

## **Parr Reactor Stirrer Options**

**Five different types of stirring options are available for Parr Reactors.**

### **Turbine Type Impellers**

Parr reactors are usually equipped with turbine type impellers which produce an excellent mixing action over the range of stirring speeds at which these reactors usually operate. These impellers are made in four-blade and six-blade styles, with the smaller four-blade impellers used only on Micro and Mini Reactors. These impellers, for reactors with 600mL volume or greater, may be positioned anywhere on the stirring shaft, with one impeller usually located near the bottom of the vessel to keep solids up in suspension and a second impeller positioned near the base of the vortex to pull reactant gases down into the liquid phase. These impellers generally provide excellent mixing for systems with effective viscosities up to approximately 25,000 centipoise with a 16 in-lb drive or up to 50,000 cp with 60 in-lb magnetic drive.

### **Anchor Stirrers**

Anchor stirrers are available in several configurations for use with moderate to high viscosity materials. This type of stirrer usually works best in vessels with an inside depth to diameter ratio of 1.5 to 1 or less. They are intended to operate at relatively slow speeds and generally require a heavy duty drive system capable of generating and delivering sufficient torque to the agitator. Footless magnetic drives work well with anchor or spiral stirrers. Three basic types are offered:

1. A U-shaped, flat bar anchor.
2. A flat blade, paddle type anchor.
3. A two-arm or three-arm, self centering anchor with PTFE wiper blades.

All of these designs may not be appropriate or available for each reactor size. Please contact the Parr Technical Service Department for assistance in selecting an anchor stirrer suitable for the intended operating volume and viscosities.

## Spiral Stirrers

Spiral stirrers can be installed in any 1 liter, 2 liter or 1 gallon reactor to produce a positive down thrust or upward thrust action when working with viscous polymers or other high viscosity mixtures. They work best in floor stand reactors with adjustable speed, heavy duty drive systems.

Either left-hand (down thrust) or right hand (upward thrust) spirals are available. The down thrust spiral is generally preferred for heavy suspensions.

## Gas Entrainment Impellers

Parr offers a new series of gas entrainment impellers for users who want to obtain maximum gas dispersion into a liquid system. This is obtained with a unique impeller attached to a hollow stirring shaft through which gases are continuously recirculated from the head space above the liquid thru the impeller into the liquid phase. As with all impellers, the speed of the stirrer creates a vacuum at the tip of the impeller. Gas enters openings near the top of the shaft and is pulled through dispersion ports located at the tips of the impellers. In the Parr system with dispersion ports located at the very tips of the impellers, the higher the stirring speed – the higher the vacuum – and the higher the driving force for this very effective gas dispersion system.

These impellers are offered as a complete package which includes the impeller, the hollow shaft with coupling, and any required foot bearings and brackets for the intended reaction. The baffles are a separate option which must be ordered individually. Since these gas entrainment impellers operate best in the 1000 - 1200 rpm range, users will want to ensure that their stirrer drive system is set up to deliver these operating speeds, alternate pulleys and belts are available to convert existing reactor systems.

## Baffles

Because it is the relative speed of the tip of the impeller to the liquid phase that governs the mass transfer, baffles, which impede the rotation of the liquid with the impeller, can greatly enhance the operation of these gas entrainment impellers. While some natural baffling is provided by the internal thermowell, dip tube and cooling coils, the removable baffles listed in the above table are recommended for use with these gas entrainment impellers. These baffles may also be beneficial with the more traditional turbine type impellers for certain applications.

## Catalyst Baskets

Catalyst baskets can be provided for holding a supported catalyst so that it will not be destroyed or changed by the stirring action of the impeller. These can be installed in reactors with volumes ranging from 300ml to 2000mL. Two interchangeable styles are available. An alternate head, internal cooling coil, thermowell and dip tube are required to provide clear space in the vessel for these baskets.

### The Static Design

In the static design the mesh basket holding the catalyst remains stationary while impellers on the stirring shaft and baffles outside of the basket direct the flow of reactants over the surface of the contained catalyst. A unique gas entrainment impeller provides a uniform flow of both gas and liquid over the fixed catalyst bed held within the annular basket. The Parr design for these baskets includes a rigid bottom support which permits high speed stirring without excessive vibration. Cooling coils, internal temperature measurements and liquid and gas sampling operations can be continued as usual without interference from the installed catalyst basket.

### The Dynamic Design

In the dynamic design the catalyst is held in an annular shaped, mesh basket which is attached to the stirrer drive in place of the stirring shaft. The rotating basket then serves as an impeller for stirring the reactants. Fixed baffles and coaxial impellers ensure good circulation over the surface of the contained catalyst. The dynamic baskets are available for reactors with volumes of 1000ml, 1800ml, and 2000mL. Dynamic baskets must be installed in reactors equipped with at least 1/4 hp motors to ensure that sufficient stirrer torque and speeds are available for proper operation. Dynamic baskets are interchangeable with static baskets in 1 liter and larger vessels.

## Gas Entrainment Impellers & Baffle Sets

Reactor Series No.	Volume mL	Impeller Part No.	Baffle Set Part No.
4560	300	A2042HC	A2043HC
4560	450	A2042HC2	A2043HC2
4560	600	A2042HC3	A2043HC3
4520/30	1000	A2044HC	A2045HC
4522/32	2000	A2044HC2	A2045HC2
4540	600	A2046HC	A2045HC
4540	1200	A2046HC2	A2045HC2
4550	3750	A2048HC	A2049HC
4550	7500	A2048HC2	A2049HC2
4555	18750	A2110HC	A2111HC
4570	1000	A2050HC*	A2045HC
4570	1800	A2050HC2*	A2045HC2
4575	500	A2052HC	A2043HC2
4580	3750	A2054HC	A2055HC
4580	5600	A2054HC2	A2049HC2

\* Please specify magnetic drive size.

## Catalyst Basket Assemblies

Reactor	Volume	Style	Catalyst Volume CC	Basket Catalog No.
4561**	300	Static	40	A2026HC
4562**	450	Static	40	A2026HC2
4563**	600	Static	40	A2026HC3
4566**	300	Static	40	A2026HC4
4567**	450	Static	40	A2026HC5
4568**	600	Static	40	A2026HC6
4520/30	1000	Static	150	A2037HC
4520/30	1000	Dynamic	150	A2038HC
4520/30**	2000	Static	150	A2037HC2
4520/30**	2000	Dynamic	150	A2038HC2
4540	600	Static	40	A2310HC
4546	1200	Static	40	A2310HC2
4570	1000	Static	150	A2039HC
4570	1000	Dynamic	150	A2040HC
4570**	1800	Static	150	A2039HC2
4570**	1800	Dynamic	150	A2040HC2
4570	500	Static	40	A2041HC

\* May require alternate inlet tube.

\*\* These baskets operate in the lower third of the reactors only. They are the same baskets as the 1000mL versions but with a longer stirrer shaft.

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