SECTION 15880 - AIR DISTRIBUTION DEVICES AND ACCESSORIES

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing:

1. Ductwork and Accessories
2. Disposable Panel Filters
3. Acoustical Housings and Louvers
4. Air Outlets and Inlets

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15750 Packaged Air Conditioning Equipment
2. Section 15855 Air Handling and Moving Equipment
3. Section 15950 HVAC Controls and Sequence of Operations
4. Section 15990 Testing, Adjusting and Balancing

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Mechanical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1.	ASHRAE	Handbook 1981 Fundamentals, Chapter 33 - Duct Design
2.	ASHRAE	Handbook 1983 Equipment; Chapter 1 - Duct Construction
3.	ASTM A 90	Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
4.	ASTM A 167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

5.	ASTM A 525	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
6.	ASTM A 527	Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality
7.	ASTM B 209	Aluminum and Aluminum Alloy Sheet and Plate
8.	ASTM B 221	Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
9.	ASTM C 14	Concrete Sewer, Storm Drain, and Culvert Pipe
10.	ASTM C 443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
11.	ASTM C 1071	Standard Specifications for Thermal and Acoustical Insulations (Mineral Fiber, Duct Lining Material)
12.	NFPA 90A	Installation of Air Conditioning and Ventilating Systems
13.	SMACNA	Low Pressure Duct Construction Standards
14.	SMACNA	Fibrous Glass Duct Construction Standards
15.	UL 181	Factory-Made Air Ducts and Connectors
16.	UL 33	Heat Responsive Links for Fire-Protection Service
17.	UL 555	Fire Dampers and Ceiling Dampers
18.	ANSI/UL 900	Test Performance of Air Filter Units
19.	ASHRAE 52	Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter
20.	AMCA 302	Application of Sound Loudness Ratings for Non-Ducted Air Moving Devices
21.	AMCA 303	Application of Sound Power Level Ratings for Ducted Air Moving Devices Recommended Typical dBa Calculation
22.	ANSI S1.1	Acoustical Terminology (including Mechanical Shock and Vibration)
23.	ANSI S1.8	Preferred Reference Quantities for Acoustical Levels
24.	ANSI S1.13	Methods for Measurement of Sound Pressure Levels

25. ARI 270 Sound Rating of Outdoor Unitary Equipment

26. ARI 575 Measuring Machinery Sound Within Equipment Rooms

27. ASA 16 (ANSI S1.36) Survey Methods for Determination of Sound Power Levels of Noise Sources

28. ASA 29 (ANSI S1.29) Measurement and Designation of Noise Emitted by Computer and Business Equipment

29. ASA 47 (ANSI S1.4) Specification for Sound Level Meters

30. ASA 49 (ANSI S12.1) Preparation of Standard Procedures to Determine the Noise Emission from Sources

31. ASA 61 (ANSI S12.10) Computer and Business Equipment

32. ASHRAE 68 Method of Testing In-Duct Sound Power Measurement Procedure for Fans

33. ASHRAE Handbook Systems Volume, Chapter "Sound and Vibration Control"

34. ASTM E90 Method for Laboratory Measurement of Airborne Sound Transmission of Building Partitions

35. ASTM E477 Method of Testing Duct Liner Materials and Prefabricated Silencers for Acoustical and Airflow Performance

36. ASTM E596 Method for Laboratory Measurement of the Noise Reduction of Sound Isolating Enclosures

37. NEBB Procedural Standards for Measuring Sound and Vibration

38. ADC 1062 Air Distribution and Control Device Test Code

39. ARI 650 Air Outlets and Inlets

40. ASHRAE 70 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets

41. ADC 1062 Air Diffusion Council Equipment Test Code

1.5 REGULATORY REQUIREMENTS

A. Ductwork shall be constructed in compliance with NFPA 90A.

1.6 QUALITY ASSURANCE

A. The WORK of this Section shall comply with the following:

1. Filter media shall be ANSI/UL 900 listed, Class 1 or Class 2.
2. Filters shall be the product of one manufacturer.
3. Filters shall be assembled to form filter banks from products of one manufacturer.
4. Acoustical work shall be performed in accordance with [ANSI S1.13] [ARI 575] [ASA 16 (ANSI S1.36] [ASA 29 (ANSI S1.20)] [ASA 61 (ANSI S12.10)] and standards and recommendations of [ASHRAE 68] [NEBB].
5. The performance of air outlets and inlets shall be tested and rated in accordance with [ADC Equipment Test Code 1062] [ASHRAE 70].
6. The performance of louvers shall be tested and rated in accordance with AMCA 500.

