



Refrigeration Division

Grasso

A detailed topographical map of Asia and Australia, overlaid on a globe. The map shows various geographical features, including mountains, rivers, and coastlines. Major countries like China, India, and Australia are clearly visible. The map is color-coded by region, with China in orange, India in purple, and Australia in red. The globe is shown from a perspective that includes the equator and parts of the northern and southern hemispheres.

# The Industrial Refrigeration World of Grasso International

## WHO WE ARE...

The success of Grasso International and the satisfaction of our customers arises not only from providing the quality products and services outlined in this brochure, but also from our enormous store of technical know-how and Grasso's marketing philosophy in the world of industrial refrigeration. Since the company was founded 140 years ago by Willem Grasso, our approach has been to put the customers' interest first.

Grasso International is one of the world leaders in all aspects of industrial refrigeration. Our organization's services include the designing, contracting, engineering, installation, commissioning, consulting, service & maintenance and sales of refrigeration systems and their components.

Grasso International covers the world market, with the exception of Western Europe, from local offices worldwide which are supported by two head offices:

- 's-Hertogenbosch, The Netherlands, where the refrigeration projects are co-ordinated and supported for countries in the Far & Middle East, Africa (except South Africa) and North & South America.
- Berlin, Germany, where Grasso International GmbH is responsible for the co-ordination and the support for countries in Central & Eastern Europe.

Information about Grasso's offices in Western Europe can be obtained via Grasso Products on request.

The various companies within the Grasso group deliver a variety of installation components:

- Industrial refrigeration reciprocating and screw compressors from Grasso Products
- Industrial refrigeration valves from Revalco
- Air coolers & air cooled condensers from Küba
- Spiral freezers from Matal
- Flake ice machines from Frigofrance.

Additionally, Grasso's fully owned local contracting companies in Western Europe can offer you a wide variety of refrigeration plants for all kinds of industrial applications.

Grasso International is a member of the Refrigeration Division of the multinational GEA AG in Germany. The GEA group employs about 17,000 people in some 50 countries and consists of some 150 operating companies. Sales in 1996 exceeded 4 billion DEM.

Together with the other GEA companies, such as Niro, Westfalia, Tuchenhausen and GEA Ahlborn, we are able to deliver turn-key projects in the food processing, dairy, brewing and beverage industry.

*Refrigeration plant for a food distribution centre operated by a large supermarket chain.*



## WHAT WE CAN DO FOR YOU

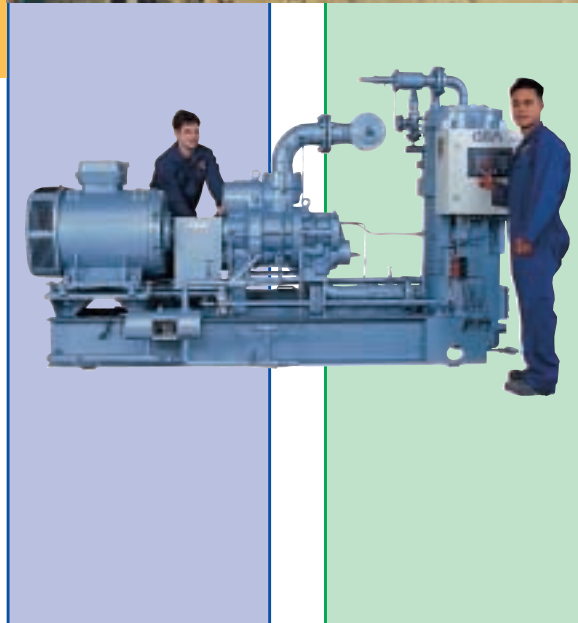
Whether you want to build an ice cream plant in China or a brewery in Malaysia, a dairy plant in Australia or a freeze-dry coffee plant in Colombia, a slaughterhouse in Russia, a cold store in Eritrea or a fish processing plant in Greece, Grasso International will take the full responsibility of the design, construction and supervision of the refrigeration installation.

The projects can be carried out in our head office in The Netherlands, at one of our Grasso International offices worldwide or locally by working together with reliable and high quality subcontractors.

Our activities can be divided into the following groups:

- **INSTALLATION DESIGN**
- **CONTRACTING AND COMMISSIONING**
- **CONSULTING**
- **SERVICE AND MAINTENANCE**
- **COMPONENTS SALES**
- **OR ANY COMBINATION OF THE ABOVE**

*The reputation of Grasso International is complemented by its experts who are able to solve problems on the spot. Individuals with patience, who know the local situation and who can organize on-site requirements.*



## INSTALLATION DESIGN



*Complete ammonia refrigeration plant installed at an ice cream factory in China. Screw compressors, made by Grasso, are the heart of the installation.*



*Computer monitoring and plant control systems (GIPC) are also features of many Grasso International installations.*



Grasso International not only has the required knowledge of refrigeration technology and the correct way to apply it but also has a comprehensive knowledge of customers' products. With the help of basic design data, such as climatic conditions, product data, quantities, desired temperatures and problem analysis, the optimum "tailor made" installation will be designed which fully meets the requirements of the customer.

