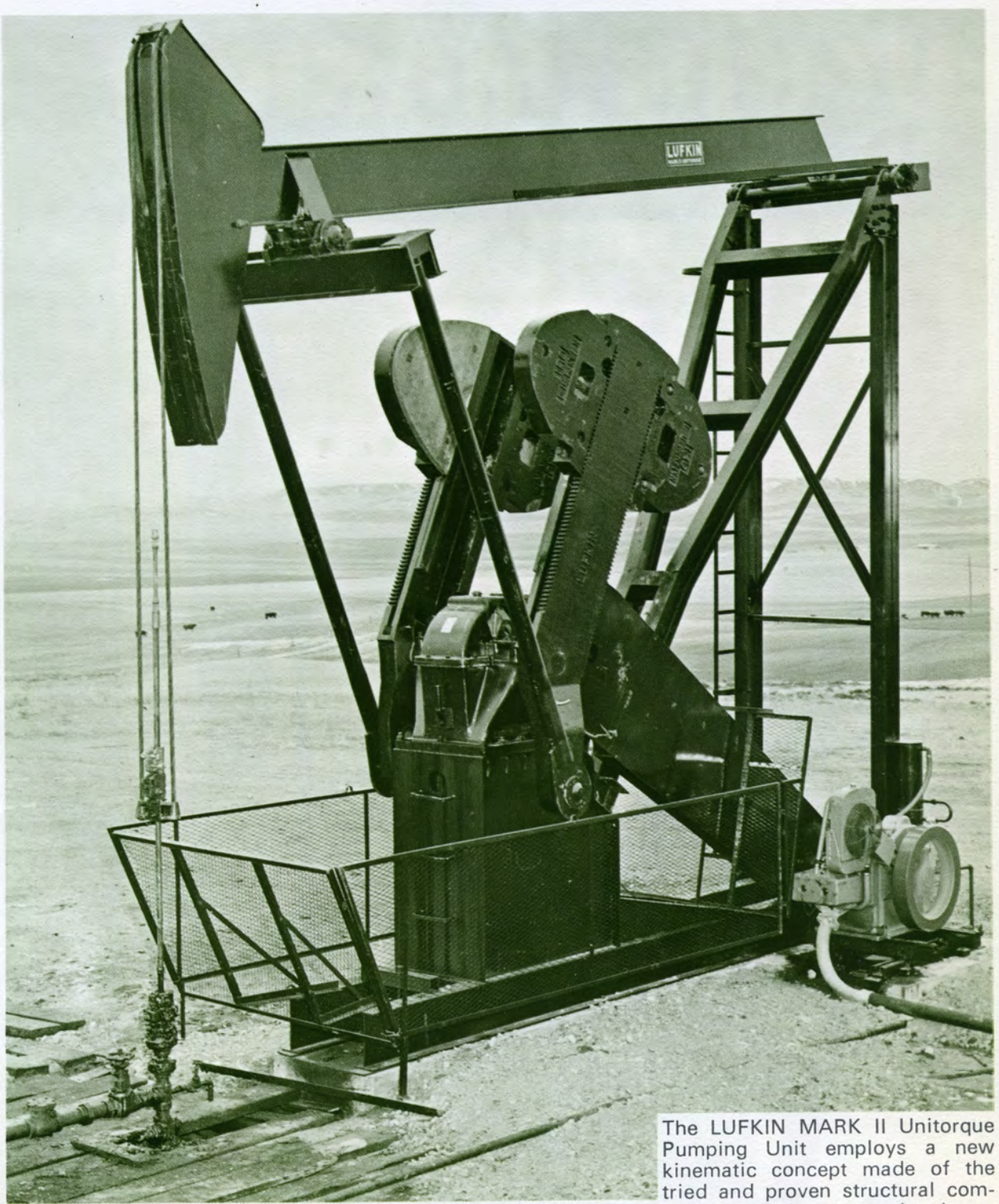
LUFKIN MARK II
UNITORQUE PUMPING UNITS

SALES
ENGINEERING
BULLETIN
M2-965

A New Concept In Oilwell Pumping



KEY TO NOMENCLATURE

M-114D-200-74

1 2 3

1. TORQUE RATING (1000 IN. LB.)
2. POLISHED ROD CAPACITY (100 LB.)
3. STROKE LENGTH (INCHES)

A Lufkin M-228D-256-100 Mark II Unit, pumping near Sidney, Montana, driven by a Lufkin H-333 engine.

