLICATION.
- IF THE SYSTEM HAS BEEN FILLED, THE TANK MUST BE ISOLATED FROM THE SYSTEM AND THE TANK EMPTIED BEFORE CHARGING. THIS ENSURES ALL FLUID HAS EXITED THE DIAPHRAGM AREA AND PROPER CHARGING WILL OCCUR.
- IF THE PRE-CHARGE ADJUSTMENT IS NECESSARY, OIL AND WATER FREE COMPRESSED AIR OR NITROGEN GAS MAY BE USED. CHECK THE PRE-CHARGE USING AN ACCURATE PRESSURE GAUGE AT THE CHARGING VALVE AND ADJUST AS REQUIRED. CHECK AIR VALVE FOR LEAKAGE. IF EVIDENT, REPLACE THE SCHRADER-TYPE TIRE VALVE CORE. DO NOT DEPEND ON THE VALVE CAP TO SEAL THE LEAK. AFTER MAKING SURE AIR CHARGE IS CORRECT, REPLACE PIPE PLUG OVER THE CHARGING VALVE FOR PROTECTION.
- SET TANK IN PLACE AND PIPE SYSTEM CONNECTION TO SYSTEM. BE SURE TO INCLUDE ISOLATION VALVE(S) AND DRAIN.
- PURGE AIR FROM SYSTEM BEFORE PLACING TANK INTO OPERATION. ALL MODELS HAVE SYSTEM WATER CONTAINED BEHIND DIAPHRAGM.
- WHEN FILLING THE SYSTEM WITH GLYCOL, OPEN VALVES TO TANK TO ENSURE THAT ANY RESIDUAL AIR IN THE TANK IS DISPLACED BY GLYCOL.
- IT IS RECOMMENDED THAT THE PRE-CHARGE BE CHECKED ANNUALLY TO ENSURE PROPER SYSTEM PROTECTION AND LONG LIFE FOR THE VESSEL.

GLYCOL SYSTEM EXPANSION TANK

SHUT-OFF VALVE

CHECK VALVE

RELIEF VALVE

MANUAL VALVE

NEW EQUIPMENT

IBSDS-M811

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VER #	DATE	BY
8.0	03-MAY-21	E.K.
7.0	08-FEB-21	E.K.
6.0	25-SEP-20	S.M.

I.B. STOREY
Rink Engineering Experts
151 GREAT GEORGE ST., SUITE 302
CHARLOTTETOWN, PEI, C1A 4K8

400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3
WWW.IBSTOREY.COM

STAMP

DRAWING NUMBER
IBSDS-M811

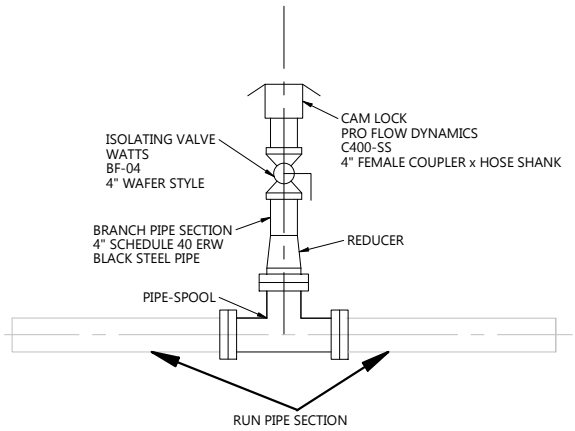
DRAWING NAME
GLYCOL SIDE DESIGN STANDARD

CLIENT
I.B. STOREY INC.

PROJECT
IB STOREY DESIGN STANDARDS

DRAWN BY	CHECKED BY
E.KADYROVA	J.RITCHIE
DATE	**REVISION**
03-MAY-21	8.0
SHEET SIZE	**SHEET NO.**
A	1 OF 1

RENTAL CHILLER CONNECTIONS DETAIL



RENTAL CHILLER CONNECTIONS SCHEDULE

DASH NUMBER	PIPE SPOOL	QTY.	REDUCER	QTY.	CAM LOCK	ISOLATING VALVE	BRANCH PIPE SECTION
-01	6" FLANGES	1	6" x 4"	1	PRO FLOW DYNAMICS, C400-SS, 4" FEMALE COUPLER x HOSE SHANK	WATTS, BF-04, 4" WAFER STYLE	4" SCHEDULE 40 ERW BLACK STEEL PIPE
-02	8" FLANGES	1	8" x 4"	1	PRO FLOW DYNAMICS, C400-SS, 4" FEMALE COUPLER x HOSE SHANK	WATTS, BF-04, 4" WAFER STYLE	4" SCHEDULE 40 ERW BLACK STEEL PIPE
-03	10" FLANGES	1	10" x 4"	1	PRO FLOW DYNAMICS, C400-SS, 4" FEMALE COUPLER x HOSE SHANK	WATTS, BF-04, 4" WAFER STYLE	4" SCHEDULE 40 ERW BLACK STEEL PIPE

IBSDS-M815

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VER #	DATE	BY
2.0	08-FEB-21	E.K.
1.0	11-FEB-20	E.K.

I.B. STOREY
Rink Engineering Experts
151 GREAT GEORGE ST., SUITE 302
CHARLOTTETOWN, PEI, C1A 4K8

400 APPLEWOOD CRES., SUITE 100
VAUGHAN, ON, L4K 0C3
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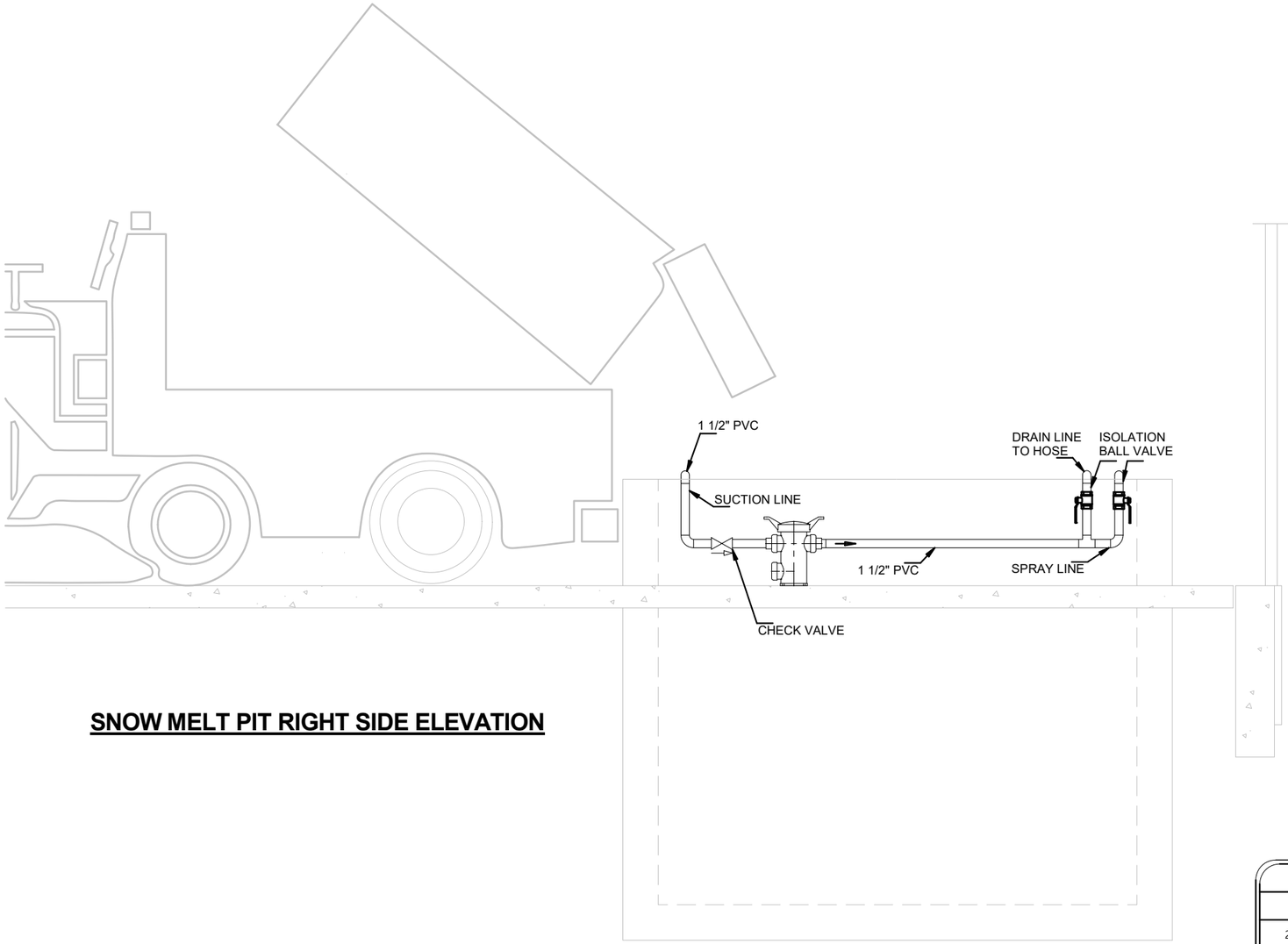
DRAWING NAME	GLYCOL SIDE DESIGN STANDARD
CLIENT	I.B. STOREY INC.
PROJECT	IB STOREY DESIGN STANDARDS
DRAWN BY	E.KADYROVA
CHECKED BY	J.RITCHIE
DATE	08-FEB-21
REVISION	2.0
SHEET SIZE	A
SHEET NO.	1 OF 1

SNOW MELT RECIRCULATION SCHEDULE					
ITEM	**SIZE**	**TYPE/PRODUCT**	**VENDOR**	**MATERIAL**	**NOTES**
TUBING	1 1/2"	5238K788	MCMASTER-CARR	CLEAR PVC TUBING	FOR CONNECTION BETWEEN SUCTION STRAINER AND SOLIDS PUMP. USE WITH BARBED FITTINGS.
SUBMERSIBLE PUMP	115 USGPM	MYERS WHR5H-11	MYERS		2" SOLIDS HANDLING PUMP FOR SNOW MELT.
SPRAY NOZZLES	3/4" ATTACHMENT	MP312-N	BETE	316 STAINLESS STEEL	60° FULL CONE 3/4" THREADED ATTACHMENT. WATER SPRAY NOZZLES.
SUCTION STRAINER	1 1/2"	4413K41	MCMASTER-CARR	ZINC-PLATE D STEEL	3/8" SCREEN OPENING
BASKET STRAINER	1 1/2"	SB1150STE	HAYWARD	PVC	1.5" THREADED FITTING CONNECTION. 1/8" PERFORATED STRAINER BASKET. EDPM O-RING SEALS.
SWITCH		FF30MH	INTERMATIC		FOR MYERS SOLIDS PUMP



SNOW MELT PIT RIGHT SIDE ELEVATION

NEW
BY OTHERS/EXISTING

VER #	REVISIONS	DATE	BY
2.0	EO-674	11-JAN-23	T.VW.
1.0	STANDARD	06-SEP-22	M.H.

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CHARLOTTETOWN PE
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STAMP

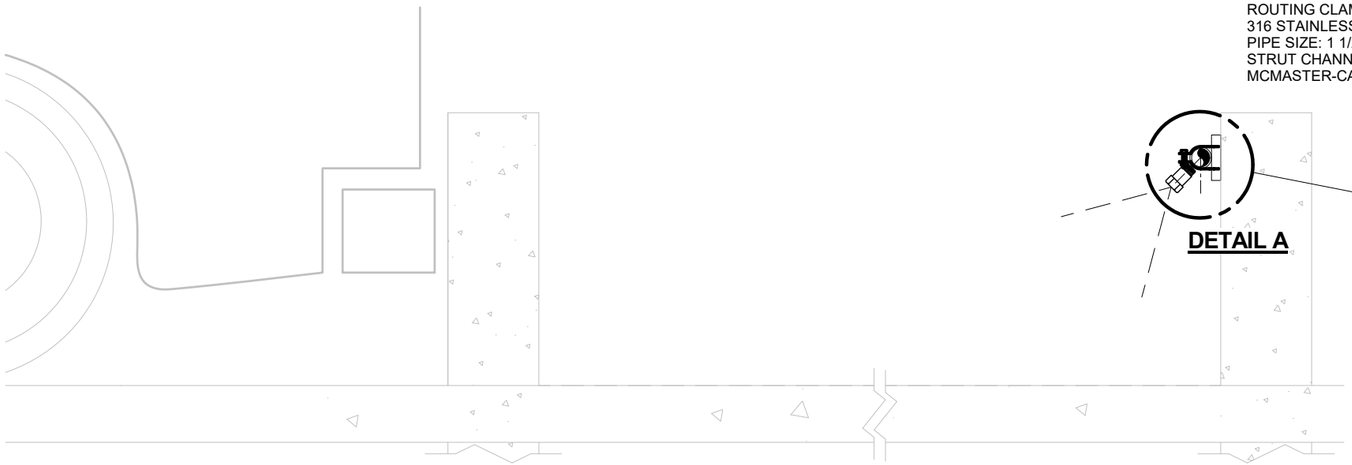
DRAWING NUMBER
IBSDS-M827

DRAWING NAME
STANDARD SNOWMELT PIT CIRCULATION

CLIENT
I. B. STOREY INC.

