

Specifying the Optimal Chemical Pump

Nancy Westcott

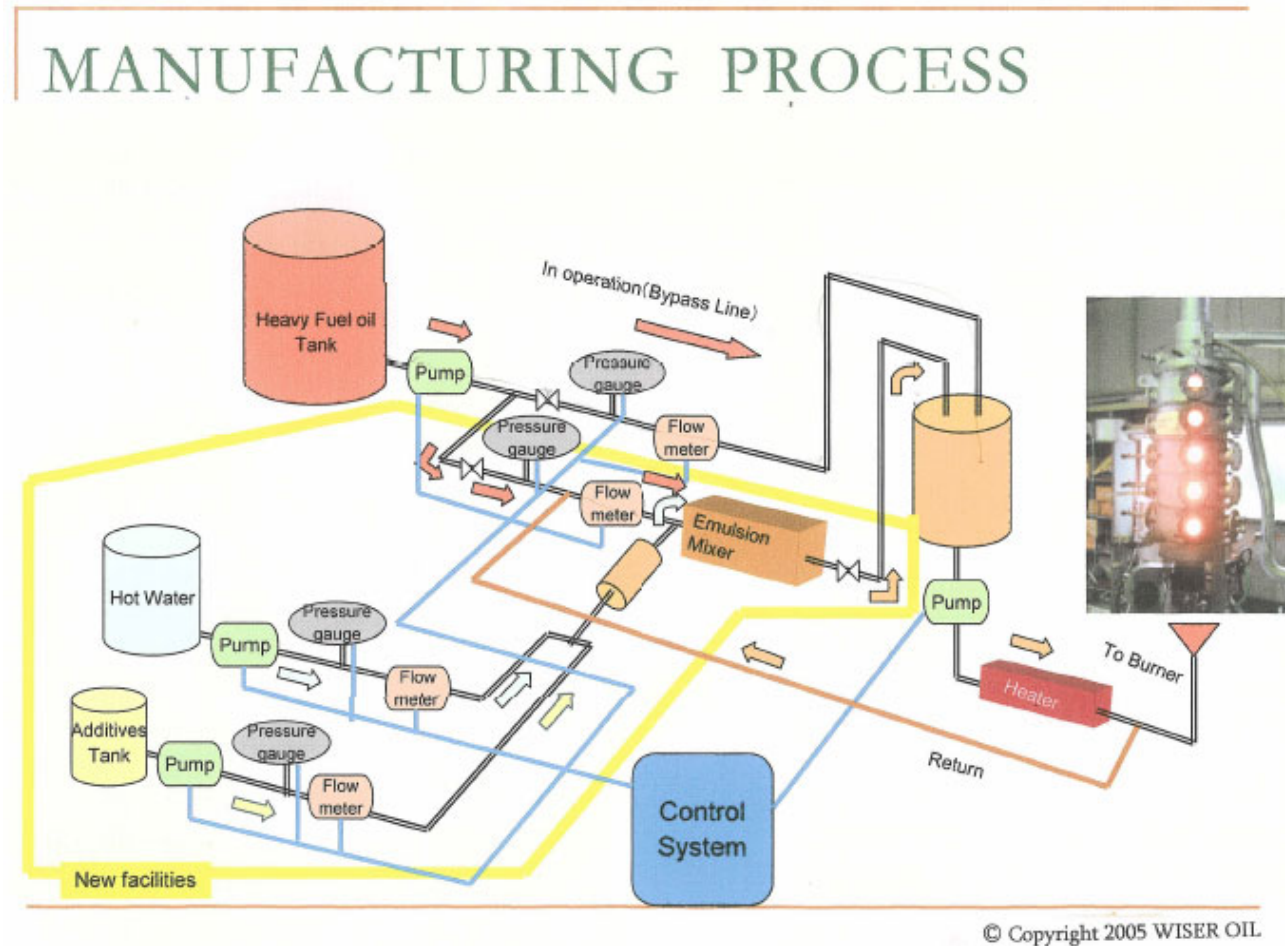
President, GoatThroat Pumps

Overview

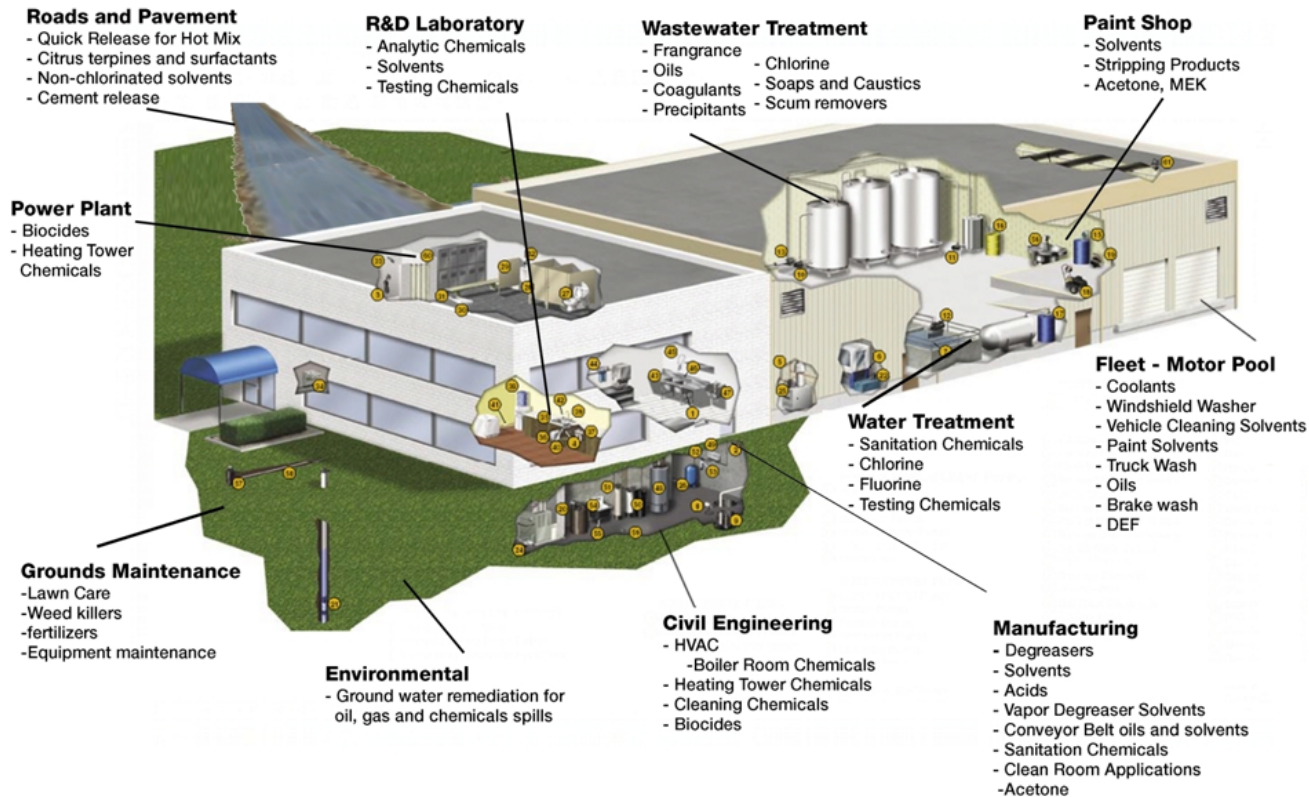
- Pump Locations and Uses
- Classification of Pumps
- Pump Selection
 - Define the Application Environment
 - Define the Specs
 - Flow Rates
 - Materials of Construction
 - Hazardous Locations

