

Workshop Drawing Manual

for Beginner Engineers

Air-conditioning system work version

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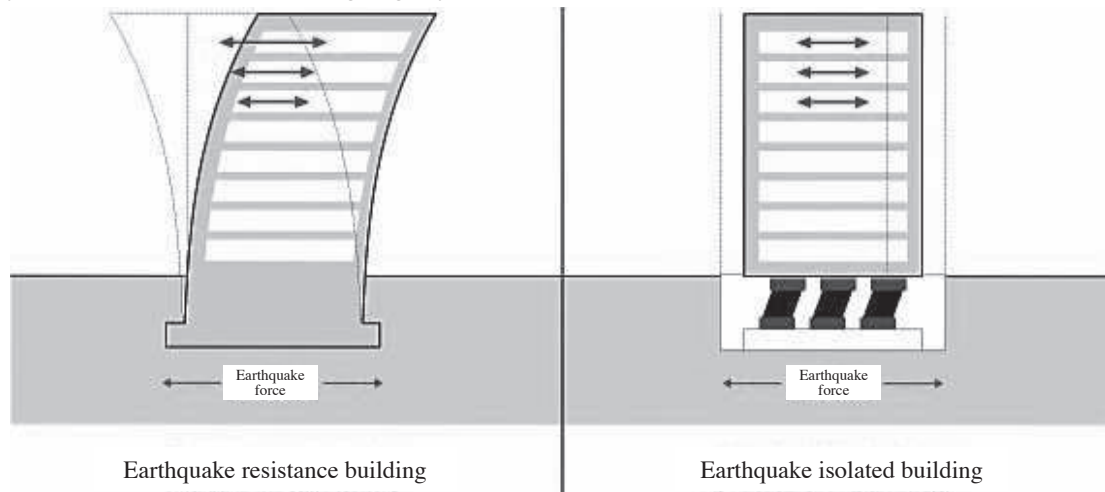
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Special building structure (earthquake isolated structure)

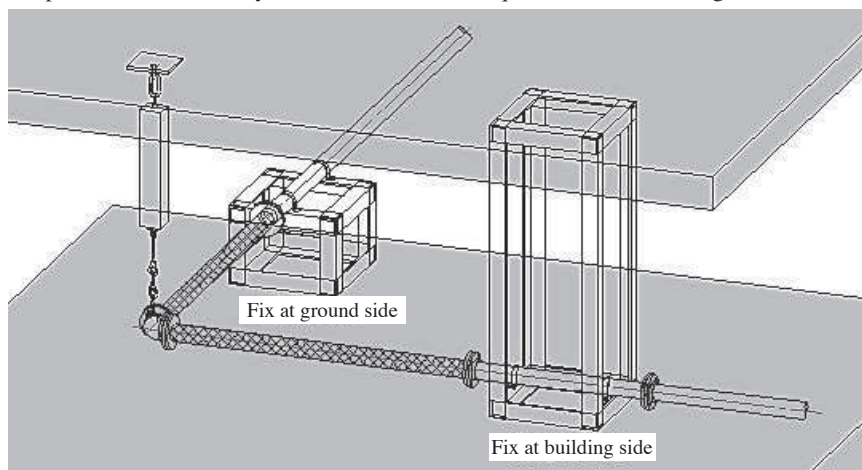
Most buildings, which have the earthquake resistance structure, stand on the ground. When the earthquake occurs, the building swings strongly because the earthquake force is transmitted on the ground directly.

The earthquake isolated building stands on the earthquake isolated facility, which is installed on the ground. When the earthquake occurs, the building doesn't swing strongly because the earthquake force is isolated by the isolated facility. The earthquake force, which is not isolated by the earthquake isolated facility, is transmitted to the building slightly.



The earthquake isolated structure can decrease the damage of the building itself. But if the piping (duct) is damaged, as a result, if the lifeline is damaged, there is no earthquake isolated effect. In order to avoid such a situation, the earthquake isolated fitting, which absorbs the large displacement by earthquake, should be used for the piping (duct).

