

**CAVEX®**  
Hydrocyclones

Excellent  
Minerals  
Solutions

**WEHR**  
MINERALS

# First choice for Hydrocyclones



## Increase your efficiency, extend wear life and reduce your costs with Weir Minerals' Cavex® hydrocyclones



### Delivering you benefits beyond innovation

The unique laminar spiral inlet geometry of Weir Minerals' Cavex® hydrocyclones has been fundamental in helping drive customer productivity upwards while also bringing down the total cost of ownership.

Yet what takes Cavex® hydrocyclone innovation even further is Weir Minerals' consistent focus on finding solutions that maximize efficiency and minimize costs, supported by our wealth of experience and knowledge, locally and around the globe, in mining and minerals processing.

The creation of the Cavex® hydrocyclone came out of the focus on finding better solutions - a design that delivers maximum efficiency, maximum capacity and longer wear life than conventional involute or tangential feed cyclones.

*Each cluster of Cavex® hydrocyclones is modelled using the latest 3D CAD technology*



## Greater hydraulic capacity, increased circuit capacity, longer wear life, improved leach kinetics

### Increasing hydraulic capacity

The Cavex® hydrocyclone was never a cone modification, but rather an entirely new feed geometry that substantially increases hydraulic capacity while minimizing localized wear on the feed chamber and vortex finder. The result – lower operating costs and fewer cyclones.

### Increasing circuit capacity

For grinding circuit applications, Cavex® hydrocyclones increase circuit capacity by minimizing the quantity of fines bypassing to the underflow stream. This is achieved by maximizing the air core diameter created within the rotating mass of fluid in the hydrocyclone. Not only has this been proven in the laboratory, but time and again in full scale operations.

### Cavex® hydrocyclones in mining

#### Achieving increased wear life

At a gold mine in Western Australia, a Cavex® hydrocyclone was tested in a cluster of 14 conventional style cyclones.

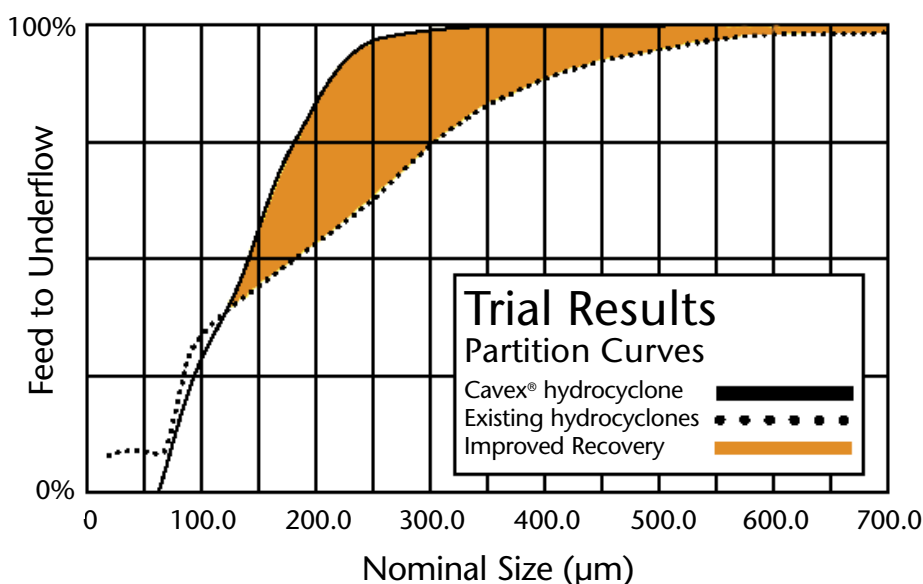
The 25mm thick conventional style feed chamber liners lasted an average 1200 hours. The Cavex® rubber feed chamber liners, also 25mm thick, lasted an average 3750 hours – a 300% increase in wear life.

#### Improved leach kinetics

In addition to the increased wear life of cyclones, the mine was able to achieve a major reduction of the >300 micron particles from the overflow.

With the use of all Cavex® hydrocyclones and some plant modifications, the mine increased gold recovery.

