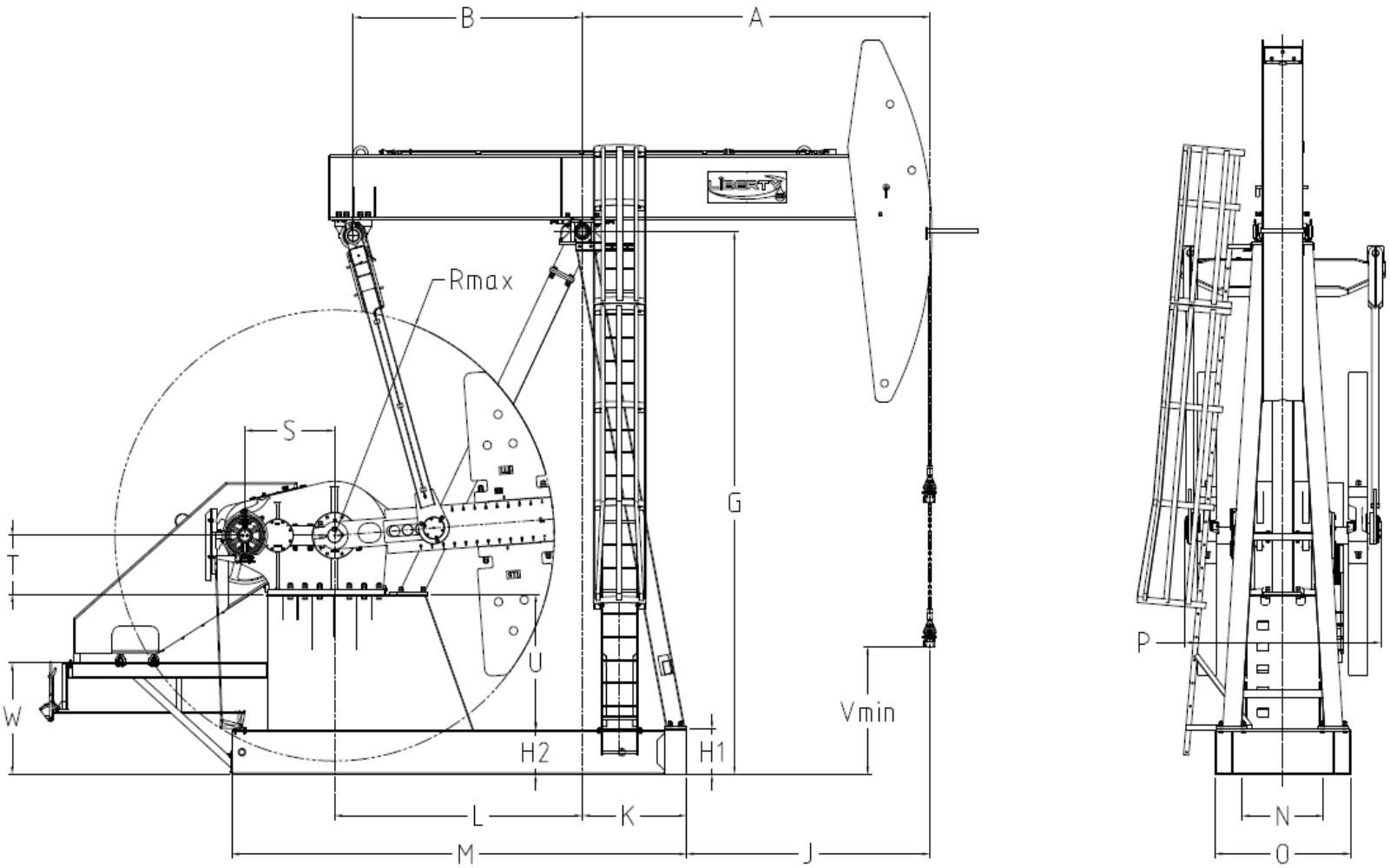
LIBERTY LIFT HE PUMPING UNIT



UNIT	A	B	G	H1	H2	J	K	L	M	N	O	P	R	S	T	U	Vmin	W
456-305-144	15'-5 1/8"	10'-2"	23'-5 5/8"	23 1/8"	23 5/8"	8'-6 5/8"	4'-7 1/2"	11'-0"	20'-2 1/4"	3'-3 3/8"	6'-0 1/4"	7'-7 3/4"	117"	39.914"	25.591"	5'-9 3/4"	6'-2 3/4"	4'-9 7/8"

