Fire Research and Test Laboratory

● Outline

This laboratory is designed to study the fire safety performance of building materials and fire resistance of structural elements. As for building materials, properties of materials under heating condition can be tested from palm-top size to a room-size. As for structural elements, behaviors of columns, beams, walls and floors under heating and loading condition can be tested by using furnaces.

(1) Apparatuses for testing fire safety performance of building materials

Our living environments is composed of numerous building materials which are being developed day by day. However, some of these materials may easily cause ignition, flame propagation, or even production of smoke and toxic gases. In order to assure life safety and reduce fire risk, use of such building materials should be controlled.

For developing fire safety materials and support their safe use, we conduct research on combustion behaviors of building materials from various perspectives. At the same time, we conduct research on burning behavior of building materials in a real fire environment. For such research of building materials, there are various apparatuses for testing the basic combustion properties of building materials. These apparatuses comply with standards of JIS (Japanese Industrial Standards), ISO (International Organization for Standardization), and Eurocode.

Examples of heat release and smoke production test using cone calorimeter (ISO5660), and full scale room corner test for surface products (ISO9705)

⑵ Apparatuses for fire resistive performance of structural elements

Fire resistance of structural elements including columns, beams, walls and floors are required for preventing the collapse and/or internal fire spread. Fire resistance of structural elements is tested using full-scale furnaces. As the components of the fire resistance, loadbearing capacity, integrity and insulation under high temperature are required.

There are three furnaces, i.e., a) vertical furnace for walls and fire doors etc (heating range: up to 4.0m by 4.0m, loading capability: up to 4.0MN), b) vertical furnace for columns (height: up to 4.3m, loading capability: up to 20MN), c) horizontal furnace for beam, floors and roofs (heating range: up to 4.0m by 8.0m, loading capability: up to 1.0MN). Especially, the loading capability of the vertical furnace for columns is quite high. So, it can even test a column used for high-rise buildings under real loading condition.

The results of tests are used to develop several technical guidelines or specifications of the Building Standard Law. These data are also valuable for development of new structural elements, new construction methods and advancement of fire resistive design method of buildings.

Horizontal furnace

A beam sample before a test using the horizontal furnace

Vertical furnace for columns

A column sample after a test using the vertical furnace for columns

Vertical furnace for walls