

# TOWN HALL BMCS REPLACEMENT

## SPECIFICATIONS

Issued for the Town of Drumheller



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**DIVISION 00**

- 00 01 15 List of Drawings

**DIVISION 01**

- 01 11 00 Summary of Work

**DIVISION 20 – GENERAL REQUIREMENTS MECHANICAL**

- 20 05 05 Mechanical Work General Instructions
- 20 05 40 Demolition and Revision Work
- 20 05 55 Testing, Adjusting and Balancing

**DIVISION 25 – CONTROLS**

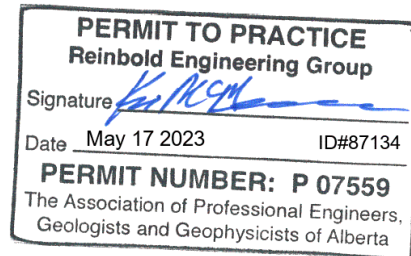
- 25 05 10 Building Automation System

**END OF SECTION**



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ID#87134





**1 GENERAL**

**1.01 DRAWINGS**

.1 The following is a list of the Drawings forming part of this package:

<b>SERIES</b>	<b>NAME/TITLE</b>	<b>DATE</b>	<b>REV</b>
<b>MECHANICAL</b>			
<b>Drumheller Civic Centre Library &amp; Firehall (UMA Group)</b>			
M1	Site Plan & Details	07. 1979	2
M2	Main Floor Plan – Heating, Ventilating & Air Cond.	07. 1979	2
M3	Second Floor Plan – Heating, Ventilating & Air Cond.	07. 1979	2
<b>Drumheller Town Hall Relocation – (HIDI RAE)</b>			
M0.01	Legend and Schedules	06.19. 2012	0
M0.02	Legend and Schedules	06.19. 2012	0
M1.01	Main Floor Plumbing & Heating Plan	06.19. 2019	0
M1.02	Main Floor Ventilation Plan	06.19. 2019	0
M2.01	Second Floor Plumbing & Heating Plan	06.19. 2019	0
M2.02	Second Floor Ventilation Plan	06.19. 2019	0
<b>CONTROLS</b>			
C-1	New & Existing System Architecture	03.15. 2023	0
1526	Automatic Controls As-Built Shop Drawings	08. 1994	0
4256	Automatic Controls As-Built Shop Drawings	01.30. 2013	0

**END OF SECTION**

## **1 GENERAL**

### **1.01 THE PROJECT**

- .1 The Work is a part of the Project, which comprises the following.
  - .1 Controls contractor will be considered as “Prime Contractor” for this project and all other trades will be consider sub-trade;
  - .2 Replace all existing controls with new BACnet controls system. New system is to be web based.
  - .3 New controls wiring is to be installed.
  - .4 New thermostats are to be installed.
  - .5 New controllers are to be installed.
  - .6 Existing conduit maybe reused.
  - .7 All new conduit, wiring is to adhere to current Canadian Electrical Code.
  - .8 Once new controls are installed, a complete building air & water balancing is to be completed to match original values.

### **1.02 CONTRACT TIME**

- .1 Date of commencement of the Contract shall be the date of issue by the Town of Drumheller of a letter acknowledging acceptance of the Bid, conditional on the bidder executing the required number of copies of the Contract, as completed by the Town to conform to the Bid, without alteration by the bidder.
- .2 Upon receipt of the letter referenced in item 1.03, the Contractor will promptly, and without undue delay, commence Work at the Project Site no later than 2 weeks from date of the letter.

### **1.03 CONTRACTUAL ARRANGEMENT**

- .1 Work shall be performed under a single contract, stipulated price arrangement.

### **1.04 WORK SEQUENCE**

- .1 Construct Work in stages to accommodate Owner's continued use of premises and cooling system during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.

### **1.05 USER OCCUPANCY**

- .1 Users will occupy premises during the Contract Time. The Contractor will cooperate with Town of Drumheller and user's representative to minimize conflict and to facilitate usage.

## **2 PRODUCTS**

NOT APPLICABLE

**3 EXECUTION**

NOT APPLICABLE

**END OF SECTION**

## **1 GENERAL**

### **1.01 REFERENCES**

- .1 The General Conditions of the Contract, the Supplementary Conditions, and all Sections of Division 01 apply to and are a part of this Section of the Specification.

### **1.02 APPLICATION**

- .1 This Section specifies requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

### **1.03 NOTE RE: BOLD LETTERING**

- .1 "**Bold**" type lettering is used throughout this Specification in an attempt to enhance the readability of the text. The use of "**bold**" lettering does not indicate a greater level of importance.

### **1.04 SUBMITTALS**

- .1 As specified in this Section, submit the following to the Consultant:
  - .1 **Notice for Field Reviews:** Written notice for attendance at the site for field reviews.
  - .2 **Project Close-out Documentation:** O & M Manuals, record as-built drawings, and all associated data.
  - .3 **Progress Payment Breakdown:** A detailed breakdown of the mechanical work cost.
  - .4 **Extended Warranties:** Copies of all extended warranties specified, and in the name of the Owner.
  - .5 **List of Acceptable Manufacturers:** A completed List of Acceptable Manufacturers to clearly indicate the names of the manufacturers of products on which the bid price is based.
  - .6 **O & M Training Schedules & Modules:** A proposed schedule of demonstration and training dates and times, and a preliminary copy of the training manual developed for operational and maintenance training.

## 1.05 DEFINITIONS

- .1 The following are definitions of words found in mechanical work Sections of the Specification and on associated drawings:
  - .1 "Concealed" – means work hidden from normal sight in furred spaces, shafts, tunnels, ceiling spaces, walls and partitions.
  - .2 "Exposed" – means work normally visible, including work in equipment rooms and similar spaces.
  - .3 "Outdoor(s)" – means outside the building, exposed to weather such as sun, snow rain, wind, etc.
  - .4 "Provide" (and tenses of provide) – means supply and install complete.
  - .5 "Install" (and tenses of install) – means install and connect complete.
  - .6 "Supply" – means supply only.
  - .7 "CAD File" – means computer assisted design and drafting file, limited to Autodesk AutoCAD .dwg and Revit .rvt files.
  - .8 "Substantial performance" – means the Owner has beneficial use of the building including occupancy permit, operating and commissioned life safety systems.
  - .9 "Finished area" - means any area or part of an area which receives a finish such as paint, or is factory finished.
  - .10 "Governing authority", "authority having jurisdiction", "regulatory authority" and/or "Municipal authority" – means all government departments, agencies, standards, rules and regulations, applicable bylaws that apply to and govern the mechanical work and to which the work must adhere.
  - .11 "Consultant" – means the Architect or Consulting Engineer who has prepared the Contract Documents on behalf of the Owner.
- .2 Wherever the words "indicated", "shown", "noted", "listed", or similar words or phrases are used in the specification they are understood, unless otherwise defined, to mean that the product referred to is "indicated", "shown", "listed", or "noted" on the drawings.
- .3 Wherever the words "reviewed" is used in the specification or on the drawings they are understood, unless otherwise defined, to mean that work or product referred to has been reviewed by the consultant for general conformance with the design intent. Review of work or equipment by the consultant does not absolve the contractor of their responsibility to meet the requirements of the building code and contract documents.
- .4 In the mechanical specification, singular may be read as plural, and vice-versa.

## 1.06 QUALITY ASSURANCE

- .1 All mechanical work is to be done by journeyman tradespeople who perform only the work that their certificates permit, or by apprentice tradespeople under direct on-site supervision of an experienced journeyman tradesman. The use of apprentice tradespeople is to be limited and the journeyman/apprentice ratio is subject to the Consultant's approval.

- .2 All journeyman tradespeople are to have valid trade certificates available at the site for review by the Consultant at any time.
- .3 An experienced and qualified superintendent is to be on-site at all times when mechanical work is being performed.
- .4 Only persons who have received equipment or systems Manufacturer's training and certification will carry out installation of equipment and systems where specified, or as required by the Manufacturer's installation instructions.

#### **1.07 CODES, REGULATIONS, AND STANDARDS**

- .1 All Codes, Regulations, and Standards referred to in this Section and in Sections to which this Section applies are the latest edition of the Codes, Regulations, and Standards in effect at the time of bidding on this Project.
- .2 All work is to be in accordance with requirements with Codes, Regulations, and Standards applied by governing authorities.
- .3 All mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards, building codes, authorities and CSA Standard, mechanical work products must bear a CRN number.
- .4 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay all associated costs associated with these submittals.
- .5 All electrical items associated with mechanical equipment are to be certified and bear the stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.
- .6 Requirements of the Contract Documents are to take precedence when they are more stringent than codes, ordinances, standards, and statutes.

#### **1.08 IMPERIAL AND METRIC MEASUREMENTS**

- .1 Conform to requirements of CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .2 Both Metric and Imperial units of measurement are indicated in the mechanical Specification. The second indicated measurements, where included, are "soft" and have been rounded off.

#### **1.09 EXAMINATION OF SITE AND DOCUMENTS**

- .1 When estimating the cost of the work and prior to submitting a bid for the work carefully examine all of the bid documents and visit the site to determine and review all existing site conditions that will or may affect the work, and include for all such conditions in the bid price.
- .2 Report to the Consultant, prior to bid submittal, any existing site condition that will or may affect performance of the work as per the drawings and specifications. Failure to do so will not be grounds for additional costs.

### **1.10 DRAWINGS AND SPECIFICATION**

- .1 Read the mechanical work drawings in conjunction with all other Consultant disciplines, Contractors P. Eng documentation, and where applicable, the Code Consultant's report.
- .2 The mechanical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of the building are to be taken at the site. Do not scale the drawings, and do not use the drawings for prefabrication work.
- .3 The drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, all offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and structural details but not shown on the drawings.
- .4 The locations of equipment and materials shown shall not be altered without prior review by the Architect and Mechanical Consultant. If the proposed locations affect other systems, equipment, disciplines or prior installed work, all alterations will be at the mechanical contractor's cost. Sections of the mechanical specification are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and the Sections are to be read as a whole.
- .5 The mechanical specification does not generally indicate the specific number of items or extent of material required. The specification is intended to provide product data and installation requirements. It is necessary to refer to drawing schedules, layouts, schematic diagrams, riser diagrams, and details to determine correct quantities.
- .6 The mechanical drawings and specification are intended to be cooperative. Perform all work that is shown, specified, or reasonably implied on the drawings but not mentioned in the specification, or vice-versa, as though fully covered by both.
- .7 The mechanical drawings and specifications have been prepared solely for the 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 other party.
- .8 When the scale and date of the drawings are the same, or when the discrepancy exists within the specification, the costliest arrangement will take precedence.

### **1.11 PLANNING AND LAYOUT OF THE WORK, AND ASSOCIATED DRAWINGS**

- .1 Properly plan, coordinate, and establish the locations and routing of services with all subcontractors affected prior to installation such that the services will clear each other as well as any obstructions, including structural components of the building.
- .2 Unless otherwise shown or specified, conceal all work in finished areas, and conceal work in partially finished or unfinished areas to the extent made possible by the area construction. Install piping, ductwork, and similar services as high as possible to conserve headroom and/or ceiling space. Notify the Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work.
- .3 Revise or alter the arrangement of work that has been installed without proper coordination, study and review, even if it was completed in accordance with the Contract Documents, in order to conceal the work behind finishes, or to allow the installation of other work, at no additional cost. In addition, pay for the cost of alterations in other work required by the alterations to your work.

- .4 All devices and equipment that require periodic inspection and or service must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be made accessible through the addition of access doors or relocated to an accessible location at no additional cost.
- .5 **Layout Drawings:** Do not use the Contract Drawing measurements for prefabrication and layout of piping and sheet metal work. Locations and routing are to generally be in accordance with the Contract Drawings, however, layout drawings are to be prepared for all such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for the work of other trades, accurately layout the work, and be entirely responsible for all work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with the Contract Drawings, notify the Consultant prior to proceeding with the work.
- .6 **Interference Drawings:** Prepare dimensioned working interference drawings, supplementary to the Contract Drawings for all areas where multiple services and/or equipment occur, or where the work due to architectural and structural considerations requires special study and treatment. Review interference drawings with the Consultant before the work is installed. Where your work has been installed in such areas without preparation of interference drawings and conflicts occur, revise your work to suit at no additional cost.

#### 1.12 COORDINATION OF THE WORK

- .1 Review all the Contract Documents and coordinate the work with the work of all subcontractors. Coordination requirements are to include, but not be limited to, the following:
  - .1 Preparation of electronic coordination drawings as required, submitted as shop drawings, with drawing scale as required to indicate the necessary details.
  - .2 Written notification of all concrete work such as housekeeping pads, sumps, bases, in-slab ductwork, in-slab piping and sleeving, required for mechanical work, and including required dimensions, operating weight of equipment and location.
  - .3 Depth and routing of excavation required for mechanical work, and requirements for bedding and backfill.
  - .4 Schematic wiring for all wiring work required for mechanical equipment and systems but not specified to be done as part of the mechanical work, including termination points, wiring type and size, and any other requirements.
  - .5 **Precast Coordination:** Fully coordinate all mechanical openings required in precast with the General Contractor, including a complete review by the mechanical trade of the precast shop drawings during the shop drawing review stage to verify information provided to the GC has been captured. No additional cost will be considered for work required to correct uncoordinated openings.

#### 1.13 GENERAL RE: INSTALLATION OF EQUIPMENT

- .1 Unless otherwise specified all equipment is to be installed in accordance with the equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.



- .2 Ensure that proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Remove and replace any equipment which does not meet this requirement.

#### **1.14 GENERAL RE: SELECTION OF MATERIALS AND METHODS**

- .1 **Material Compatibility:** Provide materials, specialities and accessories which are compatible with each other to create a complete, durable system. All materials must be installed as recommended by the manufacturer or related industry association, particularly with respect to prevention of premature failure due to wear, stress, corrosion or chemical incompatibility caused by other installed materials, specialities or accessories.

#### **1.15 ENERGY EFFICIENCY STANDARDS**

- .1 All applicable mechanical equipment has been selected to meet energy efficiency requirements of the Model National Energy Code of Canada for Buildings or ANSI/ASHRAE/IESNA 90.1, Energy Standards for Buildings, and shop drawings/product data submittals for such equipment must indicate compliance with this Standard or they will be returned for correction and re-submittal.
- .2 All applicable mechanical equipment has been selected to meet:
  - .1 The National Energy Code for Buildings
  - .2 ANSI/ASHRAE/IESNA 90.1
- .3 Shop drawings/product data submittals for such equipment must indicate compliance with these Standards, or they will be returned for correction and re-submittal.

#### **1.16 PERMITS, FEES AND CERTIFICATES**

- .1 Apply for, obtain and pay for all permits required to complete the mechanical work.
- .2 Submit to the Consultant, all approval/inspection certificates issued by governing Authorities to confirm that the work as installed is in accordance with the rules and regulations of the Authority having Jurisdiction. Pay any costs associated with issue of the certificates.
- .3 Include a copy of all approval/inspection certificates in each operating and maintenance manual.

#### **1.17 WORKPLACE SAFETY**

- .1 Refer to Division 1.
- .2 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for all products where required, and maintain one copy at the site in a visible and accessible location available to all personnel.
- .3 Comply with all requirements of Occupational Health and Safety Regulations and all other regulations pertaining to health and safety, including worker's compensation/ insurance board and fall protection regulations.

## 1.18 SHOP DRAWINGS AND PRODUCT DATA SHEETS

- .1 The contractor shall review the dimensional data, handing, clearance and installation requirements to confirm constructability based on architectural and structural drawings prior to submitting drawings to the consultant for review. If in the contractor's opinion the specified equipment cannot be installed without impacting other trades or specified building dimensions, they shall notify the consultant in writing, prior to submitting the shop drawings for review.
- .2 Prior to supplying any products to the site, submit for review, shop drawings and/or product data sheets indicating in detail the design, construction, and performance of products as requested in Sections of this Specification. The number of copies of shop drawings and/or product data sheets will be as later directed.
- .3 Shop drawings are those prepared specifically for the Project. Product data sheets are copies of manufacturer's standard catalogue, etc., literature.
- .4 Unless otherwise specified or required, submit shop drawings/product data sheets via email in PDF format, and in Autodesk file formats when requested:
  - .1 PDFs are to be digitally created files (not scans of hard copies) with text that can be searched and selected. (OCR text will be accepted only when it is error free.)
  - .2 Single files which contain shop drawings for more than 10 pieces of equipment/items, or, more than 70 pages, must include a table of contents either show page numbers for each piece of equipment in the table of contents, or, use the PDF "bookmark" function to permit electronic navigation.
  - .3 Identify the applicable specification section on the cover sheet.
  - .4 Each page of the shop drawing or product data sheet is to be identified with the project name and the product drawing tag, if applicable, i.e. "Exhaust Fan EF-1", or, if no tag is provided, a clear, specific plain-language description of intended application, e.g. "Condensate Neutralization Kit for Heating Boilers B1&B2".
- .5 Wherever possible, shop drawings and/or product data sheets are to be 216 mm x 280 mm (8½" x 11") or 356 mm x 432 mm (11" x 17") with sufficient clear space for review stamps, comments, and identification as specified below.
- .6 Shop drawings and product data sheets must confirm that the product proposed meets all requirements of the Contract Documents.
- .7 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure that this requirement is clearly indicated on the submission.
- .8 The Contractor and General Contactor shall carefully review each shop drawing and product data sheet prior to submittal to ensure that the proposed product is correct and meets with all requirements of the Project. Endorse each copy of each shop drawing or product data sheet "Correct for Review by Consultant", or "Certified to Be in Accordance with All Requirements" and include your company name, the submittal date, and the signature of a representative of your company to indicate your review and approval as above.
- .9 The Consultant will review shop drawings and product data sheets and will indicate the review status by stamping the shop drawings and product data sheets as follows:

- .1 **"Not Reviewed"** to indicate that the shop drawing was not reviewed.
  - .2 **"Reviewed" or "Reviewed as Noted"** to indicate that the review is final and no additional review is required by this Consultant. All comments by other Consultants shall be adhered to.
  - .3 **"Revise and Resubmit"** to indicate that the submission is rejected and is to be revised in accordance with comments marked on the shop drawings and product data sheets by the Consultant and re-submitted.
- .10 The following is to be read in conjunction with the wording on the Consultant's review stamp applied to each and every mechanical work shop drawing or product data sheet submitted:
- .1 "This review is for the sole purpose of ascertaining conformance with the general design concept. This review does not approve the detail design inherent in the shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the Contractor of the responsibility for errors or omissions in the shop drawings or of their responsibility for meeting all requirements of the Contract Documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades."
  - .11 The contractor is responsible to convert all scheduled / specified product data into the units used in the schedules and/or specifications to facilitate Consultant review.
  - .12 If a shop drawing is returned as "Revise and Resubmit" more than three (3) times, the specified basis of design material or equipment shall be submitted for review and approval.
  - .13 Additional reviews required for shop drawings that have been returned as "Revise and Resubmit" more than three (3) times shall be reviewed by the Consultant at a Per Diem rate and shall be charged back to the submitting contractor.
  - .14 All products shall be reviewed by the Owner's Representative Project Manager prior to ordering.

#### **1.19 CHANGES OR REVISIONS TO THE WORK**

- .1 Do not proceed with changes to Work without written authority from the Owner.
- .2 Follow procedures outlined in Division 01 Tendering and Contract Requirements for administration and execution of Contract revisions.
- .3 Whenever the Consultant proposes in writing to make a change or revision to the design, arrangement, quantity or type of any work from that required by the Contract Documents, prepare and submit to the Consultant for approval, a quotation being your proposed cost for executing the change or revision.
- .4 Quotations for changes to work shall include detailed and itemized estimate of all products, material, labour, and equipment costs associated with the changes, revisions or credits, plus overhead and profit percentages and all applicable taxes and duties. Cost shall be determined by one of the following methods as selected by the Owner.
  - .1 By estimate and acceptance of a lump sum ("Lump Sum method").

- .2 Where unit prices, discounts and allowances are set out in the Contract documents or subsequently agreed upon, in accordance with such unit prices ("Unit Price method").
- .3 By actual time and material costs and a fixed or percentage fee for overhead and profit ("Time and Material method").
- .5 Changes in the work evaluated using the lump sum method shall be based on the following factors:
  - .1 For Materials and Equipment - The latest edition of Allpriser published list prices, less the following discounts:

<u>Item</u>	<u>Discount</u>
Steel Pipe	50%
Copper Pipe	45%
Cast Iron Soil Pipe	45%
Stainless Steel Pipe and fittings	45%
Welded Fittings	50%
Grooved Fittings	30%
Threaded Fittings	40%
Cast Iron Screwed Fittings	40%
Copper Fittings	45%
Cast Iron MJ Fittings	35%
Valves	25%
Insulation Materials	35%
All Other Materials	25%
Equipment Rental	Actual Rate, but not to exceed local rates.

- .2 For Base Labour Units - The most recent edition of the Mechanical Contractors Association Labour Calculator and SMACNA published Labour Units, latest edition. If required/applicable, factors affecting productivity as outlined in the document "Change Order Protocol" shall include the following additional factors when evaluating change pricing:
  - .1 Site Conditions
  - .2 Clean Up
  - .3 Material Handling
  - .4 Scheduling
  - .5 Time Keeping
  - .6 Mobilization and Demobilization
  - .7 Labour Warranties (not included in Labour Rate).

- .8 Estimating
  - .9 Fabrication Drafting
  - .10 Measuring
  - .11 Printing
  - .12 Record Drawings and As-Built Drawings.
  - .13 Interference Drawings
  - .14 Garbage Sorting, Tagging, Disposal.
  - .15 Installation Height (applies to work 10 feet [3m] or more above working surface).
  - .16 Multi-storey - lost productivity factor.
  - .17 Environmental conditions - lost productivity factor.
  - .18 Availability of personnel - lost productivity factor.
  - .19 Stacking of trades - lost productivity factor.
  - .20 Abnormal work schedule - lost productivity and increased supervision factor(s).
  - .21 Crew size inefficiency – use of larger than planned workforce.
- .3 Under no circumstances shall the cumulative total of additional factors exceed 20% of the hours established using Base Labour units.
- .6 Unless otherwise stated in the Contract Documents, the following requirements apply to all quotations submitted:
- .1 When the change or revision involves deleted work as well as additional work, the cost of the deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from the cost of the additional work before overhead and profit percentages are applied to the additional work.
  - .2 Costs for journeyman and apprentice labour must not exceed prevailing or agreed upon rates at the time of execution of the Contract and must reflect the actual personnel performing the work.
  - .3 Labour rates shall be inclusive of base rate, vacation/stat pay, union deductions and charges, legislated burdens, expendable small tools, finance payroll, rest breaks, idle time, safety, labour warranties, and parking.
  - .4 Cost for the site superintendent must not exceed 10% of the total hours of labour estimated for the change or revision, and the change or revision must be such that the site superintendent's involvement is necessary.
  - .5 Costs for rental tools and/or equipment are not to exceed local rental costs.

- .6 If overhead and profit percentages are not specified in the General Conditions of the Contract, Supplementary Conditions, or elsewhere in preceding Sections of the Specification, but allowable under the Contract, then allowable percentages for overhead and profit are to be 10% and 5% respectively.
- .7 The overhead percentage will be deemed to cover all quotation costs other than actual site labour, product and materials, and rentals.
- .8 All quotations, including those for deleted work, must include a figure for any required change to the Contract time.
- .7 Where changes are evaluated using either the lump sum method, or the time and material method, the cost to the Owner shall be the actual cost of credits and, where additional work is required, the cost to the Owner shall be the actual cost plus a percentage covering overhead and profit, after all credits included in the change have been deducted.
- .8 Where "credit" changes are estimated, the overall factors used to establish the value of the change shall not be less than 80% of equivalent factors used for "add" changes.
- .9 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable the Consultant to expeditiously process the quotation and issue a Change Order will not be grounds for any additional change to Contract time.
- .10 If, in your opinion, changes or revisions to the work should be made, inform the Consultant in writing and, if the Consultant agrees a Notice of Change will be issued.
- .11 Do not execute any change or revision until written authorization for the change or revision has been obtained.

#### **1.20 NOTICE FOR REQUIRED FIELD REVIEWS**

- .1 Whenever there is a requirement for the Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect the work for deficiencies prior to Substantial Performance, for commissioning demonstrations, and any other such field review, give the Consultant adequate notice in writing.
- .2 If the Consultant is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until the Consultant advises that it may be concealed.
- .4 When the Consultant is requested to perform a field review and the work is not ready to be reviewed, reimburse the Consultant for all time and travel expenses.

#### **1.21 SCAFFOLDING, RIGGING, AND HOISTING**

- .1 Unless otherwise specified or directed, supply, erect and operate all scaffolding, rigging, hoisting equipment and associated hardware required for your work. Immediately remove from the site all scaffolding, rigging, and hoisting equipment when no longer required.
- .2 Do not place major erection loads on any portion of the structure without approval from the Consultant.

#### **1.22 TRIAL USAGE**

- .1 When directed by the Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with the Specification and governing Codes and Regulations, prior to Substantial Performance of the work.
- .2 When, in the opinion of the Consultant, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 All tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment or system due to the test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in the Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from the site and replace them with acceptable equipment and/or products, at no additional cost.

### **1.23 PROJECT CLOSEOUT SUBMITTALS**

- .1 Prior to application for Substantial Performance, submit all required items and documentation specified, including the following:
  - .1 Approved Backflow Preventer test reports.
  - .2 Potable water disinfection test report.
    - .1 Site service piping.
    - .2 Building service piping.
  - .3 Fire Protection Engineers Occupancy Schedule.
  - .4 All other contractor retained Engineers signed and sealed close out documents.
  - .5 Approved air and water balancing reports.
  - .6 Piping pressure test reports for all systems.
  - .7 Duct pressure tests reports for all systems.
  - .8 Approved equipment and system start-up reports.
  - .9 Approved controls system start-up and commissioning reports.
  - .10 Certification and calibration reports for all gas detection systems.
  - .11 Operating and Maintenance Manuals.
  - .12 As-built record drawings and associated data.
  - .13 Extended warranties for equipment as specified.
  - .14 Identified keys for mechanical equipment and/or panels for which keys are required, and all other items required to be submitted.

- .15 Written responses from the contractor as to how they are addressing the outstanding deficiencies noted on the consultant pre-substantial completion field review reports.
- .2 **Operating and Maintenance Manuals:** Submit three hard copies and digital copy of operating and maintenance manuals. Hard copies shall be consolidated in hardcover three "D" ring binders, each binder sized to include approximately 25% spare space for future data, and identified permanently with the Project name, "MECHANICAL OPERATING AND MAINTENANCE MANUAL" wording, and the date. Manuals are to include the following:
  - .1 An Introduction sheet listing the Consultant's, Contractor's, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses.
  - .2 A Table of Contents sheet, and corresponding index tab sheets.
  - .3 A copy of each "Reviewed" or "Reviewed as Noted" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, and the email address for local source of parts and service.
  - .4 Pressure test reports, and certificates issued by governing authorities.
  - .5 Contractor warranties with warranty start date.
    - .1 Copies of all extended warranties.
  - .6 **Operating Data:** Operating data is to include:
    - .1 A description of each system and its controls.
    - .2 Control schematics for equipment/systems including building environmental controls.
    - .3 If applicable, the building automation system (BAS) architecture and all required operating data.
    - .4 Description of operation of each system at various loads together with reset schedules and seasonal variances.
    - .5 Operation instruction for each system and each component.
    - .6 Final system operating pressures.
      - .1 System operating pressures.
      - .2 Pump system head.
      - .3 Domestic water booster pump discharge pressures.
      - .4 Expansion tank pre-charge pressures.
      - .5 Air handling unit discharge pressure.
      - .6 Pressure reducing valve discharge pressure.
      - .7 Pressure relief valve relief pressures.



- .7 Description of actions to be taken in event of emergencies and/or equipment failure.
- .8 Valve tag schedule, and flow diagrams to indicate valve locations.
- .9 Fire damper / fire smoke damper schedule and locations.
- .10 Motorized damper schedule and locations.
- .7 **Maintenance Data:** Maintenance data is to include:
  - .1 Servicing maintenance, operation and trouble-shooting instructions for each item of equipment and each system.
  - .2 Schedules of tasks, frequency, tools required, and estimated task time.
  - .3 Complete parts lists with numbers.
  - .4 Consumable parts list.
    - .1 Belt types and sizes.
    - .2 Air system filters type and sizes.
    - .3 Water system filters type and sizes.
- .8 **Performance Data:** Performance data is to include:
  - .1 Equipment and system start-up data sheets.
  - .2 Equipment performance verification test results, and final commissioning report.
  - .3 Final testing adjusting and balancing reports.
- .9 **Review Submittal:** Assemble one copy of the O & M Manual and submit to the Consultant for review prior to Owner training and instructions, and assembling the remaining copies. Incorporate all comments into the final submission.
- .10 **Digital O & M Manuals:** Submit digital versions of the hard copy manual using the latest version of Adobe Acrobat Portable Document Format. Digital copies shall be fully indexed with bookmarks and in searchable format. The digital copies are to be copied to USB key with custom labels which indicate the project name, date, the Consultant's name, and "Operating & Maintenance Manual for Mechanical Systems" and included in each hard copy manual.
- .3 **Record "As-Built" Drawings and Data:** As work progresses at the site, clearly mark in red in a neat and legible manner on a set of prints of the Contract Drawings, all significant changes and deviations from the routing of services and locations of equipment shown on the Contract Drawings and resulting from the issue of Addenda, Site Instructions, Change Orders, and job conditions. Use notes marked in red as required. Maintain the white print red line as-built set at the site for the exclusive use of recording as-built conditions, keep the set up-to-date at all times, and ensure that the set is always available for periodic review. The as-built set is also to include the following:
  - .1 The dimensioned location of all inaccessible concealed work.

- .2 The locations of control devices with identification for each.
- .3 The location of all piping system air vents and water hammer arrestors.
- .4 The location and tag identification for all tagged valves.
- .5 For underground piping, including service entrance/exit piping, record dimensions, invert elevations, all offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks that will be preserved after construction is complete.
- .6 For fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings.
- .7 The location of all concealed services terminated for future extension.
- .8 **Digital Record "As-Built" Drawings:** When work on site is complete, transfer all the as-built red line information from the site as-built drawings to a recordable and identified CAD USB key with CAD work of equal quality to the Contract Drawings.
- .9 **Review and Submittal:** Prior to inspection for Substantial Performance of the work, submit for review, the red line site as-built prints, a CAD file of the as-built drawings, and a bound set of prints. (of equal quality to the Contract Drawings) The Consultant will review the drawings and, if necessary, return the files and the marked-up prints for corrections or further revisions, in which case complete the corrective and/or revision work and resubmit the disc and prints until they are determined to be acceptable, all prior to issue of a Certificate of Substantial Performance.

#### **1.24 PROGRESS PAYMENT BREAKDOWN**

- .1 Submit, prior to submittal of the first progress payment draw, a breakdown of the cost of the mechanical work to assist the Consultant in reviewing and approving monthly progress payment claims.
- .2 The payment breakdown is subject to the Consultant's approval and progress payments will not be processed until an approved breakdown is in place. The breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, and project closeout submittals.
- .3 Equipment, material and labour costs are to be indicated for site services (if applicable), plumbing and drainage, fire protection, HVAC piping, HVAC sheet metal, controls, and insulation work, on a floor-by-floor basis in the same manner as they will be indicated on the monthly progress draw.

#### **1.25 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS**

- .1 All professional engineers retained by you to perform consulting services with regard to your work, including but not limited to , fire protection engineer, structural engineer, expansion compensation engineer, hydronic system engineer are to be members in good standing with the local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of the governing authorities in the locale of the work.

- .2 Your engineer's professional liability insurance is to protect your Consultants and Sub-Consultants, and their respective servants, agents, and employees against any loss or damage resulting from the professional services rendered by your Consultants, Sub-Consultants, and their respective servants, agents, and employees in regards to the work of this Contract.
- .3 Liability insurance requirements are as follows:
  - .1 Coverage is to be a minimum of \$5,000,000.00 inclusive of any one occurrence.
  - .2 The insurance policy is not to be cancelled or changed in any way without the insurer giving the Owner a minimum of thirty days written notice.
  - .3 Liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the location of the work.
  - .4 Evidence of the required liability insurance in such form as may be required is to be issued to the Owner, the Owner's Consultant, and Municipal Authorities as required prior to commencement of your Consultant's services.

#### **1.26 CORRECTION PERIOD**

- .1 Prior to Substantial Completion, furnish a written commitment that if, within one year after the date of the Correction Period start date as defined in Division 01, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. Furnish a written commitment to provide all materials and labour required to fully correct defective workmanship or materials supplied under Division 20, 21, 22, 23 or 25 for a period of one (1) year starting from the date of substantial performance of the work in accordance with the requirements specified.

#### **1.27 WARRANTIES**

- .1 All extended warranties specified in mechanical work Sections of the Specification are to be full parts and labour warranties, at the site, and in accordance with requirements of the Contract warranty, but direct from the equipment manufacturer/supplier to the Owner. Submit signed and dated copies of extended warranties which clearly state requirements specified above.

#### **1.28 EQUIPMENT AND MATERIAL MANUFACTURER REQUIREMENTS**

- .1 Equipment and materials scheduled or specified on the drawings or in the Specification have been selected to establish a performance and quality standard.
- .2 In most cases acceptable equipment and material manufacturers are listed for any product specified by manufacturer's name and model number. Unless otherwise stated the bid price may be based on products supplied by any of the manufacturers named as acceptable for the particular product. If acceptable manufacturers are not listed for a particular product, base the bid price on the products supplied by the specified manufacturers.

- .3 If products supplied by a manufacturer named as acceptable are used in lieu of the products specified by manufacturer's name and model number, ensure that the product is equivalent in performance, quality of construction, materials of construction, energy efficiency and operating characteristics to the specified product. Pay for any additional costs and changes to associated or adjacent work resulting from the use of products supplied by a manufacturer other than the specified manufacturer. In addition, in equipment spaces where products named as acceptable are used in lieu of the specified products and the dimensions of such products differ from the specified products prepare and submit for review, if requested, accurately dimensioned layouts of the rooms affected to prove that all the equipment in the room will fit properly without revisions to other disciplines layouts, loss of serviceability, size, electrical service requirements and structural requirements.

### **1.29 LIST OF ACCEPTABLE MANUFACTURERS AND SUPPLIERS**

- .1 Within five (5) working days after award of a Contract, submit to the Consultant for review, a list to indicate the name of the manufacturers/suppliers that have been propose to be used for each item of equipment, material, or service listed, except for items such as pipe and fittings, insulation, and similar products.

### **1.30 ALLOWANCES**

- .1 Include in the bid amount a prime cost allowance in the amount of \$ .
- .2 The allowance is for .
- .3 The amount of the allowance is to be net and is to include all product and material costs (less applicable trade discounts), including delivery to the site and all applicable taxes.
- .4 All other costs, including unloading and handling at the site, installation, overhead and profit and all other burdens are to be included in the allowance.
- .5 Whenever costs are more or less than the amount of the allowance, the Contract amount will be adjusted accordingly by Change Order.
- .6 Materials and products under the allowance will be selected by the Owner in sufficient time to avoid delays to the work, and the Owner reserves the right to take all or any part of the allowance out of the Contract amount at any time.

### **1.31 IDENTIFIED PRICES**

- .1 Identified prices for work consist of alternative prices, separate prices, and itemized prices. Definitions of these prices are as follows:
  - .1 **Alternative Price(s):** An alternative price is the difference in the bid amount (plus or minus) for substituting specified work or products for alternative work or products.
  - .2 **Separate Price(s):** A separate price is the amount of money to be added to the bid amount for new work not included as part of the Bid Documents.
  - .3 **Itemized Price(s):** An itemized price is the amount of money included in the bid amount for work as described and required for information purposes only.

### **1.33 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION**

- .1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for the equipment/system manufacturer's authorized representative to visit the site to examine the installation, and when any required corrective measures have been made, to certify in writing to the Consultant that the equipment/system installation is complete and in accordance with the equipment/system manufacturer's instructions.

#### **1.34 EQUIPMENT AND SYSTEM START-UP**

- .1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with the following requirements:
  - .1 Submit a copy of each equipment/system manufacturer's start-up report sheet to the Consultant for review, and incorporate any comments.
  - .2 Under direct on-site supervision and involvement of the equipment/system manufacturer's representative, start-up the equipment/systems, make any required adjustments, document the procedures, leave the equipment/systems in proper operating condition, and submit a complete set of start-up documentation sheets signed by the manufacturer/supplier and the Contractor.

#### **1.35 EQUIPMENT AND SYSTEM COMMISSIONING**

- .1 After successful start-up and prior to Substantial Performance, commission the mechanical work in accordance with requirements of CSA Z320, Building commissioning. Use commissioning sheets included with the CSA Standard. Submit final commissioning data sheets, TAB reports, project closeout documents, and other required submittals.

#### **1.36 EQUIPMENT AND SYSTEM O & M DEMONSTRATION & TRAINING**

- .1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.
- .2 Train the Owner's designated personnel in all aspects of operation and maintenance of equipment and systems as specified in mechanical work Sections of the Specification. All demonstrations and training are to be performed by qualified technicians employed by the equipment/system manufacturer/supplier.
- .3 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Operating and Maintenance Manuals are to be used during the training sessions, and training modules are to include:
  - .1 **Operational Requirements and Criteria:** Requirements and criteria are to include but not be limited to equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations.
  - .2 **Troubleshooting:** Troubleshooting is to include but not be limited to diagnostic instructions, test and inspection procedures.
  - .3 **Documentation:** Documentation is to include but not be limited to equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like.
  - .4 **Maintenance:** Maintenance requirements are to include but not be limited to inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools.

- .5 **Repairs:** Repair requirements are to include but not be limited to diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .4 Assemble the training modules into a training manual and submit a copy to the Consultant for review prior to scheduling training. Ensure that each participant in each training session has all required training material.
- .5 Schedule demonstrations and training at mutually agreed to times with a minimum of seven working days' notice.
- .6 Provide a follow-up training session at the Owner's request prior to the one (1) year anniversary of Substantial Performance.
- .7 **Training Session Video:** For equipment/system demonstration and training sessions as specified in mechanical work Sections, submit an identified digital video of the session prepared by a professional videographer with construction project technical training session experience.
- .8 **Demonstration and Training Confirmation:** Obtain a list of personnel to receive demonstration and training from the Owner, and have each participant sign the list to confirm that he/she understood the demonstration and training session.

**2 PRODUCTS**

NOT APPLICABLE

**3 EXECUTION**

NOT APPLICABLE

**END OF SECTION**

**1 GENERAL**

**1.01 APPLICATION**

- .1 This Section specifies requirements, criteria, methods and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

**1.02 SUBMITTALS**

- .1 Submit documentation to confirm that reclaimed refrigerant has been properly removed and stored, recycled, or disposed of as applicable.

**1.03 REFERENCE STANDARDS**

- .1 Perform demolition work in accordance with requirements of CAN/CSA-S350, Code of Practice for Safety in Demolition of Structures.

**2 PRODUCTS**

**2.01 NOT APPLICABLE**

**3 EXECUTION**

**3.01 DISCONNECTION AND REMOVAL OF EXISTING MECHANICAL WORK**

- .1 Where indicated on the drawings, disconnect and remove existing mechanical work, including hangers, supports, insulation, etc. Disconnect at the point of supply, remove obsolete connecting services and make the system safe. Cut back obsolete piping behind finishes and cap water-tight unless otherwise specified.
- .2 The scope and extent of the demolition or revision work is only generally indicated on the drawings. Estimate the scope, extent and cost of the work at the site during the bidding period scheduled site visit(s).
- .3 Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at the site during bidding period site visits will not be allowed.
- .4 If existing isolation valves are not available to isolate sections of piping to be removed, provide such valves as required. Determine this requirement at the site during the bidding period.
- .5 Where existing valves are removed, remove the valve tags, revise existing valve tag charts, and hand the obsolete tags to the Owner.
- .6 If any re-design is required due to discrepancies between the mechanical drawings and site conditions, notify the Consultant who will issue a Site Instruction. If, in the opinion of the Consultant, discrepancies between the mechanical drawings and actual site conditions are of a minor nature, the required modifications are to be done at no additional cost.

- .7 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain the services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during the renovation work, so as to be concealed behind new or existing finishes.
- .8 Unless otherwise specified, remove from the site and dispose of all existing materials which have been removed and are not to be relocated or reused.

### **3.02 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS**

- .1 Co-ordinate all shut-down and interruption to existing mechanical systems with the Owner. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning.
- .2 Upon award of contract, submit a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform the Owner in writing seventy-two hours in advance of the proposed shut-down or interruption and obtain written approval to proceed. Do not shut-down or interrupt any system or service without such written approval.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible, and, prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.
- .5 **Pipe Freezing:** Pipe freezing may be used to connect new piping to existing piping without draining the existing piping. Pipe freeze equipment is to be equal to "NORDIC FREEZE" CO<sup>2</sup> equipment supplied by Mag Tool Inc. or Rigid Tool Co. RIGID "SuperFreeze".

**END OF SECTION**



## 1 GENERAL

### 1.01 APPLICATION

- .1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each applicable Section and is to be read accordingly.

