NOTE to Engineer-of-Record – This guide specification shall not be used verbatim in the project design documents. The Engineer-of-Record is responsible for reviewing/editing this document in its entirety to ensure that it meets the project requirements. To determine the control requirements specific to each project coordinate directly with the University of Alberta Operations Remote Control Monitoring System Design Group. It is recommended that this coordination effort commence during schematic design to set design criteria for the detailed design. Once this coordination has happened, an editable version of this master specification will be provided to the Engineer-of-Record for use on the specific project.

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1 GENERAL

.1 Intent

.1 These specifications are to be considered an integral part of the drawings and other Divisions of the specifications. While this specification defines the requirements of section 13810, the Contractor is advised that other controls work may be included in the total contract document package. Any item not specified in this division, which is mentioned or reasonably implied elsewhere will be considered properly and sufficiently specified. Misinterpretation of the documents will not relieve this Division or the Contractor from his responsibility.

.2 The specifications cover the equipment and materials to be used, indicate quality and type, establish general scope of work, but do not necessarily cover each and every component or installation detail. The contractor will provide a complete and working system, tested, and put into proper operational condition.

.2 Quality Assurance

.1 Provide a complete system of automatic controls supplied and installed by firms employing competent, certified personnel who specialize in this type of work.

.2 The system will be complete in all respects and will be installed by competent mechanics and electricians who are regularly employed by the control equipment manufacturer.

.3 Division of Responsibility

.1 University of Alberta

.1 Clarification and Consultation

.1 The University of Alberta is responsible for the preparation of the specifications in Section 13810. Its agent, Energy Management Division of Facilities Management, will provide clarification and assistance, when requested, in the interpretation of the specification.

.2 Operating strategies

.1 Control logic for all computer connected systems and associated set points in a PCM will be programmed, commissioned by, and generally be solely the responsibility of the University of Alberta.

.3 Hardware

.1 PCM - The University of Alberta will supply and place the required PCM's for the building. The units will be left in a state ready for connections of power and individual points by the Contractor.

.4 Device Labeling

.1 The University will supply the required standardized device identification labels to be used to identify all points on the project. The labels will be installed by the Contractor.
.2 All other tagging and labeling required, such as wire tags, will be supplied and installed by the Contractor.

.5 Point Sheet Book

.1 The detailed point sheet book, supplied by the University of Alberta during construction, must be located at the job site to facilitate field clarification and comparisons to the contractors’ shop drawings.

.2 Prime Consultant

.1 The prime consultant is responsible for ensuring that the proper installation of the RCMS system, as defined in the specifications, is carried out.

.2 The prime consultant is also responsible for coordinating the various consultants in meeting the requirements of Section 13810.

.3 Controls Contractor

.1 Installation: The information supplied on the points is of a generic nature and shows the intent of the design. The contractor is expected to meet that intent and to seek clarification if equipment installed is at variance with interface installation details shown.

.2 The contractor shall visit the site prior to ensure that they are aware of details of existing equipment. They shall be responsible for reviewing sections 13810, 15xxx and 16000 and ensuring that, as part of their engineering process that any conflicting information is identified and clarification sought.

.3 Only University of Alberta approved vendors may bid.

.4 Electrical Contractor

.1 Motor control: The Electrical contractor will provide provision for interfacing with all motors detailed in this section to be controlled by the RCMS.

.4 Submittals

.1 Equipment Lists

The Contractor, through the prime consultant, will supply to Operations and Maintenance Division of Facilities Management an equipment list for approval prior to any purchase. This list will include all sensors and devices (actuators, transducers, etc.) that comprise the RCMS system. The list will cross reference to the appropriate EPNs of the University. This list should indicate the range of the transducer where ever applicable. Where the sensor or device has been specified in the section 13810, no alternate or equivalent will be accepted unless approved by the University of Alberta in writing.

.2 Shop Drawings

The Contractor shall provide engineering details.
The Contractor will provide detailed manufacturer’s literature for all
devices, equipment, and material to be provided for review by the
University of Alberta. Specifically note on the submittal, all specified
features.

Installed materials and equipment will meet specified requirements
regardless of whether or not shop drawings are reviewed by Owner.

Review of shop drawings by the Owner will be for general design only.
Specific items with regard to manufacturing or installation details will not
be checked and will remain the responsibility of the Contractor. The
review of shop drawings will not in any way relieve the Contractor from
responsibility for correcting errors or work and materials as may be
required for completion of the work as called for by the drawings and
specifications.

.3 Samples

.1 The contractor will provide a sample of all devices and material for review
by the University of Alberta.

.5 Description of the Computerized System

.1 Organization

The information detailing the computerized system is organized as
several appendices at the end of the section. In order to conserve space,
the information is, to a large degree, generic in nature making use of
standard details.

.2 Systems

The mechanical equipment to be controlled has been divided into logical
subdivisions, which for the most part correspond with the schematical
representation in the mechanical prints.

.1 Graphics

Each system includes a graphic, which schematically represents the
mechanical system(s) covered in the subdivision. The graphic illustrates
the approximate locations of the various system points.

