

# Lake Hills Main Blvd. & Mass Grading

Lift Station Report



**MADDEN**  
**MOORHEAD & STOKES, LLC**  
**CIVIL ENGINEERS**

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David A. Stokes, P.E. #66527  
Certificate of Authorization No. EB-0007723

## Appendices

- A Lift Station Design Calculations
- B Lift Station Pump Data

### LIFT STATION ANALYSIS/FORCE MAIN

The proposed development Lake Hills Main Blvd & Mass Grading consists of a spine road for future development. The future development consists of +/-560 senior living homes. The project will have a gravity collection system, which will connect to 1 lift station. Lift Station 1 is in the center of the site along the spine road. Lift Station 1 is designed to serve the future senior living homes and the future commercial development part of the PUD plan. Lift Station 1 has an average daily flow is 98,700 GPD and the peak hourly flow is 274 GPM.

The force main tie-in location is an existing force main stub located along a maintenance road within the Silver Springs Mission Inn Parcel that connects to the Sewer & Water Plant Investments, LLC parcel. The force main is owned and maintained by the Central Lake Community Development District. The lift station calculations are in Appendix A. The force main velocity calculations are in Appendix A, showing the minimum velocity of 2ft/sec is achieved. A Flygt pump was picked for the Lift Station. The pump curve with operating condition noted is in Appendix B along with other pump information. Lift Station 1 operates at 302 GPM at 61.1 feet TDH.

### DEMAND SUMMARY AND CAPACITY ANALYSIS

#### **Lift Station 1**

ADF Average Daily Flow:  $(558 \text{ units}) \times (150 \text{ GPD/unit}) + (150,000\text{sf}) \times (0.1\text{GPD/sf})$   
 $= 98,700 \text{ GPD} = 68.54 \text{ GPM}$

PHF Peak Hourly Flow:  $\text{ADF} \times 4 = 274.17 \text{ GPM}$

Gravity sewer capacity is given by  $Q = (1.486/n)AR_h^{2/3}S^{1/2}$

Pipe Diameter		<sup>(1)</sup> Manning's Number, n	Area, A [SF]	<sup>(2)</sup> Hydraulic Radius, R <sub>h</sub>	<sup>(3)</sup> Slope, S [FT/FT]	Pipe Capacity Flowing Full, Q		<sup>(4)</sup> Pipe Capacity at 75% Full [GPM]
[IN]	[FT]					[CFS]	[GPM]	
8	0.67	0.012	0.349	0.167	0.0028	0.69	310.9	255.2
10	0.83	0.012	0.545	0.208	0.0021	1.09	488.2	400.8
12	1.00	0.012	0.785	0.250	0.0017	1.59	714.2	586.4
15	1.25	0.012	1.227	0.313	0.0012	2.42	1,088.0	893.2

**Notes:**

- (1) Manning's n is 0.013 for PVC pipes
- (2) Hydraulic Radius, R = D/4 for full-flowing pipes
- (3) Minimum constructed slopes
- (4) Gravity sewers shall be designed at no more than 75% full at peak flow.
- (5) Per Civil Engineering Reference Manual Appendix 19.C, when d/D = 0.75, then Q/Q<sub>full</sub> = 0.82

## **APPENDIX A**

### **Lift Station 1 Design Calculations**

# **LIFT STATION CALCULATIONS**

**Lake Hills**

**Lift Station #1**

Located near Sta. 62+00

## DESIGN FLOW RATE CALCULATION:

Units	558 units
Average daily flow per unit	150 gpd/unit
Units (Commercial)	150000 sf
Average daily flow per sf	0.1 gpd/sf
Total average daily flow	98,700 gpd
Peak factor	4
Peak inflow	274.17 gpm

## WET WELL DESIGN ELEVATIONS AND CONTROL LEVELS:

B	Wet well diameter	6 ft
T	Top of wet well	73.28 ft
P	Influent invert in	55.60 ft
J	High-level alarm	54.95 ft
L	Lag pump ON	54.45 ft
M	Lead pump ON	53.95 ft
	Storage depth	1.85 ft
N	Pumps OFF	52.10 ft
	Sump depth	2.00 ft
Z	Floor of wet well	50.10 ft
	Wet well depth	23.18 ft

