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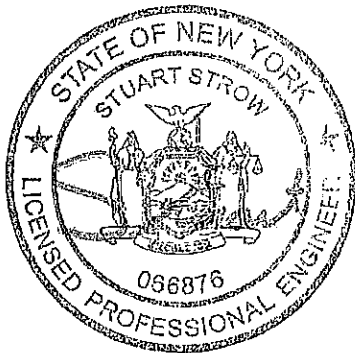
SEWAGE PUMP STATION DESIGN

Prepared for:

HILLSIDE COMMERCIAL PARK

Town of Orangetown
Rockland County, New York

November 6, 2014



Strow

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SEWAGE PUMP STATION DESIGN

Estimate Design Flow

A new sewage pump station will be designed to serve the warehouse building on the northerly side of the site. It will also receive sewage flow from the ejector pump that will serve the watchman's residence and small office on the southerly side of the site.

The watchmen's residence includes two bedrooms; the office space is 1,000 square feet and will be occupied by 2 employees.

$$\begin{aligned}\text{Water usage} &= [(2 \text{ BR}) \times (110 \text{ gal/BR/day})] + [(2 \text{ employees}) \times (15 \text{ gal/emp/day})] \\ &= 250 \text{ gpd}\end{aligned}$$

Sewage flow from the warehouse building will be based on the estimated number of employees that was used for the parking space calculation.

$$\text{Water usage} = [(132 \text{ employees}) \times (15 \text{ gal/emp/day})] = 1,980 \text{ gpd}$$

$$\text{Total flow} = (250 \text{ gpd}) + (1,980 \text{ gpd}) = 2,230 \text{ gpd}$$

$$\text{Average Flow} = Q_{\text{AVG}} = (2,230 \text{ gpd}) / (1440 \text{ min/day}) = 1.55 \text{ gpm}$$

Use peaking factor = 4

$$\text{Peak Flow} = Q_{\text{PEAK}} = (4) \times (1.55 \text{ gpm}) = 6.20 \text{ gpm}$$

Force Main Characteristics

Static Head

Invert elevation of destination manhole = 242.0

Low Level in proposed pump station = 215.0

$$\text{Static Head} = 27.0 \text{ feet}$$

Dynamic Head

Provide new 4" diameter force main

Straight length of force main = 675 feet

Equivalent length of valves and fittings (see attached table)

- (5) - 90° bends x 13 = 65.0 feet
- (4) - 45° bends x 5.5 = 22.0 feet
- (1) - Check valve x 38 = 38.0 feet
- (1) - Gate valve x 2.5 = 2.5 feet

Equivalent length = 127.5 feet

Total equivalent length = 675 feet + 127.5 feet = 802.5 feet

Total Dynamic Head Calculations

Flow (GPM)	*Friction Loss Factor (ft/100 ft)	System Dynamic Head (ft)**	Static Head (ft)	Total Dynamic Head (ft)
60	0.22	1.7655	27.0	28.77
80	0.38	3.0495	27.0	30.05
100	0.58	4.6545	27.0	31.65
125	0.88	7.062	27.0	34.06

*refer to attached chart

**system dynamic head = (friction loss factor) X (total equivalent length/100)

Pump Station Operating Characteristics

Select F.E. Myers Pump, Model WG30, 3 HP, 4.00" impeller, 3450 RPM

From plotted system curve, minimum operating discharge = 100 GPM @ 32 feet TDH

Check velocity in 4" diameter force main (Area = 0.0885 sq. ft.)

$$V = \frac{100 \text{ GPM}}{(0.0855 \text{ sq. ft.})(450 \text{ GPM/cfs})} = 2.60 \text{ ft/s}$$

OK – velocity exceeds minimum requirement of 2 ft/s

Selected Elevations

- Invert of wet well: 215.0
- Lead pump on: 218.0
- Lag pump on: 218.5
- All pumps off: 216.5
- Low level alarm: 216.0
- High level alarm: 218.5

Wet Well Volume

Use 5' diameter wet well

Area = 19.6 sq. ft.

