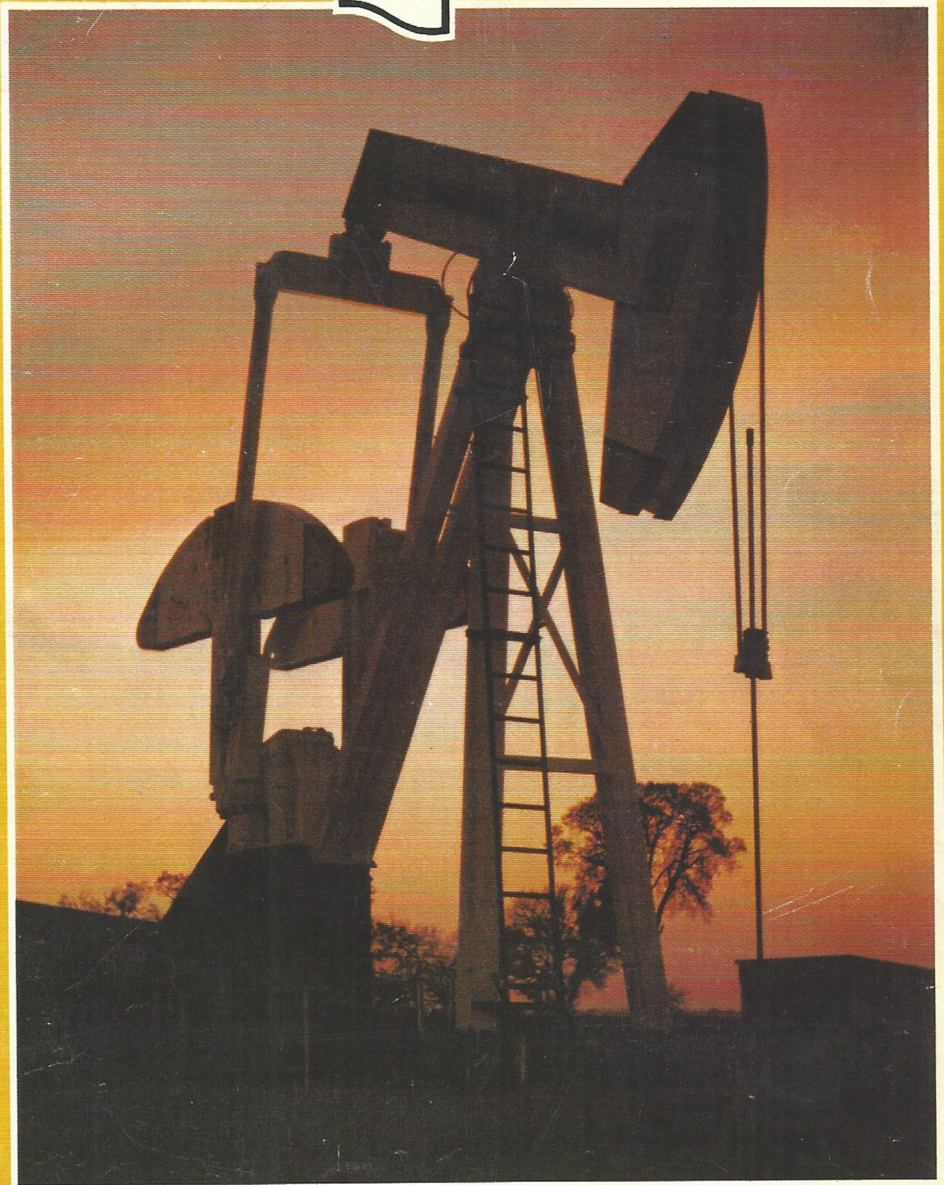
CMI® TORQMASTER™



SPECIAL GEOMETRY OIL WELL PUMPING UNITS

CMI® TORQMASTER™

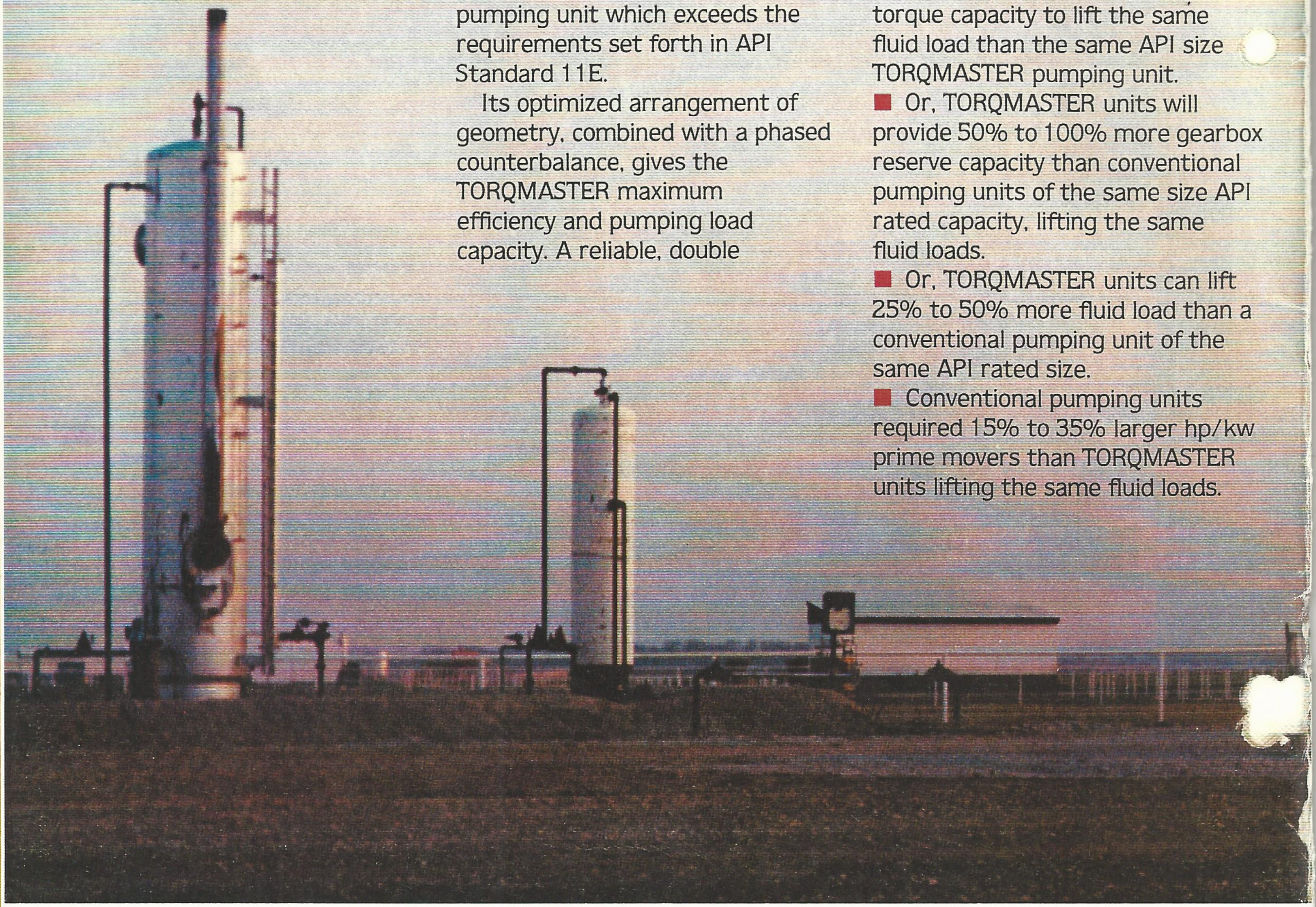
ADVANCED DESIGN SPECIAL GEOMETRY PUMPING UNITS THAT CUT LIFTING COSTS

The Special Geometry TORQMASTER is a computer-designed, quality constructed pumping unit which exceeds the requirements set forth in API Standard 11E.

Its optimized arrangement of geometry, combined with a phased counterbalance, gives the TORQMASTER maximum efficiency and pumping load capacity. A reliable, double reduction, herringbone gear reducer is incorporated in each TORQMASTER Pumping Unit for long life. And the TORQMASTER's strong backbone structure is the strongest and most stable available, designed to eliminate historical failure of base weaknesses found in conventional units.

The effects of CMI's advanced-designed TORQMASTER are many:

- Each TORQMASTER unit is designed with Special Geometry, but has the desired appearance, structure, and ease of service of a conventional pumping unit.
- All conventional pumping units require 50-100% more gearbox torque capacity to lift the same fluid load than the same API size TORQMASTER pumping unit.
- Or, TORQMASTER units will provide 50% to 100% more gearbox reserve capacity than conventional pumping units of the same size API rated capacity, lifting the same fluid loads.
- Or, TORQMASTER units can lift 25% to 50% more fluid load than a conventional pumping unit of the same API rated size.
- Conventional pumping units required 15% to 35% larger hp/kw prime movers than TORQMASTER units lifting the same fluid loads.



