

# Exhibit C

# HVAC & PLUMBING SYMBOL SCHEDULE

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
(#)	REFER TO PLAN NOTES	111	ROOM CALLOUT
(E)	EXISTING EQUIPMENT OR MATERIAL DESIGNATION	△	REVISION NUMBER
---	EXISTING COMPONENT PEN WEIGHT	○	CONNECT NEW TO EXISTING. VERIFY EXACT LOCATION.
---	DEMOLITION PEN WEIGHT - COMPONENT MAY ALSO BE SHADED	●	DISCONNECT FROM EXISTING. VERIFY EXACT LOCATION.
T.C.C.	TEMPERATURE CONTROL CONTRACTOR	G.C.	GENERAL CONTRACTOR
E.C.	ELECTRICAL CONTRACTOR	M.C.	MECHANICAL CONTRACTOR
P.C.	PLUMBING CONTRACTOR	TYP.	TYPICAL ALL INSTANCES
24x12	(UP)DUCT SEC., POSITIVE PRESSURE-FIRST SIZE IS TOP DIM.(TYP.)		BALANCING DAMPER W/ MANUAL LOCKING QUADRANT
24x12	(DOWN) DUCT SECTION, POSITIVE PRESSURE		RECTANGULAR - OPPOSED BLADE / ROUND - BUTTERFLY
24x12	(UP) DUCT SECTION, NEGATIVE PRESSURE		BALANCING DAMPER W/ MOTORIZED LOCKING QUADRANT
24x12	(DOWN) DUCT SECTION, NEGATIVE PRESSURE		RECTANGULAR - OPPOSED BLADE / ROUND - BUTTERFLY
	SUPPLY DUCT DROP	18x12	DUCT SIZE, FIRST FIGURE IS SIDE SHOWN-CLEAR INSIDE DIM.
	SUPPLY DUCT RISER		DUCT CHANGE OF ELEVATION RISE(R) DROP(D)
	RETURN DUCT DROP		FLEXIBLE CONNECTION
	RETURN DUCT RISER		SIDE WALL SUPPLY REGISTER
	FLEXIBLE DUCT	RTU	ROOFTOP UNIT
	TURNING VANES	AHU	AIR HANDLING UNIT
SA	SUPPLY AIR	VAV	VARIABLE AIR VOLUME UNIT
OA	OUTSIDE AIR	FTU	FAN POWERED TERMINAL UNIT
RA	RETURN AIR	FCU	FAN COIL UNIT
EA	EXHAUST AIR	MAU	MAKE-UP AIR UNIT
OBD	OPPOSED BLADE DAMPER	SF	SUPPLY AIR FAN
BOD	BOTTOM OF DUCT ELEVATION ABOVE FLOOR	EF	EXHAUST FAN
BOS	BOTTOM OF STEEL	SR	SUPPLY REGISTER
TOD	TOP OF DUCT ELEVATION ABOVE FLOOR	RG	RETURN GRILLE
DH	DUCT HEATER	F	FURNACE
DP	DIFFERENTIAL PRESSURE	UH	UNIT HEATER
CVR	CONSTANT VOLUME REHEAT UNIT	CRAC	COMPUTER ROOM AIR CONDITIONING UNIT
V V R	VARIABLE VOLUME REHEAT UNIT	H	HUMIDIFIER
V V T	VARIABLE VOLUME VARIABLE TEMPERATURE	VFD	VARIABLE FREQUENCY DRIVE
UV	ULTRAVIOLET STERILE CONDITIONER	FD + - +	FIRE DAMPER IN FLOOR (VERTICAL POSITION)
	RADIATION DAMPER	FD + - + ▲	FIRE DAMPER IN WALL (HORIZONTAL POSITION)
	MOTOR	SD + - + ▲	SMOKE DAMPER
	TEMPERATURE SENSOR	FSD + - + ◊	COMBINATION FIRE/SMOKE DAMPER (VERTICAL POSITION)
	HUMIDITY SENSOR	FSD + - + ▲	COMBINATION FIRE/SMOKE DAMPER (HORIZONTAL POSITION)
	ELECTRIC OR DDC HUMIDISTAT (HSTAT)	(T)	ELECTRIC OR DDC THERMOSTAT (TSTAT)
	PNEUMATIC HUMIDISTAT	(T)	PNEUMATIC THERMOSTAT
	DOUBLE CHECK BACKFLOW ASSEMBLY		BALL VALVE
	REDUCED PRESSURE ZONE BACKFLOW ASSEMBLY		CALIBRATED BALANCE VALVE - CIRCUIT SETTER
	GAS COCK		BUTTERFLY VALVE
	VALVE IN DROP		2-WAY CONTROL VALVE (PNEUMATIC)
	VALVE IN RISER		3-WAY CONTROL VALVE (PNEUMATIC)
	GATE VALVE / SHUT OFF VALVE		2-WAY CONTROL VALVE (ELECTRIC)
	GLOBE VALVE		3-WAY CONTROL VALVE (ELECTRIC)
	3 PIECE BALL VALVE		CHECK VALVE
	HYDRAULIC VALVE		PRESSURE REDUCING VALVE (PRV)
	EMERGENCY VALVE WITH FIRE LINK		WAFER CHECK VALVE
	STRAINER		AUTOMATIC FLOW CONTROL VALVE
	PLUG VALVE		CALIBRATED ORIFICE PLATE FLOW METER
	SPRING HANGER		THERMOMETER
	PIPE HANGER		PRESSURE GAUGE
	CAP		CONCENTRIC REDUCER OR INCREASER
	PIPE RISE		ECCENTRIC REDUCER
	PIPE DROP		TOP CONNECTION, 45° OR 90°
	UNION OR FLANGE CONNECTION		BOTTOM CONNECTION, 45° OR 90°
	DIRECTION OF FLOW		SIDE CONNECTION
	ANCHOR		CAPPED OUTLET

NOT ALL MAY BE USED ON PROJECT

# GENERAL NOTES

- VERIFY JOB SITE CONDITIONS AND DIMENSIONS BEFORE BEGINNING WORK. PLANS ARE SCHEMATIC IN NATURE. LAYOUT IS BASED ON BEST AVAILABLE INFORMATION. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS AND DIMENSIONS.
  - NO PIPING, DUCTWORK, ETC. SHALL PENETRATE STRUCTURAL MEMBERS.
  - PROVIDE MISCELLANEOUS CUTTING, PATCHING AND REPAIRING OF FINISHES, ROOF, WALLS, ETC., AS REQUIRED TO ACCOMMODATE THE NEW WORK.
  - G.C. IS TO PATCH ANY OPENINGS IN CORRIDORS REQUIRED TO BE CONSTRUCTED TO LIMIT THE TRANSFER OF SMOKE AND IN SMOKE BARRIERS AS REQUIRED TO MEET CODE REQUIREMENTS. SEE ARCHITECTURAL DRAWINGS FOR LOCATIONS.
  - IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY EXACT LOCATION, CONFIGURATION AND ROUTING OF EXISTING SYSTEMS REQUIRED TO REMAIN IN OPERATION DURING THE PROJECT TO PREVENT DAMAGE DURING DEMOLITION AND PHASING.
  - REMOVE ALL EXISTING EQUIPMENT, DUCTWORK AND PIPING THAT IS NOT REQUIRED FOR A WORKING INSTALLATION.
  - COORDINATE ALL WORK WITH OTHER TRADES PRIOR TO INSTALLATION.
  - UNLESS OTHERWISE INDICATED, INSTALL ALL SPACE THERMOSTATS AND OTHER OCCUPANT ADJUSTABLE CONTROL DEVICES SAME HEIGHT AS ADJACENT LIGHT SWITCHES, BUT IN NO CASE HIGHER THAN 48 INCHES ABOVE FINISHED FLOOR PER ADA REQUIREMENTS. COORDINATE EXACT HEIGHT WITH ARCHITECT PRIOR TO INSTALLATION.
  - ALL CUTTING AND PATCHING SHALL BE CLOSELY COORDINATED WITH THE G.C.
  - COORDINATE ROUTING OF PLUMBING, AND HVAC PIPING WITH DUCTWORK, LIGHTS, ARCHITECTURAL CEILING AND STRUCTURAL ELEMENTS. PIPING SHALL RISE AND DROP, JOG OR OFFSET AS REQUIRED TO AVOID CONFLICTS. DUCTWORK SHALL TAKE PRECEDENCE OVER ALL PIPING, EXCEPT WHERE GRADE MUST BE MAINTAINED FOR DRAINAGE. REWORK OF INSTALLED WORK TO RESOLVE CONFLICTS ARISING FROM LACK OF COORDINATION SHALL NOT JUSTIFY AN INCREASE IN THE CONTRACT AMOUNT.
  - ALL DIFFUSERS ARE 4-WAY BLOW UNLESS INDICATED OTHERWISE ON THE DRAWINGS.
  - FLEXIBLE DUCTWORK IS ALLOWED ON RUNOUTS TO SUPPLY DIFFUSERS ONLY. UTILIZE ONLY ABOVE LAY-IN ACCESSIBLE CEILINGS. DO NOT INSTALL FLEX DUCT ABOVE HARD CEILINGS OR WHERE EXPOSED. A MAXIMUM LENGTH OF 6'-0" MAY BE USED AT EACH CONNECTION.
  - SEAL DUCTWORK AS CALLED OUT BELOW USING HARDCAST DT TAPE AND FTA-20 ADHESIVE OR HARDCAST AFG-1402 "FOIL GRIP" PER MANUFACTURERS INSTRUCTIONS. SEAL TO SMACNA SEAL CLASS A:
 

TYPE OF DUCT	APPLY TO JOINTS
MEDIUM / LOW VELOCITY SUPPLY (ROUND)	TRANSVERSE AND LONGITUDINAL
MEDIUM / LOW VELOCITY SUPPLY (RECTANGULAR)	TRANSVERSE AND LONGITUDINAL
  - INSTALL BALANCE DAMPER WITH STANDOFF AND LOCKING QUADRANT IN AN ACCESSIBLE LOCATION AT EACH RUNOUT TO SUPPLY DIFFUSERS, EXHAUST GRILLES, AND RETURN GRILLES WHERE AIRFLOW IS INDICATED, OR AS INDICATED OTHERWISE.
  - DO NOT ROUTE PIPING OR DUCTWORK OVER ELECTRICAL PANELS OR EQUIPMENT. PIPING OR DUCTWORK SHALL NOT BE ROUTED THROUGH ELECTRICAL ROOMS, TELECOM ROOMS OR ELEVATOR EQUIPMENT ROOMS UNLESS SPECIFICALLY SERVING THAT ROOM. COORDINATE WITH E.C. PROVIDE WATERTIGHT DRIP PAN WITH DRAIN TO NEAREST APPROVED RECEPTOR WHERE REQUIRED.
  - COORDINATE SIZE AND LOCATION OF ACCESS DOORS IN CONSTRUCTION REQUIRED FOR ACCESS TO MECHANICAL EQUIPMENT WITH G.C.
  - COORDINATE SIZE AND LOCATION OF MECHANICAL EQUIPMENT PADS WITH G.C.
  - ALL WORK IS TO CONFORM WITH APPLICABLE CODES AND STANDARDS.
  - DUCT SIZES SHOWN ARE ACTUAL INSIDE CLEAR DIMENSIONS. INCREASE SHEET METAL DIMENSIONS AS REQUIRED TO ACCOMMODATE DUCT LINER WHERE LINER IS SPECIFIED.
  - ALL EQUIPMENT SUPPORT STANDS SHALL BE PRIMED AND PAINTED WITH EPOXY ENAMEL.
  - PAINT INSIDE OF DUCTWORK BLACK ANYWHERE VISIBLE THROUGH FACE OF GRILLE OR DIFFUSER.
  - TEMPERATURE CONTROLS CONTRACTOR (TCC) SHALL FURNISH AND INSTALL ALL LOW VOLTAGE WIRING AND ASSOCIATED CONDUIT REQUIRED FOR MECHANICAL CONTROL SYSTEM. WIRING SHALL BE IN CONDUIT INSIDE WALLS, IN ROOMS WITH EXPOSED CEILINGS, AND ABOVE HARD CEILINGS. LINE VOLTAGE WIRING AND ASSOCIATED CONDUIT SHALL BE PROVIDED AND INSTALLED BY E.C. CONTROL SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH SPECIFICATIONS.
  - ALL CONTROL DAMPERS SHALL BE FURNISHED BY TCC AND INSTALLED BY THE MC. MOTOR OPERATORS SHALL BE FURNISHED AND INSTALLED BY THE TCC.
  - COORDINATE ACCESS TO EQUIPMENT AND VALVES INSTALLED ABOVE 'HARD' CEILINGS AND IN MASONRY CHASES WITH GENERAL CONTRACTOR. PROVIDE LOCKING ACCESS DOORS FOR INSTALLATION BY CONTRACTOR AS REQUIRED TO SERVICE CONCEALED DAMPERS, VALVES AND EQUIPMENT. CEILING ACCESS DOORS FOR FIRE DAMPERS, SMOKE DAMPERS AND FIRE SMOKE DAMPERS FURNISHED AND INSTALLED BY CONTRACTOR.
  - CONTRACTOR TO INSTALL TEMPORARY FILTERS OVER ALL RETURN AND EXHAUST GRILLES IN WORK AREA DURING CONSTRUCTION.
  - THESE DRAWINGS ARE ACCOMPANIED BY SHEET SPECIFICATIONS. REFER TO SHEETS FOR FURTHER INFORMATION.
  - EQUIPMENT THAT REQUIRES MAINTENANCE SHALL BE LOCATED A MINIMUM OF 10'-0" FROM THE BUILDING ROOF EDGE WHERE REQUIRED BY CODE.
- NOTE: NOT ALL MAY APPLY ON PROJECT.