Reliability and maximum performance are of importance in the design of each installation, while key characteristics such as optimal quality of the product, low energy consumption, ease of service and maintenance, safety and low noise levels are regarded as normal features.

For optimization of designs Grasso International operates a large number of computer programmes to assist project engineers in computer aided engineering.

Grasso's engineering staff utilize innovations which, for example, reduce the operating time of the cooling process, or lower the energy and maintenance costs.

## CONTRACTING AND COMMISSIONING

The co-ordination, detail engineering, drafting, material purchasing and logistics of a supply and installation contract are carried out by an experienced group of people of the following expertise:

### PROJECT MANAGEMENT

For each project a project manager is appointed for direct liaison with the customer. The project manager is responsible for the execution of the project from the moment a contract is started until the successful commissioning and handing over of the installation.

### REFRIGERATION/MECHANICAL ENGINEERING

Design and engineering of the installation is carried out with the help of technical calculation and selection programmes and CAD stations. For each project P&I diagrams, foundation plans, pipe layouts and detail drawings are submitted as well as detailed installation instructions, operating and maintenance manuals.


### ELECTRICAL ENGINEERING

Our electrical engineers design the detailed control system and the electrical diagrams for the distribution and control panels as well as, if required, for the lighting of the installation. Furthermore they write the programmes for various brands of PLC's and visualization/data logging and monitoring systems (Grasso International Plant Controller, GIPC).

### SITE SUPERVISION AND COMMISSIONING

Grasso has a staff of experienced site supervisors available who can supervise and instruct the local work force during the erection of the installation. Their qualities have been proven in almost every country worldwide. Individuals with patience, who know the local situation, who can organize and are resourceful in providing practical solutions to problems. When required, additional project administrators/interpreters can be appointed to support the works on the site.

Commissioning of the installation and training of customer's operators can also be carried out by the site supervisor.



*Mechanical and electrical engineering of refrigeration installations.*



*A local engineer is being given individual attention by one of Grasso's fully trained site supervisors.*

## CONSULTING

All the technical know-how that Grasso has obtained in the field of industrial refrigeration, is accumulated in our consulting department:

### NEW PLANTS

Our consultants are experts in applying and developing the optimal process to cool your product. At the same time, possible future changes in the refrigeration process are taken into account in the engineering phase in order to avoid high alteration costs at a later date.

When engineering a plant, the equipment with the highest capacity against the lowest operating costs should be chosen. Grasso International's consulting department has an extensive knowledge of this concept. They can advise you in choosing the correct refrigeration plant or individual components.

### PLANT ERECTION

Our worldwide experience of erecting plants in almost every country in the world, ensures that our consultants can give you sound advice and assistance in the best methods of erection of your plant.

### EXISTING PLANTS

The broad experience of Grasso International in the field of refrigeration and contracting can be of great benefit when an existing refrigeration plant needs to be extended as well as for finding solutions for existing technical problems. Grasso International's consultants know the best way to retrofit existing refrigeration plants with more environmental friendly refrigerants and coolants.

### INFORMATION TECHNOLOGY IN REFRIGERATION

Our consultants have the knowledge of the latest developments in the field of microprocessor controlled refrigeration. They design the required energy management systems as well as the engineering of the data communication/ visualization systems.

Advice and training in maintenance and service of refrigeration plants, can also be provided.



*Our specialists can assist you in programming your PC and PLC controlling systems.*



*Grasso International's consultants are specialized in optimizing your existing refrigeration process.*

## SERVICE AND MAINTENANCE

It is not only important that a refrigeration plant is well designed and properly installed but, also that it is well maintained. Correct maintenance prevents breakdowns and increases the life span of the plant.

Over the years, Grasso has formed the best possible service organization within the industry. They operate throughout the world and are pleased to offer you the following service facilities:

**24 HOURS PER DAY • 7 DAYS PER WEEK SERVICE**



**Please contact your local parts & service hot-line as mentioned on the back of this brochure**

### FIELD SERVICE TEAM

Specially trained and experienced service engineers are on stand-by to give full technical assistance and after-sales service. The specialists of the Field Service Team can assist you with the installation, commissioning, maintenance, operational problems, on site inspection, overhauling and repairing. If necessary, we can provide engineers for longer periods of time as required.

### SPARE PARTS

A practical and fast working parts organization has been established to supply the necessary spare parts worldwide. Spare parts can be ordered 24 hours per day, 7 days per week. To shorten the delivery time further main distribution centres are formed in Far & Middle East and North & South America. Meanwhile, the number of offices, contractors and agents who stock our parts is increasing.

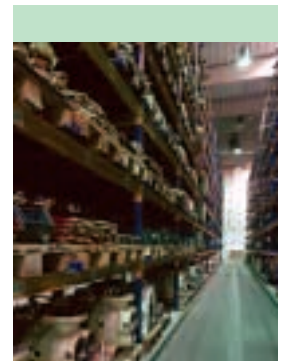
### SERVICE CONTRACTS

Service contracts tailored to suit your specific requirements can be made to keep your refrigeration plant running smoothly.