1.7 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop Drawings:

Indicating duct fittings and details such as gauges, sizes, welds, and configuration prior to start of work for [low pressure] [kitchen hood exhaust] [glass fiber duct] [ ] systems.

Indicating, for shop fabricated assemblies, [volume control dampers] [duct access doors] [duct test holes].

Indicating assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout, and connection details.

2. Product Data:

Including catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance.

Indicating configuration, general assembly, and materials used in fabrication, and including catalog performance ratings which indicate air flow, static pressure, and NC designation.

3. Design Data:

Engineering calculations, referenced to specifications and [AMCA 302] [AMCA 303] [ARI 270] [ASA 49 (ANSI S12.1)] standards indicating that maximum room sound levels are not exceeded.

4. Schedules:

Listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of [1] [ ] to [4] [ ] inches wg.

Of outlets and inlets indicating type, size, location, application, and noise level.

5. Test Reports:

Indicating [dynamic insertion loss and noise generation values of silencers] [acoustic housings meet or exceed specified sound transmission loss values].

6. Samples:

[2] [ ] of each required air outlet and inlet type.

1.8 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. Manufacturer's installation instructions.
2. Manufacturer's maintenance procedures.

1.9 PROJECT RECORD DOCUMENTS

A. The following shall be indicated on the Project Record Documents in compliance with Section 01300.

1. Record of actual locations of acoustic housings.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A **Delivery of Materials**: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. **Storage**: Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

1.11 PERFORMANCE REQUIREMENTS

A. Rooms shall be maintained at following maximum sound levels, in [Noise Criteria (NC)} [Room Criteria (RC)] as defined by [ASHRAE Handbook] [ANSI S1.8].

1.	Executive offices	[25]	[30]
2.	Conference rooms	[25]	[30]
3.	Private offices	[30]	[35]
4.	Open-plan areas	[35]	[40]
5.	Computer/business machine areas	[40]	[45]

6.	Public circulation areas		[40][45]
7.	Process areas	[ ]	[ ]

PART 2 -- PRODUCTS

2.1 GENERAL

A. **General**: Only products certified as complying with the indicated requirements shall be provided.

B. **Products:** Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

$# _____

NTS: Fibrous glass ductwork is currently a controversial choice due to industry-wide concerns for fire rating, smoke generation, and structural concerns. If the DESIGN CONSULTANT elects to use such ductwork, it must use a non-manufacturing fiberglass ductwork specialist during the design,a nd the resulting construction drawings must be stamped by a registered structural engineer. The CONSTRUCTION MANAGER will retain the same fiberglass ductwork specialist to perform on-site inspection.

_____ #$

2.2 DUCTWORK

A. Ductwork shall comply with the following:

1. General: non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.

2. Steel Ducts: [ASTM A525] [or] [ASTM A527] galvanized steel sheet,lock-forming quality, with zinc coating of 1.25 oz per sq ft on each side in conformance with ASTM A90.

3. Aluminum Ducts: ANSI/ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

4. Flexible Ducts: [interlocking spiral of galvanized steel or aluminum construction] [or] [fabric supported by helically wound spring steel wire or flat steel bands]; rated to [2 inches wg positive and 1.5 inches wg negative for low pressure ducts] [and [ ] inches wg positive or negative for medium high pressure ducts.]

5. Insulated Flexible Ducts: flexible duct wrapped with flexible glass fiber insulation, enclosed by seamless aluminum plastic vapor barrier jacket; maximum 0.23 K value at 75 degrees F.

6. Fibrous Glass Ducts: UL 181; [1 inch] [1-1/2 inch] thick rigid glass fiber with aluminum foil, glass scrim and kraft or plastic jacket vapor barrier;l maximum 023. K value at 75 degrees F.

