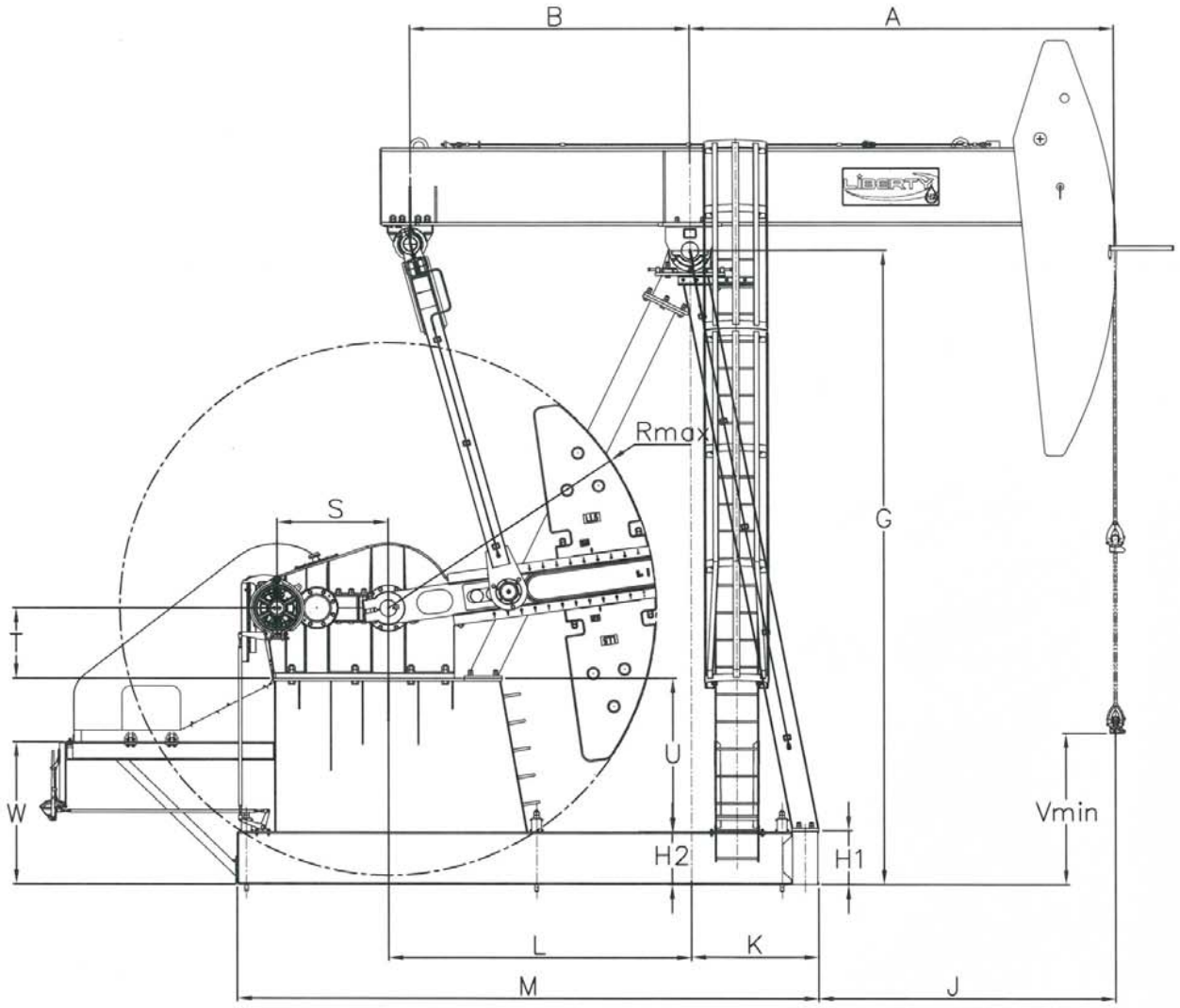
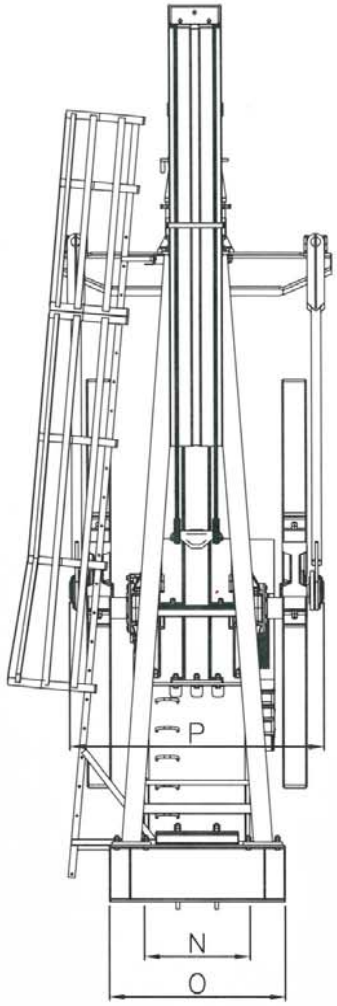
LIBERTY LIFT HE PUMPING UNIT





