

MORGAN  
PUMPING UNITS  
OPERATOR'S  
MANUAL

RAM-GEAR MANUFACTURING INC.  
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INTRODUCTION

Over a century of Morgan manufacturing excellence has culminated in your new crank balance pumping unit. This unit has been manufactured in accordance with API specifications and to the Quality Standards developed through over 115 years in customers in other industries. Its structure is one of the strongest available. The gearbox, with double helical gearing, will provide years of reliable service when properly sized for the well.

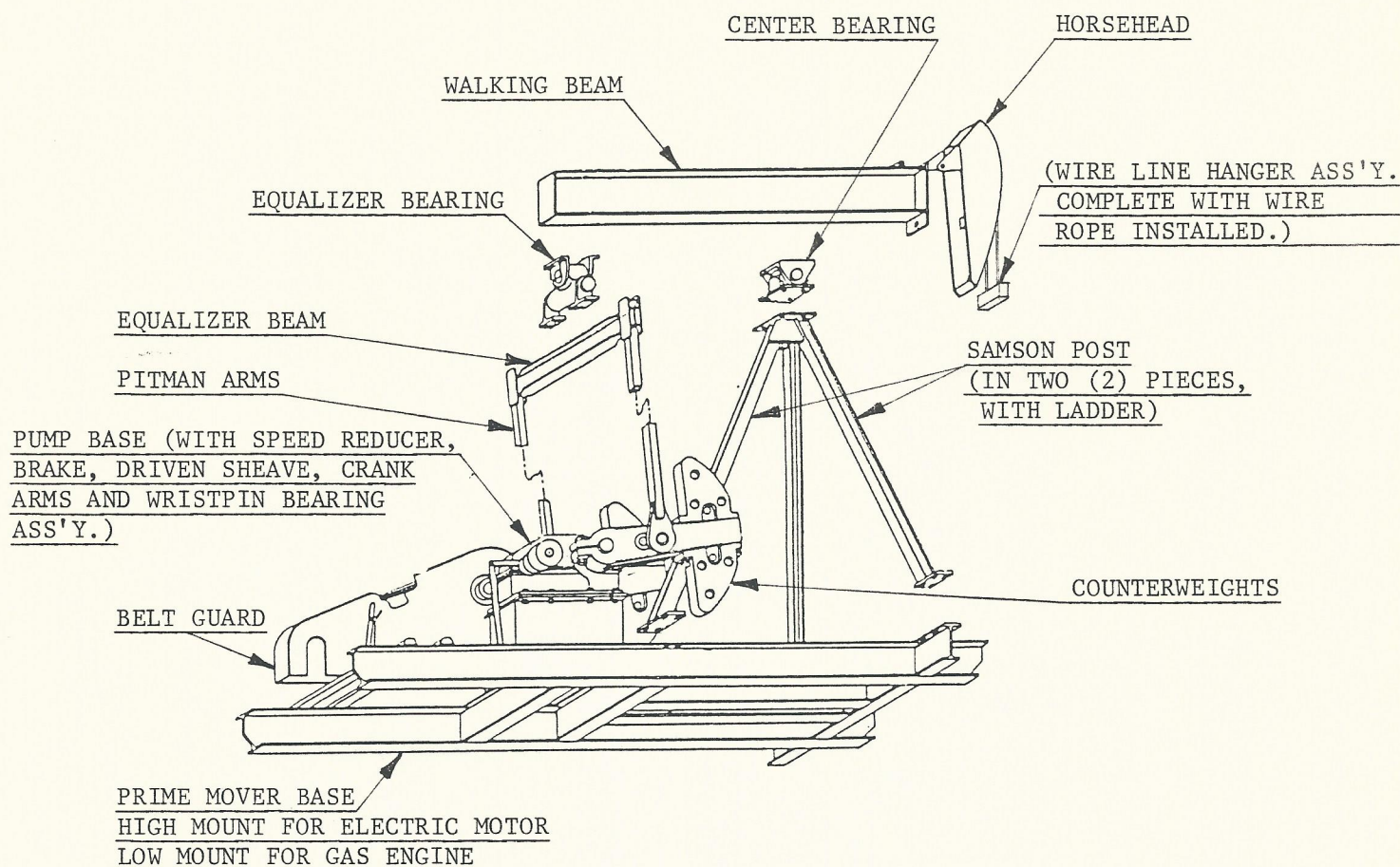
THIS UNIT HAS LARGE, HEAVY, MOVING COMPONENTS. BE AWARE THAT SERIOUS INJURY COULD RESULT IF SAFETY PRECAUTIONS ARE NOT FOLLOWED. BEFORE ASSEMBLY, ALL PERSONNEL MUST THOROUGHLY UNDERSTAND THE PRECAUTIONS TO BE PRACTICED DURING ASSEMBLY AND START-UP WHICH ARE LISTED BELOW.

1. Erectors should wear hard hats during the assembly and start-up of unit.
2. Erectors should stay clear of any person working on the upper assembly, since the dropping of fasteners or tools could cause serious injuries.
3. Although the brake system will hold the unit, mechanical failure could occur permitting gravity movement of parts. Therefore, provide additional means of bracing the parts. Fasten moving parts (walking beam, Pitman arms, etc.) with heavy duty slings, chains or properly positioned blocks of wood to prevent movement. Do not apply brake suddenly. It may damage Gear Box.

CAUTION:

STAY CLEAR OF MOVING PARTS, SINCE THIS UNIT, LIKE ANY CRANK BALANCE UNIT, HAS MANY PINCH POINTS AND COUNTERWEIGHTS THAT COULD COME LOOSE AND CAUSE SERIOUS INJURIES.

COMPONENT DIAGRAM



ADDITIONAL FEATURES

- Bearings            Anti-friction roller bearings, grease lubricated, with double seals and vented cavities. All bearings designed for long life and reliability.
- Brake                Automotive expanding shoe type with mechanical linkage to a rugged brake handle.
- Counterweights    Cast-iron with rack and pinion adjustment.
- Fasteners           High strength bolts
- Gear Unit            A heavy duty double helical gearing with alloy steel and ductile iron gears. Cast-iron housing provides rugged construction. Splash lubrication system is designed for low temperature applications. Contains magnetic drain and dipstick, and bearing lubrication reservoirs (for immediate lubrication on start-up).
- Paint                Finished in black machine enamel with orange horsehead and counterweights.
- Structural Members    Structural steel with 36,000 psi yield, designed to A.P.I. Standards.

SECTION 2

FOUNDATION

To operate properly, the pumping unit must have an adequate foundation. The foundation must meet the requirements per A.P.I. RP11G Spec. and be carefully installed as recommended in this section. A foundation plan is furnished with each unit. The location of tiedowns, bolt sizes, and the distance from the unit to the well is provided on the foundation plan. THE INSTALLER IS WHOLLY RESPONSIBLE FOR THE ADEQUACY AND RELIABILITY OF THE BASE, FILL, AND FOUNDATION.

Base orientation is commonly dictated by the prevailing wind. The unit is placed so that the prevailing wind will blow well leakage away from unit and prime mover. With prime mover (gasoline engine) placement should provide maximum cooling for the engine radiator. Consideration must be given to drainage at the well site. The foundation location should utilize natural drainage to drain water and well fluids away from the foundation. When the natural drainage is incorrect or nonexistent, the site should be graded to provide drainage away from the foundation.

It is advisable that a well head clearance of 3'-0" should be maintained from the underside of the wire line hanger casting to the well head stuffing box in order to facilitate well testing.

Under most conditions the foundation area should be excavated to firm soil (about 4 inches to 6 inches). Further compaction with a mechanical compactor to maximum possible density is desirable. Level in two (2) directions and place and position planking. Fill with sharp sand or pea gravel to a minimum depth of two (2) inches. Carefully level this fill in two (2) directions.

In some localities it is necessary to build an elevated mound of compacted earth, caliche or gravel. This mound should be firmly compacted and of sufficient area at the top to prevent movement of the fill material from beneath the base. Level in two (2) directions and cover with a minimum of two (2) inches of sand or pea gravel and again level in two (2) directions and place planking boards.

SPECIFICATION FOR FOUNDATIONS

Concrete Foundation:

The installer of the foundation shall provide a foundation with these minimum specifications: See Concrete Pad Spec. Diagram, Page 5.

1. The size of the foundation will be determined by the physical dimensions of the unit, but its dimensions should be sufficient to adequately support and stabilize the pumping unit. The design of the foundation shall be such that the maximum soil bearing pressure at any point on the foundation will not exceed that bearing pressure recommended for the area. This pressure shall be calculated assuming a well load equal to the beam rating of the unit and including the gross weight of the unit and foundation.
2. Concrete used shall have a 28 day minimum cure time, compressive strength of 4,000 p.s.i. with a maximum water to cement ratio of 6.0 to 1.

SECTION 2

Concrete Foundation: (Continued)

3. Foundation design shall include reinforcing steel of sufficient size, quantity and placement, including pre-stressing (if used) to provide a resisting moment twice the static bending moment with two (2) point pick up of the foundation.

Where concrete portable foundations are to be installed over old foundations or walkways, all bolts and projections should be removed and a fill of two (2) inches of sand or pea gravel should be placed between the old concrete and the new base.

Place the portable concrete foundation on the leveled fill, with centerline of foundations aligned with center line of well, and set back the proper distance from well tubing center. Level foundations carefully in two (2) directions.

Portable Base: See Portable Base Plank Mat Diagram, Page 6.

When dirt, gravel, sand, etc., is mounded for a base, proper planking should be used. There should be at least:

Three (3) or four (4) planks with two (2) or three (3) inch gaps between planks under Samson post legs.

Three (3) or four (4) planks under Samson post leg brace and gear reducer on 3" x 12" creosoted timbers.

Three (3) or four (4) planks placed at uniform intervals under the prime mover area or remaining length of base.

In many cases, railroad ties are used for planking. The planking is placed and compacted into the ground. Make certain that planking is level. This type of base should be attended and filled for the first year due to ground settling.

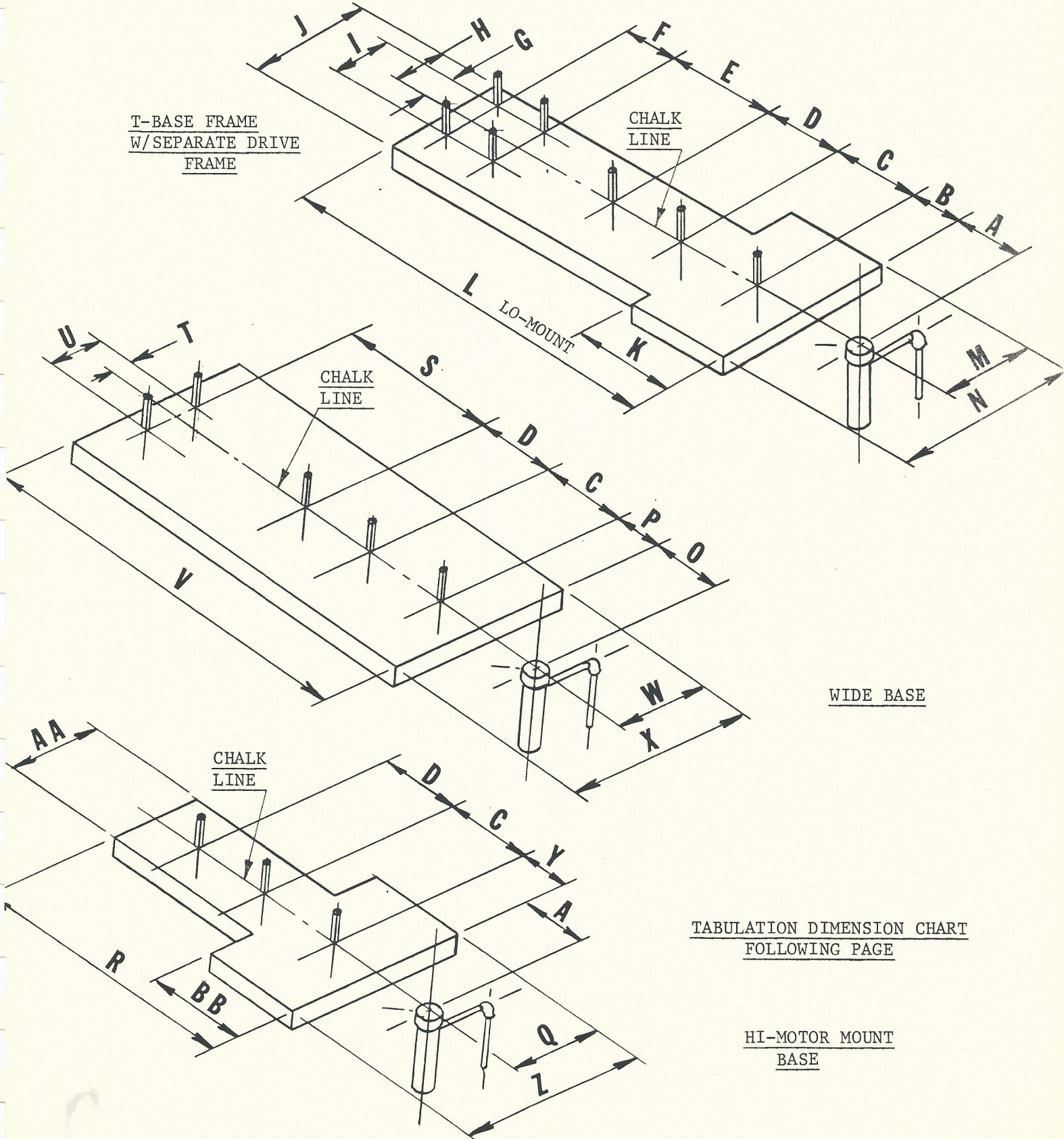
NOTE:

THE PRECEDING SECTION RELATING TO DESIGN AND INSTALLATION OF THE FOUNDATION IS MERELY SUGGESTIONS OF THE SELLER AND DOES NOT CONSTITUTE EITHER AN EXPRESSED OR IMPLIED WARRANTY THAT CONFORMITY WITH THESE SUGGESTIONS WILL RESULT IN THE PROPER INSTALLATION IN ANY PARTICULAR ENVIRONMENT SITE OR SOIL CONDITION.

