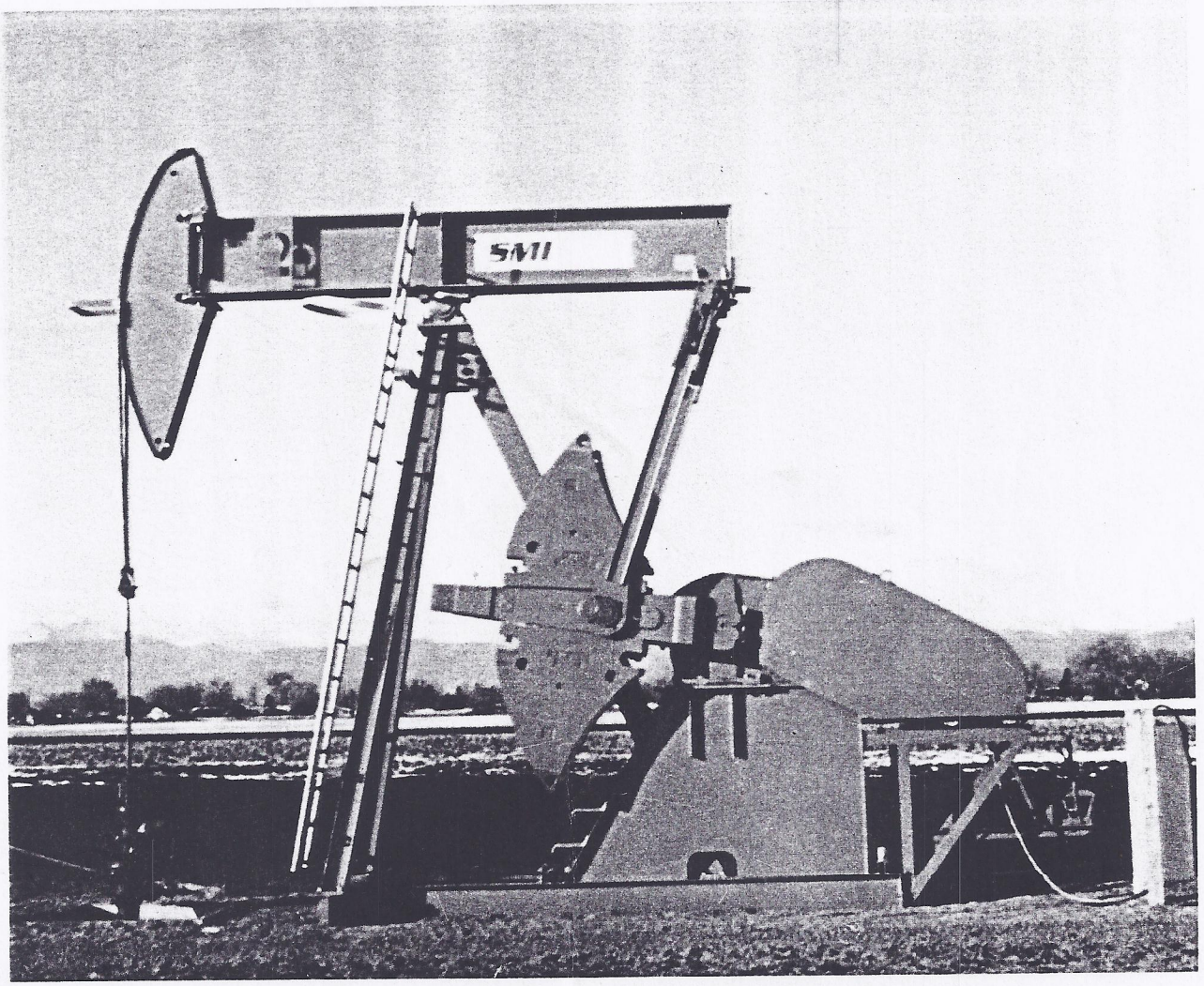
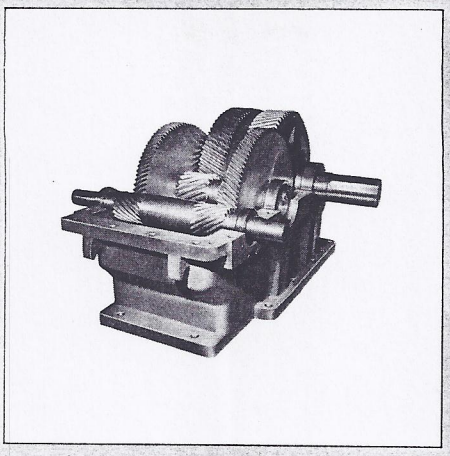
SM INDUSTRIES, INC.

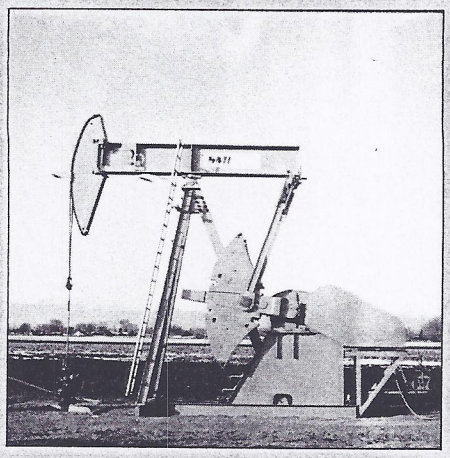
SMI Pumping Units

Unique Features
Outstanding Performance



SMI





Introducing . . .

SMI specializes in the design, manufacturing, sales and service of oilfield pumping units.

The pumping units built by SMI feature the proven design of approximately 2000 units working in the U.S. and approximately 5,700 more units working worldwide in major oilfields.

As a company incorporated and with headquarters in the State of Colorado, SMI is committed to supply a quality product and provide timely and competent service.

SMI Pumping Units

The sucker rod pumping system is the most widely used and preferred system for producing oil by artificial means due to its simplicity, reliability and nearly maintenance-free operation.

