

Laboratory and Pilot Plants

Smart Solutions for Small Plants



Equipment, Measurements and Control Systems with

- Maximum Functional Performance
- Best Cost Efficiency
- Optimal Space Utilisation

Who we are

AP-Miniplant provides

- turn-key solutions for the chemical industry, research institutes and universities
- compact and customized design
- improved cost efficiency



Dr.-Ing. Paul Appelhaus

The founder and director of AP-Miniplant, Dr.-Ing. Paul Appelhaus, studied mechanical and chemical engineering at the RWTH Aachen and got his PhD in control engineering in Dortmund.

He started his career as a project engineer at Schering AG in Berlin 1988.

Being with enthusiasm for more than 20 years in the business of small scale chemical plants, he is always personally involved to achieve the best result for each new project.

AP-Miniplant stands for experience with more than 80 small scale plants, each of them a unique setup, supplied all over the world in the last 14 years.

A strong in-house knowledge of the most important branches such as chemical, mechanical, electrical and control engineering is considered to be essential for our field of business.

This knowledge, combined with a skilled workforce, is the background to approach even challenging tasks and to react with the maximum flexibility on our customers' demands.

With this experience, the committed workforce of AP-Miniplant would enjoy to take over the responsibility for the success of your project.

References

ABB, Germany
 BASF, Germany, Brasil
 Buss Chemtech, Swiss
 BTU Cottbus, Germany
 Petroleum Res. Inst., China
 Degussa, Germany
 DOW, Germany
 DSM-Research, Netherl.
 DuPont, Germany
 Evonic, Germany
 FH Anhalt, Germany
 FH-Merseburg, Germany
 FZ Juelich, Germany
 Fraunhofer Research, Germany

Fuchs-Petrolub, Germany
 GlaxoSmithKline, UK
 GlaxoSmithKline, Italy
 GlaxoSmithKline, USA
 Henkel, Germany
 Kratzer, Germany
 Norsk Hydro, Norway
 PC Barcelona, Spain
 Reliance, India
 SABIC, Saudi Arabia
 Sachtleben, Germany
 Schering, Germany
 Schill & Seillacher, Germany
 S. C. Univ. of Tech., China

Sun Chemical, Germany
 TFL France SA, France
 Trevira GmbH, Germany
 TU Hamburg, Germany
 Uhde, Germany
 Univ. of Magdeburg, Ger.
 Univ. Jena, Germany
 Univ. of Cologne, Germany
 Univ. of Jeddah, S.-Arabia
 Univ. of Pireaus, Greece
 URGS, Brasil
 Volkswagen, Germany
 Whatman, Germany
 Wikos Group, Russia

Our Products

Our best choices for your tasks are based on our experience with small scale plants. We are not just delivering components, we will also give advice how to integrate it into a plant.

Turn-Key Solutions

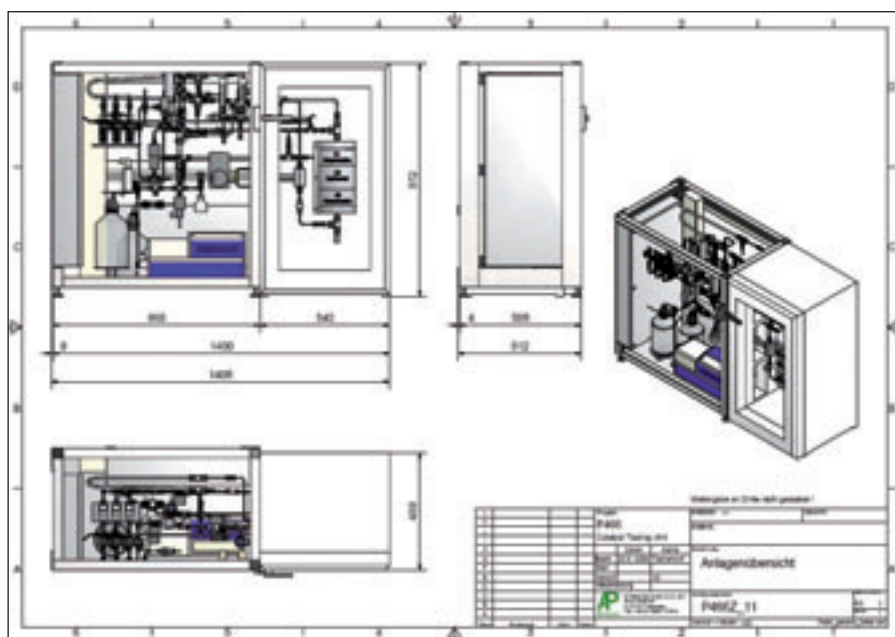
- Unique combination of know-how in process, measurement and control technologies
- Customer specific consulting and detailed planning considering a wide range of aspects including on-site conditions.
- In-house electrical panel and automation shop
- Extensive testing procedures including ISO and APM-Test guidelines
- Documentation, commissioning and training