### Head-to-head trial results comparison



Above graph shows Cavex® hydrocyclone efficiency in head-to-head trials at gold mine in Western Australia with a feed slurry of 65% w/w.

Trial showed a major reduction of the >300 micron particles from the overflow and wear life of the Cavex® hydrocyclone liner was three times longer than conventional hydrocyclone liners.

# Design that creates more even wear, longer wear life and more efficient classification

## Benefits of greatly reduced turbulence throughout the whole hydrocyclone

The laminar spiral inlet geometry design provides a natural flow path into the Cavex® hydrocyclone. Its unique shape has no sharp edges or square corners and allows the feed stream to blend smoothly with rotating slurry inside the chamber.

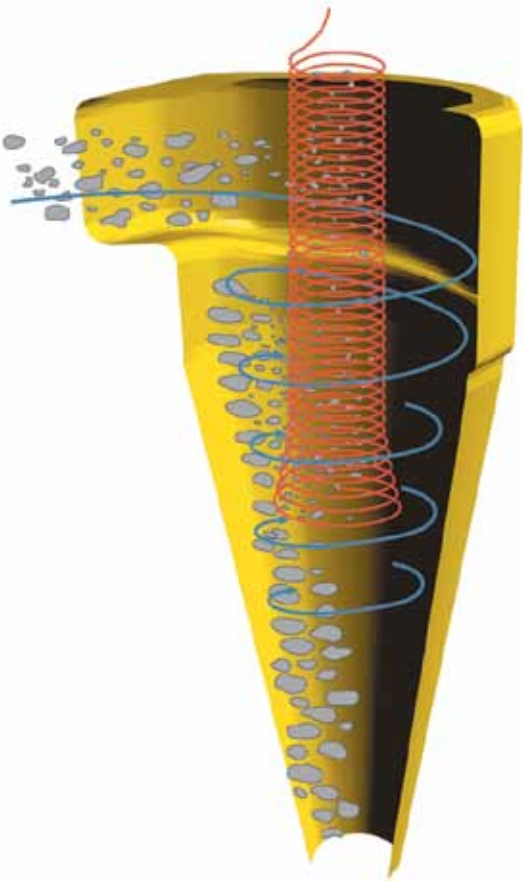
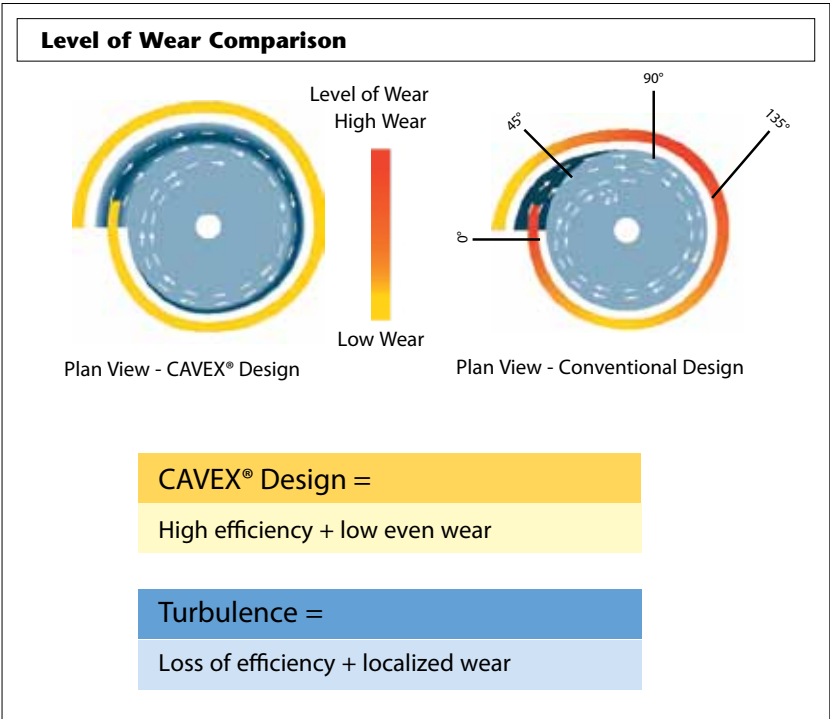
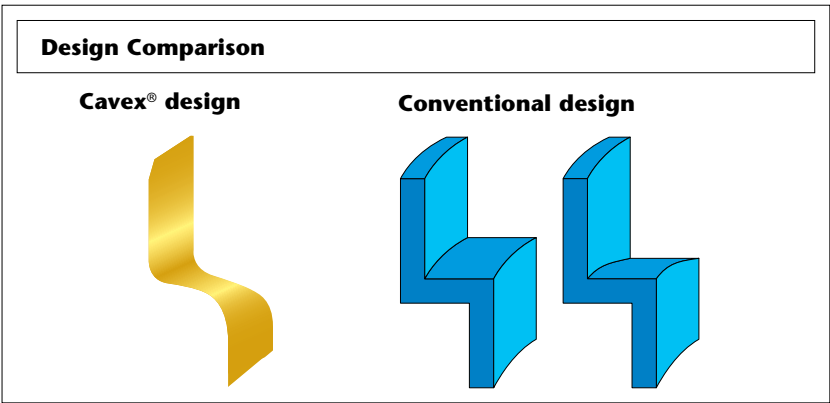
The result is greatly reduced turbulence throughout the entire hydrocyclone, creating more even wear, longer life and more efficient classification.