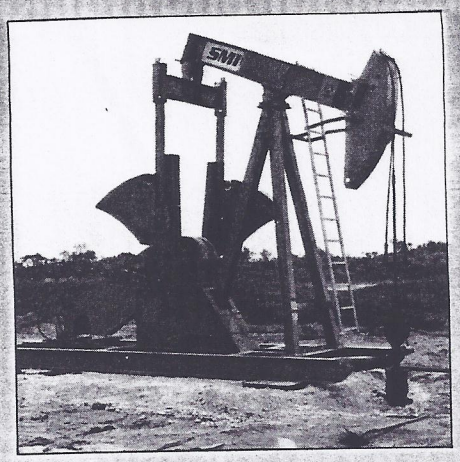
SMI pumping units, manufactured by SMI in the U.S. and supplied and serviced by SMI are backed by an experienced staff with many years of quality engineering and manufacturing experience.

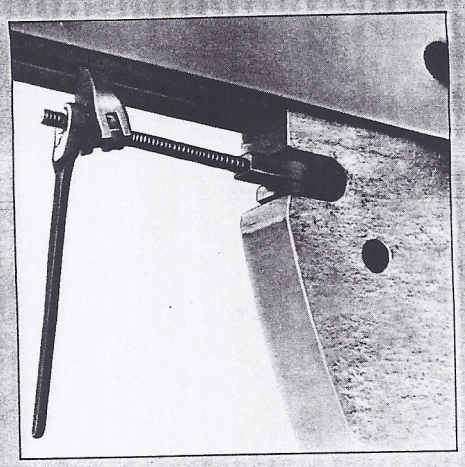
SMI crank-balanced pumping units are available in seven basic structure types covering more than 40 different sizes of API rated units. Gear boxes are from 57,000 to 912,000 in. lbs. API peak torque ratings. Peak polish rod load sizes are from 9,500 lbs. thru 42,700 lbs. Maximum stroke lengths are from 54" up to and including 168".

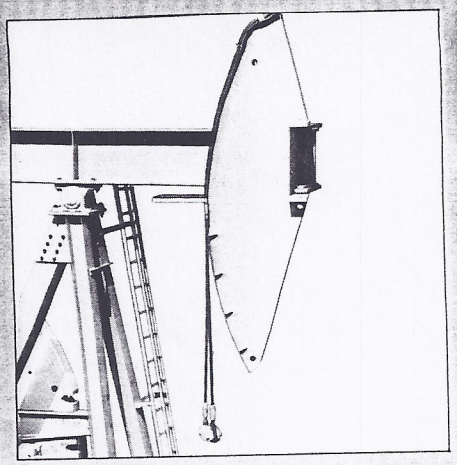
Salzgitter Gear Reducers

SMI crank-balanced pumping units feature Salzgitter double reduction gear reducers that are made in accordance with API standards. Salzgitter has had authority to use the API monogram for over 31 years.

Salzgitter gear boxes use an oil-bath lubrication system that guarantees positive lubrication of all gears and bearings. The housings are completely oiltight, dustproof and weatherproof. The brake, mounted on the high speed shaft, is of the internal expanding, self-reinforcing shoe type controlled by rachet handle and actuated by means of a cable running through watertight flexible metallic hoses.







The Structure

SMI pumping units feature the "Center Line System" in design which keeps the acceleration force peaks at a minimum. All bearings are uniformly loaded to give long bearing life. The structural bearing assemblies are equipped with self-aligning roller bearings.

The Samson post, built of wide flange H-beams, is mounted on the pumping unit base in such a manner that the bending forces in the base are practically zero. The boxed gear reducer base is designed to accommodate three sizes of gear reducers: the one initially used for a given structure size and either one size larger or one size smaller. Prime mover bases are available for any type prime mover.* Safety ladders are designed to meet OSHA safety regulations.

*Structural bases are available for mounting on standard portable concrete pads or in a wide base for mounting on timbers.

SMI can also design and manufacture custom designed bases.

The Crank and Counterbalance

SMI cranks are clamped on the slow speed shaft by means of bolts and are additionally secured by heavy keys. This makes easy removal in the field practical. To obtain the correct, effective counterbalance, SMI pumping units are equipped with counterweights mounted on the cranks, which are built with T-slots on both sides. This system permits fast and precise positioning of the counterweights to be done by one man. Auxiliary counterweights are available for additional effective counterbalance and these bolt on the inside of the master weight. All SMI units are of the floor-clearing type.

The Horsehead

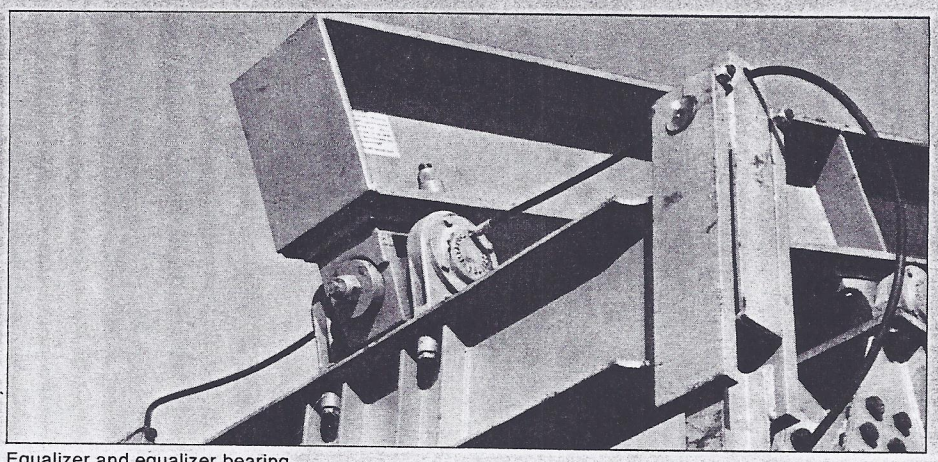
The main feature of the horsehead of SMI pumping units is its swing-away capability. By removing one set of the lockpins on one side, the horsehead can be swung out of the way of the workover rigs and held to the side of the walking beam by a locking device. This hinge-type connection uses four lock pins to fasten the horsehead to the walking mean, two on each side. The horsehead may be swung to either side of the walking beam. This swing-away feature allows safe and easy access to the well.

