

Appendix A

Certified Pump Curves – Murray
Lane and Johnson Chapel
Pump Stations



HYDRAULIC PERFORMANCE WARRANTY
GUARANTEED PER HYDRAULIC INSTITUTE STANDARDS AT
RATED POINT ONLY AND IS
CONTINGENT ON:
1. PROPER NPSH OR SUBMERGENCE AVAILABLE.
2. PROPER AND ADEQUATE FLOW TO PUMP SUCTION.
3. CLEAR WATER FREE OF GAS, AIR, AND ABRASIVE
MATTER.
4. IMPELLER WITH PROPER LATERAL ADJUSTMENT
5. TDH INCLUDES VELOCITY HEAD AT DISCHARGE

Bowl Performance Test

CUSTOMER: ENGINEERED FLUID, INC

REMARKS:

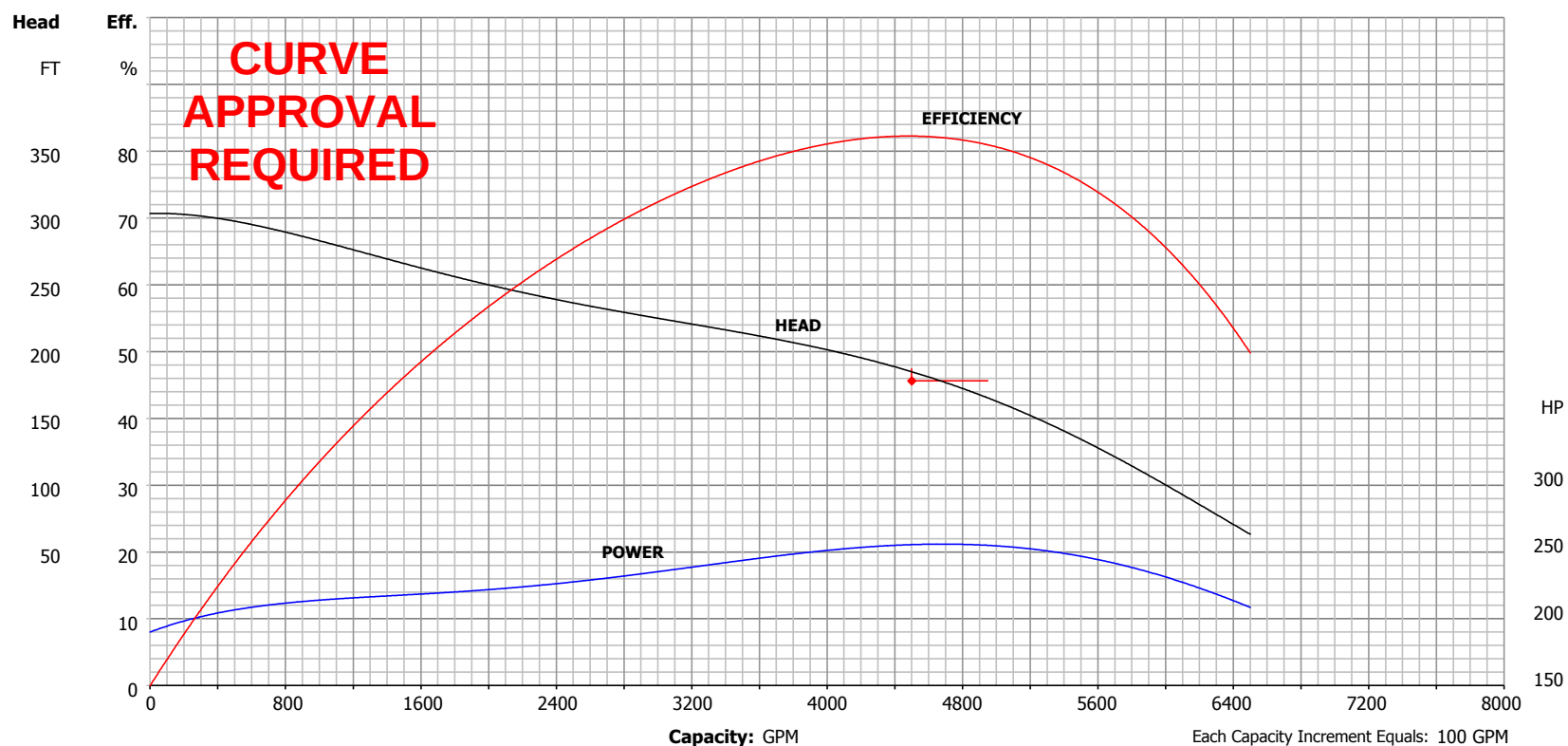
BY: CASEY WHITE

REVIEWED:

DATE: 8/22/2014

PUMP: 18HXB
STAGES: 2
I NO. 1 : 96669952
M NO. 2: N / A
P NO. 3: N / A
E NO. 4: (2) @ 11.63x12.34
L DIA. 1 : N / A
E DIA. 2: N / A
R DIA. 3: N / A

Test No.: 7081406A2P
Shop Order: 7081406
Serial No.: 7081406A
Rated Flow: 4500.00 GPM
Rated Head: 178.00 FT
Speed: 1770 RPM
Spec. Gravity: 1.000
Test Tolerance: A





PERFORMANCE TEST OF CENTRIFUGAL PUMP

TEST DATA

Test Type: Bowl Performance Test
Test Witness:
Test No.: 7081406A2P
Test Date: 8/22/2014
Tester: CASEY WHITE
Test Standard: A
Shop Order No.: 7081406
Serial No.: 7081406A
Customer: ENGINEERED FLUID, INC
Project Name.: N / A
Design Flow Rate (GPM): 4500.00
Design Head (FT): 178.00