### 1.02 SUBMITTALS

- .1 **Name and Qualifications of Testing and Balancing Agency:** Within thirty-days of work commencing at the site, submit the name and qualifications of the proposed testing and balancing agency in accordance with requirements of the article entitled Quality Assurance below.
- .2 **Sample Test Forms:** Submit sample test forms, if other than those standard forms prepared by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) are proposed for use.
- .3 **Drawing Evaluation Report:** Submit a report by the Agency to indicate the Agency's evaluation of the mechanical drawings with respect to service routing and location or lack of balancing devices. Include the set of drawings used and marked-up by the Agency to prepare the report.
- .4 **List of Testing and Balancing Instruments:** Submit a list of testing and balancing instruments and for each instrument, indicate the purpose of the instrument and include a recent calibration certificate.
- .5 **Site Visit Reports:** Submit a report by the Agency after each site visit made by the Agency during the construction phase of this Project.
- .6 **Draft Report:** Submit a draft report, as specified in Part 3 of this Section.
- .7 **Final Report:** Submit a final report, as specified in Part 3 of this Section.
- .8 **Warranty:** Submit a testing and balancing warranty as specified in Part 3 of this Section.
- .9 **Post Construction Site Visit Reports:** Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

### 1.03 DEFINITIONS

- .1 The following are definitions of words used in this Section:
  - .1 "TAB" – means testing, adjusting and balancing to determine and confirm quantitative performance of equipment and systems and to regulate the specified fluid flow rate and air patterns at the terminal equipment, e.g., reduce fan speed, throttling, etc.
  - .2 "Hydronic systems" – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.
  - .3 "Air systems" – includes all outside air, supply air, return air, exhaust air, and relief air systems.
  - .4 "Flow rate tolerance" – means the allowable percentage variation, minus to plus, of actual flow rate values in the Contract Documents.

- .5 “Report forms” – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form the permanent record to be used as the basis for required future testing, adjusting and balancing.
- .6 “Terminal” – means the point where the controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- .7 “Main” – means the duct or pipe containing the system’s major or entire fluid flow.
- .8 “Sub-main” – means the duct or pipe containing part of the systems’ capacity and serving two or more branch mains.
- .9 “Branch main” – means duct or pipe servicing two or more terminals.
- .10 “**B**branch” – means duct or pipe serving a single terminal.

#### **1.04 QUALITY ASSURANCE**

- .1 **Testing and Balancing Agency:** (the “Agency”) Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems to produce the design objectives. The testing, adjusting and balancing agency is to have successfully completed testing, adjusting and balancing of mechanical systems for a minimum of five projects similar to this Project within the past three years, and is to be certified as an independent agency **in all required categories** by one of the following:
  - .1 AABC - Associated Air Balance Council.
  - .2 NEBB - National Environmental Balancing Bureau.
- .2 **Standards:** Testing, adjusting and balancing of the complete mechanical systems is to be performed over the entire operating range of each system in accordance with one of the following publications:
  - .1 National Standards for A Total System Balance published by the Associated Air Balance Council.
  - .2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by the National Environmental Balancing Bureau.
  - .3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

## **2 PRODUCTS**

### **2.01 TESTING EQUIPMENT**

- .1 The Testing and Balancing Agency is to supply all instruments and test equipment required to conduct testing, balancing and commissioning.

### **3 EXECUTION**

#### **3.01 PREPARING FOR TESTING AND BALANCING**

- .1 Bring the work to an operating state and ready for balancing, including:
  - .1 Clean equipment and ductwork.
  - .2 Install air terminal devices.
  - .3 Provide temporary filters in air handling equipment and carry out a rough air balance to ensure all equipment performs required function.
  - .4 Replace filters with specified filters immediately prior to balancing air systems.
  - .5 Verify lubrication of equipment.
  - .6 Install permanent instrumentation.
  - .7 Clean piping systems, drain and fill with clean treated heat exchange fluid.
  - .8 Complete the "start-up" of equipment.
  - .9 Adjust stuffing boxes and packing glands on pumps and valves.
  - .10 Remove temporary strainers and install permanent strainers prior to fluid system balancing.
  - .11 Check rotation and alignment of rotating equipment and tension of belted drives.
  - .12 Verify ratings of overload heaters in motor starters.
  - .13 Set control points of automatic apparatus, check out sequence of operation.
  - .14 Clean work, remove temporary tags, stickers, and coverings.

#### **3.02 COORDINATING WITH TESTING AND BALANCING AND COMMISSIONING AGENT**

- .1 Allow Balancing Agency and Commissioning Agents free access to the site during the construction phase and inform them of any major changes made to the systems.
- .2 Provide and install any additional balancing valves, dampers, pulleys, sheaves and other materials necessary to properly adjust systems to design flow.
- .3 Provide Balancing Agency and Commissioning Agents a complete set of mechanical drawings and specifications, one (1) copy of Maintenance Manuals especially for use in balancing.
- .4 Make corrections to the work recommended by the Balancing Agency and Commissioning Agents.

#### **3.03 TESTING AND BALANCING SCOPE OF WORK**

- .1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as

required to meet design specifications and comfort conditions, and recording and reporting the results.

- .2 Mechanical systems to be tested, adjusted and balanced include:
  - .1 **Domestic Water Systems:** TAB of domestic water systems (all piping extended from the Municipal main) is to include:
    - .1 Domestic hot water recirculation piping.
    - .2 Tempered water piping flows.
  - .2 **Heating Systems:** TAB of heating systems is to include all piping and equipment fluid temperatures, flows and control, and if TAB is not done during the heating season, a follow-up site visit during the heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
  - .3 **Cooling Systems:** TAB of cooling systems is also to include all piping and equipment fluid temperatures, flows and control, and if TAB is not done during the cooling season, a follow-up site visit during the cooling season will be required to confirm proper flows and temperatures, and any required system "fine".
  - .4 **Air Handling Systems:** TAB of air handling systems is to include all equipment and ductwork air temperatures, capacities and flows.
    - .1 **Life Safety Functions:** TAB of all mechanical systems providing control of smoke movement or mechanical smoke venting, inclusive of air handling units, fans, dampers, ducts, actuators and all other elements of the complete system to ensure satisfactory operation in accordance with the procedures described in MMAH Supplementary Standard SB-4, "Measures for Fire Safety in High Buildings". Coordinate fully with fire alarm system testing to commission integrated fire protection and life safety systems as per all requirements of Standard CAN/ULC-S1001.
  - .5 **Fuel Oil System:** TAB of the fuel oil system is to include supply and return oil flows as applicable, and is to be in accordance with requirements of CAN/CSA-B139.

### **3.04 TESTING, ADJUSTING AND BALANCING**

- .1 **General Requirements:** Conform to the following requirements:
  - .1 As soon as possible after award of Contract, the Agency is to carefully examine a white print set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing the results of the evaluation.
  - .2 The set of drawings examined by the Agency is to be returned with the evaluation report, with red line mark-ups to indicate locations for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices.
  - .3 After review of the mechanical work drawings and specification, the Agency is to visit the site at frequent, regular intervals during construction of the mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting and balancing.

- .4 After each site visit, the Agency is to report results of the site visit indicating the date and time of the visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing.
- .5 Testing, adjusting and balancing is not to begin until:
  - .1 Building construction work is substantially complete and doors have been installed.
  - .2 Mechanical systems are complete in all respects, and have been checked, started, and adjusted.
- .6 All mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing.
- .7 Obtain copies of reviewed shop drawings of all applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences.
- .8 The Agency is to walk each system from the system "head end" equipment to terminal units to determine variations of installation from design, and the system installation trades will accompany the Agency.
- .9 The Agency is to check all valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment.
- .10 Wherever possible, the Agency is to lock all balancing devices in place at the proper setting, and permanently mark settings on all devices.
- .11 For belt-driven equipment, the Agency is to report to the Commissioning Agent who in turn is to inform the Contractor and Consultant of any situation where sheaves have to be replaced to suit testing and balancing, and replacements are to be done by the Contractor at no cost.
- .12 **Noise:** The Agency is to balance all systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at the design conditions, the Agency is to immediately report the problem and submit data, including sound readings, to permit an accurate assessment of the noise problem to be made.
- .13 **Stratification:** The Agency is to check all supply air handling system mixing plenums for stratification, and where the variation of mixed air temperature across coils is found to be in excess of  $\pm 5\%$  of design requirements, the Agency is to report the problem and issue a detail sketch of plenum baffle(s) required to eliminate the stratification.
- .14 **Tolerances:** The Agency is to perform testing, adjusting and balancing to within  $\pm 5\%$  of design values, and make and record measurements which are within  $\pm 2\%$  of actual values.
- .15 **Filters** for all air handling systems equipped with air filters, test and balance the systems with simulated 50% loaded (dirty) filters by providing a false pressure drop.
- .16 **Seasonal requirements:** Test, adjust and balance air conditioning systems during the summer season and heating systems during winter season, including at least a

period of operation at outside conditions within 2.8° C (5° F) wet bulb temperature of maximum summer design condition, and within 5.5° C (10° C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.

- .2 **Preparation of Reports:** Prepare reports as indicated below.
  - .1 **Draft Reports:** Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit three complete sets of draft reports. Only one complete set of draft reports will be returned.
  - .2 **Final Report:** Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 3 complete sets of final reports. Use units of measurement (SI or Imperial) as used on the Project Documents.
  - .3 **Report Format:** Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the divisions listed below, separated by divider tabs:
    - .1 General Information and Summary
    - .2 Plumbing Systems
    - .3 Air Systems
    - .4 Hydronic Systems
    - .5 Temperature Control Systems
    - .6 Special Systems
  - .4 **Report Contents:** The Agency is to provide the following minimum information, forms and data:
    - .1 Inside cover sheet to identify the Agency, the Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of the instrumentation used for the procedures along with the proof of calibration.
    - .2 The remainder of the report is to contain the appropriate forms containing as a minimum, the information indicated on the standard AABC or NEBB report forms prepared for each respective item and system.
    - .3 The Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying all equipment, terminals, and accessories.
    - .4 The Agency is to include report sheets indicating building comfort test readings for all rooms.
- .3 **Verification of Reports:** After the final testing and balancing report has been submitted, the Agency is to visit the site with the Contractor, Commissioning Agent, Consultant to

spot check results indicated on the balancing report. The Agency is to supply all labour, ladders, and instruments to complete spot checks. Note that if results of spot checks do not, on a consistent basis, agree with the final report, the spot check procedures will stop and the Agency is to then rebalance the systems involved, resubmit the final report, and again perform spot checks with the Contractor, Consultant, and Commissioning Agent.

- .4 **Certification and Warranty:** When the final report has been accepted, the Contractor is to submit to the Owner, in the name of the Owner, a certificate equal to the AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, the Contractor is to submit a written extended warranty from the Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with the exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by the Agency and reported on to the Owner, and if it is determined that the problems are a result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to the Owner.
- .5 **Post Balancing Site Visits:** After acceptance of the final report, the Agency is to perform post testing and balancing site visits in accordance with the following requirements:
  - .1 Post testing and balancing site visits are to be made:
    - .1 Once during the first month of building operation.
    - .2 Once during the third month of building operation.
    - .3 Once between the fourth and tenth months in a season opposite to the first-and third-month visit.
  - .2 During each return visit and accompanied by the Owner's representative, the Agency is to spot rebalance terminal units as required to suit building occupants and eliminate complaints.
  - .3 The Agency is to schedule each visit with the Contractor, Owner and Commissioning Agent, and inform the Consultant.
  - .4 After each follow-up site visit, the Agency is to issue to the Contractor and Consultant a report indicating any corrective work performed during the visit, all abnormal conditions and complaints encountered, and recommended corrective action.

**END OF SECTION**

## 1 GENERAL

### 1.01 ABBREVIATIONS AND DEFINITIONS

.1 Abbreviations used in this Specification are as follows:

- .1 BAS Building Automation System
- .2 DDC Direct Digital Controls
- .3 LAN Local Area Network
- .4 PC Personal Computer

### 1.02 SUBMITTALS

.1 **Shop Drawings/Product Data:** Submit shop drawings/product data sheets for all BAS components. Shop drawings/product data sheets must confirm that the components proposed meet all requirements of the Contract Documents. As a minimum, submit the following:

- .1 BAS network architecture, including all modes and interconnections.
- .2 Systems schematics, sequences, and flow diagrams.
- .3 Points schedule for each point in the BAS, including point type, object name, expanded ID, display units, controller type, and address.
- .4 Samples of graphic display screen types and associated menus.
- .5 Floor plans indicating planned locations for all BAS panels.
- .6 A detailed Bill of Materials for each system or application, identifying quantities, part numbers, descriptions, and optional features.
- .7 Control damper schedule including a separate line for each damper and a column for each of the damper attributes including code number, fail position, damper type, damper operator, duct size, damper size, mounting and actuator type.
- .8 Control valve schedules including a separate line for each valve and a column for valves as for control dampers.
- .9 A room schedule including a separate line for each HVAC terminal unit indicating type, location and address.
- .10 Details of all BAS interfaces and connections to other systems.
- .11 Product data sheets or marked catalogue pages including part number, photograph and description for all BAS hardware and software.

.2 **Site Inspection and Start-Up Report:** Submit a site inspection and start-up report from the manufacturer's representative as specified in Part 3 of this Section.

.3 **Portable Operator's Terminal:** At the time of start-up and commissioning of the BAS, supply portable operator's terminal(s) as specified in Part 2 of this Section and hand to the Owner at the site. Ensure that the Owner signs for receipt of the terminal(s).



### **1.03 DESCRIPTION OF THE BUILDING AUTOMATION SYSTEM**

- .1 The building automation system is to consist of a modular, BACnet protocol, open architecture system incorporating direct digital control and monitoring of equipment and systems and consisting of all hardware and software required for the complete system. The BAS is to be accessible through standard personal computers within the building through a wireless application protocol device, or remotely through the Internet by means of a standard web browser.
- .2 The BAS is to be field expandable, with an architectural design to eliminate dependence upon any single device for alarm reporting and control execution. Failure of any single component or network connection is not to interrupt the execution of control strategies at other operational devices. The BAS is to maintain all settings and overrides through a system re-boot, and is to incorporate, as a minimum, the following integrated features, functions and services:
  - .1 Operator information, alarm management, and control features.
  - .2 Enterprise-level information and control access.
  - .3 Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
  - .4 Diagnostic monitoring and reporting of BAS functions.
  - .5 Off-site monitoring and management access.
  - .6 Energy management.
  - .7 Standard applications for terminal HVAC systems.
- .3 The BAS is to include, but not be limited to, the following:
  - .1 A personal computer-based operator work station with colour monitor for colour graphic displays, and a colour printer.
  - .2 A portable operator's terminal.
  - .3 Standalone network automation engine(s).
  - .4 Field equipment controllers.
  - .5 Input/output modules.
  - .6 Local display devices.
  - .7 Distributed user interfaces.
  - .8 Network processing, data storage and communication equipment.
  - .9 All other components required for a complete and operating BAS.

### **1.04 QUALITY ASSURANCE**

- .1 The BAS hardware and software is to be installed by experienced personnel employed and trained by the system equipment manufacturer/supplier. All system wiring is to be

installed by journeyman electricians or under direct on-site supervision of journeyman electricians.

- .2 The BAS supplier/installer is to have a branch facility with parts within a 100 km radius of the building and have available complete maintenance and support services on a 24-hour, 7 day-a-week basis.

## **2 PRODUCTS**

### **2.01 GENERAL RE: BUILDING AUTOMATION SYSTEM**

- .1 **Control System Components:** Control system components (field devices) other than those specified in this Section are generally specified in the mechanical work Section entitled Automatic Control Systems. Component's factory installed with equipment or supplied with equipment are specified in mechanical work Sections with the equipment.
- .2 **Acceptable BAS Manufacturers:** The BAS specified in this Section is a Tridium Niagara Framework modular, expandable DDC building automation system as per drawing control diagrams and sequences, and points lists. Acceptable BAS controls manufacturers are listed in the Section titled "Alternative Equipment and Suppliers".
  - .1 Delta Controls Inc.
  - .2 Automated Logic
  - .3 Honeywell International
  - .4 Alerton
  - .5 Reliable Controls Corp.
  - .6 Delta Controls
  - .7 Schneider

## 2.02 BAS ARCHITECTURE

- .1 **Automation Network:** The BAS is to be based on a minimum PC industry standard of Ethernet TCP/IP, ensuring speeds will be acceptable to provide adequate control of all remote devices. Where used, LAN controller cards are to be standard "off-the-shelf" products available through normal PC vendor channels. The BAS is to be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication. The BAS is to be compatible with other enterprise-wide networks, and where indicated, the BAS is to be connected to the enterprise network and share resources with it by way of standard networking devices and practices.
- .2 **Control Network:** Network automation engines are to provide supervisory control over the control network and are to support the BACnet Standard MS/TP bus communication protocol (ASHRAE SSPC-135, Clause 9). The control networks are to provide either a "peer-to-peer", master-slave, or supervised token passing communications and are to operate at a minimum communication speed of 9600 baud. DDC controllers are to reside on the control network.
- .3 **Integration:** The BAS is to include appropriate hardware and software to allow BACnet bi-directional data communications between the BAS and building equipment/system control panels. The BAS is to receive, react to, and return information from the equipment and systems. All data required by the application is to be mapped into the automation engine's data base and is to be transparent to the operator. Point inputs and outputs from building equipment/system control panels is to have real-time inter-operability with BAS software features such as control software, energy management, custom process programming, alarm management, historical data and trend analysis, totalization, and local area network communications.

## 2.03 DISTRIBUTED WEB BASED USER INTERFACE

- .1 All features and functions of the dedicated web-based user interface described above are to be available on any computer connected directly or via a wide area or virtual private network to the BAS network, which conforms to the following specifications:
  - .1 The software is to run on Microsoft Internet Explorer (10 or higher), Chrome, Firefox, and Edge, on a computer meeting the following minimum hardware requirements:
    - .1 256 MB RAM.
    - .2 2.0 GHz clock speed Pentium 4 microprocessor.
    - .3 40.0 GB hard drive.
    - .4 Keyboard with 83 keys minimum.
    - .5 SVGA 1024 x 768 resolution display with 64K colours and 16-bit colour depth.
    - .6 Mouse or another pointing feature.

## 2.04 USER INTERFACE APPLICATION COMPONENTS

- .1 **Operator Interface:** An integrated browser-based client application is to be used as the user operator interface program. The system is to employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user. Additional features are as follows:

- .1 All inputs, outputs, set-points, and other parameters as defined in Part 3 of this Section, shown on the drawings, or required as part of the system software are to be displayed for operator viewing and modification from the operator interface software.
  - .2 The user interface software is to provide help menus and instructions for each operation and/or application.
  - .3 The system is to support customization of the user interface configuration and a home page for each operator.
  - .4 The system is to support user preferences in alarm, trend, display, and applications screen presentations.
  - .5 All controller software operating parameters are to be displayed for the operator to view/modify from the user interface, and these parameters are to include set-points, alarm limits, time delays, PID tuning constants, run times, point statistics, schedules, etc.
  - .6 The operator interface is to incorporate comprehensive support for functions including but not limited to the following:
    - .1 User access for selective information retrieval and control command execution.
    - .2 Monitoring and reporting.
    - .3 Alarm, non-normal, and return to normal condition annunciation.
    - .4 Selective operator override and other control actions.
    - .5 Information archiving, manipulation, formatting, display and reporting.
    - .6 BAS internal performance supervision and diagnostics.
    - .7 On-line access to HELP menus.
    - .8 On-line access to current BAS as-built records and documentation.
    - .9 Means for controlling, re-programming, and re-configuration of the BAS operation and for the manipulation of the BAS database information in compliance with applicable Codes and Regulations for individual BAS applications.
  - .7 The system is to support a list of application programs configured by the users that are called up by the Tools Menu, hyperlinks within the graphic displays, and key sequences.
  - .8 The operation of the control system is to be independent of the user interface, which is to be used for operator communication only.
- .2 **Navigation Trees:** The system is to have a minimum of five levels of nesting, and the capability of displaying multiple navigation trees to aid the operator in navigating throughout all systems and points connected, adding custom trees, defining any logical grouping of points and arranging them on a tree in any order, and nesting groups within other groups. The navigation trees are to be "dockable" to other displays such as graphics, meaning that the trees will appear as part of the display but can be detached and then minimized to the Windows task bar or closed altogether, however, a simple keystroke will reattach the navigation to the primary display of the user interface.

- .3 **Alarms:** Alarms are to be routed directly from network automation engines to PC's and servers, and it is to be possible for specific alarms from specific points to be routed to specific PC's and servers. The BAS is to annunciate diagnostic alarms indicating system failures and non-normal operating conditions annunciate application alarms as required by points lists and sequences, and as a minimum, permit four categories of alarm sounds customizable through user defined wav files. The alarm management segment of the user interface is to provide, as a minimum, the following alarm functions:
  - .1 Log, date, and time of alarm occurrence.
  - .2 Generate a "pop-up" window with audible alarm to inform a user that an alarm has been received.
  - .3 Permit a user with the appropriate security level to acknowledge, temporarily silence, or discard an alarm.
  - .4 Provide an audit trail on the PC hard drive for alarms by recording user acknowledgement, deletion or disabling of an alarm, the name of the user, the alarm, the action taken, and the time/date of the alarm.
  - .5 Facilitate the ability to direct alarms to an email address or alphanumeric pager, in addition to the pop-up window described above.
  - .6 Any attribute of any object in the system may be designated to report an alarm.
- .4 **Reports and Summaries:** Reports and summaries are to be generated and directed to the user interface displays with subsequent assignment to printers or discs. Summaries and reports are to be accessible via standard user interface functions, and selection of a single menu item, tool bar item, or tool bar button is to print any displayed report or summary. The system is to permit the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports. As a minimum the BAS is to provide the following reports and summaries:
  - .1 All points in the BAS.
  - .2 All points in each BAS application.
  - .3 All points in a specific controller.
  - .4 All points in a user-defined group of points.
  - .5 All points currently in alarm.
  - .6 All points locked out.
  - .7 All BAS schedules.
  - .8 All user defined and adjustable variables, schedules, interlocks, etc.
- .5 **Schedules:** A graphical display for time-of-day scheduling and override scheduling of building operations is to be provided, with weekly schedules for each group of equipment with a specific time use schedule, and it is to be possible to define one or more exception schedules for each schedule including reference to calendars, with monthly calendars provided to permit simplified scheduling of holidays and special days for a minimum of five years in advance, user selected with the pointing device or keyboard. Changes to schedules made from the user interface are to directly modify the network automation engine schedule database. Selection of a single menu item or tool bar button is to print any displayed schedule. As a minimum, the following functions are to be provided:
  - .1 Weekly schedules.

- .2 Exception schedules.
- .3 Monthly calendars.
- .6 **Passwords:** The BAS is to be complete with multiple-level password access protection to permit the user/manager to user interface control and display, database manipulation capabilities deemed appropriate for each user, based on an assigned password. Password access protection features are to include:
  - .1 Each user is to have a user name (24 characters minimum), a password (12 characters minimum), and access levels.
  - .2 Each user may change his or her password at any time.
  - .3 When editing or entering passwords the system is not to echo the actual characters for display on the monitor.
  - .4 A minimum of one hundred unique password is to be supported.
  - .5 Operators are to be able to perform only those commands available for their respective passwords, and display of menu selections is to be limited to only those items defined for the access level assigned to the password of each user.
  - .6 The BAS is to automatically generate a report of log-on/log-off and system activity for each user, and any action that results in a change in the operation or configuration of the control system is to be recorded, including the acknowledgement and deletion of alarms.
  - .7 A minimum of five levels of access is to be supported individually or in any combination of the following:
    - .1 Level 1 – View data
    - .2 Level 2 – Command
    - .3 Level 3 – Operator overrides
    - .4 Level 4 – Database modification
    - .5 Level 5 – Database configuration
    - .6 Level 6 – All privileges including password add/modify
- .7 **Screen Manager:** The user interface is to be equipped with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of four active display windows plus a network of user defined navigation trees.
- .8 **Dynamic Colour Graphics:** The graphics application program is to be an integral part of the user interface and is to include a create/edit function and a runtime function, and the system architecture is to support an unlimited number of graphic documents (graphic definition files) to be generated and executed. The graphics are to be capable of displaying and providing animation based on real-time data that is acquired, derived, or entered. Additional features include the following:
  - .1 **Graphics Runtime Functions:** A maximum of sixteen graphic applications are to be able to be executed at any one time on a user interface or workstation with four visible to the user, and each graphic application is to capable of the following functions:

- .1 All graphics are to be fully scalable.
  - .2 Graphics are to support a maintained aspect ratio.
  - .3 Multiple fonts are to be supported.
  - .4 A unique background is to be assigned on a per graphic basis.
  - .5 The colour of all animations and values on displays is to indicate the status of the object attribute.
- .2 **Operation From Graphics:** It is to be possible to change values (set-points) and states in the system-controlled equipment by using drop-down windows accessible via the pointing device.
  - .3 **Graphic Editing Tool:** A graphic editing tool is to be provided to permit the creation and editing of graphic files, and the graphic editor is to be capable of performing/defining all animations, defining all runtime binding, and:
    - .1 In general, facilitate the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
    - .2 Be capable of adding additional content to any graphic by importing backgrounds in the SVG, BMP, or JPG file formats.
  - .4 **Aliasing:** Many graphic displays representing part of the building and various building components are exact duplicates, with the exception that the various variables are bound to different field values, consequently, it is to be possible to bind the value of a graphic display to aliases, as opposed to physical field tags.
- .9 **Historical Trending and Data Collection:** Trend and change of value data is to be stored within the automation engines and uploaded to a dedicated trend database or exported in a selectable data format via a data export utility. Uploads to a dedicated database are to occur based on one of user-defined interval, manual command, or when the trend buffers are full. Exports are to be as requested by the user or on a time scheduled basis. The system is to be equipped with a configurable data storage sub-system for the collection of historical data which can be stored in either Microsoft Access or SQL database format. Each automation engine is to store, trend, and point history data for all analog and digital inputs and outputs as follows:
    - .1 Any point, physical or calculated, may be designated for trending, and methods of collection are to be defined time interval or a change of value.
    - .2 Each automation engine is to be capable of storing multiple samples for each physical point and software variable based on available memory, including an individual sample time/date stamp, and points may be assigned to multiple history trends with different collection parameters.
  - .10 **Trend Data Viewing and Analysis:** A trend viewing utility with access to all data points and the capability of defining trend study displays to include multiple trends is to be provided, and is to include:
    - .1 The capability of retrieving any historical database point for use in displays and reports by specifying the point name and associated trend name.
    - .2 Displays which are able to be single or stacked graphs with on-line selectable display characteristics such as ranging, colour, and plot style.

- .3 Display magnitude (zoom capability) and units selectable by the operator at any time without reconfiguration the processing or collection of data.
  - .4 Display magnitude is to be automatically scaled to show full graphic resolution of the data being displayed.
  - .5 Trend studies are to be capable of calculating and displaying calculated variables including highest value, lowest value, and time based.
  - .6 The display is to support the user's ability to change colours, sample sizes, and types of markers.
- .11 **Database Management:** The BAS is to be equipped with a database manager that separates the database monitoring and management functions by supporting two separate windows. Database secure access is to be accomplished using standard SQL authentication including the ability to access data for use outside of the BAS application. Additional features are as follows:
- .1 The database management function is to include summarized information on trend, alarm, event, and audit for backup, purge, and restore database management functions.
  - .2 The database manager is to support four tabs as follows:
    - .1 **Statistics**, which is to display database server information and trend, alarm (event), and audit information on the BAS database.
    - .2 **Maintenance**, which is to be an easy method of purging records from the BAS server trend, alarm (event), and audit databases by supporting separate screens for creating a backup prior to purging, selecting the database, and allowing for the retention of a selected number of day's data.
    - .3 **Backup**, which is to provide the means to create a database backup file and select a storage location.
    - .4 **Restore**, which is to provide a restricted means of restoring a database by requiring the user to log into an Expert Mode in order to view the Restore screen.
  - .3 The status bar is to appear at the bottom of the BAS database manager tabs and is to indicate information on the current display activity with icons as follows:
    - .1 Ready
    - .2 Purging Record from Database
    - .3 Action Failed
    - .4 Refreshing Statistics
    - .5 Restoring Database
    - .6 Shrinking A Database
    - .7 Backing-Up A Database
    - .8 Resetting Internet Information Services
    - .9 Shutting Down the BAS Device Manager



- .10 Action Successful.
- .4 The database manager monitoring functions are to be accessed through the Monitoring Settings window and are to continuously read database information once after the user has logged in.
- .5 The system is to advise the user via task bar icons and email messages when a database value has exceeded a warning or alarm limit.
- .6 The Monitoring Settings window is to have the following sections:
  - .1 **General**, to allow the user to set and review scan intervals and start times.
  - .2 **Email**, to allow the user to create and review email and telephone text messages to be delivered when a Warning or Alarm is generated.
  - .3 **Warning**, to allow the user to define the warning limit parameters, set the Reminder Frequency, and link the email message.
  - .4 **Alarm**, to allow the user to define the alarm limit parameters, set the Reminder Frequency, and link the email message.
  - .5 **Database Login**, to protect the system from unauthorized database manipulation by creating a Read Access and Write Access for each of the trend, alarm (event), and audit databases as well as an Expert Mode required to restore a database.
- .7 The Monitoring Settings taskbars to display the following informational icons:
  - .1 **Normal**, which indicates by colour and size that all databases are within their limits.
  - .2 **Warning**, which indicates by colour and size that one or more databases have exceeded their warning limit.
  - .3 **Alarm**, which indicates by colour and size that one or more databases have exceeded their alarm limit.
- .8 The BAS is to indicate via taskbar icons and email messages when a database value has exceeded a warning or alarm limit.
- .12 **Demand Limiting and Load Rolling**: The BAS is to be equipped with a demand limiting and load rolling program for the purpose of limiting peak energy usage and reducing overall energy consumption. The program is to support both Sliding Window and Fixed Window methods of predicting demand. Additional features are as follows:
  - .1 The system is to support three levels of sensitivity in the Sliding Window demand calculations for fine tuning the system, as follows:
    - .1 **Low Setting**, which sheds loads later and over the shortest period of time and maximizes the period of time the equipment is on.
    - .2 **Medium Setting**, which sheds loads earlier over a period of time greater than the Low Setting, and increases the time the equipment is on and decreases the probability of exceeding the "Tariff Target".

- .3 **High Setting**, which sheds loads earlier and over a longer period of time than the Medium Setting to minimize the probability of exceeding the "Tariff Target".
- .2 The system is to have both a Shed Mode and a Monitor Only Mode of operation, as follows:
  - .1 When the Shed Mode is engaged the system is to actively control the demand.
  - .2 When the Monitor Mode is engaged the system is to simulate the shedding action but will not take any action.
- .3 The Demand Limiting Program is to monitor the energy consumption rate and compare it to a user defined "tariff Target", and maintain the consumption below the target by selectively shedding loads based on a user defined strategy.
- .4 The Demand Limiting Program is to be capable of supporting a minimum of ten separate load priorities, with each load user assigned, and a minimum of twelve separate "Tariff Targets" defining the maximum allowed average power usage during the current interval.
- .5 The system is to support a maximum shed time for each load as determined by the user, and the system is to restore the load before the maximum shed time has expired.
- .6 The system is to support a minimum shed time for each load as determined by the user, and the system is not to restore the load before the minimum shed time has expired.
- .7 The system is to support a minimum release time for each load as determined by the user, and the system is not to shed the load until it has been off for the minimum release time.
- .8 The system is to support three user defined options if the meter does not function properly, as follows:
  - .1 Shedding – the currently shed loads will be released as their maximum shed time expires.
  - .2 Maintain the current shed rate – the system will use the demand limiting shed rate that was present when the meter began to function improperly.
  - .3 Use unreliable meter shed rate – the system is to control to a user defined unreliable shed rate target.
- .9 The Load Rolling Program is to sum the loads currently shed and compare the sum to a user defined load rolling target, and the system is to maintain consumption below the target by selectively shedding loads based on a user defined load priority.
- .10 The Load Rolling Program is to be capable of supporting a minimum of ten separate load priorities with each load user defined to a load priority.
- .11 The Load Rolling Program is to be capable of supporting a minimum of twelve separate "Tariff Targets" defining the amount of energy by which the demand must be reduced.

- .12 The system is to equip the user with a Load Tab that displays all the demand limiting and load rolling parameters for any selected load.
- .13 The system is to be complete with a Load Summary that displays all of the loads associated with the demand limiting and load rolling program, and status icons for each load are to indicate:
  - .1 Load Is Offline
  - .2 Load Is Disabled
  - .3 Load Is Shed
  - .4 Load Is Locked
  - .5 Load Is In Comfort Override
- .14 The Load Summary is to include a load summary runtime view listing the following load conditions:
  - .1 Load Priority
  - .2 Shed Strategy
  - .3 Load Rating
  - .4 Present Value
  - .5 Ineligible Status
  - .6 Active Timer
  - .7 Time Remaining
  - .8 Last Shed time

## 2.05 NETWORK AUTOMATION ENGINES

- .1 Network automation engines are to be UL/ULC listed and labelled; BACnet Testing Labs certified and labelled, fully user programmable supervisory controllers to monitor a network of a minimum of one hundred distributed application-specific controllers for a global strategy and direction and to communicate on a peer-to-peer basis with other network automation engines.
- .2 **User Interface:** Each network automation engine is to have the ability to deliver a web-based user interface as specified above, and all computers connected physically or virtually to the automation network are to have access to the web-based user interface. Additional characteristics/requirements are as follows:
  - .1 The web-based user interface software is to be imbedded in each network automation engine.
  - .2 Each network automation engine is to support a minimum of four concurrent users.
  - .3 The user is to be capable of accessing all system data through one network automation engine.
  - .4 Remote users connected to the network through an internet service provider or by telephone dial-up are also to have total system access through one network automation engine.

- .5 Each network automation engine is to be capable of generating web-based user interface graphics, and this capability is to be imbedded in the network automation engine.
- .6 The user interface is to support the following functions using a standard version of Microsoft Internet Explorer:
  - .1 Configuration
  - .2 Commissioning
  - .3 Data archiving
  - .4 Monitoring
  - .5 Commanding
  - .6 System diagnostics
- .7 Each network automation engine is to permit temporary use of portable devices without interrupting the normal operation of permanently connected modems.
- .3 **Processor:** Each network automation engine is to be a multi-tasking, multi-user, microprocessor based real time digital control processor sized to meet requirements of the system with a minimum word size of 32 bits, and standard operating systems.
- .4 **Memory:** Each network automation engine is to have sufficient memory to support its own operating system, databases, and control programs to provide supervisory control for all control level devices.
- .5 **Real Time Clock:** Each network automation engine is to include an integrated, hardware based real time clock.
- .6 **LED Indicators:** Each network automation engine is to be equipped with LED indicators to identify the following conditions:
  - .1 Power, On/Off
  - .2 Ethernet Traffic, Ethernet Traffic/No Ethernet Traffic
  - .3 Ethernet Connection Speed, 10 Mbps/100 Mbps
  - .4 FC Bus A, Normal Communications/No Field Communications
  - .5 FC Bus B, Normal Communications/No Field Communications
  - .6 Peer Communication, Data Traffic Between Network Automation Engines.
  - .7 Run, NAE Running/NAE in Start-up/NAE Shutting Down/Software Not Running.
  - .8 Battery Fault, Battery Defective/Data Protection Battery Not Installed.
  - .9 24 VAC, 24 VAC Present/Loss of 24 VAC.
  - .10 Fault, General Fault.
  - .11 Modem RX, NAE Modem Receiving Data.

- .12 Modem TX, NAE Modem Transmitting Data.
- .7 **Communications Ports:** Each network automation engine is to be equipped with ports for operation of operator input/output devices such as industry standard computers, modems, and portable operator's terminals. Ports are to be as follows:
  - .1 Two USB ports
  - .2 Two URS-232 serial data communication ports
  - .3 Two RS-485 ports
  - .4 One Ethernet port
- .8 **Diagnostics:** Each network automation engine is to continually perform self-diagnostics, communications diagnostics, and diagnostics of all pane components, and transmit both local and remote annunciation of any detected component failure, low battery condition, and repeated failures to establish communication.
- .9 **Power Failure:** In the event of loss of normal power each network automation engine is to continue to operate for a user adjustable period of up to ten minutes after which there is to be an orderly shut-down of all programs to prevent the loss of database or operating system software, and:
  - .1 During a loss of normal power, the control sequences are to go to the normal system shutdown conditions, and all critical configuration data is to be saved into Flash memory.
  - .2 Upon restoration of normal power and after a minimum off-time delay the controller is to automatically resume full operation through a normal soft-start sequence without manual intervention.

## 2.06 FIELD EQUIPMENT CONTROLLERS

- .1 Each field equipment controller is to be a fully user programmable BACnet Testing Labs certified and labelled digital controller that communicates via BACnet MS/TP protocol. Each controller is to be housed in a plenum rated plastic housing with removable base to permit pre-wiring of analog and binary input/output field points without the controller in place.
- .2 Each controller is to employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences, and are to be factory programmed with a continuous adaptive tuning algorithm that sense changes in the physical environment and continually adjusts loop tuning parameters appropriately.
- .3 Each field equipment controller is to:
  - .1 Include troubleshooting LED's to identify the following conditions:
    - .1 Power On.
    - .2 Power Off.
    - .3 Download or Start-Up In Progress-Not Ready For Normal Operation.
    - .4 No Faults.
    - .5 Device Fault.

- .6 Field Controller Bus-Normal Data Transmission.
- .7 Field Controller Bus-No Data Transmission.
- .8 Field Controller Bus-No Communication.
- .9 Sensor Actuator Bus-Normal Data Transmission.
- .10 Sensor Actuator Bus-No Data Transmission.
- .11 Sensor Actuator Bus-No Communication.
- .2 Support universal inputs, configured to monitor any of the following:
  - .1 Analog input, voltage mode.
  - .2 Analog output, current mode
  - .3 Analog input, resistive mode.
  - .4 Binary input, dry contact-maintained mode.
  - .5 Binary input, pulse counter mode.
- .3 Support binary inputs configured to monitor either of the following:
  - .1 Dry contact-maintained mode.
  - .2 Pulse counter mode.
- .4 Support analog outputs configured to output either of the following:
  - .1 Analog output, voltage mode.
  - .2 Analog output, current mode.
- .5 Support binary outputs, 24 VAC Triac.
- .6 Support configurable outputs capable of the following:
  - .1 Analog output, voltage mode.
  - .2 Binary output mode.
- .7 Have the ability to reside on a master-slave/token-passing field controller bus supporting BACnet standard protocol as follows:
  - .1 Support communications, including input/output communications between the field controllers and the network automation engines.
  - .2 Support a minimum of one hundred input/output modules and field equipment controllers in any combination.
  - .3 Operate at a maximum distance of 4560 m (15,000') between the field controller and the furthest connected device.
- .8 Have the ability to monitor and control a network of sensors and actuators over a master-slave/token-passing sensor-actuator bus supporting BACnet standard protocol as follows:
  - .1 The bus is to support a minimum of ten devices per trunk.

- .2 The bus is to operate at a maximum distance of 365 m (1200') between the field controller and the furthest connected device.
- .9 The capability of executing complex control sequences involving direct wired input/output points as well as input and output devices communicating over the field controller bus or sensor-actuator bus.
- .10 Support, but not limited to, the following:
  - .1 Hot water, chilled water/central plant applications.
  - .2 Custom air handling units for special applications.
  - .3 Terminal units.
  - .4 Special programs as required for systems control.
- .11 Support a password protected local controller LCD back-lit display with six key keypad as an integral part of the field controller or as a remote device communicating over the sensor-actuator bus to permit the user to view monitored points without logging into the system, and to view and change set-points, modes of operation, and parameters.

## **2.07 INPUT/OUTPUT MODULES**

- .1 Input/output modules to facilitate additional inputs and outputs for use in the field equipment controllers are to be similar to the field equipment controllers but less the display and with a minimum of four and a maximum of seventeen points.

## **2.08 SYSTEM CONFIGURATION TOOLS**

- .1 **System Configuration Tool:** The system configuration tool is a software package supplied with the BAS to enable a computer platform to be used as a stand-alone engineering configuration tool for a network automation engine and to permit programming of field equipment controllers. The configuration tool is to provide an archive database for the configuration and application data and is to have the same look and feel at the user interface regardless of whether the configuration is being done online or offline. Additional features and characteristics are as follows:
  - .1 The tool is to include:
    - .1 Basic system navigation tree for connected networks.
    - .2 Integration of system enabled devices.
    - .3 Customized user navigation trees.
    - .4 Point naming operator parameter setting.
    - .5 Graphic diagram configuration.
    - .6 Alarm and event message routing.
    - .7 Graphical logic connector tool for custom programming.
    - .8 Downloading, uploading, and archiving databases.
  - .2 The tool is to have the capability to automatically discover field devices on connected buses and networks.