# GENERAL DEMOLITION NOTES

- VERIFY ALL EXISTING CONDITIONS PRIOR TO BEGINNING WORK. BRING ANY DISCREPANCIES FROM THE DRAWINGS AND NOTES TO THE ARCHITECT IMMEDIATELY. MINOR CHANGES IN THE SCOPE OF THE DEMOLITION WORK SHALL NOT JUSTIFY AN ADDITIONAL COST.
  - REMOVAL OF EXISTING FIXTURES AND EQUIPMENT WILL REQUIRE ISOLATING THE PIPING RISERS OR MAINS VIA SHUT-OFF VALVES. INSTALL NEW ISOLATION VALVES WHERE REQUIRED FOR COMPLETION OF WORK.
  - REMOVAL OF EXISTING PLUMBING FIXTURES AND EQUIPMENT, ETC. WILL REQUIRE CAPPING AND SEALING EXISTING MAINS OR BRANCHES AS NECESSARY AND REQUIRED TO ALLOW THE REMAINING SYSTEMS TO FULLY OPERATE WITHOUT DEGRADATION.
  - CONTRACTOR SHALL PROVIDE PROTECTIVE PLASTIC DROP CLOTHS TO PROTECT THE EXISTING OCCUPIED AREAS AND EQUIPMENT FROM DUST AND DEBRIS DURING THE CONSTRUCTION WORK, AND SHALL CLEAN THE AREAS OF ALL CONSTRUCTION DIRT DAILY, AND UPON COMPLETION OF THE WORK.
  - ALL DRAINED PIPING RISERS AND MAINS SHALL BE REFILLED WITH PROPER FLUID AND PROPERLY VENTED BY THIS CONTRACTOR, ONCE NEW WORK HAS BEEN INSTALLED.
  - COORDINATE WITH GENERAL CONTRACTOR THE REMOVAL AND REPLACEMENT OF ALL EXISTING CEILINGS, WALLS, ETC. AS REQUIRED FOR MECHANICAL DEMOLITION WORK.
  - EXISTING PIPING AND EQUIPMENT, ETC., NOT TO BE UTILIZED IN THE COMPLETED BUILDING SHALL BE DISCONTINUED OR REMOVED AS REQUIRED. ALL ENDS OF DISCONTINUED PIPING SHALL BE CAPPED IN THE NEAREST WALL, CEILING OR FLOOR SO THAT THEY ARE COMPLETELY CONCEALED. OPENINGS LEFT IN WALLS, CEILINGS, ETC., WHERE EQUIPMENT AND PIPE, ETC., ARE REMOVED AND NOT REPLACED, SHALL BE PATCHED NEATLY WITH SIMILAR MATERIAL TO ADJACENT CONSTRUCTION. REFER TO DRAWINGS DELINEATING NEW WORK FOR ADDITIONAL INFORMATION REGARDING SYSTEMS OR PORTIONS OF SYSTEMS WHERE USE IS TO BE DISCONTINUED.
  - EXISTING PIPING, FIXTURES AND EQUIPMENT THAT ARE NOT TO BE REUSED SHALL BE REMOVED AND SHALL REMAIN THE PROPERTY OF THE OWNER IF THEY WISH TO RETAIN OWNERSHIP OF SAME. IF NOT, EQUIPMENT SHALL BECOME THE PROPERTY OF THIS CONTRACTOR AND SHALL BE REMOVED FROM THE SITE AS SOON AS PRACTICAL AND DISPOSED OF IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS.
  - ALL CUTTING AND CHANNELING OF EXISTING BUILDING SHALL BE ACCOMPLISHED IN A NEAT AND WORKMANLIKE MANNER WITHOUT REMOVAL OF EXCESS MATERIALS. THIS CONTRACTOR SHALL PATCH AND REPLACE WITH MATERIAL SIMILAR TO ADJACENT CONSTRUCTION.
  - WHERE EXISTING PIPING AND EQUIPMENT, ETC., THAT ARE TO BE UTILIZED IN THE COMPLETED PROGRAM CONFLICT WITH NEW CONSTRUCTION AND THE REQUIRED DEMOLITION, THEY SHALL BE RELOCATED AND RECONNECTED TO MAINTAIN THE DESIRED SERVICE.
  - PORTIONS OF EXISTING SYSTEMS MAY BE SHOWN FOR CLARITY EVEN THOUGH IT MAY NOT BE NECESSARY TO MODIFY OR REVISE THEM. ALL EXISTING SYSTEMS ARE SHOWN BASED ON ORIGINAL OR REMODEL BUILDING DRAWINGS. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS.
  - ALL WORK MUST BE COORDINATED AND SCHEDULED WITH THE OWNER AND OCCUPANTS OF THIS BUILDING SO AS TO PROVIDE THE LEAST AMOUNT OF DISRUPTION OF BUILDING ACTIVITIES AS POSSIBLE. MAINTAIN CONDITIONED SPACE FOR ALL OWNER OCCUPIED AREAS DURING CONSTRUCTION.
  - ALL ACCESSIBLE ABANDONED PIPING AND DUCTWORK SHALL BE REMOVED AND PROPERLY DISPOSED OF.
- NOTE: NOT ALL MAY APPLY TO PROJECT

# DRAWING SYMBOLS

EQUIPMENT CALLOUT	SECTIONS	DETAILS
	<p>SECTION LETTER</p> <p>SHEET NUMBER WHERE DRAWN</p>	<p>DETAIL NUMBER</p> <p>SHEET NUMBER WHERE DRAWN</p>
	<p>SECTION LETTER</p> <p>SHEET NUMBER WHERE DRAWN</p> <p>SHEET NUMBER WHERE REFERENCED</p>	<p>DETAIL NUMBER</p> <p>SHEET NUMBER WHERE DRAWN</p> <p>SHEET NUMBER WHERE REFERENCED</p>

# SHEET LIST

M-00	MECHANICAL COVER SHEET
M-01	SPECIFICATIONS
M-02	SPECIFICATIONS
M-03	SPECIFICATIONS
M-04	SPECIFICATIONS
M-10	HVAC DEMOLITION FLOOR PLANS
M-11	HVAC NEW FLOOR PLANS
M-20	PIPING NEW AND DEMOLITION FLOOR PLANS
M-30	HVAC SCHEDULES AND CONTROLS



SHEET CONTENTS  
MECHANICAL COVER SHEET

**LIEBERT REPLACEMENT**  
PSD INFORMATION TECHNOLOGY CENTER  
2413 LAPORTE AVE. FORT COLLINS, CO 80521



NO.	BY	DATE	DESCRIPTION
1		09-13-2019	REVIEW
2		09-30-2019	PERMIT

NO.	DATE	DESCRIPTION
1	09-30-2019	REVISIONS

SECTION 200500 – COMMON WORK RESULTS FOR FIRE PROTECTION, PLUMBING, AND MECHANICAL

1.1 GENERAL CONDITIONS

- A. The General Conditions, Supplemental General Conditions, Special Conditions and General Requirements are part of this contract and shall be referred to as they apply to this section of the specifications.

1.2 EXAMINATION OF SITE

- A. Visit the site, inspect the existing conditions and check the drawings and specifications so as to be fully informed of the requirements for completion of the work. Lack of such information shall not justify an extra to the contract price.

1.3 SCOPE

- A. The Mechanical Work shall include labor, materials, and equipment to install systems as shown on plans and hereinafter specified. The installation shall include all labor, materials, tools, transportation, equipment, services and facilities, required for the complete, proper and substantial installation of all mechanical work shown on the plans, and/or outlined in these specifications. The installation shall include all materials, appliances, and apparatus not specifically mentioned herein or noted on the drawings but which are necessary to make a complete working installation of all mechanical systems.
- B. Show on prints in red ink all changes from original plans made during the installation. Return these prints to the Architect upon completion of the project.
- C. By bidding, this contractor acknowledges his understanding of the work to be done and agrees to install complete and workable systems.

1.4 CODES

- A. Execute work in compliance with all applicable Federal, State and Municipal laws, codes, ordinances, and local customs regarding the trade to perform the work.
- B. Codes shall govern in case of any direct conflict between codes and plans and specifications; except when plans and specifications require higher standards than those required by code. Variance from the plan and specifications made to comply with code must be approved by the Architect. If approved they shall be made with no increased cost to the Owner.
- C. In addition, the following published Standards and Regulations shall be adhered to as applicable to the work involved:
  - Latest issue of the Local, State, and National Plumbing Codes
  - Latest issue of the ASHRAE Guide
  - Latest issue of the SMACNA Handbook
  - Applicable NFPA Pamphlets
  - Applicable ANSI Standards
  - American Society of Mechanical Engineers Boiler Code
  - American Society of Mechanical Engineers Unfired Pressure Vessel Code
  - American Standards Association Code for Mechanical Occupational Safety and Health Act
  - Current Editions of Uniform Building Code
  - Latest issue of the State Air Pollution Control Regulations
  - Rules of the State Boiler Inspection Department
  - Americans with Disabilities Act
  - City of Fort Collins addendums

1.5 DEFINITIONS

- A. It shall be understood that the drawings and specifications complement one another and items specified shall also meet the criteria set forth on the drawings.
- B. Where any device or item is referred to in the singular sense (such as "the unit"), such reference applies to as many devices as are required to complete the installation as shown on the drawings.
- C. The term "work" shall mean all obligations imposed upon the Contractor by the Contract Documents.

1.6 ABBREVIATIONS

- ADA - Americans with Disabilities Act
- AGA - American Gas Association
- AISI - American Iron and Steel Institute
- AMCA - Air Moving and Conditioning Association, Inc.
- ANSI - American National Standards Institute
- ASHRAE - American Society of Heating, Refrigeration & Air-Conditioning Engineers, Inc.
- ASME - American Society of Mechanical Engineers
- ASTM - American Society for Testing and Materials
- AWWA - American Water Works Association
- BPVC - Boiler and Pressure Vessel Code of ASME
- CISPI - Cast Iron Soil Pipe Institute
- NFPA - National Fire Protection Association
- SMACNA - Sheet Metal and Air-Conditioning Contractors National Association, Inc.
- UL - Underwriters' Laboratories, Inc.
- ETL - ETL Testing Laboratories, Inc.
- OSHA - Occupational Safety and Health Administration

1.7 PERMITS

- A. Obtain and pay for all licenses and permits, fees, inspection and certificates required for the execution of this work.
- B. Pay fees and charges for connection to outside services and use of property.
- C. Deliver permits and certificates to the Architect for transmittal to the Owner.

1.8 RESPONSIBILITY

- A. This contractor will be held responsible for any and all damage to any part of the building or to the work of other contractors, as may be caused through his operation.
- B. The operation and maintenance of the New Mechanical Equipment during construction shall be the responsibility of this contractor until the acceptance of the building by the Owner.
- C. The General Contractor shall pay for all fuel cost for operation of the equipment, unless indicated otherwise in the specifications.
- D. This Contractor shall make all provisions for entry of equipment, installed under this Contract, to the installed location. This Contractor shall provide openings in existing construction if necessary. This Contractor shall do all repair necessary to restore the building to the original condition. During the period of entry of equipment and removal of trash, no disruption of the Owner's normal business shall occur.

1.9 WORK TO BE DONE BY GENERAL CONTRACTOR

- A. Build in all openings, sleeves, chases, etc., for piping, as established, furnished and set by this contractor.
- B. Mechanical Contractor shall furnish bolts, brackets, hangers, etc., required for work established and arrange for General Contractor to build into concrete structure. General Contractor shall install all factory sleeved fire dampers, furnished by Mechanical Contractor, in walls and floors.
- C. Frame around and provide openings for ductwork, louvers, roof drains, etc.
- D. Build curb or install factory curb and provide flashing for roof mounted mechanical equipment. Provide heavy steel angle support under entire perimeter of roof curb for rooftop equipment. Metal deck and roof insulation shall be installed within the roof curb area of rooftop equipment for acoustical considerations.
- E. Provide lintels over wall openings.
- F. Build concrete base for equipment furnished and set by this contractor.
- G. Provide concrete housing for sewage ejector and sump pump basins.
- H. Paint all mechanical equipment so specified. Use paint which is specified by the Architect.
- I. Do excavation, provide moisture barrier, sand and/or gravel, tie down wire, and a minimum thickness of 3" of lightweight concrete for installation of duct below grade. Mechanical Contractor shall furnish duct and set in place in preparation for concrete pour.

1.10 WORK TO BE DONE BY ELECTRICAL CONTRACTOR

- A. The Electrical Contractor shall provide all motor starters complete with auxiliary contacts where required for the function of this system unless specifically noted otherwise on the plans or in these specifications.
- B. All required line voltage wiring for the mechanical control system shall be furnished and installed by the Electrical Contractor under supervision of the Control Manufacturer's representative.
- C. Check mechanical specifications to verify wiring requirements for motor driven equipment. Provide complete wiring for the equipment including all required interlocking. Provide complete wiring for power factor correction capacitors.
- D. The Electrical Contractor shall install the power factor correction capacitors furnished by the Mechanical Contractor for equipment so specified.

1.11 ELECTRICAL REQUIREMENTS BY MECHANICAL CONTRACTOR

- A. Mechanical Contractor shall furnish all motors, motor interlocking control devices, certain magnetic starters, etc.
- B. Submittals shall include complete equipment wiring diagrams and temperature control drawings for all the equipment furnished.
- C. Submittals shall show all wiring connections, starters, auxiliary contactors, interlocking selector switches, separate control voltage power supplies, for each and every item of equipment, etc., requiring wiring.
- D. Provide one copy of Engineer approved shop drawings showing all wiring and temperature control requirements of all mechanical equipment to the Electrical Contractor.

1.12 WORKMANSHIP AND COORDINATION

- A. Make installation substantially as shown on the plans.
- B. Pipe and duct routing and equipment location shown on the drawings are schematic in nature. Make alterations in location of apparatus or piping as may be required to conform to building construction without extra charge.
- C. Equipment service clearances, per equipment manufacturers' specifications, shall be maintained from general construction. No pipe or ductwork shall be installed within these clearances. No piping, coils, or ductwork shall be installed above electrical panels, starters or switch gear, or in elevator equipment rooms.
- D. Cooperate with other contractors in their installation of work.
- E. The ductwork shall take precedence over all pipe work except where it is necessary to maintain an even grade or specific slope on the piping.
- F. Use only experienced mechanics.

1.13 MATERIALS

- A. Material and equipment shall be new, of best quality and design and free from defects. A manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating manufacturer's name, address and catalog number.

1.14 MATERIALS OF APPROVED EQUAL

- A. Where items of equipment and/or materials are specifically identified herein by a manufacturer's name, model or catalog number, only such specific items may be used in the base bid, except as hereinafter provided.
- B. Unless requests for changes in base bid specifications are received and approved and noted by addendum prior to the opening of bids, the successful contractor will be held to furnish specified item.
- C. After contract is awarded, changes in specifications shall be made only as defined under "Substitution of Equipment".

1.15 SUBSTITUTION OF EQUIPMENT

- A. After execution of the contract, substitution of equipment of makes other than those specifically named in the contract documents will be approved by the Engineer only if the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence to work of other contractors, due to conditions beyond control of the contractor.
- B. Requests for substitutions must be accompanied by documentary proof of equality or difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.
- C. The Owner shall receive all benefits of the difference in cost involved in any substitution, and the contract altered by change order to credit Owner with any savings so obtained.

1.16 SUBMITTALS

- A. Contractor shall send to the Architect for approval submittals on all equipment, accessories, and components.
- B. Where catalog cuts are used, mark them to indicate equipment, capacities, controls, fittings, valves, sizes, etc.
- C. Reference each item to applicable specification paragraph number and plan sheet number. Reference items not appearing in base specification to applicable alternate numbers, change order numbers, letters of authorization, etc.
- D. All shop drawings shall be checked and signed by the mechanical contractor prior to submittal to the Engineer.
- E. Shop drawings submitted without contractor's signature or approval and verification will not be approved. Quantities will not be checked or verified. It is the contractor's responsibility to provide the proper quantities required to complete the job.
- F. Portions of the work requiring a shop drawing submittal shall not begin until the shop drawing has been approved by the Engineer.
- G. Submit wiring diagrams for all mechanical equipment requiring field wiring clearly showing all required connections.
- H. Engineer's acceptance of Compliance Submittals will not relieve Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to such deviation at the time of submission and Engineer has given written approval to the specific deviation, nor shall any acceptance by Engineer relieve Contractor from responsibility for errors or omissions in Compliance Submittals.

1.17 CUTTING AND PATCHING

- A. Notify the General Contractor in ample time, of the location of all chases, sleeves, and any other openings required in connection with the work of this contract.
- B. Cutting and patching made necessary because of failure to comply with the above shall be done by the General Contractor at the expense of the Mechanical Contractor.

1.18 MUTILATION

- A. All mutilation of finishing initiated by installation of plumbing pipes, fixtures, etc., shall be properly pointed up by the respective finishing contractor and paid for by the Mechanical Contractor.

1.19 EXCAVATION AND BACKFILLING

- A. Do all excavation required for water, gas, sewer, drainage, etc.
- B. Contractor shall do all shoring and bracing necessary per OSHA requirements to perform the work and as required for safety.
- C. Backfill and tamp the earth around pipes and bring to required level.
- D. Fill carefully to prevent future settlement.
- E. Backfill trenches under concrete floor, drive, or walks, with sand, crushed rock, or gravel, in manner to prevent future settlement. Backfilling of trenches shall be in conformance with requirements for earthwork in the Architectural Specifications.
- F. Street and alley pavement surfaces damaged must be repaired to the satisfaction of the local authorities.

1.20 TESTING

- A. Furnish testing equipment and test all piping systems under methods and conditions as specified.
- B. Test for a period of not less than 12 hours in the presence of the Architect.
- C. Make all necessary replacements and repair and repeat tests until the entire system is approved and satisfactory.
- D. Test under pressure with liquid or gas as directed or specified.

