VRIECO-NAUTA® MIXING TECHNOLOGY

HOSOKAWA MICRON B.V.

Process Technologies for Tomorrow SM

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In July 1995 Hosokawa Micron B.V. has been certified for ISO 9001.

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Principle

The working principle of the conical Vrieco-Nauta® mixer is three-dimensional originated from rotating elements in combination with a conical vessel.

- The mixing screw conveys the product from bottom of the vessel to the product surface.
- The orbital arm orbits the mixing screw along the inner vessel wall causing convective mixing of particles and shear.
- The speed of particles in the downward massflow when recirculated by gravity in a conical vessel increases as the vessel diameter decreases.

The result of these simultaneous actions is a fast and intensive mixing with low consumption of power together with high standards of mixing accuracy.

Applications

The unique features of the conical Vrieco-Nauta® mixer in combination with over 50 years of experience in the application of this machine has proved its suitability for many processes throughout all industries. A few of the most successful applications are:

- Mixing and homogenisation of powders, pastes and slurries.
- Vacuum drying of pastes and slurries
- Addition or injection of liquids to or in dry solids.
- Granulation or agglomeration of powders by the addition of a binder liquid.
- Reaction under vacuum or pressure conditions
- Crystallisation.
- Inertisation.
- Aeration or de-aeration.
- Densifying.
- Storage and discharge of products with difficult flow properties.
- Homogenisation of colours and particle sizes.
- Cooling.
- Heating.

Another important feature is the possibility to combine several processes in the one machine giving huge savings in investment, labour and space.

Features

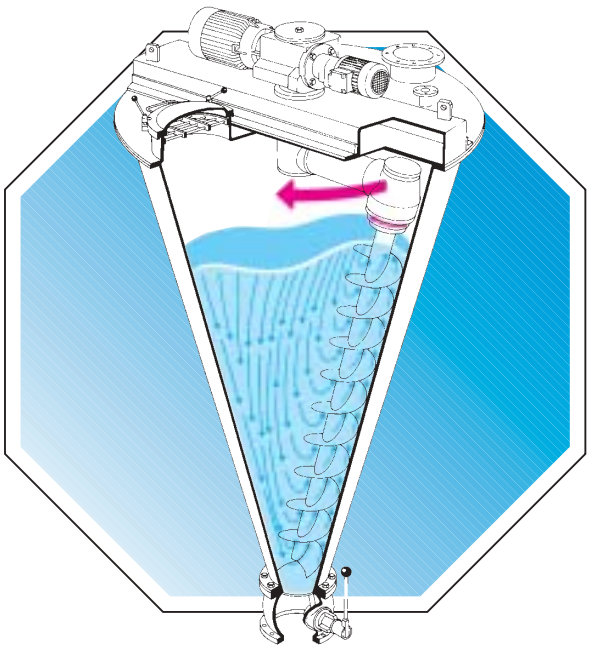
Conical Vrieco-Nauta® mixers as described in this catalogue offer great advantages over other mixing methods and have all the following in common:

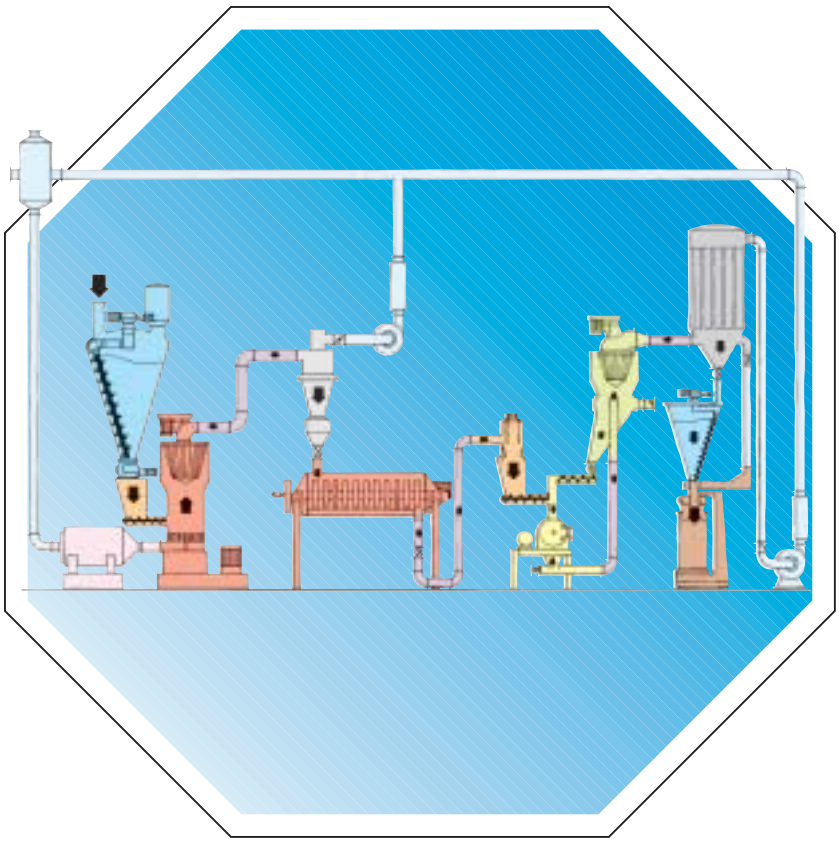
- Gentle action on product through low power consumption.
- Fast mixing times with a high degree of mixing accuracy.
- Minimum heat generation.
- Selfemptying with minimum product retention.
- Demixing effects impossible when emptying vessel.