.2 Point Lists

The point lists provide detail as to the:

EPN - External Point Name
Descriptors - abbreviated description of the point
System number - system identifier.
MRIP # - Motor Relay Interface Panel number, if applicable.
AIP # - Actuator Interface Panel number, if applicable.
SIP # - Sensor Interface Panel number, if applicable.
Point Sheet # - the identifier code of the type of point required which
would be illustrated by the generic point sheet detail bearing the number
given.
.3 Point Sheets

.1 Point Identification
Point sheets identify each specific input signal from sensors and output signals to actuators. Each point is identified by an EPN. The EPN assigned to each point also applies as the wiring designation and the MUX location. The point sheets show which components are locally mounted or mounted in MRIP's, SIP's and AIP's.

.2 Constitute Shop Drawings
Point sheets constitute the shop drawings of the University of Alberta. The points will be commissioned and accepted by the University of Alberta according to the specifications and details shown on the point sheets.

.3 The contractor shall identify and seek clarification for any detail on any point sheet, which may be seen as an error by their engineering staff.

.4 Equipment Detail drawings

.1 Drawing 1
Details the Motor Relay Interface panel.

.2 Drawing 2
Illustrates the physical layout of a typical Actuator Interface panel.

.3 Drawing 3
Details a typical Sensor Interface Panel physical layout.

.4 Drawing 5
Detail of the specified thermowell.

.5 Drawing 6
Detail of a typical static pressure probe.

.6 Drawing 7
Schematic representation of the specified power connection for the PCM room.

.7 Drawing 8
Illustrates the relationship between the building fire panel, the PCM, and the MRIP.

.8 Drawing 9
Illustrates, in overview, the relationship of PCM, MRIP, MCC panel, SIP, and an HVAC system.

.9 Drawing 10
Illustrates the numbering system relating to terminals, EPN, and wiring identification.

.5 Panel Layouts

.1 Locations
Sketches may be included which locate PCM, SIP's, AIP's, and MRIP's relative to building grid lines, where required. All locations will be finalized in the field by the contractor and the University of Alberta.
.2 MRIP's
The MRIP layouts illustrate wiring details

.3 SIP's
The Sensor Interface Panel layouts illustrate the locations of various devices on individual panels. All SIP panels will be full size as indicated on equipment detail drawing #3; unless otherwise stated. The panels should be mounted on the full sheets of plywood such that the extra space is left at the bottom of the plywood sheet for future expansion.

.4 AIP
The Actuator Interface Panel illustrate the locations of various actuator's on individual panels. All AIP panels will be full size as indicated on equipment detail drawing #2; unless otherwise stated. The panels should be mounted on the full sheets of plywood such that the extra space is left at the bottom of the plywood sheet for future expansion.

.5 MUX's
The analog and digital multiplexor layouts are included to illustrate the specific location in a MUX of each specific point.

.6 Cold Junction
The cold reference junction panels are included to illustrate the point termination locations within the panels.

.6 Definitions and Abbreviations

.1 Abbreviations
The following are abbreviations used throughout the section defining computerized control system specified herein or defined on plans.

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>RCMS</td>
<td>Remote Control Monitoring System</td>
</tr>
<tr>
<td>PCM</td>
<td>Process Control Module (Bldg. Microprocessor)</td>
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<tr>
<td>MRIP</td>
<td>Motor Relay Interface Panel</td>
</tr>
<tr>
<td>SIP</td>
<td>Sensor Interface Panel</td>
</tr>
<tr>
<td>AIP</td>
<td>Actuator Interface Panel</td>
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<tr>
<td>EPN</td>
<td>External Point Name (External to Microprocessor)</td>
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<tr>
<td>MCC</td>
<td>Motor Control Center</td>
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<tr>
<td>HVAC</td>
<td>Heating Ventilation Air-Conditioning system</td>
</tr>
<tr>
<td>MUX</td>
<td>Multiplexor (A - analog, D - digital type)</td>
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<td>TY</td>
<td>Freeze Relay</td>
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<tr>
<td>DI</td>
<td>Status Relay (Digital In)</td>
</tr>
<tr>
<td>TS</td>
<td>temperature switch</td>
</tr>
<tr>
<td>ME</td>
<td>moisture element (humidity)</td>
</tr>
<tr>
<td>PS</td>
<td>pressure switch</td>
</tr>
</tbody>
</table>
2 PRODUCTS

.1 General

.1. Products purchased are to be as specified. Any and all changes must be approved by the University of Alberta in writing.

.2 Wire and Conduit

.1 Communication Cable

.1 The communications cable shall be multi-mode fibre optic cable with at least 4 62.5 strands.

.2 Sensor Wire

.1 Sensor wire on 4-20ma loops shall be Belden #8442 (1 pair unshielded 22 gauge)

.2 Sensor wire for 4 wire connection of transducers, i.e. transducers requiring power connections shall be Belden #9744 (Stranded 2 pair unshielded 22 gauge)

.3 Sensor wire from cold junction to PCM shall be Belden #8450 (Solid 1 pair shielded 22 gauge)

.4 Sensor wire for switching applications (any place where punch blocks are used for termination) shall be Belden #8741 (Solid 2 pair unshielded 22 gauge)

.3 Power Supplies

.1 24 VDC Power

.1 The 24 VDC power supplies will be regulated with current limiting at 12 amps.