**Wetted System Parts
Must Be Inert
to the Liquid and Its Fumes**

Pump System Components

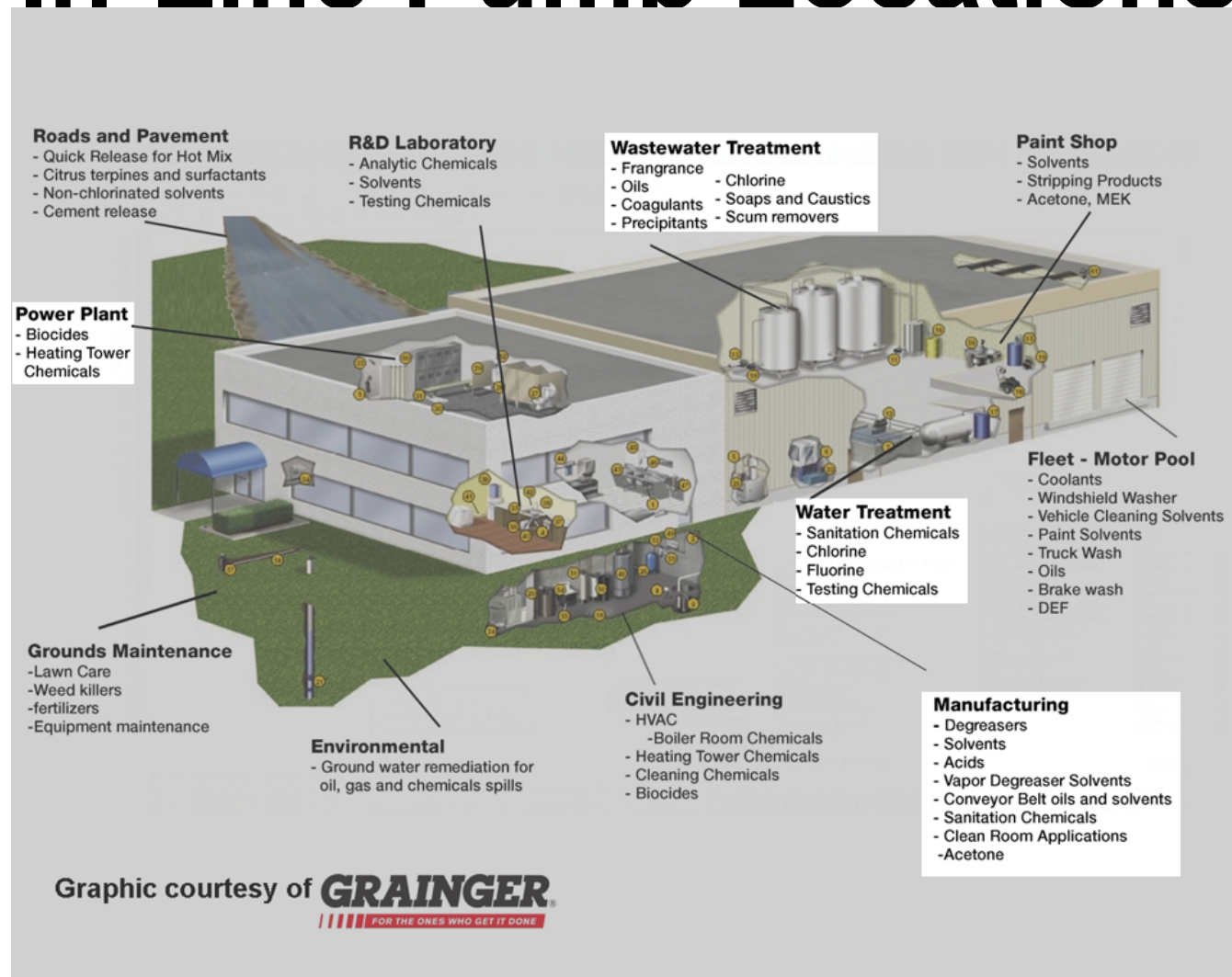


Pump Locations in a Plant

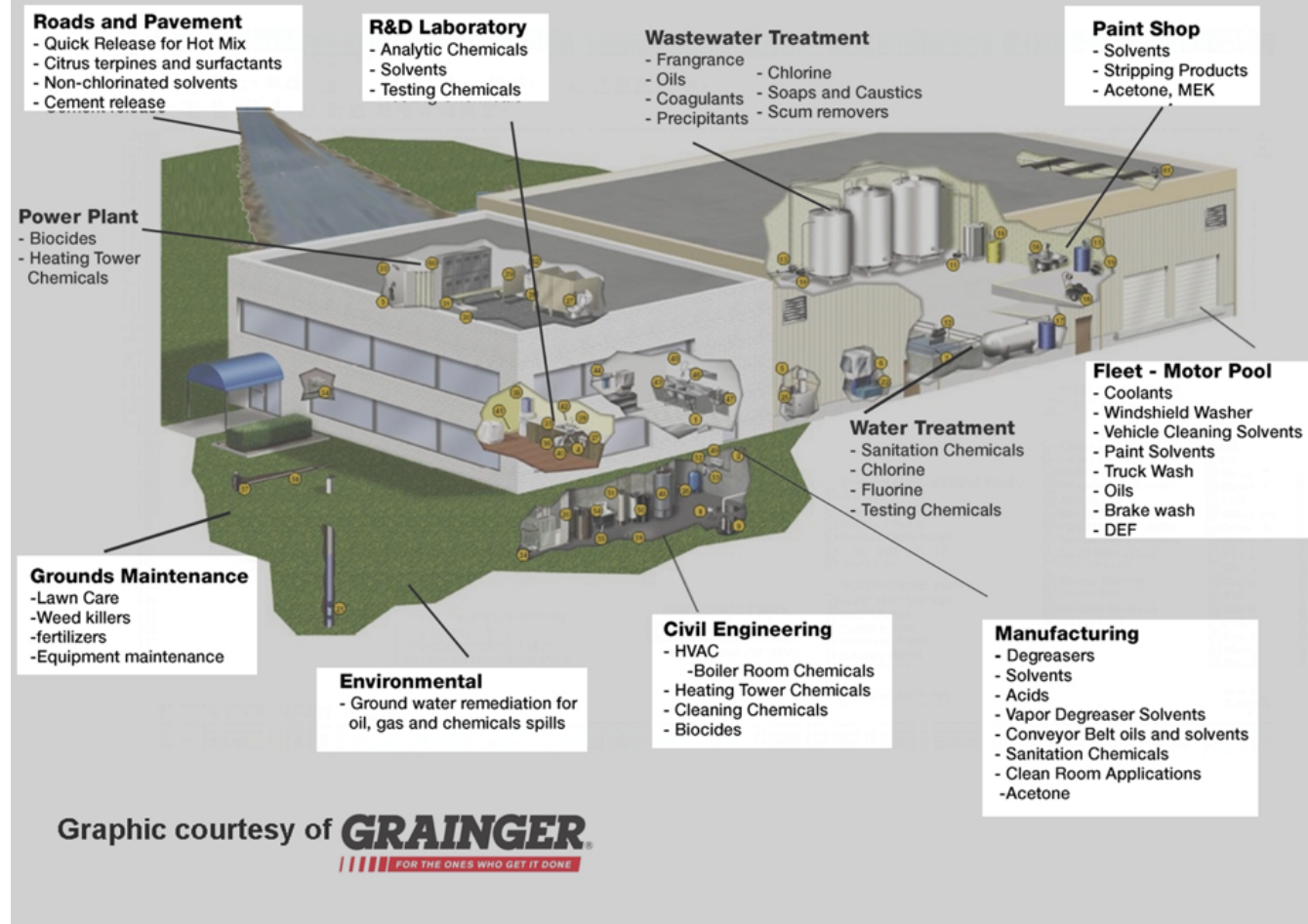


Graphic courtesy of **GRAINGER**
 FOR THE ONES WHO GET IT DONE

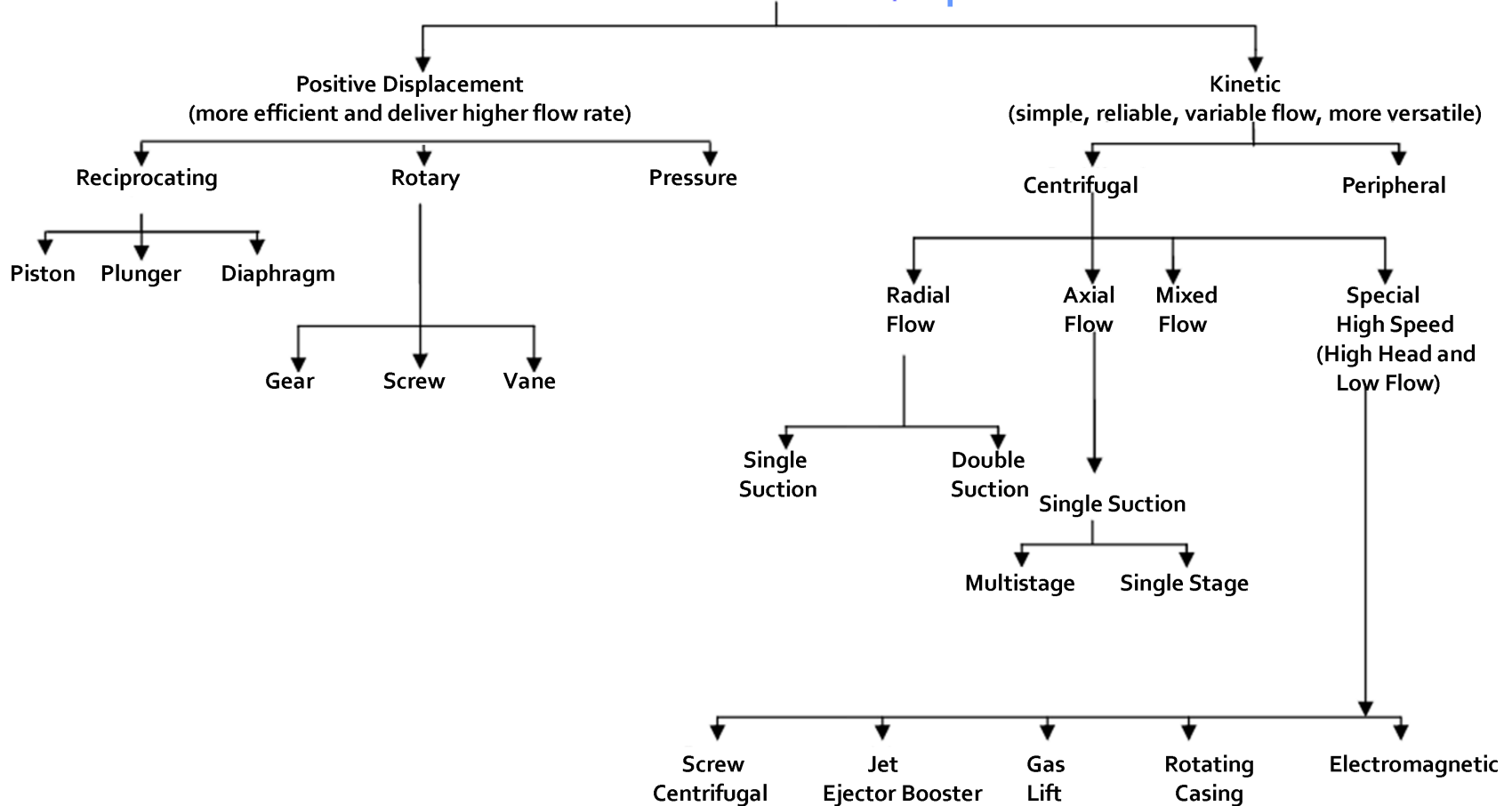
In-Line Pump Locations



Point of Use Locations

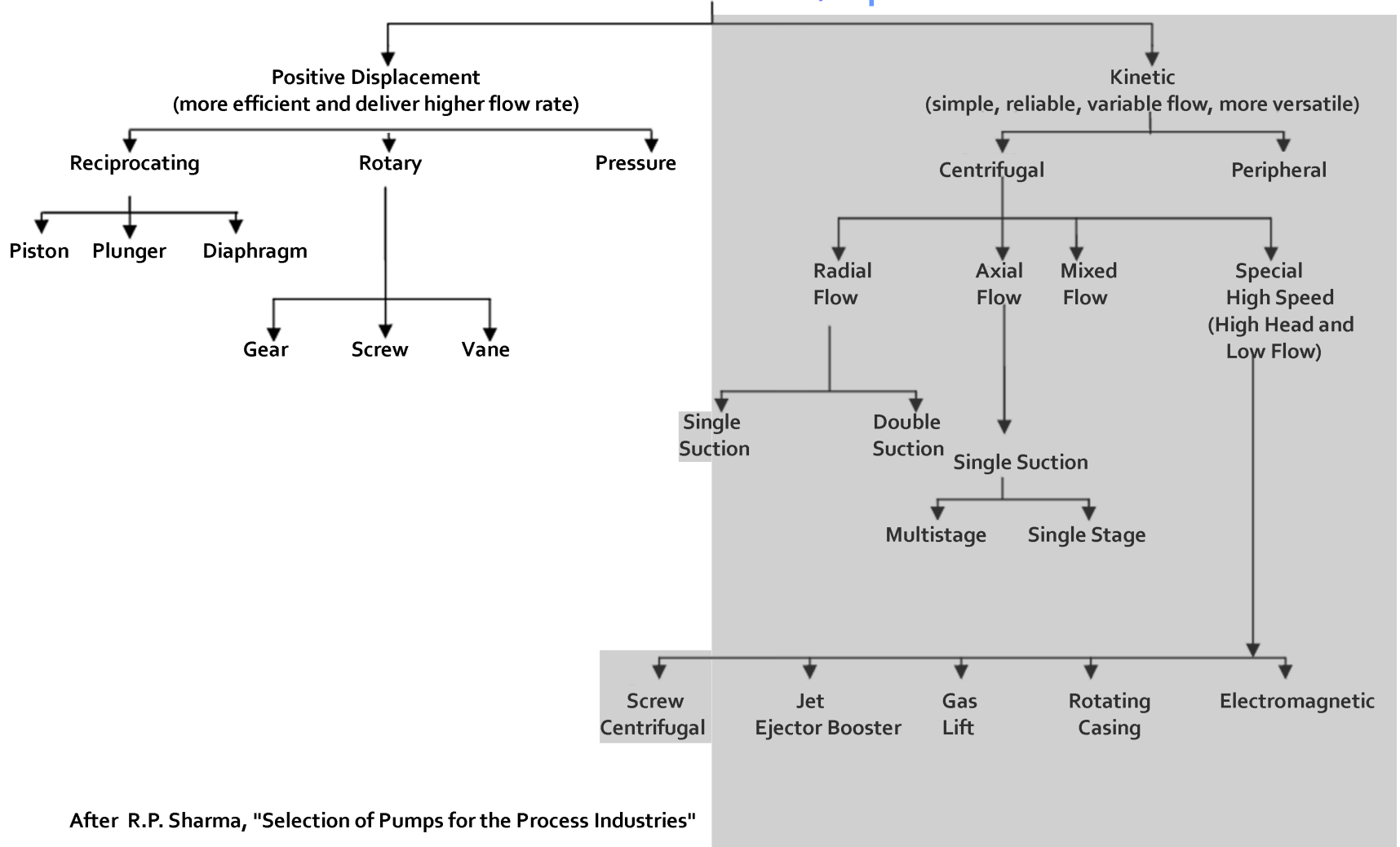


Classification of Pumps



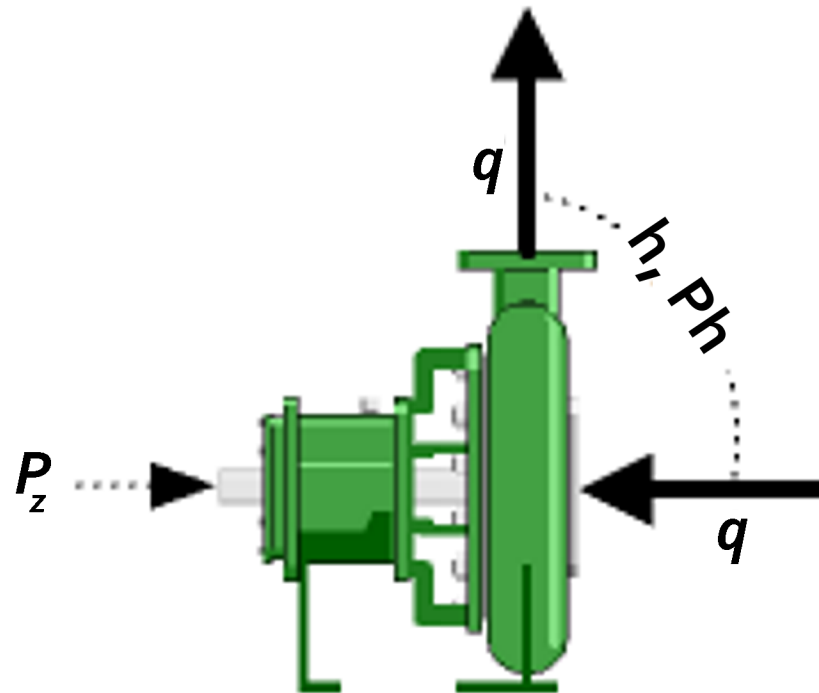
After R.P. Sharma, "Selection of Pumps for the Process Industries"