## WET WELL BUOYANCY CALCULATION:

### Assumptions:

1. SHWT is at wet well top
2. Unit weight of water 62.4 pcf
3. Unit weight of concrete 150.0 pcf
4. Unit weight of submerged soil 57.6 pcf

### Assume SHWT at wet well top.

Wet well wall thickness	8.00 in
Bottom slab lip width	18.00 in
Bottom slab thickness	12.00 in
Volume of water displaced	1,062.92 cf
Total uplift force	66,326 lbs
Volume of concrete	407.52 cf
Weight of concrete	61,128 lbs
Volume of soil above lip	964.89 cf
Weight of soil above lip	55,578 lbs
Total resistance force	116,705 lbs

Factor of safety	1.8
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**SYSTEM HEAD CURVE CALCULATION:**

**STATIC HEAD CALCULATION:**

Pressure at tie-in location	25 psi
Elevation at tie-in location	83.00 ft
HGL at tie-in location	140.70 ft
Static head for pump	88.60 ft

**SYSTEM HEAD CURVE CALCULATION:**

Pipe Length	28 ft	7,700 ft
Pipe Inside Diameter	8.00 in	8.00 in
Pipe Area	0.349 sf	0.349 sf
Roughness C	130	130

Fittings:	K-Value	No.	Tot K	No.	Tot K
Discharge	1.0	1	1	1	1
90 Deg. Bend	0.6	2	1.2	0	0
45 Deg. Bend	0.4	0	0	20	8
Expansion	0.5	1	0.5	0	0
Gate Valve	0.4	1	0.4	15	6
Check Valve	2.5	1	2.5	0	0
Total K-Value			5.6		15.0

Q, gpm	V, fps	Friction Losses in Feet					TDH, ft
		Pipe	Fittings	Pipe	Fittings	Total	
270.0	1.7	0.05	0.26	12.43	0.69	13.42	102.02
280.0	1.8	0.05	0.28	13.29	0.74	14.36	102.96
290.0	1.9	0.05	0.30	14.18	0.80	15.33	103.93
300.0	1.9	0.05	0.32	15.10	0.85	16.33	104.93
310.0	2.0	0.06	0.34	16.05	0.91	17.36	105.96
320.0	2.0	0.06	0.36	17.02	0.97	18.41	107.01
330.0	2.1	0.07	0.39	18.01	1.03	19.50	108.10

**CYCLE TIME CALCULATION:**

Operating point flow	302.00 gpm
Wet well cross-section area	28.27 sf
Storage volume	391.31 gal
Pump on time	14.06 min
Pump off time	1.43 min
Cycle time	15.49 min
Maximum starts per hour	3.9



## **APPENDIX B**

### **Lift Station 1 Pump Data**



# NP 3153 HT 3~ 462

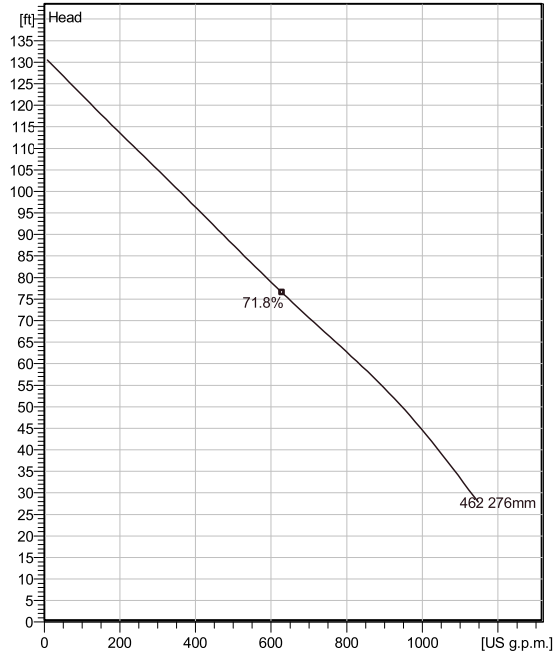
Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.



