EQUIPMENT DESIGN

LECTURE 2

Design Information and Data

Design Information and Data

Data collection

To proceed with a design, the designer must first assemble all the relevant facts and data required. For process design this will include information on possible processes, equipment performance, and physical property data. This stage can be one of the most time consuming, and frustrating, aspects of design. Sources of process information and physical properties are reviewed in Chapter 8.

Many design organisations will prepare a basic data manual, containing all the process "know-how" on which the design is to be based. Most organisations will have design manuals covering preferred methods and data for the more frequently used, routine, design procedures.

SOURCES OF INFORMATION ON MANUFACTURING PROCESSES

The most comprehensive collection of information on manufacturing processes is probably the *Encyclopedia of Chemical Technology edited by Kirk and Othmer (1978,* 1991), which covers the whole range of chemical and associated products. Another encyclopedia covering manufacturing processes is that edited by McKetta (1977). Several books have also been published which give brief summaries of the production processes used for the commercial chemicals and chemical products. The most well known of these is probably Shreve's book on the chemical process industries, now updated by Austin, Austin (1984). Others worth consulting are those by Faith *et al, (1965), Groggins (1958),* Stephenson (1966) and Weissermal and Arpe (1978). Cornyns (1993) lists named chemical manufacturing processes, with references.

SOURCES OF INFORMATION ON MANUFACTURING PROCESSES

The extensive German reference work on industrial processes, *Ullman's Encyclopedia of Industrial Technology, is now available in an English translation, Ullman (1984).*

Specialised texts have been published on some of the more important bulk industrial chemicals, such as that by Miller (1969) on ethylene and its derivatives; these are too numerous to list but should be available in the larger reference libraries and can be found by reference to the library catalogue.

Books quickly become outdated, and many of the processes described are obsolete, or at best obsolescent. More up-to-date descriptions of the processes in current use can be found in the technical journals. Chemical Engineering, *Hydrocarbon Processing, Ind. Eng. Chemistry*

SOURCES OF INFORMATION ON MANUFACTURING PROCESSES

World ***Wide Web*** Internet

It is worthwhile searching the Internet for information on processes, equipment and products. Many manufacturers and government departments maintain web sites. In particular, up-to-date information can be obtained on the health and environmental effects of products.

GENERAL SOURCES OF PHYSICAL PROPERTIES

International Critical Tables (1933) is still probably the most comprehensive compilation of physical properties, and is available in most reference libraries. Though it was first published in 1933, physical properties do not change, except in as much as experimental techniques improve, and ICT is still a useful source of engineering data.

Tables and graphs of physical properties are given in many handbooks and textbooks on Chemical Engineering and related subjects. Many of the data given are duplicated from book to book, but the various handbooks do provide quick, easy access to data on the more commonly used substances.

An extensive compilation of thermophysical data has been published by Plenum Press, Touloukian (1970-77). This multiple-volume work covers conductivity, specific heat, thermal expansion, viscosity and radiative properties (emittance, reflectance, absorptance and transmittance),

APPENDIX D
Physical Property Data Bank

Inorganic compounds are listed in alphabetical order of the principal element in the empirical formula.

Organic compounds with the same number of carbon atoms are grouped together, and arranged in order of the number of hydrogen atoms, with other atoms in alphabetical order.

NO = Number in list
MOLWT = Molecular weight
TFP = Normal freezing point, deg C
TBP = Normal boiling point, deg C
TC = Critical temperature, deg K
PC = Critical pressure, bar
VC = Critical volume, cubic metre/mol
LDEN = Liquid density, kg/cubic metre
TDEN = Reference temperature for liquid density, deg C
HVAP = Heat of vaporisation at normal boiling point, J/mol
VISA, VISB = Constants in the liquid viscosity equation:

LOG[viscosity] = [VISA] * [(1/T) − (1/VISB)], viscosity mNs/sq.m, T deg K.

DELHF = Standard enthalpy of formation of vapour at 298 K, kJ/mol.
DELGF = Standard Gibbs energy of formation of vapour at 298 K, kJ/mol.

APPENDIX D
Physical Property Data Bank

CPVAPA, CPVAPB, CPVAPC, CPVAPD = Constants in the ideal gas heat capacity equation:

Cp = CPVAPA + (CPVAPB) *T + (CPVAPC) *T **2 + (CPVAPD) *T **3,
Cp J/mol K, T deg K.

ANTA, ANTB, ANTC = Constants in the Antione equation:
Ln (vapour pressure) = ANTA − ANTB/ (T + ANTC), vap. press. mmHg, T deg K.

To convert mmHg to N/sq.m multiply by 133.32.
To convert degrees Celsius to Kelvin add 273.15.

TMN = Minimum temperature for Antoine constant, deg C
TMX = Maximum temperature for Antoine constant, deg C

Most of the values in this data bank were taken, with the permission of the publishers, from: The Properties of Gases and Liquids, by Reid, R. C., Sherwood, T. K. and Prausnitz, J. M., 3rd edn, McGraw-Hill.