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NAVFAC IGS-15810 (OCTOBER 2002)  
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Preparing Activity: LANTNAVFACENGCOM Based on UFGS-15810N

ITALIAN GUIDE SPECIFICATIONS

Use for ITALIAN projects only

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SECTION 15810

DUCTWORK AND DUCTWORK ACCESSORIES

10/02

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NOTE: This guide specification is issued by the Atlantic Division, Naval Facilities Engineering Command for regional use in Italy.

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NOTE: This guide specification covers requirements for ductwork and ductwork accessories including diffusers, registers, grilles, louvers, dampers, and louvered penthouses. It does not include air distribution and handling equipment, such as air curtains, air handlers, fans, fan-coil room units, induction units, variable-air-volume terminal units, power roof ventilators, gravity ventilators, and unit ventilators. It does not cover industrial ductwork such as dust collection systems. It does not cover and should not be used for local exhaust ventilation systems. Local exhaust systems are appropriate for the containment/removal of containments encountered in hazardous work place atmospheres. Consult Section 11501, "Industrial Ventilation and Exhaust Systems (Ducts and Fans)," for guidance regarding local exhaust system.

Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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cooling systems for buildings

- UNI 10381-1 (1996) Air conditioning plants - Ducts - Classification, design, dimensioning and installation
- UNI 10381-2 (1996) Air conditioning - Duct components - Classification, dimensions and constructive characteristics
- UNI 10522 (1996) Mineralwool products for thermal and acoustical insulation - Fibres, felts, resin bonded slabs and pipe coverings - Determination of volatile matters content

ITALIAN/EUROPEAN HARMONIZATION STANDARDS (UNI EN)(UNI ENV)(CEI EN)  
(UNI EN ISO)(UNI ISO)

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**NOTE: A UNI EN, UNI ENV, CEI EN, UNI EN ISO or UNI ISO is a European Standard with a coincident Italian National Standard or International Standard. The two standards are identical, with most (but not all) EN's available in the English language and the UNI available only in the Italian language.**

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- UNI ISO 1182 (1995) Fire tests - Building materials - Non- combustibility test
- UNI EN 1363-1 (2001) Fire resistance tests - Part 1: General requirements
- UNI EN 1366-2 (2001) Fire resistance tests for service installations - Part 2: Fire dampers
- UNI EN ISO 1461 (1999) Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
- UNI EN 1505 (2000) Ventilation for buildings - Sheet metal air ducts and fittings with rectangular cross section - Dimensions
- UNI EN 1506 (2000) Ventilation for buildings - Sheet metal air ducts and fittings with circular cross-section - Dimensions
- UNI EN 1652 (1999) Copper and copper alloys - Plate, sheet, strip and circles for general purposes
- UNI EN 2070-2 (1990) Aerospace series - Aluminium and

aluminium alloy wrought products -  
Technical specification Part 2: Sheet,  
strip, formed profiles and plate

## 1.2 RELATED REQUIREMENTS

Section 15050, "Basic Mechanical Materials and Methods," applies to this section with the additions and modifications specified herein.

## 1.3 PRESSURE CLASSIFICATION

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NOTE: In the contract drawings, the designer must identify the portion of each duct system to be constructed for a particular pressure classification or the entire system to be assigned a pressure classification. Where no designations are provided, the 250 Pa gage is the basis of compliance, except variable air volume (VAV) ducts upstream of VAV boxes has a 500 Pa gage basis of compliance.

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UNI 10381-2, and as indicated.

## 1.4 SUBMITTALS

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NOTE: Where a "G" in submittal tags follows a submittal item, it indicates Government approval for that item. Add "G" in submittal tags following any added or existing submittal items deemed sufficiently critical, complex, or aesthetically significant to merit approval by the Government. Submittal items not designated with a "G" will be approved by the QC organization.

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Submit the following in accordance with Section 01330, "Submittal Procedures

### SD-02 Shop Drawings

Locations of test holes; G

Duct hangers and supports details; G

Seismic protection components; G

Ductwork; G

Submit dimensioned layout and fabrication drawings of ductwork showing both the accurately scaled ductwork and its relation to space enclosure. Illustration shall be drawn at a minimum scale of 1:50. Drawings shall indicate actual plan dimensions and elevations noted to bottom and top of ductwork. Provide

illustrations of each mechanical equipment room, drawn at a minimum scale of 1:50, including sections as necessary to clarify ductwork installation. Submit drawings on sheets that match the size of the contract documents. Drawings shall conform to standards drafting industry procedures. Drawings shall include contractor's name and plan title in title block.

#### SD-03 Product Data

Diffusers, registers, and grilles; G

For diffusers, registers, and grilles, submit with the product data, a schedule of inlets and outlets indicating location, catalog model number, manufacturer, dimensional information, sound pressure level rating, nominal rated volumetric flow rate liter per second (L/s), neck or face velocity at specified L/s, pressure drop at specified L/s, throw and drop for outlets, range for diffusers, and maximum and minimum L/s modulation.

Dampers; G

Submit product data or manufacturer's written certification that dampers conform to UNI EN 1363-1 and UNI EN 1366-2

Sound attenuators; G

Submit product data or prototype test data from an independent acoustical testing laboratory, listing sound noise reduction characteristics, static pressure drop, air flow velocity capacity, and insertion loss data.

Acoustical duct lining

Flexible ducts and connectors

Insulation and vapor barrier

Duct-liner adhesives

Louvers

Louvered penthouse

Louvered penthouse product data or manufacturer's written verification shall substantiate that a prototype of the entire assembly has been factory tested to withstand a 200 kilometer per hour wind force.

Bird screens

Troffers; G

Test holes

Sound-attenuator ducts; G

Submit product data or prototype test data from an independent acoustical testing laboratory, listing sound noise reduction characteristics, static pressure drop, air flow velocity capacity, and insertion loss data.

Sealing Materials

Fire-stopping Materials; G

Seismic Protection Components; G

SD-07 Certificates

Fire dampers

Automatic smoke dampers

SD-10 Operation and Maintenance Data

Submit in accordance with Section 01781N, "Operation and Maintenance Data."

Dampers, Data Package 1; G

Fire dampers, Data Package 1; G

Automatic smoke dampers, Data Package 1; G

1.5 QUALITY ASSURANCE

1.5.1 Modification of References

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**NOTE: No negative pressure construction for 1000, 1500, or 2500 Pa gage is provided herein.**  
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ASAPIA TG: The recommendations in this reference shall be considered as mandatory requirements. Substitute the word "shall" for the word "should" in these manuals.

