



Experience Counts!

MODULAR PROCESS SYSTEMS

Turnkey Pilot, Demo & Commercial Plants

uniteltechnologies

Your Partner in the Pursuit of Process Innovations

1-90-G-4B
GAS OIL PUMP
TRIM-P1-0124-C1-HC
SEALPOT DETAIL
SHT: 284-09015-111 DETAIL 06

1-90-E-2
GAS OIL
PA COOLER

1-90-G-4A
GAS OIL PUMP
TRIM-P1-0124-C1-HC
SEALPOT DETAIL
SHT: 284-09015-111 DETAIL 05

“History is the memory of things said and done.”

~ Carl L. Becker



THE COMPANY: OVERVIEW

The company identifies and develops promising technologies, which are then driven towards commercialization.

Unitel Technologies is an Illinois corporation that was established in 1974 to focus on the development and commercialization of leading edge process and product technologies. Environment, energy, health and productivity applications are targeted as areas of special interest. At Unitel we thrive upon challenges that other engineering companies shy away from, plus we take pride in offering and imple-

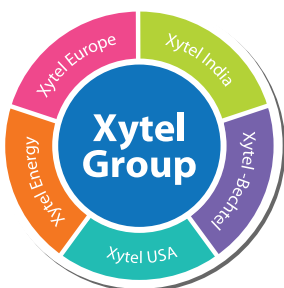
menting “out-of-the-box” solutions.

Unitel’s primary technical strengths are in process development, thermodynamics, heat transfer, reactor design, catalysis, pilot plant design, detailed engineering & design and construction. The company identifies and develops promising technologies, which are then driven towards commercialization. Many of the state-of-the-art features em-

bedded in the technologies used by Unitel were developed at Xytel-Bechtel.

Unitel’s marketing strategy is to attract, enhance, promote and support these emerging technologies as they address specific business requirements.

During the last 40 years, Unitel’s team has executed more than 1,300 pilot and mini-plant projects for 400+ major industrial firms and R&D organizations in 31 countries around the world. Many of these systems were first-of-a-kind units.



Unitel Technologies
(formerly XTP)

Unitel Technologies is a successor to the Xytel Group that was founded by Serge Randhava and Dr. Ravi Randhava in 1974. By 1984, this organization was widely recognized as the world’s leading designer and builder of pilot and mini-plants.

BREADTH OF APPLICATIONS

Catalyst Research	Energy	Pharmaceutical & Nutraceutical	Petrochemicals
Adiabatic Reactions Isothermal Heterogeneous Reactions Homogeneous Reactions Fluidized Bed Reactions Ebulliating Bed Reactions Gradientless Reactors	Coal Gasification Coal Liquefaction Fuel Cells H-Coal, H-Oil	Ethylene Oxide Sterilization Sorbitol Hydrogenation Sucrose Crystallization Vitamin Production	Ammonia Synthesis CO Shift Cumene Alkylation Dehydration Ethylbenzene Alkylation Ethylene Cracking
Petroleum Refining	Polymerization	Gasification	Miscellaneous
Adsorption/Desorption Catalyst Evaluation Catalyst Screening Catalytic Dewaxing Desulfurization Extraction Hydrocracking Hydrotreating	Bulk - CSTR Bulk - Loop Reactor Condensation Emulsion and Solution Slurry - CSTR Slurry - Loop Reactor Vapor Phase	Fluidized Bed Gasifiers Heavy Oil Gasification Agglomerating Bed Gasifiers Rotary Solid Fuel Gasifiers Electro Kinetic Gasification Petroleum Coke Gasification	Supercritical Extraction Distillation Evaporators/Crystallizers Adsorption – Desorption Proportioning/Blending Corrosion Test Rigs Electrodialysis