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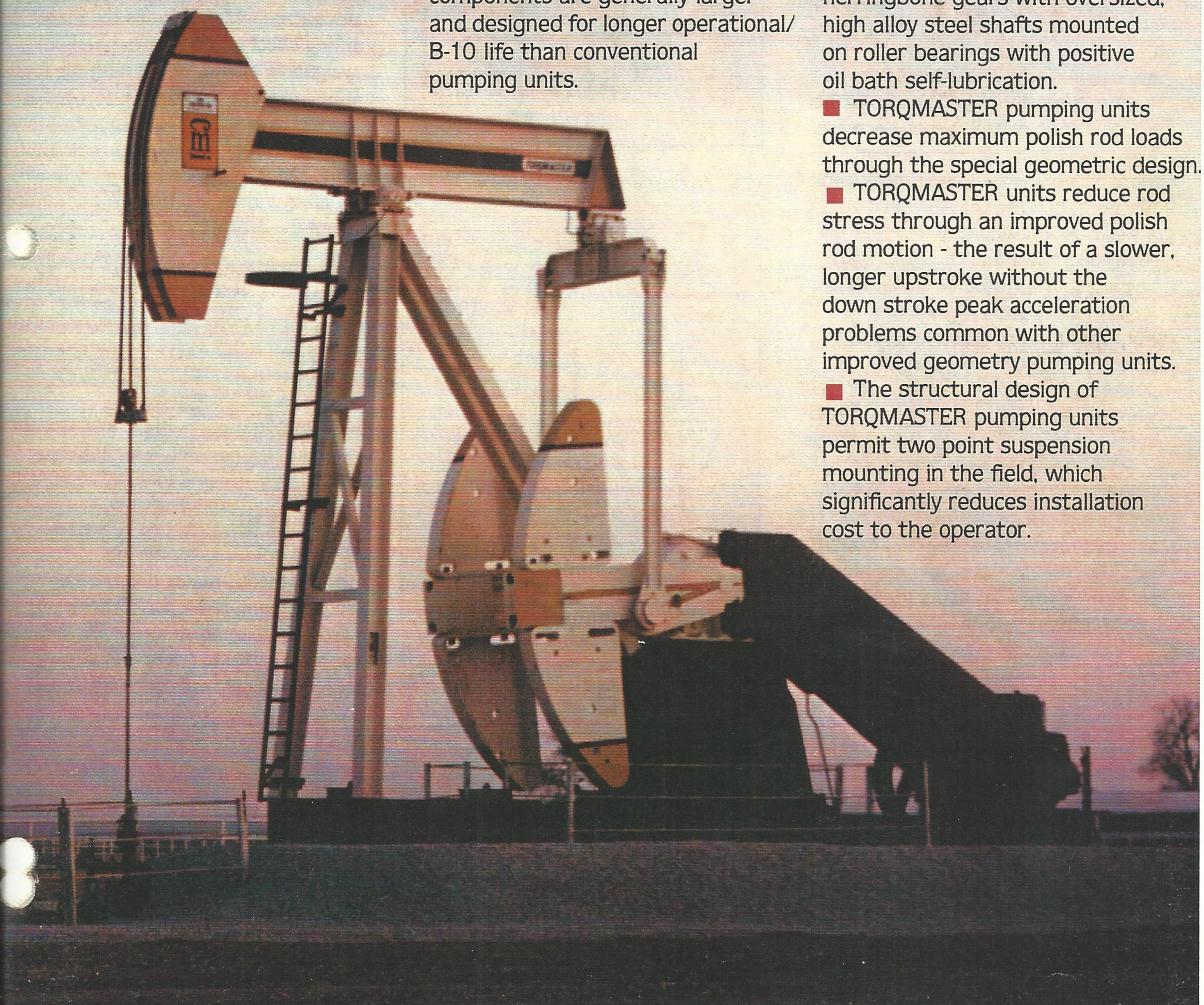
- Conventional pumping units require 15% to 35% more kw/energy than TORQMASTER units lifting the same fluid loads.
- Energy savings alone can reduce the operational cost of a TORQMASTER unit, compared to a conventional pumping unit, equal to savings of from 1 to 4 times the cost of a TORQMASTER pumping unit over the first 15 year operational life of a well.
- TORQMASTER structural members and total structural capacity generally exceeds most competitive conventional pumping units.
- TORQMASTER alloy shafts, roller bearings, wrist pins, bearing housings and other mechanical components are generally larger and designed for longer operational/B-10 life than conventional pumping units.
- All TORQMASTER bearing seals, are non-friction, self-aligning, steel labyrinth seals that cannot be blown out or damaged by over lubrication.
- The TORQMASTER gear box is heavy-duty cast iron designed specifically for oilwell pumping unit applications. Inside are wide ductile-iron double reduction herringbone gears with oversized, high alloy steel shafts mounted on roller bearings with positive oil bath self-lubrication.
- TORQMASTER pumping units decrease maximum polish rod loads through the special geometric design.
- TORQMASTER units reduce rod stress through an improved polish rod motion - the result of a slower, longer upstroke without the down stroke peak acceleration problems common with other improved geometry pumping units.
- The structural design of TORQMASTER pumping units permit two point suspension mounting in the field, which significantly reduces installation cost to the operator.



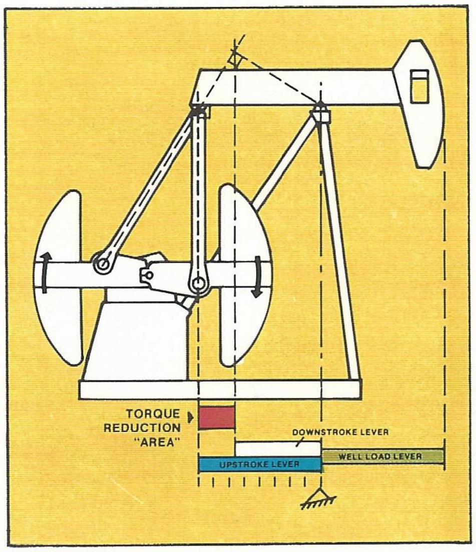
COMPUTER GENERATED SPECIA

Improved geometry oilwell pumping units have been operating over producing wells for the past thirty years. These improved lever systems have proven successful in decreasing rod loads, reducing peak torques and cutting power costs at the prime mover.

