

Series Number:

5410

Type:
Floor Stand

Vessel Geometry:
**1" ID, 36" length,
with 2.5" ID, 2" length
disengagement zone
or custom**

Standard Pressure
MAWP Rating, psi (bar):
**Up to 3000 (207)
based on
temperature**

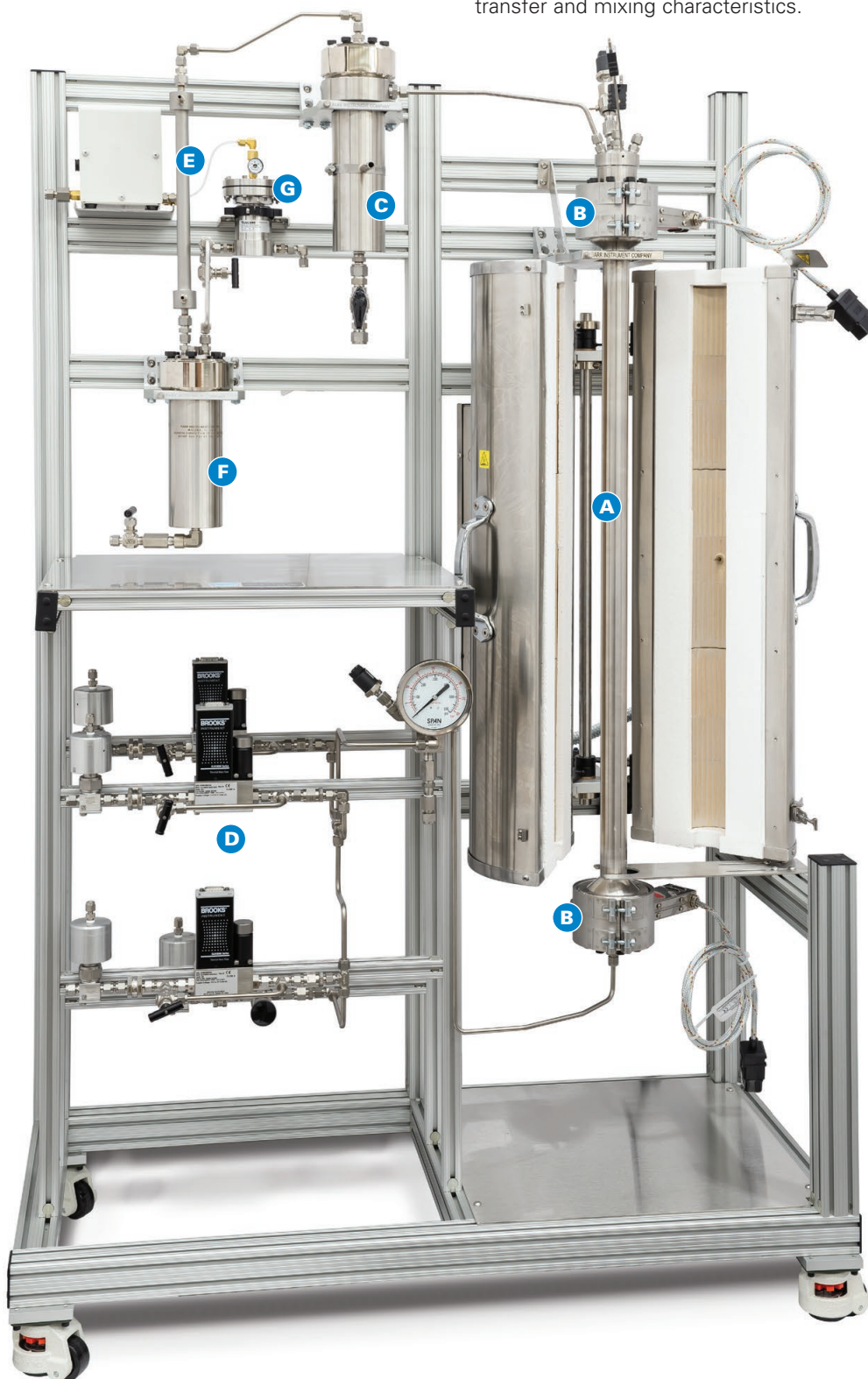
Maximum Operating
Temperature, °C:
350, 600, or >600

A 3-Zone Ceramic Heater, shown open, heats this 36-inch-long, 1-inch I.D. Fluidized Bed Reactor (A) up to 900 °C, band heaters heat the closures (B) up to 350 °C, and a flexible mantle heater (not shown) heats the cyclone separator (C) up to 350°C. This system is also equipped with three gas feeds with automated shut-off valves (D), a cooling condenser (E), a product receiver (F), a back-pressure regulator (G), and a Model 4871 Process Controller (not shown)

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.