PART 2 PRODUCTS

2.1 SOURCE MANUFACTURERS

2.1.1 Metal Ducts

The following manufacturers provide metal duct components that generally comply with these specifications:

ALP srl

Via Vezze, 62/68  
24050 Calcinante (BG)  
Tel 035/4423600  
Fax: 035/4423601  
www.alp.it

P3 s.r.l.  
voa Dpm G/ Cprtese. 5  
35010 Ronchi di Villafrance (PD)  
Tel: 049/9070301  
Fax: 049/9070302  
www.p3italy.it

TERMO VENTILAZIONE BRESCIANA S.r.l.  
Via Don Maestrini, 99  
25020 Flero (BS)  
Tel: 030/2640651/2  
Fax: 030/2641060  
E-Mail: info@tvb.it  
Web: www.tvb.it

#### 2.1.2 Sound Attenuators

The following manufacturers provide duct sound attenuators that generally comply with these specifications:

FCR S.p.A.  
Via Enrico Fermi, 3  
20092 Cinisello Balsamo (MI) Italy  
Tel: 02/617981  
Fax: 02/66013329  
e-mail: fcr@fcr.it

TROX ITALIANA S.p.A.  
Via Piemonte 23D/C  
20098 San Giuliano Milanese (MI)  
Tel: 02/9829741  
Fax: 02/98297460  
Web: www.troxitaliana.it

#### 2.1.3 Flexible Ducts

The following manufacturers provide flexible duct components that generally comply with these specifications:

FCR S.p.A.  
Via Enrico Fermi, 3  
20092 Cinisello Balsamo (MI) Italy  
Tel: 02/617981  
Fax: 02/66013329  
e-mail: fcr@fcr.it

TERMO VENTILAZIONE BRESCIANA S.r.l.  
Via Don Maestrini, 99

25020 Flero (BS)  
Tel: 030/2640651/2  
Fax: 030/2641060  
E-Mail: info@tvb.it  
Web: www.tvb.it

#### 2.1.4 Diffusers, Registers, and Grilles

The following manufacturers provide diffusers, registers, and grilles for ductwork systems that generally comply with these specifications:

CLIMAprouduct S.r.l.  
Via S. Giuseppe, 16  
20041 Agrate Brianza (MI)  
Tel: 039/6056431  
Fax: 039/653832

FCR S.p.A.  
Via E. Fermi, 3  
20092 Cinisello Balsamo (MI)  
Tel: 02/617981  
Fax: 02/61798300  
Web: www.fcr.it

TROX ITALIANA S.p.A.  
Via Piemonte 23D/C  
20098 San Giuliano Milanese (MI)  
Tel: 02/9829741  
Fax: 02/98297460  
Web: www.troxitaliana.it

#### 2.1.5 Access Doors

The following manufacturers provide ductwork access doors that generally comply with these specifications:

EURO REGISTER ITALIA S.p.A.  
Viale delle Industrie, 10/15  
20020 Arese (MI)  
Tel: 02/9377071  
Fax: 02/93589305

TROX ITALIANA S.p.A.  
Via Piemonte 23D/C  
20098 San Giuliano Milanese (MI)  
Tel: 02/9829741  
Fax: 02/98297460  
Web: www.troxitaliana.it

CLIMA PRODUCT S.p.A.  
Via delle Gerole, 15  
20040 Caponago (MI)  
Tel: 02/950071  
Fax: 02/95007238

Web: [www.climaproduct.com](http://www.climaproduct.com)

#### 2.1.6 Dampers and Louvers

The following manufacturers provide dampers and louvers for ductwork systems that generally comply with these specifications:

TROX ITALIANA S.p.A.  
Via Piemonte 23D/C  
20098 San Giuliano Milanese (MI)  
Tel: 02/9829741  
Fax: 02/98297460  
Web: [www.troxitaliana.it](http://www.troxitaliana.it)

CLIMA PRODUCT S.p.A.  
Via delle Gerole, 15  
20040 Caponago (MI)  
Tel: 02/950071  
Fax: 02/95007238  
Web: [www.climaproduct.com](http://www.climaproduct.com)

#### 2.1.7 Fire Dampers

TROX ITALIANA S.p.A.  
Via Piemonte 23D/C  
20098 San Giuliano Milanese (MI)  
Tel: 02/9829741  
Fax: 02/98297460  
Web: [www.troxitaliana.it](http://www.troxitaliana.it)

#### 2.1.8 Sealing Materials

The following manufacturers provide sealing materials for mechanical ductwork systems that generally comply with these specifications:

HILTI ITALIA S.p.A.  
Via Console Flaminio, 17  
20134 Milano  
Web: [www.hilti.com](http://www.hilti.com)

CLIMA PRODUCT S.p.A.  
Via delle Gerole, 15  
20040 Caponago (MI)  
Tel: 02/950071  
Fax: 02/95007238  
Web: [www.climaproduct.com](http://www.climaproduct.com)

#### 2.1.9 Fire-Stopping Materials

The following manufacturers provide fire-stopping materials for mechanical ductwork systems that generally comply with these specifications:

HILTI ITALIA S.p.A.  
Via Console Flaminio, 17

20134 Milano  
Web: [www.hilti.com](http://www.hilti.com)

AF SYSTEMS S.r.l.  
Via Calabria, 3  
20098 San Giuliano Milanese (NMI)  
Tel: 02/98284223  
Fax: 02/9880737

#### 2.1.10 Accessory Hardware

The following manufacturers provide accessory hardware components for mechanical ductwork systems that generally comply with these specifications:

PROSYSTEM S.r.l.  
Via dell'Industria, 2  
30031 Arino di Dolo (VE)  
Tel: 041/5101622  
Fax: 041/5131351  
Web: [www.prosystemitalia.com](http://www.prosystemitalia.com)

CLIMA PRODUCT S.p.A.  
Via delle Gerole, 15  
20040 Caponago (MI)  
Tel: 02/950071  
Fax: 02/95007238  
Web: [www.climaproduct.com](http://www.climaproduct.com)

TROX ITALIANA S.p.A.  
Via Piemonte 23D/C  
20098 San Giuliano Milanese (MI)  
Tel: 02/9829741  
Fax: 02/98297460  
Web: [www.troxitaliana.it](http://www.troxitaliana.it)

### 2.2 Ductwork

#### 2.2.1 Steel Ducts

UNI EN ISO 1461 galvanized steel sheet, lock-forming quality; coating designation G90.

#### 2.2.2 Aluminum Ducts

UNI EN 2070-2, alloy 3003-H14 for aluminum sheet and alloy 6061-T6 or equivalent strength for aluminum connectors and bar stock.

#### 2.2.3 Copper Sheets

UNI EN 1652, light cold rolled temper.

#### 2.2.4 Corrosion Resisting (Stainless) Steel Sheets

UNI 3159.

2.2.5 Duct-Liner Adhesives

UNI 10381-2, fire-resistant adhesive.

2.2.6 Duct Sheet Metal Thickness

Provide standard duct thickness for all systems, except that for all kitchen hood exhaust ductwork, provide welded stainless steel ductwork. Minimum thickness for kitchen hood exhaust ductwork shall be 1.1 mm for stainless steel sheet.

2.3 DUCTS OF PRESSURE CLASSES

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**NOTE: Do not use insulation liners for ductwork at infectious areas in hospitals, such as operational suites, nurseries, pathological facilities, intensive care units, and surgical wards; use factory prefabricated sound attenuators instead. For brig facilities, fibrous glass ductwork should not be used in inmate housing area, areas accessible to inmates, nor areas with concrete, gypsum board, or plaster ceilings. Do not use fibrous glass ducts.**

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Ducts of pressure classes 1000 to 2500 Pa gage. Construct ducts of [galvanized steel] [stainless steel].

