WNEK ENGINEERING
Consulting Civil Engineer
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360-692-3802 (fax)-692-1051

Boand Arena Septic to Sewer Duplex Grinder Pumps (Commercial) Engineering Analysis

located in:
Kitsap County, WA

prepared for:
Parks Department
614 Division St, MS#1
Port Orchard, WA 98366

date:
May 22, 2018

by:
Michael F. Wnek, P.E.

NOTE: THIS DOCUMENT IS INSCRIBED WITH A DIGITIZED SIGNATURE BY THE ENGINEER AS PROVIDED BY WASHINGTON ADMINISTRATIVE CODE 196-23-070(2)

PROJECT DESCRIPTION: Fairgrounds bathrooms near Boand Arena to abandon existing septic facilities and install a duplex grinder pump system to pump to gravity sewer found near Kitsap Pavilion.

Bathroom to be connected contains multiple lavatories, sinks, showers, and one water fountain. IPC fixture ratings were used to approximate peak flow for pump sizing. Fixture and flow information is attached with this report.

All existing septic facilities associated with the bathroom will be removed or abandoned according to Kitsap County Public Health Department regulations.

Property data & design calculations are attached. Construction plans of the same date as this report have been prepared.

Calculations are also attached to show that the system operates satisfactorily when either pump or both pumps operate simultaneously.

Fairgrounds Grinder Pump	WNEK ENGINEERING
Commercial Fixture Flow Analysis	**May 22, 2018**

