

Fluidized Bed Reactors



Fluidized Bed Reactors are used extensively in the chemical process industries.

The distinguishing feature of a fluidized bed reactor is that the bed of solid particles or catalyst is supported by an up flow of gas. This reactor provides easy loading and removal of catalyst. This is advantageous when the solids bed must be removed and replaced frequently. A high conversion with a large throughput is possible with this style of reactor. Such reactors inherently possess excellent heat transfer and mixing characteristics.

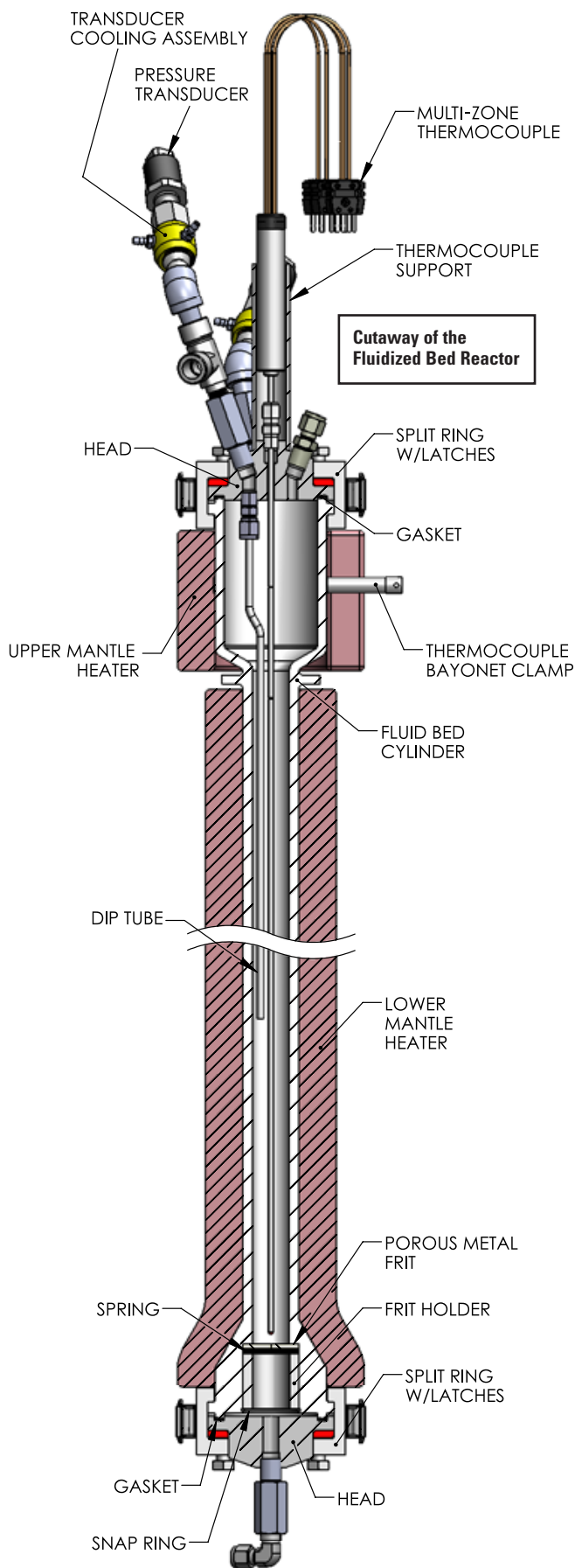
Fluidized beds have been significantly utilized in chemical processes in which parameters such as diffusion or heat transfer are the major design parameters. Compared to packed bed, a fluidized bed has notable advantages such as better control of temperature, no hot spot in the bed, uniform catalyst distribution and longer life of the catalyst.

Nearly all significant commercial applications of fluidized bed technology concern gas-solid systems. Applications of fluidized bed reactors include but are not limited to gas-solid reactions, Fisher-Tropsch synthesis, and catalytic cracking of hydrocarbons, and related high molecular weight petroleum fractions. Gasification in a fluidized bed can be utilized to convert coal, biomass and other waste materials into synthesis gas.

Flexible Mantle Heaters are wrapped around this 36-inch-long, 1-inch I.D. Fluidized Bed Reactor (A) and the Cyclonic Separator (B) to maintain temperatures to 350 °C. This system is also equipped with three gas feeds with automated shut-off valves (C), a cooling condenser (D), a product receiver (E), a back-pressure regulator (F), and a Model 4871 Process Controller (not shown).

