

The CBE Tech

The Compact Brazed Heat Exchanger (CBE) allows medias at different temperatures to come into close proximity without being allowed to mix. The medias are separated only by a thin metal barrier that enables heat from one media to be transferred to the other with very high efficiency.

The metal barriers, which are called channel plates, are corrugated with special herringbone patterns. These form separate circuits for each media when the plate package is vacuum brazed together. The plate package is sealed with cover plates that complete the CBE, and connections are assembled (see Figure 1).

The number, type and configuration of the channel plates vary depending on the application. Connections are available in a wide range of industry standards. The CBE's modular product concept is therefore possible to customize to meet specific requirements, yet uses economical massproduced components.

CBE configurations

The thermal characteristics of a CBE can be modified by varying the channel plates and other components. For example, if the medias have different flow rates, the CBE can be configured to give the same pressure drop for both sides. Below there are some examples of common configurations.

- **One-pass** In a one-pass configuration (Figure 2) the two flows are continuous through each channel plate.
- **Two-pass** In a two-pass configuration (Figure 3), the two flows are redirected by special channel plates to give the equivalent of two units connected in series.
- **Dual** In a dual configuration (Figure 4), one flow goes through the entire unit. Special channel plates split the second flow into two separate ones running back-to-back, giving three flows in all.
- **Co-current and counter-current flow** The flows inside a heat exchanger can be arranged in various ways to fulfill different purposes. In SWEP CBEs, counter-current flow (Figure 5) is the most common because it enables a higher proportion of the heat content of the warmer fluid to be extracted, which increases efficiency. However, SWEP CBEs also employ co-current flow where the application demands it, e.g. in flooded evaporators.

Materials

The flexible design of a CBE makes it possible to use different materials depending on the application. However, the properties of the material play a major role in the precision of plate pressing, which in turn is crucial to the quality of the brazing. SWEP's expertise in selecting materials and familiarity with their properties are therefore vital in ensuring successful manufacturing.









Figure 1. CBE principle









The four pillars

Customers' requirements for efficiency and compactness across a wide range of cooling, heating and industrial applications are increasing the demand for SWEP CBEs. The compactness, small refrigerant hold-up volume and true counter-current flow that a CBE offers, is making them the choice of many system builders in ever-larger capacity installations. SWEP's wide range of products dedicated to specific applications is rapidly becoming the obvious option for customers worldwide. These applications fall into four main groups: single-phase heat exchangers, evaporators, condensers and special solutions.

Single-phase heat exchangers

Single-phase heat exchange is the simplest form of heat transfer. All the medias stay in the same phase (e.g. liquid) throughout the process. Common applications for SWEP CBEs include engine and hydraulic oil cooling, domestic boiler systems and hot water systems.

Evaporators

The evaporator is one of the essential components in refrigerant systems. In a SWEP CBE acting as an evaporator, a secondary gas or liquid is cooled as it loses heat to the liquid refrigerant. The refrigerant boils and is converted into gas, absorbing more energy.

A SWEP evaporator provides a good, stable boiling process with a small temperature difference between the refrigerant and the secondary fluid. A low temperature difference means that a higher evaporation temperature is possible, which reduces the pressure difference in the system and increases the density of the refrigerant gas. These two factors increase the refrigeration capacity and reduce the power consumption of the compressor, which together increase the total system efficiency (COP).

Condensers

The condenser is another essential component in refrigerant systems. A SWEP CBE acting as a condenser accepts hot gas discharged from the compressor. The gas loses heat to a liquid refrigerant and condenses to a slightly sub-cooled liquid.

In a condenser, the temperature difference for the refrigerant between the condenser inlet and outlet is much larger than in an evaporator. The true counter-current flow in a SWEP CBE makes it possible to utilize this temperature difference by increasing the temperature on the secondary fluid side to approach or even exceed the condensing temperature. The temperature increase means a smaller flow of the secondary fluid is required for a given heat load, which reduces the required pump capacity.

Special solutions

Special requirements demand special solutions, and SWEP carries out continuous research and development (R&D) to enable it to meet such demands. Examples of special solutions include the Minex hybrid product and ADWIS, the innovative Air Dryer With Integrated Separator.

