



Stirred Reactors and Pressure Vessels

**Designing
and Building
Quality
Pressure
Apparatus
for Over
100 Years**

Chapter 2



This pdf is chapter two of our Catalog 4500.
Please refer to all five chapters to make the
proper equipment choice for your needs.

10

Stirred Reactors

Reactor Selection Procedure:
Basic Specifications
Guide to Parr Reactors
Standard Reactor Fittings
Options

Series 4590, 25 – 100 mL
Bench Top Micro Reactors

Series 4560, 100 – 600 mL
Bench Top Mini Reactors

Series 4520, 1000 & 2000 mL
Bench Top Reactors

Series 4530, 1000 & 2000 mL
Cart & Floor Stand Reactors

Series 4540, 600 & 1200 mL
Bench and Floor Stand
Reactors

Series 4550, 1 & 2 Gallon
Floor Stand Reactors

Series 4555-4556, 10 & 20 L
Pressure Reactors

Series 4570 and 4580
250 – 5500 mL
High Pressure / High
Temperature Reactors

Series 5000
Multiple Reactor System

Series 5500
High Pressure
Compact Reactors

Series 5100
Low Pressure (Glass)
Reactors

Reactor Selection Procedure

Parr has continued to revamp and expand its line of stirred reactors to give the user many additional choices when selecting a reactor for a specific set of operating conditions. New models have been added and the number of available options has been greatly expanded. But the selection

process remains the same. It should start with the establishment of the **Four Basic Specifications** discussed below. Having set these requirements, the user can then identify a suitable **Series** group from the **Guide**. A list of **Standard Reactor Fittings** is provided to confirm the basic capabilities

included with each reactor. Finally, the **Principal Options** should be considered to establish the detailed specifications for specifying the reactor using the catalog number and ordering guide.

1 Establish Basic Specifications

Four Basic Specifications

1. Vessel Size

Parr stirred reactors are offered in many sizes ranging from 25 mL to 18.75 liter (5 gallon). It should be noted that the size numbers refer to the free space in the vessel, and for safe operation the maximum liquid charge held in the vessel used in sealed batch operations should not exceed two-thirds of the available free space. Generally, several vessel volumes are offered within most series, and reactor sizes can be reconfigured with conversion parts. It is also true that the larger sizes are usually more expensive, but the price volume curve is not a smooth one.

2. Maximum Operating Pressure

Parr offers three basic operating ranges: 1900 psi for general purpose, 5000 psi for high pressure applications, and because of the nature of the design process, the small Micro and Mini Reactors (25 to 600 mL) can be rated at a higher, 3000 psi (200 bar) maximum pressure. Since these models are less expensive and much easier to handle than reactors designed for higher pressures, they are an attractive choice for use in the moderate pressure range. Substantial savings are available if the user can avoid the tendency to over-specify the expected operating pressure. ASME design criteria provides for an inherent 3.5:1 safety factor, typically sufficient for most applications.

3. Maximum Operating Temperature

Traditionally the choices here have been up to 350 °C for vessels with PTFE gaskets and up to 500 °C for flexible graphite (previously metal gaskets.) Parr has now added the option of a self sealing O-ring closure for general purpose vessels with volumes from 25 mL to 7.5 liters. These quick closing designs are practically limited to 225 °C although this can be raised to 275 °C with exotic/expensive O-ring materials.

4. Mounting Style

There are actually two aspects to the mounting question: the first is bench top or floor stand. This choice is generally limited to reactors with volumes of 600 mL thru 2 liters since reactors smaller than that are normally mounted on the bench, and larger reactors are restricted to cart or floor stand mountings. Generally a broader motor choice and better access to a bottom drain valve are available on cart or floor stand models.

A second mounting choice is between a moveable vessel or fixed head design. In the moveable vessel style the complete vessel assembly (only the head in 1 gallon and larger) is removed from the heater for charging, product recovery and vessel cleaning. As the description implies, in the fixed head style the head remains fixed in the mounting and the reactor cylinder and heater drop away to open the vessel. The fixed head design is a recent addition to the Parr line in response to those users who wish to leave inlet and feed lines, discharge and vent lines, condensers and similar connections undisturbed between runs. This option is available on all Parr reactors except the Series 4555/56 vessels.

2 Select Appropriate Series

Guide to Parr Stirred Reactors

Model Numbers	Reactor Type	Nominal Size	Maximum Pressure psig (bar)	Maximum Temperature °C	See Page Number
4591-4598	Micro, Bench Top	25-100 mL	3000 (200)	225 to 350	29
4561-4568	Mini, Bench Top	100-600 mL	3000 (200)	225 to 350	34
4523-4526	Mid-Size, Bench Top & Floor Stand	1000 and 2000 mL	1900 (130)	225 to 350	38
4531-4536	Mid-Size, Cart or Floor Stand	1000 and 2000 mL	1900 (130)	225 to 350	42
4544-4547	High Press./Moderate Temp., Bench and Floor	600 and 1200 mL (3.75 and 7.5L)	5000 (345)	350	46
4551-4554	General Purpose, Cart or Floor Stand	1 and 2 gallon (3.75 and 7.5L)	1900 (130)	225 to 350	50
4555-4556	General Purpose, Floor Stand	5 and 2.6 gallon (18.75 and 10L)	1900 (130)	350	54
4571-4572 4577-4578	High Press./High Temp., Floor Stand	1000 and 1800 mL	5000 (345)	500	58
4575-4576 4575A-4576A	High Press./High Temp., Bench Top & Floor Stand	500 and 250 mL	5000 (345)	500	58
4581-4584	High Press./High Temp., Floor Stand	1 and 1.5 gallon (3.75 and 5.5L)	3000 (200)	500	58

Size

25 mL	18.75 L
-------	---------

Parr Instrument Company offers laboratory reactors and pressure vessels in sizes from 25 mL to 18.75 L. Generally it is best to select a size that will allow for 1/3 free space. This allows for some liquid expansion during the heating phase of a reaction.

Pressures (psi)

1900	3000	5000
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Maximum operating pressures are determined by adherence to the ASME pressure vessel design criteria. There are three ranges; up to 1900 psi, up to 5000 psi, and in most cases reactors in the 25 mL to 600 mL range can be rated to 3000 psi.

Temperatures

350 °C	500 °C
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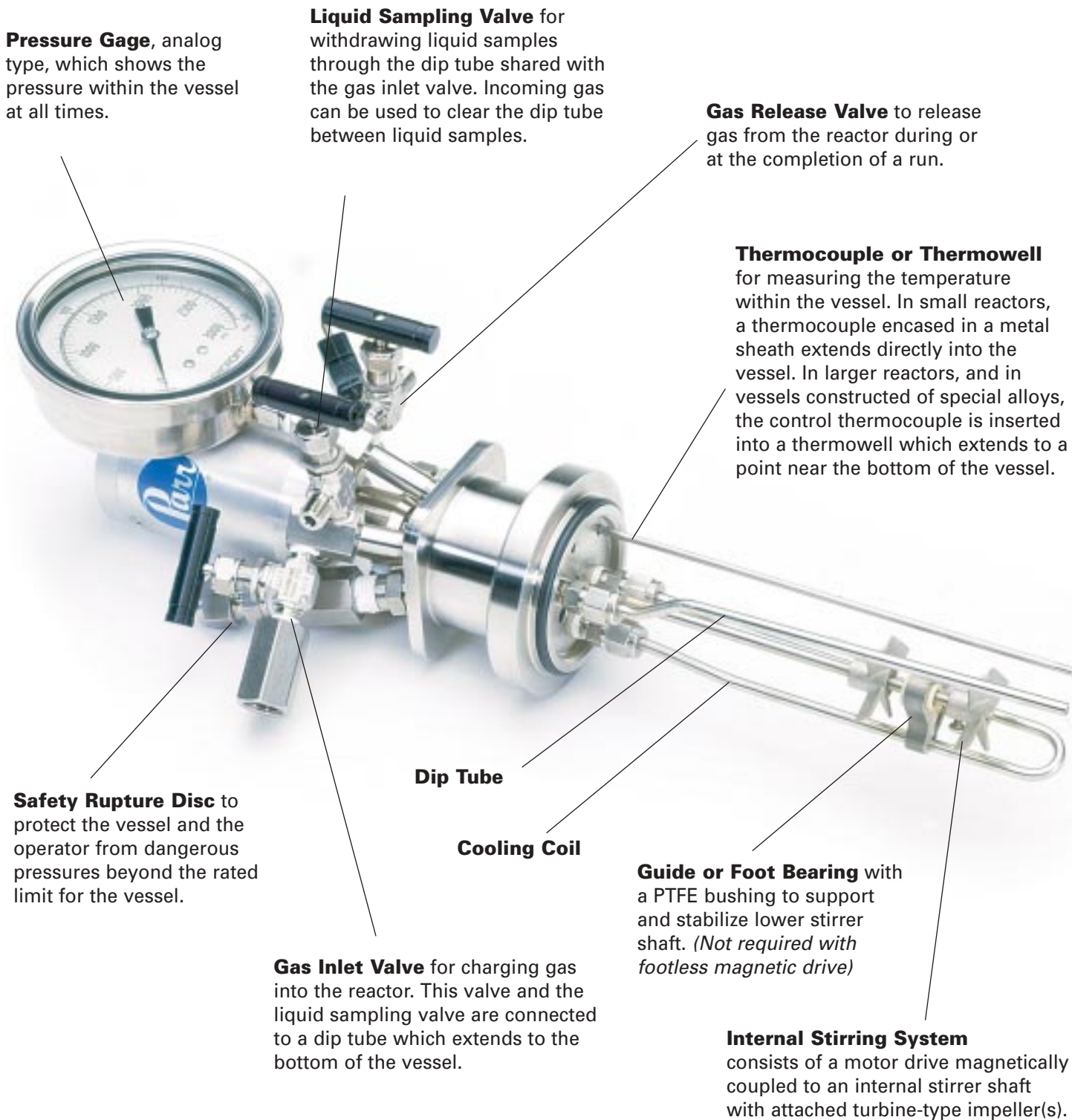
Operating Temperatures have traditionally been up to 350 °C using a flat PTFE gasket. Other materials have now extended the range to 500 °C. New quick opening designs have been added to the Parr product line that use O-rings for the seal and normally limit the temperature to 225 °C.

It is possible to convert most of these reactors from one size to another within the same series. This is done by substituting a longer or shorter cylinder with corresponding internal fittings including the stirrer shaft, thermowell or thermocouple, dip tube and cooling coil (if installed). In some cases, the heater will also need to be changed. The Parr Technical Service department will be happy to provide a list of the appropriate conversion parts for any contemplated conversion.

3

Confirm Standard Fittings

Standard Reactor Fittings



4

Specify Detailed Options

Options

There are a number of options to be considered and selections to be made in order to complete the specifications for a reactor. These include:

- 1. Material of Construction.**
The majority of organic reactions can be handled in stainless steel, but ten other corrosion resistant alloys are available to provide vessels suitable for use with a wide range of corrosive acids, bases, salts and gases. Special alloy construction can be provided for both the internal parts of the vessel and the external valves and fittings, but there is a considerable cost savings if the user will accept standard external parts made of stainless steel instead of a special alloy.
- 2. Magnetic Drive.**
On all but the smallest reactors the standard magnetic drive can be replaced with a higher torque model to handle high viscosity stirring loads. The general purpose drive may be replaced with the Footless design where appropriate. The standard drives furnished on all reactors will normally handle viscosity up to 25,000 centipoise. Materials of construction must be specified separately.
- 3. Stirrer Drive Motor.**
High viscosity materials will also dictate the choices of a larger stirrer drive motor and possibly an alternate power train.
- 4. Cooling Coil.**
An internal cooling coil can be installed in all reactors (except the Micro sizes) to remove the heat of a reaction and/or to cool the vessel at the end of a run. In some reactors a cooling coil is furnished as a standard fitting. In others, a coil can be added as an option in either spiral or serpentine configurations.
- 5. Gage and Rupture Disc Ranges.**
These components are available in many ranges and resolutions appropriate for both the reactor and the intended work to be accomplished.

- 6. Instrumentation Package.**
Two different temperature controllers and an alternate computer-based process controller are available, each with optional add-on modules for pressure measurement, high temperature cut-off, stirring speed and stirring load display.
- 7. Certification.**
ASME, CE-PED and Parr Certifications are available for users who require these recognized quality assurance certifications.
- 8. Electrical Supply.**
Parr reactors can be furnished to draw power from any standard electric supply system in the world.
- 9. Custom Options.**
A wide range of custom options such as special openings in the head or cylinder, high viscosity stirrers, windows, special valves, custom heaters or jackets, explosion proof wiring and volume modifications are available.

- 10. Accessories.**
Various accessories, such as glass and PTFE liners, condensers, catalyst holders and alternate stirrers are available to further adapt these reactors to the individual user's applications.
Detailed information for each of the above options, and for additional selections as well, is provided on pages listed in the Index to the right.

