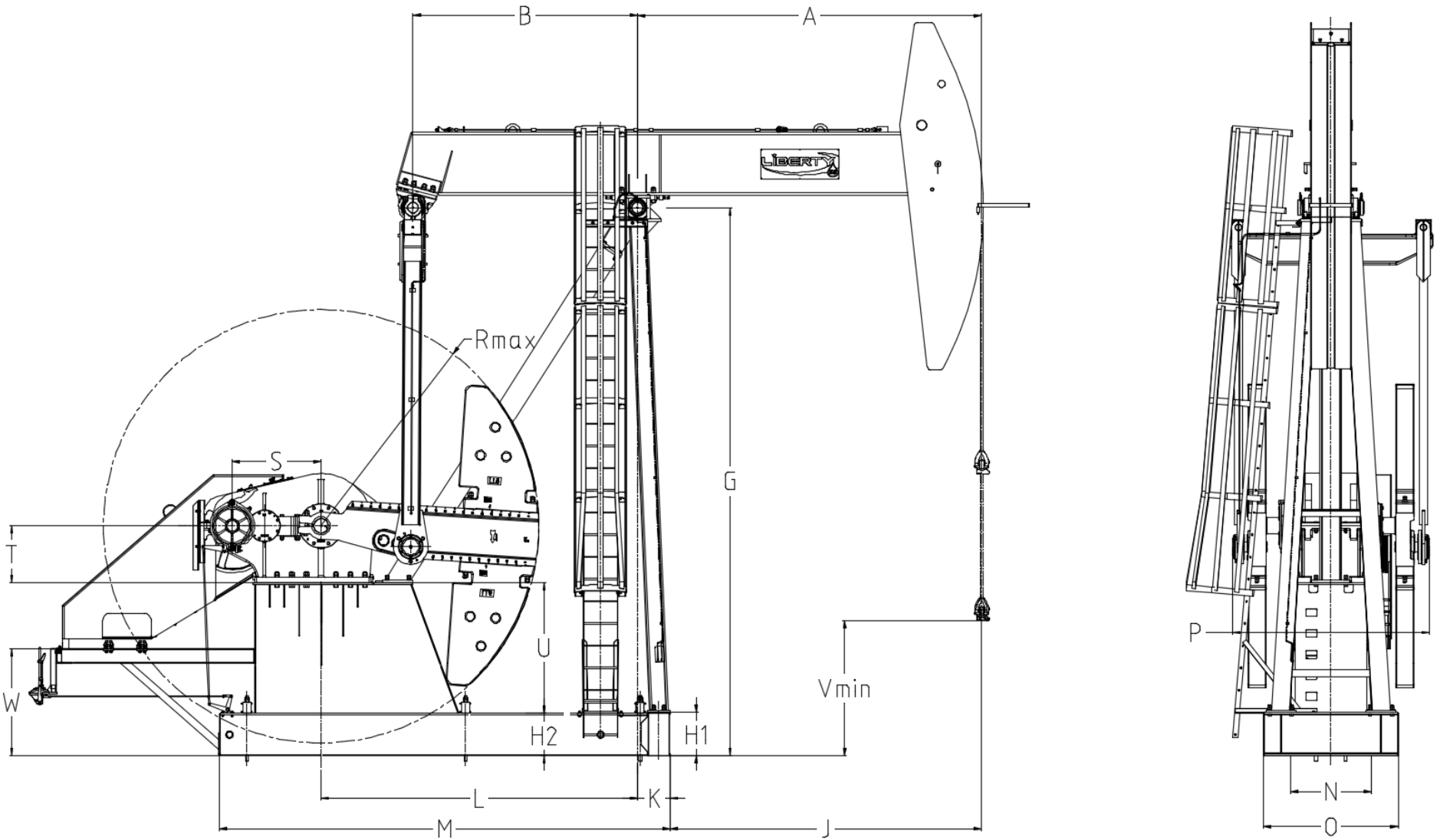
LIBERTY LIFT EG PUMPING UNIT



UNIT	A	B	G	H1	H2	J	K	L	M	N	O	P	R	S	T	U	V	W
912-427-168	15'-5 1/8"	10'-0 5/8"	24'-7 7/8"	23 3/8"	22 7/8"	13'-11 5/8"	1'-5 1/2"	14'-2"	20'-2 3/8"	3'-7 1/4"	6'-0 1/4"	8'-10"	117"	47.768"	30.512"	5'-10 1/2"	6'-0 1/8"	4'-9 7/8"