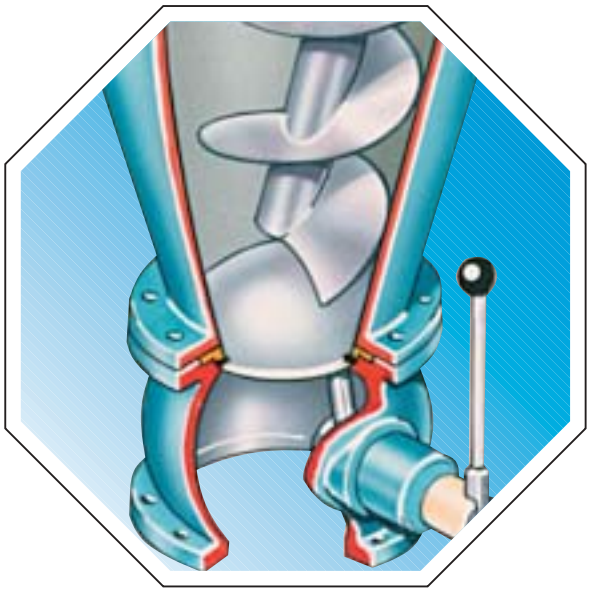
A wide range of Vrieco-Nauta® mixers in various designs and constructions is available to accomodate the requirements of our customers worldwide.
Engineered to standards complying with the various coding authorities.
Our experience of over 50 years ensures high quality in both manufacture and after sales service.
Extensive testhouse facilities are available to conduct trials and tests to ensure accurate selection of suitable designs and sizes.

Processing systems

In addition to our mixer product group, other product groups are present within our organisation, all specialized in the processing of powders.
We offer complete services for the design, engineering, manufacturing and supply of complete powder processing systems in the field of drying, grinding, pulverizing, classifying, conveying, metering, dust control and allied processes.



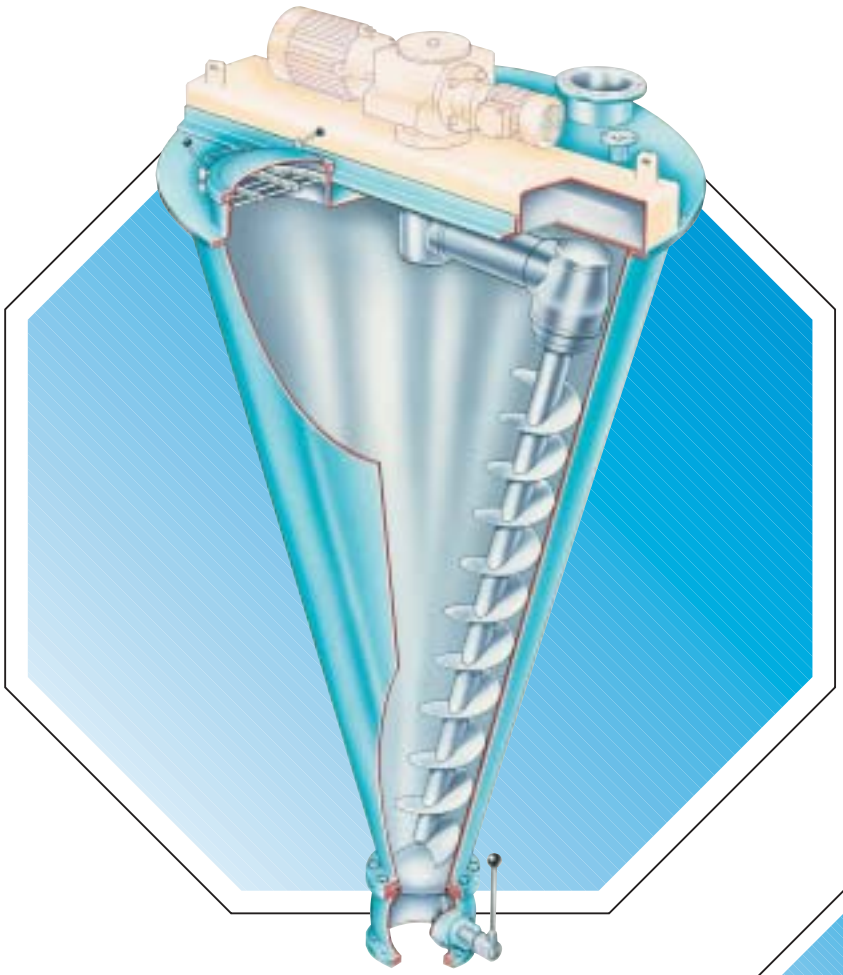


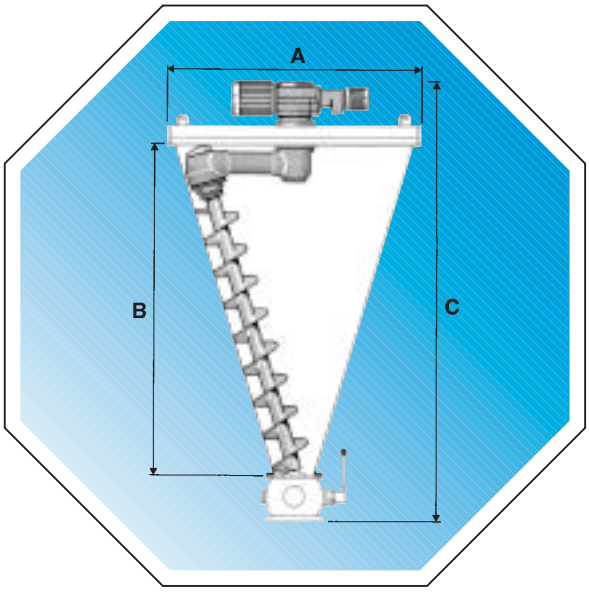


Vrieco-Nauta® mixers with cantilevered mixing screw

The mixing screw of this machine is fully supported by the orbital arm without additional support in the vessel bottom. Drive assembly and cross beam on the vessel top are designed to take full axial- and radial loads from the mixing screw. Notable advantages are:

- No bearings nor seals are in direct contact with the product.
- No degradation.
- No segregation.
- No generation of heat.
- Outlet valve or cleaning door can be fitted in the vessel bottom to accomodate total discharge and ease of cleaning.