## Technical specification



Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.428 lb/ft<sup>3</sup>, 1.6889E-5 ft<sup>2</sup>/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

## Configuration

<b>Motor number</b> N3153.185 21-18-4AA-W 20hp	<b>Installation type</b> P - Semi permanent, Wet
<b>Impeller diameter</b> 276 mm	<b>Discharge diameter</b> 4 inch

## Pump information

<b>Impeller diameter</b> 276 mm
<b>Discharge diameter</b> 4 inch
<b>Inlet diameter</b> 150 mm
<b>Maximum operating speed</b> 1760 rpm
<b>Number of blades</b> 2
<b>Max. fluid temperature</b> 40 °C

## Material

<b>Impeller</b> Hard-Iron™
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<b>Project</b>	Xylect-20111063	<b>Created by</b>	
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# NP 3153 HT 3~ 462

## Technical specification



### Motor - General

<b>Motor number</b> N3153.185 21-18-4AA-W 20hp	<b>Phases</b> 3~	<b>Rated speed</b> 1760 rpm	<b>Rated power</b> 20 hp
<b>ATEX approved</b> No	<b>Number of poles</b> 4	<b>Rated current</b> 58 A	<b>Stator variant</b> 4
<b>Frequency</b> 60 Hz	<b>Rated voltage</b> 208 V	<b>Insulation class</b> H	<b>Type of Duty</b> S1
<b>Version code</b> 185			

### Motor - Technical

<b>Power factor - 1/1 Load</b> 0.81	<b>Motor efficiency - 1/1 Load</b> 87.5 %	<b>Total moment of inertia</b> 2.38 lb ft <sup>2</sup>	<b>Starts per hour max.</b> 30
<b>Power factor - 3/4 Load</b> 0.75	<b>Motor efficiency - 3/4 Load</b> 89.0 %	<b>Starting current, direct starting</b> 345 A	
<b>Power factor - 1/2 Load</b> 0.63	<b>Motor efficiency - 1/2 Load</b> 88.5 %	<b>Starting current, star-delta</b> 115 A	