LIBERTY LIFT SOLUTIONS

TORQUE FACTOR TABLE

UNIT DESIGNATION 456-305-144 High Efficiency

Cranks : CR011

Position of Crank degrees	Polished Rod Position Length of Stroke, inches			Torque Factor Length of Stroke, inches		
	144.548	123.717	103.791	144.548	123.717	103.791
0	0.0033	0.0026	0.0020	-9.487	-7.046	-5.132
15	0.0089	0.0097	0.0103	15.941	13.953	11.810
30	0.0608	0.0611	0.0609	40.932	34.207	27.927
45	0.1538	0.1515	0.1485	60.474	50.235	40.853
60	0.2744	0.2689	0.2628	71.004	59.583	48.918
75	0.4056	0.3987	0.3909	72.589	62.060	51.820
90	0.5336	0.5279	0.5207	68.011	59.312	50.448
105	0.6501	0.6476	0.6430	60.361	53.449	46.146
120	0.7516	0.7530	0.7520	51.659	46.047	40.062
135	0.8371	0.8420	0.8442	42.747	37.895	32.879
150	0.9063	0.9130	0.9171	33.608	29.129	24.836
165	0.9584	0.9646	0.9687	23.645	19.434	15.859
180	0.9909	0.9942	0.9962	11.856	8.272	5.755
195	0.9996	0.9983	0.9967	-2.817	-4.771	-5.524
210	0.9788	0.9728	0.9676	-20.541	-19.430	-17.589
225	0.9245	0.9158	0.9081	-39.346	-34.318	-29.459
240	0.8378	0.8289	0.8203	-55.651	-47.323	-39.804
255	0.7260	0.7181	0.7096	-66.885	-56.739	-47.468
270	0.5989	0.5918	0.5837	-72.591	-61.882	-51.797
285	0.4660	0.4592	0.4513	-73.344	-62.779	-52.584
300	0.3359	0.3290	0.3214	-69.667	-59.619	-49.824
315	0.2163	0.2097	0.2029	-61.679	-52.467	-43.548
330	0.1152	0.1098	0.1046	-49.132	-41.249	-33.800
345	0.0413	0.0380	0.0351	-31.688	-25.951	-20.785

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 = 152

A =	158.386
C =	122.008
G =	118.976
H =	281.615
K =	209.469
I =	132.008
P =	162.500
R1 =	53.031
R2 =	46.024
R3 =	39.016

LIBERTY LIFT SOLUTIONS

EFFECTIVE COUNTERBALANCE TABLE

Unit Designation 456-305-144 High Efficiency

CRANK : CR011

Stroke Length, inches	144.548		123.717		103.791	
Cranks Only, pounds	6387		7301		8557	
Description	Max	Min	Max	Min	Max	Min
Cranks and 4 each LLF	12514	8773	14327	10038	16818	11775
Cranks w/2-LLF & 2-LLH	13326	9081	15258	10391	17913	12191
Cranks and 4 each LLH	14138	9389	16189	10744	19007	12606
Cranks w/2-LLH & 2-LLJ	14928	9659	17095	11053	20073	12969
Cranks and 4 each LLJ	15718	9929	18001	11362	21138	13332
Cranks w/2-LLJ & 2-LL2	16719	10236	19149	11714	22487	13746
Cranks and 4 each LL2	17720	10542	20297	12066	23836	14159
Cranks w/2-LL2 & 2-LL3	21116	12175	24191	13939	28415	16361
*Cranks and 4 each LL3	24512	13808	28085	15811	32993	18562