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Every Type has its Series

The flexibility of SWEP CBEs makes them an excellent choice for many applications. The wide range of plate sizes, plate pattern combinations and connections enables a virtually unlimited number of combinations. You should be able to find a solution for your application among the models below.



B-type

The B-type is the original SWEP CBE. Its unique plate geometry, modular design and economical long manufacturing runs mean the product is easy to customize for many different applications.



V-type

The V-type has been developed from the original B-type to achieve optimized performance in evaporators over a very wide capacity range. The refrigerant inlet has special technology to distribute the refrigerant evenly in each channel.



P-type

The P-type evaporator has been developed from the V-type to optimize performance with the refrigerant R410A. This refrigerant has been designed to minimize ozone depletion and global warming in line with the Kyoto Protocol. The P-type is used in lower capacity heat pump and chiller applications.



S-type

The S-type evaporator has been developed from the V-type to optimize performance with the refrigerant R134a. This refrigerant has also been designed to minimize ozone depletion and global warming, in line with the Kyoto Protocol. The S-type is used over a wide range of capacities at the lower end of the scale in heat pump and chiller applications.



E-type

The E-type is the most efficient CBE on the market today, with almost all the material contributing to the heat transfer process. The E-type has been developed for low-pressure boiler applications (water to water) and moderate temperatures.



DB-type

SWEP's patented true dual-circuit product puts the secondary circuit in contact with two primary circuits. Even if one primary circuit is shut off, each secondary circuit remains in contact with a primary circuit. These advantages make the DB-type the natural choice for flexible chillers, climate control and high-precision systems for food cooling cabinets in supermarkets.



DV-type

SWEP's patented true dual-circuit product puts the secondary circuit in contact with two primary circuits. Even if one primary circuit is shut off, each secondary circuit remains in contact with a primary circuit. The DV-type is optimized for evaporation, with innovative technology to distribute the vapor evenly in the heat exchanger.



DP-type

The DP-type evaporator is also based on SWEP's true dual-circuit concept, and is optimized for the refrigerant R410A. This refrigerant has been designed to minimize ozone depletion and global warming in line with the Kyoto Protocol. Applications include flexible chillers, climate control and high-precision food cooling cabinets in supermarkets.



DS-type

The DS-type evaporator is also based on SWEP's true dual-circuit concept, and is optimized for the refrigerant R134a. This refrigerant has also been designed to minimize ozone depletion and global warming in line with the Kyoto Protocol. Applications include flexible chillers, climate control and high-precision food cooling cabinets in supermarkets.



BDW-type

The Double Wall concept is designed for applications requiring high thermal efficiency and no risk of internal leakage between the two medias, such as in the food and pharmaceutical industries. In the unlikely event of a leak, water seeps out between the vented double walls to the atmosphere, giving a visual indication of a fault.



ADWIS Air Dryer With Integrated Separator

SWEP has achieved breakthrough compactness with the ADWIS, which is one of the smallest air dryers on the market. The ADWIS combines two CBE's (a refrigerated heat exchanger and a recovery unit) sandwiching an integrated separator in a modular design. This highly cost-effective solution offers stable high performance, convenient drainage and simple insulation.



M-type (Minex)

The M-type is a hybrid PHE (plate and frame heat exchanger) sealed by gaskets rather than brazing. It is a small unit, so it does not need the typical support frame used for traditional PHEs. Like SWEP CBEs, the Minex is available in various combinations of materials.

The big Y the benefits of SWEP CBEs

Compact brazed heat exchangers (CBEs) are by far the most efficient way of transferring heat. The basic construction is as simple as it is ingenious, and enables the heat exchanger to employ virtually all its material for heat transfer. Life cycle cost (LCC) studies show that SWEP CBEs offer considerably better performance and overall economy compared with other, traditional, heat transfer technologies such as rubber gasket heat exchangers and shell-and-tubes.

Some of the advantages are:

- Size
- Performance
- Materials
- Systems
- Maintenance
- Optimal solutions
- Mass customization
- Quality control
- The environment

Size

SWEP CBEs are extremely compact, being approximately 85-90% lighter by weight and volume than a shell-and-tube model of the same capacity, giving you greater flexibility when designing your systems. Shipping costs are lower and the CBE is easier to handle during installation.

