

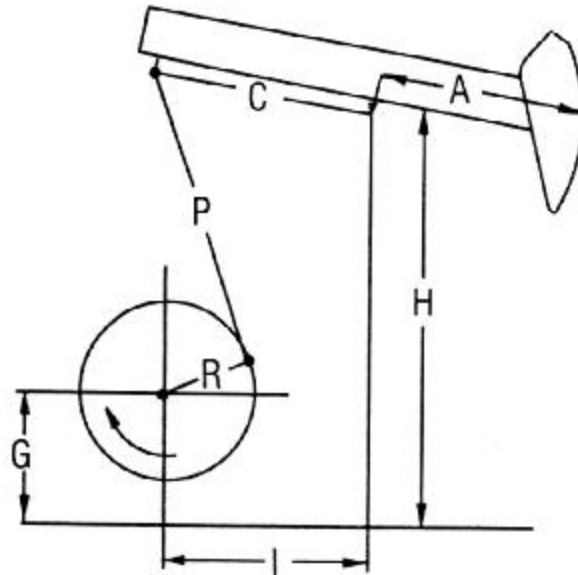


LS PUMPING UNIT API LINKAGE DIMENSIONS

UNIT MODEL	A	C	P	H	I	G	K	R1	R2	R3	SU	TORQUE FACTOR AT 90 DEGREES			series
												LONG	MIDDLE	SHORT	
912D-365-192	207	120	159.8	274	120	114.2	199.8	53.5	46.5	39.4	-915	90.136	78.976	67.323	y
912D-365-168	181	120	159.8	274	120	114.2	199.8	53.5	46.5	39.4	-74	78.815	69.056	58.867	y
912D-305-168	181	120	159.8	274	120	114.2	199.8	53.5	46.5	39.4	-74	78.815	69.056	58.867	y
912D-427-144	181	120	149.5	256	120	106.2	192	46.5	40	33.5	-220	68.894	59.649	50.191	y
912D-365-144	181	120	149.5	256	120	106.2	192	46.5	40	33.5	-220	68.894	59.649	50.191	y
640D-365-168	181	120	149.5	263	120	113.9	192	53.5	46.5	39.4	-465	78.531	68.894	58.784	y
640D-305-168	181	120	149.5	263	120	113.9	192	53.5	46.5	39.4	-465	78.531	68.894	58.784	y
640D-365-144	181	120	149.5	256	120	106.2	192	46.5	40	33.5	-220	68.894	59.649	50.191	y
640D-305-144	181	120	149.5	256	120	106.2	192	46.5	40	33.5	-405	68.894	59.649	50.191	y
640D-256-144	181	120	149.5	254	120	104.2	192	46.5	40	33.5	-525	68.894	59.649	50.191	y
640D-305-120	155	111	135	232	111	96.5	175	41.9	35.8	29.75	440	57.500	49.450	41.284	y
456D-305-168	181	120	149.5	263	120	113.9	192	53.5	46.5	39.4	-465	78.531	68.894	58.784	y
456D-305-144	181	120	149.5	256	120	106.2	192	46.5	40	33.5	-405	68.894	59.649	50.191	y
456D-256-144	181	120	149.5	254	120	104.2	192	46.5	40	33.5	-525	68.894	59.649	50.191	y
456D-365-120	151	120	149.5	254	120	104.2	192	46.5	40	33.5	1010	57.475	49.762	41.872	y
456D-305-120	155	111	135	232	111	96.5	175	41.9	35.8	29.75	440	57.500	49.450	41.284	y
456D-256-120	155	111	135	232	111	96.5	175	41.9	35.8	29.75	-265	57.500	49.450	41.284	y
456D-213-120	155	111	135	232	111	96.5	175	41.9	35.8	29.75	-185	57.500	49.450	41.284	y
456D-256-100	129	111	135	232	111	96.5	175	41.9	35.8	29.75	1035	47.855	41.156	34.359	y
320D-119-168	216	111	134	232	111	96.5	175	41.9	35.8	29.75	-920	80.079	68.880	57.512	y
320D-256-144	185	111	134	232	111	96.5	175	41.9	35.8	29.75	-410	68.568	59.994	49.258	y
320D-213-144	181	108	134	232	111	96.5	175	41.9	35.8	29.75	-890	69.469	59.681	49.775	y
320D-119-144	186	111	134	232	111	96.5	175	41.9	35.8	29.75	-890	68.957	59.313	49.525	y