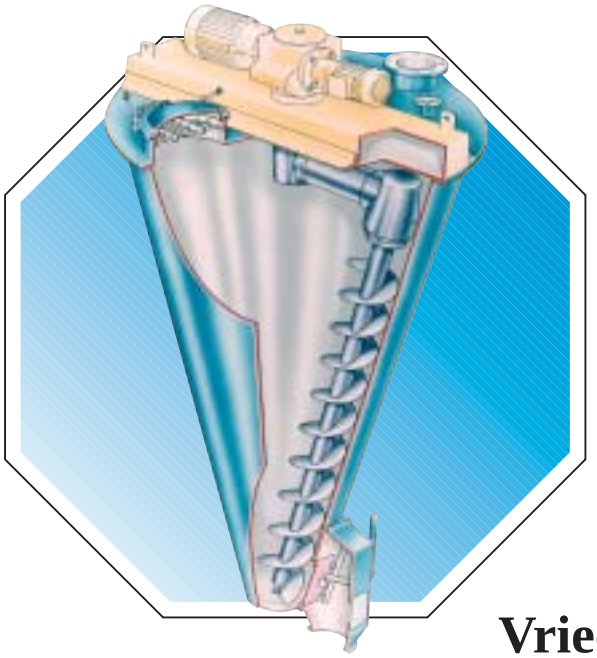


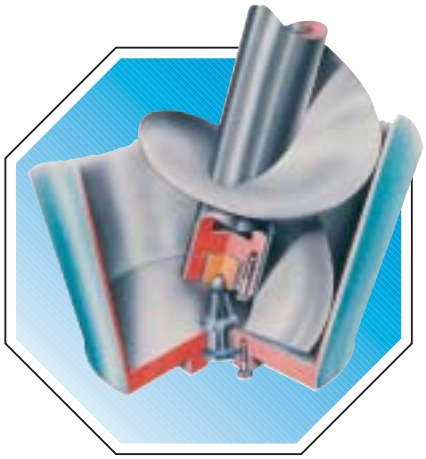
Type LFC/MFC	Working volume in litres		A mm	B mm	C mm
	liquids	solids			
5	500	430	1448	1726	2324
8	800	680	1618	2004	2602
10	1000	840	1710	2154	2752
12	1200	1000	1792	2288	2886
15	1500	1270	1910	2482	3080
20	2000	1700	2088	2773	3371
25	2500	2150	2216	2981	3735
30	3000	2625	2328	3165	3919
35	3500	3125	2474	3403	4157
40	4000	3600	2566	3554	4308
50	5000	4500	2820	3785	4795
60	6000	5400	2960	4014	5024

Data should be used as a guide only

Vrieco-Nauta® mixers with radial bottom locator for the mixing screw

Bending loads on mixing screws increase with mixers of larger volumes. To eliminate the risk of possible wall contact of the mixing screw under full load condition a bottom locator has been developed which gives additional support to the screw in radial direction.
The support in axial direction of the mixing screw is still taken by the orbital arm and prevents the occurrance of any thrust loadings in the vessel bottom. The very limited radial loads at the mixing screw bottom avoid heat generation.
Advantages are similar to those of mixers with a cantilevered mixing screw.





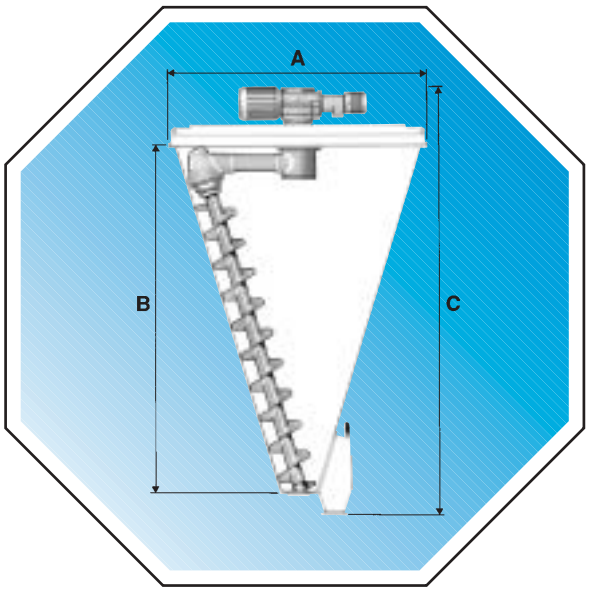
Vrieco-Nauta® mixers with supported mixing screw in vessel bottom

The mixing screw of this mixer model is actively supported in the vessel bottom by means of a pintle bearing designed to take full radial and axial loads.
Cost savings are achieved as light duty drive units can be applied.
An uniquely designed bottom support for the mixing screw is available for mixers with volumes of over 20,000 litres of which the bearings are located outside the product area. A ball-headed seal is fitted in the vessel bottom to protect the bearing assembly from the product. This very versatile range of mixers is widely used throughout all industries.

Type LFP/MFP LFR/MFR	Working volume in litres		A mm	B mm	C mm
	liquids	solids			
20	2000	1700	2088	2793	3391
25	2500	2150	2216	3002	3600
30	3000	2625	2328	3185	3783
35	3500	3125	2428	3349	3947
40	4000	3600	2520	3499	4097
50	5000	4500	2780	3738	4492
60	6000	5400	2922	3971	4725
70	7000	6400	3048	4177	4931
80	8000	7300	3166	4367	5121
100	10000	9200	3448	4829	5840
120	12000	11000	3624	5117	6128

Type	Working capacity in litres		A mm	B mm	C mm
	liquids	solids			
50 RV-5	6122	5133	2974	4031	4961
60 RV-5	6884	5984	3070	4188	5376
80 RV-5	9100	7900	3322	4597	5785

