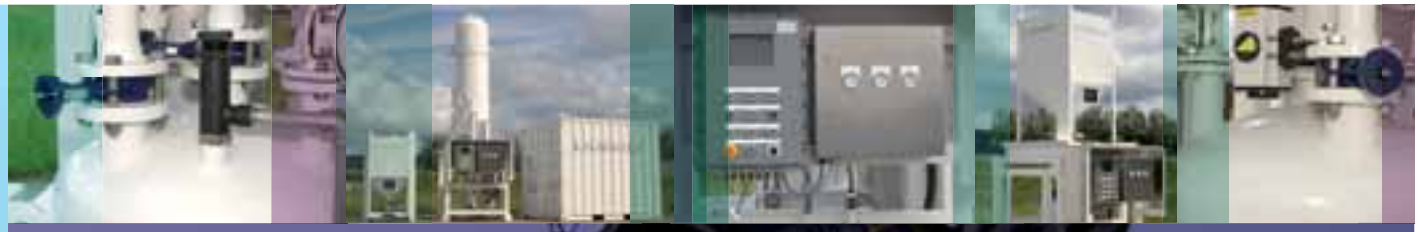
Additive Addition Unit

Easy and effective handling of FCC additives

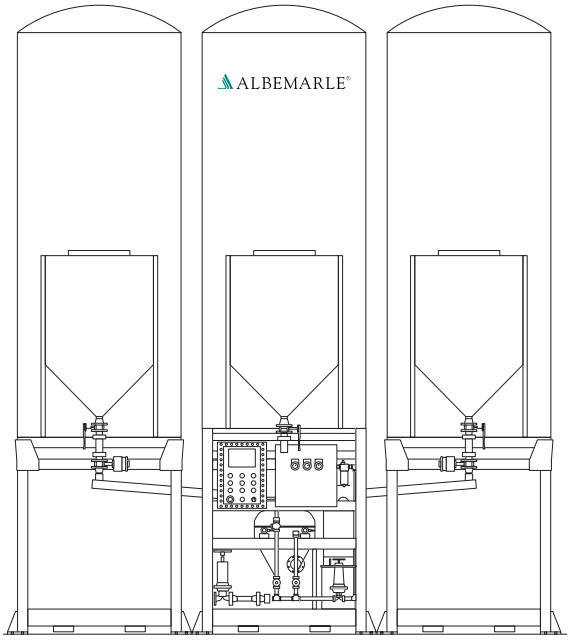


Flexible solutions for maximum advantage from FCC additives

Flexible response

To compete successfully, refiners must have the flexibility to respond quickly to market opportunities and environmental legislation. The performance of FCCUs has been continuously increased through improvements to unit design and catalyst systems and the introduction of performance-enhancing additives. Nowadays, FCC yields and product properties can be markedly influenced by the application of such additives, and their rapid, smooth introduction is a key economic advantage.

The additive addition unit (AAU) is the centerpiece of Albemarle's solutions for management of additive injection. It is supplied as a convenient and flexible package in combination with Albemarle's FCC additives.



Modular configuration showing three vacuum hoppers and three flow bins.

A concept built on experience

The AAU has been jointly developed through a combination of Albemarle's additives know-how with the engineering experience of Gambo B.V., a company with a long track record in designing FCC catalyst loading equipment. The concept has been commercially proven through extensive refinery trials.

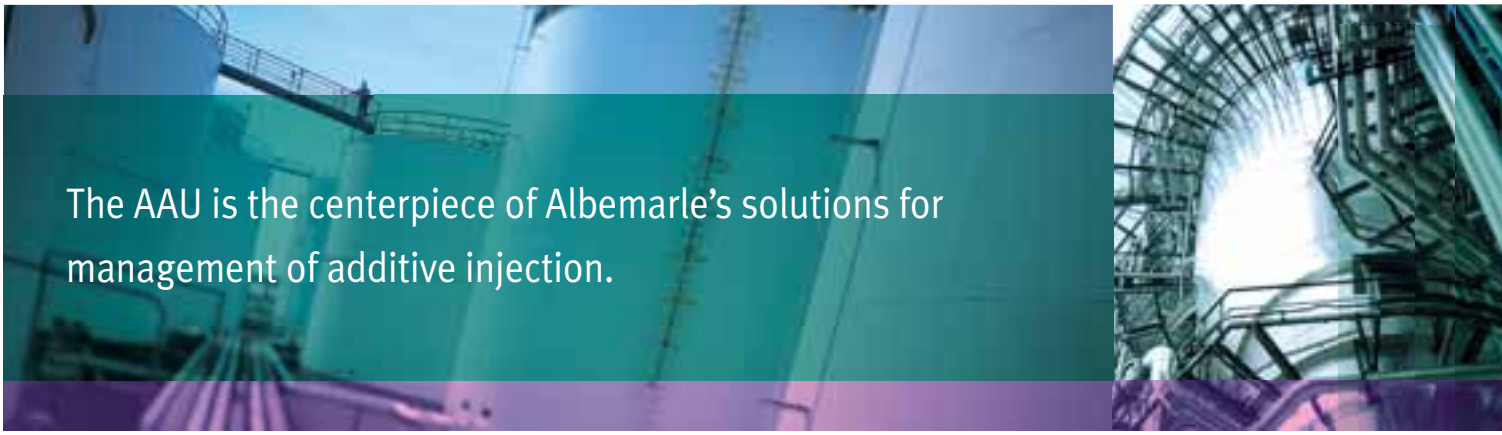
The heart of the AAU is a compact base loader that injects additives into the FCCU accurately and reliably. This base loader can be filled from 1-m^3 flow bins or from a 6-m^3 vacuum hopper. The flow bins are mounted on top of the base loader for filling and are removed when empty. With the 6-m^3 vacuum hopper, materials are vacuumed into it from big bags or flow bins. This arrangement makes additive handling convenient, minimizes space requirements and, if required, enables the refiner to optimize multiple additive programs.