In conventional hydrocyclones, slurry bursts into the cylinder with no flow control and the resulting turbulence is responsible for gouging liner walls.

## Improved flow means more with less

By minimizing flow resistance through the feed chamber, Cavex® hydrocyclones process substantially higher slurry volumes than conventional hydrocyclones with equivalent fittings.

The increased productivity effectively reduces the quantity of hydrocyclones required and/or reduces the energy required to perform given duties.



The Cavex® hydrocyclone laminar spiral inlet geometry design significantly reduces turbulence throughout the whole hydrocyclone



## Improving efficiency and performance – with Cavex® hydrocyclones, it's all by design



### Unique design

It's all by design — Cavex® hydrocyclones feature a unique laminar spiral inlet geometry designed to deliver maximum efficiency, maximum capacity, and longer wear life than conventional involute or tangential fed hydrocyclone designs. Not just a cone modification, Cavex® hydrocyclones utilize an entirely new feed geometry that allows the slurry to follow a natural flow path within the hydrocyclone. This results in a reduction of turbulence which in turn substantially increases hydraulic capacity while minimizing localized wear on the feed chamber and vortex finder.

The unique Cavex® shape has no sharp edges or square corners. These design improvements result in lower operating costs and fewer hydrocyclones required for a given duty.

### Longer wear life

Turbulence is also the cause of uneven wear in hydrocyclones. The revolutionary designed Cavex® hydrocyclones reduces turbulence, resulting in improved wear life.

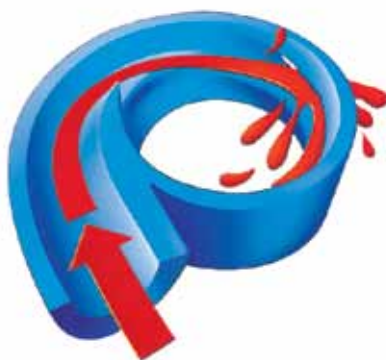
In conventional cyclones, slurry bursts into the cylinder with no flow control. The resulting turbulence is responsible for gouging the liner walls leaving major portions of the liner unworn. Cavex® hydrocyclones have been shown to deliver up to three times the life of conventional feed head liners in comparable applications.

### Cavex® hydrocyclone vs conventional hydrocyclone design



*Cavex® hydrocyclone*

*A controlled feed stream blends progressively and smoothly so turbulence is reduced throughout the Cavex® hydrocyclone.*



*Conventional hydrocyclone*

*Liner failure in conventional hydrocyclones is highly localized while major portions remain unworn.*

