

Industrial Solutions
Electrolysis & Polymers Technologies

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Industrial Solutions

Solutions for LDPE plants

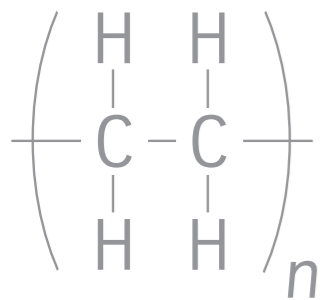
experience – know-how –
improvement



thyssenkrupp



Worldwide acknowledged specialist in HP technology



Modern life has become impossible without Low Density Polyethylene (LDPE) and Ethylene Vinyl Acetate (EVA). Photovoltaic cell encapsulation, cardboard packaging coatings, foils, pipes, shoe soles or cable jackets – thanks to its specific physical and chemical properties the thermoplastic material is the basis for products which we meet every day and which are present everywhere.

Experience, know-how, improvement

Uhde High Pressure Technology (HPT) considerably participates in the economic exploitation of LDPE: since the company's foundation in 1930 we have committed ourselves to the use of high pressure technologies and now we belong to the leading specialists in this area worldwide. As high pressure techniques form the basis

for the industrial manufacture of LDPE, we have been involved in this segment from the beginning. Already in the middle of the fifties in the last century we engaged ourselves in the development of equipment for the manufacture of LDPE and since then we have constantly accompanied and helped shaping technical innovations. Our experience and our know-how help us support our customers with respect to the improvement of LDPE production and the increased value of plants.

Quality prevails

In the most different applications of high pressure technology Uhde HPT is convincing thanks to its comprehensive performance spectrum. This includes the design and the manufacture of single components as well as highly engineered and instrumented systems, the construction of prefabricated piping systems and comprehensive service solutions.



We know that no failure is allowed. So, by means of competent teams, modern machinery and a comprehensive quality assurance management we offer economic and reliable solutions to our customers on all five continents; some of them have proved their unique performance capability for decades. And it is no accident either that we have been listed approved suppliers with all licensors worldwide as we have been deemed experts and reliable partners for high pressure technology since the beginnings of LDPE production.



Pioneer of high pressure technology

Everything from one source

Being a specialist in design, calculation and development for high pressure components in LDPE plants Uhde HPT is the market leader. Thanks to a worldwide unique spectrum of items on offer we manufacture and supply all components above 300 bars – except for compressors. By means of our comprehensive spectrum of items on offer we support our clients and licensors up to the assembly and commissioning of overall plants. Thus, our customers profit from reliable solutions from one source.

Knowledge with overview

Findings from various industries applying high pressure processes are a well-founded basis for a comprehensive know-how with respect to materials and all technologies for which pressures of up to 4,000 bars have to be mastered safely. Uhde HPT holds numerous patents and has extraordinary technical knowledge available which is integrated into the layout and design of all technological details.

Experience pays

Our long-term experience gained by the implementation of LDPE projects is consequently used in favour of our clients: on the one hand, plants being in operation for several decades give evidence of the reliability and durability of our work. On the other, we can especially exploit findings resulting from long times of operation. For example, the experience that markets, technologies and demands alter continuously, is directly integrated into developments: from the beginning, the planning of new plants considers the possibility of expansions or technical modifications.



LDPE Plant Improvement Conference

Our long-term experience gained by Since many years Uhde has annually invited interested parties for the “LDPE Plant Improvement Conference” taking place at different locations in the world. During such a conference plant operators, licensors and suppliers openly discuss challenges and technical progress in the LDPE market. This results in suggestions and ideas for the continuous optimization of the technology for LDPE and EVA plants. In the meantime, the conference has become an institution – and a highlight for the experts.





Comprehensive competence in LDPE equipment solutions

The production of LDPE imposes maximum requirements on plant construction, because during the production process materials and components must be laid out for pressure loads of up to 4,000 bars and temperatures of up to 320 °C. Uhde HPT is one of the forces driving technological development further and especially pooling a comprehensive competence for all high pressure-specific aspects of LDPE plant design. Therefore, all big engineering offices and licensors being active in that area successfully cooperate with Uhde HPT.

