Conventional Pumping Unit & Reverse Mark Nomenclature

HORSEHEAD
WALKING BEAM
CENTER BEARING
EQUALIZER BEARING
CAGED LADDER
EQUALIZER
PITMAN ARM
WIREFLINE
CARRIER BAR
CRANK
CRANK PIN BEARING
BRAKE
COUNTERWEIGHT
PRIME MOVER
SAMSON POST
BRAKE LEVER
BASE
GEAR REDUCER (not visible)

Mark II Pumping Unit Nomenclature

HORSEHEAD
CROSS YOKE
CROSS YOKE BEARING (not visible)
WALKING BEAM
SAMSON POST BEARING ASSEMBLY
PITMAN ARM
ANGLE BRACE
COUNTERWEIGHT
SAMSON POST
WIREFLINE
CRANK
CARRIER BAR
BRAKE
GEAR REDUCER
PRIME MOVER
CRANK PIN BEARING
BRAKE LEVER
PLATFORM LADDER
BASE
GEAR REDUCER (not visible)

Pumping Unit Model Number Designations

C-228D-246-86

Type of Pumping Unit
Gear Reducer Peak Torque Rating (thousands of inch lbs.)
Double Reduction Gear Reducer
Polished Rod/Structure Load Rating (hundred lbs.)
Maximum Stroke Length (inches)

*Key for Type of Pumping Unit

A = Air Balanced
B = Beam Balanced
C = Conventional
CM = Conventional (roadrunner)
M = Mark II Unitorque
LP II = Low Profile II
RM = Reverse Mark
LC = Power Lift

WARNING: Using repair or replacement parts on any Lufkin Pumping Unit that do not meet Lufkin specifications could result in equipment damage and/or serious injury to personnel near the unit. Before performing maintenance or inspection on any pumping unit, be certain the prime mover is turned off, locked and tagged in the “off” position; and be certain the cranks are secured against rotation. Any movement of the equipment during maintenance or inspection procedures can cause serious personal injury.
Lufkin designed and manufactured herringbone gears (double helical) have proven to be the standard of excellence for pumping unit gear reducers. Herringbone gears are less sensitive to misalignment and resist torque reversals better than other types of gears. Heavy-duty sleeve bushings on the crankshaft and straight roller bearings on the high speed and intermediate shafts need no adjustment at assembly or when field service is required. The nodular iron gears with high strength alloy pinion used by most manufacturers of pumping units were pioneered by Lufkin. The rugged two-piece housing is manufactured specifically for oilfield pumping applications.

All Lufkin gear reducers have been designed to exceed API and AGMA specifications. Lufkin is authorized to display the API monogram and is licensed under specification 11E. Lufkin precision-cut, herringbone gears are encased in a strong, heavily-walled, cast-iron gear reducer housing. Operating in an oil bath ensures positive lubrication of the heat-treated, nodular gears and steel alloy pinions. An oil wiper system continuously supplies oil to the bearings. An oil gage dip stick allows easy inspection of the oil level in the gear reducer housing. Special features of these rugged oilfield reducers include:

- Horizontally split gear housing designed for easy field maintenance
- Precision-cut Lufkin herringbone gears
- All shafts made from alloy steel, heat treated and precision turned to tight tolerances
- Oversized bronze bushings on crankshafts which seldom require replacement
- Positive lubrication system (no oil pumps required)

### Lufkin Gear Reducer Data

<table>
<thead>
<tr>
<th>Gear Reducer Size</th>
<th>Peak Torque Rating (ls. lbs.)</th>
<th>Gear Ratio</th>
<th>Crankshaft Diameter Conventional / Mark II (inches)</th>
<th>Sheave Bore Dia. (inches)</th>
<th>Sheave Options</th>
<th>Oil Capacity (gallons)</th>
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<tbody>
<tr>
<td>2560D</td>
<td>2,560,000</td>
<td>34.53:1</td>
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<td>120 / 55, 68</td>
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<td>1820D</td>
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<td>9 / 10.5</td>
<td>4.94</td>
<td>100 / 55, 68</td>
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<tr>
<td>1280D</td>
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<td>100 / 36, 68</td>
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<td>228D</td>
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<tr>
<td>160D</td>
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<td>20 / 20, 24, 30, 33, 6</td>
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<td>1.94</td>
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<td>20 / 20, 24, 27</td>
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</table>

*10.5 for 912D Mark II

**Bold Face** type indicates standard size sheave. All other sizes are available for a nominal fee.
The World's Most Popular Rod Pump

The Lufkin Conventional Crank Balanced Pumping Unit, widely known and accepted, is the old reliable “work horse” of the oil patch. This is the most universally adaptable unit in the Lufkin line. These units are simple to operate and require minimum maintenance. They are available in sizes up to the C-1824D-305-240; a unit with a 240-inch stroke, a polished rod capacity of 30,500 pounds and a 1,824,000 inch-pound double reduction gear box.