Design Speed: 1770
Design Spec. Gravity SG: 1.00

Report Type: Bowl Performance

Power measured by: Dynamometer

PUMP DATA

Pump Type: Vertical
Pump Model: 18HXB - 2 STG, L6
Impeller 1 Number: 96669952.00
Impeller 2 Number: N / A
Impeller 3 Number: N / A
Impeller 1 Dia. (in): 2 - 11.63 x 12.34
Impeller 2 Dia. (in): N / A
Impeller 3 Dia. (in): N / A
Impeller 1 Filing: Fig. 2 to 0.01
Impeller 2 Filing: N / A
Impeller 3 Filing: N / A
Imp. 1, 2, 3 Polish 75RA, N/A, N/A
Lateral Setting (in): 0.000
Top Bowl PartNo.: 0 0
Std. Bowl PartNo.: 0.00
Bowl Shaft Diameter (in): 1.9375
Bowl length (in): 34.9

TEST EQUIPMENT DATA

Flow Line: 16 inch
Flow Meter Type: 16IN MAG
Discharge Gauge: 150PSIG LP
Suction Gauge: NONE NPSH
Speed sensor: Tachometer Kit, QC892-1
Test Column ID/L (in): 12 / 120.625
Line-Shaft/Tube Dia. (in): 1.5
Suction Pipe Diameter N / A
Dynamometer Size / Load Cell: Small / 225LBF LC
kW Meter: KWM480S
Test Motor HP - RPM: Job
Atmospheric Pressure (in Hg): 29.22
Water Temperature (°F): 66.85
Specific Gravity SG: 1.00
Vapor Pressure: 0.325
NPSHA : 39.61
Submergence (in): 82.00

ELEVATIONS

Discharge Gauge to Floor (in): 42.00
Floor to Water (in): 5.89
Discharge Height (in): N / A
Suction Height (in): N / A
Test Z (in): 47.89