Working at the latest state of the art

Uhde HPT's performance spectrum comprises the concretization of the process engineering based design of the complete plant and extends to the design of all necessary components which are conceptualized up to the smallest design detail according to the latest state of the art. When autoclave reactors were increasingly used instead of tube reactors due to altered requirements at the beginning of the millennium, Uhde HPT could optimize that technology for many applications by current expert knowledge. Possibilities resulting from progress in material development are much more differentiated today than they were in the past: being a competent mediator between steel production and plant construction Uhde HPT can use materials which have been adapted to every application. Especially with respect to the modification of existing plants laser-based measurements capture the existing spatial situation precisely and thus create the basis for a laser-monitored 3D manufacture at maximum accuracy. Thus, it becomes possible to transfer the necessary geometries without deviations from



planning to reality. For our customers this means even more efficient production and unimpaired assembly without complications.

Safety from the beginning

The basis for safe and continuous operations of the future plant consists of precise calculations and the intense examination of the materials used. All components being of relevance for safety are tested according to the high safety requirements. The comprehensive documentations include – amongst others – operating instructions, receiving inspections of goods, suppliers as well as all manufacturing and test steps in compliance with strictest criteria, which allows the easy tracing of the entire development process of a plant and its analysis at any time till the status quo has been reached.

Not least this is also the perfect basis for later modernization or expansion of the plant.

Proven quality from the selection of material to delivery

The high quality of all core components is the prerequisite for failure safety and the problem-free operation of the plant. Our know-how concerning the selection of materials, development and manufacture of all products and comprehensive tests in in-house test labs are the elementary basis for the high quality standards of LDPE plants "Made by Uhde HPT".

Material – quality from the beginning

Already when purchasing raw steel we pay attention to optimum quality, because impurities may result in flaws. Therefore, we only use steel grades of maximum quality which we only procure from acknowledged steelworks. Quality tests are ensured by an executive department acting independent from the general management and the purchasing department.

Manufacture – drilling, bending, precision machining

Till today, Uhde HPT has manufactured many thousands of high pressure tubes in qualified processes on the basis of licenses granted by ExxonMobil, LyondellBasell and SABTEC. Smooth and clean inside surfaces are an essential guarantor for the quality and life of all high pressure components. Honing decreases the inside surface roughness of all high pressure components below Ra 0.1 µm. Thus, the development of the polymer film in the tube is reduced, whereas the heat transfer will not be impacted significantly. Depending on constructional requirements, Uhde HPT manufactures short or long bending radii according to the requirements of ovality and wall thickness. They are subjected to autofrettage to reduce operational stresses

and – most of all – clearly increase reduce service life. In addition to the precision machining of the inner surfaces the outside of high pressure tubes is also optimized: thus, if required, a copper cladding of one to two millimetres protects the outer surfaces of high pressure pipes against corrosion caused by cooling media.

Trust, but verify

From the material test till the final acceptance test we accompany all checks and acceptance tests and thus guarantee an uninterrupted quality control. All high pressure components, i.e. 100 % of them, are subjected to material testing and state-of-the-art non-destructive examination. The quality control includes advanced material testing for fracture mechanics properties as well as advanced NDE including angle beam ultrasonics and automated eddy current examinations. That process includes

material tests like tensile and notch-bar impact-bending tests, bending tests and corrosion tests in independent test labs. The approval of new materials requires the performance of bursting tests or impulse tests at pulsating pressures of up to 3,500 bars in order to confirm the fatigue strength and safe fracture mode of the components. Before approval final acceptance tests are performed, during which components and partial components are tested for their later functionality and life in different processes.

With a large underground test pit six metres deep Uhde HPT is the only manufacturer worldwide being able to test even largely dimensioned plant components like e.g. autoclave reactors after being assembled completely, but before delivery. We are the only manufacturer who can perform system integration tests as full function tests under full load to ensure functionality (agitator at maximum speed) for autoclave,

motors, auxiliary installations, bearings, thermocouple, hydraulic closures and panel heater. Hereby, components whose function is only relevant during later maintenance works can be tested beforehand as well. Due to the comprehensive testing before delivery our customers profit from two facts: on the one hand assembly on site can be performed without time delays and quality losses by re-working, on the other long-term problem-free operations are guaranteed.

