I H Correll
Sterling

#20

BETHLEHEM STEEL COMPANY
Supply Division
Tulsa, Oklahoma

BETHLEHEM API PUMPING UNITS - ENGINEERING DATA
Index and Control Sheet

Frontispiece
TAB-Engineering Data

*3-29-63	25-53-24	API Pumping Unit Stroke and Torque Factors
*3-29-63	40-67-30 25-67-30 25-53-30 25-43-30	API Pumping Unit Stroke and Torque Factors
*3-29-63	57-89-36 40-89-36 40-67-36 25-67-36 40-56-36 25-56-36	API Pumping Unit Stroke and Torque Factors
*3-29-63	57-89-42 40-89-42 57-76-42 40-76-42	API Pumping Unit Stroke and Torque Factors
*3-29-63	80-109-42 57-109-42	API Pumping Unit Stroke and Torque Factors
*3-29-63	80-109-48 57-109-48 80-95-48 57-95-48	API Pumping Unit Stroke and Torque Factors
9-20-62	114-133-48 80-133-48	API Pumping Unit Stroke and Torque Factors API Rating Form for Crank Counterbalance
9-20-62	114-133-54 80-133-54 114-119-54 80-119-54	API Pumping Unit Stroke and Torque Factors API Rating Form for Crank Counterbalance
9-25-62	160-169-54 114-169-54	API Pumping Unit Stroke and Torque Factors API Rating Form for Crank Counterbalance
9-25-62	160-143-64 114-143-64	API Pumping Unit Stroke and Torque Factors API Rating Form for Crank Counterbalance
9-25-62	228-200-64 160-200-64 160-169-64 114-169-64	API Pumping Unit Stroke and Torque Factors API Rating Form for Crank Counterbalance

* Denotes attached sheets

6-26-63
Superseding 12-21-62

9-25-62	228-173-74	API Pumping Unit Stroke and Torque Factors
	160-173-74	API Rating Form for Crank Counterbalance
9-25-62	320-246-74	API Pumping Unit Stroke and Torque Factors
	228-246-74	
	228-200-74	
	160-200-74	
	228-200-74	API Rating Form for Crank Counterbalance
	160-200-74	
9-20-62	320-246-74	API Pumping Unit Stroke and Torque Factors
	228-246-74	
	228-200-74	
	160-200-74	
	320-246-74	API Rating Form for Crank Counterbalance
	228-246-74	
*6-26-63	320-212-86	API Pumping Unit Stroke and Torque Factors
	228-212-86	API Rating Form for Crank Counterbalance
9-25-62	320-246-86	API Pumping Unit Stroke and Torque Factors
	228-246-86	API Rating Form for Crank Counterbalance
9-25-62	320-298-86	API Pumping Unit Stroke and Torque Factors
		API Rating Form for Crank Counterbalance
9-25-62	320-298-100	API Pumping Unit Stroke and Torque Factors
	320-256-100	API Rating Form for Crank Counterbalance
9-25-62	320-256-120	API Pumping Unit Stroke and Torque Factors
	320-213-120	API Rating Form for Crank Counterbalance
2-20-63	320-G256-120	API Pumping Unit Stroke and Torque Factors
		API Rating Form for Crank Counterbalance
*6-26-63	640-365-100	API Pumping Unit Stroke and Torque Factors
	456-365-100	API Rating Form for Crank Counterbalance
*6-26-63	640-304-120	API Pumping Unit Stroke and Torque Factors
	456-304-120	API Rating Form for Crank Counterbalance
2-20-63	640-365-120	API Pumping Unit Stroke and Torque Factors
	456-365-120	API Rating Form for Crank Counterbalance
2-20-63	640-356-144	API Pumping Unit Stroke and Torque Factors
		API Rating Form for Crank Counterbalance

Beam Balanced Pumping Unit

6-B21-24 through 57-B109-42

6-26-63

* Denotes Attached Sheets Superseding 2-20-63

TAB-API 6-10

TAB-API 16-25

*3-22-63	25 API	Engineering Data Dimensional Data

TAB-API 40-57

*3-22-63	40 API	Engineering Data Dimensional Data
*3-22-63	57 API	Engineering Data (89-42, 76-42, 89-36) Dimensional Data
*3-15-63	57 API	Engineering Data (109-48, 95-48, 109-42) Dimensional Data
2-20-63	57-89-36 40-89-36 40-67-36 25-67-36 40-56-36 25-56-36	Counterbalance Table - Maximum Stroke with #45 and #40 Main & Aux. Weights
2-20-63	57-89-36 40-89-36 40-67-36 25-67-36 40-56-36 25-56-36	Counterbalance Table- Maximum Stroke with #35 Main and #35 &35A Aux. Weights
2-20-63	57-89-42 40-89-42 57-76-42 40-76-42	Counterbalance Table - Maximum Stroke with #45 Main and #45 & #45A Aux. Weights
2-20-63	57-89-42 40-89-42 57-76-42 40-76-42	Counterbalance Table - Maximum Stroke with #40 Main and #40 & #40A Aux. Weights

TAB-API 80-114

*3-15-63	80 API	Engineering Data Dimensional Data
*6-26-63	80-109-42 57-109-42	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved

* Denotes Attached Sheets

6-26-63
Superseding 2-20-63

TAB-API 80-114 (Cont'd.)

*6-26-63	80-109-48 57-109-48 80-95-48 57-95-48	Counterbalance Table - Maximum Stroke Counterbalance Effect- As Weights are Moved
*3-4-63	114 API	Engineering Data Dimensional Data
*6-26-63	114-133-48 80-133-48	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved
*6-26-63	114-133-54 80-133-54 114-119-54 80-119-54	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved
*6-26-63	160-169-54 114-169-54	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved
*6-26-63	160-143-64 114-143-64	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved
*6-26-63	160-169-64 114-169-64	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved

TAB-160-228

*3- 4-63	160-API	Engineering Data Dimensional Data
*6-26-63	160-169-54 114-169-54	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved
*6-26-63	160-143-64 114-143-64	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved
*6-26-63	160-169-64 114-169-64	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved
*3- 4-63	228 API	Engineering Data Dimensional Data
7-23-62	228-200-64 160-200-64	Counterbalance Table - Maximum Stroke
8-22-62	228-200-64 160-200-64	Counterbalance Effect - As Weights are Moved

*Denotes Attached Sheets

6-26-63
Superseding 2-20-63

TAB-160-228 (Contd.)