Classification of Pumps

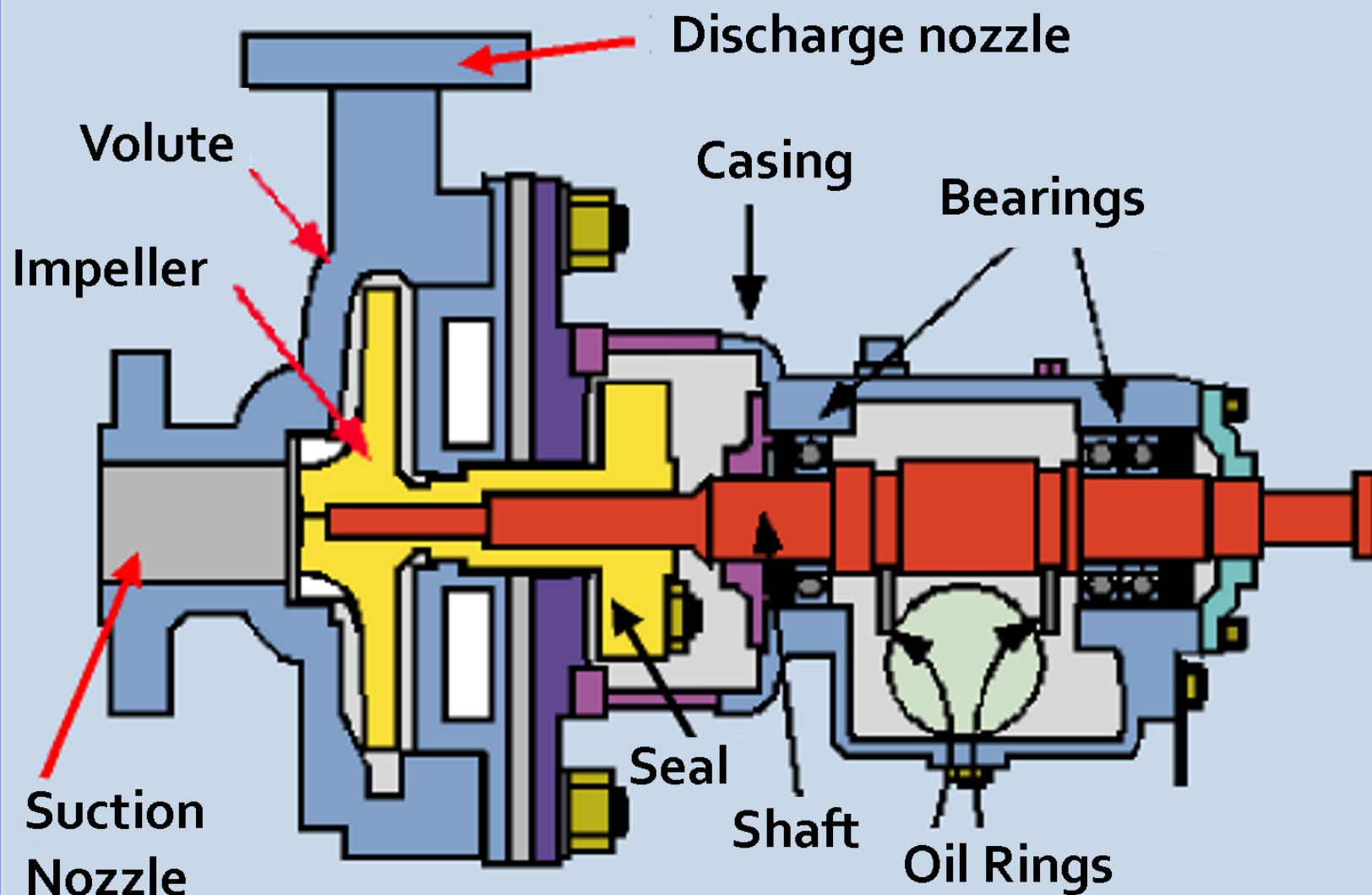


After R.P. Sharma, "Selection of Pumps for the Process Industries"

Centrifugal Pumps



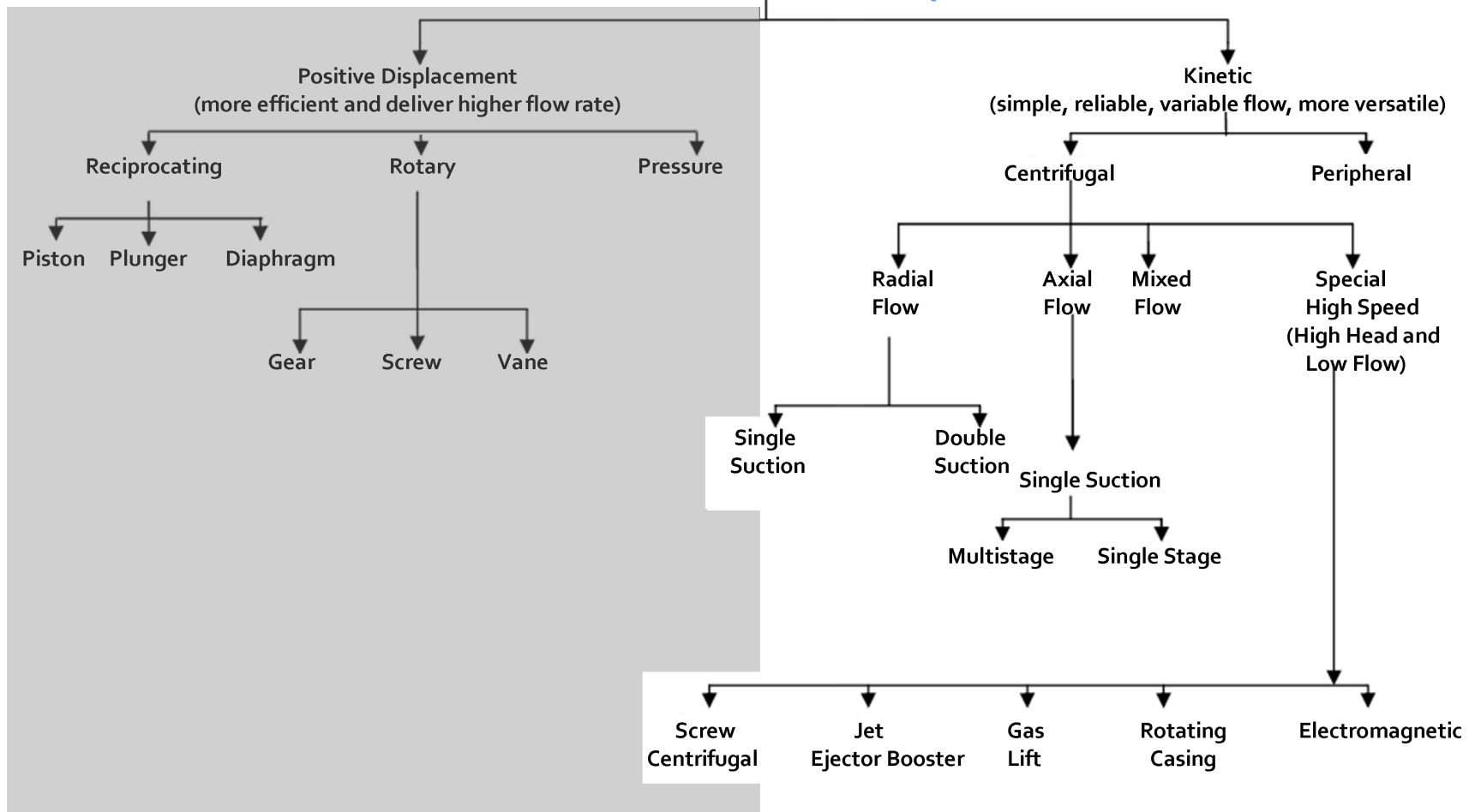
engineeringtoolbox.com



Centrifugal Pump

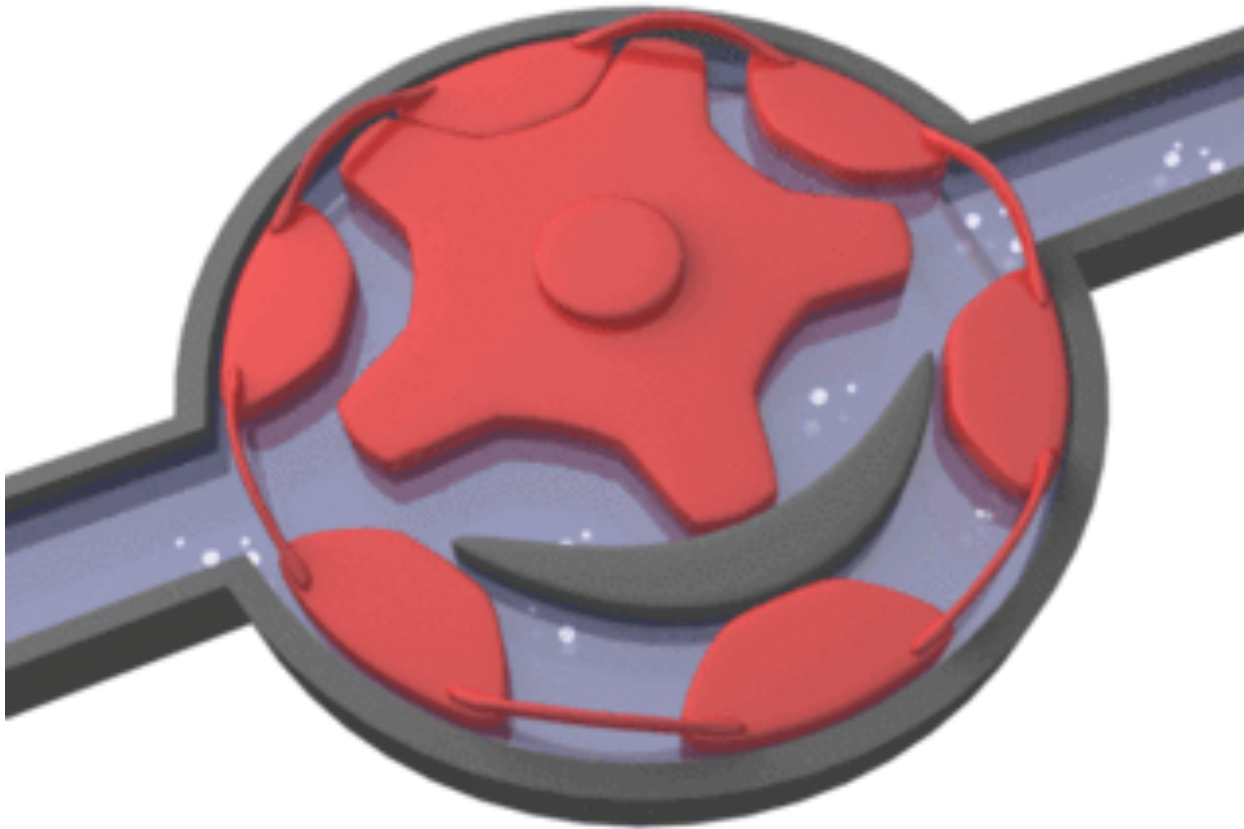
Energy Efficiency Guide for Industry in Asia- www.energyefficiencyasia.org

