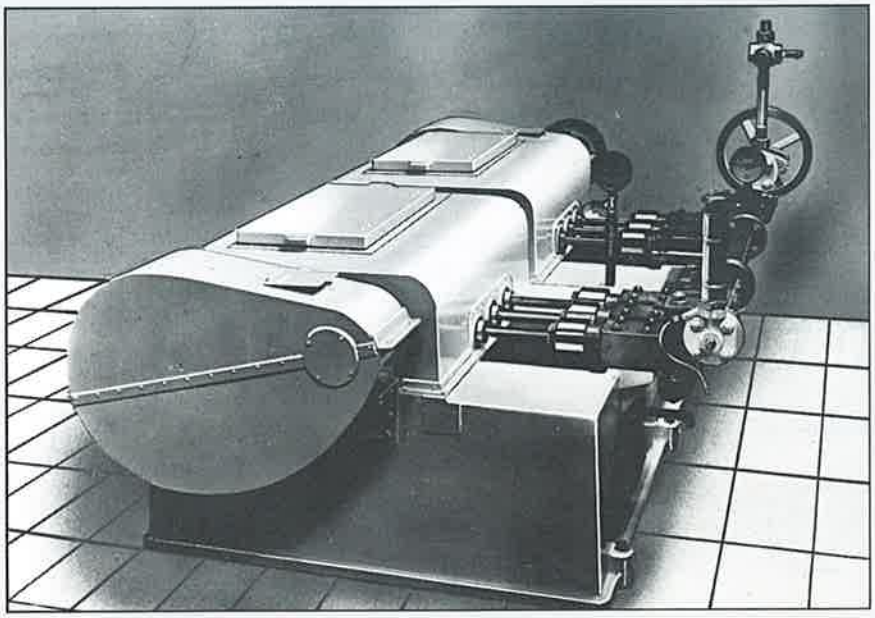
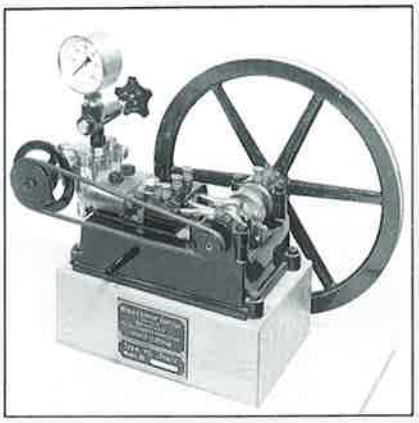
APV Gaulin Homogenizers

High Pressure Homogenization
High Pressure Pumps
High Pressure Dispersing Technology
High Pressure Disintegration Technology
High Pressure Emulsification

APV Gaulin

APV Gaulin
Tradition-Innovation
Worldwide





△ Schröder laboratory homogenizer type "HL Sterile" with rotating selfgrinding homogenizing valve assembly (year of manufacture: 1912).

◁ Schröder homogenizer type GIGANT (1938), capacity 10 000 l/h, in operation till 1972.

APV Gaulin...

The first name, the last word in homogenization. There has never been a better way to improve your products.
In 1900, a Frenchman, **August Gaulin,** invented a device **"to thoroughly mix immiscible fluids to render the product homogeneous".**
It was he who coined the word **Homogenizer** and introduced his invention to the public during the World Exibition in Paris that same year.
It took another nine years before the **Manton Gaulin Manufacturing Company** was founded in 1909 in New England, USA. Today **APV Gaulin** is the world's largest producer of high pressure homogenizers with manufacturing facilities and offices in USA, Germany and the Netherlands.
The APV Gaulin Group, consisting of APV Gaulin, Inc., USA, APV Gaulin International, the Netherlands and APV Gaulin GmbH Lübeck, West Germany, are now all part of APV PLC, a large international firm based in England and consisting of more than 100 wholly owned and affiliated companies worldwide. APV Gaulin stands for quality, reliability and innovation. Our world-wide organization guarantees prompt high quality service, whatever your problem is, whereever you are located.
APV Gaulin... the first name, the last word in homogenization.

