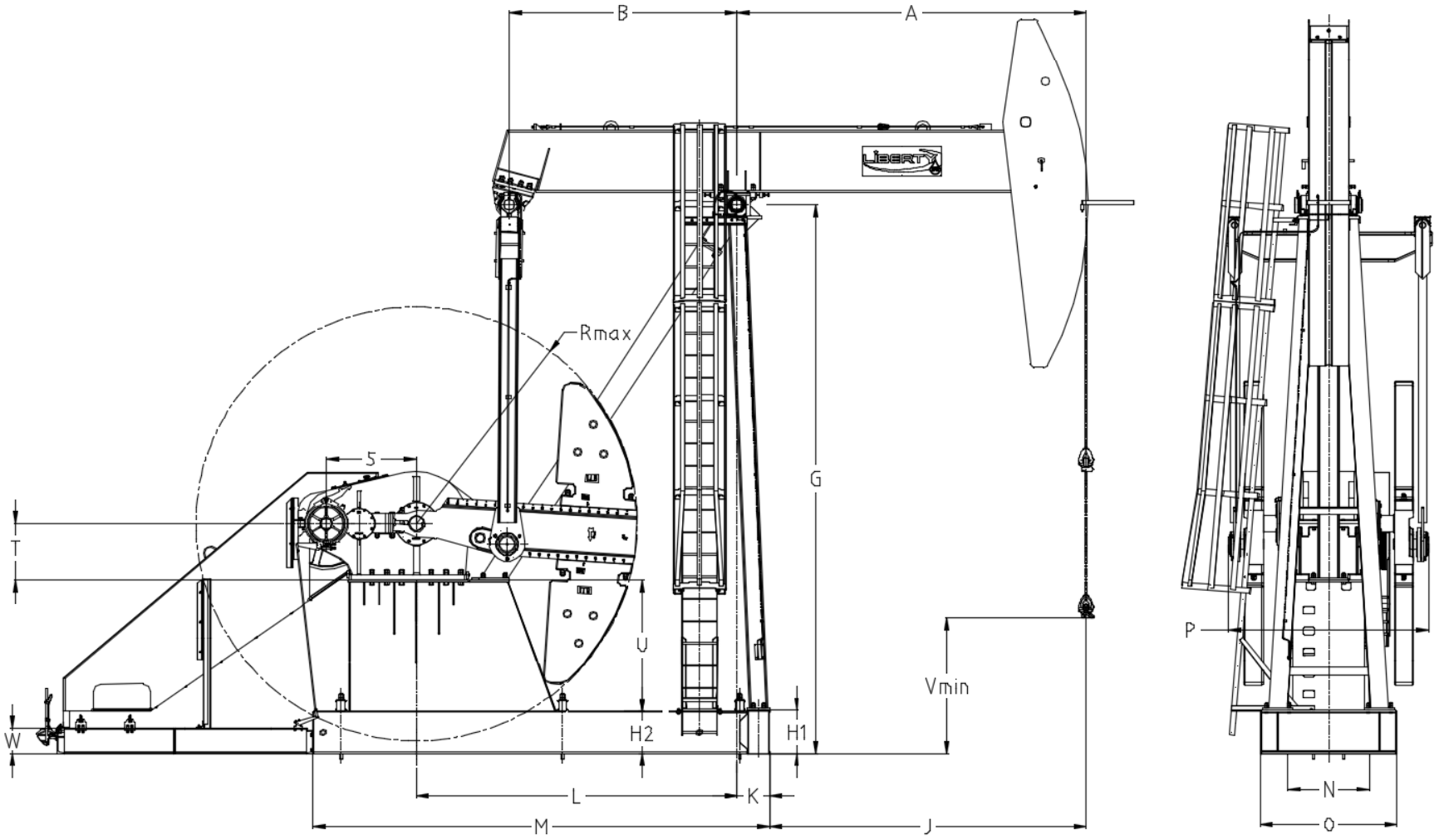
LIBERTY LIFT EG PUMPING UNIT LP MC



UNIT	A	B	G	H1	H2	J	K	L	M	N	O	P	R	S	T	U	V	W
912-427-192	17'-7 1/2"	10'-0 5/8"	26'-1 7/8"	23 3/8"	22 7/8"	16'-4"	1'-3 1/2"	14'-4"	20'-2 3/8"	3'-7 1/4"	6'-0 1/4"	8'-10 1/2"	117"	47.768"	30.512"	5'-10 1/2"	6'-6 3/8"	1'-1 3/4"