.2 Power supply to be Hammond GFOF 5-24. Recommended supplier - Cardinal Electronics.
.4 Panels

.1 MRIP’s

.1 Metal enclosure complete with lockable door keyed to RCMS University of Alberta master key #92304. Construction as outlined in shop Drawing Nos. 58000-16 and 58000-17. The contractor shall visit the site prior to ensure that they are aware of the existing panels and to locate space for the new panels as indicated on the panel layouts.

.2 Recommended supplier: Electric Power & Equipment Ltd., 15304-118 Ave., Edmonton, 455-4194.

.2 SIP’s/AIP’s

.1 The SIP and AIP panels should be 72” x 48” x 6” laminate plywood – arborite white. The contractor shall visit the site prior to ensure that they are aware of the existing panels and to locate space for the new panels as indicated on the panel layouts.

.5 Thermowells

.1 Refer to University of Alberta Drawing No. 5 for details.

.2 Recommended supplier: Thermo Kinetics Company Ltd., 14507-25 St., Edmonton, 472-1763.

.6 Local Indicators

.1 All indicators (i.e. thermostats, gauges, etc.) are to read in metric units.

.7 Electrical Starters

.1 Three-Phase

All starters are provided by the contractor and must have 120 volt coils and control transformers.

.2 Single Phase

.1 Single phase motors which are to be controlled by the RCMS must comply with the detail given for that application.

.2 They would require a Hand-Off-Auto switch and a standard Current monitoring interface unless specified otherwise.

.3 If starter is not provided on a 110 VAC motor and the current draw falls within the rating of the control relay in the MRIP, it will be used as the starter. If the current draw exceeds the MRIP relay rating, another relay is to be provided to act as a starter.

.8 Relays

.1 MRIP Panel Relays

.1 All relays mounted in the MRIP panels are to be ordered with the LED or neon indicator option built in.
.2 All relay base mounting brackets shall be DIN rail type 35 mm (Top Hat) type (DIN 46277).

.3 Relay bases shall be Releco 8 pin S2-B or Releco 11 pin S3-B.

.4 Relays shall be Releco 8 pin C2-A20 or Releco 11 pin C3-A30.

.2 Control Relays

.1 Purpose: To provide a means to start/stop electric motors via a computer signal.

.2 24 VDC coil rated at 472 ohms.

.3 10 amp contact rating.

.4 Double pole double throw contacts.

.5 Plug-in socket mount type.

.6 Typical relay Releco C2-A20X, series MR-C or approved alternate.

.3 Status Relays

.1 Motor status relay characteristics

.1 110 VAC coil.

.2 10 amp contact rating

.3 DPDT contacts

.4 Plug-in socket mount (218 BR RDI)

.5 Typical Releco C2-A20X, series MR-C or approved alternate

.2 General digital input or status contact

.1 Can be a 24 VDC or 110 VAC as appropriate. Other energization must be approved by the University of Alberta.

.2 Will be Releco C2-A20X, series MR-C or equivalent approved device.

.4 Fire and Freeze Shutdown Relays

.1 Purpose: To interface between temperature and fire alarm contacts and controlled devices in the MRIP.

.2 Typical - Releco C2-A20X or C3-A30X, series MR-C. c/w 110 VAC or 24 VDC coil depending on voltage required; and Releco Din Rail relay base S2S (8 pin) or S3S (11 pin) socket (typical KRP14DG or KRP14A relay).

.5 Sockets

.1 Socket to accommodate relays in above specifications to have an eight or eleven pin socket and eight screw type terminals for wire connections.

.2 Socket must be rated for 10 amps. Typical socket type Releco Din Rail relay base S2S (8 pin) or S3S (11 pin).
.9 Positioners

.1 General

All actuators are to be installed with positioners.

.2 RCMS Steam PRV Control

Steam control is achieved by remotely controlling the setpoint through a Fisher DPR900 controller. It is to be supplied in a water proof enclosure. The valves themselves would have Fisher electronic positioners accepting a 4-20 ma input from the DPR900.

Where the station is made up of 2 valves, each valve would be sequenced via separate output on the controller. The following sequence is to be implemented with the DPR 900. The small valve is to be closed when the large valve is at 20% and opened again when the large valve is at 10%.

.3 Heat Exchanger Valves

Heat exchanger valves will be equipped with Fisher valves and positioners; input to positioner to be 4-20 ma. The installation would be complete with pressure gauges. Dual valves to be field sequenced.

.10 Level

.1 Condensate

High alarm that is part of the pump control package.

.2 Sump

Typically a Flygt Level Switch, model ENH-10

.11 Moisture

.1 Relative Humidity

.1 Space, exhaust or return air sensors shall be Vaisala, input range 0% to 100% with output of 4-20 ma.

.2 Supply air high limit sensors shall be Greystone or General Eastern model RH2 input, range 0% to 100% with output of 4-20 ma.