Volume = (19.6 sq ft) x (7.48 gallons/cu ft) = 146.6 gallons / ft

Volume pumped = (1.5 ft) x (146.6 gallons / ft) = **219.9 gallons**

Check Cycling Times

At Peak Flow:

Pump OFF time = (219.9 Gallons) / (6.20 GPM) = 35.5 minutes

Pump RUN time (zero inflow) = (219.9 Gallons) / (100 GPM) = 2.20 minutes

Pump RUN time (peak inflow):
 $100(T) = 6.20(T) + 219.9$
 $93.8(T) = 219.9$
 $T = 2.34$ minutes

At Average Flow:

Pump OFF time = (219.9 Gallons) / (1.55 GPM) = 141.9 minutes

Pump RUN time (zero inflow) = (219.9 Gallons) / (100 GPM) = 2.20 minutes

Pump RUN time (avg. inflow):
 $100(T) = 1.55(T) + 219.9$
 $98.45(T) = 219.9$
 $T = 2.23$ minutes

FRICTION LOSS CHART

FRICTION LOSS PER 100 FEET OF PIPE OF PLASTIC PIPE

GPM	PIPE DIAMETER																				
	1/2 in.		3/4 in.		1 in.		1 1/4 in.		1 1/2 in.		2 in.		2 1/2 in.		3 in.		4 in.		5 in.		
	SCH 40	SCH 80	SCH 40	SCH 80	SCH 40	SCH 80	SCH 40	SCH 80	SCH 40	SCH 80	SCH 40	SCH 80	SCH 40	SCH 80	SCH 40	SCH 80	SCH 40	SCH 80	SCH 40	SCH 80	
1	2.08	4.02	0.51	0.86																	
2	4.16	8.03	1.02	1.72	0.55	0.88	0.14	0.21	0.07	0.10											
5	23.44	45.23	5.73	9.57	1.72	2.75	0.44	0.66	0.22	0.30	0.066	0.10	0.038	0.05	0.015	0.02					
7	43.06	83.07	10.52	17.76	3.17	5.04	0.81	1.21	0.38	0.55	0.11	0.15	0.051	0.07	0.021	0.028					
10	82.02		20.04	33.84	6.02	9.61	1.55	2.30	0.72	1.04	0.21	0.29	0.09	0.12	0.03	0.04					
15			42.46	71.70	12.77	20.36	3.28	4.87	1.53	2.20	0.45	0.62	0.19	0.26	0.07	0.09					
20			72.34		21.75	34.68	5.59	8.30	2.61	3.75	0.76	1.06	0.32	0.44	0.11	0.15	0.03	0.04			
25					32.88	52.43	8.45	12.55	3.95	5.67	1.15	1.60	0.49	0.67	0.17	0.22	0.04	0.06			
30					46.08	73.48	11.85	17.59	5.53	7.95	1.62	2.25	0.68	0.94	0.23	0.31	0.06	0.08			
35							15.76	23.40	7.36	10.58	2.15	2.99	0.91	1.25	0.31	0.42	0.08	0.11	0.03	0.04	
40							20.18	29.97	9.43	13.55	2.75	3.83	1.16	1.50	0.40	0.54	0.11	0.14	0.03	0.04	
45							25.10	37.27	11.73	16.85	3.45	4.76	1.44	1.99	0.50	0.67	0.13	0.17	0.04	0.06	
50							30.51	45.30	14.25	20.48	4.16	5.79	1.75	2.42	0.60	0.81	0.16	0.21	0.05	0.07	
60									19.98	28.70	5.84	8.12	2.46	3.39	0.85	1.14	0.22	0.30	0.07	0.10	
70											7.76	10.80	3.27	4.51	1.13	1.51	0.30	0.39	0.10	0.13	
75											8.82	12.27	3.71	5.12	1.28	1.72	0.34	0.45	0.11	0.14	
80											9.94	13.63	4.19	5.77	1.45	1.94	0.38	0.50	0.13	0.16	
90											12.37	17.20	5.21	7.18	1.89	2.41	0.47	0.63	0.16	0.20	
100											15.03	20.90	6.33	8.72	2.18	2.93	0.58	0.76	0.19	0.24	
125												9.58	13.21	3.31	4.43	0.88	1.16	0.29	0.37		
150												13.41	18.48	4.63	6.20	1.22	1.61	0.40	0.52		
175														6.16	8.26	1.63	2.15	0.54	0.69		
200														7.88	10.57	2.08	2.75	0.69	0.88		
250														11.93	16.00	3.15	4.16	1.05	1.34		
300														4.41	5.83	1.46	1.95	1.46	1.87		
350																5.87	7.76	1.95	2.49		
400																7.52	9.93	2.49	3.19		
450																		3.09	3.97		
500																			3.76	4.82	