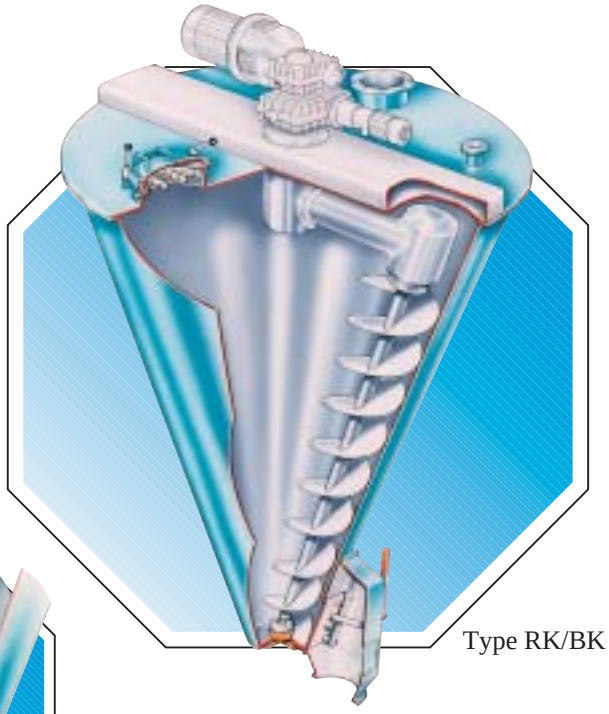
Data should be used as a guide only

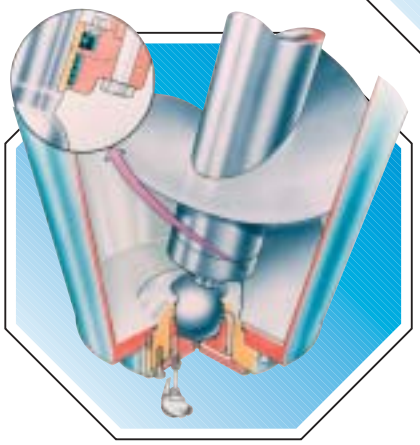


Vrieco-Nauta® mixers with tapered mixing screw

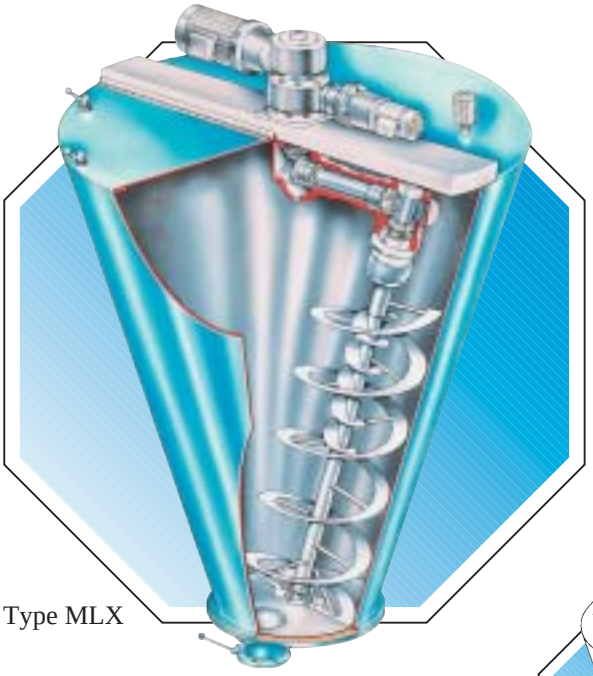
Principle and design of these mixers are identical to the standard Vrieco-Nauta® range of mixers however the cone angle of the vessel in combination with a full flight tapered screw is different.
This design requires increased drive powers but offers:
- Less overall height.
- 30 to 40% faster mixing times.
- Improved mixing efficiency.

The mixing screw is supported in the vessel bottom by means of the radial bottom locator (type RK) or, dependent on volume, with bearings which are located outside the product area in combination with a ball-headed seal in the bottom of the vessel (type BK).
Standard working capacities are ranging from 4,000 up to 60,000 litres.
Dimensions on request.

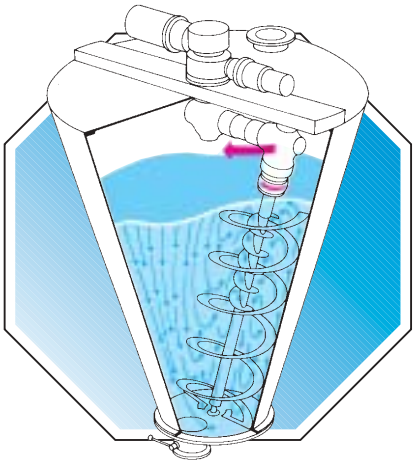




Type RK/BK



Type MLX



Vrieco-Nauta® mixers with ribbon screw

The full flight mixing screw of the standard conical mixer is replaced by a ribbon screw at this type of mixer.

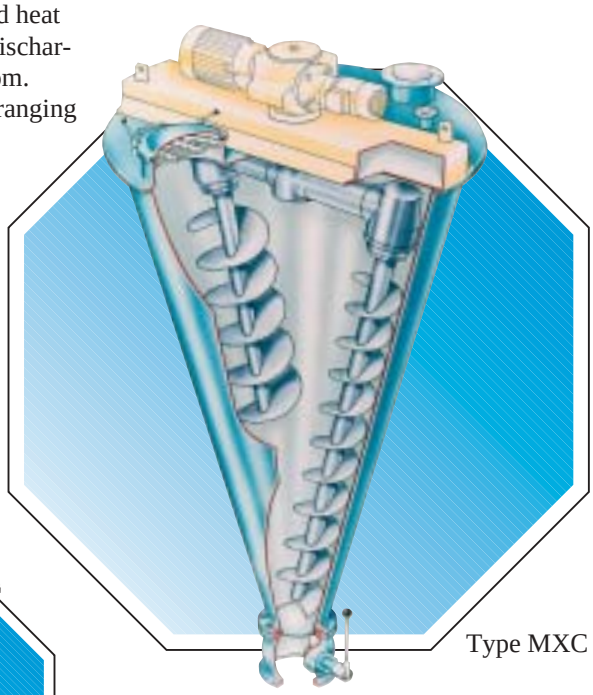
The screw consists of a counter pitched outer and inner ribbon providing high shear mixing action. This design has been developed particularly for mixing of viscous liquids, pastes and other difficult to mix materials which require high shear mixing action.
Standard working capacities are ranging from 1,000 up to 5,000 litres.
Dimensions on request.

