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F25889

PUMP DESIGN CALCULATIONS

for the

BRUSH HILL HOMES

at

34 BRUSH HILL ROAD IN SHERBORN, MASSACHUSETTS 01770

Prepared By: DGT Associates
1071 Worcester Road
Framingham, MA 01701

January 24, 2025

Pump Design Calculations
Brush Hill Homes

Total Daily Flow (Title 5):

Buildings Use:	Single Family Dwellings
Number of Bedrooms:	12 Bedrooms
Design Flow – Title 5:	110 GPD / Bedroom
Total Daily Design Flow:	1,320 Gallons

Pump Chamber Volume / Vertical Ft:

Volume/ft = 11.50 ft x 5.50 ft x 1 ft x 7.48 gal/ft^3
Volume/ft = 474 gallons/ft

Dose:

At a minimum, each dose shall clear the force main of the volume contained within.
Line Volume = 18.77 gallons/100 ft x 293 ft of Force Main = 55 gallons
Design at 6 doses/day: 1,320 gallons ÷ 6 = 220 gallons/dose
Total Minimum Dose = 220 + 55 = 275 gallons/dose

Draw Depth:

Design Draw Depth = 275 gallons/dose / 474 gallons/ft = 0.58 ft/dose
Use 0.60 ft = 284.4 gallons/dose
284.4 > 275 ← Okay

Storage Above Alarm:

Storage Volume = (Tank Volume in gal/ft) x (Invert In Elev – Alarm On Float Elev)
Storage Volume = 361 gal/ft x (213.90 – 210.90) ft = 474 gal/ft x 2.40’ = 1,422 gallons
1,422 gallons ÷ 1,320 gpd = 1.08 days (25.9 hours)

Pump Run Time:

Pump operates at 36 gal/min
Pump Run Time = 284.4 gal ÷ 36 gal/min
Pump Run Time = 7.9 minutes

TABLE 1

LINE VOLUMES IN GALLONS/100 FEET OF PIPE LENGTH

Pipe Size	SDR-26 PVC	SDR-21 PVC	Sch.40 PVC
1 1/4 inch	9.57	9.13	7.76
1 1/2 inch	12.55	11.97	10.57
2 inch	19.64	18.77	17.44
2 1/2 inch	28.65	27.68	24.91
3 inch	42.55	40.92	38.39
4 inch	70.39	67.47	66.12
6 inch	152.6	146.23	150
8 inch	258	248.11	n.a.

Job No.: F25889

Date: 2025-01-24

Head Loss in Force Main

STATIC HEAD (H_s)

Discharge elev at D-Box		219.70
Pump off elevation		210.10
	Total =	9.60

DYNAMIC HEAD

Pipe Length = 293.0 Ft

Pump Station:

Component	Pipe Size	Quantity	Equiv. Length	Total Equiv. Length
Check Valve	2"	1.0	13.0	13.0
90 deg. Elbow	2"	2.0	5.0	10.0
Tee (side out.)	2"	1.0	11.0	11.0
Ball Valve	2"	2.0	1.2	2.4
			Total =	36.4

Force Main:

Component	Pipe Size	Quantity	Equiv. Length	Total Equiv. Length
45 deg. Elbow	2"	4.0	3.8	15.2
22.5 deg. Elbow	2"	2.0	1.9	3.8
			Total =	19.0

Total Equivalent Pipe Length = 348.4 Ft (TEPL)

JOB No.: F25889

Date: 1/24/2025

Total Dynamic Head Calculations

2" SDR-21 PVC PIPE

Total Equivalent Pipe Length = 348.4 (TEPL)
Static Head = 9.60 (H_s)

		A		B	C	A+B+C=
Flow GPM	**V** (ft / sec.)	$\mathbf{V^2 / 2g}$ (ft)	H_f / 100 ft	H_f x TEPL /100 ft (ft)	H_s (ft)	TDH (ft)
10	0.87	0.01	0.19	0.68	9.60	10.29
15	1.30	0.03	0.40	1.40	9.60	11.03
20	1.74	0.05	0.68	2.35	9.60	12.00
25	2.17	0.07	1.01	3.52	9.60	13.19
30	2.61	0.11	1.41	4.91	9.60	14.62
35	3.05	0.14	1.69	5.89	9.60	15.63
40	3.48	0.19	2.43	8.47	9.60	18.25
45	3.91	0.24	3.00	10.45	9.60	20.29