* The displacement is issued by the movement of earthquake isolated building when the earthquake occurs.



* The fix frame base should be installed near the earthquake isolated fitting in both the building side and the ground side.

Annotation of fixture list

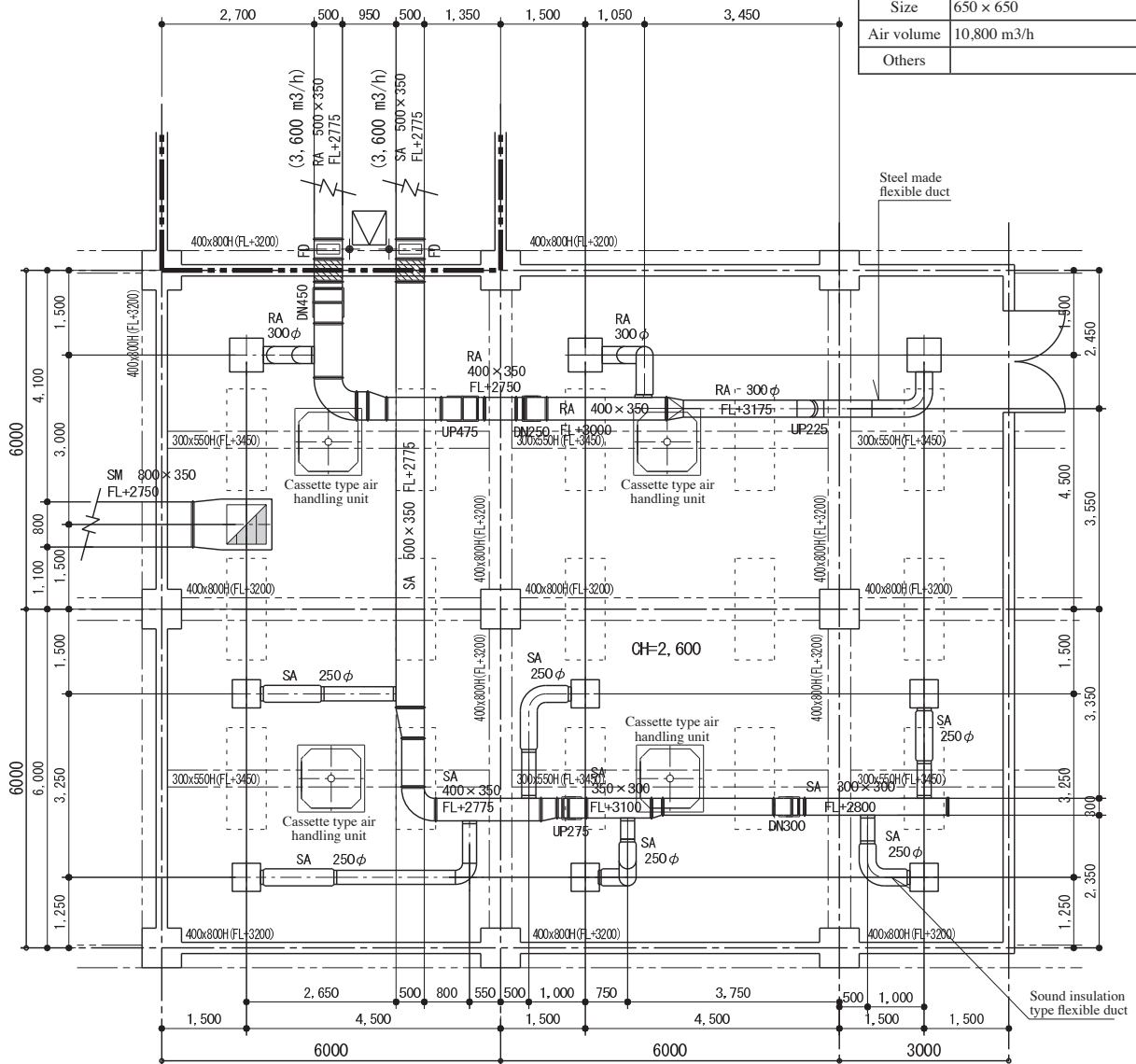
Room name	Office room
Fixture name	Anemostat diffuser C2
Size	#25
Air volume	600 m3/h
Others	Box with noise insulation