# Concrete Pad Specifications

POURED AND PRECAST (ELECTRIC PRIME MOVER)

Set the pumping unit structural base on the concrete portable base (if used) and align structural base with the chalked centerline and distance markings. Fit and hand tighten centerline tie downs in positions shown on erection drawing. If a concrete base is not used, set the units "wide base" upon the gravel (See Portable Base).



WIDE BASE

TABULATION DIMENSION CHART  
FOLLOWING PAGE

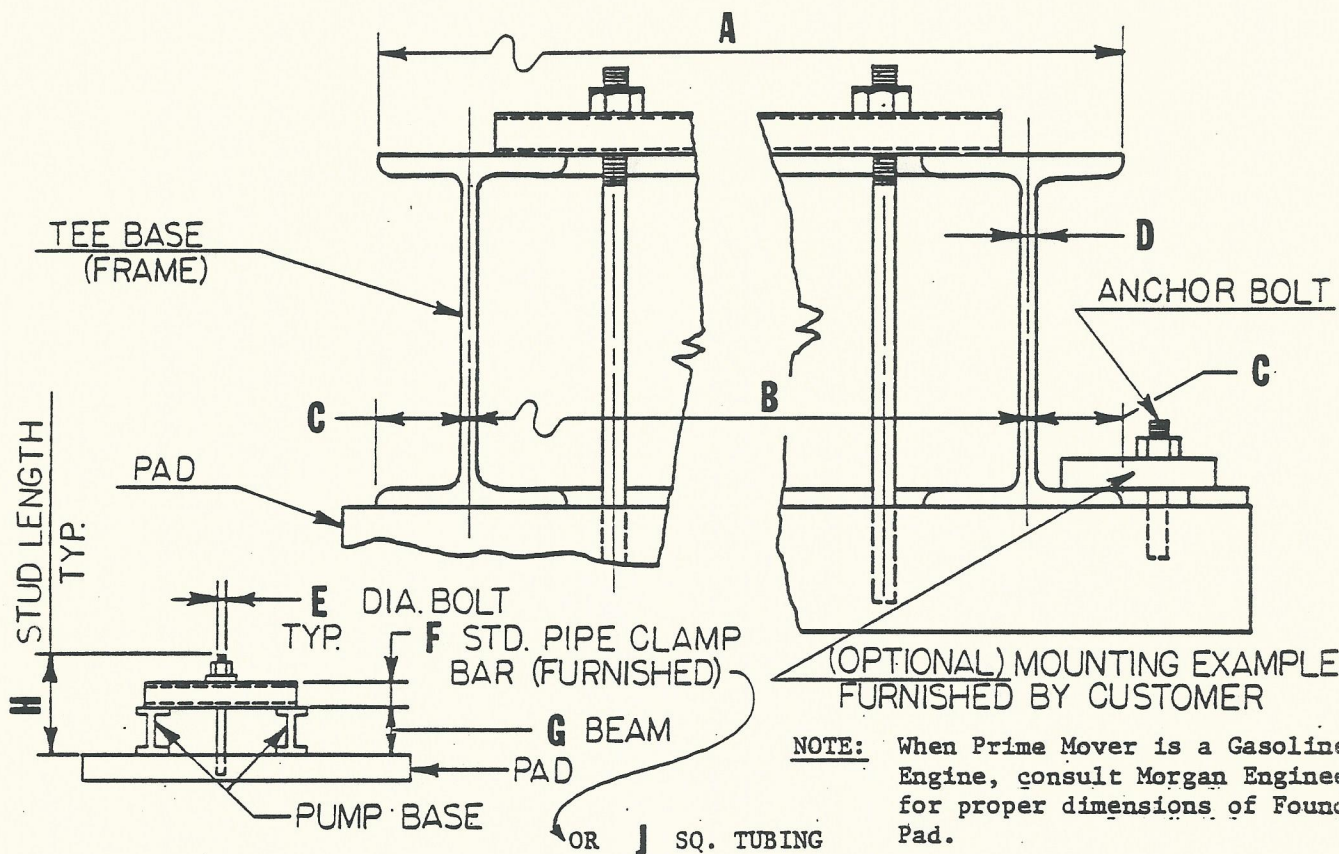
HI-MOTOR MOUNT  
BASE





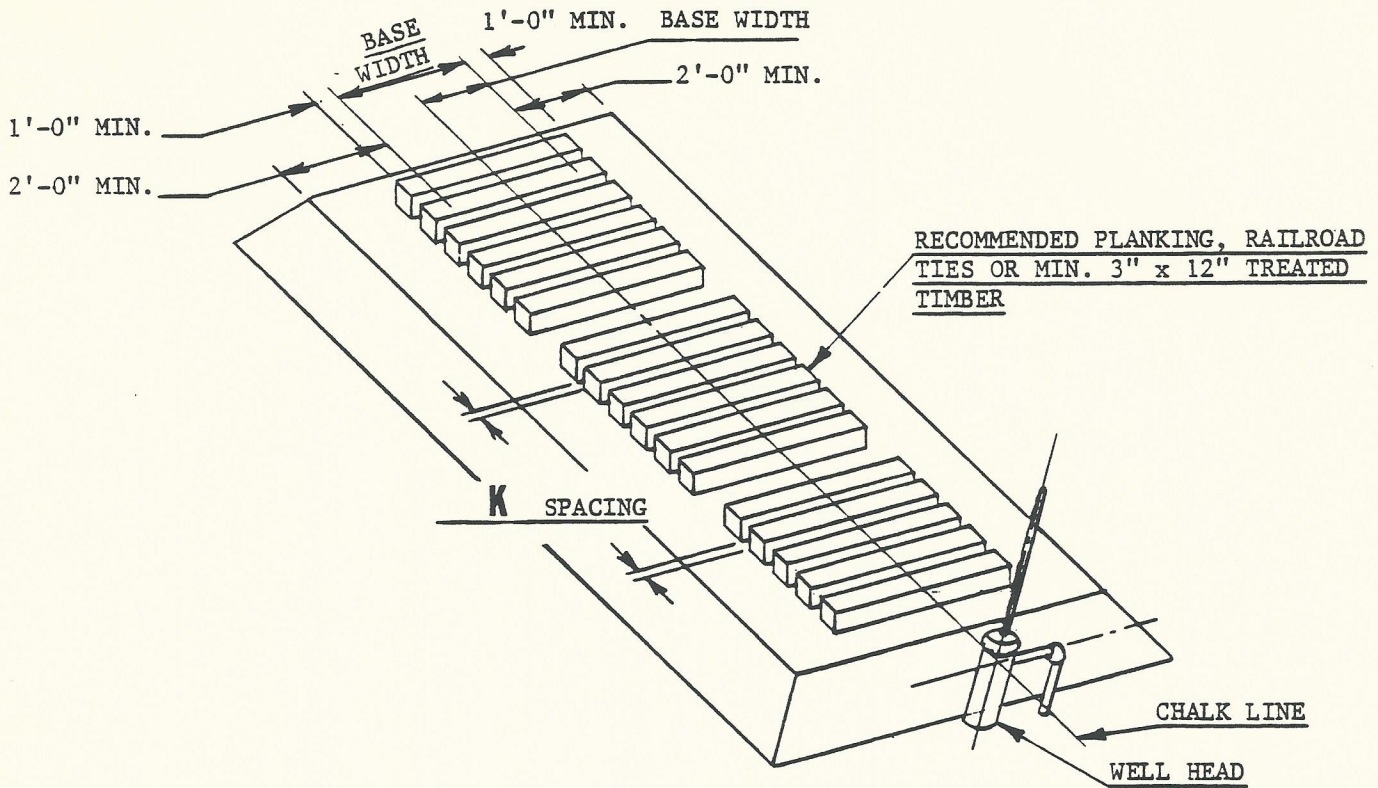
# CONCRETE PAD SPECIFICATIONS

## CROSS SECTION OF TEE BASE OR MOTOR BASE



	#114	#160	#228	#320	#456	#640	#912
A	23-1/8"	23-1/8"	24-3/4"	3'-6-1/2"	4'-2"	4'-2"	4'-2"
B	16-1/8"	16-1/8"	17-3/4"	2'-11-1/2"	3'-3"	3'-3"	3'-3"
C	3-1/2"	3-1/2"	3-1/2"	3-1/2"	5-1/2"	5-1/2"	5-1/2"
D	5/16"	5/16"	5/16"	5/16"	7/16"	7/16"	7/16"
E	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"
F	3"	3"	3"	3"	3"	3"	3"
G	15-7/8"	15-7/8"	15-7/8"	15-7/8"	18-1/4"	18-1/4"	18-1/4"
H	22"	22"	22"	22"	24"	24"	24"
J	-----	-----	-----	5"x5"x1/4"	5"x5"x1/4"	5"x5"x1/4"	5"x5"x1/4"

# Portable Base Plank Mat



Using a chalk line, strike a centerline from the center of the well tubing across the top of the foundation. Mark on this centerline the distance from the well to the pump base as specified on the erection drawing.

NOTE: PUMPING UNIT SHOULD BE ANCHORED ON ALL FOUR (4) CORNERS.