# Reduced turbulence means improved efficiency and classification

## Increased classification efficiency

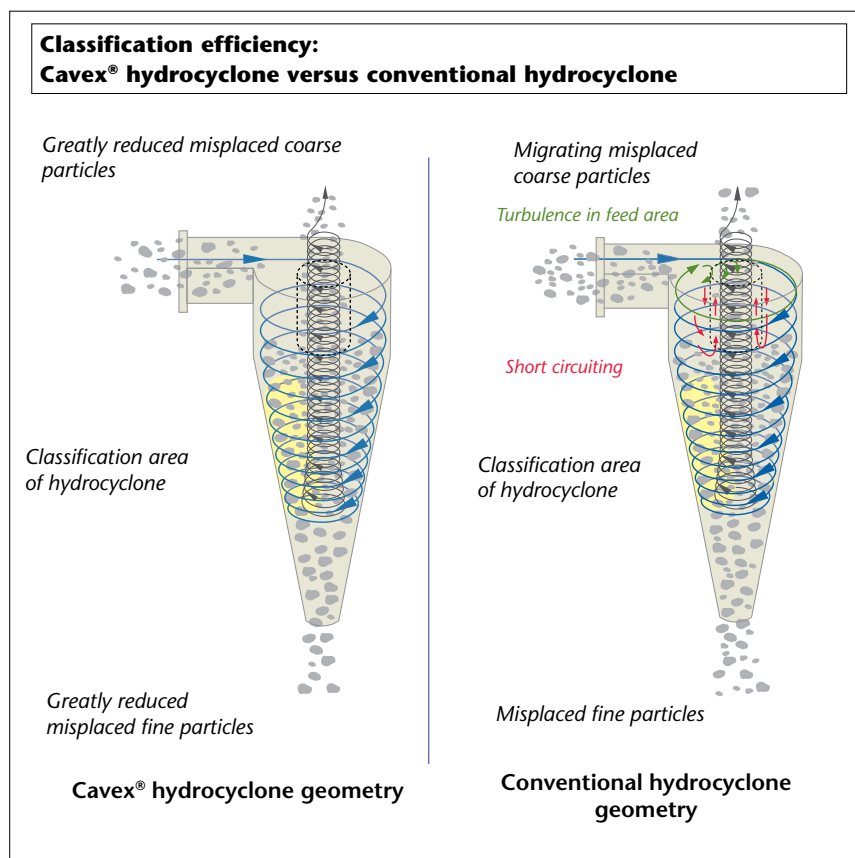
Conventional geometry causes migration of unclassified coarse solids to the overflow, which can result in valuable mineral losses. The Cavex® laminar spiral hydrocyclone geometry dramatically reduces misplaced coarse carry-over and increased classification efficiency means that over grinding and circulating loads are reduced.

## Higher separation efficiency

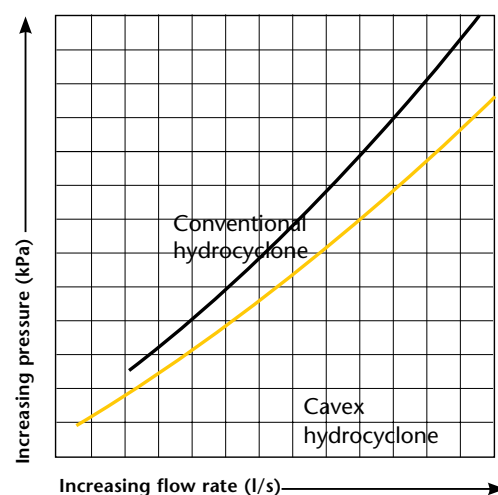
When turbulence is reduced, sorting efficiency is enhanced. As shown in the illustration, fewer misplaced fines report to the underflow and less grit reports to the overflow.

## Cavex® hydrocyclone features

- The Cavex® shape – providing maximum separation efficiency, maximum hydraulic capacity and maximum feed chamber wear life
- Corrosion resistant, polyurethane, exterior reinforcement
- Wide range of vortex finder and spigot sizes are available

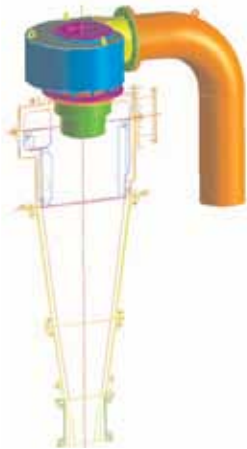


## Increased hydraulic capacity



*Because of less turbulence and a larger blending zone, material flows more freely through a Cavex® hydrocyclone. The Cavex® hydrocyclone design requires less energy to pass fluid at comparable inlet velocities.*

## Demonstrated innovation with an eye to enhanced efficiency



### Increased capacity and efficiency with Air Core Booster

Weir Minerals Cavex® hydrocyclones fitted with the patented Air Core Boosters produce improvement in capacity and hydrocyclone efficiency by reducing the total pressure across hydrocyclones, increasing the volume flow split to the overflow.