x6

Room name	Office room
Fixture name	HS
Size	500 × 500
Air volume	1,200 m3/h
Others	

x3

Room name	Office room
Fixture name	Panel type smoke exhaust outlet
Size	650 × 650
Air volume	10,800 m3/h
Others	



Story height 4,000

--- Showing fire protection zone

5-1. Making process of smoke exhaust duct workshop drawing

Special attention points in order to make the drawing of smoke exhaust duct as fire and smoke protection system are shown below.

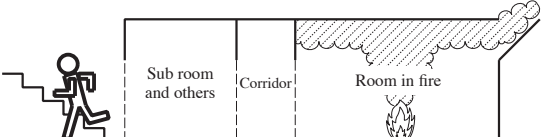
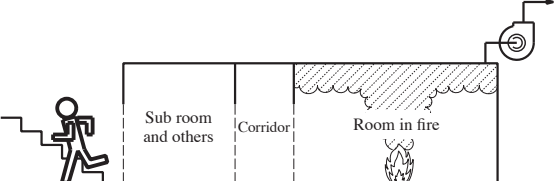
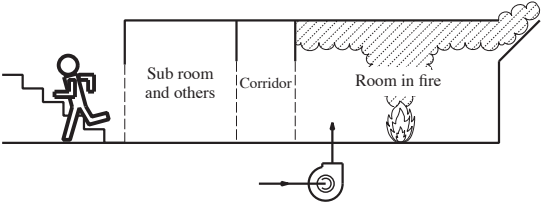
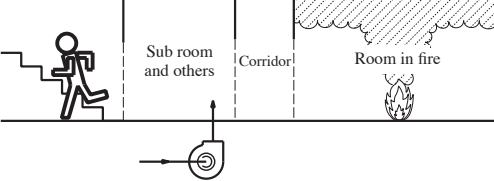
* Pay attention to the different points from the air-conditioning duct or ventilation duct.

The workshop drawing in case of the smoke exhaust duct is often made from the design drawing as same as in case of the air conditioning duct or ventilation duct. However, the smoke exhaust duct is concerned with "the human life", so decide carefully its route and size.

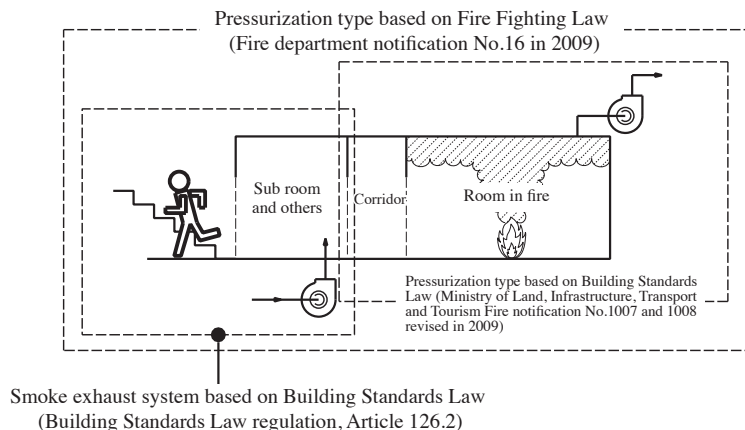
* In case of making the drawing, review the specification described in the design drawing again surely.

a) Confirmation of smoke exhaust type

The smoke exhaust has some types, for example the natural type, mechanical type, pushing out type, pressurization type and others. So decide it based on the condition.