PROJECT
IB STOREY DESIGN STANDARDS

DRAWN BY	CHECKED BY
M.HILANEH	J.RITCHIE
DATE	**REVISION**
11-JAN-23	1.0
SHEET SIZE	**SHEET NO.**
B	1 OF 2

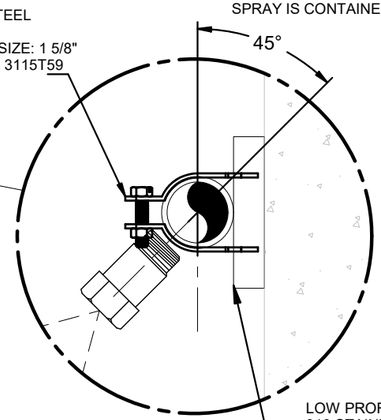


SECTION VIEW A-A (2,C3): SPRAY SYSTEM ELEVATION

ROUTING CLAMP
316 STAINLESS STEEL
PIPE SIZE: 1 1/2"
STRUT CHANNEL SIZE: 1 5/8"
MCMASTER-CARR 3115T59

DETAIL A

NOZZLE ANGLE MAY REQUIRE ADJUSTMENT AS PART OF THE START-UP PROCES TO ENSURE SPRAY IS CONTAINED IN THE PIT.

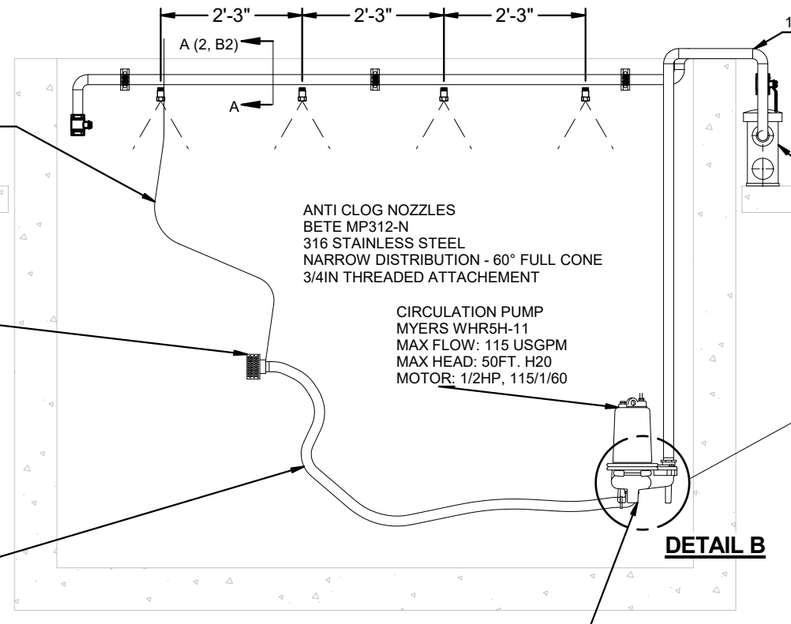


DETAIL A

LOW PROFILE STRUT CHANNEL
316 STAINLESS STEEL
TOTAL HEIGHT: 13/16"
TOTAL WIDTH: 1 5/8"
MCMASTER-CARR 33085T94
MOUNTED TO PIT WALL

TYPICAL STANDARD SPRAY SYSTEM NOZZLE SPACING.
SPACING SHOULD BE SCALED PER SITE SPECIFIC SNOW MELT PIT DIMENSIONS.

PROVIDE LIFT CHAIN ATTACHED TO SUCTION STRAINER FOR THE PURPOSE OF SUSPENDING THE STRAINER MID LEVEL TO PREVENT PULLING ACCUMULATED SLUDGE AND RUBBISH INTO THE PUMP. TIE AT A CONVENIENT LOCATION OUTSIDE THE PIT. CHAIN MUST BE LONG ENOUGH TO ALLOW SUCTION STRAINER TO BE DROPPED TO THE BOTTOM OF THE PIT FOR DRAINING.



PVC BASKET STRAINER
HAYWARD SB1150STE
EPDM O-RING SEALS
1/8" PERFORATED STRAINER

ANTI CLOG NOZZLES
BETE MP312-N
316 STAINLESS STEEL
NARROW DISTRIBUTION - 60° FULL CONE
3/4IN THREADED ATTACHEMENT

LARGE PARTICLE SUCTION STRAINER
ZINC-PLATED STEEL
1.5IN NPT FEMALE ATTACHEMENT
MCMASTER-CARR 4413K41

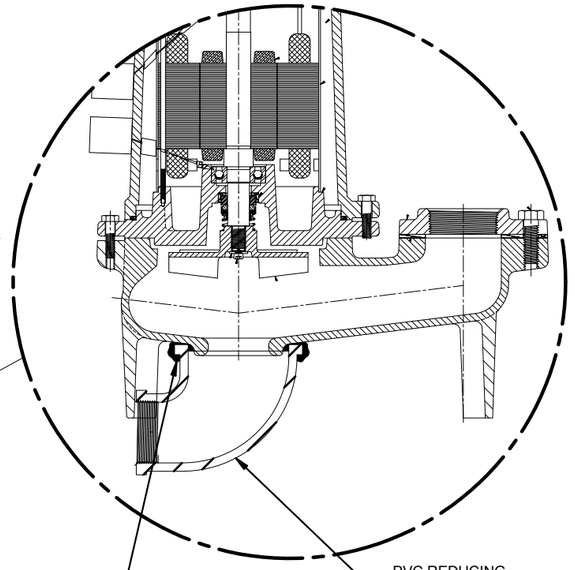
CIRCULATION PUMP
MYERS WHR5H-11
MAX FLOW: 115 USGPM
MAX HEAD: 50FT. H20
MOTOR: 1/2HP, 115/1/60

1 1/2" CLEAR FLEXIBLE TUBING
MCMASTER-CARR 5238K788
ATTACH TO PUMP AND SUTION STRAINER USING BARBED FITTINGS. MUST BE OF SUFFICIENT LENGTH TO ALLOW THE SUCTION STRAINER TO BE EASILY AND REGULARLY REMOVED FROM THE PIT FOR CLEANING.

DETAIL B

CIRCULATION PUMP SECURELY FLOOR OR WALL MOUNTED. BOTTOM OF PUMP MUST BE SUBMERGED MINIMUM OF 48" BELOW STANDING WATER.

SNOW MELT PIT FRONT ELEVATION



DETAIL B

PVC REDUCING ELBOW CONNECTION TO FLEXIBLE HOSE.

ATTACH TO PUMP WITH WATERPROOF TWO PART EPOXY.
ENSURE PROPER SURFACE PREPARATION INCLUDING REMOVAL OF PAINTS AND COATINGS FROM JOINT SURFACES.
REPAINT ALL EXPOSED STEEL SURFACES AFTER CURING IS FULLY COMPLETE.
STANDARD OF ACCEPTANCE: LOCTITE EPOXY MARINE

MINIMUM PVC PREPARATION FOR EPOXY
1. SAND BONDING SURFACES WITH MINIMUM 40 GRIT SANDPAPER
2. CLEAN SURFACERS WITH PVC CLEANER AND ENSURE ALL CLEANER EVAPORATES

NEW
BY OTHERS/EXISTING

VER #	REVISIONS	DATE	BY
2.0	EO-674	11-JAN-23	T.VW.
1.0	STANDARD	06-SEP-22	M.H.

SNOW MELT SPRAY SYSTEM (2/2)

IBSDS-M827

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I.B. STOREY
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CHARLOTTETOWN PE
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STAMP

DRAWING NUMBER
IBSDS-M827

DRAWING NAME
STANDARD SNOWMELT PIT CIRCULATION

CLIENT
I. B. STOREY INC.

PROJECT
IB STOREY DESIGN STANDARDS

DRAWN BY	CHECKED BY
M.HILANEH	J.RITCHIE
DATE	**REVISION**
11-JAN-23	1.0
SHEET SIZE	**SHEET NO.**
B	2 OF 2

Appendix G

Automation Sequences of Operation

ICE RINK CONTROL SYSTEM SEQUENCE OF OPERATIONS

SIMMONS ARENA REPLACEMENT

CHARLOTTETOWN, PE

VERSION 1.0

27-JAN-23

Prepared by:

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Redington Shores, FL
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REVISION DOCUMENTATION

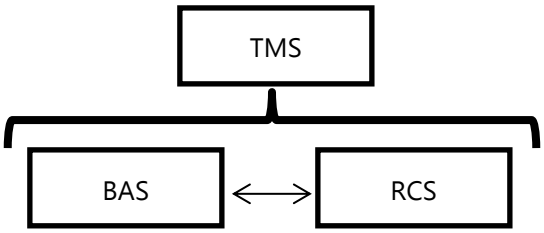
Revision	Date	EO#	Description
REV: 1.0	*27-Jan-23*		*Issued for Tender*

OVERVIEW

The Ice Rink Control System is to consist of three separate logic components working together, all running on integrated hardware.

1. Building comfort heating and cooling will be provided by the Building Automation System (BAS) layer, handling the direct control of the air handling units and terminal units throughout the building.
2. Process load management will be directed by the Refrigeration Control System (RCS) which will deal with the ice rink refrigeration system, pumps, backup HXs, the domestic hot water system and associated hardware.
3. The Thermal Management System (TMS) sits over top the other two, directing heating and cooling from the process system (rink refrigeration plant) to the building loads (comfort heating and cooling) to maximize heat recovery.

While these sections are described as though they are separate control systems, they are to be running on the same hardware and developed by the same programming team and tools so that a complete understanding of all systems is shared. The breakdown into layers is for ease of conceptual understanding and isolation of key system features.



LEGEND OF ABBREVIATION

TMS	Thermal Management System
BAS	Building Automation System – the comfort cooling portion of the controls
RCS	Refrigeration Control System – the process refrigeration portion of the controls
LCG	Leaving cold glycol – referring to cold glycol leaving the pump or refrigeration package.
LHG	Leaving hot glycol – referring to hot glycol leaving the pump or refrigeration package.
RG	Return glycol – referring to glycol returning to the pump or refrigeration package.
CC	Cooling Coil
SP	Setpoint
DPT	Dew Point Temperature
WBT	Wet Bulb Temperature
ENTH	Enthalpy
MA	Mixed Air
OA	Outdoor Air
RA	Return Air
SA	Supply Air
DAP	Discharge air static pressure
DPR	Damper rotation
$Q_{req,\ i}$	Calculated required heat load for each individual heat load in the building
Q_{roh}	Calculated required heat load for each individual heat load with adjustments for overheat
Q_a	Calculated available system heat based on current cooling loads
Q_{min}	Defined minimum heat threshold required for heat recovery use
TQ_{req}	Total required heat load for all active heat loads.
$t_{tc,\ i}$	Calculated time constant for each heating load in the building
t_{crit}	Calculated critical system time used to control the thermal management system
t_{start}	Estimated time to next CH start based on current schedule
t_{backup}	Defined minimum time period used to determine when backup heating is used

Note: *Values and variables throughout the sequences that are underlined are to be user adjustable after installation.*

CALCULATED TERMS

The following are definitions for terms that must be calculated regularly as part of the control system operation relating to available heat, required heat load and load time constants in order to properly manage heat distribution. All these calculations should be calculated at regular time intervals (e.g., every 5 minutes) and should be trended for troubleshooting.