▽ High-Pressure Homogenizer MC 120-5TBS a 5-plunger machine for capacities of up to 40.000 l/h.

APV Gaulin Homogenizers in the Food Industry

APV Gaulin Homogenizers and Highpressure Pumps – recommended around the world for quality, durability and reliability.

The confidence of APV Gaulin customers in our highly developed, reliable machine technology has earned us world leadership in the dairy and food industries.

Dairy products

Fresh milk, pasteurized milk, UHT milk, cream, fresh cream, whipped cream, condensed milk, yogurt, milkshakes, reconstituted milk, desserts, infant formulas, parenteral emulsions, whey (cheese production), ice cream mix.

Fruit and vegetable processing

Fruit juices, fruit concentrates, lemonade bases, vegetable juices, disintegration of tubers and roots, fruit and vegetable pulps, enzymatically pretreated pulps, baby food.

Basic foods

Starches from corn, potatoes, cassava, wheat, barley, rice, gluten, sugar beets, butter oil, fish oil emulsion, milk substitutes (calves' milk), casein, whey proteins, ocara.

Food additives

Spice emulsions, sauces, essences, essential oils, flavor emulsions, flavor intensifiers (nucleoides), enzymes/proteins from micro-organisms.

Delicatessen products

Catchup, salad dressings, sauces, mustard, zaziki.

Sweets

Chocolate sauces, toppings, fillings, syrups, frostings, fudges.

Alcoholic beverages

Liqueurs, Irish Cream, Pina Colada

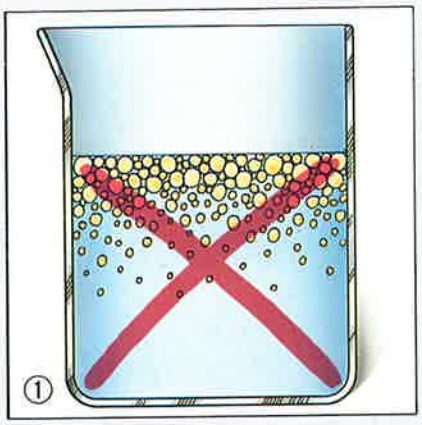
▽ High pressure homogenizer MC 25 in a dairy plant.

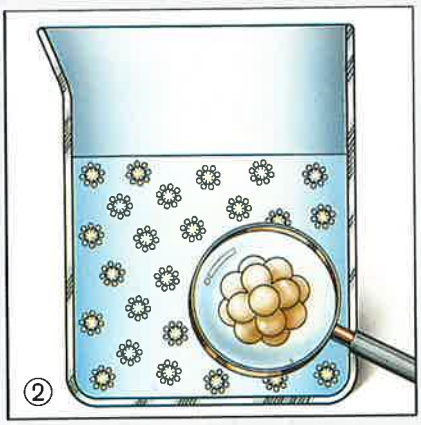
▽ Two MC 45 High-pressure homogenizers series-connected.

APV Gaulin Homogenizers the effect of homogenization

The effect of high-pressure homogenization depends to a great extent on the properties of the raw materials. For example, in the dairy industry, very fine dispersion and emulsification of the fat droplets are essential to prevent phase separation and the creaming of the fat during storage (figure 1).

During homogenization, frequent advantage is taken of the elements in the product, such as proteins and phospholipids. These are deposited on the tiny new droplet surfaces produced by homogenization and



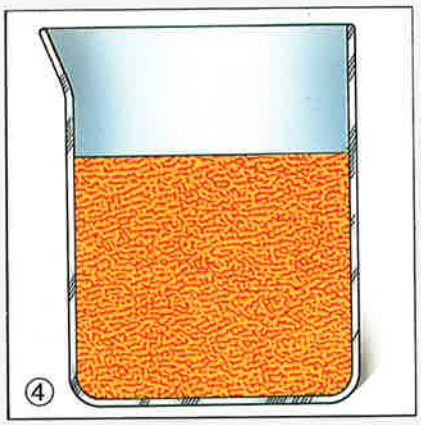


prevent coalescence (figure 2). The aim is to get a particle size-distribution as narrow as possible (see also "Micro-Gap" Technology).