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*May require modifications of vessel to install

4590 Series 4590 Micro Reactors



Series Number:
4590

Type:
Bench Top Micro Reactor

Vessel:
Moveable or Fixed Head

Sizes:
25, 50, 100 mL

Maximum Operating Pressure:
3000 psi (200) bar

Maximum Operating Temperature:
225 °C w/ FKM O-ring
275 °C w/ FFKM O-ring
350 °C w/ PTFE Flat Gasket



4592 Micro Reactor, 50 mL, Fixed Head, with 4843 Controller

These are the smallest of all Parr Stirred Reactors. They will be a good choice for chemists working with very expensive materials or materials only available in small amounts. They will also appeal to users who wish to minimize the risks associated with hazardous materials or reactions by restricting the reactants or products to a minimum. They also minimize the quantities of waste products which may require special disposal procedures.

These micro reactors have been designed to provide as many of the features of the

larger vessels as possible in the limited space available. All of the standard head fittings are provided, but cooling is not available unless some of the normal fittings are eliminated. Alternately available are aluminum block heaters with cooling capability or welded jackets.

These systems are offered in both fixed head and moveable head vessel styles with a choice of either a self sealing O-ring for temperatures up to 225 °C or with FFKM O-ring for temperatures to 275 °C or with a flat, PTFE gasket for higher temperatures to 350 °C. A split ring closure is standard.

The 25 and 50 mL micro reactors use band heaters which clamp directly onto the cylinder which has a limited surface area available for heat transfer. The 100 mL micro reactors use mantle heaters.

These micro reactors can be easily converted from one size to another by simply substituting a larger or smaller cylinder and the corresponding internal fittings. The support system can also be readily adapted to accept any of the vessels from the 4560 Mini Reactor Series. The opportunity to modify these small reactors is restricted because of the limited head space available.

Series 4590 Reactor Specifications						
Shaded bar indicates specifications that change within series.						
Model Number	4591	4592	4593	4596	4597	4598
Sizes, mL	25	50	100	25	50	100
Maximum Pressure	3000 psi (200 bar)					
Maximum Temperature						
with FKM O-ring	225 °C Screw Cap or Split Rings					
with FFKM O-ring	275 °C Screw Cap or Split Rings					
with PTFE Flat Gasket	350 °C Split Rings					
Vessel Style	Moveable			Fixed Head		
Reactor Mounting	Bench Top					
Closure (Cap Screws)	Split-Rings (6)					
Valve Connections	1/8" NPT Male					
Magnetic Stirrer, Model No.	A1120HC6					
Maximum Torque	16 Inch-Pounds					
Impeller(s), 4-Blade	1					
Pressure Gage, Size	3.5 inches					
Range	0-3000 psi (200 bar)*					
Temperature Measurement	Fixed Thermocouple					
Cooling Coil	Not Available					
Style	Not Available					
Bottom Drain Valve	Not Available					
Heater Style	Clamp-on		Mantle	Clamp-on		Mantle
Heater Power Watts	400					
Stirrer Motor	1/8 hp Variable Speed*					
Electrical Supply						
Volts	115 or 230					
Maximum Load, 115 / 230	12 / 6 amps					
Vessel Dimensions						
Inside Diameter, inches	1.0	1.3	1.3	1.0	1.3	1.3
Inside Depth, inches	2.0	2.3	4.6	2.0	2.3	4.6
Weight of Vessel, pounds	7	7	8	7	7	8
Reactor Dimensions						
Width, inches w/o Controller	11.5					
Depth, inches	17.5					
Height, inches	25.5					
Weight, pounds	55	55	56	56	56	57
Spare Parts Kit	4599M					
* Other options available. See Options Section and Ordering Guide						



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Model 4593 Reactor, Moveable Vessel, 100 mL, with PTFE Compression Gasket, and Split Ring Closure



Model 4793A, 100 mL, Moveable Vessel Assembly

Series 4590 Ordering Guide

A composite identification number to be used when ordering a 4590 Series Reactor can be developed by combining individual symbols from the separate sections.
Example: A 50 mL, T316SS, moveable head reactor with general purpose magnetic drive, O-ring seal, 115V, explosion proof motor, 3000 psi gage and PID controller with pressure display module would be listed as: **No. 4592-O-GP-SS-115-XP.25-3000-4842-PDM**

A. Model	B. Gasket	C. Stirrer	D. Material	E. Voltage	F. Motor	G. Gage	H. Controller	I. Options
No. 4592	-O	-GP	-SS	-115	-XP.25	-3000	-4842	-PDM

A. Base Model		
Model No.	Size	Vessel Style
4591	25 mL	Moveable
4592	50 mL	Moveable
4593	100 mL	Moveable
4596	25 mL	Fixed Head
4597	50 mL	Fixed Head
4598	100 mL	Fixed Head

B. Gasket / Maximum Temperature		
-O	FKM O-ring, 225 °C	FFKM O-ring, 275 °C
-T	PTFE Compression Gasket, 350 °C	

C. Stirrer Drive	
-GP	General Purpose Magnetic

D. Materials of Construction	
-SS	T316 Stainless Steel
-M0	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastelloy C-2000
-CS	Alloy 20Cb3
-Ti2	Titanium Grade 2
-Ti4	Titanium Grade 4
-NI	Nickel 200
-Zl	Zirconium 702 or 705

E. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

F. Motor Option	
-VS .12	Variable Speed, 1/8 hp
-VS .25	Variable Speed, 1/4 hp
-XP .25	Explosion Proof, Variable Speed, 1/4 hp
-AM .25	Air Motor, 1/4 hp

G. Pressure Gage	
-3000	3000 psi / 200 bar
-2000	2000 psi / 140 bar
-1000	1000 psi / 70 bar
-600	600 psi / 40 bar
-200	200 psi / 14 bar
-100	100 psi / 7 bar

H. Temperature Controller	
-4842*	PID Control
-4843*	Programmable Control
-4835	Compact Control PID
-4836*	Compact Control Ramp & Soak
-4870	Process Controller
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

I. Control Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module
-HTM*	High Temperature Cut-off Module
-AMM*	Ammeter Display Module
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module
-4846	Data Acquisition System

J. Custom Options (List All Desired)	
-RC	Reflux Condenser
-RTC	Reflux Take-off Condenser
-GE	Gas Entrainment Stirrer
-ABH	Aluminum Block Heater
-WJ	Welded Jacket

K. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification
-P	Parr Certification

4560 Series 4560 Mini Bench Top Reactors



Series Number:
4560

Type:
**Bench Top
Mini Reactor**

Vessel:
Moveable or Fixed

Sizes:
100-600 mL

Maximum Operating Pressure:
3000 psi (200) bar

Maximum Operating Temperature:
**225 °C
w/ FKM O-ring
275 °C
w/ FFKM O-ring
350 °C
w/ PTFE Flat Gasket**

These are the most popular of all Parr Stirred Reactors. Although they are called “Mini” reactors, they offer a range of sizes large enough to work with significant sample sizes, yet small enough to be handled with ease by all operators. They are made in both fixed head and moveable vessel styles, with a choice of either a self-sealing O-ring closure with no cap screws for working temperatures up to 225 °C, or with a flat, PTFE gasket for higher temperatures up to 350 °C sealed with six cap screws in a split-ring cover clamp.

Although internal and external space is limited in these small vessels, gas entrainment impellers, catalyst baskets, condensers and other options are available. All reactors in this series can also be easily converted from one size to another by simply substituting a longer or shorter cylinder and the corresponding internal fittings and heaters. The heaters for these vessels are sized to the cylinder dimensions. When converting volumes it is acceptable to use a larger volume cylinder in a smaller heater, but not a smaller cylinder in a larger heater. The heaters are designed to be in full contact with the cylinder. An air gap below a smaller vessel will cause the heater to burn-out prematurely.

The support system for these Mini Reactors is designed specifically to provide stability at stirring speeds up to 1700 rpm, in a compact mounting small enough to fit into a laboratory hood. The support system can also be adapted to accept any of the smaller vessels from the 4590 Micro Reactor Series.



Model 4566 Mini Reactor, Fixed Head, 300 mL, with O-ring Seal, Open Position



Model 4566 Mini Reactor, Fixed Head, 300 mL, Closed Position

Series 4560 Reactor Specifications										
Shaded bar indicates specifications that change within series.										
Model Number	4561	4562	4563	4564	4565	4566	4567	4568	4566B	4566C
Sizes, mL	300	450	600	160	100	300	450	600	160	100
Maximum Pressure	3000 psi (200 bar)									
Maximum Temperature										
with FKM O-ring	225 °C									
with FFKM O-ring	275 °C									
with PTFE Flat Gasket	350 °C									
Vessel Style	Moveable					Fixed Head				
Reactor Mounting	Bench Top									
Closure (Cap Screws)	Split-Ring (6)									
Valve Connections	1/8" NPT Male									
Magnetic Stirrer, Model No.	A1120HC6									
Maximum Torque	16 Inch-Pounds									
Impeller(s), 4-Blade	1	1	2	1	1	1	1	2	1	1
Pressure Gage, Size	3.5 inches									
Range	0-3000 psi (200 bar)*									
Temperature Measurement	Fixed Thermocouple									
Cooling Coil	Included			Not Included		Included			Not Included	
Style	Single Loop									
Bottom Drain Valve	A485VB, 1/4" NPT									
Heater Style	Mantle			Clamp-on		Mantle			Clamp-on	
Heater Power Watts	400	590	780	500	500	400	590	780	500	500
Stirrer Motor	1/8 hp variable speed*									
Electrical Supply										
Volts	115 or 230									
Maximum Load, 115 / 230	12 / 6* amps									
Vessel Dimensions										
Inside Diameter, inches	2.5	2.5	2.5	2.5	2	2.5	2.5	2.5	2.5	2
Inside Depth,inches	4	6	8	2	2	4	6	8	2	2
Weight of Vessel, pounds	10	13	16	8	9	12	15	18	8	9
Reactor Dimensions										
Width, inches w/o Controller	11.5									
Depth, inches	17.5									
Height, inches	25.5	29.5	33.5	25.5	25.5	25.5	29.5	33.5	25.5	25.5
Weight, pounds w/ Controller	60	63	66	60	60	62	65	68	60	60
Spare Parts Kit	4569M									
* Other options available. See Options Section and Ordering Guide										



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Model 4563 Mini Reactor, 600mL, Moveable Vessel, Flat Gasket Seal, with Vessel Disassembled, and 4843 Controller



300 mL, 100 mL, 450 mL, 160 mL, and 600 mL Cylinders

Series 4560 Ordering Guide

A composite identification number to be used when ordering a 4560 Series Reactor can be developed by combining individual symbols from the separate sections.

Example: A 600 mL, T316SS, moveable head reactor with general purpose magnetic drive, O-ring seal, 115V, explosion proof motor, 3000 psi gage and PID controller with pressure display module would be listed as: **No. 4563-O-GP-SS-115-XP.25-3000-4842-PDM**

A. Model	B. Gasket	C. Stirrer	D. Material	E. Voltage	F. Motor	G. Gage	I. Controller	J. Options
No. 4563	-O	-GP	-SS	-115	-XP.25	-3000	-4842	-PDM

A. Base Model		
Model No.	Size	Vessel Style
4561	300 mL	Moveable
4562	450 mL	Moveable
4563	600 mL	Moveable
4564	160 mL	Moveable
4565	100 mL	Moveable
4566	300 mL	Fixed Head
4567	450 mL	Fixed Head
4568	600 mL	Fixed Head
4566B	160 mL	Fixed Head
4566C	100 mL	Fixed Head

B. Gasket / Maximum Temperature		
-O	FKM O-ring, 225 °C	FFKM O-ring, 275 °C
-T	PTFE Compression Gasket, 350 °C	

C. Magnetic Stirrer Drive	
-GP	General Purpose, 16 in.-lb.
-FMD1	Footless, 16 in.-lb.

D. Materials of Construction	
-SS	T316 Stainless Steel
-M0	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastelloy C-2000
-CS	Alloy 20Cb3
-Ti2	Titanium Grade 2
-Ti4	Titanium Grade 4
-NI	Nickel 200
-Zl	Zirconium 702 or 705

E. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

F. Motor Option	
-VS .12	Variable Speed, 1/8 hp
-VS .25	Variable Speed, 1/4 hp
-XP .25	Explosion Proof, Variable Speed, 1/4 hp
-AM .25	Air Motor, 1/4 hp

G. Pressure Gage	
-3000	3000 psi / 200 bar
-2000	2000 psi / 140 bar
-1000	1000 psi / 70 bar
-600	600 psi / 40 bar
-200	200 psi / 14 bar
-100	100 psi / 7 bar

H. Bottom Drain Valve	
-No Symbol	No Bottom Drain Valve
-BDV	Bottom Drain Valve Installed

I. Temperature Controller	
-4842*	PID Control
-4843*	Programmable Control
-4835	Compact Controller PID
-4836*	Compact Controller Ramp & Soak
-4870	Process Controller
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

J. Control Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module
-HTM*	High Temperature Cut-off Module
-AMM*	Ammeter Display Module
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module
-4846	Data Acquisition System

K. Custom Options (List All Desired)			
-AS	Anchor Stirrer	-RC	Reflux Condenser
-SB	Static Catalyst Basket	-RTC	Reflux Take-off Condenser
-CAD	Catalyst Addition Device	-SCP	Solids Charging Port
-BF	Baffles	-ABH	Aluminum Block Heater
-GE	Gas Entrainment Stirrer	-WJ	Welded Jacket

L. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification/Pressure
-P	Parr Certification

4520

1 & 2 Liter Bench Top Reactors



Series Number:
4520

Type:
General Purpose
Bench Top Reactor

Vessel:
Moveable or Fixed

Sizes:
1000-2000 mL

Maximum Operating
Pressure:
1900 psi (130) bar

Maximum Operating
Temperature:
225 °C
w/ FKM O-ring
275 °C
w/ FFKM O-ring
350 °C
w/ PTFE Flat Gasket

These are the largest of the Parr Reactors that can be handled on a bench top. They can be furnished with either a self-sealing, O-ring closure for working temperatures up to 225 °C or with a flat, PTFE gas-ket for higher temperatures to 350 °C. Both fixed head and moveable vessel designs are available. It should be noted, however, that the 2 liter, fixed head model is tall and may not be convenient to operate on a standard height bench top. We recommend using a floor stand. (See Series 4530)

With their larger diameter, these mid-size reactors have sufficient space for special modifications, such as: an internal cooling coil, a bottom drain valve, a ball valve for a solids charging port, catalyst addition devices, condensers, electrical feed-throughs and more. Details are provided in the Options Section.