In actual practice, regular maintenance on a preventive basis has proved to be cheaper than waiting for calamities to occur. Grasso International engineers are fully trained to carry out this preventive maintenance or to help you to set up preventive maintenance schedules.

### TRAINING COURSES

Extensive training courses are organized regularly for service engineers and mechanics to ensure proper application and maintenance of our products by the customer.



*Our highly specialized storage for spare parts.*



*One of the Grasso service vans.*



*Service course.*

## COMPONENTS SALES

### REFRIGERANTS AND THE ENVIRONMENT

One of the elements of a good refrigeration system lies in the quality of the main components of the installation.

Grasso International is working with self designed and produced world class reciprocating and screw compressors, packages, chillers, valves and components for which Grasso is known throughout the industry. All major classification societies' certificates can be supplied with all compressors and auxiliary equipment.

The extensive range of high quality, reliable and modern refrigeration compressors, can be applied in almost every industrial refrigeration process.

The manufacturing programme covers refrigeration requirements at evaporating temperatures from -65 up to +30 °C and refrigeration capacities from 20 up to 2300 kW at -10/+30 °C. The compressors are designed for markets with use of 50 Hz and/or 60 Hz.



*Grasso screw compressor package with Grasso International Compressor Control (GICC).*



*The pistons, one of the most important parts of the reciprocating compressors. They pump the refrigerant, e.g. ammonia, through the installation. In this way "cold" can be produced.*

Each compressor type has its particular advantages depending on the required conditions of operation. For example to the question when screw compressors and when reciprocating compressors should be applied, there is no general answer. Both types have very specific properties which influence the correct choice considerably. In order to make an optimum selection, one should consider all relevant criteria, such as capacity required, ease of maintenance, operating conditions, temperature levels, energy consumption, investment and available space.

#### REFRIGERANTS AND THE ENVIRONMENT

All products are suitable for NH<sub>3</sub>, R22, R134a, R404A and other common refrigerants.

Today some new refrigerants and blends of HCFC's/HFC's are introduced to the refrigeration market. Grasso's compressors have been tested with these new fluids and are suitable for all the new refrigerants.

However, the only refrigerant with a zero Ozone Depletion Potential (ODP), a zero Global Warming Potential (GWP), superior thermodynamic properties and worldwide availability is ammonia (NH<sub>3</sub>).

Grasso has an enviable reputation gained in using ammonia as a refrigerant for more than 100 years.

The use of ammonia as a refrigerant in refrigeration systems means an important contribution to the preservation of the ozone layer.

We are convinced that, because of its efficiency and environmentally friendly properties, ammonia is an important refrigerant of the future.



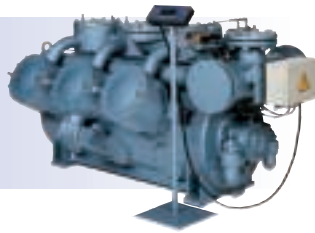
## RECIPROCATING, SCREW COMPRESSORS AND PACKAGES

### GRASSO RECIPROCATING COMPRESSORS

The supply range of Grasso reciprocating compressors comprises 41 types subdivided into 6 series. Swept volumes range from 60 to 1590 m<sup>3</sup>/h (35 to 936 CFM) at a nominal speed of 1000 min<sup>-1</sup> with a refrigerating capacity range from 20 to 936 kW for NH<sub>3</sub> at -10/+30 °C .

#### RC12 SERIES

6 single-stage types with 2 to 12 cylinders and 9 two-stage types with 3 to 12 cylinders.



#### RC9 SERIES

3 single-stage types with 2, 4 or 6 cylinders and 2 two-stage types with 3 and 6 cylinders.



#### RC6 SERIES

3 single-stage types with 4, 6 or 8 cylinders.



#### AC80R SERIES

8 single-stage types with 4 to 16 cylinders.



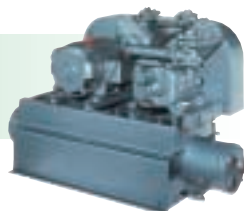
#### SAC80R SERIES

7 single-stage types with 4 to 12 cylinders.



#### THERMATROL SERIES

3 single-stage types with 2, 4 or 8 cylinders.



### GRASSO SCREW COMPRESSORS

The supply range of Grasso screw compressors comprises 15 types subdivided into 3 series. Swept volumes range from 230 to 3250 m<sup>3</sup>/h (136 to 1913 CFM) at a nominal speed of 2940 min<sup>-1</sup> with a refrigerating capacity range from 137 to 2300 kW for NH<sub>3</sub> at -10/+30 °C.

#### SH SERIES -

HIGHLY INTEGRATED SEMI-PACK  
4 single-stage and economized types.



#### MC SERIES - COMPACT

4 single-stage and economized types.