COVER: M640B-305-192 unit, with two point suspension, portable base & Lufkin engine as prime mover.

The LUFKIN MARK II Unitorque Pumping Unit employs a new kinematic concept made of the tried and proven structural components of the conventional mechanical pumping unit. This sophisticated imaginative design of the LUFKIN MARK II furnishes one of the most advanced and trouble-free systems of rod pumping available today, providing many money saving advantages not heretofore thought possible.

The Lufkin *UNITORQUE* SYSTEM

The LUFKIN MARK II Pumping Unit utilizes an ingenious patented arrangement of the regular components of the conventional crank balanced pumping unit (walking beam, samson post, gear reducer, cranks, pitmans and counterweights) to effect a more uniform loading on the gear reducer, smoothing out and decreasing peak torque as much as 40%

The LUFKIN MARK II uses a rotary counterweight system similar to the conventional unit, but lifts the front of the beam rather than pulling down on the tail end. The cross yoke (equalizer) is shifted forward toward the horsehead instead of placing it directly over the gear reducer. This produces an up and down stroke of 195° and 165° respectively (Fig. A). The 195° upstroke reduces the polished rod acceleration where the load is greatest and thus effects a reduction in peak polished road load. Further benefit is obtained by locating the cross yoke forward, where a greater mechanical advantage is obtained when lifting the load, while a lesser mechanical advantage is used for the reduced downstroke load, (i.e., the maximum upstroke torque factor is decreased and the maximum downstroke torque factors is increased). The counterbalance weights are offset on the crank. This produces a counterbalance torque which, at the beginning of the upstroke, "lags" the torque produced by the well load approximately 7½°. Similarly, at the beginning of the downstroke, this same offset condition produces a counterbalance torque which "leads" the well torque approximately 7½°. These modifications tend to distribute the pumping unit torque load much more uniformly around the crank cycle rather than laboring hard during the upstroke, coasting – then working hard the downstroke and finally coasting again.

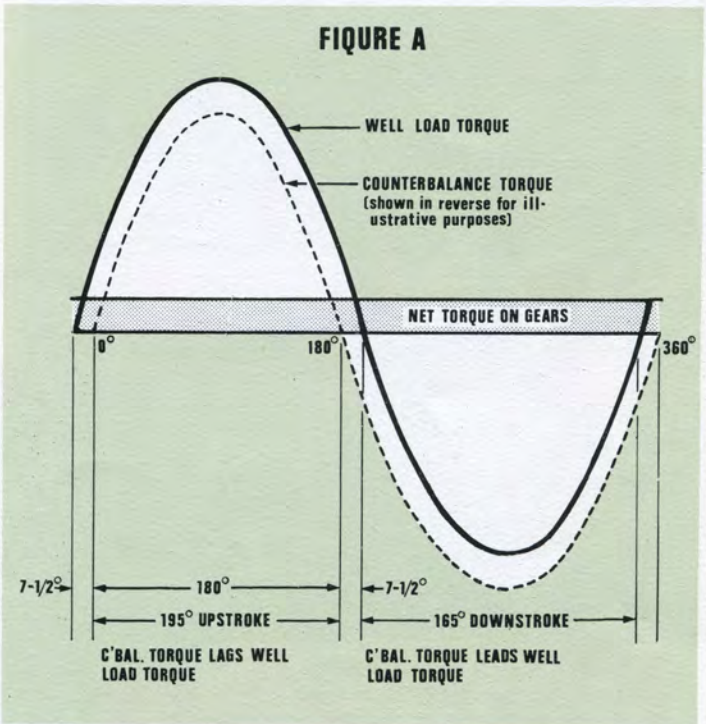
In most applications, this reduction in peak torque, an exclusive feature of the LUFKIN MARK II, permits the use of a size smaller gear reducer, generally affording a substantial first-cost savings to the operator.

Figure B (right) shows the measured crank shaft torque on turnabout comparison tests between a conventional pumping unit and a LUFKIN MARK II, pumping the same well with the same electric motor, under identical well conditions. The peak torque demand of 110,000"# would require a 114-API gear reducer on conventional geometry, while the LUFKIN MARK II peak torque demand for the same job is only 65,000"#, requiring an API-80 reducer on the same application.