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## Performance curve

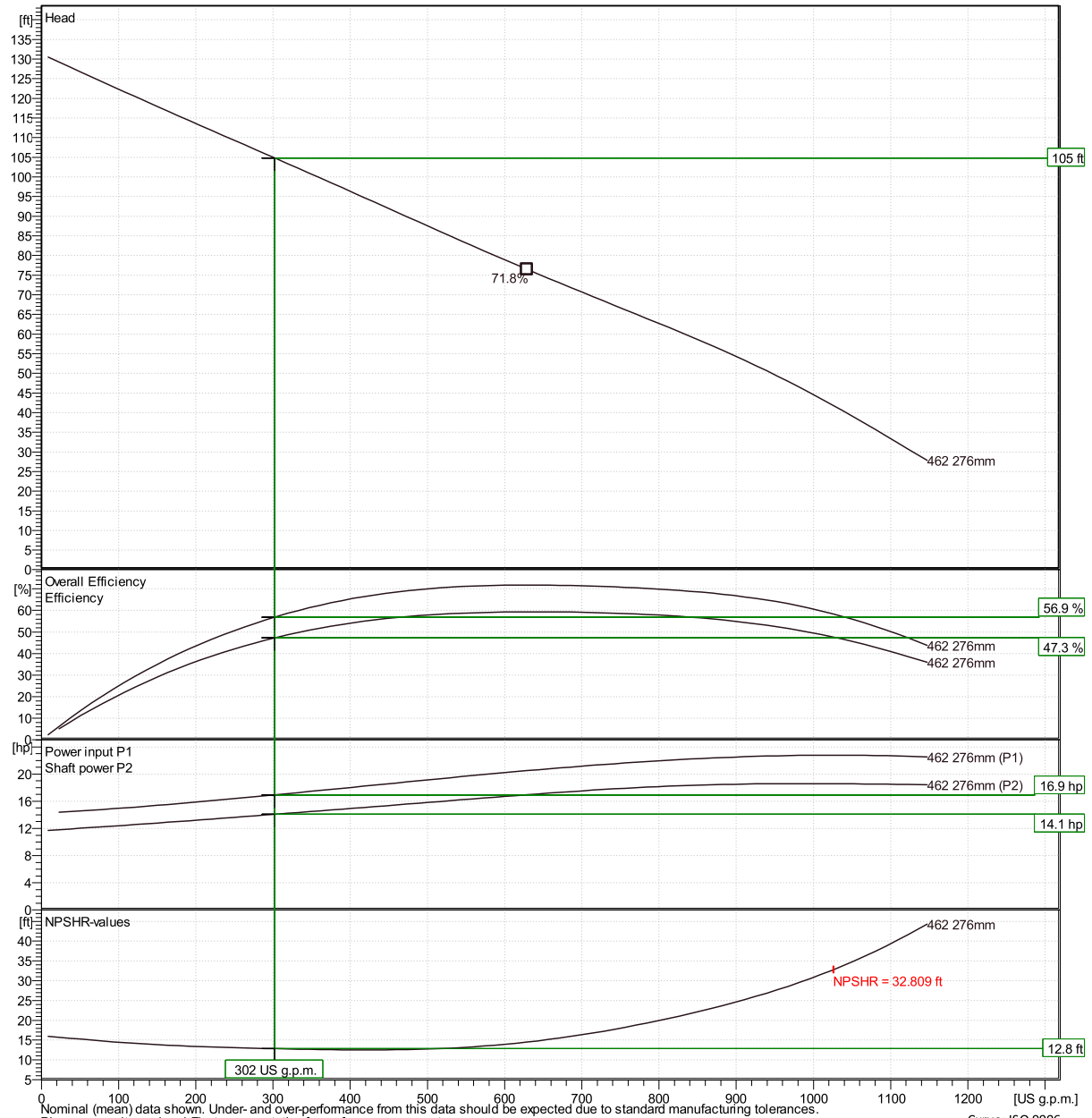


### Duty point

**Flow**  
302 US g.p.m.

**Head**  
105 ft

Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.428 lb/ft<sup>3</sup>, 1.6889E-5 