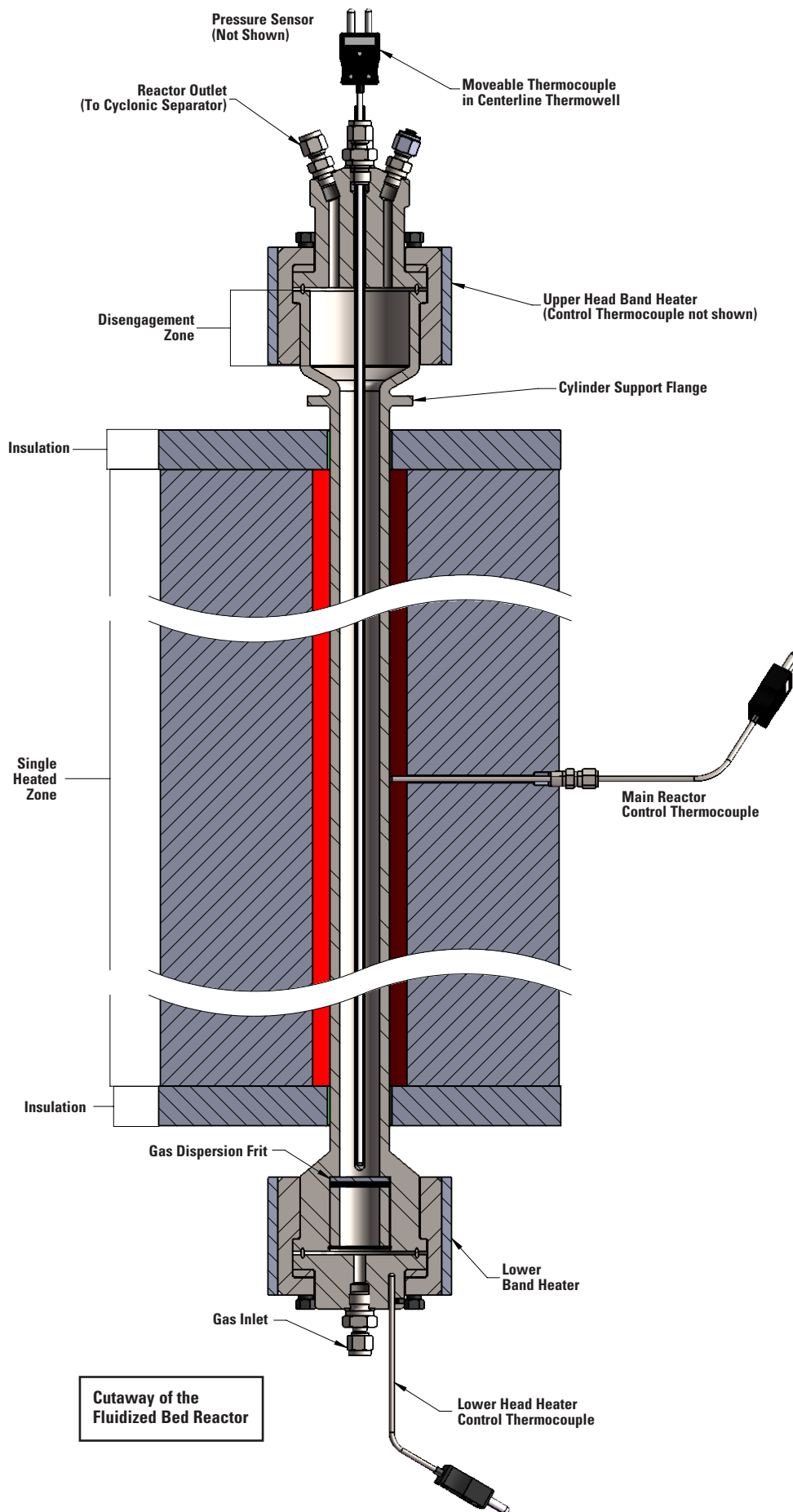


Fluidized beds have been significantly utilized in chemical processes in which parameters such as diffusion or heat transfer are the major design parameters. Compared to packed bed, a fluidized bed has notable advantages such as better control of