

### **Applications for Stirred Reactors and Pressure Vessels**

**A discussion of applications for pressure equipment and a list of users.**

One of the recurring questions we receive from our agents is, "Can you provide us with a list of customers and applications which will help us sell the pressure reaction line?"

First, the disclaimers. Our list will be restricted for the most part to United States companies because most of our international agents have not registered their customers with us. Second, our list will be incomplete. We have delivered over 20,000 reactors and you are not going to want to wade through nearly all of the American chemical industry; past and present. Finally, it's not going to be definitive because, in many cases, we have no detailed knowledge of what the user is doing with the reactor. Many processes are proprietary and kept secret. We can guess based upon their products when we recognize them, but we are not going to recognize many of them.

#### **Pharmaceuticals**

The easiest group of customers to identify and recognize are the pharmaceutical companies. These firms carry out hydrogenations over a wide range of pressures to create and modify new organic compounds. Many of these firms will have large central laboratories where these hydrogenations will be conducted by a highly specialized service group.

#### **Polymers**

A second large group of users is in the polymer business where monomers are linked under high pressures and temperatures to produce fibers, plastics and related materials. Many times these customers will be identified by their request for special stirrers to deal with the higher viscosities associated with their polymers.

#### **Petroleum and Petrochemicals**

The petroleum and petrochemical industry makes up a very large group of our customers. The applications within this field are extremely broad. Amoco Production uses pressure vessels to assay core samples for exploration purposes. Firms such as Dowell Schlumberger and Aramco use them to develop

corrosion inhibitors for injection into the wells to protect down-hole equipment. Exxon has a corrosion laboratory with over thirty stirred reactors to evaluate the corrosive effects of any new petrochemical products or processes.

## **Food and Agricultural Products**

While not the largest market by any means, the food and agricultural products group are definite market for our products. General Foods uses reactors for everything from decaffeinating coffee to developing carbonated candies. Archer Daniels Midland, CPC International, Cargill, National Starch & Chemical, and Grain Processing are all good customers working with starches. Kraft Foods, NutraSweet, Philip Morris, Thomas J. Lipton, Proctor and Gamble are all recognizable names in this field and all good Parr customers. It should not be surprising that there are a number of users in this field when we remember that the first Parr stirred reactors were developed for Swift & Co. and Armour, 57 years to hydrogenate vegetable oils. The Regional Research Laboratories of the U.S. Department of Agriculture and the Food and Drug Administration Laboratories also work with food and agricultural products.

## **Catalyst Development and Testing**

Catalytic hydrogenations are perhaps the most common reactions carried out with Parr stirred reactors. These applications span the entire chemical industry where these reactions are used. The catalyst manufacturers, Engelhard, Air Products & Chemicals, Degussa, W.R. Grace, and Mallinckrodt (Calsicat) all regularly use Parr reactors in their catalyst development and testing programs. Catalyst testing conducted by their customers also forms a significant market for these reactors.

## **Hydrometallurgy**

While most of the applications for these reactors are in the organic chemistry world, there are inorganic applications as well. Perhaps the largest single one of these is the field of hydrometallurgy where strong acids or caustics are used to extract metals from their ores. Alcoa, Kaiser, Aluminum Partners or Jamaica, Reynolds, and Alcan are all using these reactors for the extraction of aluminum from Bauxite and for assaying the ores. Kennecott, Phelps Doge, International Nickel, Amax, Hazen Research, Colorado School of Mines Research, Lakefield Research, CSIRO (Australia) are all using these reactors to extract copper, nickel, and molybdenum. In almost all cases, these applications require one of the special metal alloys for the reactor, such as Titanium, Monel 400, or one of the Hastelloy alloys.

## Universities & Research Institutes

Universities and other research institutions are again a major market to Parr reactors. In the chemical engineering departments, they can be used to simulate in the laboratory a plant reaction for teaching purposes or they can be used for research projects on any of the applications discussed in this TechNote. In the chemistry department, they will generally be used for advanced research projects.

The attached list of users was taken from Parr sales in 2004 and 2005.

## Parr Instrument Company Partial Users List for Stirred Reactors

The APPLICATION field contains our best “guess” as to the user’s application. The following firms have purchased Parr stirred reactors. Some of these have purchased 10 to 30 reactors during this period.