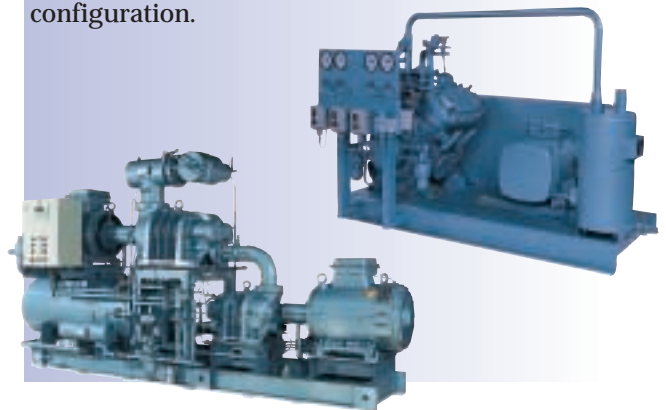
#### LT SERIES - HIGH PERFORMANCE

7 single-stage and economized types.



### GRASSO RECIPROCATING AND SCREW COMPRESSOR PACKAGES

In addition to the bare reciprocating and screw compressors, a wide assortment of standard components is available to build-up the optimum single- or two-stage compressor configuration.



# AMMONIA CHILLERS, CONTROL UNITS, PURGERS, PRESSURE VESSELS, VALVES, FLAKE ICE MACHINES AND HEAT EXCHANGERS

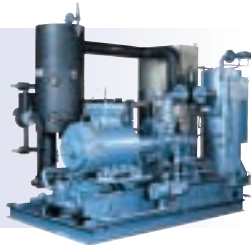
## GRASSO AMMONIA CHILLERS

The Grasso ammonia liquid chillers utilizing Grasso reciprocating and screw compressors for medium and large refrigeration, air conditioning applications, process cooling and heat pump applications.

The supply range of Grasso chillers comprises 34 types subdivided into 3 series: P, R and GC. Refrigeration capacity range from 75 to 3300 kW (21 to 939 Tons) at a water inlet temperature of 12 °C and a water outlet temperature of 6 °C.

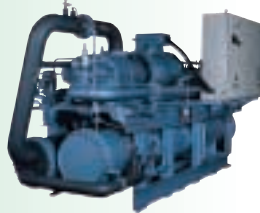
### P SERIES

Flooded evaporation chillers with plate heat exchangers and screw compressors mainly for industrial use.



### R SERIES

Direct expansion chillers with shell and tube evaporators and screw compressors especially designed for use in air conditioning applications and process cooling.



### GC SERIES

Direct expansion chillers with shell and tube heat exchangers and reciprocating compressors especially designed for use in air conditioning applications and process cooling.



## GRASSO INTERNATIONAL COMPRESSOR CONTROL (GICC)

The Grasso International Compressor Control is a PLC-based monitoring and control unit for single-stage and two-stage (compound) reciprocating and screw compressors and packages. The compact and easy-to-operate keyboard-display, provides on-line information on all relevant conditions.



## GRASSO SELF-LIMITING AUTOMATIC PURGER

The Grasso self-limiting Automatic Purger removes non-condensable gases from the refrigeration system and improves the efficiency and the characteristics of any industrial refrigeration plant.



## GRASSO PRESSURE VESSELS

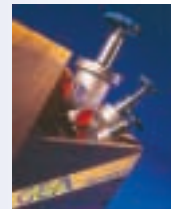
The vessel series consists of:

- High pressure refrigerant receiver vessels
- Low- and interstage pressure refrigerant separator vessels
- Interstage coolers
- Oil separators
- Oil wash columns
- Custom built vessels with a pump section for refrigeration and process industry.



## REVALCO VALVES & COMPONENTS

- Stop Valves
- Regulating Stop Valves
- Small Valves
- Filters/Strainers
- Check Valves
- Stop-Check Valves.



## GENEGLACE FLAKE ICE MACHINES

- 150 kg to 30 metric tons per day
- On board and land-based machines
- Ice storage bins

For different fields of operations like fish production and distribution, meat processing, industrial bakeries, chemical industry, civil engineering.



## KÜBA HEAT EXCHANGERS

The heat exchanger series consists of:

- Air coolers (0.5 up to 140 kW)
- Electronic controls for defrost on demand and plant management
- Condensers up to 1000 kW
- Accessories and spare parts.



## APPLICATIONS

There are almost no limits to the ways in which our refrigeration technology can be applied, for example:

- **FOOD PROCESSING INDUSTRY**
- **MULTI PURPOSE COLD STORES, COOLING AND FREEZING SYSTEMS**
- **BREWERIES, MALTINGS & THE BEVERAGE INDUSTRY**
- **SLAUGHTERHOUSES**
- **ICE PLANTS**
- **ICE RINKS**
- **ICE CREAM FACTORIES**
- **MARINE APPLICATIONS**
- **AIR CONDITIONING SYSTEMS**
- **CONCRETE COOLING**
- **CHEMICAL, PHARMACEUTICAL AND METALLURGICAL PROCESSES**



## FOOD PROCESSING INDUSTRY



*Grasso International also designs special systems for banana ripening rooms and for storage of products such as grapes, potatoes etc. which require specific conditions.*



Grasso International can offer its vast experience to the application of refrigeration technology in the field of food processing of a wide spectrum of products. Our designs are supported by our self-developed computer programmes, enabling us to offer tailor made solutions.