## PLANK PLACEMENT

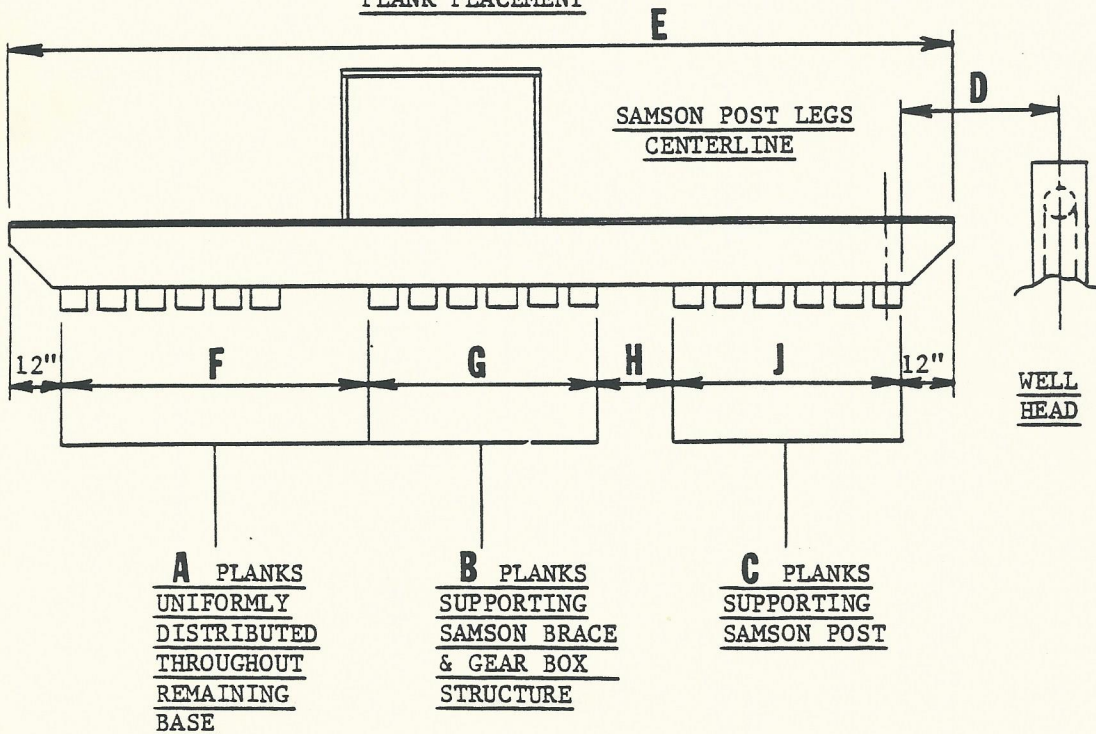


CHART NEXT PAGE

UNIT	A	B	C	D	E	F	G	H	J	K
114-143-64	3 to 4	3 to 4	3 to 4	3'-2-1/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
114-173-64	3 to 4	3 to 4	3 to 4	3'-2-1/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
114-143-74	3 to 4	3 to 4	3 to 4	4'-1-1/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
114-119-86	3 to 4	3 to 4	3 to 4	5'-2-1/2"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
160-173-86	3 to 4	3 to 4	3 to 4	5'-1-3/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
160-200-74	3 to 4	3 to 4	3 to 4	4'-0-1/2"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
160-173-74	3 to 4	3 to 4	3 to 4	4'-0-1/2"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
160-143-74	3 to 4	3 to 4	3 to 4	4'-1-1/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
160-173-64	3 to 4	3 to 4	3 to 4	3'-2-1/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
228-246-86	3 to 4	3 to 4	3 to 4	5'-1-3/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
228-213-86	3 to 4	3 to 4	3 to 4	5'-1-3/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
228-173-86	3 to 4	3 to 4	3 to 4	5'-1-3/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
228-200-74	3 to 4	3 to 4	3 to 4	4'-0-1/2"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
228-173-74	3 to 4	3 to 4	3 to 4	5'-1-3/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
228-173-100	3 to 4	3 to 4	3 to 4	6'-5-1/4"	23'-1-1/8"	9'-1-1/8"	4'-6"	3'-0"	4'-6"	3" to 4"
320-256-120	6	6	6	4'-0-5/8"	35'-1-1/2"	15'-11-1/2"	6'-10"	3'-6"	6'-10"	2" to 3"
320-213-120	6	6	6	4'-0-5/8"	35'-1-1/2"	15'-11-1/2"	6'-10"	3'-6"	6'-10"	2" to 3"
320-305-100	6	6	6	2'-1-5/8"	35'-1-1/2"	15'-11-1/2"	6'-10"	3'-6"	6'-10"	2" to 3"
320-256-100	6	6	6	2'-1-5/8"	35'-1-1/2"	15'-11-1/2"	6'-10"	3'-6"	6'-10"	2" to 3"
320-256-144	6	6	6	6'-3-1/8"	35'-1-1/2"	15'-11-1/2"	6'-10"	3'-6"	6'-10"	2" to 3"
320-213-86	6	6	3 to 4	3'-8-1/4"	32'-4-1/4"	15'-7-1/4"	7'-3"	3'-0"	4'-6"	2" to 3"
456-305-144	6	6	6	5'-0-11/16"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
456-256-144	6	6	6	5'-0-11/16"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
456-365-120	6	6	6	2'-10-5/16"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
456-305-120	6	6	6	2'-10-5/16"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
456-256-120	6	6	6	2'-10-5/16"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
456-305-168	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
640-305-168	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
640-365-144	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
640-305-144	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
640-256-144	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
640-305-120	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
912-365-168	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
912-305-168	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"
912-427-144	6	6	6	7'-3-1/8"	35'-1-1/2"	15'-3-1/2"	6'-10"	4'-2"	6'-10"	3" to 4"

SECTION 3  
INSTALLATION

LIFTING EQUIPMENT

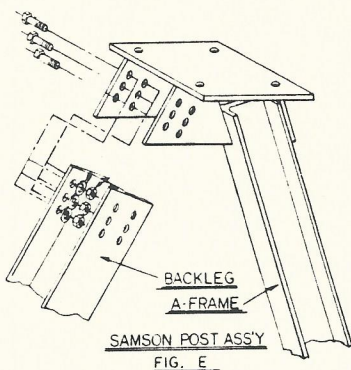
The lifting equipment used must be capable of handling the maximum individual piece height and weight for the applicable model.

<u>PUMP SIZE</u>	<u>HOOK</u>		<u>HEIGHT</u>		<u>MAX. WT. TO BE LIFTED</u>	
	<u>Meters</u>	<u>Feet</u>	<u>Kilograms</u>	<u>Pounds</u>		
114	6	20'-0"	3500	7500		
160	6	20'-0"	3600	8000		
228	6.5	21'-6"	4000	9000		

INSTALLATION STEPS

SECTION 3

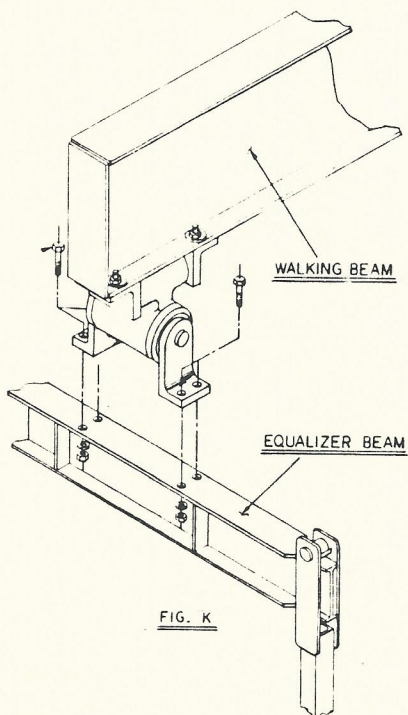
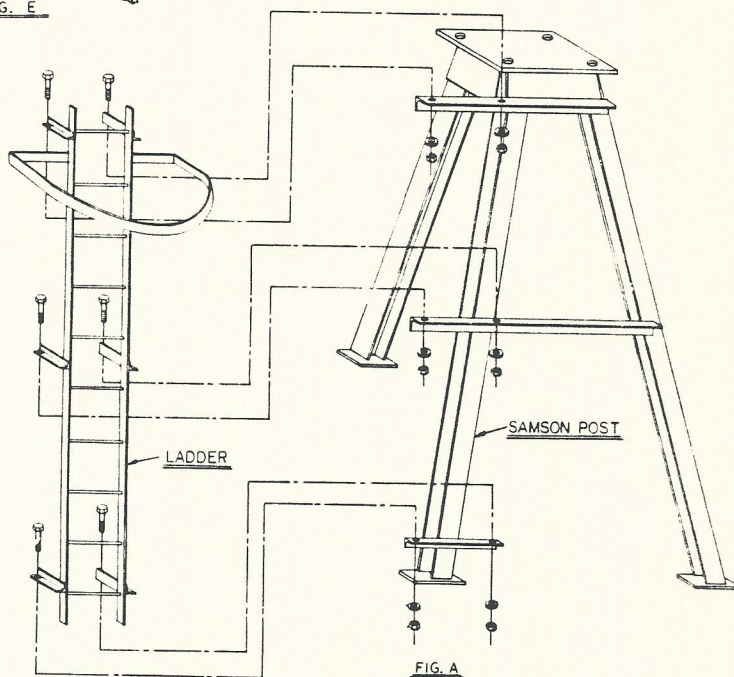
This section contains instructions for successful installation of the pumping unit. Before beginning installation, review the precautions in Section 1.



CAUTION:

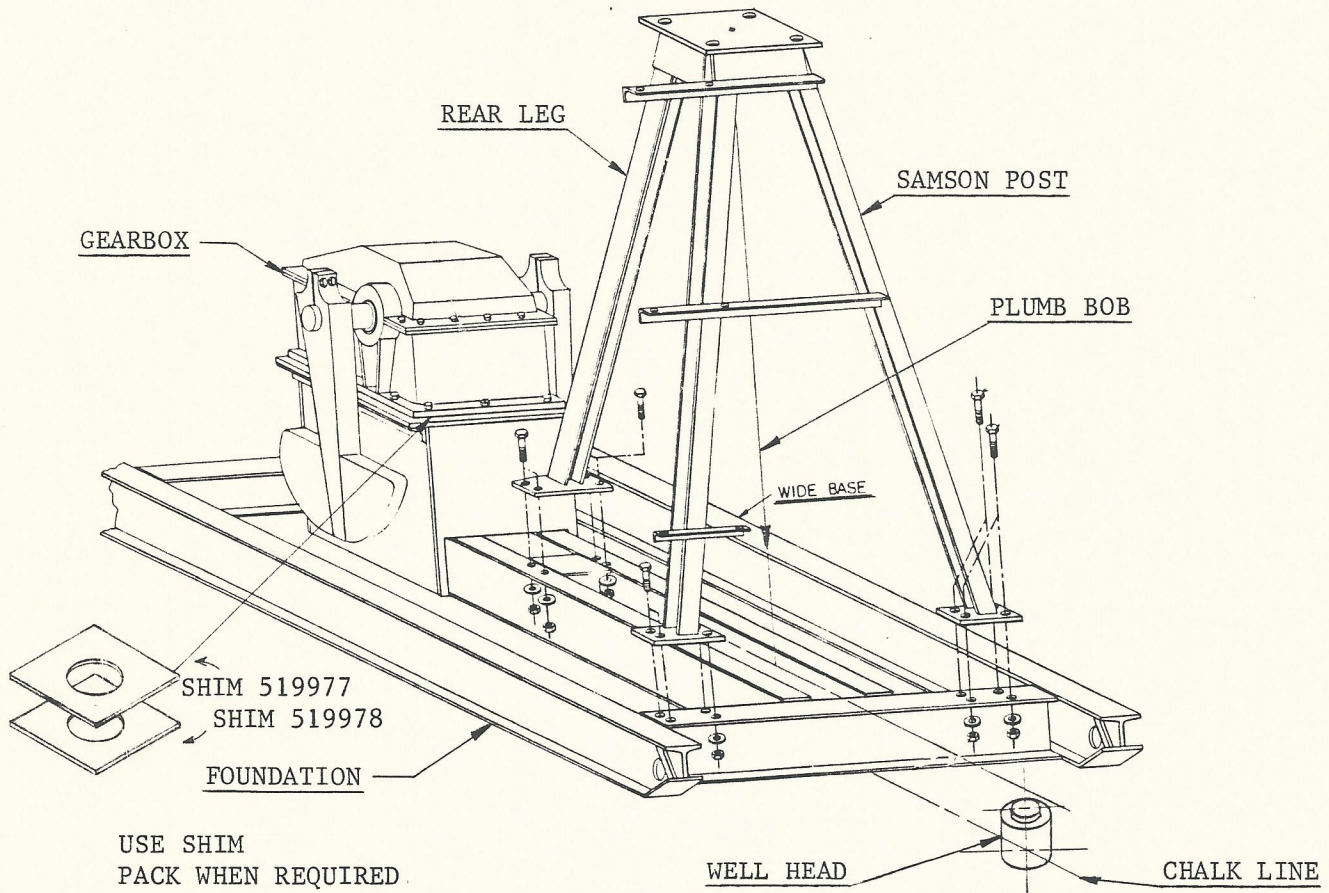
STAY CLEAR OF MOVING PARTS, SINCE THIS UNIT, LIKE ANY CRANK BALANCED UNIT, HAS MANY PINCH POINTS THAT COULD CAUSE SERIOUS INJURIES.

LOOSELY BOLT THE BACK LEG TO THE "A" FRAME ON THE GROUND. BOLT THE LADDER TO THE APPROPRIATE SIDE OF THE FRONT LEG. SLING OR CHAIN "A" FRAME AROUND CENTER BEARING PAD FOR LIFTING ON TO BASE.



THE EQUALIZER BEAM MAY BE FITTED TO THE WALKING BEAM ASSEMBLY PRIOR TO BEING LIFTED INTO POSITION. LIFT UP AND SECURE WALKING BEAM ASSEMBLY TO THE SAMSON POST. BEFORE REMOVING LIFTING SLINGS, TIE-OFF HEAD END OF WALKING BEAM TO BASE OR SAMSON POST IN AN APPROXIMATELY HORIZONTAL POSITION.

INSTALLATION STEPS



Set the Samson Post on the structural base and bolt it. The erector can use the ladder to unhook from the Samson Post, once the "A" Frame is bolted to base.

After the erection of the Samson Post on the structural base, drop plumb line from center of the Samson Post top. If the plumb bob does not fall within 1/4 inch of the chalk line centerline, check the structural base for lateral level. If the structural base is found to be level and true, it will be necessary to shim under the feet of the Samson Post legs, or shim and grout between the unit base beams and the foundation top. When the Samson Post is correctly aligned, the unit is ready for the mounting of the walking beam assembly.