320D-256-120	155	111	134	232	111	96.5	175	41.9	35.8	29.75	-265	57.464	49.428	41.270	y
320D-213-120	155	111	135	232	111	96.5	175	41.9	35.8	29.75	-185	58.309	49.979	41.605	y
320D-305-100	129	111	134	232	111	96.5	175	41.9	35.8	29.75	1030	47.825	41.137	34.348	y
320D-256-100	129	111	135	232	111	96.5	175	41.9	35.8	29.75	1030	47.855	41.156	34.359	y
320D-246-86	111	111	119	195	111	78.7	161	41.9	36.25	31.75	970	41.010	35.760	31.467	y
320D-213-86	111	96	116	195	96	78.7	151	36.25	31.25	26.4	420	41.176	35.723	30.315	y
320D-246-74	96	96	116	195	96	78.7	151	36.25	31.25	26.4	1100	35.612	30.895	26.218	y
228D-185-144	163	111	151.5	252	111	100.7	188	47.25	41.14	35	-580	68.044	59.637	50.987	y
228D-213-120	155	111	135	232	111	96.5	175	41.9	35.8	29.75	-185	57.500	49.450	41.284	y
228D-213-100	129	96	116	197	96	80.25	151	36.25	30.5	24.8	440	47.853	40.551	33.134	y
228D-173-100	129	96	116	195	96	78.7	151	36.25	31.25	26.4	96	47.854	41.516	35.231	y
228D-246-86	111	96	116	197	96	80.25	151	36.25	30.5	24.8	990	41.176	34.893	28.511	y
228D-213-86	111	96	116	195	96	78.7	151	36.25	31.25	26.4	420	41.176	35.723	30.315	y
228D-200-74	96	96	116	195	96	78.7	151	36.25	31.25	26.4	1100	35.612	30.895	26.218	y
228D-173-74	96	96	116	195	96	78.7	151	36.25	31.25	26.4	1100	35.612	30.895	26.218	y
160D-119-120	155	96	116	195	96	78.7	151	36.25	31.25	26.4	-350	57.498	49.883	42.331	y
160D-173-100	129	96	116	195	96	78.7	151	36.25	31.25	26.4	53	47.853	41.516	35.230	y
160D-173-86	111	96	116	195	96	78.7	151	36.25	31.25	26.4	420	41.176	35.723	30.315	y
160D-200-74	96	96	116	195	96	78.7	151	36.25	31.25	26.4	1100	35.612	30.895	26.218	y
160D-173-74	96	84	96.5	165	84	68.8	128	31.5	27	22.5	440	35.314	30.485	25.534	y
160D-143-74	96	84	96.5	165	84	68.8	128	31.5	27	22.5	440	35.314	30.485	25.534	y
114D-119-100	129	96	116	195	96	78.7	151	36.25	31.25	26.4	75	47.853	41.516	35.230	y
114D-119-86	111	84	96.5	165	84	68.8	128	31.69	26.77	21.85	110	40.831	35.249	29.524	y
114D-143-74	96	84	96.5	165	84	68.8	128	31.5	27	22.5	440	35.314	30.485	25.534	y
114D-173-64	84	84	96.5	165	84	68.8	128	31.5	27	22.5	475	30.899	26.675	22.342	y
114D-143-54	84	84	96.5	165	84	68.8	128	27	22.5	18	475	26.675	22.342	17.935	y
114D-143-86	110.8	96	116	195	96	78.7	151	36.25	31.25	26.4	750	41.102	35.658	30.260	y



