

# SECTION 23 00 00 - MECHANICAL SPECIFICATIONS

## PART I - GENERAL-MECHANICAL

**1-1 DESCRIPTION**

All work on these Drawings shall be done in strict accordance with these Specifications. The Work included under this Contract shall consist of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning system in all of its various phases, all as shown on the accompanying drawings and/or described in these Specifications.

**1-2 WARRANTY**

The Contractor shall guarantee the work for a period of one year beyond date of final acceptance. During that period, the Contractor shall repair or replace, at his own expense, any faults or imperfections that may arise due to defects in material and workmanship, including the loss of refrigerant and/or oil due to leaks. Defects shall include but not be limited to noisy operation, loose or missing parts, or noticeable deterioration of finish. During the period, the Contractor shall actually perform all service work required, including the servicing of air filters. All air conditioning compressors shall have parts and labor guarantees for a period of not less than 5 years beyond the date of Substantial Completion.

**1-3 PROJECT CONDITIONS**

The Contractor shall visit the Site of the Work and fully understand the conditions that affect the work, or the cost thereof, understand the existing utilities from which services will be supplied, verify locations of utility services, determine requirements for connections, and determine in advance that equipment and materials proposed for installation fit into the confines indicated.

**1-4 PERMITS AND FEES**

The Contractor shall arrange and pay for all permits, fees, test, and all inspections as required by Governmental Authorities.

**1-5 COORDINATION WITH FIELD CONDITIONS**

The Contract Documents are schematic in nature in that they are only to establish "Scope" and a minimum level of quality. All duct or pipe or equipment locations as indicated on the Documents do not indicate every transition, offset, or exact location. All transitions, offsets, and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans. All transitions, offsets, and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the Owner.

**1-6 SUBMITTALS**

Contractor shall provide six sets of Shop Drawings and Submittals on all Mechanical equipment, insulation, air devices, ductwork (flexible and rigid), and thermostats. Any deviations from the specified items shall be listed on the cover sheet and clearly itemized for all deviations. The Contractor shall provide a complete digital copy of Owner's Manual to the Architect upon completion of the Work.

**1-7 QUALITY ASSURANCE**

All Work shall be performed in accordance with all State, Local, and Federal Codes and all Authorities and Jurisdiction.

**1-8 EQUIPMENT IDENTIFICATION**

All Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal.

**1-9 TESTING AND BALANCING**

Testing and balance shall be provided by the Mechanical Sub-Contractor, with the services of an Independent Test and Balance Agency. The Test and Balance Company shall specialize in such work, and be a member of Associated Air Balance Council (AABC). The forms used shall be based on recommendations of AABC. Upon completion of the Balancing and Testing, the Balancing Contractor shall complete the test data in report forms, and forward five copies to the Architect for evaluation. The final report shall contain logged results of all tests, including such data as:

- Tabulation of air volume at each outlet. (Balanced to within 5% design).
- Outside dry bulb and wet bulb temperature.
- Inside dry bulb and wet bulb temperatures in each conditioned space room or area.
- Actual fan capacities, RPM's and static pressures. Motor current and voltage readings at each fan.
- Entering and leaving air temperatures, DB and WB.

**1-10 DELEGATED DESIGN FOR ANCHORAGE OF ROOF MOUNTED EQUIPMENT**

The Contractor shall engage a qualified professional engineer to design all roof mounted equipment curbs, equipment supports, equipment tie downs, equipment connections, and methods of attachment for components that are to be anchored to the building structure. The design shall comply with wind load and uplift requirements utilizing design criteria per ASCE 7 unless otherwise indicated in the Construction Documents. Signed and sealed engineering analysis data and accompanying details, drawings, and supplemental installation information shall be submitted to the engineer for review.

## PART II - DUCTWORK-MECHANICAL

### 2-1 METAL DUCTWORK

All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with thread pointed after installation. Strap hanger shall be attached to the bottom of the ductwork. The spacing, size and installation hangers shall be in accordance with the recommendations of latest edition of SMACNA space hangers as required to support ducts without sagging.

Ventlock No. 699 "Test Plugs" shall be provided in ductwork at all openings in ductwork required for testing and balancing.

### 2-1-1 DUCTWORK MATERIALS

**Exposed Ductwork Materials:** Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

**Sheet Metal:** Except as otherwise indicated, fabricate ductwork from galvanized sheet, steel complying with ASTM A527, lock-forming quality, with G90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.

**Stainless Steel Sheet:** Where indicated, provided stainless steel complying with ASTM A167, Type 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mil-applied adhesive protective paper, maintained through fabrication and installation.