TO OUR CUSTOMERS' ATTENTION

Please check your state and local laws to determine whether a crank guard enclosure is required in order to operate any pumping unit.

A crank guard enclosure should be used if the pumping unit is accessible to people other than experienced oil field equipment mechanics.

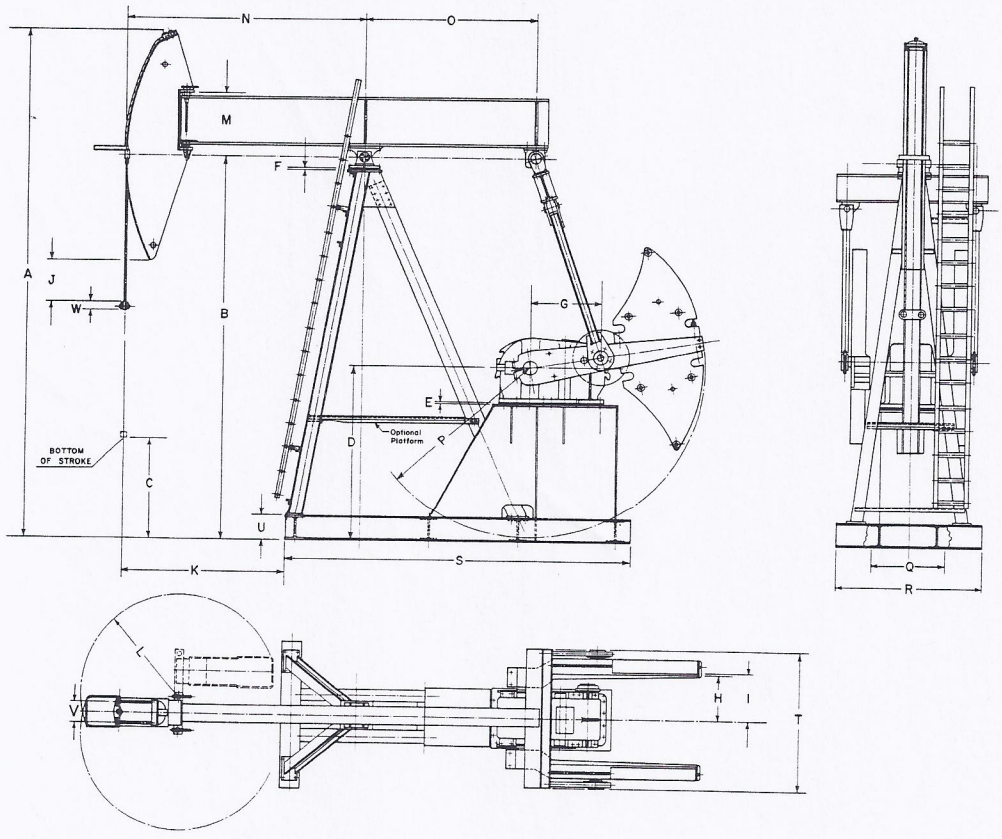
If you do not already have a crank guard enclosure to use with the pumping unit, SMI will provide you with a list of manufacturers. Please call 303-794-9864 for further information.



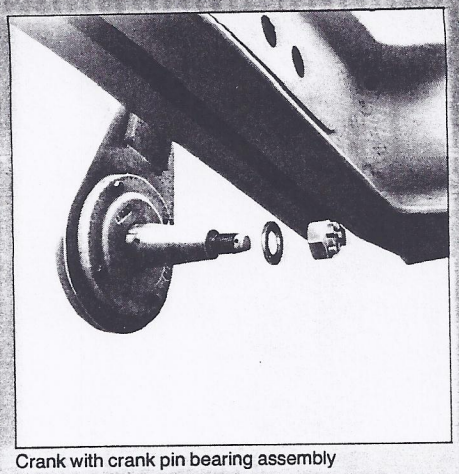
Equalizer and equalizer bearing

General Dimensions of SMI Pumping Units with Standard T-Base

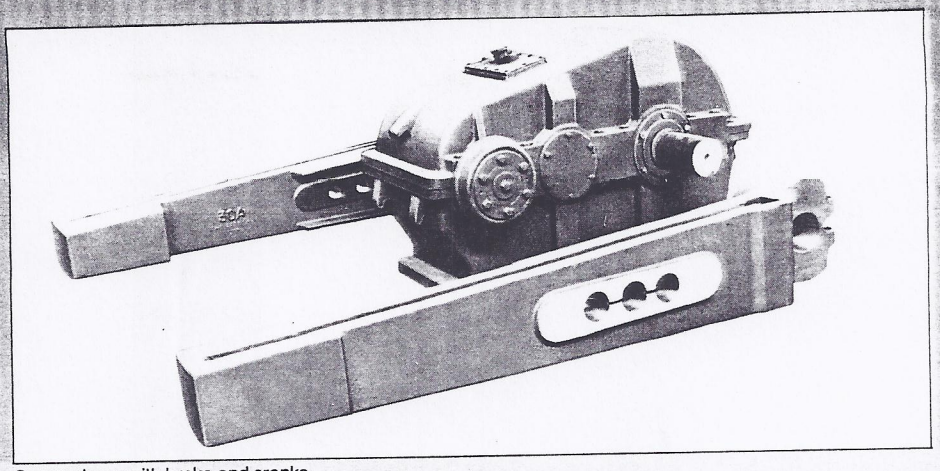
Note: Do not use these dimensions for foundation. Request foundation plan.