Natural smoke exhaust	Mechanical smoke exhaust
 <p data-bbox="215 940 726 974">This type exhausts the smoke by using the smoke buoyancy.</p>	 <p data-bbox="885 940 1364 996">This type exhausts the smoke by mechanical power with natural outdoor air supplying from the lower part.</p>
Pushing out smoke exhaust*	Pressurization smoke protection and exhaust*
 <p data-bbox="215 1344 726 1400">This type pushes out the smoke by mechanical power with outdoor air supplying from lower part.</p>	 <p data-bbox="845 1344 1412 1400">This type prevents the smoke from invading to the fire fighting base such as the sub room of special emergency stairs by pressurization.</p>

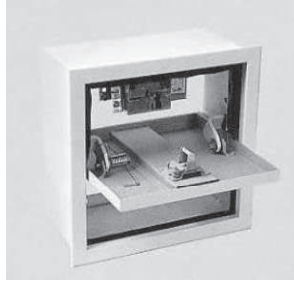
* In case of the 'pushing out type' and 'pressurization type', pay attention to the risk of strengthening the fire by the excess air supply. Besides, these types need the Minister's approval based on the Building Standard Law, Article 38. In particular, in case of the 'pressurization type', pay attention to the difference in the scope specification between the Fire Fighting Law and Building Standard Law. (Refer to the drawing below)



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b) Decision of smoke exhaust outlet

The natural type uses the smoke exhaust window installed by the building work as the smoke exhaust outlet, so the air-conditioning workshop drawing does not describe it. The smoke exhaust workshop drawing describe the duct, damper, smoke exhaust outlet and others used in 'mechanical type', 'pushing out type', 'pressurization type' and others described above. (* Here, the general panel type smoke exhaust outlet is shown below.)



Panel type smoke exhaust outlet

Decision standard of smoke exhaust outlet size

- The air volume of smoke exhaust should be 1m³/min per 1m² of the target area. (1 target area should be maximum 500m².)
- The outlet air velocity of smoke exhaust outlet should be 10m/s or less.
- The minimum smoke exhaust outlet size should be 300mm x 300mm.

$$\text{Effective area of smoke exhaust outlet [A']} = \frac{\text{Air volume of smoke exhaust [Q]}}{\text{Outlet air velocity of smoke exhaust [V]} \times 60\text{s}}$$

$$\text{Area of smoke exhaust outlet [A]} \geq \frac{\text{Effective area of smoke exhaust outlet [A']}}{\text{Opening ratio of smoke exhaust outlet [f]}}$$

Reference) Decision example of smoke exhaust outlet in case of mechanical smoke exhaust

- Target area of smoke exhaust [S] : 15m × 12m (wall center) zone area is 180m².
- Air volume of smoke exhaust [Q] : 180m² × 1m³/min=180m³/min
- Air velocity of smoke exhaust [V] : 7m/s
- Opening ratio of smoke exhaust outlet [f] : 68%

* The opening ratio of panel type smoke exhaust outlet differs depending on the manufacturer, so decide the smoke exhaust outlet after confirmation.

$$\text{Effective area of smoke exhaust outlet [A']} = \frac{\text{Air volume of smoke exhaust [Q]}}{\text{Outlet air velocity of smoke exhaust [V]} \times 60\text{s}} = \frac{180(\text{m}^3/\text{min})}{7(\text{m/s}) \times 60\text{s}} = 0.43(\text{m}^2)$$

$$\text{Area of smoke exhaust outlet [A]} \geq \frac{\text{Effective area of smoke exhaust outlet [A']}}{\text{Opening ratio of smoke exhaust outlet [f]}} = \frac{0.43(\text{m}^2)}{0.68} = 0.63(\text{m}^2)$$

So, the smoke exhaust outlet size should be 800mm × 800mm [0.64m²].