SPECIFICATION

DUCT WORK AND DUCT ACCESSORIES
PROJECT: LYCEE FRANCAIS DE BANGKOK-GYMNASIUM HVAC

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Attachments	**Revision**	**Date**

Drawings	**Revision**	**Date**

1 Sheet metal duct materials

Generally, all ductwork shall be of galvanized steel sheet conform to latest TIS standard.
Galvanized steel ductwork shall be fabricated from new, best quality, full sized galvanized flat steel sheets.
The pressure class and air leakage limit shall be as defined in ASHRAE & SMACNA standard.
All ductwork shall be rectangular type unless otherwise specified.
Kitchen exhaust duct shall be black steel sheet 2 mm. thinness.

1.1 Low Pressure Ducts

- Low pressure ducts shall be used where indicated on the drawings, or, if not, **where static pressure does not exceed 50 mm water gauge**.
- Low pressure ducting shall be constructed with galvanised steel sheet, and shall have steel bracing angles in which the thickness dimension of the respective equipment shall not be less than the indicated figures for low pressure ducting in the 1972 edition of the "guide and data book" of the American Society of Heating, Refrigeration and Air-conditioning Engineers, Equipment Volume, Chapter 1, Table 4.
- Sheet metal for slips and drive caps shall be of the same material and thickness as the ducts.
- **Leak test may be performed by smoke bomb test and using low-pressure fan for testing which leak joints could be found and corrected total leakage not to exceed 1 percent of total system air flow**.

1.2 Medium Pressure Ducts

- Medium pressure ducts shall be used are indicated on the drawings. If not, they shall be used where static pressure is higher than 50-mm water gauge, but not over 100-mm water gauge.
- Medium pressure ducting shall be constructed with galvanised steel sheet and shall have steel bracing angles in which the thickness and dimension of the respective equipment shall not be less than the indicated figures for medium pressure ducting in the 1972 edition of the "guide and data book' of the America Society of Heating, Refrigeration Air-conditioning Engineers, Equipment Volume, Chapter 1, Table 7.
- Medium pressure ducts shall be constructed without sharp edges or irregularities that may generate noise. Leakage, at a test pressure of 100-mm. water gauge, shall not exceed 15 L/S per 100 m. of length.
- **Leak test may be performed by smoke bomb test and using high-pressure fan for testing which leak joints could be found and corrected. Measurement of amount of leakage shall be made by orifice that will be installed at the air discharge side of high-pressure fan**. Leak test is not required for flexible duct. However, all flexible duct joints shall be strictly inspected.

2 Duct fittings

2.1 Joints and Fittings

All cross joints, longitudinal joints, take-offs, bends, transitions and other fittings shall be in accordance with **ASHRAE, SMACNA** for the appropriate class.

All flanges and steel works for joints and supporting members shall be galvanized.

Details of construction shall be submitted to **Employer's Representative for endorsement before commencement of fabrication.**

2.2 Ductwork Jointing Sealants

Jointing for flanged cross joints shall be formed from **a non-flammable gasket** or other approved material to thickness not less than 4mm.

Sealant for longitudinal and slip joints shall be non-flame sealing compound.

2.3 Vanes or Deflectors

Vanes or deflectors shall be provided inside ducts where required. In particular, such vanes or deflectors shall be provided at all bends having an internal radius less than the width of the duct and also where the included angle exceeds 30° at changes of section. Vanes or deflectors shall be of special profile to ensure complete change of direction of flow at the point, with extended leading and trailing edges, and with radii and spacing selected to achieve uniform velocity at the bend.

2.4 Flexible Connections

All flexible connections for use at temperatures up to a maximum of 90°C shall be of neoprene coated glass fabric having a density of not less than 1 kg/m2.

All flexible connections for use with temperatures in excess of 90°C and in "smoke spill" applications shall be of non-combustible woven glass fabric capable of withstanding 250°C under continuous operation.

All flexible connections exposed to the weather shall be covered with prime quality galvanized sheet steel or fiberglass weather shields arranged to form a complete weatherproof jacket.