Industrial Firms			
COMPANY NAME	CITY	STATE/CTRY	APPLICATION
3M Company	Cottage Grove	MN	
3M Company	St. Paul	Mn	
AT&T Bell Labs	Murray Hill	NJ	
Abbott Labs	North Chicago	IL	Pharm
Air Products & Chemicals	Allentown	PA	Catalyst
Akzo Chemicals	Dobbs Ferry	NY	
Alcan International	Montreal	Canada	Mining
Alcoa	Point Comfort	TX	Mining
Allied Corporation	Buffalo	NY	Polymers
American Cyanamid	Kalamazoo	MI	
American Cyanamid	Pearl River	NJ	
American Cyanamid	Stamford	CT	
American Synthetic Rubber	Louisville	KY	Polymers
Amoco Production	Tulsa	OK	Petro
Amoco Research	Naperville	IL	Polymers
Arco Chemical	Newtown Square	PA	Petro
Atomic Energy of Canada	Pinawa	CDA	
Avanti Polar Lipids	Alabaster	AL	
BF Goodrich	Avon Lake	OH	Polymers
BOC Group	Murray Hill	NJ	
Baker Performance Chemical	Sand Springs	OK	Petro
Bartelt GmbH	Graz	Austria	
Bend Research Inc.	Bend	OR	
Betz Laboratories	The Woodlands	TX	

<b>Industrial Firms</b>			
COMPANY NAME	CITY	STATE/CTRY	APPLICATION
Betz Laboratories	Trevose	PA	
Boehringer Ingelheim	Ridgefield	CT	Pharm
Bristol Meyers Squibb	Lawrenceville	NJ	Pharm
British Petroleum		England	Petro
Bromine Compounds Ltd.	Beer Sheva	Israel	
Callaway Chemical Co.	Columbus	GA	
Cargill Incorporated	Cedar Rapids	IA	Foods
Cargill Incorporated	Wayzata	MN	Foods
Catalytica Assoc.	Mountain View	CA	Catalyst
Centrilift Hughes	Claremore	OK	
Ciba Corning	East Walpole	MA	
Ciba-Geigy Corporation	McIntosh	AL	Pharm
Ciba-Geigy Corporation	St. Gabriel	LA	Pharm
Clairol Inc.	Stamford	CT	
Clorox Tech Center	Pleasanton	CA	
Colgate Palmolive	Sao Paulo	Brazil	
Conoco Incorporated	Ponca City	OK	Petro
Dearborn Chemicals	Lake Zurich	IL	
Dow Chemical USA	Midland	MI	
Dow Chemical USA	Plaquemine	LA	
Dow Chemical USA	Walnut Creek	CA	
Dow Chemical Co.	Freeport	TX	
Dow Chemical USA	Pittsburg	CA	
Dow Corning	Carrollton	KY	
Dow Corning	Midland	MI	
Dow Elanco	Greenfield	IN	Ag. Chem
Ecopetrol	Bogota	Columbia	
E.I. DuPont	Deepwater	NJ	
E.I. DuPont	Richmond	VA	Polymers
E.I. DuPont	Victoria	TX	
E.I. DuPont	Wilmington	DE	
Eastman Chemical	Kingsport	TN	Catalyst
Eastman Kodak Co.	Columbia	SC	Synthetics
Eisai Research Inst.	Andover	MA	
Eli Lilly	Clinton	IN	Pharm
Engelhard Corporation	Beachwood	OH	Catalyst
Ethyl Corporation	Baton Rouge	LA	Petro
Ethyl Corporation	Orangeburg	SC	Petro
Ethyl Petroleum	St. Louis	MO	Petro
Eveready Battery	Westlake	OH	
Exxon Chemical	Baytown	TX	Petro

<b>Industrial Firms</b>			
COMPANY NAME	CITY	STATE/CTRY	APPLICATION
Exxon Company	Baton Rouge	LA	Petro
Exxon Production	Houston	TX	Petro
Exxon Research & Eng.	Annandale	NJ	Petro
FMC Corporation	Pasadena	TX	Foods
Ferro Corporation	Mammond	IN	
First Chemical Corp.	Sugarland	TX	
Florida Solar Energy	Cape Canaveral	FL	
Formosa Chem & Fibre	Taipei	Taiwan	
G.D. Searle & Co.	Skokie	IL	Pharm
Gates Rubber Co.	Denver	CO	Polymers
General Electric Co.	Schenectady	NY	Polymers
Gensia Pharm	San Diego	CA	Pharm
Georgia Pacific	Neena	WI	Pulp & Paper
Givaudan Corporation	Clifton	NJ	
Glaxo Incorporated	Durham	NC	Pharm
Glaxo Incorporated	Morrisville	NC	Pharm
Glaxo Pharmaceuticals	London	England	Pharm
Goodyear Tire & Rubber Co.	Akron	OH	Polymers
Great Lakes Chemical	West Lafayette	IN	
Hazen Research Inc.	Golden	CO	
Health Research Inc.	Buffalo	NY	Pharm
Helca Mining	St. George	UT	Mining
Henkel Corp Emery Div.	Ambler	PA	Catalyst
Henkel Energy	Cincinnati	OH	
Hercules Aerospace	Rocket Center	WV	Polymers
Hoechst Celanese	Corpus Christi	TX	Polymers
Hoechst Celanese	Coventry	RI	Polymers
Hoffman La Roche	Nutley	NJ	Pharm
Hudson Bay Mining & Smelting	Manitoba	Canada	Mining
Hydrocarbon Research	Tulsa	OK	
Hydro-Quebec	Shawingan	Canada	
IBM Corporation	Yorktown	NY	
ICI Pharmaceuticals	Manchester	England	Pharm
IMI Tami Ltd.	Haifa Bay	Israel	
International Flavors & Frag.	Dayton	NJ	Foods
Intravep	Caracus	Venezuela	Petro
Israli Mineral Institute	Haita	Israel	
JM Huber Corporation	Macon	GA	
Kaiser Aluminum	Arabi	LA	Mining
Kansas State Univ/NANTEK	Manhattan	KS	
Koch Industries	Wichita	KS	Petro