The proper assembly at site is also monitored continuously through Uhde's experienced supervisors. Accompanying a final test of the overall plant guarantees maximum functional and operational safety.



High pressure equipment – everything but the compressor

Thanks to our comprehensive performance spectrum for the implementation of LDPE plants we can manufacture all components of more than 300 bars – except for compressors; so we can provide our clients and the technology licensors with complete solutions for the polymerization of ethylene.



Autoclave reactor systems

Uhde HPT manufactures full function tested autoclave reactor systems including steel construction design as ready-to-use plants including all accessories like e.g. motors, agitators, bearings, power electrodes, flushing pumps, rupture discs, hydraulic top and bottom cover and clamp handling devices, vibration measurement, various special maintenance tools for reactor volumes from 250 to more than 2,000 l.



Steel structure

Steel structures used for the carrying of reactor and intercooler are designed and supplied by Uhde with static and dynamic loads being taken into consideration. The modular design, e.g. for intercoolers, also saves assembly time on site.



Valve technology

For LDPE plants we insert shut-off, control or three-way control valves whose pressure stages comprise 300 to 4,000 bars. All port standards can be adapted according to customer wishes. As control valves substantially influence process control in case of big reactors, it is worthwhile to point out that they meet all requirements concerning speed, accuracy and long service life. The easy structure of the valves and the careful harmonization of the valve and control elements result in maximum functional safety.



Piping

Piping comprises the pressure stages PN 300 to PN 4,000. Bends can be manufactured for larger radii by cold forming and for very small bending radii by hot forging. As a matter of course we also supply all needed flanged connections, blocks, moulded pieces, sealings, thermocouple and fittings for high pressure applications. All elements are subjected to a continuously strict quality control. Maximum pressure components are additionally subjected to autofrettage.



Tubular reactors

All over the world Uhde high pressure reactors prove efficiency and reliability. Since 1955 we have been one of the major suppliers in the petrochemical industry, where we are appreciated especially for the continuous techno-logical further developments. Today, we build reactors with inside diameters of 70 to 90 mm for pressures of up to 3,600 bars. Accordingly, production capacities have been multiplied from 10,000 t/a in the past to more than 400,000 t/a.



Hydraulic units

Uhde HPT is one of the leading suppliers for high pressure pumps in LDPE plants. Since 1935 we have installed more than 1,000 high pressure pumps in the pressure range between 125 and 14,000 bars and with discharging capacities from 10 to 20,000 l/h worldwide. Double-acting oscillating piston pumps and motion controlled phased flow injectors were developed especially for the LDPE market. We manufacture high quality pumps for the catalyst injection and comonomer dosing in autoclaves and tube reactors for all well-known licensors. In the meantime permanent research and development as well as the exchange of experience with our customers have resulted in excellent service live of all main components.



Valve test station

The test equipment makes sure that valves "Made by Uhde" can also be tested in the plants. Test items are leak tightness and functionality of the valves as well as control, accuracy and speed.



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High pressure vessels

Important components of LDPE plants are high pressure vessels in all sizes; they are mostly used as separators at pressures of between 300 bars and 700 bars. Thanks to the use of selected steel grades and specific manufacturing know-how Uhde HPT high pressure vessels are among the top products.



Heat exchangers

Uhde HPT is specialized in development and manufacture as to the selection of materials and design according to the licensors' demands for high pressure applications. For double tube or tube bundle heat exchangers for operations in pressure ranges between 300 and 500 bars Uhde guarantees both, mechanical and thermal designs. Corrosion prevention is – if required – implemented by overlay-welding of stainless steel.

A reliable partner for your success

Highly complex plants require continuous services to operate reliably over a long period of time. Our customers profit from the installation up to long-term reliable operations – as a committed partner of our clients we offer service performances for all phases in the life cycle of an industrial plant.

To ascertain the problem-free start of every new plant, Uhde's service commences with assembly services or with the competent supervision of the client's or contractor's installation team.