Conventional Crank units are manufactured in either two-point foundation or standard-base foundation designs. Two-point units are suitable for front and rear, precast, concrete-block foundations or fabricated foundation pads under the front and rear of the unit. Precast concrete blocks reduce concrete requirements by approximately 80%. This simple suspension/foundation design significantly reduces installation time. Standard-base units must have a one-piece block foundation supporting the entire steel base.

<table>
<thead>
<tr>
<th>Standard Unit Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1824D-305-240</td>
</tr>
<tr>
<td>C-1824D-365-216</td>
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<tr>
<td>C-1280D-305-240</td>
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<tr>
<td>C-1280D-365-192</td>
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<tr>
<td>C-912D-305-240</td>
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<td>C-912D-365-192</td>
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<td>C-912D-305-192</td>
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<td>C-456D-305-168</td>
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<td>C-456D-265-120</td>
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<td>C-320D-256-120</td>
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<td>C-228D-213-120</td>
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<tr>
<td>C-160D-173-100</td>
</tr>
<tr>
<td>C-114D-119-86</td>
</tr>
<tr>
<td>C-80D-119-64</td>
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</tbody>
</table>
Mark II Geometry Reduces Rod Load and Peak Torque

Lufkin Mark II Unitorque Pumping Units are available in fifty different sizes up to the M-1824D-427-216; a unit with a 216-inch stroke, a polished rod capacity of 42,700 pounds and a 1,824,000 inch-pound double reduction gear box.

The Mark II’s unique UNITORQUE geometry is characterized by three (3) basic configurations which reduce the rod load and peak torque over that of a conventional pumping unit. The design characteristics which make the Mark II unique are:

- Shifting the gearbox from directly under the equalizer towards the Samson post turning in a preferred direction of rotation, creates an upstroke that occurs in approximately 195° of crank rotation and a downstroke of approximately 165° of crank rotation.

- Placing the equalizer between the horsehead and the Samson post creates a “push-up” or “Class 3” lever system.

The 195° upstroke, coupled with the front mounted geometry, reduces the acceleration at the beginning of the upstroke where the load is greatest, thereby effecting a reduction in polished rod load. Locating the cross-yoke forward of the gear reducer creates a greater mechanical advantage for lifting the heavy load on the upstroke, and a lesser mechanical advantage for the reduced downstroke load (i.e., the maximum upstroke torque factor is reduced while the maximum downstroke torque factor is increased).

- An angular offset in the crank that produces a more effective counterbalance torque which at the beginning of the upstroke “lags” the well load torque approximately 7½°. Similarly, at the beginning of the downstroke, this same offset condition produces a counter balance torque which “leads” the well load torque approximately 7½°.

Independently these features would not produce a relatively uniform torque, but working together a “unitorque” system is obtained which can reduce the torque on the gearbox up to 35% as well as lowering power costs and often, prime mover size.

Uniform torque can be obtained under ideal conditions.

NOTE: The Mark II Unit must be operated in a counter-clockwise direction (standing at the side of the unit with the wellhead to the right).
Low Profile Pumping Units

A compact unit designed for installation in fields irrigated by traveling sprinkler systems or in urban areas where the low profile feature may be desirable. These units can be shipped from the factory completely assembled.

Power Lift Folding Beam Pumping Unit

The low clearance Power Lift Unit is an API size 640D-305-144 pumping unit that can hydraulically fold to a height of 15 ft. Lowering the unit approximately 3 ft. below the ground surface will allow a 12 ft. center pivot irrigation system to travel over the unit.