Homogenization improvements in food emulsions:
- Produce very fine dispersion of the fat phase
- Prevent creaming and separation
- Increase the efficiency of expensive emulsifiers and stabilizers
- Upgrade the color of the product
- Improve the miscibility and dilutability.

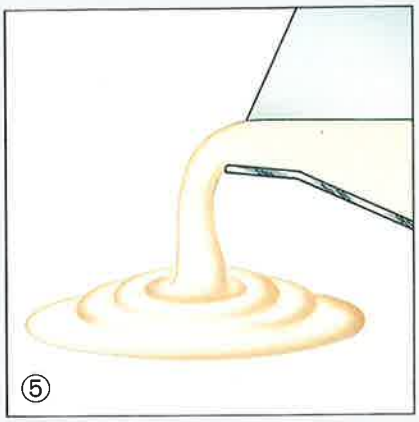
A typical example is prevention of sedimentation. If a food contains solid particles, such as fruit pulp and starch or pectin, pieces of peel or agglomerated powdered particles containing fat, particles tend to settle out in the product or wet the walls of packaging containers in streaks (figure 3). Extremely fine dispersion with the high-pressure homogenizer effectively prevents this.

Not only are agglomerated particles separated, wetted and kept in suspension, but stabilization is improved as constituents such as

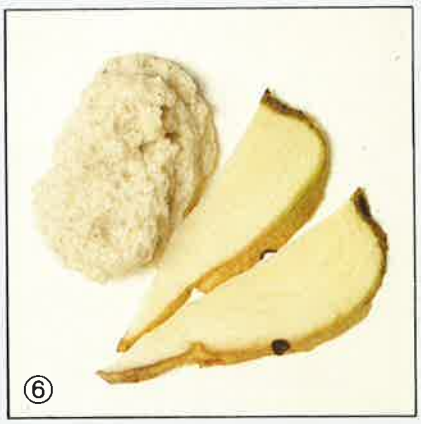


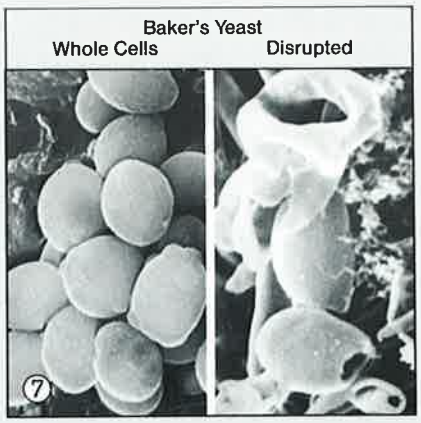
proteins or pectins are liberated from tissue components during homogenization. For example, high-pressure homogenization provides turbidity stabilization in low-viscosity fruit juices and vegetable juices (figure 4). In high-viscosity pulps, it prevents the separation of water (syneresis).

To create desired changes in flow behavior, high-pressure homogenization can build, or destroy, microstructures (figure 5). The best-known examples are the increase of viscosity produced in cream, the production of a creamy consistency in catchup, and the decreased viscosity of fruit concentrates.



High-pressure homogenization can also be used to break down vegetable tissues in the production of basic materials, such as starch, protein or sugar (figure 6). For example, with a suitable choice of pressure and valve geometry, a selective size reduction of the tissue takes place. This makes possible maximum yield during subsequent centrifugal separation of starch grains and nonstarch components.