### **VEGETABLE AND FRUIT INDUSTRY**

The Grasso International pressure cooling systems, using direct evaporating and/or wet cooling, establish a high relative humidity at a constant temperature. They are particularly suitable for cooling of packed vegetables.



*Eviscerating of poultry in temperature controlled rooms.*

### **POULTRY PROCESSING INDUSTRY**

Grasso International has developed a wide range of cooling and freezing concepts from standard Individual Quick Freezing (IQF) tunnels to tailor made blast freezers.



### **DAIRY INDUSTRY**

Milk is cooled, directly after delivery and during processing, by means of cold water heat exchangers with water at maximum +1 °C or by air coolers at a temperature of +4 °C. Grasso can supply indirect cooling systems using secondary heat transfer media such as water and glycol.

*Special storage conditions are required for ripening warehouses where cheese is stored for a longer period of time.*

# MULTI PURPOSE COLD STORES

## COOLING AND FREEZING SYSTEMS

Cold stores are indispensable as a link between the production of perishable consumer goods and the consumer. The goods must be stored in the correct manner for distribution to wherever they are needed. Products from other countries, often entire ship loads, have to be stored in the country of destination. In this case cold storage is needed not only prior to transportation to other inland stores but also during distribution in phases as required.

Grasso International has delivered and installed cold stores in many countries throughout the world, in regions where completely different climatic conditions prevail. The storage temperatures vary from  $-28^{\circ}\text{C}$  to  $+15^{\circ}\text{C}$ , depending on the products to be stored, from vegetables and fruit to meat and fish. Even very sensitive products such as bananas, which in the ripening phase require temperature variation control up to  $0.1^{\circ}\text{C}$  and ethylene management, or garlic, requiring delicate humidity and  $\text{CO}_2$  control, are covered by the expertise found within Grasso International.

### THE VARIOUS KINDS OF COLD STORES:

- **multi purpose cold stores**, which have rooms for temperatures from  $0^{\circ}\text{C}$  to  $+15^{\circ}\text{C}$  and for low temperatures of  $-28^{\circ}\text{C}$  to  $-18^{\circ}\text{C}$  or dual temperature rooms which have a combination of the above.
- **cold stores** in which products are stored at temperatures between  $0^{\circ}\text{C}$  and  $+15^{\circ}\text{C}$ . Vegetables and fruits are stored in these kinds of cold stores, often in combination with Controlled Atmosphere ( $\text{CO}_2$  control) or Ultra Low Oxygen (ULO) systems in order to extend the possible storage time.
- **frozen foods** in which frozen products are stored at  $-28^{\circ}\text{C}$  to  $-18^{\circ}\text{C}$ .

*Red berries and other small products are individually frozen in a fluidized bed freezer. At the same time, the product is conveyed by cold air. Grasso International controls these conditions.*

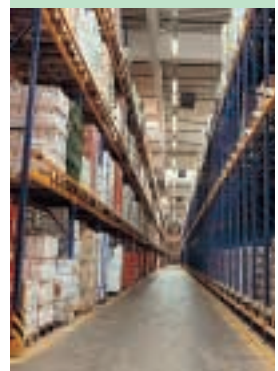
### COOLING AND FREEZING SYSTEMS

These systems are used to quickly cool or freeze the harvested products to prevent early deterioration. Grasso International supplies vacuum or wet-cooling equipment and Individual Quick Freezing (IQF) tunnels. For the latter Grasso has two options, the belt driven IQF-tunnel or the Whirlwind tunnel, using pulsating air to transport delicate products, thus eliminating mechanical damage.

*Special storage conditions are required to prevent seed potatoes from sprouting when they are stored for long periods of time.*



*A special cold store for flowers and a multi purpose cold store.*



## BREWERIES, MALTINGS & THE BEVERAGE INDUSTRY



*Beer is fermented, deep-cooled and stored in vertical tanks at temperatures of -1 °C and over, depending on the type of beer, with an accuracy of +/- 0.1 degrees.*



*Typical "old style" brew house.*

The use of refrigeration technology extends to many areas within the brewing, malting and beverage processes:

- control of the germination temperature during malting
- wort cooling
- temperature control of fermenting tanks and deep cooling and storage tanks
- recycling of carbon dioxide for use in bottling and canning lines
- cooling of beverage and syrup before bottling to allow easy injection of CO<sub>2</sub>.

Vertical tanks were often cooled by direct evaporation of liquid ammonia in the exterior cooling jacket. With safety and the environment in mind, our engineers have reduced the refrigerant contents to a minimum.

Today the vertical tanks are mostly cooled by means of a coolant such as propylene glycol- or ethanol water solution.

Extensive research work is done by Grasso International in concert with brewery engineers to find the optimum solution. The result is that parks of several hundred tanks have been provided.