.2 Dew Point

General Eastern Dew 10 chilled mirror hygrometer. Recommended supplier: Dycor Industrial Research Ltd., Edmonton.

.12 Flow

.1 Air Flow at fans

.1 Sensing element to be appropriate for mounting at fan inlet. (Tech Air from Klass Mechanical)
.2 Pressure transducer to be sized to be appropriate for velocity pressure range for the application. The range should not be more than double max expected velocity pressure. Setra pressure transducer to be used.

.3 Accuracy of sensor and transducer combination to be better than 5% throughout working range. (fan speed 25 to 100%)

.2 Liquid Flow

.1 Flow sensor to be a paddle wheel sensor.

.2 Device to be FP5300 sensor c/w FLSC 720 signal conditioner from Omega. Output to be 4-20 ma.

.13 Pressure

.1 High pressure

.1 Control (steam)
Foxboro Series E11GM Pressure Transmitter, 4-20 ma output, 0-50 psi, elevation/suppression kit if necessary. Complete with Anderson Greenwood M4AVC 3-valve integral manifold.

.2 Monitoring (expansion tanks)
Foxboro Model 841GM-BI. To have a silicone isolator and 5 year warranty.

.3 Monitoring (heating differential pressure)
  .1 Setra D/P pressure transmitter Model C230
  .2 Recommended Supplier: Alpha Controls & Instrumentation, 361 Steel Case Road West, Unit #5 & 6, Markham, Ont., L3R 3V8

.2 Low pressure (< 2500 Pa)

.1 Ventilation System Static Pressures
  .1 Device to be a Setra pressure transducer.
  .2 Range: will vary depending on application. Output to be 4 to 20 ma.
  .3 Accuracy plus/minus 1% of span.
  .4 Repeatability 0.1% full scale output.
  .5 External zero and span adjustment.
  .6 Noise content less than 10 mV PP.
  .7 Input voltage +24 VDC.
  .8 Supplier: Alpha Controls & Instrumentation, 361 Steel Case Road West, Unit #5 & 6, Markham, Ont., L3R 3V8

.2 Building Static Pressure
  .1 Device to be a Setra pressure transducer.
  .2 Range to be -50 to +50 Pascals.
  .3 Output to be 4-20 ma.
.4 Device to have external zero and span access and be complete with mounting bracket.  
.5 Recommended Supplier: Alpha Controls & Instrumentation, 361 Steel Case Road West, Unit #3, Markham, Ont., L3R 3D8  
  
.3 EP (Voltage to Pressure Relay)  
  
.1 General  
  .1 Solenoid must be able to operate continually energized.  
  .2 Working pressure of switch will be a minimum of 30 psi.  
  .3 Solenoid will be mounted in AIP panel. (Low voltage only)  
  .4 The device applied must have the appropriate number of ports for the application. e.g. a 4 port EP for operators requiring opening and closing pressurization.  
  .5 Switch will not exceed in size the Honeywell RP417B.  
  
.2 24 VDC air solenoid  
  .1 Model: Johnson V11PNA-105 - 24 VDC.  
  
.4 IP (Current to Pressure Transducer)  
  .1 Range: Input 4 to 20 ma - output 20 to 100 KPa (3 to 15 psi nominal)  
  .2 Make & Supplier: ITT Conoflo.  
  .3 Each IP must have a gauge to enable rapid check of device output. A 0-15 psig gauge must be supplied per AIP panel with the appropriate fittings.  
  .4 The 4-20 ma wire will enter the device (IP) through a CGB 192 Crouse Hinds connector.  
  
.14 Temperature  
  
.1 Thermocouple  
  .1 General  
  .1 The sensor will be made of type “T” thermocouple.  
  .2 The thermocouple sensor will be connected to shielded 20 gauge type “T” thermocouple extension wire with a solid drain wire.  
  .2 In Pipe  
  .1 The type “T” thermocouple sensor will be factory made and will be enclosed in a metal sheath.  
  .2 Recommended suppliers of the thermocouple sensor and head: Thermokinetics (model nos. 02-3171-1-4, and 02-3171-19-1-7 1/2)  
  
.2 Freeze switch  
  .1 Freeze stat will have automatic reset.  
  .2 Sensing element will be a 6000 mm bulb.
The freeze stat relay will have two normally closed contacts and four wires comprising two circuits.

Typically a Model: Penn A70GA-1

Flow

Air Flow at fans

Sensing element to be appropriate for mounting at fan inlet. (Tech Air from Klass Mechanical)

Pressure transducer to be sized to be appropriate for velocity pressure range for the application. Should not be more than double max expected velocity pressure (Modus).

Accuracy of sensor and transducer combination to be better than 5% throughout working range. (fan speed 25 to 100%)

Air Quality

Duct air quality sensor to be from Staefa Control Systems.

Device to be model FKA-Q1/T1. Available supplier is Viking Controls.

Current Sensors

Current sensing shall be Hawkeye 921 self-powered split core digital current sensor with 4-20 ma output or Hawkeye 908 with switched output as specified.