UNITEL CUSTOMERS



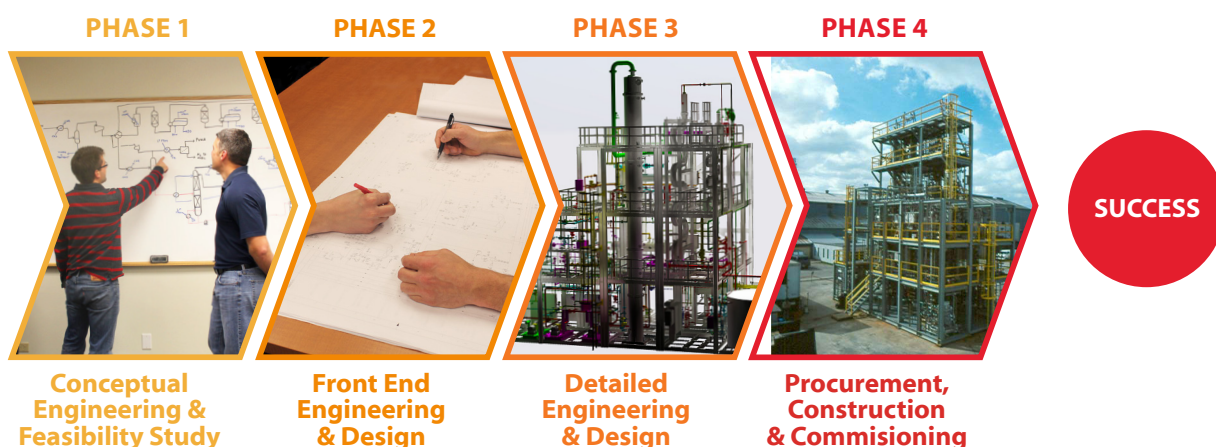
PROJECT IMPLEMENTATION SEQUENCE

At Unitel we don't serve plain vanilla. With "imagineering" and a penchant for shifting the paradigm, we promise to generate some exciting and cost-effective options for you. That's because we're not afraid to put technology to the test.

Unitel has broad experience in pilot and demonstration plants and we offer all the services that our clients need to achieve success with their projects. As an EPC contractor, we can work on a turn-key basis or we can provide selected services that can range from the conceptual design to the construction and start-up of

the plant.

Our formula of engagement is simple. Give us your "wish list" and some running room, and we'll show you the Unitel difference. Be prepared for close and frequent communication. By the time your project is completed, we will know each other very well.



OUR SERVICES



Conceptual Engineering

- Process Scenario/Option Analysis
- Experimentation
- Kinetics, Equilibrium and Thermodynamics
- Preliminary Process Simulation
- High Level Heat and Material Balance (HMB)
- High Level Process Flow Diagrams (PFDs)
- Cost Engineering – Association for the Advancement of Cost Engineering (AACE) Class 5 estimates



Feasibility Study

- Process simulation (Aspen Plus or Aspen Hysys)
- Heat and Material Balance (HMB)
- Reactor Selection
- Separation Equipment Selection
- Process Flow Diagrams
- Equipment Lists/Define and Size Major Equipment
- Preliminary Piping and Instrumentation Diagrams (P&IDs)
- Preliminary Plot Plan Development
- Cost Engineering – AACE Class 4 capital estimates
- Operating Cost Development

FEED

Front End Engineering & Design

- Process Simulation (Aspen Plus or Aspen HYSYS)
- Heat and Material Balance (HMB)
- Process Flow Diagrams (PFD)
- Piping and Instrumentation Diagrams (P&ID)
- Utility Diagrams
- Line Sizing/Hydraulics
- Relief Valve Sizing/Flare System Hydraulics
- Process Optimization
- Equipment Specifications
- Exchanger Sizing (Aspen EDR)
- Instrument Specification
- Control Philosophy
- Control System Definition and Specification
- 3D & 2D Modeling and Pipe Routing
- Preliminary Discipline Engineering
- Preliminary Bills of Materials
- Cost Engineering – AACE Class 2 Estimates
- Project Schedule

DED

Detailed Engineering & Design

Mechanical

- Vessel and Reactor Design
- Exchanger Thermal Design (Aspen EDR)
- Equipment Selection and Specification
- Rotating Equipment Selection

Piping

- 2D & 3D System Modeling
- Pipe Routing and Piping Isometrics
- Pipe Stress Analysis

Electrical

- Hazardous Area Drawings
- Power Distribution Design
- Load I/O List Development

- Panel Design
- Heat Tracing Design

Instrumentation and Controls

- Instrument Selection
- Interlock Matrixes and Shutdown Logic
- Load I/O List Development
- Control System Selection and Specifications
- Communication Plans
- Programming
- Safety Systems

