New!

5100 Low Pressure Glass Reactors

Glass Vessels To 10 atm

Metal Vessels to 65 atm

Temperatures to 225 °C

Parr Instrument Company

Series 5100 Low Pressure Reactors

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 offers stirring for better scalability, higher operating temperatures and pressures, and more extensive reactor controls and instrumentation.

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

3. Reactors designed for convenient operation at moderate pressure.

Parr 5100 Low Pressure Reactor shown with Heater and Controller

The Series 5100 Features:

- **160, 300, 450, 600, 1000, and 1500 mL Vessels**
- **Vigorous Stirring**
- **Gas Addition**
- **Liquid Sampling**
- **External Heating by Circulating Jacket or Electric Mantle**
- **Internal Cooling**
- **A Wide Variety of Instrumentation Options**
- **Interchangeable Glass and Metal Vessels**

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 atm.

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.

Split Ring for Glass Reactors

Split Ring for Metal Reactors

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 a 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 into 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.

Magnetic Drive

Positive Agitation by High Torque Magnetic Drives

These reactors are equipped with Parr magnetic drives to provide a trouble free internal stirrer. Leakages at low and moderate pressures can be as hazardous and troubling as leakages at high pressures, and so we have equipped these vessels with our fourth generation magnetic drives. These drives have been designed and tested to routinely deliver 2000 hours of operation without service. We can also provide these reactors with our compact magnetic drive for lower torque requirements, 3 ft/lbs.

Internal Stirrers

The standard internal stirrer in the 2-1/2" I.D. vessels is a 4-blade turbine type impeller. In the 300 mL vessels a single impeller is used. Two of these propellers are used in the deeper 450 and 600 mL vessels. In the 4" I.D. vessel the impeller is 6- bladed and both sizes have two. 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 recirculation from the head space of the reactor through the liquid phase.

6-Blade Internal Stirrer

The head can be removed with the vessel or remain fixed. Also, you can see many of the Standard and Optional Reactor Fittings in this photo.

Fixed Head or Removable Operation

These vessels have been designed to operate in either of two operating modes.

REMOVABLE VESSEL

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.

FIXED HEAD

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. Obviously this will appeal to users with more complex connections and continuous flow requirements.

Standard Reactor Fittings

The head of each glass reactor is equipped with:

- Pressure gage, 3-1⁄2" diameter, calibrated 0-200 psi and 0-14 atm
- Inlet tube
- Gas release valve
- Gas inlet valve
- Liquid sampling valve
- Internal thermocouple
- Internal cooling coil – optional on 1 L & 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 PFA coated.

Optional Reactor Fittings

An extensive list of optional head fittings has been developed in our more than 50 years of furnishing stirred reactors for operation at elevated temperatures and pressures. These include:

- Condensers
- Solids charging ports
- Catalyst addition devices
- Electrodes
- Pressure transducers
- Alternate stirrers

Gas and Liquid Charging Accessories

Parr offers a wide range of accessories for use with the basic reactors. These include:

- Pressure burettes for measuring the consumption of hydrogen or other reactant gases in the vessel
- Constant pressure delivery systems
- Liquid metering pumps
- Liquid charging pipettes
- Mass flow meters
- Mass flow controllers
- Back pressure regulators
- Sample collection systems

Heating and Temperature Control

A wide variety of heating and temperature control options are available to match the individual users operating requirements and available laboratory equipment and services.

JACKETED AND NON JACKETED VESSELS

These reactors can be heated with either an attached circulating jacket or with a removable 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 removable 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.

Glass and metal jacketed pressure vessels.

5120 Circulator

4835 Controller

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. The requirements for the circulator will depend upon the temperature required, but most laboratory circulators should be adequate for these small vessels.

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. Reservoir capacity 6 L. Circulator pumps 7-15 L/min. Optionally furnished with 5 L of silicone oil.

Removable electrical heating mantles are available for vessels which do not have attached circulating jackets. These are available in the following sizes:

Size	*Power*	*Size*	*Power*
160 mL	400 watts	600 mL	780 watts
300 mL	400 watts	1000 mL	450 watts
450 mL	590 watts	1500 mL	550 watts

Mantles are available for power supplies either 115 or 230 volt.

TEMPERATURE CONTROLLERS

4835 Controller

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 5100 reactors. It also provides separate cooling control. 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 furnished

4836 Controller with Ramp and Soak Option

Users who wish to program their reactor to automatically step through a pre-set temperature control will want to select the optional 4836 controller with this feature. The 4835 and 4836 controllers will control either the Parr circulator or the electric heating mantles.

Series 4840 Controller Available

The Series 4840 Controllers used with the 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. Users who already have a Parr Series 4840 Controller can use it with the Series 5100 reactors, but they must make sure that they have the proper set up in their motor speed control for the motor selected.

Stirrer Motors

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

- The standard motor is an 1/8 hp variable speed motor. This motor is not explosion proof. The standard set of drive pulleys provide stirring speeds from 0-1000 rpm. Optional pulleys are available to provide 0-1700 rpm stirring speeds.
- 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.
- If compact drive is selected, 1/50 hp VS motor is standard.
- An air motor is available for users who prefer the added safety of motors which are not electrical and have an available and suitable compressed air source.

Your inquiries for custom modifications are always welcome.

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 below include the cylinder, closure, gage, and safety relief devices for the "converted to" system. These are ordered separately from the table below.

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

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

SIZE

Series 5100 reactors can be easily converted between the 300, 450, and 600 mL sizes by simply changing the cylinders and wetted parts. Because of the myriad of sizes and options possible here, no attempt has been made to list them all. If you plan to convert at a later time, all stands are the same size, so the shield and supports will not have to be replaced.