ft<sup>2</sup>/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees. Curve: ISO 9906

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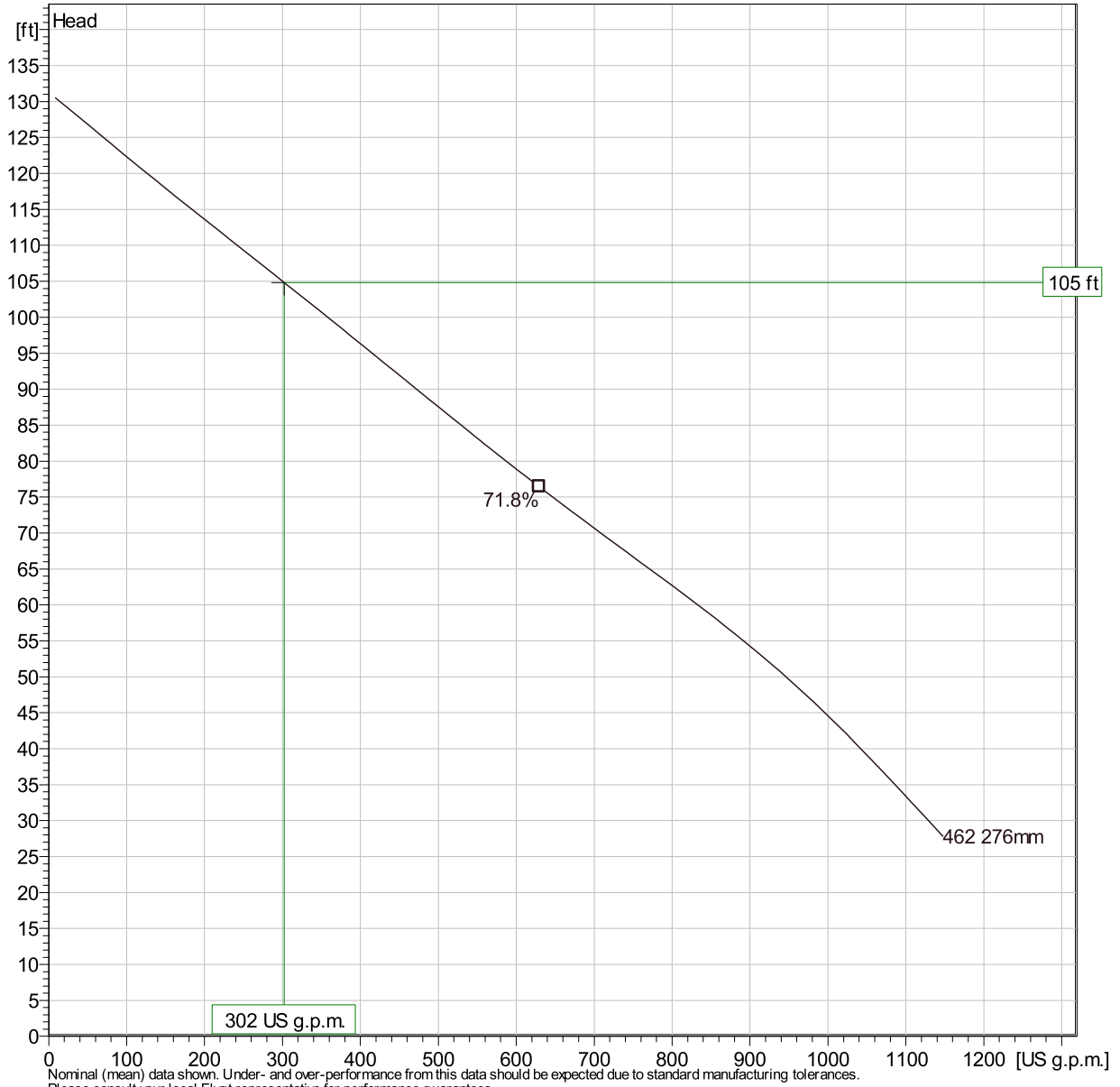
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# NP 3153 HT 3~ 462