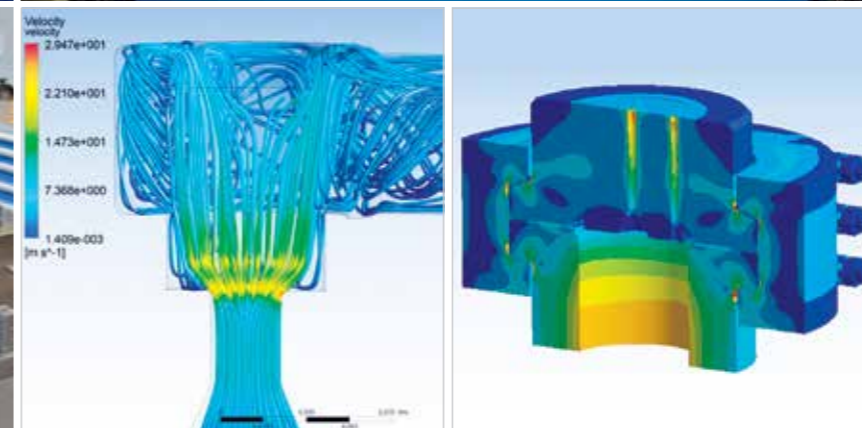
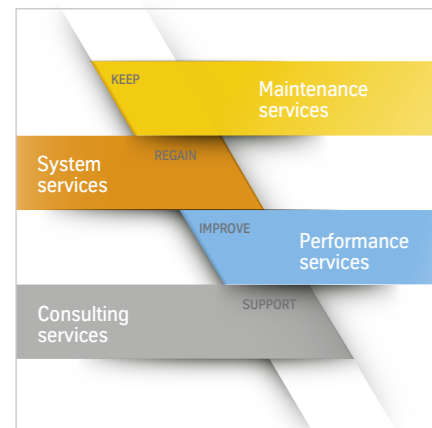
We verify the staff members' training and education and thus create the prerequisite for the safe and successful operation of the highly specialized process technology. We are also ready to instruct the staff, should everyday maintenance works be performed by themselves. We secure the continuous problem-free operation by regular inspections.

Repair works and spare parts

When repair works must be performed we – for example – offer immediate support in case of a repair of small cracks, the processing of sealing surfaces or the replacement of wearing parts. Our precise documentation of all construction and repair phases facilitates the order of proper spare parts considerably: therefore, operators have high-quality parts available years after the initial commissioning. On the one hand those parts fit, on the other they also meet requirements of the latest technical industrial standards.

Engineering in case of repairs, expansions and modernizations

Far above the product and process development for the initial installation we support our customer with all later modifications of the LDPE reactor system by offering engineering performances. They include everything from comprehensive failure analyses to the development of a customer-specific modernization and expansion concept.





Higher productivity – reduced operating cost

Being a specialized provider for plant construction and own chemistry-oriented technological processes we support the chemical industry especially with respect to rising plant productivity which increasingly becomes an essential factor of success in competition.

Therefore, it becomes more and more important to be able to flexibly react to altered market conditions and also technological progress. Already during the planning of new plants we consider all thinkable prerequisites for potential modernizations and/or expansions.

We simultaneously support the operators of existing plants in case of expansion or increase in productivity and efficiency by the replacement of individual components and plant elements.

Individual solutions for new challenges

Apart from market requirements and specific production costs it is mainly increased environmental and safety requirements which cause the need of revamping older plants.

In close cooperation with clients and licensors Uhde HPT and thyssenkrupp Industrial Solutions pool a number of competences for the modernization and expansion of existing plants. They are implemented on the basis of computer-based simulation models to optimize process-technical parameters and improve performance and efficiency on the one hand and reduce costs on the other. Together with our customers we develop individual solutions for the later integration of plant components in order to especially meet increased requirements concerning efficiency, the saving of resources and reduced operating costs.

As the market leader for high pressure technology Uhde HPT also convinces by its comprehensive consulting competence concerning all questions resulting from planning and the application of this technology: we offer comprehensive consulting services which pay from failure analyses via the development of solutions till the training of your personnel and persons of contact on site.