10-litre polymerisation plant

Small Scale Equipments

- Standard and special apparatus made of all kinds of materials
- Measurement instruments
- Valves
- Pumps
- Other equipments in small sizes



Design drawing of a micro reactor system

Engineering Service

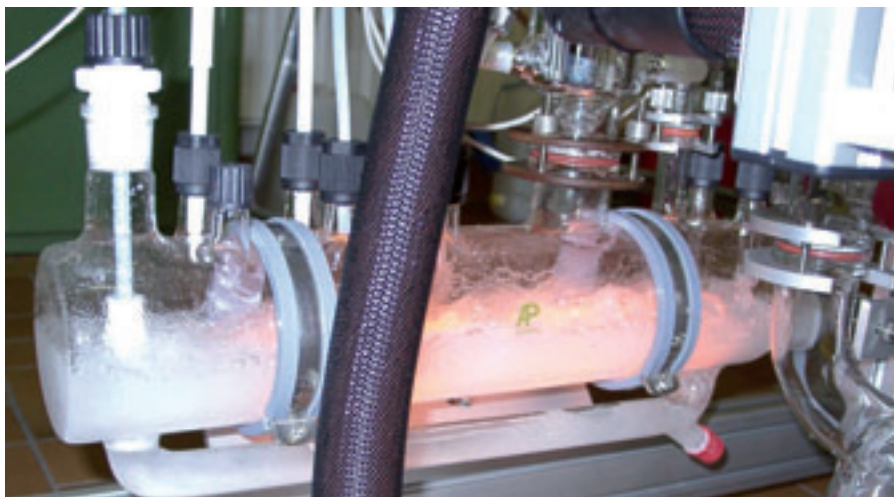
- Basic and detailed engineering
- Digital prototyping with 3D-CAD-software.
- P&I Diagram development
- Control systems engineering for existing small plants

Process Conditions

Our knowledge across many branches includes experience with high pressures, high and low temperatures as well as different materials of construction. Customers benefit from our 14 years of existing and continuously growing expertise and knowledge.



