



Exploration & Production

GENERAL SPECIFICATION

HVAC

GS EP HVA 400

Ducts and Accessories for HVAC Systems

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Contents

1. Scope	3
2. Reference documents.....	3
3. General.....	4
4. Duct systems.....	5
5. Duct design.....	5
6. Duct construction.....	5
6.1 Outdoor ductwork	6
6.2 Indoor ductwork	6
6.3 Rectangular ducts.....	6
6.4 Circular ducts (Low and High pressures).....	7
6.5 Oval ducts.....	8
6.6 Doubled case circular ducts.....	8
6.7 Flexible ducts.....	9
6.8 Fresh air intakes	9
6.9 Fire-rated ducts.....	9
6.10 Duct for fire rated wall penetration.....	9
6.11 Hood exhaust ducts	9
7. Accessories	10
7.1 Internal linings.....	10
7.2 Valves and dampers	10
7.3 Inspection panels and doors.....	11
7.4 Supports and mounting hardware.....	11
7.5 Penetrations and packing	12
7.6 Joints and mastics	13
7.7 Bolts, screws, washers, etc.	13
8. Testing	13
8.1 Test points	13
8.2 Testing requirements	13

1. Scope

This specification indicates the COMPANY general requirements for the design, fabrication, installation and testing of ducts used in the field of Heating, Ventilation and Air Conditioning systems (designated "HVAC" hereafter).

The words and expressions in capital characters are defined inside the general specification **GS EP HVA 801**.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Equipment and installations must be in accordance with (in order of precedence):

1. The country local regulations where equipment and/or installations shall be operated
2. Total General Specifications as listed in **GS EP HVA 000**
3. The International Standards
4. The French Regulation (when Country local regulation does not exist).

International System of Units (SI)

Notes:

- In case of discrepancy between documents the more stringent requirements shall apply.
- The HVAC VENDOR or CONTRACTOR may propose proven improvements to the reference documents but shall obtain written approval of the COMPANY prior to implementation.
- A International Standard is a good "engineering practice" which shall be recognised and taken into consideration by VENDOR, SUPPLIER, MANUFACTURER and/or CONTRACTOR. If required, the translation of the standards must be included into HVAC scope.
- The latest revision of Standards, codes, regulations and the published errata if any must be used and applied by VENDOR, SUPPLIER, MANUFACTURER and CONTRACTOR.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
ADC	Air Diffusion Institute (All documents concerning ducts)
AFI	American Filtering Institute (All documents concerning ducts)
AICVF Codes	Association des Ingénieurs de Chauffage, Ventilation Français All codes)
AMCA	Air Moving and Conditioning Institute (All documents concerning ducts)
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
SMACNA	Sheet Metal and Air Conditioning CONTRACTOR's National Association

Regulations

Reference	Title
Not applicable	

Codes

Statutory by law or recognised professional body approved by COMPANY.

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP HVA 000	List of HVAC specifications (all applicable)
GS EP HVA 801	Terminology, definitions, abbreviations

3. General

The Specification is exclusively sent to the HVAC Engineer of an Engineering CONTRACTOR or to the Project Engineer of a CONTRACTOR who designs an HVAC system containing ducts.

Accordingly, this Specification imposes all of the following points:

- The velocities and static pressures inside the ducts as a function of the type of system, whether low pressure (LP) or high pressure (HP)
- The principles of duct design and fabrication to be complied with
- The requirements regarding duct accessories like valves, dampers and supports
- The testing procedure.

4. Duct systems

The static pressure limit between low pressure (LP) and high pressure (HP) HVAC systems is for the air ducts 500 Pa. Below this value the ducts would be classified as LP, with internal pressure above 500 Pa and up to 2000 Pa the ducts would be classified as HP.

The maximum allowable air velocities shall be respectively as follows:

- 7 m/s for LP ducts inside main branches
- 4 m/s for LP ducts inside secondary branches
- 15 m/s for HP ducts (except in machine rooms where the maximum velocity shall be 11 m/s)
- 8 to 11 m/s for hood exhaust ducts.

5. Duct design

The duct systems shall be designed to limit pressure drops, to improve the aerodynamics, and to prevent turbulence and noise. The deformations of ducts during HVAC system operation should not induce any loss of tightness.

Main branches shall always be equipped with an initial control valve or an automatic flow rate governor of the factory-tapped type. A choke shall be used as required to control flow.