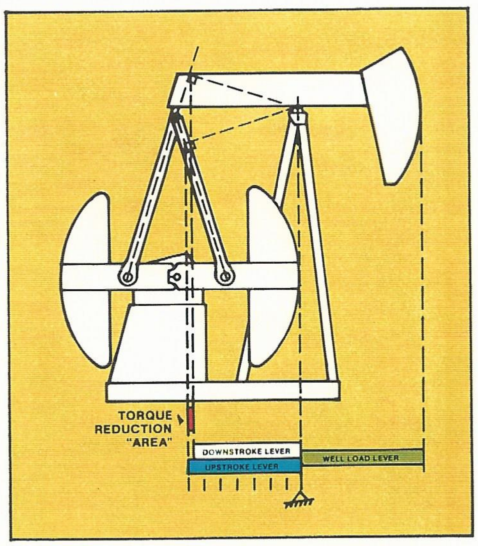
The geometry of these units, however, was designed in the 50's and have remained virtually unchanged since then. At CMI, we believed that the industry needed a line of top-quality, long-life Special Geometry pumping units which would offer new, innovative features and would significantly improve efficiency, further reduce torque requirements, decrease prime mover and energy demand, and give a higher volume production pumping capacity per API rated size.

The Special Geometry TORQMASTER Pumping Units were developed as a result. CMI engineers used computers to examine the thousands of possible combinations of improved geometry linkage arrangements and created an improved geometry pumping unit with a phased counterbalance crank. The nine models of TORQMASTER, including 57D through 912D sizes, incorporated all the proven design features that are required for years of long-life, trouble-free, low cost operation, and maintained the desired physical structure of a conventional pumping unit.

TORQMASTER OPTIMIZED GEOMETRY



CONVENTIONAL GEOMETRY



The TORQMASTER's improved leverage system is the result of a uni-directional Special Geometry which creates a lower upstroke torque factor and a higher downstroke torque factor which decrease peak torque, and an integrated phased crank which smooths net torque. The conventional's bi-directional geometry offers no significant torque advantage because there is no improvement in leverage on either the upstroke or downstroke.

The Torqmaster's Special Geometry

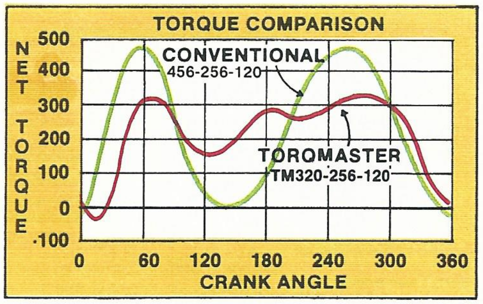
The TORQMASTER's Special Geometry is the result of an optimized arrangement of linkages and lengths, and a phased angle crank arm combined with a variable counter-balance effect. It produces a long, slow upstroke through 192° of crank rotation (compared to 180° on conventional units), with a mechanical advantage which permits the load lifting effect of the counterbalance weights to stay in phase with the load lifting requirements of the gear reducer. On the downstroke, this maximum leverage effect shifts to the well load, enabling it to lift the counterbalance weights with minimum torque required from the gear reducer.

Reduced Peak Torques

Special Geometry smooths net torque input throughout crank rotation. Peak torque requirements are reduced as much as 60% compared to conventional units. In many cases the amount of reduction is enough to lower gear reducer and prime mover requirements by one API size. And in some special cases, two API sizes. Since torque represents the instantaneous motor horsepower requirement, reduction in peak torque and a more uniform torque input allow prime movers to operate in a more efficient energy consumption range.