Load Heat Required – *(Q_{req}, Q_{roh})* –

- These calculations use sensor data to determine how much heating is required for each zone and load.
- These calculations must be completed for each heat load independently.
- The heat required equations will take the form of simple linear equations
    - e.g., Q = AX + BY + C, where
        - A, B and C are coefficients determined as part of performance commissioning and will be entered into a secured calibration page by the Owner's Engineer following start-up.
        - X, Y, and Z are specific zone sensors that will vary for each load.

Total Heat Required – (*TQ_{req}, TQ_{roh}*) –

- This calculation is the summation of all the individual load heat requirement calculations.
- It is used in calculations to help determine the system mode of operation
    - $TQ_{req} = Q_{\_req,1} + Q_{\_req,2} + Q_{\_req,3} + \ldots + Q_{\_req,n}$

Available Heat – *(Q_a)* –

- This calculation uses key information about the space and temperature data to determine how much heat is available from the refrigeration system.
- This calculation is determined based on summing load calculations ($C_{\_i}$) for each cooling load in the building.
    - $Q_a = N(C_1 + C_2 + C_3 + \ldots C_n)$

Time Constant – *(t_{tc}) –*

- These calculations will use information about the system and temperature sensor feedback data to determine a relevant time scale for each load.
- These calculations must be completed individually for each heating load in the system.
- The calculations will also take the form of simple linear equations, with coefficients included in the access-controlled calibration page.
    - $t_{tc,i} = DX + EY + FZ$
        - D, E, and F are coefficients determined as part of performance commissioning and will be entered into a secured calibration page by the Owner's Engineer following start-up.
        - X, Y and Z are specific zone sensors that will vary for each load.

Critical Time – *(t_{crit})* **–**

- The critical time is a calculated reset value that will use a tuned PID loop to adjust the system operating loads.
- This number is expected to be recalculated every iteration of the TMS (i.e., once every five minutes or on integrated refrigeration package start up) and will fluctuate up and down based on warm glycol return temperature.
- This is used to determine what heat loads can be activated at any time.
- A combination of individual load time constants ($t_{tc,i}$) and the single calculated value of critical time (t_{crit}) are used to determine which loads are permitted to run.

GRAPHICS REQUIREMENTS

The control screen must include, at a minimum, graphics screens for:

- Thermal Management System Overview
- Building Automation System Overview
- Refrigeration Control System Overview
- Back-up Heating System
- Building Floor Plans (w/ key control information)
- Each air handling unit, fan coil, and exhaust fan
- Packaged Refrigeration Units
- Refrigeration system schematic(s)
- Domestic hot water system schematic
- Ice resurfacer hot water system schematic
- Built in data trend management screens
- Schedule management screens

All graphics must be detailed and full color, with animations to indicate system operation status where appropriate. Graphics are to be submitted for approval by the owner's engineer prior to start-up of the equipment.

The following are basic examples of graphics layouts to illustrate the intended information and layout structure. Detailed graphics and animations are omitted, and specific equipment and data are not directly recreated from the proposed work.

NAV

TRENDS

SCHEDULE

FLOORPLAN

REFRIGERATION

AHU-1

AHU-2

FC-1

FC-2

FC-3

CALIBRATION

TMS OVERVIEW

GRAPHICS MOCK-UP ONLY

Ice Plant Status	Enabled
Total Available Heat TQ_{av}	19 kWh
Required Heat $TQ_{req.}$	24 kWh
Minimum Heat Setpoint Q_{min}	5 kWh
Mode	Heat Recovery

Back-up Status	Disabled

Critical Time t_{crit}	4

Unit	Setpoint	Sensor	Q	t_{ic}	TMS Override
AHU-1	20°C	21°C	0 kWh	0	N/A
AHU-2	20°C	19°C	18 kWh	5	OFF
FC-1	22°C	21°C	0 kWh	0	N/A
FC-2	22°C	22°C	1 kWh	1	OVERRIDE
FC-3	22°C	23°C	0 kWh	0	N/A
VAV-1	20°C	18°C	5 kWh	0.8	OVERRIDE
VAV-2	20°C	22°C	0 kWh	0	N/A
VAV-3	20°C	21°C	0 kWh	0	N/A
SMP-1	5°C	7°C	0 kWh	0	N/A

Thermal Management Overview example screenshot. All key aspects of the system are available on a single screen for diagnostic purposes. Similar screens are required for the Building Automation System and Refrigeration Control Systems.

GRAPHICS MOCK-UP ONLY

NAV

HOME

TRENDS

SCHEDULE

FLOORPLAN

REFRIGERATION

AHU-1

AHU-2

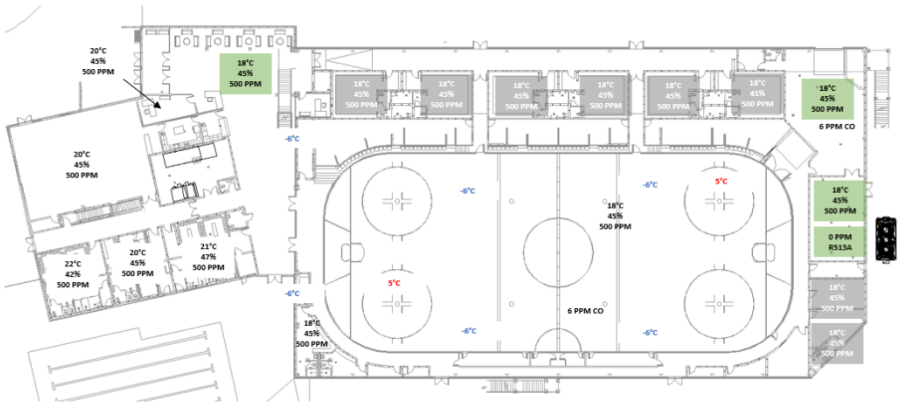
FC-1

FC-2

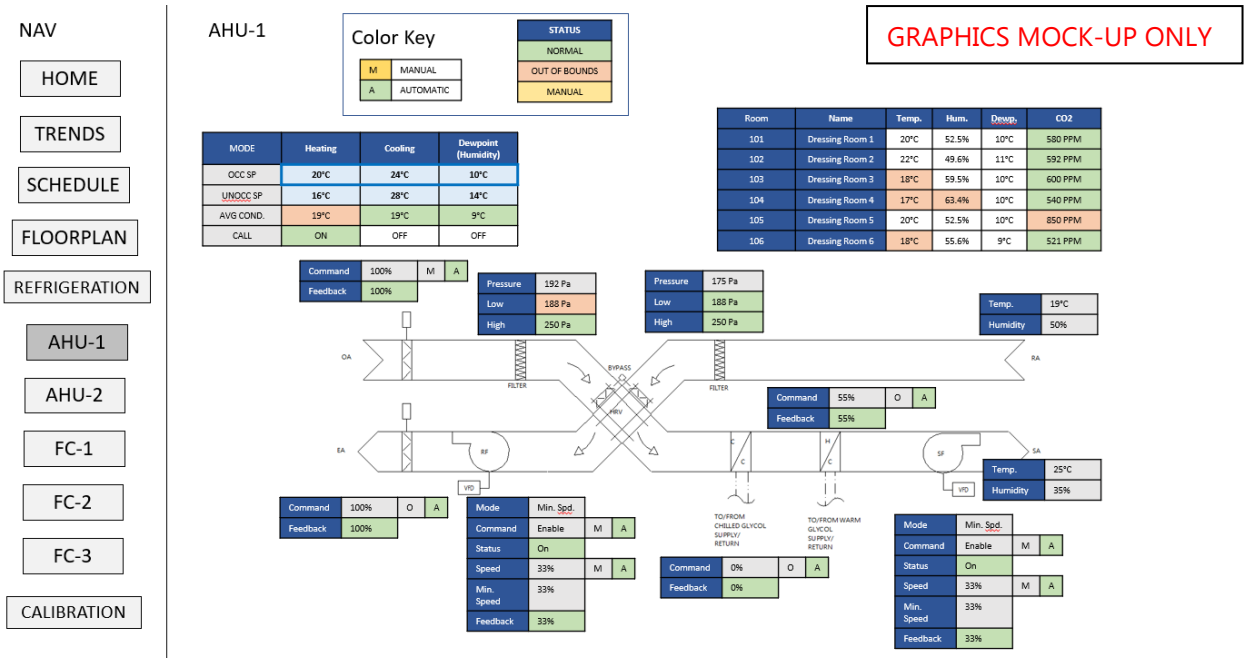
FC-3

CALIBRATION

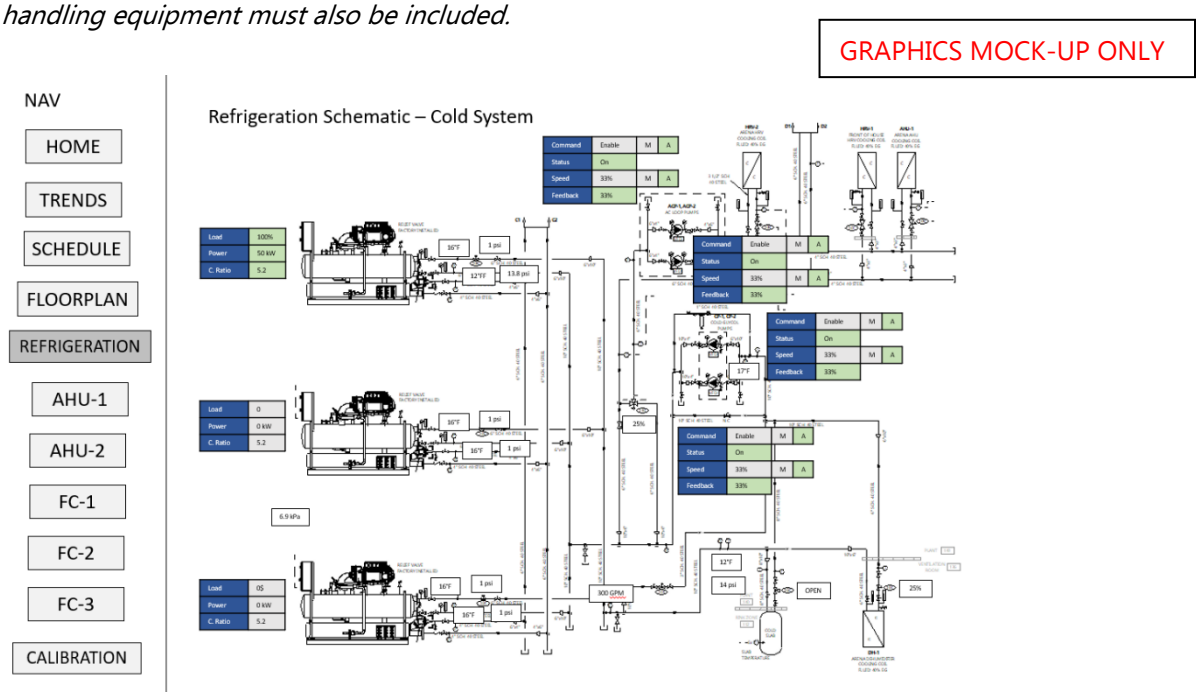
FLOORPLAN – FLOOR 1



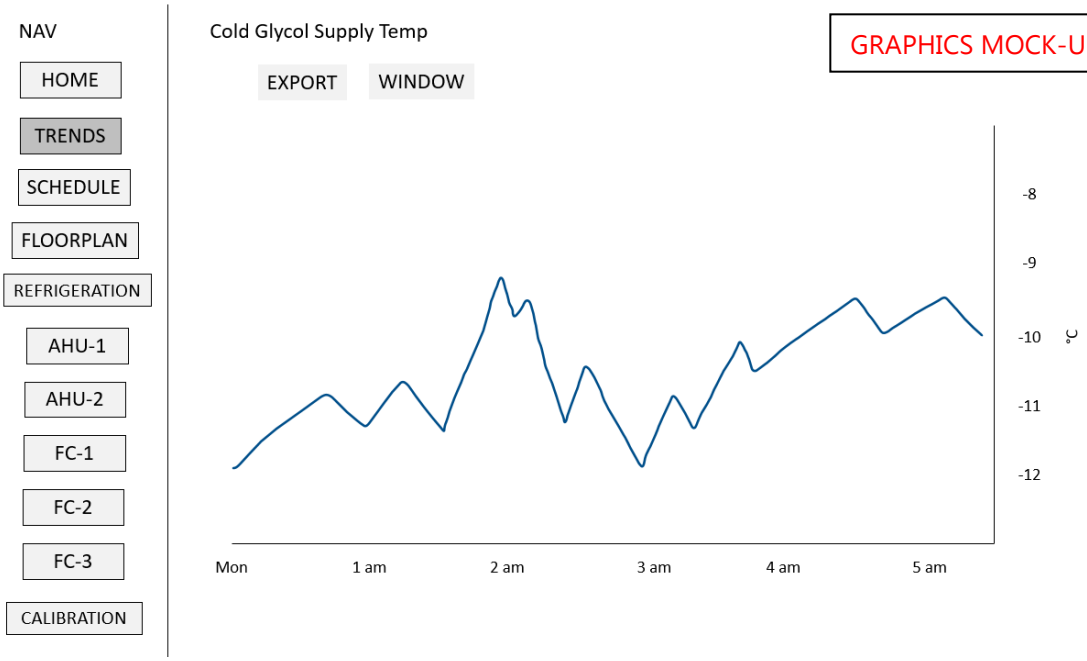
Sample building floor plan layout. Building layout is to be reproduced with key information on temperatures, air quality, and occupancy displayed graphically over each zone.