The standard stirrer drive on these 4520 Models works well for reaction mixtures with viscosity up to 25,000 centipoise. For heavier stirring loads, these reactors can be equipped with larger magnetic drives, more powerful motors and drive trains capable of delivering additional stirring torque.



Model 4523 Fixed Head Reactor Open to Show Internal Fittings, with 4843 Controller



Model 4523 Bench Top Reactor, 1000 mL, Fixed Head, with 4843 Controller

Series 4520 Reactor Specifications				
Shaded bar indicates specifications that change within series.				
Model Number	4523	4524	4525	4526
Sizes, mL	1000	2000	1000	2000
Maximum Pressure	1900 psi (130 bar)			
Maximum Temperature				
with FKM O-ring	225 °C			
with FFKM O-ring	275 °C			
with PTFE Flat Gasket	350 °C			
Vessel Style	Fixed Head		Moveable	
Reactor Mounting	Bench Top or Floor Stand			
Closure (Cap Screws)	Split-Ring (6)			
Valve Connections	1/8" Male NPT			
Magnetic Stirrer, Model No.	A1120HC6			
Maximum Torque	16 Inch-Pounds			
Impeller(s), 6 blades	2			
Pressure Gage, Size	4.5 inches			
Range	0-2000 psi (140 bar)*			
Temperature Measurement	Thermowell			
Cooling Coil	Optional			
Style	Serpentine or Spiral			
Bottom Drain Valve	A465VB 3/8" NPT			
Heater Style	Calrod			
Heater Power Watts	1000	1500	1000	1500
Stirrer Motor	1/8 hp variable speed*			
Electrical Supply				
Volts	115 or 230			
Maximum Load, 115/230	14 / 7 amps*			
Vessel Dimensions				
Inside Diameter, inches	4.0			
Inside Depth,inches	5.4	10.5	5.4	10.5
Weight of Vessel, pounds	28	32	32	36
Reactor Dimensions				
Width, inches w/o Controller	16.5			
Depth, inches	23.5			
Height, inches	36	48	36	48
Weight, pounds	125	130	120	125
Spare Parts Kit	4509M			
* Other options available. See Options Section and Ordering Guide				

4520 Series 4520 Options



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Model 4525 Reactor, 1000 mL, Moveable Vessel, and 4842 Controller



Model 4642 Stirred Vessel Assembly, 2000 mL

Model 4524 Reactor, 2000 mL, Fixed Head Style, with Aluminum Block Heater, and 4843 Controller



Series 4520 Ordering Guide

A composite identification number to be used when ordering a 4520 Series reactor can be developed by combining individual symbols from the separate sections.
Example: A 2000 mL, T316SS, reactor with fixed head, general purpose magnetic drive, PTFE Gasket, 115V, explosion proof 1/4 hp motor, 2000 psi gage and PID controller with pressure display module would be listed as: **No. 4524-T-GP-SS-115-XP.25-2000-4842-PDM**

A. Model	B. Gasket	C. Stirrer	D. Material	E. Voltage	F. Motor	G. Gage	J. Controller	K. Options
No. 4524	-T	-GP	-SS	-115	-XP.25	-2000	-4842	-PDM

A. Base Model		
Model No.	Size	Vessel Style
4523	1000 mL	Fixed
4524	2000 mL	Fixed
4525	1000 mL	Moveable
4526	2000 mL	Moveable

B. Gasket / Maximum Temperature	
-O	FKM O-ring, 225 °C
-T	Compression Gasket, 350 °C

C. Magnetic Stirrer Drive	
-GP	General Purpose, 16 in.-lb.
-HD	Heavy Duty, 60 in.-lb.
-FMD1	Footless, General Purpose, 16 in.-lb.
-FMD2	Footless, Heavy Duty, 60 in.-lb.

D. Materials of Construction	
-SS	T316 Stainless Steel
-M0	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastelloy C-2000
-CS	Alloy 20Cb3
-TI2	Titanium Grade 2
-TI4	Titanium Grade 4
-NI	Nickel 200
-Zl	Zirconium 702 or 705

E. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

F. Motor Option	
-VS .12	Variable Speed, 1/8 hp
-VS .25	Variable Speed, 1/4 hp
-VS .50	Variable Speed, 1/2 hp
-XP .25	Explosion Proof, Variable Speed, 1/4 hp
-XP .50	Explosion Proof, Variable Speed, 1/2 hp
-AM .25	Air Motor, 1/4 hp
-AM .50	Air Motor, 1/2 hp

G. Pressure Gage	
-3000	3000 psi / 200 bar
-2000	2000 psi / 140 bar
-1000	1000 psi / 70 bar
-600	600 psi / 40 bar
-200	200 psi / 14 bar
-100	100 psi / 7 bar

H. Internal Cooling Coil	
-No Symbol	No Coil
-CC	Spiral Coil
-SC	Serpentine Coil

I. Bottom Drain Valve	
-No Symbol	No Bottom Drain Valve
-BDV	Bottom Drain Valve

J. Temperature Controller	
-4842*	PID Control
-4843*	Programmable Control
-4870	Process Controller
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

K. Control Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module
-HTM*	High Temperature Cut-off Module
-AMM*	Ammeter Display Module
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module
-4846	Data Acquisition System

L. Custom Options (List All Desired)			
-AS	Anchor Stirrer	-RC	Reflux Condenser
-CB	Catalyst Basket	-RTC	Reflux Take-off Condenser
-CAD	Catalyst Addition Device	-SCP	Solids Charging Port
-BF	Baffles	-ABH	Aluminum Block Heater
-GE	Gas Entrainment Stirrer	-WJ	Welded Jacket

M. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification
-P	Parr Certification

4530 Series 4530 1 and 2 Liter Floor Stand Reactors



Series Number:
4530

Type:
General Purpose Floor Stand Reactor

Vessel:
Moveable or Fixed

Sizes:
1000-2000 mL

Maximum Operating Pressure:
1900 psi (130) bar

Maximum Operating Temperature:
225 °C w/ FKM O-ring
275 °C w/ FFKM O-ring
350 °C w/ PTFE Flat Gasket

This series of reactors will appeal to users who have any of the following needs:

• **Reactors Configured for Polymer Studies.** The reactors in this series are mounted on a sturdy floor stand which will accommodate larger stirrer drive motors and stronger power trains than are generally available for the bench top models. With these options it is possible to provide the high torque and low stirring speeds required for work with polymers and other mixtures with a viscosity of 1 million centipoise and more. These mountings are also better suited for the installation of a drain valve in the bottom of the vessel for convenient removal of the reaction mixture while it is still hot.

• **Reactors Requiring Extensive Modifications.** Floor stand mountings provide a good base for reactor modifications and for the addition of accessories, such as: condensers, packed columns, special motors, special heaters, jacketed vessels, automatic valves or regulators, and many others.

• **Reactors that Need to be Moved.** These reactors are designed for use in an area where a bench top is not available. Users who wish to move the reactor to storage when not in use, will appreciate the moveable floor stand design of the Series 4531 and 4532. All of the 1 and 2 liter reactors in this series can be furnished with either a self-sealing, O-ring closure for working temperatures up to 225 °C, or with a flat, PTFE gasket for higher temperatures to 350 °C. Both fixed head and moveable vessel designs are available.



4532 Floor Stand Reactor, 2000 mL, Moveable Vessel on Cart, with 4843 Temperature Controller and Expansion Modules



4642 Moveable Stirred Vessel Assembly, 2000 mL, with Pressure Transducer

Series 4530 Reactor Specifications

Shaded bar indicates specifications that change within series.

Model Number	4531	4532	4533	4534	4535	4536
Sizes, mL	1000	2000	1000	2000	1000	2000
Maximum Pressure	1900 psi (130 bar)					
Maximum Temperature						
with FKM O-ring	225 °C					
with FFKM O-ring	275 °C					
with PTFE Flat Gasket	350 °C					
Vessel Style	Moveable		Fixed Head		Moveable	
Reactor Mounting	Cart		Floor Stand		Floor Stand	
Closure (Cap Screws)	Split-Rings (6)					
Valve Connections	1/8" Male NPT					
Magnetic Stirrer, Model No.	A1120HC*					
Maximum Torque	16 Inch-Pounds					
Impeller(s), 6-Blade	2					
Pressure Gage, Size	4.5 inches					
Range	0-2000 psi (140 bar)*					
Temperature Measurement	Thermocouple					
Cooling Coil	Optional					
Style	Serpentine or Spiral					
Bottom Drain Valve	A465VB 3/8" NPT					
Heater Style	Calrod					
Heater Power Watts	1500	1000	1500	1000	1500	
Stirrer Motor	1/4 hp Variable Speed*					
Electrical Supply						
Volts	115 or 230					
Maximum Load, 115 / 230	12 / 8 amps*					
Vessel Dimensions						
Inside Diameter, inches	4.0					
Inside Depth,inches	5.4	10.5	5.4	10.5	5.4	10.5
Weight of Vessel, pounds	28	32	32	36	28	32
Reactor Dimensions						
Width, inches w/o Controller	35	21	21			
Depth, inches	18	28	28			
Height, inches	50	62	62			
Weight, pounds	200	215	225	240	225	240
Spare Parts Kit	4539M (General Purpose) or 4539MA (Heavy Duty)					
* Other options available. See Options Section and Ordering Guide						

* Other options available. See Options Section and Ordering Guide



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4534 Floor Stand Reactor, 2000 mL, Fixed Head, with Spiral Cooling Coil and Liquid Charging Pipette, in the Open Position



4534 Reactor, Assembled with Heater Raised



4534 Reactor, Assembled with Heater Lowered

Series 4530 Ordering Guide

A composite identification number to be used when ordering a 4530 Series reactor can be developed by combining individual symbols from the separate sections.

Example: A 2000 mL, T316SS, moveable head reactor with heavy duty magnetic drive, PTFE gasket, 115V variable speed 1/4 hp motor, 2000 psi gage and PID controller with tachometer, pressure display module and high temperature cutoff module would be listed as:

No. 4532-T-HD-SS-115-VS.25-2000-4842-TDM-PDM-HTM

A. Model	B. Gasket	C. Stirrer	D. Material	E. Voltage	F. Motor	G. Gage	J. Controller	K. Options
No. 4532	-T	-HD	-SS	-115	-VS.25	-2000	-4842	-TDM -PDM -HTM

A. Base Model		
Model No.	Size	Vessel Style
4531	1000 mL	Moveable, Cart
4532	2000 mL	Moveable, Cart
4533	1000 mL	Fixed Head, Floor Stand
4534	2000 mL	Fixed Head, Floor Stand
4535	1000 mL	Moveable, Floor Stand
4536	2000 mL	Moveable, Floor Stand

B. Gasket / Maximum Temperature		
-O	FKM O-ring, 225 °C	FFKM O-ring, 275 °C
-T	PTFE Compression Gasket, 350 °C	

C. Magnetic Stirrer Drive	
-GP	General Purpose, 16 in.-lb.
-HD	Heavy Duty, 60 in.-lb.
-XHD	Extra Heavy Duty, 120 in.-lb.
-FMD1	Footless, General Purpose, 16 in.-lb.
-FMD2	Footless, Heavy Duty, 60 in.-lb.
-FMD3	Footless, Extra Heavy Duty, 120 in.-lb.

