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# The AGITEC AGM-FC® Range Magnetic Stirring



Magnetic Mixer is and equipment recognised by the major industrial Pharmaceutical companies, FDA-approved materials of construction and it can be cleaned and sterilised in place





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# Introduction

Magnetic stirring is now an essential technology in manufacturing environments where the risk level is high and/or sterile conditions are required. This is why we worked continuously over the past ten years to developing and modifying this highend equipment which will satisfy all user requirements. The AGM-FC® range now includes other types of magnetic stirrers which comply with the stringent sterile standards.

#### AGM-TC LAB

Vessel-roof magnetic stirrers for small volumes (1 to 15 liters). These stirrers are the latest addition to the AGM-FC range for small volumes used by pharmaceutical laboratories (FDA approved). These stirrers, which work on the same magnetic coupling principle, can be used up to volumes of 4000/5000 liters (please consult us)



#### AGM-TC

Vessel-roof magnetic stirrers for large volumes from 100 liters to more than 5 m3 (FDA approval on request). These stirrers have been developed to allow existing conventional pharmaceutical stirrers to be replaced with magnetic stirrers.



#### AGM-FC Fermenters

Vessel-bottom magnetic stirrers specially designed to operate at high speeds with several blade stages (e.g.: 3 Rushton turbines or 2 pump propellers and one Rushton turbine, etc). This equipment is fully Sterilizable in place (FDA-approved).

#### AGM-FCR

These vessel-bottom magnetic stirrers run at fast speeds (up to 2000 rpm depending on the range selected). They have the advantage of being multi-blade, meaning that they can be fitted with a propeller for homogenization, with a deflocculating turbine for dispersion, or a Rushton turbine for mixing liquid or gas or creating a vortex, etc (FDA-approved).

#### AGM-T'CHIM

This type of device is an alternative to conventional large mechanical stirrers.

They have a role to play in sectors such as the chemical or even pharmaceutical industries. They have the advantage of operating at very high pressures and temperatures as well as with large volumes: 100 liters at more than 50 m3. They are built with standard components but are still custom-made stirrers (shaft length, number and type of blade(s), speed, operation, etc).

In the following you will find all general information you need in order to understand and use the range of vessel-bottom magnetic stirrers.



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# The AGM-FC range consists of 8 stirrers for volumes from 5 liters up to more than 15 m3.

- AGM-FC 100 Stirring capacity from 10 to 60 liters
- AGM-FC 130 Stirring capacity from 60 to 200 liters
- AGM-FC 160 Stirring capacity from 120 to 600 liters
- AGM-FC 200 Stirring capacity from 500 to 1000 liters
- AGM-FC 240 Stirring capacity from 900 to 2200 liters
- AGM-FC 290 Stirring capacity from 2000 to 6500 liters
- AGM-FC 400 Stirring capacity from 6000 to 15000 liters







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# Agitation blade

The blades fitted as standard on AGM-FC stirrers are **AX-AGM** type turbines: Turbines with 4 profiled blades to optimise the ratio between hydraulic effectiveness/power consumption. The **AX-AGM** hydraulic flows are slow-speed axial flows. This turbine blows at slow speed, which restricts the introduction of gas into the blended liquid. At fast speed the flow is reversed. It then becomes radial and generates a more or less significant vortex according to where the stirrer is mounted on the bottom of the vessel. This characteristic is ideal for dissolving powder.



4-blade turbine type  $\textbf{AX-AGM}_{\circledast}$ 



# Guidance system

The agitation blade is guided by a pair of **FDA-approved** silicon carbide rings. The revolving ring is grooved (number of grooves adapted to the size of the stirrer) which creates a continuous passage of fluid in the guide bearing when the turbine is rotated. There are two advantages to this process:

- Optimized ring lubrication. The passage of fluid creates a film between the friction surfaces, which considerably reduces the wear on both rings. This therefore reduces the amount of maintenance and there is hardly any graining out of particles.
- The **self-cleaning** capacity during rotation of these rings while the agitation reactors are undergoing CIP (a low rotation speed is enough to generate circulation of cleaning liquid in the rings).