Vrieco-Nauta® mixers with satellite screw

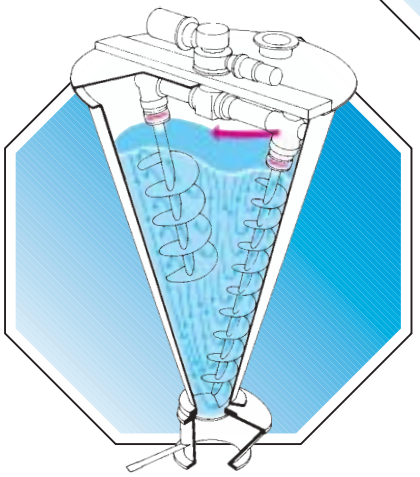
The satellite screw mixer is named after the extra mixing element which orbits in the vessel opposite the standard mixing screw. This second mixing element has a great influence on the mixing action when the mixer is operated and offers very effective mixing efficiency especially for products which are difficult to homogenize. The second mixing screw has a larger diameter and pitch in comparison to the standard screw and orbits on a shorter orbital arm.

Diameter, pitch and shape of flights are depending on application and are designed to equalise loads on the drive assembly.
Advantages are:
- Min. 30% faster mixing time.
- Reduced static product areas specifically in the centre of the vessel. This improves the mixing accuracy especially with cohesive and viscous materials which are difficult to mix.
- High injection rates when adding liquids by improved dispersability.

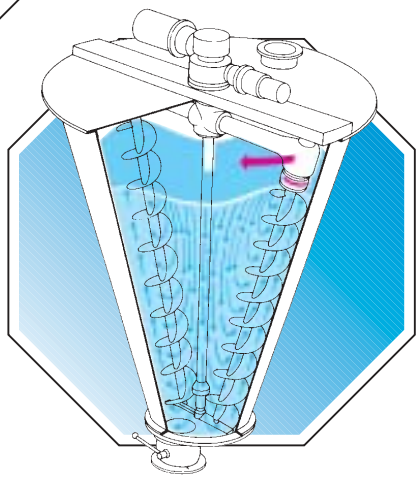
Both screws of the satellite mixer are cantilevered eliminating wear and heat generation and products can be discharged directly from the mixer bottom. Standard working capacities are ranging from 1,000 up to 10,000 litres. Dimensions on request.



Type MXC



Type M2X



Vrieco-Nauta® mixers with twin-screw

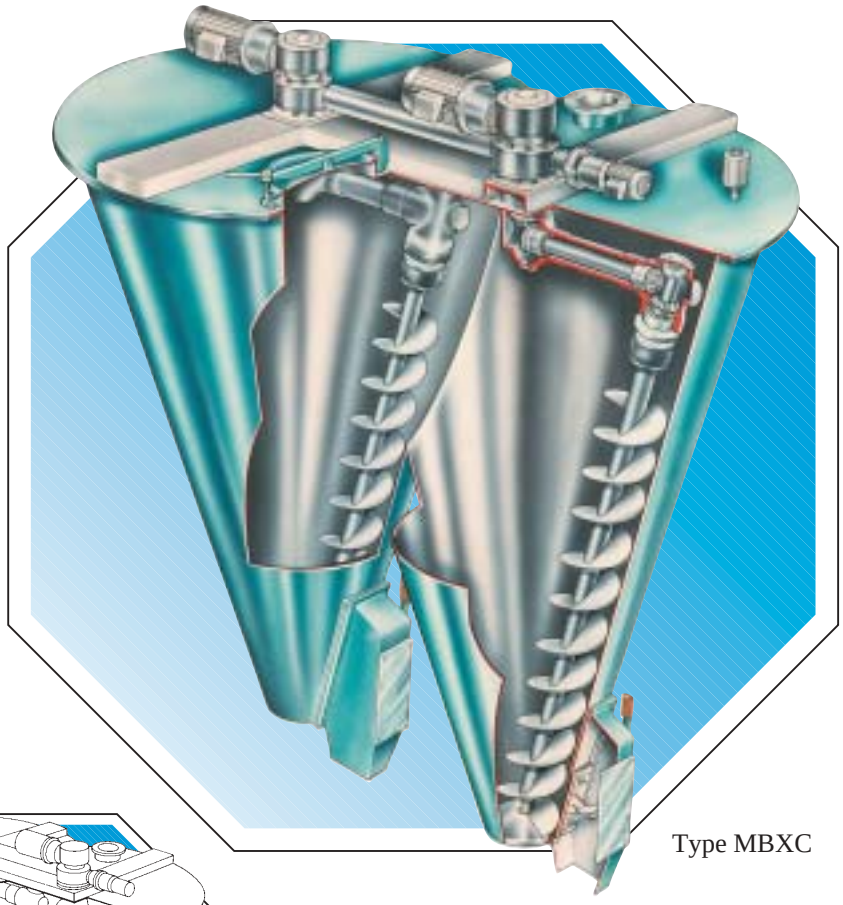
The twin-screw mixer is designed to mix and homogenize large batches of product at reduced mixing times.
A second mixing screw is fitted opposite the standard screw and orbits along the vessel wall simultaneously.
It is obvious that this will speed-up mixing times as the mixing action is virtually doubled.

A reduction in overall height results from the larger diameter of the vessel bottom for the twin-screw mixer. Also segragation effects are avoided and mixing accuracies are similar to those for single screw mixers.
Standard working capacities are ranging from 10,000 up to 30,000 litres.
Dimensions on request.

