

**AGITATORS FOR**

# MINING & REFINING



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FOR MIXING TECHNOLOGY



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## THE AGITATOR SPECIALISTS

Mixtec agitators are employed throughout the world in mining and refining projects. Advances in impeller technology and design techniques have improved the performance and efficiency of our agitators and the leaching process overall while reducing the loading of the agitator drive assembly and associated structures. Attention to details such as particle size, density, flow rate and sparge requirements to ensure the process is met; finally, the mechanical integrity of the agitator components and drive system are designed and selected to ensure our agitators are both economical and robust. Retrofitting and Refurbishment of existing agitators produces not only power savings but also increases the operational life. Mixtec offers full technical and maintenance support to all sites with our efficient after-sales service. It is our priority to ensure we are available for site visits, installation inspections and hot/cold commissioning services.

As a global manufacturer of heavy-duty agitators and associated services in the mining and refining industry, we pride ourselves on high quality, reliable designs and manufacturing capabilities. Each agitator is custom designed for your specific requirements by highly trained design engineers.

### AGITATOR REQUIREMENTS

The mining industry has many varied process conditions and agitators seldom have to perform only one simple duty. Agitators for Mining applications are often combinations of:

- Solids Suspension
- Blending / High Tank Turnovers
- Conditioning
- Attritioning
- Heat Transfer
- Mass Transfer
- Adsorption
- Leaching
- Repulping
- Head Generation

We make it easy for our clients to understand the advantages and limitations of each design to ensure every agitator supplied has the capability to carry out the process and meet or exceed expectations.

Our understanding of the science of mixing and agitation is continually improving, and we make it our duty to ensure we understand the requirements completely in order to offer an optimised solution.



## THE MIXTEC RANGE: MINING



## MODERN DAY MINING



Mixtec has successfully designed and commissioned mechanical agitators to operate in tanks larger than 6000 cubic meters, with agitator systems in excess of more than 38 tonnes, impellers manufactured over 7.6 meters in diameter and with shaft lengths of over 21 meters. For such applications, Mixtec's Series 4000 heavy-duty agitator drives are available in standard models up to 450 kW but can easily be upgraded to suit the application.

These rugged tried and tested agitator, coupled with features such as down the shaft air sparging and the high efficiency "EDICT" system ensure the best possible combination of agitator technology and proven equipment.

## SOLIDS SUSPENSION

One of the most common applications in the mineral processing industry is the suspension of solids. Grind size, material density, product viscosity and throughput; all play their part in agitator designs.

The efficiency of the agitators are also greatly influenced by the type of impeller selected. These factors combined with the operating condition, such as start-up in settled solids and varying liquid levels are examined by experienced Mixtec Applications Engineers to ensure the customer receives the best possible agitator for the duty specified. We back our designs with product know-how, computational fluid dynamics (CFD) work and a large track record of successful designs.

The EDICT system is the preferred configuration for modern day solids suspension applications, vastly improving on older impeller configurations which are less efficient and can result in higher impeller wear rates for no added benefit. This configuration has been used successfully in the suspension of solids in thousands of applications including retrofitting of existing agitators based on older technology.



## MIXTEC'S EDICT SYSTEM

The original Mixtec EDICT (**E**nergy **D**istribution **I**n **C**ylindrical **T**anks) system, developed in 2005 in our extensive Research and Development facility in South Africa has been trialled and successfully installed in literally hundreds of mining applications worldwide.

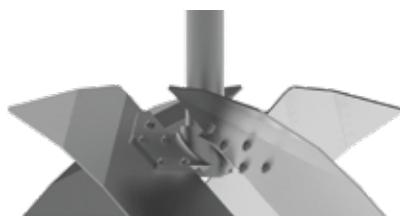
The system consists of our latest high efficiency, down pumping impeller together with the up-pumping impeller. This adds velocity to solids initially suspended by the lower impeller, by drawing them into the low-pressure area created and 'boosting' the upward motion to the upper portion of the tank. The solids then travel across the slurry surface to overflow or back down toward the flow generated by the lower impeller to repeat the cycle.