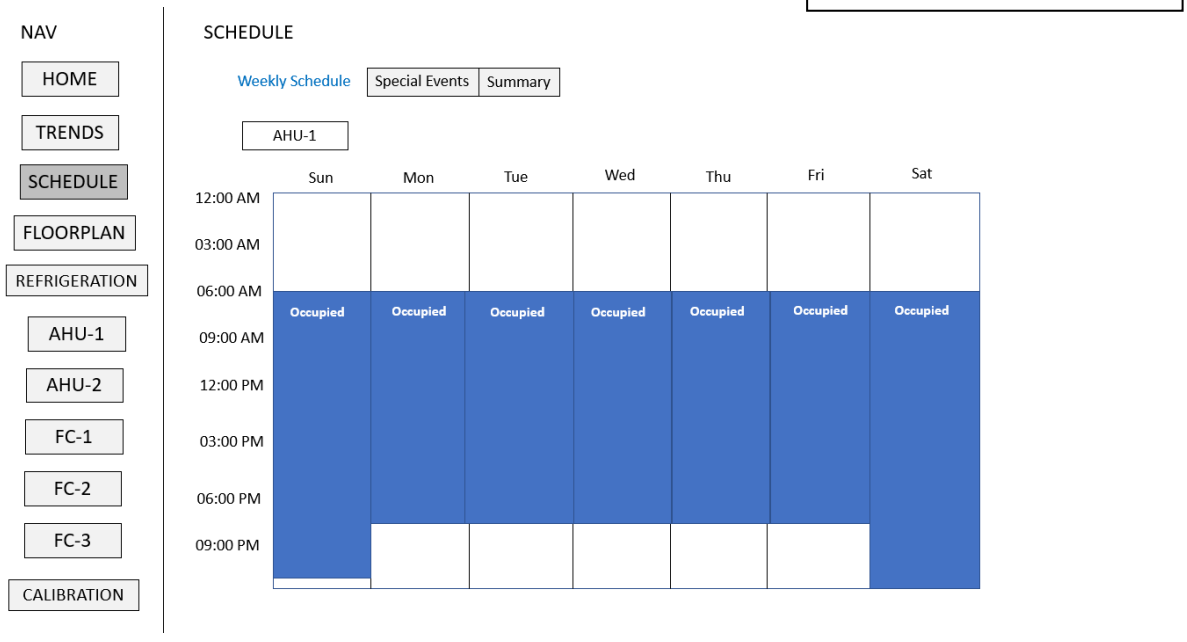
Sample equipment summary display for an air handling unit. All pieces of equipment should have dedicated pages where all relevant sensor, valve, and motor data is collected. Data for zones served by air handling equipment must also be included.



Sample refrigeration schematic screen. System schematic screens should show all interconnections between equipment, and key system level data in the form of basic equipment status, flow rates, temperatures, and pressure.



Sample analysis trend screen. All data points that are trended should be viewable as graphs, with user adjustable time and range windows. The system must also allow the direct export of the data or graphs to be used in external programs.

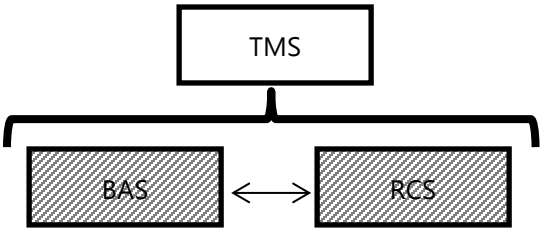


Sample schedule screen. This must be suitable for use by operators to adjust the operating time of building systems. Individual equipment must be selectable, as well as special events capability for single time scheduling interruptions.

THERMAL MANAGEMENT SYSTEM OVERVIEW

The Thermal Management System (TMS) will act as an intelligent load adjustment system sitting above the process load (ice rink and dehumidifier) controls and building comfort (BAS – air handling units, fan coils, HRVs, etc.) control system.

Individual components will be controlled as per the BAS control sequences, with the **TMS providing control overrides ONLY** to disallow heat to loads that are beyond the total available recovered heat.



TMS CALCULATION APPROACH

The control system will be expected to calculate load heat required, total heat required, available heat, time constant and critical load (refer to prior **Calculated Terms** section for details) using sensor data from throughout the building and coefficients entered by the Owner's Engineer in the access-controlled calibration page (refer to **Calibration Page** section below for details).

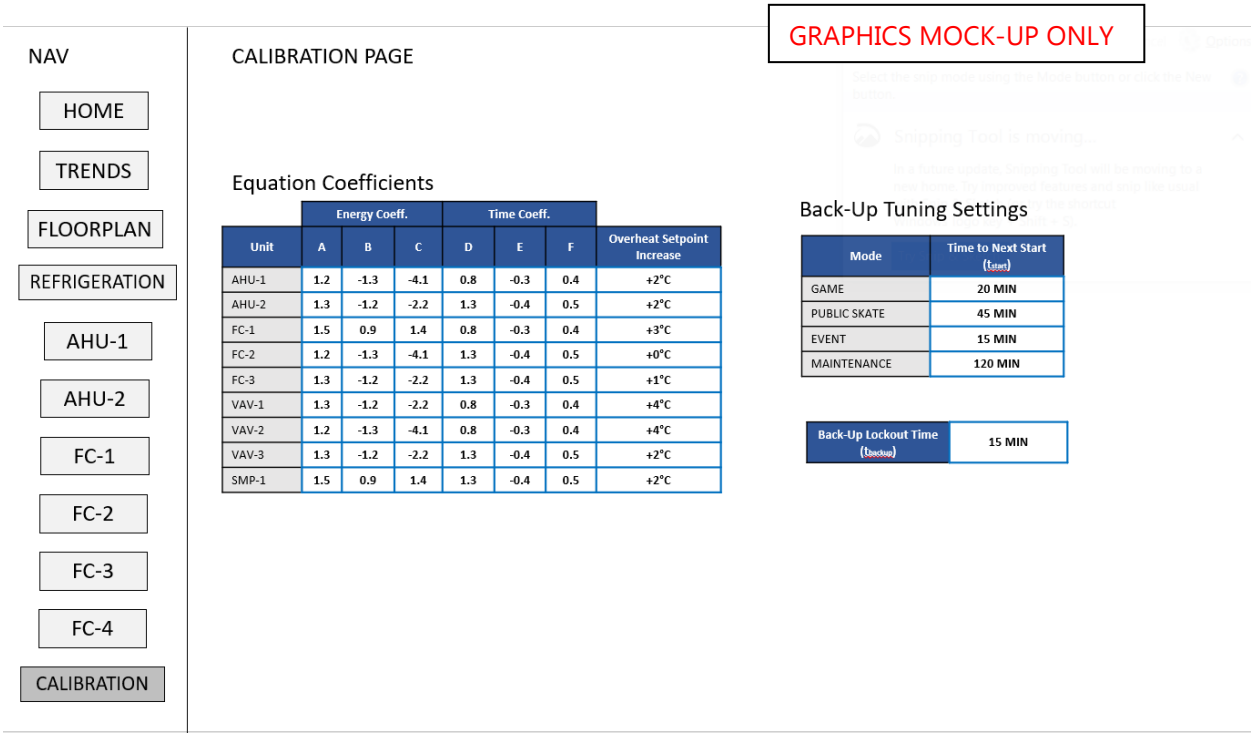
These calculations are to be repeated regularly on a pre-defined timer interval (for example, every 5 minutes) and used with comparative statements to determine what mode the system should be operating in. The TMS can direct equipment to be in Heat Recovery Mode, Overheat Mode, Floating Discharge Mode or Back Up Heating Mode depending on the outcome of the calculations.

A complete decision diagram illustrating the full calculation approach will be provided by the Owner's Engineer following contract award.

CALIBRATION PAGE

A TMS calibration page will be programmed into the system with remote access capabilities and permission controlled by the automation contractor to allow exclusive owner and/or owner's engineer access. This calibration page should not be accessible by, or visible to, operators. The calibration page will contain:

- Adjustable calculation coefficients associated with the TMS heat load and time constant calculations, to be provided by the owner and/or owner's engineer.
- Adjustable settings for every load to temporarily increase the load setpoints by a user defined value when surplus heat is available.
- Adjustable calibrated estimates of time between ice plant start up for each different ice rink operation mode on the refrigeration plant scheduler



Example of a calibration page, including user adjustable entries for all coefficients, overheat setpoint adjustments, and back-up tuning parameters.

MODES OF OPERATION

The TMS will be capable of moving into different modes which change the operation of refrigeration plant to respond to thermal comfort loads. The following sections outlines these modes of operation and the circumstances under which they are applied.

HEAT RECOVERY MODE

Description

The heat recovery mode is designed to be used during times when there is heat available to be recovered from the Refrigeration Plant, and heating is required. This is the typical mode of the system during the heating season.

Start Conditions

- A calculated value is greater than a pre-determined minimum level; AND
- The refrigeration plant is on and providing cooling (at least one IRP on)

Stop Conditions

- A calculated value is less than a pre-determined minimum level; OR
- There is no longer any available heat and no call for cooling (no IRP on)

Mode Functions

- Integrated refrigeration packages (IRPs) modulate to maintain elevated condenser leaving glycol temperature for heat recovery.
- TMS will disable certain heating loads based on the outcome of the calculation terms. The control system must compare two calculated values for each load to determine if the associated valve is to be forced closed.

Alarms

- Issue alarm if warm glycol supply temperature < T_{sp} – 5°F after 10 minutes

OVERHEAT MODE

Description

Overheat mode is used when there is more heat available than is required by building loads. Setpoints are adjusted when heat is available.

Start Conditions

- A calculated value is greater than a pre-determined minimum, but less than another calculated value; AND
- The refrigeration plant is on and providing cooling (at least one IRP on)

Stop Conditions

- A calculated value is less than a pre-determined minimum; OR
- There is no longer any available heat and no call for cooling (no IRP on)

Mode Functions

- IR packages modulate to maintain elevated condenser leaving glycol temperature for heat recovery
- All heating loads have their set points overridden up by an adjustable amount previously defined in the access-controlled calibration page.

Alarms

- Issue alarm if warm glycol supply temperature < T_{sp} – 5°F after 10 minutes

FLOATING DISCHARGE MODE

Description

The condenser entering glycol temperature is to be kept at a floating value above outdoor wet bulb temperature down to an adjustable minimum defined in the access-controlled calibration page by the Owner's Engineer.

Start Conditions

- A calculated value is less than a prescribed minimum, AND;
- The refrigeration plant is on (at least one IRP running)

Stop Conditions

- A calculated value is greater than a prescribed minimum, OR;
- All cooling loads are satisfied (no IRP on)

Mode Functions

- Fluid cooler fans modulate to maintain IRP condenser entering glycol temperature of OAWBT + 15°F down to a minimum defined in the access-controlled calibration page.

Alarms

- Issue alarm if condenser leaving glycol temperature > OAWBT + 20°F for greater than 10 minutes

BACKUP HEATING MODE

Description

In Back-Up Heating Mode, an alternate heat source is used in order to provide supplementary heat to the primary heating loop to maintain design supply temperatures. Curtailment actions will be in effect to reduce the heat load in the building in this mode.

