Kai Ödeen[1]

General Discussion

In Sweden surface finishes are classified according to a standardized test method (the Swedish box-method). When developing this method it was assumed that the problems of rapid flame spread and of heavy smoke development are so connected that they can very well be determined from the same test.

Test Method Br 8

General

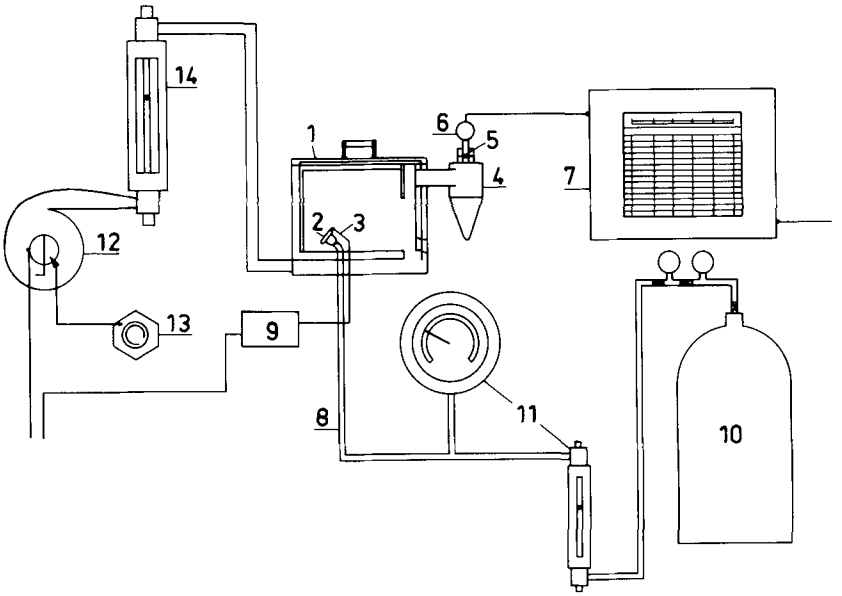
The test shall in principle be carried out by means of the method which is described in *Bulletin (Meddelande) No. 123,* of the Swedish National Institute for Materials Testing.

The material to be tested shall be placed in a combustion box along its rear wall, its side walls, and its lid. The lid shall then be fastened with a screw clamp so as to secure complete tightness of the combustion box. The test equipment is shown in Fig. 1.

Secondary air shall be supplied to the combustion box at a specified rate of flow (175 liters per min) in order to ensure approximately complete combustion. The equipment for the supply of propane, which forms the initial heat source, shall be adjusted to a constant pressure of 6 atmos gage, and shall be connected to the burner. Before starting the test, a careful check shall be made to verify that propane is flowing through the nozzle at a proper rate[2] at the above-mentioned pressure. Then the propane valve shall be closed. To commence the test, the temperature recorder shall be started, and the electric circuit of the ignition filament above the burner head shall be closed. Immediately after that, propane shall be admitted to the combustion box. The temperature of the combustion gases shall be measured at the cyclonic outlet of the combustion box. The degree of transparence of the smoke shall be recorded above

[1] National Institute for Materials Testing, Stockholm, Sweden.

[2] The proper rate of flow of propane is dependent on several factors, for example, the heat value of the gas, and shall be determined by using a specified calibration method (see, for example, *Bulletin No. 123*). Normally this rate shall be 2.5 to 3 liters per min.



1. Combustion box, inner surfaces lined with test material.
2. Burner.
3. Gas lighter.
4. Outlet for smoke.
5. Thermocouple.
6. Photocell.
7. Temperature recorder.
8. Nozzle with injector.
9. Transformer for gas lighter.
10. Container for propane gas.
11. Gas pressure and volume gage.
12. Inlet fan for secondary air.
13. Rheostat for fan.
14. Air volume gage.

FIG. 1—*Test equipment.*

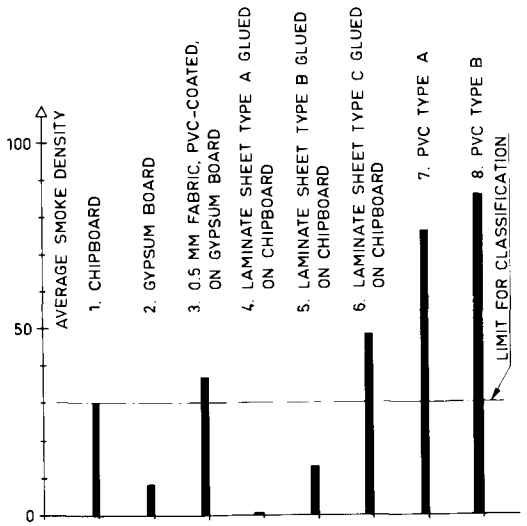


FIG. 2—*Average smoke density for some surface finishes.*

the cyclonic outlet by means of a photocell. Smoke density is reported in terms of per cent of the total opacity.

The duration of the test shall be 5 min.

The test method described previously has been used in the work of our laboratory for about 10 years, and during this time about 100 materials have been studied each year. From these tests some typical results have been picked out and brought together. As in the classification the average smoke density during the test period is relevant, these values are shown in Fig. 2. The very high values of some plastic materials may be noticed, but it is also seen that this tendency is not clear (for example, compare the different values for laminated plastic sheets). The complete time-density curves for the materials are shown in Fig. 3.

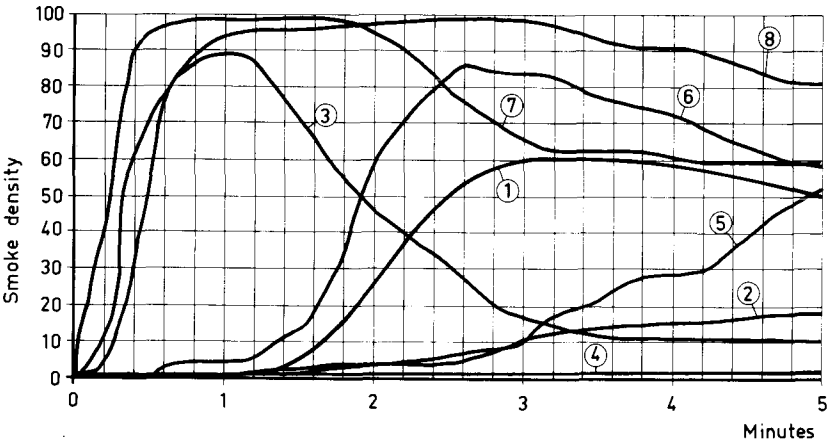


FIG. 3—*Observed smoke density-time curves for the materials in Fig. 2.*

Finally I would like to express as my opinion that a test like the box test just described will serve as a fairly good base for estimating the tendency of surface finishes to contribute to rapid flame spread and to heavy smoke development. The box can be regarded as a model compartment, and it is possible to control the heat balance of the box in a very accurate mode. However, it is quite clear that the criteria and classification limits to some extent are arbitrarily chosen, although they are based on full-scale tests. A discussion of these limits would be very valuable. It is also possible that more extensive measuring equipment would give interesting information, and it has been suggested that such an extension would be arranged in order to describe the mass-balance during the test.