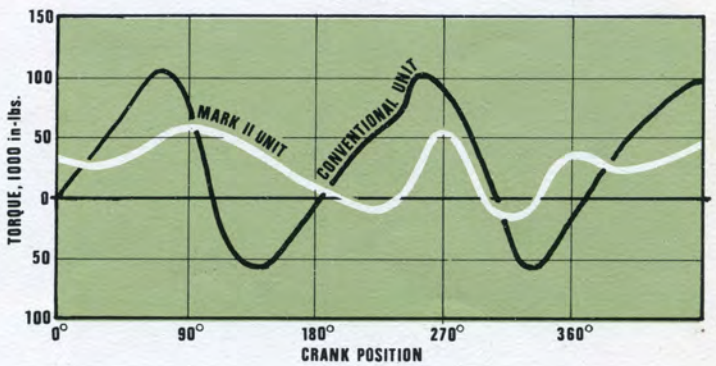
Additional advantage is obtained by making the unit work over both top and bottom of the polished rod stroke while proportionately reducing both the up and down side loads.

Independently, these structural modifications would not produce a uniform torque; but by working together a Unitorque system is obtained which in turn can effect a torque reduction on the gear reducer up to 40%.

FIQURE A



FIQURE B

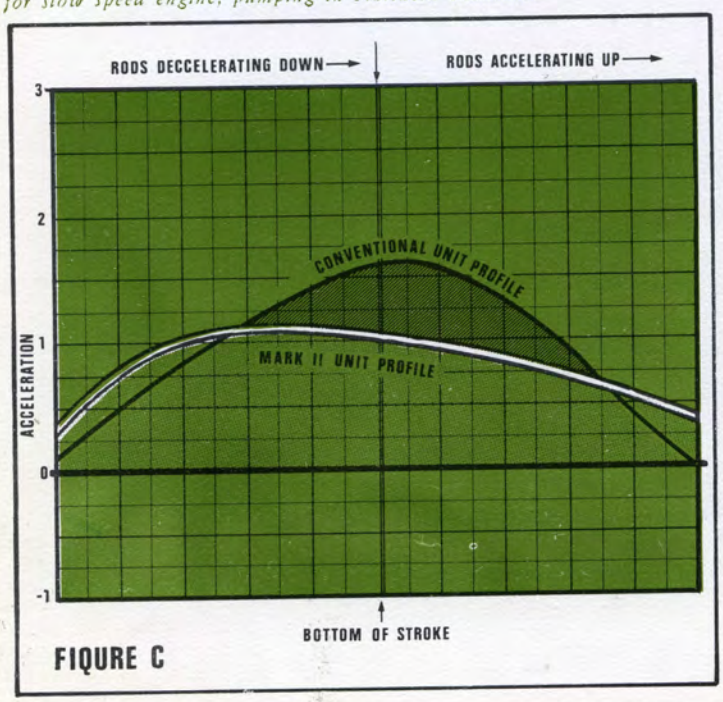


Comparative Polished Rod Motion

Due to the unique geometry of the LUFKIN MARK II, the acceleration at the bottom polished rod reversal is decreased as much as 40%. This reduces peak load up to 15% and tends to avoid shock, resulting in longer rod life, lower servicing costs, and less production loss from rod break shutdowns.

The curves below (Figure C) show comparative accelerations at the bottom polish rod reversal for a conventional unit and the Mark II turning in synchronism. Note the Mark II's lower maximum acceleration and relatively smoother profile.

A Lufkin M-456D-253-144 Mark II unit with engine house for slow speed engine, pumping in Northern Montana.



FIQURE C

The Operator Benefits On:

SLIM HOLES—Where small diameter tubing limits the size of sucker rods, the lower rod stress obtained with the LUFKIN MARK II allows the use of longer rod strings or larger pumps.

DEEP HOLES—Extends range of sucker rod pumping to depths previously unattainable.