All flexible connections shall be fixed over mild steel angle flanges at both ends and secured to same with not less than 2.5mm thick x 25mm wide mild steel bands. For circular ducts flexible connections shall be of the split semi-circular type drawn up tight with bolts at the split points. Flat bars for rectangular ducts shall be fixed with bolts or screws at not more than 150mm center. The flanges to take the connections shall be not less than that specified for the ducts and the "free" space between flanges shall not be less than 50mm. The flexible connections shall be installed with not less than 25mm additional slack length between the flanges to prevent transmission of vibration.

Flexible connections shall not be used to correct misalignment of fan and duct.

Note: Use of flexible air ducts (of maximum 0.5m or 1'8" length) is to be limited to final connection to discharge grille plenum boxes only. Flexible air ducts are generally not acceptable on return air and kitchen exhaust air.

3 Duct thermal insulation

3.1 General

Preparation of the equipment and application of all insulating materials shall be carried out only by skilled tradesmen, experienced and competent in this type of work.

In general, insulating materials shall be of best quality in their respective types, and shall have the following physical properties:

- High thermal efficiency and low moisture absorption combined with adequate strength to prevent deterioration under normal operating conditions.
- Resistance to fire and attack of algae, bacteria, vermin and the growth of mould and fungi.
- Free from objectionable smells when dry or wet and shall not cause or promote corrosion or deterioration when in contact with galvanized metal, steel, iron, copper, bronze, brass, aluminium or P.V.C.

All insulating materials shall be delivered to the site in a dry condition and shall be housed in a dry store until drawn up for use.

Prior to the application of insulation, all surfaces shall be thoroughly cleaned of scale, rust, grease, oil and dirt. The application of the insulating materials to any part of the installation shall not be commenced until all pressure tests on the relevant part have been completed and approved.

All insulation materials, regardless of the methods of fixing, shall be in close contact with the surfaces to which they are applied. Edges and ends of insulating sections shall be arranged to butt up close to one another over the whole insulated surface. Joints of insulation shall be properly sealed. Pressure sensitive tapes shall not be accepted as joints having mechanical strength.

Allowance for thermal movement shall be provided for in the application of insulation.

3.2 Insulation

All thermal insulation shall comply with the requirements of the FM approve.
Ductwork shall be insulated from hangers and supports generally as indicated

All joints shall be sealed with at least 75mm wide vapour barrier tape to provide a continuous external vapour seal. Prior to the application of tape all contact surfaces of vapour barrier foil shall be wiped clean of dust and grease using cloth and suitable solvent all in accordance with the manufacturer's recommendation.

All ductwork insulation shall extend over external flanges and stiffening.

Insulation shall be applied so as to form a continuous heat barrier without gaps, cavities and openings. Care shall be exercised to ensure that the minimum thickness specified is maintained at corners, protrusions, etc.

At the point of support, specially prepared blocks of hardwood or styrofoam material must be positioned to ensure integrity of vapour barrier by bonding the supports to the insulation.

All externally insulated ductwork exposed in plant rooms, corridors and other areas subject to normal usage traffic shall be sheathed externally by means of 0.5 mm aluminium sheet with all joints lapped and secured by self-tapping screws at 100 mm centres.

Closed cell insulation Properties

Description	Properties	Test method
Elastomer material & Cell structure	Closed cell structure	-
Density(kg/m3)	64	ASTM D 1667
Service Temperature	5°C to 85 °C	-
Water vapor permeability (perm-in)	<0.01	ASTM E 96
Water adsorption (weight %)	≤ 10	ASTM D 1056
Flammability & Smoke Density	Class V O No fire drops	ASTM D 635
Flexibility	Excellent	ASTM C 534

Open cell duct lining Properties

Description	Properties	Test method
Elastomer material & Cell structure	Physically crosslinked partially open cell polyolefin foam with aluminium foil	-
Density(kg/m3)	25	-
Service Temperature	-80°C to 100 °C	-
Noise Reduction Coefficient at 15mm. Foam thickess	0.4	ISO 354
Resistance to Fungi	Zero Growth	ASTM G21
Fire rate	Class 0	BS 476

3.3 Schedule of Insulation

All plant and equipment such as ductwork, pipe work, chiller sets, shell and tube evaporators, terminal boxes, heat exchangers, chilled water tanks, de-aeration tanks shall be fully insulated, complying with the following Schedule of Insulation and/or the requirements specified for the equipment under "Equipment" section of this Specification

Duct insulation thickness

		Operating temp °C	Thickness mm. thk.
Supply air duct	SA	12	25
Return air duct	RE	22	20
Fresh air duct	OA	24	20
Mixing box		22	20

NOTE: Insulation thickness base on commercial thickness range and calculation at condition as follow
- Room temperature 40 °C
- Convection Coefficient (h) 8 W/m2/°K, (Low air movement area)
- Thermal Conductivity (k) 0.032 W/m.K
- %RH 75

4 DUCT JACKETED

Duct jacket where exposed to sunlight and all kitchen exhaust duct shall be covered with aluminium jacket 0.5 mm with sealed (Not silicone). All covering aluminium shall be done last work to make sure its damage free before hand over the project.

