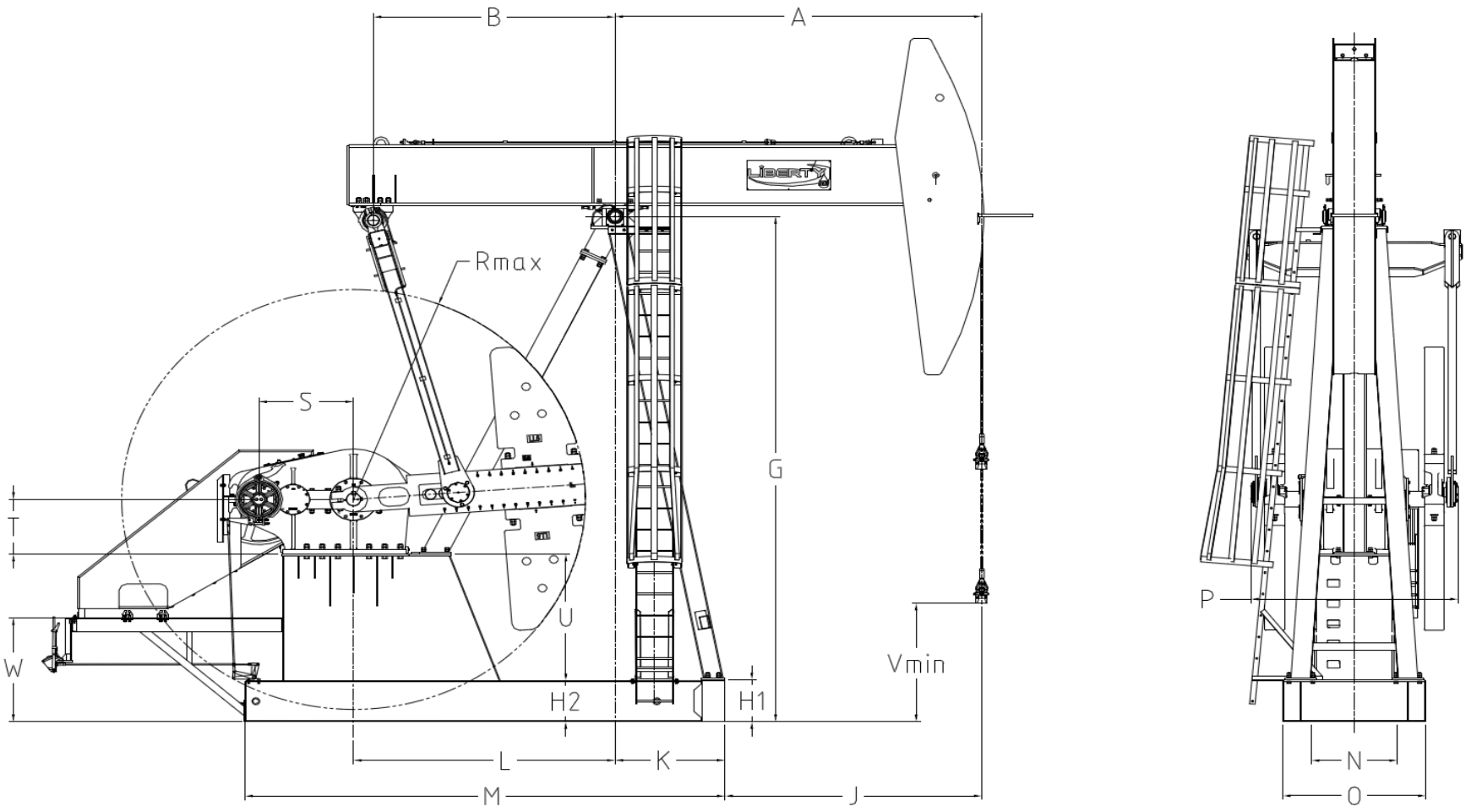
LIBERTY LIFT HE PUMPING UNIT HP



UNIT	A	B	G	H1	H2	J	K	L	M	N	O	P	R	S	T	U	Vmin	W
912-427-168	15'-5 1/8"	10'-2"	23'-5 5/8"	23 3/8"	22 7/8"	10'-9 5/8"	4'-7 1/2"	11'-0"	20'-2 3/8"	3'-7 1/4"	6'-0 1/4"	8'-8 5/8"	117"	47.768"	30.512"	5'-10 1/2"	5'-3"	4'-9 7/8"

