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/	STILL AVENUATION OF A	BACKORAST DATES		CONCAL PITTING	REDUCTIONS	UNIT ACCESS STALLANDESS. TRAVOCE SI RESERT.  N. SHEZAR VERSKITCH BOLLANDES FOR UNITS BITH JO HE FAY INDICAS AND LANGER.

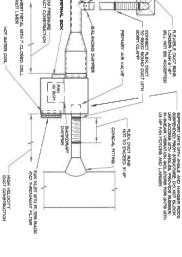
BALL VALVE, TYPICAL

VAV. UNIT HOT MATER COIL MEE VAY TERMINAL

3-WAY VALVE PLOW CONTROL VALVE

VAV HOT WATER COIL PIPING DIAGRAM

VA.V. TERMINAL UNIT DETAIL NOT TO SCALE











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REGINAL MERCHAN REGINAL MERCHA	NOIN	BALL VALVE (2-1/2" + LARACER) BUTTERFLY VALVE (2-1/2" + LARACER) 8174/HER	HOT MATTER RETURN	HOT WATER BURNEY	HOT WATER RETURN	HOT MATER BURNING Y	EXISTING CHILLED WATER RETURN	EXISTING CHILLED WATER SUPPLY	VALVE IN PAPE DROP OR RIBER	off System Build	NICOL SUNNING BOILD	CONNECT NEW TO EXISTING	EXISTING FIRE DAYFER	NEW FIRE DAYPER	THEMICOTAT	6PIN-IN TAKEOFF WITH SCOOP AND DAYFIER	SPLIT DUCT WITH SPLITTER DAYPER	TURNING VANE	DELLE ON DIPUNER HANK, BALANCING OFF	AIR FLOURATE, CUBIC FEET PER MINUTE	ACQUISTICALLY LINED DUCT	MATERIAL TO BE REMOVED	NEW MATERIAL	SHOULD SHOUND SHOULD DUCT	PLEXIBLE DUCT (6 PT. HAX LENGTH)	SYMBOLS

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- CT 912E9 SHOWN ON URNESH AND INSTALL
- ALL HATERIALS CALLED FOR TO BE SENSONED SHALL REPLAN THE PROPERTY OF THE CHAREA, WAY TIET THE CHAREA DODES NOT WISH TO KEEP SHALL BE SENSONED PROFIT THE SITE OF WORK.
- PROVIDE ALL ITEMS OF PISCELLANEOUS STEEL AS REQUIRED FOR INSTALLATION ALL INSCHARCAL ITEMS.
- PROVIDE FOR ACCESS TO ALL PECHANICAL ITEMS REQUIRES CLEANES OR ADJUSTMENT.
   PRINCE SHALL BE KENT CLEAN OF DESIRES DURING NETALLATION.

PAMEDLS  AMMON PLEMBLE DUCT (4 PT. TAUX LEMENU REGIO RICHIO RICHIO DUCT RESI TANDERAL  AMERICALLY LINED DUCT AMERICANCIA CHECH FREY HAVIE  ON 100  GRALE ON DIPMERE TANK CHECH SETT PRESSO VARE  GRALT DUCT UN HIM. MALTINE DAYPER	SERVICE ON SECURE FULL SECRETARY IN TRANSP	
SYMBOL PLEXIBL AR PLOWN	SPLIT DUCT UTH SPLITTER DAYPER	
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OR BOULD BY TRANS, CARREIER HETALANSE, PRICE, NALORA JOANNON CONTROLS, NO. OR APPROVED BOULD.
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FIFE - PARALLEL FAN POURRED BRILLE DUCT VARIABLE ARE VOUR'E TERRINAL UNT WITH HOT WITER DRAW-THRU HEATHD COLL AND EAR MOTOR WITEREAUTY (NO NOBE) BUTCH AS BRECIPED.