INSTALLATION STEPS

Continued

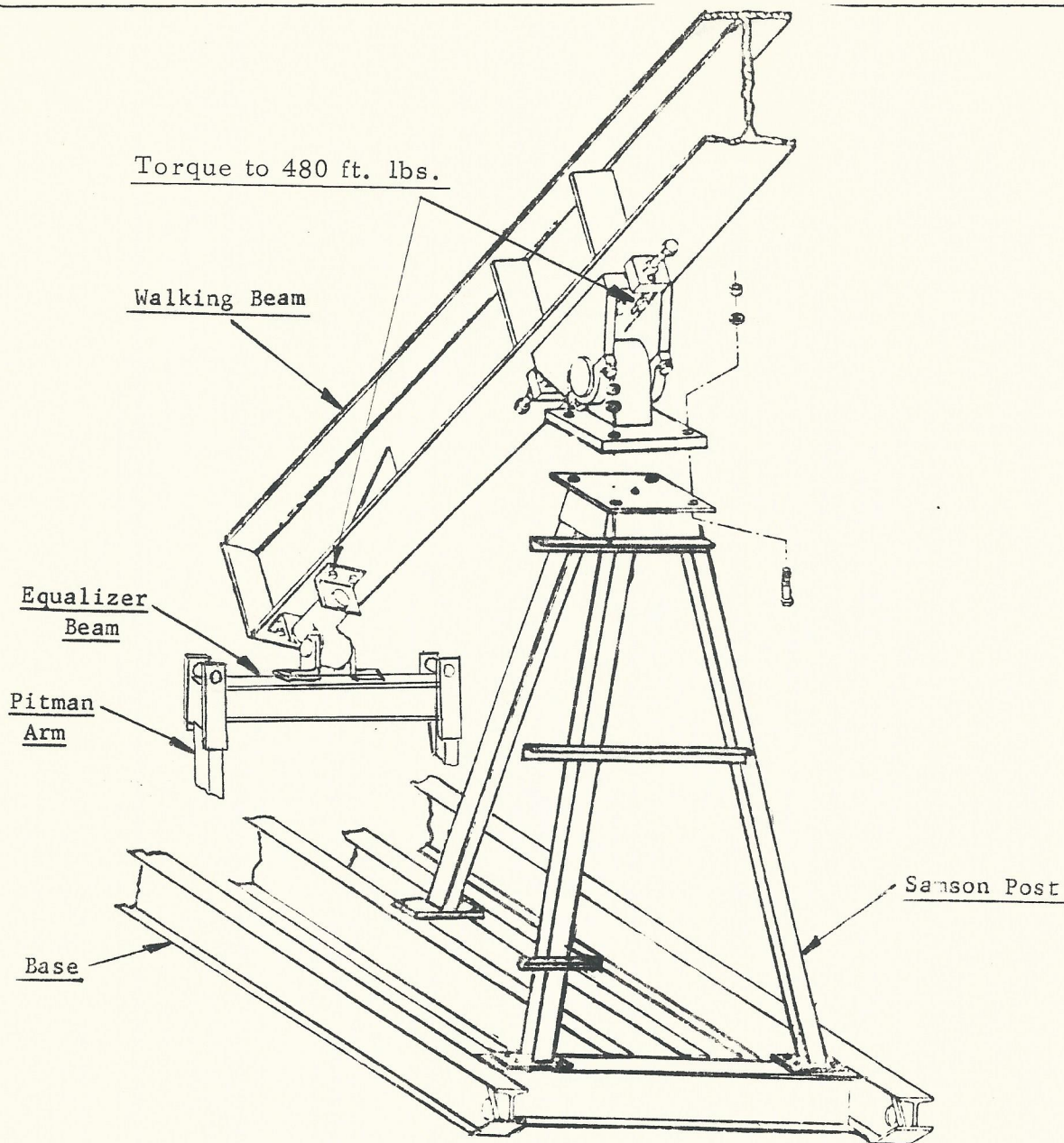
Some units require mounting gear box. The following is the proper procedure:

MOUNTING GEAR BOX TO REDUCER BASE

Thoroughly clean bottom of gear box, removing any dirt or rough spots. Also, clean to top of the reducer base "box", removing any dirt or rough spots.

Loosely place corner bolts in gear box and set the box into place, then insert all other bolts. Check each bolt location, by applying shims where gaps exist between reducer base and gear box. Shim box to nearest combination of shims, but do not lift or pry box to place shims under any circumstance.

NOTE: THE WALKING BEAM ASSEMBLY MAY APPEAR SLIGHTLY BOWED OR TWISTED DUE TO MILL TOLERANCES FOR THE I-BEAM. MORGAN MANUFACTURING PROCEDURES COMPENSATE FOR THIS, AND THE WALKING BEAM SHOULD BE ASSEMBLED TO THE UNIT AS OUTLINED BELOW.



After mounting walking beam on Samson Post and connecting pitmans to cranks, the walking beam should be checked to be sure it is parallel to unit center-line. This can be done by measuring the distance from the inside edge of the pitmans to each crank face. This gap should be the same on each side. If the gaps are unequal, loosen bolts holding the pivot bearing to the Samson Post top. Swing the beam until the gaps are equal, by means of the adjustment provided.

Move the entire pumping unit until a plumb line held at the center of the horse head (out from the arc plate one-half the thickness of the wire line) will center directly over the well tubing. An alternate method is to hang the rods on the hanger bar and adjust the walking beam until the polished rod centers in the pumping tee. (The stuffing box is unscrewed and slid up the polished rod out of the way.) When this method is used, it should be first determined that the well head is level and the tubing and polished rod are in a true vertical position and that the polished rod is neither crooked nor bent.



The horse head with bridle cable assembly after being lowered onto the walking beam, is held in place by a single bolt. This bolt should not be torqued up until final alignment is complete.

The crank arms should be rotated towards the Samson Post until in a horizontal position and preferably wedged securely with heavy lumber.

The pitman arms must be held out at an angle in order to locate top bar in equalizer beam half cup, once in position the "banjo" plate on the lower end of the arc may be positioned around the wrist pin bearing and bolted down. Note that bearing housing will only bolt in one (1) position. This is to ensure that grease relief nipple is at top of bearing.

When installing pitman to wrist pin assembly, make sure there is adequate space between "banjo" and housing. Install bolts with nuts to inside near crank arm. Evenly tighten the bolts. Torque to 360 ft. lbs.

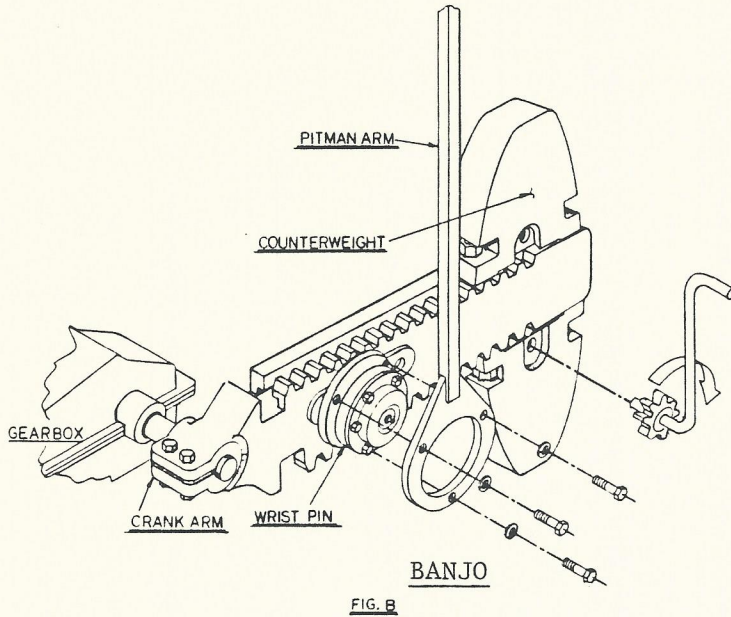


FIG. B

NOTE: CARE SHOULD BE TAKEN WHEN FITTING THE HORSE HEAD TO LOCATE THE PIVOTAL PLATE IN THE TOP END OF THE HEAD BEHIND THE CROSS SNUBBING BAR WELDED TO THE WALKING BEAM.

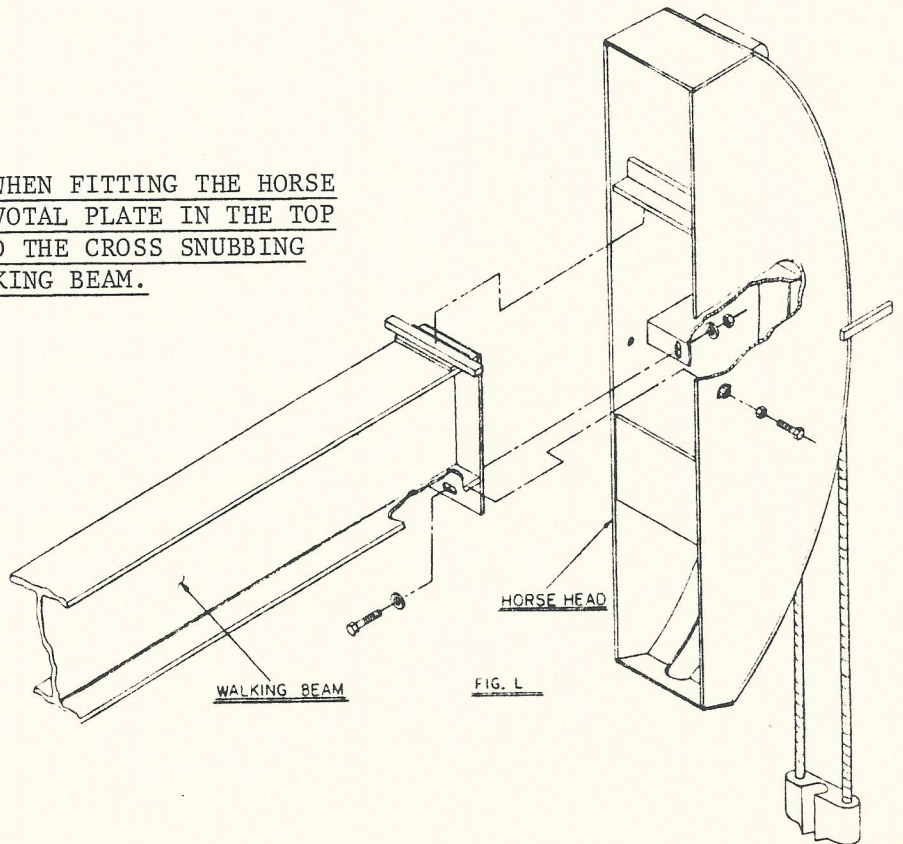
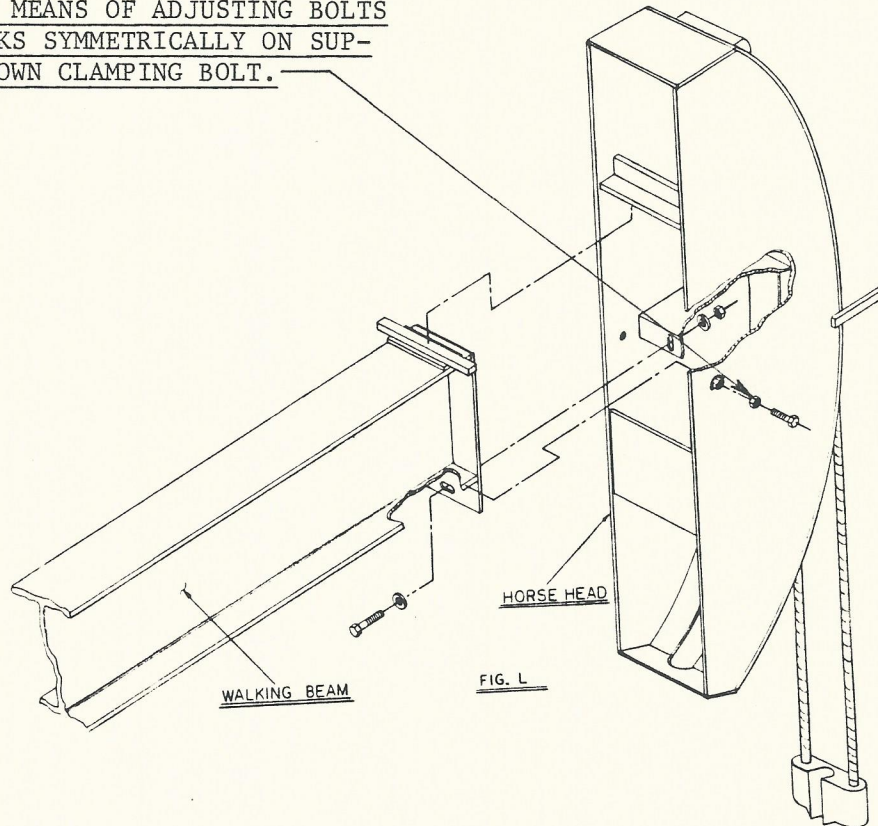


FIG. L

ADJUST HORSE HEAD BY MEANS OF ADJUSTING BOLTS UNTIL WIRE LINE TRACKS SYMMETRICALLY ON SUPPORT PLATE, TORQUE DOWN CLAMPING BOLT.



After a final alignment check has been made and necessary corrections made, torque up centerline tie downs. Fit and bolt down counterweights in estimated position.