LOSSES ADDED

Additional Power Loss (HP):	0.00
Bowl Head Loss (FT):	0.00
at Flow (GPM):	0.00

REMARKS

TEST READINGS

Curve Number	Flow Rate Q (GPM)	Discharge Pressure pD (PSIa)	Suction Pressure pS (PSIg)	Test Speed nT (RPM)	Dynamometer Force (lbf)
1	0.00	32.10	0.00	898	109.39
1	518.14	29.59	0.00	898	122.69
1	1052.22	26.07	0.00	898	128.46
1	1498.49	23.10	0.00	898	135.64
1	1840.13	21.39	0.00	898	138.49
1	2118.79	20.04	0.00	898	146.22
1	2252.92	18.94	0.00	898	147.49
1	2335.71	17.95	0.00	898	147.27
1	2672.42	14.36	0.00	898	144.54
1	2899.61	11.08	0.00	898	138.11
1	3039.01	8.83	0.00	898	132.69
1	3166.63	6.93	0.00	898	127.40
1	3244.04	5.41	0.00	898	122.70
1	3297.96	4.67	0.00	898	120.20

BOWL CHARACTERISTICS at RATED SPEED

Pump Speed (RPM)	Flow Rate Q (GPM)	TDH (FT)	Power (HP)	Efficiency (%)
1770	0.00	303.54	190.22	0.00
1770	1021.28	281.22	213.43	33.97
1770	2073.97	250.09	223.50	58.59
1770	2953.60	224.13	236.03	70.80
1770	3626.98	209.39	241.01	79.55
1770	4176.23	197.94	254.50	82.00
1770	4440.61	188.42	256.71	82.28
1770	4603.80	179.71	256.34	81.48
1770	5267.46	148.55	251.57	78.52
1770	5715.26	119.78	240.34	71.91
1770	5990.03	100.08	230.88	65.55
1770	6241.58	83.54	221.65	59.39
1770	6394.15	70.18	213.44	53.07
1770	6500.44	63.71	209.07	50.01



HYDRAULIC PERFORMANCE WARRANTY
GUARANTEED PER HYDRAULIC INSTITUTE STANDARDS AT
RATED POINT ONLY AND IS
CONTINGENT ON:
1. PROPER NPSH OR SUBMERGENCE AVAILABLE.
2. PROPER AND ADEQUATE FLOW TO PUMP SUCTION.
3. CLEAR WATER FREE OF GAS, AIR, AND ABRASIVE
MATTER.
4. IMPELLER WITH PROPER LATERAL ADJUSTMENT
5. TDH INCLUDES VELOCITY HEAD AT DISCHARGE

Bowl Performance Test

CUSTOMER: ENGINEERED FLUID, INC

REMARKS:

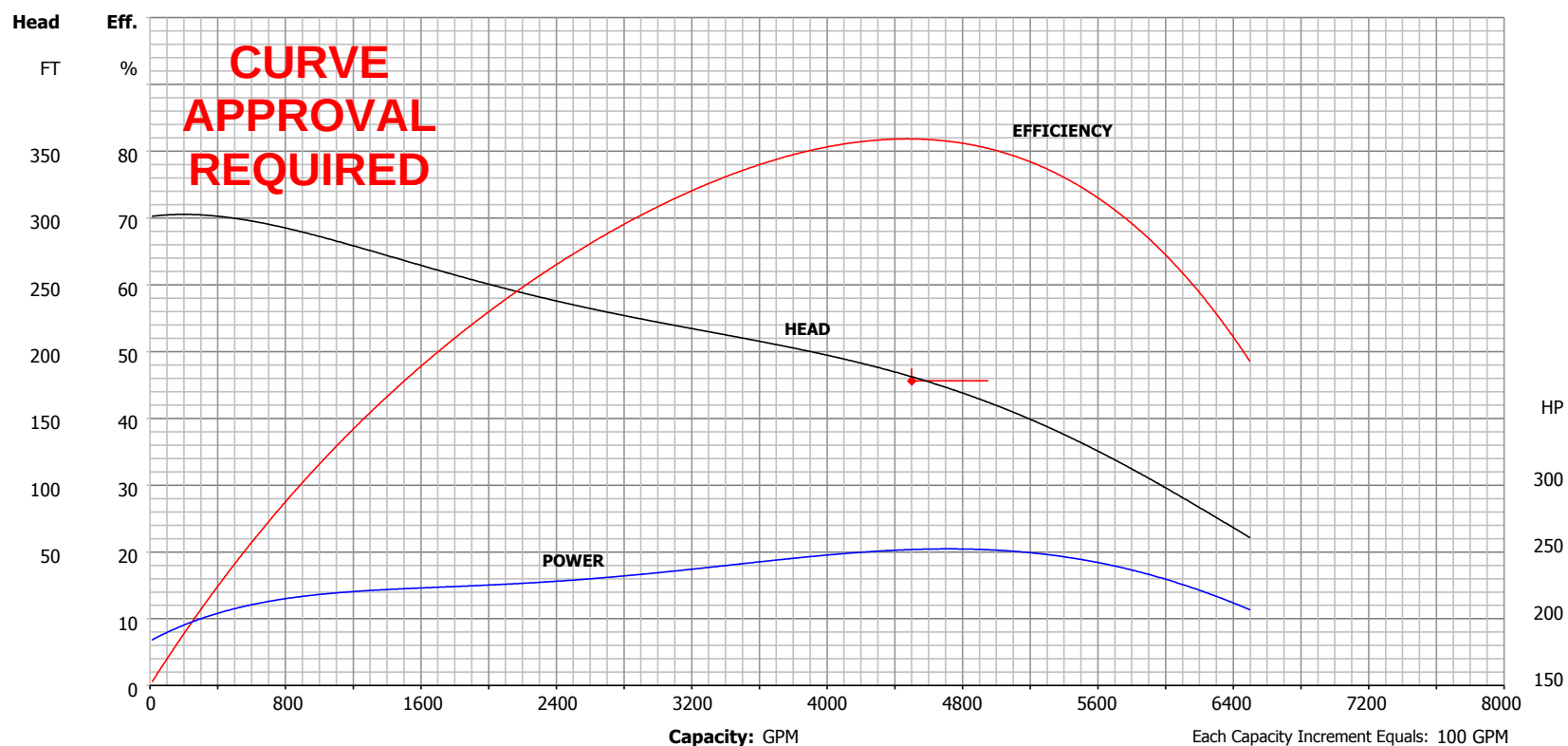
BY: CASEY WHITE

REVIEWED:

DATE: 8/28/2014

PUMP: 18HXB
STAGES: 2
NO. 1 : 96669952
NO. 2: N / A
NO. 3: N / A
DIA. 1 : (2) @ 11.63x12.34
DIA. 2: N / A
DIA. 3: N / A

Test No.: 7081406B1P
Shop Order: 7081406
Serial No.: 7081406B
Rated Flow: 4500.00 GPM
Rated Head: 178.00 FT
Speed: 1770 RPM
Spec. Gravity: 1.000
Test Tolerance: A





PERFORMANCE TEST OF CENTRIFUGAL PUMP

TEST DATA

Test Type: Bowl Performance Test
Test Witness:
Test No.: 7081406B1P
Test Date: 8/28/2014
Tester: CASEY WHITE
Test Standard: A
Shop Order No.: 7081406
Serial No.: 7081406B
Customer: ENGINEERED FLUID, INC
Project Name.: N / A
Design Flow Rate (GPM): 4500.00
Design Head (FT): 178.00
Design Speed: 1770
Design Spec. Gravity SG: 1.00
Guaranteed Efficiency:
Report Type: Bowl Performance
Power measured by: Dynamometer

