SEMLER INDUSTRIES

Liquid Equipment Reconditioning Services

Pumps, Meters, Compressors, Swivel Joints & More

Semler Industries, established in 1905, has served our customers in the greater Chicago market, and throughout the world, for over 100 years. Our customers can count on a consistent, reliable, and long-term source for products and support.

- Our technical service, support, and sales team have centuries of combined experience in providing cost-effective, problem-solving solutions to our customers in the storage, transfer, metering, and purification of fluids.
- We pride ourselves on service. Our long list of satisfied customers includes American Airlines, Abbott Labs, BP, Caterpillar, and nearly 4000 others, both large and small.
- Semler's large in-stock parts inventory, testing facility, and machine shop, as well as the experience and knowledge of our team assures our customers a cost-effective, timely, and reliable repair, time after time.
- Please review the following list of the products and equipment we repair and recondition, and allow our product specialists to review your liquid handling, filtration, and service / repair applications to see how we can help you.

Contact us today and ask for our Customer Satisfaction Department for assistance.
Phone: 847-671-5650 · E-Mail: cs@semlerindustries.com

Semler Industries is proud to offer the following list of equipment we service. This information is a general sampling of the products we recondition. If your product isn't listed, please inquire with your Semler Product Specialist. They are available to offer specific product services and answer technical questions.

Abaque	Ace	Aeromoter	Allflo	Ampco	AMT
ARO	Banjo	Bell & Gosset	Blackmer	Chesterton System One	Buffalo
Carver	Corcoran	Cornell	Crane	Crown	Dean
Ebara	Finish Thompson	Flojet	Flotec	Flowserve	Flux
Flygt	General Pump	Goulds	Graco AOD & Piston	Griswold	Grundfos
Gusher	Haight	Hypro	Iwaki	Jabsco	KSB
Liquid Controls	Lincoln	Little Giant	Liqui Flo	LMI	March
Marlow	Mepco	Milton Roy	Mono Flo	Mouvex (C-Series)	MTH
Murzan	Neptune	Oberdofer	Paco	Peerless	Pentair
Pioneer	Price	Pulsa Feeder	Ranger	Roper	Rotan
Sandpiper	Scott	Sherwood	ShurFlo	Simer	Standard
Tramco	Tsurumi	Tuthill	Vanton	Vaughn	Veeder Root
Versa-Matic	VertiFlo	Viking	Vogel	Warren-Rupp	Watson-Bridell
Weil	Waukesha	Wilden	Wright	Yamada	Yeoman

- Free Pick-Up and Delivery service available within greater Chicago area
- No Inspection fee for repaired or replaced equipment
- 48-hour repair estimates
- Rush service available upon request
- Inspection result consultation to prevent future equipment failure (upon request)
- Hydrostatic pressure testing of all repairs
- Hydrodynamic testing available (for equipment provided with a motor)
- Preventative Maintenance Recommendations

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Valuable Pump Formulas

Pressure

Feet of Water X 0.4333	= PSI
(PSI X 2.31)/Sp. Gr.	= Feet of Water
(Ft. Head x Sp. Gr.)/2.31	= PSI
PSI x 6.9	= kPa
ATM x 14.7	= PSI
ATM x 33.9	= Feet of Water
ATM x 760	= mm Hg
kg/cm2 x 1.42	= PSI
Meters of Water x 1.42	= PSI
Bar x 14.5	= PSI
Inches of Hg x 0.491	= PSI

Pipe Velocity

Velocity in Feet per Second:	GPM x 0.321 / Pipe Area in Square Inches
Rule of Thumb:	Typically, keep pipe velocities around 10 ft/second for good results.
Suction Piping:	Generally, have piping in one plane from source tank and have a straight run at least 10 times the pipes diameter leading into the pump suction.
Pipe Size:	Doubling the diameter of a pipe increases its capacity 4 times.

Centrifugal Pumps

Liquid HP: $\frac{\text{GPM x ft. of Head x Sp. Gr.}}{3960}$

Brake HP: $\frac{\text{GPM x TDH x Sp. Gr.}}{\text{3960 x Pump Efficiency}}$

Efficiency Overall HP: $\frac{\text{BHP}}{\text{Motor Efficiency}}$

Estimated effects of viscosity on Centrifugal Pumps

SSU	FLOW	HEAD	EFFICIENCY
35	100%	100%	80%
500	95%	98%	80%
1000	92%	97%	70%

Rotary Positive Displacement Pumps

Liquid HP: $\frac{\text{GPM x PSI}}{1714}$

Volumetric Efficiency: $\frac{\text{Actual GPM}}{\text{Theoretical GPM}}$

Overall Pump Efficiency: $\frac{\text{LHP}}{\text{BHP}}$

Mechanical: $\frac{\text{Overall Pump Efficiency:}}{\text{Volumetric Efficiency}}$