2.3.1 Construction

Duct construction, metal gages, and hangers and support reinforcements shall conform with the UNI 10381-2. Ducts shall not pulsate or vibrate when in operation. Pressure sensitive tape shall not be used as a primary sealant on ductwork. Air leakage shall be less than one percent of the system capacity. Curved elbows shall have a centerline radius not less than 1 1/2 times the width of ducts.

2.3.2 Joints

Construct joints to meet the requirements of the leakage test specified herein. Duct components shall fit so that joints are not mismatched. Do not use duct sealant and tape to compensate for mismatched connections. Longitudinal locks or seams known as "button-punch snap-lock" will not be permitted. Apply fire-resistant sealing compound to exposed male part of fittings collars so that sealer will be on inside of joint and fully protected by the metal of the duct and fitting. Apply one brush coat of sealing compound over outside of joint to at least 50 mm band width covering screw heads and joint gap. When tape is used, apply a single wrap of a duct tape over the wet sealer. Tape provided shall be as recommended by the sealer manufacturer to permit proper curing of the sealer. Dents in the male portion of the slip fitting collar will not be acceptable.

2.3.3 Fittings

Square elbows, round elbows, fittings, branch take-offs, transitions, splitters, duct volume dampers, fire dampers, flexible connections, and access doors shall conform with the UNI 10381-2.

2.3.3.1 Test Holes

Provide factory fabricated, airtight, and noncorrosive test holes with screw cap and gasket. Provide extended neck fittings to clear insulation.

2.3.3.2 Round Elbows

Provide 0.785 rad and 1.570 rad elbows of 2 piece die stamped construction for ducts 200 mm or less in diameter. For ducts over 200 mm in diameter, provide 5 mitered piece for 1.570 rad and 3 mitered piece for 0.785 rad.

2.3.4 Round and Oval Ducts

Make joints between sections of duct and fittings with mating angle rings, beaded sleeve joints or slide-on gasketed flange connections. Slide-on gasketed flange joints shall consist of two mating flange rings. The flanges shall be fabricated with an integral mastic to make them self-sealing. The flanges shall be joined to the duct with spot-welds or self-tapping screws. A neoprene gasket shall be used between the flanges. Final joining of the slide-on flange connection shall be made with four bolts for flat-oval ducts. A single-bolt closure ring shall be used to complete the round slide-on flange connection.

2.3.4.1 Round Duct Fittings Thickness

Provide round duct fittings with a wall thickness in accordance with the following table.

Fitting Body Diameter (mm)	Round Fitting Minimum Metal Thickness (mm)	
	0 to 500 (pascals)	501 to 1000 (pascals)
75 to 350	.551	.701
400 to 650	.701	.853
700 to 900	.853	1.006
950 to 1250	1.006	1.006
1300 to 1500	1.311	1.311
1550 to 2100	1.613	1.613

2.3.4.2 Oval Fitting Construction

Constructed in the same metal thicknesses as longitudinal seam oval duct. Round dimensions on oval fittings shall be constructed in accordance with the following table.

Round Diameter (mm)	Minimum Metal Thickness (mm)
75 to 900	1.006
950 to 1500	1.311
1550 to 2250	1.613

#### 2.3.4.3 Sealing

Standing seam joints shall be utilized on all fittings. All joints shall be sealed with cement. Instead of standing seam construction, joints may be solid welded or spot welded and bonded.

- a. All welded joint area on galvanized fittings shall be coated with a protective galvanizing paint after welding, inside and out to restore the anti-corrosion surface.
- b. Spot-welded fittings shall have all joints sealed with cement in accordance with paragraph "Joint Sealing of Round and Oval Ducts".

#### 2.3.4.4 Small Diameter Elbows

All round elbows in diameters of 250 mm or less shall be of die-stamped (0.785 and 1.57 rad only) or pleated (0.52, 0.785, 1.05 and 1.57 rad only) construction except where space restrictions require a mitered elbow.

#### 2.3.4.5 Large Diameter Elbows

All round 1.57 rad elbows in diameters of 225 mm through 350 mm and all round 0.52, 0.785 and 1.05 rad elbows in diameters of 225 through 400 mm shall be of gored or pleated construction except where space restrictions require a mitered elbow. All round 1.57 rad elbows in diameters greater than 350 mm and all round 0.52, 0.785 and 1.05 rad elbows in diameters greater than 400 mm, and all oval elbows shall be of gored construction except where space restrictions require a mitered elbow.

#### 2.3.4.6 Die-stamped Elbows

Die-stamped elbows shall be 1.0 mm and may be used in diameters through 250 mm and for all pressures. They shall be of two-piece, solid-welded construction.

#### 2.3.4.7 Gored Elbows

Gored elbows shall be constructed in accordance with paragraph "Round and Oval Fittings".

#### 2.3.4.8 Pleated Elbows

Pleated elbows shall be 0.551 mm thick galvanized steel and may be used in diameters through 400 mm.

#### 2.3.4.9 Mitered Elbows

Mitered elbows shall be used only where space restrictions do not permit the use of 1.5 bend radius elbows. Mitered elbows shall always be supplied with single-thickness turning vanes. Oval mitered elbows shall be solid welded and constructed in accordance with "Oval Fitting Construction". Round mitered elbows shall be solid welded.

2.3.4.10 Diverging Flow Fittings

Diverging flow fittings shall be constructed with a radius entrance to all branch taps and with no excess material projecting from the body into the branch tap entrance.

2.3.4.11 Entrances

All takeoff or branch entrances shall be by means of factory-fabricated fittings or factory-fabricated duct/lap assemblies.

2.3.5 Round Ducts

All supply duct shall be of round spiral lock seam construction.

2.3.5.1 Duct Metal Thickness

Steel round duct shall be of standard spiral construction and shall be provided in accordance with the following table:

Standard Spiral Duct Minimum Metal Thickness (mm)			
Duct Diameter (mm)	0 to 500 (pascals)	501 to 1000 (pascals)	
75 to 200	0.475	0.551	
225 to 350	0.475	0.551	
375 to 650	0.551	0.701	
675 to 900	0.701	0.853	
925 to 1050	0.853	1.006	
1100 to 1250	0.853	1.006	
1300 to 1500	1.006	1.311	

2.3.5.2 Single-Rib Spiral Duct

The use of single-rib spiral duct is not acceptable.

2.3.6 Oval Duct

Where space limitations prevent the use of round duct, or where indicated on drawings, supply duct shall be of oval construction.

2.3.6.1 Duct Metal Thickness

Oval duct shall be of standard spiral construction, according to the metal thicknesses in the following table.