LIBERTY LIFT SOLUTIONS

TORQUE FACTOR TABLE

UNIT DESIGNATION 912-427-168 High Efficiency

Cranks : CR002

Position of Crank degrees	Polished Rod Position Length of Stroke, inches			Torque Factor Length of Stroke, inches		
	169.108	144.675	121.349	169.108	144.675	121.349
0	0.0035	0.0027	0.0021	-11.427	-8.492	-6.188
15	0.0087	0.0095	0.0101	18.482	16.198	13.721
30	0.0605	0.0609	0.0606	47.968	40.065	32.690
45	0.1538	0.1515	0.1485	71.041	58.953	47.899
60	0.2749	0.2694	0.2631	83.376	69.902	57.343
75	0.4064	0.3995	0.3915	85.045	72.681	60.666
90	0.5344	0.5287	0.5213	79.435	69.294	58.951
105	0.6506	0.6481	0.6434	70.289	62.293	53.823
120	0.7515	0.7531	0.7520	60.032	53.573	46.662
135	0.8364	0.8415	0.8439	49.656	44.072	38.284
150	0.9052	0.9122	0.9166	39.135	33.942	28.964
165	0.9572	0.9638	0.9681	27.760	22.801	18.601
180	0.9901	0.9937	0.9959	14.327	9.982	6.940
195	0.9997	0.9985	0.9970	-2.511	-5.071	-6.123
210	0.9803	0.9741	0.9687	-23.145	-22.146	-20.182
225	0.9272	0.9181	0.9100	-45.381	-39.665	-34.113
240	0.8412	0.8319	0.8228	-64.858	-55.093	-46.333
255	0.7295	0.7213	0.7123	-78.314	-66.318	-55.434
270	0.6022	0.5949	0.5864	-85.152	-72.484	-60.616
285	0.4689	0.4620	0.4538	-86.101	-73.624	-61.623
300	0.3383	0.3313	0.3235	-81.832	-69.985	-58.456
315	0.2182	0.2115	0.2046	-72.512	-61.658	-51.156
330	0.1165	0.1111	0.1057	-57.858	-48.559	-39.776
345	0.0420	0.0387	0.0357	-37.455	-30.662	-24.545

1.) The position of the crank is the angular displacement measured clockwise from the 12 o'clock position View with the well head to the right.

2.) Position is expressed as a fraction of stroke above lowermost position

3.) Torque factor = T/P_R, where T = torque on pumping unit reducer due to polished rod load P_R.

Strctural Unbalance = -980

A =	185.091
C =	122.008
G =	123.898
H =	281.615
K =	205.671
I =	132.008
P =	157.650
R1 =	53.031
R2 =	46.023
R3 =	39.016

LIBERTY LIFT SOLUTIONS

EFFECTIVE COUNTERBALANCE TABLE

Unit Designation 912-427-168 High Efficiency

CRANK : CR002

Stroke Length, inches	169.108		144.675		121.349	
Cranks Only, pounds	4977		5849		7047	
Description	Max	Min	Max	Min	Max	Min
Cranks and 4 each LL2	14673	8535	16964	9927	20113	11841
Cranks w/2-LL2 & 2-LL3	17579	9933	20295	11530	24028	13725
Cranks and 4 each LL3	20484	11331	23625	13133	27942	15609
Cranks w/2-LL3 & 2-LL4	22575	12498	26022	14471	30759	17181
Cranks and 4 each LL4	24665	13665	28418	15808	33576	18753
Cranks w/2-LL4 & 2-LL5	26343	14676	30341	16967	35837	20116
Cranks and 4 each LL5	28020	15686	32264	18126	38097	21478
Cranks w/2-LL5 & 2-LL6	30674	17853	35306	20610	41673	24398
Cranks and 4 each LL6	33328	20020	38348	23093	45249	27317

* Not Recommended

** Maximum recommended ECB for this unit is 34160 in maximum stroke position.

LIBERTY LIFT SOLUTIONS

COUNTERBALANCE MOMENT TABLE

Unit Designation 912-427-168 High Efficiency

CRANK : CR002

Cranks Only, inch pounds	473205	
Description	Max	Min
Cranks and 4 each LL2	1243456	755837
Cranks w/2-LL2 & 2-LL3	1474245	866892
Cranks and 4 each LL3	1705033	977947
Cranks w/2-LL3 & 2-LL4	1871090	1070638
Cranks and 4 each LL4	2037146	1163328
Cranks w/2-LL4 & 2-LL5	2170413	1243631
Cranks and 4 each LL5	2303680	1323933
Cranks w/2-LL5 & 2-LL6	2514467	1496049
Cranks and 4 each LL6	2725254	1668165