The modular Albemarle AAU concept can be extended to enable simultaneous dosing of up to six different additives (or catalyst materials) from a single AAU.

Operational benefits

The modular concept and carefully controlled addition sequence confer operational advantages:

- efficient usage of additives gives maximum benefit to FCC performance
- safe, automated operation with minimal operator intervention
- multiple additives injection
- accurate dosing (>99%) and monitoring
- easy installation and maintenance
- trials for assessing new additives in small batches are easy to perform
- inventory management monitoring through Modbus or Data Link



Full service package

As with the supply of additives, the AAU also has a range of services to ensure smooth operation and to troubleshoot any problems:

- on-site commissioning by experienced specialists
- start-up assistance
- training
- spare parts supply
- 24-hour emergency call-out system.

Options include

- a maintenance and service program
- unit performance monitoring by Albemarle staff can be extended to analysis of the effect of the additives
- inventory management.

Whatever the specific requirements of your FCCU operation, Albemarle's comprehensive and integrated service package can help you create and implement the optimal additives solution for your situation.

An AAU with a flow bin and a vacuum hopper.

Packaging and shipping the AAU to you

Specially prepared metal containers for transportation ensure that the equipment can be transported and handled on-site with ease, thus minimizing the risk of damage and avoiding the need for wooden packaging.

The standard dimensions of the packaging are

- a 10-ft container for the AAU and two flow bins
- a 20-ft container for the 6-m^3 vacuum hopper or an AAU and four flow bins.

Into operation quickly and smoothly

Easy on-site handling

The arrangement with flow bins provides unique advantages in handling additives. The bins can be supplied pre-filled, and form convenient, dust-free packaging that is easy to connect to the base loader using the special valve arrangement. They are almost the same size as a pallet and take about the same load as a big bag. Their use offers environmental and safety advantages:

- UN-approved flow bin design
- convenient, rapid and dust-free handling on-site
- no spillages during handling
- waste, such as large bags and pallets, is reduced
- no additives remain in the packaging
- weather protection in the event of exposure (covered storage is preferred).

The empty flow bins are returned to Albemarle for refilling as part of a continuous supply-loop arrangement.

Alternatively, particularly when large quantities of additives must be injected, the arrangement with the 6-m^3 vacuum hopper can be used. By using vacuum, additive materials are transferred from the drums, big bags or flow bins in which they are supplied into the vacuum hopper permanently installed on top of the AAU.

To enable the refiner to take full advantage of its benefits, the AAU can be supplied under attractive conditions as part of an additives supply arrangement with Albemarle. The equipment incorporates features that help in getting it onstream quickly. In addition, Albemarle can provide the refiner with a full program of professional start-up, commissioning and maintenance services if needed.

Easy to install and commission

The AAU's design has been kept straightforward and practical so as to meet tough requirements:

- No special foundations are necessary.
- The space requirements are modest, and the apparatus can be located in the catalyst storage area.
- The only utilities required are electricity, plant air, instrument air and, optionally, vacuum.
- The additive can be unloaded by gravity in the standard arrangement with the flow bin mounted on top of the base loader. Vacuum is only essential for a bottom-loading arrangement.
- The AAU base loader is linked to the FCCU by a single connection to the discharge line of the regenerator.
- The AAU is equipped with microprocessor printed circuits that can be easily changed, rather than less user-friendly programmable logic controllers.
- The equipment has low operating costs and maintenance requirements.

The base loader can be engineered for connection to up to six flow bins or vacuum hoppers to enable multiple additive injection.

Automated sequence of operations

The AAU is equipped with microprocessor printed circuits and is programmed to perform – unattended – a continuous cycle of loading and discharge. Both the daily rate and the batch rate are pre-programmed and monitored.

- Filling – additive is loaded into the pressure vessel until the required batch weight is reached.
- Activation – pressure in the AAU is increased until the discharge pressure is reached.
- Discharge – catalyst is pushed out of the AAU into the transfer line to the regenerator.
- Standstill – air is purged continuously to prevent backflow.

The next cycle starts automatically when programmed to do so. The maximum programmable daily capacity for additive injection is 18 t/d.

Optionally, the AAU can be connected to the refinery's distributed control system to monitor addition rates over long periods and enable detailed correlation with FCCU performance

Meeting high safety and regulatory standards

The AAU meets high standards of safety and reliability, and regulatory requirements. Special features include

- a safeguarded preprogrammed sequence of valve operations for filling and injection
- a block valve that closes immediately flow is interrupted
- continuous air purging during and after addition to prevent backflow from the FCC regenerator
- compliance with
  - requirements for installation in hazardous area Class 1 Zone IIA T3
  - ATEX hazardous zone requirements
  - ASME design code VIII, div. 1 latest edition
  - CE regulations.

A purged electrical cabinet can be provided if required.

Configured to individual requirements, the AAU offers the optimal additives solution for your refinery.

We are confident that we can meet your requirements for high-quality products and services, now and in the future.
If you require more information, please contact one of our regional offices.

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