Major Axis Dimension (mm)	Standard Metal Thickness (mm)
0 to 600	0.701
650 to 900	0.853
950 to 1200	0.853
1250 to 1500	1.006
1550 to 1750	1.006
1800 and greater	1.311

#### 2.3.6.2 Reinforcement

Flat oval duct shall be reinforced based on its flat span dimension and maximum operating pressure. Reinforcement requirements shall be in accordance with duct manufacturer instructions and UNI 10381-2.

#### 2.3.7 Joint Sealing of Round and Flat Oval Ductwork

##### 2.3.7.1 Round Supply Joint Construction (Diameters less than 900 mm)

All round supply system sections in diameters of less than 900 mm shall be provided with slip couplings.

- a. All fitting ends shall be sized to slip inside mating duct sections. They shall provide a tight fit and have a minimum 50 mm insertion length with a stop bead. No additional coupling shall be required for duct-to-fitting joints.
- b. Duct-to-duct joints shall be by means of a slip coupling that fits inside both mating duct sections (fitting size). Couplings shall provide a tight fit and have a minimum 50 mm insertion length with a stop bead.
- c. Fitting-to-fitting joints shall be by means of a slip coupling that slips over both mating fitting ends (duct size). Couplings shall provide a tight fit and have a minimum 50 mm overlap length.

##### 2.3.7.2 Round Supply Joint Construction (diameters 900 mm and greater)

All round supply system sections with diameters greater than 900 mm shall be provided with flanged joints.

- a. Welded flanges shall be solid welded or tack welded and bonded with a cement for a tight joint sealing. The finished flange assembly must be able to withstand maximum design pressure with no leakage.
- b. Roll formed flanges on duct and fittings shall be tack welded and include an integral mastic sealant.

#### 2.3.7.3 Oval Supply Joint Construction

All flat oval supply system sections shall be provided with connectors of a type determined by the need for reinforcement.

- a. When no reinforcement is required, all flat oval sections with a major axis dimension less than 1000 mm may be joined with slip couplings (in accordance with "Round Supply Duct Construction (diameters less than 900 mm)").
- b. When no reinforcement is required, all flat oval sections with a major axis dimension equal to or greater than 1000 mm shall be provided with slip channel couplings or flanged joints, meeting the requirements of paragraph "Round Supply Duct Construction (diameters 900 mm and greater)".
- c. When reinforcement is required, all flat oval sections shall be joined in compliance with requirements specified in paragraph "Round Supply Duct Construction (diameters 900 mm and greater)". Flanged connections shall be sized such that they will also satisfy the requirement for reinforcement at the joint location.
- d. Slip-channel couplings shall be a combined slip joint, trapeze hanger, and channel reinforcement. When properly selected for duct size and operating pressure, these couplings are acceptable for all flat oval duct joining applications.

#### 2.3.8 Rectangular Ducts

Make joints between sections of duct and between ducts and fittings with mating angle flange joints, other joints recommended in UNI 10381-2, or slide-on gasketed flange connections. Reinforce at the joints and between the joints as recommended by A.S.A.P.I.A. The slide-on gasketed flange connections shall consist of two mating flange frames. The frames shall be made up from four pieces of straight roll formed flange and four corner pieces. The flange shall be fabricated with an integral mastic to make them self sealing. The corner pieces shall be made with a downset to allow the corner of the duct to protrude past the corner piece. The frame shall be joined to the duct wall with spot welds or self-tapping screws. A butyl gasket shall be used between the flanges. Gasket must pass UNI ISO 1182 and shall not contain vegetable oils, fish oils or any other type vehicle that will support fungal and/or bacterial growth associated with dark areas of ductwork. The connection shall be completed using drive-on corner clips and snap-on cleat. Cleat spacing and fastener spacing shall be as dictated by the manufacturer. Where joint systems recognized by SMACNA as propriety are utilized, follow the manufacturer's construction and installation guidelines.

#### 2.3.9 Sound Attenuators (Traps)

Provide factory fabricated attenuators that will reduce the rated sound pressure level of the fan down to at least 65 decibels in the 250 Hz (3rd octave band) center frequency by using a reference sound source calibrated in decibels of sound power at 10-12 watts. Maximum permissible pressure

drop shall not exceed 160 Pa. Attenuators to be constructed air-tight when operating under an internal pressure of 2500 Pa. The air-side surface shall be capable of withstanding air velocity of 50 meters per second. When attenuators are submitted for approval, provide manufacturer's certification of the sound reduction values. Sound absorbing material shall conform with UNI 5958 and UNI 10522. Provide suitable duct-transition sections for connection to ductwork.

2.3.9.1 Net Noise Reduction Values

Conform with the following:

Minimum Net Noise Reduction Values,  
Sound Pressure Level dB  
(Reference Sound Power at 10-12 Watts)

Octave Pass Band	2	3	4	5	6	7
Center-Frequency (Hz)	125	250	500	1000	2000	4000
Noise Reduction (dB)	11	16	19	30	40	32

2.3.9.2 Factory-Fabricated Sound Attenuators (Traps)

Provide sound attenuators constructed of galvanized sheet steel casing and sound absorbing material covered with an internal perforated zinc-coated metal liner. Sound absorbing materials shall be faced with glass fiber cloth and hold in compression to prevent settling. The internal perforated metal liner shall be not less than 0.6 mm, with perforations not larger than 4 mm in diameter providing a net open area not less than 22 percent of the surface. Attenuators shall be insulated to prevent sweating. Attenuators shall be acoustically tested with metal duct inlet and outlet sections while under the rated air flow conditions. Noise reduction data shall include effects of flanking paths and vibration transmission.

2.3.9.3 Factory-Fabricated Sound-Attenuator Ducts

Sound-attenuator ducts may be provided in lieu of sound attenuators (traps). Comply with requirements specified herein for sound attenuators. Construct each double-walled duct and fitting of an outer zinc-coated metal pressure shell with 25 mm thick acoustical blanket insulation and an internal perforated zinc-coated metal liner. Install sufficient length of run to obtain the noise reduction value specified. Furnish certification from manufacturer stating that the sound reduction value specified will be obtained within the length of duct run provided. The internal perforated zinc-coated metal liner shall be not less than 0.6 mm, unless ribbed, then not less than 0.4 mm for the duct liner and not less than 0.45 mm for the fitting liner with perforations not larger than 2.40 mm diameter. Seal joints as specified in paragraph entitled "Round and Oval Ducts." [Rigid molded fiber-glass inserts with the air side surface [PVC] [neoprene]-coated, when complying with requirements specified herein, may be used in lieu of internal perforated zinc-coated metal liner.]

2.3.10 Safety Relief Valve

Provide negative pressure safety relief valve indicated. Valve shall be

the standard product of duct and fitting manufacturer.

#### 2.3.11 Air Valves

Provide [manual] [or] [normally open, automatic] air valves for pressure reducing or volume control on single duct systems. [Provide manufacturer's standard linkage and motor mounted platform to accommodate pneumatic actuators.] Construct valves of corrosion-resistant materials. Frame, links, and levers may be of zinc-coated steel. Vanes, pivots, hinges or knuckle joints may be of aluminum or other non-ferrous metal. Valves shall close with maximum leakage of 0.15 or 0.26 meter per second average velocity over the valve face area at 250 or 750 Pa corresponding static pressure on high pressure side of the valve.