UNIT	A	B	G	H1	H2	J	K	L	M	N	O	P	R	S	T	U	V	W
640-365-168	15'-5 1/8"	10'-2"	23'-2 3/8"	22 7/8"	23 3/8"	10'-9 5/8"	4'-7 1/2"	11'-0"	21'-1 1/2"	3'-7 1/4"	6'-0 1/4"	8'-8 5/8"	117"	48.425"	30.906"	5'-7 1/8"	5'-6 1/8"	5'-2 1/8"

LIBERTY LIFT SOLUTIONS

TORQUE FACTOR TABLE

UNIT DESIGNATION 640-365-168 High Efficiency

Cranks : SLH53117R

Position of Crank degrees	Polished Rod Position Length of Stroke, inches			Torque Factor Length of Stroke, inches		
	168.595	144.353	121.136	168.595	144.353	121.136
0	0.0037	0.0028	0.0022	-11.697	-8.688	-6.322
15	0.0085	0.0093	0.0100	18.246	16.032	13.609
30	0.0602	0.0606	0.0604	47.869	39.998	32.644
45	0.1538	0.1514	0.1484	71.128	59.014	47.937
60	0.2754	0.2697	0.2634	83.605	70.063	57.449
75	0.4078	0.4005	0.3922	85.310	72.873	60.795
90	0.5366	0.5303	0.5225	79.635	69.443	59.052
105	0.6533	0.6502	0.6450	70.361	62.348	53.859
120	0.7545	0.7554	0.7538	59.942	53.505	46.610
135	0.8394	0.8438	0.8456	49.385	43.870	38.136
150	0.9078	0.9141	0.9180	38.675	33.609	28.729
165	0.9591	0.9651	0.9690	27.124	22.364	18.305
180	0.9910	0.9943	0.9962	13.582	9.507	6.636
195	0.9996	0.9983	0.9967	-3.182	-5.464	-6.360
210	0.9793	0.9733	0.9680	-23.451	-22.310	-20.275
225	0.9260	0.9171	0.9092	-45.133	-39.521	-34.024
240	0.8405	0.8312	0.8222	-64.189	-54.699	-46.092
255	0.7296	0.7212	0.7122	-77.531	-65.825	-55.119
270	0.6030	0.5954	0.5867	-84.475	-72.026	-60.308
285	0.4703	0.4629	0.4545	-85.617	-73.279	-61.380
300	0.3398	0.3325	0.3244	-81.555	-69.780	-58.307
315	0.2196	0.2127	0.2054	-72.427	-61.595	-51.107
330	0.1177	0.1120	0.1065	-57.939	-48.622	-39.817
345	0.0427	0.0392	0.0361	-37.664	-30.817	-24.652