This mode shall be tied to the ice rink event schedule. A calibrated time between IRP start-ups will be provided for each schedule category (e.g., "Unoccupied / Maintenance," "Game" and "Public Skate") which will be adjustable in the access-controlled calibration page. If the estimated time to next start (t_{start}) is less than a time period defined by the owner's engineer (t_{backup}) the backup system will not start.

Start Conditions

- A calculated value is greater than a pre-determined minimum level, AND;
- All IRP packages are off, AND;
- Estimated time to next IRP start (t_{start}) is greater than the required threshold (t_{backup})

Stop Conditions

- A calculated value is less than a pre-determined minimum, OR;
- Any IRP package is activated

Mode Functions

- Back-up heat source activated.
- Control valve for back up heating system modulated to maintain supply glycol temperature T_{sp}
- System-wide curtailment features put into place to minimize heat load

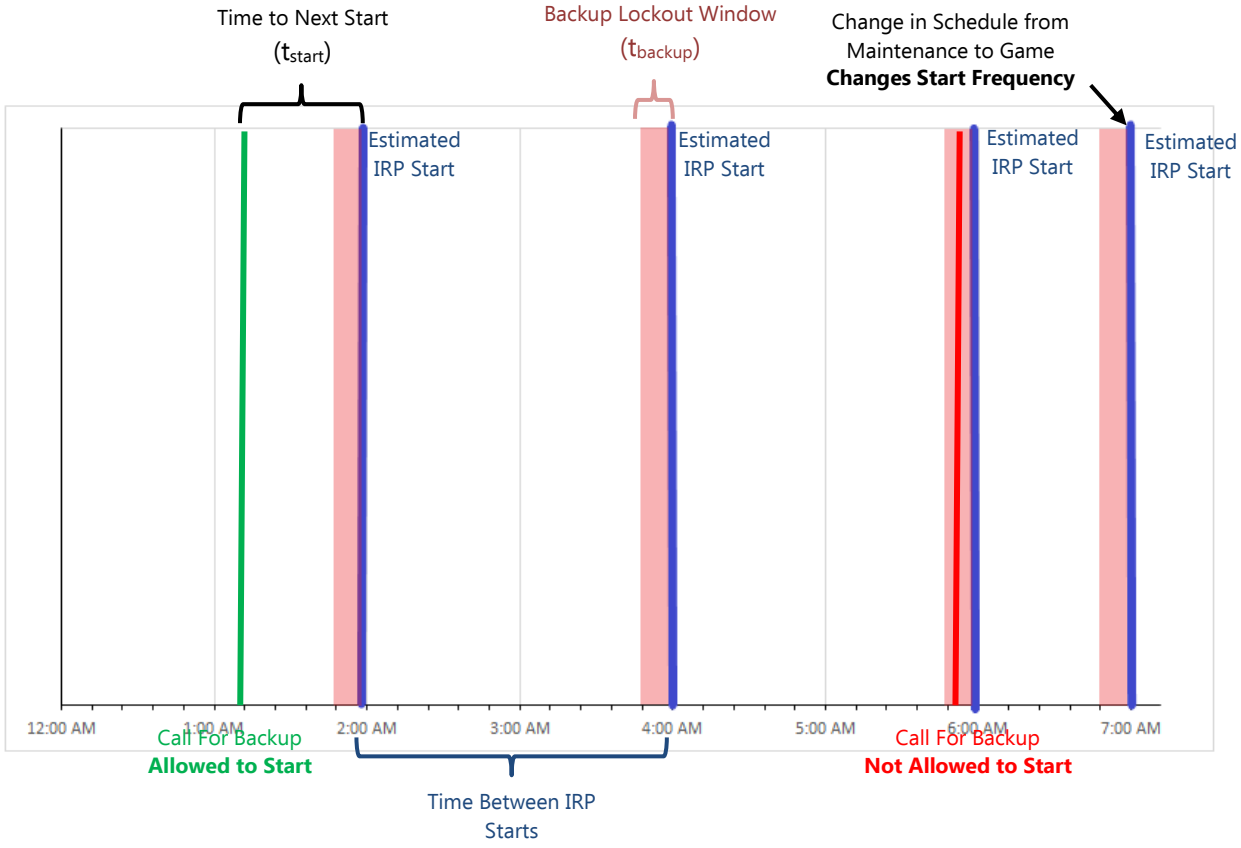
Curtailment Features

- Snow melt pit heating valves modulated closed
- Warm floor heating valves modulated closed
- Domestic and Ice Resurfacer hot water pre-heat tank valves modulated closed

Alarms

- Issue alarm if warm glycol supply temperature $< T_{sp} - 5°F$ for more than 10 minutes.

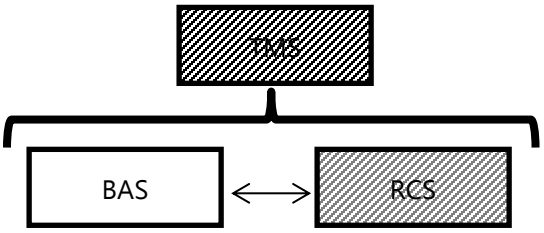
Example backup schedule for overnight 'Maintenance' operation switching to 'Game' at 6am.



BUILDING AUTOMATION SYSTEM OVERVIEW

The Building Automation System (BAS) deals with comfort cooling and heating loads throughout the building. This set of sequences directly relates to air handling and comfort control equipment throughout the building. These sequences are intended to provide zone conditioning and ventilation throughout the building intelligently based on sensor feedback.

The Thermal Management System (TMS) layer provides operational feedback to this layer to direct what loads can be served at any given time.



Detailed tables of setpoints, expected operating ranges and specific sensor point numbers will be provided to the automation contractor following contract award.

SEQUENCE OF OPERATIONS

HRV Units (HRV-1, HRV-2):

Description:

The HRV units primarily serve washrooms, dressing rooms and kitchen spaces throughout the building with single-pass air. HRV-1 serves locations near the front of the building, around the pool and front lobby. HRV-2 serves the areas around the ice rink, including washrooms and dressing rooms.

Start:

- As dictated by TOD schedule, AND;
- When any zone served by an HRV has CO2_ZONE > CO2_ZONE_MAX.

Stop:

- As dictated by TOD schedule, OR;
- When ALL zones served by an HRV have occupancy status of 'Unoccupied' or 'Standby', OR;
- As required by the fire alarm system, external to the BAS.

Operation:

1. Units shall be energized according to an operator-adjustable occupancy schedule.
    a. When starting up in occupied mode, the unit shall:
        i. Open Outdoor Air Damper and Exhaust Air Damper to maximum position if a Fan Alarm is not detected.
        ii. Start supply and return fans at minimum speed (in accordance with Fan Manufacturer Recommendations);
    b. When in unoccupied mode, the unit shall:
        i. De-energize the supply and return fans;
        ii. Close the outdoor air and exhaust air dampers;
        iii. Close the heating and cooling coil control valves.
2. Fan speed shall modulate to maintain zone air quality.
3. The units shall operate in three modes: heating, cooling, and dehumidification. Zones and outdoor air conditions shall be evaluated to determine the operating mode for the units. Dehumidification mode shall take priority over heating and cooling, and heating shall take priority over cooling.
    a. The unit shall be in Heating Mode if SAT < SAT_SP.

b. The unit shall be in Cooling Mode if SAT > SAT_SP.

c. The unit shall be in Dehumidification Mode if SADPT > SADPT_SP.

4. When in Heating Mode (SAT < SAT_HEATING_SP), the unit shall operate as follows:
   a. Modulate Heating Glycol Valve such that SAT = SAT_SP.
   b. Cooling Coil Valve to remain commanded to 0%.
   c. Modulate fan speed such that CO2_ZONE < CO2_MAX.
5. When in Cooling Mode (SAT > SAT_COOLING_SP), the unit shall operate as follows:
   a. Modulate Cooling Glycol Valve such that SAT = SAT_SP.
   b. Heating Coil Valve to remain commanded to 0%.
   c. Modulate fan speed such that CO2_ZONE < CO2_MAX.
6. When in Dehumidification Mode (SADPT > SADPT_SP), the unit shall operate as follows:
   i. Modulate Cooling Glycol Valve such that POST_CC_DPT = POST_CC_DPT_SP;
   ii. Modulate Heating Coil Valve such that SAT = SAT_SP
   iii. Modulate fan speed such that CO2_ZONE < CO2_MAX.

Alarms:

1. When the Supply Fan is commanded on and status/feedback is not received as on within 30 seconds, or after the first test is satisfied and the fan remains commanded on and status/feedback indicates off for 30 seconds, issue an alarm.
2. When the Return Fan is commanded on and status/feedback is not received as on within 30 seconds, or after the first test is satisfied and the fan remains commanded on and status/feedback indicates off for 30 seconds, issue an alarm.
3. If differential pressure across the pre-filter greater than 0.75 in H2O for more than 10 hours, issue a low-level dirty filter alarm;
4. If differential pressure across the pre-filter greater than 1.0 in H2O for more than 10 hours, issue a high-level dirty filter alarm
5. Supply air temperature is less than 50°F for more than 5 minutes, issue an alarm.
6. When the Exhaust Air Damper is commanded open and end switch status/feedback is not received as open within 30 seconds, or after the first test is satisfied and damper remains commanded open and end switch status/feedback indicates 'not open' for 30 seconds, issue an alarm.

7. When the Outdoor Air Damper is commanded open and end switch status/feedback is not received as open within 30 seconds, or after the first test is satisfied and damper remains commanded open and end switch status/feedback indicates 'not open' for 30 seconds, issue an alarm.
8. When the Heating Coil control valve position is commanded open and the status/feedback is not received as open within 2 minutes, or after the first test is satisfied and the valve remains commanded open and the feedback indicates closed for 30 seconds, issue an alarm.
9. When the Cooling Coil control valve position is commanded open and the status/feedback is not received as open within 2 minutes, or after the first test is satisfied and the valve remains commanded open and the feedback indicates closed for 30 seconds, issue an alarm.

Air Handling Unit (AHU-1):

Description:

AHU-1 serves lobby, corridor, and event space in the front of the building. This unit has full air recirculation capabilities. In these sequences, "ZONE" refers to any of the zones served that is out of setpoint.

Start:

- As required by TOD schedule, AND;
- When T_ZONE > T_ZONE_SP + 3°F; OR;
- When DPT_ZONE > DPT_ZONE_SP + 2°F, OR;
- When CO2_ZONE > CO2_MAX

Stop:

- As required by TOD schedule, OR;
- When T_ZONE < T_ZONE_SP **AND** DPT_ZONE < DPT_ZONE_SP **AND** CO2_ZONE < CO2_MAX (Minimum switchover lag time shall be 10 minutes.), OR;
- As required by the fire alarm system, external to the BAS.

Operation:

1. Unit shall be energized according to an operator-adjustable occupancy schedule.
    a. When starting up in occupied mode, the unit shall:
        i. Start supply and return fans at minimum speed (in accordance with Fan Manufacturer Recommendations);
        ii. Open Outdoor Air Damper to minimum position if a Fan Alarm is not detected.
    b. When in unoccupied mode, the unit shall:
        i. De-energize the supply and return fans;
        ii. Close the outdoor air and exhaust air dampers;
        iii. Close the heating and cooling coil control valves.
2. The units shall operate in the following modes: dehumidification, cooling, and heating. Zone and outdoor air conditions shall be evaluated to determine the operating mode for the units. If

conditions require dehumidification and cooling modes, dehumidification shall take priority. Further, heating will take priority over cooling.

a. The unit shall be in Dehumidification Mode if DPT_ZONE > DPT_ZONE_SP
b. The unit shall be in Cooling Mode if T_ZONE > T_ZONE_SP.
c. The unit shall be in Heating Mode if T_ZONE < T_ZONE_SP.