The system correctly utilises a combination of specially designed up and down pumping impellers to result in extremely effective and efficient suspension of solids. As with all our designs, various factors (tank dimensions, particle sizes, process temperatures, liquid levels, agitator impeller designs, shaft and drive) are calculated and sized for each specific application.

Mixtec is considered by many as, 'setting the benchmark' in power consumption and effective agitator equipment technology in the mining and refining industry, therefore it remains the superior choice for agitation.

### Advantages:

- Lower Power Requirements;
- Reduced loads on Gearbox, Shaft and Impellers;
- Greater interaction of Solids and Reagents/Gas due to opposing flows



## APPLICATIONS

**Homogeneous Solids Suspension:** Requiring only 75-80% of the power of a traditional Dual Down-Pumping impeller configuration.

**Solids Suspension with Low Volume of Gas:** Opposing flows further hinders gas from raising around the annulus of the tank resulting in greater gas hold up.

**Solids Suspension with High Volume of Gas:** Using our HA736, wide blade impeller, designed for high gas volume in addition to our EDICT System allows for greater gas hold up and improved kinetics within the tank.

## CARBON IN LEACH / CARBON IN PULP



Mixtec has always been at the forefront of CIL and CIP agitator technology, with hundreds of such agitators in operation around the world, developing a track record few can match.

Continuous research and development around the improvement of new and existing impellers enables us to provide optimal designs using the latest technology such as CFD modelling to reduce power requirements while still providing or exceeding the desired results.

## GAS DISPERSION IN CIL/CIP

The HA724 has been specifically designed for low- medium flow rate, gas dispersion applications and is used for solids suspension applications such as CIL/CIP circuits. This unique design ensures proper gas dispersion and generates a very aggressive flow rate which is required in many mining and industrial agitator applications.

Gas dispersion impellers allow for gas bubble size reduction by fluid velocity and not impeller contact. Therefore, the flow of air into the tank will determine the type and size of impeller. The HA724, superseding the widely used and most popular hydrofoil (the HA720) hosts many advantages including greatly reducing gearbox shaft stresses, higher flow for lower wear rates and improves gas handling capabilities.



### Impeller Design

Mixtec's impellers for the mining and refining industry offer numerous benefits:

- Higher pumping capacity with lower power
- Uniform gas dispersion
- Improved suspension of solids
- Reduced loading on the agitator drive
- Reduced loading on the associated structure

## DETOX / CYANIDE DESTRUCTION



Most gold plants around the world are required by law to destroy cyanide and metal cyanide complexes in their tailings, prior to discharge from the metallurgical site into the tailings dam. Many plants destroy the cyanide in a contained area within the metallurgical site, to minimise the exposure of wildlife, particularly birds, to these toxic solutions. Experience and CFD backed design enable us to optimally size the agitator to best suit the chosen process specifically the applications with demandingly high gassing rates.

### GAS DISPERSION IN DETOX

#### PROCESS EXAMPLE USING SO<sub>2</sub> AND O<sub>2</sub>

Process slurry from adsorption tanks discharges by gravity into the Cyanide Detox Feed Box and is distributed to the Cyanide Detox Tanks prior to it being sent to a tailings pond. The tanks are mechanically agitated with the use of Mixtec's custom impellers specifically designed for gas dispersion applications.

Typically, compressed oxygen gas (O<sub>2</sub>) and sulphur dioxide gas (SO<sub>2</sub>) can be injected into the detoxification tanks. The agitator will disperse the bubbles evenly throughout the tank contents to promote efficient transfer of O<sub>2</sub> and SO<sub>2</sub> and into the slurry. During this process, agitators will also provide uniform suspension of slurry solids.

Cyanide Destruction can be achieved in many ways. In order to achieve our client's process results, we disperse the gas being introduced into the process. The volume of gas can be substantial, requiring the use of Mixtec's HA736 and HA724 impellers. The standardised, HA736 has been specifically designed for high pumping rates required for cyanide destruction. Although there are many ways cyanide destruction can be achieved, the use of agitators is a preferred standard amongst many plant designers. This is an area where Mixtec specialises in and adds significant value through tried and true design procedures accompanied with an impressive installation list of some of the largest cyanide detox agitators in the world today.