LIBERTY LIFT SOLUTIONS

TORQUE FACTOR TABLE

UNIT DESIGNATION **912-427-192 Enhanced Geometry**

Cranks : **CR060**

Position of Crank	Polished Rod Position Length of Stroke, inches			Torque Factor Length of Stroke, inches		
degrees	192.946	159.386	128.605	192.946	159.386	128.605
0	0.0180	0.0172	0.0166	-26.960	-21.813	-17.207
15	0.0000	0.0000	0.0001	0.927	1.153	1.103
30	0.0208	0.0212	0.0211	29.569	24.379	19.411
45	0.0788	0.0787	0.0778	55.046	45.066	35.778
60	0.1671	0.1664	0.1643	73.753	60.724	48.514
75	0.2751	0.2748	0.2722	84.106	70.127	56.687
90	0.3919	0.3935	0.3920	86.926	73.563	60.282
105	0.5086	0.5139	0.5149	84.363	72.289	59.933
120	0.6194	0.6292	0.6339	78.572	67.721	56.486
135	0.7210	0.7351	0.7433	70.989	60.894	50.636
150	0.8115	0.8283	0.8387	62.151	52.231	42.738
165	0.8890	0.9056	0.9159	51.678	41.520	32.789
180	0.9504	0.9631	0.9706	38.167	27.986	20.546
195	0.9900	0.9954	0.9979	19.121	10.633	5.832
210	0.9986	0.9958	0.9929	-7.844	-10.769	-10.947
225	0.9660	0.9589	0.9528	-40.523	-34.217	-28.353
240	0.8902	0.8845	0.8786	-69.958	-55.554	-44.158
255	0.7809	0.7795	0.7756	-89.195	-71.178	-56.319
270	0.6527	0.6545	0.6525	-98.260	-79.955	-63.761
285	0.5177	0.5203	0.5193	-99.642	-82.420	-66.319
300	0.3850	0.3867	0.3856	-95.143	-79.422	-64.258
315	0.2619	0.2621	0.2606	-85.538	-71.545	-57.923
330	0.1551	0.1542	0.1525	-70.960	-59.092	-47.646
345	0.0716	0.0703	0.0690	-51.343	-42.323	-33.844

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 = -1768

A =	211.500
C =	120.630
G =	123.898
H =	313.898
K =	256.268
I =	171.969
P =	198.200
R1 =	49.500
R2 =	42.000
R3 =	34.500

LIBERTY LIFT SOLUTIONS

EFFECTIVE COUNTERBALANCE TABLE

Unit Designation 912-427-192 Enhanced Geometry

CRANK : CR060

Stroke Length, inches	192.946		159.386		128.605	
Cranks Only, pounds	5053		6292		8068	
Description	Max	Min	Max	Min	Max	Min
Cranks and 4 each LL3	18692	8313	22409	10144	27736	12768
Cranks w/2-LL3 & 2-LL4	20530	8976	24581	10927	30386	13724
Cranks and 4 each LL4	22368	9638	26752	11710	33035	14679
Cranks w/2-LL4 & 2-LL5	23842	10213	28494	12389	35161	15508
Cranks and 4 each LL5	25316	10787	30236	13067	37287	16336
Cranks w/2-LL5 & 2-LL6	27647	12139	32990	14665	40648	18285
Cranks and 4 each LL6	29977	13490	35744	16262	44009	20234
Cranks w/2-LL6 & 2-LL7	31523	14313	37571	17234	46238	21420
Cranks and 4 each LL7	33069	15135	39397	18205	48467	22606