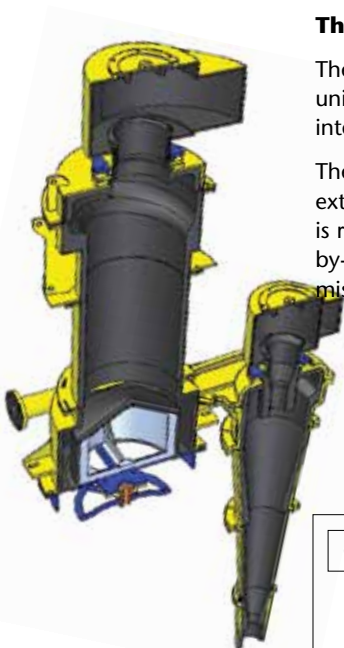
The Air Core Booster allows use of a larger apex for a given bypass of water to the underflow, which produces a more stable, larger diameter air core, increasing capacity and reducing bypass of fines.

Air Core Boosters also reduce chances of operating the hydrocyclone under roping conditions or blockages due to large steel balls in the underflow.



*Cavex® hydrocyclones fitted with Air Core Boosters in operation in a facility in Brazil.*

## Cavex® DE double efficiency hydrocyclone - Innovation in double classification



*Cutaway of the Cavex® DE hydrocyclone*

### The Cavex® DE double efficiency hydrocyclone

The Cavex® DE hydrocyclone is a double classification unit, working in a single stage, without intermediate pumping.

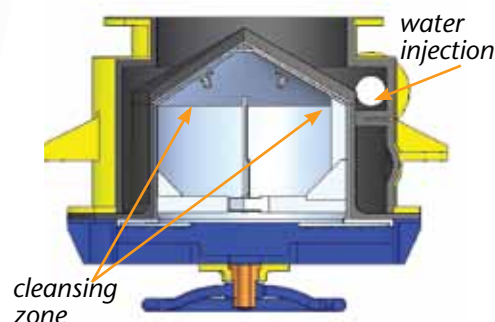
The Cavex® DE hydrocyclone has proven to be extremely efficient and the classification efficiency is reflected in the capability for generating very low by-pass of fines in the underflow while reducing the misplacement of coarse particles to the overflow.

The key to success of the double efficiency hydrocyclone is the internal control strategy implemented to impact the cleansing of the viscous layer and the mass partition between the first and second stages. This area of wash water injection is called the wash water injection chamber.

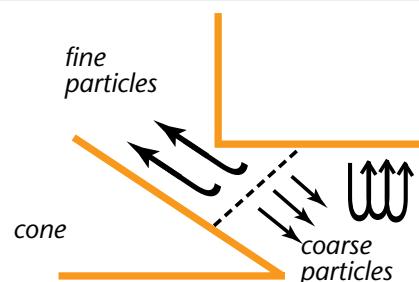
In the wash water injection chamber, crucial interactions take place among slurry, wash water and the expansion zone created by adjustment of the inverted cone body. The goal of this area is to produce a rupture of the viscous layer, in which the particles are trapped, to give them a new chance at proper classification.

The double efficiency hydrocyclone improves two aspects of classification: by-pass of fines to the underflow and the misplacement of coarse particles in the overflow.

