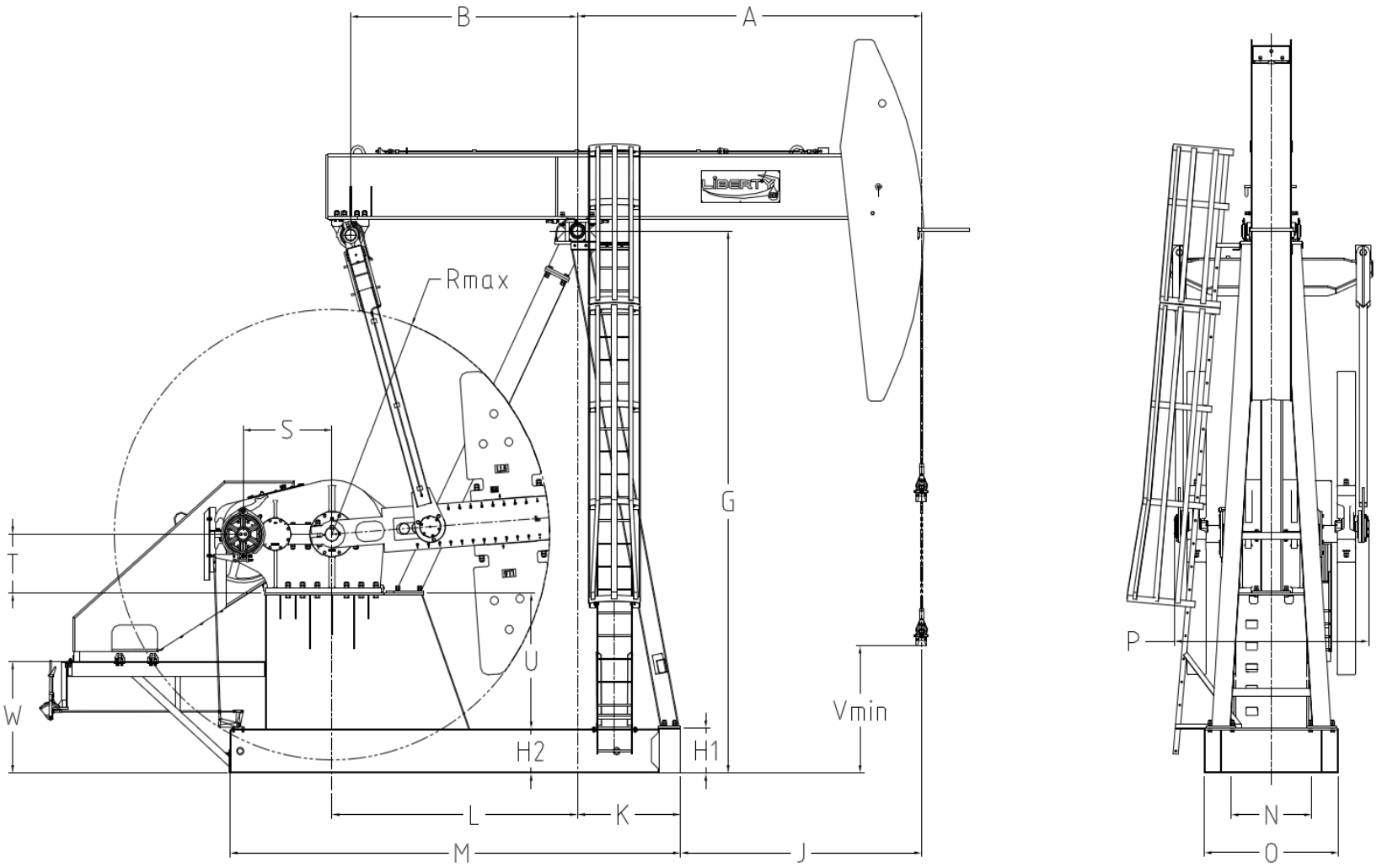
LIBERTY LIFT HE PUMPING UNIT



UNIT	A	B	G	H1	H2	J	K	L	M	N	O	P	R	S	T	U	V	W
320-305-120	11'-0 1/8"	8'-3 3/8"	21'-0 1/4"	23 3/8"	23 5/8"	7'-4 7/8"	3'-1 1/4"	9'-2"	16'-8 7/8"	3'-1 3/4 "	5'-7 3/8"	7'-0 3/8"	99.016"	36.073"	23.228"	4'-6 3/8"	5'-3 1/4"	4'-9 7/8"