* 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

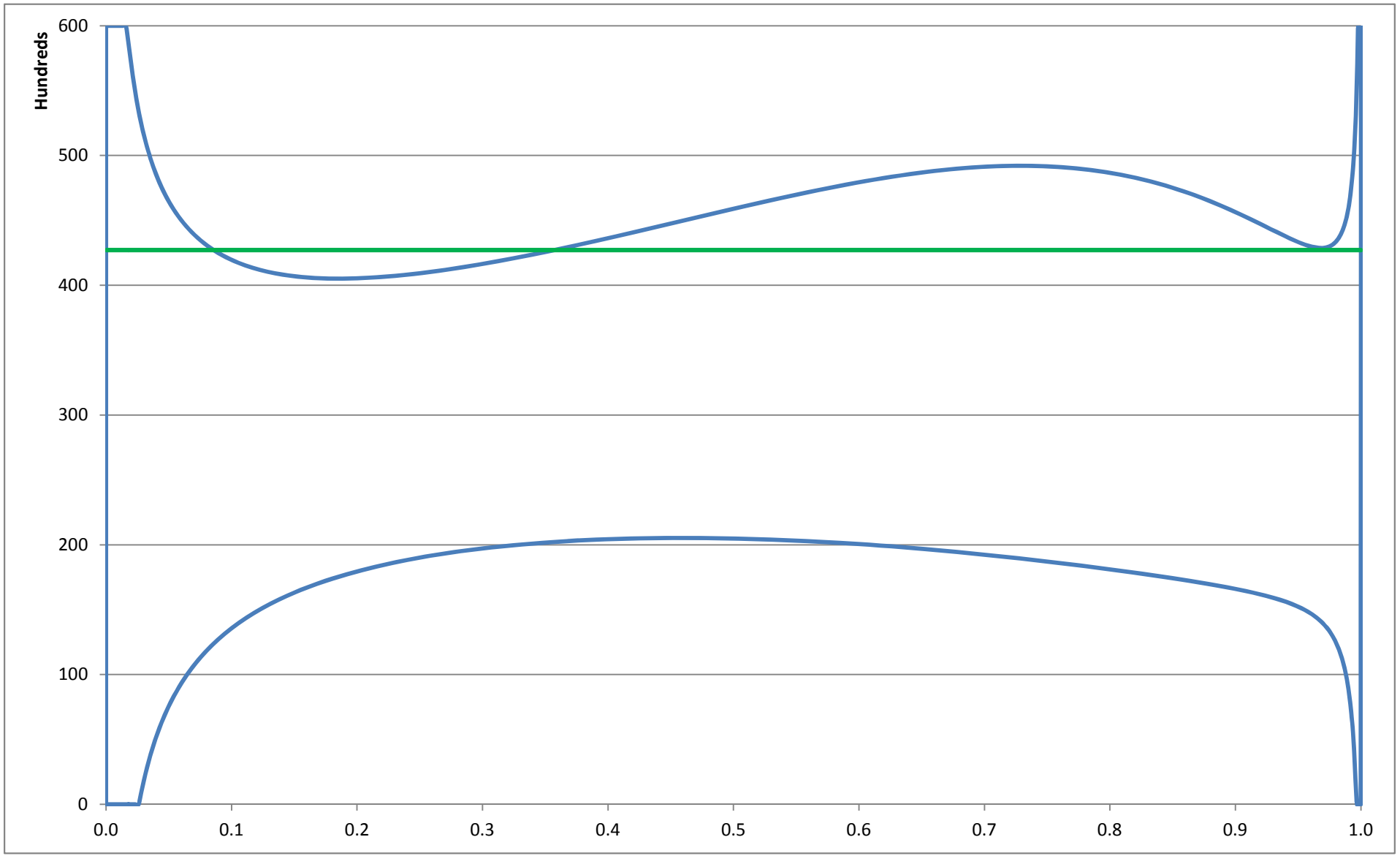
Intermediate speed pinion NU2328

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

912-427-192 Enhanced Geometry
Calculated Permissible Load with 3124862 in-lb Moment