temperature, no hot spot in the bed, uniform catalyst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

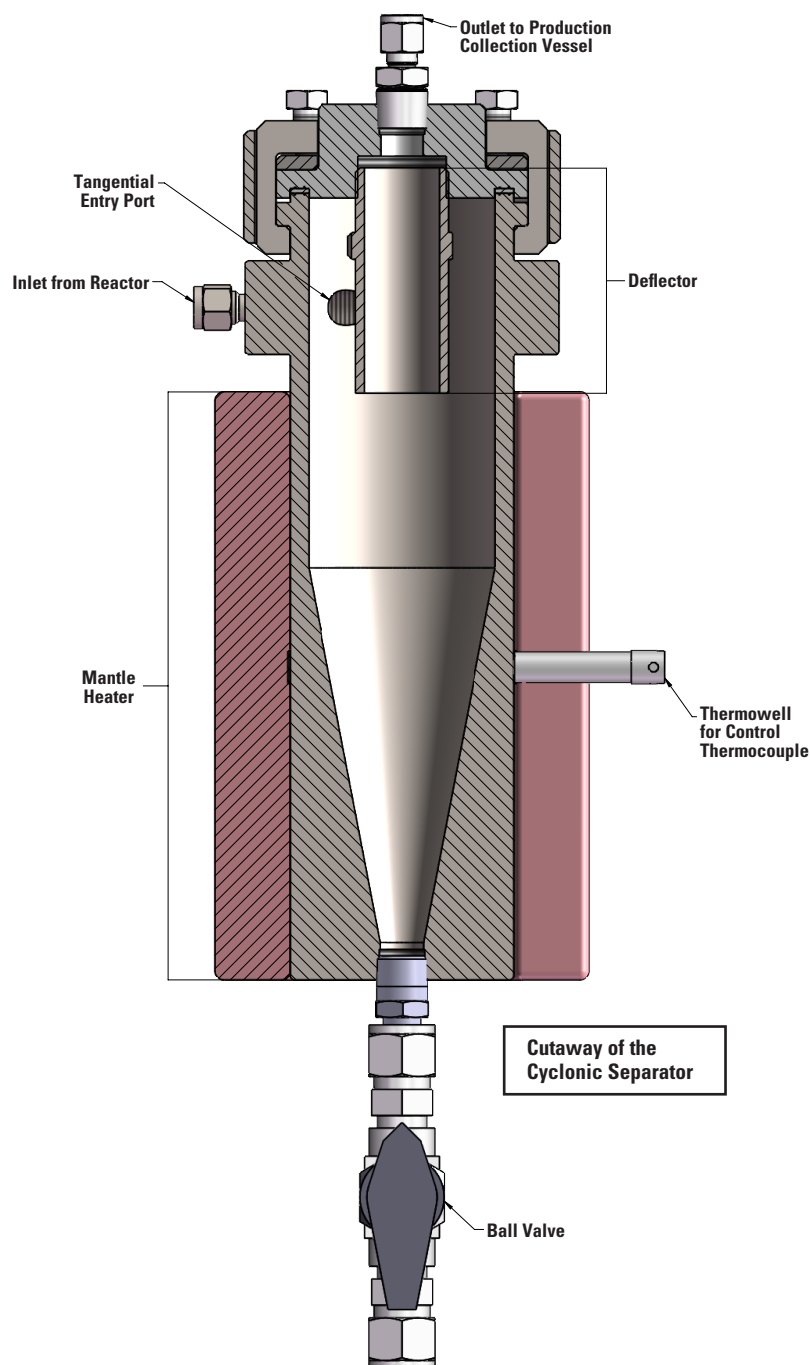
The reactor system pictured at left (page 84) includes the following key components:

- 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).