1.21 PAINTING

- A. All painting shall be done by the General Contractor.
- B. Painting shall be for the following items: all piping, ductwork, frame work, and all equipment not furnished with factory finish, etc., in all exposed areas of the building and/or as noted on the drawings. Omit painting of piping in tunnels and in concealed areas.

1.22 LABELING

- A. Install mechanically engraved metal or plastic label at equipment, not less than 2-1/2 inches wide by 3/4 inch tall with letters between 1/4 inch and 1/2 inch tall. Utilize labels with pre-drilled holes and stainless steel rivets or self-tapping screws, or labels with contact-type permanent adhesive.
- B. Identify all service piping which is accessible for maintenance operation with semi rigid plastic markers complete with direction of flow arrows. Each marker must show approved color-coded background, proper color of legend, approved legend letter size and approved marker length. Use snap on or Type SNA markers on diameters 3/4" thru 5". Use strap-on or Type STR on diameter 6" and larger. Locate pipe markers at each valve, each branch and riser takeoff, each passage through wall or floor construction, each passage to underground and at 25 foot intervals on all horizontal pipe runs.

1.23 OPERATING INSTRUCTIONS

- A. Prepare and submit to the Engineer for approval three (3) copies of operating instructions made in conjunction with Equipment Manufacturer's representative. Instruction shall contain equipment starting sequence, interlocks, controls, switches, etc. which affect the equipment operation. Place copies in maintenance instructions brochure.

1.24 MAINTENANCE INSTRUCTIONS

- A. Prepare a brochure in triplicate covering all systems and equipment furnished and installed under this contract. Each brochure shall include certified equipment drawings and/or catalog data as submitted, complete maintenance instructions, parts lists for each item of equipment, any special emergency operating instructions, all equipment warranties with starting dates identified, and a list of service organizations including addresses and telephone numbers.
- B. Brochures shall be bound in hard backed, three-ring binders with an index, sub-dividers and reinforced sheets.
- C. Label cover with the following:
  - Project name and address
  - Section of work covered by brochure, i.e., "Plumbing Heating, Ventilation, Air Conditioning", etc.
  - Name and address of Architect, Engineer, Contractor.
  - Telephone number of Contractor including night and emergency numbers.
- D. Brochures shall be submitted to the Engineer for approval and delivery to the Owner.

1.25 LOOSE EQUIPMENT

- A. All keys and special wrenches furnished with the equipment shall be kept in a safe place during construction and presented to the Owner at the completion of the project.

1.26 FINAL INSPECTION

- A. Final inspection will be made upon written request from the Mechanical Contractor after the project is completed.
- B. Furnish a workman familiar with this project to accompany the Engineer on final inspection and have available ladders, drop cords, and other equipment as required to gain access to any portion of this system.
- C. This contractor and his principal sub-contractors shall be represented at the inspection by a person of authority responsible to demonstrate to the Engineer that his work conforms to the intent of the plans and specifications.
- D. Extra inspections made necessary by the Mechanical Contractor's failure to comply with the conditions as set forth above shall be charged to the contractor at the inspector's time both on the job and spent in travel between the office and the project site.

1.27 GUARANTEE

- A. Guarantee all work, material and equipment for a period of one year after date of final certificate of acceptance by the Architect.
- B. During the year guarantee period the mechanical contractor shall be responsible for any defects which develop in the mechanical systems. Upon notification of a defect by the Architect, (s)he shall make immediate effort to correct it and shall notify the Architect when this work is completed.
- C. Repairs and/or replacements shall be made with no cost to Owner.

SECTION 200600 – MATERIALS AND METHODS COMMON TO PLUMBING AND MECHANICAL.

1.1 PIPING SYSTEMS - GENERAL

- A. Pipe for piping systems shall be cut accurately to measurements taken on the job.
- B. Install offset connections for alignment of vertical to horizontal piping wherever required to make a true connection.
- C. Make branch connections with offsets to provide for movement with the expansion of the piping system.
- D. Install horizontal piping parallel to the building walls and partitions.
- E. Do not run piping through elevator equipment rooms, transformer vaults or other electrical equipment spaces or above electrical gear or panels.
- F. Valves, strainers, control valves, check valves and fittings shall be full size of the line they serve. Make change in pipe size noted on plans after last fitting on larger pipe. When supply pipes are larger than equipment tappings, reduce pipe size immediately prior to entry.

1.2 PIPE AND FITTINGS

- A. Each piece of pipe must be clearly labeled or stenciled with manufacturer's name, type of pipe and length, in accordance with ASTM standards. All pipe must be new. Re-processed pipe which has been cleaned and re-finished due to extended yard storage will not be accepted. All pipe must be corrosion free. Submit shop drawings on piping along with certified mill specifications.
- B. Mechanically Formed Tee Connections: (Optional)
  - 1. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joint.
  - 2. The branch shall be notched to conform with the inner curve of the run tube and dimpled to insure penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube.
  - 3. All joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using B-cup series filler metal.
  - 4. Note: Soft Soldered joints will not be permitted.
  - 5. All mechanically formed branch collars shall be listed by the National Standard Plumbing Code, B.O.C.A., I.A.M.P.O., S.B.C.C., HUD, U. S. Army Corps of Engineers, and Underwriters Laboratory.
- C. Copper tubing: seamless copper water tube conforming to ASTM Standard Specification B88.

1.3 HANGERS AND SUPPORTS

- A. Manufacturers: Crane - B-Line - Grinnel - Unistrut - Elen.
- B. Use strap type pipe ring hangers on pipe up thru 3" equal to Grinnel Fig. 69 or CT-69.
- C. Use inserts or supporting members in construction above for overhead suspension. Set inserts or supporting members for hangers in form for concrete construction. Use expansion inserts only where approved by the Architect's inspector.
- D. Use heavy welded steel brackets for wall suspension. Mount brackets and wall supports on masonry walls with bolts through the wall and a suitable steel back plate on the back of the wall.
- E. Provide all surface mounted and concealed unistrut for pipe supports in all equipment rooms and above ceilings for pipe and duct mounting. Unistrut shall all be at a minimum of heavy 12 ga., 1-5/8" construction. Contractor shall insure adequate support of each unistrut section based on the load that section is to handle.
- F. Size hangers on insulated pipe 3" and smaller to fit the pipe. Use copper plated hangers for copper pipe. Size hangers on insulated pipe 4" and larger to fit the insulation, and provide pipe sleeves and high density insulation inserts as specified under "Insulation and Pipe Covering".
- G. Space hangers 8'-0" on center for steel, iron, and copper pipe up to 1".
- H. Space hangers 10'-0" on center for steel, iron, and copper pipe above 1".
- I. Mount piping so that all runs are parallel and evenly spaced.
- J. Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- K. Two-Bolt Riser Clamps: MSS Type 8.
- L. Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
  - a. Steel Turnbuckles: MSS Type 13.
  - b. Steel Clevises: MSS Type 14.
  - c. Swivel Turnbuckles: MSS Type 15.
  - d. Malleable Iron Sockets: MSS Type 16.
  - e. Steel Weldless Eye Nuts: MSS Type 17.
- M. Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
  - 1. Concrete Inserts: MSS Type 18.
  - 2. Top Beam C-Clamps: MSS Type 19.
  - 3. Side Beam or Channel Clamps: MSS Type 20.
  - 4. Center Beam Clamps: MSS Type 21.
  - 5. C-Clamps: MSS Type 23.
  - 6. Side Beam Clamps: MSS Type 27.
  - 7. Malleable Beam Clamps: MSS Type 30.
  - 8. Steel Brackets:
  - 9. Light Duty: MSS Type 31.
  - 10. Side Beam Brackets: MSS Type 34.
- N. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement. Resting of pipe in framing or structural members is not permitted.
- O. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.
- Q. Insulated Piping: Comply with the following installation requirements:
  - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
  - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields.
  - 3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

1.4 VALVES

- A. Provide all valves required for operation, service, and maintenance of systems and equipment, i.e. shut off valves both sides of equipment, coils, etc.
- B. Cut off valves in general shall be ball or butterfly valves. All shut-off valves on domestic water lines 2" and smaller shall be ball valves.
- C. Valves in air lines and throttling valves shall be globe valves.
- D. Flow control valves shall be plug valves.
- E. Standard valves shall have 125 psi. working steam pressure or 200 psi. for water, oil and gas.
- F. Sweat joint valves shall be used on all copper pipe.
- G. All gate and globe valves shall be designed for repacking under pressure when fully opened, and shall be equipped with packing suitable for the intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. All gate and globe valves shall have a gland follower. The pressure-temperature rating of valves shall be not less than the design criteria applicable to all components of the system.
- H. Bronze valves with the basic saturated steam rating of 125 psi or 150 psi shall have pressure containing parts of a material having at least the physical properties of ASTM Specification B-62. Metallic seated bronze globe, angle, check and gate valves with a basic steam rating of 200 or 300 psi shall have pressure containing parts of material conforming to ASTM Specification B-61, for temperatures to 550°F.
- I. Pressure containing parts of iron body valves shall be of material conforming to ASTM Specification A-126 Grade B. If the wedge in OS&Y gate valves is fastened to the stem by threads, it shall be secured by a nickel alloy or monel pin.
- J. Face-to-face and end-to-end dimensions of iron body valves shall conform to ANSI B16.10. Design, workmanship, materials, and testing shall conform to MSS-SP-70 and MSS-SP-71 (Manufacturers Standardization Society of the Valve and Fitting Industry).
- K. Stems of bronze and Iron Bodied Bronze Mounted valves shall be of ASTM-B-198 Class 13C (cast silicon brass), ASTM B-371, Alloy A (rolled silicon brass), or other material equally resistant to dezincification.
- L. All pressure casting shall be free of any impregnating materials.
- M. Gate valves shall be of the solid wedge type, designed and manufactured in such a way that seating surfaces are prevented from contacting until near the point of closure. Valves two inches and smaller shall be rising stem with threaded, solder, socket, or flanged end to suit service. Valves 2 1/2" and larger shall be flanged, and unless otherwise specified all shall be OS&Y.
- N. Globe valves two inches and smaller shall be threaded, flanged, solder end or socket end, to suit service. Globe valves 2 1/2 inches and larger shall be flanged, unless otherwise specified. Where composition discs are used, the disc shall be suitable for the intended service. For steam throttling service, composition disc valves shall be fitted with throttling nut. Metal seated globe valves shall have hardened stainless steel disc and seat ring.
- O. By-pass valves shall be globe type, and these two inches and smaller at pressure reducing stations, shall be 500 Brinell plug disc and seat ring type, or stellite. Those 2 1/2 inches through 4 inches shall be hardened stainless steel plug disc globe valves.



SHEET CONTENTS  
SPECIFICATIONS

LIEBERT REPLACEMENT  
PSD INFORMATION TECHNOLOGY CENTER  
2413 LAPORTE AVE. FORT COLLINS, CO 80521



NO.	BY	DESCRIPTION	DATE
1		REVIEW	09-13-2019
2		PERMIT	09-30-2019

DESIGNED BY: CRS  
CHECKED BY: CWH  
DATE: 09.30.2019

SHEET NO.: M-01

REVISIONS

- P. Unless a composition disc is specified, swing check valves two inches and smaller shall be bronze, regrinding, with seating angle 40 to 45 degrees. A stop plug is required as a renewable stop for the hanger, unless otherwise specified. Disc and hanger shall be separate parts, and the disc shall be free to rotate. Hanger pins shall be supported on both ends by removable side plugs.
- Q. Lift check valves two inches and smaller shall be bronze or forged steel, to suit the service.
- R. Butterfly valves shall conform to MSS-SP-67. Liners and discs shall be suitable for the intended service.
- S. Butterfly valves shall be lug type suitable for dead end service. Body constructed of cast or ductile iron - heavy duty stem bushing to absorb operator side thrust - aluminum bronze disc - 300 series stainless steel stem - EPDM seat - operators with ten position lever lock for sizes 2 1/2" thru 4" - wormgear with handwheel for sizes above 4" - valve pressure rated for 150 psig at 180°F.
- T. Each valve is to be given shell and seat tests by the manufacturer and will carry a permanently affixed indication that tests have been successfully completed.
- U. Ball valves two inches and smaller shall have a forged brass body with screwed pipe ends for steel pipe and sweat ends for copper pipe. Body shall be two piece for valve assembly access to allow performance of all maintenance operations. One piece hard chrome plated brass ball or stainless steel ball with full port flow, self-aligning and free floating between two Viton seats (300 psi) to provide positive seal in either direction. Stem shall be brass or stainless steel and extended 1 1/4" above the valve to clear insulation and to receive molded packing brass packing nut and handle nut. Handle shall be constructed of zinc plated steel with partial plastic coating. Valve shall be rated for 150 psig at 180°F.
- V. Insofar as possible, all valves of the same type shall be of the same manufacturer. Before purchasing any valve, contractor shall submit for approval the name of the manufacturer, the figure number which he proposes to furnish, and engineering data on each figure number, if not using those specified. The intent of this requirement is to obtain the most suitable valve for each service. Nonstandard valves will not be considered.

#### 1.5 JOINTS

- A. Provide joints of type indicated in each piping system.
- Full and clean cut.
  - Ream to the full inside diameter of the pipe with all burrs removed.
  - Sweat joints in copper tubing - with 95-5 solder.
  - Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipefitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
  - Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B31.
  - Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
  - Use insulating unions on HVAC and domestic water lines where steel and copper pipe are joined.
  - Use brass ferrules on plumbing systems where dissimilar metals are joined.

#### 1.6 UNIONS

- A. Unions 2" and Smaller (150 WSP - 200 WOG): Standard Weight brass to iron seat malleable iron body with screwed ends - Walworth #7712 or #7762 - equivalent Crane or Stockham.
- B. Unions 2 1/2" and Larger: (125 PSI WSP) Standard cast iron body with flanged ends - Walworth #1137 or #1537 - equivalent Crane or Stockham.
- C. Install wherever necessary for repair, replacement, or service of the equipment or system.

#### 1.7 SLEEVES AND COVER PLATES

- A. Install for all pipes passing through floors, walls, or partitions. Size sleeves large enough to allow for free movement of the pipes with expansion.
- B. Floor sleeves: 20 gauge galvanized sheet metal flanged at the bottom and attached to the forms before concrete is poured (straighten sleeve after floor is poured).
- C. Sleeves for insulated pipe passing through walls or partitions: 24 gauge galvanized sheet metal with plaster bead set flush with the wall finish.
- D. Sleeves for uncovered pipe passing through walls or partitions: Galvanized steel pipe sleeves, extending outside of the wall finish as required to attach the cover plates.
- E. Sleeves for basement walls or floors: Provide "Link-Seal" as manufactured by Thunderline Corp. or silicone pressure sealants as manufactured by General Electric or Dow Chemical Co., field applied under the direction of the local Manufacturer's Representative.
- F. Provide chrome plated brass cover plates attached to the sleeves independent of the pipe on all pipes which pass through floors, walls, ceilings, and partitions in finished rooms. Beaton Corbin Co. Style 2-BC for copper tube and 13-BC for standard pipe.
- G. Manufacturer: Subject to compliance with requirements, provide pipe escutcheons of one of the following:
- Chicago Specialty Mfg. Co.
  - Producers Specialty & Mfg. Corp.
  - Sanitary-Dash Mfg. Co.
- H. Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, escutcheons not required for unoccupied areas.
- I. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split or split hinged.
- J. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- K. Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

#### 1.8 EQUIPMENT SUPPORTS

- A. Provide each piece of equipment or apparatus suspended from ceilings or mounted above floor level with suitable structural support, platform or carrier in accordance with best recognized practice. All such supporting or mounting means shall be furnished by respective contractor who shall arrange for their inclusion and attachment to building structure, unless otherwise indicated on plans or herein specified. Contractors shall exercise extreme care that structural members of building are not overloaded by such equipment. In all cases details of such hangers, platforms, and supports, together with total weights of mounted equipment shall be approved by Architect-Engineer.