7. Stainless Steel Ducts: ASTM A167, Type [304.] [.]

8. Glass Fiber Reinforced Plastic Ducts: [.]

9. Coating for Buried Ducts: Asphalt base, [ ].

10. Concrete Ducts: ASTM C14; hub and spigot concrete sewer pipe with ANSI/ASTM C443 joints, rubber gaskets.

11. Fasteners: Rivets, bolts, or sheet metal screws.

12. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

13. Hanger Rod: Steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.3 VOLUME CONTROL DAMPERS

A. Volume control dampers shall be fabricated in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

2.4 SPLITTER DAMPERS

A. Splitter dampers shall comply with the following:

1. Splitter dampers shall be fabricated of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

2. Splitter dampers shall be fabricated of [single] [double] thickness sheet metal to streamline shape; secure blades shall be secured with continuous hinge or rod and shall be operated with minimum 1/4-inch diameter rod in self aligning, universal joint action flanged bushing with set screw.

3. Single blade dampers shall be fabricated for duct sizes to [9-1/2 x 30 inch] [122 x 48 inch].

4. Multi-blade dampers shall be fabricated of opposed blade pattern with maximum blade sizes 12 x 72 inch; center and edge crimped blades shall be assembled in prime coated or galvanized channel frame with hardware.

2.5 DAMPER BEARINGS AND REGULATORS

A. Damper bearings shall comply with the following:

1. Except in round ductwork [12] [ ] inches and smaller, end bearings shall be included and on multiple blade dampers, bearings shall be oil-impregnated nylon or sintered bronze.

B. Regulators shall comply with the following:

1. Locking, indicating quadrant regulators shall be included on single and multi-blade dampers except that where rod lengths exceed 30 inches include regulator at both ends.

2. On insulated ducts, quadrant regulators shall be mounted on stand-off mounting brackets, bases, or adapters.

2.6 FIRE DAMPERS

A. Fire dampers shall be fabricated as follows:

1. In accordance with NFPA 90A and UL 555, and as indicated.

2. Ceiling firestop flaps of galvanized steel, 22 gauge frame and 16 gauge flap, two layers 0.125 inch ceramic fiber on top side [, and one layer on bottom side for round flaps] with locking clip.

3. Ceiling dampers of galvanized steel, 22 gauge frame, stainless steel closure spring, and light weight, heat retardant non-asbestos fabric blanket closure.

4. Curtain type dampers of galvanized steel with interlocking blades; stainless steel closure springs and latches for horizontal installations; with blades out of air stream except for low pressure ducts up to 12 inches in height.

5. Multiple blade fire dampers with 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops and locks.

6. Fusible links, UL 33, which separate at [160] [212] [ ] degrees F with adjustable link straps for combustion fire/balancing dampers.

2.7 BACKDRAFT DAMPERS

A. Backdraft dampers shall be fabricated as follows:

1. Gravity backdraft dampers, size [18 x 18 inches] [ ] or smaller, furnished with manufacturer's standard construction.

2. Multi-blade, parallel action gravity balanced backdraft dampers of [16 gauge galvanized steel], [or] [extruded aluminum], with [center pivoted] blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together

in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel differential static pressure.

2.8 AIR TURNING DEVICES

A. Air turning devices shall comply with the following:

[1. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

[1. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with [push-pull operator strap] [ceiling mounted rotary operator knob] [worm drive mechanism with 18 inch long removable key operator.]

2.9 FLEXIBLE DUCT CONNECTIONS

A. Flexible duct connections shall be fabricated as follows:

1. In accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

2. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density [20] [36] oz per sq yd approximately [2] [3] [6] inches wide, crimped into metal edging strip.

3. Leaded vinyl sheet, minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.10 DUCT ACCESS DOORS

A. Duct access doors shall be fabricated as follows:

1. In accordance with SMACNA Low Pressure Duct Construction Standards.

2. With rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices; for insulated ductwork, minimum 1-inch thick insulation shall be installed with sheet metal cover.

3. Access doors smaller than 12 inches square may be secured with sash locks.

4. With two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches; additional hinge shall be provided for larger sizes.

5. Access doors with sheet metal screw fasteners are not acceptable.

2.11 DUCT TEST HOLES

A. Duct test holes shall be fabricated as follows:

1. Temporary test holes shall be cut or drilled in ducts and capped with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap; extended neck fittings designed to clear insulation shall be provided.

2.12 DISPOSABLE PANEL FILTERS

A. Disposal panel filters shall comply with the following:

1. Media: [2 inch] [1 inch] thick fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive, nominal size [24 x 24] [x] inches.