<b>Industrial Firms</b>			
COMPANY NAME	CITY	STATE/CTRY	APPLICATION
Korea Explosives	Seoul	Korea	
Korea Synthetic Fiber	Seoul	Korea	
Larsen & Toubroltd	Bombay	India	
Lonza Incorporated	Annandale	NJ	
Lonza Incorporated	Mapleton	IL	
Louisiana State University	Baton Rouge	LA	
Mallinckrodt Company	St. Louis	MO	Fine Chem
Mearl Corporation	Ossining	NY	Pharm
Merck & Co.	Albany	GA	Pharm
Mobay Corporation	Goose Creek	SC	
Mobil Corporation	Edison	NJ	Petro
Mobil Research & Development	Paulsboro	PA	Petro
Mobil Research & Development	Pennington	NJ	Petro
Monsanto Company	Akron	OH	Polymers
Monsanto Company	St. Louis	MO	
Monsanto Company	Springfield	MA	
Nalco Chemical	Sugarland	TX	Water Chem
Napp Technologies Inc.	Lodi	NJ	
National Chemical Lab	Pune	India	
Nestle	Helsinki	Finland	Petro
Noranda Technical Center	Point Claire	Canada	
Noranda Technology	Dorval Canada	Mining	
Norton Industries	Northboro	MA	
Nova Husky Research	Calgary	Canada	Mining
Novacor Chemicals	Calgary AB	Canada	
NutraSweet Company	Mt. Prospect	IL	Foods
OPTA Food Ingredients	Cambridge	MA	Foods
Olin Research	Cheshire	CT	
PQ Corporation	Conshohocken	PA	
Penford Products	Cedar Rapids	IA	
Petrobras	Rio de Janeiro	Brazil	Petro
Petrocel SA	Tampico	Mexico	Petro
Pfizer Incorporated	Groton	Pharm	
Procter & Gamble	Cincinnati	OH	
Quantum Chemical	Morris IL		
R.J. Reynolds Tobacco	Winston-Salem	NC	
R. W. Johnson Pharmaceuticals	Springhouse	PA	Pharm
Rhone Poulenc	Cranberry	NJ	Polymers
Rhone Poulenc	Monmouth Junction	NJ	Polymers
Rohm & Haas	Bristol	PA	Polymers
Rohm & Haas	Deer Park	TX	Polymers

<b>Industrial Firms</b>			
COMPANY NAME	CITY	STATE/CTRY	APPLICATION
SCM Organic Chemical Div	Jacksonville	FL	
SKC Limited	Suwon Kyungki	Korea	
Sandia Laboratories	Albuquerque	NM	
Sandoz Argo Inc.	E. Hanover	NJ	
Schenectady Chemicals	Schenectady	NY	
Schering Corporation	Bloomfield	NJ	Pharm
Sherex Chemical Co. Inc.	Janesville	WI	
Shell Development	Houston	TX	Petro
Sigma Chemical Co.	St. Louis	MO	Synthetics
Stepan Chemical	Northfield	IL	
Sterling Drug	Rensselaer	NY	Pharm
Sterling Group	Sewickly	PA	Pharm
Sybron Chemicals Inc.	Sybron	NJ	
Syncrude Research	Edmonton	Canada	
Syntex Chemicals	Boulder	CO	Pharm
Tah Kong Chemical Ind	Taipei	Taiwan	
Taiwan Synthetic Petro Corp	Taipei	Taiwan	
Tennessee Eastman	Kingsport	TN	
Texaco Incorporated	Glenham	NY	Petro
Texas Eastman	Longview	TX	
Thomas J. Lipton Company	Englewood Cliff	NJ	Food
Tremco Ltd.	Beachwood	OH	
U.S. Army Natick Labs	Natick	MA	
Unilever Research	Edgewater	NJ	
Union Camp Corporation	Savannah	GA	Pulp & Paper
Union Carbide Corporation	S. Charleston	WV	
Uniroyal Chemical Company	Naugatuck	CT	Polymers
United Chemicals	Abu Dhabi	UAE	
Universal Flavors	Indianapolis	IN	Foods
Universal Flavors	Kearny	NJ	Foods
Universal Oil Products	Des Plaines	IL	Petro
University of Alabama	Birmingham	AL	
University of Michigan	Ann Arbor	MI	
University of Ottawa	Ottawa Ontario	Canada	
Upjohn Company	Kalamazoo	MI	
VCHZ Synthesia	Pardubice	Czechoslovakia	
Vertex Pharmaceuticals	Cambridge	MA	Pharm
Virolac Industries	Waynesburg	PA	
Vista Chemical	Austin	TX	
W.R. Grace	Cambridge	MA	Catalyst
Welchem Inc.	Houston	TX	