Approximate RPM @ Full Load - for medium sized motors

Poles	RPM (60 Hz)	Sync Speed	RPM (50 Hz)	Sync Speed
2	3500	3600	2850	3000
4	1750	1800	1450	1500
6	1150	1200	950	1000
8	850	900	700	750

Synchronous Speed (no load) Formula RPM = $\frac{\text{Frequency(Hz) x 120}}{\text{Number of Poles}}$

Insulation Class NEMA 1.15 Service Factor

A	150° C	221° F
B	130°C	266° F
F	155° C	311° F
H	180° C	356° F

Maximum motor temperature including temperature rise plus 40° C ambient temperature

Rules of Thumb for Motors

A motor develops 1.5 ft-lbs per HP @ 3600 RPM	A 3-phase motor draws 1.00 Amp per HP @ 557 Volts
A motor develops 3.0 ft-lbs per HP @ 1800 RPM	A 3-phase motor draws 1.25 Amp per HP @ 460 Volts
A motor develops 4.5 ft-lbs per HP@ 1200 RPM	A 3-phase motor draws 2.50 Amp per HP @ 230 Volts

HP = $\frac{\text{Torque (ft-lbs) x RPM}}{5252}$

Torque (in lbs) = $\frac{\text{HP x 63,000}}{\text{RPM}}$

Particle Size Comparison

Mesh	Inch	Micron
3250	.0002	6
1600	.0005	14
750	.0010	25
325	.0016	40
250	.0024	62
200	.0029	74
180	.0033	85
150	.0041	100
120	.0046	118
100	.0055	149
80	.0070	179
50	.0117	300
40	.0150	385
30	.0200	513
24	.0280	718
20	.0340	872
18	.0390	1000
16	.0450	1154
14	.0510	1308
12	.0600	1538
10	.0750	1923
8	.0970	2488
6	.1320	3385
4	.1590	4077
2	.2030	5205

1 Micron = 10^{-6} Meters
1 Micron = 3.9×10^{-5} inch

Atmospheric Pressure

Altitude in Feet	Pressure in PSIA
0	14.70
100	14.64
300	14.54
500	14.43
700	14.33
1,000	14.17
1,500	13.92
2,000	13.66
3,000	13.17
4,000	12.69
5,000	12.23
7,000	11.34
10,000	10.11
15,000	8.29
20,000	6.76
25,000	5.45
30,000	4.36
40,000	2.72
50,000	1.68
60,000	1.04

Viscosity

CONVERSIONS:

SSU*	= Centistokes x 4.55
Degrees Engler*	= Centistokes x 0.132
Sec. Redwood 1*	= Centistokes x 4.05
1 Stoke	= 100 Centistokes
1 Poise	= 100 Centipoises
Centistokes	= Centipoise/Sp. Gr.

*Where Centistokes are greater than 50

Definitions:

Newtonian fluids are unaffected by shear, e.g. water mineral oil.

Non-Netowinian fluids are affected by shear (5 types).

Bingham-Plastic fluids have an exact shear point which once exceeded, viscosity decreases.

Pseudo-Plastic fluids have no exact yield point, but instead, viscosity decreases as the magnitude of shear rate increases.

Dilatant fluids viscosity increases as the magnitude of the shear rate increases, e.g. printing ink, candy compounds.

Thixotropic fluids decrease in viscosity both in relation to the shear magnitude and the period of time subjected to shear. Viscosity might also depend on a previous shear condition, e.g. drilling mud, starches, paint.

Rheopectic fluids increase viscosity both in relation to the shear magnitude and the period of time subjected to shear, e.g. some greases.

Affinity Laws for Centrifugal Pumps

These formulas can be used to estimate capacity, head and BHP for a pump speed or impeller diameter when a curve is not readily available.

1. Flow is directly proportional to the ratio of impeller speed:

   $GPM_2 = \frac{GPM_1 \times RPM_2}{RPM}$

2. Head is directly Proportional to the square of the ratio of impeller speed:

   $Head_2 = Head1 \times \left(\frac{RPM_2}{RPM_1}\right)^2$

3. The HP is directly proportional to the ratio of impeller speed:

   $BHP_2 = BHP_1 \times \left(\frac{RPM^2}{RPM_1}\right)$

4. Flow is directly proportional to the ratio of impeller diameter:

   $Flow_2 = Flow_1 \times \left(\frac{\text{Impeller Diameter}_2}{\text{Impeller Diameter}_1}\right)^2$

5. Head is directly proportional to the square of the ratio of Impeller diameter:

   $Head_2 = Head_1 \times \left(\frac{\text{Impeller Diameter}_2}{\text{Impeller Diameter}_1}\right)^2$

6. The HP is directly proportional to the cube of the ratio of impeller diameter:

   $BHP_2 = BHP_1 \times \left(\frac{\text{Impeller Diameter}_2}{\text{Impeller Diameter}_1}\right)^2$