

# CSTRPP PILOT PLANT

## CONTINUOUS STIRRED TANK REACTOR

This "Owner Configured" Computerized and automatic pilot plant is based on a CSTR (from 100cc up to 4L and many different alternatives) and the operation is supported by many optional devices as MFC's, pumps, pre-heaters, separators, pressure control systems,... Customer can design his own pilot plant using for it so many options as required for his operation needed, using for it a configuration sheet. Technology applied is at the top worldwide. Standardized system becomes short production delivery time and confidence on his performances. The Plant will be High Pressure Certified PED/97/23/EC.



### MAIN FEATURES

#### Gases

Until six (n) continuous gases feed lines to reactor. Flow control system by Mass Flow Controllers (Bronkhost High-Tech), including manual valves, check valves, fitting and accessories (P&ID diagram). Gases line preheating system including temperature control loop can be installed.

#### Liquids

Up to two liquid feed lines can be installed as standard. Pumps can be selected for micro-flow (HPLC from Gilson) or standard process pumps (Dosapro) for different pressures and flows. Relief valves for calibration, check valves, manometers and usual safety devices will be installed. Liquid lines preheating/evaporating systems can be selected. Inertized vessels, tracings and all usual features can be installed.

#### Stirred Tank Reactor

A stirred tank reactor from Autoclave Engineers, Magnedrive agitator, is the main device of the plant. MOC (SS316, Hastelloy C,...), P@T and volume will be selected by the customer using the configuration sheet. All safety or operational devices as manometers rupture disk, safety valve and vent valves or sample valves will be included. Also other extra options can be selected. Motor is 3PH but operate with 1PH 220VAC.

The temperature control system for reactor, by electrical oven (220 VAC) and alarm cooling system is included. Reaction temperature is measured inside the reactor through a type K thermocouple. Power control is based on Phase Angle Control (PAC) voltage supply. Overtemperature alarm is also included.

#### Wax Collector at high pressure

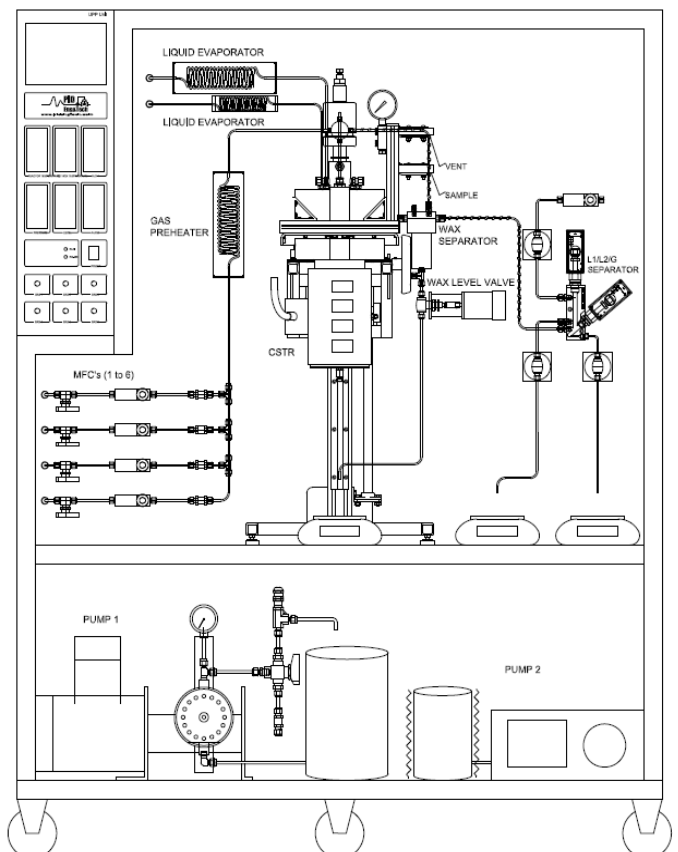
Fisher-Tropsch reactions (GTL) can be conducted at this CSTR pilot plant using the waxes SS316 temperature controlled separator system and an optional switching valve for avoid plugging at the liquid outlet filter. This L/G separator system includes level control based on a differential pressure meter and liquid outlet control valve, also includes heating tracing lines. Also weight scale can be selected on the configuration sheet for real time acquisition on computer.