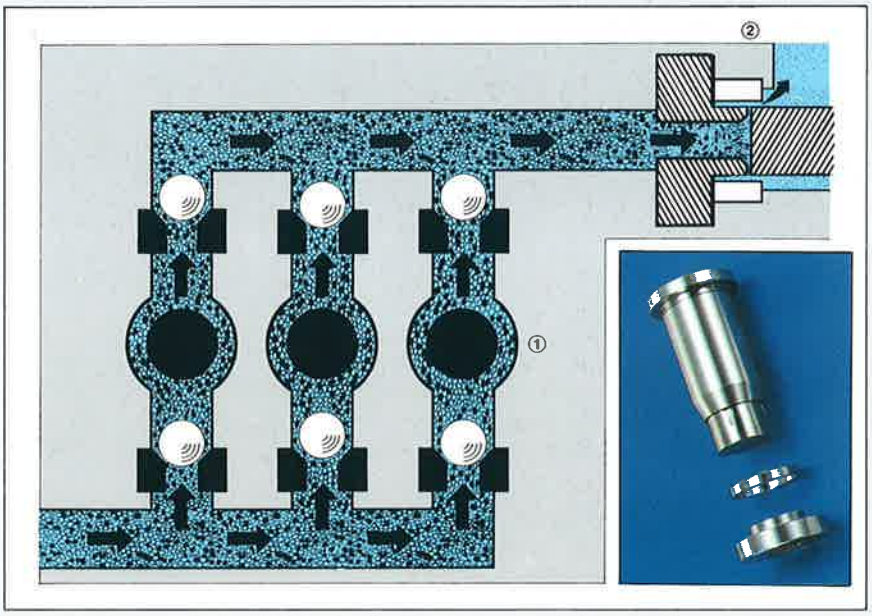


Micro-organisms can be disrupted with special cell disruption valves and extremely high pressure of up to 1600 bar.

APV Gaulin Homogenizers the working principle

Theory of homogenization

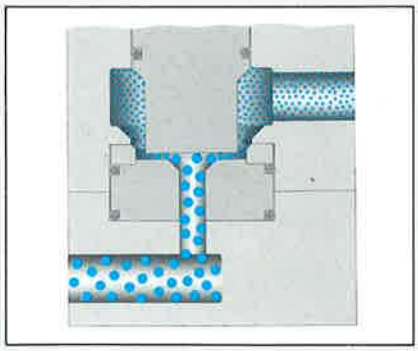
High-pressure homogenizers operate by the principles associated with high-pressure drop. The machine consists of a high-pressure positive-displacement plunger pump (1) followed by a homogenizing valve assembly (2). Depending on the application, the product is pumped up to pressures of between 100 and 700 bar, or up to 1000 bar for special application.



In the homogenizing valve, the product flow is accelerated, – from high pressure and low velocity to high velocity and low pressure – through an annular gap between the homogenizing valve and valve seat. Turbulence and frictional stress occur in combination with powerful cavitation forces to produce submicronsize reduction and distribution of constituent substances. High-energy particle collisions in the valve area further contribute to this action. An impact ring at the outlet of the valve gap serves to help displace the discharge flow and protects the valve body from hydrodynamic damage.

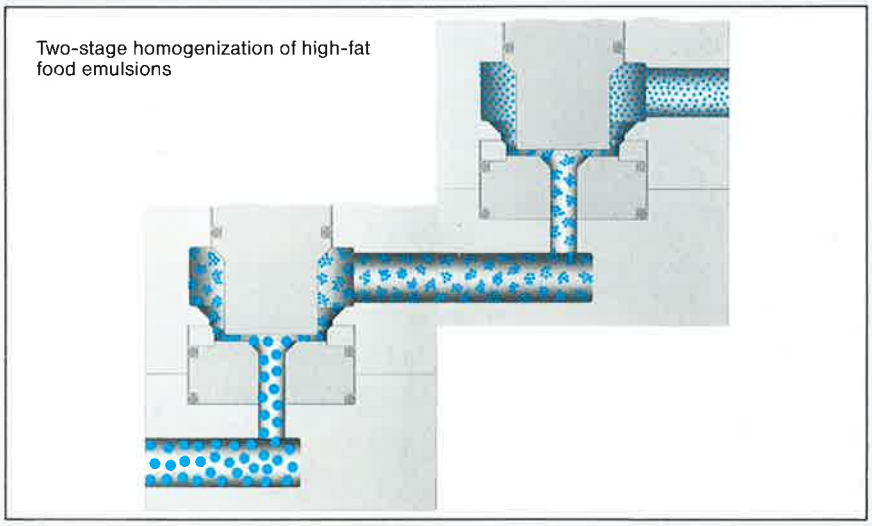
Single-stage and two-stage homogenization