#### 1.9 MOTORS

- A. Polyphase motors: NEMA MG 1, Design B medium induction motor, premium efficient, with 1.15 service factor. Multispeed motors shall have a separate winding for each speed. Bearings shall be regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Class B temperature rise with class F insulation.
- B. Polyphase motors with additional requirements: With motors used with reduced voltage and multispeed controllers, match wiring connection requirements for controller with required motor leads. Motors used with variable frequency controllers shall have copper magnet wire windings, premium efficient motors shall be Class B temperature rise with Class F insulation, and inverter duty motors shall be Class F temperature rise with Class H insulation. All motors 10 HP and larger, driven by a variable frequency PWM drive shall include a factory installed maintenance free, circumferential, conductive micro fiber or carbon brush shaft grounding ring to discharge shaft currents to ground. The conductive microfibers shall redirect shaft currents and provide a reliable, very low impedance path from shaft to motor frame by-passing motor bearings entirely. For vertical turbine pump motors, the upper shaft shall be provided with a coating to isolate the shaft from the bearings and the shaft grounding ring shall be installed within the motor casing. This information shall be provided with the shop drawing submittal for verification of method of installation and to ensure they are to be supplied. Comply with NEMA MG 1 for thermally protected motors.
- C. Single phase motors: Motors larger than 1/20 HP shall be permanent-split capacitor, split phase, or capacitor start. Multispeed motors shall be variable torque, permanent-split capacitor type. Bearings shall be prelubricated, antifriction ball bearings or sleeve bearings. Motors 1/20 HP and smaller shall be shaded pole type. All motors shall have internal automatic thermal protection calibrated to insulation temperature rating.

#### 1.10 MOTOR STARTERS

- A. Unless specifically noted otherwise on the mechanical plans, or in the specifications, all motor starters shall be furnished and installed by the Electrical Contractor. Refer to the Electrical Specifications for Motor Starter requirements.

#### 1.11 V-BELT DRIVES

- A. Capacity of V-Belt Drives at rated RPM shall be not less than 150 percent of motor nameplate horsepower rating.
- B. V-Belt Drive combinations shall be limited to A, B, C, and fractional horsepower belts. 3V, 5V, and 8V belts and sheaves shall not be used.
- C. Drives requiring single belt application shall be of the adjustable pitch type. Multiple belt drives shall be of the non-adjustable type. All fixed pitch sheaves, including single groove fan sheaves, shall be of the bushed type. Fixed bore sheaves will not be acceptable for non-adjustable pitch sheaves.

#### SECTION 200700 - INSULATION

##### 1.1 INSULATION AND PIPE COVERING

- A. Manufacturers: Johns Manville - Owens Corning - CertainTeed - Knauf.
- B. Features: All completed insulation of pipe and fittings shall have the following Underwriters Laboratories Fire Hazard Classification:
- Flame spread not to exceed - 25.
  - Fuel contributed not to exceed - 50.
  - Smoke developed not to exceed - 50.
- C. Four (4 lb.) density glass fiber insulation used for all pipe covering in this section shall have a maximum "K" factor of .23 at 75° F. mean temperature.
- D. Prepare all exposed insulated covering for painting. Apply insulation over clean dry surface. Butt all longitudinal joints tightly together. Insulate domestic hot and domestic cold water and condensate drains in their entirety. Rain leaders need not be insulated below grade.
- E. In finished rooms or areas where insulated pipes are subject to abuse, additionally finish with .032 embossed aluminum jacketing or 30 mil PVC jacketing for a distance of not less than 9 ft. up from finished floor or to finished ceiling level.
- F. Provide high density inserts at hanger locations between the pipe and pipe shield for pipe sizes 4" and larger. Maintain a continuous vapor barrier through the hangers and match the jacketing of adjoining pipe insulation.
- G. Outdoor Piping (exposed to weather): Use the same insulation for interior exposed pipes carrying the same product and add: a jacket of .032 embossed aluminum with factory applied vapor barrier. Finish fittings with Foster Sealas G-P-M 35-00 reinforced with Foster Mast-a-Fab.
- H. Insulate refrigerant suction lines with 1" thick and condensate drain lines with 1/2" thick Armstrong AP Armaflex, applied in strict accordance with manufacturer's instruction. Finish all exposed piping with two coats of white Armstrong Armaflex finish. Manville Aerolube or Owens-Corning O.C. flexible tubing approved equal.

##### 1.2 DUCT LINER (INTERNAL)

- A. Manufacturers: Johns Manville - Owens Corning - CertainTeed - Knauf.
- B. Insulate internally low velocity rectangular supply air ducts with 1" thick and rectangular return air ducts with 1/2" thick Type I liner per ASTM C 1071.
- Ductwork routed in unconditioned building spaces shall have 1-1/2" thick liner.
  - The liner shall have a NRC not less than 0.45 as tested per ASTM C423, with a minimum density of 2 pounds per Cu. ft. and a maximum "K" factor of 0.26 at 75°F mean temperature. The liner air stream surface coating shall contain an EPA registered, anti-microbial agent.
- C. Apply with coated side to air stream in cut to fit pieces fastened to interiors of duct with adhesive. Coat all exposed edges with adhesive.
- D. Adhere liner to interior sides of duct with minimum 50% coverage of fire retardant adhesive.
- E. Use mechanical fastening of Graham Welded pins, or Stick-Klips on maximum 16" centers at top sections when width exceeds 12" and on sides when height exceeds 24".
- F. Apply a brush width of Foster's Fire Retardant Coating over all joints, visible cut edges, and leading edges of insulation to prevent fiber erosion.
- G. DUCT SIZES ON DRAWINGS ARE FOR DIMENSIONS INSIDE OF LINING AND SHEET METAL SIZE SHALL BE INCREASED ACCORDINGLY.
- H. Manufacturers shall print density and thickness on face of duct liner.
- I. Duct liner shall have an Underwriters Laboratories fire hazard rating with a flame spread not to exceed 25 and fuel contributed and smoke developed ratings not to exceed 50.
- J. All ductwork exposed to weather to be insulated internally with 2" glass fiber liner with the same properties and applied in the same manner as liner in interior ductwork. Duct sizes on drawings are for dimensions inside of lining therefore sheet sizes shall be increased accordingly.
- K. All ductwork exposed to weather to be insulated internally with 2" glass fiber liner with the same properties and applied in the same manner as liner in interior ductwork. Duct sizes on drawings are for dimensions inside of lining therefore sheet sizes shall be increased accordingly.
- L. Adhesives shall be approved and listed by Underwriters Laboratory and shall bear the U. L. Label.

##### 1.2 DUCT INSULATION (EXTERNAL)

- A. Manufacturers: Johns Manville - CertainTeed - Owens Corning - Knauf.
- B. Insulate externally all concealed round ducts and rectangular outdoor air ducts with .75 pound minimum density fiberglass ductwrap with a Foil-scrim Kraft vapor barrier applied with outward-clinching staples. The insulation is to have a minimum installed R-value of 4.2 for 1-1/2" thick insulation and 5.6 for 2" thick insulation when compressed 25%. Duct wrap thickness shall be 1-1/2" for supply and return ductwork located within the conditioned building space. Thickness shall be 2" for supply and return ductwork located with-in unconditioned building space and for all outdoor air ductwork.
- C. Insulate externally all exposed rectangular outdoor air duct with 1-1/2" thick, 3 pound density board insulation with FAK facing and a maximum "K" Factor of 0.24 at 75°F mean temperature. Apply over Insul-Anchors and secure with self-locking washers. Tape all joints and washers with 3" wide FSK tape to match the facing of the insulation.
- D. The duct insulation shall have Underwriters Laboratories flame spread rating not to exceed 25 - fuel contributed rating not to exceed 50 - smoke developed rating not to exceed 50.
- E. Insulation shall be continuous through partitions, coils, etc. Insulate fire damper sleeves to partitions.
- F. Insulate kitchen grease ductwork with two layers of 1-1/2" thick "firemaster" or equal inorganic blanket encapsulated with scrim reinforced foil. Wrap duct with insulation per UL listing. Overlap seams by 3" and attach insulation using steel banding or by welded pins and clips.
- G. Ductwork located exterior to the building shall have 1" duct liner insulation and 2" external rigid glass board insulation with vapor retarder jacket. Cover with membrane duct jacket and aluminum jacket. Caulk all seams.

#### SECTION 220400 - PLUMBING

##### 1.1 CONDENSATE DRAIN PIPING (COOLING COIL DRIP)

- A. Type M copper pipe with sweat drainage fittings, galvanized steel pipe with screwed drainage fittings or Schedule 40 PVC/ABS-DWV plastic pipe with solvent welded fittings.
- B. Pitch all horizontal lines to drain at a minimum fall of 1" per 10 feet of run.
- C. Provide air trap at each equipment connection.

#### SECTION 230593 - AIR TEST AND BALANCE

##### 1.1 SCOPE

- A. The Mechanical Contractor shall procure the services of Lawrence H Finn & Associates, Jedi Balancing or another independent firm, fully certified with the National Environmental Balancing Bureau (NEEB). The firm shall test air moving equipment and air distribution and exhaust systems and to supervise the balance and adjustment of these systems. All work shall be done under direct supervision of a qualified and licensed Heating and Ventilating Engineer. The mechanical contractor shall provide workmen of the proper trade to make adjustments to the systems as determined by the Engineer. The Contractor shall provide access as required, including any necessary scaffolding, and shall cooperate with testing laboratory personnel. All instruments used in this work shall be accurately calibrated and maintained in good working order. If requested the tests shall be conducted in the presence of the Mechanical Engineer responsible for the project and/or his representative. Air balance and testing shall not begin until the system has been completed and is in full working order. The Contractor shall put all heating, ventilating, and air conditioning systems and equipment into full operation 24 hours prior to the onset of testing and balancing and shall continue the operation of same during each working day until the completion of all test and balance work. The Contractor shall award the test and balance contract upon receipt of his contract to proceed with the air conditioning installation, to allow the Air Balance and Testing Engineer to schedule his work in cooperation with other trades involved and comply with completion date. Upon completion of the air conditioning system installation, the Air Balance and Testing Engineer shall perform the following tests, supervise adjustments and system modifications, and compile the test data as required for evaluation and approval.
- B. In addition to procuring the services of an air balancing engineer as hereinafter specified the mechanical contractor shall:
- Clean air filters, ductwork, coils, fans, etc. in the air system to remove all construction dust and debris.
  - Start, lubricate and balance all fans. Change and/or adjust drive pulleys on fans to give required capacity.
  - Supply and install all balancing dampers as required for final balancing as determined by the balancing engineer.
  - Furnish workmen familiar with this project and of the proper trade to assist the balancing engineer in the air and water balancing. Also make available subject to request by the balancing engineer trained servicemen of the control and equipment suppliers to assist as needed during the testing of their portion of the project.
  - Furnish plans, operating manuals, and shop drawings of all equipment installed for use by the Air and Water Balancing Agency.
  - Have all systems in full operation a minimum of 24 hours before Balancing Engineer arrives on job.

##### 1.2 AIR SYSTEM TEST AND BALANCE PROCEDURE

- A. Procedure:
- Bring all fans to design RPM.
  - Bring air volume in each air handling system to the design air volume using pitot tube transverse method.
  - Test and record fan motor data.
  - Bring air diffusers and registers to design CFM.
  - Make recommendations for system modifications and adjustments required to facilitate proper system balancing as determined by preceding test.
  - Retest and readjust all system segments affected by system modifications.

##### 1.3 DATA FILE

- A. Prepare complete data file on all equipment and devices tested indicating name plate data, design requirements and final operating conditions. Submit a PDF of the final balance report to be distributed as follows:
- B. A data copy of the final TAB report shall be sent to the owner along with a printed copy inserted in the operation and maintenance manuals presented to the Owner.

##### 1.4 INSTRUCTION

- A. At the completion of the balancing, review the operating and maintenance brochures as supplied by the Mechanical Contractor supplement these instructions as determined through balancing experience. Meet with owners personnel to review proper operating procedures.
- B. Warranty that the system is set in accordance with values as established by the plans and specifications.

#### SECTION 230800 - AIR DISTRIBUTION

##### 1.1 DEFINITIONS

- Low Velocity Ductwork: Supply and return ductwork systems that are sized at 2,000 FPM or lower.
- Medium Velocity Ductwork: Supply ductwork systems sized at greater than 2,000 FPM to 3,000 FPM.
- Low Pressure Ductwork: Ductwork connected to fan systems with a 2" w.c. or less deadhead rating.
- Medium Pressure Ductwork: Ductwork connected to fan systems with greater than 2" w.c. and less than 6" w.c. deadhead rating.
- High Pressure Ductwork: Ductwork connected to fan systems with 6" w.c. or greater deadhead rating.

##### 1.2 PERFORMANCE REQUIREMENTS

- A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. All work shall comply with the Mechanical Codes.
- C. Structural Performance: Duct hangers and supports[ and seismic restraints] shall withstand the effects of gravity[ and seismic] loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" [and] [ASCE/SEI 7].
- D. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

##### 1.3 SHEET METAL DUCT WORK CONSTRUCTION

- A. The work under this heading includes all sheet metal work as required to complete supply and exhaust systems including ducts, housings, ventilating hoods, exhaust hoods, louvers, dampers, grilles, diffusers, registers, access doors, access panels, etc.
- B. Duct material shall be galvanized steel unless noted otherwise on the drawings.
- C. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
- Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - Outdoor, Exhaust Ducts: Seal Class A.
  - Outdoor, Return-Air Ducts: Seal Class A.
  - Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class A.
  - Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
  - Unconditioned Space, Exhaust Ducts: Seal Class A.
  - Unconditioned Space, Return-Air Ducts: Seal Class A.
  - Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class A.
  - Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
  - Conditioned Space, Exhaust Ducts: Seal Class A.
  - Conditioned Space, Return-Air Ducts: Seal Class A.
- D. Make ductwork and installation in conformance with the applicable local Mechanical Code and Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards (Latest Edition) amended as follows:
- Seal all transverse joints, fittings, connections, and seams with Hardcast DT tape and FTA adhesive. Hardcast AFG-1402 "Foil-Grip" applied per manufacturers instructions, or brushed-on liquid based joint and seam sealant.
  - Make all branch connections with 45° entry clinch collar.
  - Round branch duct take-offs shall be high efficiency takeoffs (HETO), made with 45° entry clinched collar and rectangular to round transition. If damper is provided with HETO, it shall meet the requirements of the manual balance damper section below.
- E. Use square type elbows with turning vanes for changes in direction and fittings for branch ducts. Radius elbows may also be used for duct changes in direction, refer to drawings.
- F. Offset ducts to clear pipes and obstructions.
- G. Patch all duct holes air tight after installation.
- H. All round ductwork shall be a minimum of 26 gauge sheet metal or heavier as required by SMACNA and the Mechanical Code.
- I. Exposed Spiral Ductwork:
- Provide factory-fabricated duct and fittings, manufactured on automatic spiral duct forming machines, for round (spiral) low, medium and high velocity duct systems. Provide locked seams for spiral duct and fusion-welded butt seam for longitudinal seam duct.
  - Round Ductwork: Construct of galvanized sheet steel complying with ASTM A527 by the following methods and in minimum gages listed.
    - Duct up to 14" diameter shall be a minimum gage of 26.
    - Duct 16" to 26" diameter shall be minimum of 24 gage.
    - Duct 28" to 36" diameter shall be minimum of 22 gage.
  - Fittings and Couplings: Construct of minimum gages listed. Provide continuous welds along seams.
    - Duct up to 36" diameter shall be a minimum gage of 20.
  - Use duct taps for conical 90° tees or takeoffs as per plans. Five piece 90° or smooth ells with 1 1/2 diameter radius, conical 90° reducing tees, conical 90° cross and bell mouth plenum taps.
  - Exposed ductwork shall be coordinated with the architect to determine if it will be painted. If ductwork will be painted, duct shall be paint-loc or equivalent.
- J. Duct Cleaning: Clean new and existing duct system(s) before testing, adjusting, and balancing.