3. In all modes Air Quality Control will take priority over thermal considerations.
   a. If CO2_ZONE > CO2_ZONE_SP modulate outdoor air, exhaust air and mixed air dampers to provide fresh air to reach CO2_ZONE < CO2_ZONE_SP – 100 PPM.
4. When in Dehumidification Mode (DPT_ZONE > DPT_ZONE_SP), the unit shall operate as follows:
   a. IF OADPT < DPT_ZONE, THEN:
      i. Modulate Mix Air Dampers by PID loop to maintain SADPT = SADPT_SP
      ii. Modulate Glycol Heating Valve such that SAT = SAT_SP.
   b. ELSE (OADPT ≥ DPT_ZONE):
      i. Command Mix Air Damper to Maximum Position Setpoint and Outdoor Air Damper to Minimum Position.
      ii. Modulate Cooling Glycol Valve such that LCC_DPT = DPT_ZONE_SP;
      iii. Modulate Heating Glycol Valve such that SAT = SAT_SP;
      iv. For every 1°F that DPT_ZONE exceeds DPT_ZONE_SP, increase the Fan VFD's by 5%. Re-evaluate every 5 minutes and reset VFD speed accordingly.
5. When in Cooling Mode (T_ZONE > T_ZONE_SP), the unit shall operate as follows:
   a. IF outdoor air enthalpy (OA_ENTH) < return air enthalpy (RA_ENTH) for more then 10 minutes, THEN:
      i. Modulate Outdoor, Exhaust and Mixed Air Dampers to achieve SAT = SAT_SP
   b. ELSE (OAT ≥ T_ZONE):
      i. Command Mix Air Damper to Maximum Position Setpoint, and Outdoor Air Damper to Minimum Position.
      ii. Modulate Cooling Glycol Valve such that SAT = SAT_SP;
      iii. Heating Coil Valve to remain commanded to 0%;
      iv. For every 1°F that T_ZONE exceeds T_ZONE_SP, increase the Fan VFD's by 5%. Re-evaluate every 5 minutes and reset VFD speed accordingly.
6. When in Heating Mode (T_ZONE < T_ZONE_SP), the unit shall operate as follows:

a. IF OAT > T_ZONE, THEN:
    i. Modulate Mix Air Dampers by PID loop to maintain SAT = SAT_SP
b. ELSE (OAT ≤ T_ZONE):
    i. Command Mix Air Damper to Maximum Position Setpoint, and Outdoor Air Damper to Minimum Position.
    i. Modulate Heating Glycol Valve such that SAT = SAT_SP;
    ii. Cooling Coil Valve to remain commanded to 0%;
    iii. For every 1°F that T_ZONE exceeds T_ZONE_SP, increase the Fan VFD's by 5%. Re-evaluate every 5 minutes and reset VFD speed accordingly.

Alarms:

1. When the Supply Fan is commanded on and status/feedback is not received as on within 30 seconds, or after the first test is satisfied and the fan remains commanded on and status/feedback indicates off for 30 seconds, issue an alarm.
2. When the Return Fan is commanded on and status/feedback is not received as on within 30 seconds, or after the first test is satisfied and the fan remains commanded on and status/feedback indicates off for 30 seconds, issue an alarm.
3. If differential pressure across the pre-filter greater than 0.75 in H2O for more than 10 hours, issue a low-level dirty filter alarm;
4. If differential pressure across the pre-filter greater than 1.0 in H2O for more than 10 hours, issue a high-level dirty filter alarm
5. If the zone temperature provides a reading above T_ZONE_SP + 5°F after 5 minutes, issue an alarm;
6. If the zone dew point temperature provides reading above DPT_ZONE_SP ± 5°F after 5 minutes, issue an alarm.
7. When the Exhaust Air Damper is commanded open and end switch status/feedback is not received as open within 30 seconds, or after the first test is satisfied and damper remains commanded open and end switch status/feedback indicates 'not open' for 30 seconds, issue an alarm.
8. When the Outdoor Air Damper is commanded open and end switch status/feedback is not received as open within 30 seconds, or after the first test is satisfied and damper remains commanded open and end switch status/feedback indicates 'not open' for 30 seconds, issue an alarm.

9. When the Heating Coil control valve position is commanded open and the status/feedback is not received as open within 2 minutes, or after the first test is satisfied and the valve remains commanded open and the feedback indicates closed for 30 seconds, issue an alarm.
10. When the Cooling Coil control valve position is commanded open and the status/feedback is not received as open within 2 minutes, or after the first test is satisfied and the valve remains commanded open and the feedback indicates closed for 30 seconds, issue an alarm.

Rink Zone Dehumidifier (DH-1):

Description:

DH-1 is the primary ventilation for the arena. The unit can supply direct outdoor air or recirculation air and will modulate fan speed based on the air quality in the arena.

Start:

- As required by TOD schedule, AND;
- When T_ARENA > T_ARENA_SP + 3°F, OR;
- When DPT_ARENA > DPT_ARENA_SP + 2°F, OR;
- When CO2_ZONE > CO2_MAX [1000 PPM], OR;
- When CO_ZONE > CO_MAX [45 PPM]

Stop:

- As required by TOD schedule, OR;
- When T_ARENA < T_ARENA_SP **AND** DPT_ARENA < DPT_ARENA_SP **AND** CO_ARENA < CO_MAX **AND** CO2_ARENA < CO2_MAX (Minimum switchover lag time shall be 10 minutes.), OR;
- As required by the fire alarm system, external to the BAS.

Operation:

1. Unit shall be energized according to an operator-adjustable occupancy schedule.
    a. When starting up in occupied mode, the unit shall:
        i. Start supply and return fans at minimum speed (in accordance with Fan Manufacturer Recommendations);
        ii. Open Outdoor Air Damper to minimum position if a Fan Alarm is not detected.
    b. When in unoccupied mode, the unit shall:
        i. De-energize the supply and return fans;
        ii. Close the outdoor air and exhaust air dampers;
        iii. Close the heating and cooling coil control valves.
2. The units shall operate in the following modes: dehumidification, cooling, and heating. Arena and outdoor air conditions shall be evaluated to determine the operating mode for the units. If conditions require dehumidification and cooling modes, dehumidification shall take priority.

a. The unit shall be in Dehumidification Mode if DPT_ARENA > DPT_ARENA_SP
b. The unit shall be in Cooling Mode if T_ARENA > T_ARENA_SP.
c. The unit shall be in Heating Mode if T_ARENA < T_ARENA_SP.

3. In all modes Air Quality Control will take priority over thermal considerations.
   a. If CO2_ZONE > CO2_ZONE_SP modulate outdoor air, exhaust air and mixed air dampers to provide fresh air to reach CO2_ZONE < CO2_ZONE_SP – 100 PPM.
   b. If CO_ZONE > CO_ZONE_SP modulate outdoor air, exhaust air and mixed air dampers to provide fresh air to reach CO_ZONE < 10 PPM.
4. When in Dehumidification Mode (DPT_ARENA > DPT_ARENA_SP), the unit shall operate as follows:
   a. IF OADPT < DPT_ARENA, THEN:
      i. Modulate Mix Air Dampers by PID loop to maintain SADPT = SADPT_SP
      ii. Modulate Glycol Heating Valve such that SAT = SAT_SP.
   b. ELSE (OADPT ≥ DPT_ARENA):
      i. Command Mix Air Damper to Maximum Position Setpoint and Outdoor Air Damper to Minimum Position.
      ii. Modulate Cooling Glycol Valve such that LHC_DPT = DPT_ARENA_SP;
      iii. Modulate Heating Glycol Valve such that SAT = SAT_SP;
      iv. For every 1°F that DPT_ARENA exceeds DPT_ARENA_SP, increase the Fan VFD's by 5%. Re-evaluate every 5 minutes and reset VFD speed accordingly.
5. When in Cooling Mode (T_ARENA > T_ARENA_SP), the unit shall operate as follows:
   a. IF outdoor air enthalpy (OA_ENTH) < return air enthalpy (RA_ENTH) for more then 10 minutes, THEN:
      i. Modulate Outdoor, Exhaust and Mixed Air Dampers to achieve SAT = SAT_SP
   b. ELSE (OAT ≥ T_ARENA):
      i. Command Mix Air Damper to Maximum Position Setpoint, and Outdoor Air Damper to Minimum Position.
      ii. Modulate Cooling Glycol Valve such that SAT = SAT_SP;
      iii. Heating Coil Valve to remain commanded to 0%;
      iv. For every 1°F that T_ARENA exceeds T_ARENA_SP, increase the Fan VFD's by 5%. Re-evaluate every 5 minutes and reset VFD speed accordingly.
6. When in Heating Mode (T_ARENA < T_ARENA_SP), the unit shall operate as follows:

a. IF OAT > T_ARENA, THEN:
    i. Modulate Mix Air Dampers by PID loop to maintain SAT = SAT_SP
b. ELSE (OAT ≤ T_ARENA):
    i. Command Mix Air Damper to Maximum Position Setpoint, and Outdoor Air Damper to Minimum Position.
    iv. Modulate Heating Glycol Valve such that SAT = SAT_SP;
    v. Cooling Coil Valve to remain commanded to 0%;
    vi. For every 1°F that T_ARENA exceeds T_ARENA_SP, increase the Fan VFD's by 5%. Re-evaluate every 5 minutes and reset VFD speed accordingly.

Alarms:

11. When the Supply Fan is commanded on and status/feedback is not received as on within 30 seconds, or after the first test is satisfied and the fan remains commanded on and status/feedback indicates off for 30 seconds, issue an alarm.
12. When the Return Fan is commanded on and status/feedback is not received as on within 30 seconds, or after the first test is satisfied and the fan remains commanded on and status/feedback indicates off for 30 seconds, issue an alarm.
13. If differential pressure across the pre-filter greater than 0.75 in H2O for more than 10 hours, issue a low-level dirty filter alarm;
14. If differential pressure across the pre-filter greater than 1.0 in H2O for more than 10 hours, issue a high-level dirty filter alarm
15. If the arena temperature provides a reading above T_ARENA_SP + 5°F after 5 minutes, issue an alarm;
16. If the arena dew point temperature provides reading above DPT_ARENA_SP ± 5°F after 5 minutes, issue an alarm.
17. When the Exhaust Air Damper is commanded open and end switch status/feedback is not received as open within 30 seconds, or after the first test is satisfied and damper remains commanded open and end switch status/feedback indicates 'not open' for 30 seconds, issue an alarm.
18. When the Outdoor Air Damper is commanded open and end switch status/feedback is not received as open within 30 seconds, or after the first test is satisfied and damper remains commanded open and end switch status/feedback indicates 'not open' for 30 seconds, issue an alarm.

19. When the Heating Coil control valve position is commanded open and the status/feedback is not received as open within 2 minutes, or after the first test is satisfied and the valve remains commanded open and the feedback indicates closed for 30 seconds, issue an alarm.
20. When the Cooling Coil control valve position is commanded open and the status/feedback is not received as open within 2 minutes, or after the first test is satisfied and the valve remains commanded open and the feedback indicates closed for 30 seconds, issue an alarm.

Two-Pipe Fan Coil Units – Space Conditioning:

Description:

The two-pipe fan coil unit is a terminal device for heating a single zone in the building. This sequence applies to the following fan coils:

- FC-1 to FC-15;
- FC-19 to FC-25

Start:

- As required by the occupancy schedule, AND:
- When T_ZONE < T_ZONE_SP - DB.

Stop:

- As required by the occupancy schedule, OR:
- When T_ZONE > T_ZONE_SP

Operation:

1. Units shall be energized according to an operator-adjustable occupancy schedule.
    a. When starting up in occupied mode, the unit shall:
        i. Start the fan;
        ii. Modulate Heating Glycol Valve such that SAT = SAT_SP;
    b. When the STOP conditions are reached:
        i. De-energize the fan;
        ii. Heating Coil Valve to remain commanded to 0%;

Alarms:

1. If the status of the fan is not confirmed within 30 seconds after being energized, issue an alarm.

Freeze Protection Fancoils:

Description:

These fan coils are intended to provide zone specific heat to prevent freezing conditions in mechanical spaces. The fan coils are heating only, and do not address cooling or air quality. This sequence applies to the following fan coils:

- FC-16 to FC-18;
- FC-27 and FC-28

Start:

- When T_ZONE < T_ZONE_SP.

Stop:

- When T_ZONE > T_ZONE_SP (Minimum switchover lag time shall be 10 minutes.)

Note: This system starts and stops regardless of the building occupancy schedule as it is an equipment safety protection layer.