The usual method of high-pressure homogenization is total pressure drop in one homogenizing valve (single-stage homogenization). The efficiency of the homogenizer can be increased (for some conventional valve geometries) by applying a low back pressure to the single homogenizing valve; the back pressure resulting from pressure drops in



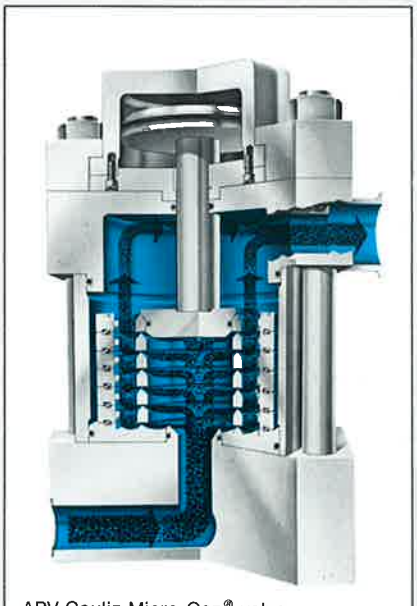
downstream equipment is frequently sufficient.

However, two-stage homogenization is necessary for some products. The most important examples are high-fat-content milk products. Small fat particles are created in the first-stage homogenizing valve, but they form larger aggregates, which increases the viscosity and impairs the creaming stability. These aggregates are subsequently broken down in a second homogenization stage (two-stage homogenization). Only then are the desired product characteristics produced.


Two-stage homogenization of high-fat food emulsions

APV Gaulin Micro-Gap® valve

APV Gaulin developed the Micro-Gap® valve, patented worldwide, to produce peak performance in homogenization. From years of study, this valve system, which maximizes the homogenization effect for all flow rates, was produced. The precision valve simultaneously permits efficient low pressure and minimizes the variance of the droplet-size distribution. Scale-up for higher capacities is obtained by using additional valve discs arranged in parallel.


APV Gaulin Micro-Gap® valve

APV Gaulin Homogenizers in the Dairy Industry

APV Gaulin high-pressure homogenizers have been the standard in the dairy and related industries for many decades.

Our machines are used in conventional dairy installations and those producing in "aseptic" conditions around the world.

APV Gaulin equipment is distinguished by long life, low wear, low noise levels and more especially unsurpassed operating reliability and economy, even under the most severe conditions.

Uncompromising **quality** and consistent **development** of our machines have made us the **world's leading manufacturer** of high-pressure homogenizers.

In constant touch with the market, APV Gaulin developed a novel, highly efficient homogenizing valve. This patented Micro-Gap Valve allows up to 30 % lower homogenizing pressure, while maintaining the same, or better, homogenizing efficiency as obtained with conventional homogenizing valve systems. This reduction in energy offers a more gentle treatment of your products.

Lower energy consumption also means a reduced load on the environment, and at the same time, lower operating pressures drastically reduce the mechanical load on the equipment, resulting in an overall reduction in maintenance and operating costs.

In our Process Development Department, we frequently work with customers to create specific production methods, for example, in the homogenization of cream and in processing whey for cheese production. The gentle, two-stage homogenization of hight-fat-condensed milk is another area of our Process Development Department's activities.

Our customers receive free consultation and the opportunity to test their products and our homogenizing systems on a laboratory, pilot plant or production scale.

◁ Model MC45-3TPS high pressure homogenizers in a condensed milk production line.

APV Gaulin Homogenizers in the Fruit, Vegetable and Beverage Industries

APV Gaulin high-pressure homogenizers – an important name in producing high-grade basic materials and top-quality products for fruit and vegetable processing.