- .3 The tool is to be capable of configuring from a library of standard applications, simulating to verify applications, and commissioning field equipment controllers and field devices.
- .4 The tool is to be complete with a Bluetooth Wireless Technology wireless access point to enable a wireless enabled portable computer to make a temporary Ethernet connection to the automation network.
- .2 **Wireless MS/TP Converter:** The Bluetooth Wireless Technology converter is to provide temporary wireless connection between the sensor-actuator bus or field-controller bus and a wireless enabled portable computer. The converter is to be powered through a connection to either the sensor-actuator bus or the field-controller bus and is to support downloading and troubleshooting field equipment controllers and field devices from the portable computer over the wireless connection. The converter is to be complete with LED indicators for the following conditions:
  - .1 Power: On/Off
  - .2 Fault: Fault/No Fault
  - .3 SA/FC Bus: Bus Activity/No Bus Activity
  - .4 Bluetooth: Bluetooth Communication Established/Bluetooth Communication Not Established

## **2.09 WIRING MATERIALS**

- .1 System wiring, conduit, boxes, and similar materials are to be in accordance with requirements specified in the appropriate Section(s) of the Electrical Work Division of the Specification.

## **3 EXECUTION**

### **3.01 GENERAL RE: INSTALLATION OF THE BAS**

- .1 Provide a complete building automation system in accordance with requirements of this Section of the Specification, the mechanical work Section entitled Automatic Control Systems, the drawings, and the input/output points list(s).
- .2 Unless otherwise specified do all BAS work in accordance with the system manufacturer's instructions.

### **3.02 INSTALLATION OF DIRECT DIGITAL CONTROL SYSTEM COMPONENTS**

- .1 Provide all required direct digital control hardware, software, accessories, and wiring for a complete BAS. Refer to drawing control diagrams and sequences, the points list(s), and the mechanical work Section entitled Automatic Control Systems.
- .2 Surface mount control units in mechanical, etc., rooms housing the equipment/systems to be controlled and monitored. Connect a maximum of two major mechanical systems to each field controller. Ensure that mounting surfaces do not vibrate.
- .3 Consult with the Owner and Consultant to ensure that all required input/output points are entered into the system.

### **3.03 IMPLEMENTATION OF ENERGY MANAGEMENT PROGRAMS**



- .1 Implement all energy management programs indicated for building equipment and systems.
- .2 Ensure that all energy management program adjustable parameters are accessible to and adjustable by the building operations personnel at the operator's work station.
- .3 Configure energy management programs so that they may be enabled/disabled on an individual basis for each system to which they apply.

### **3.04 CONTROL WIRING**

- .1 Do all required BAS wiring from 15A-1P circuits terminated as part of the electrical work in junction boxes in equipment rooms/areas.
- .2 Except as specified below, install all wiring in conduit. Unless otherwise specified the final 600 mm (2') connections to sensors and transmitters, and wherever conduit extends across flexible duct connections is to be liquid-tight flexible conduit.
- .3 Control wiring in ceiling spaces and wall cavities may be plenum rated cable installed without conduit but neatly harnessed, secured, and identified.
- .4 All wiring work is to be in accordance with the BAS manufacturer's certified wiring schematics and instructions, and the wiring standards specified in the electrical work Division of this Specification.

### **3.05 IDENTIFICATION AND LABELLING OF EQUIPMENT AND CIRCUITS**

- .1 Refer to the Basic Mechanical Materials and Methods Section.
- .2 Identify BAS equipment as follows:
  - .1 **Enclosures:** Engraved laminated nameplates with lettering such as BAS Panel CP2, or BAS Relays, or BAS E/P Transformers, with all wording listed and approved prior to manufacture of the nameplates.
  - .2 **Panel Points:** A weather-proof input/output layout sheet for each controller with the name of each point connected to the controller, and the associated wire labelling information.
  - .3 **Wiring:** Numbered sleeves or plastic rings at both ends of the conductor, with numbering corresponding to conductor identification on shop drawings and "as-built" record drawings.
  - .4 **Interface Components:** A weather-proof layout sheet clearly illustrating/identifying the purpose of each component within the enclosure such that an operator or service technician can quickly identify the exact use of each relay, transducer, contactor, etc., with each sheet fastened securely to the back of the enclosure door.

### **3.06 TESTING, ADJUSTING, CERTIFICATION, START-UP, COMMISSIONING AND TRAINING**

- .1 **Equipment and System Manufacturer's Certification:** Refer to the article entitled Equipment and System Manufacturer's Certification in the Mechanical Work General Instructions Section.
- .2 **Start-Up:** Refer to the article entitled Equipment and System Start-up in the Mechanical Work General Instructions Section.

- .3 **Commissioning:** Commission equipment after successful start-up and submittal of reports. Refer the Mechanical Work Commissioning Section.
- .5 **Demonstrations and Training:** Refer to the article entitled Equipment and System O & M Demonstration & Training in the Mechanical Work General Instructions Section. Include for demonstration and training sessions for each of two groups of Owner's operating and maintenance personnel as follows:
  - .1 Three full-day orientation sessions at the system manufacturer's office to educate personnel on BAS architecture, hardware, and software, with an overview of BAS operation and capabilities including but not limited to operational programmes, equipment functions (both individually and as part of a total integrated system), BAS commands, advisories, alarms, and appropriate operator intervention required in responding to the BAS operation.
  - .2 Two full day sessions at the site using the BAS for a "hands-on" demonstration of all BAS functions and features with instruction regarding the chronological flow of information from field devices, contacts and sensors to the operator's work station, an overview of the communications network describing the interplay between initiating devices, field hardware panels, systems communications, and their importance within the operating BAS, and alarm indications and appropriate responses.
  - .3 Two full day seasonal (summer-winter) site sessions to perform additional instruction regarding seasonal changes and how they affect the BAS.
- .5 **Additional Training:** Include for two follow-up site training and troubleshooting visits, one six months after Substantial Completion and the other at the end of the warranty period, both when arranged by the Owner and for a full day to provide additional system training as required.

### 3.07 PROJECT CLOSEOUT WORK

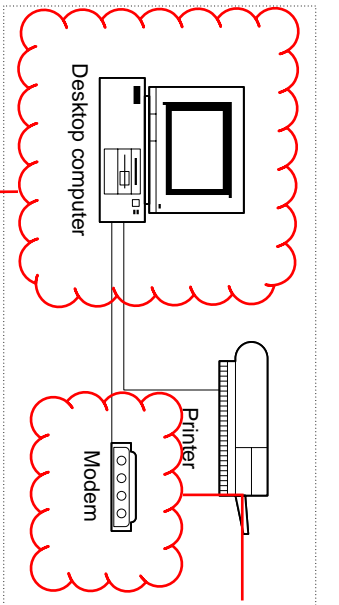
- .1 Refer to the Mechanical Work General Instructions Section.
- .2 **Record "As-Built" drawings** are to include:
  - .1 A schematic outline of the BAS for quick reference of the overall system scope.
  - .2 An adequate record of the work as installed, including the locations and routing of system wiring.
- .3 **The Operation and Maintenance Manual** is to contain:
  - .1 A hardware specification manual which gives a functional description of all hardware components.
  - .2 An operator's manual which outlines concise instructions for operation of the system and an explanation and recovery route for all system alarms.
  - .3 An engineering manual which outlines and defines system set-up, definition and application.
  - .4 A data manual which indicates the applications data programmed into the system.
  - .5 System software documentation.

**3.08 NEW ADDITIONAL POINTS LIST**

.1 Below are additional points to be added to the existing system.

SECTION 25 50 10									
New Additional Points List									
Point Name	HARDWARE POINTS				SOFTWARE		Alarm	Trend Duration	Show on Graphic
	Input		Output		Points (Virtual)				
	Binary	Analog	Binary	Analog	Binary	Analog			
Town Hall DHWT Status	X							Run Hours	X
Town Hall DHWT Trouble Alarm	X						X		X
Town Hall DHW Recirc Pump Start/Stop			X						X
Town Hall DHW Recirc Pump Status	X						X		X
Town Hall Emergency Power Status	X							Run Hours	X
Town Hall Emergency Power Trouble Alarm	X						X		X
Fire Hall DHWT Status	X							Run Hours	X
Fire Hall DHWT Trouble Alarm	X						X		X
Fire Hall MUA Start/Stop			X					-	X
Fire Hall MUA Status	X						X	-	X
Fire Hall MUA Supply Air Setpoint			X					-	X
Fire Hall MUA Air Supply Temp		X					X	7 DAYS	X

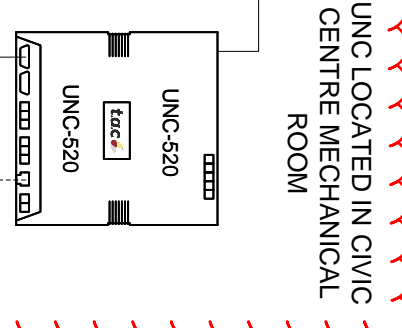
**END OF SECTION**



Existing modem will be replaced with a remote connection device. Utilize existing INTERNET connection for remote access.

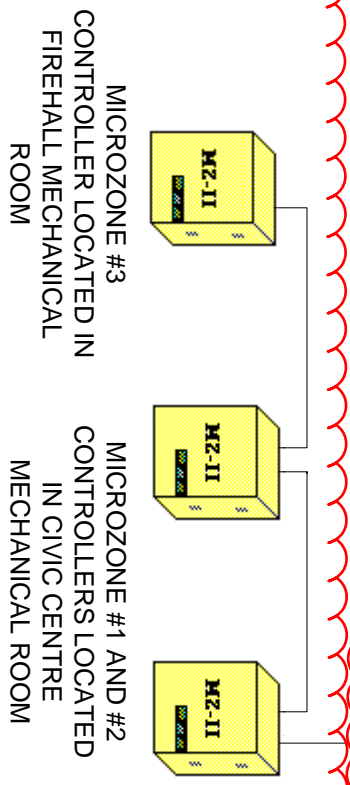
CENTRAL COMPUTER COMPLETE WITH "SIGNAL" GRAPHICS SOFTWARE LOCATED IN MAINTENANCE SHOP (WORK PACKAGE TO BE ASSIGNED)

3/4" CONDUIT TO TELEPHONE BOARD FOR THE MODEM LINE



UNC LOCATED IN CIVIC CENTRE MECHANICAL ROOM

Existing desktop will no longer be required. Remove an turn over to the Town of Drumheller.

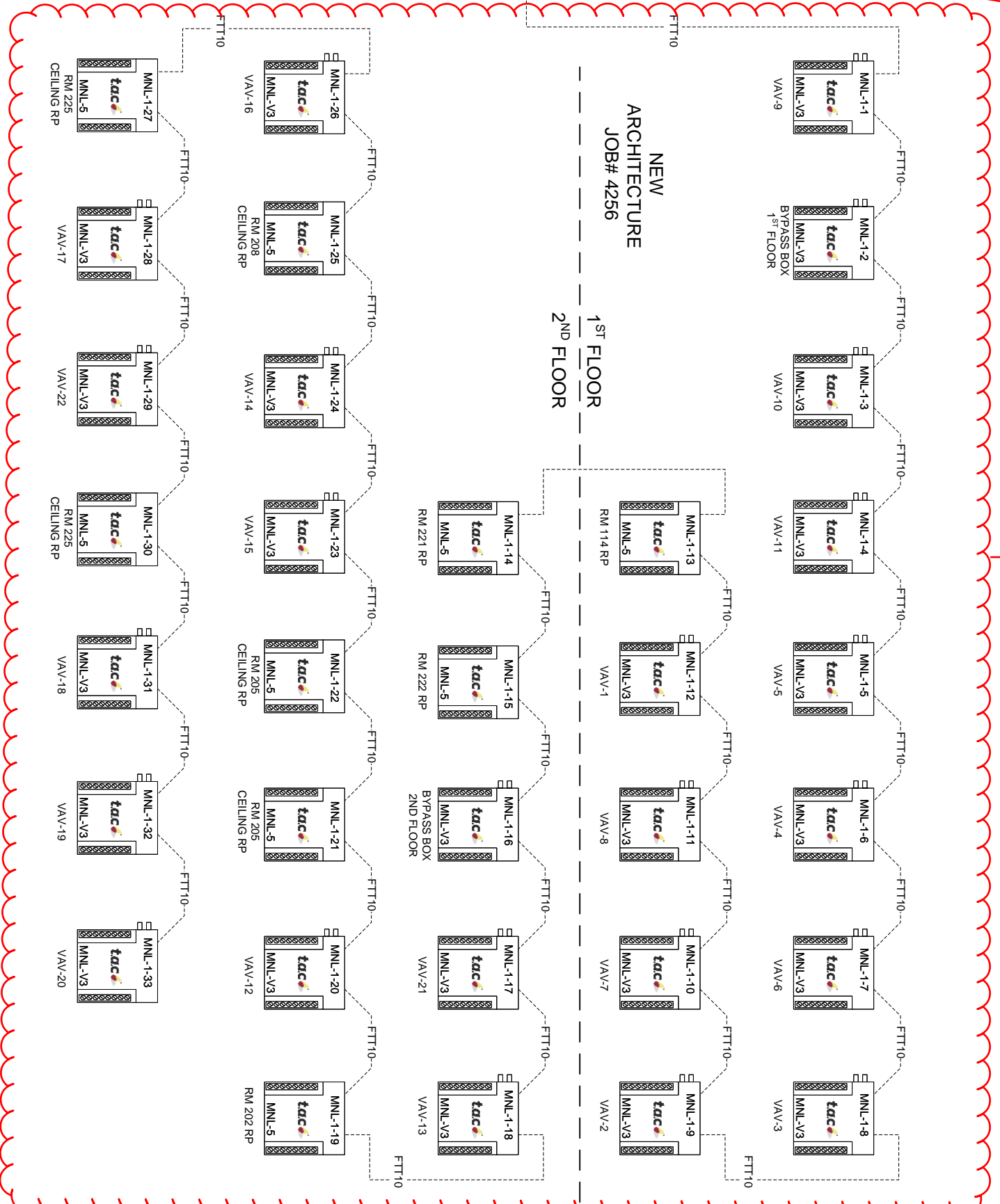


These existing controllers will be replaced with new.

EXISTING ARCHITECTURE

The existing UNC will be replaced with new BACnet unit with latest edition software. All required software licensing will be included.

Replace existing controllers with new BACnet controllers. Existing FTT10 cable is to be replaced. Existing conduit maybe reused where applicable.



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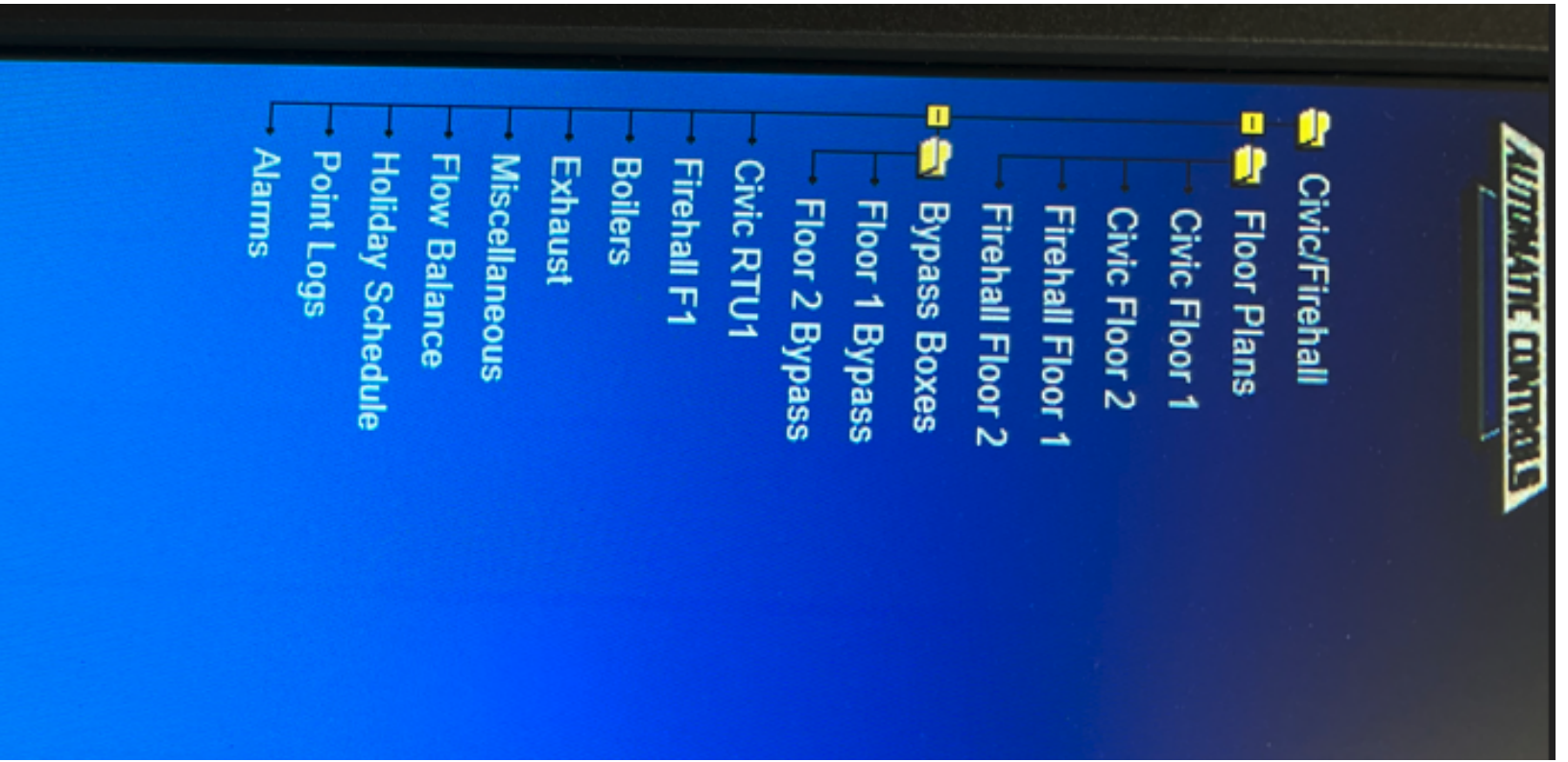
601, 10080 JASPER AVENUE NW  
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212, 214 - KING STREET WEST  
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t. 250.763.1049  
t. 647.352.1166  
t. 604.737.7353

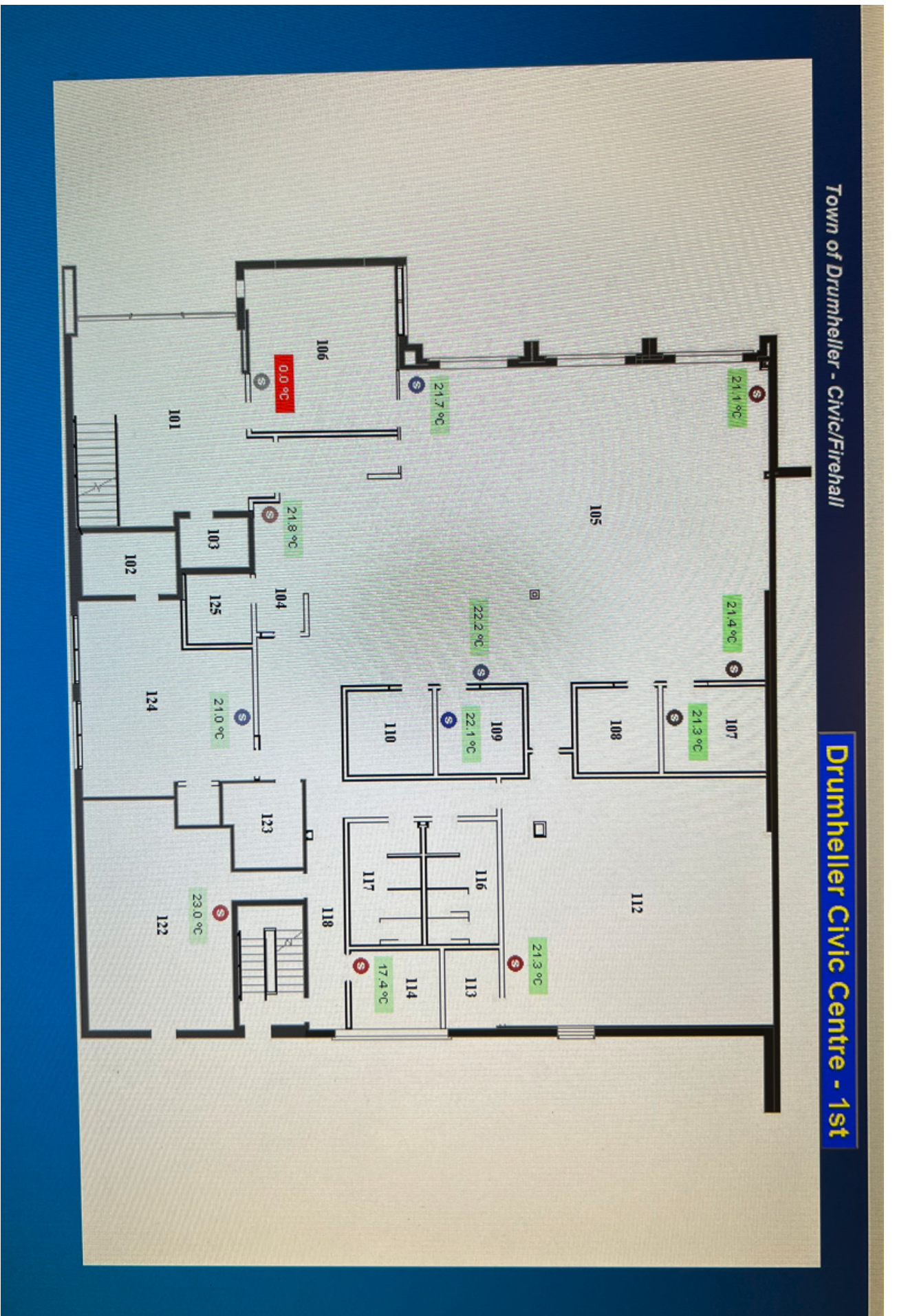
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CHECKED:	DRAWN:

DRAWING <b>New System Architecture</b>	DWG.NO.
PROJECT NAME <b>Town Hall BMCS Replacement</b>	<b>C-1</b>





1 EXISTING DIRECTORY  
C-2 N.T.S.

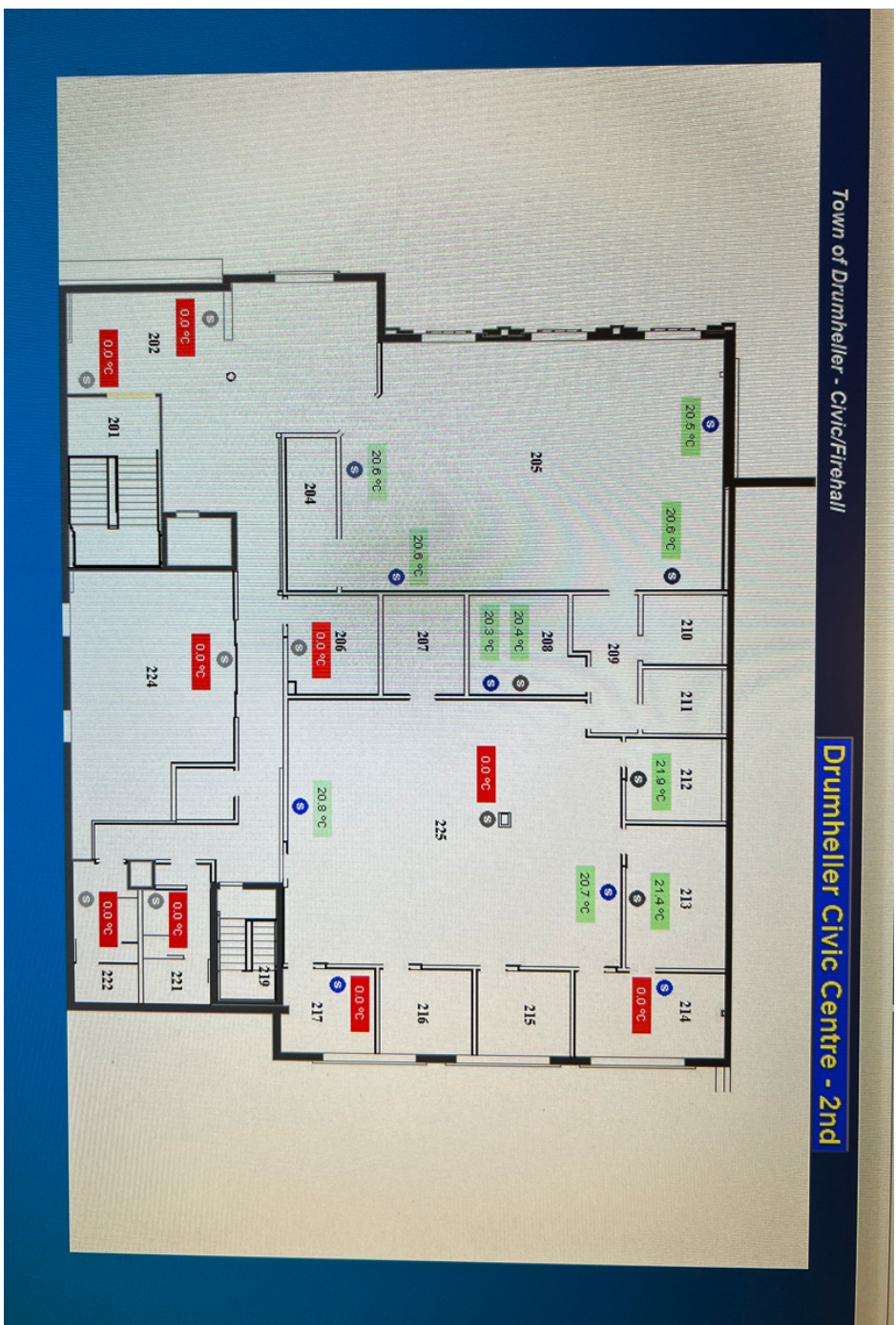


2 FIRST FLOOR THERMOSTATS  
C-2 N.T.S.

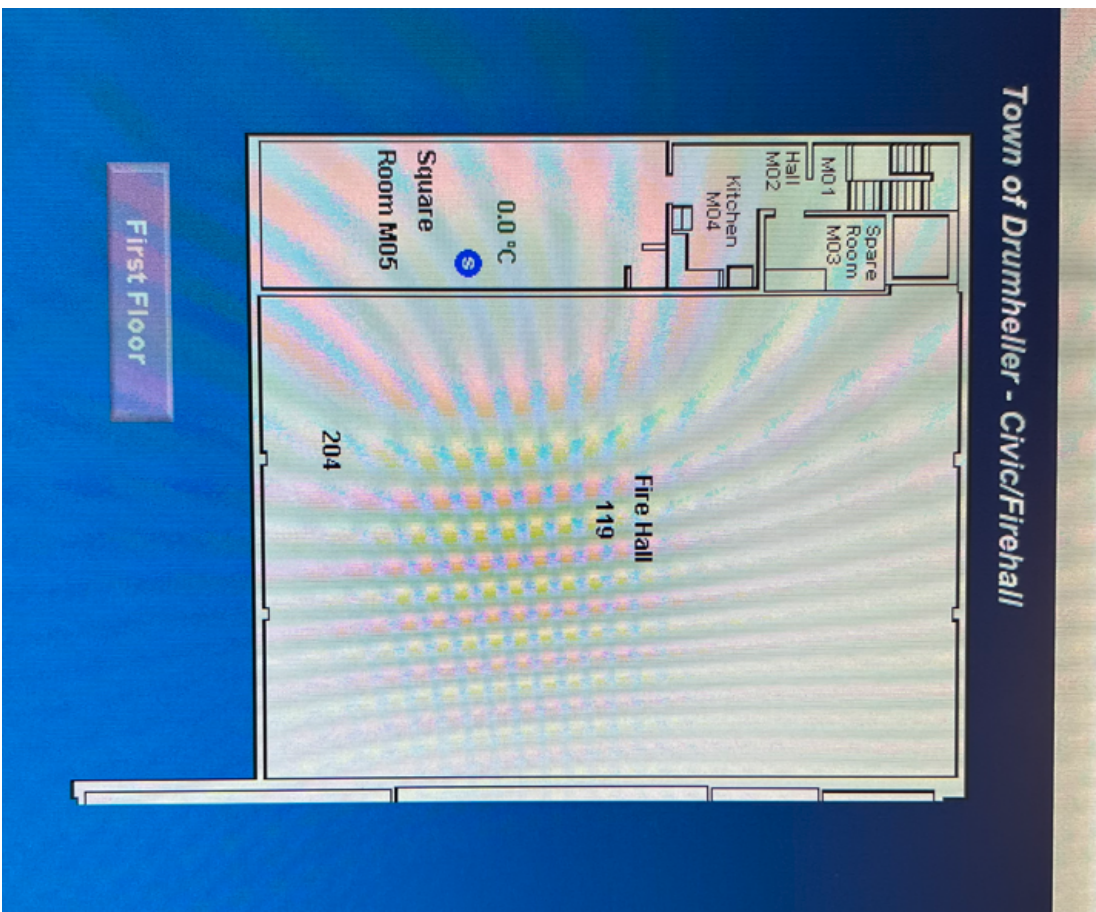
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PROJECT #: <b>16255-22</b>	SCALE:
CHECKED:	DRAWN:

DRAWING <b>Existing System Architecture</b>
PROJECT NAME <b>Town Hall BMCS Replacement</b>





1 SECOND FLOOR THERMOSTATS  
C-3 N.T.S.



2 FIRE HALL SECOND FLOOR THERMOSTATS  
C-3 N.T.S.

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DATE:

March, 2023

PROJECT #:

16255-22

SCALE:

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DRAWING

Existing System Architecture

PROJECT NAME

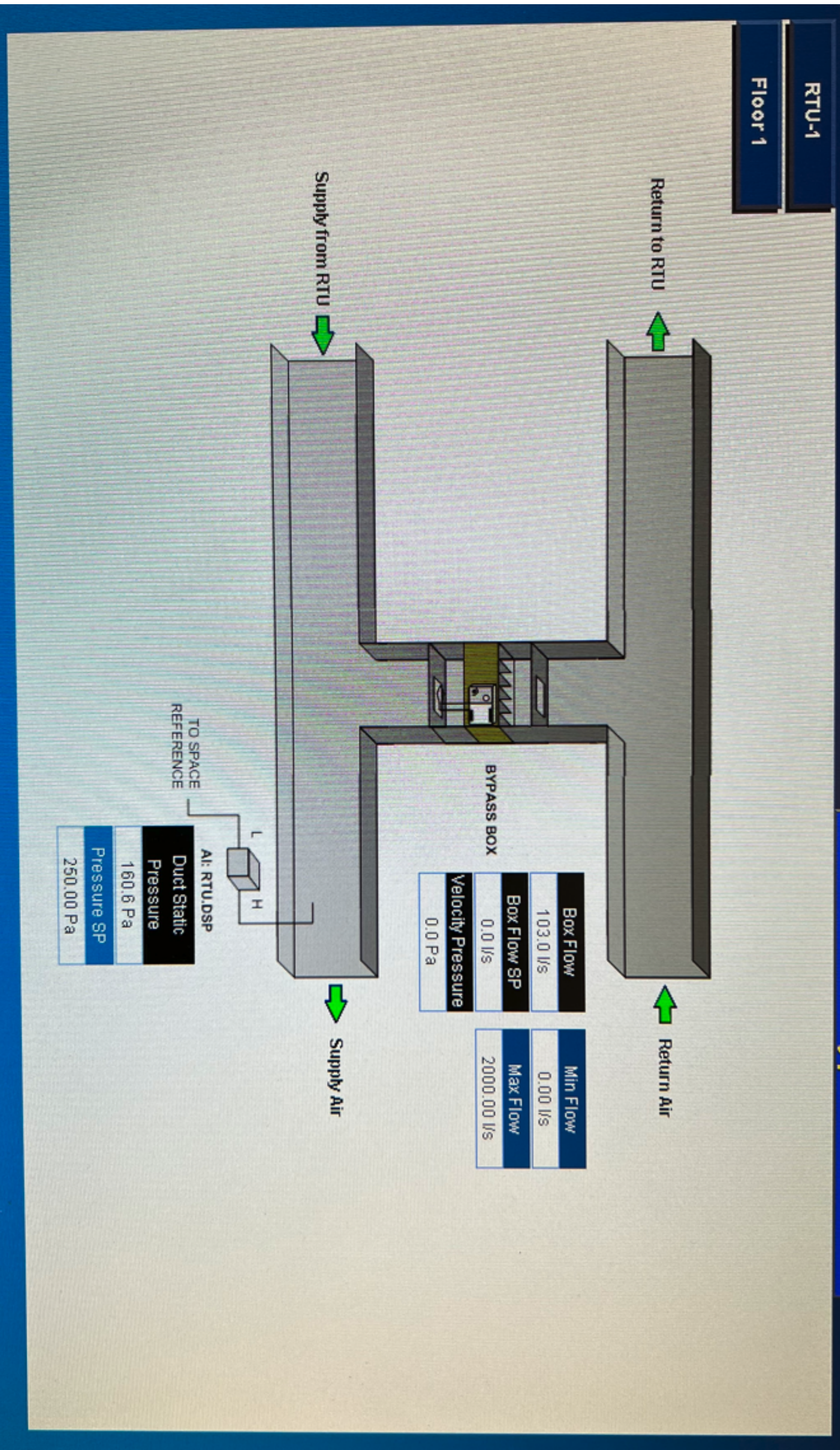
Town Hall BMCS Replacement

DWG.NO.

C-3



RTU-1  
Floor 1

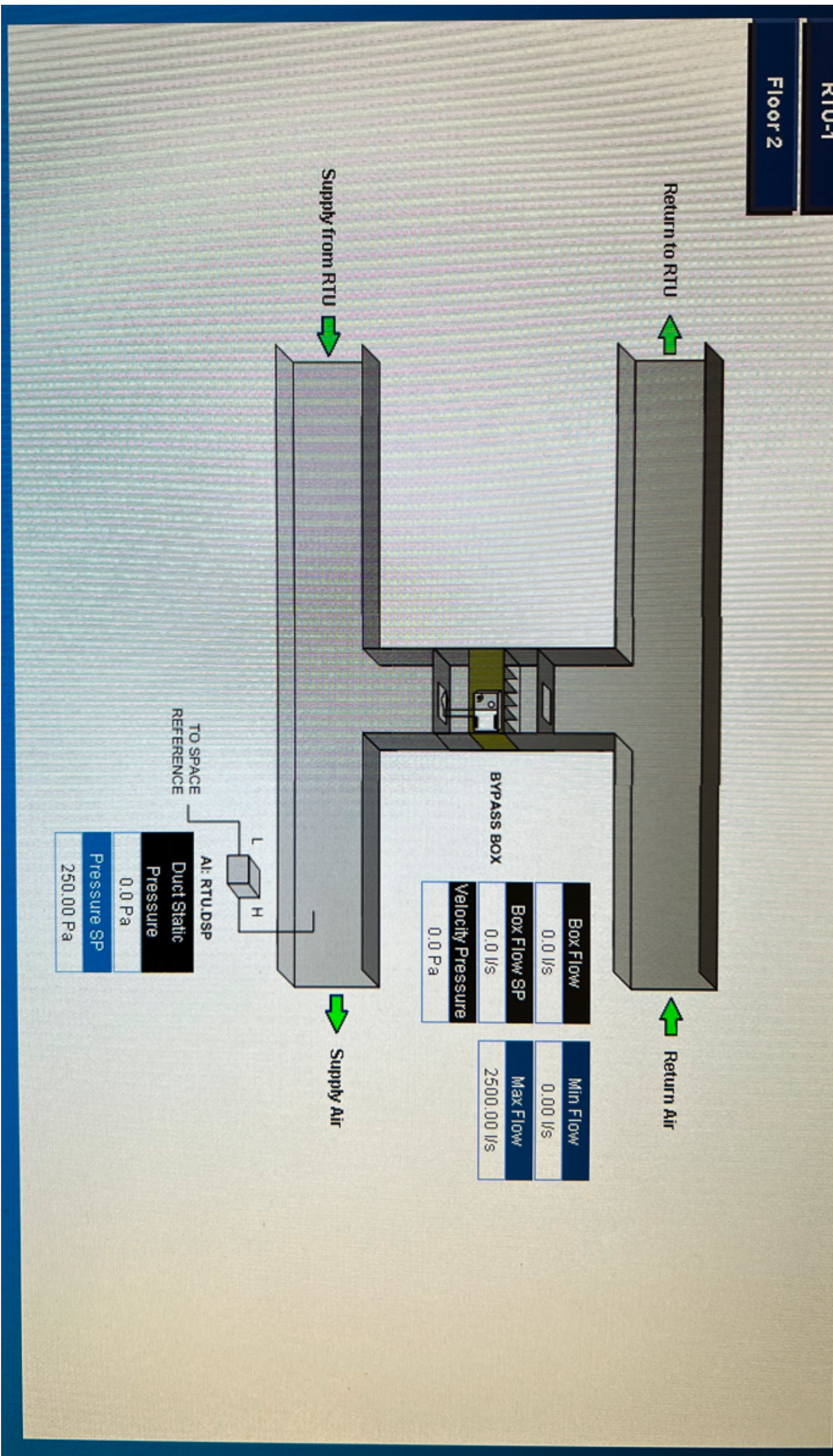


1 FIRST FLOOR BY-PASS BOX  
C-3 N.T.S.



Floor 2

RTU-1



1 2ND FLOOR BY-PASS BOX  
C-4 N.T.S.