<b>Industrial Firms</b>			
COMPANY NAME	CITY	STATE/CTRY	APPLICATION
Westinghouse Savannah	Aiken	SC	
Westvaco Corporation	N. Charleston	SC	Pulp & Paper
Wyeth Ayerst Research	Monmouth Jct.	NJ	Pharm
Xerox Research Center	Mississauga	Canada	
Yhan Corporation	Seoul	Korea	
Zeeland Chem Inc.	Zeeland	MI	
Zeon Chemicals USA	Louisville	KY	

## Parr Instrument Company Partial Users List for Stirred Reactors

<b>Universities &amp; Research Institutes</b>		
COMPANY NAME	CITY	STATE/CTRY
Auburn University	Auburn	AL
Ben Gurion Univ of Negev	Beer Sheva	Israel
Brookhaven National Labs	Upton	NY
Centro de Investigacion en	Saltillo	Mexico
Chung Shan Inst. of Science	Lung Tan Tai	Taiwan
Chung Yuan Christian University	Chung Li	Taiwan
Clemson University	Clemson	SC
Colorado State University	Fort Collins	CO
Fundacao de Desenvolvimento	Mina Gerais	Brazil
Government of India	Pune	India
Indian Inst. of Chem Tech	Hyderabad	India
Indian Institute of Tech	West Bengal	India
Inst. de Investigaciounes en	Santa Fe	Argentina
Inst. of Physical Chemistry	Warsaw	Poland
Illinois Institute of Tech	Chicago	IL
Institute of Gas Technology	Chicago	IL
Iowa State University	Ames	IA
Kings College	Wilkes Barre	PA
Massachusetts Inst. of Tech	Cambridge	MA
Mexican Institute of Petroleum	Mexico City	MX
Mississippi State University	Starkville	MS
National Central University	Taoyuan	Taiwan
National Cheng Kung University	Tainan	Taiwan
New York University	New York	NY
Oklahoma University	Norman	OK



<b>Universities &amp; Research Institutes</b>		
COMPANY NAME	CITY	STATE/CTRY
PAMA Energy Res Dev Ltd.		Israel
Penn State University	University Pk	PA
Projects & Development India	Dhanbad	India
Regional Research Lab	Orissa	India
Research Institute of Ind Sci & Tech	Pohang	Korea
Rubber Research Institute	Kuala	Lumpar
Simon Fraser University	Burnaby	Canada
South Dakota School of Mines	Rapids City	SD
Southern Illinois University	Edwardsville	IL
Southwest Research Institute	San Antonio	TX
State University of New York	Binghamton	NY
University of Arkansas	Fayetteville	AK
University of Bombay	Bombay	India
University of British Columbia	Vancouver	Canada
University of California L.A.	Los Angeles	CA
University of Cincinnati	Cincinnati	OH
University of Concepcion	Concepcion	Chile
University of Illinois	Champaign	IL
University of Laval	STE FOY	Canada
University of Michigan	Ann Arbor	MI
University of Mississippi	Univ. MS	MS
University of Nebraska	Lincoln	NE
University of Pittsburgh	Pittsburgh	PA
University of Regina	Portal	ND
University of S. Mississippi	Hattiesburg	MS
University of Toronto	Toronto	Canada
University of Virginia	Charlottesville	VA
Yonsei University	Seoul	Korea
Yuan Tze Institute of Tech	Chung Li	China

## PARR INSTRUMENT COMPANY

211 Fifty-Third Street  
Moline, Illinois 61265 USA Phone 309/762-7716 Fax 309/762-9453  
<http://www.parrinst.com> E-Mail: [parr@parrinst.com](mailto:parr@parrinst.com)