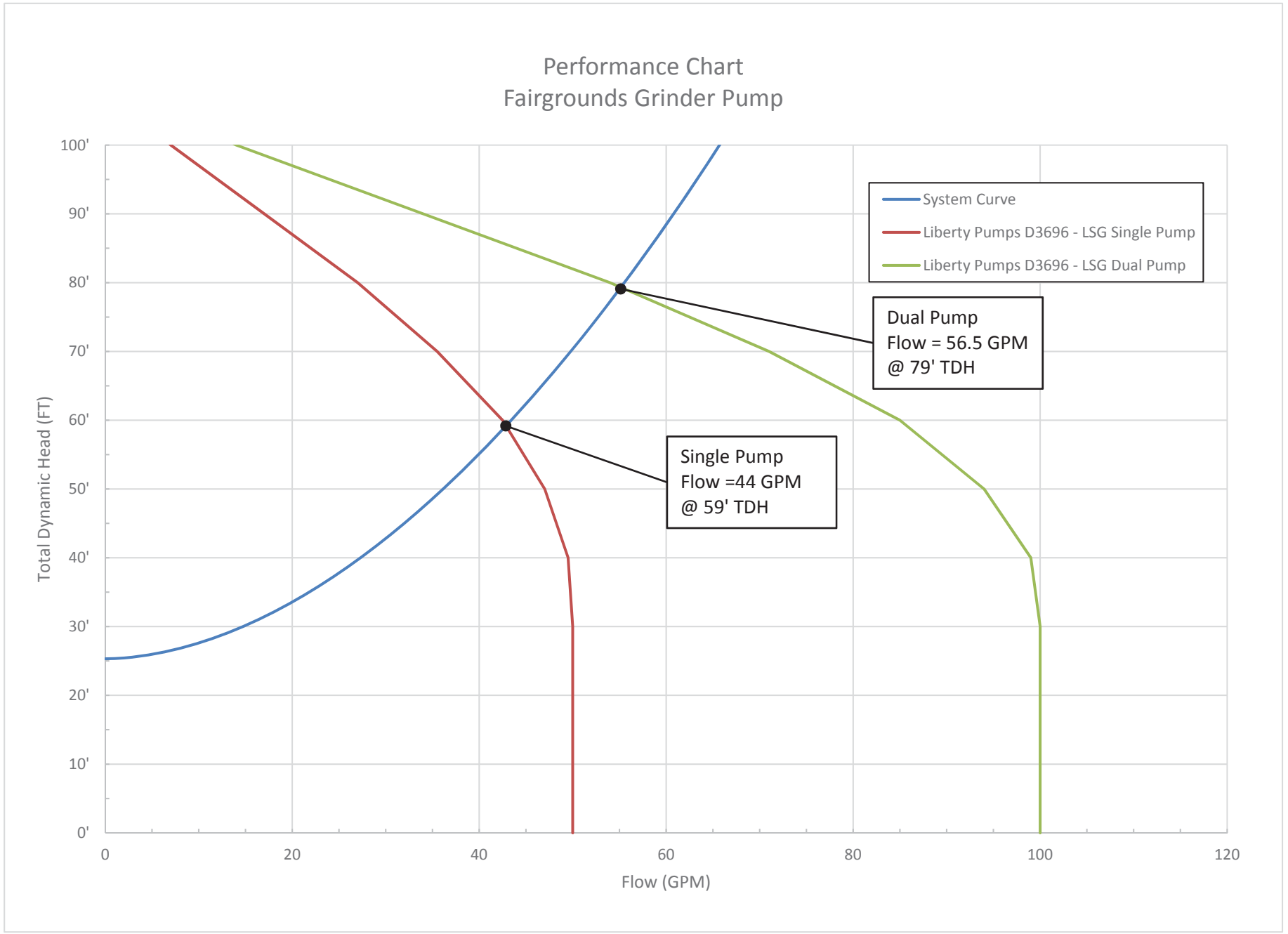
Project # 885

Fixture	Occupancy	Type of Supply Control	WSFU Total	Quantity	Total Wsfu
Drinking Fountain	Public	3/8" Valve	0.25	1	0.25
Lavatory	Public	Faucet	2	4	8
Shower Head	Public	Mixing Valve	4	4	16
Urinal	Public	3/4" Flushometer Valve	5	2	10
Water Closet	Public	Flushometer Valve	2	6	12

Total Wsfu	46.25	
Fixture Flow (Σq_n)	48 GPM	IPC
Estimated Drainage Load	3.46 GPM	$q_{est} = k \times \sqrt{(\Sigma q_n)}$

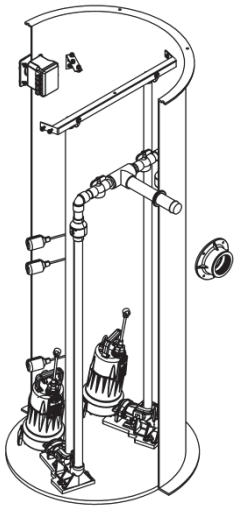
Fairgrounds Grinder Pump					WNEK ENGINEERING	
Commercial Fixture Flow Analysis					**May 22, 2018**	
COMMERCIAL GRINDER PUMP						
DESIGN CALCULATIONS - SINGLE PUMP ACTIVE						
D.O.E. CRITERIA CHECK (minimum velocity of 2 ft/sec)						
					###	= number entry
	Q =	flow (gpm)			###	= calculation
	V =	velocity (Q/A)				
	d =	pipe daimeter (in) actual				
	A =	pipe area cross-section (in^2)				
	Q =	44.0	gpm			
	d =	2.00	in			
	V =	4.5	ft/sec			
		Between 2 and 8 ft/sec allowed				
PUMP HEAD CALCULATIONS						
	44	Q	gpm			
	140	HW coefficient				
	4.2371	= head loss (ft/100lf pipe)				
	800	= run length (ft)				
	7	1	= tee fitting, line run (ea) @ 7' each			
	12	4	= 45-bend (ea) @ 3' each			
	7	1	= 90-bend (ea) @ 7.0' each			
	1.8	2	= gate valve (ea) @ 0.9' each			
	11	1	= check valve (ea) @ 11' each			
	839	= total equivalent length (ft)				
	34	= zone friction loss (ft)				
	15.32	= static head (ft)				
	10	= safety factor (ft)				
	59	= total dynamic head (ft) TDH				
STORAGE VOLUME						