GEOMETRY

NET TORQUE CURVE

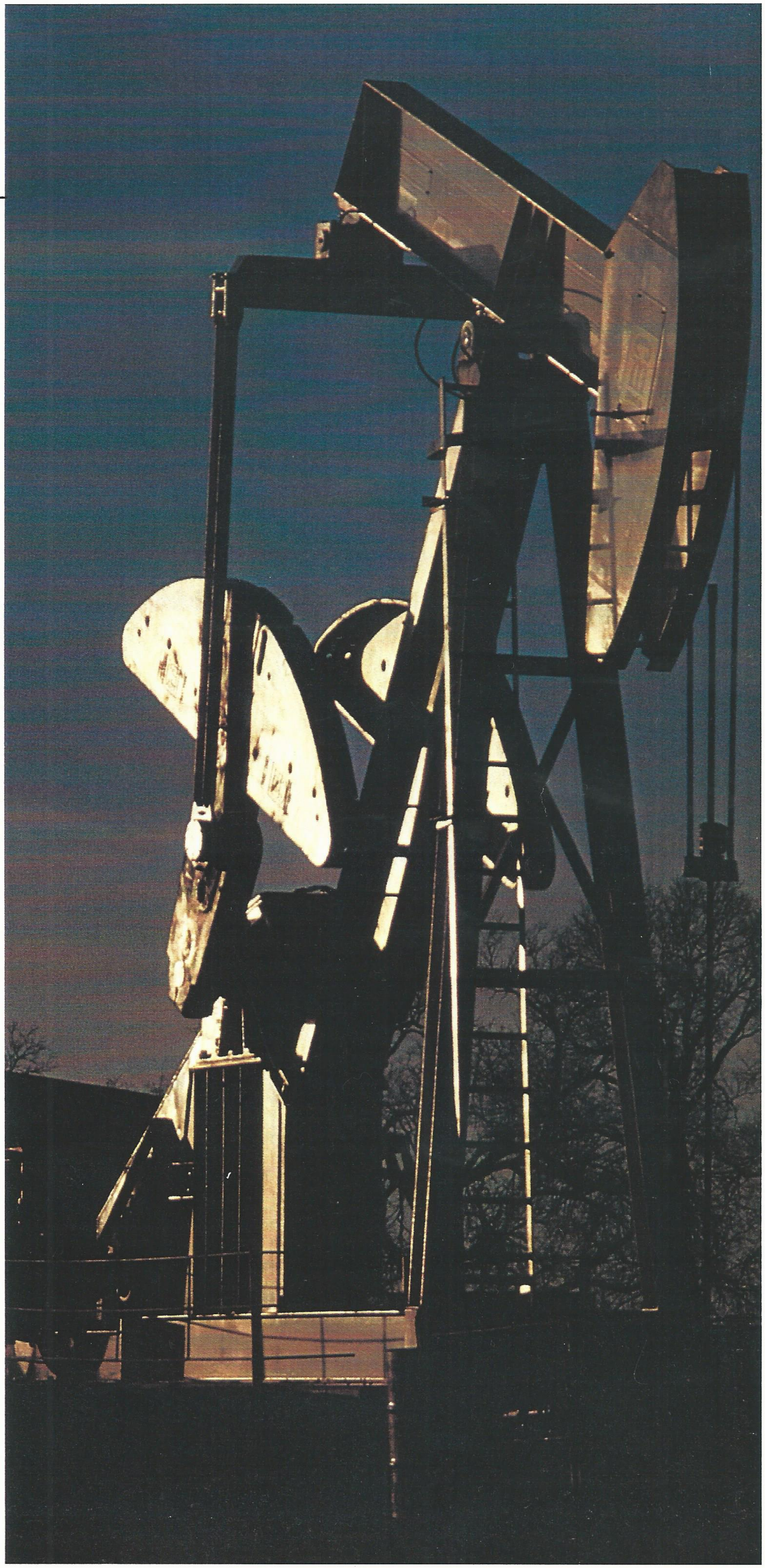


This net torque comparison between a conventional pumping unit and a TORQMASTER on the same well, under identical operating conditions, illustrates the effect of TORQMASTER'S Special Geometry in smoothing and reducing torque input throughout crank rotation. This reduction is generally enough to lower gear reducer and prime mover requirements by one or two API sizes.

Greater Reserve Gear Box Capacity

When the TORQMASTER's computer-generated Special Geometry was combined with a phased counterbalance crank, net torque requirement at the crankshaft was reduced. In most cases this reduction is enough to allow the TORQMASTER to operate at a substantially lower percentage of its gearbox rating, with a greater reserve capacity than the conventionally designed unit.

Some owners, taking advantage of the TORQMASTER's reduced peak torque requirements, use the next API-size smaller gear reducer and often still have a greater reserve capacity than the larger-sized conventional unit's gear box lifting the same fluid load.



SPECIAL GEOMETRY

Less Sucker Rod Load and Stress.