Classification of Pumps



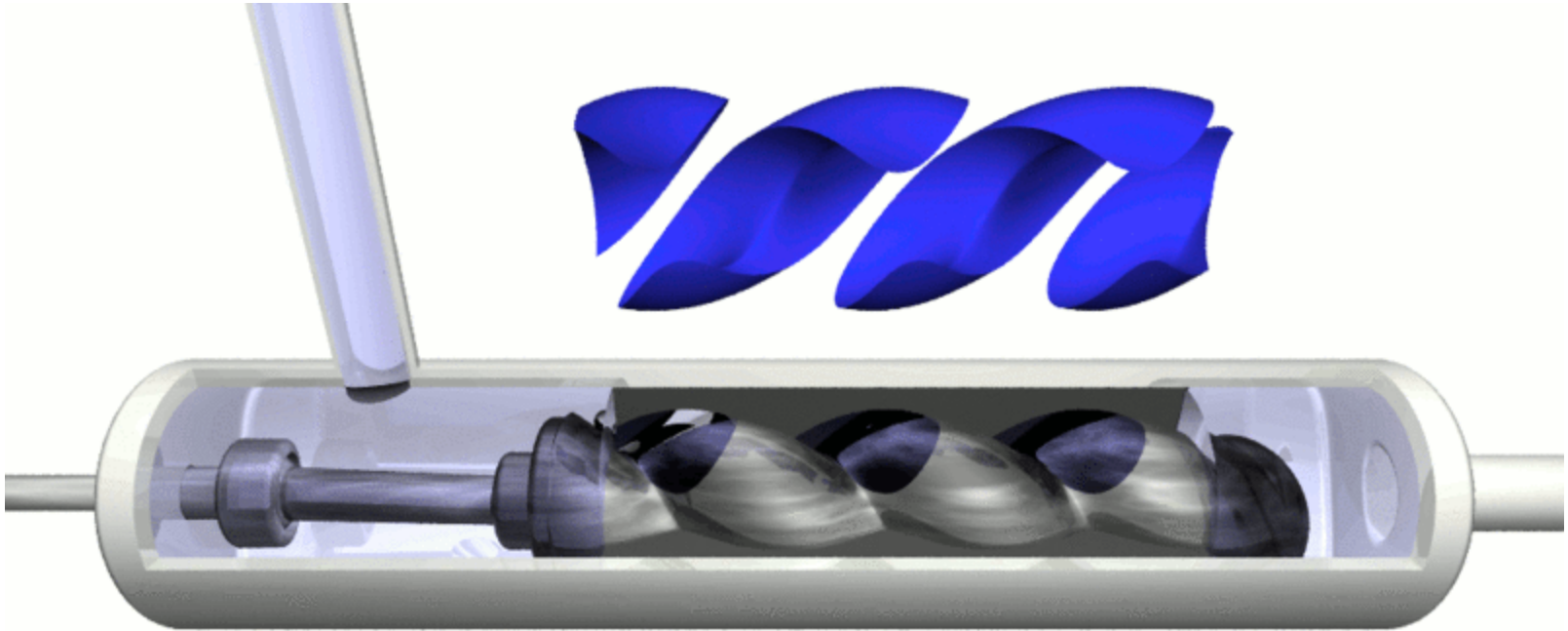
After R.P. Sharma, "Selection of Pumps for the Process Industries"

