6.7 Printing Ink

6.7.1 Process Description[1]

There are 4 major classes of printing ink: letterpress and lithographic inks, commonly called oil or paste inks; and flexographic and rotogravure inks, which are referred to as solvent inks. These inks vary considerably in physical appearance, composition, method of application, and drying mechanism. Flexographic and rotogravure inks have many elements in common with the paste inks but differ in that they are of very low viscosity, and they almost always dry by evaporation of highly volatile solvents.[2]

There are 3 general processes in the manufacture of printing inks: (1) cooking the vehicle and adding dyes, (2) grinding of a pigment into the vehicle using a roller mill, and (3) replacing water in the wet pigment pulp by an ink vehicle (commonly known as the flushing process).[3] The ink "varnish" or vehicle is generally cooked in large kettles at 200 to 600°F (93 to 315°C) for an average of 8 to 12 hours in much the same way that regular varnish is made. Mixing of the pigment and vehicle is done in dough mixers or in large agitated tanks. Grinding is most often carried out in 3-roller or 5-roller horizontal or vertical mills.

6.7.2 Emissions And Controls[1,4]

Varnish or vehicle preparation by heating is by far the largest source of ink manufacturing emissions. Cooling the varnish components — resins, drying oils, petroleum oils, and solvents — produces odorous emissions. At about 350°F (175°C) the products begin to decompose, resulting in the emission of decomposition products from the cooking vessel. Emissions continue throughout the cooking process with the maximum rate of emissions occurring just after the maximum temperature has been reached. Emissions from the cooking phase can be reduced by more than 90 percent with the use of scrubbers or condensers followed by afterburners.[4-5]

Compounds emitted from the cooking of oleoresinous varnish (resin plus varnish) include water vapor, fatty acids, glycerine, acrolein, phenols, aldehydes, ketones, terpene oils, terpenes, and carbon dioxide. Emissions of thinning solvents used in flexographic and rotogravure inks may also occur.

The quantity, composition, and rate of emissions from ink manufacturing depend upon the cooking temperature and time, the ingredients, the method of introducing additives, the degree of stirring, and the extent of air or inert gas blowing. Particulate emissions resulting from the addition of pigments to the vehicle are affected by the type of pigment and its particle size. Emission factors for the manufacture of printing ink are presented in Table 6.7-1.

Table 6.7-1 (Metric And English Units). EMISSION FACTORS FOR PRINTING INK MANUFACTURING[a]

EMISSION FACTOR RATING: E

Type of Process	Nonmethane Volatile Organic Compounds[b]		Particulates	
	kg/Mg of Product	lb/ton of Product	kg/Mg of Pigment	lb/ton of Pigment
Vehicle cooking				
General	60	120	NA	NA
Oils	20	40	NA	NA
Oleoresinous	75	150	NA	NA
Alkyds	80	160	NA	NA
Pigment mixing	NA	NA	1	2

[a] Based on data from Section 6.4, Paint and Varnish. NA = not applicable.
[b] The nonmethane VOC emissions are a mix of volatilized vehicle components, cooking decomposition products, and ink solvent.

References For Section 6.7

1. *Air Pollutant Emission Factors*, APTD-0923, U. S. Environmental Protection Agency, Research Triangle Park, NC, April 1970.

2. R. N. Shreve, *Chemical Process Industries*, 3rd Ed., New York, McGraw Hill Book Co., 1967.

3. L. M. Larsen, *Industrial Printing Inks*, New York, Reinhold Publishing Company, 1962.

4. *Air Pollution Engineering Manual*, 2nd Edition, AP-40, U. S. Environmental Protection Agency, Research Triangle Park, NC, May 1973.

5. Private communication with Ink Division of Interchemical Corporation, Cincinnati, Ohio, November 10, 1969.