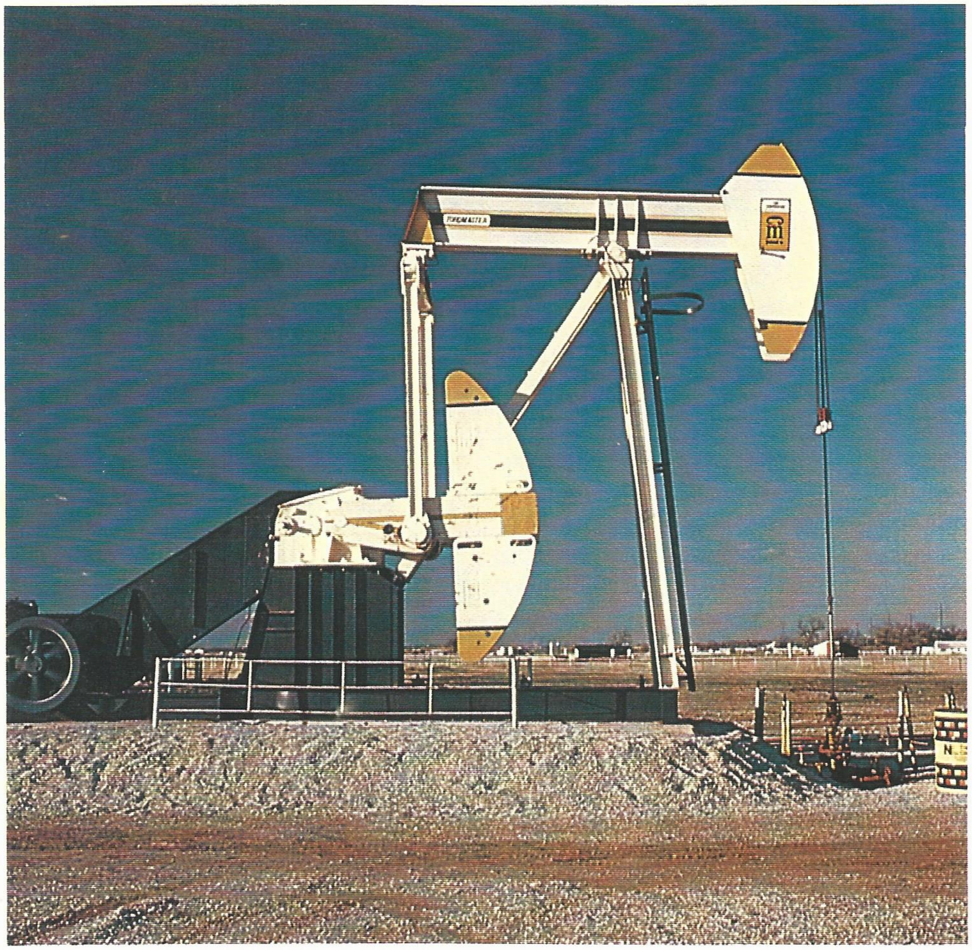
The TORQMASTER's geometry and phased counterbalance crank give it the best pumping characteristics possible, decreasing the maximum polished rod load to reduce peak stress and provide for longer sucker rod life, lower servicing costs and less production loss from rod breakage and shutdowns.

The long, slow upstroke of the TORQMASTER, through 192° of crank rotation, and a more uniform motion reduce acceleration when rod load is the greatest, and produce a reduced polished rod load.

Since polished rod velocities are proportional to torque factors, the CMI TORQMASTER, with its lower torque factors, has slower instantaneous upstroke polished rod velocities than conventional units operating at the same pumping speed.

The motion at the end of the stroke is smooth and uniform, without any jerky downstroke motion which causes rod problems and limits maximum pumping speed.

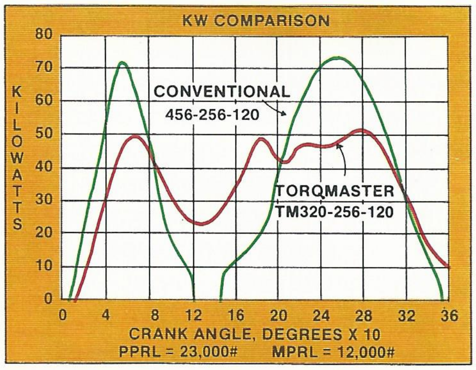
As a result, the TORQMASTER can be operated at the same high speeds as conventional units.



Lower Operating Costs.

The TORQMASTER's reduced and smooth torque input generally permits the use of 15% to 35% smaller hp/kw prime movers. Gas engine initial costs are reduced and fuel consumption is substantially decreased. Electric motors operate in efficient, cost-saving ranges. The continued day-to-day savings in electrical consumption and demand charges may, over a 10 to 15 year well life, amount to more than four times the initial cost of a TORQMASTER Unit.

KW COMPARISON CURVE



The TORQMASTER's uniform torque demand allows the use of 15% to 35% smaller prime movers which results in a significant reduction in power demand and consumption.

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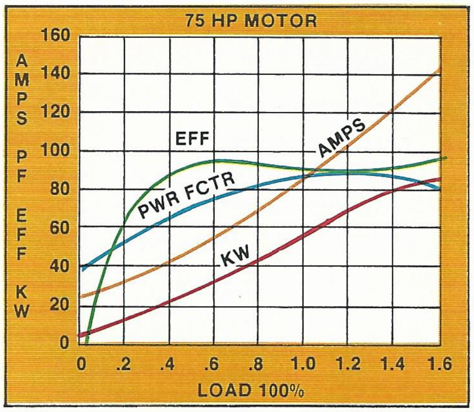
MOTOR PERFORMANCE CURVE

