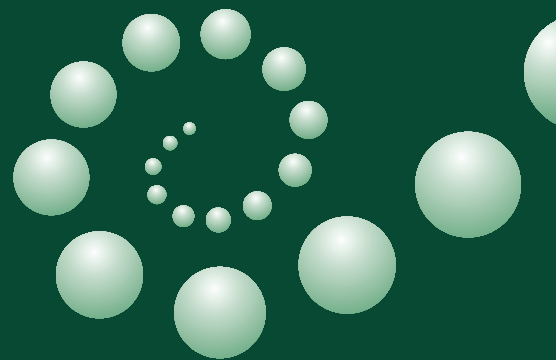


**air**  
classification

**UCX**  
air classifier series

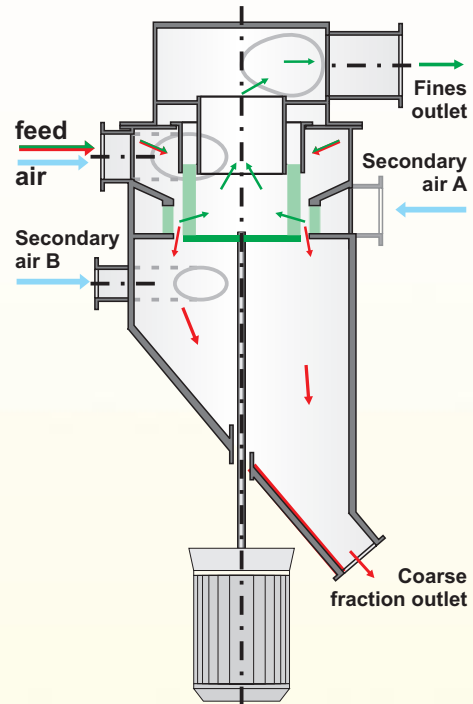


**Comex**  
Comex

# air classification

The process of air classification is of critical importance for many grinding operations. Generally the overall energy consumption for grinding can be reduced drastically provided classification efficiency is high. Furthermore production capacity can be significantly increased. For many applications this is even more important than energy savings. When the purpose of air classification is to produce different size fractions without grinding, high efficiency will be even more important in order to provide products of required particle size distribution.

The Comex UCX series air classifier has been developed by the mineral processing laboratory of SINTEF/NTNU in Norway to provide products in ultra fine particle sizes mainly below few microns and with high efficiency. This is achieved by a special construction which provides high centrifugal acceleration and high dispersion of particles in the nanometer range. This effect is achieved using low air pressure drop and rotor torque. This makes the classification process very energy efficient. Additionally, mentioned classification efficiency is high for both ultra fine particle sizes down to 1-2 micron range and for coarser particles over 200-300 microns. This makes the new classifier very universal and flexible. Very coarse and ultra-fine particles can be produced efficiently in the same machine.



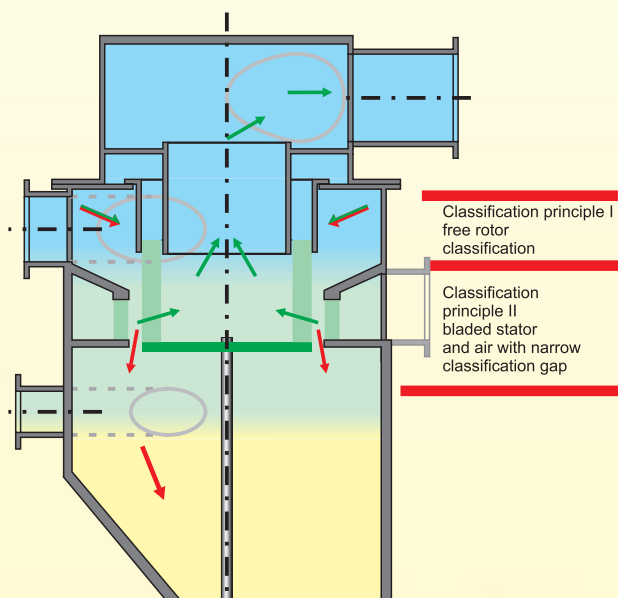
UCX classifier cross section

## Operating principle

UCX classifiers belong to the forced vortex group of classifiers where the centrifugal forces are generated and controlled by a rotor. Forced vortex can in principle be divided in two types.