The theoretical balance of the circuits must be determined by detailed calculations and must take into account the various devices planned to avoid turbulence (like elbows with turning vanes, angle branch connections, flow straighteners, etc.).

The ducts shall not be fabricated or installed before the CONTRACTOR has obtained written agreement from the COMPANY representative on the duct configuration and the pressure loss calculations.

6. Duct construction

All ducts, for outdoor or indoor installation shall be made of steel sheets (excepted for laboratory, battery rooms, or for specific use).

Where galvanised steel sheets are used for ducts or accessories, they shall be of type "GALBEST" or "SENDZIMIR". The galvanisation, in accordance with the **SMACNA** standard, shall be at least 32 microns on each face (Class Z400). The HVAC CONTRACTOR shall make the necessary galvanisation thickness tests and hand over to the COMPANY the related certificates of conformity.

The COMPANY reserves the right to verify the thickness of the galvanisation, either in the factory, or after installation. The CONTRACTOR shall remedy any shortfall in thickness by coating with paint, in accordance with COMPANY Specification, all the duct inside and outside concerned surfaces. If at any time during the fabrication of the ducts it is necessary to make welds, the galvanised surface thus damaged must be protected inside and outside by three coats of cold-applied zinc paint.

The CONTRACTOR shall clean and remove all labels and other works markings when carrying out the finishing work in equipment rooms.

All ducts, valves, fire dampers shall be identified by coloured stripes and directional arrows, with black letters or writing to identify the air network concerned.

The CONTRACTOR shall ensure that all joints are equipped with equipotential connection realised with a tinned copper braid.

6.1 Outdoor ductwork

All outdoor ductwork shall be made of Stainless steel AISI 316L (Ca < 0.03% / Mo > 2.5%) continuously welded. They shall be protected against corrosion by internal and exterior coating with paint as per COMPANY specification.

Outdoor ducts shall be 3 mm thick up to a width of 2.500 mm and 4 mm thick above 2500 mm.

Flanges, stiffeners, supports, etc. shall be made of the same material than the ducts.

Note: Even if outdoor ductwork has an insulation with a mechanical protection, the outdoor ductwork must be in Stainless steel AISI 316L (Ca < 0.03% / Mo > 2.5%) with above notified thickness.

6.2 Indoor ductwork

All the ducts shall be made of galvanised steel sheet (excepted for Laboratory, Battery room or with specific use).

The inside walls of the ducts shall be of the smooth type except where baffles or other necessary accessories are provided.

Sealing of connections between ducts elements shall be made using Minnesota sealing compound EC 108 or EC 1113 or an equivalent product approved by COMPANY.

6.3 Rectangular ducts

Low and high pressure rectangular ducts shall be fabricated of galvanised sheet with a Pittsburgh type longitudinal joint and in accordance with **SMACNA** (or ASHRAE) standards.

6.3.1 Low pressure rectangular ducts

Sheet thickness shall be as follows as a function of duct width:

- Up to 500 mm: 0.6 mm
- From 501 to 900 mm: 0.8 mm
- From 901 to 1.200 mm: 1.0 mm
- From 1.201 to 1.400 mm: 1.2 mm
- From 1.401 to 3.000 mm: 1.5 mm

For thickness greater than 1.5 mm, joints may be made according to the tooling available at SUPPLIER's works but prior written agreement from the COMPANY on the proposed solution shall be obtained.

Exhaust ducts shall be made of 1.2 mm sheet up to a width of 1200 mm and in 1.5 mm sheet for wider ducts.

Exhaust ducts for hoods shall be welded to ensure perfect tightness.

6.3.2 High pressure rectangular ducts

Sheet thickness shall be as follows as a function of duct width:

- Up to 300 mm: 1.0 mm
- From 301 to 750 mm: 1.2 mm
- From 751 to 1.000 mm: 1.5 mm
- From 1.001 to 1.500 mm: 1.8 mm
- From 1.501 to 2.500 mm: 2.0 mm

Transverse joints shall be sealed by means of 3 turns of a gauze band impregnated with one of the above-mentioned sealing compounds.

