Catalytic (stirred and flow) Pressure Reactors

High Pressure Chemistry

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Product Selection Guide
HEL Group’s top quality high pressure reactors and systems offer innovative, robust and flexible solutions to chemists working on various hydrogenation and catalysis applications.

The following is a quick selection guide; if your application is not described here, contact us to discuss your requirements. Our systems are built to our customers’ requirements and specifications, and our design team is able to offer creative and innovative solutions to most challenges!

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>SOLUTION</th>
<th>COMMENTS</th>
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</thead>
<tbody>
<tr>
<td>Low cost catalyst screening</td>
<td>CAT Units</td>
<td>HEL CAT units deliver high throughput screening on a small but representative scale and at a fraction of the cost of traditional screening tools.</td>
</tr>
<tr>
<td>Catalytic screening and process development</td>
<td>HP ChemSCAN</td>
<td>With eight parallel reactors and fully independent controls the HP ChemSCAN accelerates process development and allows process condition envelopes to be fully explored.</td>
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<tr>
<td>Custom process optimisation</td>
<td>AutoMATE II</td>
<td>A flexible platform that adapts to your changing needs. Individual control of a range of vessel options and integration of a wide range of controls.</td>
</tr>
<tr>
<td>Bench and kilo scale reactors</td>
<td>AutoLAB</td>
<td>The easy-to-use, indispensable, scale-up tool. Automation and integrated safety controls increase productivity and reduce manpower requirements.</td>
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<tr>
<td>Flow chemistry</td>
<td>FlowCAT</td>
<td>High pressure flow chemistry can be rapidly assessed. Useful for reaction screening, process development and small scale production.</td>
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Software Platform
HEL’s WinISO software on PC, laptop or touchscreen device provides intuitive and chemist friendly interface, with features such as:
- Real time graphical, tabular and mimic display of data
- Real time editing of experiments
- Alarms and safety shutdowns based on measured variables
- Data files can be imported directly into standard software packages
**CAT**

Complete units for hydrogenation and other high pressure reactions. CAT systems have been designed to provide a cost effective, simple and easy to use tool for high pressure reaction screening. They can be used directly on stirring hot plates or in oil baths.

### Manual Systems
- 100bar/250°C rated vessels (316SS or Hastelloy)
- Valves and pressure gauge to manually purge (e.g. inert) and then pressurise with reacting gas (e.g. hydrogen)
- Place on any hot plate for heating/stirring
- “Pocket” for thermocouple to monitor operating temperature

**CAT 7 and 24**
- Head fitted with coolant connection
- “Cold fingers” condense vapours and minimize cross contamination

**CAT 7**
- 7 x 10ml or 7 x 1ml

**CAT 24**
- 24 x 2ml

**CAT 18**
- Uses 18 x 2ml HPLC vials (with or without Septa) but without refluxing features

**CAT 18**
- 18 x 2ml

### Automated System
- Fully automated design based around 96 well Zinsser block
- Up to 96 x 1ml HPLC capped vials
- 35bar/200°C
- Magnetically stirred
- Computer control for:
  - Gas feed/venting
  - Temperature
  - Agitation
  - Pressure

**CAT 96**
- 96 x 1ml

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**Increase productivity with HEL’s CATalyst Screening Systems**
HP ChemSCAN II

A dedicated parallel reactor system for the rapid development of high pressure reactions and heterogeneous catalysis systems. The High Pressure ChemSCAN (HPCS) is an eight-reactor platform rated to 200bar and +200°C - each reactor is independently controlled and monitored with full computer management control. Based on HEL’s PolyBLOCK platform, the system boasts flexibility and modularity. The sophisticated software controls, allow for quick and efficient screening and development of catalytic reactions.

The system’s key features include:
- Independent temperature control in each vessel
- Individual pressure control, allowing tests at different pressure
- On-line gas consumption calculation and display, in each reactor

Agitation
- Excellent mixing – enabling heterogeneous and homogenous catalytic gas-liquid reactions. The mixing rate is such that gas uptake is mostly kinetic controlled, allowing scale up with confidence

Control system
- Software control and data logging
- Real time gas uptake display for each reactor
- Automated control sequence includes all inert purges as well as reactive stages

High pressure liquid addition
- The HP ChemSCAN has a high pressure liquid feed option, which is fully automated, up to pressure of 200bar (3000psi), with an accuracy of around 0.05ml or better

Uptake Sensitivity
- Detects ~0.04mmole gas consumption (0.1bar pressure change in standard reactor)