Structural

- Structural Analysis (STAAD) and Design
- Foundation Requirements/Loading

P

Procurement

- Vendor Identification, Qualification and Selection
- Cost and Benefit Analysis
- Request For Quotation (RFQ) Development
- Vendor Document Management

F

Fabrication

- Turnkey System Fabrication
- Factory Acceptance Testing (FAT)
- Preparation for Shipping and Transportation

CS

Commissioning & Start-Up

- Installation Assistance
- Operating Guidelines
- Maintenance Guidelines
- Onsite Commissioning Assistance
- Site Acceptance Test (SAT)

RECENT PROJECTS AT UNITEL



Oxydesulfurization (ODS) to Make ULSD Diesel

A diesel/VGO de-sulfurization pilot plant to make ultra low sulfur diesel (ULSD). This pilot plant was constructed to evaluate a totally new and novel technology using the production of peracetic acid to generate free radicals to conduct the desulfurization. The system is designed for a feed rate of 1 barrel per day. CPC is currently discussing a proposal to co-market this technology internationally in collaboration with Unitel.

Project Services



Recirculating Fluid Catalyst Biomass Pyrolysis Demo Plant

The client has developed a catalyst and technology to convert biomass into a bio-oil that can be used directly for heating purposes or can be upgraded to an oxygen-free product compatible with existing refinery feedstocks. This process uses a circulating bed similar to FCC units in oil refineries.

The system consists of six modules that include a biomass pyrolysis reactor, a catalyst regenerator and a product recovery section.

Project Services



Bitumen Upgrading Demonstration Plant

This plant was designed to demonstrate a new technology for upgrading bitumen extracted from oil sands. Unitel designed and built this plant in 2009. The project was an outstanding success and Unitel was responsible for all the design, construction and commissioning that was involved.

This plant was installed at the customer's refinery and start-up took about four weeks.

Project Services





Dimethyl Ether (DME) Demo Plant

The Korean customer developed a proprietary catalyst and process for the direct synthesis of DME from natural gas. Before going commercial, the customer needed to build and operate a demo plant (10 tons per day) to prove the efficacy of this technology and retained Unitel to generate the conceptual, basic and detailed engineering and design packages. The process includes an oxyblown auto-thermal reformer for making synthesis gas, fixed bed boiling water type DME reactors and cryogenic separation of reactants.

The development program proved successful and has enabled the company to commit to a 900 tons/day commercial project, which was also engineered by Unitel Technologies.

Project Services



Eight Reactor Hydrotreating Pilot Plant

This system was designed and built for catalyst testing for use at the customer's refinery.

Reactor Pressure: 2,800 psig

Reactor Temperature: 900 °F

The reactors can be operated in series or in parallel. The unit is 100% computer controlled for continuous operation.

Project Services



Vapor Phase Polypropylene Demo Plant

This polypropylene demo plant was designed and constructed for a major US client. It included a single fluidized bed reactor and a comprehensive feedstock purification train. This system was used as a platform to make subsequent units for other customers in Korea and Taiwan.

Project Services



Unitel's business is driven by ever changing industry and customer demands. In addition, Unitel also invests a significant amount of effort in technology developments that are likely to address emerging needs and problems.

“The important thing is not to stop questioning.”