#### 2.4 DUCTS OF PRESSURE CLASSES 750 Pa GAGE OR LESS

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**NOTE: Do not use insulation liners for ductwork at infectious areas in hospitals, such as operational suites, nurseries, pathological facilities, intensive care units, and surgical wards; use factory prefabricated sound attenuators instead. For brig facilities, fibrous glass ductwork should not be used in inmate housing area, areas accessible to inmates, nor areas with concrete, gypsum board, or plaster ceilings. Do not use fibrous glass ducts.**  
\*\*\*\*\*

Construction, metal thickness, hangers and supports, and reinforcements shall conform with UNI 10381-2, except that ducts with pressure classifications below 500 Pa gage that are located outside of the conditioned space shall have a seal of the class type in accordance with manufacturers recommendation. Ductwork shall be airtight and shall not vibrate or pulsate when system is in operation. Pressure sensitive tape shall not be used as a primary sealant on ductwork with pressure classifications above 250 Pa gage. Air leakage shall be less than 5 percent of the system capacity. Construct ductwork of [galvanized steel] [or] [aluminum].

##### 2.4.1 Curved Elbows

Make a centerline radius not less than 1 1/2 times the width or diameter of the duct.

##### 2.4.2 Laps

Make laps at joints in the direction of air flow. Space button-punch or bolt-connection in standing seams at fixed centers not greater than 150 mm. Longitudinal locks or seams, known as "button-punch snap-lock," may be used in lieu of Pittsburgh Lock [, but will not be permitted on aluminum ducts].

##### 2.4.3 Fittings

Elbows, vaned elbows, take-offs, branch connections, transitions, splitters, volume dampers, fire dampers, flexible connections, and access doors shall conform with UNI 10381-2. Provide factory fabricated airtight, and noncorrosive test holes with screw cap and gasket.

2.4.4 Round Duct

Round ducts downstream from air terminal boxes and in exhaust systems shall be low pressure ducts.

2.4.5 Acoustical Attenuator Systems

2.4.5.1 Acoustical Duct Lining

\*\*\*\*\*  
**NOTE: When internal lining is shown, the designer shall size sheetmetal ductwork on the drawings to compensate for the lining thickness.**  
\*\*\*\*\*

Flexible or rigid mineral fiber lining conforming to UNI 5958 and UNI 10522. Lining shall not be less than 25 mm thick.

2.4.5.2 Net Noise Reduction Values

Conform with the following:

Minimum Net Noise Reduction Values,  
Sound Pressure Level dB  
(Reference Sound Power at 10-12 Watts)

Octave Pass Band	2	3	4	5	6	7
Center-Frequency (Hz)	125	250	500	1000	2000	4000
Noise Reduction (dB)	11	16	19	30	40	32

2.4.5.3 Preformed Duct Liner

Preformed round duct liner designed for insertion in round ducts may be used in the sizes commercially available. Provide duct liner sections with slip-lap joints not less than 50 mm wide. Make joints in accordance with manufacturer's printed instructions. Furnish fire-resistant adhesive to field-coated joints when recommended by the manufacturer to prevent delamination or erosion at joints. Tubular sections of duct liner shall fit the metal duct snugly and without gaps between duct-liner sections.

2.4.5.4 Factory-Fabricated Sound-Attenuator Ducts

Sound-attenuator ducts may be provided in lieu of sound attenuators. Comply with requirements specified herein for sound attenuators. Provide double-walled duct and fitting of an outer zinc-coated metal pressure shell with 25 mm thick acoustical blanket insulation and an internal perforated zinc-coated metal liner. Install sufficient length of run to obtain the noise reduction value specified. Furnish certification from manufacturer that the sound reduction values specified will be obtained within the

length of duct run provided. The internal perforated zinc-coated metal-liner shall be not less than 0.6 mm thickness, unless ribbed, then not less than 28 gage for the duct liner and not less than 0.45 mm thickness for the fitting liner with perforations not larger than 2.40 mm diameter. Seal joints as specified in paragraph entitled "Round and Oval Ducts." [Rigid molded fiber-glass inserts with the air side surface [PVC] [neoprene]-coated, if complying with all requirements specified herein, may be used in lieu of internal perforated zinc-coated metal liner.]

#### 2.4.5.5 Sound Attenuators (Traps)

Provide factory-fabricated attenuators constructed of galvanized steel sheets. Outer casing shall be not less than 0.7 mm thickness. Acoustical fills shall be mineral fiber conforming to UNI 5958 and UNI 10522. Air flow capacities shall be as indicated. Pressure drops through attenuators shall not exceed values indicated, or shall be not in excess of 15 percent of the total external static pressure of the air handling system, whichever is less. Acoustically test sound attenuators with metal duct inlet and outlet sections while under rated air flow conditions. Noise reduction data shall include effects of flanking paths and vibration transmission. Attenuators shall be airtight when operating at internal static pressure not less than 500 Pa gage. Conform with noise reduction requirements specified in paragraph entitled "Net Noise Reduction Values."

### 2.5 FLEXIBLE DUCTS AND CONNECTORS

\*\*\*\*\*  
**NOTE: Care should be taken not to locate flexible ductwork in prisoner housing areas, areas accessible to prisoners, or areas with concrete, gypsum board or plaster ceilings.**  
\*\*\*\*\*

UNI EN 1505 and UNI EN 1506, UNI 10381-2, and additional requirements herein specified. Provide to connect between rigid ducts and outlets or terminals. There shall be no erosion, delamination, loose fibers, or odors from the ducts into the air stream. At 120 degrees C, minimum rating pressures shall be [1500 Pa positive and 125 Pa negative, up to 20 meters per second] [\_\_\_\_\_] [and] [500 Pa positive and 125 Pa negative, up to 13 meters per second] [\_\_\_\_\_]. Flexible ducts shall be maximum [1] [2] [2 1/2] meters [4] [6] [8] feet in length. Minimum bend radius shall be twice the duct diameter.

#### 2.5.1 Materials

Interlocking spiral or helically corrugated type constructed of [zinc-coated steel,] [corrosion-resistant steel], [aluminum,] [or] [noncollapsible fire-retardant, chloroprene or chlorosulphonated polyethylene impregnated, minimum one kilogram per square meter] woven mineral fabric.

#### 2.5.2 Insulation and Vapor Barrier

UNI 10376, minimum 25 mm nominal thickness and 12 kilogram per cubic meter

density. Sheathe insulation with a vapor barrier having a maximum water vapor permeance of 0.20 perm in accordance with UNI 5813. Coat ends of insulation with cement to prevent erosion and delamination.

### 2.5.3 Joints

Make airtight slip joints, seal with pressure-sensitive vapor-seal adhesive tape or duct sealer, and secure with sheet metal screws. To prevent insulation compression, place 50 mm wide by 25 mm thick closed cell foam plastic spacers over joints under vapor barriers. To provide a vaportight joint, provide a [zinc-coated steel] [corrosion-resistant steel] [or] [aluminum] clamp over such spacers.