* Not Recommended

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

LIBERTY LIFT SOLUTIONS

COUNTERBALANCE MOMENT TABLE

Unit Designation 456-305-144 High Efficiency

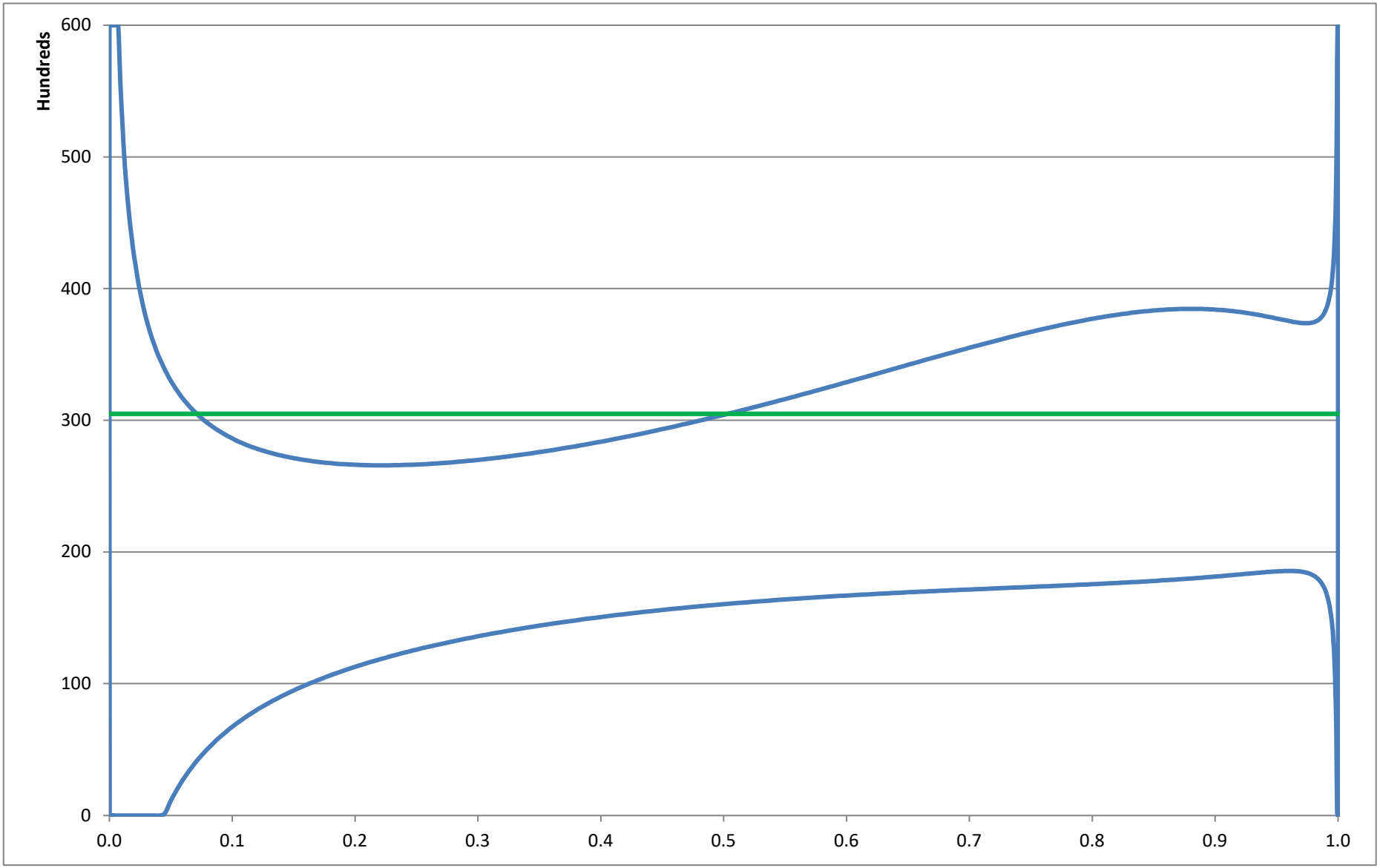
CRANK : CR011

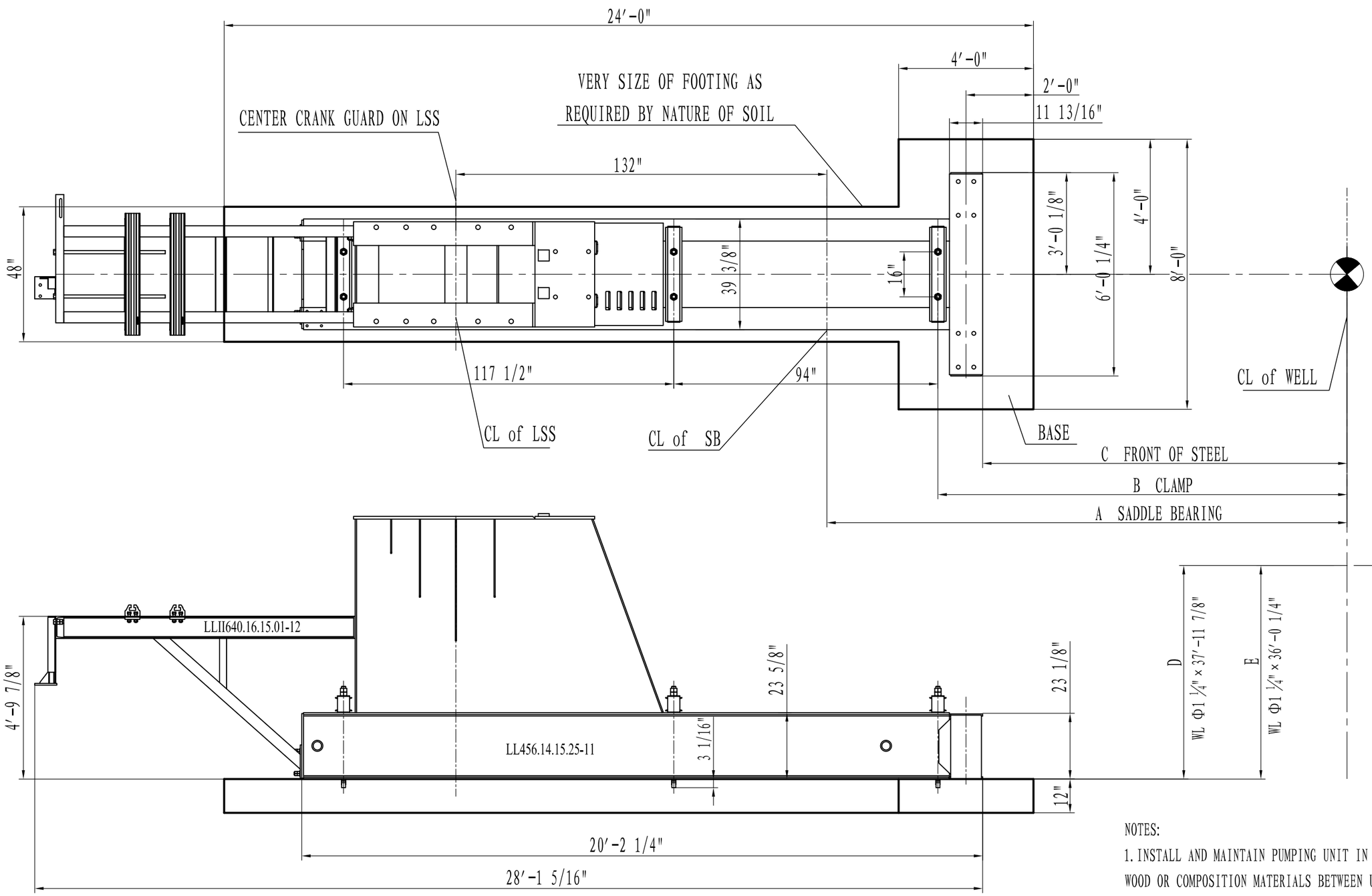
Cranks Only, inch pounds	424036	
Description	Max	Min
Cranks and 4 each LLF	840806	586367
Cranks w/2-LLF & 2-LLH	896026	607326
Cranks and 4 each LLH	951246	628284
Cranks w/2-LLH & 2-LLJ	1004983	646615
Cranks and 4 each LLJ	1058719	664946
Cranks w/2-LLJ & 2-LL2	1126783	685808
Cranks and 4 each LL2	1194846	706669
Cranks w/2-LL2 & 2-LL3	1425825	817724
*Cranks and 4 each LL3	1656804	928778