Not only is there less material in a CBE, but also as much as 95% of it is used to transfer heat, which maximizes material efficiency. A SWEP CBE offers up to 25% better capacity utilization than its plate-and-frame equivalent, and up to 1000% better than its shell-and-tube equivalent. The CBE holds only a small fraction of the system's heat transfer media, so less is needed. In a refrigerant system, small hold-up volumes are also an environmental advantage.





Performance

The ingenious design of the channel plates means the flow inside a SWEP CBE is extremely turbulent, which ensures excellent thermal performance and efficient operation even at temperature differences as low as 1K. The compactness of the CBE keeps thermal losses lower than for any other alternative, saving on insulation and energy. The option to choose true counter-current flow in SWEP CBEs allows design criteria with a close

temperature approach. For reliable performance, SWEP CBEs are leak-tested with helium.

Other performance features include optimal distribution of refrigerants in ports, special materials for heating applications and unbeatable efficiency across a range of industrial applications and capacities.



Materials

Materials can be used flexibly in SWEP CBEs to meet different demands. Thanks to years of experience in real-life applications backed up by laboratory trials and simulations, SWEP can advise on the suitability of materials for particular situations. For example, Mo-steel, a molybdenum alloy, can be used as channel plates for demanding applications. Mo-steel is highly resistant to the pitting and crevice corrosion cracking often experienced in chloride- and native iron-rich environments. SWEP's CBEs are designed for applications where the medias themselves are aggressive yet thermal performance cannot be compromised. The nickelbrazed CBE endures higher working temperatures and is more resistant to media such as ammonia solutions and fluids with high sulfur contents.



• Systems

The efficiency and compactness of SWEP CBEs bring new opportunities for system designers and unrivaled overall performance compared with other technologies. Furthermore, SWEP's mass customization concept (see page 10) also offers economy and great freedom in system design, which simplifies and reduces the cost of installation. On a more technical level, the high efficiency of SWEP CBEs enables the mass flow of the medias to be reduced across a wide range of applications. Pumps can be smaller,

saving on capital and running costs and contributing to a lower overall system cost. In many applications, the reduced use of medias that are often hazardous brings valuable safety and environmental benefits.

Maintenance

One of the main activities in the maintenance of heat exchangers is cleaning, which can be time-consuming and expensive, quite apart from the loss of service due to the lengthy downtime involved. SWEP CBEs are largely self-cleaning thanks to their high internal turbulence. This helps minimize sedimentation and fouling, which cuts cleaning costs and maximizes uptime. If a SWEP CBE needs cleaning, this can be carried out quickly and efficiently using standard methods such as CIP (cleaning in place). For example, quick and simple flushing using a weak acid is all that is needed to remove deposits of alkaline materials and maintain top performance.

Optimal solutions

SWEP can easily identify the optimal CBE solution for your application using the company's dimensioning software, SSP CBE. Its advanced calculation models use your input data to calculate which CBE will be most efficient for your application. The software also proposes an exact specification for your particular model regarding connections, fluids, size restrictions, etc. If you are frequently involved in system design, you may find it convenient to do these calculations yourself using your own copy of the software, which is available for download free of charge (see www.swep.net). If you prefer, we will be happy to take your input data and do the calculations for you.



Mass customization

Choosing a SWEP CBE gives you the best of both worlds: a fully customized product that is also cost-effectively mass-produced. This may seem contradictory, but it is simply the result of exploiting SWEP's CBE concept to the full. Although every order is handled individually, the various components in a customer-specific heat exchanger are mass-produced. Parts common to different orders are run at the same time to achieve the

best production economies. This approach, known as mass customization, enables you to buy a product specific to your application at a highly competitive price.

Quality control

A heat exchanger from SWEP is a safe and reliable choice. Each SWEP CBE is delivered with full traceability and verified functionality, with third party approvals such as PED, ULC and KHK.

SWEP leak- and pressure-tests all exchangers produced, regardless of the model, size and type of connections. The exchanger is tested for both internal and external leakage at a pressure higher than the maximum working pressure. The leak and pressure tests are certified, and a test certificate will be sent to you on request with the exchanger.