**Aluminum Sheet:** Where indicated, provide aluminum sheet complying with ASTM B209, Alloy 3003, Temper H14.

- Non combustible and conforming to UL 181, Class 1 air duct materials.
- Flexible ducts: Flexmaster U.S.A. Inc. Type 5M, Thermaflex MKE, ATCO #936 or approved equal. Flexible duct shall be corrosion resistant galvanized steel formed and Mechanically locked to inner fabric with R-6 insulation when flexible ducts are located inside the thermal envelope and with R-8 insulation when located outdoors or outside of the building envelope. Flexible duct shall have reinforced metalized outer jacket comply with UL 181, Class 1 air duct.
- Sealants: Hard-Cast "Iron Grip" or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

- For exposed stainless steel ductwork, provide matching stainless steel support materials.
- For aluminum ductwork, provide aluminum support materials.

### 2-1-2 LOW PRESSURE DUCTWORK

- Fabricate and support in accordance with latest SMACNA low pressure duct construction standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- Size round ducts installed in place of rectangular ducts in accordance with ASHRAE Table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer's approval prior to using round duct in lieu of rectangular duct.
- Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airflow-turning vanes. Where acoustical lining is indicate, provide turning vanes of perforated metal with glass fiber insulation.
- Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.
- Use double nuts and lock washers on threaded rod supports.

### 2-1-3 MEDIUM AND HIGH PRESSURE DUCTS

- Fabricate and support in accordance with SMACNA high pressure duct construction standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- Construct T's bends, and elbows with radius of not less than 1 1/4 times the width of duct on centerline. Where not possible and where rectangular elbows are used, provide airflow-turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.
- Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
- Fabricate continuously welded medium and high pressure round and oval duct fittings by actual field conditions shall be performed in SMACNA standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Price coat welded joints.
- Provide standard 45 degree lateral WYE takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

### 2-1-4 EXECUTION

- Obtain Manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.
- Provide openings in ductwork where required to accommodate thermometers and controllers. Provide Pilot tube openings where required for testing of systems. Complete with metal cap with spring device or screw to ensure against air leakage where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- Connect terminal units to medium or high pressure ducts with four feet maximum length of flexible duct. Do not use flexible duct to change direction.
- Connect diffusers or transfer boxes to low pressure ducts with 6 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.
- During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.
- All ductwork located exposed on roof shall be "Crowned" to prevent water from ponding. Reference insulation for additional requirements.
- Where ducts pass through floors, provide structural angles for duct support. Where ducts pass through walls in exposed areas, install suitable sheet metal escutcheons as closures.
- All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.
- All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

### 2-1-5 INSTALLATION OF FLEXIBLE DUCTS

- Maximum length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length.
- Installation: Install in accordance with Section 3 of SMACNA's, "HVAC duct construction standards, metal and flexible".
- Provide spin-in fitting for all round flexible duct connections to rectangular duct. Spin-in fittings shall factory fabricated, and include an air extractor scoop and a balancing butterfly damper with a locking quadrant and handle. Balancing shall be at the spin-in fitting and not at the air distribution device.

### 2-1-6 DUCTWORK HANGERS AND SUPPORTS

- All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork. Provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA Edition.
- All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this division.

### 2-1-7 DUCTWORK JOISTS AND SEAMS

- All ductwork shall be constructed to Seal Class A, as referenced in SMACNA Standards.
- All non-welded joints and seams shall be sealed. This includes but is not limited to:
  - Transverse joints.
  - Longitudinal seams.
  - Duct wall penetrations.
  - Spin-ins, taps, and other branch connections.
  - Access doors, access panels, and duct connections to equipment.
- Openings for rotating shafts shall be sealed with bushings.

### 2-2 DUCT INSULATION

All insulation shall be installed in accordance with the Manufacturer's recommendations and printed installation instructions.

All items required for a complete and proper installation are not necessarily indicated on the Plans or in the Specifications. Provide all items required as per manufacturer's requirements.

All toilet exhaust ductwork shall be unlined sheet metal with all joints sealed. Duct dimensions shown on Plans are clear inside dimensions.

### 2-2-1 EXTERNAL DUCT INSULATION

- Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above anding and insulation in place on bottom side with mechanical pins and clips on 12" centers.
- Seal all joints, fastener penetrations and other breaks in vapor barrier with 3 inch wide strips of white glass fabric embedded between two coats of vapor barrier mastic, chlders CP-30 or approved equal.
- All external duct insulation shall be Johns Manville Type 75 fiberglass duct wrap insulation with reinforced aluminum facing or approved equal.
- External duct wrap is required on all outside air ducts and supply air ducts that are not internally insulated. Duct wrap shall be provided as follows:
  - 1 1/2" thick, 10 PCF density minimum when ducts are located in conditioned spaces.
  - 2" thick with a minimum installed R-value as follows:
    - On roof or exterior of building: R-8
    - Located inside building envelope: R-6
    - Located outside the building thermal envelope: R-8