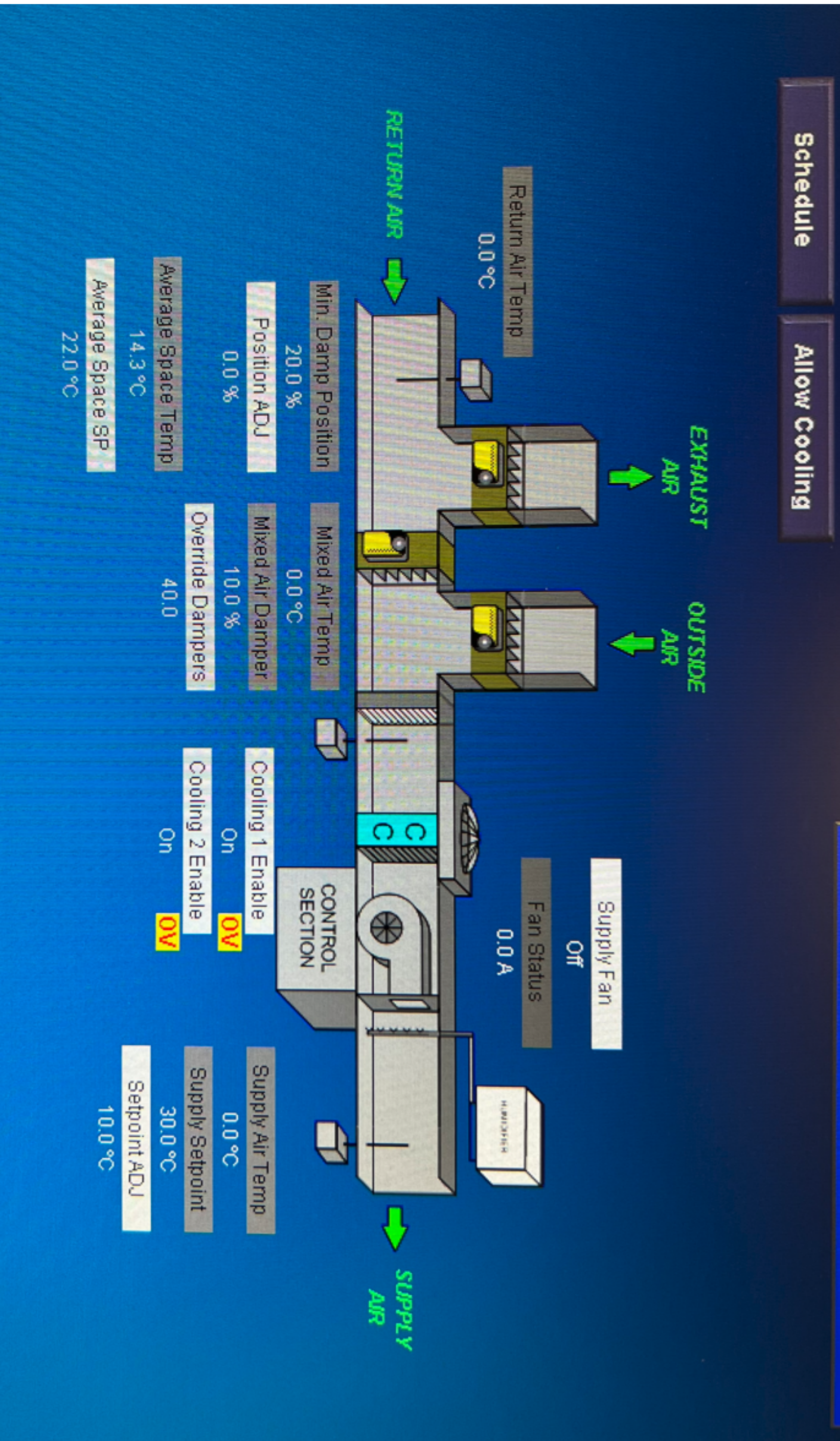


# Town of Drumheller - Civic/Firehall

Schedule

Allow Cooling

# RTU-1 Civic Center



1 TOWN HALL RTU  
C-5 N.T.S.

DATE:	March, 2023	
PROJECT #:	SCALE:	
16255-22		
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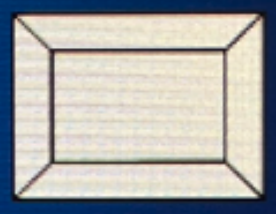
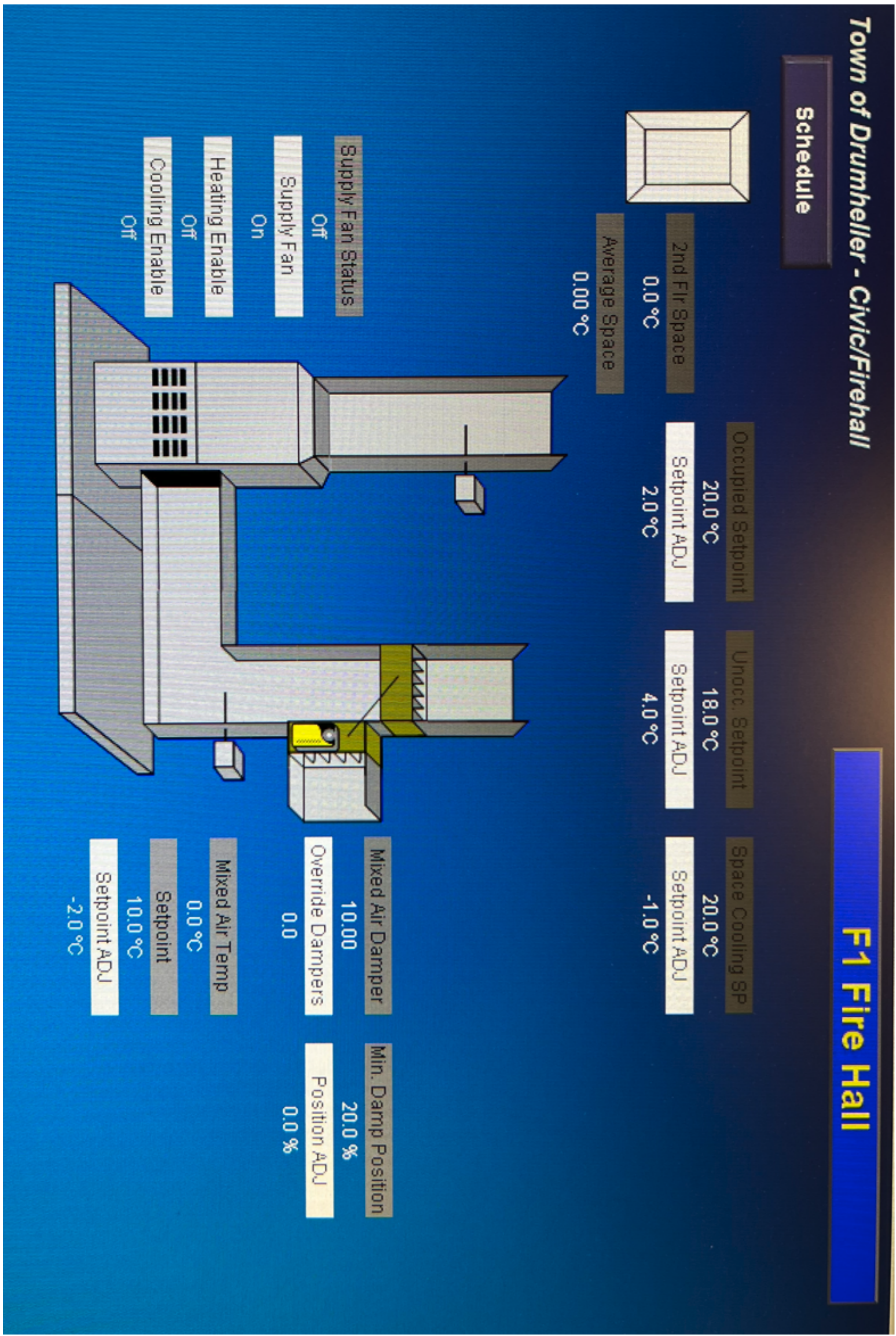
DRAWING	Existing System Architecture
PROJECT NAME	Town Hall BMCS Replacement



# Town of Drumheller - Civic/Firehall

## Schedule

## F1 Fire Hall



2nd Flr Space  
0.0 °C

Average Space  
0.00 °C

Occupied Setpoint  
20.0 °C

Setpoint ADJ  
2.0 °C

Unocc. Setpoint  
18.0 °C

Setpoint ADJ  
4.0 °C

Space Cooling SP  
20.0 °C

Setpoint ADJ  
-1.0 °C

Supply Fan Status  
Off

Supply Fan  
On

Heating Enable  
Off

Cooling Enable  
Off

Mixed Air Damper  
10.00

Override Dampers  
0.0

Min. Damp Position  
20.0 %

Position ADJ  
0.0 %

Mixed Air Temp  
0.0 °C

Setpoint  
10.0 °C

Setpoint ADJ  
-2.0 °C

1 FIRE HALL FURNACE  
c-6 N.T.S.





1  
C-7  
EXT. FIRE HALL FURNACES  
N.T.S.

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DATE:

March, 2023

DRAWING

Existing System Architecture

PROJECT #:

16255-22

SCALE:

PROJECT NAME

CHECKED:

DRAWN:

Town Hall BMCS Replacement

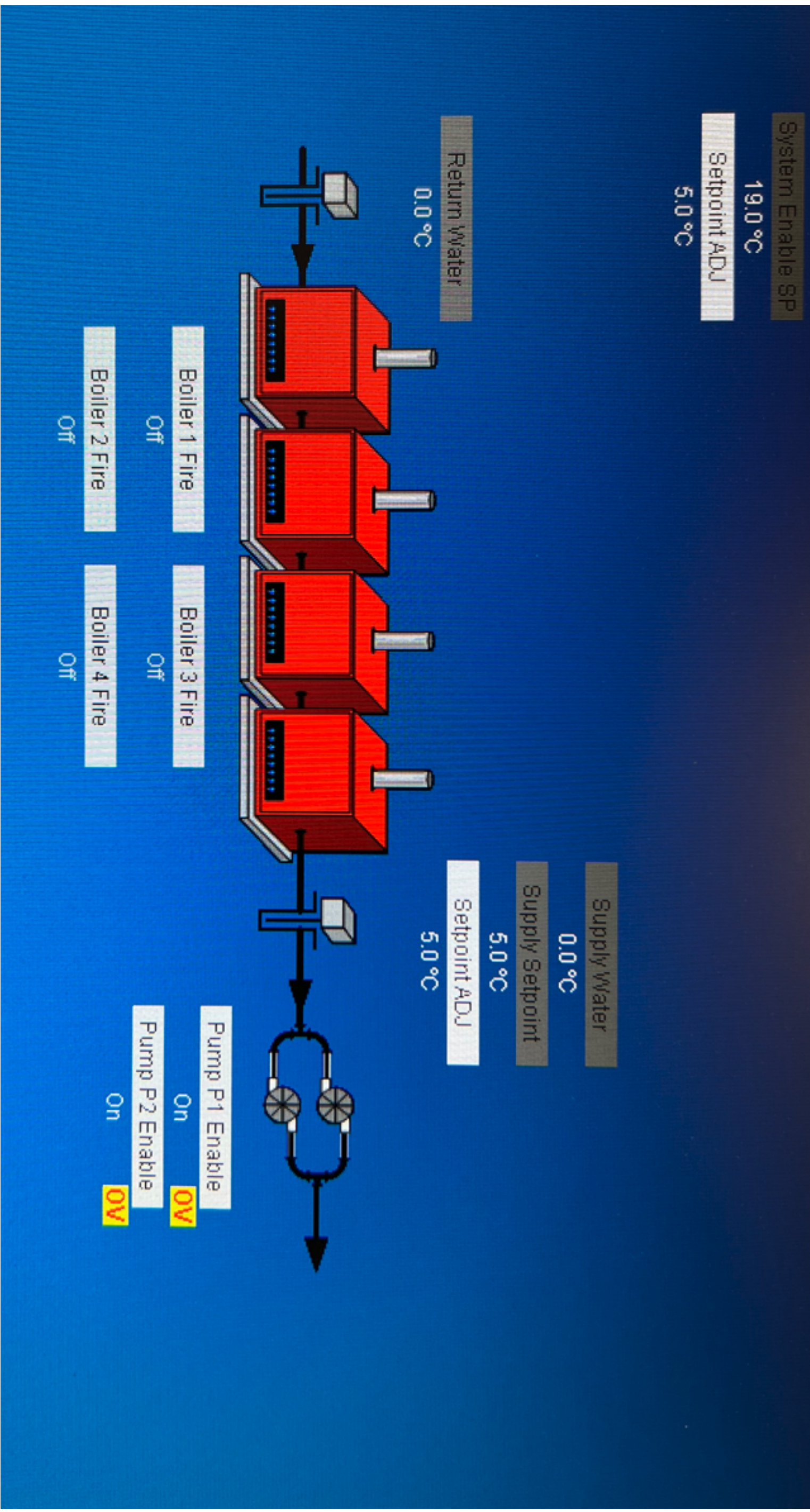
DWG.NO.

C-8



# Town of Drumheller - Civic/Firehall

# Boiler System



1 BOILER SYSTEM  
C-9 N.T.S.

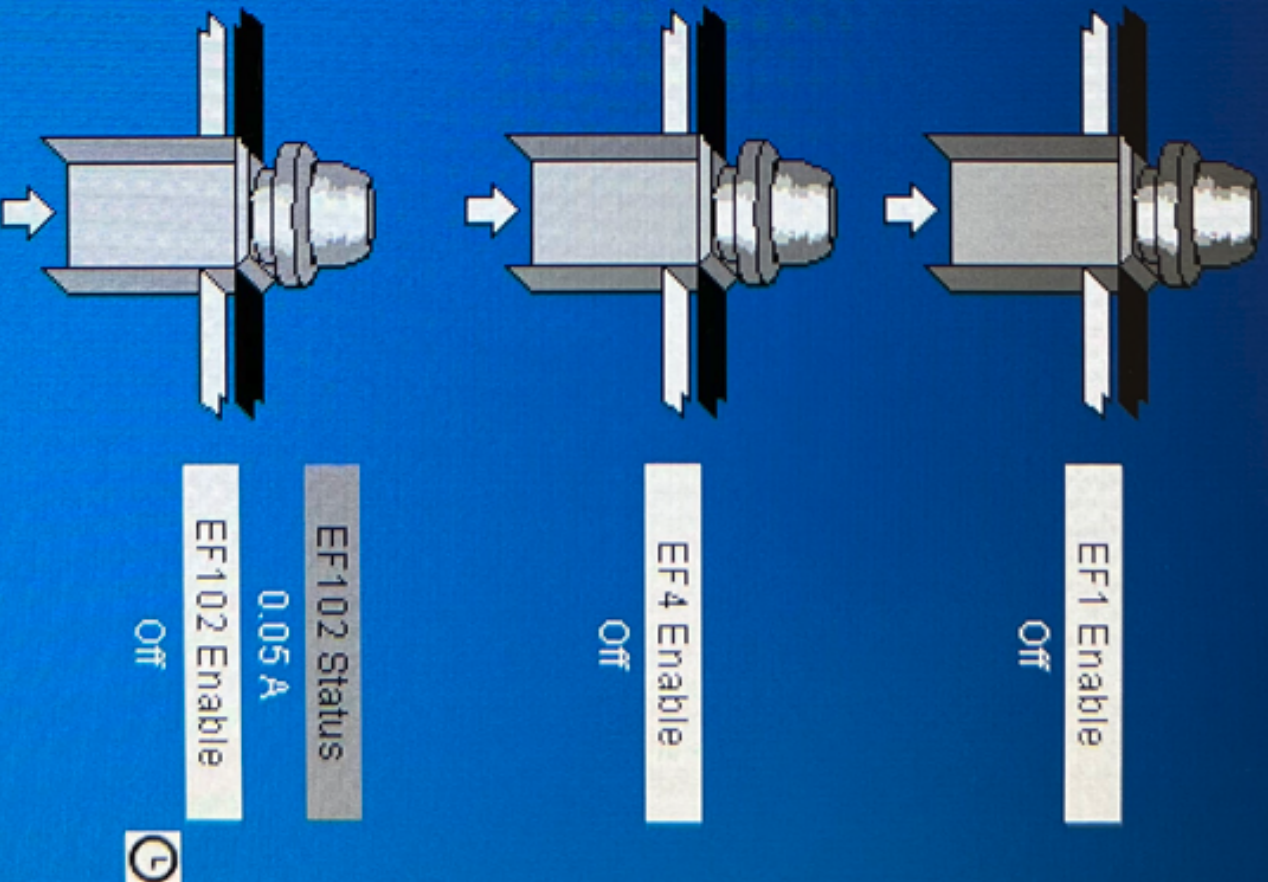
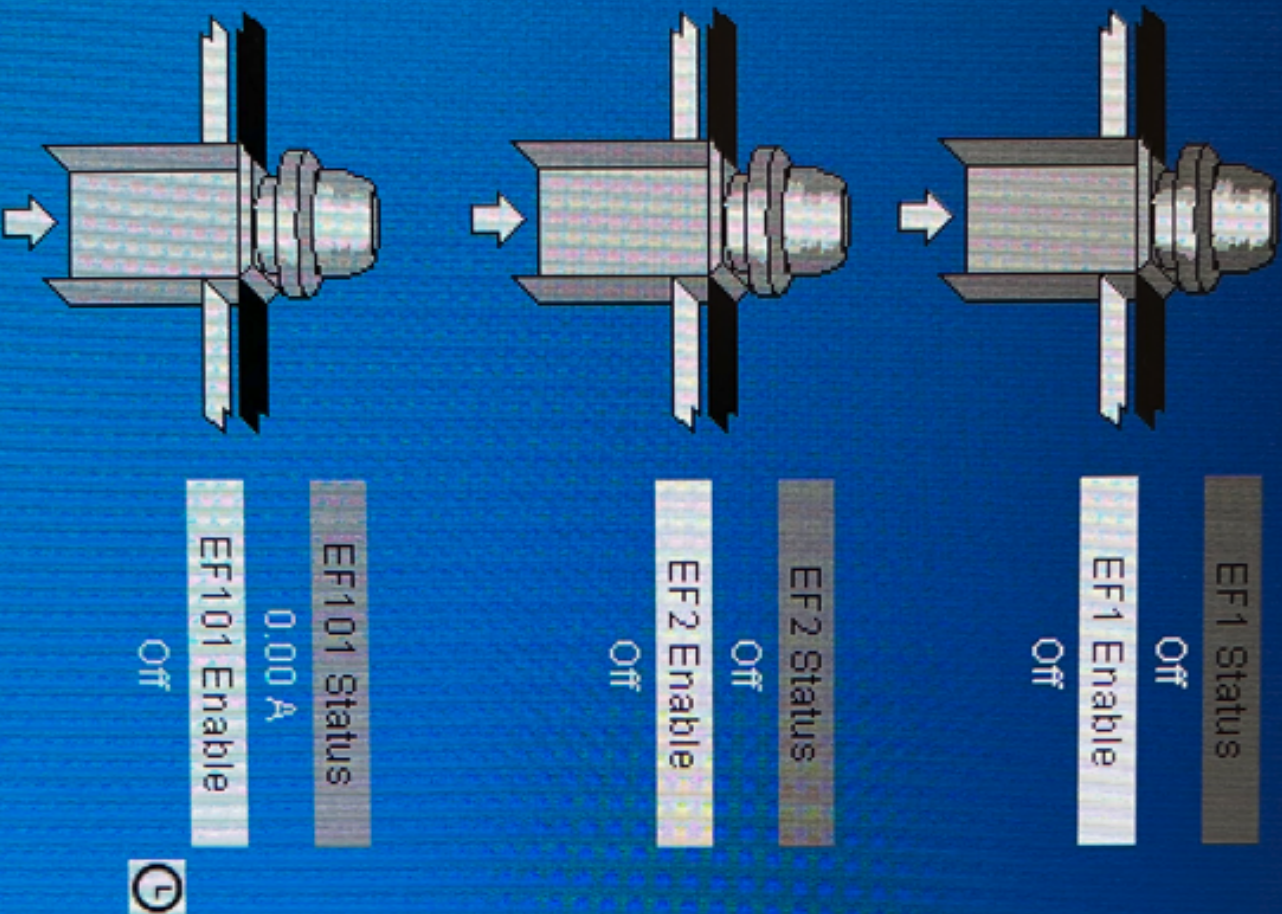


RTU-1 Civic Center Exhaust Fans

F1 Firehall Exhaust Fans

Schedule

Schedule



1 EXHAUST FANS  
C-9 N.T.S.

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SCALE:	
DRAWN:	

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PROJECT NAME	Town Hall BMCS Replacement

DWG.NO.  
**C-10**



**DX Cooling**

Calendar

Allow Cooling

On **OV**

**Car Plugs**

Schedule

Zone 1

On **OV**

Zone 2

On **OV**

**Firehall Door Switch**

Switch

Override ON

**Firehall Pushbutton Timer**

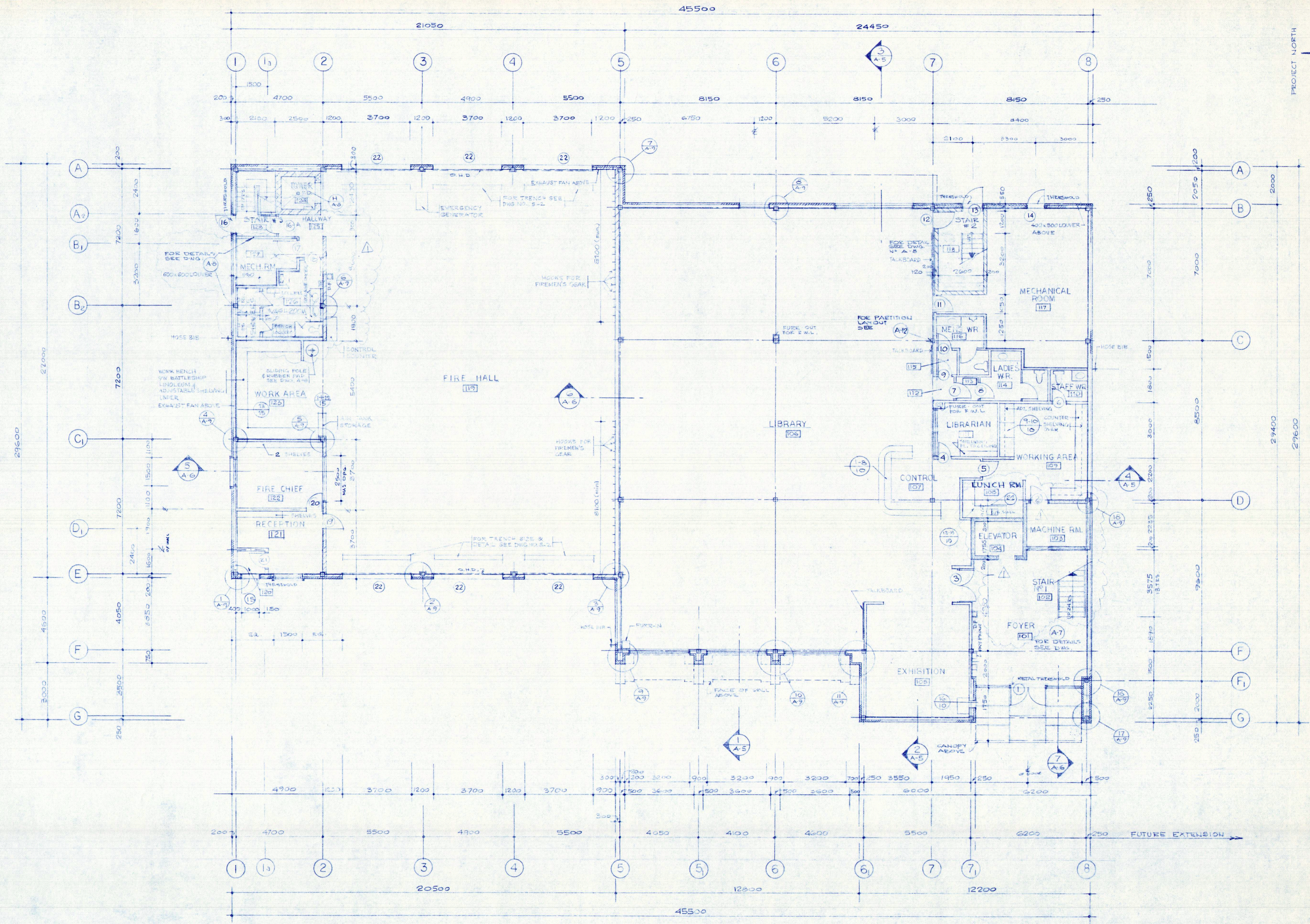
OVRD Minutes

120.0 min

Minutes ADJ

0.0 min





MAIN FLOOR PLAN  
SCALE: 1:100

ALL DIMENSIONS ARE IN MILLIMETRES - UNLESS NOTED

**STAVRO MELATHOPOULOS**  
ARCHITECT  
1347-12 AVE. S.W. - CALGARY - ALBERTA  
T3C-0P6 (403) 245-6838

ISSUE	DATE	REMARKS	NO.	REVISION	DATE	BY	APPROVED
1	20 AUG 79	FOR TENDER		RELOCATE DOOR # 17 & 18	23 OCT 79		
2	DEC 4 1979	FOR CONSTRUCTION WITH REVISIONS AS NOTED		RELOCATE WALL DIMENSION REV			
				ADD DOOR 107A			
				RELOCATE DOOR # 2	JAN 7 80		
				RELOCATE TACKBOARD			
				& SHORTEN WALL ROOM 106			

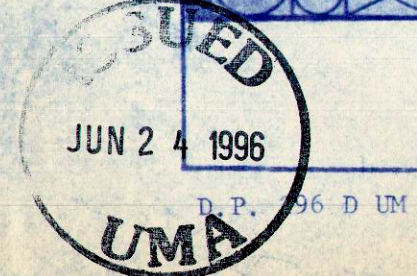
**Underwood McLellan (1977) Ltd.**  
Consulting Engineers and Planners  
Calgary, Alberta

the **uma** group

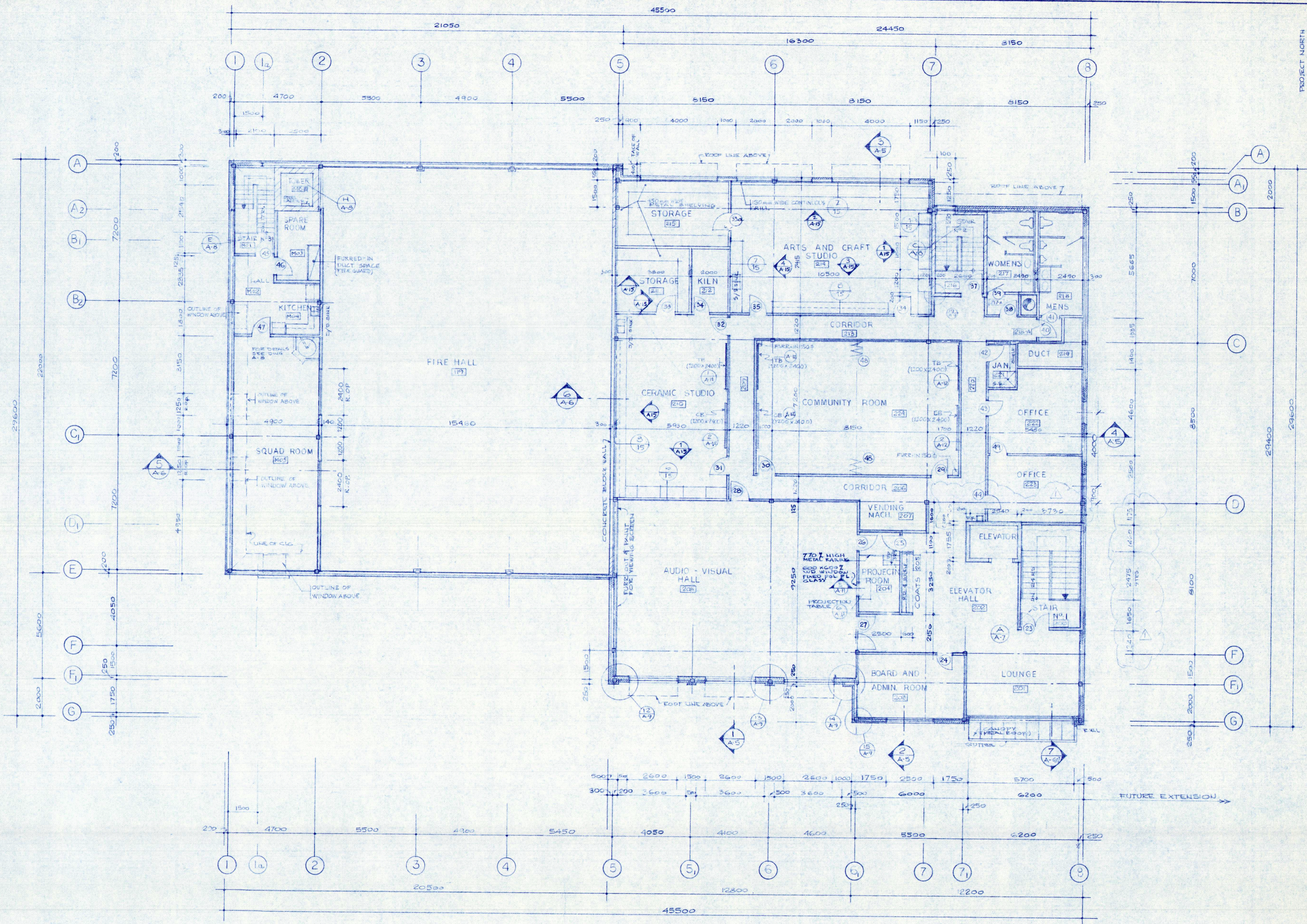
DRAWN: A.K.  
CHECKED: S.M.  
DESIGN: S.M.  
TRACED:  
SCALE: 1:100

CITY OF DRUMHELLER  
DRUMHELLER CIVIC CENTRE  
LIBRARY & FIREHALL  
MAIN FLOOR PLAN

DATE: AUG 79  
JOB: C-222-153  
SHEET: 2 of 15  
DRAWING: A-2  
ISSUE: 2







MEZZANINE AND SECOND FLOOR PLAN  
SCALE: 1:100

NOTE: ALL DIMENSIONS ARE IN MILLIMETRES.

**STAVRO MELATHOPOULOS**  
ARCHITECT  
1347-12 AVE. S.W. - CALGARY - ALBERTA  
T3C-0P8 (403) 245-8838

ISSUE	DATE	REMARKS	NO.	REVISION	DATE	BY	APPROVED
1	20 AUG 8	FOR TENDER	1	DIMENSION REVISED	NOV 1985		
2	DEC 4 1985	FOR CONSTRUCTION WITH REVISIONS AS NOTED					

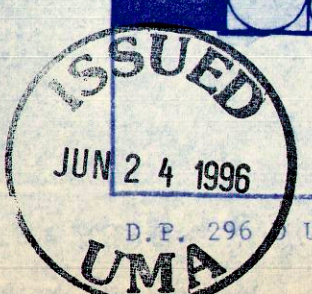
**Underwood McLellan (1977) Ltd.**  
Consulting Engineers and Planners  
Calgary, Alberta



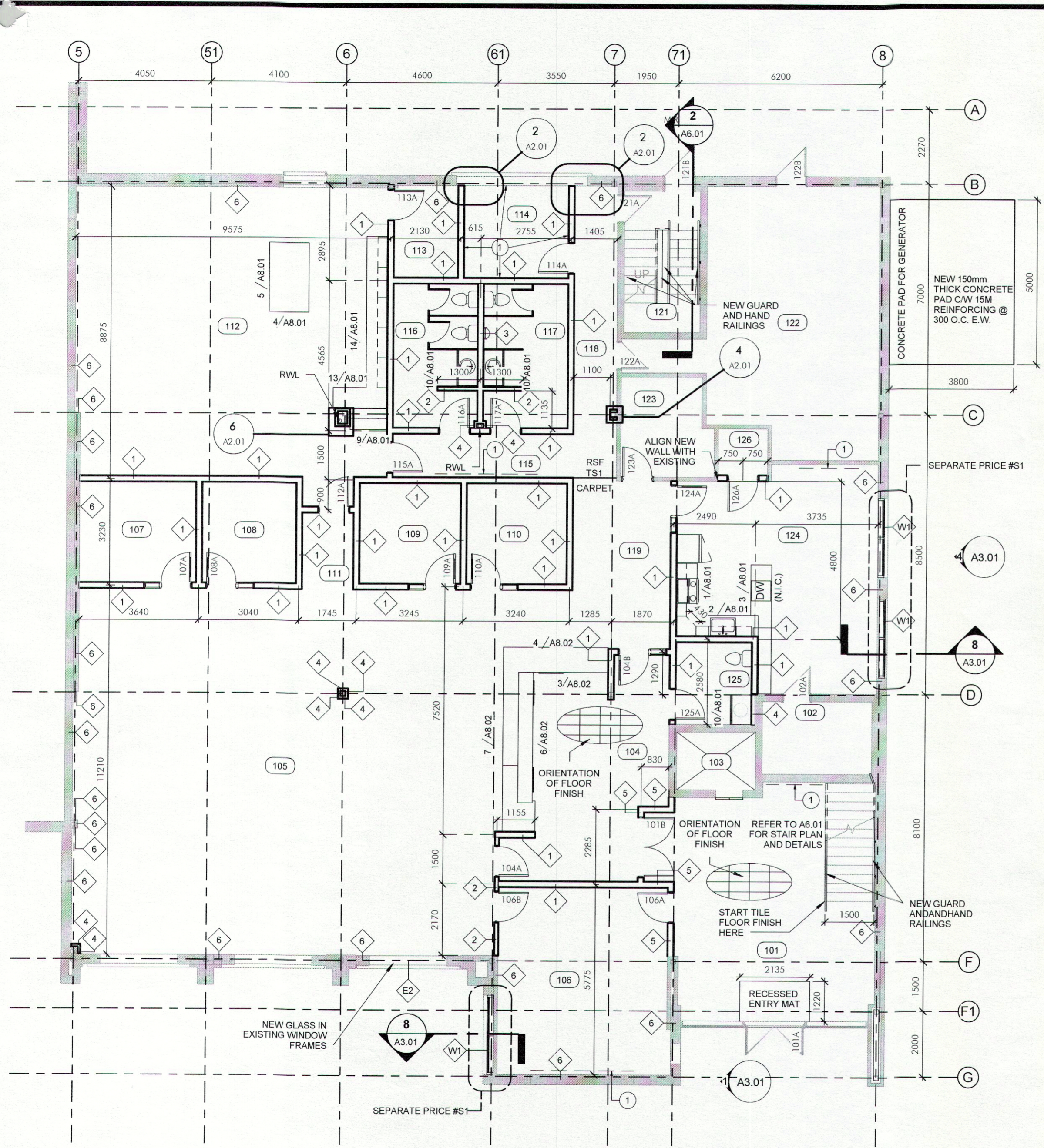
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DESIGN: S.M.  
TRACED:  
SCALE:  
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**CITY OF DRUMHELLER**  
DRUMHELLER CIVIC CENTRE  
LIBRARY & FIREHALL  
SECOND FLOOR PLAN

DATE: AUG 79  
JOB: 0200-153  
SHEET: 2 OF 18  
DRAWING: A-3  
ISSUE: 2



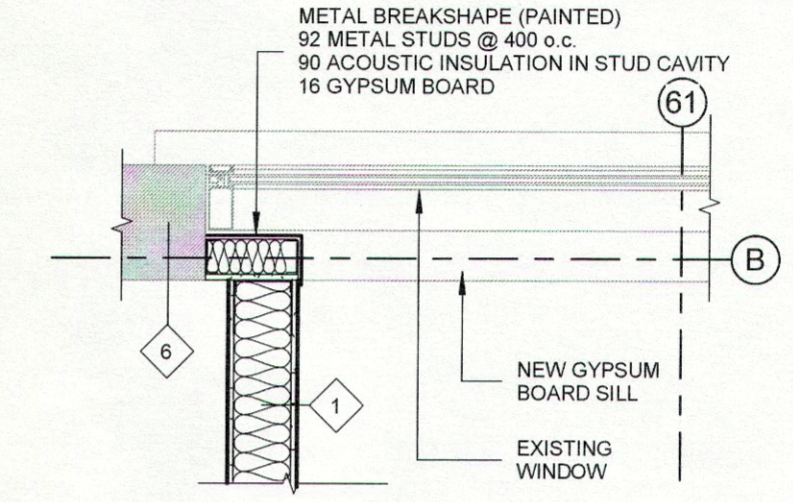
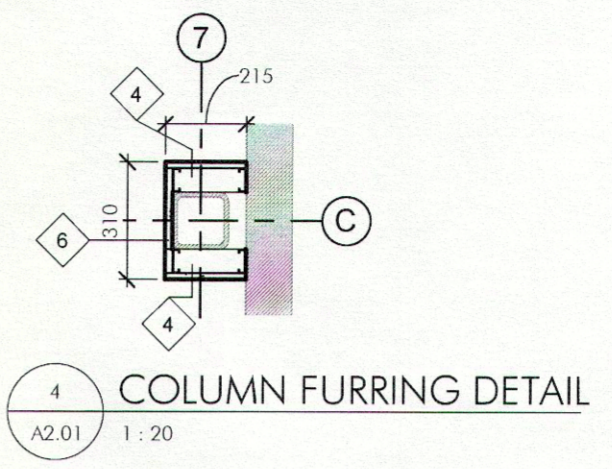




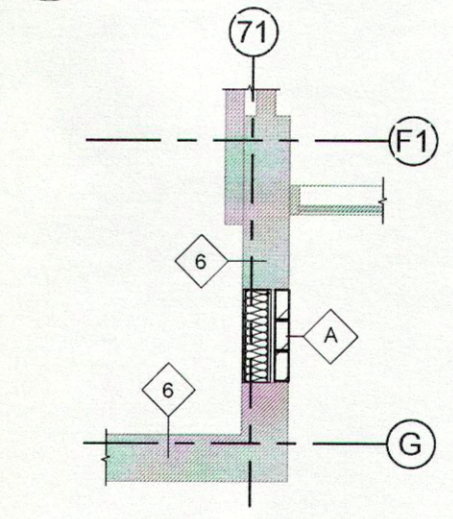
ROOM SCHEDULE - MAIN FLOOR	
101	LOBBY
102	ELEVATOR MACHINE ROOM
103	ELEVATOR
104	RECEPTION
105	OPEN WORK AREA
106	MEETING ROOM
107	OFFICE
108	OFFICE
109	OFFICE
110	OFFICE
111	CORRIDOR
112	FILE/STORAGE ROOM
113	FILE/STORAGE ROOM
114	SERVER ROOM
115	CORRIDOR
116	STAFF W/C FEMALE
117	STAFF W/C MALE
118	CORRIDOR
119	CORRIDOR
121	EXIT STAIR
122	MECHANICAL/ELECTRICAL ROOM
123	STORAGE ROOM
124	STAFF ROOM
125	PUBLIC WASHROOM

REVISIONS

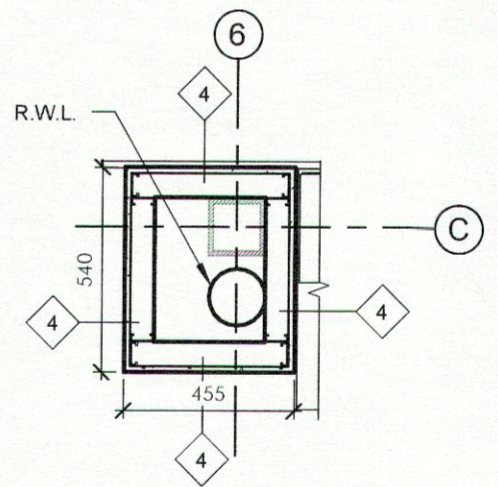
NO	DATE	REVISION	BY
1	19/09/12	ISSUED FOR BP/TENDER	JG



2 WINDOW/WALL DETAIL  
A2.01 1:20



3 BOOK DROP INFILL  
1:50



6 COLUMN FURRING DETAIL 2  
A2.01 1:20

**Group2 Architecture Interior Design Ltd., Red Deer**  
 PERMIT No. AC 552  
 ISSUED PURSUANT TO THE ARCHITECTS ACT OF ALBERTA

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PROJECT TITLE  
**DRUMHELLER TOWN HALL RELOCATION**

1 MAIN FLOOR  
A2.1

DRAWING TITLE  
MAIN FLOOR PLAN

DESIGNED	DRAWN	RO	DATE
JG			09/18/12

12034 **A2.01** 1  
 FILE DRAWING REVISION



REVISIONS

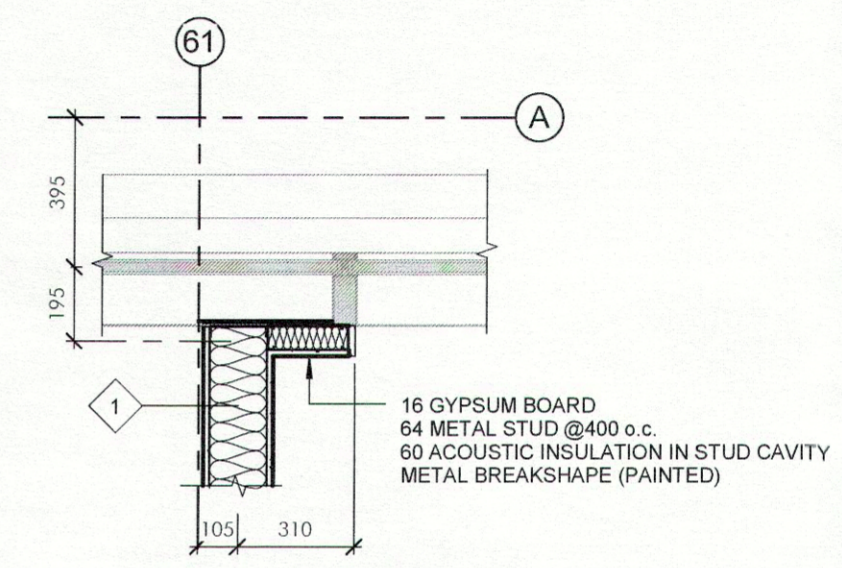
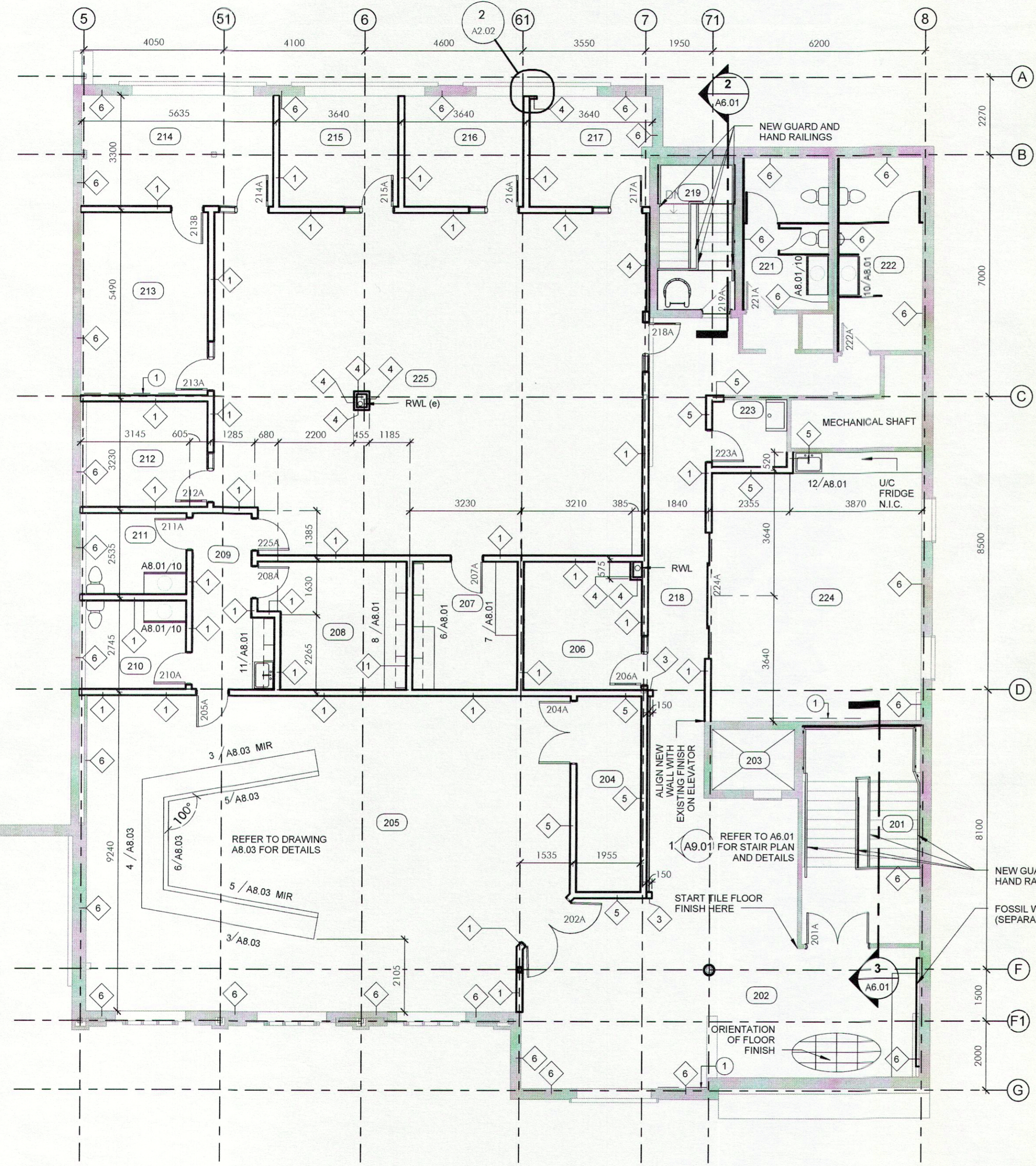
NO	DATE	REVISION	BY
1	19/09/12	ISSUED FOR BP/TENDER	JG

**KEYNOTES**

1 PROVIDE 16 PLYWOOD BACKING FOR AV EQUIPMENT  
REFER TO DRAWING A7.01 - A7.02 FOR FURNITURE LAYOUTS

**ROOM SCHEDULE - SECOND FLOOR**

201	STAIRS
202	COUNCIL LOBBY/DISPLAY AREA
203	ELEVATOR
204	CHAIR STORAGE
205	COUNCIL CHAMBER
206	OFFICE
207	FILE/COPY/AV ROOM
208	COUNCILLOR'S LOUNGE
209	CORRIDOR/COFFEE
210	STAFF W/C MALE
211	STAFF W/C FEMALE
212	OFFICE
213	MEETING ROOM
214	OFFICE
215	OFFICE
216	OFFICE
217	OFFICE
218	CORRIDOR
219	EXIT STAIR
221	PUBLIC W/C FEMALE
222	PUBLIC W/C MALE
223	JANITOR ROOM
224	MEETING ROOM
225	OPEN WORK AREA



2 WALL/WINDOW PLAN DETAIL  
A2.02 1:20



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**DRUMHELLER TOWN HALL RELOCATION**

SECOND FLOOR PLAN

CHECKED	DRAWN	DATE
JG	RO	09/18/12

12034 **A2.02** 1

FILE DRAWING REVISION

1 SECOND FLOOR  
A2.02



REVISIONS

NO. | DATE | REVISION | BY

GRILLE AND DIFFUSER SCHEDULE

TAG	MANUFACTURER	MODEL	MOUNTING	FINISH	REMARKS
S1	PRICE	SCD	DRYWALL/T-BAR	B12	SQUARE CONE DIFFUSER
S2	PRICE	520	DRYWALL/T-BAR	B12	DOUBLE DEFLECTION GRILLE
R1	PRICE	CORE 80	DRYWALL/T-BAR	B12	13x13x13 ALUMINUM GRID CORE
E1	PRICE	CORE 80	DRYWALL/T-BAR	B12	13x13x13 ALUMINUM GRID CORE c/w OBD

NOTE: REFER TO DRAWINGS FOR GRILLE & DIFFUSER SIZES

CABINET HEATER SCHEDULE



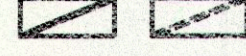
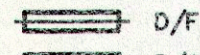
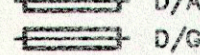
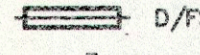
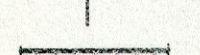

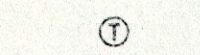



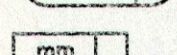
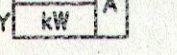
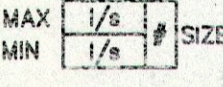
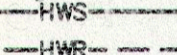
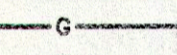
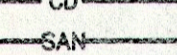
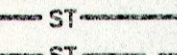
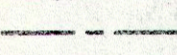
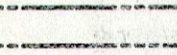
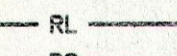
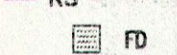
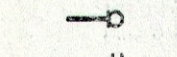
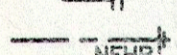



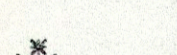
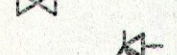
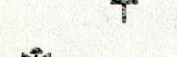
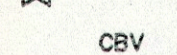
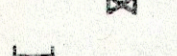
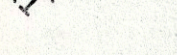

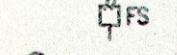
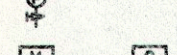
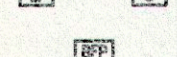







TAG	MANUFACTURER	MODEL	AIR FLOW (L/S)	HTG. CAP (kW)	GLYCOL			ELECTRICAL			REMARKS
					FLOW (L/S)	EGT/LGT (°C)	PD (kPa)	WATTS	VOLT	PHASE	
CUH-101	ENGINEERED AIR	CUH-6	283	14.4	0.32	93.3/82.2	10.04	37	120	1	LINE VOLTAGE THERMOSTAT ARRANGEMENT 19**
CUH-102	ENGINEERED AIR	CUH-6	283	14.4	0.32	93.3/82.2	10.04	37	120	1	LINE VOLTAGE THERMOSTAT ARRANGEMENT 19**

\*\* ALL ARRANGEMENTS TO BE CONFIRMED WITH ARCHITECTURAL PRIOR TO SUBMITTING SHOP DRAWINGS.