*6-26-63	228-173-74 160-173-74	Counterbalance Table - Maximum Stroke with #68 and #50 Main and Filler Weights (Reverse-with #78 Main and Filler Weights)
8-22-62	228-173-74 160-173-74	Counterbalance Effect - As Weights are Moved
7-23-62	228-200-74 160-200-74	Counterbalance Table - Maximum Stroke
8-22-62	228-200-74 160-200-74	Counterbalance Effect - As Weights are Moved
*6-26-63	320-246-74 228-246-74	Counterbalance Table - Maximum Stroke
8-22-62	320-246-74 228-246-74	Counterbalance Effect - As Weights are Moved
*6-26-63	320-212-86 228-212-86	Counterbalance Table - Maximum Stroke
8-22-62	320-212-86 228-212-86	Counterbalance Effect - As Weights are Moved
7-23-62	320-246-86 228-246-86	Counterbalance Effect - Maximum Stroke - With #78 and #68 Main & Filler Weights
7-23-62	320-246-86 228-246-86	Counterbalance Effect - Maximum Stroke - with #50 Main & Filler Weights
8-22-62	320-246-86 228-246-86	Counterbalance Effect - As Weights are Moved - with #78 and #68 Main & Filler Weights
8-22-62	320-246-86 228-246-68	Counterbalance Effect - As Weights are Moved - with #50 Main & Filler Weights

TAB-API 320-456-640

*3- 4-63	320 API	Engineering Data Dimensional Data
*6-26-63	320-246-74 228-246-74	Counterbalance Table - Maximum Stroke
8-22-62	320-246-74 228-246-74	Counterbalance Effect - As Weights are Moved
*6-26-63	320-212-86 228-212-86	Counterbalance Table - Maximum Stroke

8-22-63	320-212-86 228-212-86	Counterbalance Effect - As Weights are Moved
7-23-62	320-246-86 228-246-86	Counterbalance Table - Maximum Stroke - with #78 and #68 Main & Filler Weights
7-23-62	320-246-86 228-246-86	Counterbalance Table - Maximum Stroke - with #50 Main & Filler Weights
8-22-62	320-246-86 228-246-86	Counterbalance Effect - As Weights are Moved - with #78 and #68 Main & Filler Weights
8-22-62	320-246-86 228-246-86	Counterbalance Effect - As Weights are Moved - with #50 Main & Filler Weights
*6-26-63	320-298-86	Counterbalance Table - Maximum Stroke - with #95 and #78 Main & Filler Weights (Reverse - with #68 Main & Filler Weights)
8-22-62	320-298-86	Counterbalance Effect - As Weights are Moved - with #95 and #78 Main & Filler Weights (Reverse - with #68 Main & Filler Weights)
*6-26-63	320-298-100 320-256-100	Counterbalance Table - Maximum Stroke - with #95 and #78 Main & Filler Weights (Reverse - with #68 Main & Filler Weights)
8-22-62	320-298-100 320-256-100	Counterbalance Effect - As Weights are Moved - with #95 and #78 Main & Filler Weights (Reverse - with #68 Main & Filler Weights)
*6-26-63	456-256-120 456-213-120 320-256-120 320-213-120	Counterbalance Table - Maximum Stroke - with #95 and #78 Main & Filler Weights (Reverse - with #68 Main & Filler Weights)
8-22-62	320-256-120 320-213-120	Counterbalance Effect - As Weights are Moved - with #95 and #78 Main & Filler Weights
8-22-62	320-256-120 320-213-120	Counterbalance Effect - As Weights are Moved - with #68 Main & Filler Weights
2-20-63	320-G256-120	Counterbalance Table - Maximum Stroke with #95 and #78 Main & Filler Weights (with Beam Weights)
2-20-63	320-G256-120	Counterbalance Table - Maximum Stroke with #68 and #50 Main & Filler Weights (with Beam Weights)
2-20-63	320-G256-120	Counterbalance Table - Maximum Stroke with #95 and #78 Main & Filler Weights (less Beam Weights)

*Denotes Attached Sheets

6-26-63
Superseding 2-20-63

TAB-API 320-456-640 (Contd.)

2-20-63	320-G256-120	Counterbalance Table - Maximum Stroke with #68 and #50 Main & Filler Weights (less Beam Weights)
2-20-63	320-G256-120	Counterbalance Effect - As Weights are Moved - with #95 and #78 Main & Filler Weights (with Beam Weights)
2-20-63	320-G256-120	Counterbalance Effect - As Weights are Moved - with #95 and #78 Main & Filler Weights (less Beam Weights)
*3-15-63	456 API	Engineering Data Dimensional Data
*3-15-63	640 API	Engineering Data Dimensional Data
*6-26-63	640-365-100 456-365-100	Counterbalance Table - Maximum Stroke Counterbalance Effect - As Weights are Moved
*6-26-63	640-304-120 456-304-120 456-256-120	Counterbalance Table - Maximum Stroke
2-20-63	640-365-120 456-365-120	Counterbalance Table - Maximum Stroke with #95 and #78 Main & Filler Weights
2-20-63	640-365-120 456-365-100	Counterbalance Table - Maximum Stroke with #OARO Weights
2-20-63	640-365-120 456-365-120	Counterbalance Effect - As Weights are Moved - with #95 and #78 Main & Filler Weights
2-20-63	640-365-120 456-365-120	Counterbalance Effect - As Weights are Moved - with #OARO Weights
2-20-63	640-356-144	Counterbalance Table - Maximum Stroke with #95 Main & Filler Weights
2-20-63	640-356-144	Counterbalance Table - Maximum Stroke with OARO Weights
2-20-63	640-356-144	Counterbalance Effect - As Weights are Moved - with #95 Main & Filler & #OARO Weights

TAB-General Information

12-26-62	GI-1	Sheave Sizes
12-26-62	GI-2	Sheave Sizes
12-26-62	GI-3	Sheave Sizes

* Denotes Attached Sheets

6-26-63
Superseding 2-20-63

TAB-General Information (Contd.)