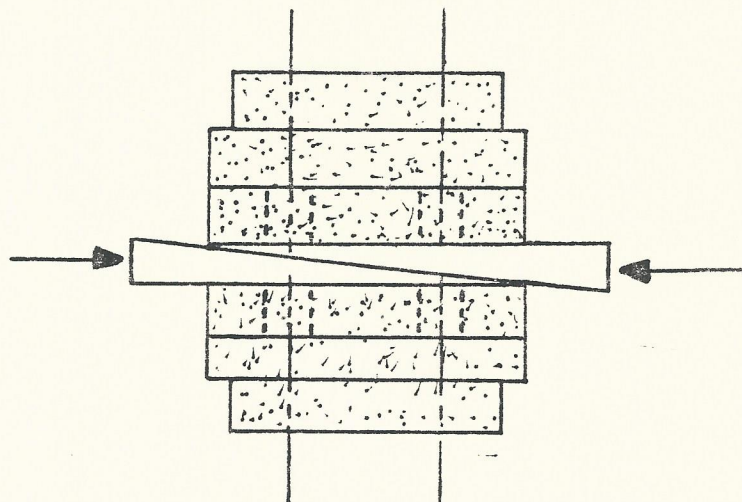
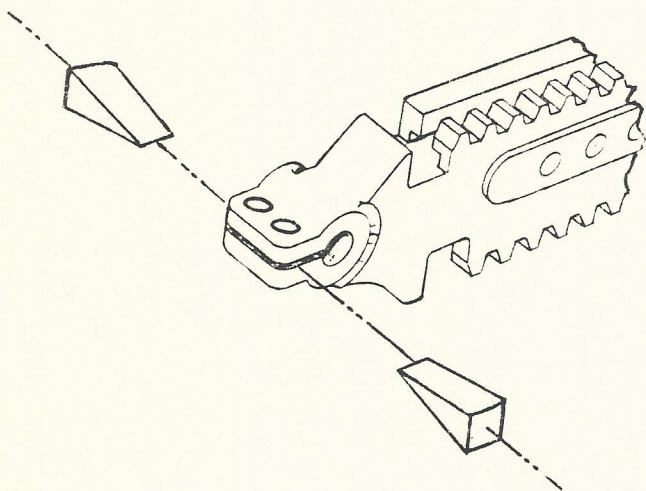
Check tightness of all structural bolts and counterweight bolts.

NOTE:

DO NOT RUN UNIT WITH COUNTERWEIGHTS WITHOUT WELL LOAD, SINCE IT WILL DO DAMAGE TO THE UNIT.

### Instructions to install crank arms on shaft

Clean bore of crank arm to remove protective coating. Then, using two (2) wedges, place in slot of crank arm as shown.



Drive wedges in, being careful not to spread too much, just enough to slip on shaft. Remove wedges and install bolts, and tighten to 550 ft.lb.

### Setting Counterweights

Position crank arm by braking in the horizontal position or slightly before center to move crank arm toward output shaft as shown on Fig. 1. Engage pinion to move weights. To extend weights outward away from output shaft as shown in Fig. 2 move arm slightly below the horizontal position and move weights with pinion crank.

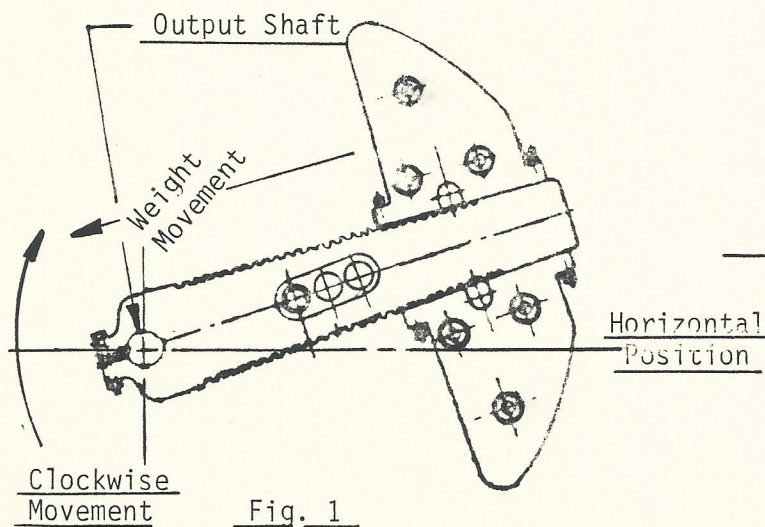


Fig. 1

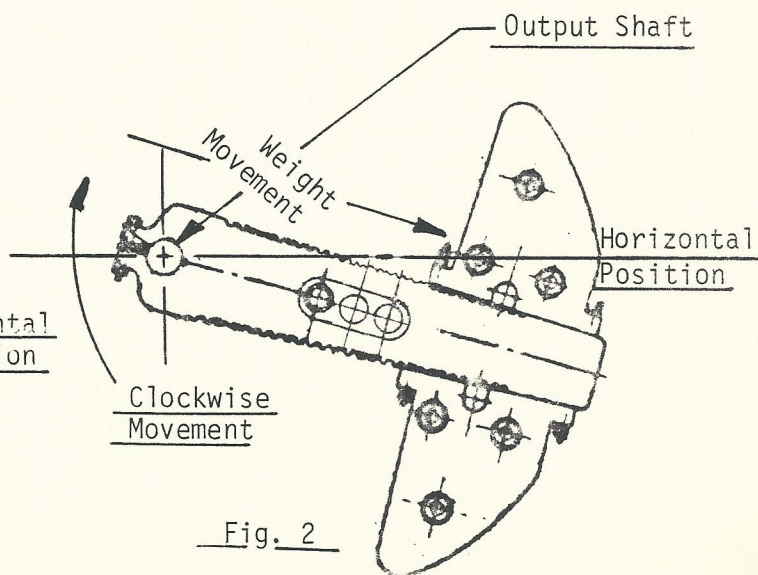


Fig. 2

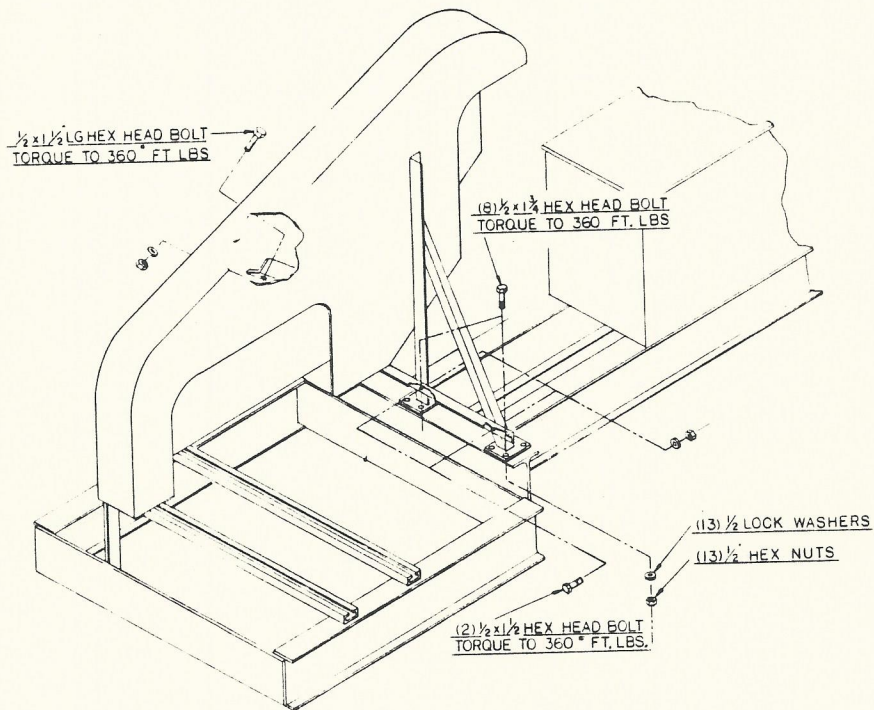
GUARD INSTALLATION

LOW MOUNT T-BASE

The following is recommended sequence for adding prime mover guard:

STEPS:

- I. Set pony base in relation to tee base - make preliminary measurement to assure that guard fits.
- II. Install prime mover.
- III. Install sheaves and v-belts - check belts for proper tension.
- IV. Install guard, (check for proper clearance). Install (8) 1/2 x 1-3/4 hex head bolts. (Do not tighten securely).
- V. Add brace, (using 1/2 x 1-1/2 hex head bolts). Tighten to specification.
- VI. Tighten (8) 1/2 x 1-3/4 hex head bolts to specification.



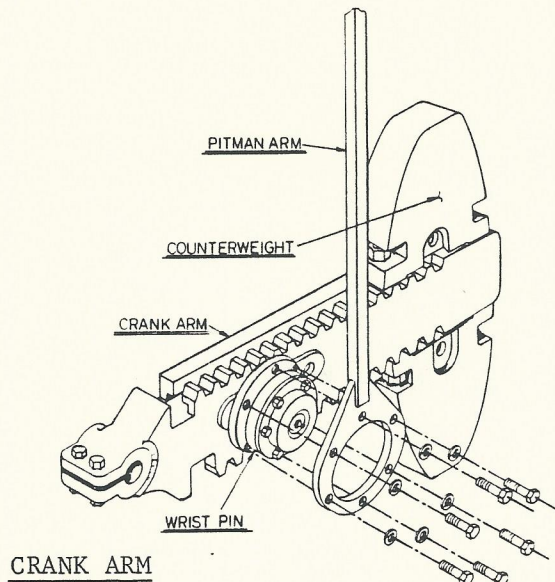


FIG. D

The wrist pin is normally fitted at the factory in the hole providing the longest stroke. However, stroke length changes may be made in the following fashion. Stop crank arms in a horizontal attitude pointing towards the well head. Apply brake, AND AS A SAFETY PRECAUTION, SUPPORT WITH HEAVY LUMBER. Clamp off the rod string and tie off head end of walking beam with "come along". A rope attached to equalizer end of walking beam may be used as a safety measure and a "steady" when relocating wrist pins.

The new wrist pin hole should be thoroughly cleansed of all protective coating and foreign matter in the bore and on nut seating face.

The cotter pin may now be removed from the wrist pin nut and the nut driven off. In order to loosen the wrist pin, a hammer drive nut should be used to protect the wrist pin thread. However, a soft metal "buffer" may be used instead as long as care is taken to protect the wrist pin from damage.

Before refitting wrist pin in new location, ensure that the taper is clean and free from contaminants. Smear with light oil and replace in crank arm.

Oil thread and replace wrist pin nut, tighten by hand until no further movement of wrist pin into hole is observed. Using hammer, tighten nut minimum of two (2), maximum of three (3) castellations past cotter pin hole and fit pin in hole. Do not back off to fit cotter pin.

Retighten polished rod clamp and remove rod string clamp. Remove all ropes, come-alongs and safety lumber. AT ALL TIMES, WATCH FOR FREE ROTATION OF CRANK ARMS. Pumping unit is now ready to restart. Readjusting of counterweights is usually required after stroke length change.

After 24 hours of operation, check the tightness of all fasteners, repeat this step after additional 24 hours. Hammer tighten wrist pin nuts, then drive them to the next castellation. Do not back off nut to insert the cotter pin. Check that the wire line tracks symmetrically on the support plate.

SECTION 4

START-UP AND OPERATION

WARNING

STAY CLEAR OF ALL MOVING PARTS. MAKE SURE THE BRAKE IS ON AND, IF NECESSARY, MOVING PARTS BRACED BEFORE SERVICING THE PUMPING UNIT. REMEMBER, GRAVITY CAN CAUSE EVEN A STATIONARY UNIT TO START MOVING.

PRECAUTIONS

BEFORE STARTING UNIT IN MOTION, CHECK:

1. OIL LEVEL IN REDUCER IS FILLED TO CORRECT HEIGHT ON DIPSTICK. BEARINGS ARE PROPERLY LUBRICATED.
2. ALL GUARDS FITTED AND CLEAR OF MOVING PARTS.
3. ALL TOOLS AND ERECTION EQUIPMENT CLEAR OF MOVING PARTS, ESPECIALLY CRANK ARMS.
4. DIRECTION OF ROTATION OF ELECTRICAL PRIME MOVER (BEFORE BELTS FITTED).
5. VISUALLY CHECK ALL PIVOT POINTS TO ASSURE THAT NOTHING HAS SHIFTED DURING ASSEMBLY.

CHECKING CLEARANCES

The first revolution may be "powered up" and inched down on brake while checking all clearances, including the downhole pump set-up.

SETTING COUNTERBALANCE (Also see Page 17)

Accurate counterbalance setting provides for lower energy consumption and extended pumping unit life. The load on the gearbox occurs at two (2) peaks. Lifting the fluid causes one (1) peak, lifting the counterbalance the other. The two (2) peaks equal out when counterbalance is properly adjusted and the gearbox experiences minimum peak load. Most gear wear results from a lack of enough counterbalance. Therefore, care should be taken in determining the correct counterweight position. Correct positioning can be achieved by any of the applicable methods on next page.

SECTION 4

Continued

	<u>ELECTRIC PRIME</u>	<u>GAS ENGINE PRIME</u>
Dynamometer	X	X
Ammeter	X	
Vacuum Gauge		X
Sound of Exhaust		X

The correct amount of counterbalance to be applied, with either an electric or gas prime mover, can be determined from a dynamometer study. A dynamometer will also indicate tubing leaks, overloading of reduction gears, excessive friction, leaking pump valves, paraffin conditions, incorrect speed, parted rods and gas locks.

An ammeter will peak equally on the upstroke and the downstroke at proper counterbalance. Connect the ammeter to any one of the motor's lead wires. A higher reading on the upstroke indicates a need for more counterbalance. A higher reading on the downstroke means less counterbalance is required.

A vacuum gauge can be utilized to check counterbalance when multi-cylinder engines are used. The gauge should peak equally on the upstroke and the downstroke.

Listening to the sound of the exhaust at peak loading conditions will indicate to the experienced operator if counterbalance is properly set.