PUMP DATA

Pump Type: Vertical
Pump Model: 18HXB - 2 STG, L6
Impeller 1 Number: 96669952.00
Impeller 2 Number: N / A
Impeller 3 Number: N / A
Impeller 1 Dia. (in): 2 - 11.63 x 12.34
Impeller 2 Dia. (in): N / A
Impeller 3 Dia. (in): N / A
Impeller 1 Filing: Fig. 2 to 0.01
Impeller 2 Filing: N / A
Impeller 3 Filing: N / A
Imp. 1, 2, 3 Polish 75RA, N/A, N/A
Lateral Setting (in): 0.000
Top Bowl PartNo.: 0 0
Std. Bowl PartNo.: 0.00
Bowl Shaft Diameter (in): 1.9375
Bowl length (in): 34.9

TEST EQUIPMENT DATA

Flow Line: 16 inch
Flow Meter Type: 16IN MAG
Discharge Gauge: 150PSIG LP
Suction Gauge: NONE NPSH
Speed sensor: Tachometer Kit, QC892-1
Test Column ID/L (in): 12 / 120.625
Line-Shaft/Tube Dia. (in): 1.5
Suction Pipe Diameter N / A
Dynamometer Size / Load Cell: Small / 225LBF LC
kW Meter: KWM480S
Test Motor HP - RPM: Job
Atmospheric Pressure (in Hg): 29.33
Water Temperature (°F): 67.42
Specific Gravity SG: 1.00
Vapor Pressure: 0.332
NPSHA : 39.32
Submergence (in): 77.00

ELEVATIONS

Discharge Gauge to Floor (in): 42.00
Floor to Water (in): 6.09
Discharge Height (in): N / A
Suction Height (in): N / A
Test Z (in): 48.09