### 2.6 CASINGS AND PLENUMS

Factory fabricated components with field installation.

### 2.7 DIFFUSERS, REGISTERS, AND GRILLES

#### 2.7.1 Material and Finishes

Provide factory-furnished diffusers, registers, and grilles constructed of [steel] [or] [aluminum]. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. [Steel parts shall be factory zinc phosphate treated prior to priming and painting or have a baked-on enamel finish.] Colors shall be selected or approved by Contracting Officer. [For ductwork of pressure classes 1000 to 2500 Pa, provide sponge-rubber gasket between flanges and wall or ceiling.]

#### 2.7.2 Sound Pressure Level

\*\*\*\*\*

**NOTE:** The designer must observe that the standard 10 dB attenuation of sound power level takes into consideration the various types of room effects and ceiling transmission losses of the design place. See details in ASHRAE "Handbook of Fundamentals." Recommended permissible room sound pressure levels are as follows:

NC Range, dB	Typical Application
20-25	Church Sanctuary, Concert and Opera Halls, Sound Reproduction Studios, Private Home
25-30	Legitimate Theaters, Board Rooms, Conference Rooms
30-35	Private Office, Ball-Rooms, Banquet Rooms, Hospital Rooms,

NC Range, dB	Typical Application
	Movie Theaters, School Classrooms, Libraries, Lecture Hall
30-35	Prisoner Housing/Brig
35-40	Public Libraries, Building Lobbies, School Laboratories, Restaurants, General Offices, Gymnasium
40-45	Halls and Corridors, Cafeterias, Retail Store
40-60	Computer Room
45-50	Supermarkets and Department Stores (Main Floor), Restaurant Kitchens, Commissary
45-75	Manufacturing Area, Light
55-75	Manufacturing Area, Heavy

\*\*\*\*\*

Manufacturer certified sound pressure level rating of inlets and outlets. Conform with the following permissible room sound pressure levels:

NC Range, dB	Typical Application
[_____]	[_____]

2.7.3 Throw

The distance from the diffuser, register, or grille to the point which the air velocity falls below [0.25] [0.50] [0.64] [1.00] meter per second shall not exceed [1.5] [\_\_\_\_\_] times the outlet mounting height.

2.7.4 Drop

Maximum drop of air stream shall not be within [1.50] [1.83] meters [\_\_\_\_\_] of the floor at the end of the throw.

2.7.5 Ceiling Diffusers

Equip with baffles or other devices required to provide proper air distribution pattern [as indicated]. Provide factory-fabricated, single

key, volume dampers. Except for linear diffusers, internal parts shall be removable through the diffuser neck for access to the duct and without the use of special tools. Provide frames for lay-in (acoustical tile) or gypsum board (hard) ceilings as indicated. Coordinate frames with reflective ceiling plans.

#### 2.7.5.1 Circular, Square, and Rectangular Diffusers

Construct each ceiling diffuser of four or more concentric elements designed to deliver air in a generally horizontal direction without excess smudging of the ceiling. Interior elements of square and rectangular ceiling diffusers may be circular, square, or rectangular as manufacturer's standard. Visual appearance shall be louver faced.

#### 2.7.5.2 Perforated Plate Diffusers

Provide adjustable [one-way,] [two-way,] [three-way,] [or] [four-way] air pattern controls as indicated. Diffuser faceplates shall not sag or deflect when operating under design conditions.

#### 2.7.5.3 Linear Diffusers

Construct of high grade extruded aluminum. Outer frame members of extruded aluminum shall be mechanically interlocked to extruded aluminum inner frame webs to produce rigid, straight, blemish free sectional lengths. Furnish concealed mounting system of hanger brackets and leveling screws. Furnish auxiliary diffuser sub-frame to suit adjacent general construction; flush plaster, gypsum board or acoustic ceiling. Surfaces exposed to view shall have a natural color anodized satin finish. Joints between diffuser sections shall appear as hairline cracks. Provide alignment slots for insertion of key strips or other concealed means to align exposed butt edges of diffusers. [Equip with plaster frames when mounted in plaster ceiling.] Do not use screws and bolts in exposed face of frames or flanges. Frames and flanges exposed below ceiling shall be metal-filled and ground smooth. Furnish separate pivoted or hinged adjustable air-volume-damper and separate air-deflection blades.

#### 2.7.6 Registers

Double-deflection supply registers. [Provide manufacturer-furnished volume dampers. Volume dampers shall be of the group-operated, opposed-blade type and key adjustable by inserting key through face of register. Operating mechanism shall not project through any part of the register face. Automatic volume control devices will be acceptable.] [Provide exhaust and return registers as specified for supply registers, except that exhaust and return registers shall have a single set of nondirectional face bars or vanes having the same appearance as the supply registers.] [Set face bars or vanes at [\_\_\_\_\_] rad.]

#### 2.7.7 Grilles

Construct and finish as specified above for registers, except that volume dampers shall be omitted.

2.8 TROFFERS

UL Classified and UL labeled. Factory-fabricated and constructed of [steel] [or] [aluminum] and accessible for adjustment without requiring the removal of troffer components or ceiling panels. Return and supply air handling sections shall be interchangeable, except that distribution plenums are not required for return sections discharging into the ceiling plenums. Appearance of return and supply troffers shall be identical when viewed from below ceiling. When returning air to the ceiling plenum, or when not connected to supply air, the troffer shall have a maximum sound transmission class rating of 40. Equip troffers with collars at least 50 mm long for connection to ductwork.

2.8.1 Air Seal

Resilient plastic self-adhering pressure sensitive seal between the diffuser and the frame of lighting fixtures.

2.8.2 Interior Dampers or Deflectors Finish

Black paint or anodized.

2.8.3 Lighting Fixture Characteristics

[As indicated] [and] [as specified in Division 16, Electrical].

2.9 DUCT SLEEVES, PREPARED OPENINGS, AND CLOSURE COLLARS

2.9.1 Duct Sleeves

\*\*\*\*\*  
**NOTE: Where sleeves are installed in the bearing walls, the designer must provide design details in drawings of the structural steel sleeves. Consult with structural engineers for the design details.**  
\*\*\*\*\*

Fabricate from minimum 1.0 mm [galvanized steel] [aluminum]. Where sleeves are installed in bearing walls, provide structural steel sleeves as indicated. Size sleeves to provide 25 mm clearance between duct and sleeve or between insulation and sleeve for insulated ducts.

2.9.2 Prepared Openings

Provide 25 mm clearance between the duct and the sleeve, or 25 mm clearance between insulation and sleeve for insulated ducts except at grilles, registers, and diffusers.

2.9.3 Packing

UNI 10376, mineral fiber.

2.9.4 Closure Collars

100 mm wide minimum, fabricated from minimum 1.0 mm [galvanized steel] [aluminum].