LIBERTY LIFT SOLUTIONS

TORQUE FACTOR TABLE

UNIT DESIGNATION 320-305-120 High Efficiency

Cranks : CR004

Position of Crank degrees	Polished Rod Position Length of Stroke, inches			Torque Factor Length of Stroke, inches		
	120.098	103.392	87.365	120.098	103.392	87.365
0	0.0033	0.0027	0.0022	-7.743	-5.924	-4.463
15	0.0084	0.0090	0.0095	12.606	11.052	9.405
30	0.0579	0.0581	0.0579	32.444	27.364	22.591
45	0.1468	0.1448	0.1424	48.118	40.411	33.276
60	0.2628	0.2584	0.2535	57.097	48.385	40.180
75	0.3908	0.3854	0.3791	59.338	51.078	43.029
90	0.5179	0.5135	0.5079	56.667	49.587	42.419
105	0.6358	0.6342	0.6309	51.235	45.393	39.307
120	0.7404	0.7421	0.7418	44.546	39.661	34.542
135	0.8296	0.8343	0.8368	37.282	33.009	28.653
150	0.9025	0.9086	0.9126	29.465	25.562	21.835
165	0.9574	0.9629	0.9667	20.636	17.093	14.052
180	0.9912	0.9940	0.9958	10.031	7.224	5.196
195	0.9993	0.9981	0.9968	-3.030	-4.253	-4.681
210	0.9763	0.9715	0.9671	-18.296	-16.904	-15.128
225	0.9193	0.9126	0.9064	-33.832	-29.412	-25.227
240	0.8307	0.8241	0.8174	-46.860	-40.057	-33.857
255	0.7181	0.7124	0.7059	-55.658	-47.594	-40.121
270	0.5913	0.5861	0.5798	-60.031	-51.595	-43.559
285	0.4593	0.4540	0.4478	-60.431	-52.126	-44.051
300	0.3304	0.3249	0.3187	-57.235	-49.344	-41.617
315	0.2123	0.2069	0.2013	-50.513	-43.302	-36.295
330	0.1129	0.1084	0.1040	-40.085	-33.957	-28.139
345	0.0404	0.0377	0.0353	-25.750	-21.347	-17.347

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 = -270

A =	132.087
C =	99.370
G =	101.260
H =	252.283
K =	186.837
I =	110.000
P =	150.312
R1 =	42.992
R2 =	37.500
R3 =	32.008

LIBERTY LIFT SOLUTIONS

EFFECTIVE COUNTERBALANCE TABLE

Unit Designation 320-305-120 High Efficiency

CRANK : CR004

Stroke Length, inches	120.098		103.392		87.365	
Cranks Only, pounds	5488		6310		7422	
Description	Max	Min	Max	Min	Max	Min
Cranks and 4 each LLF	11556	8212	13245	9423	15529	11061
Cranks w/2-LLF & 2-LLH	12340	8894	14141	10203	16576	11972
Cranks and 4 each LLH	13124	9576	15037	10982	17623	12883
Cranks w/2-LLH & 2-LLJ	13894	9547	15917	10949	18652	12845
Cranks and 4 each LLJ	14663	9518	16796	10916	19680	12806
Cranks w/2-LLJ & 2-LL2	15667	9865	17942	11312	21020	13269
Cranks and 4 each LL2	16670	10211	19088	11708	22360	13732
Cranks w/2-LL2 & 2-LL3	19919	12081	22801	13845	26701	16230
Cranks and 4 each LL3	23168	13950	26514	15981	31041	18727

* Not Recommended

** Maximum recommended ECB for this unit is 24400 in maximum stroke position.

LIBERTY LIFT SOLUTIONS,LLC GEAR REDUCER DATA SHEET

MANFACTURED BY: Dwang Jinai DATE SUBMITTED : October , 2014

NOMINAL API REDUCER SIZE : 320

CALCULATED VALUES

PITTING RESISTANCE TORQUE

First reduction 577,831 in-lb

Second reduction 483,607 in-lb

STATIC TORQUE

First reduction :

Gear 614,933 in-lb Pinion 799,073 in-lb

Second reduction:

Gear 480,297 in-lb Pinion 580,994 in-lb

BENDING STRENGTH TORQUE

First reduction :

Gear 749,176 in-lb Pinion 880,057 in-lb

Second reduction:

Gear 592,204 in-lb Pinion 647,591 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=19	Ng=104	Pnd=5.0800	Pd=4.5000
Second reduction,	Np=21	Ng=113	Pnd=3.3867	Pd=2.9902

Center distance ans net face width

First reduction,	CD=13.667 in	F=6.923 in
Second reduction,	CD=22.406 in	F=11.417 in

Helix angle and normal pressure angle or transverse pressure angle

First reduction,	HA=27.646 deg	NPA=20 deg
Second reduction,	HA=28.00 0deg	NPA=20 deg

Geometry factors I and J for the pinion and gear

First reduction,	I=.2543	Jp=.5408	Jg=.5103
Second reduction,	I=.2516	Jp=.5413	Jg=.5486

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 - 275
Pinion material	Q and T AISI4140	Hardness	BHN 285 - 315