* Not Recommended

** Maximum recommended Moment for this unit is 2791336 inch pounds.

LIBERTY LIFT SOLUTIONS,LLC GEAR REDUCER DATA SHEET

MANFACTURED BY: Dwang Jinai DATE SUBMITTED : August 28, 2014

NOMINAL API REDUCER SIZE : 912

CALCULATED VALUES

PITTING RESISTANCE TORQUE

First reduction 1,378,463 in-lb

Second reduction 1,328,722 in-lb

STATIC TORQUE

First reduction :

Gear 1,595,258 in-lb Pinion 2,083,148 in-lb

Second reduction :

Gear 1,331,170 in-lb Pinion 1,628,437 in-lb

BENDING STRENGTH TORQUE

First reduction :

Gear 1,884,846 in-lb Pinion 2,225,015 in-lb

Second reduction :

Gear 1,457,483 in-lb Pinion 1,620,663 in-lb

Notes:

1. First reduction is high-speed reduction.
2. Seond reduction is the slow-speed reduction.

CONSTRUCTION FEATURES

TYPE OF REDUCER : Double Reduction, Double Helical, Involute gearing

TEETH

Number of teeth and normal diametral pitch or transverse diametral pitch:

First reduction, Np = 18 Ng = 95 Pnd = 3.6286 Pd = 3.2616

Second reduction, Np = 21 Ng = 118 Pnd = 2.5400 Pd = 2.2828

Center distance ans net face width :

First reduction, CD = 17.323 in F = 8.661 in

Second reduction, CD = 30.445 in F = 14.906 in

Helix angle and normal pressure angle or transverse pressure angle.

First reduction, HA = 25.99 deg NPA = 20 deg

Second reduction, HA = 26.01 deg NPA = 20 deg

Geometry factors I and J for the pinion and gear.

First reduction, I = .2535 Jp = .5476 Jg = .5141

Second reduction, I = .2539 Jp = .5544 Jg = .5476

Manufacturing methods

Teeth generated by hobbing process. Teeth finished by hobbing process.

Tooth hardening method through hardened.