## Duty Analysis



Curves according to: Water, pure [100%]; 39.2°F; 62.428lb/ft<sup>3</sup>; 1.6889E-5ft<sup>2</sup>/s



### Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	
1	302	105	14.1	302	105	14.1	56.9 %	697	12.8

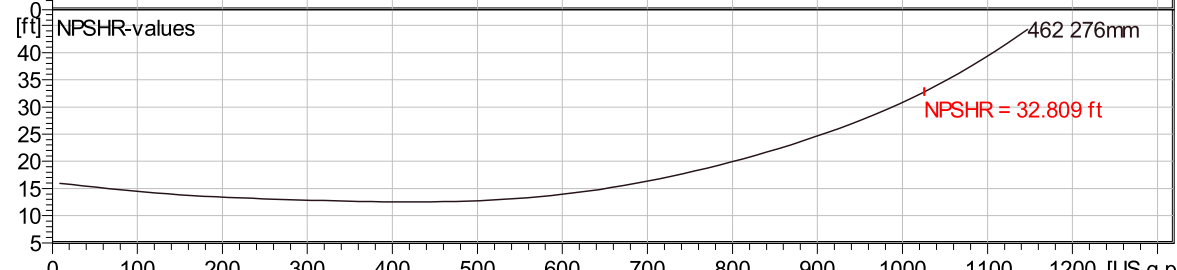
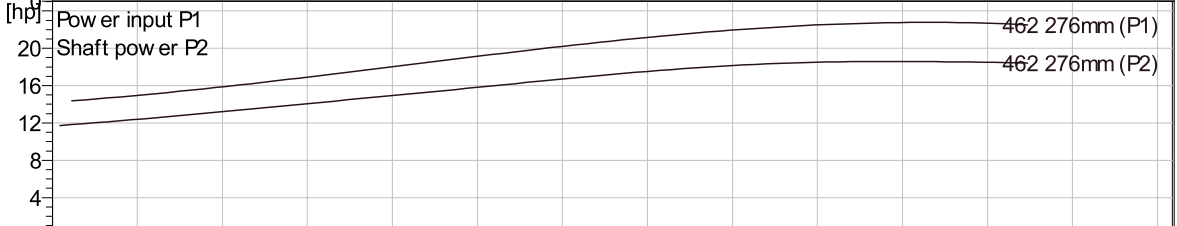
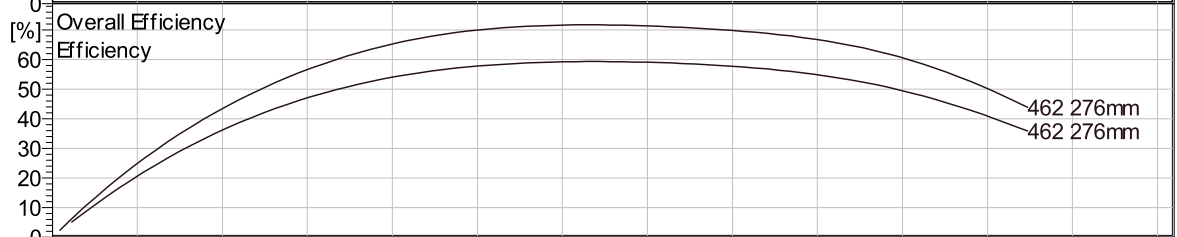
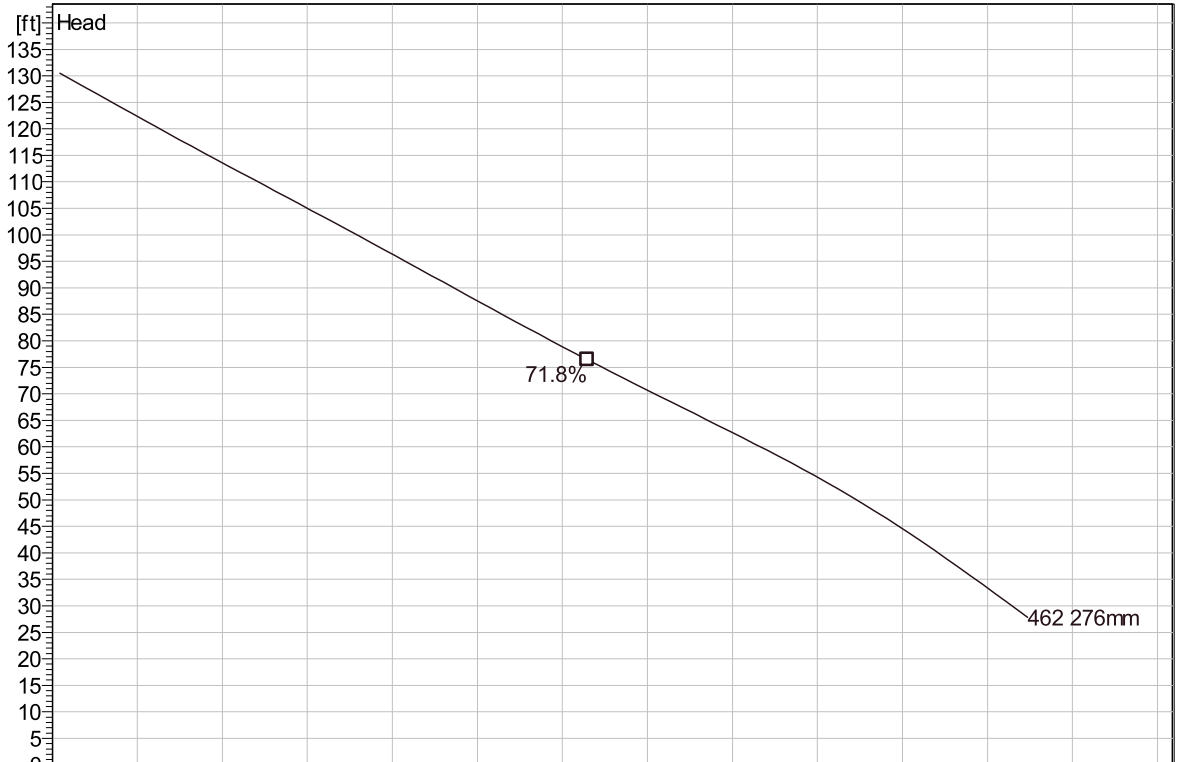
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## VFD Curve



