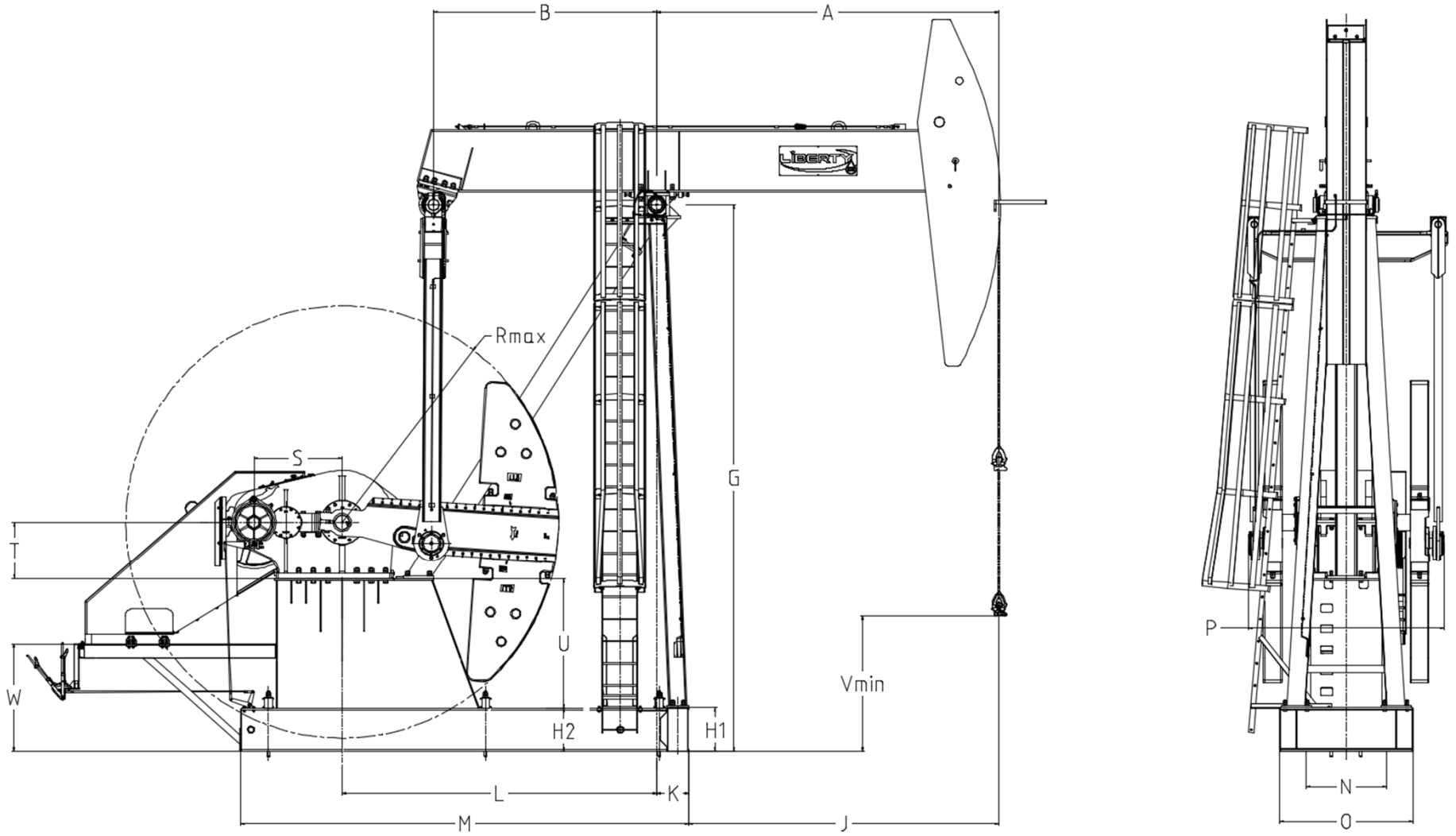
# LIBERTY LIFT EG PUMPING UNIT




| 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'-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'-5 3/8" | 117" | 45.033" | 28.346" | 5'-10 1/2" | 6'-0 7/8" | 4'-9 7/8" |