~ Albert Einstein



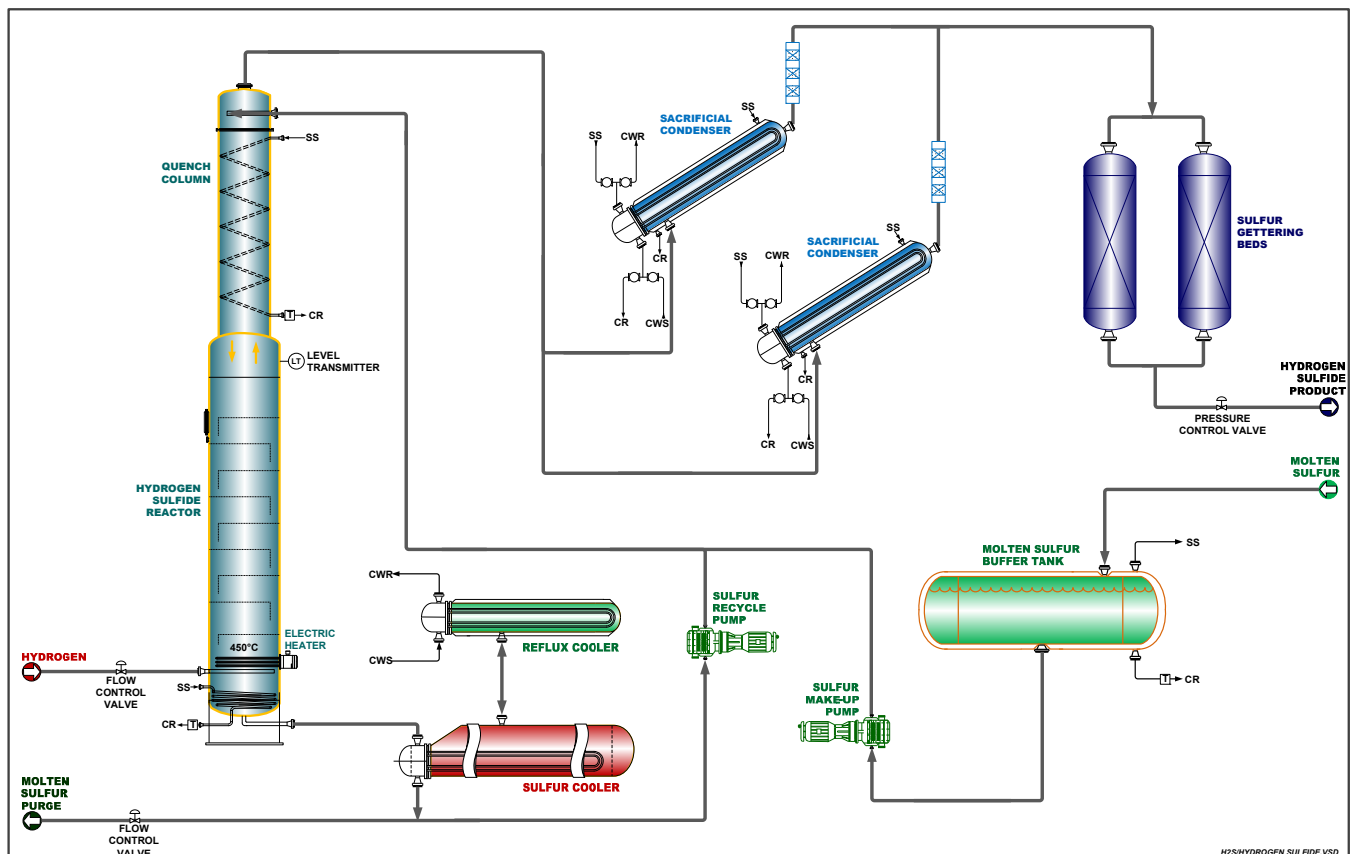
HYDROGEN

In collaboration with Argonne National Laboratory, Unitel has developed a unique technology for autothermal reforming of a wide variety of fossil and biofuel feedstocks to make hydrogen. Conversion of natural gas and JP8 are two significant applications.

HYDROGEN SULFIDE (H₂S)

The worldwide market for H₂S continues to grow at an impressive rate for the production of mercaptans, downstream chemicals and mining and metallurgical applications. Unitel has recently provided the technology

and engineering & design for two commercial H₂S plants. A unit located in Europe is making 48 TPD of H₂S while the other one in Southeast Asia includes two trains each making 60 TPD of H₂S.



METHANOL MINI PLANTS

Worldwide methanol prices are increasing at an unprecedented rate -- the supply of this chemical is limited while demand continues to grow. The use of stranded, remote and shut in shale gas is of special interest in this regard. Midstream gas processing operators can also benefit from this technology. Unitel's model makes use of satellite units that produce crude methanol which is then sent to a central station for purification.

NATURAL DIESEL

All the biodiesel manufactured today has a serious flaw insofar that this product contains oxygen. In order to make a fuel that is similar to conventional diesel, it is necessary to remove the oxygen. Currently hydroprocessing is the favored operation for this purpose.

Unfortunately, hydrogen is expensive and its availability is limited to the proximity of refineries and hydrogen pipelines. Unitel is developing a technology that eliminates the need for hydrogen and gets rid of the oxygen by decarboxylation. Feedstocks being investigated include a variety of plant oils and animal fats.