Cyanide destruction  
agitators installed  
internationally:

- Indonesia
- Burkina Faso
- Mexico
- Australia
- Kyrgyzstan
- Columbia
- Cote d'Ivoire
- Mali
- Ghana
- Zimbabwe
- Senegal
- Argentina

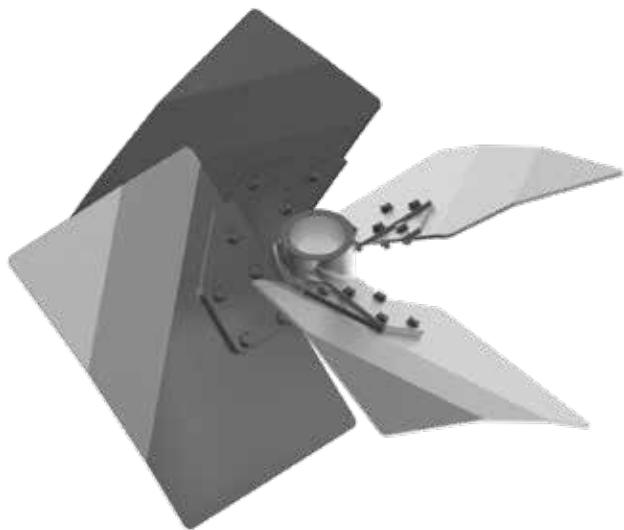
## BIOLOGICAL LEACHING

The Biological Leaching process, which pre-treats refractory sulphide gold ores such as pyrite, arsenopyrite and pyrrhotite, was developed to increase gold recovery rates during the metallurgical extraction process. The gold in these sulphide ores is encapsulated in sulphide minerals which prevent the gold from being leached. The Biological Leaching process destroys the sulphide minerals and exposes the gold for subsequent cyanidation, increasing recovery rates.

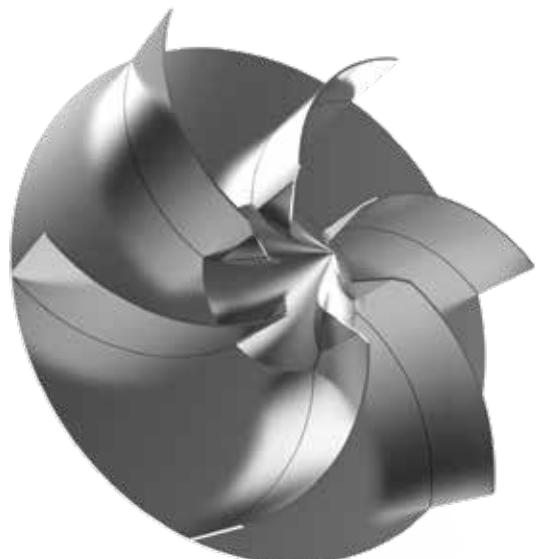
Mixtec's Biological Leaching certified HA736 is the ideal choice for this application. Mixtec has produced various agitators for the largest biological leach plants. The design functions of our efficient impeller system for biological leach application include:

- Providing a high primary flow volume
- Producing good in-tank flow patterns
- Ensuring high fluid velocities over the heat transfer and gas inlet surfaces

All these features were incorporated into the effective development of the HA736 to ensure excellent solids suspension, heat transfer and gas dispersion are achieved, whilst shear is minimised to prevent biological damage.



## SOLVENT EXTRACTION



At the heart of the solvent extraction plant are the primary pump mixers and secondary mixers.

Solvent Extraction is a mass transfer reaction where the metallic ion on the solution (Cu or Mo for example) is transferred from the aqueous phase to the organic phase due to chemical affinity with the extractants reagent.

It is clear that in order to improve the reaction kinetics, reaction surfaces play an important role, therefore droplet size is a key factor on the overall efficiency and valuable metal recovery.

Extensive mixing and pumping test work both in the laboratory and field has been essential to fully develop superior solvent extraction technology.

## BACKFILL & TAILINGS



Mine backfill is the material used to fill the cavities such as stopes created during underground mining. Backfilling can also be an environmentally friendly means to dispose of tailings.