D. Materials of Construction	
-SS	T316 Stainless Steel
-M0	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastelloy C-2000
-CS	Alloy 20Cb3
-TI2	Titanium Grade 2
-TI4	Titanium Grade 4
-NI	Nickel 200
-Zl	Zirconium 702 or 705

E. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

F. Motor Option	
-VS .25	Variable Speed, 1/4 hp
-VS .50	Variable Speed, 1/2 hp
-XP .25	Explosion Proof, Variable Speed, 1/4 hp
-XP .50	Explosion Proof, Variable Speed, 1/2 hp
-AM .25	Air Motor, 1/4 hp
-AM .50	Air Motor, 1/2 hp
-GDD	Geared Direct Drive (Fixed Head Units Only)

G. Pressure Gage	
-3000	3000 psi / 200 bar
-2000	2000 psi / 140 bar
-1000	1000 psi / 70 bar
-600	600 psi / 40 bar
-200	200 psi / 14 bar
-100	100 psi / 7 bar

H. Internal Cooling Coil	
-No Symbol	No Coil
-CC	Spiral Coil
-SC	Serpentine Coil

I. Bottom Drain Valve	
-No Symbol	No Bottom Drain Valve
-BDV	Bottom Drain Valve

J. Temperature Controller	
-4842*	PID Control
-4843*	Programmable Control
-4870	Process Controller
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

K. Control Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module
-HTM*	High Temperature Cut-off Module
-AMM*	Ammeter Display Module
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module
-4846	Data Acquisition System

L. Custom Options (List All Desired)			
-AS	Anchor Stirrer	-RC	Reflux Condenser
-CB	Catalyst Basket	-RTC	Reflux Take-off Condenser
-CAD	Catalyst Addition Device	-WJ	Welded Jacket
-BF	Baffles	-SA	Spiral Stirrer
-GE	Gas Entrainment Stirrer	-PS	Paddle Stirrer
-ABH	Aluminum Block Heater		

M. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification
-P	Parr Certification

4540

Series 4540 600-1200 mL High Pressure Reactors

- 
- Series Number:
4540
- Type:
Bench Top and Floor Stand High Pressure Reactor
- Vessel:
Moveable or Fixed
- Sizes:
600-1200 mL
- Maximum Operating Pressure:
5000 psi (345) bar
- Maximum Operating Temperature:
350 °C w/ PTFE Flat Gasket

This series of stirred reactors has been designed for users who need higher operating pressures than the 2000 to 3000 psi offered by the General Purpose Reactor, but do not require the high operating temperatures provided by the Series 4570 High Pressure-High Temperature Reactors. These reactors offer working pressures to 5000 psi (345 bar) at temperatures to 350 °C.

These vessels have been designed with outside dimensions comparable to the Series 4520 and 4530 Reactors so that they can use the same support system, stirrer drive and heater as these popular general purpose models. This provides not only an attractively priced high pressure/moderate temperature system, but also reactors that can be interchanged with the 1 and 2 liter sizes. The thicker walls required for higher operating pressures reduce the volumes of these reactors to 600 and 1200 mL.

These reactors can be furnished in either the bench top or floor stand mountings. While the 1200 mL reactor is offered as a “bench top model”, it is too tall and too heavy to be handled comfortably on a standard height bench top. It is recommended that the floor stand support option should be selected unless the user has an “adjustable bench top” which will accommodate the overall height of the 1200mL systems.



Model 4544 High Pressure Reactor, 600 mL, Moveable Style Vessel, with Heater Lowered, and a 4842 Controller

Series 4540 Reactor Specifications						
Shaded bar indicates specifications that change within series.						
Model No. - Moveable Vessel	4544	4546	4544A	4546A	4544C	4546C
Model No. - Fixed Head	4545	4547	4545A	4547A		
Sizes, mL	600	1200	600	1200	600	1200
Maximum Pressure	5000 psi (345 bar)					
Maximum Temperature						
with FFKM O-ring	NA					
with PTFE Flat Gasket	350 °C					
Reactor Mounting	Bench Top		Floor Stand		Moveable Cart	
Closure (Cap Screws)	Split-Ring (8)					
Valve Connections	1/4" Male NPT					
Magnetic Stirrer, Model No.	A1120HC*					
Maximum Torque	16 Inch-Pounds					
Impeller(s), 6-Blade	2					
Pressure Gage, Size	4.5 inches					
Range	0-10,000 psi (700 bar)*					
Temperature Measurement	Thermowell					
Cooling Coil	Included					
Style	Single Loop					
Bottom Drain Valve	A177VB 1" NPS					
Heater Style	Calrod					
Heater Power Watts	1500	2000	1500	2000	1500	2000
Stirrer Motor, hp	1/8*	1/8*	1/8*	1/8*	1/4*	1/4*
Electrical Supply						
Volts	115 or 230					
Maximum Load 115 / 230	16 / 8 amps					
Vessel Dimensions						
Inside Diameter, inches	3.25					
Inside Depth, inches	4.7	9.8	4.7	9.8	4.7	9.8
Weight of Vessel, pounds	51	57	51	57	51	57
Reactor Dimensions						
Width, inches	16		18		35	
Depth, inches	23		23		18	
Height, inches	36		75		50	
Weight, pounds	125	135	175	185	175	185
Spare Parts Kit	4549MA		4549MB		4549MB	
* Other options available. See Options Section and Ordering Guide						



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Model 4546C Reactor, 1200 mL, Moveable Head Style, on a Moveable Cart



1200 mL Fixed Head, and 600 mL Moveable Reaction Vessels

Series 4540 Ordering Guide

A composite identification number to be used when ordering a 4540 Series reactor can be developed by combining individual symbols from the separate sections.

Example: A 600 mL, T316SS, moveable head bench top reactor with general purpose footless magnetic drive, PTFE Gasket, 115V, explosion proof 1/4 hp motor, 5000 psi gage and PID controller with pressure display module would be listed as: **No. 4544-T-FMD1-SS-115-XP.25-5000-4842-PDM**

A. Model	B. Gasket	C. Stirrer	D. Material	E. Voltage	F. Motor	G. Gage	J. Controller	K. Options
No.4544	-T	-FMD1	-SS	-115	-XP.25	-5000	-4842	-PDM

A. Base Model		
Model No.	Size	Vessel Style
4544	600 mL	Moveable Bench Top
4544A	600 mL	Moveable Floor Stand
4544C	600 mL	Moveable Cart
4545	600 mL	Fixed Head Bench Top
4545A	600 mL	Fixed Head Floor Stand
4546	1200 mL	Moveable Bench Top
4546A	1200 mL	Moveable Floor Stand
4546C	1200 mL	Moveable Cart
4547	1200 mL	Fixed Head Bench Top
4547A	1200 mL	Fixed Head Floor Stand

B. Gasket / Maximum Temperature	
-T	PTFE Compression Gasket, 350 °C

C. Magnetic Stirrer Drive	
-GP	General Purpose, 16 in.-lb.
-FMD1	Footless, General Purpose, 16 in.-lb,

D. Materials of Construction	
-SS	T316 Stainless Steel
-M0	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastelloy C-2000
-CS	Alloy 20Cb3
-Ti2	Titanium Grade 2
-Ti4	Titanium Grade 4
-NI	Nickel 200
-Zl	Zirconium 702 or 705

E. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

F. Motor Option	
-VS .12	Variable Speed, 1/8 hp
-VS .25	Variable Speed, 1/4 hp
-XP .25	Explosion Proof, Variable Speed, 1/4 hp
-AM .25	Air Motor, 1/4 hp

G. Pressure Gage	
-3000	3000 psi / 200 bar
-5000	5000 psi / 345 bar
-7500	7500 psi / 517 bar
-10000	10000 psi / 700 bar

H. Internal Cooling Coil	
-No Symbol	No Coil
-SC	Serpentine Coil

I. Bottom Drain Valve	
-No Symbol	No Bottom Drain Valve
-BDV	Bottom Drain Valve

J. Temperature Controller	
-4842*	PID Control
-4843*	Programmable Control
-4870	Process Controller
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

K. Control Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module
-HTM*	High Temperature Cut-off Module
-AMM*	Ammeter Display Module
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module
-4846	Data Acquisition System

L. Custom Options (List All Desired)			
-AS	Anchor Stirrer	-RC	Reflux Condenser
-SB	Static Catalyst Basket	-RTC	Reflux Take-off Condenser
-CAD	Catalyst Addition Device	-GE	Gas Entrainment Stirrer
-BF	Baffles		

M. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification
-P	Parr Certification

4550

Series 4550 1 & 2 Gallon Reactors



Series Number:
4550

Type:
**General Purpose Floor
Stand Reactor**

Vessel:
Moveable or Fixed

Sizes:
1 & 2 Gallon

Maximum Operating
Pressure:
1900 psi (130) bar

Maximum Operating
Temperature:
**225 °C
w/ FKM O-ring
275 °C
w/ FFKM O-ring
350 °C
w/ PTFE Flat Gasket**

These 4550 Reactors extend the size range of the 4530 Series to 1 and 2 gallon (3.75 and 7.5 liter) sizes, providing excellent facilities for pilot plant studies. They can be furnished with either a self-sealing O-ring closure for working temperatures up to 225 °C, or with a flat, PTFE gasket for higher temperatures to 350 °C. Both fixed head and moveable head designs are available. The moveable head, Models 4551 and 4552 reactors are designed so that they can be opened or closed conveniently without removing the cylinder from the heater and without auxiliary handling equipment. The split-ring cover clamp sections can be moved into place from the sides, and the cap screws can be tightened with the vessel in place in its heater. The fixed-head versions, Models 4553 and 4554, allow the head (and the connections made to it) to remain in place while the cylinder and heater are lowered with the aid of the included pneumatic lift system.

The 1 gallon size is usually recommended for high viscosity polymer studies, with a bottom drain valve



4551 Floor Stand Reactor, 1 Gallon, with Bottom Drain Valve, and 4842 Temperature Controller

added for convenient product recovery. As with the smaller floor stand models, these larger, self-contained systems can be equipped with a variety of attachments, such as: condensers, solids charging port, bottom drain, special motors,

special heaters, jacketed vessels and automatic valves and regulators. Because of the higher wattage heaters for these reactors, all models in the 4550 Series require a 230 volt power supply.

Series 4550 Reactor Specifications				
Shaded bar indicates specifications that change within series.				
Model Number	4551	4552	4553	4554
Sizes, Gallon (Liter)	1 (3.75)	2 (7.50)	1 (3.75)	2 (7.50)
Maximum Pressure	1900 psi (130 bar)			
Maximum Temperature				
with FKM O-ring	225 °C			
with FFKM O-ring	275 °C			
with PTFE Flat Gasket	350 °C			
Vessel Style	Moveable		Fixed Head	
Reactor Mounting	Cart		Floor Stand	
Closure (Cap Screws)	Split-Ring (10)			
Valve Connections	1/4" Male NPT			
Magnetic Stirrer, Model No.	A1180HC*			
Maximum Torque	60 Inch-Pounds			
Impeller(s), 6-Blades	2			
Pressure Gage, Size	4.5 inches			
Range	0-2000 psi (140 bar)*			
Temperature Measurement	Thermowell			
Cooling Coil	Optional			
Style	Serpentine or Spiral			
Bottom Drain Valve	A465VB 3/8" NPT (Optional)			
Heater Style	Calrod			
Heater Power Watts	2250	3750	2250	3750
Stirrer Motor	1/2 hp variable speed*			
Electrical Supply				
Volts	230			
Maximum Load	16 amps	18 amps	16 amps	18 amps
Vessel Dimensions				
Inside Diameter, inches	6.0			
Inside Depth, inches	8.6	17.2	8.6	17.2
Weight of Vessel, pounds	95	120	115	140
Reactor Dimensions				
Width, inches w/o Controller	35		20	
Depth, inches	18		30	
Height, inches	50		75	
Weight, pounds	265	295	315	345
Spare Parts Kit	4559M			
* Other options available. See Options Section and Ordering Guide				



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Model 4554 Reactor, Fixed Head, Two Gallon Vessel



Model 4554 Reactor Fixed Head, Two Gallon Vessel, Opened to Show Internal Fittings and Serpentine Cooling Coil

Series 4550 Ordering Guide

A composite identification number to be used when ordering a 4550 Series reactor can be developed by combining individual symbols from the separate sections.

Example: A 2 Gallon, T316SS, moveable head cart mounted reactor with a heavy duty magnetic drive, PTFE gasket, 230V, variable speed 1/2 hp motor, 2000 psi gage, serpentine internal cooling coil, bottom drain valve, PID controller with tachometer, pressure display module and high temperature cutoff module would be listed as: **No. 4552-T-HD-SS-230-VS.50-2000-SC-BDV-4842-TDM-PDM-HTM**

A. Model	B. Gasket	C. Stirrer	D. Material	E. Voltage	F. Motor	G. Gage	H. Cooling Coil	Etc.
No.4552	-T	-HD	-SS	-230	-VS.50	-2000	-SC	

A. Base Model		
Model No.	Size	Vessel Style
4551	1 Gallon	Moveable, Cart
4552	2 Gallon	Moveable, Cart
4553	1 Gallon	Fixed Head, Floor Stand
4554	2 Gallon	Fixed Head, Floor Stand

B. Gasket / Maximum Temperature		
-O	FKM O-ring, 225 °C	FFKM O-ring, 275 °C
-T	PTFE Compression Gasket 350 °C	

C. Magnetic Stirrer Drive	
-HD	Heavy Duty, 60 in.-lb.
-XHD	Extra Heavy Duty, 120 in.-lb.
-FMD1	Footless, Heavy Duty, 60 in.-lb.
-FMD3	Footless, Extra Heavy Duty, 120 in.-lb.