Duct jacketed appropriate for insulation Duct protection at expose area.

5 Duct painting, labelling and finishing

5.1 Materials

All parts of the work installed under this Specification shall be painted with approved first quality enamel paints, except those items specified as being painted by the Contractor or otherwise exempted from painting in this section of the Specification.

The requirement for painting of all duct work and duct work is in addition to the colour coding or banding specified in this Specification.

Paint shall be selected to withstand the temperature on the surface which it is applied, and shall be suitable in all respects for the environmental conditions in which it shall be located.

All paint used shall be of one approved manufacture, and finishes shall be full gloss unless otherwise specified.

Before ordering any primer, undercoat and finishing paint, propose the colour scheme to the satisfaction of the Employer.

Before ordering any painting materials, the Contractor shall satisfy the Employer the type and manufacturer of all materials.

Select all finishing and painting materials from types suitable for the surfaces to which they are applied and for the environmental conditions in each area.

5.2 Plant, machinery & equipment

All items of plant, machinery and equipment supplied painted ex-factory shall be given one finishing coat of full gloss enamel, except where the manufacturer's standard finish is approved.

5.3 Exposed metalwork

All exposed metalwork shall be wire-brushed and cleaned from rust, scale, dirt and grease, and shall then be given one priming coat, one undercoat and one finishing coat of full gloss enamel.

The priming coat for exposed galvanized iron shall be an approved galvanized iron primer.

The priming coat for exposed non-ferrous metalwork shall be approved as suitable for the metal to which it will be applied.

5.4 Concealed metalwork

All galvanized iron surface concealed in roof spaces, false ceilings, building ducts etc. shall not be painted.

All black iron and steel surface shall be wire brushed and given one coat of zinc chromate or red lead.

Colour banding for identification shall be provided.

5.5 Ductwork & pipework & metal sheathing

Un-insulated ductwork, internally insulated ductwork, un-insulated duct work and metal sheathing shall be painted as for exposed for concealed metalwork as applicable.

Turned parts of valves, controls etc., shall be cleaned and polished to approval.

5.6 Labelling

All plant and equipment provided under this Specification is to be labelled in both English and Thai as to duty or services, all such labelling to correspond to schedules, diagrams, etc. to be provided as part of the Record Drawings. Labels are of white Traffolyte with black engraved lettering not less than 20mm high or as otherwise required and approved.

Manufacturers' nameplate shall generally be provided for all plant and equipment and shall show serial and model numbers and date of manufacture.

The following refers to specific items (but not by way of limitation) requiring labelling:

- All valves, motor starters, fans, distribution boards, gauges, contactors, cable terminals in switchboards, circuit breakers, fan coils, air handlers, pumps etc.

- Labels to be attached to valves (or pipe adjacent thereto) with a light gauge metal band or alternatively to be screwed to the insulated valve box where provided. These labels shall state the valve number.

- Distribution boards, starters etc. are to be labelled to indicate the circuit number, phase and item controlled.

Label shall be screwed or riveted to sheet metal. Adhesive fixing is not acceptable.

Details of exact lettering shall be agreed with the Employer prior to manufacture.

A complete valve schedule shall be incorporated in the as-built drawings and this schedule shall clearly indicate the valve numbers, duty, function, size, flow rate and any other relevant information necessary to allow the Employer's plant operators to safely operate each valve and to subsequently maintain or replace the valve as required.

The valve schedule shall clearly relate to the various system schematics to enable the entire operating sequence and circuitry to be followed.

5.7 Application of painting

All paints shall be prepared and applied in accordance with the manufacturer's recommendations.