Stirred vessel, 175 bar



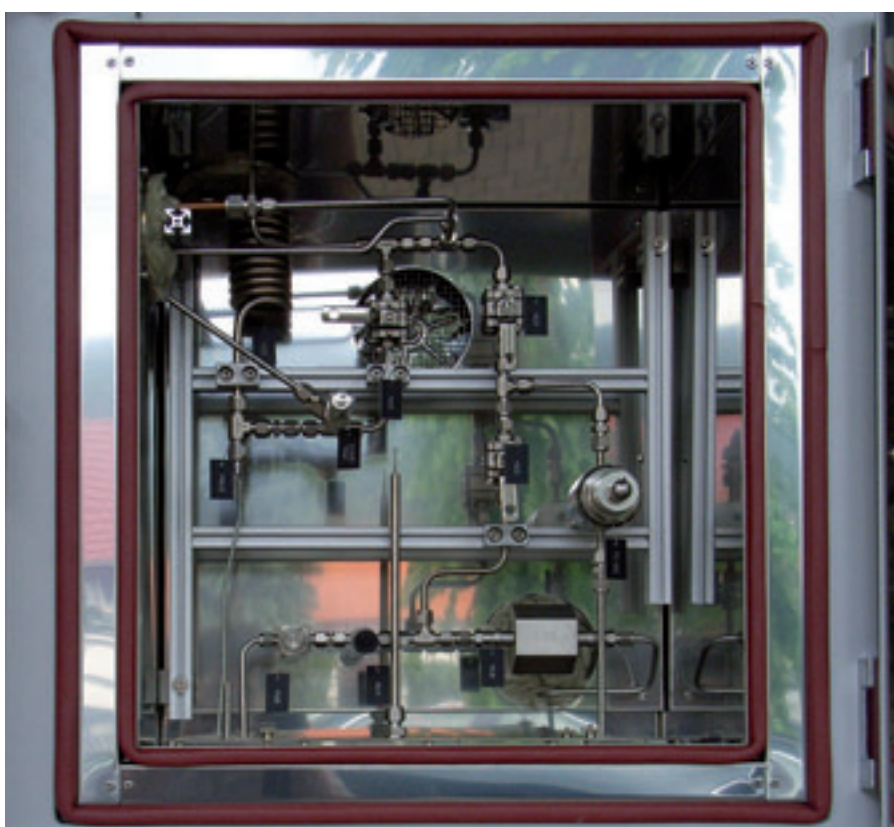
Glass evaporator with solid circulation

Process Conditions

Temperature range:	-100 to 1000 °C
Pressure range:	-1 to 200 bar
Apparatus volume:	1 ml to 100 l
Flow liquid:	1 ml/h to 100 l/min
Flow gas:	1 Nml/h to 2 Nm ³ /min
Main Pipe diameter:	0.5 to 50 mm



Tubular reactor, 1000 °C



Prevention of condensate using a circulating air oven

Materials

Construction Materials

Stainless steel • Hastelloy™, Incolloy™ • High temperature stainless steel
Glass lined steel • Borosilicate and quartz glass • High performance polymers like PFA, PTFE, PVDF, PEEK • Standard polymers



PTFE equipment



Glass lined steel reactor (100 litre)



Phase separator



Lid of a 10l reactor



Measurement container, PTFE



Stainless steel reactor inside



Cooled vessel, stainless steel



Curved blade anchor stirrer, Hasteloy™

Providing Turn-Key Solutions

We provide customized fully automated laboratory and pilot plants and deliver a turn-key plant including commissioning and training.



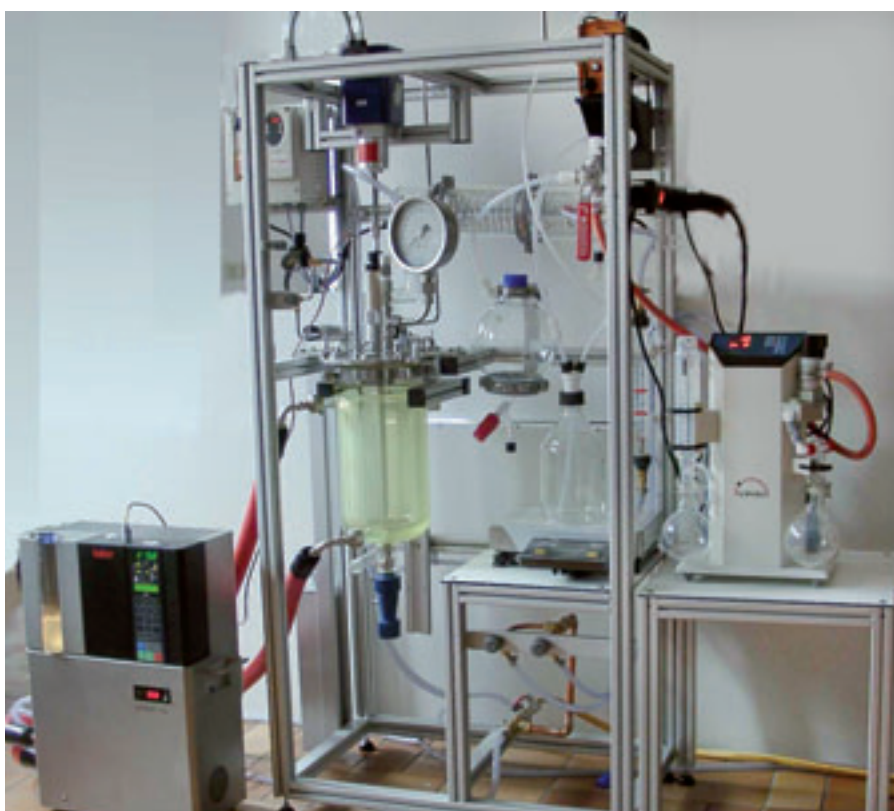
Starting with an empty fume cupboard, detailed planning and experienced work is necessary to produce a complex automated plant.