PLUMBING FIXTURE SCHEDULE

TAG	SERVICE	FIXTURE	TRIM	ACCESSORIES and REMARKS
WC-1	FLOOR MOUNTED VITREOUS FLUSH VALVE WATER CLOSET HANDSFREE HARDWIRED	AMERICAN STANDARD MADERA 3451001 ELONGATED VITREOUS CHINA	HANDSFREE FLUSH VALVE DELTA 81T2018TA BATTERY OPERATED	SUPPLY WITH SEAT
WC-2	FLOOR MOUNTED VITREOUS FLUSH VALVE WATER CLOSET BARRIER FREE - HANDSFREE HARDWIRED	AMERICAN STANDARD MADERA 410mm HIGH 3461001 ELONGATED VITREOUS CHINA	HANDSFREE FLUSH VALVE DELTA 81T2018TA BATTERY OPERATED	SUPPLY WITH SEAT
UR-1	LOW CONSUMPTION VITREOUS CHINA URINAL ***BARRIER FREE WHERE NOTED ON ARCHITECTURAL DRAWINGS	ZURN Z5799 "THE PINT"		WITH FLOOR MOUNTED FIXTURE CARRIER ZURN Z1221
L-1	VITREOUS CHINA WALL HUNG LAVATORY HANDSFREE ***BARRIER FREE***	AMERICAN STANDARD WALL HUNG CHINA LAVATORY LUCERNE 0356115	DELTA DEMD-311 ELECTROMIC FAUCET WITH MIXER TO ADJUST TEMPERATURE. SUPPLY WITH HARDWIRED KIT AND TRANSFORMER	
SK-1	STAINLESS STEEL SINGLE COMPARTMENT SINK WITH SINGLE LEVER FAUCET	KINDRED QSL 2020/8 520x510x200 OD WITH LEDGE	SINGLE LEVER HANDLE DECKMOUNT FAUCET DELTA 160LF-HDF	
SS-1	FLOOR MOUNTED JANITORS SERVICE SINK	FIAT MSR-3024 WITH MCP BRACKET, VINYL BUMPER GUARDS, AND STAINLESS STEEL WALL GUARDS	WALL MOUNTED FAUCET AND HOSE BRACKET DELTA 2879	

LEGEND

 SUPPLY AIR DUCT (UP / DOWN)  
 RETURN AIR DUCT (UP / DOWN)  
 EXHAUST AIR DUCT (UP / DOWN)  
 D/F FIRE DAMPER  
 D/A AUTOMATIC DAMPER WITH OPERATOR  
 D/G GRAVITY BACKDRAFT DAMPER  
 D/FS FIRE/SMOKE DAMPER  
 MANUAL BALANCING DAMPER  
 DUCTWORK WITH ACOUSTIC INSULATION (SEE ALSO SPECIFICATION)  
 ① LINE VOLTAGE THERMOSTAT  
 ② SENSOR  
 CONTROL LINE  
  $\frac{\text{mm}}{\text{L/S}} \#$  DIFFUSER, REGISTER OR GRILLE  
  $\frac{\text{mm}}{\text{L/S}} \#$  RADIATION OR RADIANT PANEL  
 MAX MIN  $\frac{\text{L/S}}{\text{L/S}} \#$  SIZE AIR TERMINAL UNIT  
 HWS HEATING WATER - SUPPLY  
 HWR HEATING WATER - RETURN  
 G GAS LINE (1.75 kPa TO 3.5 kPa)  
 CD CONDENSATE DRAIN  
 SAN SANITARY  
 ST STORM DRAIN IN CEILING SPACE  
 ST STORM DRAIN BELOW FLOOR  
 DOMESTIC COLD WATER  
 DOMESTIC HOT WATER  
 DOMESTIC HOT WATER RECIRCULATION  
 RL REFRIGERANT LIQUID  
 RS REFRIGERANT SUCTION  
 FD FLOOR DRAIN  
 CLEANOUT (IN SLAB)  
 CLEANOUT  
 NFHB NON-FREEZE HOSE BIBB  
 FIRE EXTINGUISHER WITH CABINET  
 ISOLATION VALVE  
 BALANCING VALVE  
 CHECK VALVE  
 PRESSURE REDUCING VALVE  
 SUPERVISED VALVE  
 (SAFETY) RELIEF VALVE  
 CONTROL VALVE  
 CBV CIRCUIT BALANCING VALVE  
 STRAINER  
 SOLENOID VALVE  
 UNION  
 FS FLOW SWITCH  
 PRESSURE GAUGE  
 EXISTING WATER METER / GAS METER  
 BP BACKFLOW PREVENTOR

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PROJECT TITLE  
**DRUMHELLER TOWN  
 HALL RELOCATION**

DRAWING TITLE  
**LEGEND AND SCHEDULES**

CHECKED | DRAWN | DATE  
 CS | AP | 06/19/12

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 FILE | DRAWING



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RADIANT PANEL SCHEDULE

TAG	TYPE	MANUF	PANEL SIZE (mm)	HEATING		
				No. OF TUBES	MEAN WATER TEMP. (°C)	HEATING OUTPUT
RP1	LINEAR	AIRTEX	610 WDE	6	87.7	542 W/m

FAN SCHEDULE

TAG	SERVICE	MANUFACTURER	MODEL	CAP. L/S	ESP (Pa)	ELECTRICAL			REMARKS
						HP	VOLT/PH	RPM	
EF-101	MAIN WASHROOMS EXHAUST	GREENHECK	GB-121-3	708	124	1/3	120/1	1725	C/W 300mm PRE-MANUFACTURED ROOF CURB, BACK DRAFT DAMPER.
EF-102	WASHROOM EXHAUST	GREENHECK	GB-081-8	180	82	1/6	120/1	1725	C/W 300mm PRE-MANUFACTURED ROOF CURB, BACK DRAFT DAMPER.

RADIATION SCHEDULE

TAG	MANUFACTURER	SERVICE	MODEL	ELEMENT			CAPACITY kW/m	REMARKS
				# of ROWS	O.C.	ENCLOSURE HEIGHT		
A	ENGINEERED AIR	ELEVATOR MACHINE ROOM	WF-1A	1	-	305	1.17	-
B	ENGINEERED AIR	BARE FIN ELEMENT	BARE-FIN	1	-	NONE	1.31	BARE-FIN ELEMENT WITHOUT ENCLOSURE

AIR CONDITIONING UNIT SCHEDULE

TAG	SERVICE	UNIT		COOLING (Kw)	ELECTRICAL V/Ph	REMARKS
		MANUFACTURER	MODEL			
AC-101 CU-101	SERVER ROOM AIR CONDITIONING	mitsubishi electric				

AIR TERMINAL UNIT SCHEDULE

TAG	MANUFACTURER	MODEL	SIZE	REMARKS
4	PRICE	SDV	4	900mm ATTENUATOR
6	PRICE	SDV	6	900mm ATTENUATOR
7	PRICE	SDV	7	900mm ATTENUATOR
8	PRICE	SDV	8	900mm ATTENUATOR
9	PRICE	SDV	9	900mm ATTENUATOR
10	PRICE	SDV	10	900mm ATTENUATOR
12	PRICE	SDV	12	900mm ATTENUATOR
14	PRICE	SDV	14	900mm ATTENUATOR

NOTES: 1. REFER TO PLANS FOR MINIMUM/MAXIMUM AIR VOLUMES.  
2. REFERENCE PLANS: ALL BOXES TO BE SUPPLIED WITH REHEAT COILS. TAGS WITH \* INDICATES BOX TO BE SUPPLIED WITHOUT REHEAT COIL.

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PROJECT TITLE  
**DRUMHELLER TOWN HALL RELOCATION**

DRAWING TITLE  
**LEGEND AND SCHEDULES**

CHECKED/DRAWN: CS/AP | DATE: 06/19/12

12034 | MO.02 | FILE | DRAWING



REVISIONS

NO. | DATE | REVISION | BY

GENERAL NOTES:

1. SLOPE ALL SANITARY MAINS AT 1% SLOPE UNLESS OTHERWISE NOTED.
2. PLUMBING VENTS NOT SHOWN. CONTRACTOR TO INSTALL PLUMBING VENTS IN ACCORDANCE WITH NATIONAL PLUMBING CODE. PLUMBING VENTS TO BE COLLECTED AND TERMINATED THRU ROOF WHERE SHOWN ON DRAWING M201.
3. EXTEND CLEANOUTS OUT OF ALL HIGH TRAFFIC AREAS
4. ALL HEATING WATER BRANCH LINE SIZES TO BE 20mm UNLESS NOTED OTHERWISE ON PLAN.

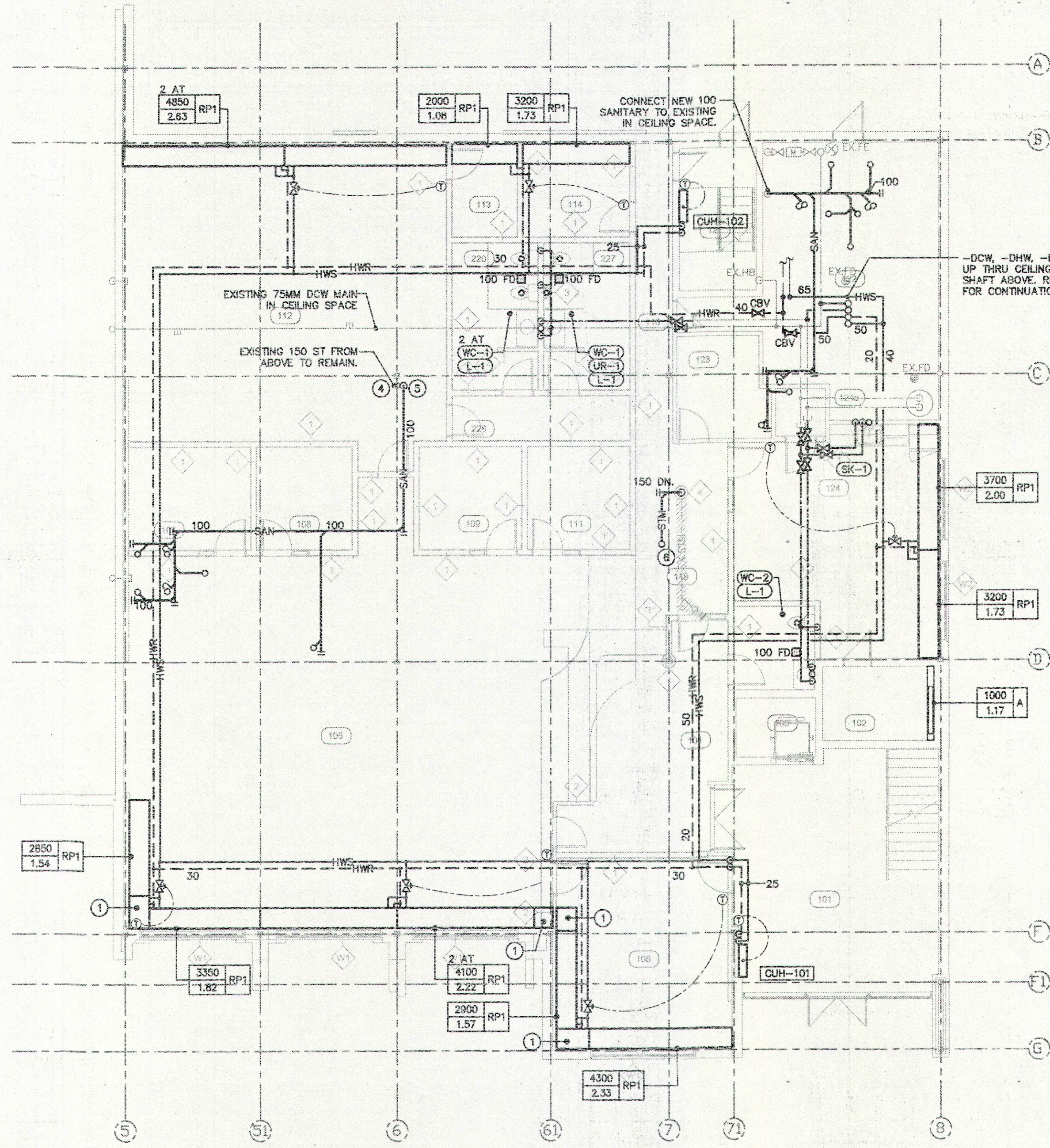
FIXTURE ROUGH-IN TABLE

FIXTURE TYPE	COLD WATER	HOT WATER	WASTE	VENT
WATER CLOSET (FLUSH VALVE)	25	-	100	50
URINAL	15	-	50	40
LAVATORY	15	15	30*	30*
SINGLE COMPARTMENT SINK	15	15	40*	30*
SERVICE SINK	15	15	75	50
DRINKING FOUNTAIN	15	-	40*	40*
FLOOR DRAIN	-	-	100	50
FLOOR DRAIN WITH TRAP PRIMER	7	-	100	50

\* BELOW SLAB PIPE SIZE 50mm

KEYNOTES:

- ① INACTIVE RADIANT PANEL.
- ② CUT RADIANT PANELS FOR STRUCTURAL COLUMNS. REFER TO STRUCTURAL DRAWINGS FOR EXACT LOCATIONS.
- ③ DROP 15 DCW & 15 DHW DOWN FOR DISTRIBUTION TO LAV'S. REFER TO FIXTURE ROUGH-IN SCHEDULE FOR CONNECTION SIZES.
- ④ EXISTING STORM TO REMAIN AS IS.
- ⑤ NEW 100 SANITARY IN CEILING SPACE TO DROP DOWN AND CONNECT TO EXISTING SANITARY BELOW GRADE.
- ⑥ REMOVE EXISTING 150 STORM PIPING IN CEILING AND RECONNECT IN VERTICAL AS SHOWN.



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PROJECT TITLE  
**DRUMHELLER TOWN HALL RELOCATION**

DRAWING TITLE  
**MAIN FLOOR PLUMBING AND HEATING PLAN**

CHECKED | DRAWN | DATE  
 CS | AP | 08/19/12

12034 | M1.01  
 FILE | DRAWING



REVISIONS

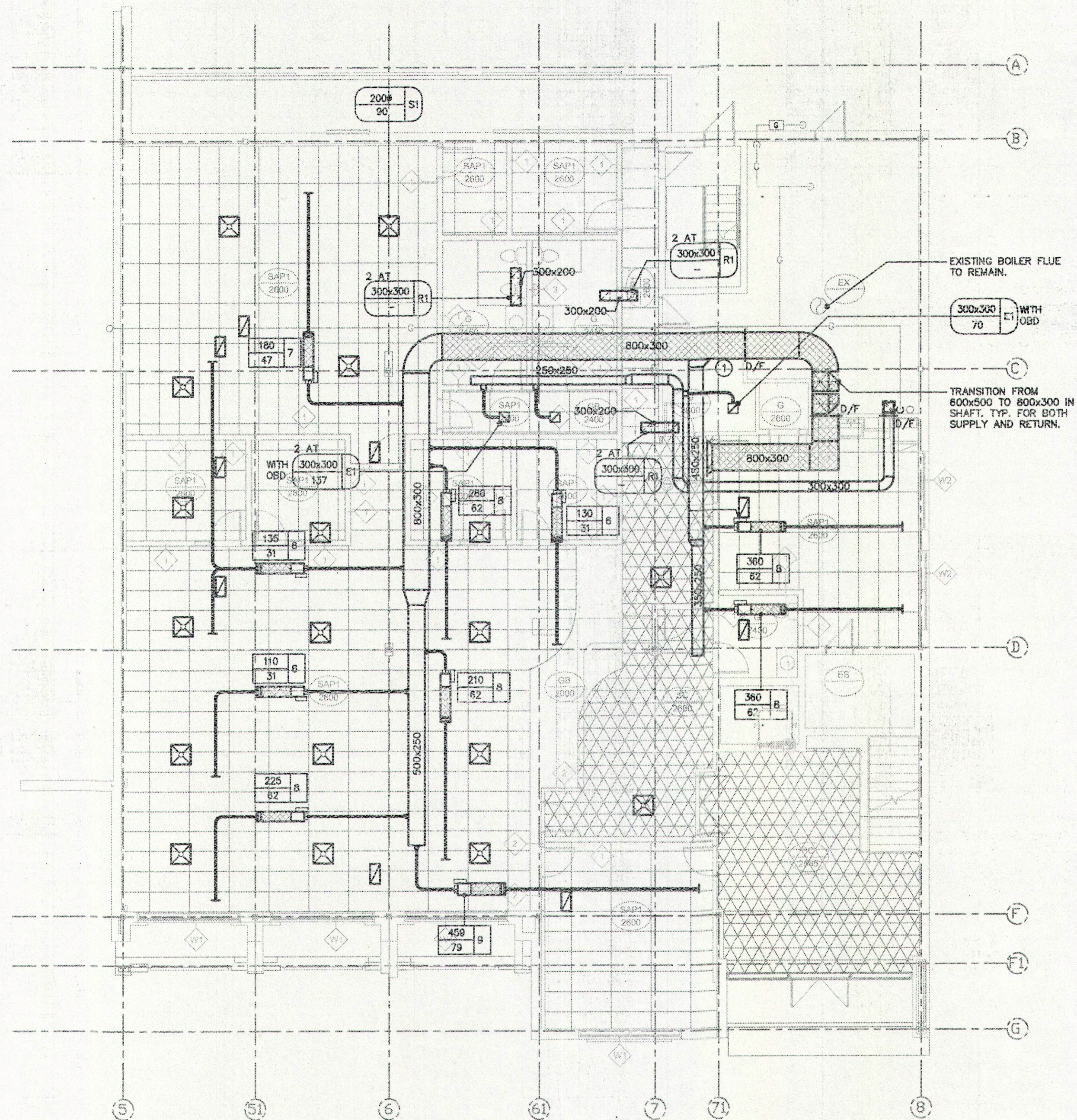
NO. | DATE | REVISION | BY

**GENERAL NOTES:**

1. ALL RETURN AIR GRILLES TO BE TYPE R1 600x300 UNLESS NOTED OTHERWISE.
2. SIZE OF ALL DUCTWORK TO VAV BOXES TO BE EQUAL TO BOX INLET SIZE UNLESS NOTED OTHERWISE.
3. REFER TO THE PLUMBING AND HEATING PLANS FOR ALL THERMOSTAT LOCATIONS.
4. REFER TO DETAIL'S SHEET FOR DETAIL OF TRANSFER AIR DUCTS.

**KEYNOTES:**

- ① INSTALL SP SENSOR IN DUCT WHERE SHOWN. PROVIDE STAND ALONE INTELLIGENT CONTROLLER FOR PRESSURE CONTROL VALVE.



EXISTING BOILER FLUE TO REMAIN.

300x300 WITH OBD 70

TRANSITION FROM 600x500 TO 800x300 IN SHAFT. TYP. FOR BOTH SUPPLY AND RETURN.

HEN RAE CONSULTING ENGINEERS INC.  
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 F. 403.271.0122

MECHANICAL - ELECTRICAL - COMMUNICATIONS

**Group2**  
 architecture  
 engineering  
 Group2 Architecture Engineering Ltd.

Reg. Head Office: 11012 Woodland Trail S., Ste. 240, Calgary, Alberta T2J 0A6  
 Calgary Office: 11012 Woodland Trail S., Ste. 240, Calgary, Alberta T2J 0A6  
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 W: www.group2.ca

PROJECT TITLE  
**DRUMHELLER TOWN HALL RELOCATION**

DRAWING TITLE  
**MAIN FLOOR VENTILATION PLAN**

CHECKED | DRAWN | DATE  
 CS | AP | 06/19/12

12034 | M1.02  
 FILE | DRAWING



REVISIONS

NO. | DATE | REVISION | BY

GENERAL NOTES:

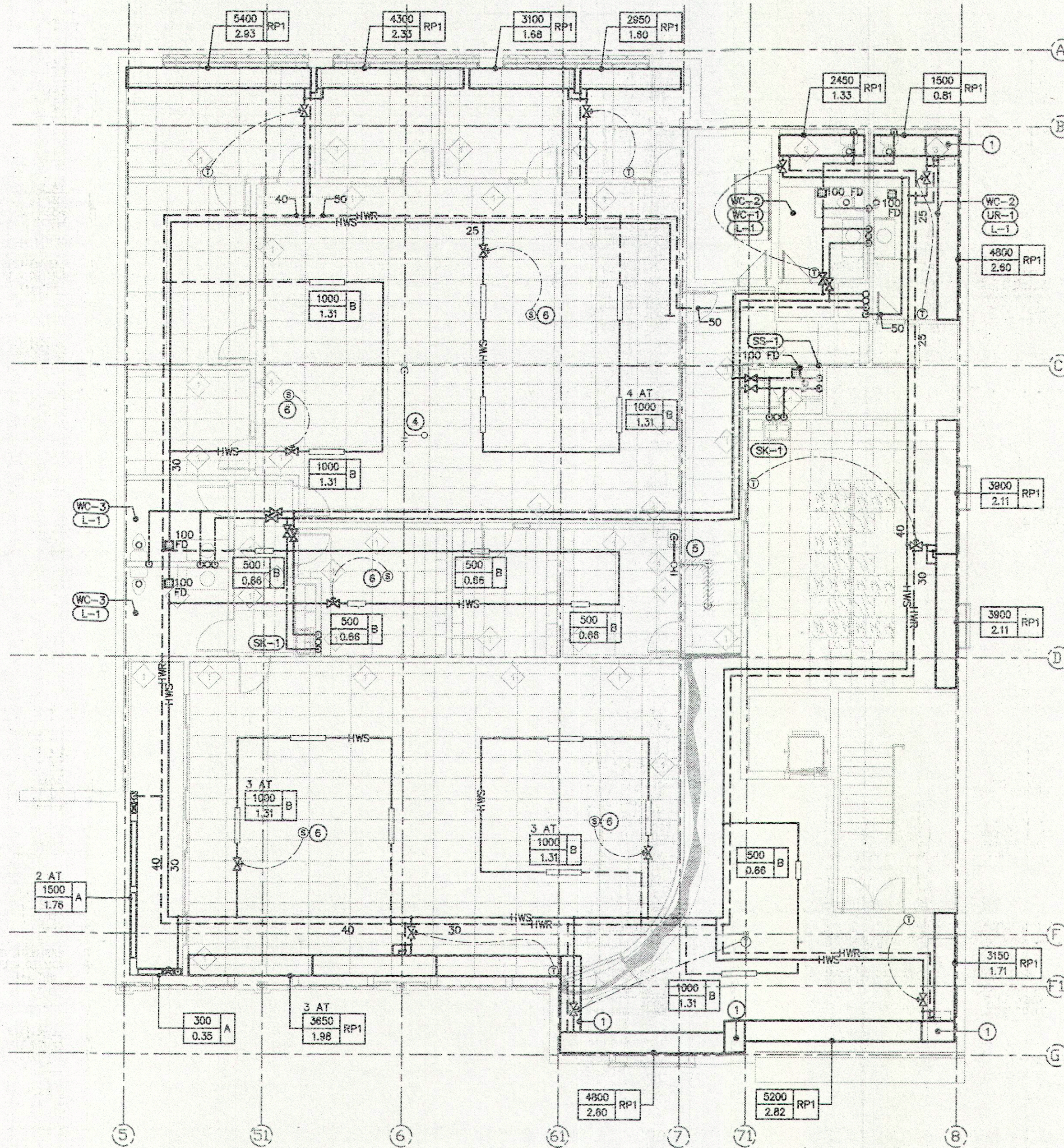
1. SLOPE ALL SANITARY MAINS AT 1% SLOPE UNLESS OTHERWISE NOTED.
2. PLUMBING VENTS NOT SHOWN. CONTRACTOR TO INSTALL PLUMBING VENTS IN ACCORDANCE WITH NATIONAL PLUMBING CODE. PLUMBING VENTS TO BE COLLECTED AND TERMINATED THRU ROOF WHERE SHOWN ON DRAWING M201.
3. EXTEND CLEANOUTS OUT OF ALL HIGH TRAFFIC AREAS
4. ALL HEATING WATER BRANCH LINE SIZES TO BE 20mm UNLESS NOTED OTHERWISE ON PLAN.

FIXTURE ROUGH-IN TABLE

FIXTURE TYPE	COLD WATER	HOT WATER	WASTE	VENT
WATER CLOSET (FLUSH VALVE)	25	-	100	50
URINAL	15	-	50	40
LAVATORY	15	15	30	30
SINGLE COMPARTMENT SINK	15	15	40	30
SERVICE SINK	15	15	75	50
DRINKING FOUNTAIN	15	-	40	40
FLOOR DRAIN	-	-	100	50
FLOOR DRAIN WITH TRAP PRIMER	7	-	100	50

KEYNOTES:

- ① INACTIVE RADIANT PANEL.
- ② CUT RADIANT PANELS FOR STRUCTURAL COLUMNS. REFER TO STRUCTURAL DRAWINGS FOR EXACT LOCATIONS.
- ③ DROP 15 DCW & 15 DHW DOWN FOR DISTRIBUTION TO LAV'S. REFER TO FIXTURE ROUGH-IN SCHEDULE FOR CONNECTION SIZES.
- ④ EXISTING STORM TO REMAIN AS IS.
- ⑤ REMOVE EXISTING 150 STORM PIPING IN CEILING AND IN VERTICAL RECONNECT AND DROP IN NEW SHAFT LOCATION AS SHOWN.
- ⑥ SENSOR TO BE MOUNTED IN CEILING SPACE.



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PROJECT TITLE  
**DRUMHELLER TOWN  
 HALL RELOCATION**

DRAWING TITLE  
**SECOND FLOOR  
 PLUMBING AND HEATING PLAN**

CHECKED | DRAWN | DATE  
 CS | AP | 06/19/12

12034 | M2.01 |  
 FILE | DRAWING



REVISIONS

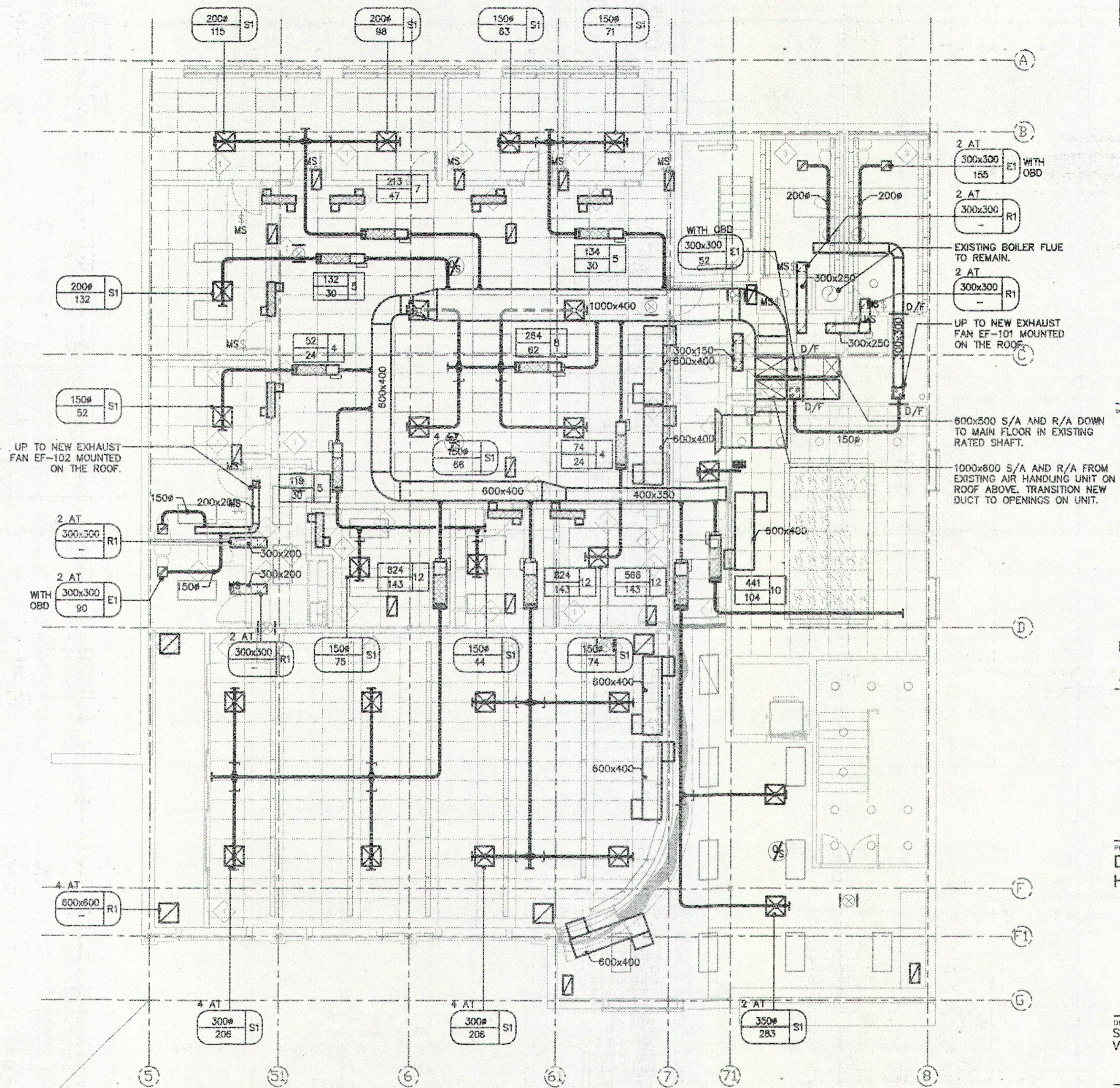
NO. | DATE | REVISION | BY

GENERAL NOTES:

1. ALL RETURN AIR GRILLES TO BE TYPE R1 600x300 UNLESS NOTED OTHERWISE.
2. SIZE OF ALL DUCTWORK TO VAV BOXES TO BE EQUAL TO BOX INLET SIZE UNLESS NOTED OTHERWISE.
3. REFER TO THE PLUMBING AND HEATING PLANS FOR ALL THERMOSTAT LOCATIONS.
4. ALL TRANSFER AIR DUCTS TO BE 250x250 UNLESS NOTED OTHERWISE.
5. REFER TO DETAIL'S SHEET FOR DETAIL OF TRANSFER AIR DUCTS.