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<tr>
<td>Temperature</td>
<td>-60°C and up to 200°C</td>
<td>Temperature difference of over 100°C between reactors can be set. Independent control of each reactor.</td>
</tr>
<tr>
<td>Working volumes</td>
<td>16ml vessels, 75ml and 120ml also available</td>
<td>Minimum working volume 3ml. Available in 316SS or Hastelloy.</td>
</tr>
<tr>
<td>Pressure</td>
<td>100bar (200bar optional)</td>
<td>Individual pressure measurement and control in each reactor. Pressure difference between reactors in a single run can be up to 30bar (450psi).</td>
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</table>

Compact platform for rapid screening and development of catalytic reactions
PolyBLOCK or AutoMATE II

Flexible and customisable chemistry platforms. HEL’s PolyBLOCK and AutoMATE II platforms are designed to offer cost-effective, compact and modular solutions to each customer’s requirements. With in-house software, mechanical and electrical engineering capabilities as well as extensive chemistry and chemical engineering knowledge, we are able to provide our customers a flexible and innovative approach to their needs.

Highlights
- Interchangeable reactors
- Wide temperature range (-80°C to 250°C or higher)
- Separate monitoring and control of each zone
- Range of options for feed of gas and liquid
- Fully integrated, compact designs

Process Development with independent pressure and temperature measurement and control. Available with gas, solid and liquid dosing options, using fully stirred reactors, volumes from 16 to 300ml.

8 x 75ml high pressure reactors with complete gas feed/venting manifold and suspended mechanical agitation

4 x 300ml high pressure reactors, fully automated, with suspended mechanical stirring

100ml and 300ml reactors (interchangeable), with overhead stirring

8 x high pressure, high temperature reactors with stirring

Demanding applications made simple and reliable
**HP AutoLAB**

Bench and pilot scale reactors for research and kilo-labs. Volumes over 20 litres, available as manually operated or computer controlled custom designs.

**Gas liquid reactions under pressure**
- Liquid and gas dosing
- Gas consumption online
- Homogenous or heterogeneous catalysis
- Single or parallel systems

**Complex Synthesis Reactions**
- Research scale and complete pilot plants
- High viscosity reactions
- High temperature and pressure
- Batch and continuous processes

**Stirred reactors** for a range of applications and budgets
FlowCAT
A computer controlled platform for the development of continuous flow chemical processes, running up to 200bar and 550°C. The flexible design allows scale up of both homogenous and heterogenous chemistries in the same unit and can incorporate a combination of gas and liquid feeds.

FEATURES & BENEFITS

Software
- Full software control of pressure, temperature and feed rates of liquid/gas
- Edit conditions any time without stopping

High Throughput Operation
- Possible to write recipes to automatically cover a range of process conditions, running in sequence
- At the end of each run, product is sampled and the next run initiated

Applications
- Screen new chemistries, rapidly
- Optimize yield, identify new catalysts
- Use for small-scale production, quickly and safely
- Also includes Carbonylation, Polymerisation, Bio-Fuel Research, Fischer-Tropsch, Refinery Unit Operations

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<td>Temperature</td>
<td>300°C (Higher Optional)</td>
<td>Multiple heating zones to suit larger length reactors</td>
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<tr>
<td>Reactor sizes</td>
<td>Reactor diameter 6-24mm, Reactor length 150-500mm</td>
<td>Available in 316SS or Hastelloy.</td>
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<tr>
<td>Pressure</td>
<td>100bar (200bar optional)</td>
<td>Robust and precise control valve, suitable for liquids, gases and two-phase mixtures, provides back pressure control.</td>
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<tr>
<td>Feeds</td>
<td>1 gas, 1 liquid</td>
<td>Optionally, any number of separate and independent feeds can be controlled.</td>
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Novel engineering features provide ease of use and quality data.
Over the past 20 years we have developed expertise and become industry leaders in:

- Reaction hazards, calorimetry, vent sizing
- Process development and optimisation
- Dust and powder flammability
- Other hazard consultancy services, including expert opinion, HAZOPS, DIERS, incident and accident investigation and professional training

ABOUT HEL

HEL is an international company that specialises in research and pilot scale chemical reactors and related data logging/automation tools for process R&D in the pharmaceutical, fine chemical and petrochemical industries. Established in 1987 and with clients worldwide our key strengths are:

Knowledgeable staff - highly qualified and experienced chemical engineers and chemists
Quality - underpinned by ISO9001 certification for over 16 years
Service - choice of service contracts backed by established culture of unmatched client support
Range of products - both off-the-shelf and custom designs, manual and fully automated controls, low and high pressure/temperature applications, single and parallel/multi-vessel products

CONSULTANCY & TESTING SERVICES

Over the past 20 years we have developed expertise and become industry leaders in:

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- Dust and powder flammability
- Other hazard consultancy services, including expert opinion, HAZOPS, DIERS, incident and accident investigation and professional training

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