- All material and work shall comply with the Katlanah Fra Codes of the NFPA, Netkand and local codes and the 2015 International Building Code and Mechanical Codes.
- Dravings for work under Dixision 33 are diagrammatic and generally, indicate researche arrangements. Which under Dixision 23 includes all work necessary make HYAC systems complete and fully operational. DEMOUTION ITEMS: The owner reserves the right to least any items colled for to be removed in the construction documents. Items not hope by the Owner shall be corride owner from the alte of work. Coordinate with Owner on each item to be removed. SITE VISIT: It is highly recommended that all bidders visit the site of work become familiar with existing conditions before submitting a bid.
- SUBSTITUTIONS: For substitution requests made during the bidding of the project. All requests for substitutions shall be submitted in writing so as to the resulted by the Engineer of least the (10) calendor days perfect to final pricing and must be granted permission to quality before area of contract.
- SIMMITALS, Shorth for move debined primiting of all explanated and all bounds of the characteristics. At examination and the bound in a hardware from the characteristics and the state of the proposet. Framin for (i) all the characteristics are characteristics and characteristics of characteristics MATERIAL AND EQUIPMENT

## . Test and Balance Firm Mechanical Insulation I. WAV Terminal Units I. Grilles and Offusers I. Controls

- DAMISHIP: Work that is not of good quality will require removal siliation.
- DBANIDM: No work shall be performed on this project before thoroughly facility oil space requirements for place, control princia, and control onertia with all trades contained and additing conditions. Temperature ment control wining is included under Division 23.
- 1.10 DAMACES DIFFING CONSTRUCTION: Contractor shot be responsible for any costs of repoliting any domages conset by this contractor, to the building, building contents, and site duting construction and sentantly period. The reaponsibility for obtoining, outling, and patching for work under Division 23 of the specifications is included Division 23.
- WROMENT: Marrant of countred components, playing and any other malaridate specified under Drisland 23. Worsteid all supplement, duckrises, playing and use other materials specified under Drisland 23 for a period of one (1) year from the dobts of implet doctoplands unless otherwise inflated Upon folking or the product of implet doctoplands unless otherwise inflated Upon folking or graphy of the awaren primary period, the offereign proble and los reports or implement period in the awareness of the Centrolland.
- IDENTIFICATION: Identify each piece control component. Items shall be identified by name and numerical exquence. Numerical exquence and by 1/16" thick plates with 1/2" high with electrary on block bodinground, thermplates shall be chloched securely. Numericales shall be officient securely with ecroser, not qued.
- At any limit the controller exconstrux catestate containing materials, in self immediately stop when det suppared by faithers. Controllers that ill observes controllers materials are removed by eithers. Controllers shall, upon the controllers of self-shall shallow materials by the Young of the two self-shallows are the self-shallows and the self-shallows are the place of shallows are removed to demails an shall be by cream; Emphaser is not un "Omer or Deposition" on defined shall be by cream; Emphaser is not un "Omer or Shallows are shallows as the self-shallows and the SSSSA.
- Contractor is responsible for, and shall be aware of all state and federal laws perfaining to usbestos as well as NESHAP requirements.
- All moterics shall comply with the 2015 internant wind requirements. MECHANICAL; HVAC, ADJUSTING, TESTING AND BALANCING national Building Code for seternic
- All work shall be performed by an independent test and Balance Agency, Testing, adjusting and belancing versit shall be the firm's orde source of secome. All work shall be two first supervision of a polytel manager who is qualified for testing and balancing the hybrides and performance of heating, oir conditioning, and vestibilities systems.
- I realing and bolancing of the HAVIC poption is defined as the collections of the intraded episters. The evaluation shouldes be used for evaluations elevation sonly, industry elevatorists of +/-(10% one considered to be benchmorist and with each be used on an obsolute replanment for fine complaints of the parties. Approval of the final report will be the evaluation of the parties.
- 2.0 MECHANICAL: HVAC. INSULATION JACESS DOMS: Provide heary day 16 go, steel access door with primed finish, connected himps, and fineth mounted layed leeting device, trated on affected to permit access. Provide down as monatinativaril by Karp, Emidour, Milato, or Bibto. Provide Testing and Balancing of the new VAV terminal units and all new grilles and diffusers.
- All insafetion material shall have a fire income desaffection not to exceed forms preed of 25 and smoke developer rating of 50, can listed by Indomentius aborations and acceptable under HFPA standards. This is to apply to the completis griders and to the composite healation with jacket or follogs, vapor barrier, jobs sealing tapes, maste and fittings.
- All insulation work shall be performed by a franchised insulation company firm.
  All insulation which be installed in a rest and clean monner by qualified worker in the regular employ of the insulation company.
- DUCT INSULATION
- Induction for hitself metal ducts located intelled the building shall be 2° thick bloomlies litterable "commercial guide" duch werp or sport, induction and be 1 to, identify (fc-7,5 min) with FSV vapor borrier.