LIBERTY LIFT SOLUTIONS

TORQUE FACTOR TABLE

UNIT DESIGNATION 912-427-168 Enhanced Geometry

Cranks : CR051

Position of Crank degrees	Polished Rod Position Length of Stroke, inches			Torque Factor Length of Stroke, inches		
	168.162	138.909	112.097	168.162	138.909	112.097
0	0.0203	0.0194	0.0186	-25.172	-20.307	-15.963
15	0.0000	0.0000	0.0000	-0.510	-0.007	0.201
30	0.0192	0.0196	0.0196	25.111	20.710	16.479
45	0.0768	0.0767	0.0757	48.093	39.274	31.095
60	0.1658	0.1648	0.1623	64.963	53.316	42.460
75	0.2750	0.2740	0.2708	74.106	61.625	49.685
90	0.3929	0.3936	0.3911	76.272	64.463	52.751
105	0.5100	0.5143	0.5144	73.545	63.044	52.278
120	0.6204	0.6295	0.6332	68.018	58.749	49.094
135	0.7211	0.7346	0.7421	61.084	52.593	43.884
150	0.8102	0.8268	0.8369	53.293	45.022	37.017
165	0.8864	0.9034	0.9138	44.395	35.907	28.523
180	0.9473	0.9608	0.9687	33.284	24.609	18.188
195	0.9879	0.9942	0.9971	17.877	10.216	5.797
210	0.9995	0.9971	0.9943	-4.192	-7.710	-8.435
225	0.9716	0.9637	0.9571	-32.091	-27.840	-23.439
240	0.9003	0.8929	0.8857	-58.605	-46.754	-37.356
255	0.7937	0.7904	0.7849	-76.682	-61.053	-48.328
270	0.6663	0.6665	0.6631	-85.575	-69.399	-55.269
285	0.5309	0.5324	0.5301	-87.424	-72.113	-57.927
300	0.3968	0.3978	0.3957	-83.944	-69.934	-56.490
315	0.2718	0.2715	0.2692	-75.907	-63.394	-51.246
330	0.1628	0.1614	0.1591	-63.451	-52.766	-42.476
345	0.0766	0.0750	0.0733	-46.488	-38.252	-30.522

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 = -752

A =	185.091
C =	120.630
G =	123.898
H =	295.898
K =	241.834
I =	170.000
P =	183.320
R1 =	49.500
R2 =	42.000
R3 =	34.500

LIBERTY LIFT SOLUTIONS

EFFECTIVE COUNTERBALANCE TABLE

Unit Designation 912-427-168 Enhaned Geometry

CRANK : CR051

Stroke Length, inches	168.162		138.909		112.097	
Cranks Only, pounds	7156		8575		10610	
Description	Max	Min	Max	Min	Max	Min
Cranks and 4 each LL2	16877	9145	20077	10928	24666	13485
Cranks w/2-LL2 & 2-LL3	19789	10008	23522	11949	28876	14733
Cranks and 4 each LL3	22700	10871	26967	12970	33086	15981
Cranks w/2-LL3 & 2-LL4	24795	11626	29445	13864	36114	17073
Cranks and 4 each LL4	26889	12381	31923	14757	39142	18165
Cranks w/2-LL4 & 2-LL5	28569	13036	33911	15532	41572	19112
Cranks and 4 each LL5	30249	13690	35899	16307	44001	20058
Cranks w/2-LL5 & 2-LL6	32906	15231	39042	18130	47842	22286
*Cranks and 4 each LL6	35562	16772	42185	19952	51682	24513