Because no two installations are identical, Grasso International engineers are accustomed to looking for the optimum solutions for each customer. This means that our customers always receive a refrigeration plant which is reliable and energy efficient and which is tailored to their current and future needs.

Grasso International's expertise makes us the preferred choice of many of the world's leading companies.

## SLAUGHTERHOUSES

There are many animal species whose meat is used for human consumption. Whatever species it is, it will generally be slaughtered at a communal place in accordance with sanitary, veterinarian, humanitarian and possibly religious rules.

After slaughtering the meat must be given the possibility to pass its biochemical process, meat ageing time. The meat must also be chilled as quickly as possible in order to prevent unacceptable bacterial growth which would cause deterioration. Both processes must be considered in order to achieve and maintain an optimum meat quality.

It will be evident that the direct transportation of meat after slaughtering to a cold store without being cooled is not an adequate method to preserve optimum quality.

After slaughtering, meat is cooled down in phases: first, the meat enters into a rapid cooling tunnel at an air temperature of approx.  $-25^{\circ}\text{C}$ , in the second phase it is further cooled before entering an equalizing room where the meat finally reaches a core temperature of  $+7^{\circ}\text{C}$  at an air temperature slightly below the end temperature. The loss of weight is thus normally less than 1.2% without the meat becoming frozen.

The chilling system to be used depends on the kind of meat. Beef that has long ageing time and is susceptible to cold shortening, will have to be cooled less quickly and, as a consequence, at not too low temperatures. Mutton is also very susceptible to cold shortening.

With its knowledge of the product and refrigeration technology Grasso International has developed a computer programme which has been tested under practical conditions, in order to determine the appropriate chilling system for various kinds of meat.



*By means of phased cooling, meat is rapidly brought down to a storage temperature of  $+7^{\circ}\text{C}$ . The result is improved quality with only slight weight loss, normally less than 1.2%.*

# ICE PLANTS



Ice as a cooling medium has many applications, for instance on board fishing vessels, in fish and meat processing. Also many chemical processes require the rapid cooling by ice.

In all parts of the world, especially in tropical countries, there is a high demand for economically produced ice. Grasso International supplies several options for ice production:

*Grasso International offers a complete range, from 5 to 100 tons/day, of high standard conventional block ice plants, complete with all necessary equipment for block weights of 25 (55), 50 (110) and 150 kg (330 lbs).*

## CONVENTIONAL BLOCK ICE PLANTS

In the reliable and robustly constructed Grasso International conventional block ice plant, brine is cooled by submersion type evaporator coils and circulated by agitators through the brine tank. The temperature of the brine (approx.  $-10^{\circ}\text{C}$ ) causes the water in ice cans to freeze into solid blocks. After the freezing process, the ice cans are lifted from the brine tank by means of an over head crane and immersed in a thawing tank to release the ice from the cans. A tipping device unloads the blocks on to an ice chute or conveyor for transport to the ice storage room.



## FULLY AUTOMATIC BLOCK ICE PLANTS (TGA)

The fully automatic block ice plant (TGA) consists of a water tank equipped with specially developed freezing batteries. Each freezing battery is provided with a number of double-walled vertical freezing pipes. Liquid refrigerant evaporates in the pipes, causing the surrounding water to freeze into blocks. When the blocks have reached the required size, the batteries are heated by hot gas, releasing the blocks. The blocks rise to the water surface and are automatically harvested and transported to the ice chute.



*Grasso TGA fully automatic ice plants are available in a standard range from 5 to 100 tons/day, for block weights of 25 (55), 50 (110) and 150 kg (330 lbs).*



## ICE PLANTS ICE RINKS AND ICE CREAM FACTORIES

Direct freezing of water around the evaporator tubes, minimizes the freezing time of the blocks to less than 3 hours. This reduces the required building space of a TGA by 70% compared to a conventional plant, and, consequently, reduces the investment and maintenance costs of the building. The absence of aggressive brine, ice cans and human labour will lower the operating costs even further. With the same TGA it is possible to produce either block ice or crushed ice, simply by changing the freezing time.

### GENEGLACE FLAKE ICE PLANTS

Flake ice is sub cooled and very dry, which means it has an excellent cooling potential, enhancing the quality of products for a longer time. Its flat and thin form provides a large heat exchange surface area, so it cools the product more quickly.

*Practising sport on natural ice is not possible everywhere. With Grasso International ice rinks quality ice is available always and around the world.*