Gear Pumps



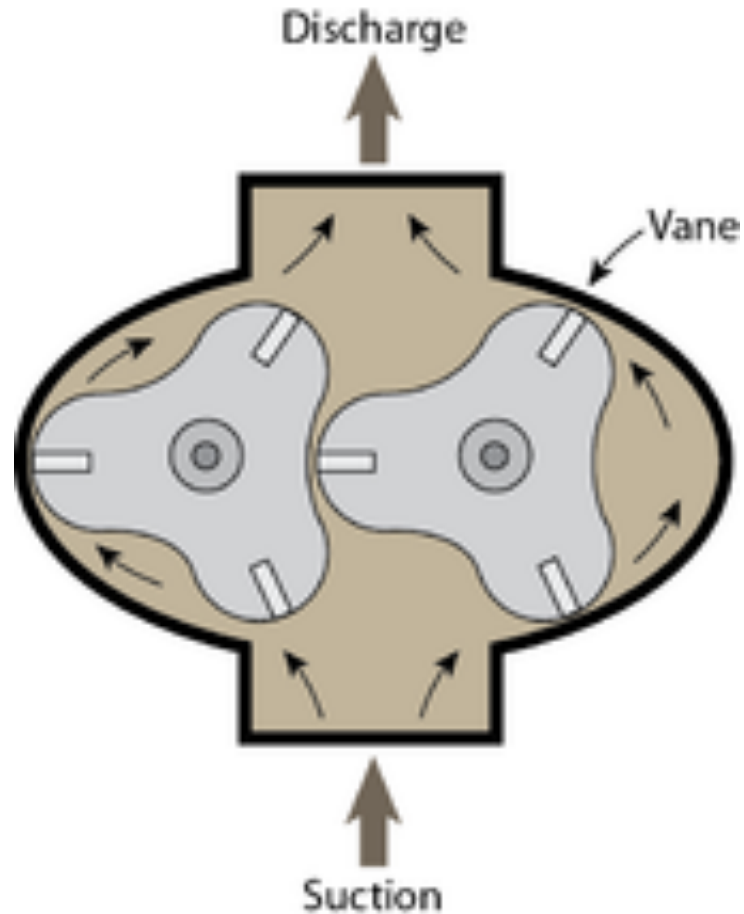
From Wikipedia.com

Progressive Cavity Pumps



From Wikipedia.com

Lobe Pumps



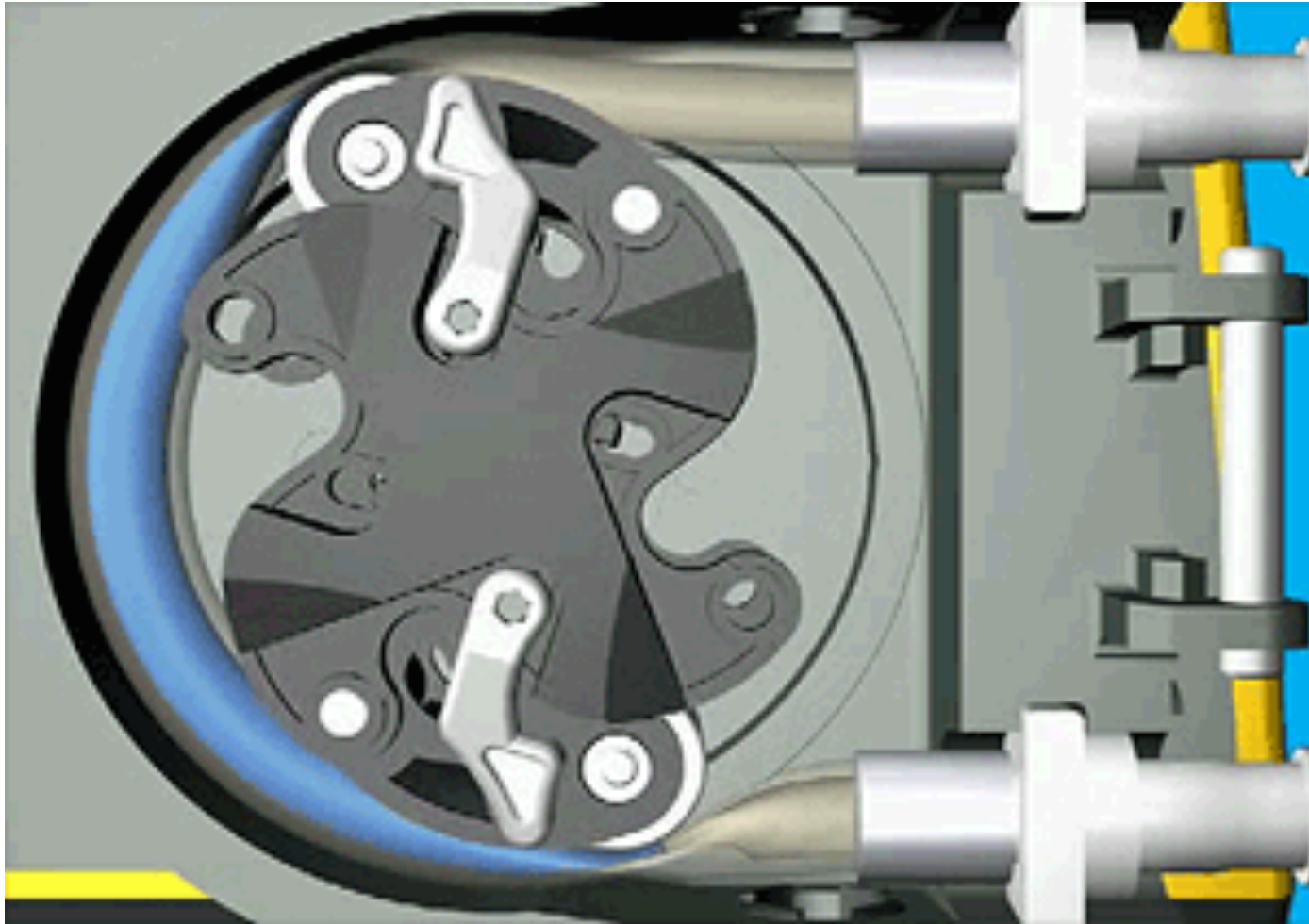
From Wikipedia.com

Rotary Vane Pump



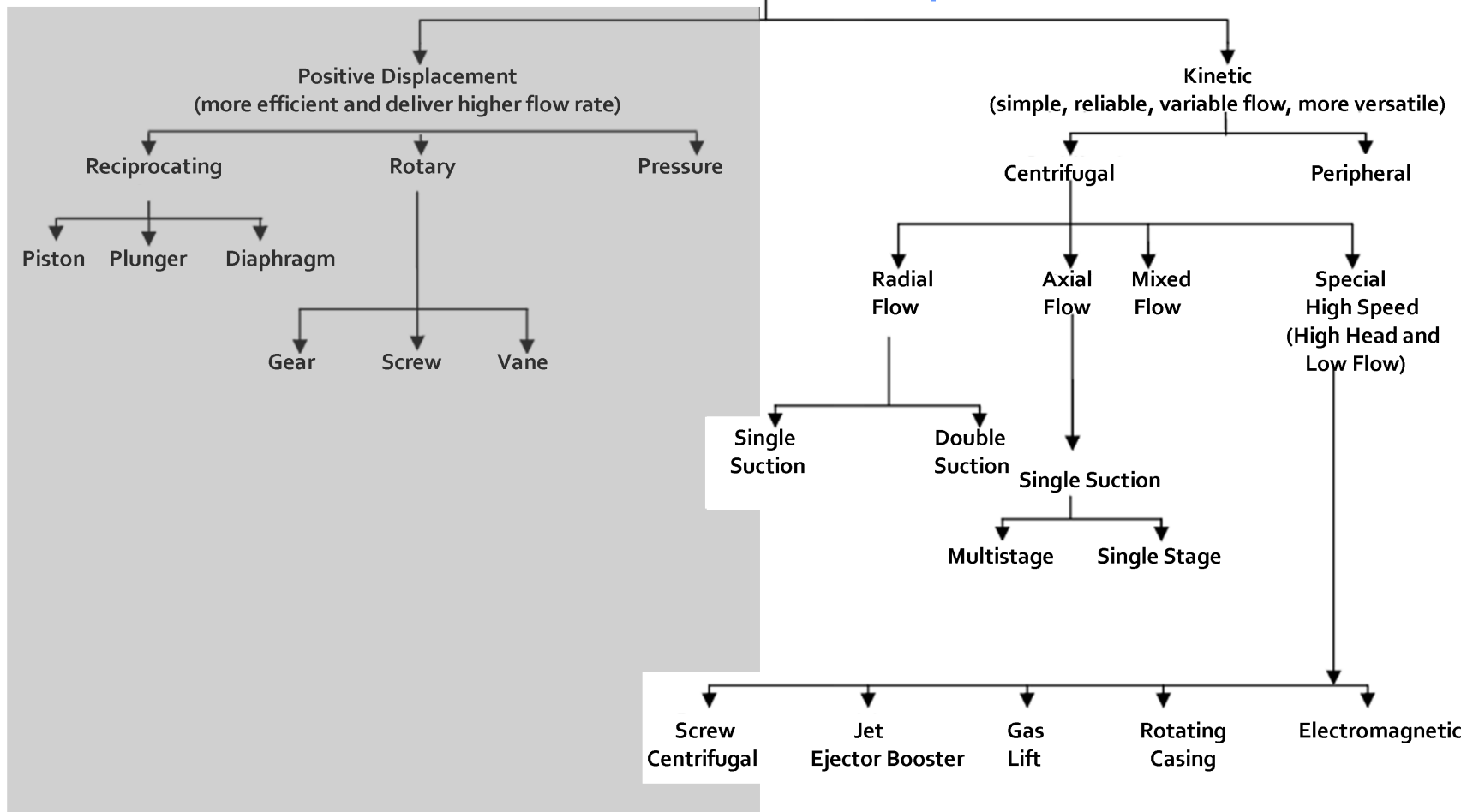
From Wikipedia.com

Peristaltic Pumps



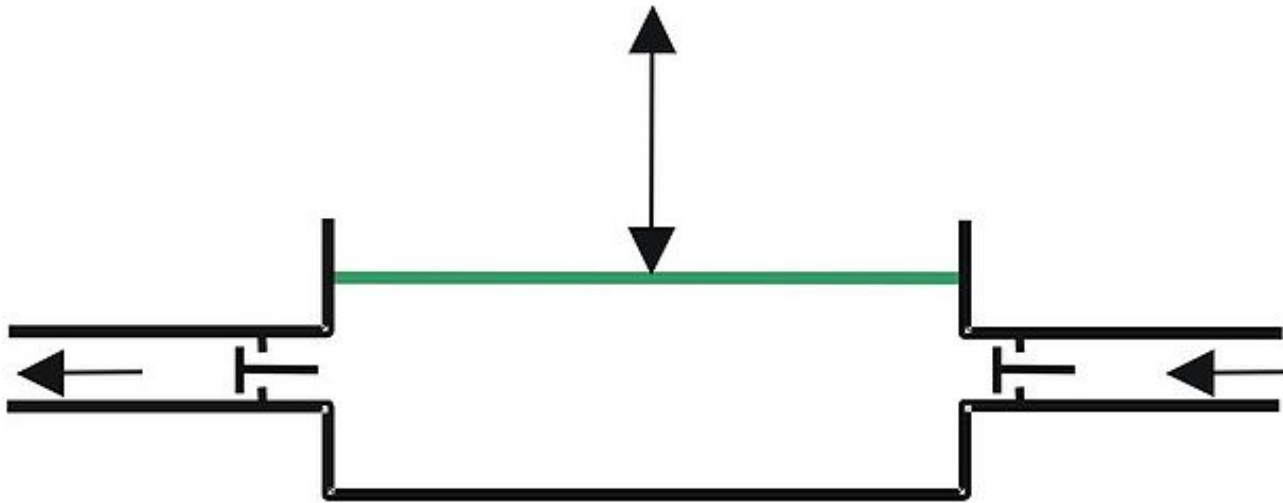
From Wikipedia.com

Classification of Pumps



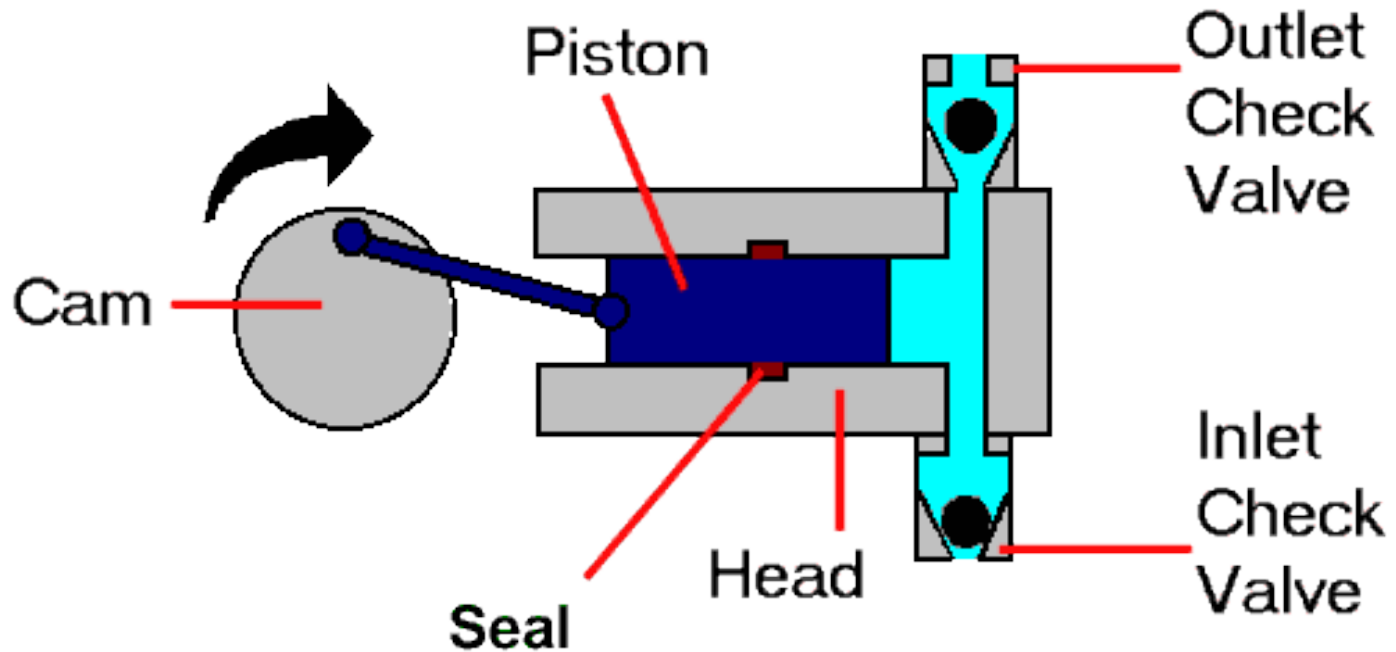
After R.P. Sharma, "Selection of Pumps for the Process Industries"