BASIC UNIT TYPE	PUMPING UNIT SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	912-365-168	30'-3"	21'-10 5/8"	5'-1 5/8"	9'-5"		2 3/4"	46 27/32"	27 7/16"	30 1/2"	21 1/2"	12'-11 1/4"	6'2"	43 1/2"	16'-0 1/2"	11'-5 5/8"	9'-0 1/4"	36 1/2"	7'-8"	20'-9 1/2"	8'-0 7/8"	16"	13 1/4"	51 1/2"
1	912-305-168	"	"	"	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
1	912-427-144	29'-2"	"	"	"		"	"	"	"	46 1/2"	9'-9 3/4"	5'-11"	"	13'-9"	"	"	"	"	"	"	"	"	"	"
1	912-365-144	"	"	"	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
1	640-365-168	30'-0 1/4"	21'-7 7/8"	58 7/8"	9'-2 1/4"			41 11/32"	25 1/16"	28 1/8"	21 1/2"	12'-11 1/4"	6'-2"	"	16'-0 1/2"	"	"	"	"	"	"	"	"	"
1	640-305-168	"	"	"	"			"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
1	640-427-144	28'-11 1/4"	"	"	"			"	"	"	46 1/2"	9'-9 3/4"	5'-11"	"	13'-9"	"	"	"	"	"	"	"	"	"
1	640-365-144	"	"	"	"			"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
2	640-305-144	27'-2"	19'-10 5/8"	5'-1 3/4"	8'-8 3/4"		2 3/8"	"	"	27 1/2"	22 1/2"	9'-11 3/4"	"	39"	"	9'-9 3/8"	8'-4 1/2"	31 7/8"	6'-9 7/8"	18'-8"	7'-4 3/8"	"	"	"
2	640-256-144	"	"	"	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
2	640-365-120	26'-1"	"	"	"		"	"	"	"	47 1/4"	7'-8 1/4"	5'-0"	"	11'-5 5/8"	"	"	"	"	"	"	"	"	"	"
2	640-305-120	"	"	"	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

