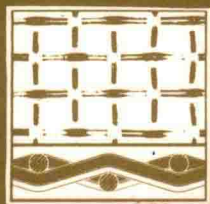
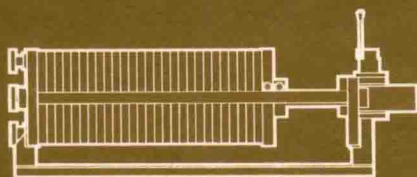
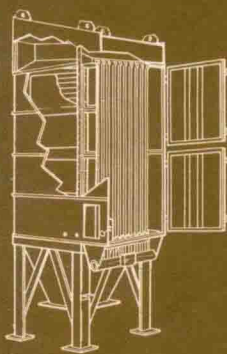


FILTERS and FILTRATION HANDBOOK



4th Edition

FILTERS and FILTRATION HANDBOOK

4th Edition

T. Christopher Dickenson FIMgt.



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FILTERS and FILTRATION HANDBOOK

4th Edition

Preface

THE ONGOING development of filtration and separation equipment to meet new industry standards in safety and health, coupled with the need from end users to improve their competitiveness and develop new processes, have contributed to an increase in the demand for filtration and separation products.

Environmental issues too are of growing concern for governments and industry alike. Air and water pollution have still to be addressed on a global scale, despite the introduction of more stringent legislation and regulations in some countries.

The timely publication of the Fourth Edition of the *Filters and Filtration Handbook* is a welcome addition to every engineers bookshelf.

Revised and updated, it is structured to take particular account of the latest developments in this technology driven market.

A massive amount of practical information and data is combined in one volume to make the *Filters and Filtration Handbook* a first source of reference and practical guide to filtration and separation products and their application.

The generous assistance and co-operation given by so many manufacturers and individuals in support of this handbook is gratefully acknowledged. Sincere apologies are made for any errors, omissions or misinterpretations that may have occurred.

Now passing its 20th year of publication, the *Filters and Filtration Handbook* can truly be said to have withstood the test of time, as a primary International information provider and a valuable source for equipment purchase and supply.

T. Christopher Dickenson
December 1997

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SECTION 1

Basic Principles

FILTRATION AND SEPARATION
CONTAMINANTS
SURFACE AND DEPTH FILTRATION
FILTER RATINGS
FILTER TESTS

Filtration and Separation

WITHIN THE next four years, it is expected that the cost of meeting environmental legislation will be in excess of \$600 billion world-wide. Countries with comprehensive environmental policies and well-developed regulations and standards have the most competitive environmental industries.

The world-wide environmental technology industry is dominated by the U.S.A., Germany and Japan for this very reason, with each of these countries having substantial government support.



The environmental market is increasingly being driven by technology with equipment suppliers spending massive sums on research and development.

As industrial applications become more demanding, and more new areas of production processes are subjected to filtration and separation, there is a growing need for suppliers to have on hand highly knowledgeable engineers to analyse and solve problems.

With the installation of filtration and separation equipment being a major capital expense, it is right to look to suppliers of these products for service and support, and to help come up with effective solutions to filtration and separation problems.

Efficiency of use within the manufacturing process is of prime importance.

Filtration and separation equipment is used mainly in the following areas. The water and sewage industry, the chemical industry, power generation, the food and beverage industry, electronics, biotechnology, pharmaceuticals, mining and the pulp and paper industry.

A filter is basically a device for separating one substance from another—hence, filtration is basically a process of separation. Immediately this expands the scope of filtration beyond the use of filters, as such. It must equally well include separating devices which work on other than pure filtering mechanics.

Two immediate problems then arise—where to stop, and how to group and classify the various types of filters and separators. There is no complete answer to either, except that the various methods and processes of filtration and/or separation fall broadly into four categories:

- (i) Solids–gas separation.
- (ii) Solids–liquids separation.
- (iii) Liquids–liquids separation.
- (iv) Solids–solids separation.

The broad field of solids–gas separation is mainly represented by air filters and air filtration services, but also includes industrial gas processing, etc. The former uses mainly filters; the latter mainly separators, precipitators and scrubbers; plus filters as necessary.

Solids–liquids separation is also an obvious field for mechanical filtration as such, but varying widely in volume requirements. Equally, it is a practical field for the application of inertial separation, particularly for process industries, and other methods which can readily be automated or semi-automated.

Liquids–liquids and solids–solids separation are more restrictive in the types of filters or separators which can be used successfully, and economically. These categories, therefore, represent more specialised fields of filtration/separation. Yet they are particularly significant in many industrial processes, although the process involved may be marginal or beyond representative coverage of filtration/separation. A basic method of liquids–liquids separation, for example, is