Fixture Flow (q_n)	48	GPM	IPC			
Estimated Drainage Load	3.46	GPM	$q_{est} = k \times \sqrt{(\Sigma q_n)}$			
Storage	3741	Gallons	24 hour volume			
PUMP UNIT		UNIT	STORAGE	FLOW	MANUFACTURER	
Restroom Facility		D3696-LSG202	423 GAL	44 GPM	Liberty Pumps	

Fairgrounds Grinder Pump					WNEK ENGINEERING	
Commercial Fixture Flow Analysis					**May 22, 2018**	
COMMERCIAL GRINDER PUMP						
DESIGN CALCULATIONS - <u>BOTH PUMPS ACTIVE</u>						
D.O.E. CRITERIA CHECK (minimum velocity of 2 ft/sec)						
					###	= number entry
	Q =	flow (gpm)			###	= calculation
	V =	velocity (Q/A)				
	d =	pipe daimeter (in) actual				
	A =	pipe area cross-section (in^2)				
	Q =	56.5	gpm			
	d =	2.00	in			
	V =	5.8	ft/sec			
		Between 2 and 8 ft/sec allowed				
PUMP HEAD CALCULATIONS						
	56.5	Q	gpm			
	140	HW coefficient				
	6.7327	= head loss (ft/100lf pipe)				
	800	= run length (ft)				
	7	1	= tee fitting, line run (ea) @ 7' each			
	12	4	= 45-bend (ea) @ 3' each			
	7	1	= 90-bend (ea) @ 7.0' each			
	1.8	2	= gate valve (ea) @ 0.9' each			
	11	1	= check valve (ea) @ 11' each			
	839	= total equivalent length (ft)				
	54	= zone friction loss (ft)				
	15.32	= static head (ft)				
	10	= safety factor (ft)				
	79	= total dynamic head (ft) TDH				
STORAGE VOLUME						
Fixture Flow (q_n)	48	GPM	IPC			
Estimated Drainage Load	3.46	GPM	$q_{est} = k \times \sqrt{(\Sigma q_n)}$			
Storage	3741	Gallons	24 hour volume			
PUMP UNIT		UNIT	STORAGE	FLOW	MANUFACTURER	
Restroom Facility		D3696-LSG202	423 GAL	56.5	Liberty Pumps	