Supplier:
Veris Industries, 10831 S. W. Cascade Blvd., Portland, Oregon, 97223
Ph: 1-800-354-8556
www.veris.com

EXECUTION OF WORK

Installation

General

Remotely mount device if vibration of pipe, duct, or support can harm device or cause erroneous readings.

Install all components so that they can be removed using normal hand tools, screwdrivers, wrenches, etc.). Do not use pop rivets or welding.

Sensors with a 4-20 ma output shall interface at the mux through a 50 ohm resistor with a 1% or better tolerance.

Low Voltage Wiring

All low voltage sensor and actuator wiring unless stated will have a PVC jacket.

All low voltage sensors connected to mechanical equipment will have the wiring enter 10 mm nominal (3/8") aluminum flexible conduit of sufficient
length to permit detachment of sensor from mechanical equipment without disconnecting wiring from sensor.

.3 The sensor cables may be collected and:
   .1 run in conduit or run in an open tray or
   .2 run in large size E.M.T. conduit or
   .3 run in 75 mm nominal (3") panduit at the AIP and SIP only.

.4 All low voltage sensor wiring will be kept away a minimum of 150 mm from any power line conductors.

.5 All low voltage wiring will be run in dedicated conduit.

.6 All low voltage sensing will be run in twisted and shielded wire.

.3 Interface Panels

.1 All interface panels will have wiring run in panduit only.

.2 All interface panels and PCM's will have 110 VAC wiring run in dedicated conduit.

.4 High Pressure

.1 Each IP must have an appropriate gauge on the output.

.2 The 4-20 ma wire will enter the device (IP) through a CGB 192 Crouse Hinds connector.

.5 Components in Sheet Metal

.1 Components on sheet metal duct work: mount using metal mounting brackets attached to duct work with sheet metal screws or bolts. Support all flexible type elements.

.6 Sensor Installation

.1 Location

   All sensor locations and installation details MUST be approved by the University of Alberta PRIOR to installation. Any changes required, as a result of not obtaining approval, will be done at NO EXTRA COST TO THE OWNER.

.2 Coils shall be sufficiently spaced to allow the installation and servicing of sensors.

.3 Test jacks must be installed with all sensors except on thermocouples.

.4 Thermocouples

   .1 General

   .1 The temperature points in the thermocouple cold reference junction panel will be wired to the specified PCM multiplexer using 8450 Belden type wire.

   .2 All thermocouple extension wires will be installed in conduit or run in approved wire ways.
.3 The thermocouple extension wire will be continuous, without splices, between the sensor and the thermocouple cold reference junction panel.

.2 In Pipe

.1 The weldalet will be installed in the pipe with a maximum of 25 mm protruding above the pipe.

.2 The sensor will be spring loaded to press against the bottom of the thermowell filled with thermal conducting grease.

.3 Minimum sensor immersion will be 13 cm into the pipe thermowell.

.4 The sensor wire will terminate on a fixed terminal block inside an electrical enclosure. The enclosure will have a screw cap to permit easy access to the thermocouple connection. The actual sensor will be enclosed in a water proof and electronically insulated casing.

.5 The thermocouple extension wire will be connected through a flex conduit to the sensor enclosure to permit easy withdrawal of the sensor.

.6 All exposed portions of the thermowell shall be heavily insulated right up to the sensor head.

.3 Outdoor air sensor

.1 The outdoor air sensor will be enclosed in a vented weatherproof metal enclosure.

.2 The sensor is be mounted in a manner which eliminates influences on its accuracy such as solar radiation, building skin radiation and near-by exhausted air.

.4 Space

.1 The space sensor will be mounted inside an enclosure normally provided for a room thermostat.

.2 The connection between the conduit and enclosure is to be sealed with duct seal to prevent air movement from the conduit into the enclosure.

.3 The height of the installation will be standard thermostat height.

.5 Duct Sensors

.1 Type: Thermocouple Temperature Device

.2 The sensing element will be mounted inside the end of a 460 mm stainless steel tube.

.3 The tube will come with a bulkhead fitting to mount on the plenum wall.

.4 The sensor will terminate by marretts in an electrical enclosure.

.6 Averaging sensors

.1 General

.1 The average is accomplished through multiple thermocouples connected in parallel.

.2 Each leg in the parallel runs will be interfaced by a 100 ohm load resistor as shown on generic point sheet type A33

.2 Plenums

.1 Sensor will be mounted in conduit and T fitting.

.2 The sensor will be made of type “T” thermocouple.
.3 Temperature to be sensed every 300 mm and averaged, running diagonally across the plenum.

.4 The temperature sensing portion of the sensor will be 300 mm away from the bulkhead fitting on the plenum wall.

.5 Static Pressure sensors

.1 Static pressure tip to be installed on all in-duct pressure measurements. See Drawing No.6

.6 Flow Sensor

.1 The device installation must comply with the manufacturer's recommendations regarding the number of pipe diameters offset from a source of turbulence.

.7 Level

.1 Condensate

.1 Conductivity point level probes will be inserted from the top of the tanks.

.2 The high level probe will be positioned above the start point for the second pump.

.3 The high level probe will be bent 90° at the point of intended contact to provide a large working surface for the probe.