Diaphragm Pump



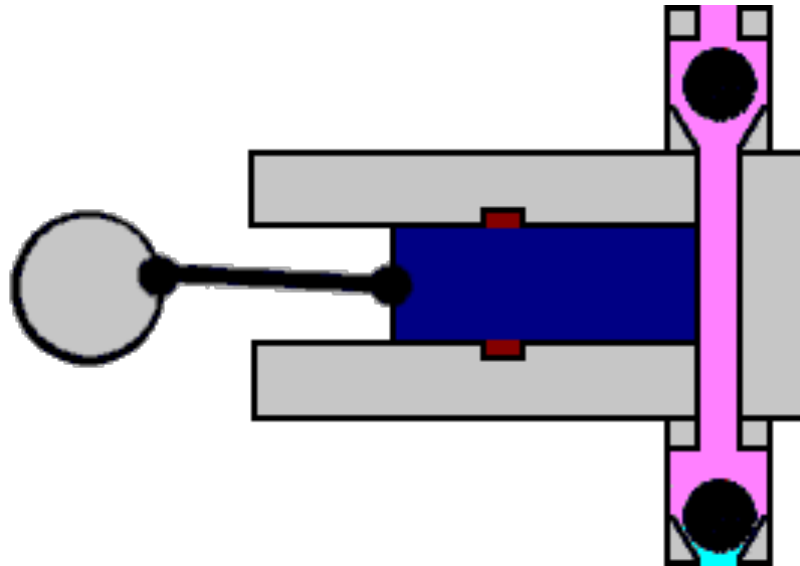
From Wikipedia.com

Piston Pump



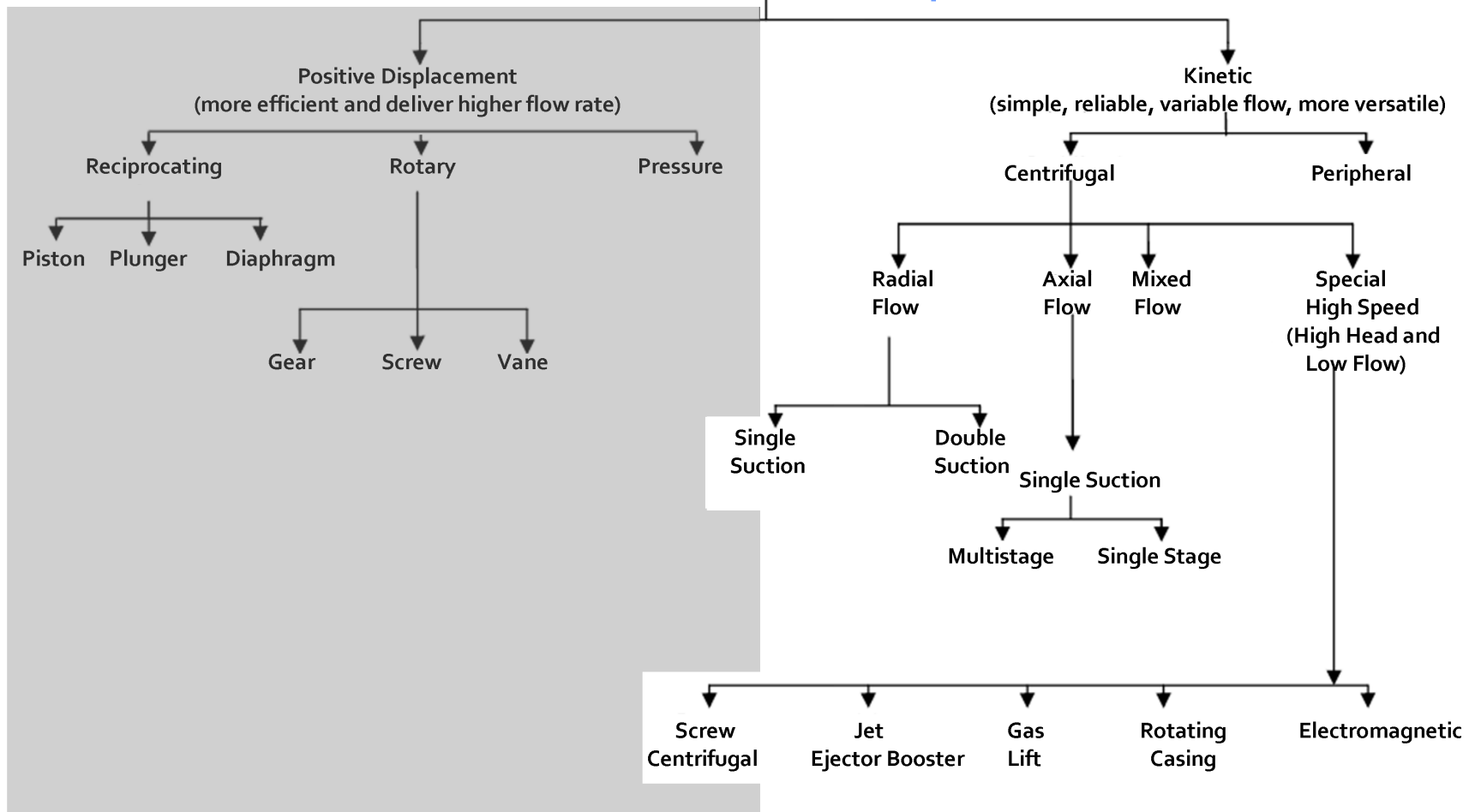
From Wikipedia.com

Piston Pump



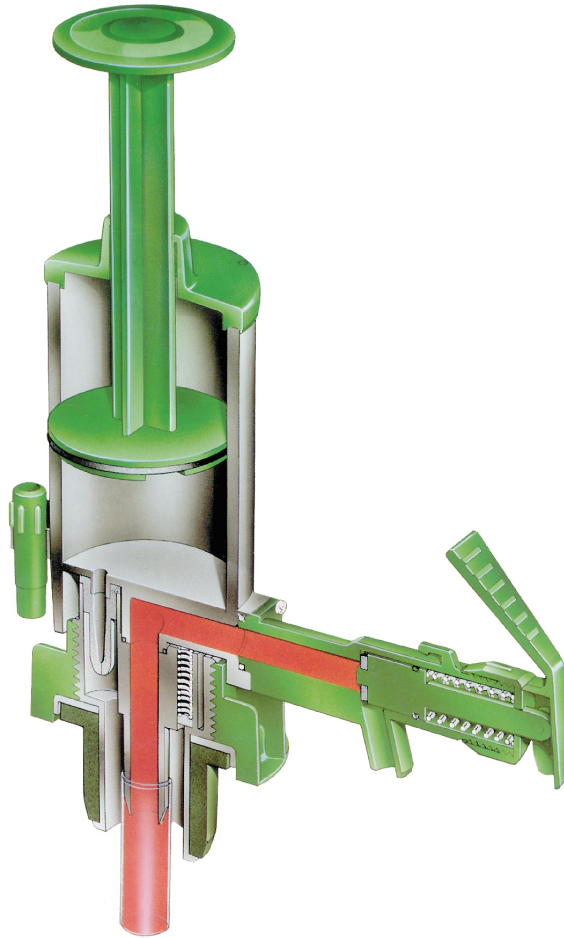
From Wikipedia.com

Classification of Pumps



After R.P. Sharma, "Selection of Pumps for the Process Industries"

Pressure Pump



Pump Selection: Define the Need

- Centrifugal
 - Variable Flow Rate depending on pressure head and flow rate
 - Not good with viscous fluids
 - Changing pressure or head will have a dramatic effect on flow rate
- Positive Displacement
 - Fixed Flow Rate
 - Good with Viscous fluids
 - Changing system pressure or head will have no effect on flow rate

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Pump Selection: Define the Specs

- **KIND OF MATERIAL BEING PUMPED**
- **PUMP OPERATION**
- **OPERATING ENVIRONMENT**
- **HOW POWERED**
- +++++++ many more

Pump Selection: Define the Specs

- **KIND OF MATERIAL BEING PUMPED**
 - Food
 - Base, Acid, Solvent
 - Flammable or combustible liquid
 - Slurry, Solid Or Clear
 - Viscosity Of Material
 - Hot or Cold Liquid Temperature
- **PUMP OPERATION**
- **OPERATING ENVIRONMENT**
- **HOW POWERED**
- +++++++ many more

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- Hot or Cold Liquid Temperature

- **PUMP OPERATION**

- Adjustable Or Fixed Flow Rate
- Continuous Or Occasional Duty
- Continuous Flow Vs Pulsing
- Might It Need To Run Dry?

- **OPERATING ENVIRONMENT**

- **HOW POWERED**

- +++++++ many more

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- **OPERATING ENVIRONMENT**

- Temperature
- Wet vs Dry Environment

- **HOW POWERED**

- +++++++ many more

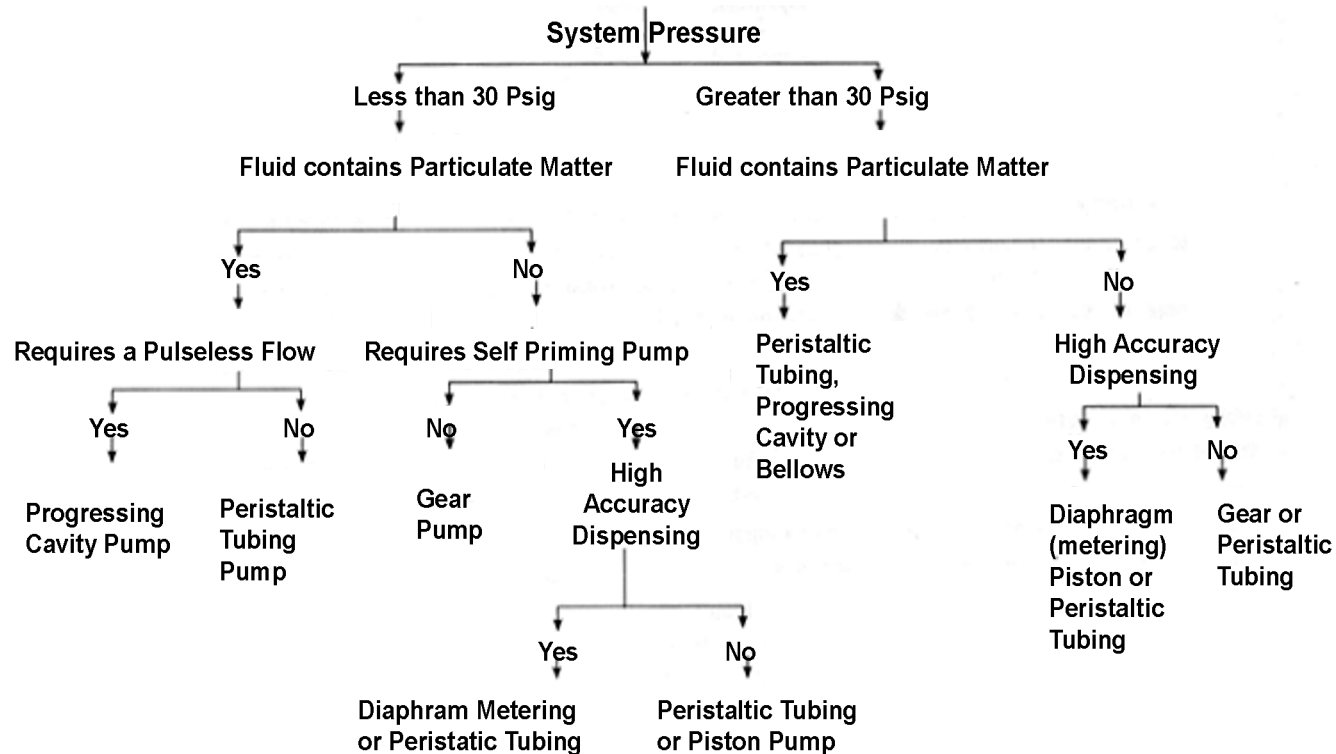
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- **PUMP OPERATION**
 - Adjustable Or Fixed Flow Rate
 - Continuous Or Occasional Duty
 - Continuous Flow Vs Pulsing
 - Might It Need To Run Dry?
- **OPERATING ENVIRONMENT**
 - Temperature
 - Wet vs Dry Environment
- **HOW POWERED**
 - Electric, Pneumatic Or Hand Operated

Pump Selection: Flow Rate

Selection Based on Flow "Decision Tree"

Case - I: Fluid flow less than 1 gpm

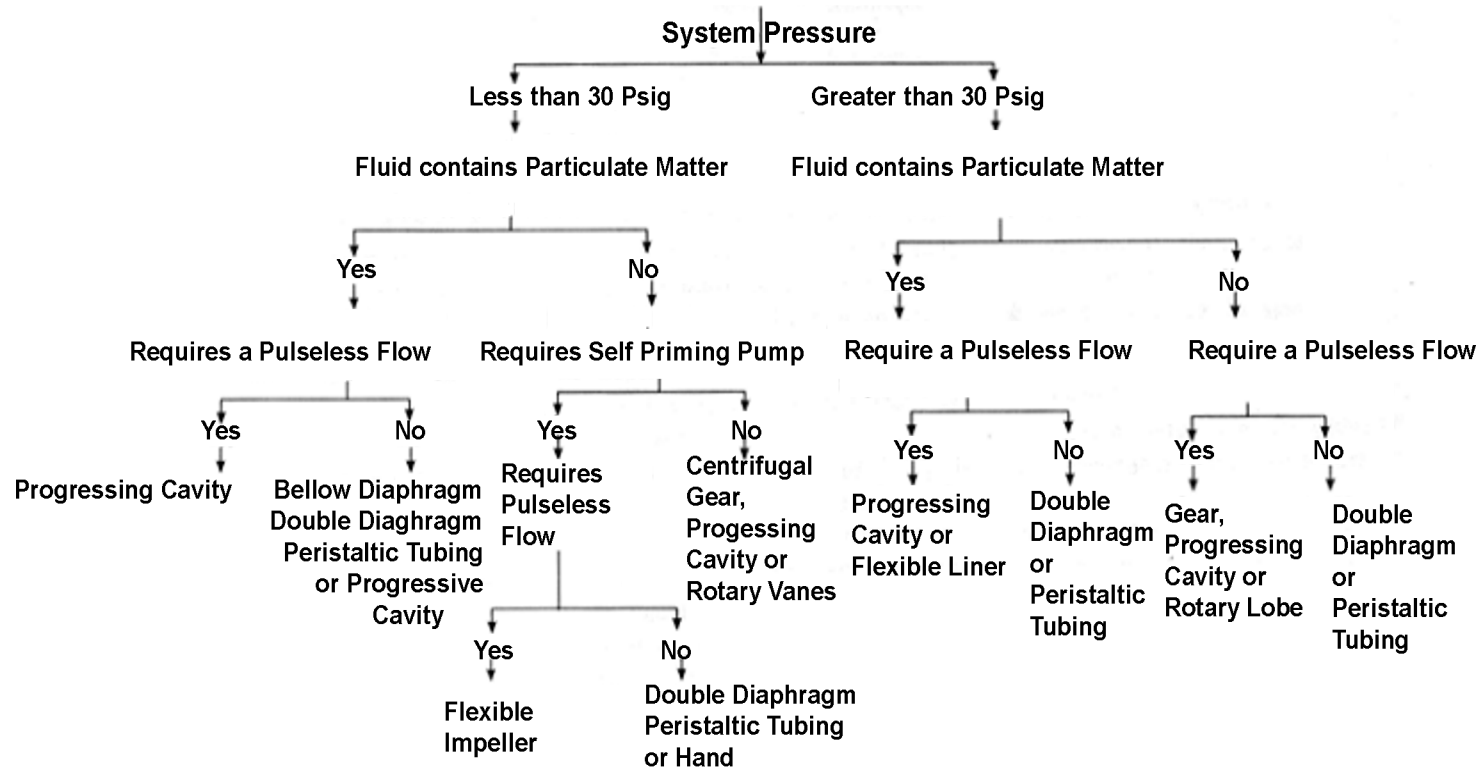


R.P. Sharma: "Selection of Pumps for the Process Industry"