6.4 Circular ducts (Low and High pressures)

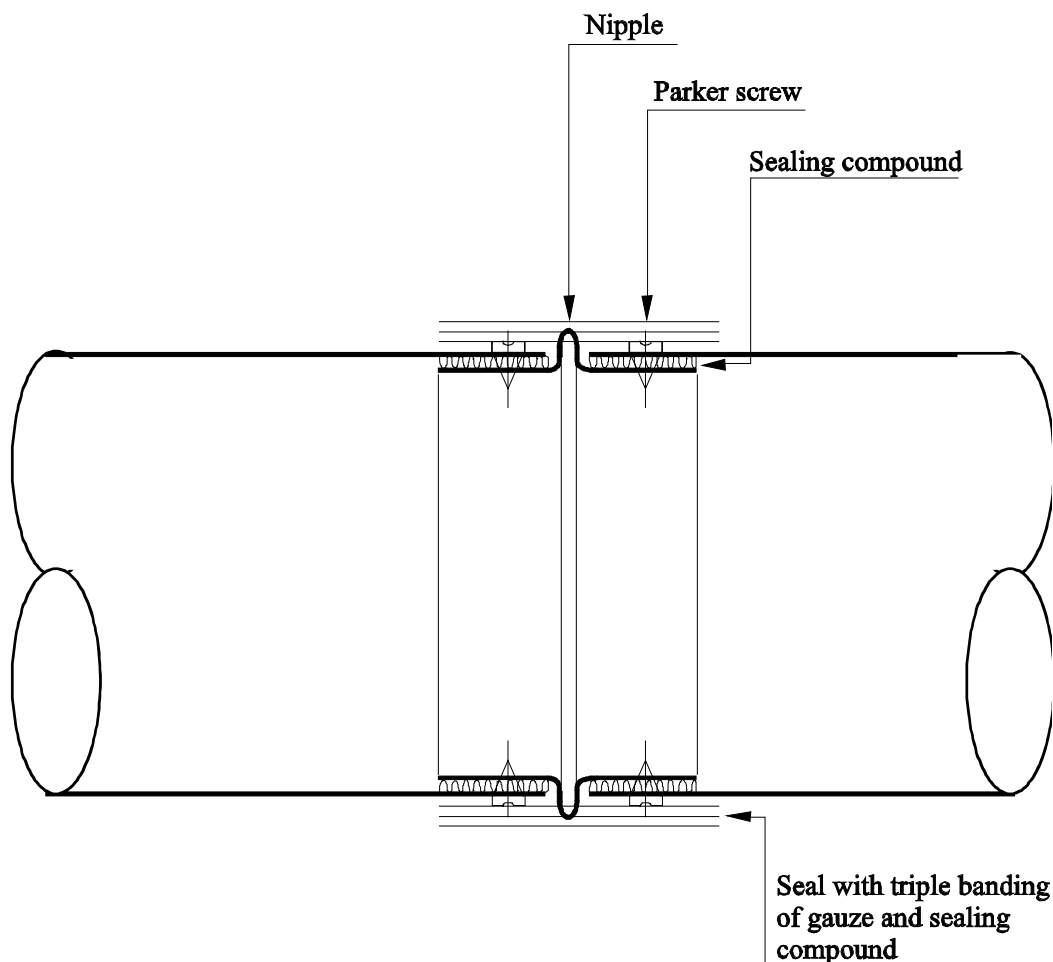
The low and high pressure circular ducts shall be fabricated using spiralled and stapled galvanised steel strip. All joints between special parts and between the different sections of duct shall be made with couplers. The ducts shall be fastened to these using cadmium-plated Parker screws, at least three for a diameter of 150 mm and spaced approximately 10 cm apart from one another for larger diameters.

Thickness shall be as follows as a function of diameter:

- Up to 300 mm: 0.6 mm
- From 301 to 550 mm: 0.8 mm
- From 551 to 1.200 mm: 1.0 mm
- From 1.201 to 1.500 mm: 1.2 mm

The joints shall be sealed in the same way as the joints in high pressure rectangular ducts.

Prior to sending them to the construction site, the ducts shall be cleaned with a detergent to remove all traces of oil.



Detail of low and high pressure circular duct installation

6.5 Oval ducts

The requirements applicable to round ducts shall apply. The thickness shall be as follows:

- Up to 300 mm: 0.8 mm
- From 301 to 500 mm: 1.0 mm
- From 501 to 1.000 mm: 1.2 mm

The joints shall be sealed in the same way as the joints in high pressure rectangular ducts and the ducts shall be delivered to the site without traces of oil.

6.6 Doubled case circular ducts

These ducts shall have the same thickness than the circular ducts. The two sheets shall be separated from one another by an annulus of synthetic rubber or Teflon to prevent heat bridges. The joints shall be made with special connectors complying with the MANUFACTURER's specification.