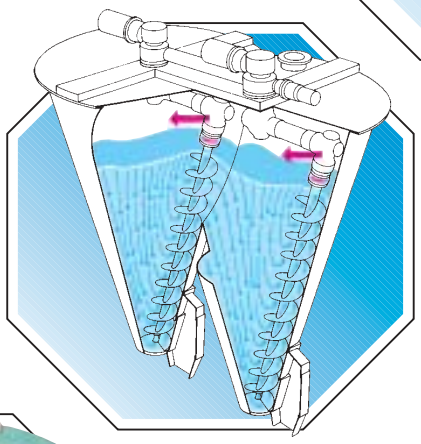
Vrieco-Nauta® double cone mixers

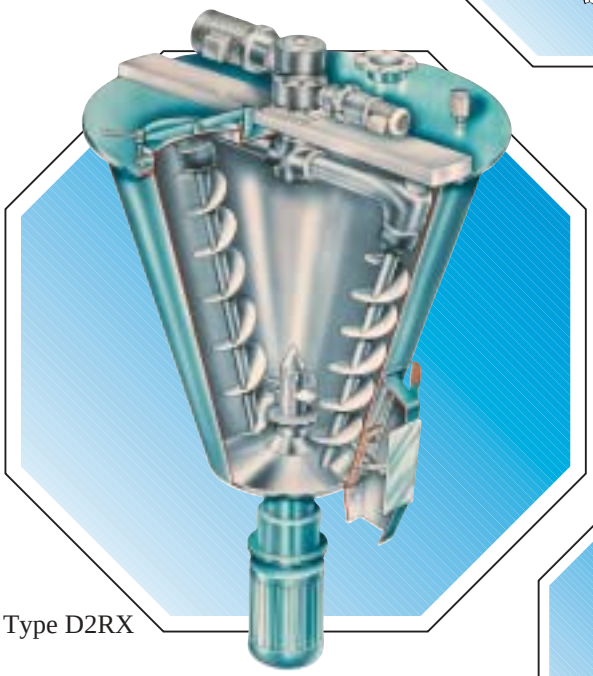
This mixer combines two or more standard conical vessels into one mixing machine and is called the combimixer. Every individual mixing vessel is provided with its own independend drive assembly for mixing screw and orbital arm.

The way the vessels are fitted together allows the product to interchange from one vessel into another ensuring uniformity of the total batch. The total batch size of combimixers can reach 100,000 litres without negative effects on mixing times, accuracies and power consumptions. Vrieco-Nauta® combimixers offer substantially reduced overall heights when compared to single cone mixers of equal volume.
Standard working capacities are ranging from 10,000 up to 60,000 litres.
Dimensions on request.

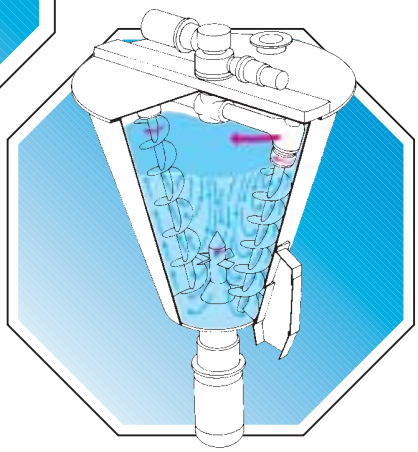


Type MBXC





Type D2RX



Vrieco-Nauta® millmix

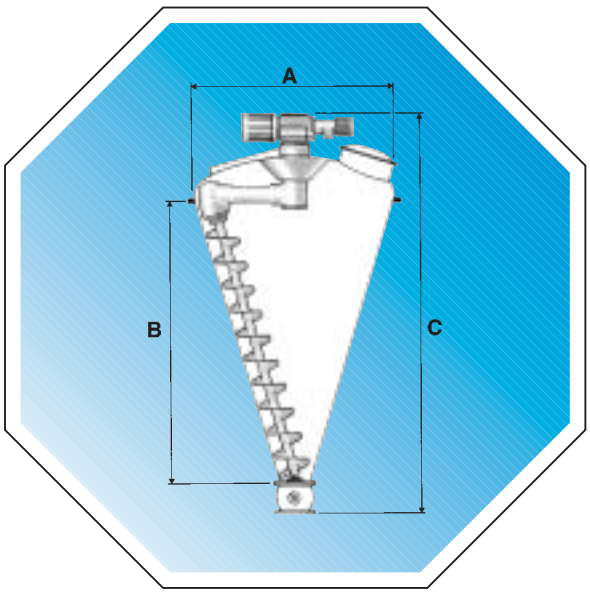
The Millmix is a combination of a twin-screw mixer with a Rotojet and is applied for processes which require additional kinetic energy.

The Rotojet is fitted in the vessel bottom and separately driven by an E-motor. The rotor assembly of the Rotojet rotates at high speed and disperses fats and liquids efficiently. At the same time intensive homogenisation takes place and the possible formation of agglomerates is neutralized. The Millmix is also suitable for reaction processes where the Rotojet ensures a quick temperature rise by convertion of kinetic energy into thermal energy.
Standard working capacity is ranging from 500 up to 2,000 litres.
Dimensions on request.

Vrieco-Nauta® pharma mixers

For processing pharmaceuticals and pharma-chemicals special drive units are available to meet the hygienic standards as usually required for this type of industries.
Pharma mixers are designed to avoid contamination of products by foreign particles and between batches. Hygienic standards comply with the F.D.A. and G.M.P. guidelines. Design pressure of vessels are subjected to process conditions and include approval by coding authorities if required.

Vrieco-Nauta® pharma mixers are mixing with a cantilevered screw combined with a hygienic ball segment valve fitted in the vessel bottom. This to avoid static pockets in the product area. Special C.I.P.-cleaning systems are available to prevent cross contamination between batches.