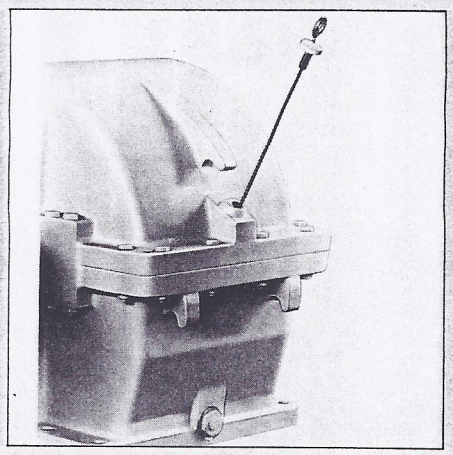


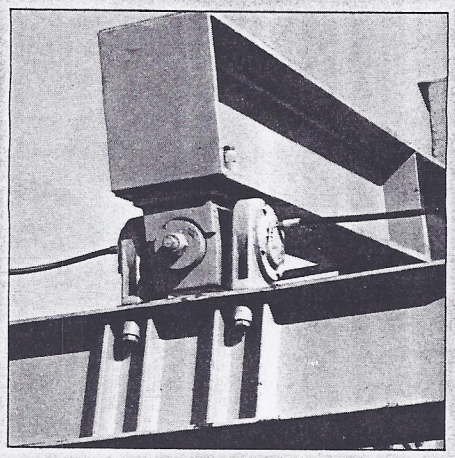
Crank with crank pin bearing assembly



Gear reducer with brake and cranks

BASIC UNIT TYPE	PUMPING UNIT SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	456-365-168	30'-0 1/4"	21'-7 7/8"	587/8"	9'-2 1/4"	2 3/8"		37 19/32"	22 11/16"	26"	21 1/2"	12'-1 1/4"	6'-2"	43 1/2"	16'-0 1/2"	11'-5 5/8"	9'-0 1/4"	36 1/2"	7'-8"	20'-9 1/2"	8'-0 7/8"	"	"	"
1	456-305-168																							
1	456-427-144	28'-11 1/4"									46 1/2"	9'-9 3/4"	5'-11"		13'-9"									
1	456-365-144																							
2	456-305-144	27'-2"	19'-8 1/4"	591/4"	8'-6 3/8"					25 3/8"	22 1/2"	9'-11 3/4"		39"		9'-9 3/8"	8'-4 1/2"	31 7/8"	6'-9 7/8"	18'-8"	7'-4 3/8"			
2	456-256-144																							
2	456-365-120	26'-1"									47 1/4"	7'-8 1/4"	5'-0"		11'-5 5/8"									
2	456-305-120																							
3	456-256-120	24'-0 5/8"	17'-10 5/8"	5'-1 1/2"	8'-0 1/2"		2"			25 3/16"	23 1/4"	8'-0 3/4"		31"		8'-2 1/4"	7'-8 1/2"	29 1/16"	6'-4 1 /8"	16'-3 9/16"	6'-10 3/8"			
3	456-213-120																							
3	456-305-100	23'-1 5/8"									44"	6'-1 3/4"	51"		9'-6 5/8"									
3	456-256-100																							
2	320-305-144	27'-2"	19'-8 1/4"	591/4"	8'-6 3/8"	2"		33 21/32"	19 9/16"	23 1/4"	22 1/2"	9'-11 3/4"	5'-11"	39"	13'-9"	9'-9 3/8"	8'-4 1/2"	31 7/8"	6'-9 7/8"	18'-8"	7'-4 3/8"			
2	320-256-144																							
2	320-365-120	25'-10 5/8"									47 1/4"	7'-8 1/4"	5'-0"		11'-5 5/8"									
2	320-305-120																							
3	320-256-120	23'-10 5/8"	17'-8 5/8"	591/2"	7'-10 1/2"					23"	23 1/4"	8'-0 3/4"		31"		8'-2 1/4"	7'-8 1/2"	29 1/16"	6'-4 1/8"	16'-3 9/16"	6'-10 3/8"			
3	320-213-120																							
3	320-305-100	22'-11 5/8"									44"	6'-1 3/4"	51"		9'-6 5/8"									
3	320-256-100																							
4	320-213-100	21'-1 3/8"	15'-11 3/16"	5'-1 1/8"	7'-4 3/4"		2 5/32"			21 1/2"	22"	6'-5 1/2"		26"		6'-9 7/8"	7'-0 5/8"	25 7/8"	5'-4 1/2"	13'-10"	5'-11"	12"	10 1/4"	4 3/4"
4	320-173-100																							
4	320-246-86	20'-5 7/8"									36 1/2"	5'-1"	44"		8'-2 1/2"									
4	320-213-86																							
3	228-256-120	23'-10 5/8"	17'-8 5/8"	591/2"	7'-10 1/2"	2 5/32"		29 29/32"	18 5/16"	21 3/4"	23 1/4"	8'-0 3/4"	5'-0"	31"	11'-5 5/8"	8'-2 1/4"	7'-8 1/2"	29 1/16"	6'-4 1/8"	16'-3 9/16"	6'-10 3/8"	16"	13 1/4"	5 1/2"
3	228-213-120																							
3	228-305-100	22'-11 5/8"									44"	6'-1 3/4"	51"		9'-6 5/8"									
3	228-256-100																							
4	228-213-100	20'-11 3/16"	15'-9"	59"	7'-2 5/8"					20 1/4"	22"	6'-5 1/2"		26"		6'-9 7/8"	7'-0 5/8"	25 7/8"	5'-4 1/2"	13'-10"	5'-11"	12"	10 1/4"	4 3/4"
4	228-173-100																							
4	228-246-86	20'-3 3/4"									36 1/2"	5'-1"	44"		8'-2 1/2"									
4	228-213-86																							
5	228-173-86	19'-1 3/8"	14'-7 3/16"	59 1/8"	6'-8 1/2"		1 25/32"			20 1/2"	22 1/4"	5'-4"		21 1/2"		5'-10 1/2"	6'-4 3/4"	25 3/8"	5'-1 3/4"	12'-4"	5'-7 3/4"			
5	228-143-86																							
5	228-119-86																							
5	228-200-74	18'-7 1/4"									34 3/4"	50 1/4"	38"	23 1/2" 21"	7'-0 7/8"									
5	228-173-74																							
4	160-213-100	20'-11 3/16"	15'-9"	59"	7'-2 5/8"	1 25/32"		26 25/32"	16 11/16"	18 5/16"	22"	6'-5 1/2"	51"	26"	9'-6 5/8"	6'-9 7/8"	7'-0 5/8"	25 7/8"	5'-4 1/2"	13'-10"	5'-11"			
4	160-173-100																							
4	160-246-86	20'-3 3/4"									36 1/2"	5'-1"	44"		8'-2 1/2"									
4	160-213-86																							
5	160-173-86	18'-11 7/8"	14'-5 1/4"	57 3/8"	6'-6 3/4"					18 1/2"	22 1/4"	5'-4"		21 1/2"		5'-10 1/2"	6'-4 3/4"	25 3/8"	5'-1 3/4"	12'-4"	5'-7 3/4"			
5	160-143-86																							
5	160-119-86																							
5	160-200-74	18'-5 1/2"									34 3/4"	50 1/4"	38"	23 1/2" 21"	7'-0 7/8"									
5	160-173-74																							
6	160-143-74	17'-2 5/8"	13'-2 1/2"	54 1/2"	5'-11 7/8"		2"			18 5/8"	22 3/4"	5 3/4"				5'-0 5/8"	5'-8 7/8"	21 5/8"	59"	10'-10 3/4"	5'-2 5/8"	10"		
6	160-173-64	16'-9 1/4"									33"	42 1/4"	37" 36"	20 1/2" 17"	6'-1 1/2"									
6	160-143-64																							
5	114-173-86	18'-11 7/8"	14'-5 1/4"	57 3/8"	6'-6 3/4"	1"		24 13/32"	14 3/4"	17 1/8"	22 1/4"	5'-4"	44"	21 1/2"	8'-2 1/2"	5'-10 1/2"	6'-4 3/4"	25 3/8"	5'-1 3/4"	12'-4"	5'-7 3/4"	12"		
5	114-143-86																							
5	114-119-86																							
5	114-200-74	18'-5 1/2"									34 3/4"	50 1/4"	38"	23 1/2" 21"	7'-0 7/8"									
5	114-173-74																							
6	114-143-74	17'-2 5/8"	13'-1 1/2"	53 1/2"	5'-10 7/8"					17 5/16"	22 3/4"	5 3/4"				5'-0 5/8"	5'-8 7/8"	21 5/8"	59"	10'-10 3/4"	5'-2 5/8"	10"		
6	114-173-64	16'-8 3/16"									33"	42 1/4"	37" 36"	20" 17"	6'-1 1/2"									
6	114-143-64																							
7	114-119-64	14'-9"	11'-2 7/8"	47 1/4"	56 3/8"		2"			17 1/8"	16 1/2"	51"				53 1/8"	53 1/8"	18 1/8"	54 1/2"	9'-2"	59 1/2"			
7	114-133-54	14'-3 1/2"									27 1/4"	39 1/4"	33"		5'-1 7/8"									
7	114-119-54																							
6	80-143-74	17'-2 5/8"	13'-1 1/2"	53 1/2"	5'-10 7/8"	1"		22 1/4"	13 9/16"	16 1/8"	22 3/4"	5 3/4"	38"	21"	7'-0 7/8"	5'-0 5/8"	5'-8 7/8"	21 5/8"	59"	10'-10 3/4"	5'-2 5/8"			
6	80-173-64	16'-8 3/16"									33"	42 1/4"	37" 36"	20" 17"	6'-1 1/2"									
6	80-143-64																							
7	80-119-64	14'-8"	11'-1 7/8"	46 1/4"	55 3/8"					16"	16 1/2"	51"				53 1/8"	53 1/8"	18 1/8"	54 1/2"	9'-2"	59 1/2"			
7	80-133-54	14'-2 1/2"									27 1/4"	39 1/4"	33"		5'-1 7/8"									
7	80-119-54																							
7	57-119-64	14'-8"				1"		19 7/8"	12 13/16"	15 3/8"	16 1/2"	51"	36"		6'-1 1/2"									
7	57-133-54	14'-2 1/2"									27 1/4"	39 1/4"	33"		5'-1 7/8"									
7	57-119-54																							