12-26-62	GI-5	V-Belt Centers
12-26-62	GI-6	V-Belt Centers
12-26-62	GI-7	V-Belt Centers
12-26-62	GI-8	V-Belt Centers
12-26-62	GI-11	V-Belt Drives for Minimum Belt Centers
12-26-62	GI-12	V-Belt Drives for Minimum Belt Centers
12-26-62	GI-13	V-Belt Drives for Minimum Belt Centers
12-26-62	GI-14	V-Belt Drives for Minimum Belt Centers
12-26-62	GI-15	V-Belt Drives for Minimum Belt Centers
12-26-62	GI-16	V-Belt Drives for Minimum Belt Centers
12-26-62	GI-17	V-Belt Drives for Minimum Belt Centers
12-26-62	GI-20	Memo on Wrist Pin Interchangeability
12-26-62	GI-21	Wrist Pin Interchangeability Chart
12-26-62	GI-22	Wrist Pin Interchangeability Chart
12-26-62	GI-23	Wrist Pin Interchangeability Chart

TAB-Operating and Maintenance

Bul. #T-628 Installation - Operation - Lubrication

25-53-24

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES			TORQUE FACTOR (3)(4) LENGTH OF STROKE - INCHES		
	24"	16"		24"	16"	
0	0.000	0.000		0.17	0.00	
15	0.019	0.020		3.81	2.41	
30	0.080	0.077		7.43	4.60	
45	0.174	0.166		10.16	6.33	
60	0.291	0.278		11.71	7.46	
75	0.418	0.404		12.12	7.94	
90	0.545	0.532		11.63	7.85	
105	0.663	0.655		10.55	7.29	
120	0.767	0.766		9.13	6.37	
135	0.856	0.860		7.48	5.17	
150	0.925	0.932		5.61	3.74	
165	0.974	0.980		3.48	2.11	
180	0.998	1.000		1.01	0.32	
195	0.994	0.989		- 1.81	- 1.58	
210	0.959	0.948		- 4.84	- 3.48	
225	0.892	0.878		- 7.75	- 5.24	
240	0.796	0.780		-10.16	- 6.70	
255	0.679	0.663		-11.80	- 7.71	
270	0.549	0.534		-12.57	- 8.20	
285	0.415	0.401		-12.47	- 8.11	
300	0.287	0.275		-11.54	- 7.45	
315	0.173	0.163		- 9.79	- 6.23	
330	0.082	0.076		- 7.24	- 4.51	
345	0.022	0.019		- 3.97	- 2.38	

(1) Position of crank is the angular displacement measured clockwise from the 12 o'clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) − M SIN θ

Where θ = Position of Crank Degrees (See Col. 1 above)
M = Maximum Moment of Counterbalance (See Page 4)
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.
B = Structural Unbalance = 200#
$\overline{TF}$ = Torque Factor Corresponding to θ.

40-67-30
25-67-30

25-53-30
25-43-30

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE • INCHES			TORQUE FACTOR (3)(4) LENGTH OF STROKE • INCHES		
	30"	20"		30"	20"	
0	0.000	0.000		- 0.21	- 0.00	
15	0.019	0.020		4.76	3.01	
30	0.080	0.077		9.28	5.75	
45	0.174	0.166		12.70	7.91	
60	0.291	0.278		14.64	9.32	
75	0.418	0.404		15.14	9.93	
90	0.545	0.532		14.53	9.81	
105	0.663	0.655		13.19	9.11	
120	0.767	0.766		11.41	7.96	
135	0.856	0.860		9.35	6.46	
150	0.925	0.932		7.01	4.68	
165	0.974	0.980		4.35	2.64	
180	0.998	1.000		1.26	0.40	
195	0.994	0.989		- 2.26	- 1.98	
210	0.959	0.948		- 6.05	- 4.36	
225	0.892	0.878		- 9.69	- 6.55	
240	0.796	0.780		-12.70	- 8.37	
255	0.679	0.663		-14.75	- 9.64	
270	0.549	0.534		-15.71	-10.25	
285	0.415	0.401		-15.59	-10.14	
300	0.287	0.275		-14.42	- 9.31	
315	0.173	0.163		-12.23	- 7.79	
330	0.082	0.076		- 9.05	- 5.64	
345	0.022	0.019		- 4.97	- 2.80	

(1) Position of crank is the angular displacement measured clockwise from the 12 o' clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) − M SIN θ

Where θ = Position of Crank Degrees (See Col. 1 above)
M = Maximum Moment of Counterbalance (See Page 4)
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.
B = Structural Unbalance = 150#
$\overline{TF}$ = Torque Factor Corresponding to θ.

57-89-36 40-67-36 40-56-36
40-89-36 25-67-36 25-56-36

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES			TORQUE FACTOR (3)(4) LENGTH OF STROKE - INCHES		
	36"	28"	20"	36"	28"	20"
0	0.000	0.000	0.000	- 0.73	- 0.28	- 0.06
15	0.018	0.019	0.019	5.79	4.39	3.01
30	0.081	0.080	0.077	11.85	8.65	5.81
45	0.181	0.175	0.168	16.33	11.92	8.03
60	0.306	0.294	0.282	18.57	13.80	9.45
75	0.438	0.425	0.410	18.69	14.30	10.03
90	0.566	0.554	0.540	17.37	13.68	9.86
105	0.681	0.674	0.663	15.30	12.32	9.07
120	0.781	0.779	0.774	12.92	10.52	7.85
135	0.863	0.866	0.866	10.44	8.44	6.29
150	0.927	0.934	0.936	7.85	6.14	4.49
165	0.973	0.979	0.982	5.01	3.61	2.48
180	0.997	0.999	1.000	1.74	0.79	0.30
195	0.996	0.992	0.989	- 2.12	- 2.30	- 1.99
210	0.966	0.956	0.948	- 6.50	- 5.55	- 4.27
225	0.904	0.891	0.879	-10.96	- 8.69	- 6.40
240	0.813	0.798	0.783	-14.81	-11.40	- 8.19
255	0.698	0.683	0.668	-17.51	-13.35	- 9.48
270	0.569	0.555	0.540	-18.88	-14.39	-10.14
285	0.435	0.422	0.407	-18.93	-14.42	-10.11
300	0.305	0.293	0.280	-17.74	-13.45	- 9.35
315	0.188	0.178	0.167	-15.32	-11.48	- 7.87
330	0.092	0.085	0.078	-11.64	- 8.54	- 5.74
345	0.027	0.023	0.021	- 6.72	- 4.73	- 3.07

(1) Position of crank is the angular displacement measured clockwise from the 12 o' clock position, viewed with the well head to the right.