LOSSES ADDED

Additional Power Loss (HP):	0.00
Bowl Head Loss (FT):	0.00
at Flow (GPM):	0.00

REMARKS

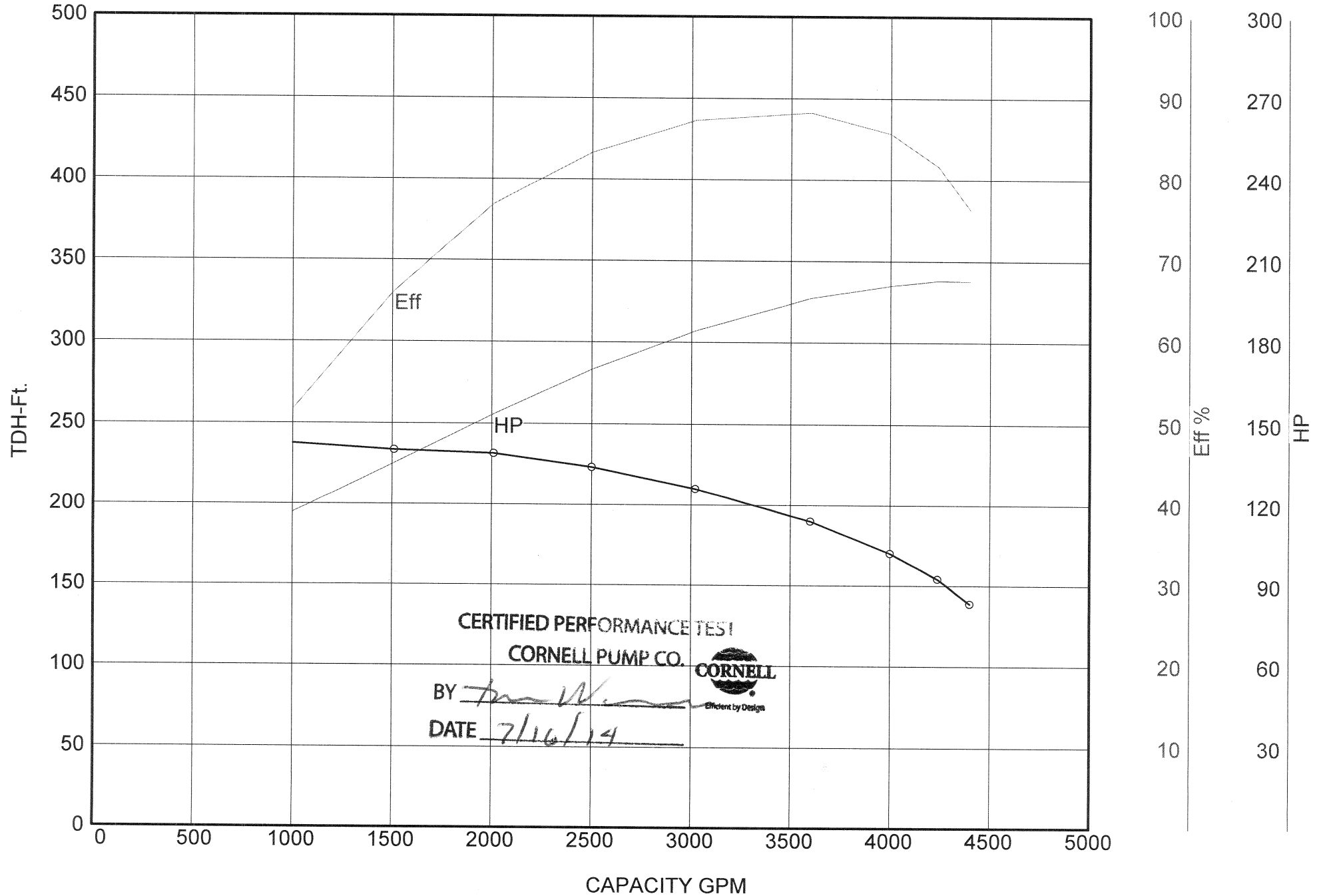
TEST READINGS

Curve Number	Flow Rate Q (GPM)	Discharge Pressure pD (PSIG)	Suction Pressure pS (PSIG)	Test Speed nT (RPM)	Dynamometer Force (lbf)
1	6.63	32.11	0.00	899	108.15
1	262.30	30.81	0.00	894	116.09
1	692.14	28.94	0.00	895	130.36
1	1199.19	25.07	0.00	901	132.01
1	1478.31	23.10	0.00	901	135.62
1	1711.59	21.14	0.00	897	135.06
1	1963.77	20.85	0.00	897	142.83
1	2273.26	18.42	0.00	900	146.37
1	2339.84	17.76	0.00	899	146.76
1	2441.76	16.63	0.00	899	146.36
1	2751.01	13.06	0.00	898	142.13
1	2937.73	10.13	0.00	898	136.04
1	3079.40	8.00	0.00	899	130.42
1	3241.28	5.30	0.00	898	122.76
1	3299.81	4.44	0.00	899	120.58

BOWL CHARACTERISTICS at RATED SPEED

Pump Speed (RPM)	Flow Rate Q (GPM)	TDH (FT)	Power (HP)	Efficiency (%)
1770	13.05	303.06	186.51	0.54
1770	519.32	294.67	202.57	19.07
1770	1368.81	277.44	227.20	42.20
1770	2355.79	239.82	227.06	62.81
1770	2904.12	222.67	233.31	69.97
1770	3377.38	207.43	234.42	75.45
1770	3875.00	205.39	248.01	81.01
1770	4470.74	183.11	252.51	81.85
1770	4606.81	177.72	253.75	81.45
1770	4807.47	167.94	253.06	80.54
1770	5422.37	137.12	246.24	76.23
1770	5790.39	111.44	235.60	69.14
1770	6062.90	92.68	225.29	62.96
1770	6388.71	69.24	212.42	52.57
1770	6496.84	61.55	208.16	48.50

CORNELL PUMP COMPANY PERFORMANCE TEST
Test Number: 38162 Date : 7/15/2014 S/N: 193768
8H HORIZ 15.22" Impeller Diameter
ENGINEERED FLUID, INC. SO# 270345
DESIGN POINT = 195 FT. TDH @ 3600 GPM



PERFORMANCE TEST - Open Loop

Test Number 38162

Customer ENGINEERED FLUID, INC.