Lubrication Instructions

Gear Reducer

For temperatures from -0°F to +212°F, use an SAE EP 90 or an AGMA 6EP Premium extreme pressure lubricant with corrosion protection, oxidation inhibitor and an anti-foam agent. Lubricant should have a pour point of 5°F or less.

For temperatures down to -40°F, use an SAE EP 80 or an AGMA 3EP Premium extreme pressure lubricant with corrosion protection, oxidation inhibitor and an anti-foam agent. Lubricant should have a pour point of -15°F or less. Select type of oil in accordance with the ambient requirements of the site.

The oil level must always come up to the dipstick mark. Insufficient oil impairs the lubrication of the gears and bearings and can cause premature wear.

Collect a sample of the gear reducer oil every six months and check oil for dirt and water emulsion. Evaluate oil for further usability and change oil if required.

In the case of intermittent operation in areas with high humidity, the oil tends to emulsify, which leads to corrosion and premature wear of gears and bearings. For this reason, the water due to condensation collected in the gear reducer must be drained from time to time.

Structural Bearings

Bearings used in SMI Pumping Units are designed for long operating life with little maintenance required.

For temperatures above 0°F, use an NLGI No. 1 Multipurpose Lithium soap base grease with corrosion protection and oxidation inhibitor.

For temperatures down to -30°F, use an NLGI No. 0 Multipurpose Lithium soap base grease with corrosion protection and oxidation inhibitor.

The center bearing, equalizer bearings, and crankpin bearings are adequately lubricated at the factory. These bearings are anti-friction bearings and are equipped with lubrication fittings.

These bearings should be lubricated every six months or as required. Grease should be pumped until fresh grease emerges from the sealing ring.

Gear Reducer Data (Double Reduction)

*Calculated on a Maximum Speed of 20 SPM

Salzgitter Gear Reducer API Size			57	80	114	160	228	320	456	640	912
API-Peak Torque Rating*		in. lbs.	57,000	80,000	114,000	160,000	228,000	320,000	456,000	640,000	912,000
Gear Ratio			28:1	28:1	28:1	28:1	29.3:1	29.3:1	29.3:1	29.3:1	29.3:1
Shaft Diam.	Low Speed	mm	80	90	100	120	140	150	170	190	210
	High Speed	mm	50	55	60	60	65	75	85	100	110
V-Belt Drive Info.	Size		3 C	3 C	3 C	3 C	4 C	4 C	5 C	5 C	5 C
	Grooves		3	3	3	3	4	4	5	5	5
	Max. Sheave Diam.	in.	20	24	30	36	36	44	50	50	50
	Bore Diam.	mm	50	55	60	60	65	75	85	100	110
	Key Way Width/Height	mm	14/5.5	16/6.0	18/7.0	18/7.0	18/7.0	20/7.5	22/9.0	28/10	28/10
Oil Capacity of Gear Box		gal.	17	21	25	31	46	59	80	122	163
Kind of Gears			Double Helical								
Kind of Bearings			Antifriction Self-aligning Roller Bearings								

Maximum Strokes per Minute

Max. Speed and Stroke Length Combination	Stroke	in.	168	144	123	120	103	102	100	87	86	85	83	75	74	72	65	64	56	55	54	48	47	39
	Ltd. to 0.7 of Free Fall Velocity	SPM	13.22	14.29	15.46	15.65	16.89	16.98	17.15	18.38	18.49	18.60	18.82	19.80	19.93	20.21	21.27	21.43	22.91	23.12	23.33	24.75	25.01	27.41
	Ltd. to the Acc. Factor 1.3		11.22	12.12	13.11	13.28	14.33	14.40	14.54	15.59	15.68	15.77	15.96	16.79	16.91	17.14	18.04	18.12	19.43	19.61	19.79	20.99	21.21	23.20

Limited to 0.7 of Free Fall Velocity $SPM = 0.7 \sqrt{\frac{60{,}000}{\text{Stroke [in.]}}}$

Limited to the Acc. Factor 1.3 $SPM = \sqrt{\frac{(1.3\text{-}1) \times 70{,}500}{\text{Stroke [in.]}}}$

Counterbalance Effect at Polished Rod W_{CBE} for max. stroke incl. structural unbalance

1. Example for change of CBE when changing the stroke

Unit 640-365-168 with Counterweights No. 10 and 4 Auxiliary Weights No. 11 would have a maximum counterbalance effect of 25,320 pounds in the 168" stroke. This effect includes a structural unbalance of -904 pounds.