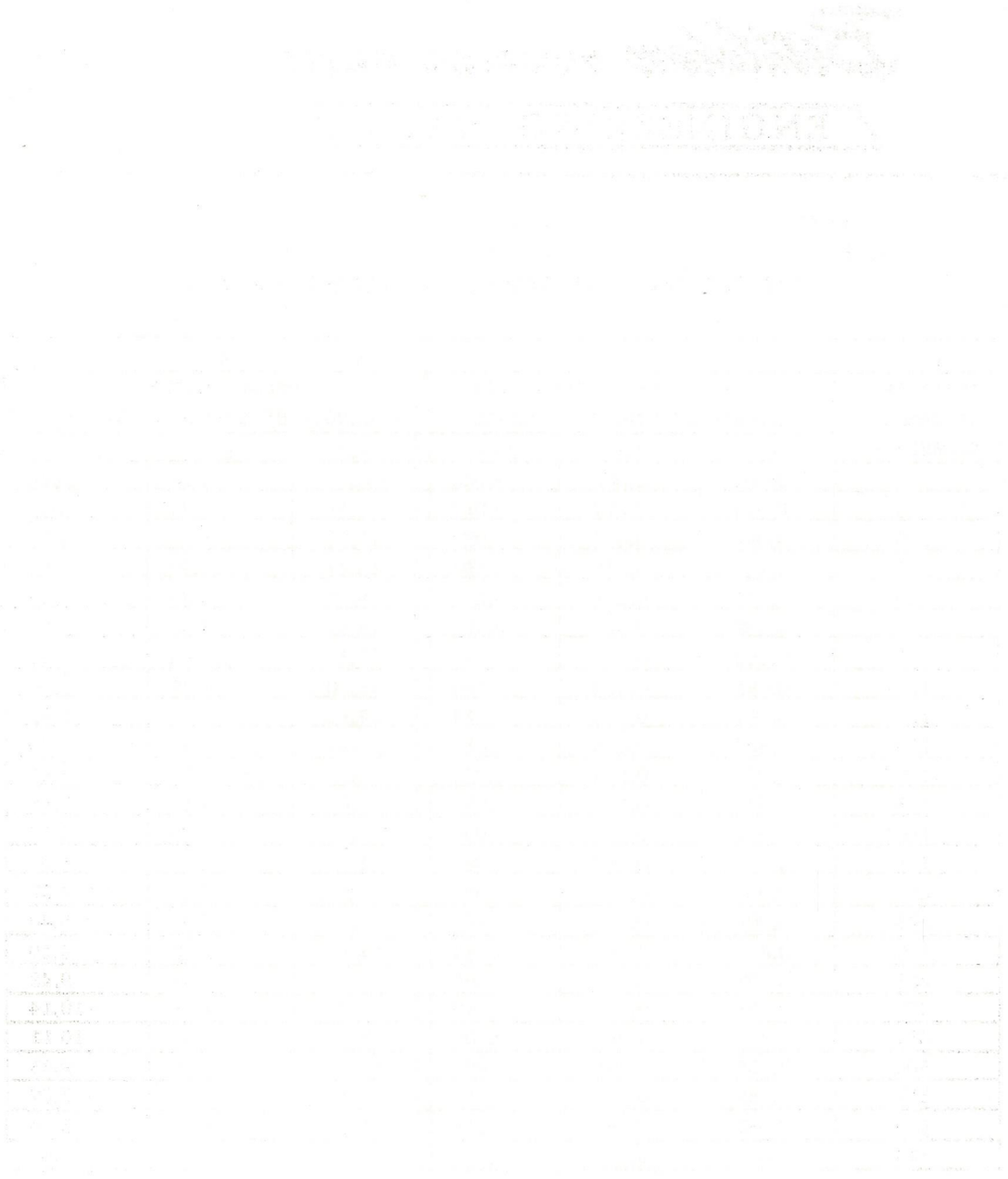
(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) $-$ M SIN θ

Where θ = Position of Crank Degrees (See Col. 1 above)
M = Maximum Moment of Counterbalance (See Page 4)
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.
B = Structural Unbalance = 275#
$\overline{TF}$ = Torque Factor Corresponding to θ.



57-89-42
~~40~~-89-42

57-76-42
40-76-42

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES			TORQUE FACTOR (3)(4) LENGTH OF STROKE - INCHES		
	42"	33"	23"	42"	33"	23"
0	0.000	0.000	0.000	- 0.85	- 0.32	- 0.07
15	0.018	0.019	0.019	6.76	5.12	3.52
30	0.081	0.080	0.077	13.82	10.10	6.78
45	0.181	0.175	0.168	19.05	13.91	9.37
60	0.306	0.294	0.282	21.66	16.10	11.03
75	0.438	0.425	0.410	21.81	16.68	11.71
90	0.566	0.554	0.540	20.27	15.96	11.50
105	0.681	0.674	0.663	17.85	14.37	10.59
120	0.781	0.779	0.774	15.08	12.27	9.15
135	0.863	0.866	0.866	12.18	9.85	7.34
150	0.927	0.934	0.936	9.16	7.17	5.23
165	0.973	0.979	0.982	5.85	4.21	2.89
180	0.997	0.999	1.000	2.03	0.92	0.35
195	0.996	0.992	0.989	- 2.47	- 2.68	- 2.32
210	0.966	0.956	0.948	- 7.59	- 6.47	- 4.98
225	0.904	0.891	0.879	- 12.79	- 10.14	- 7.46
240	0.813	0.798	0.783	- 17.28	- 13.30	- 9.56
255	0.698	0.683	0.668	- 20.43	- 15.58	- 11.06
270	0.569	0.555	0.540	- 22.02	- 16.78	- 11.84
285	0.435	0.422	0.407	- 22.08	- 16.82	- 11.79
300	0.305	0.293	0.280	- 20.70	- 15.69	- 10.91
315	0.188	0.178	0.167	- 17.87	- 13.39	- 9.19
330	0.092	0.085	0.078	- 13.58	- 9.96	- 6.70
345	0.027	0.023	0.021	- 7.84	- 5.51	- 3.59

(1) Position of crank is the angular displacement measured clockwise from the 12 o' clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) − M SIN θ

Where θ = Position of Crank Degrees (See Col. 1 above)
M = Maximum Moment of Counterbalance (See Page 4)
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.
B = Structural Unbalance = 150#
$\overline{TF}$ = Torque Factor Corresponding to θ.