D. Materials of Construction	
-SS	T316 Stainless Steel
-M0	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastelloy C-2000
-CS	Alloy 20Cb3
-Ti2	Titanium Grade 2
-Ti4	Titanium Grade 4
-NI	Nickel 200
-Zl	Zirconium 702 or 705

E. Electrical Supply	
-230	230 Volt, 50/60Hz

F. Motor Option	
-VS .50	Variable Speed, 1/2 hp
-XP .50	Explosion Proof, Variable Speed, 1/2 hp
-AM .50	Air Motor, 1/2 hp
-GDD	Geared Direct Drive (Fixed Head Units Only)

G. Pressure Gage	
-3000	3000 psi / 200 bar
-2000	2000 psi / 140 bar
-1000	1000 psi / 70 bar
-600	600 psi / 40 bar
-200	200 psi / 14 bar
-100	100 psi / 7 bar

H. Internal Cooling Coil	
-No Symbol	No Coil
-CC	Spiral Coil
-SC	Serpentine Coil

I. Bottom Drain Valve	
-No Symbol	No Bottom Drain Valve
-BDV	Bottom Drain Valve

J. Temperature Controller	
-4842*	PID Control
-4843*	Programmable Control
-4870	Process Controller
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

K. Control Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module
-HTM*	High Temperature Cut-off Module
-AMM*	Ammeter Display Module
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module
-4846	Data Acquisition System

L. Custom Options (List All Desired)			
-AS	Anchor Stirrer	-RC	Reflux Condenser
-SB	Static Catalyst Basket	-RTC	Reflux Take-off Condenser
-CAD	Catalyst Addition Device	-GE	Gas Entrainment Stirrer
-BF	Baffles		

M. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification
-P	Parr Certification

4555

Series 4555 10-20 L Floor Stand Reactors



Series Number:
4555

Type:
General Purpose Floor Stand Reactor

Vessel:
Moveable

Sizes:
10 & 20 Liter

Maximum Operating Pressure:
1900 psi (130) bar

Maximum Operating Temperature:
350 °C w/ PTFE Flat Gasket

The Model 4555 Reactor with its 5 gallon (18.75 L) capacity is the largest stirred reactor offered by Parr. The 4556 Model is a similar unit with a 10 liter (2.6 gal) volume which falls between the larger 5 gallon design and the smaller 1 and 2 gallon models in the 4550 Series.

These reactors are available only with a flat, PTFE gasket in a moveable head designed for operating temperatures up to 350 °C maximum. A fixed head is not offered because it would become too tall for reasonable operation if equipped with a bottom drain valve, which is usually requested. The vessel is held in a support system which minimizes the physical effort required to handle these heavy components. A hoist attached to a support column provides a convenient means for lifting the head and cylinder out of the stand and transferring these parts to an opening in the right hand table. Since these vessels are usually equipped with a bottom drain, the cylinder will probably remain in the heater most of the time, but it can be lifted out when necessary.

These reactors are generally used for pilot plant or for custom chemical production purposes, usually with a variety of attachments added to the basic units. Special heaters, larger motors, heavier stirrer drives and remote controls appropriate to the size of these reactors have been designed and are available. Other volume, pressure and temperature limits have also been built into



4555 Floor Stand Reactor, 5 Gallon, Electric Hoist, Direct Drive, with 4842 Temperature Controller

these units within the outside dimensions of the 5 gallon system, including a special stirred system rated as high as 5000 psi and 500 °C.

Approximately 7.5 kW of electric power is required to operate these reactors. This is usually too large a load to be drawn from a single phase,

230 volt line. This requirement must therefore be considered carefully when ordering any of these reactors to be sure that the ordered unit is configured to operate on the available power.

Series 4555 Reactor Specifications

Shaded bar indicates specifications that change within series.		
Model Number	4555	4556
Sizes, Gallon (Liter)	5 (18.75)	2.6 (10)
Maximum Pressure	1900 psi (130 bar)	
Maximum Temperature		
with PTFE Flat Gasket	350 °C	
Vessel Style	Moveable	
Reactor Mounting	Floor Stand	
Closure (Cap Screws)	Split-Ring (12)	Split-Ring (10)
Valve Connections	3/8" Male NPT	
Magnetic Stirrer, Model No.	A1750HC*	
Maximum Torque	60 Inch-Pounds	
Impeller(s), 6-Blade	2	
Pressure Gage, Size	4.5 inches	
Range	0-2000 psi (140 bar)*	
Temperature Measurement	Thermowell	
Cooling Coil	Standard	
Style	Serpentine	
Bottom Drain Valve	A285VB 3/4" NPT	
Heater Style	Ceramic, 3-Zone	
Heater Power Watts	7550	
Stirrer Motor	3/4 hp variable speed*	
Electrical Supply		
Volts	230-1P or 400/415-3P	
Maximum Load, amps, 115/230	1P=33 3P=15/leg	
Vessel Dimensions		
Inside Diameter, inches	9.5	7.75
Inside Depth,inches	16.25	12.2
Weight of Vessel, pounds	375	250
Reactor Dimensions		
Width, inches	62	
Depth, inches	24	
Height, inches	91	
Weight, pounds	1000	900
Spare Parts Kit	4559PCM	4559PDM
* Other options available. See Options Section and Ordering Guide		



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Model 4556 Reactor, 10 Liter Vessel, with Head Removed



10 Liter Stirred Vessel



10 Liter Stirred Vessel Removed from Heater

Series 4555 Ordering Guide

A composite identification number to be used when ordering a 4555 Series reactor can be developed by combining individual symbols from the separate sections.

Example: A 5 Gallon, T316SS reactor with a heavy duty magnetic drive, 230 volt, 3/4 hp variable speed motor, 2000 psi pressure gage, serpentine cooling coil, manual bottom drain valve, ceramic three-zone heater, electric hoist, 3:1 gear drive, PID controller with tachometer, pressure display module and high temperature cutoff module would be listed as:

No. 4555-T-HD-SS-230-VS.75-2000-SC-BDV-C3-EH-3D-4842-TDM-PDM-HTM

A. Model	B. Gasket	C. Stirrer	D. Material	E. Voltage	F. Motor	G. Gage	H. Cooling Coil	Etc.
No.4555	-T	-HD	-SS	-230	-VS.75	-2000	-SC	

A. Base Model		
Model No.	Size	Vessel Style
4555	5 Gallon	Moveable
4556	10 Liter	Moveable

B. Gasket / Maximum Temperature	
-T	Compression Gasket, 350 °C

C. Stirrer Drive	
-HD	Heavy Duty, 60 in.-lb.
-XHD	Extra Heavy Duty, 120 in.-lb.
-FMD2	Footless, Heavy Duty, 60 in.-lb.
-FMD3	Footless, Extra Heavy Duty, 120 in.-lb.

D. Materials of Construction	
-SS	T316 Stainless Steel
-HB	Alloy B-3
-HC	Alloy C-276
-Ti2	Titanium Grade 2
-Other materials may be available, contact Parr.	

E. Electrical Supply	
-230	230 Volt, 50/60Hz
-400	400/415 Volt, 3 Phase

F. Motor Option	
-VS .75	Variable Speed, 3/4 hp
-XP .75	Explosion Proof, Variable Speed, 3/4 hp
-AM	Air Motor, 1 hp

G. Pressure Gage	
-3000	3000 psi / 200 bar
-2000	2000 psi / 140 bar
-1000	1000 psi / 70 bar
-600	600 psi / 40 bar
-200	200 psi / 14 bar
-100	100 psi / 7 bar

H. Internal Cooling Coil	
-No Symbol	No Coil
-CC	Spiral Coil
-SC	Serpentine Coil

I. Bottom Drain Valve	
-No Symbol	No Bottom Drain Valve
-BDV	Bottom Drain Valve, 3/4" NPT
-BDV1	Bottom Drain Valve, 1" NPT
-ABDV	Air Actuated Bottom Drain Valve

J. Heater Options	
-C3	Ceramic, 3-Zone
-CA3	Cast Aluminum, 3-Zone
-WJ	Welded Jacket

K. Head Lift Mechanism	
-EH	Electric Hoist (115 V)
-MH	Manual Hoist

L. Stirrer Drive Gear Ratios	
DD	Direct Drive
3D	3:1
5D	5:1
10D	10:1

J. Temperature Controller	
-4842*	PID Control
-4843*	Programmable Control
-4870	Process Controller
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

K. Control Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module
-HTM*	High Temperature Cut-off Module
-AMM*	Ammeter Display Module
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module
-4846	Data Acquisition System

K. Custom Options (List All Desired)			
-AS	Anchor Stirrer	-GE	Gas Entrainment Stirrer
-CAD	Catalyst Addition Device	-BF	Baffles
-RC	Reflux Condenser	-SCP	Solids Charging Port
-RTC	Reflux Take-off Condenser		

M. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification
-P	Parr Certification



Series Number:
4570-4580

Type:
**High Temperature,
High Pressure
Reactors**

Vessel:
**Moveable or
Fixed Head**

Sizes:
250 mL - 1.5 Gallon

Maximum Operating
Pressure:
**4570:
5000 psi (345 bar)
4580:
3000 psi (200 bar)**

Maximum Operating
Temperature:
**500 °C
w/ FG Flat Gasket**



Model 4575 High Temperature / High Pressure Reactor Bench Top, Moveable Vessel, 500 mL

Parr offers a number of different reactors in the 4570 and 4580 Series in a variety of sizes and with different mountings for operating pressures to 5000 psi (345 bar) and temperatures to 500 °C.

4571 - 4572 Reactors.
These are 1000 and 1800 mL moveable head reactors mounted in movable carts.

4577 - 4578 Reactors.
These are 1000 and 1800 mL fixed head reactors mounted on a floor stand.

4575 - 4576A Reactors.
These are 500 and 250 mL bench top reactors with 5000 psi (345 bar) and 500 °C ratings. They are available as either moveable or fixed head vessels.

4581 - 4582 Reactors.
These 1 gallon (3.75 L) and 1-1/2 gallon (5.5 L) cart mounted reactors are designed for 3000 psi (200 bar) maximum pressure with a 500 °C maximum working temperature and mounted on movable carts.

4583 - 4584 Reactors.
These are 1 gallon (3.75 L) and 1-1/2 gallon (5.5 L) fixed head reactors mounted on floor stands.

All of these reactors have been designed with suitable valves, fittings and modifications to the vessel itself to operate at the higher temperature and pressure ratings.

Flat, flexible graphite (FG) gaskets are used for temperatures in the higher range to 500 °C. These can be replaced with PTFE gaskets for procedures in which the temperature will not exceed 350 °C. All cart and floor stand models use ceramic heaters to achieve the higher operating temperatures.

Series 4570/4580 Reactor Specifications						
Shaded bar indicates specifications that change within series.						
Model No., Moveable Vessel	4571	4572	4575	4576	4581	4582
Model No., Fixed Head	4577	4578	4575A	4576A	4583	4584
Reactor Mounting	Cart / Floor Stand		Bench Top		Cart / Floor Stand	
Sizes, mL	1000	1800	500	250	3750	5500
Maximum Pressure	5000 psi (345 bar)		5000 psi (345 bar)		3000 psi (200 bar)	
Maximum Temperature						
with FG Flat Gasket	500 °C					
Closure (Cap Screws)	Split Ring (12)		Split Ring (8)		Split Ring (16)	
Valves Mounted	Head					
Valve Connections	1/4" NPT Female					
Magnetic Stirrer, Model No.	A1120HC*		A1120HC*		A1180HC*	
Maximum Torque	16 Inch-Pounds		16 Inch-Pounds		60 Inch-Pounds	
Impeller(s), 6-Blade	2					
Pressure Gage, Size	4.5 inches					
Range	0-10,000 psi (700 bar)*		0-10,000 psi (700 bar)*		0-5,000 psi (345 bar)*	
Temperature Measurement	Thermowell					
Cooling Coil	Included					
Style	Serpentine		Single Loop		Serpentine	
Bottom Drain Valve	A177VB 1" NPS (Optional)					
Heater Style	Ceramic		Calrod		Ceramic	
Heater Power Watts	2250		1500		3000	3500
Stirrer Motor, Variable Speed	1/4 hp*		1/8 hp*		1/2 hp*	
Electrical Supply						
Volts	230		115 or 230		230	
Maximum Load, 115 / 230, amps	11		14 / 7		11	
Vessel Dimensions						
Inside Diameter, inches	3.75		2.5		5.5	
Inside Depth, inches	6.2	10.5	6.6	3.2	9.7	15
Weight of Vessel, pounds	70	85	35	29	100	130
	85	100				
Reactor Dimensions						
Moveable Head	4571	4572	4575	4576	4581	4582
Width x Depth x Height, inches	35 x 18 x 50		16 x 16 x 30		35 x 18 x 50	
Fixed Head	4577	4578	4575A	4576A	4583	4584
Width x Depth x Height, inches	20 x 33 x 75		17 x 24 x 44		20 x 33 x 75	
Weight, pounds	245	265	125	120	325	355
Spare Parts Kit	4579B		4579D		4589B	
* Other options available. See Options Section and Ordering Guide						

4570/80 Series 4570/80 Options

Parr

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Model 4571 High Pressure / High Temperature Reactor, Moveable Vessel, 1000 mL



500 mL Moveable Vessel Assembly for Model 4575 High Pressure / High Temperature Reactor

Series 4570/80 Ordering Guide

A composite identification number to be used when ordering a 4570 or 4580 Series reactor can be developed by combining individual symbols from the separate sections.