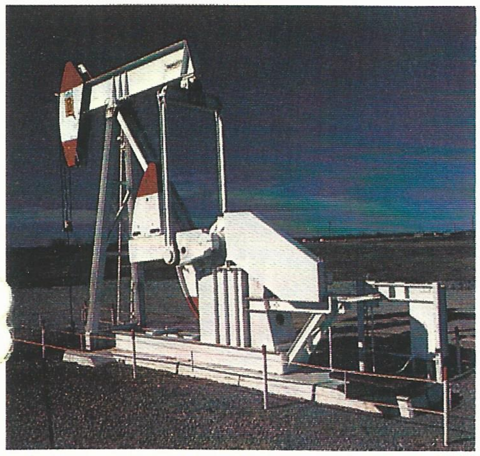


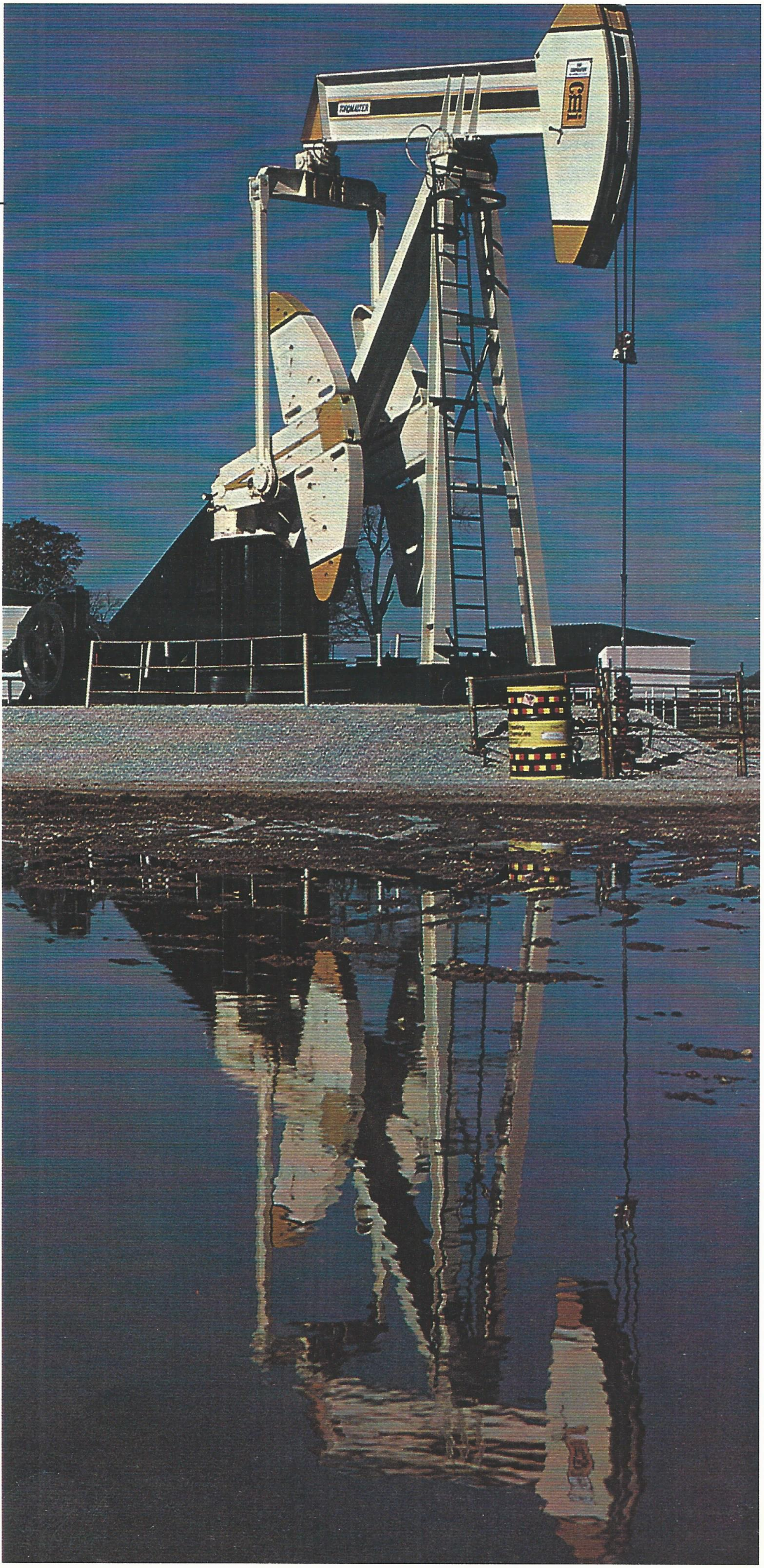
The TORQMASTER's Special Geometry smooths torque loads, increases efficiency, improves the power factor and reduces electrical demand charges.

Use on any Well

Slim holes, deep holes, big volume wells and heavy oil are all within the TORQMASTER's lifting capabilities. Lower rod stress allows the use of longer rod strings or longer stroke pumps in wells where small diameter tubing limits the size of the sucker rods, or in depths previously out of range of sucker rod pumping.

Reduced peak load conserves more of the polished rod capacity for pumping additional fluid. The reduced torque requirements which allow a long, slow upstroke increase maximum delivery capacity in high viscosity oil.