##### 1.4 FLEXIBLE CONNECTIONS

- A. Duct connections to fans and where noted elsewhere on plans, shall be sound and vibration isolation flexible connections made with fire resistant, water proof heavy glass fabric with double coating of neoprene as manufactured by Ventfabrics, Inc., Ductmate Industries, Inc., Duo Dyne, Inc., or Ward Industries, Inc. Connections shall be not less than 4" long, shall have suitable metal collar frame at each end and shall be made with at least one-inch slack in material to prevent transmission of vibration.



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SPECIFICATIONS

**LIEBERT REPLACEMENT**  
PSD INFORMATION TECHNOLOGY CENTER  
2413 LAPORTE AVE. FORT COLLINS, CO 80521



NO.	BY	DESCRIPTION	DATE
1		REVIEW	09-13-2019
2		PERMIT	09-30-2019

DESIGNED CRS	CHECKED CWH	DATE 09.30.2019	SHEET NO. <b>M-02</b>
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1.5 FLEXIBLE DUCTS

- A. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Flexible ducts - Thermaflex Type MKE or equivalent, meeting amended code standards of NFPA and NEFU Pamphlet 90A with U.L. Fire rating of not over 25 flame spread and a developed smoke rating of not over 50. U.L. Standard 181 Class 1 woven and coated fiberglass supported by helically wound spring steel wire. 1" fibrous glass insulation. Aluminumized vapor barrier film. Pressure rating of 10 inch wg positive and 2 inch wg negative. A maximum of six feet of flexible duct may be used for each connection to supply diffusers only, only above accessible ceilings.
- E. Accessories: Strap dampers with stainless steel band and cadmium plated hex screw to tighten band with worm-gear action.
- F. Installation: Duct connections to collars shall be made in accordance with the duct manufacturer's recommendations.

1.6 GRILLES, REGISTERS, AND DIFFUSERS

- A. Manufacturers: Carnes - Titus - Krueger - Price
- B. Capacity: As indicated on drawings.
- C. Accessories: As scheduled on the drawings for finish, opposed blade dampers, borders, directional vanes, etc.

1.7 MANUAL VOLUME DAMPERS (UNDER 1500 FPM)

- A. Manufacturers: Air Balance Inc. - Ruskin - Carnes - Nailor - Greenheck - Pottorff - Metalaire - Flexmaster USA - McGill Airflow or equivalent.
- B. Features: 20 gauge min. galvanized steel blades - 20 gauge min. galvanized steel frame with blade stops - noncombustible bearings (Oilite or Nylon) - rectangular dampers to have blade linkage concealed in frame - full width 3/8" minimum square cadmium plated steel axle shaft extending through frame - manual locking quadrant bracketed 1-1/2" minimum from frame to allow for insulation.
- C. Single blade dampers may be used for duct sizes of 12" high x 36" wide and less. Sizes greater than 12" high or 36" wide shall be multiple opposed blade dampers.

1.8 BACKDRAFT DAMPERS

- A. Manufacturers: Air Balance Inc. - Cesco - Ruskin - Carnes - Nailor - Greenheck - Pottorff - Metalaire - American Warming and Ventilating - Flexmaster USA - McGill Airflow.
- B. Features: All aluminum parallel blades (Max. width 6") with felt or vinyl tips - 16 gauge aluminum frame with stops - steel ball bearings - blade linkage with adjustable counterbalance and/or spring assist.

1.9 CRAC UNIT (LIEBERT VS)

A. Summary

- a. These specifications describe requirements for a Thermal Management system. The system shall be designed to control temperature and humidity conditions in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment to be fully compatible with heat-dissipation requirements of the room.

B. Design Requirements

- a. The thermal Management system shall be a Liebert self-contained, factory-assembled unit. Standard 60 Hz units shall be CSA-certified to the harmonized U.S. and Canadian product safety standard, "CSA C22.2 No 236/UL 1995 for Heating and Cooling Equipment" and are marked with the CSA c-us logo.
- b. The system shall be AHRI Certified™, the trusted mark of performance assurance for heating, ventilation, air conditioning and commercial refrigeration equipment, using AHRI Standard 1360.

C. Submittals

- a. The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, "Hi-Pot." The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

D. Product

a. Frame

- 1. The frame shall be welded, formed sheet metal. It shall be protected against corrosion using the autophoretic coating process. The frame shall be capable of being separated into three parts in the field to accommodate rigging through small spaces.
  - 1. Upflow Air-flow Configurations
    - a. Upflow Air Supply
      - 1. The supply air shall exit from the top of the unit.
    - b. Upflow Air Return, Rear
      - 1. The return air shall enter the unit from the back of the cabinet.

b. Exterior Panels

- 1. The exterior panels shall be insulated with a minimum 1 in. (25 mm), 1.5 lb. (0.68 kg) density fiber insulation. The main front panel shall have captive quarter-turn fasteners. The unit color shall be per owner preference.

b. Filters

- 1. On Upflow units with rear return, the filters are removed from the side of the unit and are located in the rear-return filter box.
  - 1. Filters
    - a. Filters shall be deep pleated 4-in. filters with an ASHRAE 52.2-2007 MERV8 or 2-in. MERV8 pre-filter with 2-in. filter MERV11

c. Locking disconnect switch

- 1. The electrical panel shall provide at least 65,000A SCCR (60hz) or 5000A SCCR (50 Hz). Short-circuit current rating (SCCR) is the maximum short-circuit current a component or assembly can withstand when protected by a specific overcurrent protective device(s) or for a specified time.
  - 1. Short-circuit current rating (SCCR)
    - a. The electrical panel shall provide at least 65,000A SCCR (60hz) or 5000A SCCR (50 Hz). Short-circuit current rating (SCCR) is the maximum short-circuit current a component or assembly can safely withstand when protected by a specific overcurrent protective device(s) or for a specified time.

d. Fan section

- 1. Electronically Commutated (EC) Fan
  - 1. The blower section shall be designed for airflow and static pressure indicated on mechanical schedules. The fans shall be plug/plenum type, single inlet and shall be dynamically balanced. The drive package shall be direct drive, electronically commutated and variable speed. The fans shall be located to draw air over the coil to ensure even air distribution and maximum coil performance.
  - 2. EC fans shall be available on upflow models and fans shall operate outside the unit in a factory-protected plenum with a minimum height of 24 in. (610 mm).
    - a. DS/VS042 air or water cooled unit fan motor(s) shall be nominal 3.75 hp (2.8 kW) each with a maximum operating speed of 1230 rpm; quantity, 1.

2. Forward Curved Blower

- 1. The blower section shall be designed for airflow and static indicated in schedules.
- 2. The fans shall be the centrifugal type, double-width and double-inlet, and shall be dynamically balanced as a completed assembly.
- 3. The shaft shall be heavy-duty steel with self-aligning, permanently-sealed, pillow-block bearings with a minimum L3 life of 200,000 hours.
- 4. The fans shall be located to draw air over the coil to ensure even air distribution and maximum coil performance.
- 5. The fan motor shall be an open drip-proof, premium efficiency hp (kW) at 1750 rpm @ 60 Hz (1450 rpm @50 Hz), mounted to an automatic, spring tensioning base. The motor shall be removable from the front of the cabinet. The drive package shall be two-belt, variable speed, sized for 200% of the fan-motor horsepower. [Forward Curved Blower only available on upflow units]

e. Infrared humidifier

- 1. A humidifier shall be factory-installed inside the unit. The humidifier shall be of the infrared type, consisting of high-intensity quartz lamps mounted above and out of the water supply. The humidifier pan shall be stainless steel and arranged to be removable without disconnecting high-voltage electrical connections. The complete humidifier section shall be pre-piped, ready for field connection to the water supply. The humidifier shall be equipped with an automatic water-supply system and shall have an adjustable water-overfeed to prevent mineral precipitation. A high-water detector shall shut-down the humidifier to prevent overflowing. A 1 in. (24 mm) air-gap in compliance with ASME A112.1.2 section 2.4.2 (backsiphonage testing) shall prevent back-flow of the humidifier supply water. The humidifier capacity shall be 11 lb./hr. The humidifier shall be removable from the front of the cabinet.

f. Refrigeration system

1. Evaporator Coil

- 1. The evaporator coil shall be A-frame design for downflow units and V-frame design for upflow units and have 17 sq. ft. (m2) face area, 3 rows deep.
- 2. It shall be constructed of rifed copper tubes and aluminum fins. A stainless-steel condensate drain pan shall be provided.

2. Compressorized Systems

- 1. Digital Scroll Compressors
  - a. The compressor shall be scroll-type with a variable capacity operation capability. The compressor solenoid valve shall unload the compressor and allow for variable capacity operation. The compressor shall be suction gas cooled motor, vibration isolators, thermal overloads, automatic reset high-pressure switch with lockout after three failures, rotalock service valves, pump-down low-pressure transducer, suction-line strainer and a maximum operating speed of 3500 rpm.
- 2. Expansion Valve
  - a. Thermostatic Expansion Valve (TXV)
  - b. A manual adjustable externally equalized expansion valve thermostatic expansion valve (TXV) shall control the flow of liquid refrigerant entering the direct expansion coil. The TXV shall maintain consistent superheat of the refrigerant vapor at the outlet of the evaporator coil over the unit's operating range. The TXV shall prevent liquid refrigerant from returning to the compressor.
- 3. Crankcase Heaters
  - a. The compressors shall include crankcase heaters, powered from the indoor unit electric panel.
- 4. R-407C Refrigerant
  - a. The system shall be designed for use with R-407C refrigerant, which meets the EPA clean air act for phase-out of HCFC refrigerants.

g. Cooling system

1. Air-Cooled System

- 1. System Description
  - a. The indoor evaporator refrigerant piping shall be filled with an inert gas holding charge and spun shut. Field relief of the Schrader valve shall indicate a leak-free system. Evaporator unit shall be matched with a Liebert MC condenser.

B. Controls

a. Liebert iCOM™ microprocessor control with 7-in. Color touchscreen

- 1. The Liebert iCOM shall be microprocessor-based with a 7-inch, high definition, capacitive, color touchscreen display and shall be mounted in an ergonomic, aesthetically pleasing housing. The display and housing shall be viewable while the front panel is open or closed. The controls shall be menu driven. The system shall display user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in percentage of each function, date and time), total run hours, various sensors, display setup and service contacts. A password shall be required to make system changes. Service menus shall include setpoints, standby settings (lead/lag), timers/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards and diagnostics/service mode. The Liebert iCOM control shall provide Ethernet/RS-485 ports dedicated for BMS connectivity (i.e. Base-Comms).
  - 1. Password Protection - The Liebert iCOM shall contain two unique passwords to protect against unauthorized changes. An auto hide/show feature shall allow the user to see applicable information based on the login used.
  - 2. Unit Backup/Restore - The user shall be able to create safe copies of important control parameters. The Liebert iCOM shall have the capacity for the user to automatically backup unit configuration settings to internal memory or USB storage drive. Configuration settings may be transferred to another unit for a more streamlined unit startup.
  - 3. Parameter Download - The Liebert iCOM shall enable the user to download a report that lists parameter names, factory default settings and user-programmed settings in .csv format for remote reference.
  - 4. Parameter Search - The Liebert iCOM shall have search fields for efficient navigation and parameter lookup.
  - 5. Parameter Directory - The Liebert iCOM shall provide a directory that lists all parameters in the control. The list shall provide Line ID numbers, parameter labels, and current parameter values.
  - 6. Context-Sensitive Help - The Liebert iCOM shall have an on-board help database. The database shall provide context-sensitive help to assist with setup and navigation of the menus.
  - 7. Display Setup - The user shall be able to configure the display information based on the specific user's preference. Language, units of measure, screen contrast, home screen layout, back-light timer and the hide/show of certain readouts shall be configurable through the display.
  - 8. Additional Readouts - The display shall enable the user to configure custom widgets on the main screen. Widget options will include items such as fan speed, call for cooling, call for free-cooling, maintenance status, call for hot water reheat, call for electric reheat, call for dehumidification, call for humidification, airflow, static pressure, fluid flow rate and cooling capacity.
  - 9. Status LED's - The Liebert iCOM shall show the unit's operating status using an integral LED. The LED shall indicate if the unit has an active alarm; if the unit has an active alarm that has been acknowledged; or if the unit is On, Off or in standby status.
  - 10. Event Log - The Liebert iCOM shall automatically store the last 400 unit-only events (messages, warnings, and alarms).
  - 11. Service Contact Information - The Liebert iCOM shall be able to store the local service or sales contact information.
  - 12. Upgradeable - Liebert iCOM firmware upgrades shall be performed through a USB connection.
  - 13. Timers/Sleep Mode - The menus shall allow various customer settings for turning the unit On or Off.

- 14. Menu Layout - The menus shall be divided into two main menus: User and Service. The User screen shall contain the menus to access parameters required for basic unit control and setup. The Service screen shall be designed for service personnel and shall provide access to advanced control setup features and diagnostic information.

- 15. Sensor Calibration - The menus shall allow unit sensors to be calibrated with external sensors.
- 16. Maintenance/Wellness Settings - The menus shall allow reporting of potential component problems before they occur.
- 17. Options Setup - The menus shall provide operation settings for the installed components.
- 18. Auxiliary Boards - The menus shall allow setup of optional expansion boards.
- 19. Various Sensors - The menus shall allow setup and display of optional custom sensors. The control shall include four customer-accessible analog inputs for sensors provided by others. The analog inputs shall accept a 4 to 20mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display. When configuring the analog inputs, the selectable items to choose from shall include air pressure, fluid pressure, temperature, percentage, general amperage, condenser amps, compressor amps, reheat amps, humidifier amps, unit amps, fan amps factory standard, and not used.
- 20. Diagnostics/Service Mode - The Liebert iCOM control shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as On or Off at the front display. Control outputs shall be able to be turned On or Off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.