Check counterbalance and readjust weights at start of pumping and recheck regularly until well is stabilized.

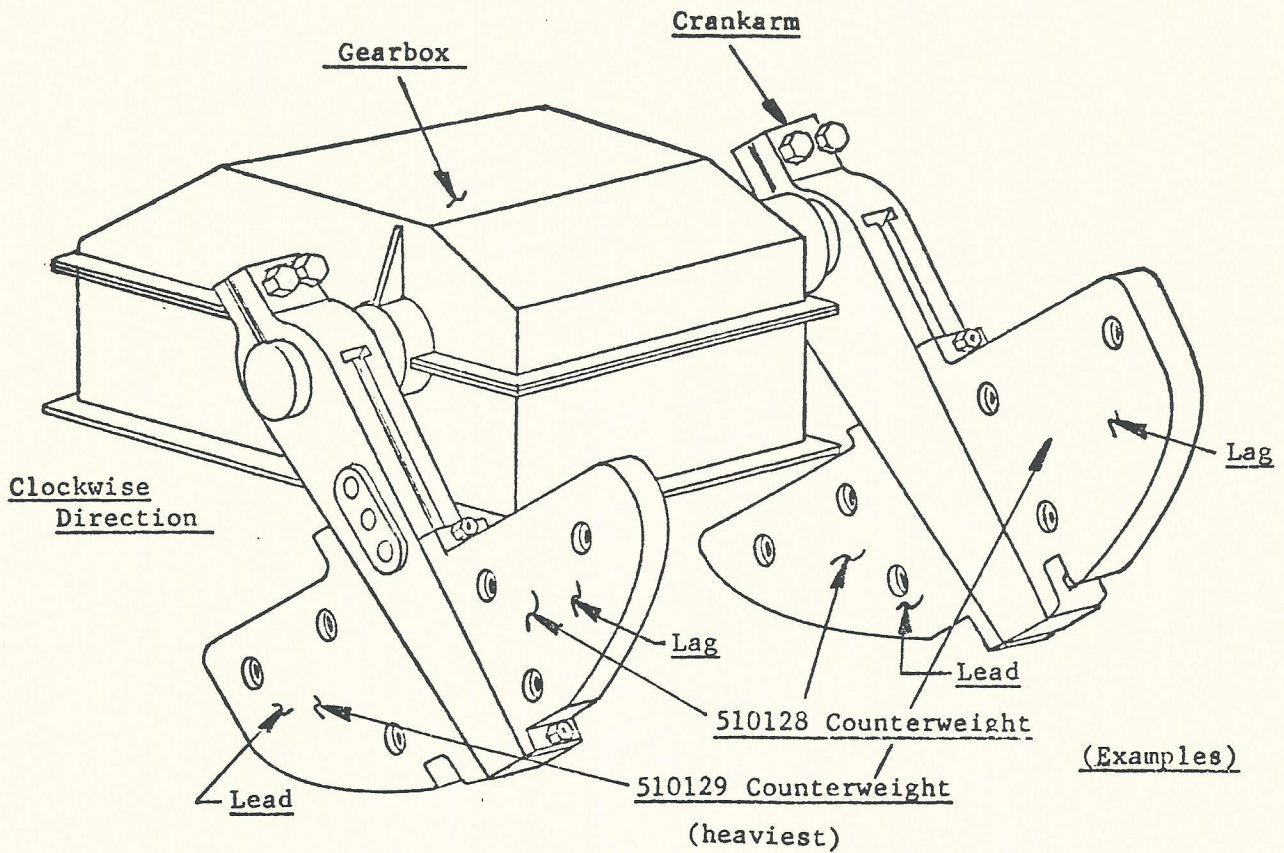
Counterweight adjustment should be carried out as follows: The unit must be stopped with the crank arm centerline in a horizontal position and the brake applied.

CAUTION

THE COUNTERWEIGHT HOLD DOWN BOLTS  
ON UPPER COUNTERWEIGHT SHOULD BE  
LOOSENEED SUFFICIENTLY TO ALLOW  
MOVEMENT OF THE WEIGHTS.

With the aid of the counterweight adjusting pinion, the weights may be repositioned and the hold down bolts retorqued to the correct value as shown on erection drawing, recheck after twelve (12) hours. Crank arms should be rotated thru 180° and procedure repeated for remaining weights.

COUNTERWEIGHT SEQUENCE



EXPLANATION:

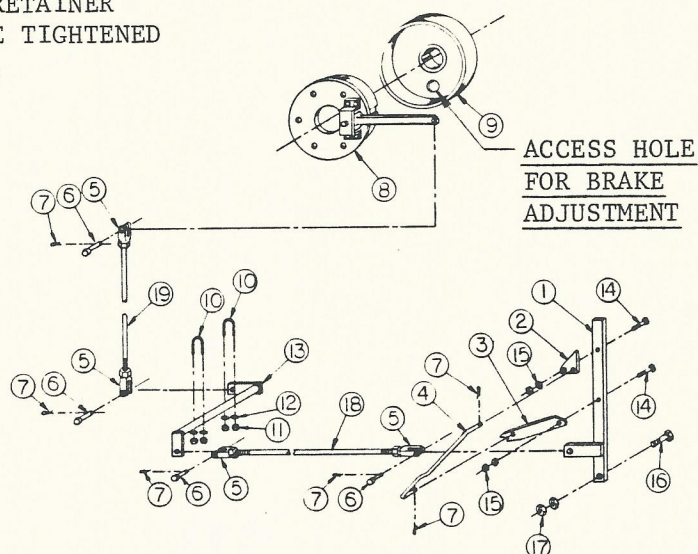
When the direction of rotation is clockwise, the lead weight is the weight that is ahead of crank arm and the lag weight is the weight behind crank arm. If direction of arms is counterclockwise, the lead and lag would be reversed.

EXAMPLE

Always apply counterweights on crank arms so that they are balanced, when using two (2) heavy and two (2) light weights; never apply two (2) light weights on one side. Use one (1) heavy counterweight as a lead weight on one side and other heavy counterweight as lag on the other side.



FASTENERS FOR RETAINER  
PLATE SHOULD BE TIGHTENED  
TO 120 FT. LBS.



BRAKE ASSEMBLY

ADJUSTING THE BRAKE

WARNING

ALWAYS DISENGAGE THE PRIME MOVER  
BEFORE ENGAGING BRAKE. BRACE THE  
CRANK ARMS BEFORE ADJUSTING THE  
BRAKE OR DOING ANY MAINTENANCE  
TO UNIT.

To adjust the brake, rotate the brake drum until the access hole is opposite the brake adjustment wheel. Adjust so the shoes touch the drum, then back off four (4) notches. Since excessive usage of brake induces wear, brake should be adjusted periodically according to usage.

Adjust the brake rods. Replace any broken or bent pieces.

Apply brake slowly several times before usage to assure proper functioning. Do not apply brake suddenly because damage to gear teeth may result. Make sure brake is completely disengaged while operating unit.

## SECTION 5

### MAINTENANCE

#### PREVENTIVE MAINTENANCE PROGRAM

A pumpjack's efficiency reflects its maintenance. A complete maintenance program helps ensure reliable, expected-life operation. Preventive maintenance also prevents costly down time and personnel hazards.

A good maintenance program consists of inspecting, lubricating, and (when necessary) repairing the pumping unit. At regular intervals, lubricate and inspect the unit. During inspection, adjustments and minor repairs can be performed. Replace parts when damage or improper operation is observed. Such preventive repairs are inexpensive compared to the cost of correcting extended damage produced by failed parts.

Only the user can determine how often the various components should be inspected or lubricated. Time between inspections is dictated by the severity or lack of use, atmospheric conditions. A master check list should be created listing the type and frequency of inspection for each component. The date each item is inspected or lubricated should be entered onto the checklist. Any unusual maintenance should also be noted on the check list. Retain these check lists to form a case history of the unit. Reviewing these records will reveal problem areas and keep them from becoming serious.

#### INSPECTION PROCEDURE

Follow the steps listed below to inspect the pumping unit:

1. Check that wire line tracks symmetrically on the support plate. If not, adjust the horse head with the adjusting bolts until it is centered. Make certain there are no broken strands or badly worn areas on the wire line. Lubricate as indicated in WIRE LINE LUBRICATION.
2. Inspect the center bearing and grease seals for leakage. Make sure relief nipples operate properly. All bolting must be tight. Rust around bolt heads indicates looseness. Lubricate according to BEARING LUBRICATION.
3. Check equalizer bearing and grease seals for leakage. Make sure relief nipple is in working condition. All bolting must be tight. Rust around bolt heads indicates looseness. Lubrication instructions are given in BEARING LUBRICATION.
4. Look for rust around wrist pin holes. Inspect the wrist pin, nut and crank hole. If any one (1) piece shows movement of wear, replace the entire wrist pin assembly. Mark the used crank hole as bad so it is not reused. Check wrist pin bearing and seals for leakage. Relief fittings must operate properly. Lubricate bearing as detailed in BEARING LUBRICATION.
5. Check that the counterbalance is accurately set as detailed in SETTING COUNTERBALANCE (Section 4).
6. Inspect unit alignment according to Step 8 of INSTALLATION STEPS (Section 3). Misalignment may be indicated by any of the following: wire line not tracking on the horse head, wear on one side of the polish rod and stuffing box or back end of the walking beam drawing a figure eight as it moves through a cycle.

SECTION 5

Continued

7. Make sure unit tie downs are secure.
8. Run the unit. Listen for unusual noise. Locate the source and make necessary adjustments.
9. Check drive belt tension and sheave alignment. Unusual belt wear or deterioration is possibly caused by worn sheave or sheave misalignment. The belt's back should ride above the edge of the sheave. Check groove wear with a groove gauge. Replace belts in sets.
10. Inspect prime mover according to manufacturer's instructions.
11. Inspect the brake according to ADJUSTING THE BRAKE (Section 4).
12. Lubricate and inspect the gear unit as detailed in GEAR UNIT LUBRICATION AND MAINTENANCE.

WIRE LINE LUBRICATION

Brush dirt, grime and old lubrication off wire line. DO NOT USE SOLVENTS TO CLEAN THE WIRE LINE. Lubricate with a wire rope lubricant.

BEARING LUBRICATION (3 Point Ground Level Lubrication)

The center, equalizer and wrist pin bearings are to be lubricated with UNIREX Lo-Temp EP grease, or direct equivalent, good for -50°C + 107°C (-60°F to +225°F). Do not use cup grease or heavy wheel bearing grease. Do not mix types or brands of grease.

Always inspect bearing seals when lubricating. Immediately replace any ruptured or leaking seals.

Bearings should be greased at regular intervals depending on operating conditions, temperature and the condition of the grease seals. Under normal conditions, relubricate at least every six (6) months.

GEAR UNIT LUBRICATION AND MAINTENANCE

It is ruggedly constructed to withstand arduous conditions and, provided it is properly maintained, it should give trouble free operation for the life of the gears.

1. LUBRICANT

Before starting the reducer, it is to be filled with oil to the level marked on the dip stick. For winter operation when ambient temperature is between -30° to +50°F, use an oil with a ISO viscosity grade of 150, (SAE Gear Lube 85W) (AGMA #4). Pour point of oil should be -10 or lower. For summer operation when ambient temperature is between 50° to 125°F, use an oil with a ISO grade of 220, (SAE Gear Lube 90W)(AGMA #5). Pour point of oil should be 0° or lower. Lubricating oil should be a high grade, high quality, well refined, mild extreme pressure type oil (E.P.) that agrees with the aforementioned specs. It must not be corrosive to gears or anti-friction bearings. It must be neutral in reaction, free from grit and abrasives, and possess good defoaming properties.

SECTION 5

Continued

1. LUBRICANT (Cont'd.)

After the first two (2) weeks of operation, drain the unit and fill with fresh oil. Using a pressure pump, flush the gear unit with a cleaning solvent, light weight oil or diesel fuel. (Do not use kerosene.) Remove as much of the flush as possible by draining and wiping the gears and gear box with lint free rags. Fill and run a few minutes under no load conditions to coat the gearing surfaces.

2. OIL CHANGES

Oil changes are recommended every six (6) months, normally in spring and fall unless working under adverse conditions such as: intermittent operation, excessive dust, sulphur fumes and high humidity with large variation in ambient temperature.

Under the most favorable conditions of minimum daily and seasonal temperature changes, low humidity and freedom of atmospheric dust, a reducer may operate through one (1) or more years before the oil is contaminated or deteriorated to the point that an oil change is required.

The method used to determine how often oil should be changed to maintain the desired condition is a matter of policy with the individual company. Some operators periodically inspect reducers and take samples of oil for laboratory analysis to determine the percentages of water, sludge and foreign material in the oil. Checks may also be made on other factors such as acidity and viscosity. Oil is then changed whenever the analysis shows that the limit set for any one of the various factors has been exceeded. If an additive-type oil is used for cold weather operation, it should be drained in warm weather because additive oils have an affinity for water.