DIMETHYL ETHER (DME)

The demand for this chemical as a transportation fuel is expected to grow very rapidly but the supply side of the equation in North America is currently very limited. In developing

countries, DME is seen as an excellent additive or substitute into the liquefied petroleum gas pool. For more information about DME please visit www.aboutdme.org

HYDROPROCESSING SYSTEMS

These units have seen a recent growth in interest for research for various hydrotreating applications including performance studies on different catalysts. Desulfurization of tight oil

feedstocks is growing in popularity, especially in North America. Unitel has designed and built a variety of hydroprocessing systems with configurations that include 1-8 reactors.

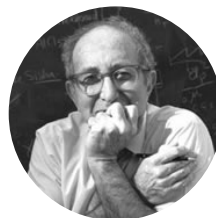
MONETIZATION OF WASTE CARBON DIOXIDE (CO₂)

The US Environmental Protection Agency is actively pursuing regulations that are intended to reduce the amount of CO₂ that is being generated by coal fired power plants. Capturing and

sequestering the CO₂ is one recognized option, but this is a capital intensive process. An emerging approach is to use the CO₂ to make a liquid fuel such as methanol.

OCTAVE - GENERAL PURPOSE CATALYST RESEARCH SYSTEMS

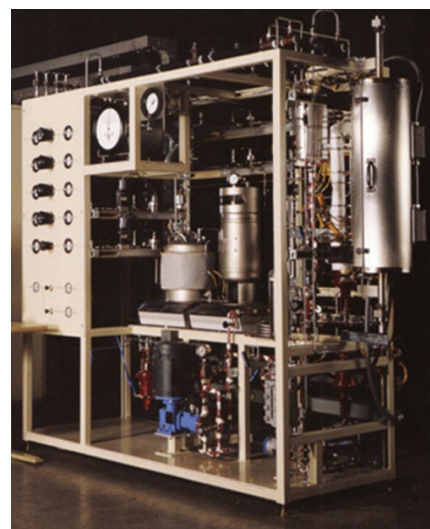
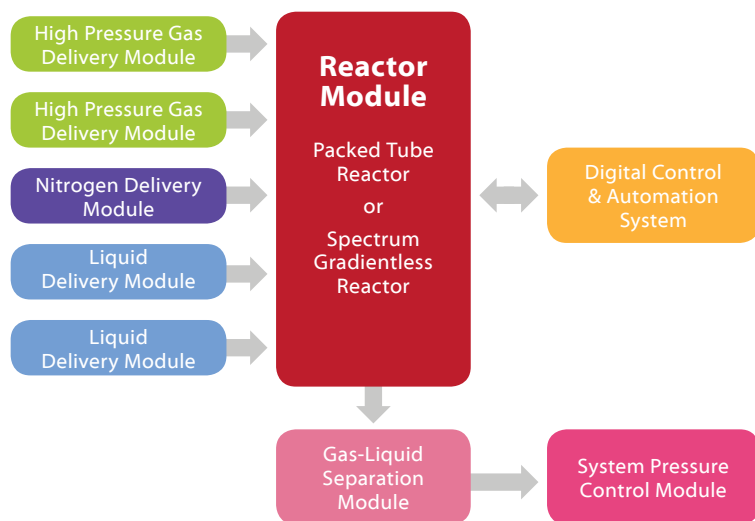
The Octave series by Unitel enables you to generate and evaluate accurate performance data about your catalyst – activity, conversion, selectivity, deactivation rates, longevity, regeneration, attrition and ruggedness. The system offers a choice of a packed tube reactor or the Spectrum gradientless reactor.