2. Rating: 500 FPM face velocity, [0.15 inch wg] [0.10 inch wg] initial resistance, 0.50 inches wg final resistance.

3. Holding Frames: 20 gauge minimum galvanized steel frame with expanded metal grid on outlet side and steel rod grid on inlet side, hinged with pull and retaining handles.

2.13 DUCT SILENCERS

A. Duct silencers shall comply with the following:

1. Description: duct section with sheet metal outer casing sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction and fabricated in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

[2. Configuration: tubular [with] [without] inner casing and liner, [without center body] [without absorptive] [aerodynamically shaped center body with nose cone and truncated tail cone] [splitters with radiused nose and contoured tails], [ ] diameter [as indicated], length [1.5] [2] [3] [4] times diameter.]

[2. Configuration: rectangular with lined splitters with radiused nose and contoured tails, modular [ ] high, [ ] wide, [ ] long.]

3. Materials:

Outer Casing: Minimum [22 gauge] [20 gauge] required, with [mastic filled lock formed] [welded] joints on both ends.

Inner Casing and Splitters: Minimum 24 gauge thick perforated galvanized steel.

Fill: Glass fiber or mineral wool of minimum [4 lb/cu ft] [3 lb/cu ft] density.

Fill Liner: [Bonded glass fiber matting.] [1 mil mylar film.]

2.14 ACOUSTIC HOUSINGS

A. Acoustic housings shall comply with the following:

1. Description: modular panels, including access doors and windows, nominal 4 inches thick, with filled outer and inner casing and shall be fabricated in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

2. Materials:

Outer Casing: minimum [18 gauge] [22 gauge] thick galvanized steel stiffened as required, with [mastic filled lock formed] [welded] seams for [internal flange butt] [covering strip butt] [overlapping lip] [tongue and groove] joining.

Inner Casing and Splitters: minimum 22 gauge thick perforated galvanized steel.

Fill: glass fiber or mineral wool of minimum [4 lb/cu ft] [4-3/4 lb/cu ft] density.

Fill Liner: [bonded glass fiber matting.] [1 mil mylar film.]

Window: [ ] x [ ] inch double glazed with 1/4-inch safety glass.

2.15 ACOUSTICAL LOUVERS

A. Acoustical louvers shall comply with the following:

1. Configuration: [8] [12] [ ] inch deep louvers with blades on 45 degree slope; sound absorbing fill material, and inner surface of perforated sheet metal, heavy channel frame, birdscreen.

2. Materials:

Louvers: 16 gauge galvanized steel] [or] [12 gauge extruded aluminum], welded assembly, with factory [prime coat] [baked enamel] [color anodized] finish.

Inner Surface: minimum 24 gauge thick perforated galvanized steel.

Fill: glass fiber or mineral wool of minimum [4 lb/cu ft] [3 lb/cu ft] density.

Fill Liner: [bonded glass fiber matting] [1 mil mylar film].

Birdscreen: [1] [1/2] [3/4] inch square wire mesh.

Mounting: [interior] [exterior] [flat flange.] [angle flange] [screw holes in jambs.] [masonry strap anchors.]

2.16 ROUND CEILING DIFFUSERS

A. Round ceiling diffusers shall comply with the following:

1. Diffusers shall be round, [adjustable pattern,] stamped or spun, multicore type designed to discharge air in 360 degree pattern, with sectorizing baffles where indicated.

2. Diffuser collar shall project [not more than one inch] above ceiling face and connect to duct with duct ring. [In plaster ceilings, plaster ring and ceiling plaque shall be included.]

3. Diffusers shall be fabricated of steel with baked enamel [off-white] finish [painted to match adjacent surface].

4. Diffusers shall include [radial opposed blade] [butterfly] [combination splitter] damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.17 RECTANGULAR CEILING DIFFUSERS

A. Rectangular ceiling diffusers shall comply with the following:

1. Diffusers shall be rectangular, [adjustable pattern,] stamped or spun, multicore type designed to discharge air in 360 degree pattern, with sectorizing baffles where indicated.

2. Diffusers shall include [surface mount] [snap-in] [inverted T-bar] [spline] type frame. [In plaster ceilings, plaster frame and ceiling frame shall be included.]