Second reduction

Gear material	Normalized Ductile Iron	Hardness	BHN 245 - 275
Pinion material	Q and T AISI4140	Hardness	BHN 285 - 315

Other components

Crankshaft material	Q and T AISI4140	Hardness	BHN 285 -315
Housing material	Cast Iron		
Housing type	Split Type		

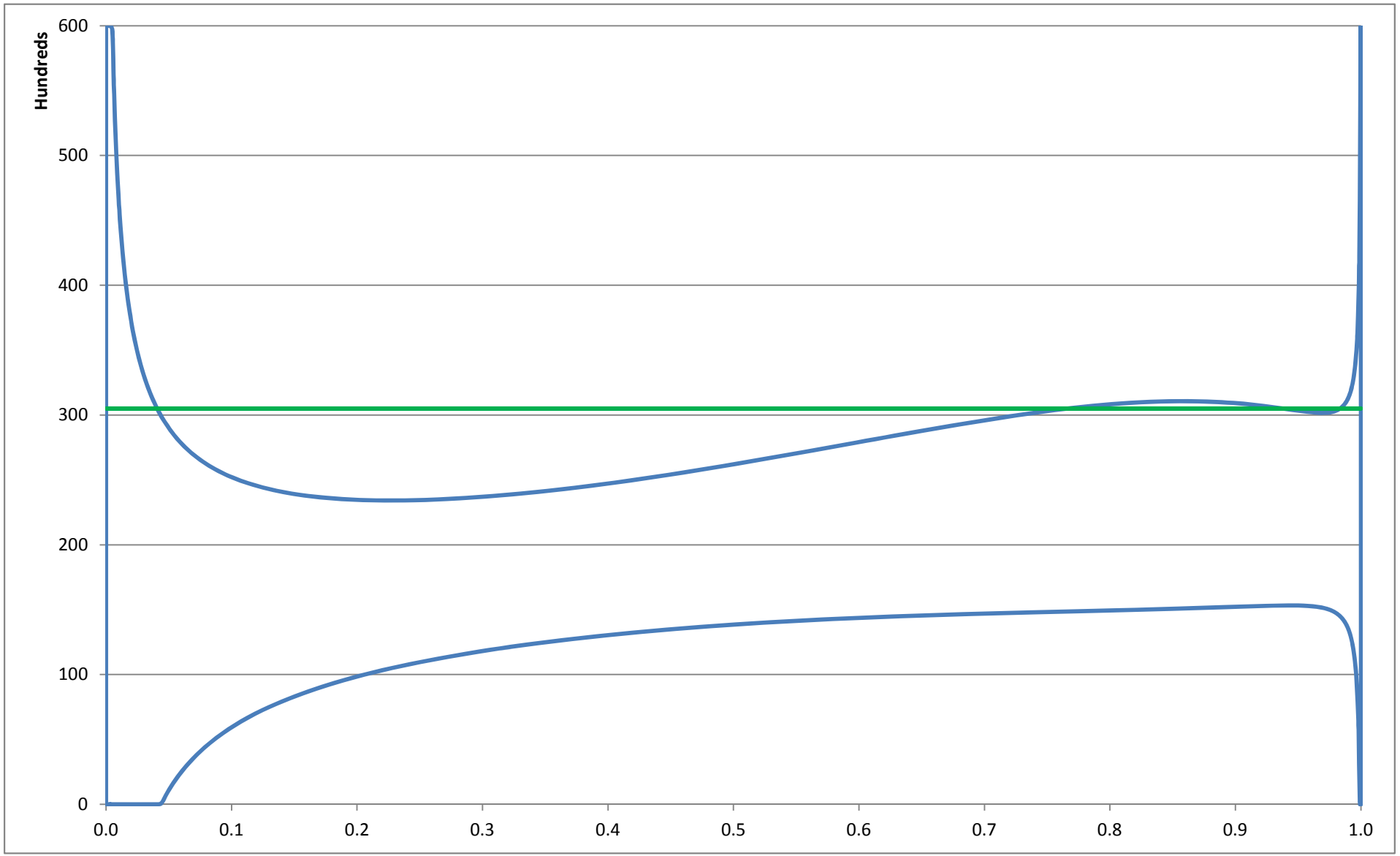
Bearing Sizes

High speed pinion	NU319M/C3
Intermediate speed pinion	NU2324EM/C3
Low speed shaft	NJ1040EM/C3