- 21. Base-Comms for BMS Connectivity - The Liebert iCOM controller shall provide one Ethernet Port and RS-485 Port dedicated for BMS Connectivity. Provides ground fault isolated RS-485 Modbus, BACnet IP & Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, provides ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include SNMP for Network Management Systems, HTTP for web page viewing, SMTP for email, and SMS for mobile messaging. The iCOM controller can support dual IP on one network and one 485 protocol simultaneously.

b. Alarms

- 1. All unit alarms shall be announced through both audio and visual cues, clearly displayed on the screen, automatically recorded in the event log and communicated to the customers Building Management System/Building Automation System. The Liebert iCOM control shall activate an audible and visual alarm in event of any of the following conditions:
  - 1. High Temperature
  - 2. Low Temperature
  - 3. High Humidity
  - 4. Low Humidity
  - 5. EC Fan Fault
  - 6. Change Filters
  - 7. Loss of Air Flow
  - 8. Loss of Power
  - 9. Compressor Overload (Optional)
  - 10. Humidifier Problem
  - 11. High Head Pressure
  - 12. Low Suction Pressure
  - 13. Custom Alarms

- a. Custom alarm inputs shall be provided to indicate facility-specific events. Custom alarms can be identified with programmable labels. Frequently used alarm inputs include:
  - 1. Leak Under Floor
  - 2. Smoke Detected
  - 3. Standby Unit On
- b. Each alarm (unit and custom) shall be separately enabled or disabled, selected to activate the common alarm and programmed for a time delay of 0 to 255 seconds.

c. Liebert iCOM™ control methods and options

- 1. The Liebert iCOM shall be factory-set to allow precise monitoring and control of the condition of the air entering and leaving the unit. This control shall include predictive methods to control air flow and cooling capacity-based control sensors installed. Proportional and Tunable PID shall also be user-selectable options.
  - 1. Controlling Sensor Options
    - a. Liebert iCOM shall be flexible in the sense that it shall allow for controlling the capacity and fan from multiple different sensor selections. The sensor selections shall be:
      - 1. Cooling Capacity
        - 1. Supply
        - 2. Remote
        - 3. Return
      - 2. Fan Speed
        - 1. Supply
        - 2. Remote
        - 3. Return
        - 4. Manual (for diagnostic or to receive a signal from the BMS through the Liebert remote monitoring devices or analog input)
        - 5. Static Pressure
    - 2. Temperature Compensation
      - a. The Liebert iCOM shall be able to adjust the capacity output based on supply and return temperature conditions to meet SLA guidelines while operating to highest efficiency.
    - 3. Humidity Control
      - a. Dew point and relative humidity control methods shall be available (based on user preference) for humidity control within the conditioned space.

d. Wired supply sensor

- 1. Each Liebert iCOM shall have one factory-supplied and connected supply air sensor that may be used as a controlling sensor or reference. When multiple sensors are applied for control purposes, the user shall be able to control based on a maximum or average temperature reading.

e. Virtual master

- 1. As part of the robust architecture of the Liebert iCOM control, it shall allow for a virtual master that coordinates operation. The Virtual Master function shall provide smooth control operation if the group's communication is compromised. When the lead unit, which is in charge of component staging in teamwork, unit staging and standby rotation, becomes disconnected from the network, the Liebert iCOM shall automatically assign a virtual master. The virtual master shall assume the same responsibilities as the master until communication is restored.

f. Virtual back-draft damper

- 1. The Liebert iCOM shall allow the use of a virtual back-draft damper, eliminating the need for a mechanical damper. This shall allow the fans to spin slower (15% or less) to act as a damper.

g. Compressor short cycle control

- 1. To help maximize the life of the compressor(s), there shall be start-to-next start delay for each single compressor. The control shall monitor the number of compressor starts in an hour. If the compressor starts more than 10 times in 60 minutes, the local display and remote monitoring shall notify the user through a Compressor 1 or 2 Short Cycle event.

h. Liebert MC™ condenser communication

- 1. The Liebert iCOM shall communicate directly with the Liebert MC condenser via field-supplied CANbus communication wires and via field-supplied, low-voltage interlock wires. This shall provide enhanced monitoring, alarming, diagnostics, low-noise mode, and condenser-fan reversal for cleaning mode.

i. System auto restart

- 1. The auto restart feature shall automatically restart the system after a power failure. Time delay shall be programmable. An optional capacitive buffer may be provided for continuous control operation through a power failure.

j. Sequential load activation

- 1. On initial startup or restart after power failure, each operational load shall be sequenced with a minimum delay of one second to minimize total inrush current.

k. Low-pressure monitoring

- 1. Units shall ship standard with low-pressure transducers for monitoring individual compressor suction pressure. If the pressure falls due to loss of charge or other mechanical cause, the corresponding circuit shall shut down to prevent equipment damage. The user shall be notified of the low-pressure condition through the local display and remote monitoring.

l. Winter start time delay—air-cooled models

- 1. An adjustable software timer shall be provided to assist with compressor starting during cold weather. When the compressor starts, the low-pressure input shall be ignored for the period set in the user-adjustable timer. Once the time period has elapsed after the compressor start, the low-pressure input should remain in the normal state. If the low-pressure input does not remain in the normal state when the time delay has elapsed, the circuit shall lock out on low pressure. The low-pressure alarm shall be announced on the local display and communicated to remote monitoring systems.

m. Advanced freeze protection

- 1. Units shall ship standard with advanced freeze protection enabled. The advanced freeze protection shall monitor the pressure of each circuit using a transducer. The control shall interact with the fan and compressor to prevent the unit coil from freezing if circuit suction pressure drops. Applying fan speed to direct expansion systems requires limitations to avoid freezing condensate on the coil when the unit operates below 100% fan speed. Liebert iCOM's advanced freeze protection provides the ability to predict freeze conditions and correct this condition automatically by adjusting fan speed and compressor capacity. If a freeze condition is detected, the user shall be notified through the local display and remote monitoring systems.

- n. Advanced high-pressure protection—water/glycol-cooled models with variable capacity compressors
  - 1. When the compressor is initially activated, the system shall be monitored for high pressure. When high pressure is detected, the control shall alter the compressor operation and the condenser fans speed to reduce the system discharge pressure, preventing circuit shut down. If the unit is unsuccessful in correcting the problem through this interaction, an alarm shall occur and the affected compressor shall be immediately locked off. The control shall re-enable the compressor when the pressure returns to a safe level. This feature is standard on units equipped with liquid line transducers and these compressor types:
    - 1. Digital Scroll

o. Refrigerant pressure transducer failure

- 1. The control shall monitor the high-side and low-side refrigerant pressure transducers. If the control senses the transducer has failed, has been disconnected, has shorted or the reading has gone out of range, the user shall be notified through an event on the local display and remote monitoring. The corresponding circuit that the failure has occurred on shall be disabled to prevent unit damage.

p. Oil return protection

- 1. The control shall monitor compressor operation and staging to ensure that liquid and hot gas velocity are maintained for proper oil return to the compressor.

q. Digital scroll high-temperature protection

- 1. The control shall monitor digital scroll temperature during unit operation. A compressor temperature limit shall be imposed to help prevent damage to the compressor. If the temperature reaches the maximum temperature limit, the compressor shall be locked out for 30 minutes and an alarm shall be announced on the local display and through monitoring. After the initial lockout, the control shall continue to monitor compressor temperature during the off-cycle and re-enable the circuit once a safe operating temperature is reached and the 30 minutes has elapsed. The control shall store the number of high-temperature trips. The number of trips shall be accessible through the local display.

r. Digital scroll sensor failure

- 1. The control shall monitor the status of the digital scroll sensor(s). If the control senses that the thermistor is disconnected, shorted or the reading goes out of range, the user shall be notified through an event on the local display and remote monitoring.

s. Compressor high- and low-temperature limit protection

- 1. The control shall monitor the return air to ensure that the compressor(s) are operated within the manufacturer's defined window of operation. If the return air temperature deviates from the manufacturer's window of operation, the Liebert iCOM shall automatically adjust to prevent damage to the cooling unit or reduction in its reliability.

t. Compressor run time monitoring

- 1. The control shall log these compressor statistics:
  - 1. Number of compressor starts
  - 2. Run hours
  - 3. Average run time
  - 4. Starts per day
  - 5. Starts per day worst
  - 6. Number of high-pressure alarms
  - 7. Operating phase in which the high-pressure alarm occurred
  - 8. Number of low-pressure alarms
  - 9. Operating phase in which the low-pressure alarm occurred
  - 10. Number of compressor overloads
  - 11. Number of high-temperature alarms (scroll compressors)
- 2. The user shall have the ability to monitor compressor operating temperature and pressure from the local display to be used as a diagnostic tool.

u. Manual compressor disablement

- 1. The user shall have the ability to disable compressor operation using a set of either normally open or normally closed dry contacts tied directly to the control or through remote monitoring. An additional enable/disable feature shall be provided to allow the user to permanently disable an individual compressor circuit for maintenance using the local display.

v. Manual compressor operation

- 1. The user shall be able to operate each compressor(s) manually from the local display. The user shall be able to energize refrigeration components including liquid line solenoid valves, compressor contactors, electronic expansion valves and adjust capacity for troubleshooting or repair. The control shall monitor the compressor during manual operation and shall shut the compressor down if needed to prevent electrical or mechanical damage.

w. Flooded start protection

- 1. The control shall isolate each compressor through a dedicated circuit liquid line solenoid valve and/or electronic expansion valve. These devices, combined with a spring-closed discharge check valve and compressor crankcase heater (air-cooled models), shall help ensure refrigerant does not migrate/carry oil out of the compressor case during the off cycle.

x. Compressor dehumidification

- 1. The control shall permit the user to specify which compressor is used for dehumidification. The choices shall be 1st compressor, 2nd compressor, 1 or 2, or BOTH.

F. Miscellaneous option

- a. High temperature sensor
  - 1. The high-temperature sensor shall immediately shut down the environmental control system when activated. The high-temperature sensor shall be mounted in the electrical panel with the sensing element in the return air.



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1		REVIEW	09-15-2019
2		PERMIT	09-30-2019

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- b. Smoke sensor
    1. The smoke sensor shall immediately shut-down the environmental control system and activate the alarm system when activated. The smoke sensor shall be mounted in the electrical panel with the sensing element in the return-air compartment. The smoke sensor is not intended to function as or replace any room smoke- detection system that may be required by local or national codes. The smoke sensor shall include a supervision contact closure.
  - c. Condensate pump, dual float
    1. The condensate pump shall have a minimum capacity of GPH ( l/h) at ft. ( kPa) head. It shall be complete with integral dual-float switches, pump-and-motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shall shut down the unit upon high water condition.
  - d. Low-voltage terminal package
    1. Factory-installed and factory-wired terminals shall be provided.
      1. Remote Shutdown Terminals - Two additional pairs of terminals provide the customer with additional locations to remotely shut down the unit by field-installed devices or controls.
      2. Extra Common Alarm Contacts - Two additional pairs of terminals provide the customer with normally open contacts for remote indication of unit alarms.
      3. Main Fan Auxiliary Switch - One set of normally open contacts wired to the EC fan motor contactor will close when EC fan operation is required. This set of dry contacts could also be used to initiate air economizer operation. Air economizer and associated devices by others.
      4. Liqui-TECT Shutdown - One pair of dry contacts for the Liqui-TECT sensor signal will provide unit shut down. (Liqui-TECT sensor is not included)
  - e. Main fan overload
    1. A pair of normally open contacts shall be factory-installed and wired to indicate Main Fan Overload.
  - f. Compressor overload
    1. A pair of normally open contacts shall be factory-installed and factory-wired to each compressor to indicate Compressor Overload.
  - g. Wired remote sensor(s)
    1. Each Liebert iCOM shall have up to ten 2T sensors (20 sensor readings total) for control or reference. As part of the U2U network, those sensors shall be shared and used to control the units and provide greater flexibility, visibility, and control using that to respond to changes in the data center. When the sensors are used for control, the user may set the control to be based off a maximum or average of a select highest temperature reading.
  - h. Liebert LIQUI-TECT™ sensors
    1. Provide (minimum of 1) solid state water sensor(s) under the raised floor.
  - i. Floor stand
    1. The floor stand shall be constructed of a welded steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be same height as existing raised floor.
  - j. Discharge air plenum for upflow units, without discharge grille(s)
    1. The air plenum shall be constructed of 20-gauge steel, powder-coated to match unit color. The plenum shall be 12 in. high. Air shall discharge from the top of the plenum.
  - k. Liebert VNSA™ network switch
    1. The Liebert vNSA network switch is designed for networking multiple iCOM unit-level controllers together. There shall be two different styles of the vNSA14 panel available:
      1. vNSA14 – enclosure with network switches only
      2. vNSA14-iCOM-H – enclosure with network switches and 9" iCOM color touchscreen display Each offering shall be housed inside a steel enclosure secured with a key lock and contain two network switches, providing a total of 14 Ethernet ports available for iCOM controller unit-to-unit networking. The Liebert vNSA requires field supplied, hard wiring, 16AWG, 100-240VAC universal (12V, 1.5A) single-phase input power supply for 120V or 230V operation with factory supplied power connector.
- G. Heat rejection
- a. Options—air-cooled liebert mc condenser
    1. Liebert MC Summary
      1. These specifications describe requirements for a Liebert air-cooled condenser for a Liebert Thermal Management system. The condenser shall be designed to reject waste heat to outdoor air and to control refrigerant head pressure as indoor equipment loading and outdoor ambient conditions change.
      2. The manufacturer shall design and furnish all equipment in the quantities and configurations shown on the project drawings.
      3. Standard 60-Hz units shall be CSA-certified to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for "Heating and Cooling Equipment" and shall be marked with the CSA c-us logo.
    2. Liebert MC Design Requirements
      1. The air-cooled condenser shall be a factory-assembled unit, complete with integral electrical panel, designed for outdoor installation. The condenser shall be a draw-through design.
    3. Liebert MC Standard Features
      1. Condenser shall consist of microchannel condenser coil(s), propeller fan(s) direct-driven by individual fan motor(s), electrical controls, housing and mounting legs. The Liebert air-cooled condenser shall provide positive refrigerant head pressure control to the indoor cooling unit by adjusting heat rejection capacity.
      2. Microchannel coils shall provide superior heat transfer, reduce air-side pressure drop, increase energy efficiency and significantly reduce the system refrigerant volume required. EC fans and fan operating techniques shall reduce sound levels. Various methods shall be available to match indoor unit type, maximum outdoor design ambient and maximum sound requirements.
    4. Liebert MC Coil
      1. Liebert MC coils shall be constructed of aluminum microchannel tubes, fins and manifolds. Tubes shall be flat and contain multiple, parallel-flow microchannels and span between aluminum headers. Full-depth louvered aluminum fins shall fill spaces between the tubes. Tubes, fins and aluminum headers shall be oven-brazed to form a complete refrigerant-to-air heat exchanger coil. Copper stub pipes shall be electric resistance-welded to aluminum coils and joints protected with polyolefin to seal joints from corrosive environmental elements. Coil assemblies shall be factory leak tested at a minimum of 300 psig (2068 kPag). Hot-gas and liquid lines shall be copper and shall be brazed using nitrogen gas flow to the stub pipes with spun-closed ends for customer piping connections. Complete coil/piping assembly shall be then filled and sealed with an inert gas holding charge for shipment.
        - a. Aluminum Microchannel Coil With E-Coat—Optional
          1. Aluminum microchannel coil with E-coat shall provide a flexible epoxy coating to all coil surface areas without material bridging between fins. E-coat shall increase coil corrosion protection and shall reduce heat rejection capacity degradation to less than 10% after a severe 2000 hour 5% neutral salt-spray test (ref. ASTM B117). The coating process shall ensure complete coil encapsulation, and the color shall be black.
    5. Liebert MC™ Fan Motor/Blade Assembly
      1. The fan motor/blade assembly shall have an external rotor motor, fan blades and fan/finger guard. Fan blades shall be constructed of cast aluminum or glass-reinforced polymeric material. Fan guards shall be heavy gauge, close-meshed steel wire, coated with a black, corrosion-resistant finish. Fan terminal blocks shall be in an IP54 enclosure on the top of the fan motor. Fan assemblies shall be factory-balanced, tested before shipment, and mounted securely to the condenser structure.
        - a. Liebert MC Condenser EC Fan Motor
          1. The EC-fan motors shall be electronically commutated for variable-speed operation and shall have ball bearings. The EC fans shall provide internal overload protection through built-in electronics. Each EC-fan motor shall have a built-in controller and communication module linked via RS485 communication wire to each fan and the Premium Control Board, allowing each fan to receive and respond to precise fan speed inputs from the Premium Control Board.