### Cavex® DE hydrocyclone cleansing chamber



### Cavex® DE hydrocyclone reclassification



# Cavex® G4 hydrocyclone dewatering technology

## Features

- Delivers the same underflow density regardless of any uncontrolled variation in solids content in the feed
- Readily handles unexpected tramp oversize in the feed without plugging
- Produces a very high underflow density (essentially water and slime free) without risking 'roping' conditions that result in solids losses via the overflow
- Features simple variation of the underflow density, as required via the syphon control valve, without the need to resort to troublesome and expensive mechanical or hydraulic adjustable spigot arrangements
- Delivers lower spigot maintenance. The various features and benefits of the dewatering hydrocyclone means that the unit can be sized considerably smaller than other dewatering devices. This means it can easily be mounted on structures or over bins for use with screens

## Applications

- Coal fines dewatering
- Coal refuse dewatering
- Phosphate beneficiation
- Iron ore processing
- Dewatering mine tailings
- Sand washing and dewatering
- Dewatering crushed stone screenings
- Desliming processes
- Concentrate dewatering
- Classification in grinding operations
- Preparation of flotation conditioner feed
- Heavy metal (titanium sands) processing
- Degritting wastewater effluents
- Mill scale recovery and dewatering
- Dewatering granulated slag
- Pre-thickening of feed to vacuum filters
- Closed circuit milling

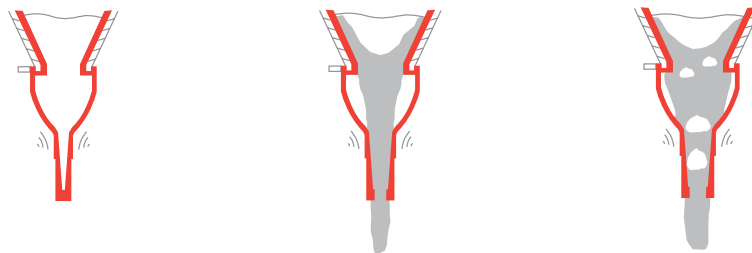
The key to the success of the dewatering hydrocyclone lies in the discharge regulator which is fitted below the spigot on the underflow.

When feed is introduced into the dewatering hydrocyclone, the coarser solids report to the spigot where the density and discharge rate of the solids are controlled by the underflow regulator.

An extended overflow pipe induces a syphon effect which in turn creates a vacuum on the discharge regulator, causing it to close and trap the majority of the water, silts and clays. When the weight of solids inside are sufficient to overcome the vacuum, the discharge regulator is forced open and allows discharge of the solids.

The control of the material reporting to the underflow results in a much higher underflow density than otherwise obtainable.

### Discharge regulator



*The Linatex® discharge regulator, utilizing premium wear resistant Linatex® rubber, is key to ensuring the proper function and long life of the dewatering hydrocyclone. When only water is fed to the dewatering hydrocyclone, the discharge regulator remains closed, so all the water goes to the overflow. As solids are introduced to the dewatering hydrocyclone, the discharge regulator opens up just enough to allow the dewatered solids to deposit from the hydrocyclone underflow.*



## Linings designed to support myriad applications and environments

### Different needs - different liners

Cavex® hydrocyclones are designed to be used successfully in myriad applications and environments, so depending on whether you are using them in grinding circuits, potash operations, mineral processing, or even heavy media; Weir Minerals has a wide range of sizes and linings to meet your needs.



**Cavex® hydrocyclones - sizes and linings**

	Solid Poly	Monolithic Ceramic	Urethane Liners	Rubber Lined	Reinforced Poly Housing	Metal Housing	Ceramic Tiled	Cavex® DE Hydrocyclone	ACB
40CVX	■	■							
100CVX	■	■		■	■				
150CVX	■	■	■	■	■				
250CVX			■	■	■	■	■	400/250	■
400CVX			■	■	■	■	■	500/400	■
500CVX			■	■		■	■	650/500	■
650CVX			■	■		■	■		■
800CVX				■		■	■		
1000CVX						■	■		
1200CVX				■		■			

**Cavex® hydrocyclones - applications and sizes**

	40CVX	100CVX	150CVX	250CVX	400CVX	500CVX	650CVX	800CVX	1000CVX	1200CVX
Grinding Circuit	■	■	■	■	■	■	■	■		■
Sand and Gravel	■	■	■	■	■	■	■	■		■
Tailings	■	■	■	■	■	■	■	■		■
Phosphate	■	■	■	■	■	■	■	■		■
Mineral Concentrate	■	■	■	■	■	■	■	■		■
Heavy Media				■	■	■	■	■	■	
Limestone	■	■	■	■	■	■	■	■		■
FGD	■	■	■	■	■	■	■	■		
Oil Sands	■	■	■	■	■	■	■	■		
Coal Classification			■	■	■	■				
Flotation	■	■	■	■	■	■	■	■		
Waste Water	■	■	■	■	■	■	■	■		■