### ICE RINKS

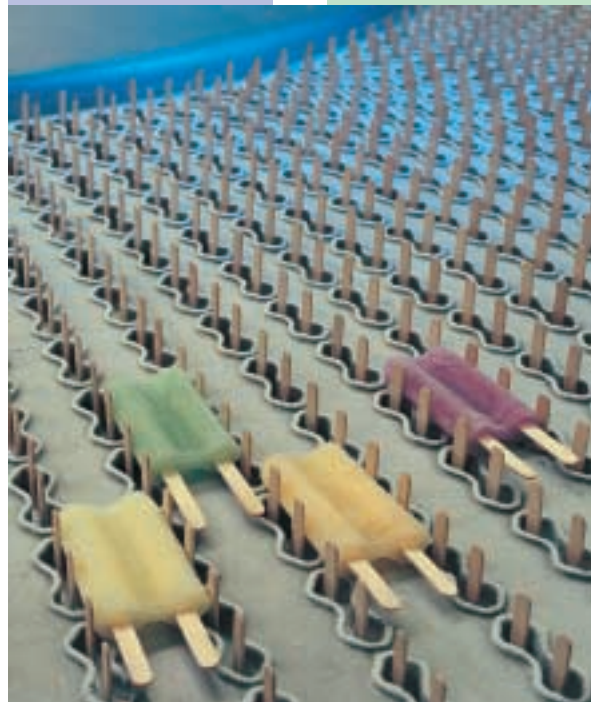
Our experience in the field of ice rinks includes the construction of indoor and outdoor facilities for sporting and recreational activities such as ice hockey and speed skating.

Grasso International ice rink systems are designed to use environmentally friendly refrigerants and for compliance with local authority regulations on noise and safety aspects.

### ICE CREAM FACTORIES

Ice cream is one of the oldest known food stuffs. Cooling the mix and freezing and hardening of the ice cream or freezing water ice has no refrigeration secrets for Grasso International. Ice cream refrigeration plants with different capacities and varying from low budget plants to high tech installations are designed and delivered all over the world by Grasso International.

*The highly efficient Geneglace flake ice machines are available with capacities between 200 to 40000 kg (440 to 88000 lbs) per day. With 30 sizes available, this is the broadest range on the market for flake ice.*

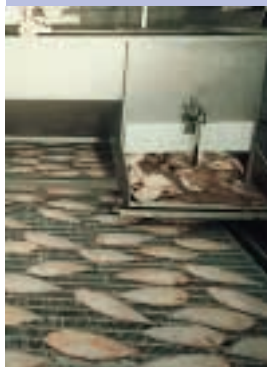


*Within the ice cream production process refrigeration is a vital part.*

# MARINE APPLICATIONS



*A reefer, suitable for the transportation of bananas (+12 °C) or fruit (different temperatures, according to the variety) or deep frozen products (-25 °C) must be equipped with a multi-functional refrigeration system.*



*Sole fillets are frozen undamaged by means of a special Grasso mesh belt freezer. A cooling system for a ship requires compact design and construction.*

## **FISH PROCESSING INDUSTRY**

Grasso International supplies specialized cooling and freezing installations for fish trawlers and seiners throughout the world. For fish from northern waters but also from other seas where the cooling of fish require completely different methods.



The processing and rapid freezing on board greatly improves the storage and consumption quality of the fish. For some kinds of fish, cooled storage is sufficient. This is realized by storage in tanks with refrigerated sea water at a temperature of about +1 °C. Another method is storage between crushed ice in a refrigeration hold. One of the most advanced cooling systems is the use of slurry ice, which has incredible intense heat transfer properties, thus reducing cool down times significantly.

Grasso International can supply IQF freezing, blast freezing and brine cooling.



*The considerable number of installations is proof of the trust put into Grasso International by the worldwide fishing industry.*

# AIR CONDITIONING SYSTEMS, CONCRETE COOLING, CHEMICAL, PHARMACEUTICAL AND METALLURGICAL PROCESSES

## **AIR CONDITIONING SYSTEMS**

We take your comfort seriously and provide all kinds of air conditioning installations for office building, shopping centres, domestic purposes etc. We are able to tackle all your air handling demands concerning air distribution, temperature and/or humidity control as well as purity. We provide climate chambers for, amongst others, cars, wood drying chambers, clean rooms, compressed air dryers etc.

## **CONCRETE COOLING**

The addition of chilled water or ice to a concrete mixture provides a better control over the hardening process. Crack formation is avoided and durability is improved; important for heavy concrete constructions such as fly overs, dams and bridges and nuclear reactors.

## **CHEMICAL, PHARMACEUTICAL AND METALLURGICAL PROCESSES**

### **CHEMICAL PROCESSES**

Grasso International designs and builds vapour recovery plants to reduce the emission of injurious vapours, for example benzene. Petrol, hydrocarbons or natural gasses can be handled better if liquefied; we design and build the required refrigeration plants.

Reactors in the chemical industry may suddenly release heat which cannot be handled by standard chillers. For this particular reason, Grasso International has developed cooling systems which will operate reliably at very different temperature levels. If necessary an explosion proof execution can be provided. We can handle all international as well as company specifications.

### **PHARMACEUTICAL AND METALLURGICAL PROCESSES**

These processes require refrigeration plants for very low temperatures. Grasso International is able to design and build multiple stage and cascade chillers with natural refrigerants such as ammonia for the high stage and ethane for the low stage as well as special coolants able to handle temperatures down to -70 °C.