.7 Instrument Air Piping

.1 General

.1 Where lines are exposed use copper tubing or plastic tubing in metal conduits, and where concealed use copper tubing and/or plastic tubing.

.2 Support horizontal copper tubing at least every meter, vertical copper tubing at least every 1 1/3 meter, and support vertical and horizontal plastic tubing at least every 1 1/3 meter.

.8 Components in Pipe

.1 General

.1 Components in pipes: mount using separate welds so that removal of component does not cause loss of fluid from pipe.

.2 Weldalets

.1 All weldalets will be 19 mm NPT, threaded to a depth of 25 mm.

.2 Weldalets will be made of regular pipe steel thick enough to withstand welding.

.3 The weldalet will be installed in the pipe with a maximum of 25 mm protruding above the pipe.

.3 Thermowells

.1 Refer of University of Alberta Drawing No. 5.

.2 For pipe sizes greater than 300 mm diameter, the insertion length will be 190 mm.
.3 For pipe sizes up to 300 mm diameter, the insertion length will be 112.5 mm.

.4 Thermowells installed in pipe diameter 100 mm and smaller, will be installed at an angle or in an elbow, to maximize exposure of well. In pipe diameters greater than 100 mm, install wells perpendicular to flow.

.5 Thermowell shall not protrude more than 50mm above the pipe.

.6 Confirm pipe sizes with the Mechanical Consultant, and increase pipe sizes if necessary to ensure that fluid flow is not restricted by the thermowell.

.9 Electrical Test Jacks

.1 Voltage
The voltage signal out of transducers must be accessible at the device through a jack of the type: Molex miniature nylon connector housing, 03-06-2032 plus crimp type terminal 02-06-1103. The jack brings out the device excitation, common and signal voltage.

.2 Current
All 4 to 20 milliamp signals must be accessible at the field device via a normally closed phone jack. The type should be Switchcraft SF-JAX-24B.

.10 Power Supplied to PCM's

.1 Power connections to be arranged as shown in Drawing No. 7. The supply should be 120 VAC. The power connection will be installed by the Contractor. Both emergency and regular power supplies will have breaker locks, locked on. PCM will have a lamacoid tag on the door, indicating power is fed from two sources and location of regular power supplies will have breaker locks, locked on. PCM will have a lamacoid tag on the door, indicating power is fed from two sources and location of sources (CCT and panel numbers). Tag will be supplied by the University.

.2 Communications Cable to the PCM

.1 The communications cable link from the Utility Corridor to the main communications room will be multi-mode fibre optic cable containing no less than 4 strands of 62.5 micron fibre. The run from the main communications room to the PCM shall be 4 strand 62.5 micron multi-mode break-out cable.

.3 Wire and Conduit

.1 Conduit

.1 All conduit will be anchored and terminated according to standard electrical codes.

.2 The flex conduit will connect to a 13 mm nominal (1/2") E.M.T. conduit which will be located above the mechanical equipment to prevent damage or conflict with working space.

.3 Each sensor conduit will terminate in a common junction box or collecting conduit of sufficient size to accommodate other sensor cables which might be installed in a given area.

.2 Conduit fill
.1 Conduit to be consistent with electrical specification. In no case will conduit fill be greater than 60% of code requirement.

.3 Tray
.1 A vent rib tray of adequate size will be installed to collect all conduits leading to the PCM room.
.2 The tray will be dedicated to low voltage and pneumatic lines only. Its usage is solely for the RCMS system. The tray will be designed for a 60% fill. The tray specification must be approved by the University of Alberta.

.4 Wire
.1 2 spare runs of each type of wire pulled will be left at the PCM on conduit runs from other machine rooms and the services corridor for future requirements.
.2 Wire to be consistent regarding gauge and color with the point sheets.

.4 Panels
.1 MRIP (Motor Relay Interface Panel)
.1 Panel will be mounted with the provision for mounting an additional future panel butted to the existing panel.
.2 Relays will be mounted in vertical rows only. See MRIP drawing for a lay-out.
.3 Preferred conduit entry into the MRIP will be from the top, the bottom, or one side. One panel side will remain free of obstruction as stated above.
.4 Wiring from the MRIP to the MCC for the start-stop and status relay circuits will be 14 GA thermo-plastic 75 degrees C 600 VAC stranded (TWH or equal)
.5 Color: 
   -Start - Stop to be Brown
.6 Minimum conduit size will be 30 mm nominal (1 1/4").
.7 Spare wires will be provided as follows:
   - Brown: one per motor controlled.
.8 Wire from the C/T to the converter will be twisted and shielded. The shield is to be grounded. This wire would not be run in the same conduit with 110 VAC circuits.

.2 AIP
.1 A gauge must be installed on each IP.
.2 Each panel to contain a regulator to supply 175 KPa air to the actuators.
.3 Panel type - as outlined in shop Drawing No. 2

.3 SIP
.1 All sensor transmitters and pressure to voltage transducers are to be mounted on the SIP, except as noted on drawings.