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The guide rings used on our new **AGM-FC** stirrers are SSic type silicon carbide. This material is unusual in having a very high degree of resistance to chemical attack (its Ph limits are 1 to 14).

The new **AGI-Zir**® reinforced fixed bearing option allows operation until complete draining without having to stop the stirrer at a minimum operating level.

These rings are slipped on with flush-fitting seals (held in place by a *"non-retaining"* process developed by **AGITEC**<sup>®</sup>) which eliminates the problems encountered in ring shrink-fitting techniques:

- Maintenance is performed on site, by an inhouse person, using the maintenance manual supplied with the replacement ring kits. No more returning the stirrer to the factory each time the rings need changing. Production downtime is reduced from a minimum of 15 days to around 2 or 3 hours per stirrer.
- From a mechanical point of view, fitting the rings with seals alleviates all the problems encountered with differential expansions during a manufacturing process. In fact, silicon carbide has a very different thermal expansion coefficient from stainless steel.



area deliberately enlarged





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### Magnetic coupler

The **AGM-FC**<sup>®</sup> stirrer is unusual in that it transmits torque through a wall (Or chamber) of stainless steel (or other material on request).

This chamber can be removable (sealed with an O-ring seal in a flush-fitting pharmaceutical type assembly), or directly welded to the bottom of the vessel. Magnetic stirring can therefore **guarantee** the process is **100% sealed**. The removable guide pin including the fixed carbide ring is fixed on the top of this chamber.

The drive is a synchronous magnetic coupler: no slip irrespective of the load the torque to be transmitted must not exceed the maximum torque that can be transmitted by the magnetic components.

It consists of several magnets: the number of components differs according to the size of the **AGM-FC**<sup>®</sup>. They are made of an unusual material:

strong magnetization, resistance to high temperatures (250°C max) Only a temperature exceeding this threshold causes them to gradually lose their magnetic memory.

The magnets on the process side are encapsulated in a seal-tight stainless steel body. Those on the atmosphere side are coated with a fine layer of hard plastic material to avoid damage during assembly or disassembly (the magnets are made of very brittle material).





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## **Motorization**

**AGM-FC**<sup>®</sup> stirrers are fitted as standard with worm gearboxes of generous dimensions. The motors have IP55 protection as standard.

They are also available in the following versions:

ATEX flameproof version: EEx dII BT4, EEx dII CT4, etc, with their own heat sensors.

- Air motor
- With **UL standard** motorisation (American manufacturing standard)
- DC or even Brushless motor

# **Cleaning in place of AGM-FC stirrers**

Vessel-bottom magnetic stirrers have been designed to be cleaned in place. These stirrers can therefore remain connected to the electrical network; both the geared motors and the tachometers remain in place under their vessels.

Silicon carbide rings are designed to cause the liquid to circulate at the heart of the guide bearing during rotation (see paragraph on carbide rings).

To clean the stirrer in place, simply immerse the stirrer blade (minimum level of 200 mm below the agitation blade) and turn it at a high enough speed but taking care not to create a vortex.

Correct cleaning depends on a number of criteria:

- The temperature (sterilisation occurs at temperatures of around 130°C)
- The type of detergent used
- The general conditions around the reactor (compatibility of the detergent with the construction materials)
- The product to be cleaned





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# Cleaning in place (CIP) of an AGM-FC stirrer can be performed as follows:

- First bathe with de-mineralized water to remove the worst of any residual products (rinsing after manufacture or after equipment installation).
- Wash with detergent (product can be alkaline or acid: please consult us). The stirrer can then be started to circulate the cleaning liquid around the guide bearing.
- Drain the detergent.
- Finally rinse with sterile de-mineralized water to remove any trace of detergent (stirrer rotating).

For sterilization in place (SIP steam at approximately 140°C), it is possible to start the stirrer running. You then need to check that the concentration of steam in the reactor is sufficient to create dripping water on the vessel walls. This presence of liquid then provides lubrication for the stirrer bearing during slow rotation (frequency between 5 and 10 Hertz for 2 to 5 minutes).