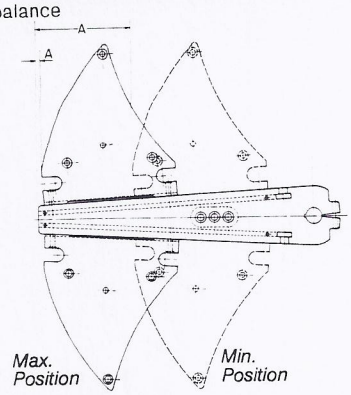
If the counterbalance effect is designed for the 144" stroke, subtract the structural unbalance from the effect in the 168" stroke and multiply this difference by the ratio of 168":144". Then add the structural unbalance to this product. Thus, counterbalance effect in the 144" stroke:

$$[25{,}320-(-904)]\times\frac{168}{144}+(-904)=\mathbf{29{,}690\ lbs.}$$

2. Example for change of CBE when utilizing 2 counterweights only:

Unit 640-365-168 with its 4 main weights No. 10 has a CBE of 21,725 pounds. From this value is to be deducted the CBE cranks only with 3,979 pounds. The difference is to be divided by 2, and the CBE cranks only must be added to the quotient. The result is:

$(21{,}725-3{,}979)\times\frac{1}{2}+3{,}979=\mathbf{12{,}852\ lbs.}$



Structure Basic Type	1		2		3		4	
PUMPING UNIT SIZE	912, 640, 456 -365-168 / -305-168	912, 640, 456 -427-144 / -365-144	640, 456, 320 -305-144 / -256-144	640, 456, 320 -365-120 / -305-120	456, 320, 228 -256-120 / -213-120	456, 320, 228 -305-100 / -256-100	320, 228, 160 -213-100 / -173-100	320, 228, 160 -246-86 / -213-86
Stroke inch	168-144-120	144-123-103	144-120-100	120-100-83	120-102-86	100-85-72	100-87-74	86-75-64
Struct. Unbalance (lbs.)*	−904	−176	−728	−132	−551	+44	−163	+99
Eff. Counter-Balance	Max. Position	Max. Position	Max. Position	Max. Position	Max. Position	Max. Position	Max. Position	Max. Position
Master Weight No. +4 Aux. Weights No. +8 Aux. Weights No.								
No. 10	21725	26235	22160	27300				
+4 No. 11	25320	30435						
+8 No. 11	28915	34630						
No. 20	17590	21420	17570	22160	18805	23290		
+4 No. 21	20360	24635	20490	25660				
+8 No. 21	23130	27865	23410	29160				
No. 30	14210	17460	14320	17910	15035	18770	15850	18750
+4 No. 31	16180	19765	16415	20410	17295	21480		
+8 No. 31	18150	22070	18510	22930	19555	24195		
No. 40			11930	15035	12490	15710	13160	15620
+4 No. 41			13745	17220	14460	18080	15300	18100
+8 No. 41			15560	19390	16435	20450	17430	20580
No. 50					9940	12640	10430	12420
+4 No. 51					11530	14550	12150	14430
+8 No. 51					13120	16460	13870	16420
No. 60							8960	10725
+4 No. 61							10250	12220
+8 No. 61							11550	13730
Cranks only	3979	4652	3240	3880	2830	3395	2290	2670

Structure Basic Type	5		6		7		
PUMPING UNIT SIZE	228, 160, 114 -173-86 / -143-86 / -119-86	228, 160, 114 -200-74 / -173-74	160, 114, 80 -143-74	160, 114, 80 -173-64 / -143-64	114, 80, 57 -119-64	114, 80, 57 -133-54 / -119-54	
Stroke inch	86-75-64	74-65-55	74-64-54	64-55-47	64-55-46	54-46-39	
Struct. Unbalance (lbs.)*	−287	−110	−220	−121	−236	−82	
Eff. Counter-Balance	Max. Position	Max. Position	Max. Position	Max. Position	Max. Position	Max. Position	
Master Weight No. +4 Aux. Weights No. +8 Aux. Weights No.							
No. 10							
+4 No. 11							
+8 No. 11							
No. 20							
+4 No. 21							
+8 No. 21							
No. 30							
+4 No. 31							
+8 No. 31							
No. 40	12800	15070					
+4 No. 41							
+8 No. 41							
No. 50	10010	11840	10185	11900			
+4 No. 51	11780	13890					
+8 No. 51	13550	15940					
No. 60	8500	10070	8310	9730	6360	7750	
+4 No. 61	9820	11620	9630	11265	7410	8990	
+8 No. 61	11140	13160	10970	12810	8440	10230	
Cranks only	1764	2039	1488	1709	1069	1268	

*Structural unbalance with a negative sign indicates a walking beam assembly that is heavy on the well end.
Structural unbalance with positive sign indicates a walking beam assembly that is heavy on the gear reducer end.

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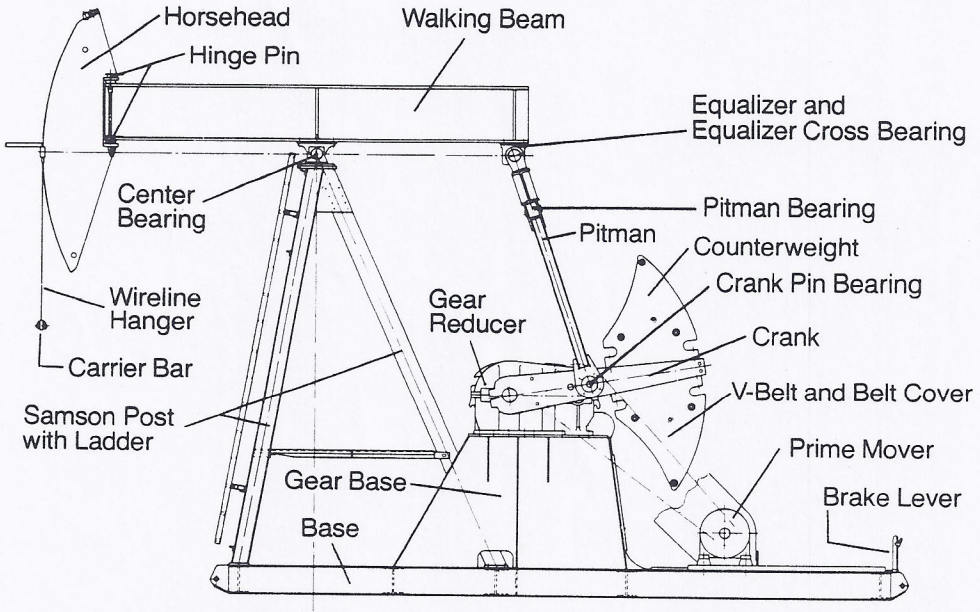