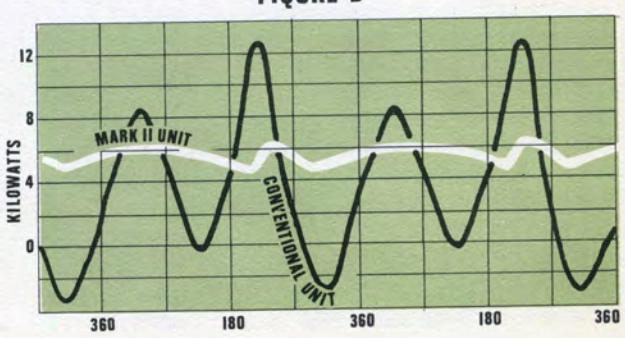
BIG VOLUME WELLS — Lowered peak load conserves a greater portion of the polished rod capacity for handling additional fluid.

Prime Mover Savings

The LUFKIN MARK II, due to its more uniform torque demand, illustrated by the following power curves (Figure D) generally permits the use of a smaller prime mover to pump any given well. In the case of a gas engine drive, the first costs savings are substantial. With an electric motor drive, additional savings are obtained, when electric power charges are based on demand or connected horsepower. The following curves show watt meter studies on a head-to-head comparative test betwen a conventional pumping unit and the LUFKIN MARK II, pumping the same well under identical conditions.

Where electric motors are used, the continual day-to-day savings in demand charges may, in the long run, amount to as much or more than the original first cost savings.

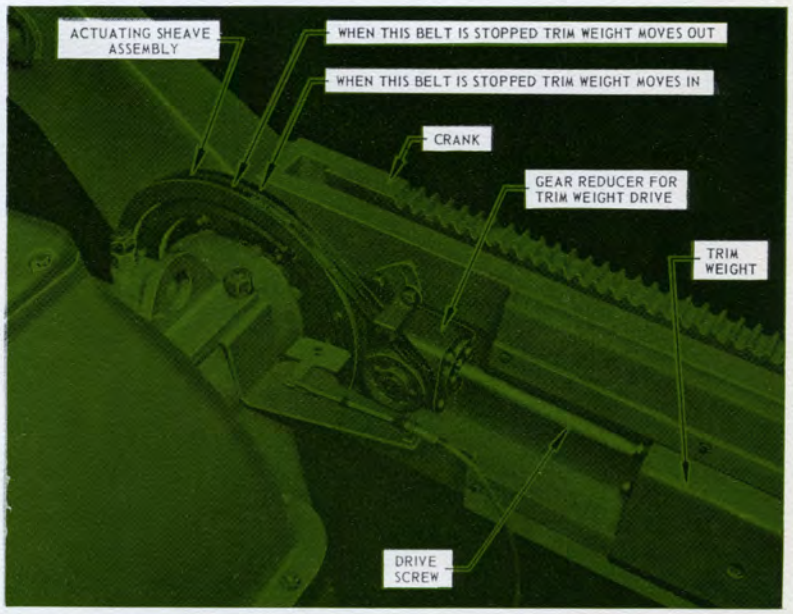
FIQURE D



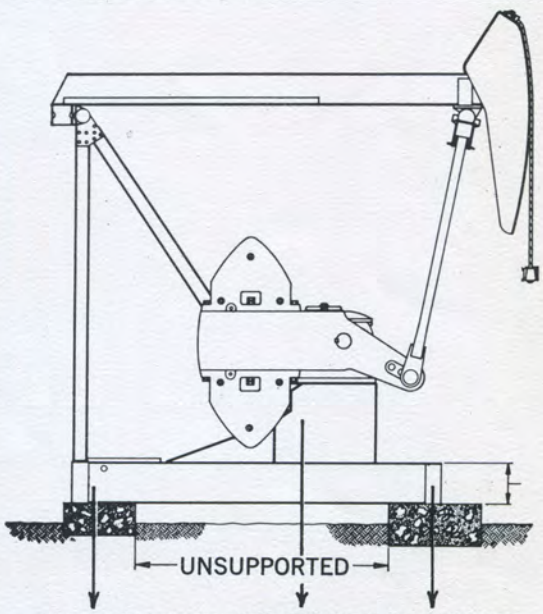
Semi-Automatic Counterbalancing*

For those applications where changing well conditions necessitate changing counterbalance requirements, an exclusive patented semi-automatic counterbalancing device (optional) is avaliable on the LUFKIN MARK II Unitorque Units (Figure E). A counterbalance TRIM WEIGHT, located in each crank, can be moved either in or out, depending on whether less or more counterbalance is required. Moving the trim weights is easily accomplished while the unit is running by moving a lever either forward or backward. One lever actuates the right hand trim weight; the other lever operates the left hand. Obviously, this is a significant safe ty feature since the weights do not have to be positioned manually.