Example: An 1800 mL, T316SS, fixed head reactor, heavy duty magnetic drive, 230 volt, 1/2 hp variable speed motor, 5000 psi gage, PID controller with tachometer, pressure display module and high temperature cutoff module would be listed as: **No. 4578-FG-HD-SS-230-VS.50-5000-4842-TDM-PDM-HTM**

A.	B.	C.	D.	E.	F.	G.	J.	K.
Model	Gasket	Stirrer	Material	Voltage	Motor	Gage	Controller	Options
No.4578	-FG	-HD	-SS	-230	-VS.50	-5000	-4842	-TDM-PDM-HTM

A. Base Model		
Model	Size	Vessel Style
4571	1000 mL	Moveable Head, Cart
4572	1800 mL	Moveable Head, Cart
4575	500 mL	Moveable Head, Bench Top
4576	250 mL	Moveable Head, Bench Top
4575A	500 mL	Fixed Head, Bench Top
4576A	250 mL	Fixed Head, Bench Top
4577	1000 mL	Fixed Head, Floor Stand
4578	1800 mL	Fixed Head, Floor Stand
4581	1.0 Gallon	Moveable Head, Cart
4582	1.5 Gallon	Moveable Head, Cart
4583	1.0 Gallon	Fixed Head, Floor Stand
4584	1.5 Gallon	Fixed Head, Floor Stand

B. Gasket / Maximum Temperature	
-FG	Flexible Graphite Gasket, 500 °C
-T	PTFE Compression Gasket, 350 °C

C. Magnetic Stirrer Drive	
-GP	General Purpose, 16 in.-lb.
-HD	Heavy Duty, 60 in.-lb.
-XHD	Extra Heavy Duty, 120 in.-lb.
-FMD1	Footless, General Purpose, 16 in.-lb.
-FMD2	Footless, Heavy Duty, 60 in.-lb.
-FMD3	Footless, Extra Heavy Duty, 120 in.-lb.

D. Materials of Construction	
-SS	T316 Stainless Steel
-MO	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastelloy C-2000
-CS	Alloy 20Cb3
-Ti2	Titanium Grade 2
-Ti4	Titanium Grade 4
-NI	Nickel 200
-Zl	Zirconium 702 or 705

E. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

F. Motor Option	
-VS .12	Variable Speed, 1/8 hp (4575-4576 Only)
-VS .25	Variable Speed, 1/4 hp
-VS .50	Variable Speed, 1/2 hp
-XP .25	Exposion Proof Variable Speed, 1/4 hp
-XP .50	Exposion Proof Variable Speed, 1/2 hp
-AM .25	Air Motor, 1/4 hp (4575-4576 Only)
-AM .50	Air Motor, 1/2 hp
-GDD	Geared Direct Drive (Fixed Head Unit Only)

G. Pressure Gage	
-2000	2000 psi / 140 bar
-3000	3000 psi / 200 bar
-5000	5000 psi / 345 bar
-7500	7500 psi / 517 bar
-10000	10000 psi / 690 bar

H. Bottom Drain Valve	
-No Symbol	No Bottom Drain Valve
-BDV	Bottom Drain valve

J. Temperature Controller	
-4842*	PID Control
-4843*	Programmable Control
-4870	Process Controller
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

K. Control Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module
-HTM*	High Temperature Cut-off Module
-AMM*	Ammeter Display Module
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module
-4846	Data Acquisition System

K. Custom Options (List All Desired)			
-AS	Anchor Stirrer	-RC	Reflux Condenser
-SB	Static Catalyst Basket	-RTC	Reflux Take-off Condenser
-DB	Dynamic Catalyst Basket	-BF	Baffles
		-GE	Gas Entrainment Stirrer

M. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification
-P	Parr Certification

5000

Series 5000 Multiple Reactor System (MRS)



Series Number:
5000

Type:
Bench Top Multiple Vessel

Vessel:
Moveable

Sizes:
45 & 75 mL

Maximum Operating Pressure:
3000 psi (200) bar

Maximum Operating Temperature:
225 °C w/ FKM O-ring
275 °C w/ FFKM O-ring
300 °C w/ PTFE Flat Gasket



Model 5000 Multiple Reactor System with 4870 Process Controller

The Parr Series 5000 Multiple Reactor System has been designed to provide an integrated system for running multiple reactions simultaneously and applying the principles of high throughput experimentation to reactions conducted at elevated temperatures and pressures.

The principle features of the new instrument include:

- Six reactors with internal stirring.
- Operating pressures to 3000 psi.
- Operating temperatures to 300 °C.
- Individual temperature control.
- Continuous individual pressure monitoring.
- Computer control and data logging
- Manifold system for rapid turn around and to allow two different input gases.

- Volumes and reactor geometry designed for three phase reactions.
- Flexible Control Software.
- Data Reduction Software.

Stirred Batch Reaction Vessel

This multiple reaction system has been designed around a vessel with 75mL total volume. This will accommodate between 15 and 40mL of liquid reactants which is close to the minimum volume appropriate for heterogeneous catalytic reactions.

The vessel valves and accessories are designed for maximum operating pressures up to 3000 psi at operating temperatures up to 300 °C. A system with 45 mL vessels is also available.

Stirring System

All six vessels are stirred with a single magnetic stirrer system specifically designed and built for this application. The magnetic drives and fields are focused on the stirrer bars within each vessel. High strength compact magnets are used to provide coupling forces which will operate through the heaters and vessels. The stirring speed of the stir bar is variable from 0-1200 rpm. All vessels will have the same stirring speed during a single run of the apparatus. For manual controlled stirring, a digital tachometer is included. An optional computer controlled stirrer speed and display is also available.

Heaters

The external heaters surround the vessel walls and bottom for rapid and uniform heating and temperature control. Each vessel is individually temperature controlled. The 250-watt heaters used on each vessel produce heating rates up to 15 °C per minute.

Operating Modes

The Series 5000 Multiple Reaction System provides an apparatus for running up to six reactions in parallel to build a database for comparing and optimizing operating conditions. The user can design experiments to:

- Run all reactions at the same temperature and pressure while varying catalyst loading or reactant concentrations to optimize these parameters.
- Run all reactors with identical loads varying pressures and a common temperature to study the effect of pressure on reaction rates.
- Run individual reactors with individual loading and temperature and pressure to screen multiple options for activity.
- We expect a comparison of the plots of pressure drop versus time within the reactors running under parallel conditions to be the most useful means of measuring reaction rates and comparing operating conditions. The internal thermocouple also provides a means of detecting parameters of exothermic reactions.

Reactor Options

As Parr customers have come to expect with our line of laboratory pressure reactor equipment, these reactors are

offered with a number of options which permit the user to configure the system to their reactions and intended operating conditions, these options include:

O-ring or Flat Gasket Seals. Vessels with O-ring seals are closed by simply tightening the screw cap down hand tight. The maximum operating temperature will depend upon the O-ring material. When equipped with FKM (Viton®) O-rings operating temperatures up to 225 °C are permitted. By substituting FFKM (Kalrez®) O-rings this limit can be raised to 275 °C. Careful consideration of chemical compatibility must also be given when selecting O-ring materials. PTFE gaskets can be used to temperatures in the 300 °C range and offers virtually universal chemical compatibility. Three cap screws are used to develop the sealing forces on the PTFE gaskets in this design.

Head Configuration. Each reaction vessel is equipped with an inlet valve, exhaust valve, safety rupture disc, and pressure transducer in addition to an internal thermocouple. The user can choose to have the valves, transducer and rupture disc mounted on a gage block connected directly to the vessel head, or remotely mounted on the back panel and connected to the valve with a quick coupling flexible high pressure hose. The head mounted design makes it possible to remove pressurized vessels from the heater/stirrer assembly or to prefill the vessels in a remote location. The remote panel mounted arrangement connects all of the pressure inlets/outlets to each vessel with a single flexible connection for the greatest ease of handling.

Materials of Construction. Type 316 stainless steel is the standard material of construction for both the vessel with its wetted parts and the gage block assemblies exposed to vapors. For investigators working with systems containing strong mineral acids or other more corrosive systems these vessels can be made of any of the Parr standard materials of construction.

Stirrer Configuration.

Our testing has shown that the best stirring option is a loose stirring bar. PTFE coated or glass stirrer bars are available.

Thermocouple Configuration. Thermocouples are mounted inside the vessel for the best temperature monitoring and control. These thermocouples are protected by stainless steel sheaths which are inserted into a protective thermowell. These thermowells make it easy to install and remove thermocouples from the vessels, plus provide additional chemical and mechanical protection for the thermocouple.

Inlet Valve Tube. Two gas inlet valves are provided and are connected to a manifold. The third valve is for venting the lines. The manifold allows for adding a purge gas, usually nitrogen, and a reactant gas, usually hydrogen, to these reactors. The valves for the gas inlet to each vessel can be either an automatic check valve or manually controlled. The automatic check valves permit the operator to fill all six vessels simultaneously to the same operating pressure. Manual needle valves permit the operator to fill each vessel to a unique starting pressure.

5000 Series 5000 Specifications



Series 4870 Process Controller

The Series 5000 Multiple Reaction System is controlled by a dedicated Parr 4870 Process Controller. A detailed description of this controller is found on page 110 of this catalog. For this application this controller is set up to provide:

- Temperature monitoring of all six reaction vessels.
- PID Temperature control of each individual reactor.
- Pressure monitoring of each of the six reaction vessels.
- Data logging of temperature and pressure in each vessel.
- Digital stirrer speed readout and manual control.
- Optional computer control-stirrer speed and digital display.

In addition to its standard configuration, the controller can provide Ramp & Soak programming for individual reaction vessels, digital inputs and outputs for interlocks, alarms or other safety features, and additional analog and digital inputs and outputs to control flow meters or other accessories which might be added at some future date.

The users control station is a PC running any current Windows operating system. A simplified graphical user interface has been designed for the control and monitoring of the Series 5000 Multiple Reaction System. The PC is used strictly as the user interface and data logging module. All control actions are generated in the 4870 Process Controller (not the PC).

Series 5000 Reactor Specifications				
Shaded bar indicates specifications that change within series.				
Model Number	5000			
Sizes, mL	75			
No. of Reaction Vessels	6			
Maximum Pressure	3000 psi (200 bar)			
Maximum Temperature				
with FKM O-ring	225 °C			
with FFKM O-ring	275 °C			
with PTFE Flat Gasket	300 °C			
Closure				
with O-ring	Screw Cap			
with Flat Gasket	Screw Cap with 6 Cap Screws			
Material of Construction	T316SS*			
Process Controller	Model 4870			
Analog Inputs	6 Temperature			
	6 Pressure			
	1 Motor Speed			
Analog Outputs	1 Stirrer Speed			
Digital Outputs	6 PID Temperature Control			
Temperature Measurement	6 Type J Thermocouple			
Heater Style	Aluminum Block			
Heater Power Watts	250W Per Station 1500W Total			
Stirrer Motor Type	VS or Computer Controlled			
Stirrer Style	Magnetic Stirrer Bar			
Electrical Supply				
Volts	115 or 230			
Maximum Load, amps	15 / 7.5			
Vessel Dimensions				
Inside Diameter, inches	1.5			
Inside Depth, inches	2.69 Flat Gasket, 2.50 O-ring			
Weight of Vessel, pounds	3			
Dimensions	Width, in.	Depth, in.	Height, in.	Weight, lb.
Heater	25.75	9.25	2.875	31
Stirrer	28	9.5	7.625	12
Controller	15	13	22	25
Manifold, Remote	26.5	9.0	15	36
Manifold, Head Mount	26.5	9.0	15	18

* Other options available. See Ordering Guide

Series 5000 Ordering Guide

A composite identification number to be used when ordering a 5000 Series reactor can be developed by combining individual symbols from the separate sections.