Bearing Life, L10

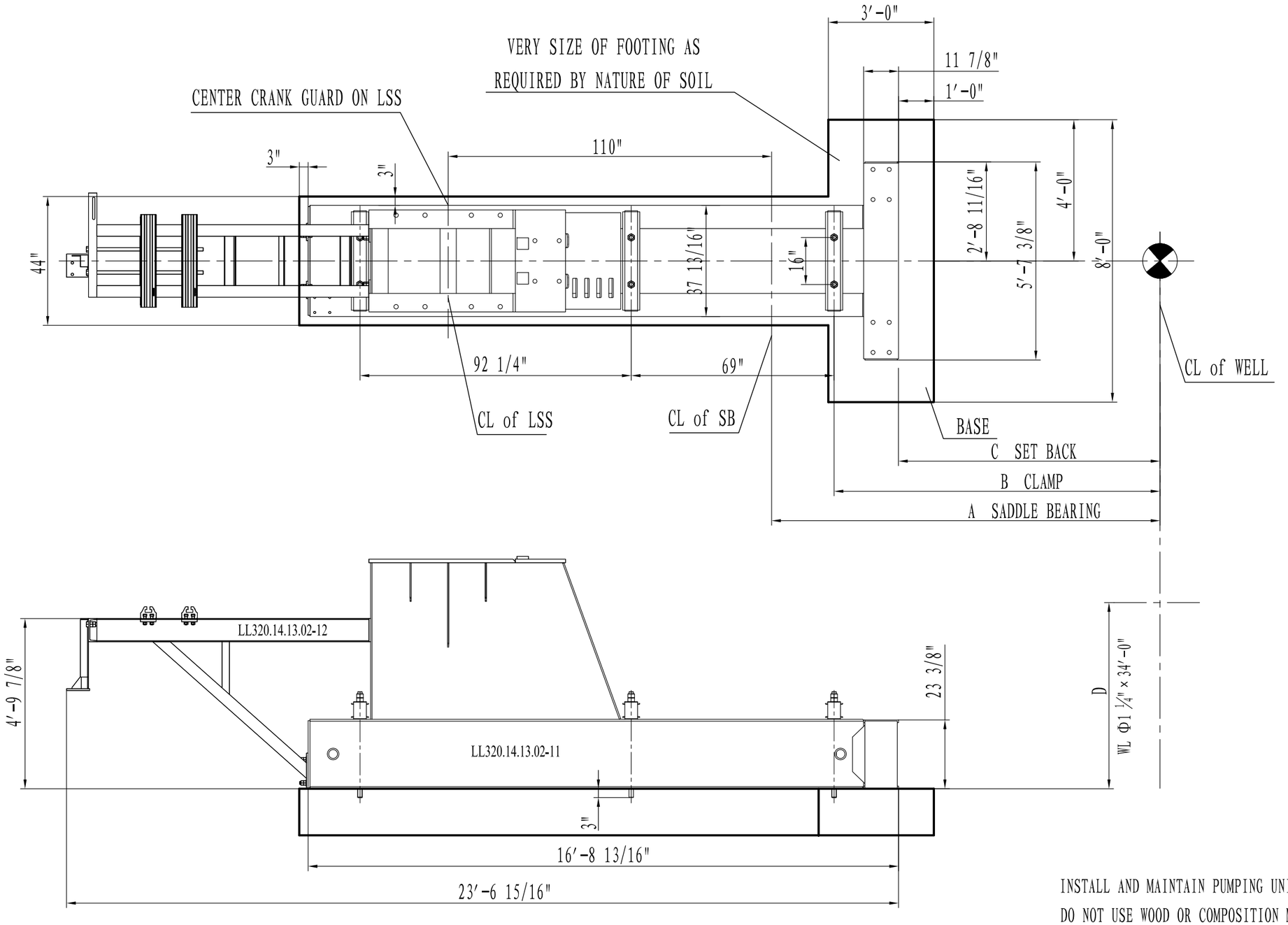
High speed pinion	>135,000 hours
Intermediate speed pinion	>135,000 hours
Low speed shaft	>120,000 hours

320-305-120 High Efficiency
Calculated Permissible Load with 1196693 in-lb Moment



CRANK CR004

HE 320				
B/G LL320.14.13.02-14 (64.3-69.79)				
RDCR SHEAVE	PM SHEAVE	OVERALL RATIO	SPM @1200	V-BELT
44	8	162.0	7.4	C225
	16	81.0	14.8	C225
36	9.5	111.62	10.8	C210
	14	75.74	15.8	C210
30	7	126.23	9.5	C195
	13	67.97	17.7	C195



INSTALL AND MAINTAIN PUMPING UNIT IN ACCORDANCE WITH API RP 11G. DO NOT USE WOOD OR COMPOSITION MATERIALS BETWEEN UNIT FRAME AND CONCRETE FOUNDATION.

UNIT	A	B	C	D	E	F
320-305-120	11'-0 1/8"	9'-2 7/8"	88.90"	5'-3 1/4"		

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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	LL50020	DRAWING NUMBER US		REV	
TITLE	FOUNDATION, HP		WEIGHT		
MATERIAL	ASSEMBLY		SCALE	1:36	
DRAWING NUMBER CHINA	LLB1.11		REV	0	