2-reactor glass plant, installed at South China University of Technology



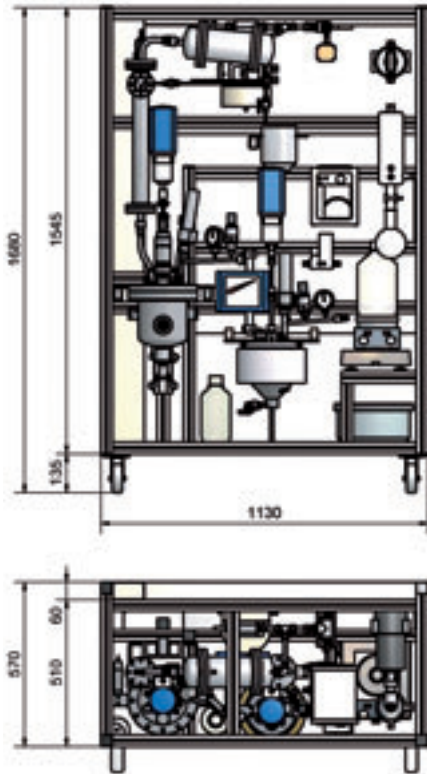
3-litre glass plant for 3 bar



Glass plant with single controllers, 5 l, 300 °C

Compact Design

Very often the challenge is not only to find a practical technical solution, but there also is limited space and limited budget. These important side-aspects are always considered in the AP-Miniplant planning process.



Design drawing of a 2-litre Hastelloy plant with filter dryer and distillation.



Bench-top micro reactor system for catalyst testing
Dimensions W x D x H = 1400 x 490 x 980 mm



Final plant
Dimensions W x D x H =
1130 x 570 x 1680 mm



Automated continuous rectification plant with Sulzer™-packing, Ø 30 mm, with phase separator, completed with all necessary measurements and control instruments (Dimensions W x D x H = 1500 x 800 x 2300 mm)

Testing, Commissioning & Training

AP-Miniplant is a TUEV-certified manufacturer with a quality assurance system according to Pressure Equipment Directive (PED, 97/23/EC), Module H and DIN EN ISO 9001:2000.

Extensive Testing Procedures

With extensive tests we ensure the functional performance and the safety of the user. APM-Test guidelines include: Leak tests for the assembly and functional tests for all components.

We certify the safety of our equipments according to the applicable European safety standards, such as 2006/95/EC (Low Voltage Directive), 2004/108/EC (EMC Directive), 97/23/EC (Pressure Equipment Directive), 94/9/EC (ATEX Directive) and 2006/42/EG (Machinery Directive)

Documentation, Commissioning and Training

Our on-site commissioning and initial skill adaptation training ensures that the user utilizes the benefits of the plant within the shortest period of time.

Extensive documentation for the complete plant as well as for all parts and components is provided for later reference.



On-site training



Certificate Pressure Equipment Directive Module H



Simatic™ PCS7 Lab Plug & Play Control System

AP-Miniplant provides different automation concepts starting from manual control up to automatic recipe control.

For automatic systems we use state of the art control system technology with Hard- and Software from Siemens, recognized worldwide in all industries.

The system allows an unattended 24 h operation if required.