  Macillo attal be nation commit, non-florimable equal to Epohac Cadopren 723.

# All sheet melds exply of octors and be installed. Adhere healthon on ducts to melds with of "stelling of installed modified gatheries of C ovoltens. Socrare hazalistics on ducts over 2.4" who is this widd plan ond dip washing spood not more than 15" oc., to bottom of duct. Social seams with outword clock attaigue and vapor seaded with a limitables at all seams with outword clock attaigue and vapor seaded with V plans of Gandin content completely into 10 times reducing to mestals. This opposition is on spoiler at conveniences to per-insulated finable ductions.

- Obtain copies of applicable "Sheet Matal and Air Conditioning Contractors Notional Association, inc." (SMACNA) Manuals, latest edition, and keep are copy of each on job
- Ductevork shall be air tight, smooth on irealde and neatly finished on outside Defails of support, constituation and materials not specified herein to be in occordance with recommendations of SMACNA.
- No ductwork shall be fabricated or installed until all space requirements have been thoroughly coordinated with all other trades (see shap drawings).
- All supply duet down stream of terminal units and return oir duets shall be low pressure sheet metal. Seal oil joints and seams with duet sealant.

- Unless otherwise indicated, color and finish to be as askeded by Owner. Machinum nodes feed on one unit should be of least 5 less than noise critici feed (not) feet which no nie demograd unless obtained indicated foom NO to be desiranted to be 35 unless from the finish of the demograd for the Stammer of the secret of Stammer of the St
- Provide complete, operational variable oir volume (NN) terminal units as hamin specified and in accordance with the manufacturer's printed recommendations, and rated in accordance with ARE 410.
- All variable oir volume terminal units shall be EnviroTec of capacity, etc indicated in schedule on drawings or equal by Yrane, Johnson Controls, Nation, Price, Metalaire, or approved equal.
- Units shall include Johnson Controls, Inc. VMA's (DDC) controllars and actualors for communication interfoce with the building network control panel. The VMA controllars shall be furnished to the VMV terminal unit manufacturer for factory mounting complets.
- Units shall have pressure independent primary pir volves, secondary air and not water feeding coils.
- F. All units shall plastic to shipped to the job site shall with ends sealed with
- prevent occumulation of dirt and debris. Plastic shall be removed only upon irrelations of boses. All removining openings stat be fally protected with plantin sender unit like unit is predefined in openings. Undits and protected and statistical in this manner will be rejected and respicted of the contractor's exposes.
- Provide temporary filters to maintain a cisen system during oracy service. Filters shall cover openings with a minimum METV-B filter to protect the equipment from accumulation of organic material.
- DRIMANCE REQUIREMENTS
- The expenditure shall be pressure independent and shall must be one of the beneath sea and the maximum catalogue of workers. Soond refleque of all of a designations assessment what not exceed \$5.00, residued and substitutions are shall recommended and simple statement of the process of the
- Furnish and install EnviroTec fan powered berminal unit in the sizes and configurations as listed on the schedule and indicated on the drawings.
- The unit casing shall be constructed of galvanized steel with a minimum meterful thickness of 20 gauge. The discharge panel shall be constructed of 18 gauge galvanized steel for increased rigidity and sound attenuation

5.8

- Foil Board Liner FB. Provide round inlet collers, suitable for standard fissible duct sizes.

  Provide rectangular unit discharges, suitable for flanged duct connection.
- Insulation shall comply with UL 181 erosion, mold growth and humidity requirements in accordance with ASHRAE 62.1, and shall a have a
- maximum flame/smoke spread of 25/50 for both the insulation the adhesive when tested in accordance with ASTN E84.

- All ductions what meet job conditions and after coordinating with all tookes and waiting conditions. Follow dark differenties included on a density on decely on possible. Prancial offseed, very allops or other text if regularly to meet efractions for other inferiences. Where shops of dock is noted, other differenties applied specially appeared to prove this highly differenties.