The press log that accompanies each batch of heat exchangers also contains information about the tool that pressed the plates. If a problem occurs in a batch, it can easily be traced to the press tool used. SWEP uses Statistical Process Control (SPC) throughout manufacturing to analyze and evaluate the mass of production data and to identify deviations from control values.



The environment

A SWEP CBE represents an environmentally virtuous circle in which less and less material is used more and more efficiently, saving energy and costs and minimizing environmental impact throughout manufacturing: extraction, processing, machining, transportation, installation and operation. Systems using SWEP CBEs need smaller, less expensive, pumps and smaller quantities of medias, with obvious financial and environmental savings compared with traditional competitors.

Refrigerants such as R410A and R134a have environmental advantages, and they help countries comply with their Kyoto obligations, but they have been difficult to use efficiently. SWEP's most recent technical achievement is the production of CBEs optimized for these preferred refrigerants: the new P- and S-type CBEs.

WCPS World-class products and services

WCPS is the concept behind SWEP's determination to offer both products and services with genuinely world-class stature and to ensure total consistency between what we say and what we deliver. For SWEP, WCPS involves the three main areas of Attitude, Lean manufacturing and Customer focus, each of which in turn covers a number of key concepts:

World-Class Products — WCP

World-class products have optimal combinations of performance, economy and reliability. The precise solution varies according to the application and your specific needs, of course. However, it will usually involve the factors described below, which SWEP has identified as crucial to world-class quality and is subjecting to QSFV (Quality, Speed, Flexibility, Value) analysis.

SWEP products will comply fully with their specifications in every way, from physical dimensions to performance. They will be available with acceptable lead times, and will arrive appropriately packaged. Assembly will be as simple as possible, to save time and costs, and the CBE will be visually attractive in case it can be seen when installed and operational.

Wherever possible and necessary, the CBE will represent an innovative solution for your application, and will reflect or lead the latest technological advances. However, the CBE will also be a fully developed product that has been comprehensively tested and proven in SWEP's laboratories and test rigs. In use, the CBE will be free from faults and offer excellent long-term reliability. In the longer term it will offer sustained high performance and a good return on investment.

World-Class Services – WCS

World-class services could be summed up as being there when you need us – perhaps even before you know you need us – and delivering what we promise. SWEP's broad aims are to:

- Offer flexible terms and conditions
- Be a knowledge provider
- Ensure human availability
- Provide a next hour response to inquiries
- Be genuinely multicultural
- Innovate service solutions

To achieve these broader aims, a focused program has been set up to promote and ensure excellence across a wide range of contacts with you. Whether this involves face-to-face meetings or the documentation associated with quotations, ordering, invoicing and delivery, SWEP's QSFV analysis will identify critical aspects and ensure that the company handles them in the best possible way. On the hardware side, priority is being given to the things that matter to you: co-operative R&D, customization and prototyping. SWEP is also committed to improving knowledge transfer in areas such as communication, software tools and technical documentation.

World-class manufacturing

For SWEP, the keys to world-class manufacturing are competence and efficiency. Over the years, the company has acquired enormous competence in every aspect of CBE manufacturing. This competence can be broken down into seven main layers, all of which are constantly refreshed by innovative R&D. The drive for efficiency is embodied in SWEP's adoption of the Lean manufacturing philosophy. As a Lean company, SWEP emphasizes continuous workflow, customer pull and the elimination of all forms of waste.

Layers of competence

• Simulation

Simulation reinforces R&D creativity and is one of the most important stages in the development of new and existing CBEs. It accelerates time-to-volume and improves the functionality of new products.

Tooling

SWEP precision-mills its own press tools in a totally integrated CAD/CAM process. This assures quality and availability at a vital stage in production, and guarantees consistency from series to series.

Laboratory

SWEP has its own fully developed R&D laboratory, which has facilities for testing the heat transfer capacity of single-phase and two-phase applications, flow distribution, strength, mechanical and thermal fatigue performance, etc.

Material

SWEP has developed far-reaching specifications, and buys only from certified suppliers. This ensures that our products have a long and reliable service life backed up by the traceability demanded by many third party approvals.