Other operators depend upon periodic visual inspection to determine when to change oil. An inspection includes a look inside the gear case and an examination of a sample of oil that has been drawn off the bottom of the gear case and allowed to settle. Oil is changed when an inspection shows: sludge on the surfaces inside the reducer, emulsification of oil, sludging of the oil and contamination of the oil with foreign material such as dirt, sand or metal particles. Sludging and emulsification of oil are usually found if there has been an excessive accumulation of water in the reducer.

Each time the oil is changed, the reducer should be flushed out with automobile crank case flushing oil or other light oil. The reducer should be filled with flushing oil and operated for about five (5) minutes under no load. Check the oil grooves and be sure that all foreign matter that may have collected is removed. Drain the flushing oil and fill the reducer to the proper level with new oil. Do not use kerosene or gasoline for flushing. If the unit is not immediately returned to operation, the unit should be operated for at least ten (10) minutes to ensure that all surfaces are covered with a protective film of oil.

SECTION 5

Continued

3. MAINTENANCE

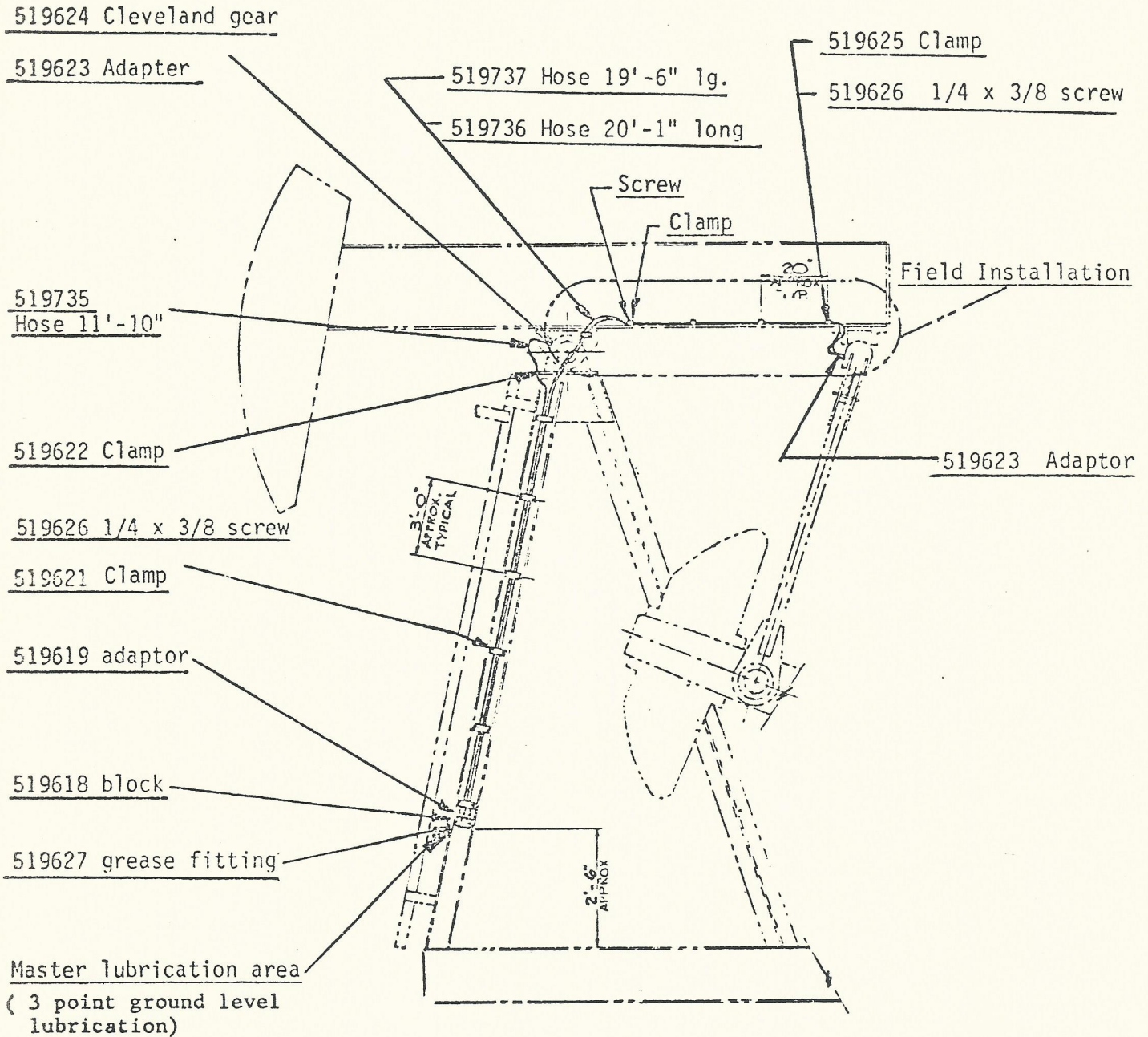
Oil level must be maintained between marks on the dipstick. Check oil level only when the unit is at rest and after the oil has been allowed to settle. When adding oil, the level must not be considerably increased above the high mark, or the churning of the oil will result in rapid deterioration of its qualities due to overheating and oxidation.

Check for water build-up in the oil due to atmospheric condensation. Drain the oil off via the drain plug until only oil is discharging.

Breather air vents must be kept clear to permit air pressure to equalize. The filter element of the breather should be replaced or washed periodically.

Inspect the inside of the unit. Check the oil for: emulsification with water, sludging and the presence of dirt, metal chips or other contaminants. Visually inspect the gear teeth for pitting, scoring, galling, abrasion or scratching. The presence of any of the above conditions probably indicates a lubrication or loading problem. (See the Troubleshooting Chart.)

LUBE ASSEMBLY & DIAGRAM



Designated items, (in Phantom) consisting of hose, clamps and screws are to be field assembled. The hose, shipped temporarily fastened to the rear leg, is to be placed on walking beam. Using clamps and self tapping screws in shipping box, fix hose to walking beam by placing clamps and self tapping screws in holes provided. End fitting to be installed in the adaptor located on equalizer beam. Using grease gun, grease at master lubrication area until air is bled from the lines.

After two (2) weeks of operation, check gearbox oil level. Lubricate all bearings. Check all fasteners for tightness.

Monthly program should be started at this time.

## SCHMATIC OF MORGAN GEARBOX

### HARDNESS AND HORSEPOWER RATINGS SELECTED FROM THE API STANDARDS

The first and second shafts are mounted in spherical roller anti-friction bearings mounted to allow the gearing to "train" in line behind the output gears.

The output shaft is held rigidly in place by tapered roller bearings which are installed with a slight pre-load to prevent shaft oscillations or movement and reduce the bearing noise level.

All shaft openings are sealed with dual lip seals.

All bearings to be oil splash lubricated using diverters for feeding and maintaining oil level at the dams located at each bearing.

**PINIONS:**  
Quenched and tempered Alloy Steel.

All bearings are mounted in bearing carriers to prevent damage to the housing if a bearing failure should ever occur.

**GEARS:** Quenched and tempered Ductile Iron.

The housing is of heavy cast iron construction with a horizontal split for easy and reliable installation of gears.

Double helical gear design allows for the use of modern gear hobbing machines for generated gearing which gives the quality level of a helical gear and eliminates the thrust loads as do the herringbone gears. Not only does the double helical design combine the best features of the other two designs, but additionally creates a balanced load on the gear box shafting and bearings.

#### DOUBLE REDUCTION GEAR BOX WITH GEAR RATIOS AS FOLLOWS:

#114 29.7:1	#456 29.78:1
#160 30.3:1	#640 30. 0:1 (approx.)
#228 29.8:1	#912 30. 0:1 (approx.)
#320 29.2:1	

GEAR UNIT TROUBLESHOOTING CHART

This chart contains some of the common problems (with probable cause and solution) encountered during gear unit operation. However, due to the variance in pumping unit usage and maintenance, the information contained in the chart may not be applicable to certain situations.

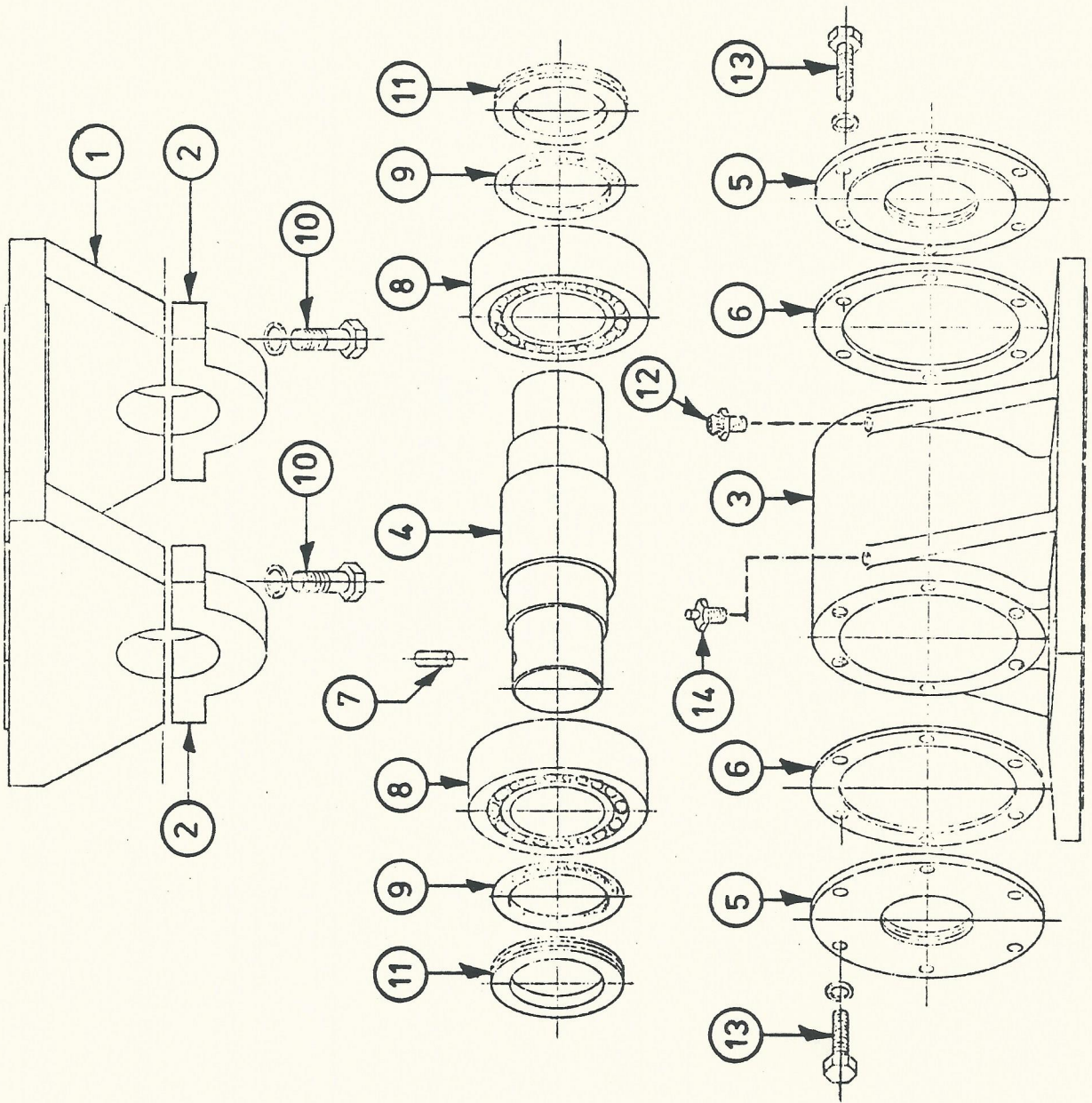
<u>PROBLEM</u>	<u>CAUSE</u>	<u>SOLUTION</u>
1. Pitting, galling, abrasion or scratching on gears or gear teeth.	Overloading from improper counterbalance. Improper type, contaminated, or degraded oil.	Adjust counterbalance. Drain, flush and re-fill with proper oil.
2. Excessive rust on gears or bearings.	Inadequate operation in humid conditions. Water in gear case. Improper type or deteriorated oil. Lack of ventilation.	<u>In all cases</u> , drain, flush and refill with the proper oil. Be sure breather valve is open.
3. Excessive wearing of gears or bearings.	Dirty oil.	Drain, flush and re-fill with proper oil.
4. Deposits on gears or bearings.	Improper type or worn out oil.	Drain, flush and re-fill with proper oil.
5. Insufficient oil lifted by the gears and channeled to the bearings.	In high temperatures, oil too thin. In low temperatures, oil too thick.	<u>In either case</u> , modify with a heavier (high temperature) or lighter (low temperature) oil of the same grade, or drain, flush and re-fill with an oil of proper viscosity.
6. Foam rises in gear box.	Incorrect lubricant. Overfilled unit.	Drain, flush and re-fill with proper oil. Drain to proper level.
7. Heavy, soapy sludge.	Types or brands of oil mixed.	Drain, flush and re-fill with proper oil.
8. Starts hard (in cold temperatures).	Oil too heavy.	Modify with a lighter oil of the same type, or drain, flush and re-fill with the proper oil.
9. Milky appearing oil.	Oil emulsified with water.	Drain, flush and re-fill with the proper oil.
10. When unit makes unusual sounds (cracking noise)	Tailbearing is loose.	Tighten tailbearing to Torques specified.