Dimensional Data (inches)

<table>
<thead>
<tr>
<th>Unit Size</th>
<th>Height</th>
<th>Folded Height</th>
<th>Base Length (w/Hi-Prime)</th>
<th>Set Back</th>
<th>Overall Length</th>
<th>Min. Carrier Bar Ground Clearance</th>
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</thead>
<tbody>
<tr>
<td>LPII-114D-173-64</td>
<td>118.00</td>
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<td>LPII-160D-173-64</td>
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<tr>
<td>LPII-228D-173-74</td>
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<td>18.00</td>
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<td>LPII-320D-246-86</td>
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<td>134.33</td>
<td>209.66</td>
<td>144.80</td>
<td>8.90</td>
<td>71.50</td>
</tr>
</tbody>
</table>

*Low Profile II units are available in either two-point foundation or wide-skid foundation designs. Dimension "M" is for two-point units and dimension "M1" is for wide-skid units. Dimension "H1" is the overall height of the unit when the rear leg is folded back.

**NOTE:** Do not use above dimensions for foundation. Request foundation plan.
Reverse Mark Pumping Units

The Lufkin Reverse Mark or ‘RM’ Series Pumping Unit offers the customer an improved alternative to the conventional type geometry. Although similar in appearance to the Lufkin Conventional Pumping Unit, the RM unit geometry can reduce the torque and power requirements on many pumping applications. In some instances a smaller reducer and prime mover can be used.

Portable Roadrunner Pumping Units

The Lufkin “Roadrunner” is a trailer-mounted, self-contained conventional pumping unit that lowers for legal highway transport. It can be erected and fully functional in a few minutes at the well site. These units are available for sale, rental or lease. Typical applications include: removing frac fluids, stripper well pumping, gas well dewatering, temporary production pumping, well testing, and an alternative to swabbing units.

### Standard Unit Sizes

| RM-1280D-427-192 | RM-912D-395-144 | RM-640D-305-144 | RM-228D-213-120 |
| RM-1280D-365-192 | RM-640D-305-192 | RM-640D-256-144 | RM-228D-256-100 |
| RM-1280D-427-192 | RM-640D-427-144 | RM-640D-256-120 | RM-228D-246-86 |
| RM-1280D-365-192 | RM-640D-395-144 | RM-640D-256-144 | RM-228D-213-86 |
| RM-1280D-365-168 | RM-640D-305-144 | RM-640D-320D-305-120 | RM-228D-200-74 |
| RM-1280D-427-192 | RM-640D-256-144 | RM-640D-320D-305-120 | RM-228D-200-74 |
| RM-1280D-365-192 | RM-640D-256-120 | RM-320D-256-120 | RM-228D-173-74 |

### Standard Unit Sizes

| CM-456D-305-120 |
| CM-320D-305-100 |
| CM-228D-246-86 |
| CM-160D-173-74 |
**Air Balanced Pumping Units provide:**

- Perfect counterbalance with finger-tip control.
- Lower installation cost.
- Compact and portable; ideal for well testing.
- Small size and lighter weight make unit ideal for export.
- Stroke lengths to 20 feet for high volume production from great depths.

These are some of the outstanding advantages of Lufkin Air Balanced Pumping Units. These units employ compressed air to counterbalance the well load rather than beam weights or crank weights. The air system has been so simplified that the only continuously operating parts are the balance cylinder and piston. The reservoir capacity of the cylinder is enlarged by a steel receiver which moves with the cylinder as a unit.

On engine-driven units, when the system is in need of air, an automatic regulator engages an air operated clutch (driven by one belt from the unit sheave) and replaces any lost air. The operator sets the regulator, initially, at a pressure sufficient to counterbalance the well load. Then, this pressure is maintained automatically. Should the load change appreciably, a slight adjustment of the regulator will restore perfect counterbalance.

A safety shut-off switch is available, which will ground out the engine, or shut off the motor, if pressure should exceed a preset figure or fall below a minimum preset figure.

For units pumping with electricity, a separate motor-driven compressor assembly is standard equipment.

Lufkin Air Balanced Units are approximately 35% shorter and 40% lighter than crank-type units, which makes them ideal for use as portable or test units, and for installation on piling or superstructures. Since changing counterbalance effect is a matter of adjusting a valve, air balanced units are ideal for use in testing wells.

All of the ruggedness and simplicity of conventional Lufkin Pumping Units are incorporated in the design of Lufkin’s Air Balanced Pumping Units.
The Industry's Preferred Shallow-Well Unit

Churchill Beam Balanced Pumping Units, available exclusively from Lufkin Industries, have been field proven since 1954. They offer the same rugged dependability as our conventional units. On shallow wells around the world, they have long been the producer's unit of choice.

Churchill's precision-cut helical gears are encased in a strong, heavy-walled, cast-iron gear reducer housing. For smaller, beam balanced pumping units, these gear reducers are the most economical and reliable available.