SO# 270345

Remarks DESIGN POINT = 195 FT. TDH @ 3600 GPM

8H HORIZ 15.22" Impeller Diameter

3" Single Seal

Date : 7/15/2014 Serial Number 193768

Suction	DWT	Man A	Man B	TDH	Orifice	Flow	Torque	Watts	Power			Speed
Hg In	PSI	Hg In	Hg In	Ft	Hg In	GPM	Meter	Read	Output	Eff%	NPSHA	RPM
1.70	100.50	0.00	0.00	237.7	0.00	1000	0.00	573	116.75	51.70	31.1	1795
2.10	98.20	0.00	0.00	233.7	0.00	1510	0.00	664	135.29	66.18	30.7	1794
1.80	96.90	0.00	0.00	231.6	0.00	2010	0.00	753	153.43	76.92	31.1	1793
2.80	92.20	0.00	0.00	223.3	0.00	2500	0.00	834	169.93	83.27	30.1	1792
3.05	85.50	0.00	0.00	210.1	0.00	3020	0.00	904	184.19	87.26	29.9	1791
3.50	75.50	0.00	0.00	190.1	0.00	3600	0.00	964	196.42	88.23	29.6	1791
4.05	65.70	0.00	0.00	170.1	0.00	4000	0.00	987	201.10	85.68	29.1	1791
4.25	58.20	0.00	0.00	154.3	0.00	4240	0.00	996	202.94	81.64	28.9	1790
4.45	51.00	0.00	0.00	138.8	0.00	4400	0.00	995	202.73	76.29	28.8	1790

CERTIFIED PERFORMANCE TEST

CORNELL PUMP CO.