# LIBERTY LIFT SOLUTIONS

## TORQUE FACTOR TABLE

**UNIT DESIGNATION** **640-365-168 EG**

**Cranks :** **CR051**

| Position of Crank degrees | Polished Rod Position Length of Stroke, inches | | | Torque Factor Length of Stroke, inches | | |
|---|---|---|---|---|---|---|
| | 168.218 | 138.961 | 112.139 | 168.218 | 138.961 | 112.139 |
| 0 | 0.0199 | 0.0190 | 0.0182 | -24.879 | -20.074 | -15.783 |
| 15 | 0.0000 | 0.0000 | 0.0000 | -0.235 | 0.211 | 0.369 |
| 30 | 0.0196 | 0.0200 | 0.0200 | 25.321 | 20.879 | 16.614 |
| 45 | 0.0774 | 0.0773 | 0.0763 | 48.201 | 39.373 | 31.183 |
| 60 | 0.1664 | 0.1655 | 0.1630 | 64.977 | 53.349 | 42.504 |
| 75 | 0.2756 | 0.2747 | 0.2715 | 74.073 | 61.620 | 49.699 |
| 90 | 0.3934 | 0.3942 | 0.3919 | 76.243 | 64.453 | 52.754 |
| 105 | 0.5104 | 0.5149 | 0.5151 | 73.552 | 63.050 | 52.285 |
| 120 | 0.6209 | 0.6300 | 0.6339 | 68.067 | 58.778 | 49.108 |
| 135 | 0.7216 | 0.7352 | 0.7428 | 61.159 | 52.633 | 43.899 |
| 150 | 0.8108 | 0.8274 | 0.8376 | 53.368 | 45.053 | 37.019 |
| 165 | 0.8871 | 0.9040 | 0.9144 | 44.429 | 35.899 | 28.492 |
| 180 | 0.9480 | 0.9613 | 0.9692 | 33.220 | 24.526 | 18.105 |
| 195 | 0.9883 | 0.9944 | 0.9973 | 17.644 | 10.028 | 5.651 |
| 210 | 0.9993 | 0.9969 | 0.9941 | -4.628 | -8.001 | -8.638 |
| 225 | 0.9708 | 0.9629 | 0.9564 | -32.613 | -28.175 | -23.665 |
| 240 | 0.8987 | 0.8915 | 0.8845 | -59.002 | -47.041 | -37.560 |
| 255 | 0.7917 | 0.7886 | 0.7833 | -76.884 | -61.239 | -48.476 |
| 270 | 0.6641 | 0.6645 | 0.6613 | -85.629 | -69.481 | -55.347 |
| 285 | 0.5287 | 0.5303 | 0.5282 | -87.380 | -72.108 | -57.937 |
| 300 | 0.3949 | 0.3959 | 0.3940 | -83.830 | -69.858 | -56.441 |
| 315 | 0.2702 | 0.2699 | 0.2677 | -75.733 | -63.259 | -51.146 |
| 330 | 0.1614 | 0.1601 | 0.1579 | -63.224 | -52.583 | -42.335 |
| 345 | 0.0757 | 0.0742 | 0.0725 | -46.217 | -38.034 | -30.353 |

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 = -590

| | |
|---|---|
| A = | 185.091 |
| C = | 120.630 |
| G = | 121.732 |
| H = | 295.898 |
| K = | 243.379 |
| I = | 170.000 |
| P = | 184.938 |
| R1 = | 49.500 |
| R2 = | 42.000 |
| R3 = | 34.500 |