Performance Chart
Fairgrounds Grinder Pump
Total Dynamic Head (FT)
100'
90'
80'
70'
60'
50'
40'
30'
20'
10'
0'
0
20
40
60
80
100
120
Flow (GPM)
System Curve
Liberty Pumps D3696 - LSG Single Pump
Liberty Pumps D3696 - LSG Dual Pump
Dual Pump
Flow = 56.5 GPM
@ 79' TDH
Single Pump
Flow =44 GPM
@ 59' TDH

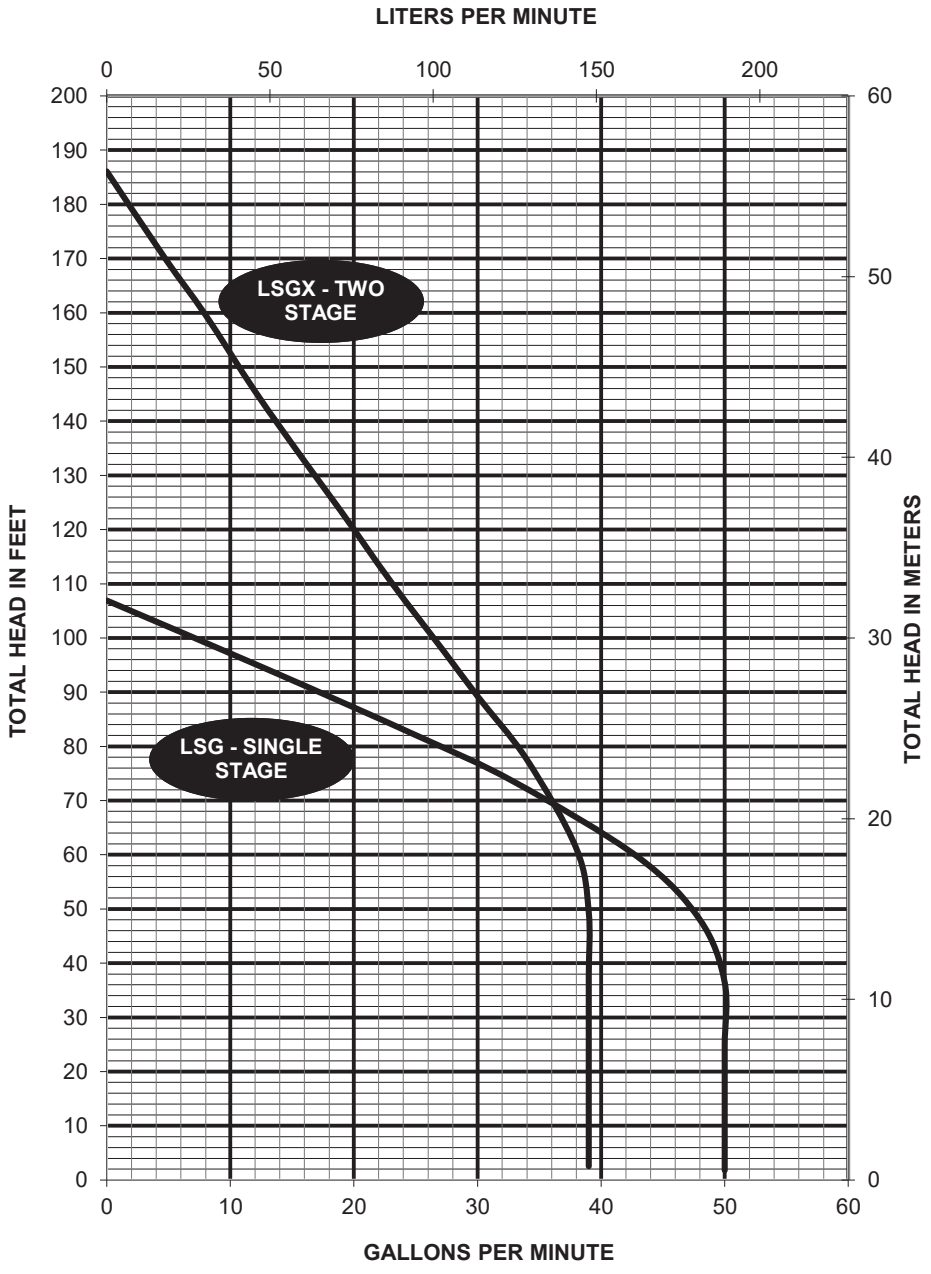
Liberty Pumps®

Omnivore® Grinders



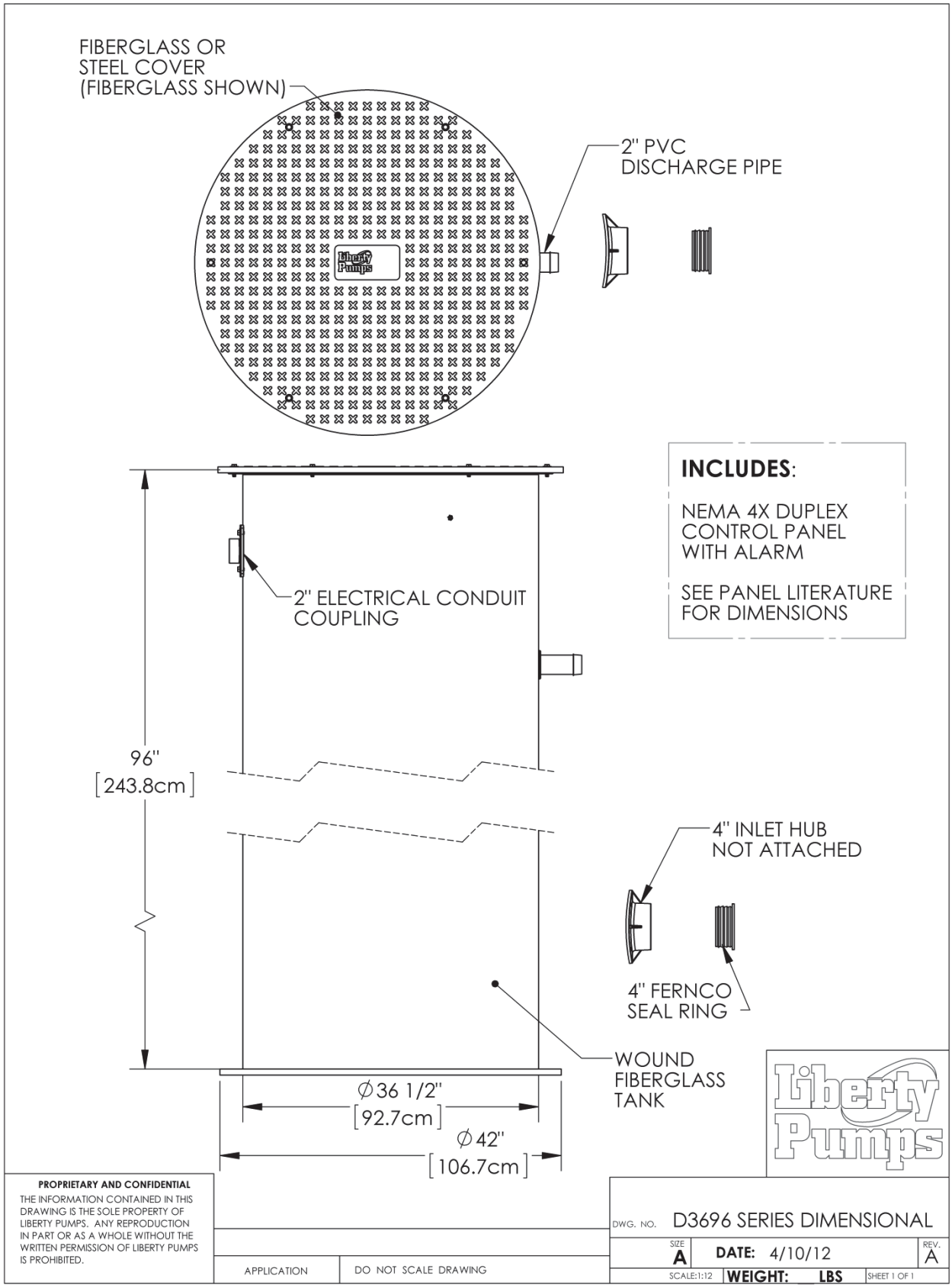
Pump Specifications

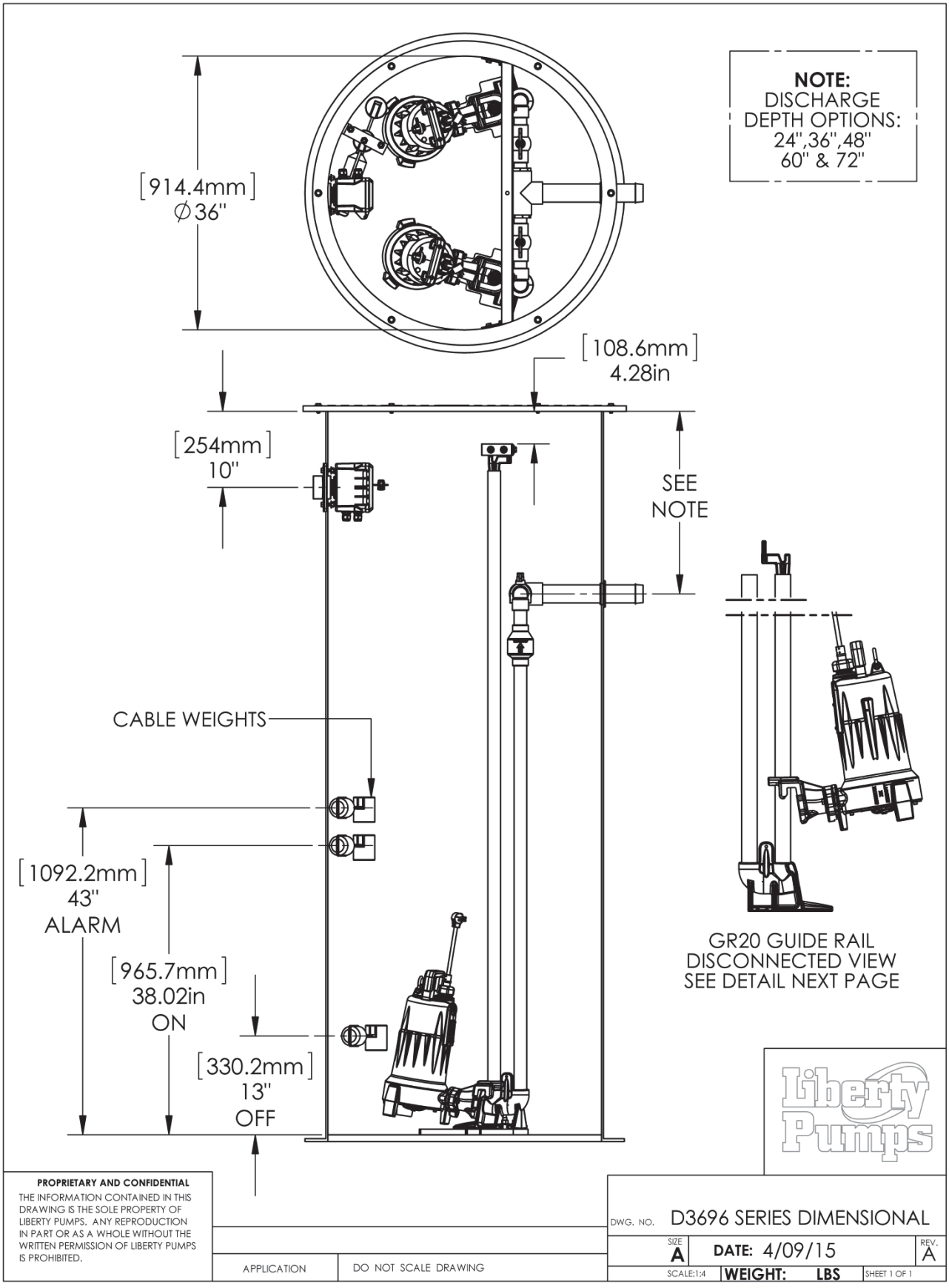
D3696LSG, D3696LSGX Omnivore®
2HP Duplex Grinder Packages