All galvanized metal surfaces shall be properly etch-primed to ensure correct adhesion of the paint to the surface. Materials for etch-priming shall be as recommended by the paint manufacturers. Subsequent painting of galvanized surfaces shall comply with this Specification.

Prior to painting, all metallic surfaces except galvanized surfaces shall be thoroughly scraped and wire brushed as necessary to remove scale, rust and swarf. Surfaces shall then be solvent cleaned to remove all oil, grease and dirt.

When the surfaces to be painted are clean and dry, one coat of an approved primer shall be evenly applied over the entire area. After surfaces have been primed, notify the Engineer so that an inspection of the primed surfaces can be made prior to the application of the undercoat and the finishing coats.

When the priming coat has been approved, one coat of an approved paint flat undercoat shall be applied. Before applying the finishing coats, ensure that the undercoated surface is rubbed flat and smooth. Finally, an approved high gloss finishing paint shall be applied when all dust has been removed.

Each successive coating shall be completely dry prior to the application of the next coat.

6 Grilles and diffusers

6.1 General

All supply and return or exhaust grille shall have either an opposed blade volume control device, the vanes of which shall be spring-loaded or otherwise arranged so that they remain permanently in their set position without vibration or noise, or butterfly dampers in spigots upstream.

Wherever possible butterfly dampers will be used provided access is available to the butterfly damper.

All grilles, registers and diffusers shall be capable of being removed easily from the ductwork for access to dampers, etc., and constructed in accordance with the best practice and free from sharp edges.

All air fittings shall have concealed fixing systems. Exposed screw fixings will not be accepted.

All supply and return air grilles and registers shall be of extruded aluminum with baked enamel finish of an approved colour unless otherwise specified.

All grilles, diffusers, etc., shall be erected square and level and accurately set out as to spacing. All fittings shall be mounted on substantial frames and shall be provided with 7mm thick soft rubber or felt joining ring serted under the frame, or as the case may be, so as to obviate air leaks and prevent the formation of condensation on the fittings.

For adjustment vanes, keys are to be provided, no projecting adjusting device being permitted. Vanes shall be spring loaded or otherwise arranged so that they remain permanently in their set position without vibration or noise.

Before any diffusers, etc., are ordered or manufacture of fittings commences, confirmation must be obtained from the Employer's Representative as to exact position and finish of fittings required. Samples of every type of grilles diffusers, etc., **shall be submitted to the Employer's Representative for endorsement before orders are placed**.

All internal parts of outlets, such as straightening vanes and volume controllers shall be finished matt black. External finishes shall be colour to match adjacent surfaces. Unless otherwise specified aluminium steel outlets shall be finished in baked enamel.

Internal duct surfaces visible through any air outlet shall be painted matt black.

Outlets shall be installed with trim gaskets where applicable and in accordance with the manufacturer's recommendation.

Contractor have to confirm linear slot diffuser's sizing in each area with interior designer before construction work.

6.2 Sidewall Registers and Grilles

Unless otherwise specified, grilles shall be of the double deflection type with the horizontal blades mounted at the front of the grille. All grilles shall be capable of 0-45" adjustable deflections in both the vertical and horizontal planes at 12mm center. Grilles shall be held in position with "secret" fasteners.

Powder coated to colour approved by the Employer's Representative.

6.3 External Louvers

Louvers shall be fabricated from stainless steel or "window grade" aluminum.
Galvanized or aluminum mesh to suit the material of the louvers shall be fitted across the inside surface of the louvers. Mesh shall be 13mm x 13mm x 1.2mm. Provide an insect screen.

Blades shall incorporate a return fold and weather bar on the high side, a vertical stiffener on the lower edge and shall be fitted at 45°.

Louvers shall be powder coated to a colour from the Employer's representative approval.

6.4 Return or Relief Grilles

Grilles shall be of extruded aluminum or pressed steel, with fixed horizontal blades adequately supported and braced by means of concealed stiffeners and bars and fixed at 45° to the direction of air flow so as to be sight proof when viewed from the same level.

Grilles shall be arranged such that their core is hinged and demountable for access to the filter for cleaning. Grilles shall be with blades at 20mm center.

Powder coated to colour approved by the Employer's Representative.

6.5 Wire Mesh Grilles

Grilles shall be made of extruded aluminum or pressed steel with wire mesh core and flanged frame. The free area of the opening in the grilles shall not be less than 75%.