• Pressing

SWEP produces channel plates on automatic integrated press lines that guarantee consistently high quality. This precise and carefully supervised process ensures maximal efficiency for each SWEP CBE and cost-effective manufacturing.

Brazing

Meticulous brazing is the key to leak-free, corrosion-resistant heat exchangers. SWEP has developed specific brazing programs, with precisely adapted heating and cooling cycles, for every combination of materials and size of heat exchanger.

Testing

SWEP leak- and pressure-tests all heat exchangers produced, regardless of the model, size and type of connections. Heat exchangers are normally pressure-tested at 1.5 times the maximum working pressure.

Lean manufacturing

The Lean approach to manufacturing emphasizes the maximization of customer value and the minimization of waste in all its forms: time, energy and materials. SWEP's introduction of Lean manufacturing has led to a number of successful projects that have revitalized priority areas. For example, the availability of finished CBEs has been improved to such an extent that many lines are available for essentially immediate delivery through SWEP's eBusiness Internet ordering service. Yet at the same time, inventories are being steadily reduced, bringing cost savings that can be passed on to you.

Use the net www.swep.net

SWEP is determined to make it easy for you to do business with us. We have a comprehensive and informative website at www.swep.net, which offers a number of resources to help you in your everyday work. You can also meet us at major exhibitions and fairs all over the world, or simply contact your local SWEP representative to arrange a meeting in your office. These are just a few of the ways we want to be your helpful, accessible and reliable partner.

eBusiness

SWEP's eBusiness enterprise, available via the Internet, is a very important service that gives customers access to powerful customized distribution and logistics solutions. Many CBE models are available through eBusiness, and some are exclusive to the service. On your PC screen you have a complete overview of prices, outstanding orders, invoices and deliveries. You can place your order directly through the system, have it confirmed by email in seconds, then monitor its progress through dispatch and transportation.

What makes all this possible is SWEP's just-in-time manufacturing system, which is backed up by advanced logistics solutions including strategically located warehouses and distribution facilities.

Product information

SWEP's website is dedicated to giving you the information you need about our products as quickly and simply as possible. A quick selection guide helps you choose the CBE you need, or you can download SSP, SWEP's advanced CBE calculation software. If you are converting from a competing product, the Cross Reference guide will, for example, quickly identify SWEP's alternatives to your existing models. When you know which products you are interested in, full product sheets are instantly available from the SWEP website. These sheets allow you to examine full technical data (including capacities, connections and third party approvals) on screen, and even view and manipulate 3D models of the CBE. To complete the product picture, another click gives you access to installation manuals in PDF format.

Your partner

If we had to sum up our approach to you in one word, it would be partnership. Everything we do is devoted to ensuring you have timely access to the bestperforming and most reliable products at competitive prices. To achieve this we must discover your needs, so we can suggest solutions. We must also be able to anticipate your needs, using R&D to innovate in CBE technology so that we have solutions ready when your market or the world changes. A good example is the way we have optimized some models for use with the environmentally preferred refrigerants R410A and R134a, which are becoming increasingly popular.

Beyond the products themselves, our advanced logistics solutions ensure quick and reliable distribution to support your advances into rapidly growing or emerging markets. Finally, and perhaps equally important, there is the high quality of SWEP's customer communications and relationships, and the feeling of reassurance you get from working with the leading company in its field. These are powerful reasons for choosing SWEP as your heat exchanger partner. Download calculation software

Place your order

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See CBE in 3D



SWEP is the world's leading supplier of compact brazed heat exchangers (CBEs). These products are used where heat needs to be transferred efficiently in air conditioning, refrigeration, heating and industrial applications. SWEP has sales of USD 160 million and is close to its customers, with representation in more than 50 countries and its own dedicated sales force in more than 20 countries. Highly efficient production units in Sweden, Switzerland, the USA, Malaysia, Slovakia and soon also in China enable SWEP to serve customers all over the world. SWEP is part of the global Dover Corporation, which is a multi-billiondollar, NYSE-traded, diversified manufacturer of a wide range of proprietary products and components for industrial and commercial use.

www.swep.net

EXPECT A CHANGE

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