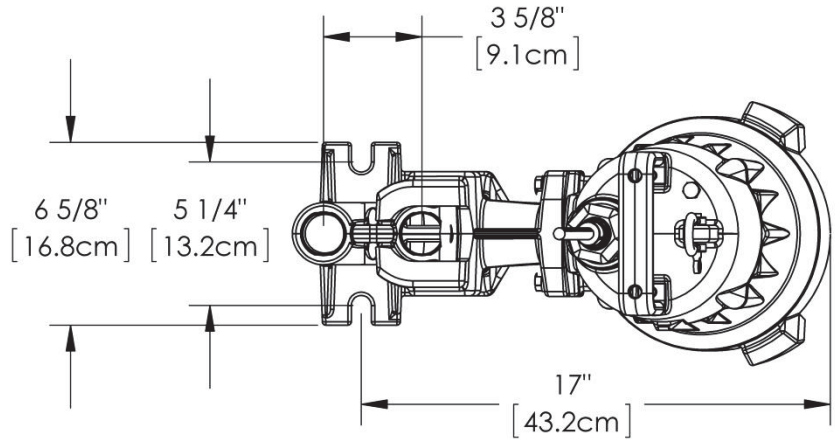


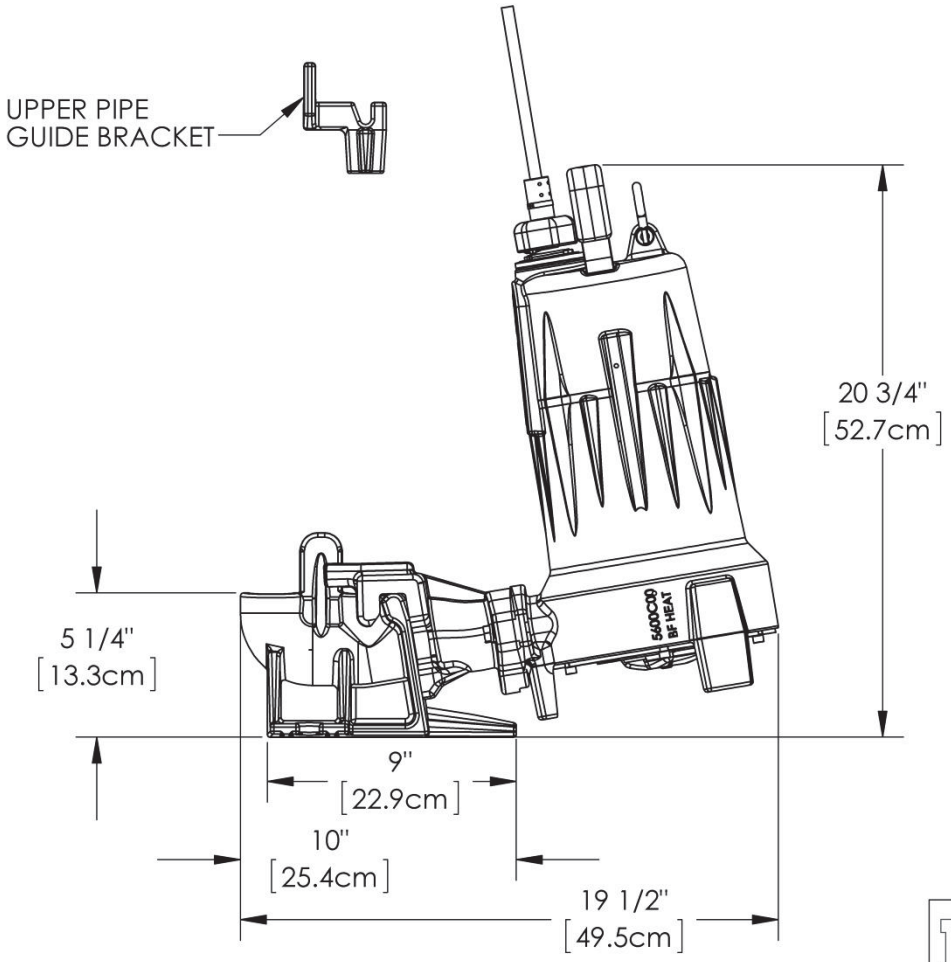
Liberty Pumps®

D3696LSG/LSGX - Series Dimensional Data









GR20 GUIDE RAIL BASE

APPLICATION | DO NOT SCALE DRAWING

DWG. NO. D3696 SERIES DIMENSIONAL

SIZE A | **DATE:** 4/10/12 | REV. A

SCALE:1:6 | **WEIGHT:** __ **LBS** | SHEET 1 OF 1

D3696LSG/LSGX - Series Electrical data

MODEL	HP	VOLTAGE	PHASE	SF	FULL LOAD AMPS * (Per Pump)	LOCKED ROTOR AMPS * (Per Pump)	THERMAL OVERLOAD TEMP	STATOR WINDING CLASS	CORD LENGTH FT	DISCHARGE	STANDARD CONTROL PANEL *
D3696LSG202	2	208/230	1	1.0	15	53	135˚C	B	25	1-1/4" NPT	AE24H=3
D3696LSG202-C	2	208/230	1	1.0	15	53	135˚C	B	35	1-1/4" NPT	AE24HC=3
D3696LSG203	2	208/230	3	1.0	10.6	61	N/A	B	25	1-1/4" NPT	AE34=3-511
D3696LSG204	2	440-480	3	1.0	5.3	31	N/A	B	25	1-1/4" NPT	AE34=3-171
D3696LSG205	2	575	3	1.0	4.9	31	N/A	B	25	1-1/4" NPT	AE54=3-161
D3696LSGX202	2	208-230	1	1.0	15	53	135˚C	B	25	1-1/4" NPT	AE24H=3
D3696LSGX202-C	2	208-230	1	1.0	15	53	135˚C	B	35	1-1/4" NPT	AE24HC=3
D3696LSGX203	2	208/230	3	1.0	10.6	61	N/A	B	25	1-1/4" NPT	AE34=3-511
D3696LSGX204	2	440-480	3	1.0	5.3	31	N/A	B	25	1-1/4" NPT	AE34=3-171
D3696LSGX205	2	575	3	1.0	4.9	31	N/A	B	25	1-1/4" NPT	AE54=3-161

***NOTE: AMPERAGE VALUES SHOWN IN THE TABLE ABOVE ARE FOR EACH PUMP. ELECTRICAL SERVICE SHALL BE SIZED TO SUPPORT BOTH PUMPS RUNNING SIMULTANEOUSLY.**

D3696LSG/LSGX - Series Technical Data

TANK	WOUND FIBERGLASS WITH ANTI FLOATATION FLANGE FIBERGLASS COVER STANDARD STEEL COVER OPTIONAL
CAPACITY	423 GALLON TOTAL BASIN VOLUME (PUMP CYCLE = 115 GALLONS)
GUIDE RAIL	STANDARD –SCHEDULE 40 GALVANIZED OPTIONAL SCHEDULE 40 STAINLESS STEEL
GUIDE RAIL BASE / DISCONNECT (GR20)	CAST IRON
INLET HUB	4" WITH FLANGE GASKET AND PIPE SEAL
DISCHARGE PIPING	2" SCHEDULE 80 PVC
CONTROL	NEMA 4X DUPLEX ALTERNATING PANEL, OUTDOOR, WITH AUDIBLE (80 DBI) AND VISUAL HIGH WATER ALARM
IMPELLER	300 SERIES S.S.
PAINT	POWDERCOATING
MAX LIQUID TEMP	140˚F/ 60˚C
MAX STATOR TEMP	275˚F/ 135˚C
THERMAL OVERLOAD	275˚F/ 135˚C (single phase only)