# LIBERTY LIFT SOLUTIONS

## EFFECTIVE COUNTERBALANCE TABLE

## Unit Designation 640-365-168 EG

**CRANK : CR051**

| | | | | | | |
|---|---|---|---|---|---|---|
| Stroke Length, inches | 168.218 | | 138.961 | | 112.139 | |
| Cranks Only, pounds | 7098 | | 8504 | | 10521 | |
| Description | Max | Min | Max | Min | Max | Min |
| Cranks and 4 each LL2 | 16823 | 9087 | 20008 | 10857 | 24576 | 13396 |
| Cranks w/2-LL2 & 2-LL3 | 19736 | 9951 | 23454 | 11879 | 28785 | 14644 |
| Cranks and 4 each LL3 | 22648 | 10814 | 26899 | 12900 | 32994 | 15891 |
| Cranks w/2-LL3 & 2-LL4 | 24743 | 11569 | 29377 | 13794 | 36022 | 16983 |
| Cranks and 4 each LL4 | 26838 | 12324 | 31855 | 14687 | 39050 | 18075 |
| Cranks w/2-LL4 & 2-LL5 | 28519 | 12979 | 33844 | 15462 | 41480 | 19022 |
| *Cranks and 4 each LL5 | 30200 | 13634 | 35832 | 16237 | 43909 | 19968 |
| *Cranks w/2-LL5 & 2-LL6 | 32857 | 15176 | 38976 | 18060 | 47749 | 22196 |
| *Cranks and 4 each LL6 | 35514 | 16717 | 42119 | 19883 | 51589 | 24423 |

* 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 1, 2014

NOMINAL API REDUCER SIZE : 640

## CALCULATED VALUES

PITTING RESISTANCE TORQUE

| | |
|---|---|
| First reduction | 990,103 in-lb |
| Second reduction | 908,476 in-lb |

STATIC TORQUE

First reduction :

Gear 1,033,058 in-lb Pinion 1,339,473 in-lb

Second reduction:

Gear 901,375 in-lb Pinion 1,107,510 in-lb

BENDING STRENGTH TORQUE

First reduction :

Gear 1,246,217 in-lb Pinion 1,460,733 in-lb

Second reduction:

Gear 1,074,702 in-lb Pinion 1,193,707 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=106 | Pnd=4.2333 | Pd=3.6744 |
| Second reduction, | Np=21 | Ng=111 | Pnd=2.6737 | Pd=2.3552 |

Center distance ans net face width

| | | |
|---|---|---|
| First reduction, | CD=17.010 in | F=6.929 in |
| Second reduction, | CD=28.023 in | F=12.205 in |

Helix angle and normal pressure angle or transverse pressure angle

| | | |
|---|---|---|
| First reduction, | HA=29.78 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=.2526 | Jp=.5211 | Jg=.4927 |
| Second reduction, | I=.2510 | Jp=.5402 | Jg=.5391 |

