

## 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

**T**he 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.**

## 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  $200\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  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						