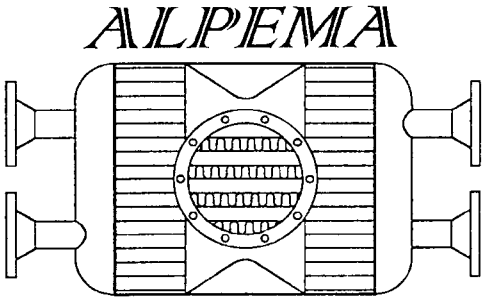
ALPEMA

Third Edition
2010

THE STANDARDS OF THE BRAZED ALUMINIUM PLATE-FIN HEAT EXCHANGER MANUFACTURERS' ASSOCIATION



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PREFACE

This is the Third Edition of the Standards of the Brazed Aluminium Plate-Fin Heat Exchanger Manufacturers' Association (ALPEMA). It is the result of the work by a technical committee of all the Members to meet the objective of the Association to promote the quality and safe use of this type of heat exchanger. The Standards contain all relevant information for the specification, procurement, and use of Brazed Aluminium Plate-Fin Heat Exchangers.

The First Edition, published in 1994, was extremely successful and popular and the Second edition was published in 2000. The ALPEMA Members review the Standards every year to consider whether updates are required and what these should be. Two amendments to the Second Edition were issued as a result of these reviews. Changes in the industry, experience with using the Standards and feedback from Users has indicated that the time is right for the Third Edition. The additions and amendments that have been made are summarised here.

1. A new Chapter 9 has been added to cover cold boxes and block-in-shell heat exchangers.
2. Photographs of typical plate-fin designs have been added, and some figures have been redrawn for clarity.
3. Information is provided on two-phase distributors.
4. Guidance on flange design and transition joints is included.
5. Guidance on acceptable mercury levels is given.
6. New information on proper storage of Brazed Aluminium Plate-Fin Heat Exchangers, manifold assemblies, and the Manufacturer's scope of supply has been added.
7. Many small changes have been made to improve clarity.

Comments by Users of the Standards are welcomed.

NO WARRANTY EXPRESSED OR IMPLIED

The Standards herein are recommended by The Brazed Aluminium Plate-Fin Heat Exchanger Manufacturers' Association to assist Users, engineers and designers who specify, design and install Brazed Aluminium Plate-Fin Heat Exchangers. These Standards are based upon sound engineering principles, research and field experience in the manufacture, design, installation and use of these exchangers. These Standards may be subject to revision as further investigation or experience may show is necessary or desirable. Nothing herein shall constitute a warranty of any kind, expressed or implied, and warranty responsibility of any kind is expressly denied.

PLEDGE

ALPEMA members will conduct themselves fairly and honestly, always practicing within legal and legislative boundaries.

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1 GENERAL DESCRIPTION AND NOMENCLATURE

1.1 GENERAL DESCRIPTION

1.1.1 Background

Brazed aluminium plate-fin exchangers are the most compact and energy efficient heat exchangers for handling a wide range of services, noted particularly for their relative high thermal efficiency, compactness, low weight and low maintenance. They provide low capital, installation and operating costs over a wide range of cryogenic and non-cryogenic applications. Typically, these units have a total surface area of 1000-1500 m^2/m^3 of volume; this compares, for instance, with a shell-and-tube unit where the surface area per unit volume is of the order of 40 to 70 m^2/m^3. Plate-fin heat exchangers with surface areas of 2000 m^2/m^3 are sometimes employed in the process industry. For these reasons plate-fin heat exchangers find applications in aircraft, automobiles, rail transport, offshore platforms, etc. The main applications are in industrial gas processing, natural gas processing and LNG, refining of petrochemicals and refrigeration services. Their ability to carry multiple streams, occasionally up to 12 or more, allows process integration in certain industrial processes, establishing them firmly in air separation processes and other cryogenic systems. The very large surface area per unit volume is particularly advantageous when low temperature differences apply. Such applications are typically found in cryogenic systems and hydrocarbon dewpoint control systems where temperature difference is linked to compressor power.

While plate-fin heat exchangers are available in various materials, this Standard refers solely to brazed aluminium plate-fin heat exchangers.

Where it is feasible to use a brazed aluminium plate-fin heat exchanger, it is nearly always the most cost effective solution, often by a significant margin.

1.1.2 Introduction

A brazed aluminium plate-fin heat exchanger consists of a block (core) of alternating layers (passages) of corrugated fins. The layers are separated from each other by parting sheets and sealed along the edges by means of side bars, and are provided with inlet and outlet ports for the streams. The block is bounded by cap sheets at the top and bottom.

