



Business Area  
Nitric Acid

# UAN Solution



**Chematur**  
Engineering Group

## The UAN Facility: A totally integrated design

Weatherly Inc. combines proven UAN plant experience with a commitment to continuously improve. Weatherly's integrated facility design is unique because it brings together four chemical processes; urea, ammonium nitrate, nitric acid and UAN. The result is an efficient and cost-effective way to produce UAN Solution.

During the last four decades, most of Weatherly's ammonium nitrate, urea and fertilizer solutions plants have been supplied on a turnkey basis. The remainder was provided on the basis of engineering, procurement and construction advisory services designed to match clients' needs.

Weatherly's facilities maintain low capital investment while yielding high conversion efficiency along with low production costs.



An integrated UAN facility.

## Weatherly's UAN Process

The diagram on the opposite page presents a simplified illustration of integrated UAN process. Production starts with the raw materials, liquid anhydrous ammonia and carbon dioxide (liquid or gaseous). These enter the battery limits and are fed to the urea plant.

Urea is produced utilizing Weatherly's proven Partial Recycle Urea Process. High- and low-pressure urea off gas (containing ammonia, carbon dioxide and water) move on to the nitric acid and ammonium nitrate plants respectively.

The nitric acid and ammonium nitrate plants also utilize proven Weatherly technologies. Nitric acid is fed to the ammonium nitrate plant where it is converted to ammonium nitrate solution.

In the UAN plant, ammonium nitrate and urea solutions are blended to produce UAN fertilizer solution. The plant has the flexibility to adjust the ratio of these two solutions to obtain the percentage of nitrogen desired (usually between 28 and 32 wt %). Process condensate from the ammonium nitrate plant is available to adjust UAN composition. This condensate is also used as absorber feed water in the nitric acid plant.

## Principle process features: An overview

### Urea

- $\text{NH}_3/\text{CO}_2$  feed mole ratio of 4:1 to achieve 72 to 75 %  $\text{CO}_2$  conversion to urea at 4,000 psig.
- Partial recycle of ammonia only, thereby avoiding high pressure pumping of carbamate recycle.
- More economical equipment design compared to carbamate recycle systems.

These facilities are extremely simple and cost-effective. Unreacted ammonia and carbon dioxide are separated and sufficient ammonia is recycled to achieve the correct  $\text{NH}_3/\text{CO}_2$  mole ratio in the high pressure reaction system for optimum conversion. Low pressure steam is generated in the reaction system by recovering heat of reaction.

The majority of the older Weatherly once-through urea plants have now been redesigned and retrofitted to the partial recycle process to increase urea production.

## Nitric Acid

- High ammonia conversion efficiency provided by: high quality filtration of both air and ammonia off gas feeds to the gauze; intimate mixing of feeds in a static mixer; Weatherly's proven converter design; and use of all stainless steel piping and equipment.
- Use of urea off-gas for ammonia feed.
- Control of  $\text{NO}_x$  emissions is obtained by utilizing Weatherly's proven absorption design coupled with selective catalytic  $\text{NO}_x$  reduction system.
- High efficiency heat recovery including: generation of high pressure superheated steam for feed to the steam turbine; tail gas reheating for enhanced power recovery in the expander; and exhaust stack heat recovery for boiler feed water preheating.
- Compact layout providing easy access for operation and maintenance.

Weatherly's technology operates at a single high pressure, allowing equipment to be smaller and economical. Clean raw materials, thorough mixing, even distribution and stable catalyst temperature result in high ammonia conversion. The vertical equipment arrangement minimizes piping runs and site area. Weatherly's plant design is extremely efficient, obtaining energy recoveries as high as 5.23 GJ per metric ton (4,500,000 BTU per short ton).

## Ammonium Nitrate & UAN Solution

Production of 75 to 83 wt. percent ammonium nitrate in a two stage neutralization/scrubbing system results in low nitrogen losses (therefore high efficiency) and low level effluent contamination.

Use of urea off-gas for ammonia feed.