Built for Safe Operation in Daily Laboratory Practice

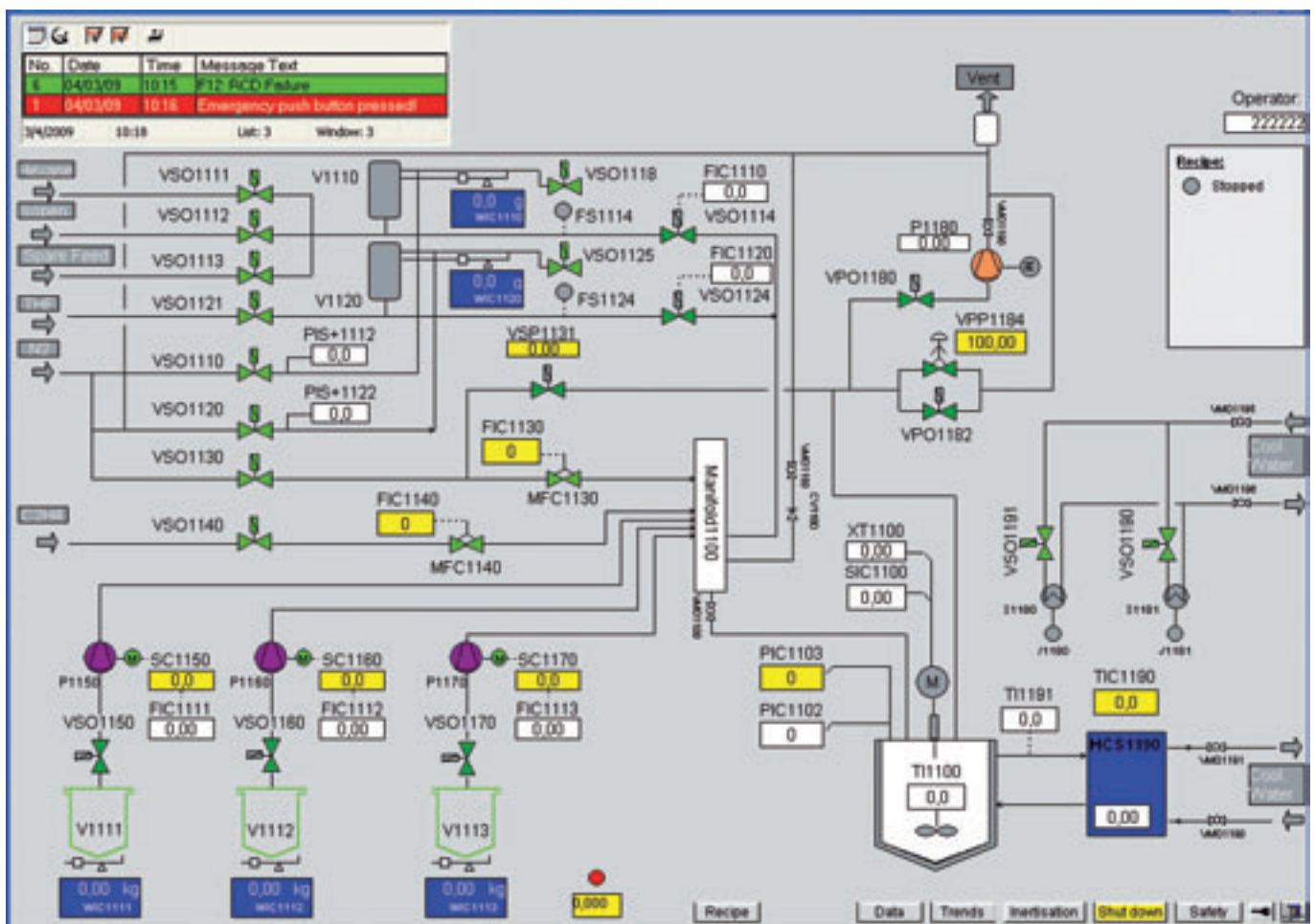
Safety measures reducing the risk of human errors and technical malfunctions are key. The safe and user-friendly design leads to a high level of customer satisfaction.

The control system is designed considering our risk analysis according to Machinery Directive 2006/42/EG and is equipped with the sophisticated AP-Miniplant 3-phased safety concept, ensuring safe operational conditions at all times.



User's safety parameters

< Switching cabinet with Simatic™ S7 Process Logical Control (PLC)