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 = -600

A =	185.091
C =	122.008
G =	120.984
H =	278.307
K =	205.370
I =	132.008
P =	158.622
R1 =	53.031
R2 =	46.024
R3 =	39.016

LIBERTY LIFT SOLUTIONS

EFFECTIVE COUNTERBALANCE TABLE

Unit Designation 640-365-168 High Efficiency

CRANK : SLH53117R

Stroke Length, inches	168.595		144.353		121.136	
Cranks Only, pounds	5342		6214		7413	
Description	Max	Min	Max	Min	Max	Min
Cranks and 4 each LL2	15014	8891	17306	10284	20456	12199
Cranks w/2-LL2 & 2-LL3	17912	10286	20629	11883	24365	14080
Cranks and 4 each LL3	20810	11680	23952	13482	28273	15960
Cranks w/2-LL3 & 2-LL4	22895	12905	26343	14887	31085	17612
Cranks and 4 each LL4	24980	14130	28734	16292	33896	19264
Cranks w/2-LL4 & 2-LL5	26653	15153	30653	17465	36152	20643
Cranks and 4 each LL5	28325	16175	32571	18637	38407	22022
*Cranks w/2-LL5 & 2-LL6	30974	18490	35608	21292	41979	25144
*Cranks and 4 each LL6	33622	20804	38645	23946	45551	28265

* Not Recommended

** Maximum recommended ECB for this unit is 29200 in maximum stroke position.

LIBERTY LIFT SOLUTIONS,LLC GEAR REDUCER DATA SHEET

MANFACTURED BY: Dwang Jinai DATE SUBMITTED : November 14, 2013

NOMINAL API REDUCER SIZE : 640

CALCULATED VALUES

PITTING RESISTANCE TORQUE

First reduction 1,128,034 in-lb

Second reduction 968,361 in-lb

STATIC TORQUE

First reduction :

Gear 1,722,572 in-lb Pinion 1,829,633 in-lb

Second reduction :

Gear 1,113,229 in-lb Pinion 1,214,395 in-lb

BENDING STRENGTH TORQUE

First reduction :

Gear 2,024916 in-lb Pinion 1,944,291 in-lb

Second reduction :

Gear 1,321,646 in-lb Pinion 1,303,341 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 = 22 Ng = 120 Pnd = 2.5400 Pd = 2.2828

Center distance ans net face width :

First reduction, CD = 17.3228 in F = 8.8976 in

Second reduction, CD = 31.1023 in F = 12.2047 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 = .2248 Jp = .4837 Jg = .5583