In a similar manner 1 L and 1.5 L are interchangeable. The 300 – 600 mL stand cannot be converted to hold 1 L and 1.5 mL vessels. We can convert the larger stand to accommodate the 300 – 600 mL vessels.

5100 Mini Reactor Specifications

Model Number	5101	5102	5103	5111	5112
Sizes, mL	300	450	600	1000	1500
Max. Pressure, Glass, psi (bar)	150 (10)				
Max. Pressure, Metal, psi (bar)	950 (65)				
Max. Temp. °C w/FKM O-ring	225				
Vessel Style	Fixed				
Reactor Mounting	Bench Top				
Closure (Cap Screws)	Split Ring (6)				
Valve Connections, NPT	1/8" Male				
Magnetic Stirrer, Model No.	A1120HC9				
Maximum Torque, Inch-Pounds	16				
Impeller(s), number (blades)	1 (4)	2 (4)	2 (4)	2 (6)	2 (6)
Pressure Gage, Size, inches	3.5				
Range, Glass, psi (bar)	0-200 (0-14)*				
Range, Metal, psi (bar)	0-1000 (0-65)				
Temperature Measurement	Fixed, Type J, T.C.				
Cooling Coil	Included			Optional	
Style	Single Loop				
Heater Style	Mantle				
Heater Power (Watts) Glass	400	590	780	400	550
Heater Power (Watts) Metal	400	590	780	450	650
Stirrer Motor, hp, type	1/8 V.S.*				
Electrical Supply					
Volts	115 or 230				
Maximum Load, amps, 115/230	12				
Vessel Dimensions					
Inside Diameter, inches	2.5	2.5	2.5	4	4
Inside Depth, inches	4.0	6.0	8.0	6.0	8.0
Weight of Vessel,Glass, pounds	0.75	1.1	1.25	3	5
Weight of Metal Vessel, pounds	3	5	7	9	13
Reactor Dimensions					
Width, inches w/o Controller	16.5			20.4	
Depth, inches	23.5			26	
Height, inches	29.6			32.6	
Total Weight, pounds	60	63	66	109	113
Spare Parts Kit	5109M			5119M	

* Other options available. See Options Section and Ordering Guide

Indicates specifications that change within models

Series 5100 Ordering Guide

A composite identification number to be used when ordering a 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 internal fittings, gas entrainment impeller, 115 voltage variable speed 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-200-C-4835-TDM

	Model	Vessel	Material	Impeller	Voltage	Motor	Gage	Heater	Controller	Control Options
No.	5103 —	GJ —	SS —	GE —	115 —	VS —	200 —	C —	4835 —	TDM
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.

A. BASE

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

B. CYLINDER TYPE

–GJ	Glass Jacketed
–G	Glass without Jacket
–MJ	Metal Jacketed
–M	Metal without Jacket

C. MATERIALS OF CONSTRUCTION (METAL CYLINDERS)

–SS	T316 Stainless Steel
–HC	Alloy C-276
–HB	Alloy B-3
–TI	Titanium

D. STIRRER OPTIONS

–4B	Four-Bladed Stirrer, 2-1/2" I.D. vessels
–6B	Six Bladed Stirrer, 4" I.D. vessels
–GE	Gas Entrainment Stirrer

E. ELECTRICAL SUPPLY

–115	115 Volt, 50/60 Hz
–230	230 Volt, 50/60 Hz

F. MOTOR OPTION

–VS	Variable Speed, 1/8 hp
–XP	Explosion Proof Variable Speed, 1/4 hp
–AM	Air Motor

G. PRESSURE GAGE

–200	200 psi/14 atm
–100	100 psi/7 atm

H. HEATER

–C	Circulator (Jacketed Vessels Only)
–M	Mantle (Non-Jacketed Vessels Only)
–NH	No Heater

I. TEMPERATURE CONTROLLER

–4835	PID Control
–4836	Programmable Control
–4842	PID Control
–4843	Programmable Control
–NC	No Controller
–A800E	Speed Control only

J. CONTROL OPTIONS

(List All Desired)

–TDM	Tachometer Display Module
–SVM	Solenoid Valve Module
–Other options available for Series 4840 Controller	

K. ADDITIONAL OPTIONS

–ASME	ASME Certification (Metal Vessels Only)
–TUV	TUV Certification (Metal Vessels Only)
–CE	European Community Standard

Materials of Construction

These reactors are a combination of a glass reaction vessel with a metal head, internal stirrer, dip tube, thermowell, cooling coil, 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 PFA coated T316SS internal fittings. As an alternative the head and wetted parts can be provided in:

- Alloy 20Cb-3
- Alloy 400
- Alloy 600
- Alloy B-3
- Alloy C-276
- Alloy C-2000
- Titanium
- Zirconium

Parr will be happy to provide corrosion resistance information on any of these alloys to help the user make an informed choice regarding materials of construction.

The PARR Warranty

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

Exclusive Warranty

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

Express Warranties

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

Are as described in the applicable Parr sales literature, or as specified in Parr shipping documents.

Will function as described in corresponding Parr sales bulletins, or for specifically engineered assemblies, as stated in the sales proposal and purchase agreement.

Will remain free from defects in materials and workmanship for one year from date of delivery of the product to the original purchaser/user. Note that there is no guarantee of a service life of one year after delivery.

Limitations On The Parr Warranty

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

Replacement or repair. With respect to express warranties herein, Parr's only obligation is to replace or repair any parts, assemblies or products not conforming to the warranties provided herein.

Disclaimer of consequential damages. In no event shall Parr be liable for consequential commercial damages, including but not limited to: damages for loss of use, damages for lost profits, and damages for resulting harm to property other than the Parr product and its component parts.

Due to their fragile nature, glass parts are not warrantied beyond incoming inspection at user's facility.

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