Use of double-cased circular metal ducts shall be limited to offshore installations and to a maximum diameter of 350 mm.

The same tightness tests shall be applied as for high pressure circular ducts.

Heat insulation of these ducts is not necessary inside the space to be ventilated.

For particularly long runs, the CONTRACTOR shall present a calculation note in order to define the actual temperature of the air introduced into the space to be ventilated taking into account the heat gains or losses.

6.7 Flexible ducts

Flexible ducts shall be made of non-flammable material and as short as possible (0.5 m maximum). Assembly of several flexible ducts to obtain longer runs shall be prohibited.

Each flexible duct delivered to the site shall be custom-fabricated in terms of both length and diameter.

At each connection with rigid ducts, clamping collars and sealing compound shall be used.

Flexible ducts shall be erected with due care to avoid any deformation at elbows or other directional changes.

Any flexible ducts damaged or cracked after installation shall be replaced (repair is not allowed).

Flexible ducts shall be suitably tight for a pressure of least 2500 Pa.

6.8 Fresh air intakes

Fresh air intakes for AHUs shall be located in non hazardous areas at a minimum of 2 meters outside the hazardous area and at a minimum of:

- 8 m from non hazardous ventilation exhaust
- 10 m from hazardous ventilation exhaust
- 10 m from engines or thermal equipment exhaust (gas turbines, diesel motor, compressed air package, chiller, aero-condenser etc.).

Two separated air intakes shall be installed.

6.9 Fire-rated ducts

Fire-rated ducts shall be made of galvanised steel. The longitudinal joints shall be **continuously welded**. All the transverse joints shall be made with flanges of galvanised steel angles. They shall be coated with fire-proofing material adequate to guarantee their fire barrier function. The coating shall in any case **not be less than 1.5 mm thick. The coating material shall be approved by the fire-fighting authorities and by the COMPANY.**

The gaskets jointing the flanges must have the same fire rating than the duct (**a fire rating certificate must be provided**).

6.10 Duct for fire rated wall penetration

The sleeve and flanges shall be made of a 1.5 mm minimum Stainless Steel AISI 316L (Ca < 0,03% / Mo > 2.5%). The sleeve extension from each sides of the wall shall be 200 mm.

6.11 Hood exhaust ducts

On every hood exhaust ducts, sound attenuators and linings are **strictly forbidden**.

Ducts for kitchen hood exhaust shall be made of Stainless Steel AISI 316L (Ca < 0.03% / Mo > 2.5%). It shall be continuously welded, flanges are prohibited.

For laboratory (fume cupboard and hood) exhaust duct shall be made of Stainless Steel AISI 316L (Ca < 0,03% / Mo > 2.5%) or PVC (depending on pollutant and safety requirement). Material shall be notified on D&ID or layout or particular specification (when not notified, COMPANY, and only COMPANY, shall provide information).

For mechanical workshop and welding area, general requirements for inside and outside material apply.

For exhaust of battery room, the duct shall be made of PVC.

Whatever the above exhaust duct systems, ducts shall be welded or stuck (for PVC) to ensure a perfect tightness.

7. Accessories

7.1 Internal linings

All duct interior linings, whether for noise dampening or thermal insulation, shall be secured against loosening by air turbulence or vibrations. The surface in contact with the air shall resist erosion (neoprene coated type Flamex GW). The lining and materials used shall be non-flammable. The lining shall be at least 25 mm thick. The end portion and any joints made in the lining shall comprise a fabric lining bonded by means of an appropriate sealant. At the joints between different duct sections, a protective metal sheet shall be provided. On large ducts, mechanical fasteners shall be used in addition to the adhesive to secure the lining material. These linings shall be prohibited for ducts installed outdoors.

No such ducts shall be erected before the COMPANY checks the condition of the insulation.

Detailed workshop drawings shall be provided to COMPANY for review.

7.2 Valves and dampers

All dampers shall be of the multi-blade type, with opposed-action blades in the case of proportional control and possibly same-way blades in the case of on/off valve action.

Special attention shall be paid to the workmanship of the blades to guarantee complete air tightness when closed. The blade shafts shall have journal phosphor-bronze bearings located outside of the air stream. The various mechanisms shall allow the valves to be easily controlled and opened with a differential pressure of 750 Pa in low-pressure systems and 2000 Pa in high pressure systems.