A Six Station MRS, reactor with PTFE flat gasket, T316SS, 115V electrical, fixed thermowell, on-head valve, with automatic check valve, a transducer range of 1000, a PTFE magnetic bar stirrer, computer controlled stirrer, and ASME certification would be listed as:

Example: No. 5000-T-SS-115-TW-H-AC-1000-MB-CC-ASME

A.	B.	C.	D.	E.	F.	Etc.
Model	Gasket	Material	Voltage	Temp. Meas.	Valve Mount.	
No.5000	-T	-SS	-115	-TW	-H	

A. Base Model		
Model No.	Size	Vessel Style
5000	45 or 75 mL	6 Stations

B. Gasket / Maximum Temperature	
-JV	FKM O-ring, 225 °C
-JK	FFKM O-ring, 300 °C
-T	PTFE Flat Gasket, 275 °C

C. Materials of Construction	
-SS	T316 Stainless Steel
-MO	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastalloy C-2000
-CS	Alloy 20Cb3
-TI2	Titanium Grade 2
-TI4	Titanium Grade 4
-NI	Nickel 200
-Zl	Zirconium 702 or 705

D. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

E. Temperature Measurement	
-TW	Thermocouple in Thermowell

F. Valve Mounting	
-H	On Head
-P	On Manifold Panel

G. Inlet Valve	
-AC	Automatic Check Valve
-MV	Manual Check Valve

H. Transducer Range	
-1000	0-1000 psi
-2500	0-2500 psi
-5000	0-5000 psi

I. Stirrer Type	
-MB	Magnetic Bar Stirrer, PTFE
-GB	Magnetic Bar Stirrer, Glass

J. Stirring Control	
-M	Manual
-CC	Computer Controlled



Rear Panels of the 4870 Process Controller, Heater, Stirrer, and Manifold Panel of the Series 5000 Multiple Reactor System

K. Certifications	
-No Symbol	No Certification
-ASME	ASME Certification
-CE/PED	European Community Certification
-P	Parr Certification

Other Options	
Glass Liner	
PTFE Liner	
Dip Tube with Sampling Valve	
Cold Finger	
Input Pressure Gage	
Type K or RTD	

Parr also designs and builds a wide range of multiple reactor systems with overhead magnetic drive stirrers. These have been based upon our Series 4590 Micro Reactors, Series 4560 Mini Reactors, and our Series 5500 High Pressure Compact Reactors. Please contact our Customer Service Department for details and proposals for custom systems.

5500

Series 5500 High Pressure, Compact Laboratory Reactors



Series Number:
5500

Type:
**High Pressure
Compact Reactor**

Vessel:
Moveable

Sizes:
25 mL – 600 mL

Maximum Operating
Pressure:
3000 psi (200 bar)

Maximum Operating
Temperature:
**w/ FKM
O-ring 225 °C
w/ FFKM
O-ring 275 °C
w/ PTFE
Flat Gasket 350 °C**



Parr Series 5500 HPCL reactor shown with the Parr 4835 Process Controller

Familiar Parr Designs

All of the safety, convenience and reliability features which have been the hallmark of Parr pressure reaction equipment for more than 50 years have been incorporated into a new line of high pressure, compact laboratory reactors. (HPCL – reactors.)

These new Series 5500 HPCL reactors are based upon our popular micro and mini, Series 4590 & 4560 reactors. There are four principal differences between these new reactors and their original counterparts. These are:

1. A smaller, more compact magnetic drive is installed.

- 2. A smaller, more compact variable speed stirrer motor is directly coupled to the new magnetic drive.**
- 3. The larger support stand, overarm and motor have been eliminated.**
- 4. A temperature controller with reduced expandability has been designed for use with these compact systems.**

As a result of these changes, we are now able to offer these new reactors to users who do not require the wide variety of options and expandability provided by our Series 4500 reac-

tors at a significantly lower cost. These new designs will be welcomed by not only investigators with limited space or budgets, but also by investigators building multiple reactor installations for combinatorial chemistry or high throughput investigations.

The reaction vessels used in these new HPCL reactors are identical to the ones furnished in the Series 4590 micro reactors and the Series 4560 mini reactors. HPCL reactors use the popular Parr split ring closure. These vessels are rated for a maximum working pressure of 3000 psi. The maximum operating temperature is dependent upon the seal selected,

PTFE gasket for up to 350 °C; with FKM O-ring to 225 °C or FFKM O-ring to 275 °C.

The 25, 50, and 100 mL reactors are equipped with gas inlet and outlet valves, a liquid sampling valve, pressure gage, safety rupture disc and internal thermocouple in addition to the internal stirrer. The 300, 450 and 600 mL reactors provide an internal cooling loop in addition to these fittings.

In addition to the standard Type 316 stainless steel, the vessels for these new HPCL reactors can also be constructed from any of the standard Parr materials of construction.

These vessels are designed, built and can be certified to the ASME Pressure Vessel Code, European community P.E.D. and other appropriate local codes. Electrical safety is certified by CSA and the EC-CE mark.

New Magnetic Drive

To take advantage of the new technology available in magnets today, Parr has designed a new compact, magnetically-coupled stirrer drive especially for these smaller vessels. Tests show that this new drive is sufficient to stir reactor mixtures with viscosity up to 10,000 centipoise in a 600 mL reaction vessel.

Direct Coupled Motor

A 1/50 hp variable speed motor is incorporated directly into the smaller magnetic stirrer drive installed on these reactors. The motor is equipped with an inline gear-box, which delivers sufficient torque to drive the magnetic coupling to its limit and pro-

vides stirring speeds adjustable from 0 to 1500 rpm. The motors are equipped with a tachometer pickup to provide a signal to the optional tachometer display module which can be installed in the 4835 and 4836 Controllers.

New Heater / Reactor Support

A new heater that also serves as the vessel support has been designed for the HPCL reactors. This is an aluminum block style heater for excellent thermal uniformity. The cartridge heaters used in this heating block are easily replaceable if required. A stainless steel heat shield is provided around the heating block. This style of heater/reactor support provides a very small footprint, ideal for limited bench space.

Models 4835 and 4836 Temperature Controllers

Parr has developed a compact temperature controller for use with these reactors. It features a 1/16 DIN controller providing PID (proportional-integral-derivative) control. The controller includes a load relay capable of handling the electrical loads of all of the heaters used with the Series 5500 reactors. It also provides separate cooling control. Users who wish to program their reactor to automatically step through a pre-set temperature profile will want to select the optional 4836 controller with the ramp-and-soak feature. This controller also includes the motor speed control for the variable speed motor and can be expanded to include a tachometer to provide a digital display of the stirrer speed.

Alternate Controllers Available

The Series 4840 Controllers used with the standard Parr line of medium and high pressure reactors are also available for use with these reactors. These offer the user options for cascade control, redundant temperature control, digital pressure read out, stirring speed read out, motor current draw, and analog or digital outputs not available on the 4835 and 4836 controllers.

Up to eight High Pressure, Compact Laboratory Reactors can be controlled with a single 4870 Process Controller.

Options

As shown in the ordering guide, a variety of options are available for these Series 5500 Reactors. In addition to the options described here, there are a number of additional options and accessories such as glass or PTFE liners, special stirrers, gages, gas and liquid feed systems, custom valves, etc., as described in the options section of this catalog.

Please remember that the Series 5500 reactors have been designed and packaged to provide the basic functions of these small laboratory reactors and certainly not all of the options available for the more versatile Series 4500 reactors can be incorporated into these units. Investigators who need explosion proof operation, jacketed vessels, bottom drain valves, high torque stirrers, catalyst baskets, etc., will need to start with a Series 4590 micro reactor or a Series 4560 Mini reactor.

5500

Series 5500 Specifications



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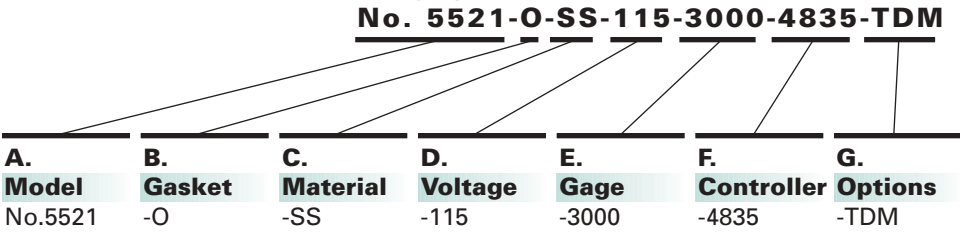
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Series 5500 Reactor Specifications								
Shaded bar indicates specifications that change within series.								
Model Number	5511	5512	5513	5521	5522	5523	5524	5525
Sizes, mL	25	50	100	300	450	600	160	100
Maximum Pressure	3000 psi (200 bar)							
Maximum Temperature								
with FKM O-ring	225 °C							
with FFKM O-ring	275 °C							
with PTFE Flat Gasket	350 °C							
Vessel Style	Moveable							
Reactor Mounting	Compact Bench Top							
Closure (Cap Screws)	Split Ring (6)							
Valve Connections	1/8" Male NPT							
Maximum Torque, Inch-Pounds	.5 (5.5 Ncm)							
Impeller(s), 4-Blade	1, 2 on 600 mL only							
Pressure Gage, Size	3.5 inches							
Range	0-3,000 psi (200 bar)*							
Temperature Measurement	Fixed Thermocouple							
Cooling Coil	NA			Included			Special	
Style	NA			Single Loop			Special	
Bottom Drain Valve	NA							
Heater Style	Aluminum Block							
Heater Power Watts	400	500	400	500	600	400		
Stirrer Motor, Variable Speed	1/50 hp							
Electrical Supply								
Volts	115 or 230							
Max. Load 115 / 230, amps	10 / 5							
Vessel Dimensions								
Inside Diameter, inches	1	1.3	1.3	2.5	2.5	2.5	2.5	2
Inside Depth, inches	2	2.25	4.5	4	6	8	2	2
Weight of Vessel, pounds	7	7	8	10	13	16	8	9
Reactor Dimensions								
Width, inches w/o Controller	6.0							
Depth, inches	6.25							
Height, inches	20	20	20	20	22	24	22	22
Weight, pounds	25	25	25	26	28	30	25	25
Spare Parts Kit	5529SPK							
* Other options available. See Options Section and Ordering Guide								

Series 5500 Ordering Guide

A composite identification number to be used when ordering a 5500 Series reactor can be developed by combining individual symbols from the separate sections.
Example: A 300 mL, T316SS, reactor with O-ring seal, 115V electrical, 3000 psi gage and PID controller with tachometer display module would be listed as:



A. Base Model		
Model No.	Size	Motor/Drive
5511	25 mL	Variable Speed
5512	50 mL	Variable Speed
5513	100 mL	Variable Speed
5521	300 mL	Variable Speed
5522	450 mL	Variable Speed
5523	600 mL	Variable Speed
5524	160 mL	Variable Speed
5525	100 mL	Variable Speed

B. Gasket / Maximum Temperature	
-O	O-ring 225 °C
-T	Compression Gasket, 350 °C

D. Materials of Construction	
-SS	T316 Stainless Steel
-M0	Alloy 400
-IN	Alloy 600
-HB	Alloy B-3
-HC	Alloy C-276
-HC2	Hastelloy C-2000
-CS	Alloy 20Cb3
-TI2	Titanium Grade 2
-TI4	Titanium Grade 4
-NI	Nickel 200
-TI	Titanium

E. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

E. Pressure Gage	
-5000	5000 psi / 345 bar
-4000	4000 psi / 280 bar
-3000	3000 psi / 200 bar
-2000	2000 psi / 140 bar
-1000	1000 psi / 70 bar
-600	600 psi / 40 bar
-200	200 psi / 14 bar
-100	100 psi / 7 bar

F. Controller	
-4835*	PID Control
-4836*	Programable Control
-4842*	PID Control
-4843*	Programmable Control
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

G. Controller Options (List All Desired)	
-TDM*	Tachometer Display Module
-PDM*	Pressure Display Module (4842 & 4843 Only)
-HTM*	High Temp. Cut-off Module (4842 & 4843 Only)
-(A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)
-SVM	Solenoid Valve Module
-CM	Communications Module (4842 & 4843 Only)
-4846	Data Acquisition System

H. Custom Options (List All Desired)	
-GE	Gas Entrainment Stirrer
-BF	Baffles
-SCP	Solids Charging Port
-CAD	Catalyst Addition Device
-RC	Reflux Condenser
-RTC	Reflux Take-off Condenser

I. Certifications	
No Symbol	No Certification
-ASME	ASME Certification (metal vessels only)
-CE-PED	European Community PED (metal vessels only)
-CE	European Community Standard (for EMC Compliance)

5100

Series 5100 Low Pressure Reactors



Series Number:
5100

Type:
**Bench Top Glass or
Metal Reactor**

Vessel:
**Moveable or
Fixed Head**

Sizes:
160 mL – 1.5 L

Maximum Operating
Pressure:

Glass:
150 psi (10 bar)

Metal:
950 psi (65 bar)

Maximum Operating
Temperature:
225 °C



5111 Bench Top Reactor, 1000 mL, Fixed Head, Glass Jacketed Vessel

The Parr series 5100 Low Pressure Reactors are offered in response to users requests for:

1. A system for running reactions similar to those that have been conducted for many years in the "Parr shaker", but which offer stirring for better scalability, higher operating temperatures and pressures, and more extensive reactor controls and instrumentation.