- 6. Liebert MC Electrical Controls
    1. Electrical controls and service-connection terminals shall be provided and factory-wired inside the attached control panel section. Only high-voltage supply wiring and low-voltage indoor-unit communication/interlock wiring are required at condenser installation.
      - a. EC Fan Speed and Premium Control
        1. The EC fan/Premium Control System shall include an electronic control board, EC-fan motor(s) with internal overload protection, refrigerant and ambient temperature thermistors and refrigerant pressure transducers. The Premium Control Board shall communicate directly with the indoor unit's Liebert iCOM control via field-supplied CANbus communication wires and via field-supplied low-voltage interlock wires. The control board shall use sensor and communication inputs to maintain refrigerant pressure by controlling each EC fan on the same refrigerant circuit to the same speed. The Premium control board shall be rated to a temperature of -30°F to 125°F (-34.4°C to 51.7°C). The Premium control shall be factory-set for (fan speed) (fan speed with Liebert Lee-Temp™) control.
          - b. Locking Disconnect Switch
            1. A locking-type disconnect switch shall be factory-mounted and wired to the electrical panel and be capable of disrupting the flow of power to the unit and controlled via an externally mounted locking and lockable door handle. The locking disconnect shall be lockable in support of lockout/tagout safety programs.
          - c. Short Circuit Current Rating
            1. The electrical panel shall provide at least 65,000A SCCR.
    7. Cabinet
      1. The condenser cabinet shall be constructed of bright aluminum sheet and divided into individual fan sections by full-width baffles. Internal structural support members, including coil support frame, shall be galvanized steel for strength and corrosion resistance. Panel doors shall be provided on two sides of each coil/fan section to permit coil cleaning. An electrical panel shall be contained inside a factory-mounted NEMA 3R weatherproof electrical enclosure. Units with the 575V option shall include a second, factory-mounted, NEMA 3R weatherproof electrical enclosure opposite the main electrical enclosure.
    8. Liebert MC Mounting Legs Standard Aluminum Legs
      1. Aluminum legs shall be provided to mount unit for vertical air discharge with rigging holes for hoisting the unit into position. Standard height is 18 in. (457 mm).
        - a. Optional Galvanized-Steel Legs With Bracing
          1. Condensers shall be shipped with (36 in. [914 mm]) (48 in. [1219 mm]) (60 in. [1524 mm]) mounting legs with stabilization bracing. Legs, bracing and hardware shall be galvanized steel.
    9. Liebert MC Condenser Accessories
      1. Liebert Lee-Temp™ System—Optional
        - a. Liebert Lee-Temp Receiver Kit shall contain an insulated, heated receiver tank with sight glasses, mounting plate, mounting hardware, pressure-relief valve, rota-lock valve for refrigerant charge isolation and piping assembly with head-pressure operated 3-way valve and check valve. Components shall be field-assembled to the condenser. The 3-way valve shall sense refrigerant head pressure and adjust the flooding charge in the condenser coil to adjust the condenser heat-rejection capacity. The Liebert Lee-Temp heater shall be 150 W, shall include an integral thermostat to maintain refrigerant temperature at a minimum of 85°F (29°C) and shall require a separate power supply of (120V - 1 ph - 60 Hz).
        - b. The Liebert Lee-Temp Kit shall function with Liebert MC variable-speed fan motors and electronic controls that lower fan speed in lower outdoor ambient temperatures for maximum energy efficiency. This system shall allow system start-up and positive head-pressure control with ambient temperatures as low as -30°F (-34.4°C).
      10. Fusible Plug Kit—Optional
        1. A fusible plug kit shall be field-installed on the liquid line for compliance with building codes requiring refrigerant relief during high-temperature and building-fire conditions.
      11. IBC/OSHPD Seismic Certification and IBC Wind/Snow Load Compliant—Optional
        1. IBC/OSHPD Seismic Certification and IBC Wind/Snow Load Compliant condensers shall be provided with any applicable bracing and field-installation instructions. Condensers shall bear a label certifying compliance with IBC/OSHPD requirements.
- H. Execution
- a. Installation of thermal management units
    1. General
      1. Install Thermal Management units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain manufacturer's recommended clearances.
    2. Electrical Wiring
      1. Install and connect electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.
    3. Piping Connections
      1. Install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.
      2. Supply and Drain Water Piping
        - a. Connect water supply and drains to air-conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.
  - b. Field quality control
    1. Start the system in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. These specifications describe requirements for a computer-room environmental-control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment.
    2. The manufacturer shall design and furnish all equipment to be fully compatible with heat-dissipation requirements.
  - c. Warranty start-up and control programming
    1. Engage manufacturer's field service technician to provide warranty start-up supervision and assist in programming of unit(s) controls and ancillary panels supplied by them.

SECTION 230923 - TEMPERATURE CONTROL SYSTEMS

1.1 SYSTEM SUMMARY

A. The intent of this specification is to provide control strategies for expanding the existing BAS system, and utilizing the same software license agreement for the applications. All equipment as listed on the mechanical drawings/control drawings shown to be controlled by the BAS system shall adhere to this specification. Temperature controls shall be xxx by xxx, to match existing.

1.2 QUALITY ASSURANCE

A. The Building Automation System (BAS) herein specified shall be fully integrated and installed as a complete package by the Temperature Controls Contractor. The system must be fully compatible with the current system installed at the facility. The system shall include all wiring, electrical conduit, installation supervision, calibration, adjustments, and checkout necessary for a complete and fully operational system.

1.3 MATERIALS AND EQUIPMENT

A. General: Provide temperature control products in sizes and capacities indicated consisting of valves, dampers, thermostats, clocks, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their product information; designed and constructed as recommended by manufacturer, and as required for application indicated.

B. Control Valves: Provide selection as determined by manufacturer for installation requirements and pressure class, based on maximum pressure and temperature in piping system. Provide valve size in accordance with scheduled or specified maximum pressure drop across control valve. Equip control valves with electric actuators, with proper shutoff rating for each individual application.

C. Thermostats: Thermostats shall be a similar style to existing installed in the facility.

D. Building Automation System: The BAS shall be capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection and archiving.

E. Control Wiring:

1. Provide and install all low-voltage wiring required for temperature control systems under this section excluding power feeder wiring.

2. E.C. shall provide and install conduit for all control wiring.

All wiring and installation shall be in accordance with the Electrical Specifications.

1.4 CLOSEOUT PROCEDURES

A. Owner's Instructions: Provide services of manufacturer's technical representative to instruct Owner's personnel in operation and maintenance of control systems.



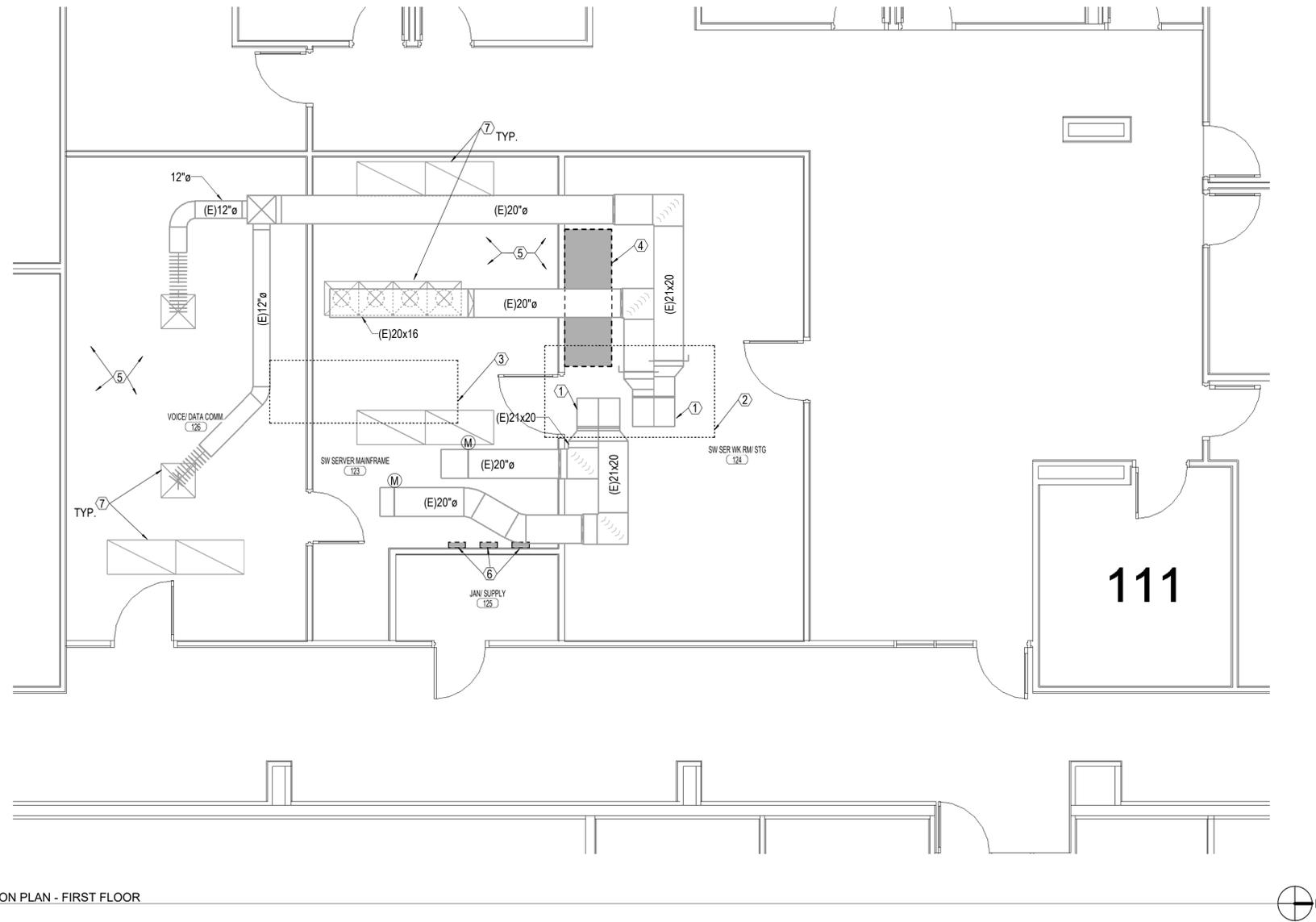
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1	CWS	REVIEW	09-19-2019
2	CWH	PERMIT	09-30-2019

CHECKED CWH	CHECKED CWH	SHEET NO. M-04
DATE 09.30.2019		



2 HVAC DEMOLITION PLAN - FIRST FLOOR  
 1/4" = 1'-0"

# DEMOLITION PLAN NOTES

- EXISTING DUCT RISERS UP TO ROOF TO REMAIN.
- EXISTING RTU ON ROOF TO REMAIN.
- EXISTING CONDENSING UNIT ON ROOF TO BE REMOVED.
- EXISTING CRAC UNIT AND STAND TO BE REMOVED. MECHANICAL CONTRACTOR TO REMOVE AND PATCH RAISED FLOOR AND WALLS AS NEEDED FOR EXISTING EQUIPMENT REMOVAL.
- ALL EXISTING PERFORATED FLOOR TILES TO BE REMOVED AND REPLACED WITH SOLID TILES. TYPICAL OF 19 TILES.
- EXISTING FLOOR MOUNTED TRANSFER GRILLES TO BE REMOVED AND FLOOR TILES TO BE REPLACED.
- EXISTING CEILING MOUNTED RETURN GRILLES AND SUPPLY DIFFUSERS TO REMAIN.

MECHANICAL DEMO NOTES

- PLANS ARE SCHEMATIC IN NATURE. LAYOUT IS BASED ON BEST AVAILABLE INFORMATION. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS AND DIMENSIONS. BRING ANY DISCREPANCIES FROM THE DRAWINGS AND NOTES TO THE OWNER'S REPRESENTATIVE IMMEDIATELY. MINOR CHANGES IN THE SCOPE OF THE DEMOLITION WORK SHALL NOT JUSTIFY AN ADDITIONAL COST.
- REMOVAL OF EXISTING FIXTURES AND EQUIPMENT WILL REQUIRE ISOLATING THE PIPING RISERS OR MAINS VIA SHUT-OFF VALVES. INSTALL NEW ISOLATION VALVES WHERE REQUIRED FOR COMPLETION OF NEW WORK.
- REMOVAL OF EXISTING DUCTWORK, DIFFUSERS, GRILLES, REGISTERS, PLUMBING FIXTURES, ETC. WILL REQUIRE TEMPORARY CAPPING AND SEALING EXISTING MAINS OR BRANCHES AS NECESSARY AND REQUIRED TO ALLOW THE REMAINING SYSTEMS TO FULLY OPERATE WITHOUT DEGRADATION.
- CONTRACTOR SHALL PROVIDE PROTECTIVE PLASTIC DROP CLOTHS TO PROTECT ANY EXISTING OCCUPIED AREAS AND EQUIPMENT FROM DUST AND DEBRIS DURING THE CONSTRUCTION WORK AND SHALL CLEAN THE AREAS OF ALL CONSTRUCTION DIRT DAILY, AND UPON COMPLETION OF THE WORK.
- COORDINATE WITH OWNER THE REMOVAL AND REPLACEMENT OF ALL EXISTING CEILINGS, WALLS, ETC. AS REQUIRED FOR MECHANICAL DEMOLITION WORK.
- EXISTING DUCTS, PIPING, AND EQUIPMENT, ETC., NOT TO BE UTILIZED IN THE COMPLETED BUILDING SHALL BE DISCONTINUED OR REMOVED AS REQUIRED. ALL ENDS OF DISCONTINUED PIPING AND DUCTS SHALL BE CAPPED IN THE NEAREST WALL, CEILING, OR FLOOR SO THAT THEY ARE COMPLETELY CONCEALED. OPENINGS LEFT IN WALLS, CEILINGS, ETC. WHERE EQUIPMENT, PIPE AND DUCTS, ETC. ARE REMOVED AND NOT REPLACED, SHALL BE PATCHED NEATLY WITH SIMILAR MATERIAL TO ADJACENT CONSTRUCTION.
- EXISTING PIPING, FIXTURES, AND EQUIPMENT THAT NOT TO BE REUSED SHALL BE REMOVED AND SHALL REMAIN THE PROPERTY OF THE OWNER IF THEY WISH TO RETAIN OWNERSHIP OF THE SAME. IF NOT, EQUIPMENT SHALL BECOME THE PROPERTY OF THIS CONTRACTOR AND SHALL BE REMOVED FROM THE SITE AS SOON AS PRACTICAL AND DISPOSED OF IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS.
- ALL CUTTING AND CHANNELING OF EXISTING BUILDING SHALL BE ACCOMPLISHED IN A NEAT AND WORKMANLIKE MANNER WITHOUT REMOVAL OF EXCESS MATERIALS. THIS CONTRACTOR SHALL PATCH AND REPLACE WITH MATERIAL SIMILAR TO ADJACENT CONSTRUCTION.
- CUTTING OF STRUCTURAL MEMBERS IS NOT ALLOWED.
- WHERE EXISTING DUCTS, PIPING, AND EQUIPMENT, ETC. THAT ARE TO BE UTILIZED IN THE COMPLETED PROGRAM CONFLICT WITH NEW CONSTRUCTION AND THE REQUIRED DEMOLITION, THEY SHALL BE RELOCATED AND RECONNECTED TO MAINTAIN THE DESIRED SERVICE.
- ALL CONTRACTORS SHALL GIVE FULL COOPERATION TO THE OWNER IN THE SCHEDULING AND PROCEDURE OF WORK AND SHALL TAKE EVERY PRECAUTION TO PREVENT DAMAGE FROM FREEZING TO EXISTING SYSTEMS.
- DEMOLISH ALL DUCTWORK, PIPING, AND EQUIPMENT SHOWN DASHED AND IN A DARK LINE WEIGHT.