80-109-42
57-109-42

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES			TORQUE FACTOR (3)(4) LENGTH OF STROKE - INCHES		
	42"	32"	22"	42"	32"	22"
0	0.000	0.000	0.000	- 1.04	- 0.41	- 0.10
15	0.017	0.018	0.019	6.65	4.95	3.27
30	0.080	0.079	0.076	13.86	9.87	6.35
45	0.181	0.174	0.166	19.22	13.66	8.80
60	0.307	0.294	0.281	21.89	15.85	10.40
75	0.440	0.425	0.408	22.01	16.44	11.07
90	0.569	0.555	0.539	20.39	15.73	10.90
105	0.685	0.676	0.663	17.87	14.15	10.05
120	0.784	0.781	0.774	15.02	12.04	8.68
135	0.866	0.869	0.867	12.06	9.61	6.94
150	0.930	0.935	0.937	8.99	6.95	4.93
165	0.974	0.980	0.982	5.68	4.02	2.68
180	0.997	0.999	1.000	1.89	0.81	0.27
195	0.996	0.992	0.988	- 2.54	- 2.69	- 2.24
210	0.966	0.956	0.947	- 7.53	- 6.34	- 4.73
225	0.905	0.890	0.877	- 12.62	- 9.87	- 7.04
240	0.814	0.798	0.782	- 17.06	- 12.92	- 8.98
255	0.701	0.684	0.667	- 20.24	- 15.15	- 10.39
270	0.573	0.557	0.540	- 21.90	- 16.36	- 11.12
285	0.440	0.424	0.408	- 22.04	- 16.45	- 11.09
300	0.310	0.295	0.281	- 20.74	- 15.38	- 10.27
315	0.192	0.180	0.168	- 18.00	- 13.17	- 8.66
330	0.095	0.087	0.079	- 13.77	- 9.83	- 6.33
345	0.028	0.024	0.021	- 8.05	- 5.49	- 3.41

(1) Position of crank is the angular displacement measured clockwise from the 12 o' clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) $-$M SIN θ

Where θ = Position of Crank Degrees (See Col. 1 above)

M = Maximum Moment of Counterbalance (See Page 4)

W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.

B = Structural Unbalance = 500#

$\overline{TF}$ = Torque Factor Corresponding to θ.

80-109-48
57-109-48

80-95-48
57-95-48

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES			TORQUE FACTOR (3)(4) LENGTH OF STROKE - INCHES		
	48"	37"	25"	48"	37"	25"
0	0.000	0.000	0.000	- 1.19	- 0.46	- 0.12
15	0.017	0.018	0.019	7.60	5.65	3.74
30	0.080	0.079	0.076	15.84	11.28	7.26
45	0.181	0.174	0.166	21.96	15.61	10.06
60	0.307	0.294	0.281	25.02	18.12	11.89
75	0.440	0.425	0.408	25.16	18.79	12.65
90	0.569	0.555	0.539	23.30	17.98	12.46
105	0.685	0.676	0.663	20.43	16.17	11.48
120	0.784	0.781	0.774	17.16	13.76	9.92
135	0.866	0.869	0.867	13.78	10.99	7.94
150	0.930	0.935	0.937	10.28	7.94	5.63
165	0.974	0.980	0.982	6.49	4.60	3.07
180	0.997	0.999	1.000	2.16	0.92	0.31
195	0.996	0.992	0.988	- 2.90	- 3.07	- 2.55
210	0.966	0.956	0.947	- 8.61	- 7.25	- 5.40
225	0.905	0.890	0.877	- 14.42	- 11.28	- 8.04
240	0.814	0.798	0.782	- 19.50	- 14.77	- 10.27
255	0.701	0.684	0.667	- 23.13	- 17.32	- 11.87
270	0.573	0.557	0.540	- 25.02	- 18.70	- 12.71
285	0.440	0.424	0.408	- 25.19	- 18.79	- 12.68
300	0.310	0.295	0.281	- 23.70	- 17.58	- 11.74
315	0.192	0.180	0.168	- 20.57	- 15.04	- 9.90
330	0.095	0.087	0.079	- 15.74	- 11.24	- 7.23
345	0.028	0.024	0.021	- 9.20	- 6.28	- 3.89

(1) Position of crank is the angular displacement measured clockwise from the 12 o' clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) $-M \sin \theta$

Where θ = Position of Crank Degrees (See Col. 1 above)
M = Maximum Moment of Counterbalance (See Page 4)
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.
B = Structural Unbalance = 400#
$\overline{TF}$ = Torque Factor Corresponding to θ.

Bethlehem API PUMPING UNITS

ENGINEERING DATA

320-212-86

228-212-86

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7	8	9
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES				TORQUE FACTOR (3) (4) LENGTH OF STROKE - INCHES			
	86	74	62	51	86	74	62	51
0	.000	.000	.000	.000	- 2.28	- 1.39	- 0.78	- 0.38
15	.017	.018	.018	.019	13.52	11.56	9.60	7.66
30	.080	.079	.078	.077	28.37	23.59	19.15	15.02
45	.181	.177	.173	.169	39.40	32.69	26.51	20.81
60	.307	.300	.293	.285	44.82	37.62	30.84	24.44
75	.441	.433	.424	.414	44.96	38.44	32.05	25.80
90	.570	.562	.554	.545	41.53	36.20	30.74	25.16
105	.686	.681	.675	.668	36.33	32.14	27.69	23.00
120	.785	.784	.781	.777	30.49	27.16	23.59	19.77
135	.866	.868	.869	.868	24.49	21.72	18.83	15.79
150	.929	.933	.936	.937	18.31	15.91	13.57	11.24
165	.974	.978	.980	.982	11.62	9.57	7.80	6.23
180	.997	.999	.999	1.000	3.97	2.48	1.47	0.81
195	.996	.994	.991	.989	- 5.04	- 5.47	- 5.38	- 4.90
210	.966	.960	.955	.950	-15.26	-14.04	-12.48	-10.66
225	.905	.897	.889	.881	-25.76	-22.52	-19.33	-16.06
240	.815	.806	.796	.787	-34.81	-29.88	-25.21	-20.66
255	.702	.693	.683	.673	-41.27	-35.23	-29.53	-24.00
270	.574	.565	.555	.546	-44.62	-38.11	-31.85	-25.78
285	.441	.432	.423	.413	-44.92	-38.37	-32.01	-25.80
300	.311	.303	.294	.286	-42.30	-36.03	-29.92	-23.98
315	.193	.186	.179	.172	-36.77	-31.08	-25.60	-20.34
330	.096	.091	.086	.082	-28.22	-23.52	-19.11	-14.98
345	.029	.026	.024	.022	-16.61	-13.46	-10.66	- 8.17
		MAXIMUM TORQUE FACTORS						
64.9	.377				45.46			
276.1	.496				-45.16			

(1) Position of crank is the angular displacement measured clockwise from the 12 o'clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) - M SIN θ

Where θ = Position of Crank Degrees (See Col. 1 above)

M = Maximum Moment of Counterbalance (See Page 4)

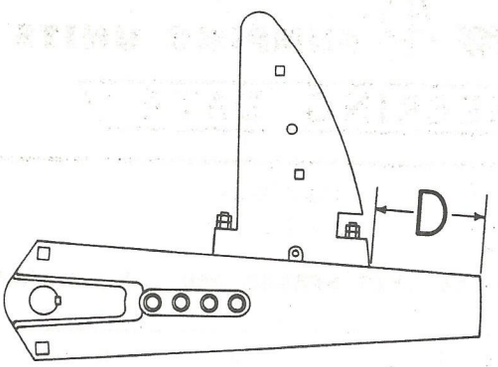
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.