KEYNOTES:

① -



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PROJECT TITLE  
**DRUMHELLER TOWN HALL RELOCATION**

DRAWING TITLE  
**SECOND FLOOR VENTILATION PLAN**

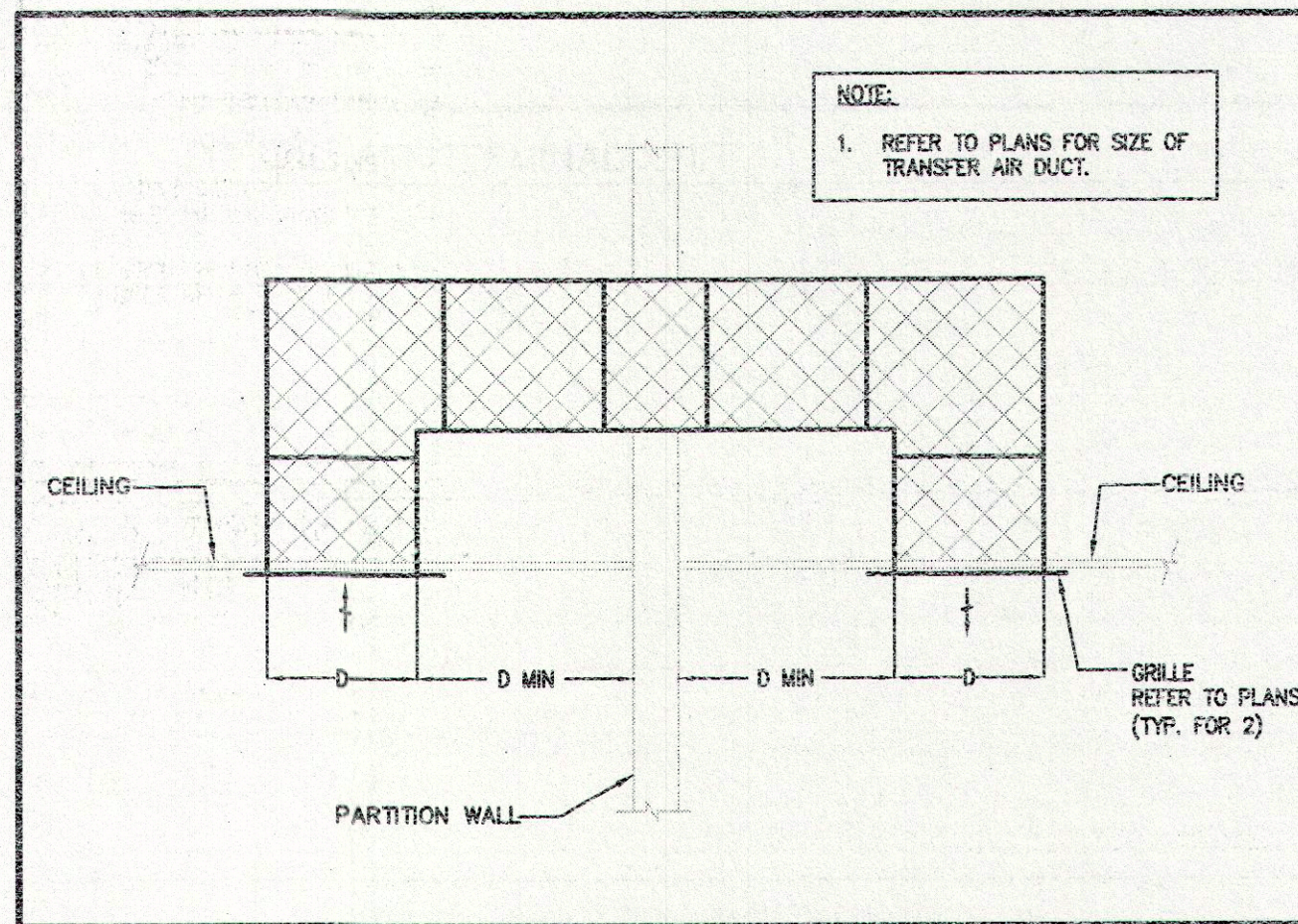
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 CS | AP | 06/19/12

12034 | M2.02 |  
 FILE | DRAWING

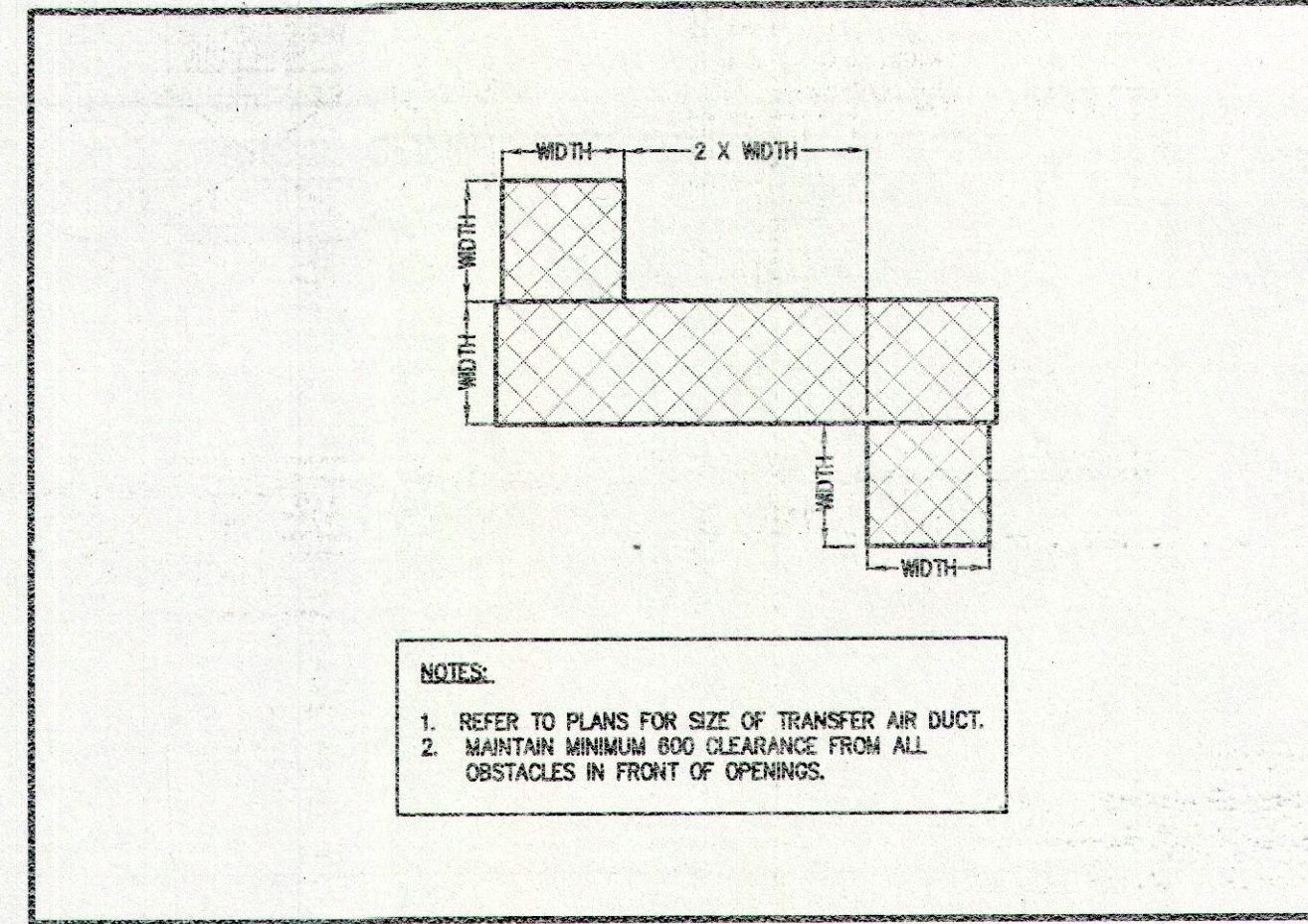


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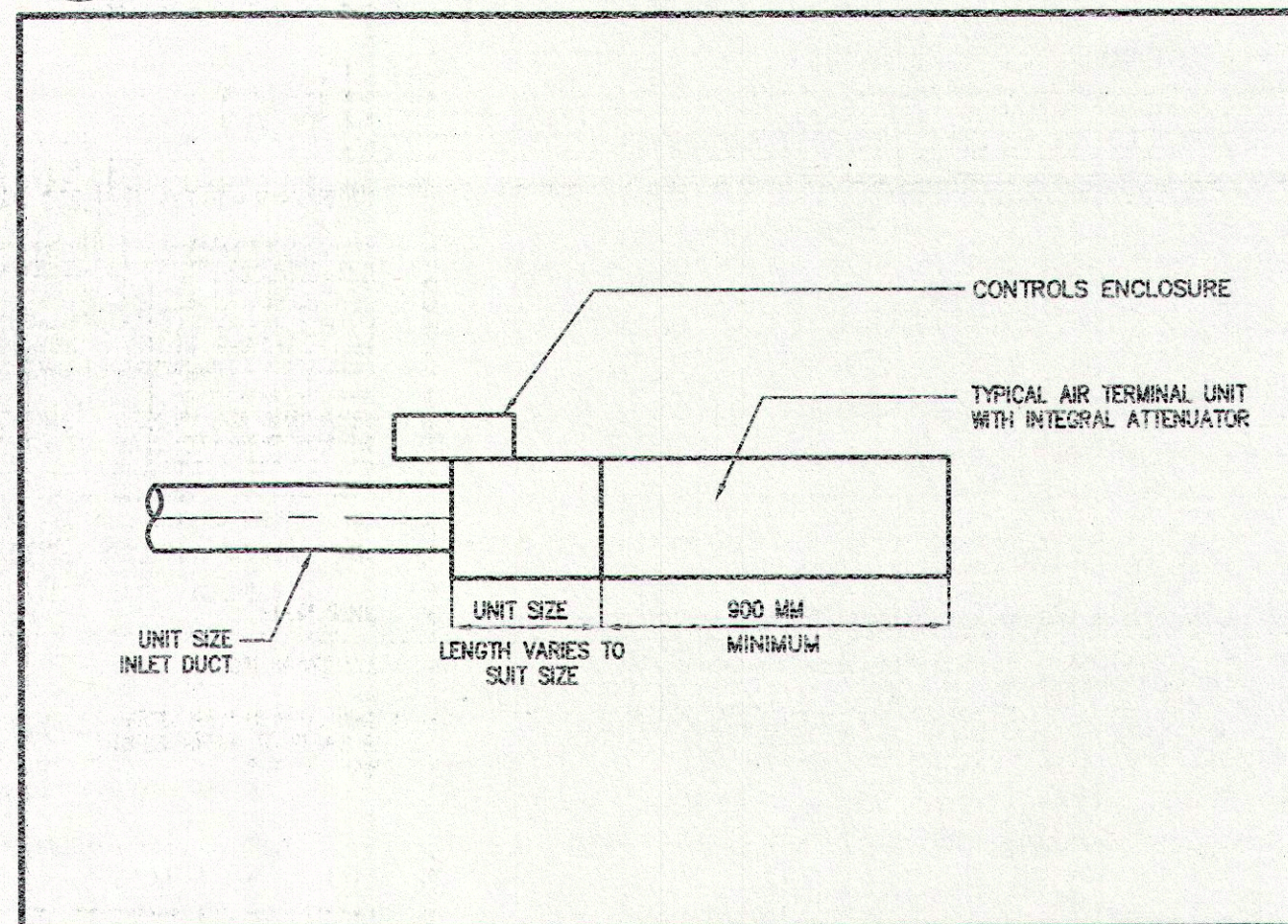
NO. | DATE | REVISION | BY



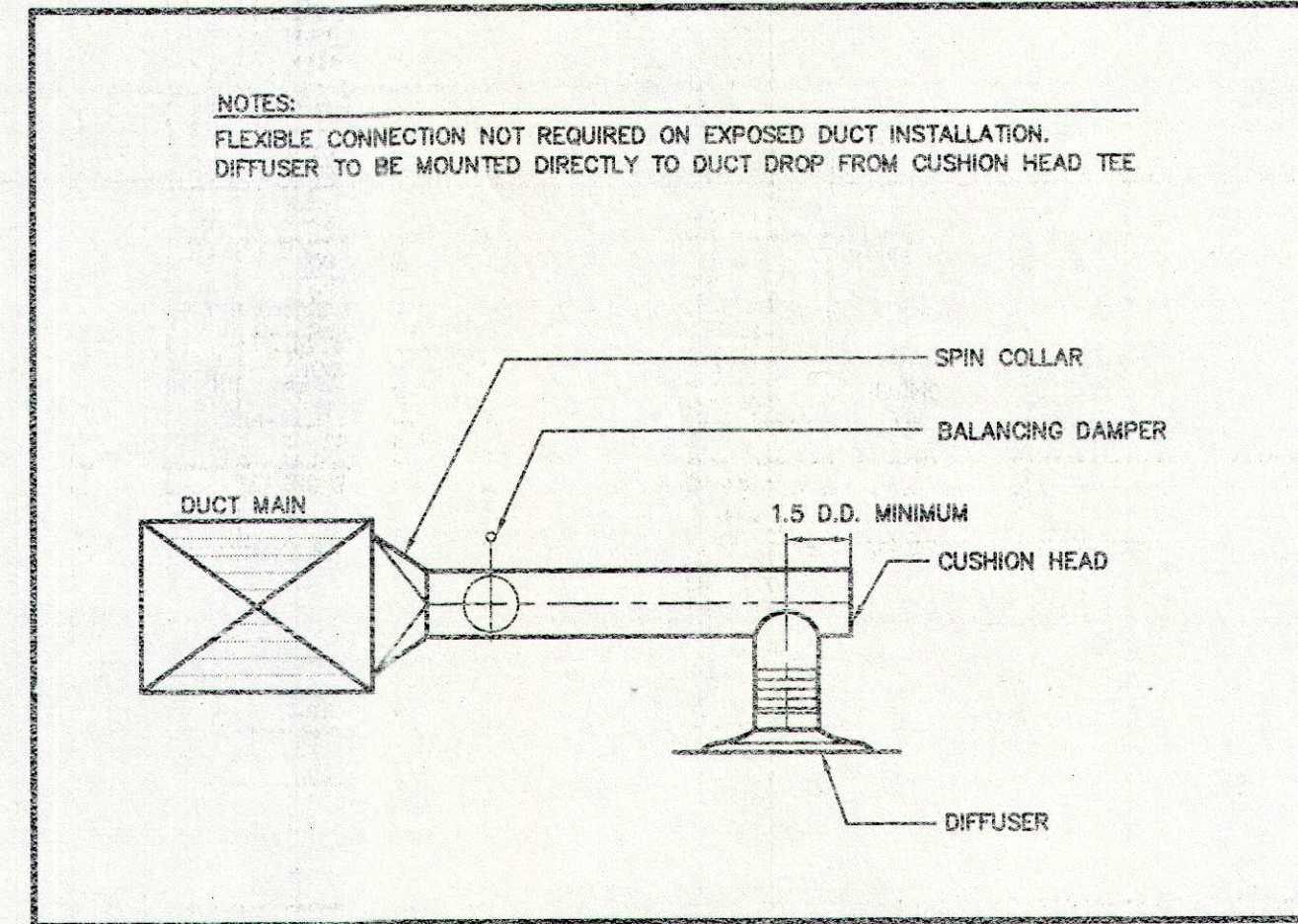
2 ROOM TO ROOM TRANSFER AIR DUCT DETAIL  
M3.01 NTS



1 TYPICAL TRANSFER AIR DUCT  
M3.01 NTS



4 TYPICAL AIR TERMINAL UNIT  
M3.01 NTS



3 TYPICAL CEILING DIFFUSER INSTALLATION  
M3.01 NTS

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www.group2.ca

PROJECT TITLE  
**DRUMHELLER TOWN  
HALL RELOCATION**

DRAWING TITLE  
DETAILS

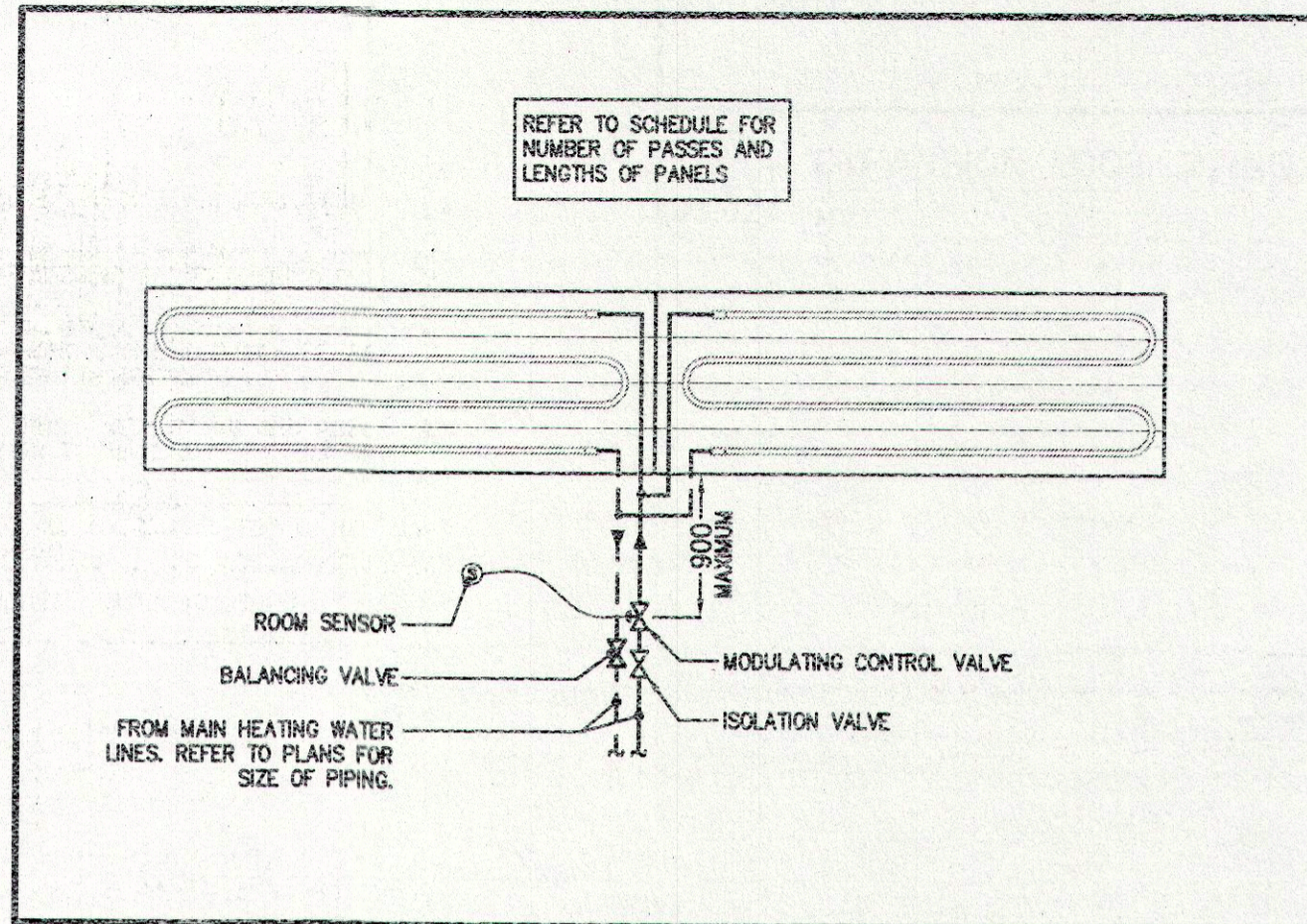
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CS | AP | 06/19/12

12034 | M3.01 |  
FILE | DRAWING

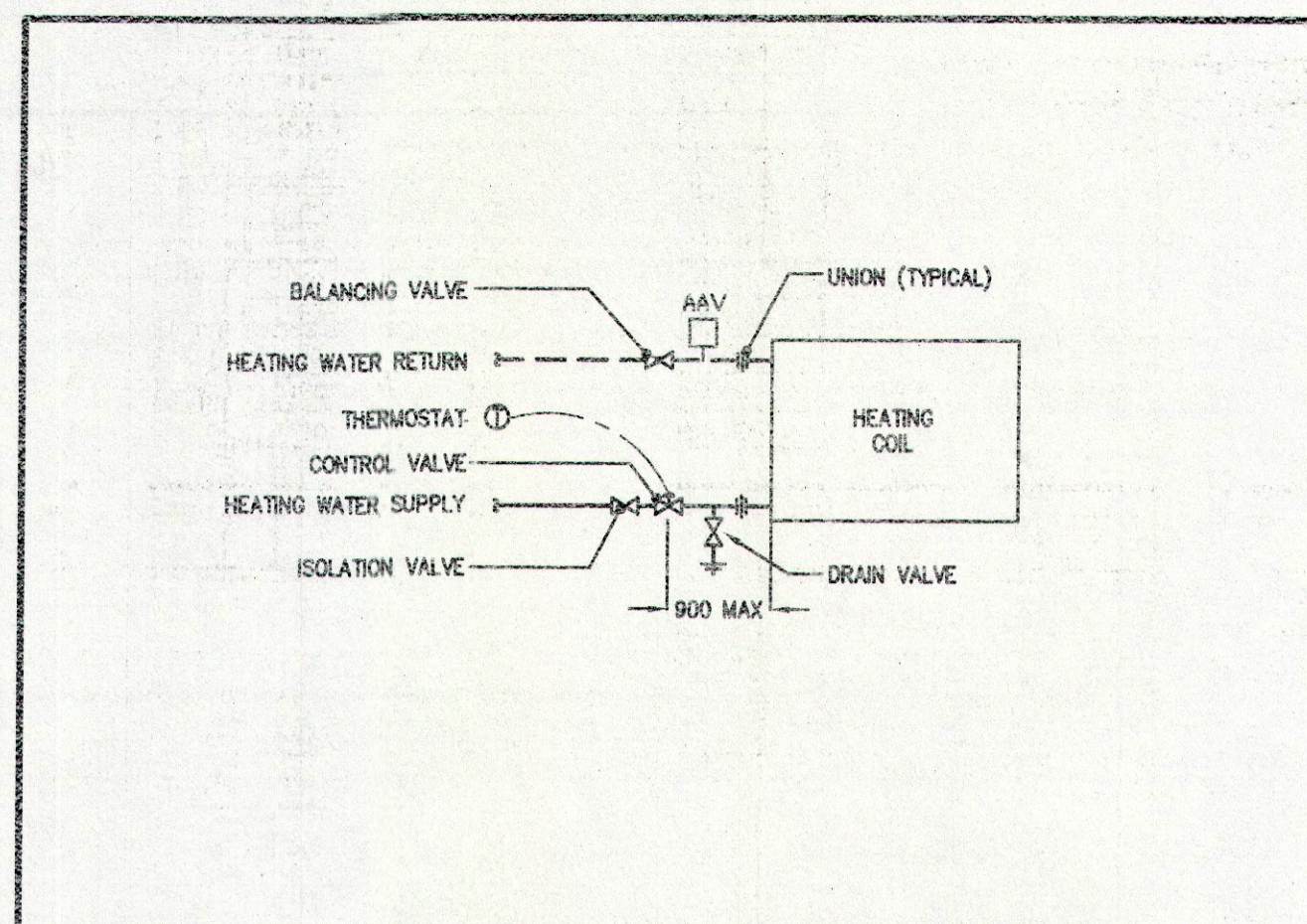


REVISIONS

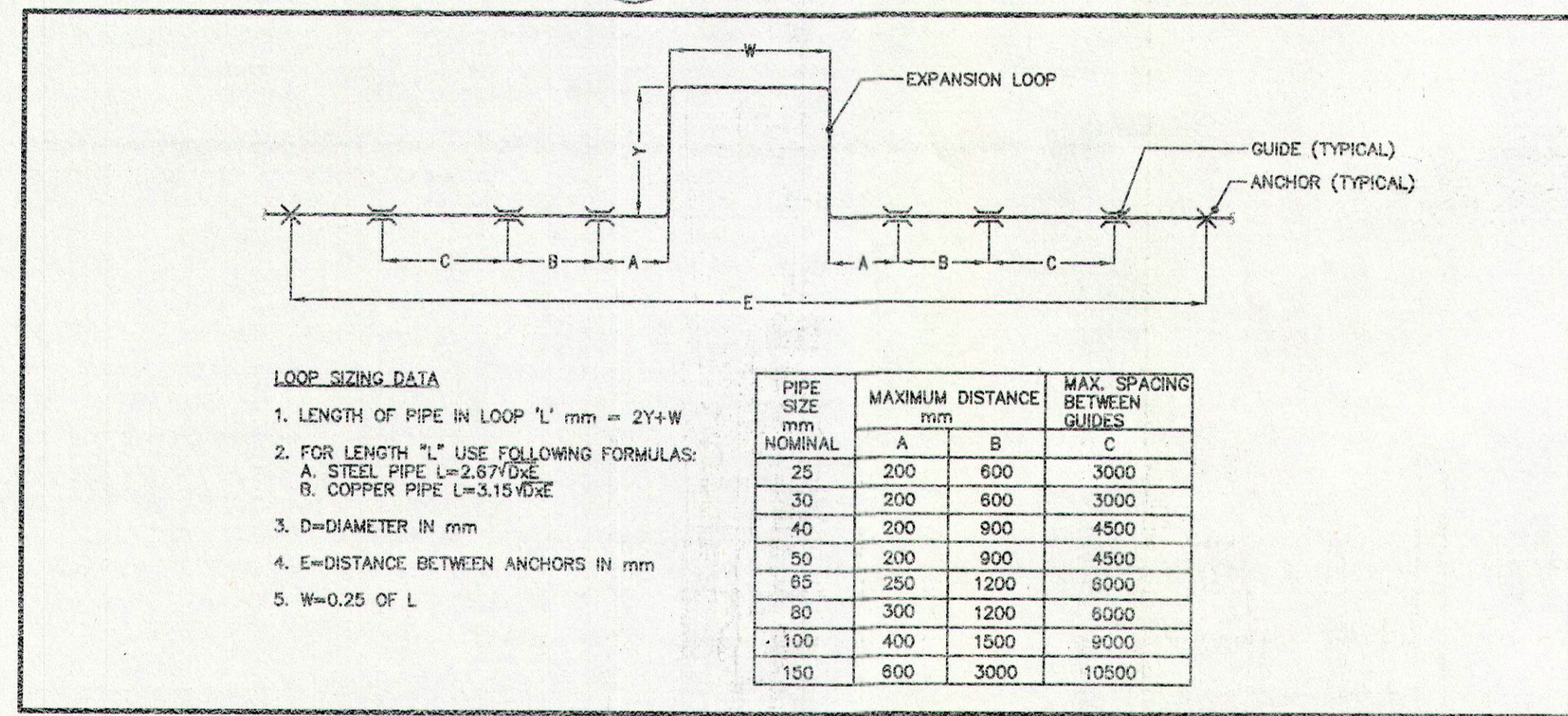
NO. | DATE | REVISION | BY



2 TYPICAL RADIANT PANEL INSTALLATION DETAIL  
M3.02 NTS



1 HOT WATER HEATING COIL PIPING DETAIL  
M3.02 NTS



3 EXPANSION LOOP SIZING DETAIL  
M3.02 NTS

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www.group2.ca

PROJECT TITLE  
**DRUMHELLER TOWN  
HALL RELOCATION**

DRAWING TITLE  
**DETAILS**

CHECKED | DRAWN | DATE  
CS | AP | 06/19/12

12034 | M3.02  
FILE | DRAWING



Automatic Controls (Edmonton) Ltd.  
As-built Control Shop Drawings For  
**City of Drumheller**  
City Hall  
Job # 1526



*ENVIRONMENTAL CONTROLS*  
BARBER COLMAN / ROBERTSHAW

**Automatic Controls (Edmonton) Ltd.**

5912-82 Avenue  
Edmonton, Alberta  
T6B 0E7  
Phone (403) 468-1996  
Fax (403) 468-9409

# Drumheller City Hall

Job # 1526

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Drawings 1, 1A, 1B, 1C

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Drawing 1

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Drawing 3

Information Sheets in Alphabetical Order

**Drumheller City Hall**  
**JOB# 1526**  
**SEQUENCE OF OPERATION**

Main Ventilation Unit AHU-1

Drawings 1, 1A, 1B, 1C

This system consists of a supply fan, two return air dampers, an outside air damper, a glycol pre-heat coil, a face and bypass steam re-heat coil and interlocks with two general exhaust fans.

The system operates on an occupied/unoccupied schedule as programmed into the Network 8000.

During unoccupied mode the supply fan is off, the mixing dampers are in their full recirculation positions, the glycol pre-heat coil modulates in order to maintain a mixed air temperature of 10 °C, the steam valve to the re-heat coil is only open if the pre-heat temperature is below 10 °C, the face and bypass dampers are in the full face position and both exhaust fans are off.

During heating season the unit will automatically pre-start using full heat from both coils and full return air prior to occupancy time in order to recover from the night setback by occupied time.

During cooling season a night purge routine will operate the unit using 100% outside air, both heating coils off and both exhaust fans on in order to lower the space temperature to 20 °C. This routine is only enabled when the space temperature is above 22 °C (adjustable), the outdoor air temperature is below 16 °C (adjustable) it is between 1:00 AM and 5:00 AM and it is a scheduled "on" day.

At occupied time the mixing dampers come under control and maintain a minimum of 20% (adjustable) outdoor air. A low limit routine will not allow the mixed air temperature to drop below 5 °C (adjustable).

The pre-heat coil steam valve will modulate in order to maintain the discharge air temperature setpoint. If the discharge air temperature setpoint cannot be maintained the steam face and bypass dampers will modulate in order to maintain it. The discharge air temperature setpoint is reset by the space temperature as follows:

SPACE TEMPERATURE

DISCHARGE TEMPERATURE

22 °C  
20 °C

12 °C  
18 °C

The mixing dampers will modulate open to 100 % outside air in order to provide free cooling. Whenever the outdoor air temperature exceeds the return air temperature the dampers will revert to minimum position.

The steam valve on the re-heat coil is only open when heating is called for by the face and bypass dampers.

The glycol pump only operates when the pre-heat coil steam valve on the exchanger is calling for heat.

The two general exhaust fans operate continuously during occupied mode. Whenever the outside air temperature is below -20'c (adjustable) a cycling routine will modulate the outside air damper from minimum to full closed and back to minimum every 20 minutes (adjustable) in order to prevent damper freezeups.

A manually reset freezestat will shut down the supply fan, revert the mixing dampers to full re-circulation position, fully open the pre-heat and re-heat coils, turn on the glycol pump, shut down the exhaust fans, and alarm on the system should a temperature of 5 °C or lower be sensed.

The following alarms are provided:

1. Supply fan failure
2. Exhaust fan failure
3. Glycol pump failure
4. Low mixed air temperature
5. Freezestat shutdown

#### Perimeter Zone Heating

Drawing 1

There are five zones of perimeter heating. Each zone has a space temperature sensor to modulate it's respective zone valve.

These zones operate on an occupied/unoccupied schedule as programmed into the Network 8000. During unoccupied mode the space temperature is allowed to drop to 16 °C (adjustable). During occupied mode the space temperature setpoint is 21 °C (adjustable).

Low space temperature alarms are provided.

#### Stand Alone Cooling Units

Drawings 2, 2A

There are three stand alone cooling units, one in the basement committee room, one on the main floor reception area, and one on the 2nd floor in the council chambers.

These units consist of a supply fan and a cooling coil. These units operate on an occupied/unoccupied schedule as programmed into the Network 8000. They only operate during occupied mode when no heat is being called for, the outdoor air temperature is above 15 °C (adjustable) and the space temperature is 23 °C or higher. Once operating the cooling will cycle in order to maintain a space temperature of 22 °C. Each unit has a separate time schedule to allow for low usage scheduling.

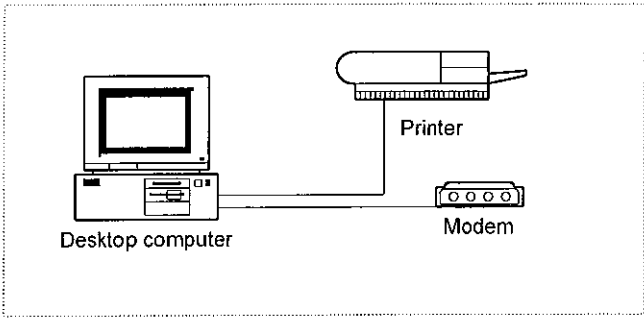
#### Steam Boiler Enable

#### Drawing 3

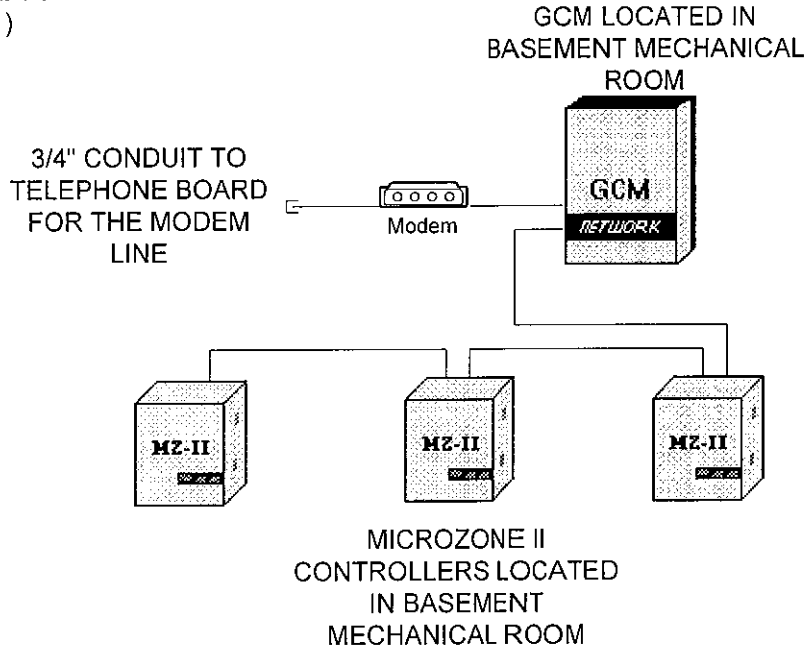
The steam boiler is enabled by the Network 8000. Whenever the outdoor air temperature exceeds 15°C (adjustable) the boiler is shut-down. The outdoor air temperature must drop to between 12 °C and 10 °C (adjustable) for at least 12 hours or to below 10 °C (adjustable) prior to the boiler being re-enabled.

Once the boiler is enabled it will cycle via it's existing controls to maintain 12 psi.

A main steam header pressure sensor will provide an input of the system steam pressure. A low pressure alarm is generated whenever 0 PSI is sensed and the boiler enable is "on".



CENTRAL COMPUTER  
COMPLETE WITH "SIGNAL"  
GRAPHICS SOFTWARE LOCATED  
IN MAINTENANCE SHOP  
( WORK PACKAGE TO BE  
ASSIGNED )














EQUIPMENT LIST			
KEY	QTY	PART #	DESCRIPTION
GCM	1	GCM-84121	GLOBAL CONTROL MODULE
MZ-II	3	MZ2-1E	MICROZONE II CONTROLLER

<i>Project Name</i>		<i>Project No.</i>		<i>Designed</i>		<i>Title</i>	
DRUMHELLER CITY HALL		1526		RJB		SYSTEM ARCHITECTURE	
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		<i>Date</i>		AUG 1994			
		<i>File Identifier</i>		1526SYS		<i>Dwg no.</i>	
		<i>Rev</i>		1	2	3	
<i>Date</i>							

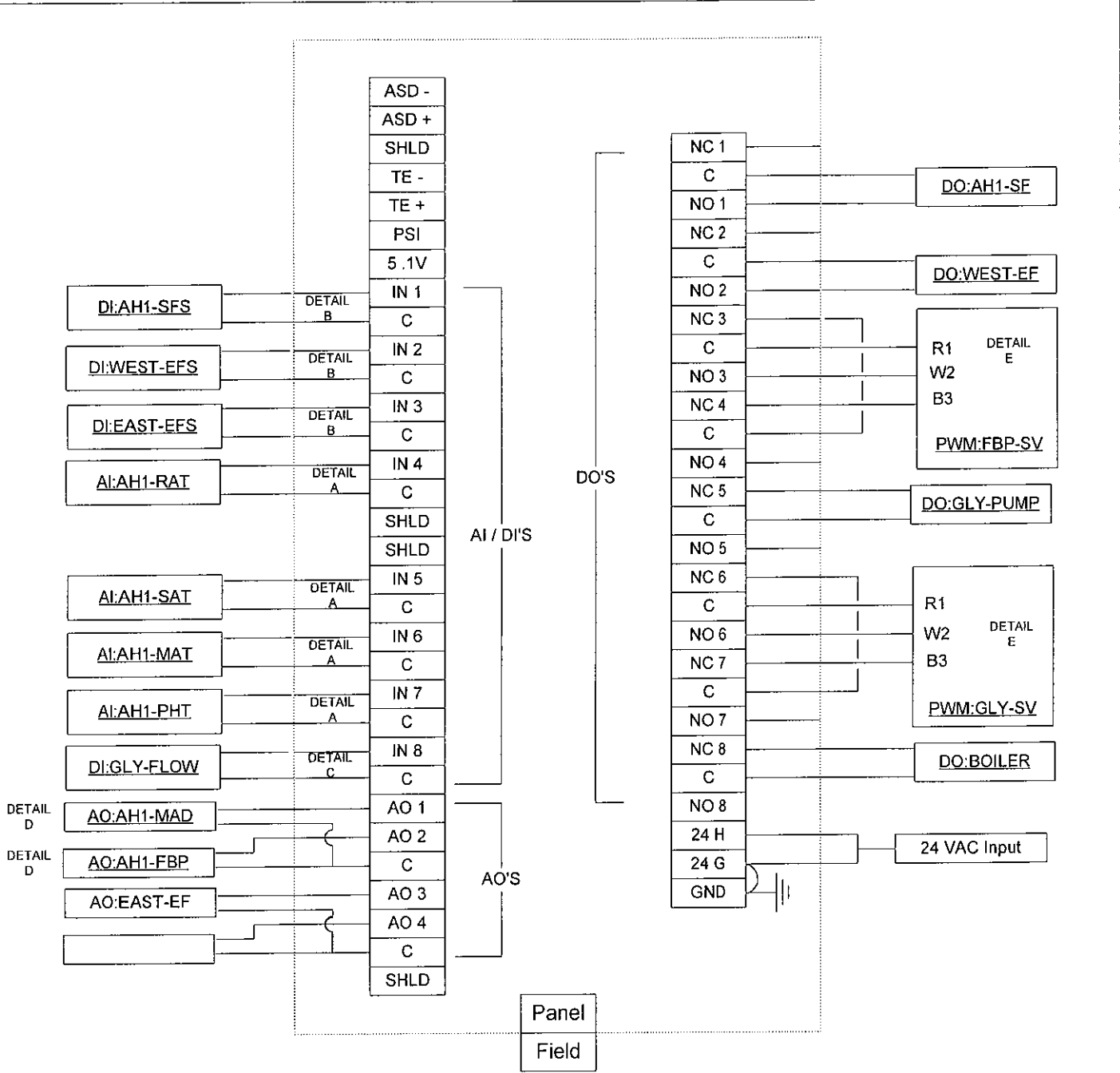


## TERMINAL LEGEND

	MICROZONE TERMINATION
	FIELD EQUIPMENT TERMINATION
	LOCAL PANEL TERMINATION
	FIELD DEVICE TERMINATION
	MCC OR STARTER TERMINATION
	SHIELDED 2 CONDUCTOR CABLE ( GROUNDING SHIELD )
	SHIELDED 2 CONDUCTOR CABLE ( ISOLATED SHIELD )
	PANEL OR STARTER WIRING
	FIELD WIRING
	STARTER COIL
	MOTOR

<i>Project Name</i>	<i>Project No.</i>	<i>Designed</i>	<i>Title</i>		
DRUMHELLER CITY HALL	1526	RJB	TERMINAL LEGEND		
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		<i>Date</i>			
		AUG 1994			
		<i>File Identifier</i>	<i>Dwg no.</i>		
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		<i>Rev</i>	1	2	3
		<i>Date</i>			



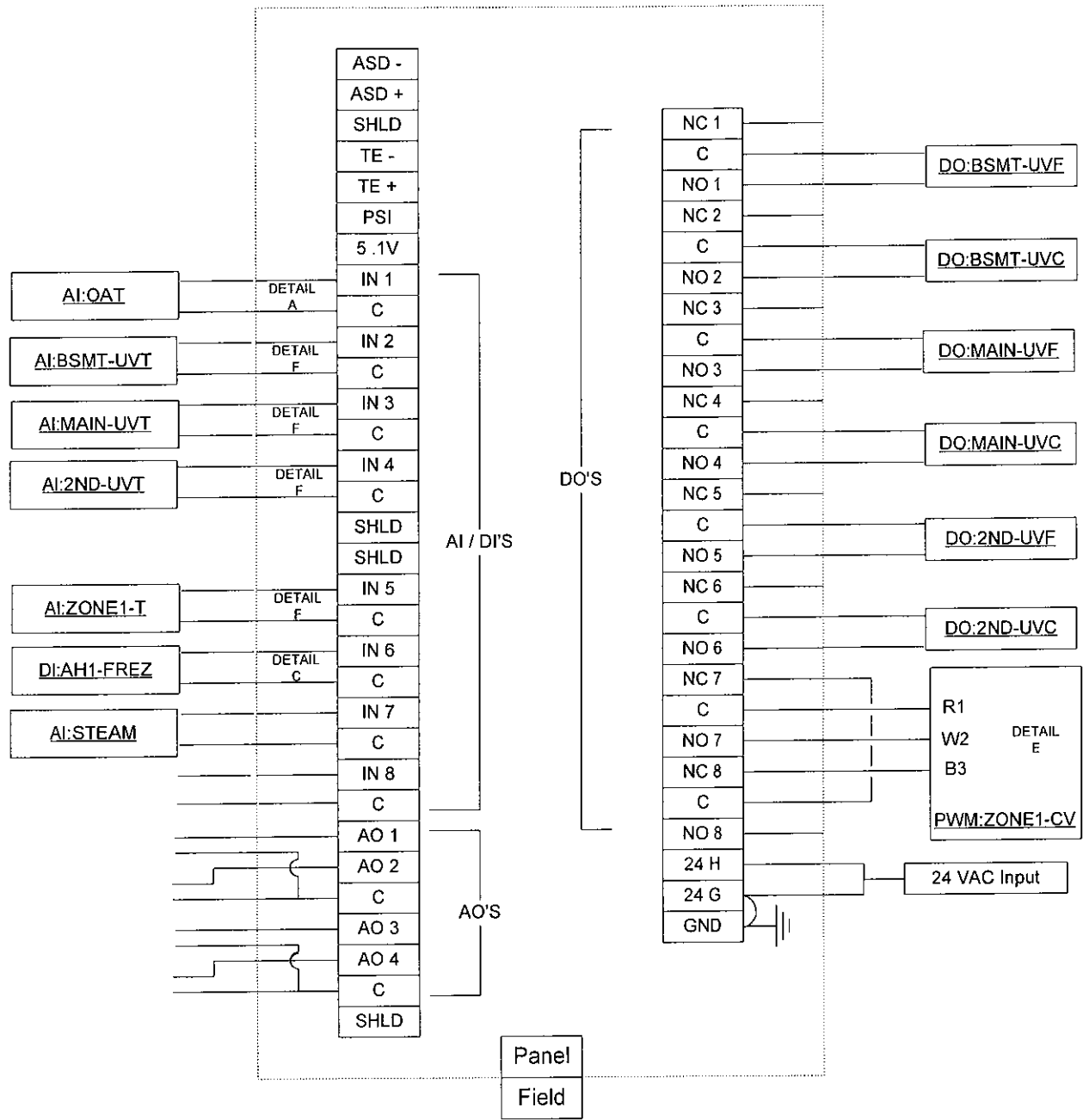


Terminate All Shields to Shield Terminals

For Details See Drawings D1 And D2

PANEL #	1
ADDRESS	1
ZONE	AHU-1

Project Name	Project No.	Designed	Title		
DRUMHELLER CITY HALL	1526	RJB	MICROZONE II TERMINATIONS		
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		Date			
		File Identifier	Dwg no.		
		1526T1	T1		
		Rev	1	2	3
		Date	DEC 94		

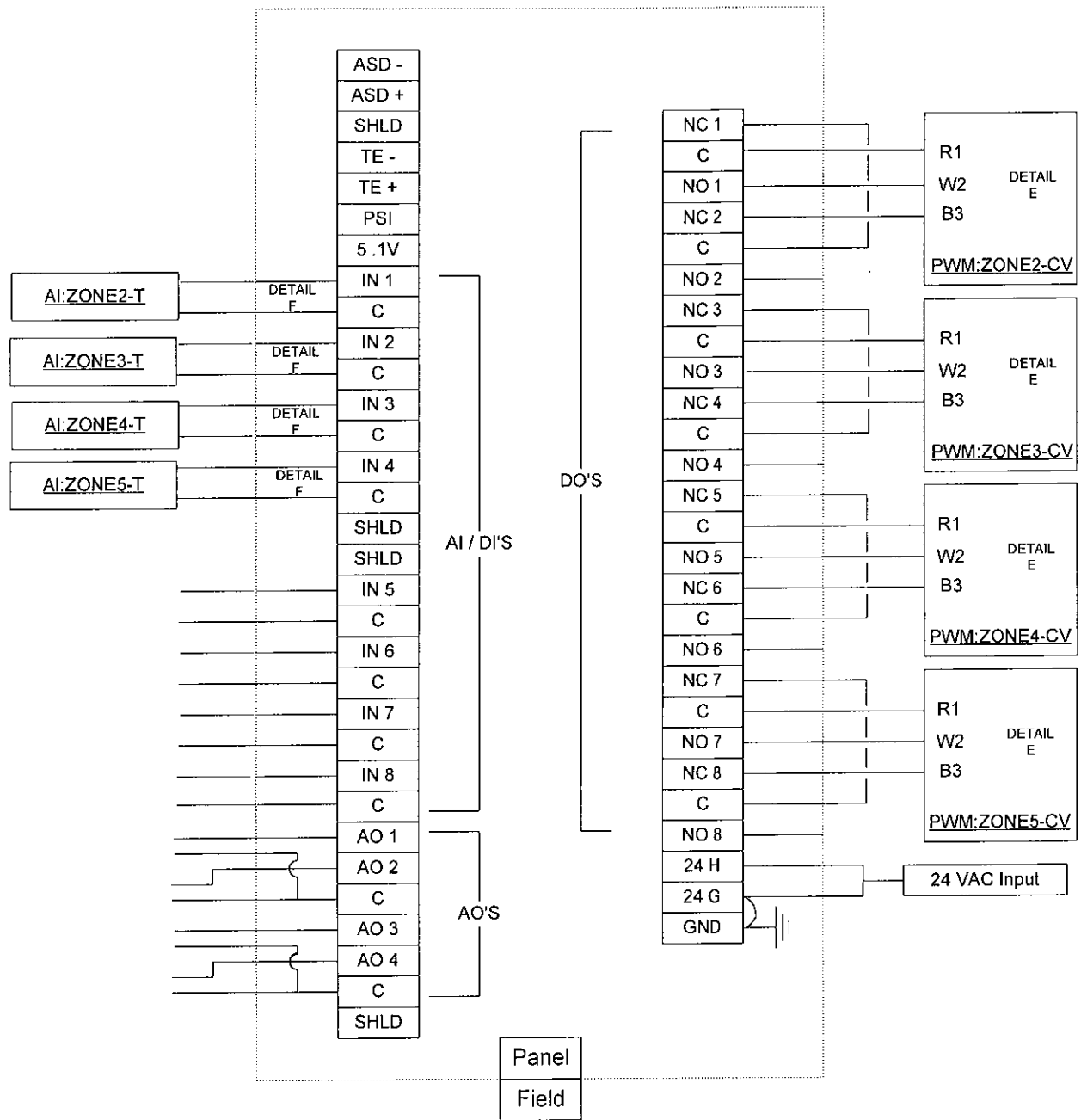


Terminate All Shields to Shield Terminals

For Details See Drawings D1 And D2

PANEL #	2
ADDRESS	2
ZONE	UV

<i>Project Name</i>	<i>Project No.</i>	<i>Designed</i>	<i>Title</i>		
<b>DRUMHELLER CITY HALL</b>	<b>1526</b>	RJB	<b>MICROZONE II TERMINATIONS</b>		
<b>Automatic Controls (Edmonton) Ltd.</b> <b>5912 - 82 Avenue</b> <b>Edmonton, Alberta</b> <b>Tel: (403) 468 1996</b> <b>Fax: (403) 468 9409</b>		<i>Date</i>			
		AUG 1994			
		<i>File Identifier</i>	<i>Dwg no.</i>		
1526T2	<b>T2</b>				
<i>Rev</i>	1	2	3		
<i>Date</i>					