The first type refers to the rotor operating in a significantly large free area with no restrictions around. In this case the feed can be introduced into the classifier as an air suspension, which provides good dispersion of fine particles and thus efficient classification.

The second type of classifiers has a rotor operating inside a stator containing static diagonal blades having close distance to the rotor and supplying the main air. In this case the feed is supplied as a solid material from the top part of the rotor and is further exposed to the air flowing from the stator area to the rotor centre. This results in good classification efficiency as all particles and agglomerates are exposed to significant shear forces and are close to the rotor blades. However, in this configuration the feed material cannot be introduced to the classifier as a mixture of the air and particles. This limits a possibility for efficient separation especially with ultra fine particles which normally require very good dispersion by mixing feed material with primary air. The new Comex UCX classifier solution combines the advantages of both types. The table below compares both classifier types to the new UCX classifier.



Operating principle of the UCX classifier

# air classification

In the UCX air classifier the feed material enters the classifier unit mixed with the air stream by a tangential inlet at the top part of the classifier. In this area the feed material is well dispersed in the air. At this stage the first classification step takes place around the upper part of the rotor where very fine particles are removed from the feed material within relatively short time period. The coarse particles and those which are slightly finer than the cut point are forced to flow through the narrow opening between the rotor and the static blades. Behind those blades another air flow is introduced (secondary A). In this area particles slightly finer than the cut point are exposed to significant shear forces close to the rotor.

Consequently these particles end in the finer material fraction and only coarser ones proceed to the lower coarse fraction outlet. Additionally, there is another secondary air flow applied below the rotor (secondary B) providing a possibility to rinse the coarse particles from the fine grains agglomerated on their surface. In addition it reduces the sedimentation velocity of the particles in both classification zones which is critical to obtain optimal conditions. This configuration combines the best of the two operating principles considered originally and has therefore a superior performance.

*Performance limitations for conventional forced vortex classifier types and the UCX*

Parameter/feature	Free rotor classifier	Classifier with static blades	New Comex UCX classifier
Feed material mixed with primary air	+	-	+
Performance at high capacity	+	-	+
Efficient classification of ultra-fines	+	+	+
Efficient classification of fine particles close in size to the cut point	-	+	+
Efficient classification in the wide size range from ultra-fines to coarse sizes	-	+	+

### The most important design features which make this classifier unique are:

- Pneumatic transport of the feed material to the classifier, which provides excellent dispersion of the material in the air during a turbulent flow inside the inlet pipe
- Tangential feed inlet providing preliminary particle acceleration which reduces wear rate of the rotor blades
- Preliminary classification of ultra fines in the upper classifier zone
- Final classification of the middle size particles in the second classifier zone
- Lack of collisions between the entering trajectories of the feed and the descending coarse stream inside the classifier. This prevents mixing of the fine particles from the feed stream with the coarse particles flowing to the classifier outlet
- Special rotor geometry and angular blade position make it possible to achieve much finer products than with traditional construction
- The main fine fraction outlet is spiral shaped, hence kinetic energy of rotating particles and air molecules is easily transferred to positive displacement at the outlet pipe. This is of critical importance, providing lower pressure loss during classification
- Exchangeable rotor blades
- Simple rotor replacement through the inspection window on top of the classifier
- Compact design