Fluidized Bed Reactors

Ordering Guide

**A Base Model****Model No.**

5410	1" I.D. w/2.5" I.D. Disengagement Zone
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B Materials of Construction

-SS	T316 Stainless Steel
-HC	Alloy 276
-HT	High Temperature Alloy to be determined

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
->600	> 600 °C

E Cylinder Length

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

F Maximum System Pressure

-200	200 psi / 14 bar
-500	500 psi / 34 bar
-1500	1500 psi / 103 bar
-3000	3000 psi / 207 bar, 200 bar for CE

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 Moveable 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.



The Parr Limited Warranty

Parr Instrument Company (Parr) combustion bombs, calorimeters, reactors, pressure vessels and associated products are designed and manufactured only for use by or under the direct supervision of trained professionals in accordance with specifications and instructions for use supplied with the products. For that reason, Parr sells only to professional users or distributors to such users. Parr produces precision equipment and associated products which are **not intended for general commercial use.**

EXCLUSIVE WARRANTY

To the extent allowed by law, the express and limited warranties herein are the sole warranties. **Any implied warranties are expressly excluded**, including but not limited to implied warranties of merchantability or fitness for a particular purpose.

WARRANTY CONDITIONS:

- 1. Non-assignable.** The warranties herein extend only to the original purchaser-user and to the distributors to such users. These warranties or any action or claims based thereon are **not assignable or transferable.**
- 2. Use of product.** The warranties herein are applicable and enforceable only when the Parr product:
 - a. Is installed and operated in strict accordance with the written instructions for its use provided by Parr.
 - b. Is being used in a lawful manner.
 - c. Has not been modified by any entity other than Parr Instrument Company.
 - d. Has been stored or maintained in accordance with written instructions provided by Parr, or if none were provided, has been stored and maintained in a professionally reasonable manner.
- 3. The user's responsibility.** Parr engineers and sales personnel will gladly discuss available equipment and material options with prospective users, but the final responsibility for selecting a reactor, pressure vessel or combustion bomb which has the capacity, pressure rating, chemical compatibility, corrosion resistance and design features required to perform safely and to the user's satisfaction in any particular application or test must rest entirely with the user – not with Parr. It is also the user's responsibility to install the equipment in a safe operating environment and to train all operating personnel in appropriate safety, operational and maintenance procedures.

- 4. Warranty period.** Unless otherwise provided in writing by Parr, the warranties herein are applicable for a period of one year from date of delivery of the product to the original purchaser/user. Note, however, that there is no guarantee of a service life of one year after delivery.
- 5. Notification.** To enforce any express warranty created herein, the purchaser/user must notify Parr in writing within thirty (30) days of the date any defect is detected. Upon request of Parr, the part or product involved must be returned to Parr in the manner specified by Parr for analysis and non-destructive testing.

EXPRESS WARRANTIES

Subject to the above Conditions, Parr expressly warrants that its products:

1. Are as described in the applicable Parr sales literature, or as specified in Parr shipping documents.
2. Will function as described in corresponding Parr sales bulletins or, for specially engineered assemblies, as stated in the sales proposal and purchase agreement.
3. Will remain free from defects in materials and workmanship for the Warranty Period.

LIMITATIONS ON THE PARR WARRANTY

As to the original purchaser/user and to the distributors to such users, Parr limits its liability for claims other than personal injury as follows:

- 1. Replacement or repair.** With respect to express warranties herein, Parr's only obligation is to replace or repair any parts, assemblies or products not conforming to the warranties provided herein.
- 2. Disclaimer of consequential damages.** In no event shall Parr be liable for consequential commercial damages, including but not limited to: damages for loss of use, damages for lost profits, and damages for resulting harm to property other than the Parr product and its component parts.

INDEMNITY AND HOLD HARMLESS

Original purchaser-user agrees to indemnify and hold Parr harmless for any personal injuries to original purchaser-user, its employees and all third parties where said injuries arise from misuse of Parr products or use not in accordance with specifications and instructions for use supplied with the Parr products.



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