Gear and pinion materials and hardness

First reduction,

Gear material Normalized Ductile Iron Hardness BHN 245 - 285

Pinion material Q and T AISI4145 Hardness BHN 285 - 325

Second reduction,

Gear material Normalized Ductile Iron Hardness BHN 260 - 300

Pinion material Q and T AISI4145 Hardness BHN 300 - 340

Other components

Crankshaft material Q and T AISI4140 Hardness BHN 300 - 330

Housing material Cast Iron

Housing type Split Type

Bearing Sizes

High speed pinion NU2324

Intermediate speed pinion NU2328

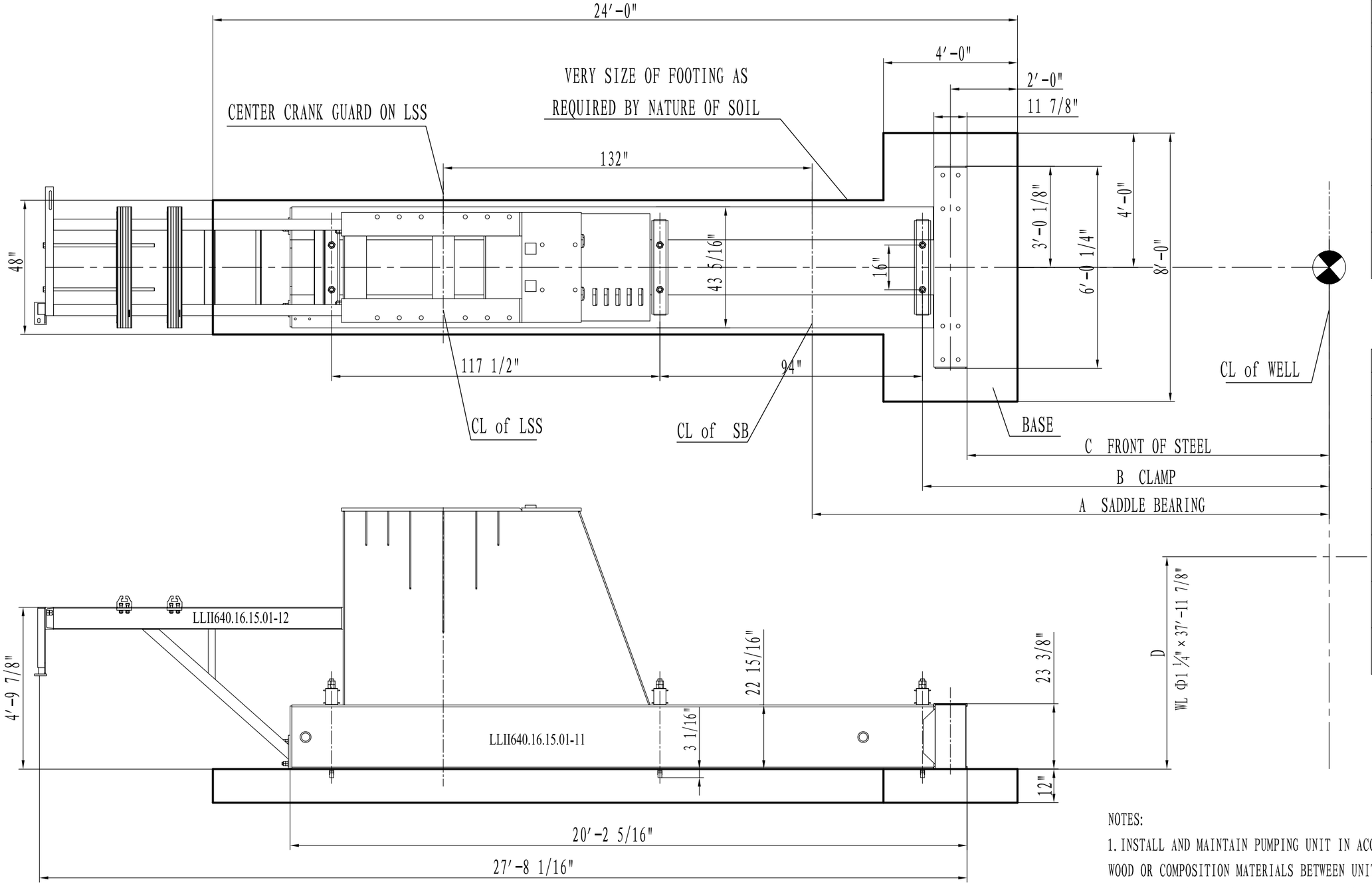
Low speed shaft NJ2244

Bearing Life, L10

High speed pinion >135,000 hours

Intermediate speed pinion >135,000 hours

Low speed shaft >120,000 hours



640 B/G					
DN#	LLII640.16.15.01-14				
PN#	LL14070				
LLII640.16.15.01-14 (70.5"-81.4")					
RDCR SHEAVE		PM SHEAVE	OVERALL RATIO	SPM @1160	V-BELT
50	8C	7	210.6	5.5	C255
	6C	18	81.9	14.2	C255
44	8C	7	185.4	6.3	C240
	6C	16	81.1	14.3	C240
40	8C	8	147.5	7.9	C240
	6C	14	84.3	13.8	C240
36	8C	7	151.7	7.6	C225
	6C	13	81.7	14.2	C225

912 B/G					
DN#	LLII912.16.15.01-14				
PN#	LL14117				
LLII912.16.15.01-14 (71.9"-81.2")					
RDCR SHEAVE		PM SHEAVE	OVERALL RATIO	SPM @1160	V-BELT
50	8C	7.5	197.7	5.9	C255
		18	82.4	14.1	C255
44	8C	7	186.4	6.2	C240
		16	81.6	14.2	C240
40	8C	8	148.3	7.8	C240
		14	84.7	13.7	C240
36	8C	7	152.5	7.6	C225
		13	82.1	14.1	C225

UNIT	A	B	C	D	E	F	CRANK
640-365-168	15'-5 1/8"	12'-1 1/2"	129.62"	5'-6 1/16"			CR002
912-365-168	15'-5 1/8"	12'-1 1/2"	129.62"	5'-6 1/16"			CR002
640-305-168	15'-5 1/8"	12'-1 1/2"	129.62"	5'-6 1/16"			CR002
912-427-168	15'-5 1/8"	12'-1 1/2"	129.62"	5'-3"			CR002

NOTES:

1. INSTALL AND MAINTAIN PUMPING UNIT IN ACCORDANCE WITH API RP 11G. DO NOT USE WOOD OR COMPOSITION MATERIALS BETWEEN UNIT FRAME AND CONCRETE FOUNDATION.
2. USE WITH FOUNDATION CLAMP DN# LLII640.16.15.01-16A01, PN# LL16035.