THIS CHART GIVES FRICTION LOSSES FOR YOUR GIVEN FLOW RATE PER 100 FEET OF PIPE. EXAMPLE: IF YOU HAVE 80 GALLONS PER MINUTE AND YOU'RE USING 2 INCH SCHEDULE 80 PIPE AND YOU HAVE A 150 FEET OF PIPE, YOUR FRICTION LOSS IS $8.12 \times 1.5 = 12.98$ FEET.

NOTE: IT IS BEST TO KEEP YOUR FRICTION LOSS (PER 100 FEET OF PIPE) TO LESS THAN 5 FEET.

FRICTION LOSS IN PVC FITTINGS IN EQUIVALENT FEET OF STRAIGHT PIPE

NORMAL PIPE SIZE (IN)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
90° ELBOW, STANDARD	1.5	2.0	2.25	4.0	4.0	6.0	8.0	8.0	12.0
45° ELBOW, STANDARD	0.75	1.0	1.4	1.75	2.0	2.5	3.0	4.0	5.0
INSERT COUPLING	0.5	0.75	1.0	1.25	1.5	2.0	3.0	3.0	4.0
GATE VALVE	.3	.4	.6	.8	1.0	1.5	1.6	2.0	3.0
MALE-FEMALE ADAPTERS	1.0	1.5	2.0	2.75	3.5	4.5	-	6.5	9.0
TEE - FLOW THROUGH RUN	1.0	1.4	1.7	2.3	2.7	4.3	5.1	6.3	8.3
TEE - FLOW THROUGH BRANCH	4.0	5.0	6.0	7.0	8.0	12.0	15.0	16.0	22.0

PUMP STATION DESIGN

BBE #57007

Total Equivalent Length: 802.5 LF

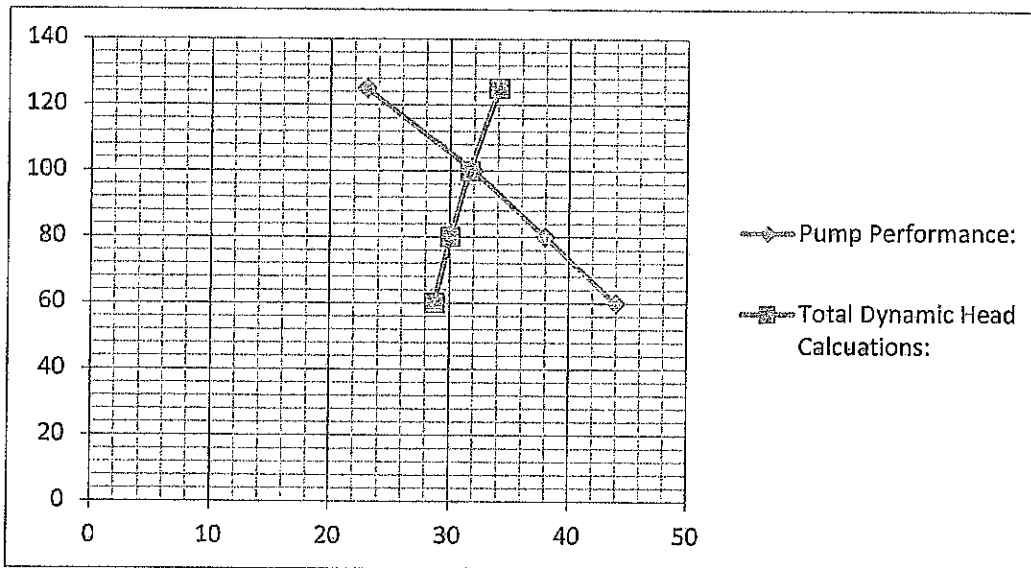
Total Dynamic Head Calculations:

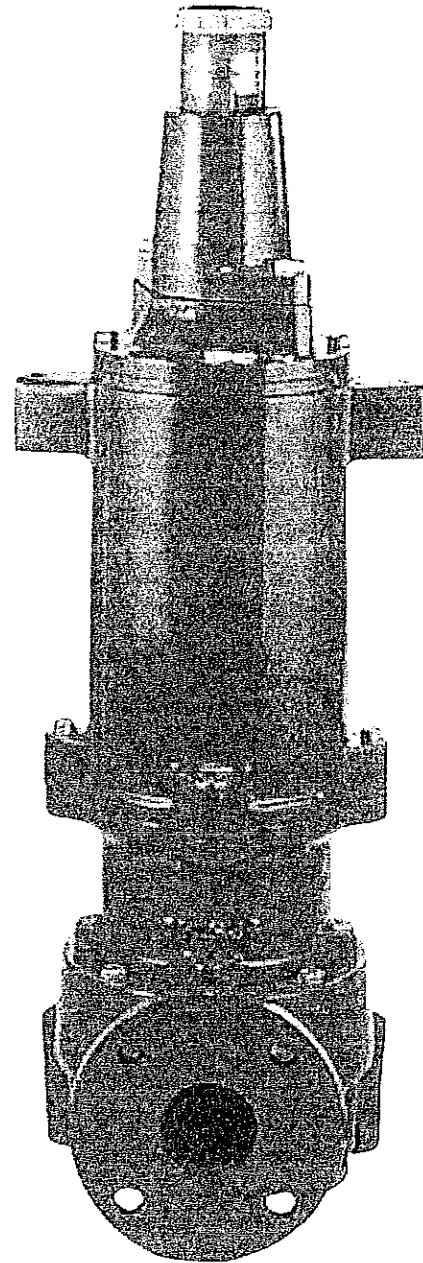
Flow (GPM)	Flow (GPH)	Friction Loss Factor (ft/100ft)	System Dynamic Head (ft)	Static Head (ft)	Total Dynamic Head (ft)
60.0	3600	0.22	1.7655	27.0	28.77
80.0	4800	0.38	3.0495	27.0	30.05
100.0	6000	0.58	4.6545	27.0	31.65
125.0	7500	0.88	7.062	27.0	34.06

Pump Performance:

Flow (GPM)	Total Dynamic Head (ft)
60	44
80	38
100	32
125	23

Per F.E. Myers Pump, Model WG30, 3 HP, 4.00" impeller, 3450 RPM





MYERS®

MODELS WG30/50 & WGX30/50

STANDARD AND HAZARDOUS LOCATION
3-5 HP SUBMERSIBLE GRINDER PUMPS



MYERS® MODELS WG30/50 & WGX30/50 Submersible Grinder Pumps

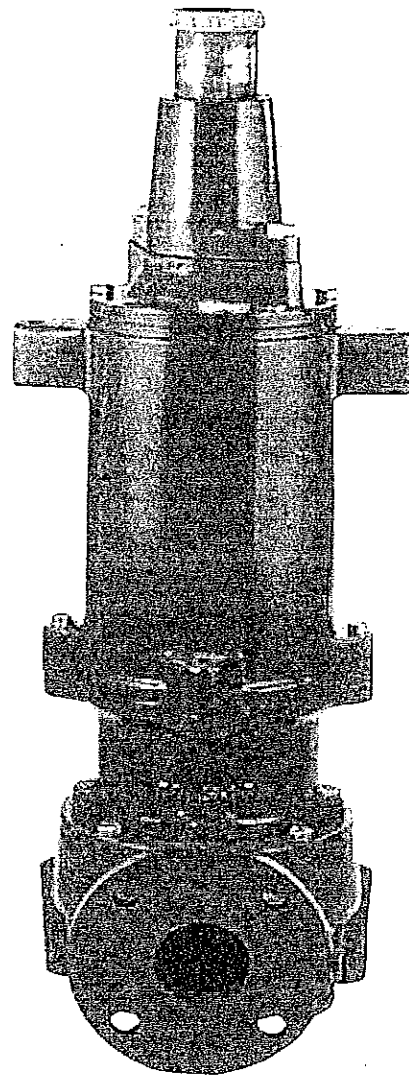
The Right Choice

The Myers WG30/50 are rugged 3-5 horsepower submersible centrifugal grinder pumps designed for residential, light commercial, industrial or municipal applications. They are especially designed for grinder pump applications requiring higher flows at low to moderate heads. The WG30/50 feature a heavy-duty cutter mechanism and recessed impeller design to efficiently grind typical sewage solids into a fine slurry.

WG30/50 grinder pumps are available in standard and FM Listed hazardous location (WGX30/50) construction for use in Class I, Group D hazardous locations.

WG30/50 grinder pumps can be installed in a variety of packaged systems. Factory-assembled simplex or duplex packages with guide rail systems are available.

Individual rail components are also available for installation in on-site concrete systems. Myers offers a complete line of submersible sump, sewage effluent, grinder, solids handling wastewater pumps, controls, basins and accessories. For additional information, contact your local Myers representative or the Myers sales office at 419-289-1144.

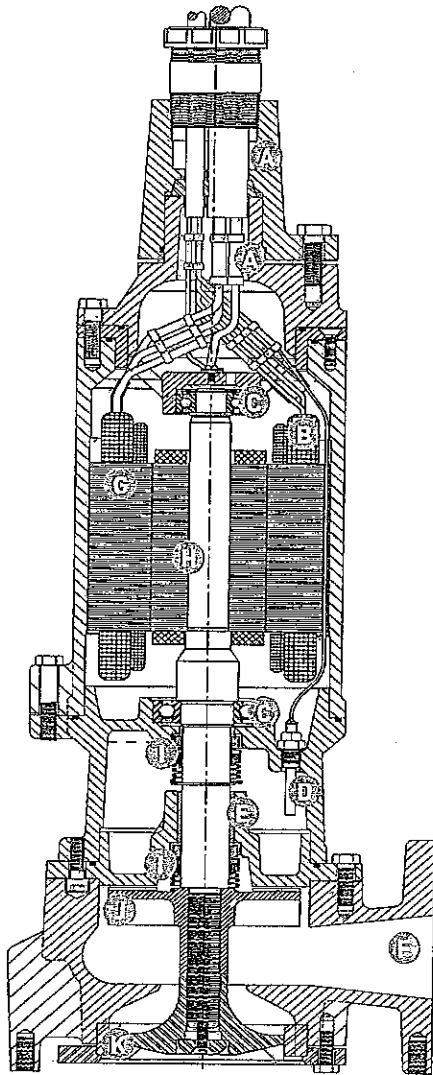


Product Capabilities		
Capacities To	185 gpm	693 lpm
Heads To	92 ft.	28.1 m
Liquids Handling	domestic raw sewage	
Intermittent Liquid Temp.	up to 140°F	up to 60°C
Winding Insulation Temp. (Class F)	311°F	155°C
Motor Electrical Data	3-5 hp, 3450 RPM	
<small>(Single phase motors are capacitor start type. Myers control panels or capacitor kits are recommended for proper operation and warranty.)</small>	1 ph, 230 volt - 3 ph, 200/230/460 volt - 60 Hz	
Std. Third Party Approvals	CSA	
Optional Approvals	FM, Class I, Group D (WGX30/50)	
Acceptable pH Range	6 - 9	
Specific Gravity	.9 - 1.1	
Viscosity	28 - 35 SSU	
Discharge (Flange Dia.)	2-1/2 in.	63.5 mm
Min. Sump Diameter		
Simplex	36 in.	91.4 cm
Duplex	48 in.	121.9 cm