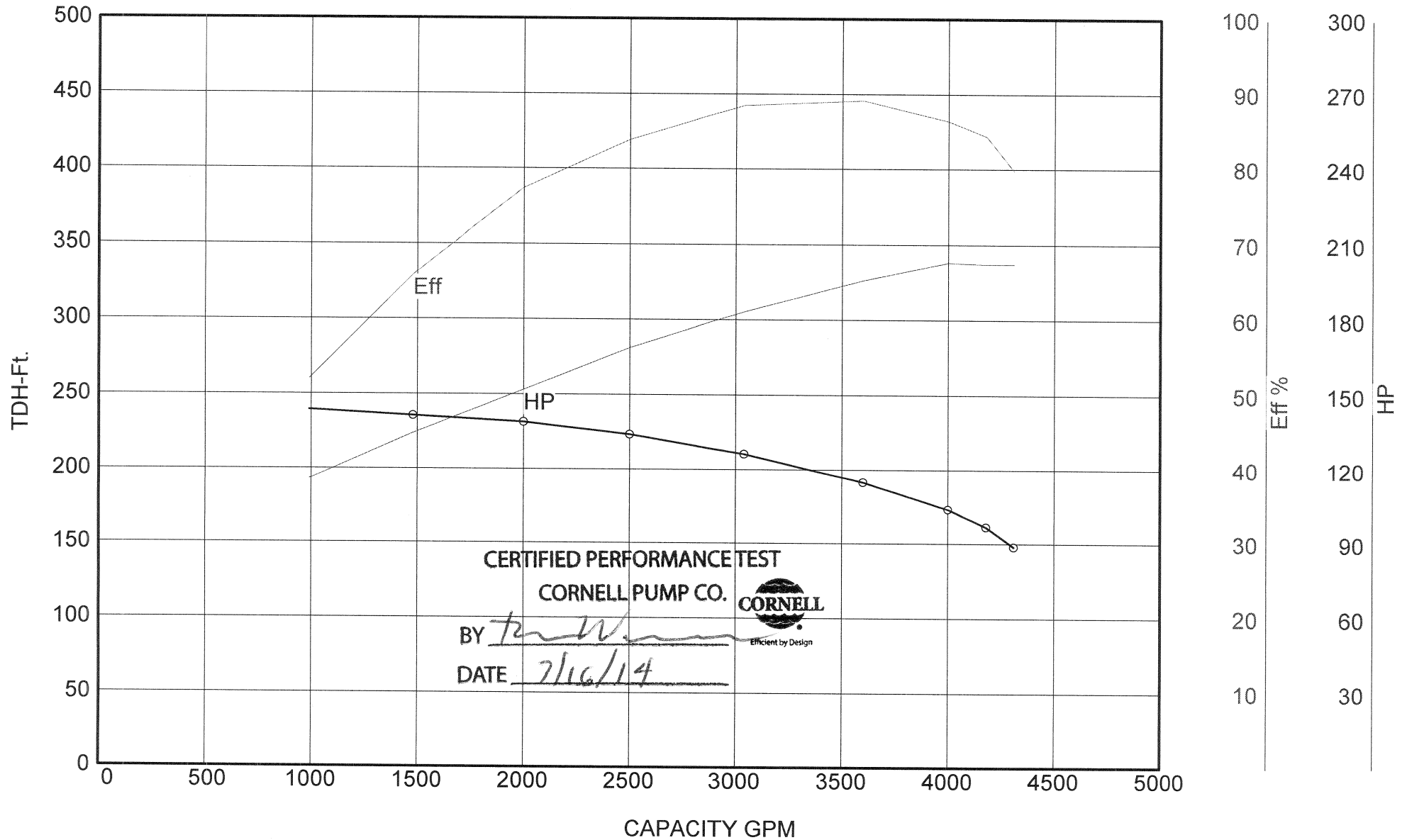
BY

[Signature]

DATE

7/16/14

CORNELL PUMP COMPANY PERFORMANCE TEST
Test Number: 38167 Date : 7/16/2014 S/N: 193769
8H HORIZ 15.22" Impeller Diameter
ENGINEERED FLUID, INC. SO# 270345
DESIGN POINT = 195 FT. TDH @ 3600 GPM



PERFORMANCE TEST - Open Loop

Test Number 38167
 Customer ENGINEERED FLUID, INC.
 Remarks DESIGN POINT = 195 FT. TDH @ 3600 GPM
 8H HORIZ 15.22" Impeller Diameter
 3" Single Seal
 Date : 7/16/2014 Serial Number 193769

SO# 270345

Suction Hg In	DWT PSI	Man A Hg In	Man B Hg In	TDH Ft	Orifice Hg In	Flow GPM	Torque Meter	Watts Read	Power Output	Eff%	NPSHA	Speed RPM
2.70	100.80	0.00	0.00	239.5	0.00	990	0.00	568	115.73	52.03	29.9	1795
2.70	98.70	0.00	0.00	235.5	0.00	1480	0.00	659	134.27	65.86	30.0	1794
3.00	96.30	0.00	0.00	231.5	0.00	2000	0.00	745	151.80	77.35	29.7	1793
3.20	92.00	0.00	0.00	223.3	0.00	2500	0.00	828	168.71	83.88	29.6	1792
3.65	85.30	0.00	0.00	210.4	0.00	3040	0.00	899	183.17	88.46	29.2	1791
4.15	75.80	0.00	0.00	191.5	0.00	3600	0.00	961	195.81	89.17	28.8	1761
4.50	66.80	0.00	0.00	173.1	0.00	4000	0.00	996	202.94	86.42	28.5	1790
4.80	61.10	0.00	0.00	161.3	0.00	4180	0.00	993	202.33	84.39	28.2	1790
4.90	54.90	0.00	0.00	147.8	0.00	4310	0.00	993	202.33	79.74	28.2	1790

CERTIFIED PERFORMANCE TEST

CORNELL PUMP CO.



BY [Signature]

DATE 7/16/14