An illustration of a multi-stream plate-fin heat exchanger is shown in Figure 1-1.

The stacked assembly is brazed in a vacuum furnace to become a rigid core. To complete the heat exchanger, headers with nozzles are welded to the side bars and parting sheets adjacent to the ports.

The size of a brazed aluminium plate-fin heat exchanger shall be specified by width W, stacking height H and length L of the rectangular block. (Figure 1-2).

The three dimensions shall be given always in the same sequence as $W \times H \times L$, e.g. 900 $\times$ 1180 $\times$ 6100 mm.

1.1.3 Successful Applications for Brazed Aluminium Plate-Fin Heat Exchangers

1.1.3.1 Typical services

Most brazed aluminium plate-fin heat exchangers have been installed in process plants used to separate a feed gas into its constituents, for example by the partial liquefaction of the feed and subsequent distillation and separation. The products and waste streams are then re-warmed against the feed streams. Condensers and reboilers are associated with distillation columns. Often chillers using standard refrigerants are used. Brazed aluminium plate-fin heat exchangers are well suited for these and many other services. A partial listing includes:

Name	Service
Main exchanger	To cool inlet feed streams against return product and residue streams
Reversing exchanger	Air separation application to cool air and remove atmospheric water and CO_2 by reversing flow
Subcooler	To subcool liquid products or other liquid streams
Reboiler	To reboil column bottoms or vaporise tray liquids. Often this exchanger is installed inside a column
Overhead condenser	To condense column overheads, usually against a refrigerant stream
Chiller	To cool a process stream with a vaporising refrigerant
Liquefiers	To liquefy the feed gas in a closed loop
Dephlegmators, reflux condensers	To condense overheads with vapour and liquid in countercurrent flow and perform simultaneous heat and mass transfer
Aftercooler	To cool vapour coming from a compressor discharge
Block-in-shell exchangers	Type of reboiler with horizontal block inside a shell. Operates as a kettle reboiler (See Chapter 9).

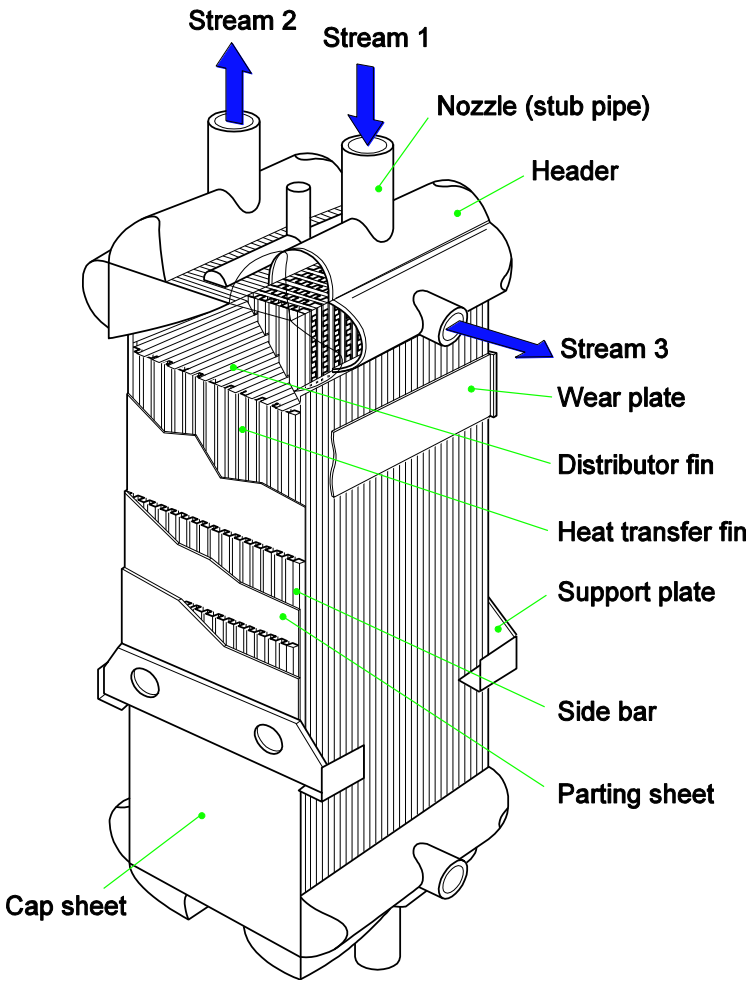

Figure 1-1: Illustration of a Typical Multi-Stream Brazed Aluminium Plate-Fin Heat Exchanger