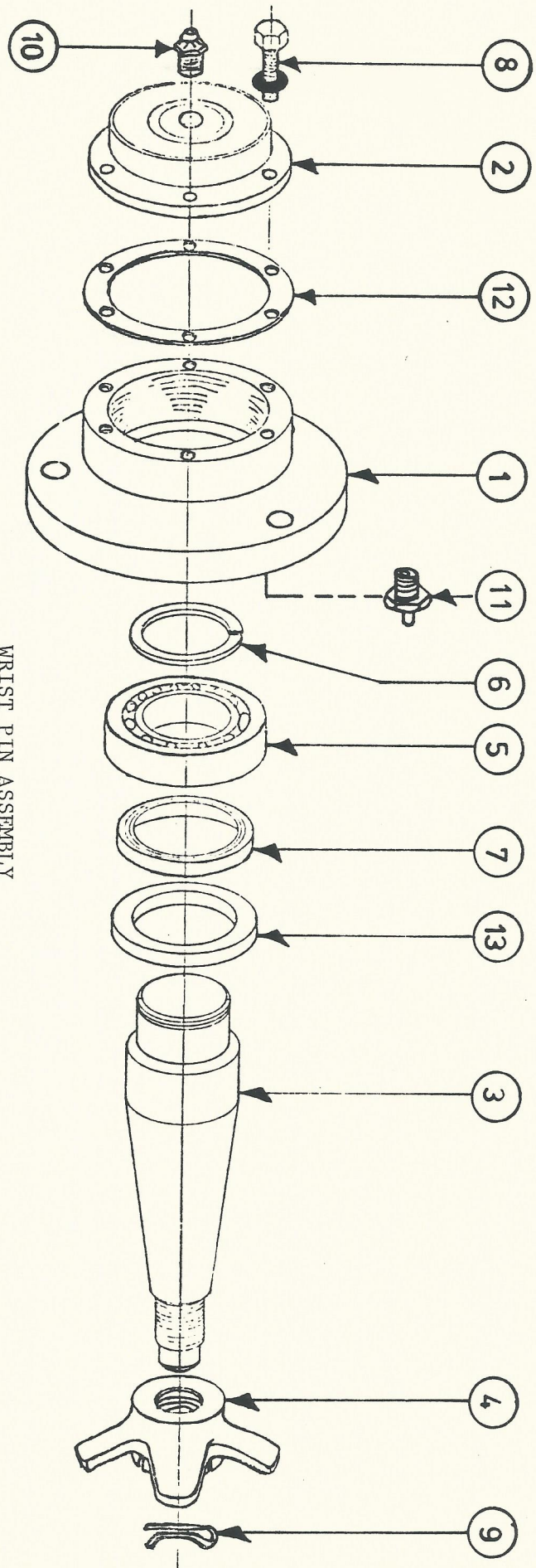


ASSEMBLY CENTER BEARING PARTS LIST

1. Saddle - Center Bearing
2. Cap - Center Bearing
3. Housing - Center Bearing
4. Shaft
5. Plate - End
6. Gasket - Plate End
7. Pin - Roll
8. Bearing
9. Seal 'O' Ring
10. 3/4  $\varnothing$  Bowmalok Bolt with Lockwasher
11. Seal - Secondary
12. Nipple - Grease
13. 3/8  $\varnothing$  Bowmalok Bolt with Lockwasher
14. Nipple - Pressure Relief

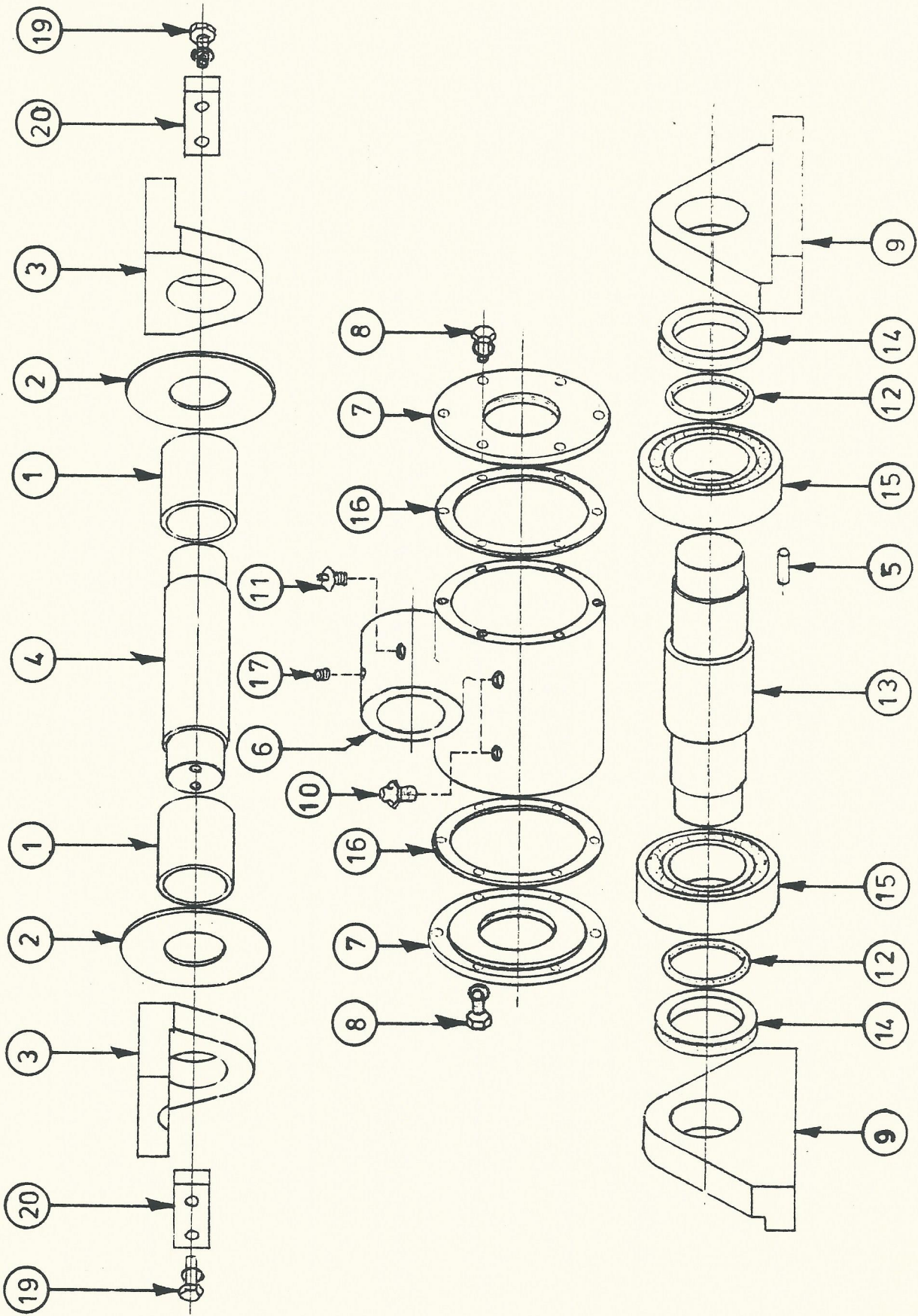


ASSEMBLY CENTER BEARING



WRIST PIN ASSEMBLY

1. Housing
2. Cover
3. Wrist Pin
4. Castellated Nut
5. Bearing
6. Retaining Ring
7. Primary Seal
8. Bolts and Lockwashers
9. Grease Nipple
10. Pressure Relief Nipple
11. Gasket
12. Secondary Seal
13. Secondary Seal



ASSEMBLY EQUALIZER BEARING

ASSEMBLY EQUALIZER BEARING PARTS LIST

1. Bushing
2. Washer - Thrust
3. Support - Secondary Shaft
4. Shaft - Secondary
5. Pin Roll
6. Housing
7. Plate End
8. Bolt - 3/8" and Lockwasher
9. Support - Main Shaft
10. Nipple - Grease
11. Nipple - Pressure Relief
12. Seal 'O' Ring
13. Main Shaft
14. Seal - Secondary
15. Bearing
16. Gasket - End Plate
17. 1/8" Pipe Plug - Countersunk
- 18.
19. Bolt - 1/2" and Lockwasher
20. Plate - Keeper

MORGAN PUMP

TWO YEAR ORIGINAL USER WARRANTY

DURATION

In order to activate the effective warranty date the Original User (hereinafter "Buyer") will be required to complete the Warranty Card enclosed in the Users Operations Manual package once the unit has been sold to the Buyer. To comply with said warranty, the warranty will COMMENCE upon the original shipment date from Seller/Manufacturer (hereinafter "SELLER") and CONTINUE for a period of THIRTY (30) MONTHS on Original Equipment OR for a period of TWENTY-FOUR (24) MONTHS from date unit is put into service, as indicated on warranty card by the Buyer, whichever occurs first.

WARRANTY TO ORIGINAL USER

The MORGAN PUMP purchased is subject to the following express warranties and no other.

The equipment is warranted to be properly manufactured and shall be free from defects in material and workmanship under normal use and proper operating condition as used by the Buyer. This warranty shall not apply to any equipment subject to misuse due to common negligence or accident, nor to any equipment made by Seller which is not operated in accordance with the printed suggested instructions of Seller or which have been operated beyond the rated capacity of the equipment.

The Seller makes NO WARRANTY of any kind, express or implied, EXCEPT that the original equipment sold shall be of the standard quality of the Seller and BUYER ASSUMES ALL RISK AND LIABILITY resulting from the use of the equipment. Seller neither assumes nor authorized any person to assume for Seller any other liability in connection with the sale or use of the equipment sold, and there are no oral agreements or warranties collateral to or affecting this agreement.

The Seller's liability shall be limited to repairing or replacing any part or parts at its works in Alliance, Ohio, which do not conform to the quality as warranted; if returned within the duration period. The Seller shall bear the Cost of incoming and outgoing freight charges for the defective part or parts to the Buyer's original shipment designation or such other destination as the Buyer may indicate. Irrespective of the above, Seller reserves the right to repair, replace or otherwise return to normal service any equipment under warranty.

Notwithstanding the return of defective parts this warranty SHALL NOT APPLY to parts damaged in shipment or by misuse, abuse, neglect, improper installation, repair by someone other than the Seller or usage. Nothing occurring within the Duration of the warranty and nothing occurring prior to or in addition to the sale shall serve to modify the warranties contained herein. THE WARRANTIES SET FORTH IN THIS PROVISION ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER STATUTORY, EXPRESS OR IMPLIED. WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR ARISING FROM COURSE OF DEALING OR USAGE OF TRADE ARE SPECIFICALLY EXCLUDED.

THE REMEDIES PROVIDED ABOVE ARE THE PURCHASER'S SOLE REMEDIES FOR ANY FAILURE OF THE COMPANY TO COMPLY WITH ITS OBLIGATIONS. CORRECTION OF ANY NON-CONFORMITY IN THE MANNER AND FOR THE PERIOD OF TIME PROVIDED ABOVE SHALL CONSTITUTE COMPLETE FULFILLMENT OF ALL THE LIABILITIES OF THE COMPANY WHETHER THE CLAIMS OF THE PURCHASER ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE) OR OTHERWISE WITH RESPECT TO OR ARISING OUT OF THE SERVICES OR REPAIRED/REPLACED ITEMS FURNISHED HEREUNDER.

CLAIMS AND NOTIFICATION

Claims under these Warranties will not be considered unless the Seller is notified in writing within ten (10) days after any alleged breach of the aforesaid warranties. Seller shall have the option of inspecting the equipment at the Buyer's site before allowing or rejecting the Buyer's claim. Claims for shortages or other errors must be in writing sent to Seller within ten (10) days after receipt of shipment and failure to give such notice shall constitute unqualified acceptance and a waiver of all such claims by Buyer. No claim for correction will be allowed except for work done with the written consent of the Seller.

Defects that do not impair the service of the product, do not fall within the ambit of this warranty and are thereby excluded.

Buyer or User agrees that whenever any representative of Seller shall be on the premises of Buyer or User at any place directed by the Buyer or User for purpose of inspecting, repairing or servicing of the equipment sold herein, the Buyer or User shall indemnify and hold Seller harmless from all claims, suits or actions arising from or growing out of the inspecting, repairing or servicing of such equipment and from all expenses of defending against such claims, suits or actions.

THE ERECTION INSTRUCTIONS AND SUGGESTIONS FOUND IN THE OWNER'S MANUAL CONTAIN NO WARRANTIES EXPRESS OR IMPLIED AND NO INFORMATION CONTAINED THEREIN SHALL BE CONSTRUED AS ENLARGING SELLER'S LIABILITY OR BUYER'S REMEDIES UNDER THIS WARRANTY OR THE SALES AGREEMENT.

THIS WARRANTY IS NONTRANSFERABLE AND EXTENDS ONLY TO THE ORIGINAL BUYER UNLESS WRITTEN CONSENT IS OBTAINED FROM THE SELLER.