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2" SDR-21 PVC PIPE

Total Equivalent Pipe Length = 348.4 (TEPL)
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		A		B	C	A+B+C=
Flow GPM	**V** (ft / sec.)	$\mathbf{V^2 / 2g}$ (ft)	H_f / 100 ft	H_f x TEPL /100 ft (ft)	H_s (ft)	TDH (ft)
40	3.48	0.19	2.43	8.47	9.60	18.25
45	3.91	0.24	3.00	10.45	9.60	20.29
50	4.35	0.29	3.65	12.72	9.60	22.61
60	5.22	0.42	5.16	17.98	9.60	28.00
70	6.10	0.58	6.91	24.07	9.60	34.25
80	6.96	0.75	8.97	31.25	9.60	41.60
90	7.83	0.95	11.15	38.85	9.60	49.40

TECHNICAL BROCHURE
B3886 R2

WS_B Series

Model 3886

SUBMERSIBLE SEWAGE PUMP

BUILT IN THE USA
ENGINEERED, ASSEMBLED & TESTED

GOULDS WATER TECHNOLOGY
a xylem brand

FEATURES

Impeller: Cast iron, semi-open, dynamically balanced, non-clog with pump out vanes for mechanical seal protection. Optional Silicon bronze impeller available.

Casing: Cast iron volute type for maximum efficiency. Designed for easy installation on A10-20 guide rail or base elbow rail systems.

Mechanical Seal: SILICON CARBIDE VS. SILICON CARBIDE sealing faces for superior abrasive resistance, stainless steel metal parts, BUNA-N elastomers.

Shaft: Corrosion-resistant stainless steel. Threaded design. Locknut on all models to guard against component damage on accidental reverse rotation.

Fasteners: 300 series stainless steel.

Capable of running dry without damage to components.

Designed for continuous operation when fully submerged.

EXTENDED WARRANTY AVAILABLE FOR RESIDENTIAL APPLICATIONS.

AGENCY LISTINGS

Tested to UL 778 and CSA 22.2 108 Standards
By Canadian Standards Association
File #LR38549

APPLICATIONS

Specifically designed for the following uses:

- Homes
- Sewage systems
- Dewatering/Effluent
- Water transfer

SPECIFICATIONS

Pump

- Solids handling capabilities: 2" maximum
- Discharge size: 2" NPT
- Capacities: up to 185 GPM
- Total heads: up to 38 feet TDH
- Temperature: 104°F (40°C) continuous, 140°F (60°C) intermittent

MOTORS

- Fully submerged in high grade turbine oil for lubrication and efficient heat transfer. All ratings are within the working limits of the motor.
- Class B insulation

Single phase (60 Hz):

- All single phase models feature capacitor start motors for maximum starting torque.
- Built-in overload with automatic reset.
- SJTOW or STOW severe duty oil and water resistant power cords.
- ⅓ – 1 HP models have NEMA three prong grounding plugs.