Note: Consult factory for applications outside these recommendations.

Construction Materials	
Motor Housing, Seal Housing, Cord Cap and Volute Case	cast iron, Class 30, ASTM A48
Impeller	recessed, bronze
Power Cord	S00W, W
Control Cord	S00W
Mechanical Seals:	
Standard	double tandem carbon and ceramic
Optional	lower tungsten carbide
Pump, Motor Shaft	416 SST
Fasteners	300 Series SST
Shredding Ring	440 SST,
Grinding Impeller	58-60 Rockwell

Pump Features and Applications



A. Cable Entry System

Provides double seal protection. Cable jacket sealed by compression fitting. Individual wires sealed by epoxy potting.

B. Heat Sensor

Protects motor from burnout due to excessive heat from any overload condition. Automatically resets when motor has cooled.

C. Ball Bearings

Upper and lower ball bearings support shaft and rotor and take axial and radial loads.

D. Seal Leak Probe

Detects water in seal housing; activates warning light in control panel.

E. Sleeve Bearing

Takes radial load; provides flame path. (FM Listed pumps only.)

F. Volute Case

Cast iron, horizontal discharge. Drilled for 2-1/2" pipe flange.

G. Stator

3450 RPM, 1 and 3 phase. Press fit for perfect alignment and best heat transfer. Oil-filled motor conducts heat and lubricates bearings.

H. Heavy 416 SST Shaft

Corrosion resistant. Reduces shaft deflection due to grinding loads.

I. Shaft Seals

Double tandem mechanical shaft seals protect motor. Oil-filled seal chamber provides continuous lubrication.

J. Impeller

Bronze recessed impeller handles ground slurry without clogging or binding. Provides unobstructed flow passage. Reduces radial loads. Pump-out vanes help keep trash from seal, reduce pressure at seal faces.

K. Grinder Assembly

Grinder impeller and shredding ring are replaceable without dismantling pump. Constructed of 440 SST hardened to 56-60 Rockwell.

Ideal for Use in Lift Stations.

- Recessed impeller provides non-overloading high flow operating curve.

The WG30/50 Is Designed for Easy Maintenance.