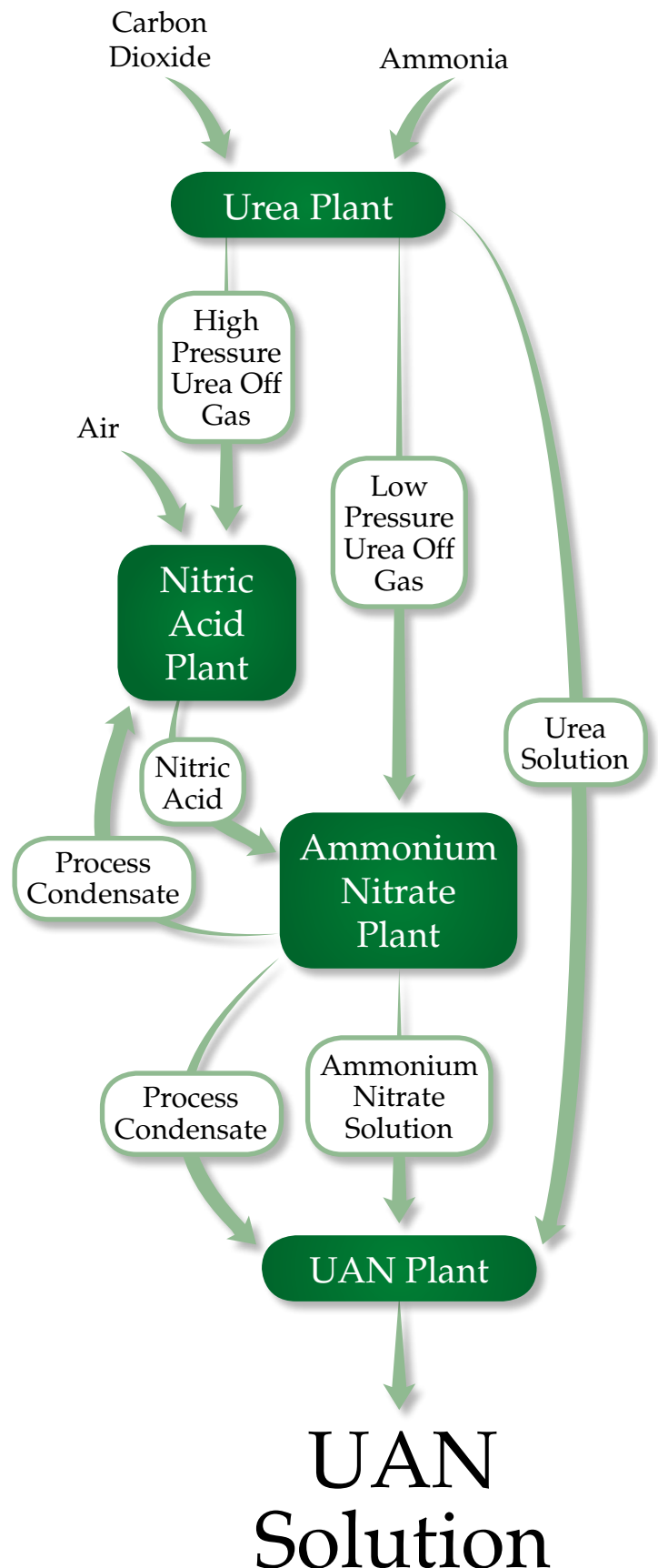
Clean up of neutralizer overheads containing  $\text{NH}_3$ ,  $\text{CO}_2$  and  $\text{H}_2\text{O}$  in a circulated packed scrubber.

Cooling of circulated condensate to packed scrubber produces feed water for absorber.

Unique in its simplicity, the ammonium nitrate process is designed for high energy recovery while maintaining low emission levels. Weatherly designed ammonium nitrate plants are also available to produce solutions, high density prills or granular product.

By integrating the urea, nitric acid and ammonium nitrate processes, Weatherly's facility provides a highly reliable source of UAN solutions. This plant can produce varying UAN solution strengths, and has flexibility to vary the ammonium nitrate/urea ratio, based on client requirements.

# Integrated UAN Process



## The bottom line

By yielding high conversion efficiency and low production costs, Weatherly's integrated UAN facility can lower your total operating costs. In addition to producing high quality chemicals, Weatherly facilities are extremely cost-effective to start up and maintain. If you're looking to bring UAN solution production in-house, research Weatherly.

## About Weatherly

Based in Atlanta, Weatherly Inc. is a member of the Chematur Engineering Group. The Chematur Engineering Group is active in many process areas utilizing its own technologies. In addition to the Integrated UAN process, we design a wide range of process for fertilizers, ethanol, nitration, peroxide and isocyanates. If you would like to know more about our other services, our contact information is listed below.

Since its inception in 1954, Weatherly has been actively engaged in developing and applying process technology for the chemical industry. In addition to process work, Weatherly offers full-service engineering services including basic and detail engineering, procurement, project management and construction services.

Weatherly has experience and knowledge in designing, engineering and constructing chemical plants on a world-wide bases. The company welcomes projects utilizing a variety of technologies. It makes no difference whether the process technology is owned by the customer, the Chematur Engineering Group, or is licensed from another supplier; Weatherly will be glad to devote its skills toward the successful completion of the project.



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