.4 Power Supply Cabinets
.1 The panels are to be installed against a wall such that outlets to provide power for all of the supplies are readily accessible through the open back of the cabinet.
.2 The power supplies are to be 19 inch wide rack mounted with each face plate containing a 24 VDC LED indicating the output of the power supply and a fuse wired to the AC input of the power supply. There would also be a Curtis GFTX-4 feed-through terminal block bringing the DC out to the face plate.
.3 The upper portion of one cabinet will contain a power distribution panel. It must be capable of terminating all feeds to various panels. Each red conductor in will be terminated using Buchanan connector blocks with internal fuses. (#0318)

.5 Cold Reference Junction Panel

.1 This panel should be the same height and colour as the PCM's and Power Supply cabinets.

.2 The panel would be 24 inches wide and 12 inches deep. It must be air tight.

.11 Tagging

.1 General

.1 Label all instruments as to function as indicated on the point sheets, and identify all wires and piping.

.2 Electrical

.1 Motor control and monitoring

.1 The tagging of the points is done with lamaco id tags, provided by the University of Alberta, which are placed on the starter bay in the MCC or at the relay which passes for the starter on a single phase motor.

.2 Wire tagging

.1 All wires run for use on the RCMS will be properly "rung out" to ensure accurate identification.

.2 All field wires will be tagged at both ends, at each, terminal of termination point, with a designation unique for each wire.

.3 All wires of the motor control circuit leaving the MCC module will be considered - as field wires.

.4 The University will show the standards required for tagging prior to job commencement by the contractor.

.5 All wire labeling will use the TY-553M TY-RAP tie. The TY-RAP cable tie will be marked on one side by a permanent black waterproof pen. (The Venus Sanford's - Sharpie Felt Point).

.3 Mechanical

.1 Point tagging - All end devices are to be tagged with the University of Alberta tags. Devices on a panel will be tagged at that location with a lamacoid label.

.2 Tubing tags - The tagging of tubing follows the same specification as the wire tagging.

.2 Testing

.1 Calibration

.1 Personnel Involved

.1 The Contractor will provide qualified personnel to perform the calibration of the devices. These individuals should be journeymen in the appropriate trade. It is not acceptable to have an Electrical journeyman performing calibrations on devices which are normally maintained by Instrument personnel.
.2 **Procedure**

.1 The test procedures will be derived through collaboration of the University of Alberta and Contractor personnel on site.

.2 The Contractor is responsible for the correct termination and calibration of points at the PCM termination point. The Contractor will check, adjust and calibrate each device.

.2 **Testing**

.1 The Contractor is responsible for all testing and calibration of devices. The University of Alberta's role on site at this stage is only to define and provide input as to the test procedures, and to provide clarification as required.

.2 The Contractor shall not rely on operation of the PCM to do his testing and calibration. Therefore he shall provide any necessary meters, instrumentation, and apparatus required for him to do testing and calibration.

.3 Acceptance testing by the University of Alberta will not begin until the Contractor has completed testing and calibration.

.4 The Contractor will complete all calibration and testing of points by qualified personnel and request, through the prime consultant, that the University of Alberta begin acceptance tests not less than 22 working days (one calendar month) prior to anticipated substantial performance. This is the minimum time required by University of Alberta forces to run acceptance tests and to commission the control strategies.

.5 The Contractor's request, for the University of Alberta to start acceptance tests, shall be in writing and certify that:

- everything is installed and terminated.
- all tagging is complete.
- all testing and calibrating is complete.

.3 **Acceptance testing**

.1 By University of Alberta with Contractor on site

.2 Contractor to provide one journeyman of each discipline required for the entire duration of the acceptance test by University of Alberta

.3 Contractor to immediately correct all deficiencies and, changes or repairs that are identified by the University of Alberta during acceptance testing.

.4 The Contractors installation will not be deemed as being complete until all deficiencies are rectified, final acceptance testing is completed, and final certification is received from the University.

.4 **Relocation of existing points**

.1 All points which are removed or disturbed by the construction process must be properly re-installed, tested and commissioned in the same manner as the new points.

.3 **Warranty**
The Contractor will provide a 1 year material and workmanship warranty for his work.
APPENDICES

SYSTEM XXX000 - GRAPHIC
### SYSTEM XXX000 - POINT LIST

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<th>Descriptors</th>
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Point Sheet Number A19
Point Sheet Number A26
Point Sheet Number A30
Point Sheet Number A31
Point Sheet Number A33
Point Sheet Number A51
ANALOG OUT POINT SHEET LIST

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DIGITAL IN POINT SHEET LIST

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Point Sheet Number D21
### DIGITAL OUT POINT SHEET LIST

### LIST OF POINT SHEETS – DIGITAL OUT

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Point Sheet Number E06
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Point Sheet Number E08
Point Sheet Number E10
Point Sheet Number E13
NOTES:

ENCLOSURE: 14GA, 28 1/2" x 41" C/W DOOR WITH 2-POINT HINGE AND GASKET, 3-POINT LOCKING DOOR

INSIDE DOOR AND ENCLOSURE & MOUNTING PLATE SHALL BE PAINTED WHITE.

OUTSIDE DOOR AND ENCLOSURE SHALL BE PAINTED GREY.