*Grasso International provides air conditioning installations for hotels.*



*The addition of chilled water or ice to a concrete mixture provides a better control over the hardening process of dams.*



*Chemical plant for chlorine liquefaction.*

# WHERE CAN YOU FIND US



**The Netherlands** • Headquarters Far & Middle East, Africa (except South Africa), North & South America, Central & Eastern Europe  
Grasso International B.V. • Parallelweg 27 • 5223 AL 's-Hertogenbosch • P.O. Box 343 • 5201 AH 's-Hertogenbosch  
Phone: +31 (0)73 - 6203 911 • Fax: +31 (0)73 - 6214 210 • E-Mail: [internat@grasso.nl](mailto:internat@grasso.nl)

## Philippines

Grasso Philippines, Inc. • 4A Panorama Compound • Veterans Center • 1630 Taguig • Metro Manila  
Phone: +63 (0)2 - 837 3211 • Fax: +63 (0)2 - 838 8158 • E-Mail: [info@grasso.com.ph](mailto:info@grasso.com.ph) • Website: [www.grasso.com.ph](http://www.grasso.com.ph)

## Indonesia

Sales Office Grasso International B.V. • 6th Floor Gapuramas Building • Jl. S. Parman Kav. 91 • Jakarta 11420  
Phone: +62 (0)21 - 566 8374/5 • Fax: +62 (0)21 - 566 8171 • E-Mail: [grasindo@cbn.net.id](mailto:grasindo@cbn.net.id)

## Thailand

Grasso (Thailand) Co., Ltd. • 66/361 Moo 12 • Phutta Monthon Sai 5 Road • Tambol Rai Khing • Amphur Sampran • Nakorn Pathom 73210  
Phone: +66 (0)2 - 811 8571-6 • Fax: +66 (0)2 - 811 9907 • E-Mail: [grasso@grasso.th.com](mailto:grasso@grasso.th.com)

## Chile

Grasso Chile S.A. • Avda. Santa Maria 2698 • Casilla 16064 • Providencia, Santiago  
Phone: +56 (0)2 - 3358 140 • Fax: +56 (0)2 - 3358 141 • E-Mail: [grasso@grasso.cl](mailto:grasso@grasso.cl) • Website: [www.grasso.nl/chile](http://www.grasso.nl/chile)

## China

GEA Technology Equipment (Shanghai) Co. Ltd. • Grasso International • No. 1678 Xinzhen Road • Qibao No. 1 • Industrial Zone • Minhang District • Shanghai 201101  
Phone: +86 (0)21 6419 1318 • Fax: +86 (0)21 6459 0468 • E-Mail: [sophiaj@online.sh.cn](mailto:sophiaj@online.sh.cn)

## Australia

Grasso Australia Pty. Ltd. • 47 Nevin Drive • Thomastown • Victoria 3074 • Melbourne  
Phone: +61 (0)3 9464 6166 • Fax: +61 (0)3 9464 6016 • E-Mail: [grasso@grasso.com.au](mailto:grasso@grasso.com.au)

## U.S.A.

Grasso, Inc. • 1101 N. Governor Street • P.O. Box 4799 • Evansville • IN 47724 - 0799  
Phone: +1 800 - 821 - 3486 • Fax: +1 812 - 465 - 6610 • E-Mail: [fbuckale@grassousa.com](mailto:fbuckale@grassousa.com)

## Russia

Grasso International B.V. • Semenovski val, 6, bldg.1 • 105094 Moscow  
Phone: +7 095 787 2011 • Fax: +7 095 787 2012 • E-Mail: [grasso@gea.ru](mailto:grasso@gea.ru)

## Ukraine

Branch Office Grasso International GmbH • P.O. Box 457 • 252001 Kiev - 001 • Prospekt Pobedy • d. 12 • kv. 124 • 252135 Kiev - 135  
Phone: +38 (0)44 274 5618 • Fax: +38 044 274 8859 • E-Mail: [grasso@naverex.kiev.ua](mailto:grasso@naverex.kiev.ua)

## Slovakia

Branch Office Grasso International GmbH • Liptovská 18 • 82109 Bratislava  
Phone/Fax: +42 17 53 41 43 63 • E-Mail: [grassoba@isternet.sk](mailto:grassoba@isternet.sk)

## Poland

Grasso Spolka z o.o. • ul. Hryniewickiego 10, building 24 • 81-340 Gdynia  
Phone: +48 (0)58 627 63 90 • Fax: +48 (0)58 627 63 91 • E-Mail: [grasso@grasso.pl](mailto:grasso@grasso.pl)

## Lithuania

Grasso UAB • Savanoriu pr. 178 • 2600 Vilnius  
Phone: +370 2 311 900 • Fax: +370 2 311 901 • E-Mail: [grasso@post.omnitel.net](mailto:grasso@post.omnitel.net)

## Your contact in Western Europe:

Grasso Products B.V. • Parallelweg 27 • 5223 AL 's-Hertogenbosch • P.O. Box 343 • 5201 AH 's-Hertogenbosch • The Netherlands  
Phone: +31 (0)73 - 6203 911 • Fax: +31 (0)73 - 6214 320 • E-Mail: [products@grasso.nl](mailto:products@grasso.nl)

with offices in The Netherlands, Germany, U.K., France, Italy, Portugal and Republic of South-Africa.



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