The blades and frames shall be made of SENDZIMIR or GALBEST galvanised sheet metal, or of AG5 aluminium alloy. The shafts shall be made of cadmium steel or stainless steel.

In the case of offshore or seaside installation, blades, frames and shafts shall be fabricated of stainless steel AISI 316L (Ca < 0.03% / Mo > 2.5%) and coated with corrosion-proof paint.

Losses due to leakage when the valve is completely closed shall never exceed 2.5% of the flow normally carried, with a differential pressure of 750 Pa for low pressure ducts and 2000 Pa for high pressure ducts. Open/closed labelling shall be provided to allow the valve position to be known by looking at the shaft.

The shafts of motor-actuated dampers shall be made such as to provide a square end in line with the control arm. Round shaft outputs shall be prohibited. The diameter of the shafts shall

be calculated to prevent twisting stress. To this end the maximum depth of the dampers shall be less than 1.5 m. No single actuator shall be expected to act on more than three square metres of damper. For larger damper surface areas, the CONTRACTOR shall install multiple devices in parallel and the closing time through spring-loaded actuators shall not exceed 3 sec.

The minimum face velocity shall be 5 m/sec and the maximum allowable shall be 8.5 m/sec.

Butterfly-type control valves may be used for ducts with a maximum dimension of 300 mm.

The non-return valves shall be manufactured from aluminium or stainless steel according to the risk of corrosion. They shall be designed to preclude fluctuation from the rush of air.

Control counterweights shall ensure opening of the valve as soon as the required pressure is achieved. The same result can be obtained by means of actuators with automatic return to the closed position. They must in addition have Teflon or synthetic rubber seals for enhanced tightness. If necessary, they shall be equipped with springs or damping systems. The maximum permissible face velocity shall be 8.5 m/sec.

The non-return valves (whether "self-closing" or motor actuated) installed in the standby fan discharges shall be able to handle a leak flow rate at most equal to 0.5% of the nominal flow rate with a differential pressure 2.5 times the total maximum of the fans in order to prevent induced rotation of the machine when stopped. These dampers shall be delivered with the COMPANY approved individual test certificates.

7.3 Inspection panels and doors

The CONTRACTOR shall supply all the necessary sealed panels and doors to enable access to the equipment of the system and allow cleaning of ducts (legionella) and installation of sound dampers and absorbent linings. The closing devices provided on such doors and panels shall be readily manoeuvrable (1/4 turn fasteners). Screw fasteners of all types shall be prohibited.

For ducting network such as supply air, return air and kitchen exhaust, sealed panels and doors for inspection shall be installed at each equipment as dampers, fire dampers, heaters, etc. and at each elbow.

7.4 Supports and mounting hardware

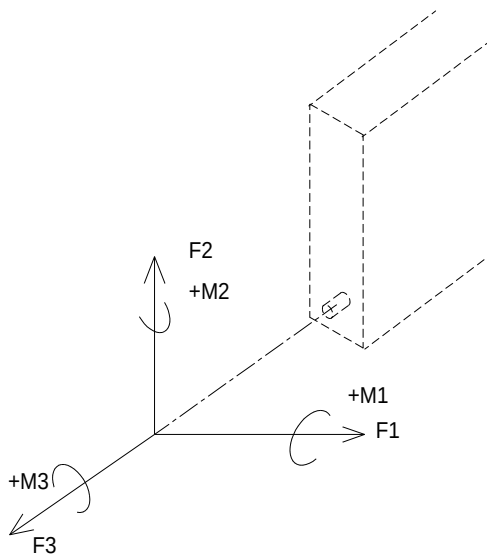
Their mountings and supports shall be engineered to avoid all transfer of vibrations to the structure and be readily dismantled and adjustable for any future modification. The supports shall be attached to the structure in accordance with the specifications of the building frame design engineer or CONTRACTOR. Felt or Teflon strips shall be provided between the supports and the ducts in order to fully isolate the ducts from the supports. Supports shall be generally spaced a maximum of about two metres apart.

All supports for ducts and accessories shall be made of cadmium-plated steel or of galvanised steel (or Stainless steel AISI 316L (Ca < 0.03% / Mo > 2.5%) for outdoor ducts). When it is not possible and only for internal ducting, the supports, rods and mounting hardware must be protected against corrosion with paint in accordance with the requirements of COMPANY Specification.