Pump Selection: Flow Rate

Selection Based on Flow "Decision Tree"

Case - II: Fluid flow 1 to 20 gpm

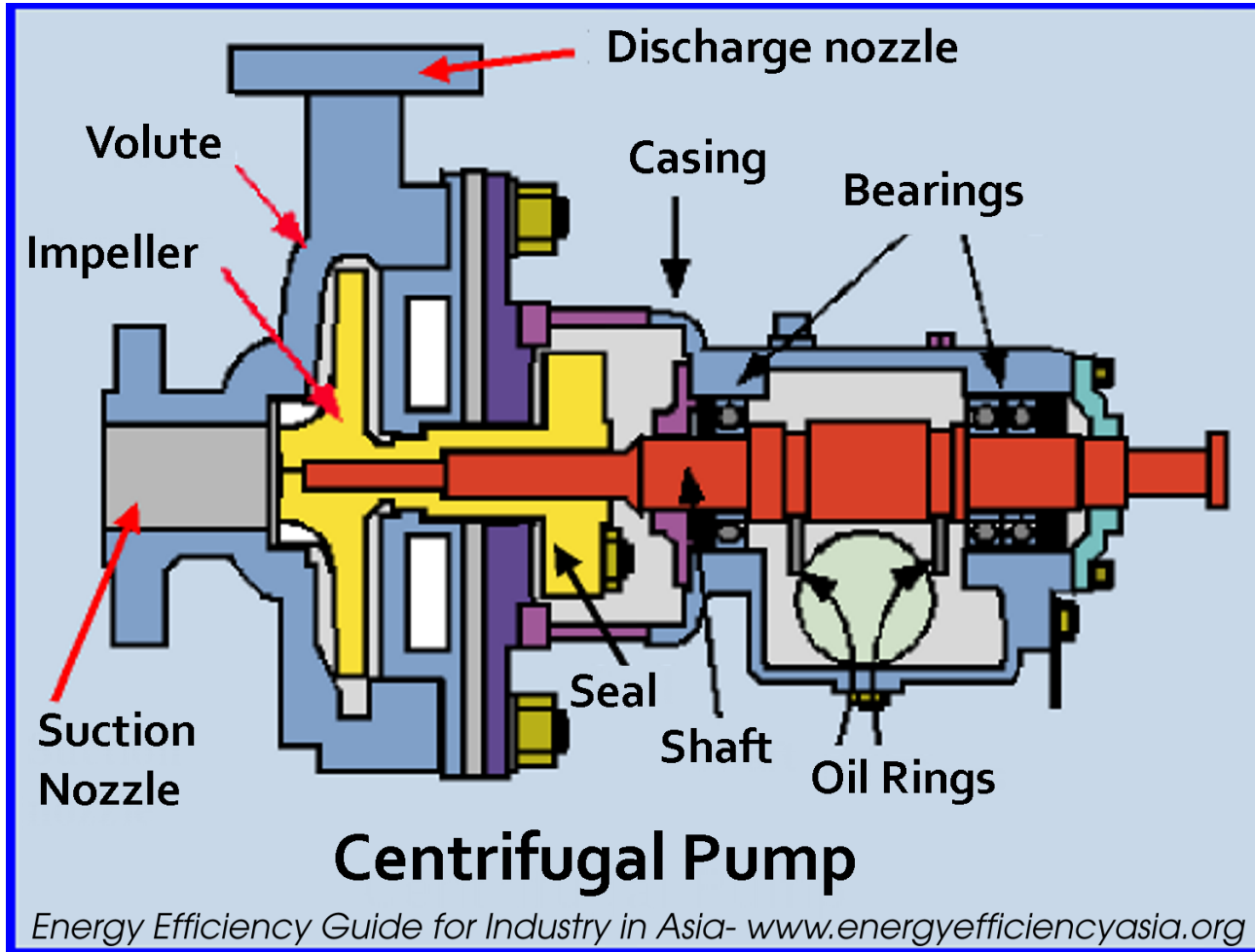


R.P. Sharma: "Selection of Pumps for the Process Industry"

Materials of Construction

- Match the liquid with the pump components to avoid corrosion or deterioration of either the product or the pump.

Materials of Construction



Materials of Construction

- FOOD GRADE PUMPS
 - Must be made of FDA compliant materials
 - Must be cleanable to appropriate standards with heat or chemical
 - Stainless Steel
 - Food grade plastics and elastomeric parts (rubber parts)

Materials of Construction

- Hazardous chemicals require MSDS
- This special paperwork can help figure out what pump materials are correct.

Materials of Construction

- Hazardous chemicals require MSDS
- This special paperwork can help figure out what pump materials are correct.
- The MSDS, Material Safety Data Sheet has a new name – SDS.
- See more at:
<http://www.msdsonline.com/blog/2012/08/from-msds-to-sds/#sthash.Mr11Dqm0.dpuf>

Materials of Construction

- ON-LINE RESOURCES FOR MATERIALS SELECTION
- <http://www.coleparmer.com/Chemical-Resistance>
- <http://www.flw.com/datatools/compatibility/>
- <http://goatthroat.com/complete-chemical-liquid-compatibility-guide/>
- <http://www.goatthroat.com/downloads/GoatThroat%20Training/Johnson%20Chemical%20Guide.pdf>

Materials of Construction

The screenshot shows the Cole-Parmer Chemical Compatibility Database website. The browser window title is "Chemical Compatibility Database from Cole-Parmer - Mozilla Firefox". The address bar shows "www.coleparmer.com/Chemical-Resistance". The website header includes the Cole-Parmer logo, contact information (1-800-323-4340), a welcome message, and a shopping cart icon. The main navigation bar includes "Shop All Products", "Shop by", "Service & Support", "Technical Resources", and "My Account". The "Technical Resources" section is expanded, showing "Resource Types" (Articles and White Papers, Case Studies, Conversions and Technical Data) and "Product Resources" (Actuators, Air Cleaners, Air Compressors). The "Chemical Compatibility Database" section is the main focus, with instructions: 1. Select a Material or Chemical. 2. Optional - select another category (Material, Chemical, or Rating) to narrow your results. 3. Click "See results". Below these instructions are two dropdown menus: "Material" (with options: All, ABS plastic, Acetal (Delrin®), Aluminum, Brass) and "Chemical" (with options: Oils:Ginger, Oils:Hydraulic Oil (Petro), Oils:Hydraulic Oil (Synthetic), Oils:Lemon, Oils:Linseed). A "Rating" dropdown menu is set to "All". A "See Results" button is highlighted with a red arrow. A "WARNING" section states: "The information in this chart has been supplied to Cole-Parmer by other reputable sources and is to be used ONLY as a guide in selecting equipment for appropriate chemical compatibility. Before permanent installation, test the equipment with the chemicals and under the specific conditions of your application." On the right side, there is a "Share" button, a "Cole-Parmer Chemicals" advertisement with "Typical Savings 30-50%", and a "Masterflex I/P Digital Process Drive" advertisement.



1. Select a Material **or** Chemical.
2. **Optional** - select another category (Material, Chemical, or Rating) to narrow your results for a specific combination or compatibility rating.
3. Click "See results"

Note: You can not choose Rating with BOTH Material **and** Chemical selected.

Material

All
ABS plastic
Acetal (Delrin®)
Aluminum
Brass

Chemical

Oils:Ginger
Oils:Hydraulic Oil (Petro)
Oils:Hydraulic Oil (Synthetic)
Oils:Lemon
Oils:Linseed

Rating

All

See Results



WARNING

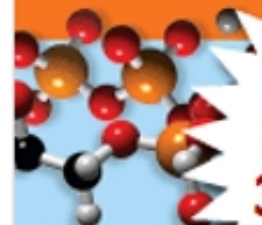
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derMain\$ContentPlaceHolderMainContents\$BtnSeeResults',")

Cole-Parmer
Chemicals

Your formula
savings & qu

Exceptional
values!



Compared
to competitive
list prices

Masterflex
Proces

Powder-
Coated
Housing,
Reversible
motor,



Pumps and pum...



3 Firefox



Pumps v1.ppt



Microsoft Excel - ...



Corel PH

Materials of Construction

Untitled Page from Cole-Parmer - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Untitled Page from Cole-Parmer

www.coleparmer.com/Chemical-Resistance

Technical Resources

Resource Types:

- Articles and White Papers (419)
- Case Studies (105)
- Conversions and Technical Data (93)
- [+] Show more (4)

Product Resources:

- Actuators (1)
- Air Cleaners (1)
- Air Compressors (2)
- [+] Show more (97)

Industries:

- Chemical Process (61)
- Electrochemistry (47)
- Energy (75)
- [+] Show more (18)

Technical Resource Map

Chemical Compatibility Results

Material and their Compatibility Rating with your selected Chemical are listed below:

Chemical Selected: Oils:Hydraulic Oil (Petro)

New search

Shop now

Material	Compatibility
ABS plastic	N/A
Acetal (Delrin®)	B-Good
Aluminum	A-Excellent
Brass	A-Excellent
Bronze	A-Excellent
Buna N (Nitrile)	A-Excellent
Carbon graphite	B-Good
Carbon Steel	A-Excellent
Carpenter 20	A-Excellent
Cast iron	A-Excellent
Ceramic Al2O3	N/A
Ceramic magnet	N/A
ChemRaz (FFKM)	A-Excellent
Copper	A-Excellent
CPVC	N/A
EPDM	D-Severe Effect
Epoxy	A-Excellent
Fluorocarbon (FKM)	A-Excellent

Explanation of Footnotes

1. Satisfactory to 72°F (22°C)
2. Satisfactory to 120°F (48°C)

Ratings -- Chemical Effect

A = Excellent.

B = Good -- Minor Effect, slight corrosion or discoloration.

C = Fair -- Moderate Effect, not recommended for continuous use. Softening, loss of strength, swelling may occur.

D = Severe Effect, not recommended for ANY use.

N/A = Information not available.

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Cole-Parmer Chemicals

Your formula for cost savings & quality

Exceptional values!