- All turns greater than 45 degrees shall be made with turning vanes. Turning vanes exall be single vane type (hatcilled on runners.

### CRILLES AND DIFFUSERS

- 5.0 VARIABLE AIR VOLUME TERMINAL UNITS (VAY BOXES) Grilles and diffusers shall be Price model numbers listed in schedule on drawings or equal by Krueger, Comms, Metalcire, Nation or accepted equal

- VAV boxes shall be stored indoors and protected from damage to installation. Washhared or damaged boxes will be rejected and in the contractor's expense. Washinared or domoged boxes will be rejected and replaced at stor's expense.

- WARRANTY Provide 18 month manufacturer warranty from date of shipment for air terminal units, integral heating coller, and integral control
- Fins shall be formed in a high heat transfer sine wave configuration.
- Standard call shall be constructed with 10 fins-per-inch fin specing.
- The water coil shall be certified in accordance with AHRI 410 and units shall bear an AHRI 410 label.
- The plenum return shall be a
- ELECTRICAL REQUIREMENTS
- The terminal unit equipment of NFPA 70. with the requirements

- edges exposed to sinstream shall be cocked with secions.
- The damper assembly shall be heavy-gauge, galvanized steel with a solid shaft rotating in bushings.

Supported until from thremoted make from floor or nod support at some part of the control of the

install all V.A.V. Terminal Units per manufa instructions. See detail on drawings.

Sem Section 25.55.00 — Automatic Temperature Controls, thermostor and actuators for controls requirements and sequence of operation. Controls shall be provided by JCI and factory mounted and wined.

- The low leakage 18 gauge damper assembly shall incorporate a periphera gastet on the damper blades for light airflow shutoff. The damper, seal and bushing system shall be tested to 1.25 million cycles, or the equivalent of 100 full open/clearnes per day for 35 years, with no visible signs of wear, tear, or failure of the damper assembly ofter such testing. Air leakage post the closed deriper shall not exceed two percent of the unit machinum circles at 3 inch water gauge inlet static pressur-tested in accordance with ASHRAE 130.

- The differ sensor stell be furnished with a minimum of levelet stell presure sensing ports and four shold, sensing ports, and shell includ a center averaging chamber that amplifes the sensed pirition signal.

CONTROL AND INTERLOCK

WARRANTY: The entire control system shall be secrontled free of defects and shall include required servicing and maintenance for one year after final acceptance. The complete control system shall be provided and installed by Johnson Controls Inc. (JCI).

- The inlet valve shall include a 1/8 inch raised single bead weld for added strength.

- shall be with the motor shaft shall be directly connected to the fan. lectated from the casing to prevent transmission Electrically Commutated Mater (ECM).

SECUENCE OF OPERATION

CFC controls for sequence of operation shall be preformed using movuel lusting PDI loops. If sel-turning PDI loops are unest, additional manusity based loops shall be used to see vectors like for self-turning loops manusity based loops shall be used to see vectors like for self-turning loops. Applications to occlaims its impairburs, markin humidity, oir flow and CXZ self-oirts shall be minor and share recording.

Control wifing shall be color coded §16 TFF of TFFN wire with 800 volt insulation. Sun all wifing between terminal points without changing color. Color code of control wifing shall be as indicated on central wifing daysman. Multi-conductor thermoetict code will not be acceptable.

- The hot water coil casing shall be constructed from a minimum 22 gauge, 0.032 Inch golvanized steel, factory-installed on the terminal discharge with sitp-and drive attachment for downstream ductwork.
- The water call fine shall be 0.0045 inch aluminum fine, mechanically-bonded to seamless 0.50 by 0.016 inch copper tubes A gualisated and insulated access door shall be provided, located on bottom of unit.
- The vater coil shall be leak tested to a minimum 390 pounds per equare inch, with a minimum burst pressure of 1800 pounds per equare inch.
- PLENUM RETURN FILTER
- When tested in accordance with ASHRAE 52.2, the filter shall have a Minimum Efficiency Reporting Value of MERV 8 filter, supplied complet with a filter boot to decrease filter face velocity and pressure drop.
- For powered terminal units shall be provided with single-point power connection.

