Similarly for a 310UC158 with four side exposure to the fire:

$t = -4.7 + 0.0263T + (0.213T / k_{sm})$
$t = -4.7 + 0.0263 \times 500 + (0.213 \times 500 / 9.66)$
$= 19.5$ minutes

2.4 Methods of fire protection

If fire engineering design does not provide an acceptable unprotected steel design for the building, then the steel must be provided with some form of applied fire protection. The following are the usual options:

- sprayed insulation
- rigid board insulation
- flexible blankets
- intumescent paint
- concrete encasement

Of these, sprayed insulation and intumescent paint are most commonly used for beams, with concrete encasement, sprayed insulation and intumescent paint being most commonly used for columns.

Sprayed insulation is usually a proprietary material that is sprayed onto unpainted steel. Its performance is based on laboratory fire testing. One commonly used product is Monokote, a vermiculite-based product. The insulation must be sealed so that particles are not picked up by the return air in the ceiling plenum as they will eventually clog the air filters. It should also be sufficiently strong that it is not easily detached by installers of the building services and the finishing trades. (Allowance should be made to make good damaged areas before ceiling installation, but this is not always practicable due to the presence of ducts, cable trays and the like.) Coating thickness varies depending on the insulating material, the surface area-to-mass ratio of the steel and the required period of structural adequacy. A typical thickness would be 30mm.

Rigid board insulation can vary from plasterboard to mineral-fibre-reinforced boards. Special attention must be paid to fastening methods to ensure that the material stays in place during a fire. The board is usually fixed to a sub-frame of timber or light-gauge steel, making it an expensive solution except for small-scale applications. The level of fire protection is based on laboratory fire testing of the material and its fixings.

Flexible blankets are not commonly used in the building industry for protecting structural steel. When used, the blanket is wrapped around the steel member and fixed in place with studs and washers. It is then protected by cladding of some sort.

Factory-applied intumescent paint is a preferred insulating method as it least affects the on-site construction activities. It tends to appear expensive until the beneficial construction aspects are properly considered and costed. The intumescent paint is applied over a blast cleaned and primed steel surface. It can achieve a fire resistance of up to two hours (but one-and-a-half hours is more common) and the dry film thickness can be up to 6000 microns (6mm). On-site repairs to the paint will be necessary to make good damage caused during transport, erection and the installation of building services.

Concrete encasement was once a commonly used method of fire protection of both beams and slabs, but nowadays it is used only for columns where it can contribute to the load capacity of the member. A minimum cover to the steel of 50mm is required, but more cover is often appropriate to allow for the reinforcing steel and its required cover, as well as concrete placing and compaction requirements.

2.5 Fire resistance of composite slabs

The performance of concrete slabs on structural decking in respect of integrity and insulation requirements is based on standard laboratory fire tests carried out on behalf of the manufacturer of the steel decking. These define the minimum overall slab thickness for a given FRL and are published in the manufacturers' technical brochures.

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