△ Model MC 45-5TBS High-pressure homogenizer for the production of fruit nectars in a 15000 l/h installations

High-pressure homogenization provides for size reduction and extremely fine dispersion of pulp fragments to produce the pulp stabilization, indispensable for high-quality juices. Color and flavor components of the fruit are also released in this process, as are texturizers from the fruit tissue. All contribute to upgrading the appearance and flavor of the product.

In the case of fruit juice beverages, homogenization is used to disperse and stabilize hydrophobic essential oils and flavors, to keep rings from forming in the necks of bottles.

A step ahead in quality – the APV Gaulin high-pressure homogenizer is the key to reach this objective. Highpressure homogenization also provides many benefits to the beverage-base industry. For instance, it is used in the treatment of fruit concentrates to reduce viscosity and to improve their evaporating properties; it standardizes and stabilizes fruit and vegetable pulps to a desired consistency, and it provides the disintegration of vegetable tissue, enhancing enzymatic liquefaction.

△ Model MC7 high-pressure homogenizer for small and medium production capacities in the fruit and vegetable industry.

APV Gaulin Homogenizers in the basic food-stuff industry

APV Gaulin high-pressure homogenizers can be used as disintegrators in the wetprocessing of grain, tubers and roots – a new process technology in the processing of raw materials containing starch, proteins and sugar.

Starch production from tubers and roots

The starch grains in tubers and roots are present in the cell sap of the tuber tissue. The task of the high-pressure homogenizer is the selective, mechanical disintegration of the cell tissue from which the undamaged starch grains can then be simply rinsed out. An example of such processes is the extraction of starch from potatoes and cassava roots (Tapioca starch) in which the raw material, already washed and premilled, is fed to specially equipped APV Gaulin high-pressure homogenizers.

Clear economic benefits of this new process are an increase in yield because of the complete tissue disintegration, the exclusion of air during the entire process and the use of simple, standardized equipment.

High-pressure homogenizers for wheat flour slurry – 8000 l/h.

Starch production from grain

In the types of grain used for the production of starch, such as wheat, corn, rice and millet, the starch is mechanically bound in a matrix of proteins and non-starch carbohydrates. To obtain the pure starch fraction, this matrix can be broken down by a combination of swelling processes and mechanical disintegration by high-pressure homogenization. This new technology increases quality of the end products, improves total yield, and produces substancial improvements in cost and efficiency. For example, in the production of corn starch, homogenization drastically reduces the swelling times and makes it possible to use new steeping processes, which eliminate the need for sulfur dioxide. Thus varieties of corn with hard endosperm can now be processed into high-quality starch.

Production of gluten from wheat flour

To separate the gluten protein fraction from the wheat starch, the starch fraction is rinsed out of wheat flour paste. The residue obtained is the wheat gluten, consisting of approximately 90% protein. This process can be accelerated and the yield decisively improved by high-pressure homogenization of the wheat flour slurry. APV Gaulin high-pressure homogenizers have been used successfully for several years in this new process.

Sucrose production from sugar beets

In the production of sugar, the cellular material of the rinsed premilled beet tissue can be opened up by high-pressure homogenization reducing the cost of operation of the extraction tower. At the same time, a greater mechanical degree of dewatering of the pulp residue is possible, leading to cost savings in thermal drying.


Rice


Sugar Beet Pulp


Wheat


Cassava Root


Wheat Flour Slurry

APV Gaulin Laboratory Homogenizers

△ Universal homogenizer for laboratory Operation: LAB 60

◁ LAB 100 – The miniature design of large production machinery for process development.