Naturally, when a radical change in counterbalance is required, such as when the stroke length is changed, the main counterweights themselves may be moved in the regular manual fashion.



Two-Point Suspension



ALL RESULTANT FORCES ARE DOWNWARD ELIMINATING NECESSITY FOR MASSIVE CONCRETE BLOCKS TO AVOID LIFT UP.

Extra heavy "two point suspension" base reduces concrete requirement by approximately 80%.

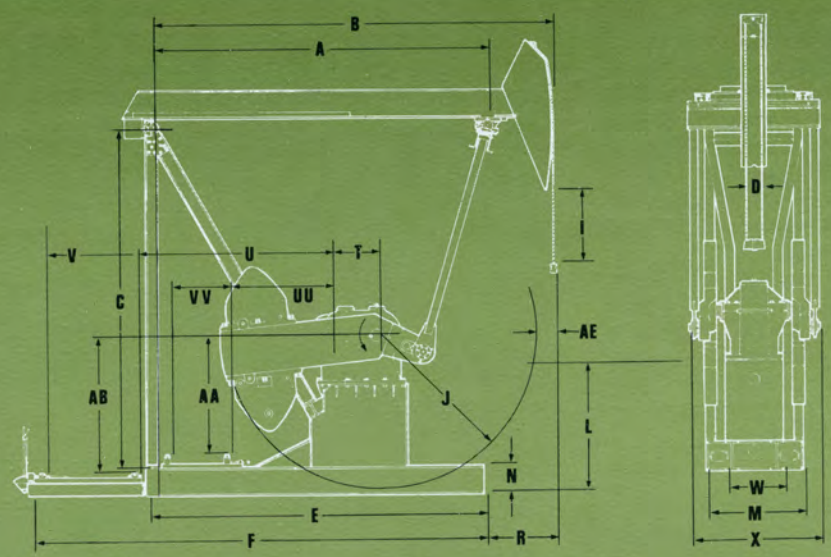
Small, portable type foundation blocks can be used, thus making the entire installation 100% salvable.

Ideal for areas where drifting sand and snow is a problem.

Although two-point bases cost slightly more, this new "Base-Foundation" combination offers a substantial first cost saving on the complete installation.

*(optional at additional cost)