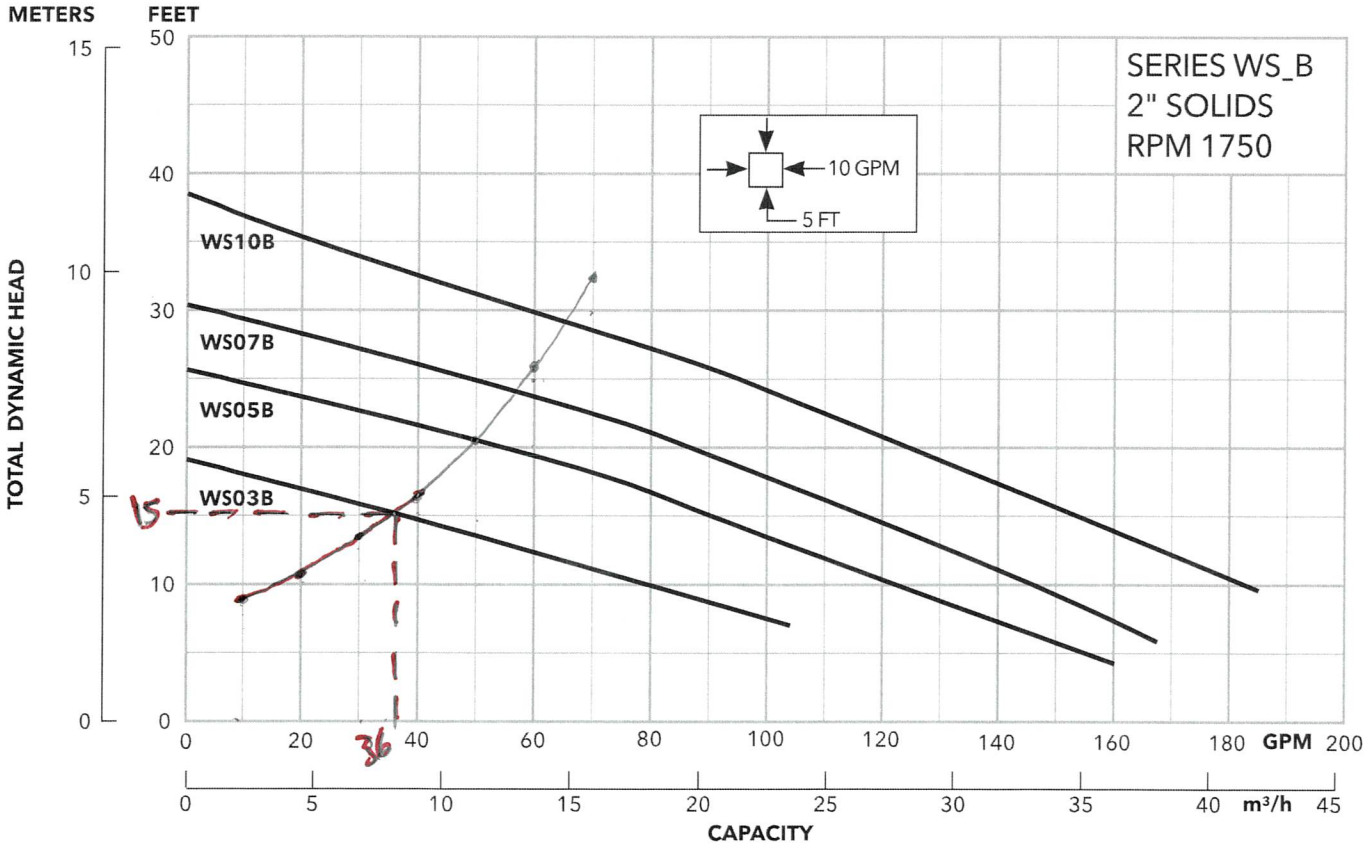
Three phase (60 Hz):

- Class 10 overload protection must be provided in separately ordered starter unit.
- STOW power cords all have bare lead cord ends.

- **Bearings:** Upper and lower heavy duty ball bearing construction.
- **Designed for Continuous Operation:** Pump ratings are within the motor manufacturer's recommended working limits, can be operated continuously without damage when fully submerged.
- **Power Cable:** Severe duty rated, oil and water resistant. Epoxy seal on motor end provides secondary moisture barrier in case of outer jacket damage and to prevent oil wicking. Standard cord is 20'. Optional lengths are available.
- **Motor Cover O-ring:** Assures positive sealing against contaminants and oil leakage.