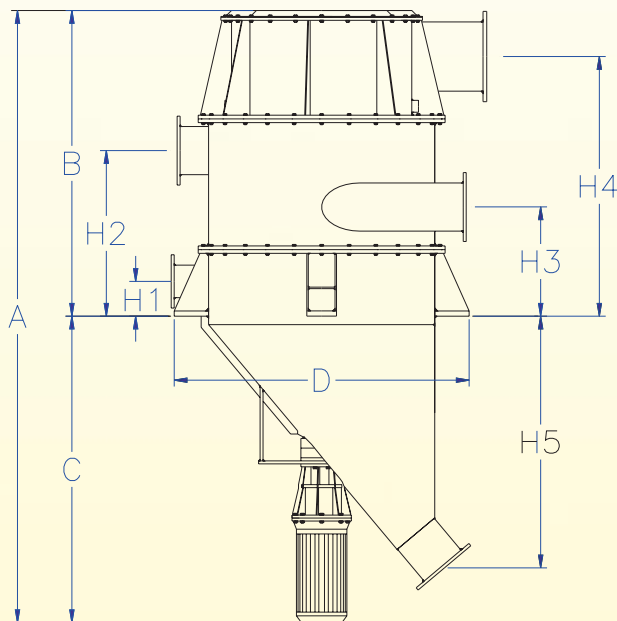


UCX 750 classifier unit

# air classification

UCX classifier weights and dimensions

UCX	Weight [t]	A [mm]	B [mm]	C [mm]	D [mm]	H1 [mm]	H2 [mm]	H3 [mm]	H4 [mm]	H5 [mm]
200	0.25	1099	549	550	530	62	297	196	466	452
350	1	1923	960	963	927	109	520	343	816	791
500	2.4	2747	1371	1376	1324	156	743	490	1166	1130
750	5	4121	2057	2064	1986	234	1114	735	1749	1695
950	7.5	5220	2606	2614	2516	296	1411	931	2215	2147
1200	12	6593	3291	3302	3178	374	1783	1176	2798	2712
1500	20	8241	4114	4127	3973	467	2229	1470	3497	3390
1700	25	9340	4663	4677	4503	529	2526	1666	3963	3842



## This results in the following benefits from application of the Comex UCX air classifier:

- High classification efficiency
- Large processing capacity from smaller units
- Ultra-fine cut size down to d97 of 1.5 microns
- High efficiency in very wide product range from 1.5 to 300 microns
- Low pressure loss and power requirement
- Low wear rate of the moving parts
- Reduced maintenance and operating cost

## Size range

Comex UCX air classifiers have different rotor sizes, ranging from 200 mm diameter up to 1700 mm diameter. Production capacity ranges from 1200 kg/h to 100 t/h. Tables below show the range of classifiers including the most important operating and construction parameters. The UCX 200 is used in pilot plants for carrying out small scale investigations or for classifying the finest of products.

# air classification



◀ UCX 350  
during testing

## UCX classifier technical specifications

Classifier type	Scale factor	Fan motor power [kW] <sup>1)</sup>	Classifier motor power [kW]	Capacity [t/h] <sup>2)</sup>	Air flow rate [m <sup>3</sup> /h]	Product particle size d97 [μm]
UCX 200	1	4-7.5	7.5	0.3 - 1.2	800	2-300
UCX 350	3	7.5-15	15	0.9 - 3.6	2600	3-300
UCX 500	6.25	11-22	22	1.8 - 7.5	5500	4-300
UCX 750	14	15-30	30	4 - 18	14000	5-300
UCX 950	20	22-37	37	7 - 30	20000	6-300
UCX 1200	36	30-55	55	10 - 50	32000	8-300
UCX 1500	56	37-75	75	15 - 75	48000	10-300
UCX 1700	72	45-90	90	20 - 100	62000	12-300

<sup>1)</sup>- fan motor power depending on classifier circuit configuration

<sup>2)</sup>- capacity depending on product properties and particle size produced

# air classification

## Energy saving potential

UCX air classifier provides high classification efficiency and simultaneously gives a very low pressure loss during operation. This is of critical importance when the overall energy for material processing is considered. Application of the UCX classifiers in many industrial grinding circuits provided significant benefits in form of reduced specific energy and increased production capacity. In some cases up to 80% increased capacity has been reported after replacing old air classifiers with the Comex UCX units.

## Applications

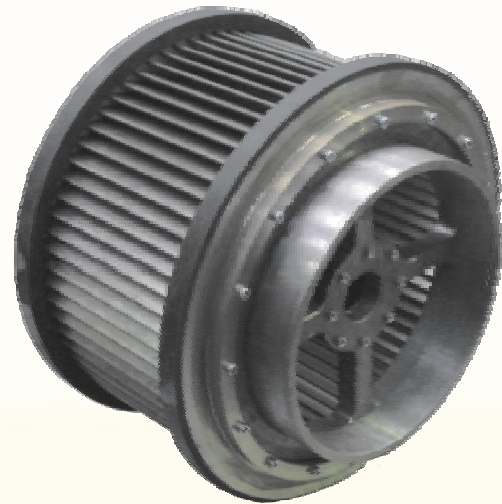
Comex air classifiers can be applied to processing of various materials having different physical properties. High classification efficiency can be obtained with materials that are difficult to disperse. Furthermore, thanks to its unique construction and thus low wear rate of moving parts, this type of classifier provides a high application potential for processing abrasive materials and high purity products. The UCX classifiers were successfully tested or applied to the production of:

