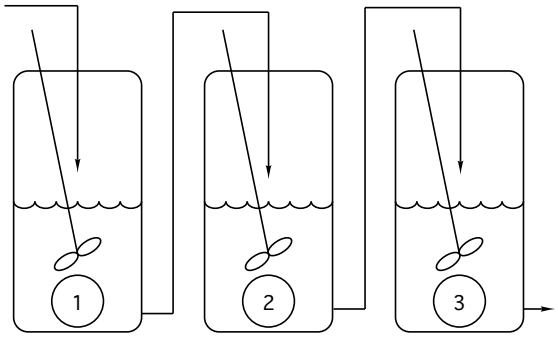
Flow Chemistry - *Ideal Reactor Geometries*

Steady State Flow Reactors are ideal for industrial purposes when large quantities of material are to be processed and when the rate of reaction is fairly high to extremely high. Supporting equipment needs are great: however extremely good product quality control can be obtained.

There are two ideal steady state flow reactors types. The first is know as *plug flow – these reactors are rewiewed in our* ***Salamander*** *range.* Plug flow reactors are characterised by the fact that the flow of fluid through the reactor is orderly with no element of fluid overtaking or mixing with any other element ahead or behind. There my be lateral or radial mixing of fluid but no mixing or diffusion along the flow path.

Plug flow reactor are more efficient than mixed reactors. However when reaction starting material or conditions don't lend themselves to a plug flow approach, a mixed reactor geometery should be considered.

Our ***Chameleon*** are constand flow stirred tank reactors in which the contents are well stirred and uniform thoughout. The exit stream for this reactor has the same fluid composition as the fluid within the reactor.



Cambridge Reactor Design have a range of real reactors so that their flows approach these ideals . Our Salamander or Chameleon series, one or the other usually represents the best way of contacting reagents – no matter what the operation. We has devised simple, but effective systems to overcome some of the problems associated with flow chemistry methods when slurries and solid

particulates are involved. Our Chameleon Series offers and alternative approach, available in a range of different sizes. We also have backpressure regulators (BPRs) that are more resilient than those available off the shelf.

Chameleon – Steady State Mixed Flow Reactor

Design Considerations

For the vessel geometry we have included the following features:

- A 100mL working volume to the weir, 120mL total volume
- Weir tube feature for solid and liquid transfer.
- Total jacketed
- Screw tight Rodavis fittings on all chemical joints
- Integrated lid with Central port (B29) and four surrounding ports (1 x B24, 4 x B19)

  Solids Dosing Option (B24 Central Port)
  Condenser option (B19) with GL14 hose connections
  Condensers don't interfere the vessel assembly in the stack arrangement.
  PT100 thermometer (B19 to 1/4-28 UNF Female connection)
  For monitoring or control purposes
  Stirrer (B19) Stirrer gland, 6mm shaft (glass) with folding paddle (PTFE)
  Liquid feed connection (B19 to 1/4-28 UNF Female, 1/8" tube)
  B19 Fitting to accommodate a Raman Probe or another

- GL14 Fittings for jacket connections

  Supported Insulated Hoses

- Reactor Geometry

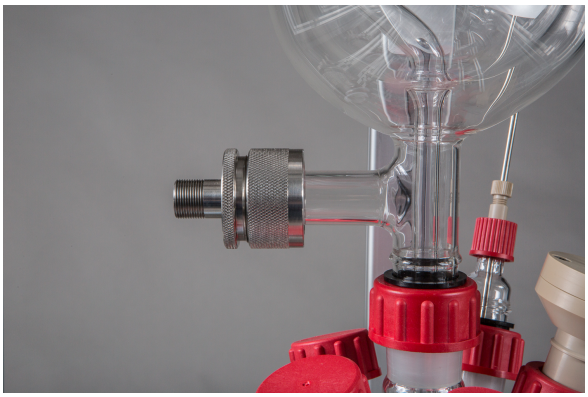
  Angular entry to limit vortex formation
  Stirrer size is tailored to provide the maximum sweep.
  Stirrer height is adjustable to optimize particle suspension.
  Vessel probes will facilitate vortex breaking and smooth liquid transfer.

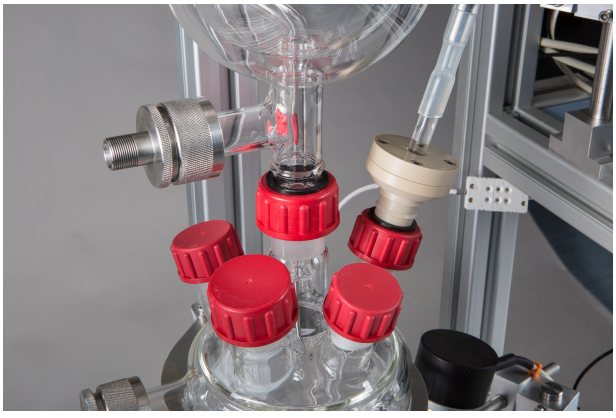
- Solids Handling
  For the top vessel a short condenser on the central B24 port assist solids dispensing.

In considering the design for a system with three mixed reactors in series - we have included the following:

- Frame is manufactured in anodized aluminum.

- Vertical arrangement – fits inside a standard fumehood
- Scalable
- 100mL and 500mL standard versions. Other sizes to order
- Gravity Feed - pumps only required for feed reagents
- The reactor can be tailored to meet the demands of a particular chemistry
- Multiple ports allows for example, reflux, nitrogen purge, sampling and access for analytical probes
- Individual temperature control if required
- Variable speed stirring in each reactor
- Central port access to vessel one for solid additions using dispensing device
- All glass construction (high pressure version also available).





Providing solutions globally in: • Batch and continuous chemistry • Downstream processing • Intelligent vision systems • Robot assistants • Bespoke engineering and automation

CRD CAMBRIDGE REACTOR DESIGN