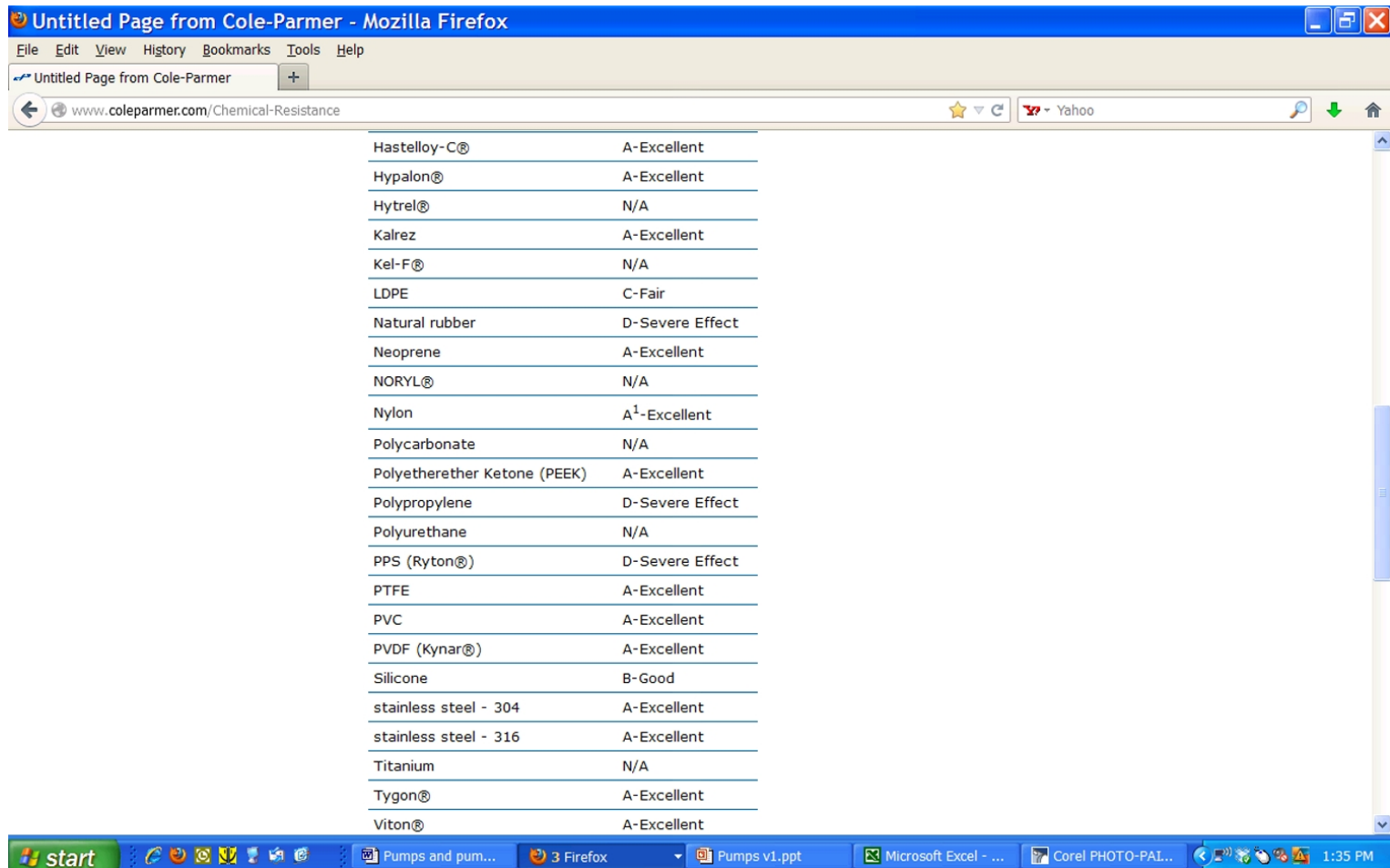
Typical Savings 30-50%

Compared to competitive list prices

start

Pumps and pum... 3 Firefox Pumps v1.ppt Microsoft Excel - ... Corel PHOTO-PAL... 1:35 PM

Materials of Construction



Untitled Page from Cole-Parmer - Mozilla Firefox

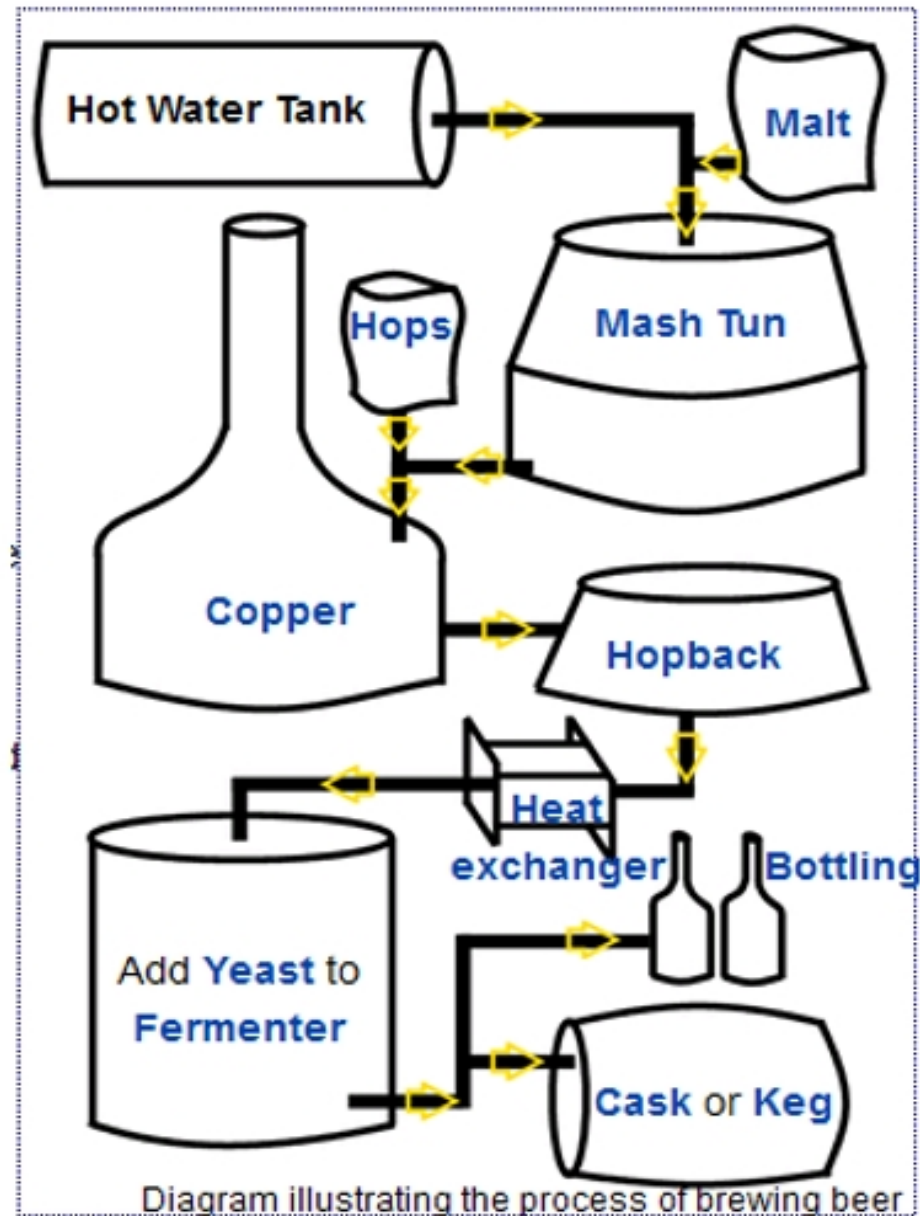
File Edit View History Bookmarks Tools Help

Untitled Page from Cole-Parmer

www.coleparmer.com/Chemical-Resistance

Hastelloy-C®	A-Excellent
Hypalon®	A-Excellent
Hytrel®	N/A
Kalrez	A-Excellent
Kel-F®	N/A
LDPE	C-Fair
Natural rubber	D-Severe Effect
Neoprene	A-Excellent
NORYL®	N/A
Nylon	A ¹ -Excellent
Polycarbonate	N/A
Polyetherether Ketone (PEEK)	A-Excellent
Polypropylene	D-Severe Effect
Polyurethane	N/A
PPS (Ryton®)	D-Severe Effect
PTFE	A-Excellent
PVC	A-Excellent
PVDF (Kynar®)	A-Excellent
Silicone	B-Good
stainless steel - 304	A-Excellent
stainless steel - 316	A-Excellent
Titanium	N/A
Tygon®	A-Excellent
Viton®	A-Excellent

start | Pumps and pum... | 3 Firefox | Pumps v1.ppt | Microsoft Excel - ... | Corel PHOTO-PAL... | 1:35 PM



Pumps for Hazardous Locations

Pumps for Hazardous Locations

EQUIPMENT CERTIFICATIONS

- WORLDWIDE STANDARDS
 - **IECEX**
- EUROPEAN STANDARDS
 - **ATEX**
- U.S. STANDARDS
 - **NFPA**
 - **UL**
 - **FM**
 - **INTERTEK**

Discussion Groups

- Linked-In has some great discussion groups going and they have answers from all over the world:
 - **Pump engineers**
 - Current discussions – slurry pumps; dry run production devices; fish mortality, injury and removal in cooling water intake systems
 - **Pump Professionals**
 - Current discussion: What is the benefit of having two pressure vessels on discharge header for two pumps instead of one vessel for two pumps, is it possible to select properly one vessel on one side instead of having 2?
 - **Pump Bombas – In English language**
 - Current discussions: Centrifugal Force is Farce !@#&

Contact:
Nancy Westcott
President, GoatThroat Pumps

www.goatthroat.com

nwestcott@goatthroat.com

Call 212.255.6964/ 866.639.4628

Reference Material

- All about plastics in pumps
<http://www.roadsbridges.com/application-possibilities-grow-plastic-pumps>
- When to choose a pd vs centrifugal
<http://www.michael-smith-engineers.co.uk/pdfs/When%20to%20use%20a%20Positive%20Displacement%20Pump%2002.pdf>
- When to choose peristaltic
<http://www.pump-zone.com/topics/pumps/pumps/choosing-right-pump-paint-systems>

Reference Material

- Slurry vs others
<http://www.pumpscout.com/articles-expert-advice/slurry-pumping-aid103.html>
- Centrifugal vs diaphragm
<http://www.wwdmag.com/pumps-centrifugal/picking-pump>
- Ebay's version choose the right pump
<http://www.ebay.com/gds/5-Tips-for-Choosing-the-Right-Pump-/10000000177634171/g.html>

Reference Material

- Really good British equipment overview
<http://www.pumpeng.co.uk/choosing-the-right-pump.aspx>
- Sizing etc
[http://www.edwardsvacuum.com/uploadedFiles/Resource/Technical Articles/How%20to%20Select%20the%20Right%20Vacuum%20Pump%20for%20the%20Application.pdf](http://www.edwardsvacuum.com/uploadedFiles/Resource/Technical%20Articles/How%20to%20Select%20the%20Right%20Vacuum%20Pump%20for%20the%20Application.pdf)
- Excellent pump selection primer
<http://www.energymanagertraining.com/Journal/24092005/SelectionofPumpsforProcessIndustries.pdf>

Reference Material

- Everything about centrifugal pumps
<http://net.grundfos.com/doc/webnet/mining/downloads/pump-handbook.pdf>
- Immersible pumps
http://us.grundfos.com/products/find-product/mtr-spk-mth-mta/jcr%3Acontent/tabbedpanel/brochures/par2/downloads/download_2/file/file.res/L-MT-SL-002.pdf

Reference Material

- Electrical energy useage and pump selection
http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=17&ved=0CHcQFjAGOAo&url=http%3A%2F%2Fwww.retscreen.net%2Ffichier.php%2F908%2FChapter%2520Pumps%2520and%2520Pumping%2520Systems.pdf&ei=AJB7UpiuDNStsATI14GACA&usg=AFQjCNH3kekNDCAMJnfpD_CasiMuZgwh_A&sig2=mVikpmGGMQUihJfUGio92A

Reference Material

- Life cycle cost
- [http://www.ciras.iastate.edu/publications/
EnergyBP-ChemicalIndustry/
Sourcebook_Chapter7.pdf](http://www.ciras.iastate.edu/publications/EnergyBP-ChemicalIndustry/Sourcebook_Chapter7.pdf)
- Gorman Rupp
[http://www.grpumps.com/files/
AV-05559.pdf](http://www.grpumps.com/files/AV-05559.pdf)