## 2.10 DEFLECTORS

Factory-fabricated and factory- or field-assembled units consisting of curved turning vanes [or scoop type extractors] for uniform air distribution and change of direction with minimum turbulence and pressure loss. Provide curved vanes for square elbows. [For round ducts taking off from rectangular ducts, provide factory fabricated, galvanized sheet metal, spin-in fittings. These fittings shall have scoop extractors, butterfly dampers, and locking quadrant operators.]

## 2.11 ACCESS DOORS

Door shall be rigid and airtight with neoprene gaskets and two or more [chrome-plated [with copper or nickel base]] [enamel [painted] [galvanized]] steel hinges and quick fastening locking devices. Provide doors as large as practical. Mount doors, if possible, so that air pressure holds them closed. As an alternative, removable access doors may be used. These access doors shall be constructed from stamped sheet metal and consist of an inner and outer door panel. Where insulated doors are needed, the inner door shall consist of two panels spot-welded together which totally encapsulate fiberglass insulation. The inner and outer doors shall be joined by bolts and threaded handles in such a configuration that the panels can be drawn together to secure the door to the duct in a sandwich fashion. The handles shall be high impact plastic with threaded metal inserts. Conical springs shall be used between the door panels to facilitate installation and removal of the door. Neoprene gasket shall be used around the outside edge of the inner or outer panel, but not both, to seal the door. This type of door is approved for use on rectangular, round and flat-oval ductwork.

## 2.12 DAMPERS AND LOUVERS

\*\*\*\*\*

**NOTE: The design should indicate the type of dampers to be provided on the equipment schedules. Dampers must be provided on every take-off for balancing purposes. Opposed blade dampers may be required in some instances to ensure proper air mixing, but not for all customers.**

\*\*\*\*\*

Construct dampers and louvers with galvanized sheet metal two gages heavier than ducts in which installed. Except as modified herein, the construction shall be of aluminum or galvanized steel with interlocking edges and maximum 250 mm blade width. Conform with UNI 10381-2. [Dampers shall be opposed-blade type [where indicated]. Damper blades shall be connected to the damper frame with a non-metallic anti-friction bushing. The blades shall be connected to the frame with a galvanized, zinc coated steel anti-friction bearing pin. The pin shall consist of a single or double row sealed, stainless steel, maintenance free, roller or ball bearing, lubricated for life. The bearing shall be pressed onto a steel shaft via a

knurled stud. A slotted dowel pin is then inserted thru a hole connecting the two pins.]

2.12.1 Backdraft Dampers (Gravity Dampers or Shutters)

Factory-fabricated, with statically balanced blades that open automatically when the fan starts and close by gravity when the fan stops. Provide the edges of blades with felt or rubber strips to prevent rattling.

2.12.2 Manual Volume Dampers

- a. Multiple Blade Type: Provide dampers with opposed blade configuration. Construct blades of 1.626 mm galvanized steel. Provide heavy duty molded self-lubricating nylon bearings and 12.5 mm diameter steel axles. Construct frame of 125 mm x 25 mm x 1.6 mm steel channel. Furnish with locking linkage handle assembly to secure damper in required position.
- b. Single Blade Type: Provide dampers with center pivot blade configuration. Construct blade of 1.321 mm galvanized steel. Provide nylon end bearings and 6.25 mm diameter steel axle. Construct frame of 1.626 mm galvanized steel. Furnish with locking linkage handle assembly to secure damper in required position. Notch all damper rod ends. Maximum face size: 300 mm x 300 mm. Provide nylon or brass damper rod end seals.

2.12.3 Manual Volume Dampers

Balancing, factory-fabricated type. Equip dampers with accessible mechanism such as quadrant operators or 5 mm rods brought through the side of ducts with locking setscrew and bushing. Where quadrant operators are furnished, provide chrome plated or enamel painted type with exposed edges rounded.

2.12.4 Fire Dampers

Provide in accordance with UNI 10365, UNI EN 1363-1 and UNI EN 1366-2.

2.12.5 Automatic Smoke-Fire Dampers

\*\*\*\*\*  
**NOTE: For smoke-fire dampers, use UL 555S Class III, unless the particular building and application such as hospital dictates the use of UL 555S Class II instead.**  
\*\*\*\*\*

Multiple blade type, 82 degrees C fusible fire damper link; smoke damper assembly to include pneumatically powered operator. UNI 10365, UNI EN 1363-1 and UNI EN 1366-2 rated fire damper. Pressure drop in the damper open position shall not exceed 25 Pa with average duct velocities of 13 meters per second.

2.12.6 Automatic Smoke Dampers

UL listed multiple blade type, supplied by smoke damper manufacturer, with pneumatic damper operator as part of assembly. Qualified under UNI 10365, UNI EN 1363-1 and UNI EN 1366-2. Pressure drop in the damper open position shall not exceed 25 Pa with average duct velocities of 13 meters per second.

#### 2.12.7 Dampers

\*\*\*\*\*  
**NOTE: Allow maximum 12 liters per second leakage.  
For particular building and application, such as  
hospital, 5 liter per second leakage may be allowed.**  
\*\*\*\*\*

Provide factory manufactured opposed blade adjustable manual dampers where indicated for duct heights of 305 mm 12 inches and larger. Provide factory manufactured single leaf dampers for duct heights less than 305 mm 12 inches.

Provide damper shafts with 51 mm 2 inch standoffs to clear 51 mm 2 inches of duct insulation with bearings at both ends of the shafts. Provide adjustment quadrant with indicator and locking devices. Provide galvanized steel dampers 0.15 mm thicker one gage heavier than duct in which dampers are installed. [Provide automatic dampers under Section 15901N, "Space Temperature Control Systems."] [Provide automatic dampers under Section 15910N, "Direct Digital Control Systems."]

#### 2.12.8 Louvers

[Manual] [Fixed] type. Fold or bead the edges of louver blades to exclude driving rain. [Louvers blades shall be oriented to minimize the entrainment of rainwater.] Make louver frames of [1.5 mm] [1.2 mm] [galvanized steel] [or] [aluminum]. Provide bird (insect) screen constructed of the same type metal as the louvers.

##### 2.12.8.1 Bird Screens

General industrial-use wire cloth, medium light or heavier, nominal 2 mesh 1.60 mm wire diameter, [aluminum] [or] [galvanized steel] bird screens. Provide removable insect screens of grooved type, with vinyl or neoprene spline insert for securing screen cloth.

##### 2.12.8.2 Louvered Penthouse

Low-silhouette, curb-mounted, dome-type roof [intake] [exhaust] unit equipped with waterproof top and rainproof louvers around the sides. Provide a removable roof constructed of not less than 2 mm thick [aluminum] [or] [galvanized] steel sheet insulated with 25 mm thick glass fiber with vapor barrier attached to underside of roof. Internally brace the unit with not less than 50 by 50 by 3 mm aluminum or galvanized steel angles. Provide curb tie-downs and bird screens. Provide [aluminum] [or] [stainless steel] bolts or screws in the assembly.

#### 2.13 TIE RODS

Galvanized steel, 6 mm minimum diameter for 900 mm length or less; 9.4 mm

minimum diameter for lengths longer than 900 mm.