Caution: This procedure can only be used for a stirrer equipped with a gearbox or fitted with the AGI-Zir® reinforced fixed bearing option. Stirrers with direct drive motors have a low frequency speed which is too fast to run without a minimum amount of liquid (risk of damaging the bearings).

For other cleaning and sterilization procedures, please consult us.





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## **Available Options**

#### TA = Speed sensor

Detects the actual speed of the agitation blade.

This magnetic tachometer does not alter the stirrer's appearance when installed, because it is set inside the body of the AGM-FC $\otimes$ . The sensor slots are provided as standard. This system can therefore be inserted on the stirrer at any time. The length of the sensor cable is 2 m (for any other type please consult us). The option consists of a magnetic sensing pin + 2 meters of mounded cable

#### **CFC = Frequency/current converter**

The frequency/current converter is used to retrieve and convert data from the speed sensor. It should be placed in the control unit. Recommended model: P&F KFU8-FSSP-1.D

#### **DE** = Height spacer for double jacket

The AGM-FC® is supplied as standard with height spacer for a single jacket. However, it can be fitted with a height spacer for a double jacket so that it does not interfere with the heat insulation.

#### **PEL** = electro polishing

The standard finish is PME mechanical mirror polishing ( $Ra < 0.3\mu m$ ). In addition, the PEL electro polishing option is available.

#### CN.../... = Demounting rod

This rod is used to fit the guide pin in the bottom of the vessel from the outside by passing through the manhole, in a similar operation, with the rod, and a different end piece for mounting and demounting the turbine. It is telescopic, allowing it to be used in vessels with different profiles.

This system exists in 2 versions: For AGM-FC 100 & 130 stirrers- For AGM-FC 160 & 200 stirrers.

#### LEM... = Blade guard

This is installed instead of the motorization to allow the vessel and its blade to be placed inside the sterilization machines. The vessel can be turned upside down without the blade falling out. It simulates the magnetic effects of the coupler's internal rotor.

Two sorts of guard are available: one which is a simple axial retainer and the other which is an axial retainer + anti-torque (blade rotation impossible: please consult us). They are easy to fit: they use the stirrer motorization clamp system.





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#### **CD** = **Disconnect jack**

It consists of a column placed under the geared motor and a handle which remains under the stirrer at all times: even during operation. This option is recommended for medium and large AGM-FC® stirrers. It can be used to uncouple the two rotors to avoid having any magnetic resistance when mounting and demounting the blade. If this system is not in place the magnetic attraction power attracts the blade. This jolts the silicon carbide slip-rings, which may damage them.

#### HAL = Edible oil

The standard geared motor oil is replaced by edible oil.

#### **M** = Construction materials

Our stirrers are made as standard of 316L (1.4404) and 316TI (1.4571) stainless steel. However, there are options for atypical materials such as Alloy (HC22, HC276, HC2000...), URANUS (UB6, U45N), 316 Mo+ or completely 316TI. For these versions: please consult us.

#### ZIR = AGI-Zir® FDA reinforced bearing

The AGI-Zir® reinforced fixed bearing is a new material developed to improve the silicon carbide (AGI-Carb®). It means that our stirrers can operate without any liquid (after draining or during SIP) for long periods and also better withstand knocks from transporting and handling.

#### MTI = Stainless steel motor

This motor has a smooth outer casing of polished stainless steel (without cooling fin), without ventilation (for sizes 80, 100, 130, 160) and IP66.

#### CLD = Removable chamber

This option incorporates a removable chamber as well as a welding neck flange and bronze centering bridges to limit any deformations that might be caused by the welds and allow boilermakers to run hydraulic tests on their vessels without causing stirring to increase. The standard version is a welded chamber: CLS

#### VF = Forced ventilation

For some applications, a wide frequency variation range is needed. This is often low (close to a few hertz). The forced ventilation allows operation at frequencies close to 3 Hz while still cooling the motor correctly.

#### **CEL = Switch box**

This box is used to control the stirrer from the enclosure front panel. It is available in two variants: with or without recorder. The speed display takes account of either the actual speed (read by the tachometer as an option), or a speed calculated by the frequency inverter.