* Not Recommended

** Maximum recommended Moment for this unit is 1649134 inch pounds.

456-305-144 High Efficiency
Calculated Permissible Load with 1656804 in-lb Moment





456 B/G				
DN#	LL456.14.14.05-14			
PN#	LL14200			
LL456.14.14.05-14 (81.8"-88.1")				
RDCR SHEAVE	PM SHEAVE	OVERALL RATIO	SPM @1160	V-BELT
44 5C	7	177.6	6.8	C255
4C	16	88.8	13.5	C255
36 5C	7	145.3	8.3	C240
4C	12	84.8	14.2	C240
30 5C	7	121.1	9.9	C225
4C	8.5	99.7	12.0	C225

UNIT	A	B	C	D	E	F	CRANK
456-305-168	15'-5 1/8"	12'-1 5/8"	129.63"	5'-3 3/4"			CR011
456-305-144	13'-2 3/8"	9'-10 7/8"	102.94"		6'-2 3/4"		CR011

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	LL50086	DRAWING NUMBER US		REV	
TITLE	FOUNDATION, HE, HP		WEIGHT		
MATERIAL	ASSEMBLY		SCALE	1:36	
DRAWING NUMBER CHINA	LLB1.43		REV	0	

LIBERTY LIFT SOLUTIONS,LLC GEAR REDUCER DATA SHEET

MANFACTURED BY: Dwang Jinai DATE SUBMITTED : August 8, 2014

NOMINAL API REDUCER SIZE : 456

CALCULATED VALUES

PITTING RESISTANCE TORQUE

First reduction 650,406 in-lb

Second reduction 649,379 in-lb

STATIC TORQUE

First reduction :

Gear 660,640 in-lb Pinion 857,487 in-lb

Second reduction :

Gear 648,107 in-lb Pinion 827,361 in-lb

BENDING STRENGTH TORQUE

First reduction :

Gear 816,155 in-lb Pinion 957,642 in-lb

Second reduction :

Gear 790,063 in-lb Pinion 911,754 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 = 4.6182 Pd = 3.9995

Second reduction, Np = 19 Ng = 103 Pnd = 2.8222 Pd = 2.4861

Center distance ans net face width :

First reduction, CD = 15.3771 in F = 5.1181 in

Second reduction, CD = 24.5367 in F = 11.0236 in

Helix angle and normal pressure angle or transverse pressure angle.

First reduction, HA = 30.00 deg NPA = 20 deg

Second reduction, HA = 28.25 deg NPA = 20 deg

Geometry factors I and J for the pinion and gear.

First reduction, I = .2519 Jp = .5199 Jg = .4911

Second reduction, I = .2504 Jp = .5292 Jg = .5082

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 AISI4145 Hardness BHN 285 - 315

Second reduction,

Gear material Normalized Ductile Iron Hardness BHN 245 - 275

Pinion material Q and T AISI4145 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 NU2322

Intermediate speed pinion NU2326

Low speed shaft NJ2240

Bearing Life, L10

High speed pinion >135,000 hours

Intermediate speed pinion >135,000 hours

Low speed shaft >135,000 hours