Second reduction, I = .2325 Jp = .5148 Jg = .5785

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 245 - 285

Pinion material Q and T AISI4145 Hardness BHN 285 - 325

Other components

Crankshaft material Q and T AISI4140 Hardness BHN 285 - 325

Housing material Cast Iron

Housing type Split Type

Bearing Sizes

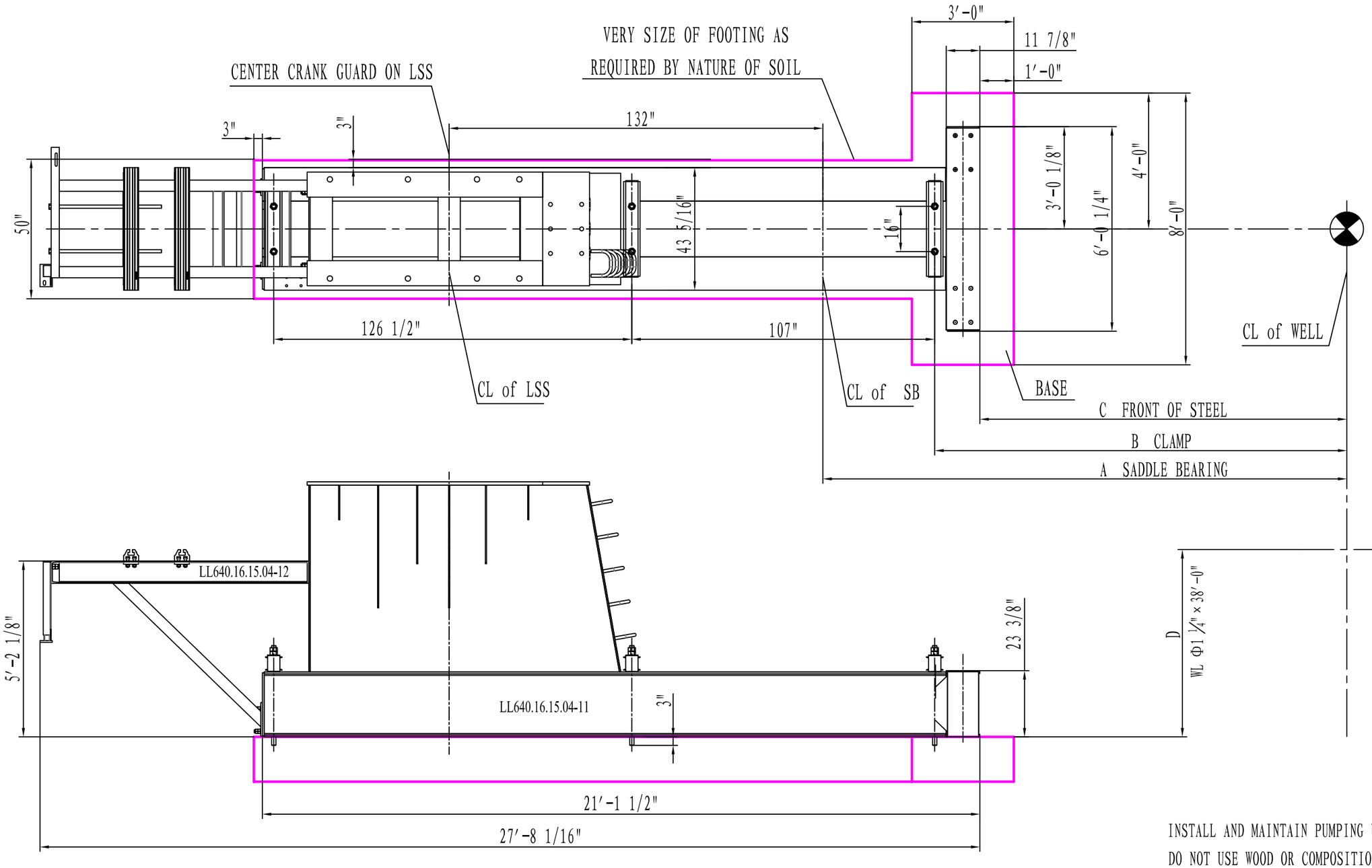
High speed pinion	NU2324
Intermediate speed pinion	NU2330
Low speed shaft	22244CA

Bearing Life, L10

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

CRANK CR002

912&640				
B/G LL640.16.15.04-14 (67.794-76.2)				
RDCR SHEAVE	PM SHEAVE	OVERALL RATIO	SPM @1160	V-BELT
50 8C 6C	7	205.6	5.6	C240
	14	102.8	11.3	C240
	16	90.0	12.9	C255
	18	80.0	14.5	C255
44 8C 6C	7	181.0	6.4	C225
	10.5	120.6	9.6	C225
	10	126.7	9.2	C240
	16	79.2	14.7	C240



UNIT	A	B	C	D	E	F
640-365-168	15'-5 1/8"	12'-1 5/8"	129.62"	5'-6 1/8"		
912-365-168	15'-5 1/8"	12'-1 5/8"	129.62"	5'-6 1/8"		
912-427-168	15'-5 1/8"	12'-1 5/8"	129.62"	5'-6 1/8"		

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

THIS DRAWING IS PROPERTY OF LIBERTY LIFT SOLUTIONS, LLC, AND IS LOANED TO THE RECIPIENT FOR HIS CONFIDENTIAL USE ONLY.IN CONSIDERATION OF THE LOAN OF THIS DRAWING.THE RECIPIENT PROMISES AND AGREES THAT IT SHALL NOT BE USED IN ANY WAY DETRIMENTAL TO THE INTEREST OF LIBERTY LIFT SOLUTIONS, LLC.THAT IT SHALL BE RETURNED UPON REQUEST.AND THAT IT SHALL NOT BE REPRODUCED, COPIED, LOANED OR OTHERWISE DISPOSED OF, DIRECTLY OR INDIRECTLY WITHOUT THE EXPRESS WRITTEN CONSENT OF LIBERTY LIFT SOLUTIONS, LLC.

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	LL50004	DRAWING NUMBER US		REV	
TITLE	FOUNDATION, HP			WEIGHT	
MATERIAL	ASSEMBLY			SCALE	1:36
DRAWING NUMBER CHINA	LLB1.04			REV	0