# Cavex® hydrocyclones



## Models 100, 150, 250 and 400 Design Features

- Laminar spiral inlet geometry
- Fibre reinforced plastic casing (FRP)
- Snap fit, replaceable elastomer liners. Ceramic cone(s) available
- Stainless steel quick release clamp fasteners
- Polyurethane or hyperchrome vortex finders
- Rubber, urethane or ceramic spigots
- Moulded HDPE overflow pipe

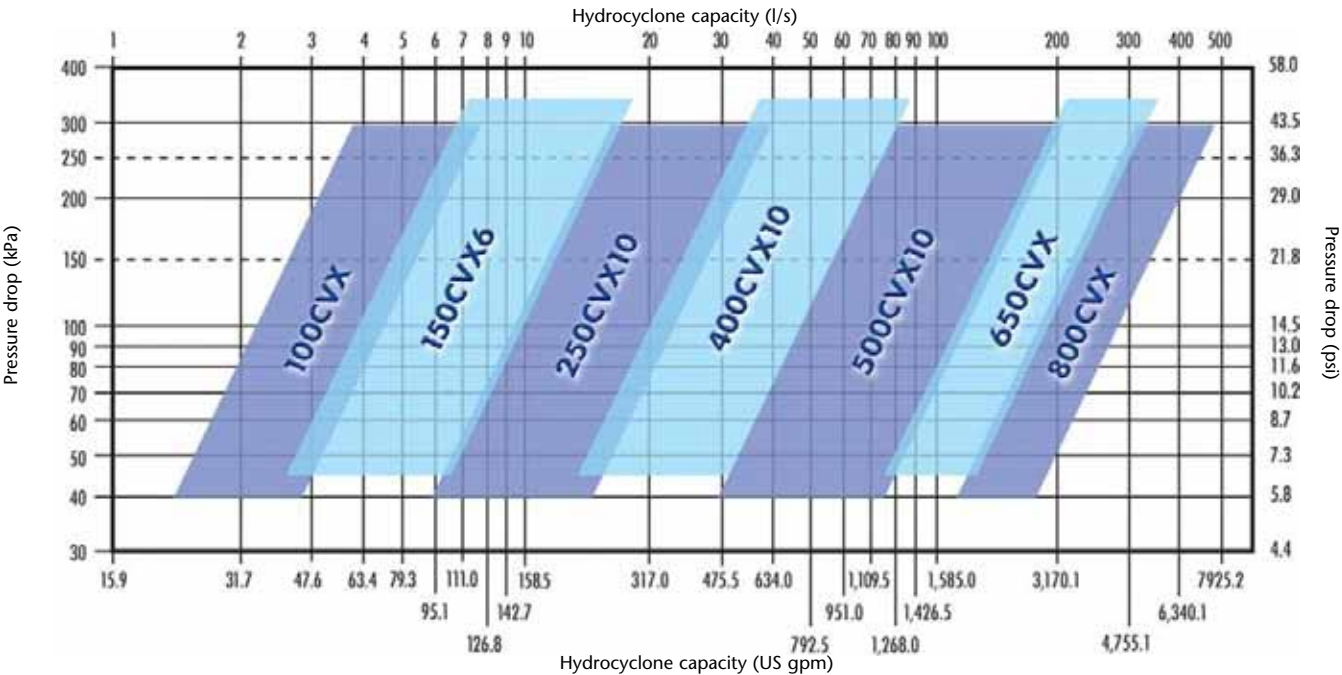


## Models 500, 650 and 800 Design Features

- Laminar spiral inlet geometry
- Fabricated steel or cast ductile iron casings\*
- Replaceable elastomer liners up to 45 mm thick. Ceramic lower cone available
- Rubber vortex finders
- Rubber or ceramic spigots
- Rubber lined steel overflow pipe or 'Air Core Booster' cap available

\* cone casings on Model 500 CVX10 are polyester fibreglass and fabricated steel

Cavex Hydrocyclone Capacities (approximate)



# From the world's largest mining and minerals multinationals to single site operators, customers around the world have benefited from the unique advantages of Cavex® hydrocyclones

## **Osborne Mine, Australia: the same grind at higher tonnage**

The efficient classification of Cavex® hydrocyclones at the Osborne Mine in Australia produced a lower P80 and a lower circulating load. This allowed Osborne to increase tonnage at the original P80.