POWER CORD TYPE	SJOOW (1-phase) / SEOOW (3-phase) SOOW (external capacitor models)
MOTOR HOUSING	CLASS 25 CAST IRON
VOLUTE	CLASS 25 CAST IRON
SHAFT	300 SERIES S.S.
HARDWARE	STAINLESS
ORINGS	BUNA N
MECHANICAL SEAL	UNITIZED SILICON CARBIDE
MIN BEARING LIFE	50,000 HRS
WEIGHT	565 LBS / 256 kg

* ADD **–IP** TO THE MODEL NUMBER **FOR IP-SERIES** PANEL UPGRADE.

Liberty Pumps®

D3696LSG/LSGX - Series Specifications

1.01 GENERAL

The contractor shall provide labor, material, equipment, and incidentals required to provide 2 (QTY) centrifugal grinder pumps as specified herein. The pump models covered in this specification are Series LSG/LSGX200 single phase grinder pumps. The pump furnished for this application shall be model LSG202 as manufactured by Liberty pumps.

2.01 OPERATING CONDITIONS

Each submersible pump shall be rated at 2 hp 208 volts single phase 60 Hz. 3450 RPM. The unit shall produce 44 G.P.M. at 59 feet of total dynamic head.

The submersible pump shall be capable of handling residential and commercial sewage and grinding it to a fine slurry enabling it to be pumped over long distances in pipelines as small as 1.25" in diameter. The LSG series single stage submersible pump shall have a shut-off head of 110 feet and a maximum flow of 50 GPM @ 10 feet of total dynamic head. The LSGX series two stage submersible pump shall have a shut-off head of 185 feet and a maximum flow of 38 GPM @ 10 feet of total dynamic head.

3.01 CONSTRUCTION

Each centrifugal grinder pump shall be equal to the C US certified Series LSG/LSGX Grinder pumps as manufactured by Liberty Pumps, Bergen NY. The castings shall be constructed of class 25 cast iron. The motor housing shall be oil filled to dissipate heat. Air filled motors shall not be considered equal since they do not properly dissipate heat from the motor. All mating parts shall be machined and sealed with a Buna-N o-ring. All fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a dual seal arrangement. The first seal is a double lip seal molded in FKM fluoroelastomer or Buna N.