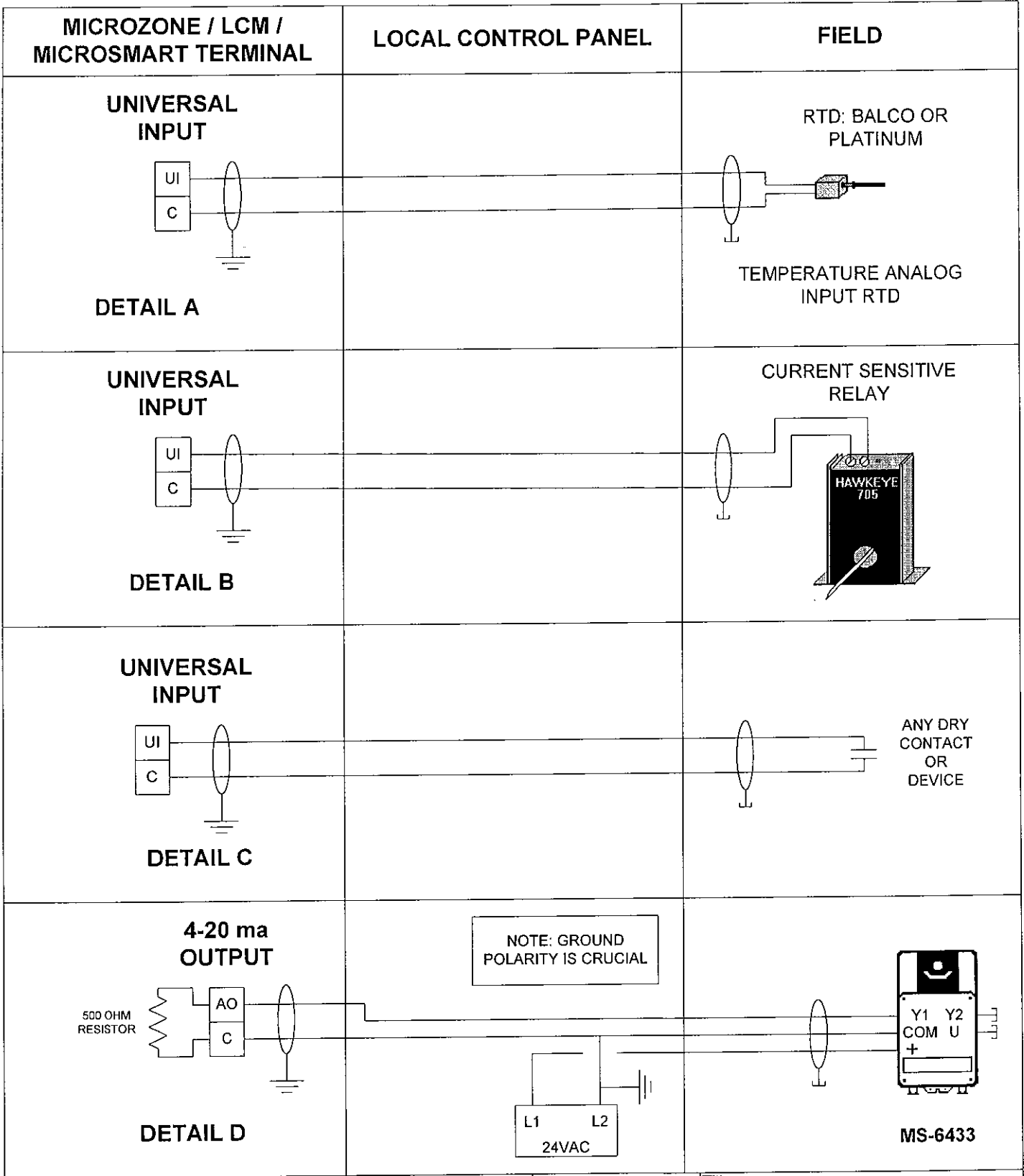


Terminate All Shields to Shield Terminals

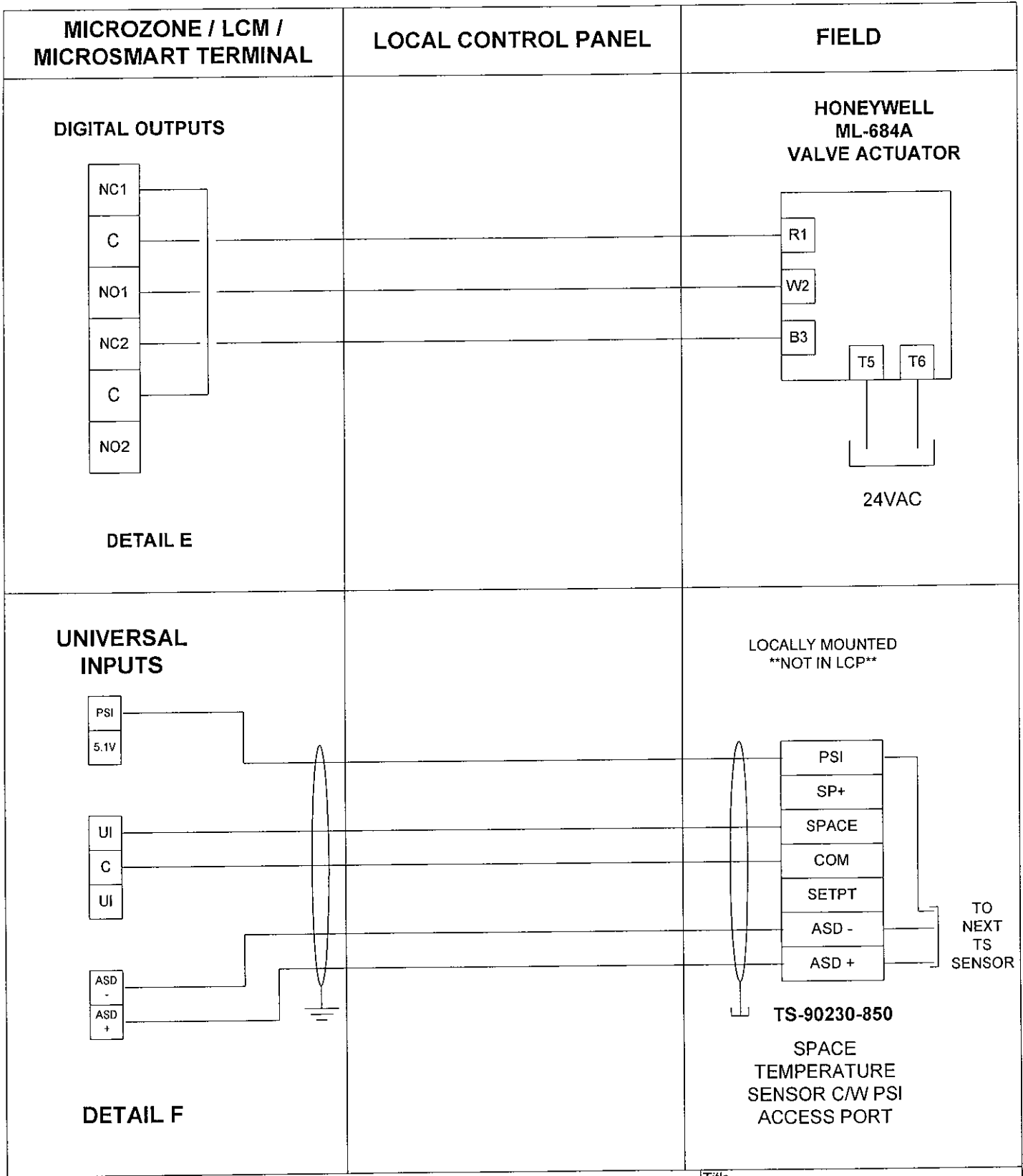
For Details See Drawings D1 And D2

PANEL #	3
ADDRESS	3
ZONE	RAD VALVES

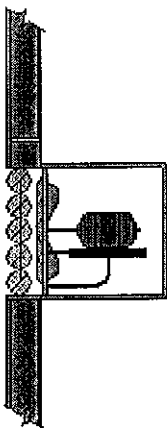
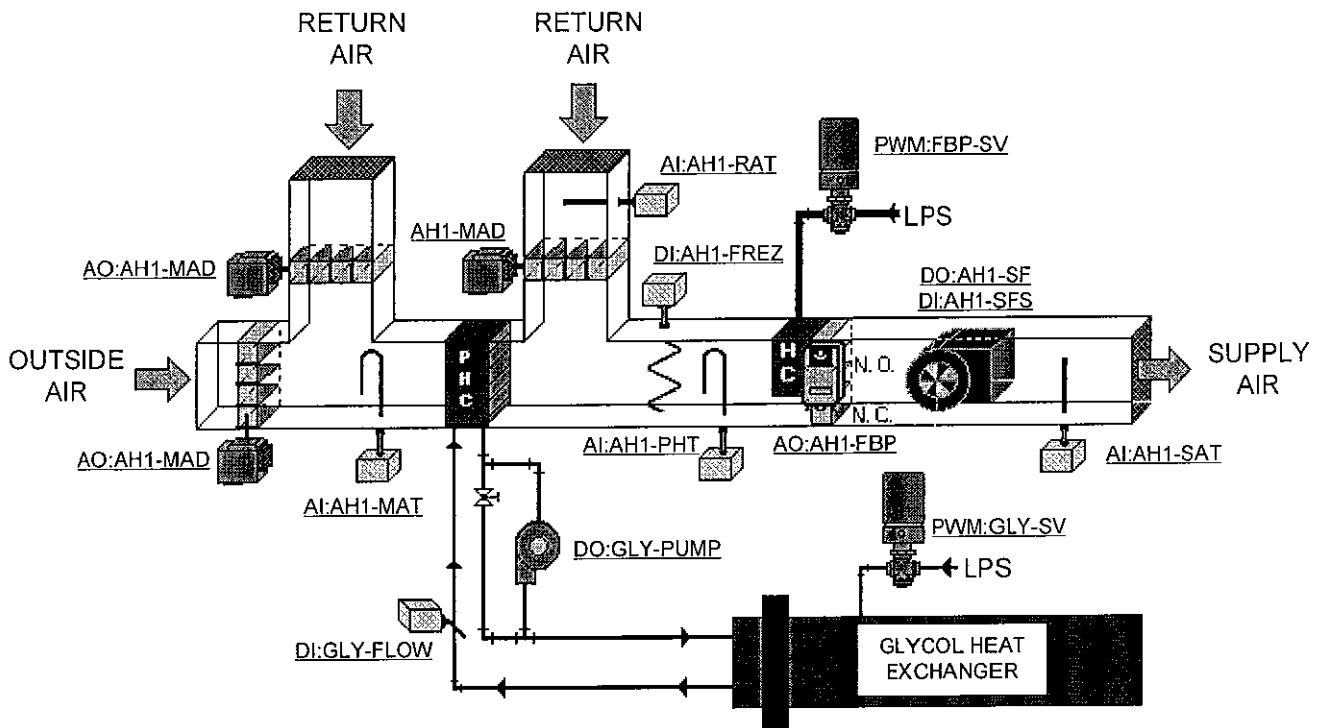
<i>Project Name</i>	<i>Project No.</i>	<i>Designed</i>	<i>Title</i>		
<b>DRUMHELLER CITY HALL</b>	<b>1526</b>	RJB	<b>MICROZONE II TERMINATIONS</b>		
<b>Automatic Controls (Edmonton) Ltd.</b> 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		<i>Date</i>			
		AUG 1994			
		<i>File Identifier</i>	<i>Dwg no.</i>		
1526T3	T3				
	<i>Rev</i>	1	2	3	
	<i>Date</i>				



<i>Project Name</i> <b>DRUMHELLER CITY HALL</b>	<i>Project No.</i> <b>1526</b>	<i>Designed</i> RJB	<i>Title</i> <b>WIRING DETAILS</b>		
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		<i>Date</i> AUG 1994	<i>Dwg no.</i> <b>D1</b>		
		<i>File Identifier</i> 1526D1			
		<i>Rev</i>	1	2	3
		<i>Date</i>			



<b>DRUMHELLER CITY HALL</b>		<b>1526</b>	<b>RJB</b>	<i>Title</i>		
<b>Automatic Controls (Edmonton) Ltd.</b> 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		<i>Date</i>		<b>WIRING DETAILS</b>		
		AUG 1994				
		<i>File Identifier</i>		<i>Dwg no.</i>		
		1526D2		<b>D2</b>		
		<i>Rev</i>		1	2	3
		<i>Date</i>				



TYPICAL FOR  
TWO GENERAL  
EXHAUST FANS

DO:EF  
DI:WEST-EFS  
DI:EAST-EFS

NEW SPACE TEMPERATURE  
SENSORS LOCATED IN THE  
SAME LOCATION AS THE OLD  
SPACE THERMOSTATS



AI:ZONE1-T  
AI:ZONE2-T  
AI:ZONE3-T  
AI:ZONE4-T  
AI:ZONE5-T

PWM:ZONE1-V  
PWM:ZONE2-V  
PWM:ZONE3-V  
PWM:ZONE4-V  
PWM:ZONE5-V

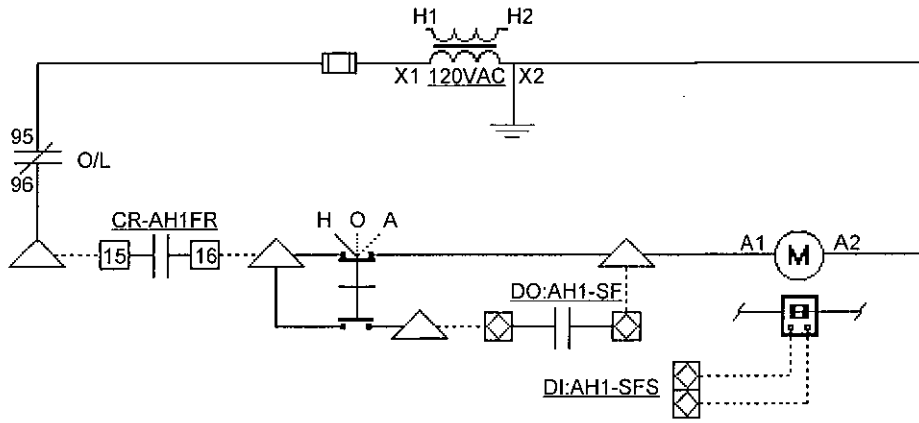
ZONE 1 MAIN FLOOR RECEPTION EAST AND SOUTH
ZONE 2 COUNCIL CHAMBERS EAST AND SOUTH
ZONE 3 LOWER MEETING ROOM AND LUNCHROOM
ZONE 4 BASEMENT N.W. CORNER, MAIN FLOOR AND 2ND FLOOR NORTH SIDE
ZONE 5 HALLWAYS AND SOUTH SIDE BETWEEN STAIRWELLS



TYPICAL HEATING ZONE

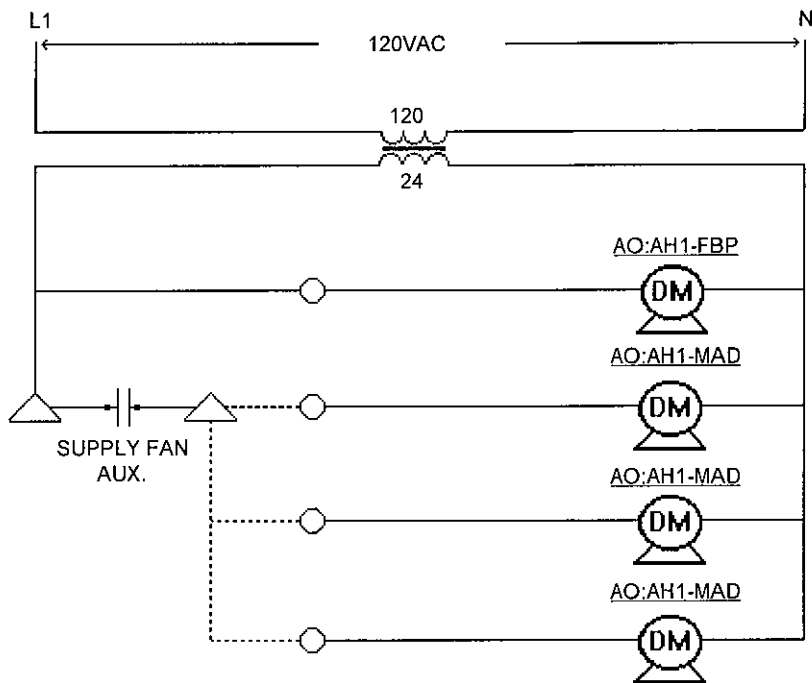
Project Name	Project No.	Designed	Title			
DRUMHELLER CITY HALL	1526	RJB	MAIN VENTILATION UNIT AHU-1 AND STEAM HEATING ZONES			
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		Date	Dwg no.			
		AUG 1994	1			
		File	15261	Rev	1	2
			Date	DEC 94		





AHU-1  
SUPPLY  
FAN  
CONTROL

AHU-1  
SUPPLY  
FAN  
STATUS

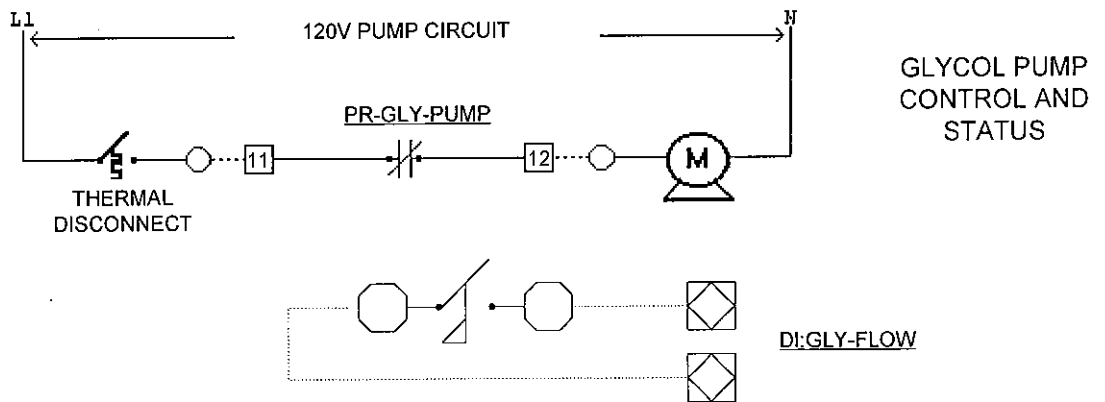
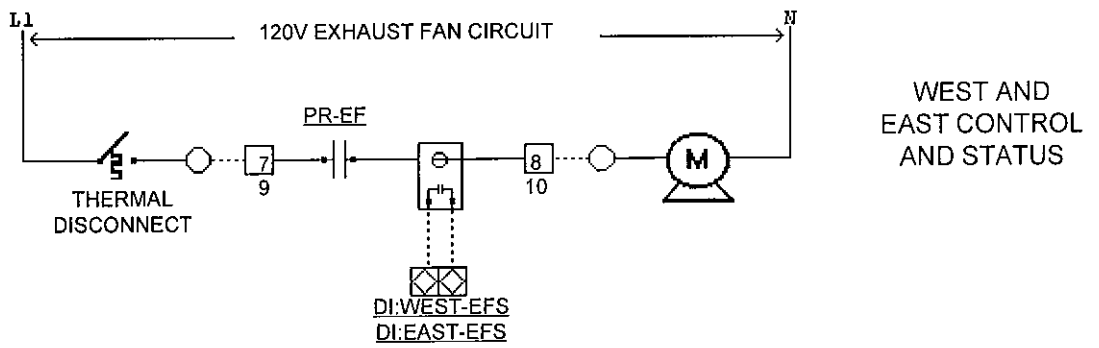
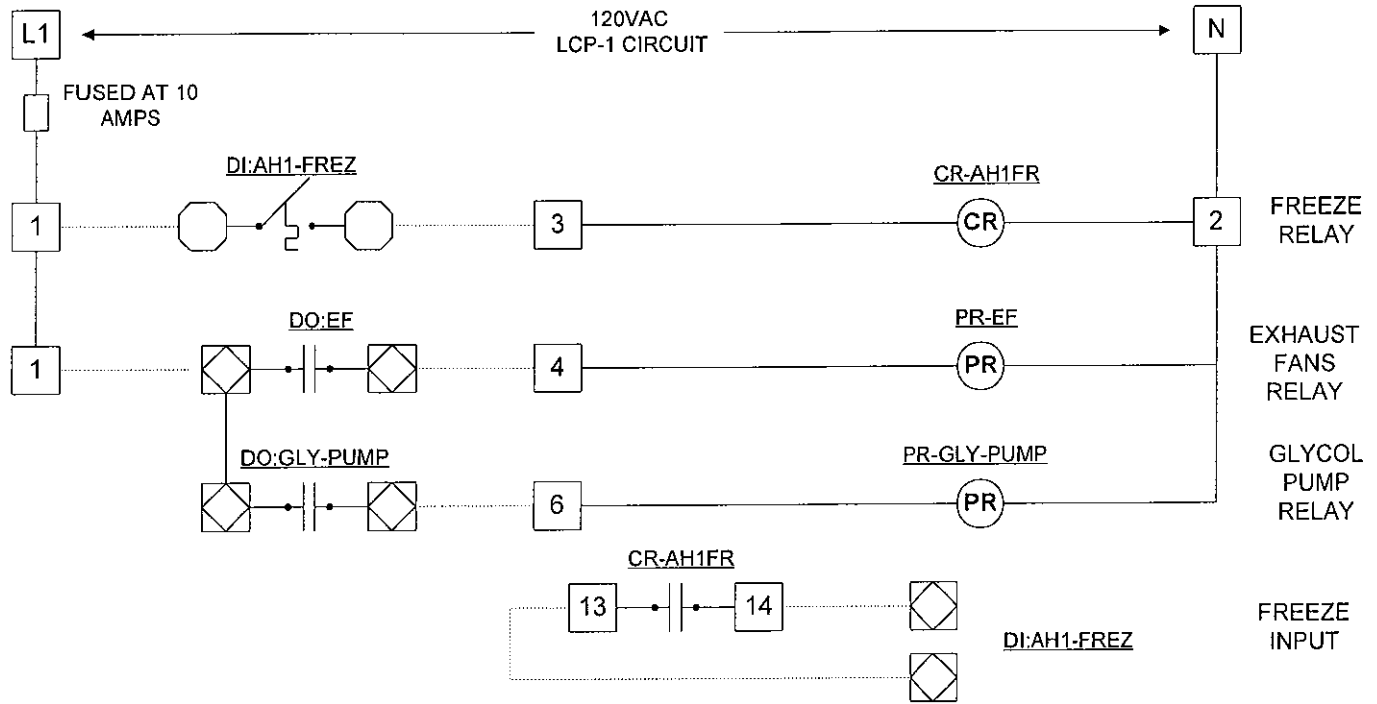


FACE AND  
BYPASS  
DAMPERS

MIXED AIR  
DAMPERS

NOTE: FOR DETAILED  
WIRING OF DAMPER  
ACTUATORS REFER TO  
DETAIL D ON DETAIL  
DRAWING D1

Project Name	Project No.	Designed	Title		
DRUMHELLER CITY HALL	1526	RJB	MAIN VENTILATION UNIT AHU-1 WIRING		
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		Date			
		AUG 1994	1A		
		File	15261A	Rev	1
		Date			



<b>Project Name</b> DRUMHELLER CITY HALL		<b>Project No.</b> 1526		<b>Designed</b> RJB		<b>Title</b> MAIN VENTILATION UNIT AHU-1 EXHAUST FAN AND GLYCOL PUMP INTERLOCK WIRING		
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409				<b>Date</b> NOV 1994		<b>Dwg no.</b> 1B		
				<b>File</b> 15261B		<b>Rev</b> 1      2      3		
						<b>Date</b> DEC 94		

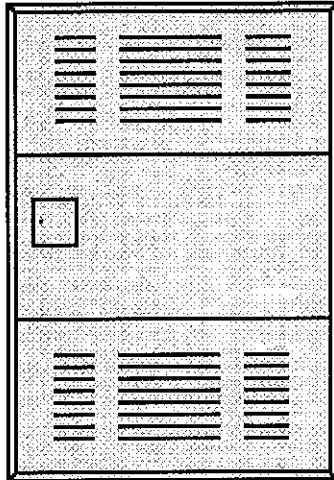
### EQUIPMENT LIST

KEY	QTY	PART #	DESCRIPTION
<u>AI:AH1-MAT.PHT</u>	2	TS-8422	AVERAGING DUCT TEMPERATURE SENSOR
<u>AI:AH1-RAT.SAT</u>	2	TS-8201	DUCT TEMPERATURE SENSOR
<u>AI:ZONE1-T,ZONE2-T,ZONE3-T,ZONE4-T,ZONE5-T</u>	5	TS-90230-850	SPACE TEMP. SENSOR C/W OVERRIDE BUTTON AND PSI PORT
<u>AO:AH1-FBP,MAD</u>	4	MS-6433	24V MODULATING ACTUATOR
<u>DI:AH1-SFS.WEST-EFS.EAST-EFS</u>	3	HAWKEYE 705	CURRENT SENSITIVE RELAY
<u>DI:AH1-FREZ</u>	1	TC-5141	MANUAL RESET FREEZESTAT
<u>CR-AH1FR</u>	1	OMRON	120V CONTROL RELAY
<u>PR-WEST-EF,EAST-EF.GLY-PUMP</u>	3	OMRON	120V POWER RELAY

<i>Project Name</i>	<i>Project No.</i>	<i>Designed</i>	<i>Title</i>		
<b>DRUMHELLER CITY HALL</b>	<b>1526</b>	RJB	<b>MAIN VENTILATION UNIT AHU-1 EQUIPMENT LIST</b>		
<b>Automatic Controls (Edmonton) Ltd.</b> 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		<i>Date</i>			
		AUG 1994	<b>1C</b>		
		<i>File</i>	15261C	<i>Rev</i>	1
		<i>Date</i>			



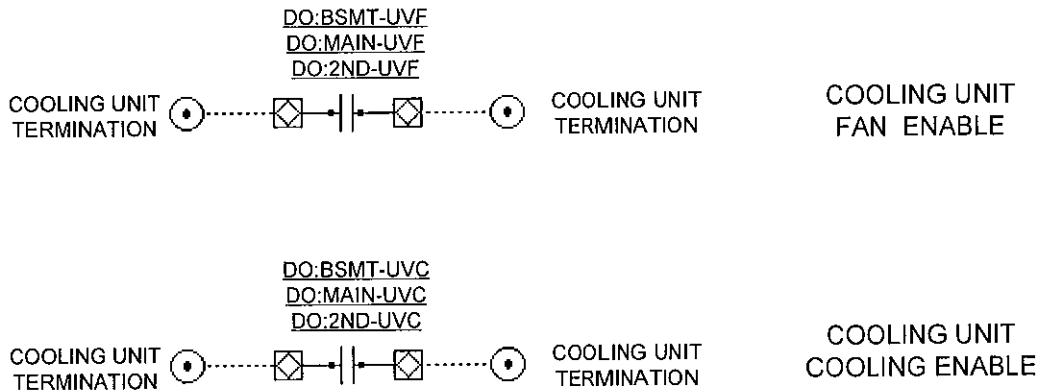
STAND ALONE  
COOLING UNITS  
BASEMENT AND MAIN  
FLOOR UNITS



DO:BSMT-UVF  
DO:BSMT-UVC  
DO:MAIN-UVF  
DO:MAIN-UVC

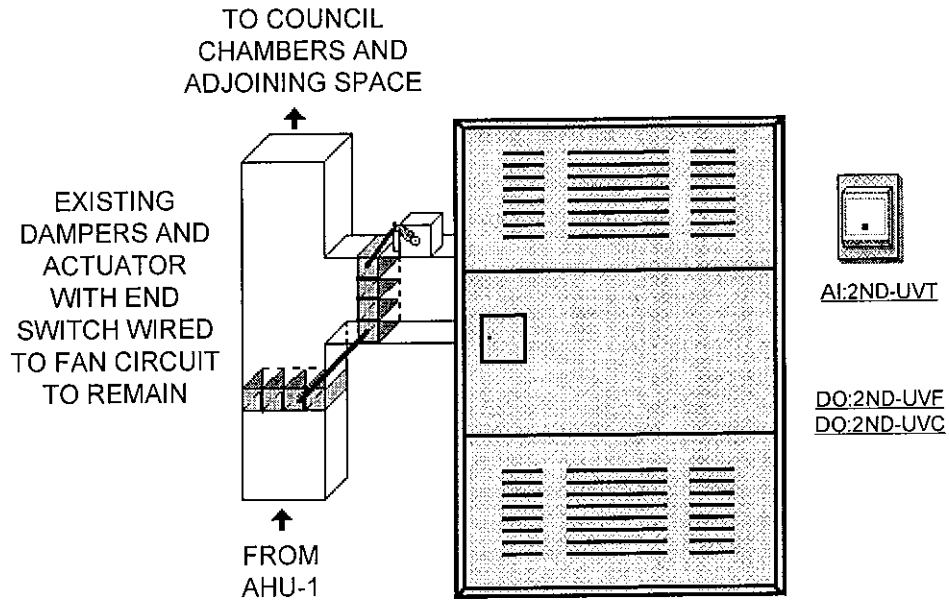


AI:BSMT-UVT  
AI:MAIN-UVT



<i>Project Name</i>		<i>Project No.</i>		<i>Designed</i>		<i>Title</i>		
DRUMHELLER CITY HALL		1526		RJB		STAND ALONE COOLING UNITS BASEMENT, MAIN FLOOR AND 2ND FLOOR		
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409				<i>Date</i>		<i>Dwg no.</i>		
				AUG 1994		2		
				<i>File</i>		<i>Rev</i>		
		15262		1	2	3		
				<i>Date</i>	DEC 94			

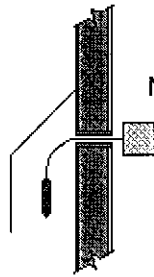
### COUNCIL CHAMBERS UNIT ONLY



### EQUIPMENT LIST

KEY	QTY	PART #	DESCRIPTION
AI:BSMT-UVT,MAIN-UVT,2ND-UVT	3	TS-90230-850	SPACE TEMP. SENSOR C/W OVERRIDE BUTTON AND PSI PORT

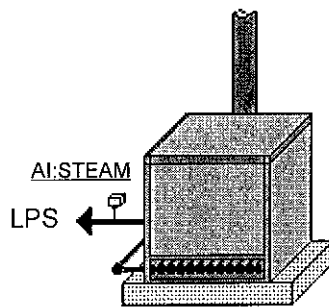
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<b>DRUMHELLER CITY HALL</b>	<b>1526</b>	RJB	<b>STAND ALONE COOLING UNITS EQUIPMENT LIST</b>		
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409		<i>Date</i>			
		AUG 1994	<b>2A</b>		
		<i>File</i>	15262A	<i>Rev</i>	1
		<i>Date</i>	DEC 94		



MOUNT ON  
NORTH FACE

AI:OAT

OUTSIDE AIR  
TEMPERATURE  
SENSOR



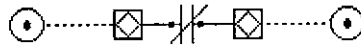
DO:BOILER

AI:STEAM

LPS

DO:BOILER

BOILER  
TERMINATION



BOILER  
TERMINATION

BOILER ENABLE

### EQUIPMENT LIST

KEY	QTY	PART #	DESCRIPTION
AI:OAT	1	TS-8501	OUTSIDE AIR TEMPERATURE SENSOR
AI:STEAM	1	LVDT-030	0-30 PSI SENSOR

<i>Project Name</i> <b>DRUMHELLER CITY HALL</b>		<i>Project No.</i> <b>1526</b>	<i>Designed</i> RJB	<i>Title</i> <b>STEAM BOILER ENABLE</b>		
Automatic Controls (Edmonton) Ltd. 5912 - 82 Avenue Edmonton, Alberta Tel: (403) 468 1996 Fax: (403) 468 9409			<i>Date</i> AUG 1994	<i>Dwg no.</i> <b>3</b>		
			<i>File</i> 15263	<i>Rev</i> Date	1	2





9010 - 20 STREET  
EDMONTON, ALBERTA

PHONE 780.417.7000  
FAX 780.417.7001

**4256**

## ***Drumheller Town Hall Reno***

Engineer: HIDI RAE

Contractor: Dee Jay Plumbing

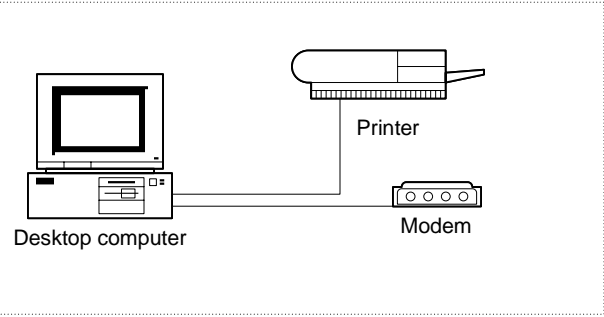


9010 - 20 STREET  
EDMONTON, ALBERTA

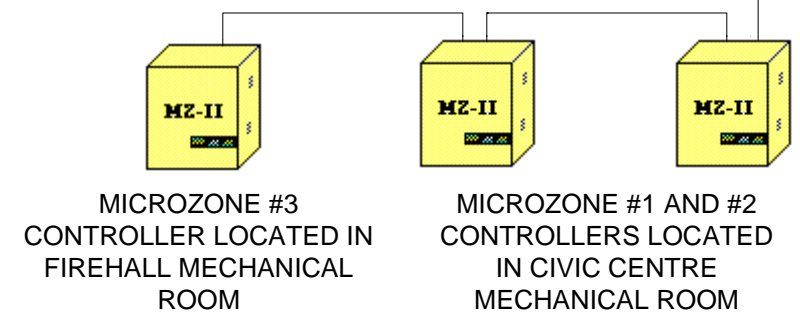
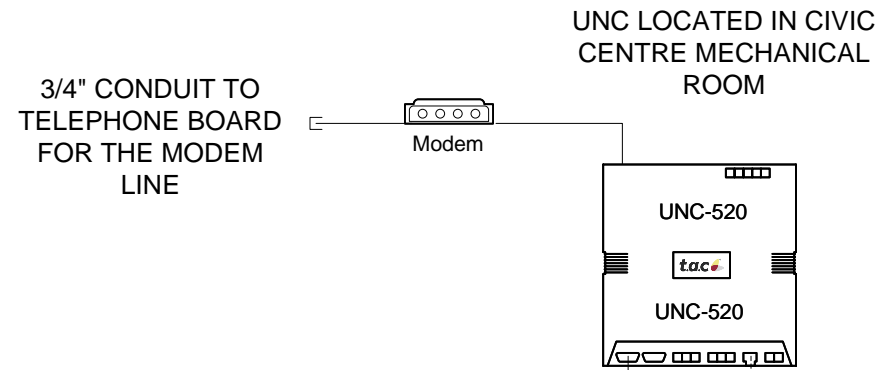
PHONE 780.417.7000  
FAX 780.417.7001

### **Drawing Index:**

System Architecture	Page 1	Unit Heaters	Page 6
Valve Schedule	Page 2	Zones	Page 7
Bypass Box	Page 3	Zones	Page 8
Exhaust Fans	Page 4	Zones	Page 9
Air Conditioning	Page 5	Zones	Page 10



CENTRAL COMPUTER COMPLETE WITH "SIGNAL" GRAPHICS SOFTWARE LOCATED IN MAINTENANCE SHOP ( WORK PACKAGE TO BE ASSIGNED )



EXISTING ARCHITECTURE



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Engineer: Dee Jay Plumbing  
Contractor: wjr  
Designed by: Date: 01/31/13  
Software by: Date:  
Checked by: Date:

Drumheller Town Hall Reno  
System Architecture

JOB NUMBER 4256  
FILE NAME System Architecture.vsd  
SHEET NO. 1 OF 10



Company: Automatic Controls Ltd.  
 Phone: 780-417-7000  
 Fax: 780-417-7001

Project Name: Drumheller Town Hall  
 Project Number: 4256  
 Owner:  
 Engineer: HIDI RAE  
 Contractor: Dee Jay Plumbing

Date:  
 Revision #:  
 Approved:

VALVE PRESSURE DROP (PSI) TO BE USED IN H<sub>2</sub>O CALCULATIONS: 3.0

STEAM INLET PRESSURE (PSIG) TO BE USED IN STEAM APPLICATIONS: 5.0

**AUTOMATIC TEMPERATURE CONTROL VALVE SCHEDULE (PLEASE SEE INSTALLATION NOTES)**

ITEM	SYSTEM	TAG	QTY	SERVICE	PART # VALVE ASSEMBLY	ACTUATOR	SPRING RANGE	POS. POSIT.	VLV. TYPE	VLV. SIZE	PIPE SIZE	VLV. ACTION	CONN. TYPE	FLOW GPM	VALVE CV		ACT. PRESS. DROP (PSI)	CLOSE OFF (PSI)		PIPING DETAIL
															CALC.	ACT.		STEM UP	STEM DN.	
1	Radiant Panels Only Room 202	CV-1	1	Hot Water	VBS2N12+M112A01	M112A01	FLOATING	N	2 Way Straight	3/4"		Fails Normally Open	Screwed			1.2		130	130	
2	Radiant Panels and Wall Fin Only	CV-2	3	Hot Water	VBS2N11+M112A01	M112A01	FLOATING	N	2 Way Straight	3/4"		Fails Normally Open	Screwed			0.7	0.00	130	130	
3	Radiant Panels with (RHC-1, 4, 12, 15, 19)	CV-3	5	Hot Water	VBS2N11+M113A01	M113A01	0-10 VDC, 5-10 VDC	N	2 Way Straight	3/4"		Fails Normally Open	Screwed			0.7		130	130	
4	Radiant Panels with (RHC-5, 6, 10, 13, 14, 20)	CV-4	6	Hot Water	VBS2N11+M113A01	M113A01	0-10 VDC, 5-10 VDC	N	2 Way Straight	3/4"		Fails Normally Open	Screwed			0.7		130	130	
5	Ceiling Radiant Panels	CV-5	5	Hot Water	VBS2N11+M112A01	M112A01	FLOATING	N	2 Way Straight	3/4"		Fails Normally Open	Screwed			0.7	0.00	130	130	
6	Reheat Coils ALL OTHERS	CV-6	18	Hot Water	VBS2N11+M131A01	M131A01	FLOATING	N	2 Way Straight	3/4"		No Fail Safe Position	Screwed			0.7	0.00	130	130	
7	Reheat Coils RHC-13, 14, 15	CV-7	3	Hot Water	VBS2N12+M131A01	M131A01	FLOATING	N	2 Way Straight	3/4"		No Fail Safe Position	Screwed			1.2	0.00	130	130	