3. Diffusers shall be fabricated of steel with baked enamel [off-white] finish [painted to match adjacent surface].

4. Diffusers shall include [radial opposed blade] [butterfly] [combination splitter] damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.18 PERFORATED FACE CEILING DIFFUSERS

A. Perforated face ceiling diffusers shall comply with the following:

1. Perforated face diffuser shall be fully adjustable pattern with removable face.

2. Diffusers shall include [surface mount] [snap-in] [inverted T-bar] [spline] type frame. [In plaster ceilings, plaster frame and ceiling frame shall be included.]

3. Diffusers shall be fabricated of steel or aluminum frame and baked enamel [off-white] finish [painted to match adjacent surface].

4. Diffusers shall include [radial opposed blade] [butterfly] [combination splitter] damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.19 CEILING SUPPLY REGISTERS/GRILLES

A. Ceiling supply registers/grilles shall comply with the following:

1. Grilles shall be streamlined and individually adjustable curved blades designed to discharge air along face of grille with [1-way] [2-way] deflection.

2. Grilles shall be fabricated of [1-1/4] [one] [ ] inch margin frame with [countersunk screw] [concealed] mounting and gasket.

3. Aluminum extrusions shall be fabricated with factory [clear lacquer] [prime coat] [ ] finish [painted to match adjacent finish].

4. Grilles shall include integral, gang-operated opposed blade dampers with removable key operator, operable from face.

2.20 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Ceiling exhaust and return registers/grilles shall comply with the following:

1. Grilles shall include streamlined blades; depth shall exceed 3/4-inch spacing, with spring or other device to set blades, [vertical] [horizontal] face.

2. Grilles shall be fabricated of [1-1/4] [one] [ ] inch margin frame with [countersunk screw] [concealed] mounting.

3. Grilles shall be fabricated of steel with [20] [ ] gauge minimum frames and [22] [ ] gauge minimum blades, steel and aluminum with [20] [ ] gauge minimum frame, or aluminum extrusions, with factory [baked enamel] [prime coated] [clear lacquer] finish [painted to match adjacent surface].

4. Where not individually connected to exhaust fans, grilles shall include integral, gang-operated opposed blade dampers with removable key operator, operable from face.

2.21 WALL SUPPLY REGISTERS/GRILLES

A. Wall supply registers/grilles shall comply with the following:

1. Grilles shall be streamlined and individually adjustable blades; depth shall exceed 3/4-inch maximum spacing with spring or other device to set blades, [vertical] [horizontal] face, [single] [double] deflection.

2. Grilles shall be fabricated of [1-1/4] [1] [ ] inch margin frame with [countersunk screw] [concealed] mounting and gasket.

3. Grilles shall be fabricated of steel with [20] [ ] gauge minimum frames and [22] [ ] gauge minimum blades, steel and aluminum with [20] gauge minimum frame, or aluminum extrusions, with factory [baked enamel] [prime coated] [clear lacquer] finish [painted to match adjacent surface].

2.22 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Wall exhaust registers and grilles shall comply with the following:

1. Grilles shall include streamlined blades; depth shall exceed 3/4 inch spacing, with spring or other device to set blades, [vertical] [horizontal] face.

2. Grilles shall be fabricated of [1-1/4] [1] [ ] inch margin frame with [countersunk screw] [concealed] mounting.

3. Grilles shall be fabricated of steel with 20 gauge minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or aluminum extrusions, with factory [baked enamel] [prime coated] [clear lacquer] finish [painted to match adjacent surface].

4. Where not individually connected to exhaust fans, grilles shall include integral, gang-operated opposed blade dampers with removable key operator, operable from face.

2.23 DOOR GRILLES

A. Door grilles shall comply with the following:

1. Grilles shall include V-shaped louvers of [20] [ ] gauge steel, one-inch deep on 1/2-inch centers.

2. Grilles shall be fabricated of [20] [ ] gauge steel frame with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish [painted to match adjacent surface].

2.24 LOUVERS

A. Louvers shall comply with the following:

1. Grilles shall include [4] [6] [ ] inch deep louvers with blades on 45 degree slope [with center baffle and return bend], heavy channel frame, birdscreen with 1/2-inch square mesh for exhaust and 3/4-inch for intake.

2. Grilles shall be fabricated of [16 gauge galvanized steel] [or] [12 gauge extruded aluminum], welded assembly, with factory [prime coat] [baked enamel] [color anodized] finish [painted [ ]].

3. Grilles shall include [interior] [exterior] [flat flange] [angle flange] [screw holes in jambs] [masonry strap anchors] for installation.