General Dimensions And Specifications



UNIT	A	B	C	D	E	F	I	J	L	M	N	R	T	U	V	W	X	AA	AB	AE	UU	VV
M-1280D-427-192	25'6"	32'-0"	26'9⅞"	16"	20'2½"	29'-2"	55⅛"	130"	72½"	8'0"	124""	36"	52½"	8'-2½"	68½"	50"	8'11"	★★	9'-0⅛"	26"	★★	★★
M-912D-305-192	"	"	"	"	"	"	"	"	"	"	"	"	48½"	8'-6½"	"	"	"	★★	"	"	★★	★★
M-640D-305-192	"	"	"	"	"	"	"	"	"	"	"	"	41½"	9' 1½"	"	"	"	★★	"	"	★★	★★
M-456D-305-192	"	"	"	"	"	"	"	"	"	"	"	"	38⅜"	9'4⅜"	"	"	8'7⅜"	★★	"	"	★★	★★
M-912D-356-168	22'6"	27'10"	23'0⅞"	12"	23'1½"	★	42⅝"	108"	71⅜"	69¾"	16⅛"	60"	48½"	★	★	49¾"	8'9"	7'2⅛"	★	19	6'10½"	67
M-912D-305-168	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	•
M-912D-356-144	21'6"	26'0"	21'0⅞"	"	21'7¼"	"	39⅝"	"	76⅜"	"	"	55¼"	"	"	"	"	"	"	"	13¼"	6'5¼"	55
M-912D-304-144	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	8'7⅜"	"	"	"	"	"
M-640D-305-168	22'6"	27'10"	23'0⅞"	"	23'1½"	"	42⅝"	"	71⅜"	"	"	60	41½"	"	"	46½"	8'5"	"	"	23⅞"	7'1¼"	67
M-640D-356-144	21'-6"	26'-0"	21'-0⅞"	12"	21'-3½"	"	39⅝"	"	76⅜"	69¾"	16⅛"	60"	41½"	"	"	46½"	8'-5"	47⅞"	"	18"	29⅝"	29¾
M-640D-304-144	"	"	"	"	"	"	63⅝"	"	"	"	"	"	"	"	"	"	8'-3⅜"	"	"	"	"	"
M-604D-253-144	"	"	"	9"	"	"	44⅜"	"	74"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-640D-365-120	"	"	"	12"	"	"	63⅝"	"	76⅜"	"	"	"	"	"	"	"	8'-5"	"	"	"	"	"
M-640D-304-120	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	8'-3⅜"	"	"	"	"	"
M-640D-256-120	"	"	"	9"	"	"	69⅛"	"	73¼"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-456D-305-168	22'6"	27'10"	23'0⅞"	12"	23'1½"	"	42⅝"	"	71⅜"	"	"	"	38⅜"	"	"	"	8'5"	7'2⅛"	"	23⅞"	7'4¾"	67
M-456D-356-144	21'-6"	26'-0"	21'-0⅞"	"	21'-3½"	"	39⅝"	"	76⅜"	"	"	"	38⅜"	"	"	"	8'-5"	47⅞"	"	18"	32¾"	29¾
M-456D-304-144	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	8'-3⅜"	"	"	"	"	"
M-456D-253-144	"	"	"	9"	"	"	44⅜"	"	74"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-456D-365-120	"	"	"	12"	"	"	63⅝"	"	76⅜"	"	"	"	"	"	"	"	8'-5"	"	"	"	"	"
M-456D-304-120	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	8'-3⅜"	"	"	"	"	"
M-456D-256-120	"	"	"	9"	"	"	69⅛"	"	73¼"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-320D-304-144	"	"	"	12"	"	"	39⅝"	"	76⅜"	"	"	"	34"	"	"	43"	7'-4⅜"	"	"	"	37⅛"	"
M-320D-253-144	"	"	"	9"	"	"	44⅜"	"	74"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-320D-304-120	"	"	"	12"	"	"	63⅝"	"	76⅜"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-320D-256-120	"	"	"	9"	"	"	69⅛"	"	73¼"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-320D-213-120	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-320D-298-100	"	"	"	12"	"	"	83⅝"	"	76⅜"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-320D-256-100	"	"	"	9"	"	"	89⅛"	"	73¼"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-228D-256-120	"	"	"	"	"	"	69⅛"	"	"	"	"	"	30"	"	"	37"	6'-9⅜"	"	"	"	41⅛"	"
M-228D-213-120	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-228D-256-100	"	"	"	"	"	"	89⅛"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-228D-246-86	15'-6"	18'-6"	15'-8⅜"	9"	15'-6½"	21'-0"	45¼"	86⅝"	65¼"	57"	15⅞"	39"	"	103¾"	51½"	"	6'-8⅜"	65¼"	74⅞"	11⅜"	53¼"	33¼*
M-228D-200-86	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-228D-246-74	"	"	"	"	"	"	58⅝"	"	65½"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-228D-200-74	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-228D-173-74	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-160D-246-86	"	"	"	"	"	"	45¼"	"	65¼"	54"	"	"	26"	107¼"	"	32"	6'-0⅜"	"	"	"	57¼"	33¼"
M-160D-200-86	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-160D-173-86	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-160D-246-74	"	"	"	"	"	"	58⅝"	"	65½"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-160D-200-74	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-160D-173-74	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-114D-143-86	13'-6"	15'-9"	12'-3½"	"	13'-0¾"	18'-6¼"	14⅜"	62"	53½"	42"	12"	36"	24"	96½"	"	25"	6'7⅜"	44¼"	50"	16"	50"	29¾"
M-114D-200-74	15'-6"	18'-6"	15'-8⅜"	"	15'-6½"	21'-0"	58⅝"	86⅝"	65½"	54"	15⅞"	39"	"	109¾"	"	"	69"	65¼"	74⅞"	11⅜"	59¼"	33¼"
M-114D-173-74	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-114D-143-74	13'-6"	15'-9"	12'-3½"	"	13'-0¾"	18'-6¼"	25⅞"	62"	53"	42"	12"	36"	"	96½"	"	"	6'7⅜"	44¼"	50"	16"	50"	29¾"
M-114D-169-64	"	"	"	"	"	"	21"	"	67⅜"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-114D-143-64	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
M-80D-143-74	"	"	"	"	"	"	25⅞"	62"	53"	42"	12"	36"	"	96½"	"	"	6'7⅜"	"	50"	16"	"	"

* Multi-cylinder engines mount forward of sampson post. ** Multi-cylinder engines mount behind sampson post. See dimensions U, V, and AB.