Operation:

1. Units shall be energized according to an operator-adjustable occupancy schedule.
    a. When starting up in occupied mode, the unit shall:
        i. Start the fan;
        ii. Modulate Heating Glycol Valve such that SAT = SAT_SP;
    b. When the STOP conditions are reached:
        i. De-energize the fan;
        ii. Heating Coil Valve to remain commanded to 0%;

Alarms:

1. If the status of the fan is not confirmed within 30 seconds after being energized, issue an alarm.

Temperature Control Exhaust Fans:

Description:

A wall- or ceiling-mounted exhaust fan. The fan ventilates the room if the temperature rises above set-point to prevent equipment overheating. This sequence applies to the following fans:

- EF-2 – Ice Resurfacer Room
- EF-3 – Electrical Room
- EF-4 – Pool Mechanical Room
- EF-5 – Elevator Exhaust

Start:

- When T_ZONE > T_MAX

Stop:

- When T_ZONE < T_MAX – 2°F

Operation:

1. The unit shall operate as follows:
    a. When the space temperature sensor reads a zone temperature above the maximum setpoint:
        i. The fan shall activate.
        ii. The Outdoor Air Damper shall be commanded to maximum position.
    b. When the space temperature sensor reads a zone temperature below the maximum setpoint:
        i. The fan shall deactivate.
        ii. The Outdoor Air Damper shall be commanded to minimum position.

Alarms:

1. If the status of the exhaust fan is not confirmed within 30 seconds after being energized, issue an alarm;
2. If T_ZONE > T_MAX + 5°F after 5 minutes, issue an alarm;

Mechanical / Refrigeration Room Exhaust Fan (EF-1):

Description:

A wall-mounted exhaust fan and motorized damper located in the refrigeration plant room. The fan activates if the plant room is occupied, and enters a higher speed if refrigerant is detected in the space or when a manual purge is triggered. This sequence applies to EF-1 - Ice Plant Room Exhaust.

Start

- Upon receiving a low- or high-level alarm from the zone's refrigerant detector; **OR**
- When refrigeration package is ON; **OR**
- When the CO concentration exceed the CO_ZONE_SP; **OR**
- When the Co2 concentration exceeds the CO2_ZONE_SP; **OR**
- When T_Zone > T_ZONE_SP;

Stop

- When T-ZONE = T_ZONE_SP **± 0.5°F AND** CO_ZONE < CO_ZONE_SP **AND** All IRPs are OFF **Minimum switchover lag time shall be 10 minutes. The manual momentary switch overrides this lag time.**

Note: *This unit includes a safety exhaust start located outside of the room that will latch the fan "ON" in a high-speed setting and can only be disabled physically on site for safety reasons.*

Operation

2. The unit shall operate as follows:
    c. When an IRP is running
        i. The fan shall start at a low-speed setting
    d. When the T_ZONE > T_ZONE_SP
        i. The fan shall start at a low-speed setting
    e. When the space CO sensor reads a zone CO level above the medium level setpoint
        i. The fan shall start at a low-speed setting
    f. When the space CO2 sensor reads a zone CO2 level above the medium level setpoint.
        i. The fan shall start at a low-speed setting
    g. When the space CO sensor reads a zone CO level above the high level setpoint
        i. The fan shall modulate up to a high speed.
    h. When the space CO2 sensor reads a zone CO2 level above the high level setpoint

i. The fan shall modulate up to a high speed

i. When STOP conditions are reached

i. The fan shall modulate off.

3. Upon receiving a low-level alarm from the zone's R513a refrigerant detector, the DDC system shall:
    a. Operate the fan at a minimum low speed;
    b. Issue an alarm through the automation system
4. Upon receiving a high-level alarm from the zone's R513a refrigerant detector the DDC system shall:
    a. Override the fan controls to operate the fans at high speed;
    b. Issue an alarm through warning strobe lights (red), sound a horn, and send remote pages.

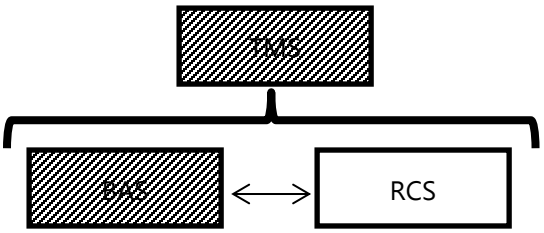
Alarms

3. Upon detection of refrigerant concentrations above **25 ppm**, a low-level alarm shall be issued by the zone's R513a refrigerant detector.
4. Upon detection of refrigerant concentrations above **650 ppm**, a high level emergency alarm shall be issued by the zone's R513a refrigerant detector. In the event of this, the DDC system shall:
    a. Activate a red strobe light alarm;
    b. Sound a horn;
    c. Send remote pages to:
        i. Operators;
        ii. Facility management.
5. The system shall issue an alarm upon the malfunction of the refrigerant monitor, including the following situations:
    a. In the event of a power outage;
    b. In the event of a failure in the electronics of the saturated sensor;
    c. If the monitor detects a faulty wiring connection;
    d. The monitor experiences communication problems.
6. If the status of the exhaust fan is not confirmed within **30 seconds** after being energized, issue an alarm;
7. If the zone temperature provides a reading above T_ZONE_SP **± 5°F** after **5 minutes**, issue an alarm;
8. If the fan status is "ON" but the automation system has not called for it, issue an alarm.

REFRIGERATION CONTROL SYSTEM OVERVIEW

The Refrigeration Control System (RCS) provides specialized control for the process cooling equipment used to provide ice for the ice rink. These sequences manage the cooling and heating distribution pumps as well as the refrigeration packages that directly provide the heating and cooling.

The Thermal Management System (TMS) layer provides mode information to the RCS, directing the system to coordinate the delivery of recovered heat to the BAS.



Detailed tables of setpoints, expected operating ranges and specific sensor point numbers will be provided to the automation contractor following contract award.

Integrated Refrigeration Packages (IRP-1, IRP-2, IRP-3)

Description:

The Integrated Refrigeration Packages (IRPs) operate to provide refrigeration to the ice sheet, cooling to building ventilation systems, and recovered heat for use in heating loads throughout the building. Key mode changes (Heat recovery, floating discharge) are directed by the Thermal Management System (TMS) layer.

Start:

- When the average cold slab temperature, COLD_SLAB_T > Ice Temperature Setpoint ICE_T_SP, OR;
- When rink dehumidification/cooling load is not satisfied, OR;
- When Air Conditioning (AC) Pumps are On **AND** AC_T (AC loop glycol return temperature) above AC_T_SP (AC loop glycol temperature setpoint)

Stop:

- When COLD_SLAB_T ≤ ICE_T_SP **AND** rink dehumidification/cooling load is satisfied **AND** AC Pumps are OFF **AND** AC_T ≤ AC_T_SP.

1. The IRPs shall operate in the following modes:
    a. If IRP in Ice Building Mode (triggered by operator schedule):
        1. Modulate IRP saturated suction temperature such that Leaving Cold Glycol Temperature LCG_T = Leaving Cold Glycol Temperature Ice Setpoint LCGT_ICE_SP
        2. Modulate IRP saturated discharge temperature such that Leaving Hot Glycol Temperature LHG_T = Leaving Hot Glycol Temperature Setpoint LHGT_F_SP
    b. If IRP in Heat Recovery Mode (TMS is calling for heat):
        1. Modulate IRP suction temperature such that Leaving Cold Glycol Temperature LCG_T = Leaving Cold Glycol Heat Recovery Temperature LCGT_HR_SP

2. Modulate IRP saturated discharge temperature such that Leaving Hot Glycol Temperature LHG_T = Leaving Hot Glycol Heat Recovery Temperature Setpoint LHGT_HR_SP

c. If IRP in Floating Discharge Mode (TMS is satisfied):
    1. Modulate IRP suction temperature such that LCG_T = LCGT_HR_SP
    2. Modulate IRP saturated discharge temperature such that LHG_T = Leaving Hot Glycol Floating Discharge Setpoint LHGT_F_SP

d. If IRP in AC Mode:
    i. Both loads: ice slab cooling and ice area cooling are satisfied **AND** AHUs are calling for cooling **AND** TMS is satisfied
        1. Modulate IRP suction temperature such that LCG_T = Leaving Cold Glycol Air Conditioning Temperature Setpoint LCG_AC_SP
        2. Modulate IRP saturated discharge temperature such that LHG_T = LHGT_F_SP
    ii. Both loads: ice slab cooling and ice area cooling are satisfied **AND** AHUs are calling for cooling **AND** TMS is calling for heat
        1. Modulate IRP suction temperature such that LCG_T = LCGT_AC_SP
        2. Modulate IRP saturated discharge temperature such that LHG_T = LHGT_HR_SP
    iii. Dehumidifier in the air-cooling mode
        1. Modulate IRP suction temperature such that LCG_T = LGT_AC_SP
        2. Modulate IRP saturated discharge temperature such that LHG_T = LHGT_F_SP

2. IRPs shall operate to maintain the evaporator supply temperature setpoint.
    i. If required cooling exceed the rated cooling capacity of a single IRP, then unload the lead unit to 70%, start lag IRP at 70%.
    ii. If required cooling exceed the rated cooling capacity of two IRPs, then unload the lead IRP to 70%, start lag IRP at 70%, start last IRP at 70%.
    iii. Modulate all active units simultaneously to balance loading

Alarms:

1. If IRP status of one machine is not confirmed within 30 seconds after being energized, command next IRP to be turned on (Minimum switchover lag time shall be 10 minutes). If after minimum switchover lag time system command IRP to On **AND** status is not confirmed within 30 seconds, issue an alarm.
2. If any cold slab temperature sensor is out of agreement with the average by 4°F for more than 10 minutes, issue an alarm.

Note: Refer to TMS section for operation mode definitions.

Adiabatic Fluid Cooler (AFC-1):

Description:

The adiabatic fluid cooler operates to provide cooling to the heat rejection loop when the refrigeration plant is running and the heat loads are satisfied. It controls the IRP condenser entering glycol temperature to ensure the system operates as designed.

Start:

- The system shall be started if any IRP is On **AND** RGT > RGT_SP**.**

Stop:

- If any IRP is On **AND** Heating Available ≤ TMS calling for heat**.**
- All IRPs are Off.
- (Minimum switchover lag time shall be 10 minutes.)

Operation:

1. The unit shall operate with specific conditions for the following modes: heat recovery and floating discharge.
    a. When the TMS triggers heat recovery mode:
        a. In Heat Recovery Mode, RGT_SP = RGT_SP_HR
    b. The unit shall be in Floating Discharge Mode if directed by the TMS.
        a. In Floating Discharge Mode, RGT_SP = Maximum of OAWBT+20°F and RGT_SP_MIN
            i. Note: Target OAWBT offset to be user adjustable with above as default.
2. When the unit is on:
    a. IF OA_DP_T < 42°F, THEN:
        i. Close fill valve
        ii. Open drain valve
    b. IF OAT > 60°F, THEN:
        i. Open fill valve
        ii. Close drain valve
    c. When in Floating Discharge Mode a staged approach is to be used:
        a. Stage 1: Modulate Fluid Cooler Bypass Valve to maintain RGT = RGT_SP.
            i. Increase to Stage 2 if:
                1. Fluid Cooler Bypass Valve position reaches 100% flow to Adiabatic Fluid Cooler; OR
                2. RGT > RGT_SP + 3°F

b. Stage 2: Place Fluid Cooler Bypass Valve position to 25% flow to Adiabatic Fluid Cooler, and run adiabatic fluid cooler fans at minimum speed. Then, modulate Fluid Cooler Bypass Valve to maintain RGT = RGT_SP with fluid cooler fans at minimum speed.
    i. Increase to Stage 3 if:
        1. Fluid Cooler Bypass Valve position reaches 100% flow to Adiabatic Fluid Cooler; OR
        2. RGT > RGT_SP + 3°F
c. Stage 3: Fix Fluid Cooler Bypass Valve position to 100% flow to Adiabatic Fluid Cooler. Modulate adiabatic fluid cooler fans to maintain RGT = RGT_SP.

d. When in Heat Recovery or Overheat Mode:

e. Fluid cooler on board control system to modulate fans and water supply to maintain leaving glycol temperature as close to RGT_SP as possible

Alarms:

1. If the return glycol temperature provides a reading above RGT_SP + 5°F after 5 minutes, issue an alarm.

Cold Glycol Pumps (CP-1, CP-2)

Description:

The cold glycol pumps operate to distribute the cold glycol to the ice sheet and air conditioning circuit.

Start:

- When Ice Surface Temperature > ICE_T_SP, OR;
- When rink dehumidification/cooling load is not satisfied, rink dewpoint temperature DPT_RINK > rink dewpoint setpoint DPT_RINK_SP, OR:
- When Air Conditioning (AC) Pumps are On **AND** AC_T (AC loop glycol return temperature) above AC_T_SP

Stop:

- When Ice Surface Temperature ≤ ICE_T_SP. **OR/AND** rink dehumidification/cooling load is satisfied **AND/OR** AC Pumps are OF **AND/OR** AC_T ≤ AC_T_SP. (Minimum switchover lag time shall be 10 minutes.)