4. Exterior louvers shall have drainable louver blades.

5. Exterior louvers shall have invisible mullions unless indicated otherwise.

2.25 ROOF HOODS

A. Roof hoods shall comply with the following:

1. Air inlet or exhaust hoods shall be fabricated in accordance with SMACNA Low Pressure Duct Construction Standards.

2. Hoods shall be fabricated of galvanized steel, minimum 15 gauge base and 20 gauge hood, or aluminum, minimum 16 gauge base and 18 gauge hood; suitably reinforced; with removable hood; birdscreen with 1/2-inch square mesh for exhaust and 3/4-inch for intake, and factory [prime coat] [baked enamel] grey finish.

3. Hoods shall be mounted on minimum 12-inch high curb base with insulation between duct and curb.

4. Hood outlet area shall be minimum of twice throat area.

2.26 GOOSENECKS

A. Goosenecks shall comply with the following:

1. Goosenecks shall be fabricated in accordance with SMACNA Low Pressure Duct Construction Standards of minimum 18 gauge galvanized steel [painted [ ]].

2. Hoods shall be mounted on minimum 12-inch high curb base where size exceeds [9 x 9 inch] [.]

2.27 SPARE PARTS

A. The WORK of this Section includes two replacement filters for each type of filter installed on the project.

2.28 MANUFACTURERS

A. **Fibrous Glass Ducts:** Products of the model indicated shall be manufactured by one of the following (or equal):

1. Owens-Corning
2. Air Transmission Systems Plastiweave FX

B. **Air Inlets and Outlets**: Inlets and outlets shall be manufactured by one of the following (or equal):

1. Titus
2. Agitair
3. Krueger

C. **Weather Louvers**: Louvers shall be manufactured by one of the following (or equal):

1. Krueger
2. Airolite

D. **Inspection Doors**: Doors shall be manufactured by one of the following (or equal):

1. Plexiglas
2. Lucite

E. **Acoustic Louvers**: Acoustic louvers of the model indicated shall be manufactured by one of the following (or equal):

1. Koppers (Model LP)
2. Industrial Acoustics Co.

F. **Fire Dampers**: Dampers shall be manufactured by one of the following (or equal):

1. Pacific Air Products Co.
2. Air Balance

G. **Air Extractors**: Extractors shall be manufactured by one of the following (or equal):

1. Carnes
2. Tuttle and Bailey

PART 3 -- EXECUTION

3.1 INSTALLATION

A. **General**: Products shall be installed in accordance with the manufacturer's written installation instructions.

3.2 DUCTWORK FABRICATION

A. Low pressure ductwork shall be fabricated as follows:

1. Ductwork shall be fabricated and supported in accordance with SMACNA Low Pressure Duct Construction and ASHRAE handbooks, except as otherwise indicated and shall include duct material, gauges, reinforcing, and sealing for operating pressures indicated.

2. Round ducts installed in place of rectangular ducts shall be sized in accordance with ASHRAE table of equivalent rectangular and round ducts.

3. T's, bends and elbows shall be constructed with radius of not less than 1-1/2 times width of duct on centerline; where not possible and where rectangular elbows are used, [air foil] turning vanes shall be installed; where acoustical lining is indicated, turning vanes of perforated metal with glass fiber insulation shall be installed.

4. Duct sizes shall be increased gradually and shall not exceed 15 degrees divergence wherever possible; convergence upstream of equipment shall not exceed [30] [ ] degrees; convergence downstream shall not exceed [45] [30] degrees.

5. Easements shall be provided where low pressure ductwork conflicts with piping and structure; where easements exceed 10 percent duct area, duct shall be split into two ducts maintaining original duct area.

6. Flexible ducts shall be connected to metal ducts with [adhesive only,] [liquid adhesive plus tape.] [draw bands.] [adhesive plus sheet metal screws.]

7. Crimp joints shall be used with or without beads for joining round duct sizes [8] [ ] inch and smaller with crimp in direction of air flow.

8. Double nuts and lock washers shall be used on threaded rod supports.

9. Duct systems shall be cleaned by forcing air at high velocity through duct to remove accumulated dust.

3.3 FABRICATION OF CASINGS

A. Casings shall be fabricated as follows:

1. Casings shall be fabricated in accordance with SMACNA Low Pressure Duct Construction Standards and shall be constructed for operating pressures indicated.