Octave Levenspiel

Dr. Seuss of Chemical Engineering

The Catalyst Testing System/Octave is named in honor of Octave Levenspiel, Emeritus Professor of Chemical Engineering at Oregon State University



Option 1 | Packed Tube Reactor

Option 2 | Gradientless Reactor

Maximum System Pressure | 100 bar or 200 bar

Maximum Reactor Temperature | 500 °C

Catalyst Capacity | 50 mL

Gas Delivery Modules | Two (2)

Low Pressure Nitrogen | One (1)

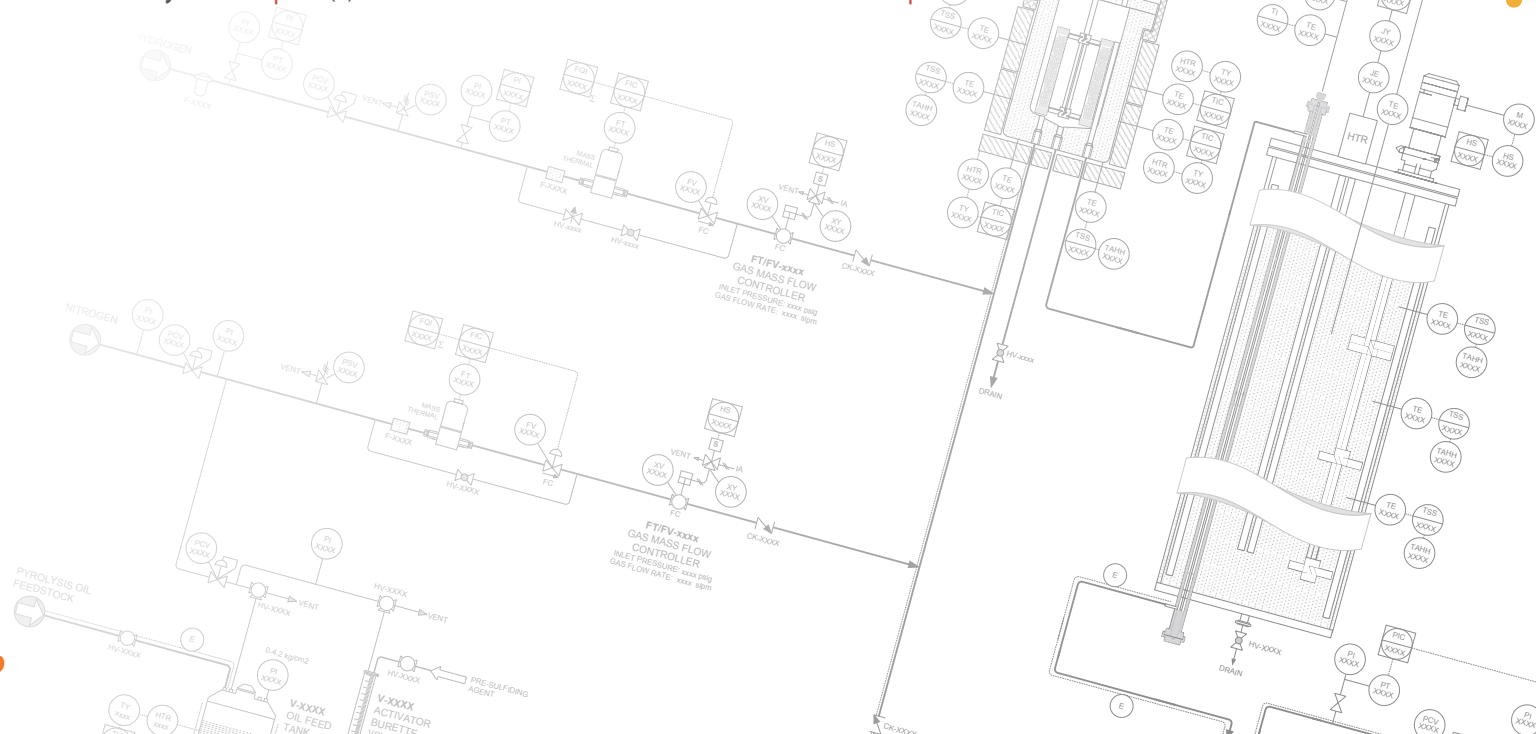
Gas Feed Rate | Up to 1200 SLPH

Liquid Delivery Module | Two (2)

Liquid Feed Rate, Standard | 3-600 mL/hr

Liquid Feed Rate, Optional* | 0.6-300 mL/hr

Standard Materials of Construction | 316 SS



MULTIPURPOSE POLYOLEFIN PILOT PLANTS

Polymerization is a process where reactive monomer molecules combine together to form polymer chains or three dimensional networks. Various methods are deployed to produce high-molecular-weight uniform products. These methods enable the control of initiation, propagation and termination rates during chain polymerization. Simultaneously, due to the fact that all polymerization reactions are exothermic, concentrated design efforts have to be made to remove excess heat.