## **Zinkgruven Mine, Sweden: increased metal recovery**

At the Zinkgruven Mine in Sweden, eight Cavex® cyclones replaced eight conventional style cyclones. Fewer coarse particles in the flotation feed gave an additional increase of 0.5% metal recovery. Payback of the Cavex® installation was calculated at just 28 days.

## **BHP Billiton Olympic Dam, Australia: significantly reduced total cost of ownership**

By the start of 2005, the push for ever higher production rates had drastically reduced hydrocyclone wear life. The BHP Billiton Mill Optimization Team invited three companies to improve the situation. Weir Minerals developed a new rubber grade for the upper liners of the existing Cavex® cyclones and fitted high specification silicon carbide lower liners. Another company supplied their own well known hydrocyclone brand and the third supplied composite ceramic liners for all parts of the Cavex® cyclones. An inspection at 3000 hrs. would reveal the winner.

The thin ceramic section of the composite liners did not last the distance and their fragile nature was problematic in handling and prone to tramp damage in operation. The well known hydrocyclone also did not make the 3000 hr. cut off. Cavex® hydrocyclones, with new rubber and high grade ceramics, passed the 3000 hrs. mark and the ceramics went on to 6000 hrs.

## **Worsley Alumina, Australia: reduced minus 44 microns in hydrocyclone underflow**

The metal liner Cavex® hydrocyclone was tested against other cyclones at one of the world's largest alumina refineries in the south west of Western Australia. The main trial objective was to reduce minus 44 microns particles in the hydrocyclone underflow (product). The Cavex® hydrocyclone outperformed the others and was the only one similar to the simulation prediction.

*Worsley Alumina purchased 56 Weir Minerals Cavex® hydrocyclones with fibre reinforced plastic (FRP) housing and synthetic rubber liners and 170 in solid high chrome alloy (A05) material as a result of competitive trials.*



## Geographical footprint

Weir Minerals has the geographical presence to service all the major minerals markets around the world. This global supply capability provides a competitive advantage in this relatively fragmented market.

Weir Minerals has operations across:

- North America
- Latin America
- Africa
- Russia
- Europe
- Australia
- Asia

## Customer profile

Our customers range from the world's largest minerals and mining multinationals to single pumpset operators.

We support customer operations worldwide with consistent products and local engineering expertise. As part of The Weir Group, we have the reach and resource to build close, long term relationships with all our customers, helping them to achieve ...

### The Lowest Cost of Ownership

## Service and support

This global capability with our own dedicated service teams combined with the service centres of our sister companies within The Weir Group and those of our strategic partners provide support in virtually every developed market.

**WARMAN®** Centrifugal Slurry Pumps  
**GEHO®** PD Slurry Pumps  
**LINATEX®** Rubber Products  
**VULCO®** Wear Resistant Linings  
**CAVEX®** Hydrocyclones  
**FLOWAY® PUMPS** Vertical Turbine Pumps  
**ISOGATE®** Slurry Valves  
**MULTIFLO®** Mine Dewatering Solutions  
**HAZLETON®** Specialty Slurry Pumps  
**LEWIS® PUMPS** Vertical Chemical Pumps  
**WEIR MINERALS SERVICES™**



For further information on any of these products, service or support services contact your nearest sales office or visit:

**[www.weirminerals.com](http://www.weirminerals.com)**

### Weir Minerals North America

2701 S Stoughton Road    Tel: +01 608 221 2261  
Madison, WI 53716    Fax: +01 608 221 5810  
USA    [www.weirminerals.com](http://www.weirminerals.com)

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