2. Floor mounted casings shall be mounted on [4] [ ] inch high concrete curbs; panels shall be riveted on 8-inch centers to angles; where floors are acoustically insulated, liner of 18 gauge galvanized expanded metal mesh shall be supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.

3. Door frames shall be reinforced with steel angles tied to horizontal and vertical plenum supporting angles; install hinged access doors shall be installed where indicated or required for access to equipment for cleaning and inspection.

4. Acoustic casings shall be fabricated with reinforcing turned inward. Provide 16 gauge back facing and 22 gauge perforated front facing with 3/32 inch diameter holes on 5/32-inch centers. Panels 3 inches thick shall be packed with 4.5 lb/cu ft minimum glass fiber media, on inverted channels of 16 gauge.

3.4 FIBROUS GLASS DUCTS

A. Fibrous glass ducts shall be fabricated as follows:

1. Ducts shall be fabricated and installed in accordance with SMACNA Fibrous Glass Duct Construction Standards.

2. Fibrous glass ducts and fittings shall be machine fabricated and only minor on-site manual adjustments are permitted.

3. Duct joints shall be stapled and taped with [3-inch wide 2 mil thick or 2-inch wide 3 il thick aluminum pressure sensitive tape, UL approved.] [2-inch wide pressure sensitive tape, UL approved.] [3-inch wide heat activated chemical bonding tape.]

4. Fibrous glass ducts shall not be used within 12 inches of electric or fuel fired heaters.

3.5 BURIED UNDERGROUND DUCTS

A. Buried underground ducts shall comply with the following:

1. Buried ducts may be [concrete encased sheet metal] [PVC jacketed sheet metal] [fiber glass reinforced plastic] [concrete] as indicated.

2. Metal ductwork shall be fabricated in accordance with SMACNA Low Pressure Duct Construction Standards, except as otherwise indicated.

3.6 HOOD EXHAUST DUCTWORK

A. Kitchen hood exhaust ductwork shall comply with the following:

1. Ductwork shall be fabricated in accordance with SMACNA Low Pressure Duct Construction Standards and NFPA 96.

2. Ductwork shall be constructed of 16 gauge carbon steel or 18 gauge stainless steel, using continuous external welded joints.

3.7 INSTALLATION OF DUCTWORK

A. Ductwork shall be installed as follows:

1. Manufacturer of fibrous glass duct shall inspect and accept fabrication and installation of glass fiber ductwork at beginning of installation.

2. Openings shall be provided in ductwork where required to accommodate thermometers and controllers and pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, insulation material shall be installed inside a metal ring.

3. Ducts shall be located with sufficient space around equipment to allow normal operating and maintenance activities.

4. Underground ducts shall be sloped to plenums or low pumpout points and shall include access doors for inspection.

5. Buried, metal ductwork without factory jacket shall be coated with one coat [and seams and joints with additional coat] of asphalt base protective coating.

6. Buried supply duct runs over [70] [ ] feet long shall be insulated with one-inch thick insulation covered with plastic vapor barrier.

7. Buried metal ductwork shall be encased in 3-inch minimum of concrete; adequate tie-down points to prevent ducts from floating during concrete placement shall be included.

8. Plenum doors shall be installed 6 to 12 inches above floor; door swings shall be arranged so that fan static pressure holds door in closed position.

9. Terminal units shall be connected to medium or high pressure ducts [directly or] with one-foot maximum length of flexible duct; flexible ducts shall not be used to change direction.

10. Diffusers shall be connected to low pressure ducts with 5 feet maximum length of flexible duct and held in place with strap or clamp.

11. Residue traps shall be installed in hood exhaust ducts at base of vertical risers with provisions for cleanout; stainless steel [or painted galvanized steel] shall be installed for ductwork exposed to view and stainless steel or galvanized steel for ducts where concealed.

12. Fibrous glass ductwork may be substituted for internally or externally insulated or uninsulated low pressure sheet metal ductwork.

13. During construction, temporary closures of metal or taped polyurethane shall be installed on open ductwork to prevent construction dust from entering ductwork system.

3.8 FILTER INSTALLATION

A. Filters shall be installed as follows:

1. To prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

2. Fan system shall not be operated until filters (temporary or permanent) are in place. Temporary filters used during construction shall be replaced.