Generally, at least 100 monomer molecules combine to make a polymer that can be tailored to develop unique physical properties such as elasticity, high tensile strength and the ability to form fibers.

The seven primary polymerization processes are the following:

- Suspension
- Solution
- Slurry Phase
- Emulsion
- Condensation
- Bulk or Block
- Gas Phase



The orange colored units relate to a configuration for the production of High Density Polyethylene (HDPE)



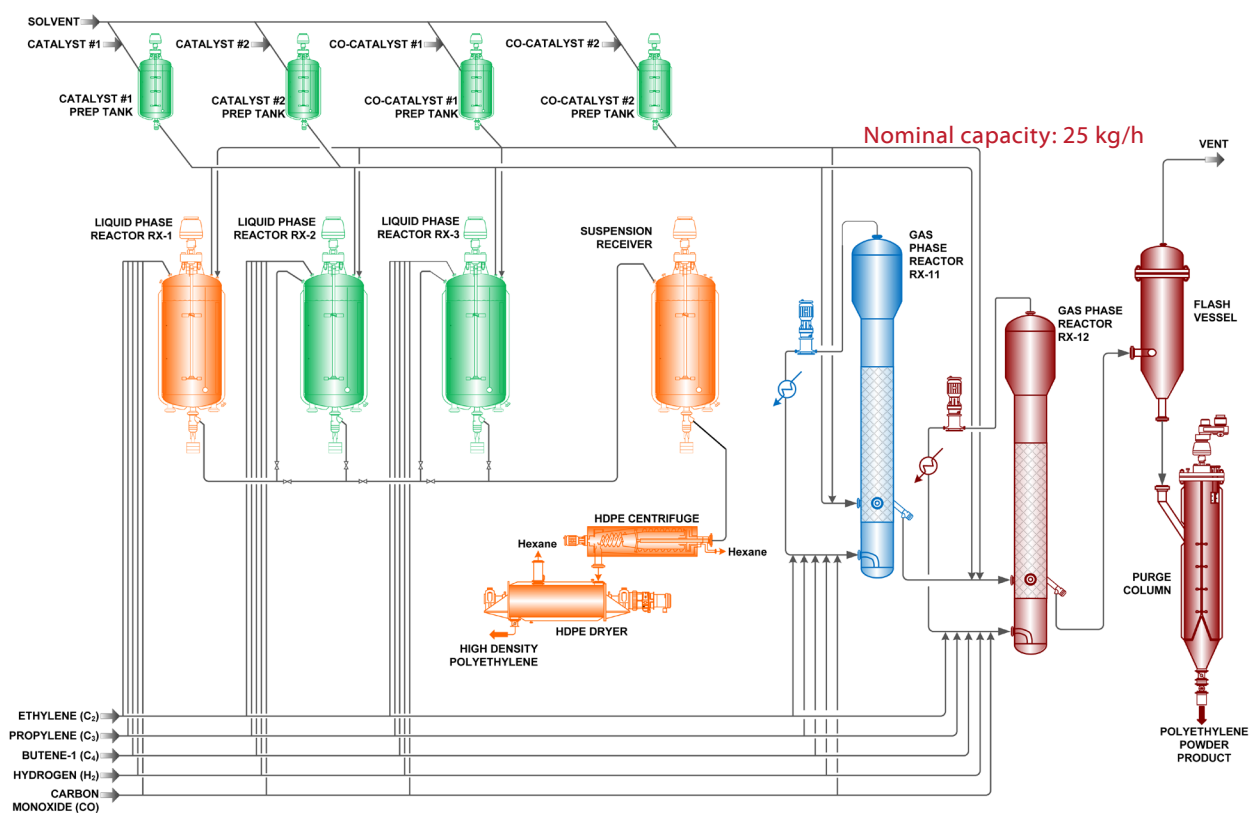
The red colored units relate to a configuration for the production of Polypropylene and also Linear Low Density Polyethylene (LLDPE)



The blue colored units relate to a configuration for the production of Polypropylene (PP)



The green colored units are common to all configurations



www.uniteltech.com



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