STEEL QUIZ

STEEL QUIZ, A MONTHLY FEATURE IN *MODERN STEEL CONSTRUCTION*, allows you to test your knowledge of steel design and construction.

If you or your firm are interested in submitting a Steel Quiz column, please contact Scott Melnick at 312/670-8311 or via email at melnick@aiscmail.com.

October is home to Fire Prevention Week, October 3 - 9. The origin of Fire Prevention Week stems from the Great Chicago Fire (October 9 , 1871), one of the most devastating events in the history of Chicago. Take this month's Steel Quiz to test your knowledge of structural steel and the effects of fire.

QUESTIONS

1. What ASTM standard provides the standard time-temperature relationship used to perform fire tests in the United States?

2. What is the approximate melting point of structural steel?

3. True or False: Fire rating times (for example, 1 hour, 2 hour, etc.) relate only to the structure's ability to sustain a load for a given time period.

4. What portion of the AISC *Manual of Steel Construction* is useful in the design of fire protection for structural steel?

5. Name one of the most comprehensive directories of tested assemblies and their fire ratings.

6. True or False: Steel construction must always be considered as "unrestrained."

7. "Intumescent" paint is:
a. glow-in-the-dark
b. radioactive
c. highly flammable
d. none of the above

8. Explain briefly why the metal deck on some composite slabs is left free of fire protection material, while the supporting steel beams must be protected.

9. True or False: Spray-applied fire protection material should always be applied over primed steel.

10. What is the single most effective means of reducing loss of human life in residential building fires?

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ANSWERS

1. ASTM E119, *Test Methods for Fire Tests of Building Construction and Materials*, provides a time-temperature relationship to be followed during fire tests. The curve rises steeply at first, to 1700 degrees F after one hour, then rises more slowly after that. At 4 hours, the temperature is approximately 2000 degrees F.

2. Structural steel becomes a liquid at approximately 2600 degrees F. It is interesting to note that structural steel retains about 80% of its room temperature strength at 800 degrees F, and about 50% of its room temperature strength at 1100 degrees F.

3. False. Fire rating times are assigned based on the time at which an assembly "fails" any one of a number of criteria, including: temperature rise on the unexposed side of the assembly, the temperature of various components of the assembly, the physical integrity of the assembly, and structural failure.

4. Part 1 of the AISC Manual of Steel Construction includes tables of surface areas and box surface areas for W-shapes. These tables are useful in determining the thickness of fire protection required when member sizes differ (as they often due) from the member sizes typically used in fire tests. Many UL designs allow for this calculation.

5. The UL Fire Resistance Directory (Underwriters Laboratories, 847/272-8800) is an annual compilation of fire-tested structural assemblies.

6. False! There are several factors that come into play, not the least of which is the fact that usually only a small portion of the building is involved in a fire. The cooler, uninvolved areas can act to restrain the expansion of the involved portion of the structure. "Restrained" and "Unrestrained" designations stem from fire tests themselves: "unrestrained" assemblies are constructed and tested without edge restraints against thermal expansion.

7. **d**, none of the above. Intumescent paint is the generic name for coatings that expand when exposed to heat. The paint film expands to many times its original thickness to provide a layer of insulation between the substrate and the source of the heat.

8. It's a thermodynamics problem. Don't worry, we'll skip the equations. In some cases the composite slab is of sufficient thickness to provide a "heat sink" effect: the slab absorbs heat from the metal deck, keeping its temperature within desired limits. The flanges and webs of wide-flange beams, however, are not as effective in transferring heat to the composite slab, and therefore must often be protected.

9. False. Many shop-applied coatings (and field-applied coatings, for that matter) are incompatible with common fire protection materials, causing them to adhere poorly to the steel. In most cases, unprimed steel is the best surface to receive applied fire protection materials.

10. Sprinklers. If the sprinklers do not completely extinguish the fire, they do help slow its progress. This gives the occupants additional time to escape…even seconds can be