MODELS

Order Number	HP	Phase	Volts	RPM	Impeller Diameter (in.)	Maximum Amps	Locked Rotor Amps	KVA Code	Full Load Efficiency	Resistance		Weight (lbs.)
										Start	Line-Line	
WS0311B	0.33	1	115	1750	4.69	10.7	30.0	M	54	11.9	1.7	63
WS0318B			208			6.8	19.5	K	51	9.1	4.2	
WS0312B			230			4.9	14.1	L	53	14.5	8.0	
WS0511B	0.5		115		5.00	14.5	31.1	J	55	9.3	1.4	65
WS0518B			208			8.0	19.5	K	51	9.1	4.2	
WS0512B			230			7.3	16.5	J	54	11.7	5.6	
WS0538B		3	200			3.8	12.3	K	75	NA	6.7	
WS0532B			230			3.3	9.7	K	75	NA	9.9	
WS0534B			460			1.7	4.9	K	75	NA	39.4	
WS0537B			575			1.4	4.3	K	68	NA	47.8	
WS0718B	0.75	1	208		5.38	11.0	39.0	K	65	2.6	1.4	85
WS0712B			230			9.4	24.8	J	57	4.8	2.3	
WS0738B		3	200			4.1	21.2	H	74	NA	4.3	
WS0732B			230			3.6	17.3	J	76	NA	5.6	
WS0734B			460			1.8	8.9	J	76	NA	22.4	
WS0737B			575			1.5	7.3	J	71	NA	29.2	
WS1018B	1	1	208		5.75	14.0	39.0	K	65	2.6	1.4	
WS1012B			230			12.3	30.5	H	60	4.3	1.8	
WS1038B		3	200			6.0	21.2	H	74	NA	4.3	
WS1032B			230			5.8	17.3	J	76	NA	5.6	
WS1034B			460			2.9	8.9	J	76	NA	22.4	
WS1037B			575			2.4	7.3	J	71	NA	29.2	

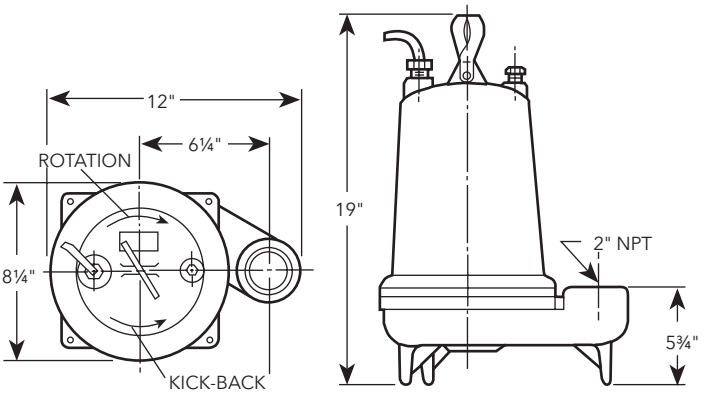


PERFORMANCE RATINGS (gallons per minute)

Order No.		WS03B	WS05B	WS07B	WS10B
HP ▶		⅓	½	¾	1
RPM ▶		1750	1750	1750	1750
Total Head Feet of Water	10 ▶	80	122	145	183
	15	36	90	116	152
	20	–	50	86	123
	25	–	–	48	95
	30	–	–	–	58
	35	–	–	–	20

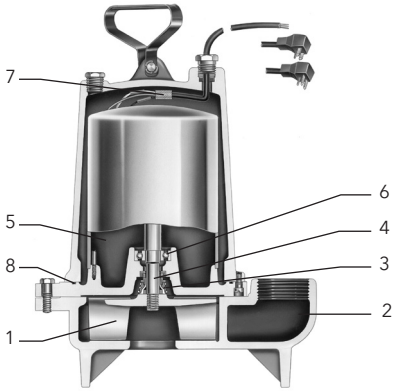
DIMENSIONS

(All dimensions are in inches. Do not use for construction purposes.)



COMPONENTS *(for reference only)*

Item No.	Description
1	Impeller
2	Casing
3	Mechanical Seal
4	Motor Shaft
5	Motor
6	Ball Bearings
7	Power Cable
8	Casing O-Ring



NOTE: *For specific parts breakdown, see repair parts.*

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