2. Reactors for elevated pressures with glass vessels that permit direct observation of mixing action, color changes, or changes of state.

3. Reactors designed for convenient operation at moderate pressure.

Convenient and Easy Sealing with O-rings and Split Ring Closures

Parr has developed a new O-ring and closure system to accommodate the requirements of this unique glass-to-metal seal and support, which is convenient to use. A face type O-ring seal is used with the proven and popular Parr split ring closure. For this application a special gasket groove was designed to retain the O-ring on the head of the reactor when it is opened. A full range of O-ring materials are

available for chemical compatibility with reactants, products and solvents.

The split ring for the glass vessel is padded with high temperature plastic cushions so the glass vessel does not come in direct contact with the metal split ring. Six sealing screws are tightened only hand tight to develop the seal on the O-ring closure. The split ring snaps together with latches to provide a secure and positive closure.

The alternate metal cylinders use a different split ring designed to handle the higher working pressure of the metal vessels.



Split Ring for Glass Reactors



Split Ring for Metal Reactors

Positive Agitation by High Torque Magnetic Drives

These reactors are equipped with Parr magnetic drives to provide a trouble free internal stirrer. These drives have been designed and tested to routinely deliver 2000 hours of operation without service.

Internal Stirrers

The standard internal stirrer for these vessels is a turbine type impeller. These propellers have been designed to provide good axial mixing to keep any solid particles up in suspension and to provide good gas distribution through the liquid phase.

A gas entrainment impeller is available as an alternate agitator for those users whose primary need is gas re-circulation from the head space of the reactor through the liquid phase.

Fixed Head or Moveable Operation

These vessels have been designed so that they can be operated as either fixed head or moveable vessels. The entire sealed vessel can easily be removed from the support and drive system for charging in a glove box, product recovery, and cleaning. This mode of operation will be attractive

to users who intend to operate fairly simple batch systems or who need to prepare the vessel in a special atmosphere. Alternatively the user can choose to leave the head in place in the support stand and simply drop the reaction cylinder away from the head of the vessel. In this mode, all attachments to the head (gas and liquid feeds, discharge lines, cooling water, condensers, and instrumentation leads) can remain permanently attached to the head of the vessel.

Standard Reactor Fittings

The head of each glass reactor is equipped with:

- Pressure gage, 3-1/2 inch diameter, calibrated 0-200 psi and 0-14 bar
- Inlet valve and dip tube
- Gas release valve
- Gas inlet valve
- Liquid sampling valve
- Internal thermocouple
- Internal cooling loop – standard 300 mL to 1.5 L
- Internal stirrer with magnetic drive
- Heads intended for use with glass cylinders are equipped with spring-loaded relief valves adjustable between 50-150 psi.
- All heads are equipped with a rupture disc rated for 1000 psi.
- Internal fittings are T316 stainless steel with PFA coating.

Materials of Construction

These reactors are a combination of a glass reaction vessel with a metal head, internal stirrer, dip tube, thermowell, cooling loop, and external valves and fittings, or alternatively an all metal system.

The standard material of construction for the head is Type 316 Stainless Steel with

Glass Under Pressure

In the seventy years Parr has been offering apparatus incorporating glass vessels and bottles to be used under pressure, we have learned the following important lessons.

1. Reactions at elevated pressures and temperatures can be conducted safely only if the user takes into consideration all of the potential hazards that may occur if the glass vessel should break under pressure. Shields are provided to protect from the obvious hazards of flying glass, but equal or greater potential hazards include the release of flammable or toxic liquids or gases and the exposure to air of potentially pyrophoric catalysts. Proper location, adequate catchment and ventilation will be as critical to the safe operation of these reactors as the design of the vessel and included shielding.

2. Vessel design is important.

Glass vessels must have rounded sections, proper annealing, cushioning supports, and provisions for dealing with differential thermal expansion as well as adequate thicknesses, careful construction, inspection and testing. All of the glass vessels used in these reactors are tested to a minimum of 225 psi or 15 bar.

3. Careful maintenance is also critical

to safe operation of glass vessels. Scratches on metal vessels which are highly ductile are cosmetic. Scratches on brittle glass vessels create enormous stress risers which can completely destroy the structural integrity of the vessel. Great care must be employed in handling and washing these vessels to maintain the strength designed into them and confirmed by their original hydrostatic testing.

4. Finally, operators must be trained to recognize the potential hazards and ensure that adequate safety provisions are in place and operational at all times.

5100

Series 5100 Low Pressure Reactors



PFA coated T316SS internals. As an alternative the head and internal wetted parts can be provided in any of the standard Parr materials of construction.

Heating and Temperature Control

A wide variety of heating and temperature control options are available to match the individual user's operating requirements.

Jacketed and Non-Jacketed Vessels

These reactors can be heated with either an attached circulating jacket or with a removeable heating mantle. While we would normally expect glass vessels to be equipped with circulating jackets to maintain their transparent feature, some users may not need to heat their reactions or may prefer to use moveable heating mantles when they need to work at elevated temperatures. Although transparency is not an issue with metal vessels, users will generally want to select the same heating method for metal vessels as they use for glass vessels so they can utilize the same heating and control system for both.

Heating Systems

Users who already have a circulating bath available for use with these reactors will want to order the reactor without a circulator/controller. Most laboratory circulators should be adequate for these small vessels. A stand-alone speed controller is optionally available for users with their own circulators.

Parr offers a circulator for use with jacketed vessels. It has a 1000 watt heater and is sufficient to heat all of these vessels to the 200 °C ± 1 °C maximum operating temperature. The reservoir capacity is 6L with a circulator pump capacity of 7-15 L/min. Optionally furnished with 5 L of silicone oil.

Moveable electrical heating mantles are available for vessels which do not have attached circulating jackets. These mantles are available for power supplies of either 115 or 230 volt.

Temperature Controllers 4835 and 4836 Controllers

Parr has developed a compact temperature controller for use with these reactors. This controller also includes the motor speed control for the variable speed motor and can be expanded to include a tachometer to show the speed of the stirrer. Only one expansion module can be incorporated into the compact controller.

Users who wish to program their reactor to automatically step through a pre-set temperature profile will want to select the optional 4836 controller with this feature. These controllers will control either the Parr circulator or the electric heating mantles.

Series 4840 Controller Available

The Series 4840 Controllers are also available for use with these reactors. These controllers offer the user options for cascade control, redundant temperature monitoring, digital pressure read out, stirring speed read out, motor current draw, and analog or digital outputs.

Stirrer Motors

Series 5100 reactors are provided with a choice of three motors.

- The standard motor is an 1/8 hp variable speed motor.
- The standard stirring speed is from 0-1750 rpm. A dual pulley can be inverted to double the torque and halve the speed.
- An explosion proof motor (1/4 hp) is available. This motor is also variable speed and offers the same stirrer speed ranges as the standard motor.
- An air motor is available for users who prefer the added safety of motors which are not electrical and have available a compressed air source.

Size

Series 5100 reactors can be easily converted between the 160, 300, 450, and 600 ml sizes by simply changing the cylinders and wetted parts. If you plan to convert at a later time, be sure to order the stand for the largest size you plan to use so the shield and supports will not have to be replaced.

In a similar manner 1 L and 1.5 L reactors are interchangeable. While the 160 – 600 mL stand cannot be converted to hold 1 & 1.5 L vessels, the larger stand can be converted to accommodate the 160 - 600 mL vessels.

5110 Conversion Sets Glass to Metal or Metal to Glass

Series 5100 reactors can be easily converted between glass and metal cylinders. The conversion sets listed on page 74 include the cylinder, closure, gage and safety relief devices for the "converted to" system. These are ordered separately from the table.

Series 5100 Specifications

Series 5100 Reactor Specifications						
Shaded bar indicates specifications that change within series.						
Model Number	5101	5102	5103	5104	5111	5112
Sizes, mL	300	450	600	160	1000	1500
Maximum Pressure, Glass	150 psi (10 bar)					
Maximum Pressure, Metal	950 psi (65 bar)					
Maximum Temperature						
with FKM O-ring	225 °C					
Vessel Style	Fixed					
Reactor Mounting	Bench Top					
Closure (Cap Screws)	Split-Rings (6)					
Valve Connections	1/8" Male NPT					
Magnetic Stirrer, Model No.	A1120HC9					
Maximum Torque	16 Inch-Pounds					
Impeller(s), 4-blade	1	2	2	1	2	2
Pressure Gage, Size	3.5 inches					
Range, Glass	0-200 psi (0-14 bar)*					
Range, Metal	0-1000 psi (0-65 bar)					
Temperature Measurement	Fixed, Type J, Thermocouple					
Cooling Coil	Included			None	Optional	
Style	Single Loop					
Heater Style	Mantle					
Heater Power (Watts) Glass	400	590	780	400	400	550
Heater Power (Watts) Glass	400	590	780	400	450	650
Stirrer Motor	1/8 hp Variable Speed*					
Electrical Supply						
Volts	115 or 230					
Maximum Load 115 / 230	12 amps					
Vessel Dimensions						
Inside Diameter, inches	2.5				4	4
Inside Depth, inches	4.0	6.0	8.0	2.0	6.0	8.0
Weight of Cylinder, Glass, pounds	0.75	1.1	1.25	0.75	3	5
Weight of Cylinder, Metal, pounds	3	5	7	3	9	13
Reactor Dimensions						
Width, inches w/o Controller	16.5			20.4		
Depth, inches	23.5			26		
Height, inches	29.6			32.6		
Weight, pounds	60	63	66	60	109	113
Spare Parts Kit	5109M			5119M		
* Other options available. See Options Section and Ordering Guide						

Series 5100 Ordering Guide

A composite identification number to be used when ordering a 5100 Series reactor can be developed by combining individual symbols from the separate sections.

Example: A 600 ml reactor with jacketed glass vessel, with stainless steel head and PFA coated wetted parts, gas entrainment impeller, 115 voltage, variable speed 1/8 hp motor, 0-200 psi gage, with circulator, 4835 controller with tachometer and solenoid valve module would be listed as:

No. 5103-GJ-SS-GE-115-VS.12-200-C-4835-TDM-SVM

A.	B.	C.	D.	E.	F.	G.	H. I. J.
Model	Vessel	Material	Impeller	Voltage	Motor	Gage	etc.
No.5103	-GJ	-SS	-GE	-115	-VS.12	-200	-C -4835 -TDM -SVM

A. Base Model	
Model No.	Size
5101	300 mL
5102	450 mL
5103	600 mL
5104	160 mL
5111	1000 mL
5112	1500 mL

B. Cylinder Type	
-GJ	Glass Jacketed
-G	Glass
-MJ	Metal Jacketed
-M	Metal

C. Materials of Construction*	
-SS	T316 Stainless Steel
-HB	Alloy B-3
-HC	Alloy C-276
-TI	Titanium

* Other Alloys Available on Request

D. Stirrer Options	
-4B	4-Bladed Stirrer Impeller, 160-600 mL
-6B	6-Bladed Stirrer Impeller, 1000 & 1500 mL
-GE	Gas Entrainment Stirrer Impeller

E. Electrical Supply	
-115	115 Volt, 50/60Hz
-230	230 Volt, 50/60Hz

F. Motor Option	
-VS .12	Variable Speed, 1/8 hp
-VS .25	Variable Speed, 1/4 hp
-XP .25	Explosion Proof, Variable Speed, 1/4 hp
-AM .25	Air Motor, 1/4 hp

G. Pressure Gage	
-200	200 psi / 14 atm
-100	100 psi / 7 atm
-1000	950 psi / 65 atm (Metal Only)

H. Heater	
-C	Circulator (Jacketed Vessels Only)
-MH	Mantle (Non-Jacketed Vessels Only)
-NH	No Heater

I. Controller	
-4835	PID Control
-4836	Programmable Control
-4842*	PID Controller
-4843*	Programmable Control
-NC	No Controller
-A800E	Motor Speed Control Only
* (A)	Add to above for Analog Output (0-5 or 0-10 VDC or 4-20mA)

J. Control Options (List All Desired)	
-TDM	Tachometer Display Module
-SVM	Solenoid Valve Module
-Other options available for Series 4840 Controllers	

K. Certifications	
-ASME	ASME Certification (Metal Vessels Only)
-CE/PED	European Community PED (Metal Vessels Only)
-CE	European Community Standard (for EMC Compliance)

5110 Conversion Sets

Glass to Metal

Catalog Number	Size mL	Converts From	Converts To
5110A	300	Glass Jacketed	Metal Jacketed
5110B	300	Glass	Metal
5110C	450	Glass Jacketed	Metal Jacketed
5110D	450	Glass	Metal
5110E	600	Glass Jacketed	Metal Jacketed
5110F	600	Glass	Metal

Metal to Glass

Catalog Number	Size mL	Converts From	Converts To
5110G	300	Metal Jacketed	Glass Jacketed
5110H	300	Metal	Glass
5110I	450	Metal Jacketed	Glass Jacketed
5110J	450	Metal	Glass
5110K	600	Metal Jacketed	Glass Jacketed
5110L	600	Metal	Glass



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