APV Gaulin laboratory homogenizers are the key to production success. Our available equipment for laboratories and pilot plants extends from the MICRON-LAB 40 homogenizer, with a processing volume of only 40 ml (ask for our special brochure), through the standard laboratory Models LAB 60 and LAB 100, the 15MR, 30CD, and the MC4 pilot plant homogenizer. The LAB 60 is a continuously operating, universal homogenizer, with a capacity of 40/60 l/h and a pressure range of up to 1000 bar. With the LAB 60, batches can be processed for product development even starting with a product volume as small as 1,0 liters. The LAB 100, APV Gaulin triplex homogenizer for operating pressures of up to 420 bar, developed especially for diary, fruit and vegetable processing. The LAB 100, because of its larger throughput, can also be installed in continiuos pilot plants. All lab-units (except the Micron-LAB 40) can also be supplied for aseptic operations with steamsterilizable surfaces. Cylinder blocks are available for heating and/or cooling. We developed the Model MC 4 for the overlapping range of pilot plant and small-scale production. The MC 4 series covers a broad range of capacities for throughtput/pressure combinations from up to 300 l/h at 1100 bar to a maximum of 2.800 l/h at 140 bar. The Model MC 4 has all the design features of the larger production size homogenizers.

▽ Laboratory homogenizer model Micron-Lab 40 for research and development.
Capacity 40 ml/70 ml, 100-1600 bar

▽ High pressure homogenizer model MC 4 for pilot plant and production.
Capacity 300 l/h, 1100 bar variable up to 700 l/h, 1100 bar (shown a special sub-base and with frequency converter for capacity variation)

APV Gaulin High Pressure Pumps

APV Gaulin high pressure pumps of the MCP series were developed from the APV Gaulin series of high-pressure homogenizers. They conform to the corresponding MC homogenizers in capacity, pressure range and design and equipment details. Flow media of almost all viscosity ranges are pumped in APV Gaulin machines, and they are often used to pump difficult products such as high viscosity liquids, pastes, slurries, solutions and suspensions with high proportions of solids. Decades of experience in the processing of heterogeneous substances with our high-pressure homogenizers can be of substantial benefit, even meeting unique customers requirements.

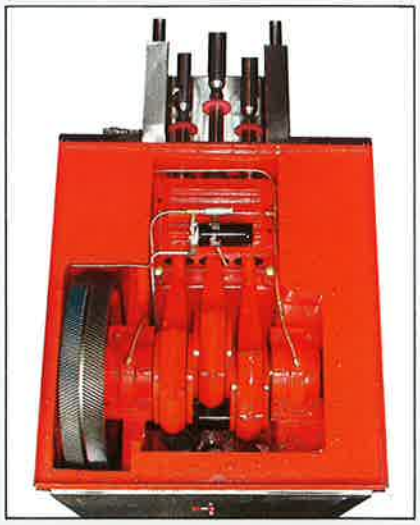
Special machines with specially designed pump valves are available for pumping high-viscosity pulps. The modular construction of the MCP series allows effective operation within the favorable low-speed range which means less down-time and machine maintenance. When handling abrasive or other difficult products the use of special plunger packing arrangements, in combination with liquid seals, provide for a maximum plunger- and packing life.

APV-Gaulin high-pressure pumps are also available as complete units for combined pumping and homogenization.

Two different designs – standard compact construction and low silhouette version – permit matching the pumps to special space conditions. The low silhouette version with special sub-base allows use of large special drives, for example: variable speed drives and explosion-proof motors, which would not normally fit in the standard APV Gaulin homogenizer/ pump motor compartment.

APV Gaulin high pressure slurry pump type MCP 15-3 TBSX, low-silhouette-version with variable speed motor.

APV Gaulin design for long life and durability



Rugged low-speed drive

Motor, transmission, gear-drive and crankshaft are integrated into the rugged machine housing, while standard gear reduction provides quietly running and extremely low crankshaft speed. These features, plus a modern, pressurized, oil-lubricating system help provide for service-free operation and high durability.

Where homogenizers or pumps are not equipped with variable speed drives, capacity changes are fast and economically accomplished by simply replacing the unit's V-belt drive.

Modular cylinder block design

Each pump-model has a number of cylinder block designs with modular construction available in each model series. All parts in contact with the product are made of high-strength, forged, corrosion-resistant stainless steel material in CIP design. Heated and cooled cylinder blocks can be supplied for all models and special corrosion – or abrasions-resistant materials are available to meet specific product characteristics.