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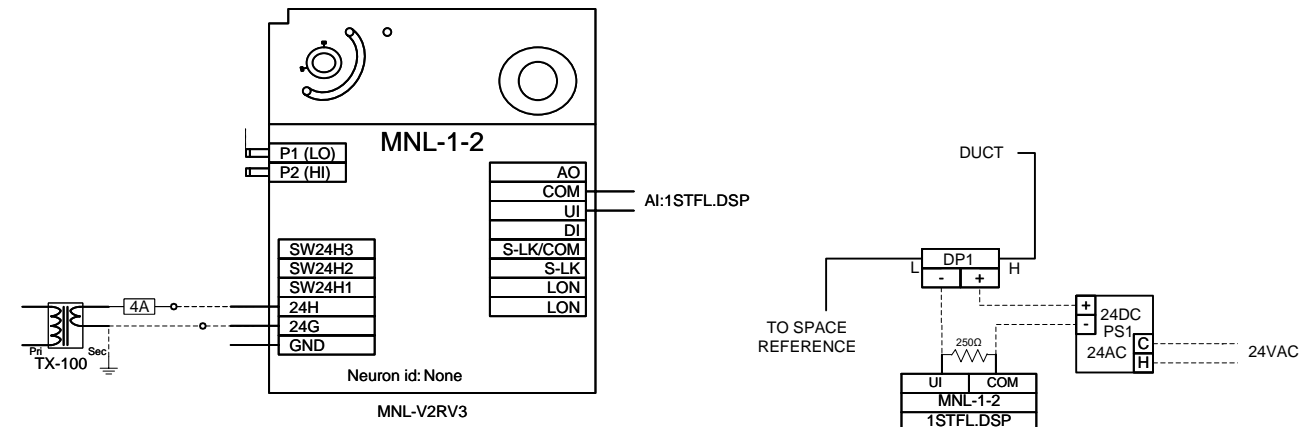
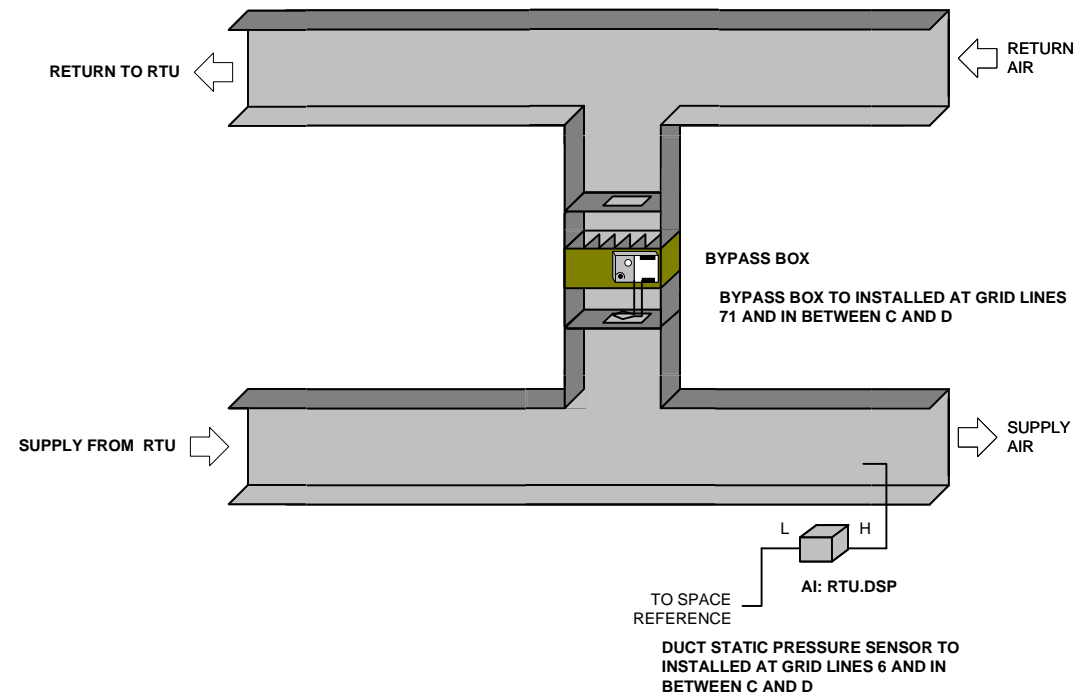
Architect: Drumheller Town Hall Reno  
 Engineer: HIDI RAE  
 Contractor: Dee Jay Plumbing  
 Designed by: wjr Date: 01/30/13  
 Software by: Date:  
 Checked by: Date:

Drumheller Town Hall Reno  
 Valve Schedule



JOB NUMBER  
4256  
 FILE NAME  
Valve Schedule.vsd  
 SHEET NO.  
2 OF 10

## MAIN FLOOR



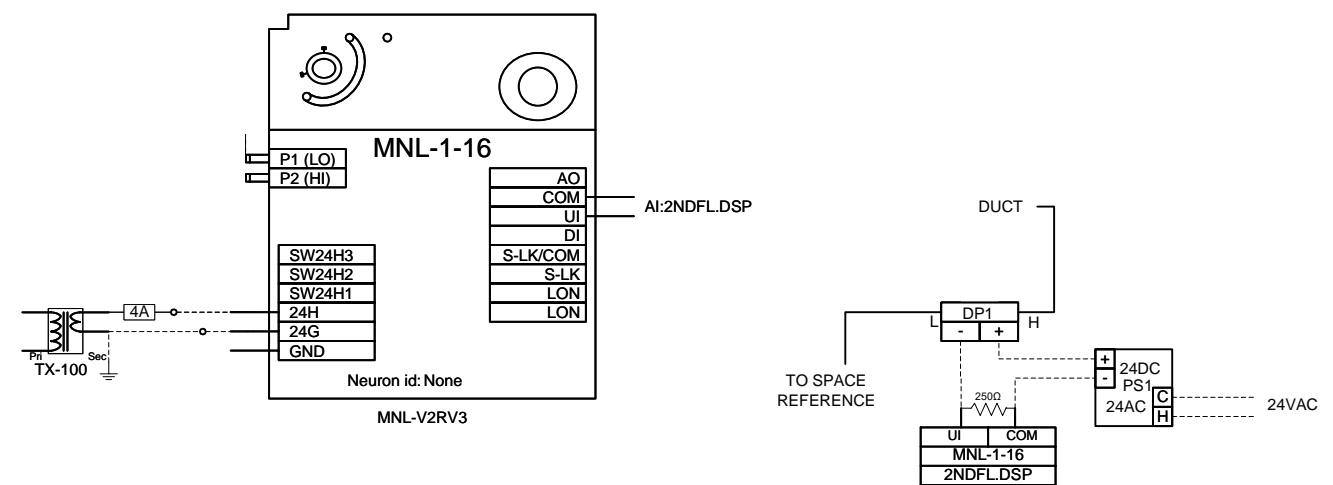
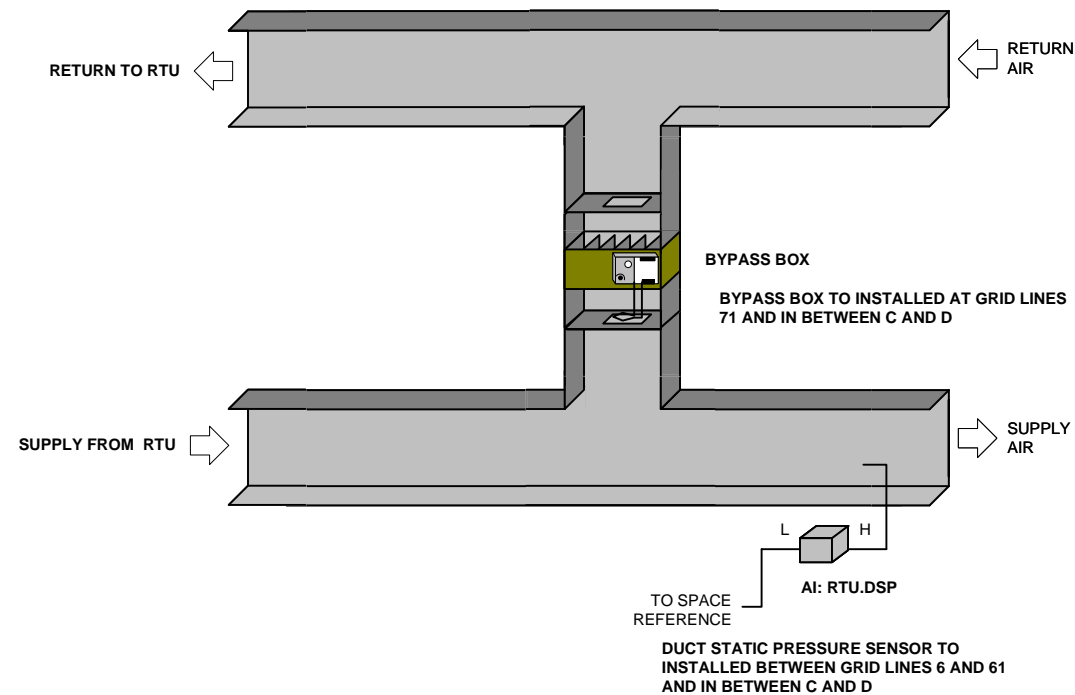
### Sequence of Operations

These systems consist of a pressure independent variable air volume by-pass boxes.

The bypass box is to maintain constant air flow through the existing roof top unit. The BAS shall monitor duct static pressure and modulate the damper to maintain the airflow setpoint measured by the internal crossflow sensor. The airflow setpoint shall be changed based on the duct pressure (set during air balancing). As the duct pressure rises above setpoint, the airflow setpoint is increased. Below the duct pressure setpoint, the airflow setpoint is decreased.

All setpoints to be determined during balancing to ensure constant airflow through the rooftop unit

## SECOND FLOOR



AHU Device	Qty	Part Number	Description	Manufacturer
DP1	2	SET-2641-003WD-11-A1-C	PRESSURE TRANSDUCER	SETRA
MNL-1-2,16	2	MNL-V2RV3	OBSOLETE (REPL W/ MNL-V2RV3-2)	Schneider Electric
PS1	2	PS-10	POWER SUPPLY REGULATED 24AC TO	Contractor Instruments
TX-100	2	T-208	TRANSFORMER 120/24VAC 99VA UL	Veris Industries



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Engineer: HIDI RAE  
Contractor: Dee Jay Plumbing  
Designed by: wijr  
Software by: wijr  
Checked by: Date: 01/31/13

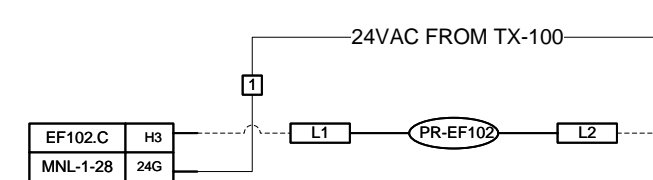
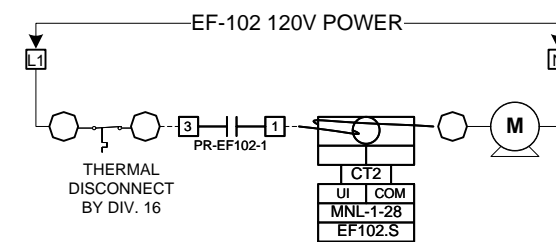
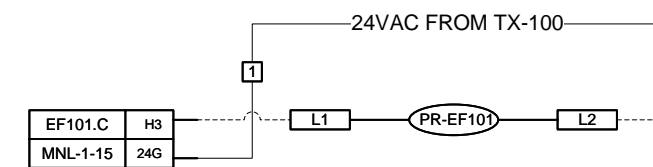
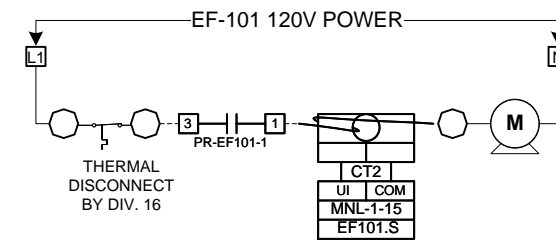
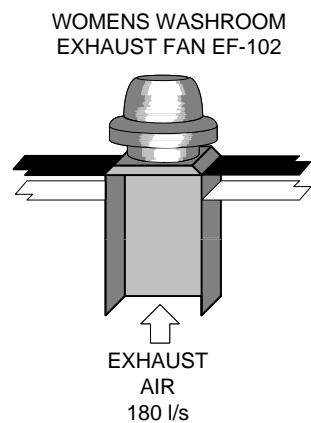
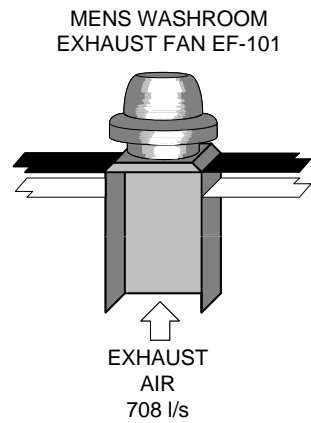
Architect: Drumheller Town Hall Reno  
Engineer: HIDI RAE  
Contractor: Dee Jay Plumbing  
Designed by: wijr  
Software by: wijr  
Checked by: Date: 01/31/13

Architect: Drumheller Town Hall Reno  
Engineer: HIDI RAE  
Contractor: Dee Jay Plumbing  
Designed by: wijr  
Software by: wijr  
Checked by: Date: 01/31/13

JOB NUMBER: 4256  
FILE NAME: AHU Handling Unit Bypass Box.vsd  
SHEET NO.: 3 OF 10

Bypass Box





**Sequence of Operations:**

Washroom exhaust fans are interlocked with rooftop unit AHU-101 and shall operate whenever the air handling unit is operating.

Alarms shall be provided for the following:

1. Exhaust Fan Failure

Misc Device	Qty	Part Number	Description	Manufacturer
CT2	2	C2343	Analog Current Switch 0-5Vdc	SENA
PR-EF101-102	2	90-340	24V Power Relay	Allied Electronics



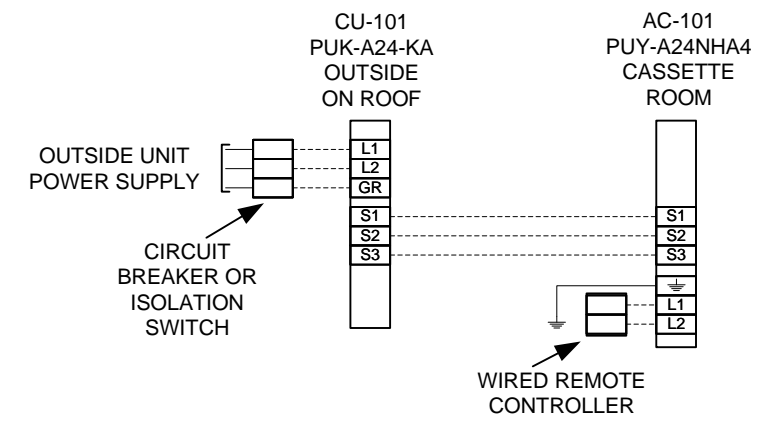
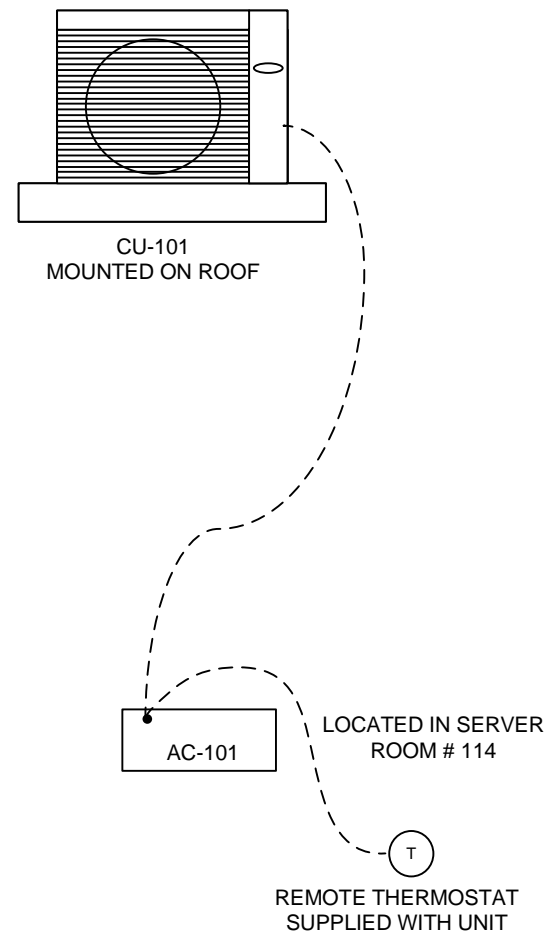
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 Contractor: Dee Jay Plumbing  
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 Software by: Date:  
 Checked by: Date:

Drumheller Town Hall Reno  
 Exhaust Fans

JOB NUMBER  
4256  
 FILE NAME  
Misc.vsd  
 SHEET NO.  
4 OF 10



Sequence of Operations: Air Conditioning Unit

AC-101 & CU-101 is a self-contained ductless split air conditioning system. A wired remote thermostat is supplied with the unit and cycles the air conditioning on a call for cooling. Setpoints of heating and cooling thermostats to be set 2°C differential to prevent crossover.



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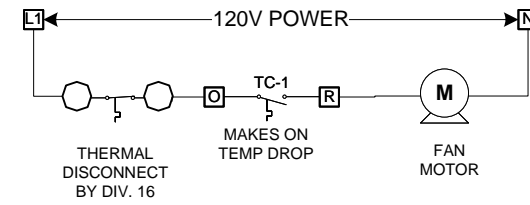
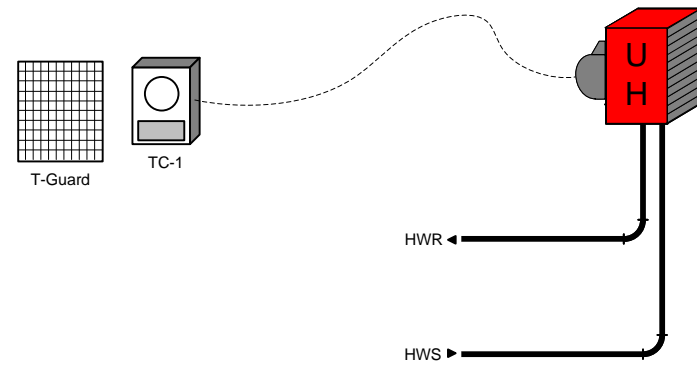
Revisions	
#	Date:

Architect: HIDI RAE  
Engineer: Dee Jay Plumbing  
Contractor: wjr  
Designed by: Date: 01/17/13  
Software by: Date:  
Checked by: Date:

Drumheller Town Hall Reno  
Air Conditioning

JOB NUMBER 4256  
FILE NAME Air Conditioning.vsd  
SHEET NO. 5 OF 10

UNIT HEATERS  
TYPICAL OF 2



Sequence of Operation

The line voltage space thermostat will cycle the fan on a call for heat to maintain the space temperature setpoint initially set at 20°C . Deadband shall be set 1.1°C. The unit heaters will shut down when the space temperature reaches 21.1°C.

UH Device	Qty	Part Number	Description	Manufacturer
TC-1	2	CT60A	120V HEATING THERMOSTAT	HONEYWELL
T-Guard	2	77-PG9	Plastic lockable stat cover	



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 Engineer: **Dee Jay Plumbing**  
 Contractor: **wjr** Date: **01/17/13**  
 Designed by: **wjr** Date:   
 Software by:  Date:   
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Drumheller Town Hall Reno

JOB NUMBER  
4256

FILE NAME  
Unit Heaters.vsd

SHEET NO.  
6 OF 10

Unit Heaters



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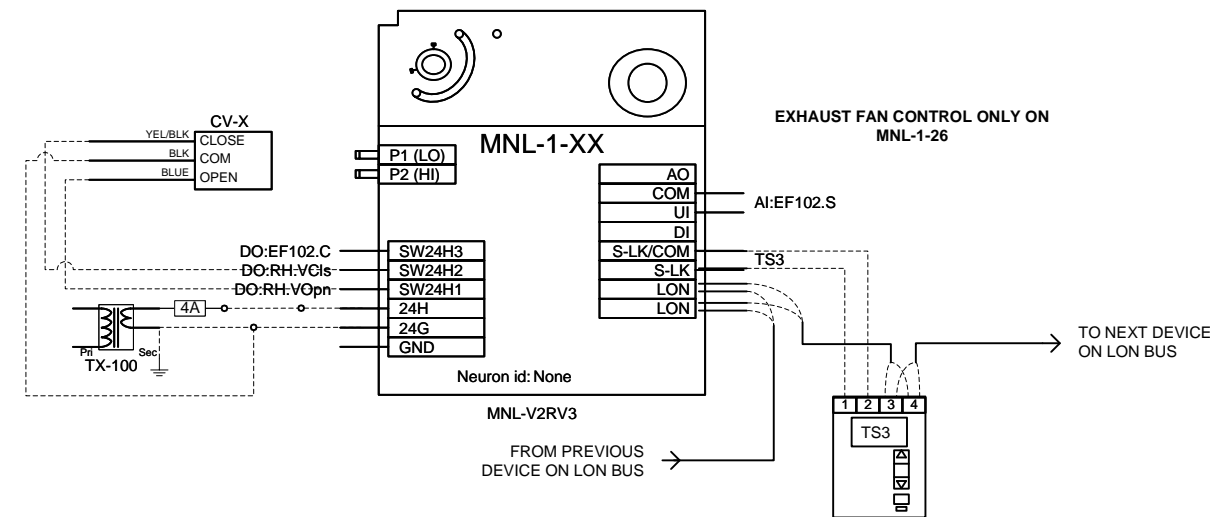
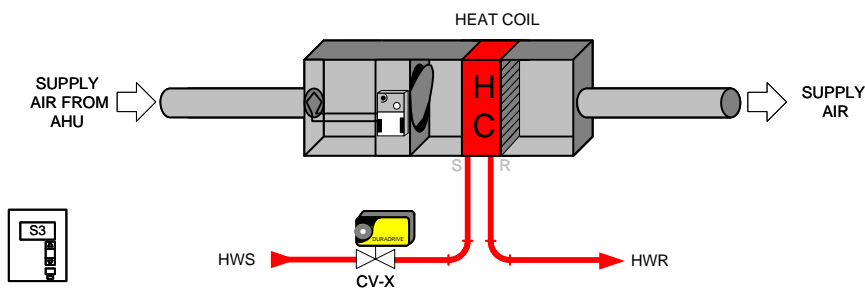
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Dee Jay Plumbing  
wjr  
Date: 01/16/13  
Date:  
Date:

Architect:  
Engineer:  
Contractor:  
Designed by:  
Software by:  
Checked by:

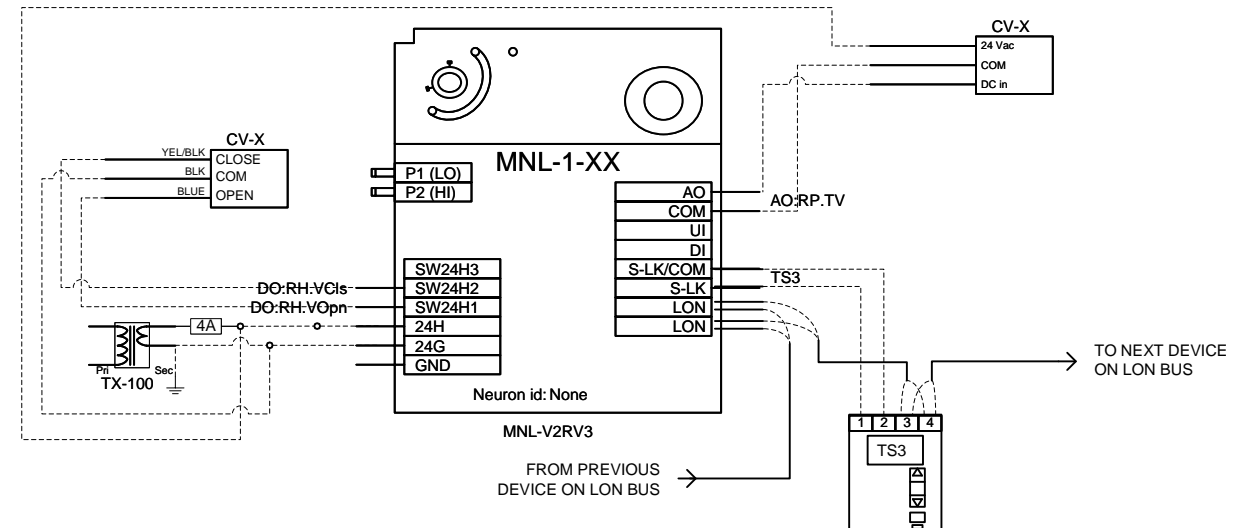
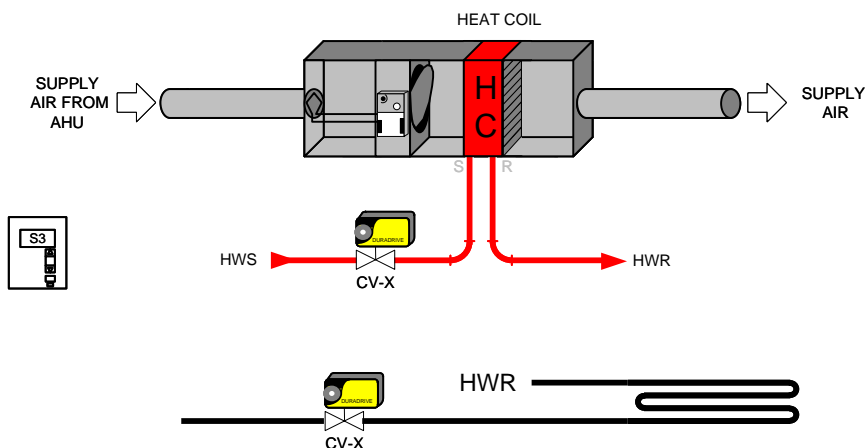
Drumheller Town Hall Reno  
Zones

JOB NUMBER  
4256  
FILE NAME  
Zones.vsd  
SHEET NO.  
7 OF 10

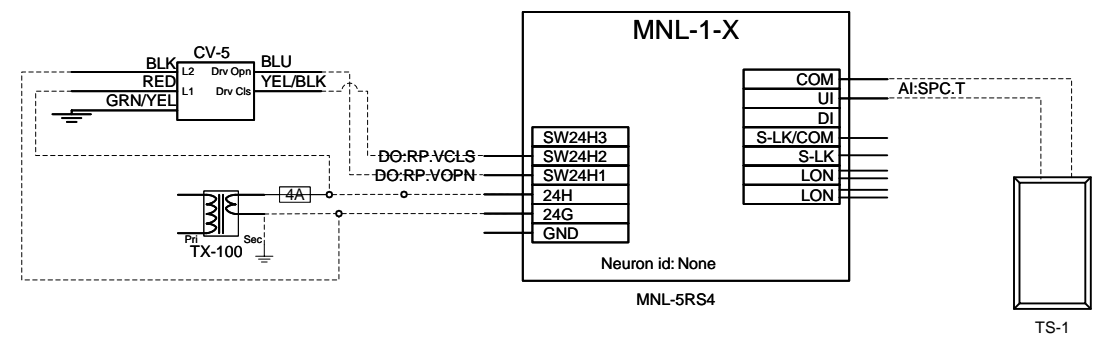
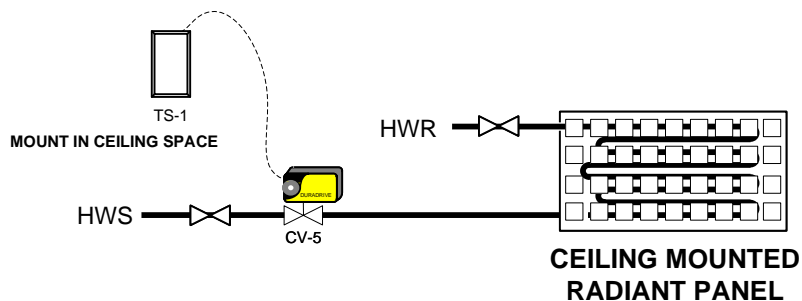
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DETAIL 1



TYPICAL OF 11  
DETAIL 2



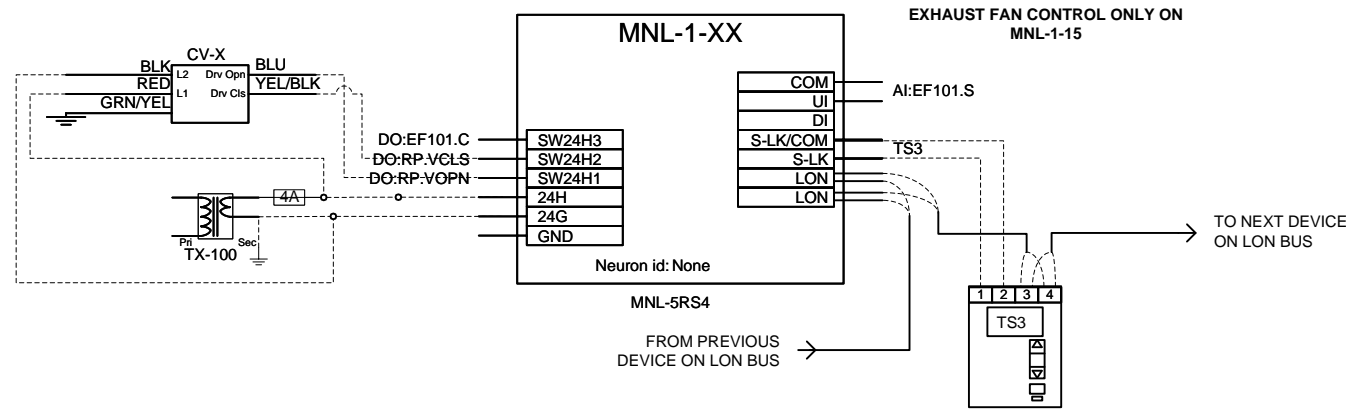
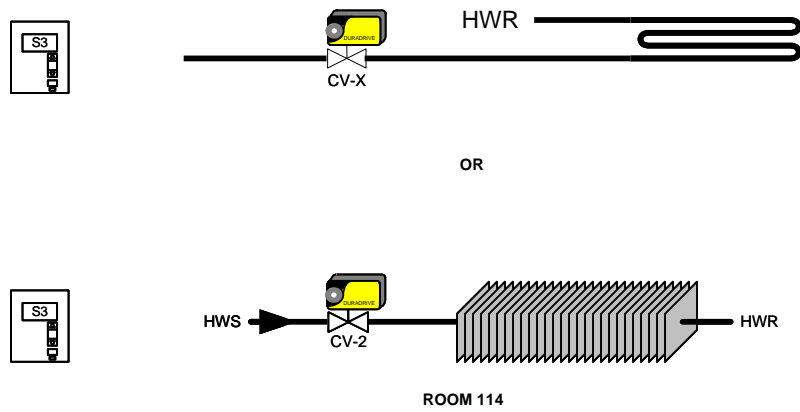
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DETAIL 3



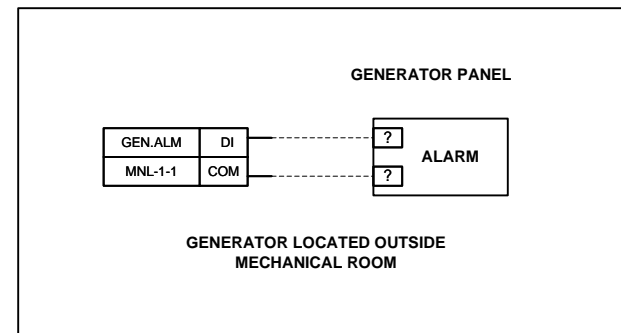
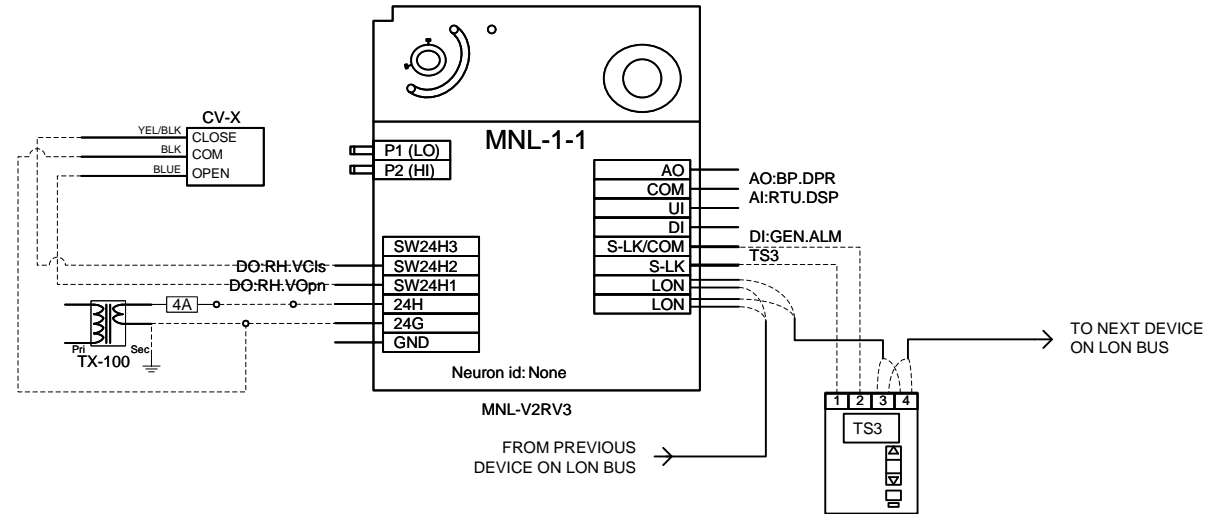
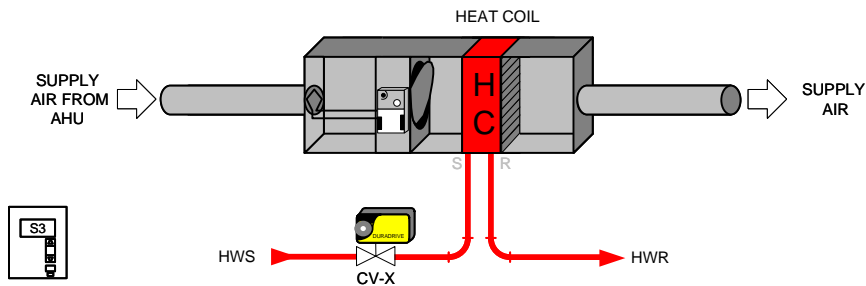




TYPICAL OF 4  
DETAIL 4



TYPICAL OF 1  
DETAIL 5



ZONES Device	Qty	Part Number	Description	Manufacturer
CV-5	5	SEE VALVE SCHEDULE		TAC COMPONENTS
CV-X	36	SEE VALVE SCHEDULE		TAC COMPONENTS
MNL-1-1	1	MNL-V2RV3	OBSOLETE (REPL W/ MNL-V2RV3-2)	Schneider Electric
MNL-1-X	5	MNL-5RS4	50 CNTRLR LON ROOFTOP SAT	Schneider Electric
MNL-1-XX	4	MNL-5RS4	50 CNTRLR LON ROOFTOP SAT	Schneider Electric
MNL-1-XX	20	MNL-V2RV3	OBSOLETE (REPL W/ MNL-V2RV3-2)	Schneider Electric
TS3	25	MN-S3	LRI-T SNSR W SP & OR	Schneider Electric
TS-1	5	TE200AS14	10K Thermister Stainless Temp	Greystone
TX-100	30	T-208	TRANSFORMER 120/24VAC 99VA UL	Veris Industries

Revisions	
#	Date:

Architect: HIDI RAE  
 Engineer: Dee Jay Plumbing  
 Contractor: wjr  
 Designed by: wjr  
 Software by:  
 Checked by:

Drumheller Town Hall Reno  
 Zones

JOB NUMBER: 4256  
 FILE NAME: Zones.vsd  
 SHEET NO.: 8 OF 10





### ZONE SCHEDULE

ROOM #	ROOM DESCRIPTION	H1	H2	H3	DI	UI	SLINK	DETAIL & DRWG #	CONT #	NOTES
114	Server Room	RP.VOPN	RP.VCLS				S3		MNL-1-13	Wall Fin
221	Female Washroom	RP.VOPN	RP.VCLS				S3		MNL-1-14	Radiant Panel
222	Female Washroom	RP.VOPN	RP.VCLS	EF101.C		EF101.S	S3		MNL-1-15	Radiant Panel
202	Lobby	RP.VOPN	RP.VCLS				S3		MNL-1-19	Radiant Panel
225	Open Work Area	RP.VOPN	RP.VCLS				10K SS		MNL-1-27	Ceiling Mounted Bare Fin
225	Open Work Area	RP.VOPN	RP.VCLS				10K SS		MNL-1-30	Ceiling Mounted Bare Fin
205	Council Chamber	RP.VOPN	RP.VCLS				10K SS		MNL-1-21	Ceiling Mounted Bare Fin
205	Council Chamber	RP.VOPN	RP.VCLS				10K SS		MNL-1-22	Ceiling Mounted Bare Fin
208	Lounge	RP.VOPN	RP.VCLS				10K SS		MNL-1-25	Ceiling Mounted Bare Fin

### ZONE SCHEDULE

ROOM #	ROOM DESCRIPTION	VAV BOX #	RHC #	H1	H2	H3	DI	UI	AO	SLINK	DETAIL & DRWG #	CONT #	NOTES
112	?	1	1	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-12	
105	Open Work Area	4	4	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-6	
105	Open Work Area	6	6	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-7	
106	Meeting Room	5	5	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-5	
124	Staff Room	10	10	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-3	
214	Office	19	19	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-32	
217	Office	20	20	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-33	
205	Council Chamber	15	15	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-23	
205	Council Chamber	14	14	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-24	
202	Lobby	12	12	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-20	
224	Meeting Room	13	13	RH.VOPN	RH.VCLS				RP.TV	S3	2	MNL-1-18	
107	Office	2	2	RH.VOPN	RH.VCLS					S3	1	MNL-1-9	
105	Open Work Area	3	3	RH.VOPN	RH.VCLS					S3	1	MNL-1-8	
105	Open Work Area	7	7	RH.VOPN	RH.VCLS					S3	1	MNL-1-10	
109	Office	8	8	RH.VOPN	RH.VCLS					S3	1	MNL-1-11	
104	Reception	11	11	RH.VOPN	RH.VCLS					S3	1	MNL-1-4	
122	Mech/Elec Room	9	9	RH.VOPN	RH.VCLS		GEN.ALM			S3	5	MNL-1-1	
213	Meeting Room	18	18	RH.VOPN	RH.VCLS					S3	1	MNL-1-31	
212	Office	17	17	RH.VOPN	RH.VCLS					S3	1	MNL-1-28	
208	Lounge	16	16	RH.VOPN	RH.VCLS	EF102.C		EF102.S		S3	1	MNL-1-26	
225	Open Work Area	22	22	RH.VOPN	RH.VCLS					S3	1	MNL-1-29	
225	Open Work Area	21	21	RH.VOPN	RH.VCLS					S3	1	MNL-1-17	



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Engineer: Dee Jay Plumbing  
Contractor: wijr  
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**Sequence of Operations: VAV c/w Reheat**

Each zone will operate on an occupied/unoccupied schedule as programmed into the Niagara system. The zone will follow the schedule of RTU-1. The building occupants can override the schedule by pressing the occupancy override button on the digital space thermostat.

During unoccupied periods, the VAV box will remain in the full closed position and the heating is normally off. Should the space temperature drop to 14°C, the associated RTU is started using 100% return air and the reheat coil valve is fully opened in order to return the space temperature to 16°C.

On a call for heating, the VAV box will provide the minimum flow.

Heating Demand	Reheat Valve	Box Flow
0%	0%	Minimum
100%	100%	Minimum

On a call for cooling, the VAV box will modulate from minimum to maximum flow position.

Cooling Demand	Reheat Valve	Box Flow
0%	0%	Minimum
100%	0%	Maximum

**Sequence Of Operations: VAV c/w Reheat and Rad Panel**

Each zone will operate on an occupied/unoccupied schedule as programmed into the Niagara system. The zone will follow the schedule of RTU-1. The building occupants can override the schedule by pressing the occupancy override button on the digital space thermostat.

On a call for heating, the VAV box will provide the minimum flow.

On a call for cooling, the VAV box will modulate from minimum to maximum flow position.

The space setpoint is locally adjustable between 19°C and 24°C from the digital space thermostat. The initial occupied setpoint is 21°C and the unoccupied setpoint is 16°C.

The reheat and radiation/ radiant panel valves will be controlled by the zone heating demand as follows:

Heating Demand	Reheat Valve	Radiant Panel Valve	Box Flow
5%	0%	0%	Minimum
30%	0%	100%	Minimum
55%	35%	100%	Minimum
100%	100%	100%	Minimum

On a call for cooling, the VAV box will modulate from minimum to maximum flow position.

Cooling Demand	Reheat Valve	Radiant Panel Valve	Box Flow
0%	0%	0%	Minimum
100%	0%	0%	Maximum

**Sequence of Operations: Ceiling Rad/Rad Panel**

Each zone will operate on an occupied/unoccupied schedule as programmed into the Niagara system.

When the associated air system is Off, the rad panel valve will be modulated to maintain the night set back setpoint of 16°C (adjustable).

When the pushbutton on the space sensor is pushed, the rad panel valve is modulated as required to maintain the occupied space temperature setpoint for one hour.

The space setpoint is locally adjustable between 19°C and 24°C from the digital space thermostat. The initial occupied setpoint is 21°C and the unoccupied setpoint is 16°C. If the night setback temperature falls 1°C below the night setback temperature setpoint (initially set at 16°C adjustable), the air systems shall start, the heating valve shall modulate as required to bring the night setback temperature back to setpoint.

When the associated air system is On, the rad panel valve will be modulated to maintain the occupied space temperature setpoint as set on the local digital thermostat.



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