Lufkin's Churchill brand gear reducers are also designed to exceed API and AGMA specifications. All tapered roller bearing cups are mounted in bearing carriers. This unique configuration minimizes field replacement time and prevents damage to the housing should a bearing fail. Special features include:

- Unique StepDown™ housing design, which minimizes shaft deflection and improves proper gear meshing
- Positive lubrication by integral wiper system
- Built-in oil level sight gauge
- Precision-cut Lufkin helical gears
- All shafts made from high grade steel, heat treated and precision turned to tight tolerances

### Standard Unit Sizes

<table>
<thead>
<tr>
<th>Gear Reducer</th>
<th>Peak Torque Rating (in. lbs.)</th>
<th>Gear Ratio</th>
<th>Sheave Pitch Dia. (inches)</th>
<th>Sheave Belt Section</th>
<th>Gear Reducer Oil Capacity (gallons)</th>
<th>Gear Design</th>
<th>Crankshaft Bearings</th>
<th>Intermediate &amp; High Speed Bearings</th>
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</thead>
<tbody>
<tr>
<td>B-114</td>
<td>114,000</td>
<td>30:48:1</td>
<td>20, 24, 30</td>
<td>3-C</td>
<td>9</td>
<td>Double Helical</td>
<td>Tapered Roller</td>
<td>Cylindrical Roller</td>
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<td>B-80</td>
<td>80,000</td>
<td>30:06:1</td>
<td>24</td>
<td>4-B, 3-C</td>
<td>13</td>
<td>Helical</td>
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<td>Tapered Roller</td>
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<tr>
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<td>31:57:1</td>
<td>24</td>
<td>4-B, 3-C</td>
<td>13</td>
<td>Helical</td>
<td>Tapered Roller</td>
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<tr>
<td>B-50</td>
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<td>31:11:1</td>
<td>18.4</td>
<td>3-B</td>
<td>4</td>
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<td>2</td>
<td>Helical</td>
<td>Tapered Roller</td>
<td>Tapered Roller</td>
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</table>
Lufkin maintains sales and service centers in key producing regions around the world. These centers are fully equipped and professionally staffed to operate 365 days a year. Our Oilfield Services Group refurbishes and sells used pumping units and provides installation, repair and field maintenance services from the following locations:

- Bakersfield, California
- Denver, Colorado
- Glendive, Montana
- Farmington, New Mexico
- Lovington, New Mexico
- Oklahoma City, Oklahoma
- Andrews, Texas
- Breckenridge, Texas
- Denver City, Texas
- Giddings, Texas
- Kilgore, Texas
- Levelland, Texas
- Odessa, Texas
- Snyder, Texas
- Casper, Wyoming
- Gillette, Wyoming
- Drayton Valley, Alberta
- Medicine Hat, Alberta
- Nisku, Alberta
- Comodoro Rivadavia, Argentina
- Neuquen, Argentina
- Bulimba, Australia
- Cairo, Egypt
- Muscat, Oman

Experienced manufacturing and field service personnel provide a wide-variety of pumping unit services for oil producers around the world including:

- OEM replacement parts for Lufkin, Churchill and American pumping units
- Replacement parts for all brands of pumping units
- Repair or rebuilding damaged pumping units
- Transportation of pumping units to and from field locations
- Inspection and preventive maintenance services
- Manufacturing/supply of portable concrete bases.
Exclusive OEM Parts for Lufkin, American and Churchill Units

Lufkin Industries is the only source for Lufkin, American and Churchill brand pumping unit OEM parts. Our service centers maintain a complete stock of critical parts. Each center is networked to a centralized manufacturing and inventory control system for quick parts identification, availability and delivery to minimize downtime and production losses. All parts are manufactured to OEM design requirements under the API-Q-1 quality program for which few, if any, local machine shops can qualify.

There are tens of thousands of older Lufkin, American and Churchill units still pumping in fields all over the world. We help keep them running. From bearings, to gears, to structural components, we provide OEM quality backed by expert repair and maintenance services. Additionally, we can machine or fabricate replacement parts for any other brand of rod pump.

Repair Facilities

Lufkin’s Oilfield Service Group works on all brands of units. Operating from well-equipped service vehicles, experienced personnel make many repairs on location. For more complicated repairs and equipment testing, our state-of-the-art service facilities are fully equipped to provide necessary machining and fabrication operations.

The development of these regional manufacturing, testing and repair centers has allowed us to provide complete localized service in real time. Customers don’t have to wait for our main factory to open to solve a repair or maintenance problem.