- mineral concentrates
- abrasive materials
- fillers for paper, rubber, paint and plastic
- raw materials for microelectronics
- raw materials for fibre optics
- advanced composite materials
- construction and building materials
- chemical industry materials

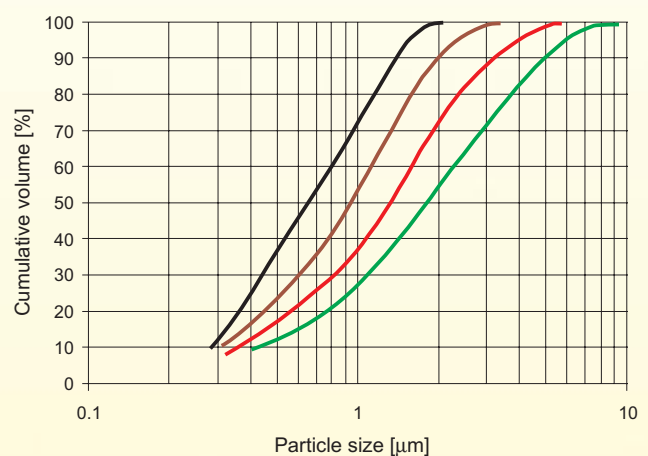
Classification examples for the UCX air classifiers

Material classified	Product d97 µm	Yield Efficiency <sup>1)</sup> %
Dolomite	6.15	64.1
Dolomite	4.45	28.6
Dolomite	1.65	22.3
Quartz	145	94.3
Quartz	185	96.6
Silicon carbide	19.5	65.1
Silicon carbide	7.3	45.8
Limestone	15.6	47.9
Limestone	44.5	73.4

<sup>1)</sup> - yield efficiency calculated as a ratio between the fine fraction percent recovery and the percent content of the produced size in the feed



Rubber lined UCX 350 rotor



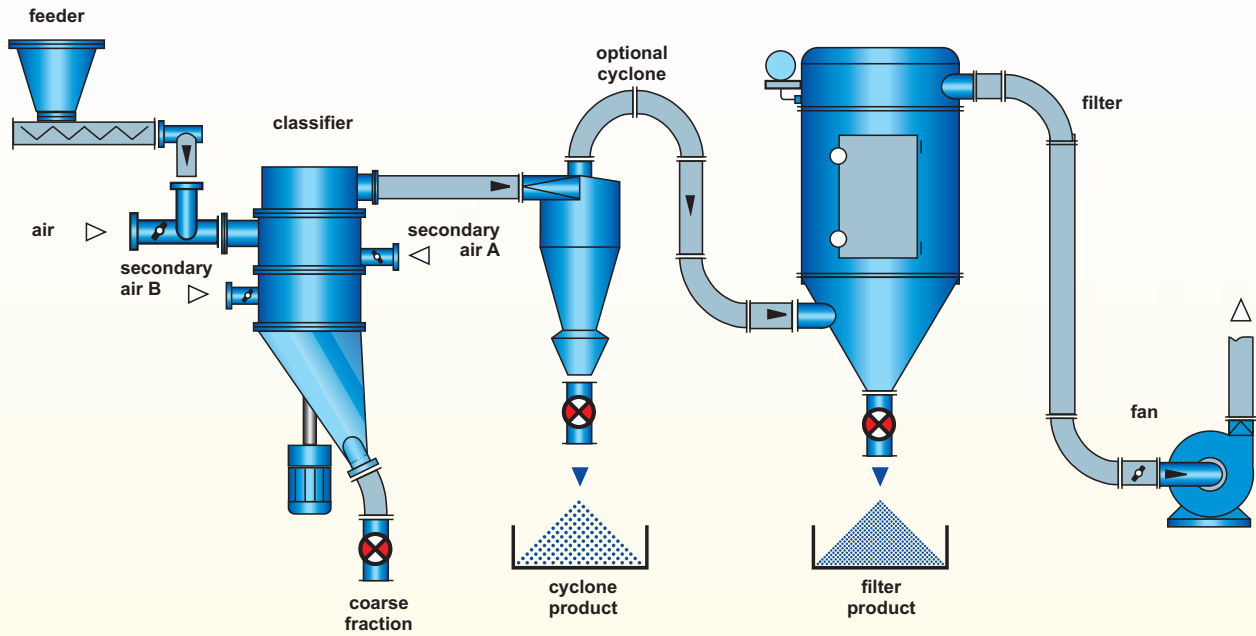
Classification examples - fine dolomite fractions