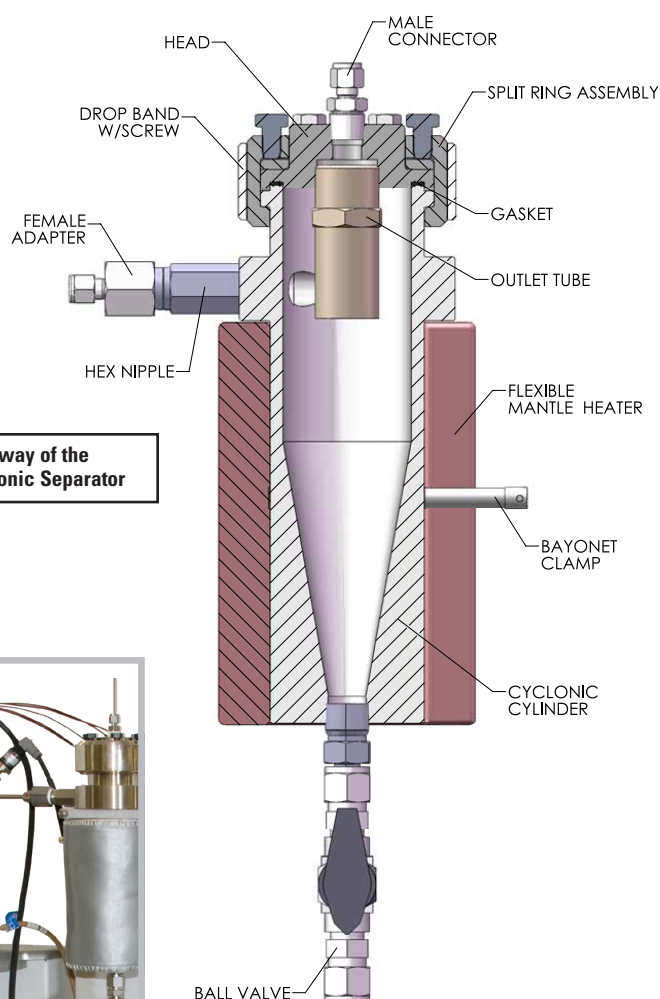
The reactor system pictured at left ([page 84](#)) includes the following key components:

- A gas handling and mixing sub-system used to blend and regulate the flow of reactant gas to the bottom of the reactor.
- A reactor roughly one meter long with a 2.5 cm ID. The lower portion of the reactor incorporates an easily replaced porous metal gas diffusion plate and the top of the reactor widens abruptly to form a disengaging zone for the fluidized bed. Separate heaters are provided for both the main reactor and disengaging zone.
- A moveable thermocouple in a thermowell is provided for monitoring the internal reactor temperature distribution.
- A heated cyclone separator or filter is provided immediately downstream of the reactor to capture the fines resulting from particle attrition.
- The reaction products are then cooled by a condenser and collected in a 600 mL product receiver.
- The system pressure is maintained by an automated, dome-loaded, back pressure regulator.
- All system functions and parameters are monitored and maintained by a Parr 4871 Process Controller (not shown, see [Chapter 6, page 109](#)).



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Ordering Guide



**Cutaway of the
Cyclonic Separator**



The Flexible Mantle Heater attaches in two pieces and provides even heating to the entire length of the reactor.

A Base Model**Model No.**

5410

B Materials of Construction

-SS	T316 Stainless Steel
-HC	Alloy 276
-HT	High Temperature Alloy to be determined (for use up to 900 °C)

See *Materials of Construction* on [page 10](#) for other available alloys

C Electrical Supply

-115	115 VAC
-230	230 VAC

D Maximum Temperature

-350	350 °C
-600	600 °C
-900	900 °C

E Cylinder Length

-(36)	36-inches
-(xx)	Other

F Maximum System Pressure

-500	500 psi / 35 bar
-1500	1500 psi / 100 bar
-3000	3000 psi / 200 bar

G Control

-PCC	PC-based Process Control (4871-style)
-LCS	Local Control System (4838-style)

H Custom Options (List all desired)

-GF(#)	Number of Gas Feeds (1-3 or TBD)
-PL	Purge Gas Feed Line
-LF(#)	Number of Liquid Feeds (1-3 or TBD)
-ITW	Internal Thermowell, with Movable T/C
-IZT	Internal, 3-PT, Fixed T/C
-CCD	Cooling Condenser
-GLS(#)	Gas/Liquid Separator (300, 600, 1000, 2000 mL)
-SPH	Separator Heater
-MPC	Manual Pressure Control
-APC*	Automated Pressure Control
-ASV(#)*	Automated Shut-off Valves (1-12)

*Available only with 4871 Process Control (PCC)

I Certifications

-No Symbol	No Certification Required
-ASME	ASME Certification
-PED	PED Certification
-P	Parr Certification

Please note that all options and combinations are not compatible with all models.