3.9 INSTALLATION OF ACOUSTICAL PRODUCTS

A. Acoustical products shall be installed as follows:

1. Duct silencers shall be supported [independent of] [rigidly to] ductwork [with flexible duct connections, lagged with leaded vinyl sheet on inlet and outlet].

2. Ductwork shall be lagged where indicated by wrapping with insulation and covering; covering shall be air tight; covering shall not be attached rigidly to ductwork.

3. Ductwork shall be attached to acoustic louvers with flexible duct connections.

3.10 INSTALLATION OF AIR OUTLETS AND INLETS

A. Air outlets and inlets shall be installed as follows:

1. Location of outlets and inlets shall be checked and necessary adjustments shall be made in position to conform with architectural features, symmetry, and lighting arrangement.

2. Diffusers shall be connected to ductwork with air tight connection.

3. Balancing dampers shall be installed on duct take-off to diffusers and grilles.

4. Ductwork visible behind air outlets and inlets shall be painted matte black.

3.11 DUCTWORK APPLICATION

A. Except as otherwise indicated, ductwork WORK shall comply with the following:

1. Low Pressure Supply	[Steel] [Aluminum] [Fibrous Glass]
2. Buried Supply or Return	[Steel] [Concrete] [Glass Fiber Reinforced Plastic]
3. Return and Relief	[Steel] [Aluminum]
4. General Exhaust	[Steel] [Aluminum]
5. Kitchen Hood Exhaust	[Steel] [Stainless Steel]
6. Fume Hood Exhaust	[Stainless Steel] [Glass Fiber Reinforced Plastic]
7. Outside Air Intake	Steel
8. Combustion Air	Steel
9. Emergency Generation Ventilation	Steel

10. Ventilation of Corrosive Atmospheres Glass Fiber Reinforced Plastic

3.12 APPLICATION OF ACCESSORIES

A. The installation of accessories shall comply with the following:

1. Balancing dampers shall be installed at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing; splitter dampers shall be installed only where indicated.

2. Fire dampers shall be installed at locations indicated, where ducts and outlets pass through fire rated components [, and where required by authorities]. Dampers shall be installed with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

3. Re-setting of fire dampers shall be demonstrated to authorities having jurisdiction and [OWNER] [and] [CONSTRUCTION MANAGER].

4. Backdraft dampers shall be installed on exhaust fans or exhaust ducts nearest to outside and where indicated.

4. Flexible connections shall be installed immediately adjacent to equipment in ducts associated with fans and motorized equipment.

5. Duct access doors shall be installed for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated; doors shall be minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

6. Duct test holes shall be installed where indicated and required for testing and balancing purposes.

3.13 APPLICATION OF ACOUSTIC PRODUCTS

[A. Acoustical products shall be installed where indicated and in the following locations:

[1. centrifuge bays]
[2. mechanical equipment rooms]
[3. where air compressors with air-driven diaphragm pumps are indicated]
[4. [ ]]

[3.14 MANUFACTURER'S FIELD SERVICES

A. The WORK of this Section includes the following:

1. Services of [AABC] [NEBB] testing agency to take noise measurement with meters meeting requirements of ASA 47 (ANSI S1.4).

2. After startup, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations indicated.

3. One-third octave band measurements of artificial sound sources in areas indicated as having critical requirements.

4. Submittal of complete report of test results including sound curves.]

3.15 SCHEDULES

A. Filters shall comply with the requirements indicated on the attached Air Filter Schedules.

B. Acoustical devices shall comply with the requirements indicated on the attached Acoustical Silencing Schedule.

** END OF SECTION **

AIR FILTER SCHEDULE

	AF-1	AF-2	AF-3	AF-4
Drawing Reference Location				
Type				
Number				
Size				
Air Flow CFM				
Face Velocity, FPM				
Overall Height, inches				
Overall Width, inches				
Initial Resistance, inch wg				
Final Resistance, inch wg				

ACOUSTIC SILENCING SCHEDULE

	AF-3	AF-4
Drawing Reference		
Location		
System		
Duct Location		
Width or inside dia., inch		
Depth or outside dia., inch		
Length, inch		
Total air flow, CFM		
Face velocity, FPM		
Air pressure drop, inch wg		
Dynamic insertion loss (dB)-		
2nd Octave		
3rd Octave		
4th Octave		
5th Octave		
6th Octave		
7th Octave		
8th Octave		