B = Structural Unbalance = 500#

$\overline{TF}$ = Torque Factor Corresponding to θ.

320-212-86
228-212-86

API RATING FORM FOR CRANK COUNTERBALANCE



TWO #7478-B CRANKS - TOTAL WEIGHT - 4650# MOMENT - 183,117"#

ABOVE TOTAL WEIGHT AND MOMENT OF TWO #7478-B CRANKS IS INCLUDED IN FIGURES SHOWN BELOW

Distance "D" Counterweights From End Of Crank	4 Main Weights #78		One Filler Weight #78		4 Main Weights and 12 Filler Weights #78	
	Total Weight	Total Moment	Total Weight	Total Moment	Total Weight	Total Moment
0"	7,830	378,687	5,055	207,781	12,690	674,661
6"	"	359,607	"	205,351	"	626,421
12"	"	340,527	"	202,921	"	578,181
18"	"	321,447	"	200,491	"	529,941
24"	"	302,367	"	198,061	"	481,701
30"	"	283,287	"	195,631	"	433,461
36"	"	264,207	"	193,201	"	385,221
42"	"	245,127	"	190,771	"	336,981
46" (Max.)	"	232,407	"	189,151	"	304,821

Distance "D" Counterweights From End Of Crank	4 Main Weights #68		One Filler Weight #68		4 Main Weights and 12 Filler Weights #68	
	Total Weight	Total Moment	Total Weight	Total Moment	Total Weight	Total Moment
0"	7,590	366,867	4,948	201,369	11,166	585,897
6"	"	349,227	"	199,581	"	546,801
12"	"	331,587	"	197,793	"	507,705
18"	"	313,947	"	196,005	"	468,609
24"	"	296,307	"	194,217	"	429,513
30"	"	278,667	"	192,429	"	309,417
36"	"	261,027	"	190,641	"	351,321
42"	"	243,387	"	188,853	"	312,225
48"	"	225,747	"	187,065	"	273,129

NOTE: To obtain moment of one filler weight deduct moment of cranks (118,117"#) from total moment of one filler weight.

640-365-100
456-365-100

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7	8	9
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES				TORQUE FACTOR (3) (4) LENGTH OF STROKE - INCHES			
	100	85	70	56	100	85	70	56
0	0.000	0.000	0.000	0.000	- 2.25	- 1.30	- 0.67	- 0.28
15	0.018	0.018	0.019	0.019	15.60	13.18	10.77	8.40
30	0.080	0.080	0.079	0.077	32.26	26.54	21.24	16.33
45	0.181	0.177	0.173	0.168	44.61	36.65	29.33	22.58
60	0.306	0.299	0.291	0.283	50.73	42.18	34.14	26.56
75	0.439	0.431	0.421	0.411	50.98	43.20	35.58	28.13
90	0.567	0.560	0.551	0.542	47.24	40.83	34.26	27.55
105	0.683	0.678	0.672	0.665	41.46	36.39	30.99	25.29
120	0.782	0.781	0.779	0.775	34.93	30.87	26.50	21.81
135	0.864	0.866	0.867	0.866	28.17	24.77	21.21	17.47
150	0.928	0.932	0.935	0.936	21.16	18.19	15.32	12.46
165	0.973	0.977	0.980	0.981	13.53	10.99	8.82	6.91
180	0.997	0.999	0.999	1.000	4.76	2.91	1.68	0.89
195	0.996	0.994	0.991	0.989	- 5.61	- 6.16	- 6.04	- 5.44
210	0.967	0.960	0.954	0.949	-17.43	-15.95	-14.04	-11.79
225	0.906	0.896	0.888	0.880	-29.52	-25.61	-21.72	-17.74
240	0.815	0.805	0.795	0.786	-40.00	-33.98	-28.31	-22.77
255	0.701	0.691	0.681	0.671	-47.41	-40.05	-33.11	-26.42
270	0.572	0.563	0.553	0.543	-51.19	-43.26	-35.68	-28.32
285	0.438	0.429	0.420	0.410	-51.43	-43.48	-35.78	-28.28
300	0.308	0.300	0.291	0.283	-48.28	-40.71	-33.35	-26.21
315	0.191	0.184	0.177	0.170	-41.81	-34.98	-28.42	-22.14
330	0.094	0.089	0.084	0.080	-31.91	-26.32	-21.09	-16.22
345	0.028	0.025	0.023	0.021	-18.57	-14.90	-11.64	- 8.75
MAXIMUM TORQUE FACTORS								
65.2	0.378				51.49			
275.6	0.496				-51.75			

(1) Position of crank is the angular displacement measured clockwise from the 12 o' clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

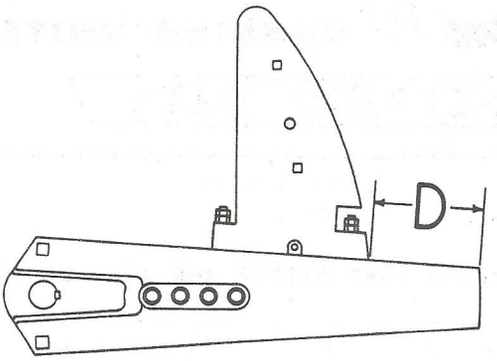
(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) $-M \sin \theta$

Where θ = Position of Crank Degrees (See Col. 1 above)
M = Maximum Moment of Counterbalance (See Page 4)
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.
B = Structural Unbalance = 700#
$\overline{TF}$ = Torque Factor Corresponding to θ.