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 |

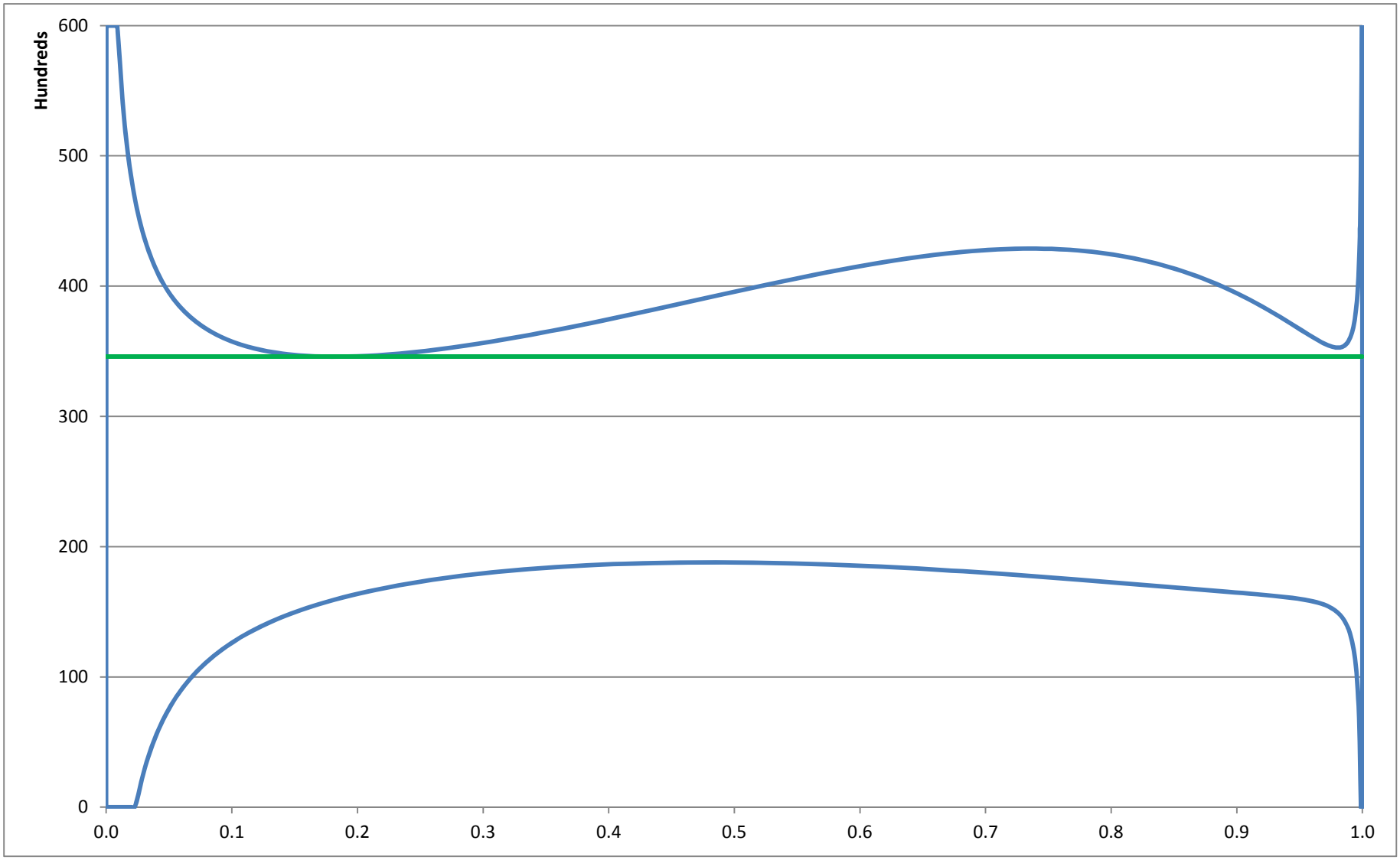
Other components

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

| Bearing Sizes | | Bearing Life, L10 | |
|---|---|---|---|
| High speed pinion | NU2324 | High speed pinion | >135,000 hours |
| Intermediate speed pinion | NU2328 | Intermediate speed pinion | >135,000 hours |
| Low speed shaft | NJ2240 | Low speed shaft | >120,000 hours |