Operation:

1. The pumps shall operate as follows:
2. If Ice Surface Temperature > Ice Temperature Set Point + 0.5°F
    i. Cold Glycol Pump shall modulate speed such that a temperature differential of 3°F is maintained between ice supply and return glycol temperatures.
    ii. The pump will maintain flowrate above some minimum to maintain required flow rate for the active IRPs as determined by the manufacturer, and as measured by the Cold Glycol Flow Meter.
        1. If a conflict arises between the differential temperature control and the minimum flow rate control, maintaining the minimum flow rate will be prioritized.
3. If air conditioner is calling for cooling and T_AC> T_AC_SP and Ice Surface is not calling for cooling
    i. Cold Glycol Pump shall modulate speed such that a temperature differential of 10°F is maintained between cold glycol supply and return temperature sensors. The pump will maintain speed above some minimum to maintain required flow rate for the IRPs.
4. Modulate Cold Bypass Valve such that CG_FLOW ≥ CG_FLOW_SP

Alarms:

1. If COLD_SLAB_T > ICE_T_SP + 5°F after 5 minutes issue an alarm.
2. If CGR_T > CGR_T_SP + 5°F after 5 minutes issue an alarm.
3. If Cold Glycol Pump status is not confirmed within 30 seconds after being energized issue an alarm and start the backup pump.
4. If the backup Cold Glycol Pump status is not confirmed within 30 seconds after being energized issue a critical alarm.

Hot Glycol Pumps (HP-1, HP-2)

Description:

The hot glycol pumps operate to dissipate heat generated by the IRPs through the adiabatic fluid cooler and provide heating to loads throughout the building.

Start:

- When IRPs are On **OR** Backup Heating Mode is commanded by the TMS

Stop:

- When IRPs are Off **AND** Backup Heating Mode is not commanded by the TMS

1. The pumps shall operate as follows:
    a. If any IRP is On
        a. Activate lead condenser pump and modulate speed with PID loop to target differential pressure setpoint P_COND_SP.
            i. If after 30 seconds lead condenser pump is not active, activate lag condenser pump.
        b. Condenser Pumps shall operate at the same speed to maintain the minimum flow required for the IRPs.
2. Adiabatic fluid cooler bypass valve shall be modulated such that MIN_HG_FLOW = MIN_HG_FLOW_SP.
    a. Hot Glycol Flowrate is to be measured by the Hot Glycol Flow Meter
    b. Minimum hot glycol flow rate will be adjusted based on the number of IRPs currently active based on the minimum condenser flow rate supplied by the package manufacturer.

Alarms:

1. If WGR_T > CGR_T_SP + 2.8°C (5°F) after 5 minutes issue an alarm.
2. If Condenser Pump status is not confirmed within 30 seconds after being energized issue an alarm and start the backup pump.
3. If the backup Condenser Pump status is not confirmed within 30 seconds after being energized issue a critical alarm.

DHW Heaters (WH-1, WH-2)

Description:

Domestic hot water is heated by a gas fired water heater.

Start:

When any domestic hot water tank temperature < tank setpoint temperature DHW_T_SP

Stop:

When all domestic hot water tank temperatures > tank setpoint temperature DHW_T_SP + 1°C (2°F)

Operation:

1. Activate lead water heater when any tank temperature below setpoint. On board water heater controls to modulate to achieve DHW tank setpoint DHW_T_SP.
    a. If lead water heater is at full capacity and DHW_T < DHW_T_SP after 5 minutes, activate lag water heater.
2. When STOP condition is reached, water heaters are deactivated.
3. Cycle lead and lag water heaters after each use.

Alarms:

1. Issue an alarm if DHW tank setpoint (DHW_T_SP) is not reached in 30 minutes.
2. If supply temperature to tempered Domestic Hot Water system exceeds 35°C (95°F) issue an alarm
3. If lead DHW heater does not activate upon call for heating, after 5 minutes issue an alarm and activate the lag DHW heater.

DHW Preheat Heat Exchanger (HX-2)

Description:

The DHW Pre-Heat (DPH) system pre-heats domestic cold water to an intermediate temperature prior to being delivered to the domestic hot water tanks for heating. This reduces the loading on the domestic hot water tanks using recovered heat from the refrigeration plant.

Start:

- TMS is in Heat Recovery or Overheat mode AND all heating loads have t_tc < t_crit

Stop:

- TMS is not in Heat Recovery or Overheat mode OR not all heating loads have t_tc < t_crit

Operation:

1. When START condition is reached, modulate control valve until HX1_LWT = HX1_LWT_SP.
2. When STOP condition is reached, control valve is closed.

Alarms:

1. If valve position is not confirmed, issue an alarm
2. If HX-1 Water Inlet > HX-1 Water Outlet issue an alarm.

Ice Resurfacer Water Heater (WH-3)

Description:

The Ice Resurfacer Hot Water (IRWH) system consists water heaters that heat treated water to resurface the ice after use.

Start:

When ice resurfacer tank temperature < ice resurfacer tank setpoint IRHW_T_SP

Stop:

When ice resurfacer tank temperature > ice resurfacer tank setpoint IRHW_T_SP + 2°F

Operation:

1. Activate water heater when tank temperature below setpoint. On board water heater controls to modulate to achieve IRHW tank setpoint IRHW_T_SP.
2. When STOP condition is reached, tank water heater to deactivate.

Alarm:

1. If IRHW tank setpoint IRHW_T_SP is not reached in 30 minutes, issue an alarm.

Ice Rink Warm Floor (WFP-1, WFP-2)

Description:

The ice rink warm floor system circulates tempered warm glycol through a piping circuit under the ice rink in order to prevent frost heaving from long term operation. The system will cycle on pumps to maintain a minimum warm slab temperature of T_WARMSLAB_SP, using heat injected from the heat recovery loop.

Start:

When the average of the two warm slab sensors T_WARMSLAB < T_WARMSLAB_SP – 2°F

Stop:

When the average of the two warm slab sensors T_WARMSLAB > T_WARMSLAB_SP + 2°F

Operation:

1. Start lead warm floor pump to begin circulating glycol.
    a. If, after 30 seconds, the lead pump status is not confirmed switch to lag pump.
2. Modulate Hydraulic Separator Control Valve on a PID loop to maintain supply glycol temperature (T9) of T_WARMFLOOR_SUPPLY.
3. When STOP condition is reached, close Hydraulic Separator Control Valve and deactivate pump .
4. Switch Lead and Lag pump after each STOP.

Alarms:

1. If warm slab temperature average <= 0°C (32°F), issue an alarm
2. If disagreement between the two warm slab temperature sensors is greater than 4°F for more than 10 minutes issue an alarm.
3. If supply glycol temperature exceeds 50°F issue an alarm
4. If lead warm floor pump status is not confirmed after 30 seconds, issue an alarm
5. If lag warm floor pump is not confirmed after 30 seconds, issue a critical alarm
6. If Hydraulic Separator Valve Position status and feedback are not confirmed, issue an alarm

Snow Melt Pit

Description:

The snow melt pit is a heated tank used to melt the ice shavings following ice resurfacing. A warm glycol coil heated by recovered waste heat is used to maintain the water temperature slightly above freezing to foster improved melting times. The control valve will modulate to maintain the tank temperature at the desired setpoint.

Start:

When snow melt pit temperature < T_SNOWMELT_SP – 2°F

Stop:

When snow melt pit temperature >= T_SNOWMELT_SP

Operation:

1. Modulate Snow Melt Pit Control Valve on PID loop to maintain snow melt pit temperature at setpoint (T_SNOWMELT_SP).
2. When STOP condition is reached close Snow Melt Pit Control Valve.

Alarms:

1. If snow melt pit temperature < 33°F for 10 minutes, issue an alarm
2. If snow melt pit supply glycol temperature < snow melt pit temperature, issue an alarm
3. If Snow Melt Pit Control Valve status and feedback are not confirmed issue an alarm

Back-Up Heating Package (HX-2, WP-1)

Description:

Back-up heating is provided by a back-up heating system. This back-up heating is to be used to allow the system to deliver supply setpoint temperature glycol during periods of prolonged refrigeration package downtime. This system should **not** be used regularly to boost supply loop heat, and is to be activated under the direction of the Thermal Management System.

Start:

When directed by the Thermal Management System (TMS). Refer to TMS sequences for details.

Stop:

When directed by the Thermal Management System (TMS). Refer to TMS sequences for details.

Operation:

1. Activate WP-1 to circulate domestic hot water through the water-side of HX-2.
2. Modulate Back Up Heating Valve to maintain glycol supply temperature at heating glycol supply temperature T_HG_SUPPLY_SP.
3. When STOP condition is reached deactivate steam supply to heat exchanger and modulate Back Up Heating Valve to close back-up heating source.

Alarms:

1. If hot glycol supply temperature (T3) exceeds T_HG_SUPPLY_SP + 5°F issue an alarm
2. If heat exchanger leaving temperature T2 < T_HG_SUPPLY_SP for 5 minutes issue an alarm
3. If WP-1 pump status is not confirmed, issue an alarm.
4. If WP-1 pump does not activate upon call, issue an alarm.

Air Conditioning Glycol Distribution (ACP-1, ACP-2)

Description:

Air conditioning loads are served by cool glycol that is blended from the main supply cold glycol loop. This system operates with a modulating pump on a fixed differential pressure control system in order to deliver target flow rates for each load. An independent control valve modulates to blend low temperature glycol to maintain target cool glycol supply temperature.

Start:

Any associated A/C Cooling Load is open for 5 minutes

Stop:

All associated A/C Cooling Loads are closed.

Operation:

1. When start condition is reached:
    a. Activate lead A/C glycol pump.
        i. If the duty pump stops or fails to start an alarm is generated in the TMCS, and the alternate pump will startup.
    b. Speed control on each pump shall be modulated by the TMCS in response to the A/C Differential Pressure sensor SCGWP-SP (determined during fluid balancing – this is the differential pressure required to achieve design flow at all valves and required operating range pressure drop across each of the system's control valves).
    c. Modulate A/C Injection Control Valve from normally closed position to maintain Secondary Supply Glycol Temperature at Secondary Glycol Supply Temperature Setpoint (SCGST-SP).
        i. The Secondary Chilled Glycol Supply Temperature setpoint will be determined by a reset over time as follows:
            1. Upon initial start up the EFFSCGST-SP will be set according to the following schedule:

Outdoor Air Temperature	Secondary Chilled Glycol Supply Temperature Setpoint
OAT-LO-SP [-15 C]	SCGST-HI-SP [13 C]
OAT-HI-SP [15 C]	SCGST-LO-SP [4 C]

2. As each A/C Load is started up, a 'startup time delay' of (STARTUP-DLY, [5 minutes]) is triggered to allow for control settling. After this time delay has expired the AHU or Fan Coil Cooling Valve will be considered 'operational' for the sequence below.
3. When an AHU or Fan Coil is not operational, its associated cooling valve will not be considered.
4. If any associated AHU or Fan Coil cooing control valve is less than (VLV-MIN) for a period of (STEP-DLY), the Secondary Chilled Glycol Fluid Supply Temperature Setpoint is increased by (STEP-AMT). This action will continue to occur at the same time period as long as a cooling valve is less than (VLV-MIN) capacity.
5. If any associated A/C Load Control Valve is greater than (VLV-MAX) for a period of (STEP-DLY), the Secondary Chilled Glycol Fluid Supply Temperature Setpoint is decreased by (STEP-AMT). This action will continue to happen at the same time period as long as a cooling valve is greater than (VLV-MAX) capacity.
6. Valves that are greater than 90% capacity take precedence over valves that are less than 50% capacity in terms of the Secondary Chilled Glycol Fluid Supply Temperature Setpoint.

2. When STOP condition is reached modulate A/C Injection Control Valve closed and deactivate A/C glycol pump.

Alarms:

1. If A/C supply glycol temperature exceeds setpoint T_AC_SP + 5°F for 5 minutes issue an alarm
2. If A/C supply glycol temperature reaches setpoint T_AC_SP – 5°F issue an alarm
3. If A/C circuit differential pressure is below setpoint P_AC_SP for 5 minutes issue an alarm