640-365-100
456-365-100

API RATING FORM FOR CRANK COUNTERBALANCE



TWO #8495-B CRANKS - TOTAL WEIGHT - 7020# - MOMENT - 324,675#

ABOVE TOTAL WEIGHT AND MOMENT OF TWO #8495-B CRANKS IS INCLUDED IN FIGURES SHOWN BELOW

Distance "D" Counterweights From End Of Crank	4 Main Weights #95		One Filler Weight #95		4 Main Weights and 12 Filler Weights #95	
	Total Weight	Total Moment	Total Weight	Total Moment	Total Weight	Total Moment
0"	11,700	687,843	7,515	362,641	17,640	1,143,443
12"	"	631,683	"	356,701	"	1,016,001
18"	"	603,603	"	353,731	"	952,281
24"	"	575,523	"	350,761	"	888,561
30"	"	547,443	"	347,791	"	824,841
36"	"	519,363	"	344,821	"	761,121
42"	"	491,283	"	341,851	"	697,401
48"	"	463,203	"	338,881	"	633,681
54"	"	435,123	"	335,911	"	569,961
60" (Max.)	"	407,043	"	332,941	"	506,241

Distance "D" Counterweights Fron End Of Crank	4 Main Weights #78		One Filler Weight #78		4 Main Weights and 12 Filler Weights #78	
	Total Weight	Total Moment	Total Weight	Total Moment	Total Weight	Total Moment
1-1/4"	10,200	571,443	7,425	355,860	15,060	945,663
6"	"	556,338	"	353,936	"	907,473
12"	"	537,258	"	351,506	"	859,233
18"	"	518,178	"	349,076	"	810,993
24"	"	499,098	"	346,646	"	762,753
30"	"	480,018	"	344,216	"	714,513
36"	"	460,938	"	341,786	"	666,273
42"	"	441,858	"	339,356	"	618,033
48"	"	422,778	"	336,926	"	569,793
54"	"	403,698	"	334,496	"	521,553
60"	"	384,618	"	332,066	"	473,313
62" (Max.)	"	374,283	"	330,750	"	447,183

NOTE: To obtain moment of one filler weight deduct moment of cranks (324,675"#) from total moment of one filler weight.

6-26-63

640-304-120
456-304-120

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7	8	9
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES				TORQUE FACTOR (3) (4) LENGTH OF STROKE - INCHES			
	120	102	85	67	120	102	85	67
0	0.000	0.000	0.000	0.000	- 2.70	- 1.56	- 0.80	- 0.34
15	0.018	0.018	0.019	0.019	18.74	15.83	12.94	10.09
30	0.080	0.080	0.079	0.077	38.77	31.89	25.52	19.62
45	0.181	0.177	0.173	0.168	53.60	44.03	35.24	27.13
60	0.306	0.299	0.291	0.283	60.95	50.68	41.02	31.92
75	0.439	0.431	0.421	0.411	61.25	51.91	42.75	33.80
90	0.567	0.560	0.551	0.542	56.76	49.06	41.16	33.10
105	0.683	0.678	0.672	0.665	49.82	43.73	37.24	30.38
120	0.782	0.781	0.779	0.775	41.97	37.09	31.84	26.21
135	0.864	0.866	0.867	0.866	33.85	29.76	25.49	20.99
150	0.928	0.932	0.935	0.936	25.42	21.86	18.41	14.97
165	0.973	0.977	0.980	0.981	16.26	13.21	10.60	8.30
180	0.997	0.999	0.999	1.000	5.72	3.50	2.02	1.07
195	0.996	0.994	0.991	0.989	- 6.74	- 7.40	- 7.25	- 6.53
210	0.967	0.960	0.954	0.949	-20.94	-19.16	-16.87	-14.17
225	0.906	0.896	0.888	0.880	-35.47	-30.78	-26.09	-21.31
240	0.815	0.805	0.795	0.786	-48.07	-40.83	-34.01	-27.36
255	0.701	0.691	0.681	0.671	-56.96	-48.12	-39.79	-31.74
270	0.572	0.563	0.553	0.543	-61.51	-51.98	-42.87	-34.03
285	0.438	0.429	0.420	0.410	-61.79	-52.24	-42.99	-33.98
300	0.308	0.300	0.291	0.283	-58.02	-48.92	-40.08	-31.50
315	0.191	0.184	0.177	0.170	-50.24	-42.04	-34.15	-26.61
330	0.094	0.089	0.084	0.080	-38.35	-31.63	-25.34	-19.49
345	0.028	0.025	0.023	0.201	-22.32	-17.90	-13.98	-10.52
MAXIMUM TORQUE FACTORS								
65.2	0.378				61.87			
275.6	0.496				-62.18			

(1) Position of crank is the angular displacement measured clockwise from the 12 o' clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

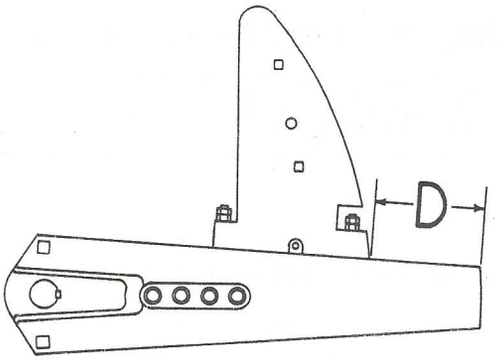
(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) $-$ M SIN θ

Where θ = Position of Crank Degrees (See Col. 1 above)
M = Maximum Moment of Counterbalance (See Page 4)
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.
B = Structural Unbalance = 200#
$\overline{TF}$ = Torque Factor Corresponding to θ.

640-304-120
456-304-120

API RATING FORM FOR CRANK COUNTERBALANCE



TWO #8495-B CRANKS - TOTAL WEIGHT - 7020# - MOMENT - 324,675"#

ABOVE TOTAL WEIGHT AND MOMENT OF TWO #8495-B CRANKS IS INCLUDED IN FIGURES SHOWN BELOW

Distance "D" Counterweights From End Of Crank	4 Main Weights #95		One Filler Weight #95		4 Main Weights and 12 Filler Weights #95	
	Total Weight	Total Moment	Total Weight	Total Moment	Total Weight	Total Moment
0"	11,700	687,843	7,515	362,641	17,640	1,143,443
6"	"	659,763	"	359,671	"	1,079,721
12"	"	631,683	"	356,701	"	1,016,001
18"	"	603,603	"	353,731	"	952,281
24"	"	575,523	"	350,761	"	888,561
30"	"	547,443	"	347,791	"	824,841
36"	"	519,363	"	344,821	"	761,121
42"	"	491,283	"	341,851	"	697,401
48"	"	463,203	"	338,881	"	633,681
54"	"	435,123	"	335,911	"	569,961
60" (Max.)	"	407,043	"	332,941	"	506,241

Distance "D" Counterweights From End Of Crank	4 Main Weights #78		One Filler Weight #78		4 Main Weights and 12 Filler Weights #78	
	Total Weight	Total Moment	Total Weight	Total Moment	Total Weight	Total Moment
1-1/4"	10,200	571,443	7,425	355,860	15,060	945,663
6"	"	556,338	"	353,936	"	907,473
12"	"	537,258	"	351,506	"	859,233
18"	"	518,178	"	349,076	"	810,993
24"	"	499,098	"	346,646	"	762,753
30"	"	480,018	"	344,216	"	714,513
36"	"	460,938	"	341,786	"	666,273
42"	"	441,858	"	339,356	"	618,033
48"	"	422,778	"	336,926	"	569,793
54"	"	403,698	"	334,496	"	521,553
60"	"	384,618	"	332,066	"	473,313
62" (Max.)	"	374,283	"	330,750	"	447,183

NOTE: To obtain moment of one filler weight, deduct moment of cranks (324,675"#) from total moment of one filler weight.