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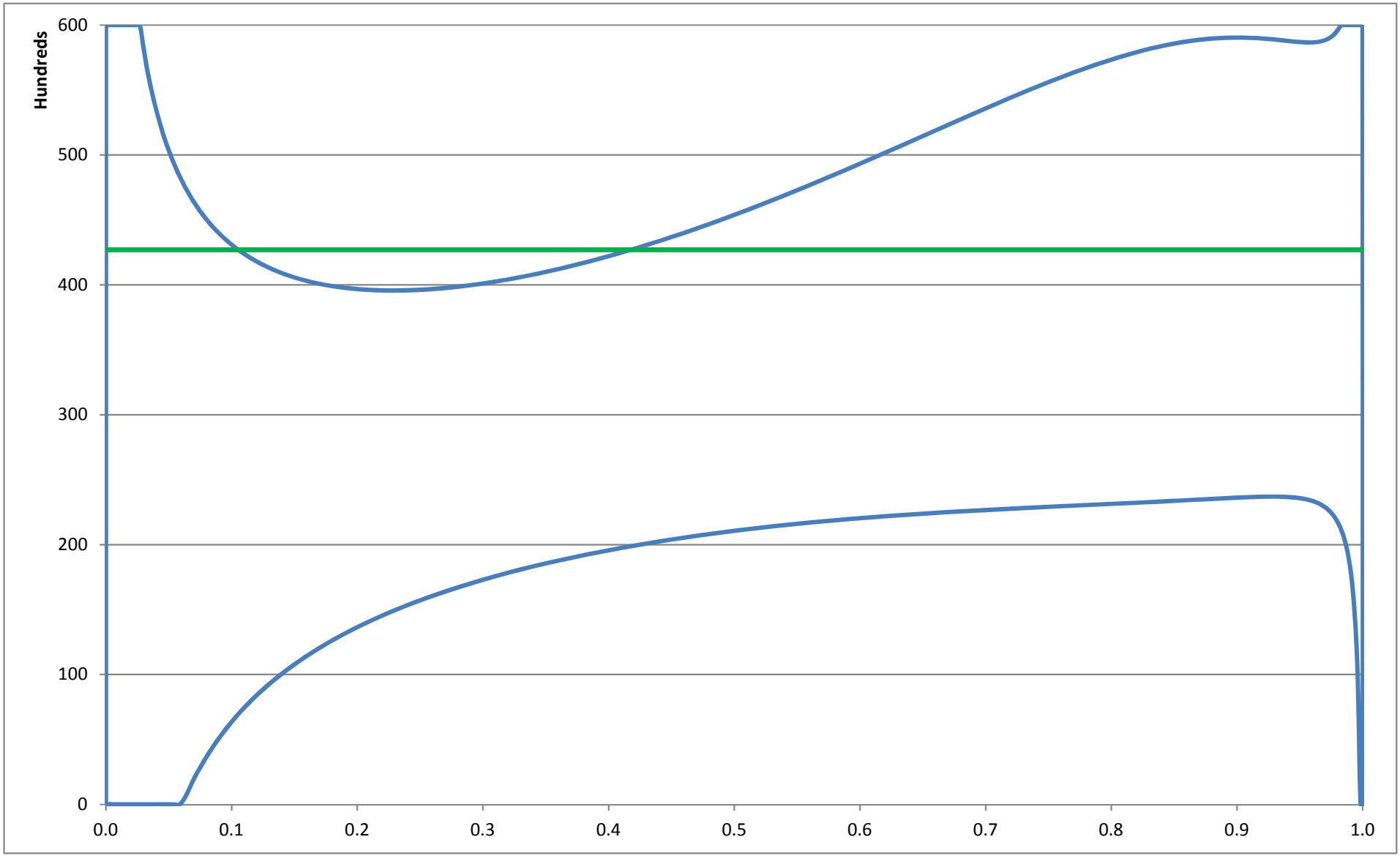
LIBERTY LIFT
1250 Wood Branch Park Dr
Suite 250
Houston, TX 77079

TOLERANCES:
a. X.X: ±3
b. X.XX: ±1
c. X.XXX: ±0.25
d. ANGULAR: ±1°

SURFACE FINISH:
a. X.X: 25
b. X.XX: 6.3
c. X.XXX: 3.2

DRAWN		STANDARD	
CHECKED		APPROVAL	
DATE			

PART NUMBER CHINA	LL50014	DRAWING NUMBER US		REV	
TITLE	FOUNDATION, HE3, HP		WEIGHT		
MATERIAL	ASSEMBLY		SCALE	1:36	
DRAWING NUMBER CHINA	LLB1.08		REV	0	

912-427-168 High Efficiency
Calculated Permissible Load with 2873603 in-lb Moment