- PRIMARY AIR DAMPER ASSEMBLY fraulation thickness shall be 1 inch thick, R-value of 4.2. MPP/
- damper shaft shall incorporate a visual position indicator etched end of the damper shaft to clearly indicate damper position over range of 90 degrees.

A. Fire dampers shall be provided with 212F fasible link.
 B. Fire dampers shall be Ruskin model DIB32, type "B" dynamic dampers.

Ensure the damper operator attached to the assembly allows full modulation of flow range from 100 percent of design flow to minimum listed in the achedide.

Pipe heating coil as detailed on the drawings.

CENTER

- The difflow sensor shall be a differential pressure difflow device measuring total and static pressure, and shall be mounted to the valve.
- The airflow sensor shall be RoHS (Restriction of Hazardous Substan compliant. Plastic parts shall be fireteistant, complying with UL 94.
- Control tubing shall be protected by grammats at the wall of the driftow sensor's housing.

7.1

SCOPE OF WORK AUTOMATIC TEMPERATURE CONTROLS

Equal fire dampers by Air Balance, American Warming will be accepted

inc. or Safe Air, Inc., Prefor

Provide access doors adequately sized to service fire dampers, minimum  $10^{\circ}\mathrm{K}10^{\circ}$ . Fire dompers penetrating floors and walts rated up to 2 hours shall be L rated for 1-1/2 hours. Fire dampers penetrating floors and walts rated more than 2 hours shall be U.L. rated for 3 hours. Exception — fire dompers required behind wall mounted grilles or shall be type "A".

- The airflow sensor signal acturacy shall be plus or minus five percent throughout terminal operating range.
- The inlet valve shall be a consistent diameter to retain fex duct provide a stop for hard duct.
- The inlet valve shall knotude two heavy duty stop pins to occurately position the damper in the open and closed position. The gasket seal shall be a low feekage continuous piece with a peripheral gasket for tight airflow shutoff.

All control wiring shall be run in golves BE ACCEPTED.

All electrical work required under this swith the 2014 National Electrical Code, be served by a separate breaker and sprotection.

section of epecifications shell camply Control system power supply shall fused in control center for secondary ENT. PLENUM CABLE WILL

- The terminal unit whall be supplied with a forward curved, centrifugal type fon,  $% \left\{ 1,2,\ldots,n\right\}$
- Brankleau DC controlled by on integrated controller/frenetic that coperates the award states of easies price position to the available controlled the authorities retain award as supplied with a separate position of the motions, and delete for motion repeated objects the control of the two formation and delete for motion speed objectment, or 0 2–10 VDC or 4–20 mA signal for writings speed control.
- WATER HEATING COIL Designed to meintain a minimum 70 percent efficiency over the entire operating range. Permanent magnet type mater with near-zero rator losses designed for synchronous rotation.
- Luring the unoccupied cycle, the privacy of rowne shell modulate to minitian the unoccupied coding elegation. When the unoccupied coding selection the unoccupied working selection the bear reached the privacy of valve shell close to the minimum patient. When the unoccupied heavile patient, When the support temperature drops before the unoccupied heavile action; the terminal for and if his heating CPM and what shell cycle as selected to residently the unoccupied process. The ordistic of volume terminal units that he excelled/excelled by the Carryy Minespirent system (CSD). Upto a risk in score inventuries down the coding extport, the terminal unit shall modeled spen to provide more coding printing of the ordinal manifolds in records of, doing in the coding printing of the ordinal manifolds of the coding of the co
- Furnish to engineer two caples of certific representative that: Lobel oil new controllers with engrowed beloadille plattic plates indicating control function and correct set point. Label shall clearly relate to controlle by functional name as indicated on control wining diagram. ations signed by authorized
- Control system has been checked-out and operates according to drawings and specifications.
- All controls are warrantied uncanditionally for one year from date of acceptance and will be serviced for this period free of charge.
- Maintenance personnel or responsible party has been instructed to the operation of control system.







M400 Sheet



FOODSERVICE RENOVATIONS FOR SWEARINGEN ENGINEERING UNIVERSITY OF SOUTH CAROLINA Columbia, 5.C.