## Research and Development

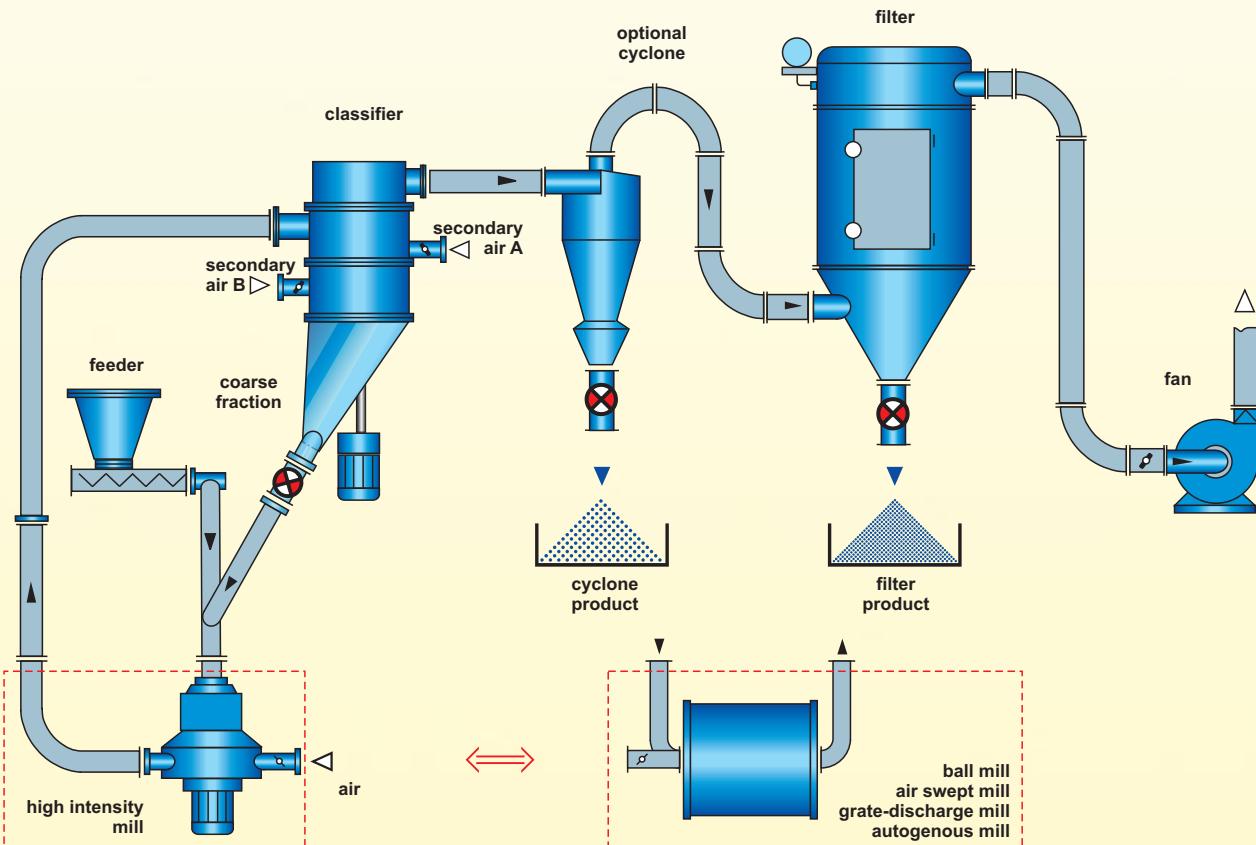
Comex AS offers extensive test and development facilities, where different products can be accurately tested prior to final design, for determination of the optimal process. The pilot scale facilities include different sizes of various types of Comex classifiers together with a wide range of grinding equipment. Extensive instrumentation of the pilot scale circuits, including on-line particle size measurement, makes it possible to achieve optimum operating conditions and provide accurate results.



# air classification



Typical air classification configuration



Typical air classification configuration with grinding equipment

# Comex AS

Comex AS  
P.O.Box 53  
1309 Rud  
Norway  
tel.: +47-93 03 38 25  
fax: +47-92 57 36 65  
[www.comex-group.com](http://www.comex-group.com)  
e-mail: [info@comex-group.com](mailto:info@comex-group.com)

Comex