The ducts shall be secured against both horizontal and vertical movement. Vertical ducts shall be supported taking into account the structure as a whole.

Duct supports shall be equipped with vibration damping devices and shall be dimensioned for a load **three times the weight of heat-insulated ducts or 75 kg per metre**, whichever is larger.

System of tag used:



Supports should be connected directly to the duct by screws or rivets. At the fan discharges, the supports must be able to withstand the **axial thrust from the air pressure without any deformation (or straining) of the flexible connectors.**

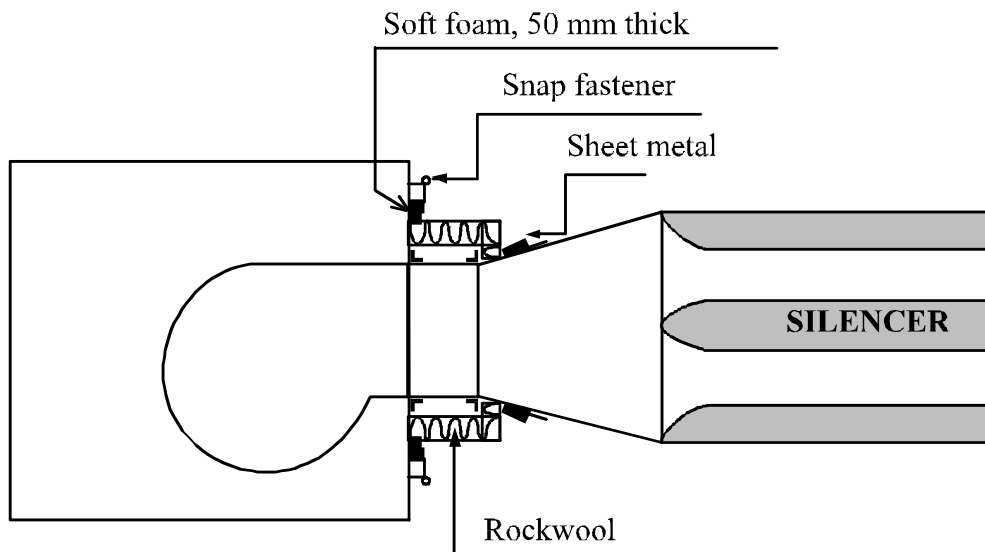
All bolts, nuts, washers and other fasteners shall be corrosion protected (cadmium plated) or made of stainless steel.

The duct support must have the same fire classification than the duct itself (e.g. A60, H60, H120, etc.).

7.5 Penetrations and packing

Where ducts penetrate floors, ceilings, walls or partitions, suitable packing shall be provided, using a non-combustible material to carefully fill the whole space between the ducts and the penetration, with frames to ensure perfect sealing. The packing system must be approved by the structural CONTRACTOR and comply with the relevant codes and standards.

All the vibration reducing packings upstream of the duct silencers shall be acoustically protected by means of readily removable boxes made of 1.2-1.5 mm thick aluminium sheet with at least 100 mm thickness of Rockwool weighing approximately 150 kg/m². Installation shall comply with the detail of schematic hereafter. This protection shall be provided for all fans having a noise level greater than 60 dBa.



Sound-proofing of vibration reducing packings for medium and high pressure fans
(Air flow rate above 15,000 m³/h)

7.6 Joints and mastics

Joints and tight mastics for ducting shall be non-combustible according to safety requirements.

They shall be free from asbestos.

Joints and mastics shall be airtight in all conditions including during test pressures.

7.7 Bolts, screws, washers, etc.

Bolts, screws, washers etc. shall be protected against corrosion (cadmium coating, etc.) or shall be made of stainless steel. The minimum material requirement is the material of the duct itself.

8. Testing

8.1 Test points

Test points shall be provided for making flow and pressure measurements. The corresponding bosses shall be large enough to allow the use of Pilot tubes or similar equipment. Each boss shall be provided with a plug and a retaining chain.

8.2 Testing requirements

For low pressure ducts, no particular testing will be required after verification of workmanship at erection time and during system tests.

For high pressure ducts, before installation of heat insulation, the CONTRACTOR shall carry out a tightness test in accordance with the procedure which shall be submitted to COMPANY for review (only a method in accordance with an official standard shall be submitted).

COMPANY shall witness all tests.

Heat insulation shall only be applied to the ducts after successful leak testing and with written authorisation from the COMPANY representative.