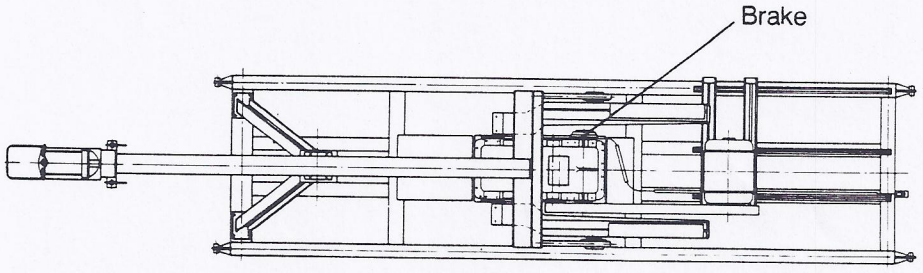

Subject to technical modifications.

Note: If sucker rod string is disconnected from pumping unit when cranks are in the horizontal position with maximum counterweights mounted at the long end of the crank, the brake is designed to allow the cranks to gently rotate to the lower position, thus protecting gears and pinions from damage.

b. Mount brake lever on bracket mounted at prime mover base.
c. Attach brake cable to brake actuating arm and brake lever by means of clevises as provided.

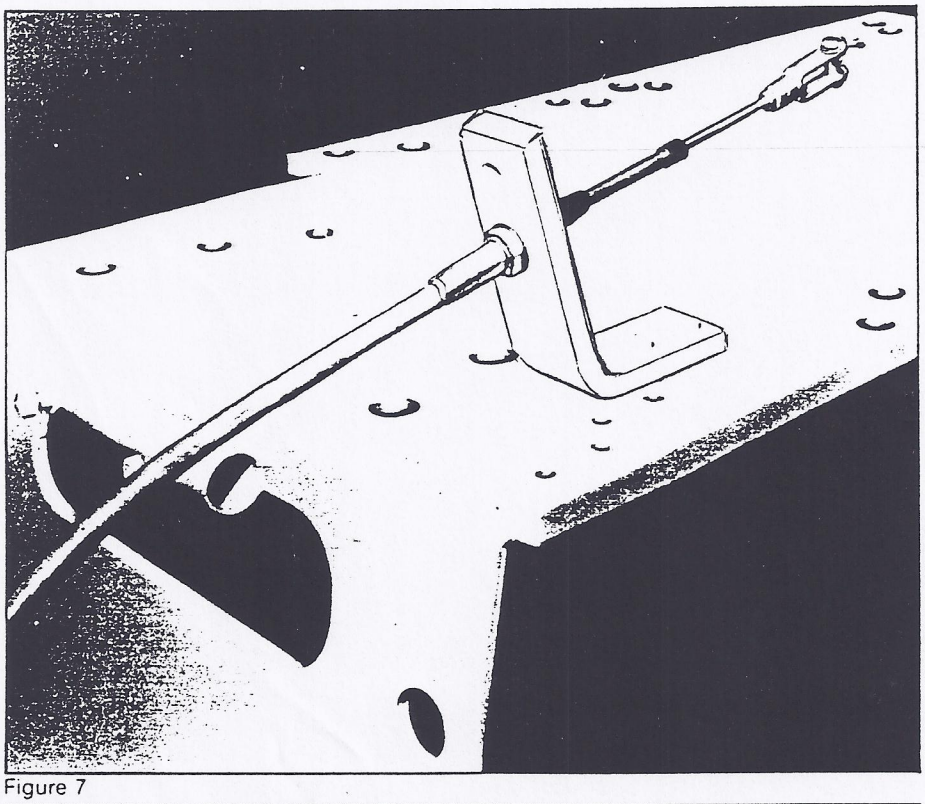

Figure 7

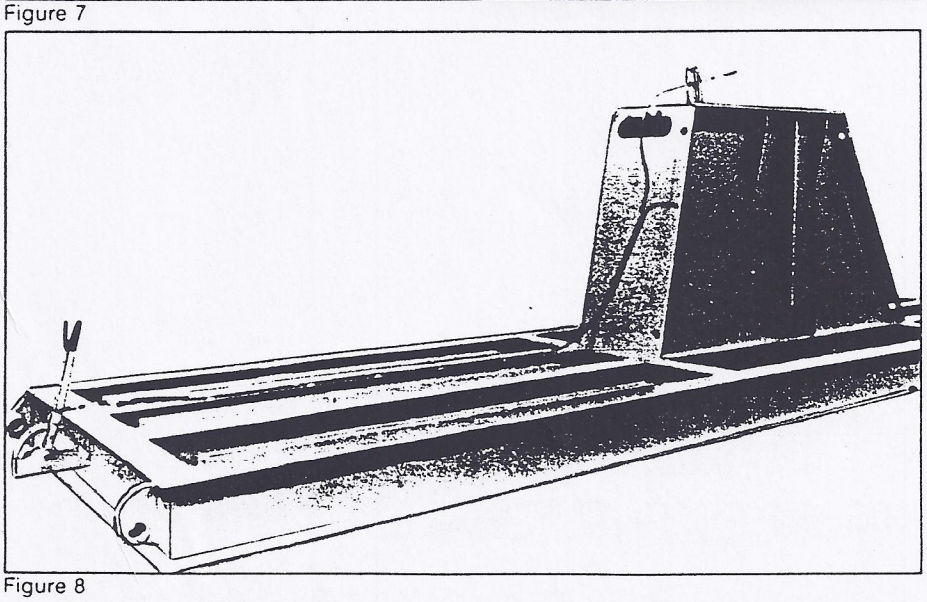

Figure 8