## 2.14 SEALING MATERIALS

### 2.14.1 Joint and Seam Sealants, General

The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics.

### 2.14.2 Tape Sealing System

Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with the tape to form a hard, durable, airtight seal.

### 2.14.3 Joint and Seam Sealant

One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 70 percent solids.

### 2.14.4 Flanged Joint Mastics

One-part, acid-curing, silicone elastomeric joint sealants.

## 2.15 FIRE-STOPPING MATERIALS

### 2.15.1 Fire Resistant Sealant

Provide two-part, foamed-in-place, fire-stopping silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies.

## 2.16 DUCT HANGERS AND SUPPORTS

### 2.16.1 Building Attachments

Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 100 mm thick.

### 2.16.2 Hangers

Galvanized sheet steel, or round, uncoated steel, threaded rod.

### 2.16.3 Hangers Installed in Corrosive Atmosphere

Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.

### 2.16.4 Duct Attachments

Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.

## 2.17 ACCESSORIES

### 2.17.1 Instrument Test Holes

Provide factory fabricated, airtight, and noncorrosive test holes to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide extended neck fittings to suit duct insulation thickness.

### 2.17.2 Splitter Damper Accessories

Zinc-plated damper blade bracket, 6 mm, zinc-plated operating rod, and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

### 2.17.3 Flexible Duct Clamps

Stainless steel band with cadmium-plated hex screw to tighten band with a worm-gear action. Provide in sizes from 75 mm to 450 mm to suit duct size.

## 2.18 SEISMIC PROTECTION COMPONENTS FOR DUCTWORK

UNI 10381-1 and UNI 10381-2, as supplemented or modified by this section.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Conform to UNI 8199 and UNI 10381-2 except as supplemented and modified by this specification section. Provide mounting and supporting of ductwork and accessories including, but not limited to, structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors, and dampers. Provide electrical isolation between dissimilar metals. Electrical isolation may be fluorinated elastomers or sponge-rubber gaskets. Install ductwork accessories as indicated and as recommended by manufacturer's printed instruction. Allow clearance for inspection, repair, replacement, and service.

#### 3.1.1 Ductwork

Air distribution systems shall operate with no chatter or vibration.

##### 3.1.1.1 Louvers

Louvers in accordance with I.S.P.E.S.L. (National Institute of Occupational Safety and Prevention) instructions.

##### 3.1.1.2 Dampers

When installed on ducts to be thermally insulated, equip each damper operator with stand-off mounting brackets, bases, or adapters to provide clearance between the duct and operator not less than the thickness of insulation. Stand-off mounting items shall be integral with the operator or standard accessory of damper manufacturer.

3.1.1.3 Deflectors

Provide in square elbows, duct-mounted supply outlets, take-off or extension collars to supply outlets, and tap-in branch-off connections. Adjust supply outlets to provide air volume and distribution as [indicated or] specified.

3.1.1.4 Fire Dampers

Install in accordance with manufacturer's instructions for condition of UNI 10365 and UNI 8199. Locate as indicated and provide surface penetration sleeves in accordance with approved detail drawings.

3.1.1.5 Access Doors

\*\*\*\*\*  
**NOTE: For this paragraph to be effective, indicate on the drawings locations of all access doors in ductwork.**  
\*\*\*\*\*

Provide for automatic dampers, volume dampers, fire dampers, coils, thermostats, temperature controllers, valves, filters, humidifiers and other concealed apparatus requiring service and inspection in the duct systems.

3.1.1.6 Duct Sleeves, Prepared Openings, and Closure Collars

Provide for ductwork penetrations in floors, walls, and partitions through which ductwork passes.

- a. Duct Sleeves: Fill space between duct and sleeve or between insulation and sleeve for insulated ducts with mineral fiber, except at grilles, registers, and diffusers.
- b. Prepared Openings: Fill space between duct and opening or between insulation and opening for insulated ducts with mineral fiber, except at grilles, registers, and diffusers.
- c. Closure Collars: Fit collars snugly around ducts or insulation. Grind edges of collar smooth to preclude tearing or puncturing insulation covering or vapor barrier. Provide nails with maximum 150 mm centers on collars.

3.1.1.7 Packing

Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber.

### 3.1.2 Duct Hangers and Supports

\*\*\*\*\*  
**NOTE: The designer must provide typical seismic restraint details on drawings.**  
\*\*\*\*\*

UNI 10381-2. [Provide seismic restraint complying with UNI 9742.]

#### 3.1.2.1 Flexible Ducts

Support ducts by hangers every one meter, unless supported by ceiling construction. Stretch flexible air ducts to smooth out corrugations and long radius elbows. Maximum length permitted is two metersto make connections.

#### 3.1.2.2 Flexible Connectors

Provide flexible connectors between fans and ducts or casings and where ducts are of dissimilar metals [as indicated]. For round ducts, securely fasten flexible connectors by zinc-coated steel clinch-type draw-bands. For rectangular ducts, lock flexible connectors to metal collars.

#### 3.1.3 Inspection Plates and Test Holes

Provide, where required, in ductwork or casings for all balance measurements. If possible, test holes should be located at least 7.5 times diameters downstream from a disturbance. Extend cap through insulation.

#### 3.1.4 Acoustical Duct Lining

\*\*\*\*\*  
**NOTE: Do not use insulation liners for ductwork at infectious areas in hospitals, such as operational suites, nurseries, pathological facilities, intensive care units, and surgical wards; use factory prefabricated sound attenuators instead.**  
\*\*\*\*\*

UNI 10381-2. Apply lining in cut-to-size pieces attached to interior of ducts with fire-resistant adhesive. Top and bottom pieces shall lap the side pieces. Secure pieces together with welded pins or clips. Do not distort ducts, burn through or mar the finish surface of ducts. Pins and washers shall be flush with the surface of duct liners. Seal breaks and punctures of duct-liner coating with fire-resistant adhesive. Coat exposed edges of the liner at duct ends and other joints where lining will be subject to erosion with a heavy brush coat of fire-resistant adhesive, to prevent delamination of glass fibers.

#### 3.1.5 Flashing

[Section 07600, "Flashing and Sheet Metal."] [Provide waterproof flashing where ducts pass through exterior walls and roofs.]

### 3.1.6 Cleaning of Ducts

Remove all debris and dirt from ducts and wipe clean. Before installing air outlets, force air through entire system at maximum attainable velocity to remove accumulated dust. Provide temporary air filters to protect ductwork which may be harmed by excessive dirt. For large systems, clean duct with high power vacuum machines.

### 3.2 FIELD QUALITY CONTROL

Requirements for duct air leakage tests (DALT) specified in Section 15950, "HVAC Testing/Adjusting/Balancing". Provide support personnel and equipment as specified in Section 15950, to assist TAB team to meet the TAB work requirements.

### 3.3 IDENTIFICATION INSTALLATION REQUIREMENTS

Where identification is to be applied to surfaces which require insulation, painting or other covering of finish, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

-- End of Section --