Pumping Unit API Linkage Geometry



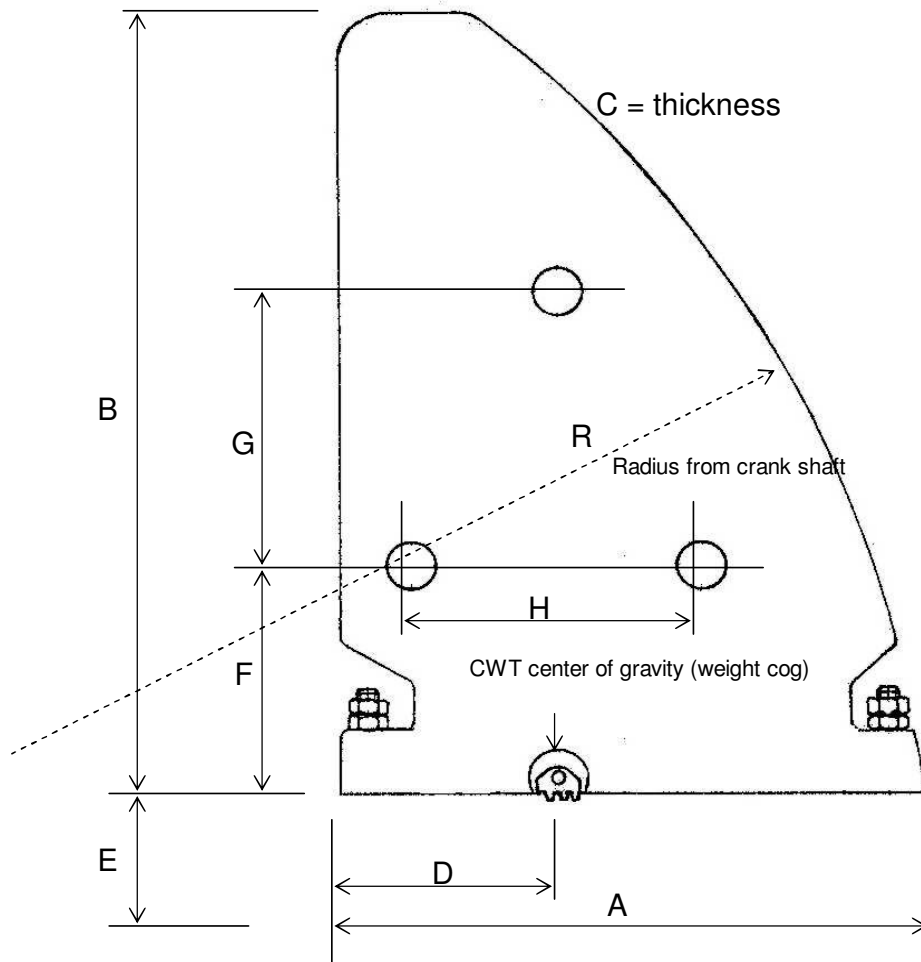
Symbol Identification

- A: Distance from center of center-bearing to centerline of polished rod (inches).
- C: Distance from center of center-bearing to center of equalizer bearing (inches).
- P: Effective length of pitman arm as measured from center of equalizer bearing to center of crank-pin bearing (inches)
- R: Distance from center of crankshaft to center of crank-pin bearing (inches)
- H: Height from center of center-bearing to bottom of main base beams (inches)
- I: Horizontal distance from centerline of center-bearing to centerline of crankshaft (inches)
- G: Height from center of crankshaft to bottom of main base beams (inches)
- K: Distance from center of crankshaft to center of center-bearing (inches).

Counterweight Dimensions

Counterweight No.	1	2	3	4	5	6	7	8	9
A	49.25	47.25	43.25	43.25	43.25	39.375	35.5	29.5	25.5
B	66.875	66.875	59.0625	59.0625	55.125	49.1875	45.25	39.375	31.5
C	9.5	7.875	8	7.25	6.75	6.75	5.875	5.875	5.875
D	18.5	17.75	16.75	16.75	16.75	15	14	11.5	10
E	11.875	11.875	11.875	10.5	8.875	8.875	6.875	6.875	6.875
F	19.75	19.75	17.75	17.75	15.75	15.75	15.75	13.75	14.625
G	23.625	23.625	23.625	23.625	23.625	19.625	19.625	15.75	9.625
H	23.625	23.625	23.625	23.625	23.625	19.625	19.625	7.875	9.125
I	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.25
R	102.375	102.375	102.375	94.5	76.875	76.875	66.325	66.375	54
Weight/ea, lbs									
2H, 2 bolt holes						2200	1650	1215	850
3H, 3 bolt holes	5280	4211	3582	3247	2622				

weights in lbs. & dimensions in inches





Counterweight Position & Counterbalance Effect

Symbol Identification

(plug-in values found in FORM: B030400)

CBT:	Counterbalance Torque (inch-lbs.)
CBTC:	Counterbalance Torque due to Cranks (inch-lbs.)
CBE:	Counterbalance Effect at Polished Rod (lbs.)
R _{cg} :	Distance to Center of Gravity of Crank as Measured from Crank Shaft Center (inches)
SU:	Structural Unbalance (lbs.)
W:	Weight of Counterweight (lbs.) (see FORM: B060400)
CW:	Crank Weight (lbs.)
CPW:	Crank Pin Weight (lbs.)
R _{1,2,or 3} :	API 'R', Distance from Crank Shaft Center to Crank Pin Shaft Center (inches)
N:	Number of Same Counterweights
X:	Position of Counterweight* as Measured against Scale on LS Crank Arm (inches from Crank Shaft Center)
	<i>*Position of counterweight is measured at the location of the counterweight locking cog</i>
TF@ 90°:	Torque Factor at 90 Degrees Crank Position