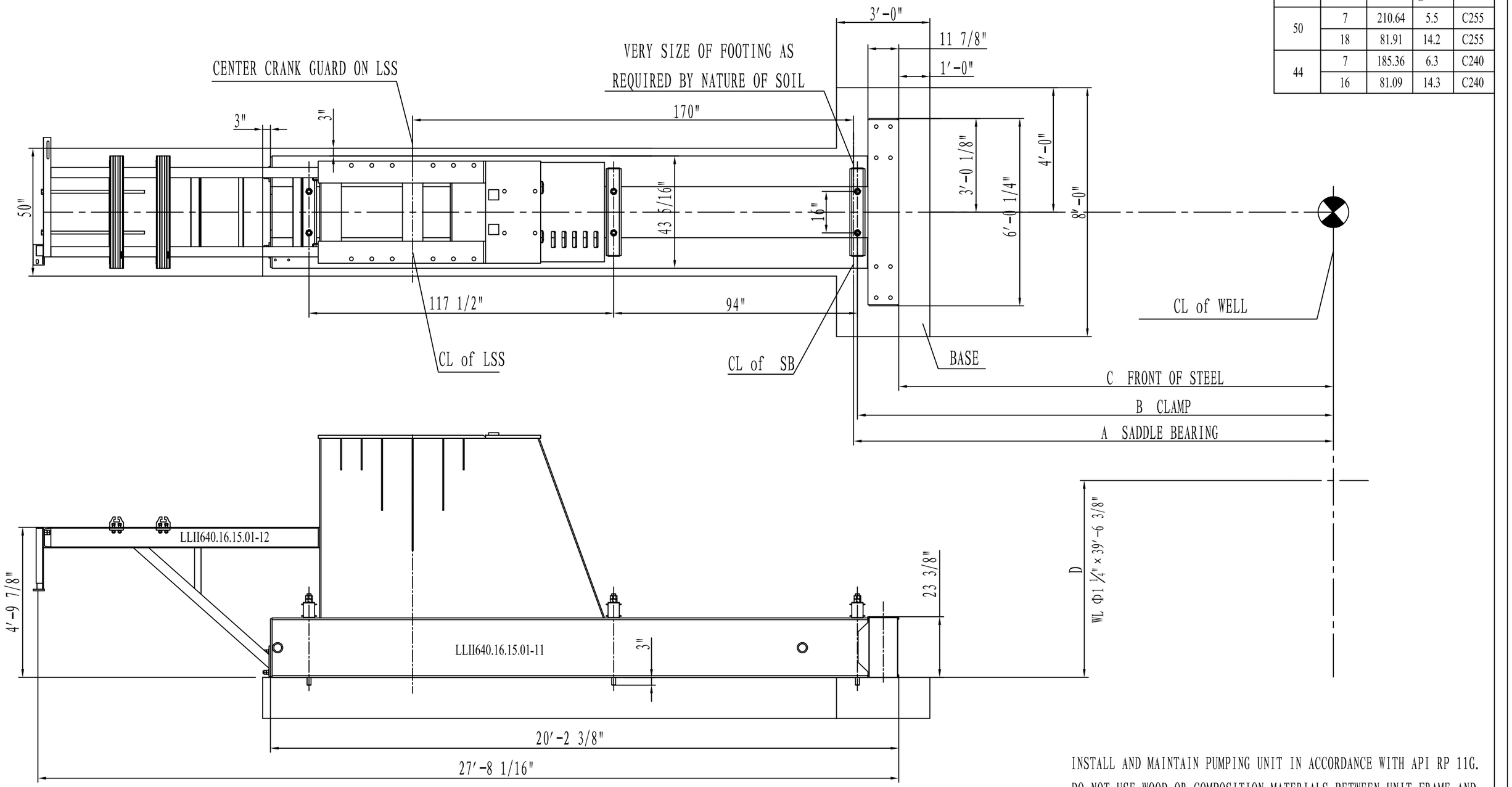
# 640-365-168 EG

## Calculated Permissible Load with 2329586 in-lb Moment



CRANK CR051

| 640 | | | | |
|---|---|---|---|---|
| B/G EG 640.16.15.01-14 (70.5-81.4) | | | | |
| RDCR SHEAVE | PM SHEAVE | OVERALL RATIO | SPM @1160 | V-BELT |
| 50 | 7 | 210.64 | 5.5 | C255 |
| | 18 | 81.91 | 14.2 | C255 |
| 44 | 7 | 185.36 | 6.3 | C240 |
| | 16 | 81.09 | 14.3 | C240 |




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 |
|---|---|---|---|---|---|---|
| EG 640-365-168 | 15'-5 1/8" | 15'-3 5/8" | 167.61" | 6'-0 7/8" | | |
| | | | | | | |
| | | | | | | |

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 | LL50013 | DRAWING NUMBER US | | REV | |
| TITLE | FOUNDATION, HP | | WEIGHT | | |
| MATERIAL | ASSEMBLY | | SCALE | 1:36 | |
| DRAWING NUMBER CHINA | LLB1.07 | | REV | 0 | |