Several years go, the TULSA DAILY WORLD*, whose Petroleum Section is highly regarded throughout the oil industry, hailed the MARK II UNITORQUE Pumping Unit as the second major advance in beam driven sucker rod pumping systems in the past century. Today, several thousand LUFKIN MARK II's are in operation among over 200 oil companies in practically all the major oil producing areas of the free world — and most of these companies are installing MARK II's in ever increasing numbers.

Is this popularity justified — indeed, how can it be explained? Perhaps the answer can be summed up in one phrase — SAVINGS to the operator — initial *and* continuing.

1. SAVINGS in rod maintenance costs and lost production, because of reduced peak polished rod loads resulting from the unit's unique geometry and lowest off-bottom acceleration. This feature becomes increasingly more important for deeper wells, or as well loads become heavier.
2. SAVINGS in installation costs because of the MARK II's exclusive TWO-POINT mounting arrangement which lowers setting costs, frequently reducing the package cost of unit and foundation. TWO-POINT foundations permit the units to be easily moved from location to location, since the mounting piers are both portable and salvable.
3. SAVINGS in prime mover first cost, since in many cases the UNITORQUE system permits the use of a smaller motor or engine to perform the same job at the polished rod.
4. SAVINGS in continuing operating costs. The patented UNITORQUE system can reduce power cost by a significant amount, no matter whether the prime mover is an electric motor or an internal combustion engine. With the torque loads smoothed out, electric motors run closer to their rated load, substantially increasing their efficiency; increasing the average power factor; and reducing electrical demand charges and the need for power factor correction devices. Because of the UNITORQUE loading, engines, too, run more efficiently and economically.
5. SAVINGS in down time and lost production when counter-balancing the well with the patented semi-automatic counterbalancer. This simple mechanical device uses the unit's own energy to reposition a portion of the counterweights — when the unit is in operation — safely and effortlessly. The hazardous job of manhandling the massive counterweights is, for all practical purposes, eliminated.

ADDITIONALLY — the MARK II system

1. Produces a longer net plunger stroke under most pumping conditions, maximizing fluid production.
2. Provides greater bottomhole pump fill-up time for increasing productivity.
3. Permits greater safe allowable work input into the rod string, further increasing the unit's capability of handling greater fluid loads.

These, and other money saving features partially explain the MARK II's ever increasing popularity with operators throughout the world.

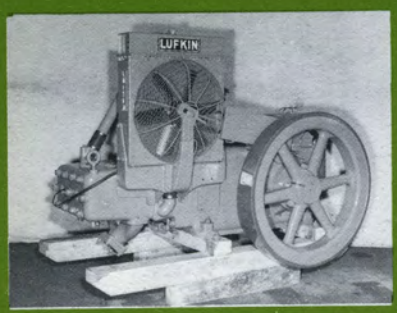
See your closest LUFKIN representative for further details.

* Tulsa, Okla.

MANUFACTURERS OF:

AIR BALANCE
PUMPING UNITS

CONVENTIONAL
PUMPING UNITS



ENGINES

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TRIPOLI, LIBYA
Sahara Oilfield Services Company
of Libya, Ltd.
(Serrag & Co.)
P. O. Box 800
Phone: 34874

TULSA, OKLAHOMA 74119
1302 Petroleum Club Building
Phone: 918-587-7171

*WICHITA FALLS, TEXAS 76307
727 Oil & Gas Building
P. O. Box 2465
Phone: 817-322-1967

WILLISTON, NORTH DAKOTA 58801
P. O. Box 1232
Phone: 701-572-6770

EXECUTIVE OFFICES AND FACTORY:
LUFKIN, TEXAS
PHONE: 713-634-4421

* Indicates Warehouse Maintaining Parts Stock.

LUFKIN FOUNDRY & MACHINE COMPANY
LUFKIN, TEXAS