The second / main seal shall be a unitized hard face silicon carbide seal with stainless steel housings and spring.

The upper and lower bearing shall be capable of handling all radial thrust loads. The lower bearing shall have the additional ability to handle the downward axial thrust produced by the impeller and cutters by design of angular contact roller races. The pump housing shall be of the concentric design thereby equalizing the pressure forces inside the housing which will extend the service life of the seals and bearings. Additionally there shall be no cutwater in the housing volute in order to discourage the entrapment of flowing debris. The pump shall be furnished with stainless steel handle having a nitrile grip.

4.01 ELECTRICAL POWER CORD

The submersible pump shall be supplied with 25 feet of multiconductor power cord. It shall be cord type SJOOW (1-phase), SEOOW (3-phase), or SOOW (external capacitor models), capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity. This will eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.

5.01 MOTORS

All motors shall be oil filled and class B insulated NEMA B design, rated for continuous duty. Since air filled motors are not capable of dissipating heat as effectively, they shall not be considered equal. At maximum load, the winding temperature shall not exceed 135 degrees C unsubmerged. Single phase motors shall be capacitor start / capacitor run and have an integral thermal overload switch in the windings for protecting the motor.

6.01 BEARINGS AND SHAFT

An upper radial and lower thrust bearing shall be required. The upper bearing shall be a single ball / race type bearing. The lower bearing shall be an angular contact heavy duty ball / race type bearing, designed to handle axial grinder pump thrust loads. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The bearing system shall be designed to enable proper cutter alignment from shut off head to maximum load at 10 ' of TDH. The motor shaft shall be made of 300 or 400 series stainless steel and have a minimum diameter of .670".

7.01 SEALS

The pump shall have a dual seal arrangement consisting of a lower and upper seal to protect the motor from the pumping liquid. The lower seal shall be a FKM fluoroelastomer OR Buna N molded double lip seal, designed to exclude foreign material away from the main upper seal. The upper seal shall be a unitized silicon carbide hard face seal with stainless steel housings and spring equal to Crane Type T-6a. The motor plate / housing interface shall be sealed with a Buna-N o-ring.

8.01 IMPELLER

The impeller shall be a investment cast stainless steel impeller, with pump out vanes on the back shroud to keep debris away from the seal area. it shall be keyed and bolted to the motor shaft.

9.01 CUTTER MECHANISM

The cutter and plate shall consist of 440 stainless steel with a Rockwell C hardness of 55-60. The stationary cutter plate shall have specially designed orifices through it, which enable the slurry to flow through the pump housing at an equalized pressure and velocity. The stationary cutter shall consist of V shapes to maximize cutting action and arc shape exclusion slots to outwardly eject debris from under the rotary cutter. The rotary cutter shall have (4) blades and be designed with a recessed area behind the cutting edge to prevent the accumulation and binding of any material between rotary cutter and the stationary cutter. The cutting system must incorporate close tolerances for optimum performance. Ring or radial cutters, or those that grind on the outside circumference of shall not be considered equal.

10.01 CONTROLS

The pumps shall be controlled with a NEMA 4X outdoor duplex control panel with three float switches and a high water alarm or with optional IP Series NEMA 4X outdoor duplex control panel with transducer, adjustable set-points, data logging, and a high water alarm.

11.01 PAINT

The exterior of the casting shall be protected with Powder Coat paint.

12.01 SUPPORT

The pump shall have cast iron support legs, enabling it to be a free standing unit. The legs will be high enough to allow solids and long stringy debris to enter the cutter assembly.

13.01 SERVICEABILTY

Components required for the repair of the pump shall be shipped within a period of 24 hours.

14.01 FACTORY ASSEMBLED TANK SYSTEMS WITH GUIDE RAIL AND QUICK DISCONNECT DISCHARGE

Factory mounted guide rail system with pump suspended by means of bolt-on quick disconnect which is sealed by means of nitrile grommets. The discharge piping shall be schedule 80 PVC and furnished with a check valve and PVC shut-off ball valve. The tank shall be wound fiberglass, and an inlet hub shall be provided with the system.

15.01 TESTING

The pump shall have a ground continuity check and the motor chamber shall be Hi-potted to test for electrical integrity, moisture content and insulation defects. The motor and volute housing shall be pressurized, and an air leak decay test is performed to ensure integrity of the motor housing. The pump shall be run, voltage current monitored, and the tester checks for noise or other malfunction.

16.01 QUALITY CONTROL

The pump shall be manufactured in an ISO 9001 certified Facility.

17.01 WARRANTY

Standard limited warranty shall be 3 years.