Determine Counterweight Position, X, to achieve a desired CBE

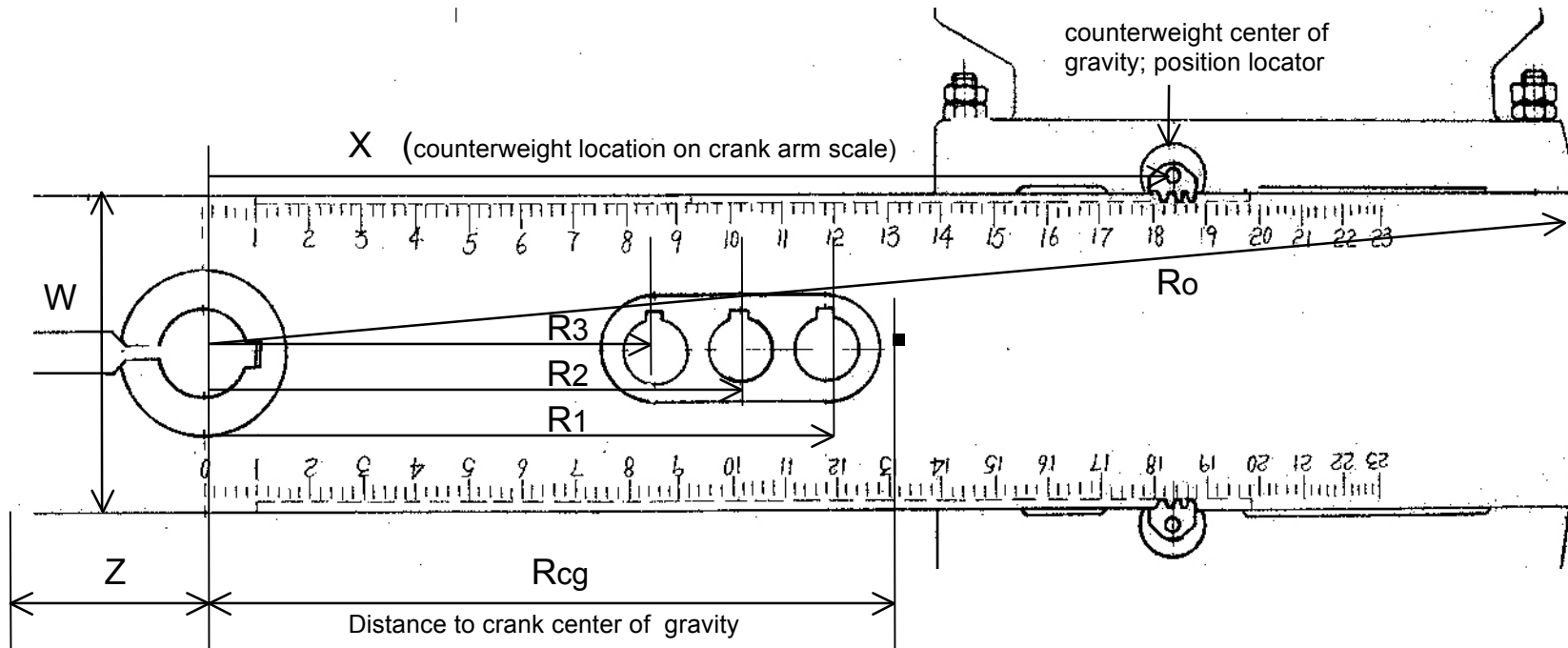
$$\begin{aligned} \text{Solve for CBT:} & \quad \text{CBT} = (\text{CBE} - \text{SU}) * \text{TF@ } 90^\circ \\ \text{Solve for CBTC:} & \quad \text{CBTC} = (2 * \text{CW} * \text{R}_{\text{cg}}) + (2 * \text{R}_{1,2,\text{or } 3} * \text{CPW}) \\ \text{Solve for X:} & \quad \text{X} = \frac{\text{CBT} - \text{CBTC}}{\text{N} * \text{W}} \end{aligned}$$

Determine Counterbalance Effect, CBE, at current counterweight position

$$\begin{aligned} \text{Solve for CBTC:} & \quad \text{CBTC} = (2 * \text{CW} * \text{R}_{\text{cg}}) + (2 * \text{R}_{1,2,\text{or } 3} * \text{CPW}) \\ \text{Solve for CBT:} & \quad \text{CBT} = (\text{X} * \text{N} * \text{W}) + \text{CBTC} \\ \text{Solve for CBE:} & \quad \text{CBE} = \frac{\text{CBT}}{\text{TF@ } 90^\circ} + \text{SU} \end{aligned}$$



Crank Arm Specifications



Crank Name	Crank Weight	Rcg	Ro	Crank Width, W	Z
1587	1,587	28.50	66.90	17.72	7.87
1940	1,940	33.50	76.88	17.72	7.87
3064	3,064	42.60	94.50	20.87	7.87
4045	4,045	46.50	102.40	23.62	7.87
4354	4,354	49.50	110.00	23.62	7.87