Type MDC	Working volume in litres		A mm	B mm	C mm
	liquids	solids			
5	500	425	1360	1896	2609
8	800	680	1526	2204	2917
10	1000	820	1510	2354	3067
12	1200	1000	1590	2513	3226
15	1500	1240	1710	2722	3435
20	2000	1725	1880	3035	3748
25	2500	2150	2020	2808	4100
30	3000	2625	2200	2994	4324
35	3500	3125	2310	3167	4577
40	4000	3600	2410	3331	4743
50	5000	4500	2570	3661	5328
60	6000	5400	2710	3890	5582

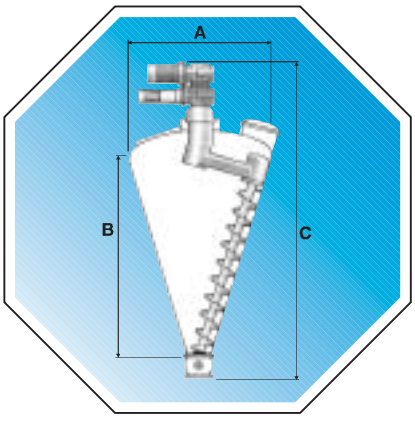
Type MDP/MDR	Working volume in litres		A mm	B mm	C mm
	liquids	solids			
20	2000	1645	1880	2600	3468
25	2500	2120	2010	2812	3705
30	3000	2540	2120	2993	3906
35	3500	3125	2280	3240	4311
40	4000	3600	2370	3388	4477
50	5000	4500	2510	3503	4641
60	6000	5400	2650	3732	4889
70	7000	6400	2780	3945	5135
80	8000	7300	2890	4122	5325

Larger sizes on request
Data should be used as a guide only

Vrieco-Nauta® sanitary mixers

A new drive concept for conical mixers has been developed recently. Till then, bevel gear power transmission inside the orbit arm to drive the mixing screw was very common.
However, gears need lubrication and for this purpose the orbital arm had to be filled with lubricants making seals located in the product area very critical.
This new generation of drive units are avoiding this problem as gears have been replaced by a timing belt transmission and lubrication is not longer necessary.

Therefore, this design is very suitable to operate at hygienic conditions because contamination risks are eliminated even in the event of leaking seals. The design of this new concept is of high quality and a substantial reduction in maintenance costs could be achieved.



Type	Working capacity in litres		A mm	B mm	C mm
	liquids	solids			
5-FDC-53	500	430	1486	1737	3203
8-FDC-53	800	680	1626	1966	3490
10-FDC-53	1000	840	1640	2145	3681
15-FDC-53	1500	1270	1840	2472	4041
10-FDC-54	1000	840	1680	2212	3877
15-FDC-54	1500	1270	1880	2539	4237
20-FDC-54	2000	1700	2010	2751	4476
25-FDC-54	2500	2150	2140	2964	4715
35-FDC-54	3500	3125	2344	3291	5075
25-FDC-55	2500	2150	2134	2948	4773
30-FDC-55	3000	2625	2338	3281	5153
35-FDC-55	3500	3125	2384	3356	5255
40-FDC-55	4000	3600	2504	3553	5486
50-FDC-55	5000	4500	2674	3831	5771

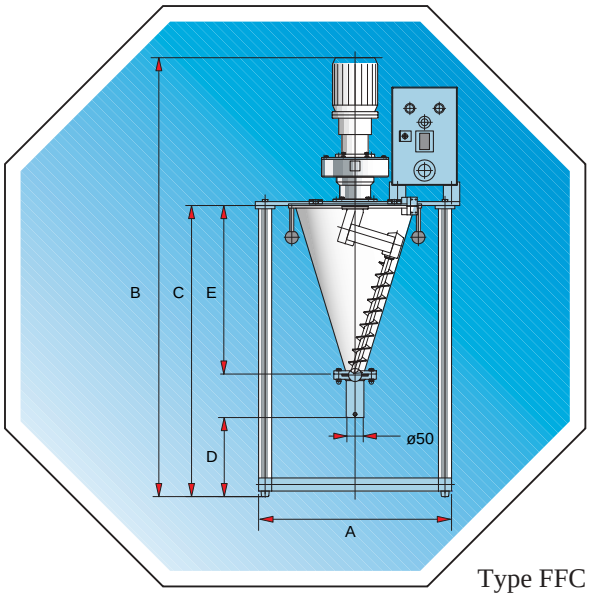
Data should be used as a guide only

Vrieco-Nauta® laboratory and pilot plant mixers

A range of small laboratory scale mixers is available for testing and experimental purposes.
In addition to possessing the qualities that have given Vrieco-Nauta® production mixers such an outstanding record, they include the following additional features:
- Exchangeable containers.
- Easy cleaning.
- Variable speed drives.
- Reliable scale-up data.
- Short delivery times.

From 30 litres upward Vrieco-Nauta® Laboratory mixers are supplied complete with:
- Separate drive for swinging arm and mixing screw.
- Domed cover with loading port.
- Bottom valve.
- Support stand.

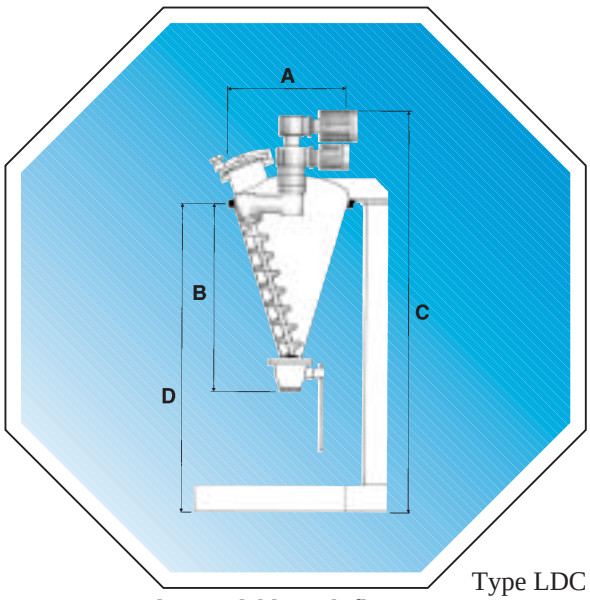
Extra features include quick release clamps for the cover, liquid injection facilities and heating jacket.



Type FFC

Type	Working capacity in litres		A mm	B mm	C mm	D mm
	liquids	solids				
005-FFC-50	5,0	4,2	590	1342	890	242
010-FFC-50	10,0	8,4	620	1402	950	249
020-FFC-50	20,0	16,5	680	1547	1095	242
04-LDC-41	40	34	720	1056	2390	1866
08-LDC-41	80	68	840	1251	2609	2061
1,2-LDC-41	120	100	920	1382	2758	2192

Data should be used as a guide only



Type LDC

Also available with flat cover

Accessories

Side outlets

Slide gate

Advantages:
- Optimum discharge capacity.
- Closing against product.
- Shortened building height.