### 2-2-2 DUCT LINER

- Duct liner shall be kept clean and dry during transportation, storage and installation. Care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.
- All portions of duct designed to receive duct liner shall be completely covered by duct fittings two gages heavier than duct gages indicated in SMACNA standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Price coat welded joints.
- The duct liner shall be tested according to erosion test method in UL 181 and shall be guaranteed to withstand velocities in the duct system up to 5000 FPM without surface erosion.
- Duct liner shall be adhered to the sheet metal with full coverage of an approved adhesive that conforms to ASTM C 916, and all exposed leading edges and transverse joints shall be coated with permacote factory-applied or field-applied edge coating and shall be neatly butted without a screw to ensure against air leakage where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at forward discharge and at any point where lined duct is proceeded by unlined duct.
- When velocity exceeds 4000 FPM (20.3 M/SEC), use metal nosing on every leading edge. Nosing may be formed on duct or be channel or zee attached by screws, rivets or welds.
- The liner shall further be secured with graham welding pins and washers on not more than 18 inch centers both vertical and horizontal surfaces, and the pins and washers shall be pointed up with adhesive.
- Duct liner shall be Knauf Insulation Atmosphere Duct Liner with ECOSSE Technology, Johns Manville Linacoat R-2 duct liner with factory-applied edge coating and acrylic coating on the mat surface of airstream side or approved equal. The liner shall meet the life safety standards as established by NFPA 90A and 90B, FHC 2650 and limited combustibility and the air stream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22, the duct liner shall conform to the requirements of ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than 0.24 BTU/(HR\*FT^2) at 75°F mean temperature.
- Duct liner is required on all return air ductwork, return air boots and supply air ductwork downstream of the terminal units. Duct liner shall be provided as follows:
  - 1" thick, 1.5 PCF density minimum; minimum installed R-value of 4.2 when ducts are located in conditioned spaces.
  - 1 1/2" thick with a minimum installed R-value of 6 when ducts are located inside of the building thermal envelope.
  - 2" thick with a minimum installed R-value of 8 when ducts are located outdoors OR outside of the building thermal envelope.
- Line supply and return ductwork at connection of HVAC unit to a point of 15 feet upstream and downstream of the equipment and in return air boots. Attach with full cover coat of cement, duct dimensions up to 16 inches, space 16 inches O.C. maximum. Provide sheet metal liner cap over all leading edges of internal insulation exposed to air stream. R-value shall be in accordance with the requirements listed above.

### 2-2-3 EXPOSED DUCTWORK LOCATED INDOORS

- Duct routed exposed in occupied spaces shall be double wall.
- Round and flat oval duct routed exposed shall be double wall with perforated inner liner and 1" thick layer of glass mineral wool insulation as manufactured by United McGill Company model no. Acousti-27 or approved equal. Insulation density shall be a minimum of 1.0 PCF.

### 2-2-4 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

- The backside of all supply air devices shall be insulated with taped and sealed 1 1/2 inch thick external duct wrap.
- The Contractor shall install an additional layer of 1 1/2 inch thick external fiberglass duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and sealed and located until all evidence of the condensation had been eliminated at no additional cost to the owner.

## PART III: EQUIPMENT - MECHANICAL

### 3-1 AIR DISTRIBUTION

- Air distribution devices shall be selected at a maximum of 30 noise criteria and at a maximum of 0.06" W.G. total pressure drop. Approved Manufacturers are Metatlare, Titus, Price, Nailor, and Krueger.
- The backside of all supply air devices shall be insulated with taped and sealed 1-1/2" thick one lb. density fiberglass insulation with vapor barrier.