6-26-63

640-356-144
640-304-144

API PUMPING UNIT STROKE AND TORQUE FACTORS

1	2	3	4	5	6	7	8	9
POSITION OF CRANK DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE - INCHES				TORQUE FACTOR (3) (4) LENGTH OF STROKE - INCHES			
	144	124	106	88	144	124	106	88
0	0.000	0.000	0.000	0.000	- 3.69	- 2.31	- 1.34	- 0.69
15	0.017	0.018	0.018	0.019	22.22	19.18	16.13	13.11
30	0.079	0.079	0.078	0.077	46.54	39.13	32.21	25.75
45	0.180	0.177	0.173	0.169	64.60	54.21	44.60	35.68
60	0.306	0.299	0.292	0.285	73.54	62.39	51.85	41.87
75	0.439	0.431	0.423	0.414	73.91	63.80	53.87	44.14
90	0.567	0.561	0.553	0.545	68.47	60.16	51.66	43.00
105	0.683	0.679	0.674	0.668	60.09	53.52	46.58	39.28
120	0.782	0.782	0.780	0.777	50.60	45.34	39.73	33.77
135	0.864	0.867	0.868	0.867	40.77	36.36	31.79	27.01
150	0.929	0.932	0.935	0.936	30.56	26.71	22.98	19.30
165	0.974	0.977	0.980	0.981	19.42	16.12	13.29	10.76
180	0.997	0.999	0.999	1.000	6.59	4.23	2.60	1.49
195	0.996	0.994	0.992	0.990	- 8.51	- 9.15	- 9.02	- 8.32
210	0.965	0.960	0.955	0.950	-25.60	-23.57	-21.08	-18.22
225	0.904	0.896	0.889	0.882	-42.90	-37.76	-32.67	-27.53
240	0.813	0.804	0.796	0.788	-57.76	-49.96	-42.59	-35.41
255	0.699	0.691	0.682	0.673	-68.19	-58.74	-49.79	-41.13
270	0.571	0.563	0.555	0.546	-73.52	-63.37	-53.62	-44.14
285	0.438	0.431	0.422	0.414	-73.86	-63.70	-53.81	-44.14
300	0.309	0.302	0.294	0.286	-69.46	-59.75	-50.27	-41.03
315	0.192	0.185	0.179	0.173	-60.33	-51.52	-43.02	-34.82
330	0.095	0.091	0.086	0.082	-46.28	-38.99	-32.13	-25.68
345	0.029	0.026	0.024	0.022	-27.21	-22.33	-17.95	-14.04
		MAXIMUM TORQUE FACTORS						
65.2	0.378				74.65			
275.7	0.495				-74.30			

(1) Position of crank is the angular displacement measured clockwise from the 12 o' clock position, viewed with the well head to the right.

(2) Position is expressed as a fraction (percentage) of stroke above lowermost position.

(3) Torque factor = $\frac{T}{W}$ where T = torque on pumping-unit reducer due to polished rod load W.

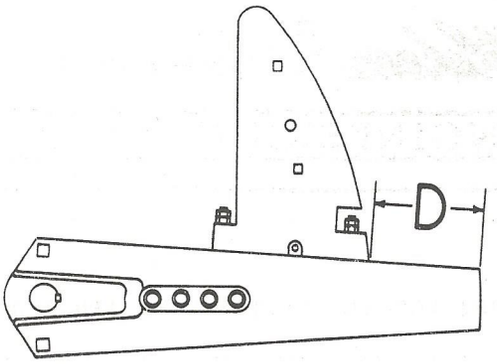
(4) Negative signs on torque factor indicate a clockwise torque on crankshaft.

NET REDUCER TORQUE = $\overline{TF}$ (W-B) $-M \sin \theta$

Where θ = Position of Crank Degrees (See Col. 1 above)
M = Maximum Moment of Counterbalance (See Page 4)
W = Measured Polish Rod Load (Lbs.) At Position Of Rods Corresponding to θ.
B = Structural Unbalance = 500#
$\overline{TF}$ = Torque Factor Corresponding to θ.

640-356-144

API RATING FORM FOR CRANK COUNTERBALANCE



TWO #94110-B CRANKS - TOTAL WEIGHT - 8700# MOMENT - 463,275"#

ABOVE TOTAL WEIGHT AND MOMENT OF TWO #94110-B CRANKS IS INCLUDED IN FIGURES SHOWN BELOW

Distance "D" Counterweights From End Of Crank	4 Main Weights #95		One Filler Weight #95		4 Main Weights and 16 Filler Weights #95	
	Total Weight	Total Moment	Total Weight	Total Moment	Total Weight	Total Moment
0"	13,380	896,643	9,195	508,666	21,300	1,622,907
12"	"	840,483	"	502,726	"	1,471,707
24"	"	784,323	"	496,786	"	1,320,507
36"	"	728,163	"	490,846	"	1,169,307
48"	"	672,003	"	484,906	"	1,018,107
60"	"	615,843	"	478,966	"	866,907
72"	"	559,683	"	473,026	"	715,707
75" (Max.)	"	545,643	"	471,541	"	677,907

Distance "D" Counterweights From End Of Crank	4 - OARO Weights		4 - OARO Plus 4 - OAS		4 - OARO Plus 4 - OAD	
	Total Weight	Total Moment	Total Weight	Total Moment	Total Weight	Total Moment
0"	19,500	1,373,715	22,844	1,655,447	26,188	1,937,179
12"	"	1,244,115	"	1,485,719	"	1,727,323
24"	"	1,144,515	"	1,315,991	"	1,517,467
36"	"	984,915	"	1,146,263	"	1,307,611
48"	"	855,315	"	976,535	"	1,097,755
60"	"	725,715	"	806,807	"	887,899
72"	"	596,115	"	637,079	"	678,043
80" (Max.)	"	509,715	"	523,927	"	538,139

NOTE: To obtain moment of one filler weight, deduct moment of cranks (463,275"#) from total moment of one filler weight.

2/20/63