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 PLANS

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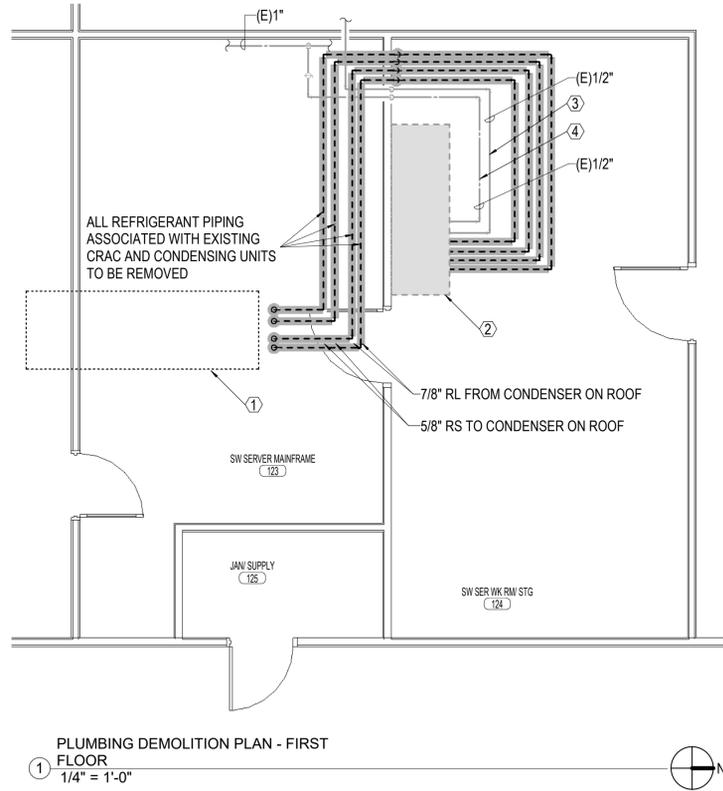


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1	CS	REVIEW	09-19-2019
2	CWH	PERMIT	09-30-2019

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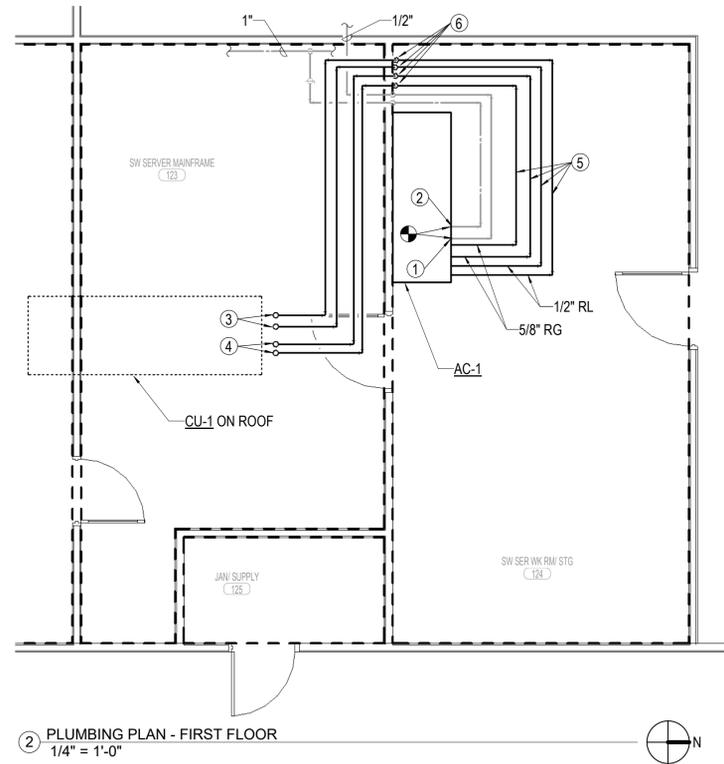


**PLUMBING DEMO NOTES**

1. FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO BEGINNING WORK. BRING ANY DISCREPANCIES FROM THE DRAWINGS AND NOTES TO THE OWNER'S REPRESENTATIVE IMMEDIATELY. MINOR CHANGES IN THE SCOPE OF THE DEMOLITION WORK SHALL NOT JUSTIFY AN ADDITIONAL COST.
2. CONTRACTOR SHALL PROVIDE PROTECTIVE PLASTIC DROP CLOTHS TO PROTECT THE EXISTING OCCUPIED AREAS AND EQUIPMENT FROM DUST AND DEBRIS DURING THE CONSTRUCTION WORK AND SHALL CLEAN THE AREAS OF ALL CONSTRUCTION DIRT DAILY, AND UPON COMPLETION OF THE WORK.
3. CUTTING OF STRUCTURAL MEMBERS IS NOT ALLOWED.
4. THIS CONTRACTOR SHALL GIVE FULL COOPERATION TO THE OWNER IN THE SCHEDULING AND PROCEDURE OF WORK AND SHALL TAKE EVERY PRECAUTION TO PREVENT DAMAGE FROM FREEZING TO EXISTING SYSTEMS.
5. RELOCATE EXISTING PIPING AS NECESSARY TO ACCOMPLISH FINAL INSTALLATION AS SHOWN.
6. CAP ALL EXISTING PIPING SHOWN TO BE DISCONNECTED AND NOT RE-USED AT MAIN. ALL ACCESSIBLE ABANDONED PIPING SHALL BE REMOVED.
7. CONTRACTOR SHALL CLEAN ALL EXISTING PLUMBING FIXTURES TO REMAIN OR BE REUSED IN AREA OF WORK AND PROVIDE A LIST OF ANY DEFICIENCIES TO OWNERS REPRESENTATIVE.
8. REMOVE EXISTING ABANDONED EQUIPMENT WHETHER SHOWN OR NOT.

**DEMOLITION PLAN NOTES**

1. EXISTING CONDENSING UNIT ON ROOF AND ALL ASSOCIATED REFRIGERANT PIPING FROM CONDENSER TO INDOOR UNIT TO BE REMOVED. EXISTING REFRIGERANT PIPING ROOF PENETRATIONS TO BE REUSED.
2. EXISTING CRAC UNIT AND ALL ASSOCIATED REFRIGERANT PIPING TO BE REMOVED.
3. EXISTING CONDENSATE LINE TO BE DISCONNECTED FROM UNIT AND REUSED FOR NEW AC-1.
4. EXISTING COLD WATER SUPPLY LINE TO HUMIDIFIER TO BE DISCONNECTED FROM UNIT AND REUSED FOR NEW AC-1.



**PLUMBING GENERAL NOTES**

1. FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO BEGINNING WORK. BRING ANY DISCREPANCIES FROM THE DRAWINGS AND NOTES TO THE OWNER'S REPRESENTATIVE IMMEDIATELY. MINOR CHANGES IN THE SCOPE OF THE DEMOLITION WORK SHALL NOT JUSTIFY AN ADDITIONAL COST.
2. CONTRACTOR SHALL PROVIDE PROTECTIVE PLASTIC DROP CLOTHS TO PROTECT THE EXISTING OCCUPIED AREAS AND EQUIPMENT FROM DUST AND DEBRIS DURING THE CONSTRUCTION WORK AND SHALL CLEAN THE AREAS OF ALL CONSTRUCTION DIRT DAILY, AND UPON COMPLETION OF THE WORK.
3. ALL DRAINED PIPING RISERS AND MAINS SHALL BE REFILLED WITH FLUID AND PROPERLY VENTED BY THIS CONTRACTOR, ONCE NEW WORK HAS BEEN INSTALLED.
4. ALL CUTTING AND CHANNELING OF EXISTING NON-STRUCTURAL ELEMENTS SHALL BE ACCOMPLISHED IN A NEAT AND WORKMANLIKE MANNER WITHOUT REMOVAL OF EXCESS MATERIALS. THIS CONTRACTOR SHALL PATCH AND REPLACE WITH MATERIAL SIMILAR TO ADJACENT CONSTRUCTION.
5. CUTTING OF STRUCTURAL MEMBERS IS NOT ALLOWED.
6. RELOCATE EXISTING PIPING AS NECESSARY TO ACCOMPLISH FINAL INSTALLATION AS SHOWN.
7. CAP ALL EXISTING PIPING SHOWN TO BE DISCONNECTED AND NOT RE-USED AT MAIN. ALL ACCESSIBLE ABANDONED PIPING SHALL BE REMOVED.
8. COORDINATE ROUTING OF PLUMBING AND HVAC PIPING WITH DUCTWORK, LIGHTS, ARCHITECTURAL CEILINGS AND STRUCTURAL ELEMENTS. PIPING SHALL RISE AND DROP, JOG OR OFFSET AS REQUIRED TO AVOID CONFLICTS. DUCTWORK SHALL TAKE PRECEDENCE OVER ALL PIPING, EXCEPT WHERE GRADE MUST BE MAINTAINED FOR DRAINAGE. PROVIDE ADDITIONAL MANUAL AIR VENTS FOR PIPING WHERE REQUIRED FOR PIPING TO OFFSET.
9. ANY EXPENSE ARISING FROM LACK OF COORDINATION SHALL BE AT CONTRACTORS EXPENSE.

**PLAN NOTES**

1. CONNECT AC-1 CONDENSATE DRAIN TO EXISTING DRAIN LINE BELOW FLOOR.
2. CONNECT AC-1 HUMIDIFIER SUPPLY LINE TO EXISTING COLD WATER SUPPLY LINE BELOW FLOOR.
3. NEW 1/2" REFRIGERANT LIQUID LINE UP THROUGH EXISTING ROOF PENETRATIONS TO NEW CONDENSING UNIT ON ROOF.
4. NEW 5/8" HOT GAS REFRIGERANT LINE UP THROUGH EXISTING ROOF PENETRATIONS TO NEW CONDENSING UNIT ON ROOF.
5. REFRIGERANT PIPING RUNNING UNDER FLOOR.
6. REFRIGERANT PIPING RUNNING UP ON OUTSIDE OF WALL.

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1		REVIEW	09-19-2019
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PLUMBING NEW AND DEMOLITION  
 FLOOR PLANS



**PEC**  
 PROFESSIONAL ENGINEERING CONSULTANTS, P.A.  
 430 LINCOLN ST., SUITE 110 FORT COLLINS, CO 80524  
 970-232-6558 www.pec1.com

**SEQUENCE OF OPERATION:**

THE CRAC UNIT AC-1 SHALL BE CONTROLLED BY THE MANUFACTURER CONTROL SYSTEM. THE UNIT SHALL BE PROVIDED WITH A BACNET/IP CARD THAT WILL COMMUNICATE WITH THE OWNER'S NETWORK. SENSORS SHALL BE INSTALLED IN THE ROOM AND RACK AS SHOWN. SENSORS SHALL BE DISTECH ALLURE EC-SMART-VVE. SENSORS SHALL BE CONNECTED TO OWNERS NETWORK AND A SEPARATE CONNECTION FOR THE IT DEPARTMENT FOR MONITORING ONLY AND WILL NOT HAVE CONTROL OF THE UNIT.

AC-1 AND EXISTING RTU SHALL OPERATE IN LEAD/STANDBY OPERATION. STANDBY UNIT (EXISTING RTU) TO REMAIN OFF UNLESS LEAD UNIT (AC-1) GOES INTO ALARM. AN ISOLATION CONTROL DAMPER WITH END SWITCH SHALL BE PROVIDED BY THE MECHANICAL CONTRACTOR IN THE DUCT MAIN FOR EACH UNIT AS CALLED OUT ON THE MECHANICAL PLANS. THIS DAMPER SHALL BE CONTROLLED BY THE LIEBERT CONTROL PANEL. UNIT SHALL NOT START UNTIL THE DAMPER IS PROVEN OPEN. ONCE STANDBY UNIT IS ON, THE LEAD UNIT SHALL TURN OFF AND ITS ISOLATION CONTROL DAMPER SHALL CLOSE. UNTIL SUCH TIME AS THE LEAD UNIT ALARM HAS BEEN RESOLVED. ONCE RESOLVED THE LEAD UNIT CONTROL DAMPER TO OPEN, UNIT SHALL NOT START UNTIL THE DAMPER IS PROVEN OPEN. ONCE LEAD UNIT IS ON, THE STANDBY UNIT SHALL RUN OFF AND ITS ISOLATION CONTROL DAMPER SHALL CLOSE. WIRING FROM CONTROL DAMPER TO LIEBERT CONTROL PANEL BY MC.

MANUFACTURER CONTROL SYSTEM SHALL ALSO BE RESPONSIBLE FOR CYCLING THE CONDENSING UNIT FANS TO CONTROL REFRIGERANT HEAD PRESSURE AS WELL AS THE LEETEMP RECEIVER LOW-AMBIENT CONTROLS.

LEAD UNIT SHALL HAVE A LEAK DETECTION SENSOR INSTALLED BELOW IT AND WIRED BACK TO THE MANUFACTURER CONTROL SYSTEM FOR ALARMING. CONTROLS CONTRACTOR TO COORDINATE WITH Poudre SCHOOL DISTRICT TO DETERMINE THE EXACT POINTS AND ALARMS DESIRED.

① CRAC UNIT SEQUENCE OF OPERATION  
 NO SCALE

AT THE TIME OF STARTUP, REPRESENTATIVES WITH THE Poudre SCHOOL DISTRICT SHALL BE PRESENT TO WITNESS THE START-UP AND TESTING OF THE NEW COOLING SYSTEM (AC-1 & CU-1). TESTING SHALL INCLUDE THE OPERATION OF THE NEW UNITS, OPERATION OF THE BACKUP UNIT AND A COMPLETE SEQUENCE OF OPERATION SHOWING THE UNITS TURNING OFF AND MODULATING DAMPERS.

② CRAC UNIT START UP  
 NO SCALE

## COMPUTER ROOM AIR CONDITIONER SCHEDULE

MARK	TYPE	CAP MBH TOTAL/S ENS.	O.A. TEMP °F	COMPRESSOR			ESP	AIR FLOW (CFM)	CONDENSER			VOLT/PHASE	MANUFACTURER AND MODEL		REMARKS
				REF TYPE	TYPE	FLA / OPD			AMB. TEMP.	NO.	FLA/ ODP		AC-1	CU-1	
AC-1 / CU-1	UPFLOW	121 / 111	105	R-407c	DIGITAL SCROLL	78.1 / 110	0.2	6360	105	2	12.8 / 15	208/3	LIEBERT VS042AD	LIEBERT MCL110E2	NOTES

- NOTES:
- INTERFACE TO EXISTING BAS FOR ALARMS
  - UPFLOW BLOWER CONFIGURATION , REAR-RETURN WITH FORWARD-CURVED BLOWERS AND FIELD ASSEMBLED PLENUM OVER EC MOTOR.
  - PROVIDE WITH ICOM CONTROLS WITH HIGH DEFINITION DISPLAY AND BAS CARD, SMOKE DETECTOR, 2 LEAK DETECTORS, DIGITAL SCROLL COMPRESSORS, CONDENSATE PUMP, INTEGRAL NON-LOCKING ELECTRICAL DISCONNECT, EC FANS, AND INFRARED HUMIDIFIER.
  - PROVIDE WITH 150 WATT HEATER ON EACH CONDENSER SECTION, WITH 120 VOLT SIGLE PHASE POWER.

## GRILLE & REGISTER SCHEDULE

MARK	TYPE	BASED ON		MATERIAL			FINISH		ACCESSORIES & REMARKS	OBD	FILTER
		MANUF.	MODEL	SS	STEEL	ALUMI	WHITE	OTHER			
A	RETURN GRILLE	PRICE	500		X		X		SURFACE MOUNT		
B	TRANSFER GRILLE	PRICE	STG		X		X		SURFACE MOUNT		



GRILLE CALLOUT IN GRILLE AND REGISTER SCHEDULE → A-12x12 → GRILLE SIZE  
 CUBIC FEET OF AIR PER MINUTE → 600 (FD) → FIRE DAMPER  
 GRILLE CALLOUT SYMBOL



SHEET CONTENTS  
 HVAC SCHEDULES AND CONTROLS

LIEBERT REPLACEMENT  
 PSD INFORMATION TECHNOLOGY CENTER  
 2413 LAPORTE AVE. FORT COLLINS, CO 80521



NO.	BY	DESCRIPTION	DATE
1		REVIEW	09.19.2019
2		PERMIT	09.30.2019

DESIGNED LCS	CHECKED CWH	DATE 09.30.2019	SHEET NO. <b>M-30</b>
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