END OF SECTION

AIR DEVICE SCHEDULE			
MARK	MFR. & MODEL	TYPE	REMARKS
A	TITUS OMNI AA	24"x24" SQUARE FACE SUPPLY AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR LAY-IN CEILING OR HARD CEILING, DEPENDING ON CEILING TYPE. REFER TO ARCHITECTURAL PLANS FOR CEILING TYPE, SIZE NECK ACCORDING TO DRAWING.
A1	TITUS OMNI-AA	SQUARE FACE SUPPLY AIR GRILLE	12"x12" FACE, ALUMINUM CONSTRUCTION WITH FRAME FOR LAY-IN CEILING OR HARD CEILING, DEPENDING ON CEILING TYPE.
B	TITUS OMNI AA	24"x24" SQUARE FACE RETURN / EXHAUST AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR LAY-IN CEILING OR HARD CEILING, DEPENDING ON CEILING TYPE. REFER TO ARCHITECTURAL PLANS FOR CEILING TYPE, PROVIDE 18" NECK OPEN TO PLENUM UNLESS OTHERWISE NOTED ON DRAWINGS. PROVIDE O.B.D. WHEN USED FOR DUCTED EXHAUST.
C	TITUS 300 FL	SIDEWALL SUPPLY AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR SURFACE MOUNT. 3/4" BLADE SPACING, DOUBLE DEFLECTION WITH FRONT BLADES PARALLEL TO LONG DIMENSION. PROVIDE O.B.D. PROVIDE SIZE ACCORDING TO DRAWING.
D	TITUS 350 FL	SIDEWALL RETURN / EXHAUST AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR SURFACE MOUNT. 3/4" BLADE SPACING, 35° DEFLECTION WITH BLADES PARALLEL TO LONG DIMENSION. PROVIDE O.B.D. WHEN USED FOR DUCTED EXHAUST, PROVIDE SIZE ACCORDING TO DRAWING.
E	TITUS FL-15-HT W/ FBPH-15	CONTINUOUS 1.5" SINGLE WIDTH SLOT WITH 4" LENGTH PLENUMS LINEAR FLOWBAR HIGH THROW SUPPLY AIR SLOT DIFFUSER	ALUMINUM CONSTRUCTION, PROVIDE PATTERN CONTROLLERS ENTIRE LENGTH OF SLOT, PROVIDE 4 FOOT EXTERNALLY INSULATED PLENUM, CONNECT PLENUM TO NECK OF SLOT DIFFUSER, PROVIDE ROUND INLET SIZED AS INDICATED ON PLAN, PROVIDE BORDER TYPE 22. PROVIDE REMOTE DAMPER OPERATOR WHEN LOCATED ABOVE UNACCESSIBLE CEILINGS. REFER TO ARCHITECTURAL DRAWINGS FOR SLOT RADII.

- NOTES:
- PAINT FACE OF ALL AIR DEVICES TO MATCH CEILING FINISH. REFER TO ARCHITECTURAL DRAWINGS FOR SPECIFICATIONS.
  - INSULATE BACK-PAN OF ALL DEVICES.
  - PROVIDE FRAME TO MATCH CEILING TYPE INDICATED ON ARCHITECTS REFLECTED CEILING PLAN.
  - PAINT INTERIOR SURFACES OF DUCTWORK VISIBLE FROM FACE OF RETURN AIR GRILLES FLAT BLACK.

**3 CABLE REMOTE DAMPER OPER.**

NOT TO SCALE

**4 SLOT DIFFUSER CONNECTION**

NOT TO SCALE

**5 SPIN-IN DETAIL**

NOT TO SCALE

**6 CENTRIFUGAL ROOF EXHAUST FAN**

NOT TO SCALE

**7 SOUND RETURN AIR BOOT AT GRILLE**

NOT TO SCALE

**8 SIDEWALL REGISTER RETURN AIR BOOT**

NOT TO SCALE

**9 REMOTE SPIN-IN DAMPER OPERATOR**

NOT TO SCALE

**10 TYP. MFP INSTALLATION DETAIL**

NOT TO SCALE

**11 FLOWBAR LINEAR DIFFUSER**

NOT TO SCALE

FAN SCHEDULE	
MARK	EF-1
TYPEDRIVE	CENTRIFUGAIDIRECT
INTERLOCK	RTU-16
CFM	200
EXT. S.P. (IN. W.G.)	0.125
HORSEPOWER	1/10
RPM (MAX.)	866
SONES (MAX.)	2.4
VOLTS/PHASE/HERTZ	115/160
MANUFACTURER	GREENHECK
MODEL NUMBER	G-090-VG
NOTES	ALL

- NOTES:
- EXTERNAL STATIC PRESSURE DOES NOT ACCOUNT FOR LOSSES DUE TO FILTERS, HOUSING, NOR ACCESSORIES.
  - PROVIDE WITH 12" PREFABRICATED ROOF CURB, WEATHERPROOF DISCONNECT SWITCH, AND BIRO SCREEN.
  - PROVIDE WITH MOTORIZED DAMPER, INSTALLED WITHIN THE ASSOCIATED DUCTWORK, INTERLOCKED WITH FAN OPERATION SUCH THAT DAMPER SHALL OPEN WHEN FAN IS ENERGIZED AND SHUT WHEN FAN IS DE-ENERGIZED.
  - PROVIDE WITH DIRECT DRIVE, ELECTRONICALLY COMMUTATED VARIOGREEN FAN MOTOR.



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Date Description

Seal / Signature



Project Name  
Woodlands Township - Office Renovation

Project Number

02:9171.000

Description

MECHANICAL SCHEDULES

Scale

As indicated

**M5.01**



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DBR Project Number 230237.000

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