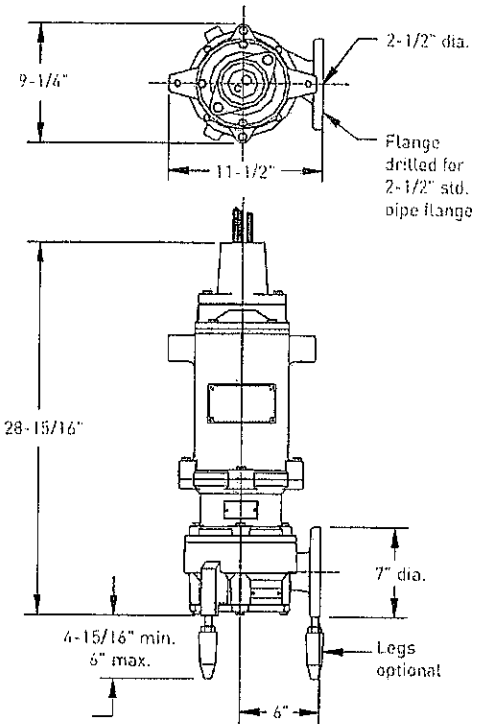
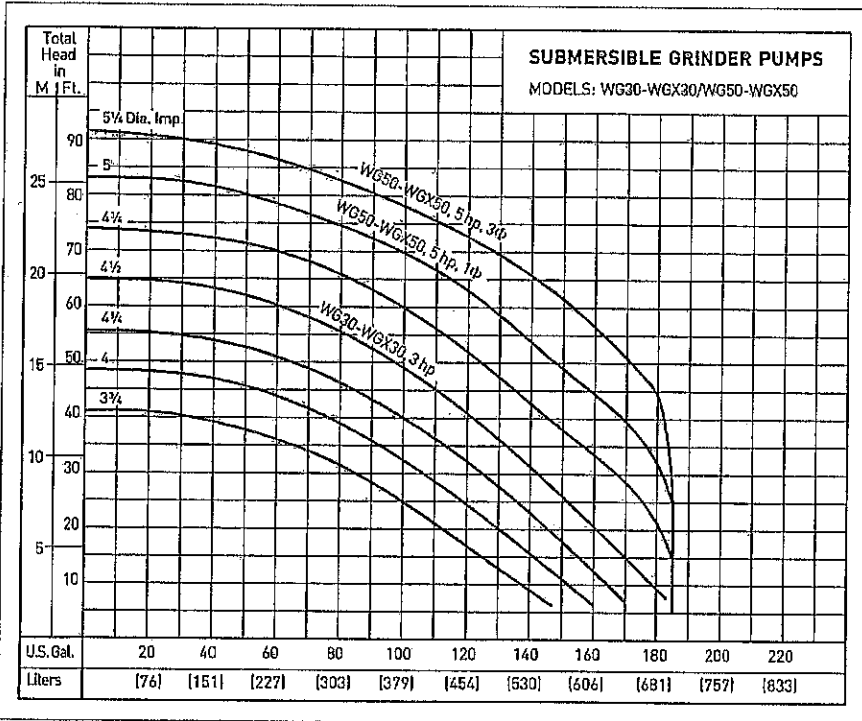
- Shredding ring and grinder impeller are replaceable without dismantling pump or motor.

Durable Motor Will Deliver Many Years of Reliable Service.

- Oil-filled motor for maximum heat dissipation and constant bearing lubrication.
- Recessed impeller reduces radial bearing loads, increases bearing life.
- High torque capacitor start single phase or three phase motors for assured starting under heavy load.
- Seal leak probes and on-winding heat sensors warn of seal leak condition and stop motor if motor overheats. Help prevent costly motor damage.

Performance Data and Dimensions

3450 RPM



Note: On single phase 5 hp pumps, do not exceed 5" dia. impeller.

Available Models		Motor Electrical Data										
Standard	Hazardous Location	HP	Volts	Phase	Hertz	Start Amps	Full Load Amps	Full Load kW	Start KVA	Full Load KVA	NEC Code Letter	Service Factor
WG30-21	WX30-21	3	230	1	60	111	30.5	6.5	25.5	7.0	K	2.0
WG30-03	WX30-03	3	208	3	60	95	19.6	6.0	34.2	7.1	N	2.0
WG30-23	WX30-23	3	230	3	60	102	17.8	6.0	40.6	7.1	P	2.0
WG30-43	WX30-43	3	460	3	60	51	8.9	6.0	40.6	7.1	P	2.0
WG30-53	WX30-53	3	575	3	60	30	7.1	6.0	29.9	7.1	L	2.0
WG50-21	WX50-21	5	230	1	60	111	35.0	8.0	25.5	8.1	F	1.7
WG50-03	WX50-03	5	208	3	60	95	24.2	8.0	34.2	8.7	H	1.7
WG50-23	WX50-23	5	230	3	60	102	21.9	8.0	40.6	8.7	K	1.7
WG50-43	WX50-43	5	460	3	60	51	10.9	8.0	40.6	8.7	K	1.7
WG50-53	WX50-53	5	575	3	60	30	8.8	8.0	29.9	8.8	G	1.7



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