Curves according to: Water, pure, 39.2 °F, 62.428 lb/ft<sup>3</sup>, 1.6889E-5 ft<sup>2</sup>/s

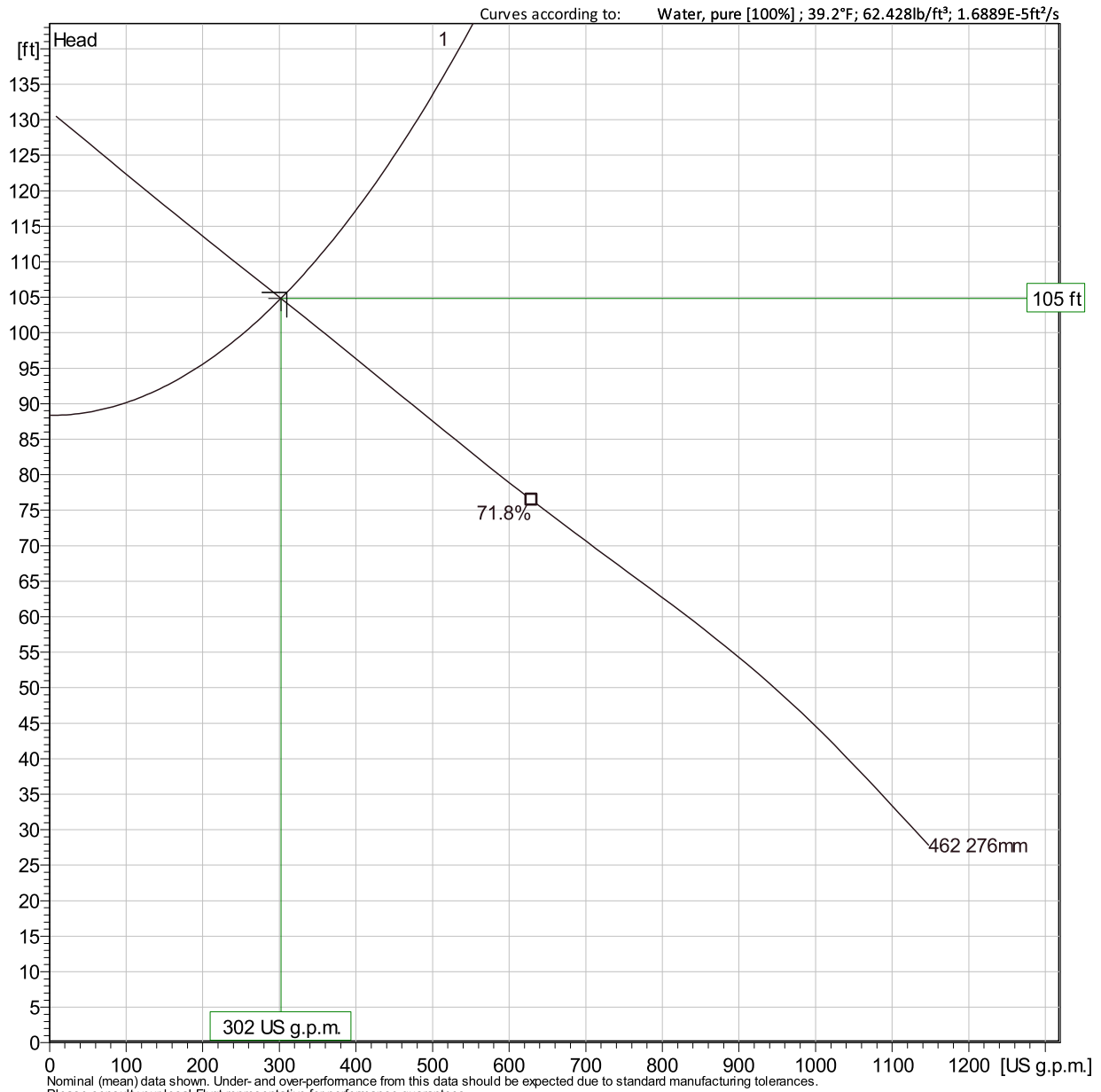


Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees. Curve: ISO 9906

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## VFD Analysis



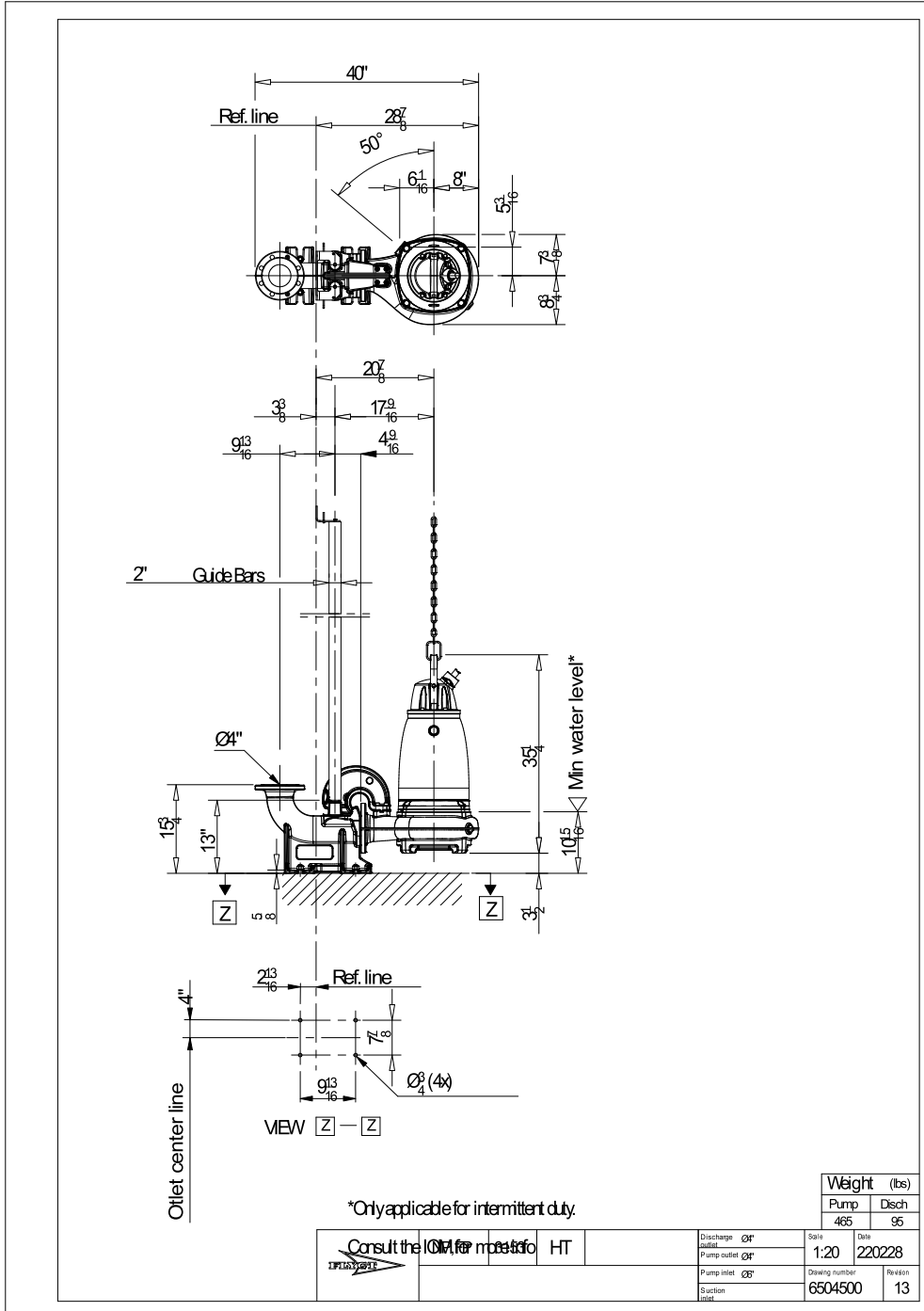
### Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr. eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	
1	60 Hz	302	105	14.1	302	105	14.1	56.9 %	697	12.8

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Dimensional drawing



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