Agitators are utilised in many areas of the backfill process. Preventing the solids from settling is of utmost importance to ensure that the material remains pumpable and easy to transport. Tailings are often required to go through surge tanks to maintain a constant feed to filter presses. Tailings can be thickened through various processes including the additions of binders and cement.

Thickened tailings/paste can be used to strengthen underground supports or minimise the risks associated with storage of more fluid tailings slurry while allowing for the reclamation of the process water. Our extensive knowledge in both areas allows us to best design a mixer to suit client specific needs.

Mixtec has custom engineered numerous mixers for all tailing's applications, including horizontal mixers which have been requested to ensure a high-quality mixture in either batch or continuous operations. Mixtec's R&D team has developed prototype mixers as well as full scale production units for a number of these paste applications with solids concentrations in excess of 80%, proving our dedication to innovation within the industry and commitment to solving our customers problems, even where it might involve non-standard equipment.

### Backfill material can be split into the following groups

1. Coarse crushed waste rock fill
2. De-slimed gold plant tailings
3. Reduction plant tailings
4. Reduction plant tailings with binders
5. Reduction plant tailings with waste rock



Mixing duties employed on backfill operations include:

- Uniform suspension of coarse solids
- High density repulping
- High-density storage
- Dry Binder addition
- Wet Binder addition
- Binder mixing and storage
- Flocculant make up

## AUTOCLAVES & PRESSURE REACTORS

An autoclave agitator duty includes gas dispersion, solid suspension, mass transfer and heat transfer. To satisfy these duties it requires experience and an intimate understanding of the desired process results and autoclave setup. With the aid of our extensive use of scaled up test work and CFD modelling, we understand the kinetics inside the autoclaves under operating pressures of 6000 kPa and temperatures over 200 degrees centigrade.

Sophisticated materials of construction are often required, which require special skills to ensure fitness for purpose, this includes titanium. Rugged cartridge seal housings ensure that minimum deflection and extended seal life are selected to ensure reliability, and ease maintenance. Autoclave seals are available in two variants. One with a bearing to steady the shaft and impart the upward axial force into the mounting plate and the other without a bearing that allows the axial force up into the gearbox.

Replacement or retrofitting of existing autoclave agitators with improved impeller design and/or configurations can enhance the reactivity in the vessel and overall process results.

## HIGH PRESSURE REACTORS

### MECHANICAL DESIGN

Sound process technology must be backed by conservative mechanical design that is both simple to install and easy to maintain. The standard drive configuration is possible up to 2000kPa and with the aid of an auxiliary seal bearing pedestal up to 6000kPa working pressure.

The standard Mixtec drive configuration includes oversized bearings and output shaft to accommodate the thrust loads from high tank pressures and to limit shaft run-out, thereby ensuring maximum seal life.

### MECHANICAL SEALS

Single dry running mechanical seals are now available as well as double sleeve cartridge seals. The flanged double balanced cartridge seals allows bench pressure testing while the rugged housing has been designed to take the high thrust pressures some seals can generate. Mixtec's seal housing designs are versatile and strong, therefore ensuring minimum deflection and long seal life.



## ENGINEERING

Agitator drives are selected to withstand the static and dynamic loads generated during the operation of the agitator. Additional bearing life calculations are conducted on all 4000 series agitators to ensure longer life and greater peace of mind.

Mixtec's conservative design along with the use of FEA provides the highest level of assurance that our equipment is robust and optimised for the greatest operational life possible. Mixtec is frequently called on to replace existing equipment due to failures surrounding key areas such as the shaft coupling.



## QUALITY ASSURANCE

Mixtec aims to conduct all our business activities in a sensible and professional manner, whilst seeking continuous improvement and ensuring compliance to all legal and other requirements.

Mixtec's units are manufactured under the strictest conditions and to the highest standards to suit their intended operating environments, from hot, dusty, arid deserts to backfill units operating in humid conditions thousands of meters underground.

Mixtec's components undergo various testing such as non-destructive testing, magnetic particle, ultrasonic and x-rays, according to client requirements. Mixtec has commissioning engineers that are permanently available to oversee all installations of new equipment on site to ensure correct procedure is followed.





“The Perfect  
Blend of Experience  
and Drive.”

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