* Not Recommended

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

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

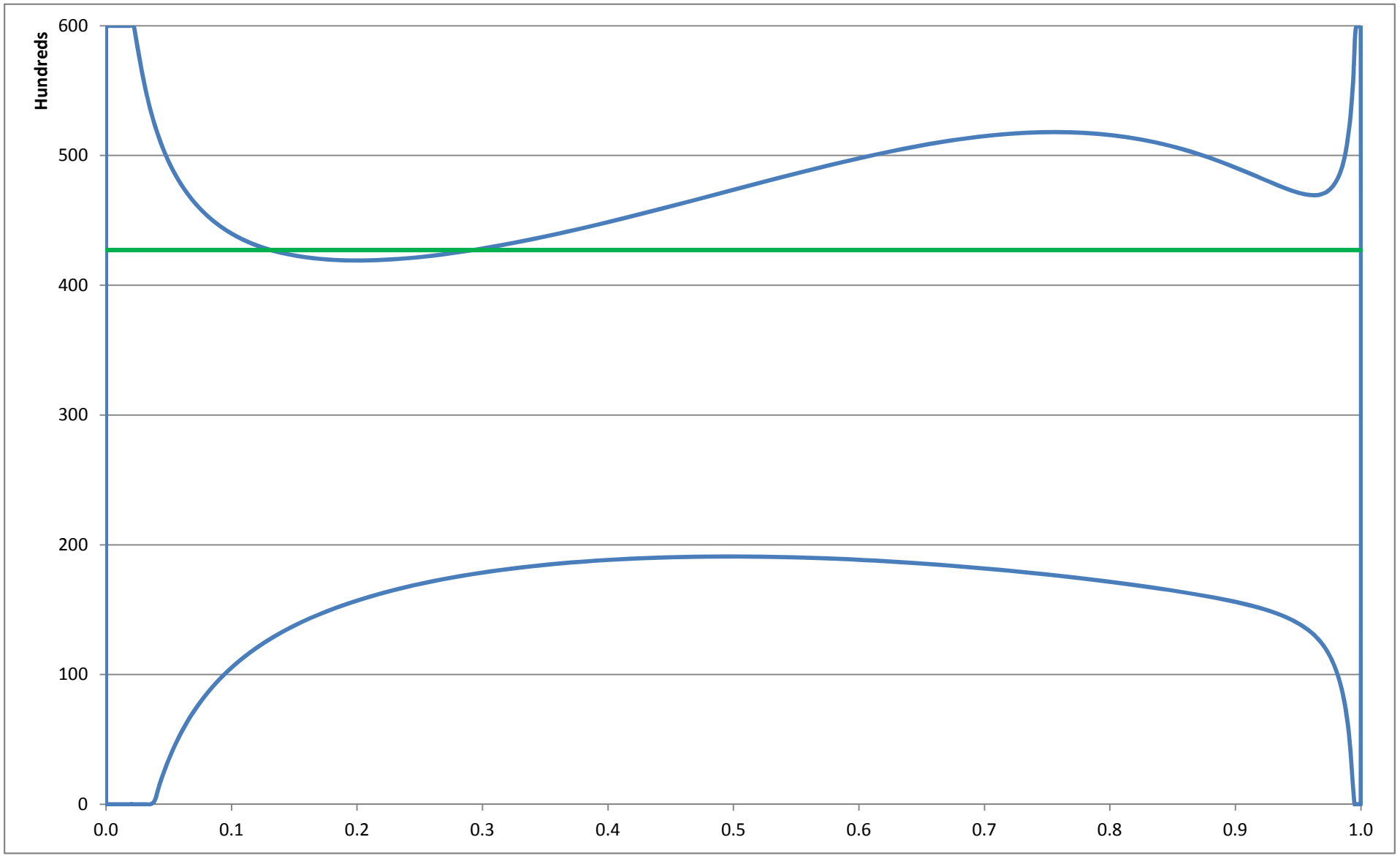
Bearing Life, L10

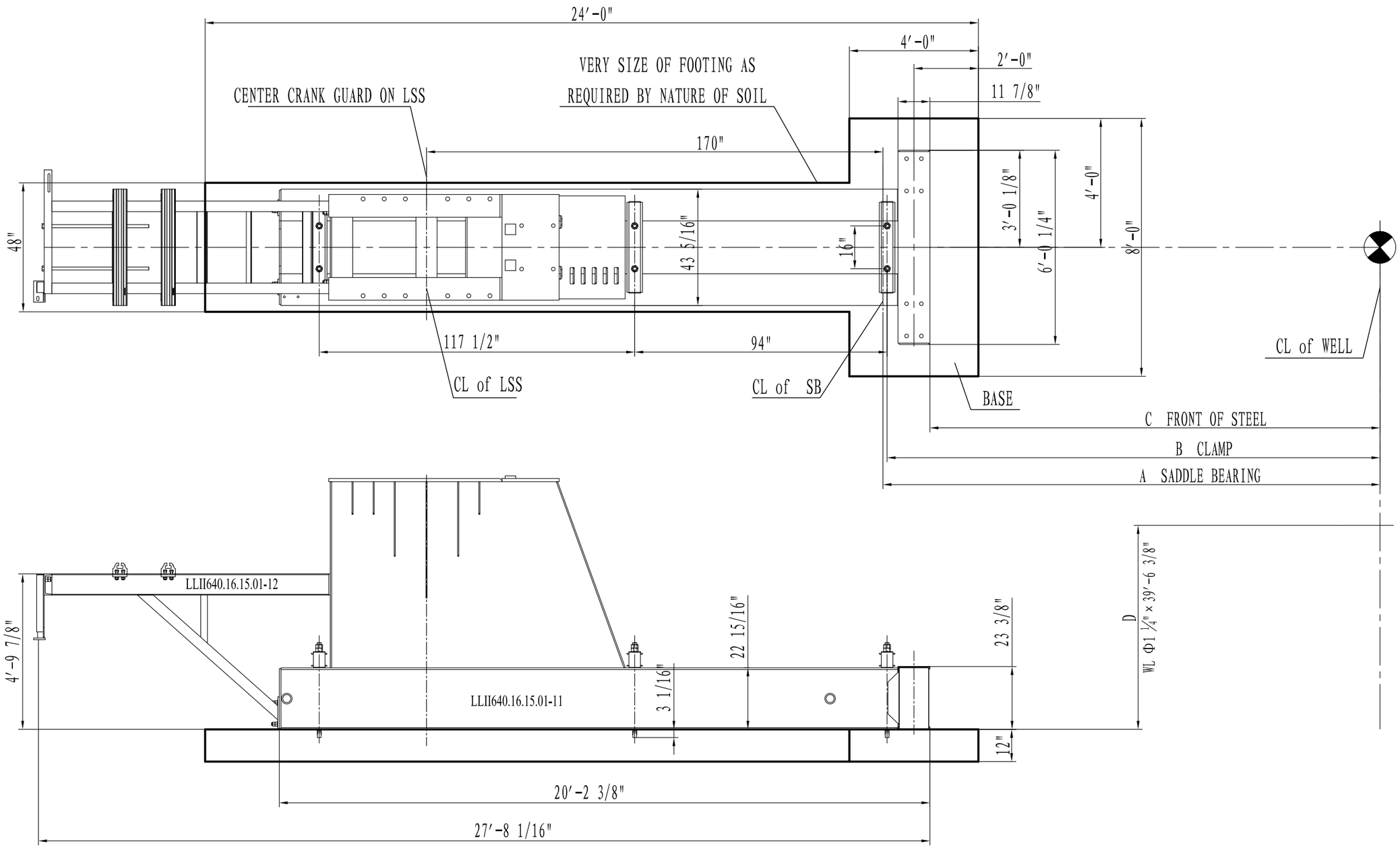
High speed pinion >135,000 hours

Intermediate speed pinion >135,000 hours

Low speed shaft >120,000 hours

912-427-168 Enhanced Geometry
Calculated Permissible Load with 2644827 in-lb Moment





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"	15'-3 5/8"	167.61"	6'-0 7/8"			CR051
912-365-168	15'-5 1/8"	15'-3 5/8"	167.61"	6'-0 7/8"			CR055
912-427-168	15'-5 1/8"	15'-3 5/8"	167.61"	6'-0 1/8"			CR051

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

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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		PART NUMBER CHINA	LL50015
DRAWN		STANDARD		DRAWING NUMBER US	
CHECKED		APPROVAL		REV	
DATE				TITLE	FOUNDATION, EG, HP
				WEIGHT	
				MATERIAL	ASSEMBLY
				SCALE	1:38
				DRAWING NUMBER CHINA	LLB1.09
				REV	0