#### The Two Liquid phases-Gas Separator at high pressure

A SS316 liquid1-liquid2-gas patented separator system with no dead volume, allows L/G separation even when water and hydrocarbons are obtained simultaneously at reactor outlet. Level dead volume is nearly 1cc for each liquid phase, which implies real time liquid outlet, no accumulation. Level control system includes liquid outlet control valve for each liquid outlet. Two models (L/G or L/L/G) can be selected by the user. Type of temperature control also can be selected. One or two weight scales for real time acquisition on computer can be selected. Pressure control system for the reactor or , when a fractionation is needed, two different pressure controllers for reactor and separators can be selected. Pressure control is based on the patented PID Eng&Tech microregulation servocontrolled valve (at this brochure). Overpressure interlocks with feeding and oven are installed.

#### Computer System

Control system based on distributed PID controllers and remote computerized supervision and automation (for process recipes). PC and Process@ software is included. Engineering and documentation is shared with Microactivity reactor, 15 years worldwide experienced.



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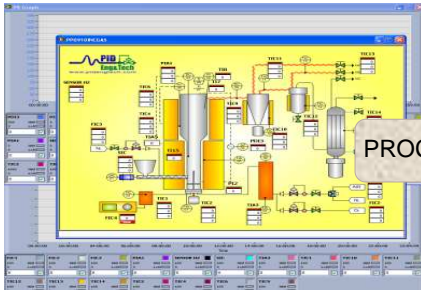
## CONTINUOUS STIRRED TANK REACTOR BASED PILOT PLANT

### CONFIGURATION SHEET

PED/97/23/EC High Pressure Certification	W. Temperature	W. Pressure	GASES	Number of Mass Flow Controllers	Type of MFC's	Gas Preheater	LIQUID FEED 1	Type of pump	Evaporator	LIQUID FEED 2	Type of pump	Evaporator	HIGH PRESS STIRRED REACTOR	Type of valve	Reactor Volume	Type of Autoclave	Lift mechanism	Material	Seal (gasket)	Cooling	WAXES SEPARATOR	Wax collector	Scale	LIQUIDS H.P. SEPARATOR	Liquid separator	Temp. Control	Scales	Pressure control	Meter
CSTRPP	T	P	G	n	MFC	PH	L1	F1	E1	L2	F2	E2	CSTR	VLV	V	AE	LM	M	G	C	S1	W	WW	S2	S	TC1	W1	PC	F
	Work temperature	Work pressure	Number of gases (MFC's) 0 to 6	Type of MFC's S-Standard (up to 100bar) V-VaryP (up to 400bar)	Type of gas preheater 0- without gas preheater 1- with gas preheater	Type of pump 0- no pump G005- Gilson 5 cc/m 600 bar G010- Gilson 10 cc/m 600 bar G025- Gilson 25 cc/m 280 bar D040- Dosapro 40 cc/m 480 bar D095- Dosapro 95 cc/m 390 bar D170- Dosapro 170 cc/m 200 bar	CSTR Volume 010- 100ml $\phi=46$ mm; L=70mm 030- 300ml $\phi=46$ mm; L=170mm 050- 500ml $\phi=76$ mm; L=116mm 100- 1 Liter $\phi=76$ mm; L=221mm 200- 2 Liter $\phi=127$ mm; L=152mm 400- 4 Liter $\phi=127$ mm; L=312mm Others to consult	Manual elevator 0- None 1- Manual Screw Jack	Cooling 0- none 1- refrigeration coil	Without wax collector 1- With wax collector	Without separator 1- with L/G separator 2- with 2L/G separator	Without scale 1- With scale 2- With two scales	Without Temp control 1- T. Control 25 / 65°C 2- T. Control (-5) / 65°C	Without pressure control 1- in the CSTR 2- in the CSTR & S1															

**Autoclave Type**  
 ZC- ZipperClave (151 bar@232°C)  
 ES- Eze-Seal (227 bar@454°C)  
 BC- Bolted Closure (400 bar@343°C)  
 BT- Bolted Closure HT (350 bar@510°C)  
 SP- Special executions

**Standard Volumes**  
 ZipperClave (fast closure) only 050,100,200 & 400  
 Eze-Seal all the volumes  
 Bolted Closure all the volumes  
 Bolted Closure HT only 030, 100.  
 Max Temp is function of sealing elastomer MOC



PROCESS@ SOFTWARE

### CONFIGURATION SHEET

### CSTR PILOT PLANT P&I DIAGRAM