Disadvantages:
- Slight static pocket between vessel and slide.
- No liquid tightness.

Ball segment valve (side)

Advantages:
- Sanitary design.
- Suitable for vacuum and pressure process conditions up to 6 bar.
- Closing against product flow possible.
- Easy to clean.

Disadvantage:
- Slight static pocket between vessel and ball segment.

Bottom outlets

Slide gate

Advantages:
- No product left when vessel emptied.
- No static pocket.

Disadvantages:
- Only applicable for mixers with cantilevered screw.
- Limitations in discharge capacity.
- Increased building height.

Ball segment valve (bottom)

Advantages:
- Sanitary design.
- Suitable for vacuum and pressure process conditions up to 6 bar.
- No static pocket.
- No product left when vessel is emptied.

Disadvantages:
- Only applicable for mixers with cantilevered screw.
- Limitations in discharge capacity.
- Increased building height.

Sampling device

For fitment in vessel wall of mixer and suitable for taking productsamples when mixer is in operation, may also be used when vessel is under vacuum or pressure conditions without disturbance of such conditions.

Intensifier

The separately driven intensifier is fitted through the centre shaft of the drive assembly of the Vrieco-Nauta® mixer. The mixing rotor is thus centrally located in the mixing volume. Rotating at a high speed, the mixing element avoids building up of agglomerates, prevents the location of low density components and effectively disperses liquids into powders. The continuous transport of material by the mixing screw to the intensifier ensures an efficient and homogeneous processing of the product. Pat.pend.
Also available with liquid injection device.

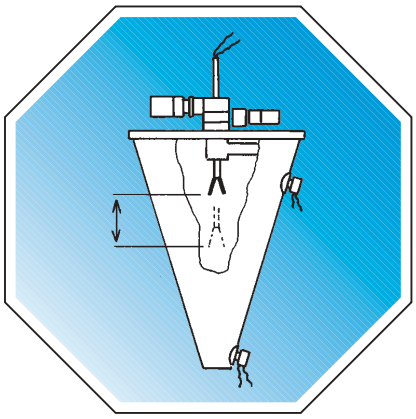
NEW

Domed cover

When the vessel has to operate under vacuum or pressure conditions a domed cover can be fitted.
Domed covers designed to resist maximum bursting pressures of 10 bar are available.
Domed covers are always reinforced to be able to take full loads of the drive unit.
We also recommend a domed cover when cleaning is very important especially when C.I.P. cleaning systems are used.

Level control

The volume of product in the mixer can be controlled by level probes fitted in the vessel wall. A high level probe can be installed through the hollow centre shaft of the drive assembly as a protection against product being fed to the mixer over the maximum working volume of the vessel. The degree of filling can be controlled also by measuring the batch-weight before feeding it to the mixer or in the mixer itself. A set of special brackets is available to install the mixer on load cells.



Liquid addition

For the addition of liquids to powders or moistening of dry solids one or several spray nozzles can be fitted. Liquids are fed to the nozzle through the hollow centre shaft of the drive assembly and sprayed on to the product surface.
The rotary joint is fitted outside the product area to prevent any harm to product or machine in case of a seal failure.
When large quantities of liquids have to be added a Microjet can be fitted in the vessel wall. This Microjet injects, disperses and homogenizes the liquid directly into the product and its high speed rotor breaks down agglomerates at the same time.

Cleaning

Vrieco-Nauta® mixers can be dry- or wet cleaned.
Mixers with flat top covers are usually dry cleaned.
For the dry cleaning of large mixers a special cleaning ladder is recommended for reasons of safety. This ladder comes complete with a rail inside the vessel to hook on the ladder allowing the operator to manouvre along the vessel wall.
Wet cleaning is necessary when cross contamination between batches is not allowed for reasons of hygiene. We supply a choice of C.I.P. cleaning systems such as troll balls, spray lances and spray nozzles fitted in the vessel wall.

Heating / Cooling

A jacketed vessel can be supplied to heat or cool the product.
Dependant on temperature, pressure and medium, one or several jacket segments are welded to the vessel wall fully in compliance with the requirements of coding authorities.
The jacket is designed to force the medium around the vessel achieving maximum temperature transfer effect.

Lumpbreaker

One or several lumpbreakers can be installed in the vessel wall. Available are a choice of rotors to avoid the building of agglomerates which might occur during certain process phases.

Research and Development

Hosokawa Micron B.V. offer extensive test and development centres where customer's products can be accurately tested prior to final design and determination of the most efficient process, system or plant.
All data collected over the many years of testing various materials, is building the firm base of our know how.
By utelizing the latest processing technologies a continuous update of know how is ensured.
Whether you require a single machine or a complete powder processing system, the same skilled and experienced staff is at your service to ensure that your requirements are met and the most suitable equipment will be offered.
Our research and development centres are backed up by the Hosokawa Micron Corporation. The Hosokawa Micromeritics Laboratory in Hirakata/Japan is sourcing technical developments in Europe, America, Australia and Asia.
When you have problems in the field of powder processing we could be of help to solve them.
Hosokawa Micron test and development centres are looking forward to assist you in finding solutions to solve such problems.

Service

Behind each Hosokawa Micron installation there is an effective and well trained service organisation, carrying essential parts in stock. In the event of a breakdown, our customers can be back into production with minimum time loss and inconvenience. Fitters and parts can be on site at very short notice. When purchasing Hosokawa Micron equipment you may rely on this fast and effective service. An additional service that we offer is that of periodical maintenance contracts to ensure that your installations operate efficiently.

Process engineers for: mixing-drying-grinding-separating-metering-weighing

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HOSOKAWA MICRON B.V.

Hosokawa Micron B.V. is a member of the Hosokawa Micron Group, responding to global needs through an emphasis on materials science and engineering. The Group is an international provider of equipment and technology for powder and particle processing, plastics processing and confectionery products. The Group maintains facilities for research, engineering, manufacturing and service in each of the world's major industrial markets.

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