HINGE: FEDERAL PACIFIC ELECTRIC C19580/C19581

DIN rail type 35 mm (Top Hat) type (DIN46277)

2" h x 3" w x 24" WIREWAY

2" h x 3" w x 32 1/2" WIREWAY

NOTE:

FOR CONSTRUCTION DETAILS PLEASE SEE UNIVERSITY OF ALBERTA DRAWING # 58000-16 and 58000-17 AVAILABLE UPON REQUEST.
U OF A DRAWING 58000-2

NOTES:
1. SECTION 3 AND 4 ARE EXACT DUPLICATES OF SECTION 2
2. PHONE JACKS (MILITARY SPECS) ARE MOUNTED IN SLOTTED SIDES OF RACEWAY
3. SUPPLY AIR - 3/8" COPPER TUBE - 700 kPa
4. PNEUMATIC RACEWAY
5. ELECTRICAL RACEWAY
6. 1/4" (PE) TUBE
7. 3/8" (PE) TUBE
8. E.P. SWITCHES LOCATED IN THIS QUADRANT (AS SHOWN) IN LIEU OF CONOFLOW (CURRENT TO PNEUMATIC TRANSDUCER)
9. EACH SECTION IS 20" x 40" CONSTRUCTED BY LAMINATING WHITE FORMICA TO 3/4" FIR PLYWOOD ON BOTH SIDES
10. ACTUATOR INTERFACE PANEL IS LIMITED TO FOUR SECTIONS MAX.
11. PRESSURE REDUCING REGULATOR MAXIMUM SUPPLY TO 11 I/P's
12. PRESSURE SAFETY RELIEF VALVE TO BE SET AT 30 PSIG
13. NUPRO B4C-PA2-3 C/W COVER 4CP4-P12-BR
14. ISOLATOR VALVES
15. SHUTOFF VALVE

R.C.M.S ACTUATOR INTERFACE PANEL (A.I.P.)
U OF A DRAWING 58000-3
NOTES:

1. 40 x 20" SHEETS OF 3/4" FIR PLYWOOD SIDES AND EDGES COVERED IN WHITE FORMICA WHICH ARE BOLTED TO STRUTS

2. PANDUIT E3x2WH6 PLASTIC WIRING DUCT

3. UNISTRUT SUPPORT COLUMN BOLTED TO FLOOR

4. AIR PRESSURE TEST PLUG

5. ELECTRONIC TEST PLUG

6. PRESSURE TRANSDUCER

7. 1/4" BLACK PLASTIC TUBING

8. NSC PRESSURE TRANSDUCER
U OF A DRAWING 58000-5
NOTES:
1. ALL DIMENSIONS IN INCHES.
2. WHEN A = 6   U = 4 1/2  
    A = 9   U = 7 1/2
3. MATERIAL TO BE 304SS.
U OF A DRAWING 58000-6
1/4" BARB FITTING SOLDERED INTO PIPE

1/4" COPPER TUBING

1/4" FLOOR MOUNTED FLANGE

6 HOLES 1/32"

STATIC AND FILTER DIFFERENTIAL PRESSURE SENSOR

THIS END SEALED SHUT
U OF A DRAWING 58000-7
NEUTRAL

LOCATED ABOVE MRIP

R1

20 AMP CONTACT

NO

R1

20 AMP CONTACT

NC

REGULAR POWER

EMERGENCY POWER

PCM EQUIPMENT

POWER SUPPLY TO PCM

DRAWING NO. 7
U OF A DRAWING 58000-8

FIRE ALARM WIRING
GENERAL APPROACH

LOCATION
ANNUNCIATOR
CONTACTS

FIRE ALARM PANEL

5.6K OHMS
OPEN ON ALARM

+24 V POWER

TO PCM

QY RELAYS

TO ALL MRIPS THAT SHOW FIRE RELAYS (QY)

WIRED TO UNIVERSITY
MASTAFIRE ALARM PANEL
(MASTER AUX N/C)

TO ACU PANEL

TO UNIVERSITY
U OF A DRAWING 58000-9
U OF A DRAWING 58000-10
DRAWING NO. 10
NUMBERING SYSTEM
AT PCM TERMINALS

PCM

ANALOG MUX
00 10 20 30 40 50 60 70 80 90
05 15 25 35 45 55 65 75 85 95

EXAMPLE OF EPN
PCM11A086

POIN 86

DIGITAL MUX
00 01 02 03 04 05 06 07
08 09 10 11 12 13 14 15

EXAMPLE OF EPN
PCM11D065

POIN 5

POWER SUPPLIES

TO RCMS HOST

TO SIP, AIP, MRIP
MRIP # 1
MRIP # 2
SIP # 1
AIP # 1
AIP # 3
ANALOG MUX ASSIGNMENTS - MUX 1
DIGITAL MUX ASSIGNMENTS - MUX 1
DIGITAL MUX ASSIGNMENTS - MUX 2
THERMOCOUPLE COLD REFERENCE JUNCTION PANEL #1
THERMOCOUPLE COLD REFERENCE JUNCTION PANEL #2
DESCRIPTOR ONE LIST
DESCRIPTOR TWO AND THREE LIST
PCM ROOM LAYOUT