APV Gaulin Homogenizers... optimized in design

Cylinder block for aseptic operations with additional sterile water – or steam seal.

For aseptic operation, APV Gaulin cylinder blocks have double packing sets in the cylinder area for optional steam sterilization of plunger surfaces that contact the product, or for flush cleaning with sterile liquid.

If extremely hygienic requirements are specified, we can supply electropolished finish for all parts in contact with the product. This processing technique greatly reduces the surface potential for formation of deposits.

Plunger and sealing system advantages

The plunger packing systems developed by APV Gaulin in combination with the cylinder block design offer a number of advantages over other designs:

- Long life even in aseptic operations
- Simple packing replacement – acces from the front of the machine, requiring a minimum of down-time
- Optional open/closed plunger cooling with/without leak detection system
- Self-adjusting spring loaded plunger packings for maximum packing life
- Optional fluid seal systems on the high-pressure side of the packing system, to separate product from the packing area.

Standard material for plungers is a high-grade, tough and durable stainless steel. For special applications and in general for aseptic operations, we equip our machines with special ceramic or chromium plunger coatings with special surface tempering. Coupled with sealing systems especially tailored to the running characteristics of these plungers, we offer the optimum overall design available for the customer's product and process.

Pump valves

The characteristics of the customer's product ... such as viscosity, solids content, density differences in suspensions and abrasiveness ... determine material and shape of the pump valves. Standard APV Gaulin valves are low-noise poppet valves for low-viscosity liquids, and heavy-duty ball valves for higher-viscosity media. We make special pump valves for pumping and homogenizing slurries, pastes and suspensions with a tendency to separate. Depending on the application, these valves differ from standard valve design, for example, in their flow area, orifice geometry, spring loading and weight of the valve body.

The valve seats are easily replaceable precision parts shrunk into the cylinder block. Special design facilitates cleaning and special materials guarantee long service life.

△ Free or spring loaded ball valves for suspensions and high riscosity media.

Homogenizing valve .... heart of the homogenizer

In the constantly expanding range of APV Gaulin applications, high stress may be encountered on homogenizing valves. In many cases, customer needs can only be met using hightechnology materials, such as carbides and ceramics, in which APV Gaulin has pioneered development.

Besides high-tensile structural materials, APV Gaulin has also adopted the special materials and the technology provided by aviation and space research.

△ Special carbide (left) and high desity special ceramics as material for APV Gaulin homogenizer valves

APV Gaulin Homogenizers
Technical Data

Type	Maximum throughput capacity in l/h	Maximum operating pressure in bar PSJ x 14,2	Maximum allowable drive power in kW*	Maximum crankshaft speed in rpm	Weight in kg without motor	Dimensions in mm, l x w x h
 LAB 60 LAB 100	LAB 60: 60/40 LAB 100: 100 to 400	700/1000 400 to 200	2,2/1,8 2,2	180 220	195 210	700 x 500 x 700 700 x 500 x 700
 MC 4	250 to 2500	1100 to 140	15	220	670	1000 x 700 x 1350
 MC 7	350 to 5000	1000 to 140	30	220	1150	1200 x 900 x 1350
 MC 15	1000 to 6000	1000 to 140	45	210	1920	1650 x 1000 x 1350
 MC 18	1500 to 12000	1000 to 140	65	210	2300	1650 x 1100 x 1350
 MC 25	3000 to 20000	700 to 100	75	210	2500	1650 x 1250 x 1350
 MC 30	3000 to 16000	1000 to 140	90	210	3750	2000 x 1200 x 1600
 MC 45	4000 to 25000	1000 to 140	120	210	4050	2100 x 1300 x 1650
 MC 120	5000 to 40000	1000 to 140	165	210	5700	2100 x 1600 x 1700
 MC 126	6000 to 40000	1000 to 140	180	210	5900	2100 x 1750 x 1700

(other capacities, up to 60000 l/h, on request)

All specification are subject to change without notice.