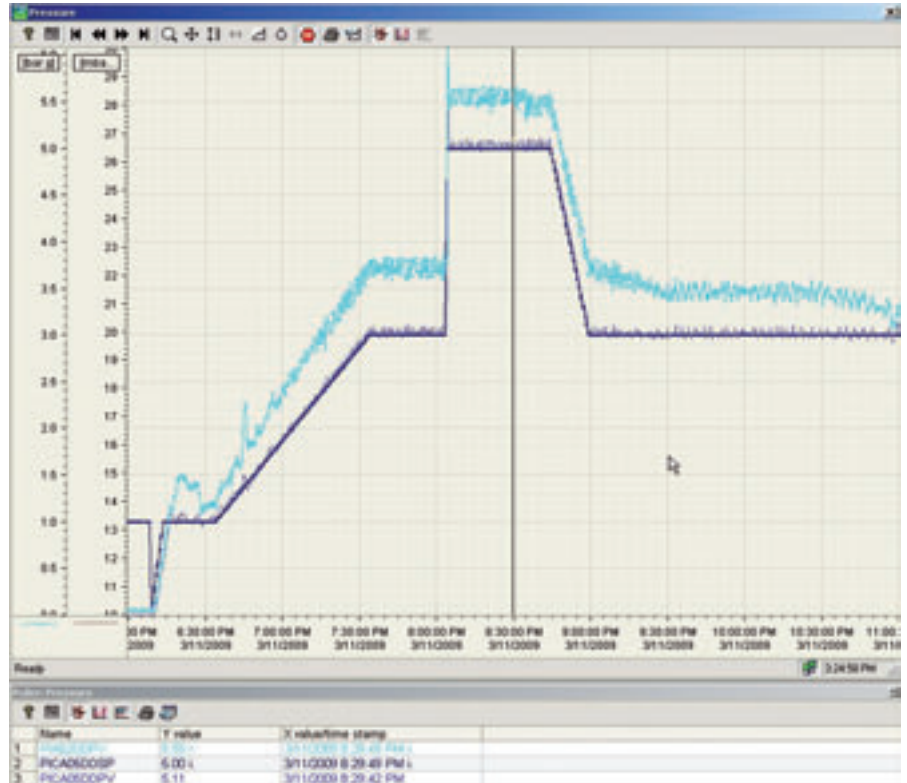
WinCC™ operator screen for a stirred tank reactor plant

Automatic Recipe Control

Our recipe control system is based on MS-Excel™. Especially designed for research plants, it allows reproducible process conditions.

Recipe Features:

- Unattended step by step operation
- Individually adapted to the plant
- Maximum flexibility in recipe definition
- User intervention during run possible
- Data record for each run



Example for a recipe controlled pressure program

The screenshot shows the 'Recipe Definition Catalyst reactor' window. It includes a 'Choice of recipe' dropdown set to 'Cat_Rec_3'. Below this, there are tabs for 'Excel', 'Start', 'MasterTable', 'Data', 'Overview', 'Copy step', and 'Delete step'. The 'Data' tab is active, showing a list of steps: S6: Flushing, S7: stirring, S8: Add 100 ml Al, S9: Flushing, S10: Stirring 1h, S11: Add 100 ml Ti, and S12: Flushing. The 'Name of step' field is set to 'S11: Add 100 ml Ti'. The 'Change of step' is set to 'Time of step reached' with a value of 300. The 'Time of step [min]' field is also set to 300. The 'Temperature reactor' section has 'Setpoint via sensor reactor' selected, with 'Temperature [°C]' set to 35. The 'Stirrer speed' section has 'Setpoint clockwise' selected, with 'Speed [rpm]' set to 70. The 'Pressure mode reactor' section has 'Setpoint overpressure' selected, with 'Press [mbar abs]' set to 500. The 'Dosing Ethylene' section is set to 'Off'. The 'Dosing Titan' section has 'Setpoint' selected, with 'Frequency [pps]' set to 0.26. The 'Dosing Mg/Al/Future' section is set to 'Off'. The 'Dosing THF' section is set to 'Off'. The 'Dosing Hexane/isopentane' section is set to 'Off'. The 'Sampling mode' section is set to 'Off'.

Recipe definition screen, each tab is one step. Step change conditions: Time, temperature, pressure, inertisation ready, manual step change or other conditions

Laboratory and Pilot Plants

**An Installed Base of more than 80 Systems Worldwide
Includes a Wide Range of Applications.**



Catalyst testing unit with two reactors, 750 °C, 40 bar



Continuous distillation unit, 30 mm glass-column



Stainless steel polymerization reactor



Extraction unit for plastic pellets, vacuum, 250 °C



Lid of a 2 l reactor on compensated load cells



Pulsed extraction column and batch distillation

Separation
Absorption
Adsorption
Catalyst Test Systems
Continuous Reactors
Distillation
Dosing Units
Drying
Extraction
Evaporation
Fixed Bed Reactors
Filtration
Fluidized Bed Reactors
Fuel Cell Test Systems
Furnaces
Gas Conditioning
Stirred Tank Reactors
Humidification
Metal Free Units
Mixing
Polymerisation Reactors
Precipitation
Reactive Distillation
Rectification
Special Reactors
Storage Units

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