COMPUTE-A-SIZE™ WELL ANALYSIS

SPECIAL GEOMETRY
CMI TORQMASTER
OIL WELL PUMPING UNITS

COMPUTE·A·SIZE™ ANALYSIS

Customer name ____________________
Well number ____________________
City/State ____________________
Final destination ____________________
Recommended size ____________________
Recommended HP requirement ____________________

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H, FLUID LEVEL =                     8350
L, PUMP DEPTH =                      8350
N, PUMPING SPEED =                     10
S, LENGTH OF STROKE =                 144
D, DIAMETER OF PLUNGER =               1.25
G, SP. GR. FLUID =                      .9
TUBING IS ANCHORED
API ROD SIZE =                         86

SP, BOTTOM HOLE  STROKE, INCHES 136
PUMP DISPLACMENT @ 80%               198.4
PUMP DISPLACMENT @ 100%              248
WEIGHT OF RODS IN FLUID            15418

 FO/SKR  N/NO'  N/NO   SP/S   TA    WRF/SKR  2T/SKR  F1/SKR  F2/SKR  F3/SKR
 .1694   .2948  .3408  .9468 1.044  .6544    .35     .419    .22     .263

* * * * * * RESULTS WITH CONVENTIONAL GEOMETRY UNIT * * * * * *

PEAK POLISHED ROD LOAD, POUNDS                25307
MINIMUM POLISHED ROD LOAD, POUNDS             10225
PEAK TORQUE, INCH POUNDS                     621138
COUNTER BALANCE EFFECT, POUNDS                18458
POLISHED ROD HORSEPOWER, HP                      22.6
PRIME MOVER HP REQ'D. =   45.2 W/ELEC. & M.C.;   40.68 W/S.C.

PEAK ROD STRESS                               32223
ALLOWABLE STRESS GRADE C =                    29823
ALLOWABLE STRESS GRADE D =                    36073
GRADE D RODS OK, SF =                             .89

* * * * * * RESULTS WITH CMI TORQMASTER OPTIMIZED GEOMETRY * * * * * *

TORQMASTER PEAK POLISHED ROD LOAD, POUNDS     23819
TORQMASTER MINIMUM POLISHED ROD LOAD, LBS.     8765
TORQMASTER PEAK TORQUE, INCH POUNDS          418816
TORQMASTER COUNTER BALANCE EFFECT, POUNDS     18083
TORQMASTER POLISHED ROD HORSEPOWER, HP           22.6
TORQMASTER PRIME MOVER HP REQ'D. =  36.4 W/ELEC. & M.C.;   32.76 W/S.C.

PEAK ROD STRESS                               30327
ALLOWABLE STRESS ON GRADE C RODS              28777
ALLOWABLE STRESS ON GRADE D RODS              35027
GRADE D RODS OK, SF =                             .86
-----------------------------------------------------------------------
PERCENT INCREASE IN PEAK TORQUE WITH CONVENTIONAL = 48%
INCH-LB INCREASE IN PEAK TORQUE WITH CONVENTIONAL = 202321 IN-LBS
PERCENT INCREASE IN PRIME MOVER HP WITH CONVENTIONAL = 23%
INCREASE IN PRIME MOVER HP W/CONV. =  8.6 W/ELEC. & M.C.;  7.74 W/S.C.
***********************************************************************
  YEARLY POWER BILL INCREASE WITH CONVENTIONAL UNIT, BASED ON
     6 CENTS/KWH ELECTRICITY COST AND 80% UNIT RUN TIME = $2747.00
***********************************************************************
  CONVENTIONAL UNIT WITH 640 GEARBOX = 97% OF RATED TORQUE
-----------------------------------------------------------------------
  CMI TORQMASTER WITH 640 GEARBOX = 65% OF RATED TORQUE
  CMI TORQMASTER WITH 456 GEARBOX = 91% OF RATED TORQUE
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A COMPUTE-A-SIZE well analysis compares loads and torques between a TORQMASTER and a conventional pumping unit on your well.

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The design of a rod pumping system is quick and accurate through the use of CMI's COMPUTE-A-SIZE well analysis program.

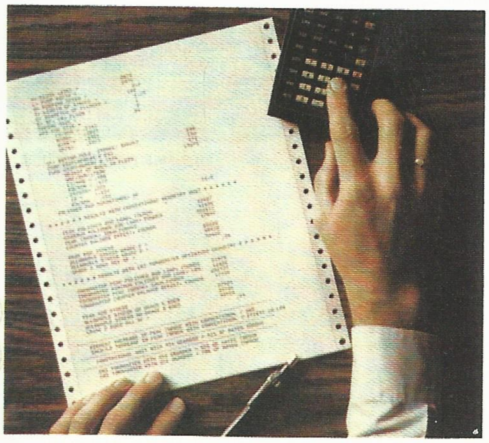
A COMPUTE-A-SIZE predictive program is a computer simulation of actual pumping conditions on a producing well, and compares torques and loads between a TORQMASTER and a conventional unit on the same well.

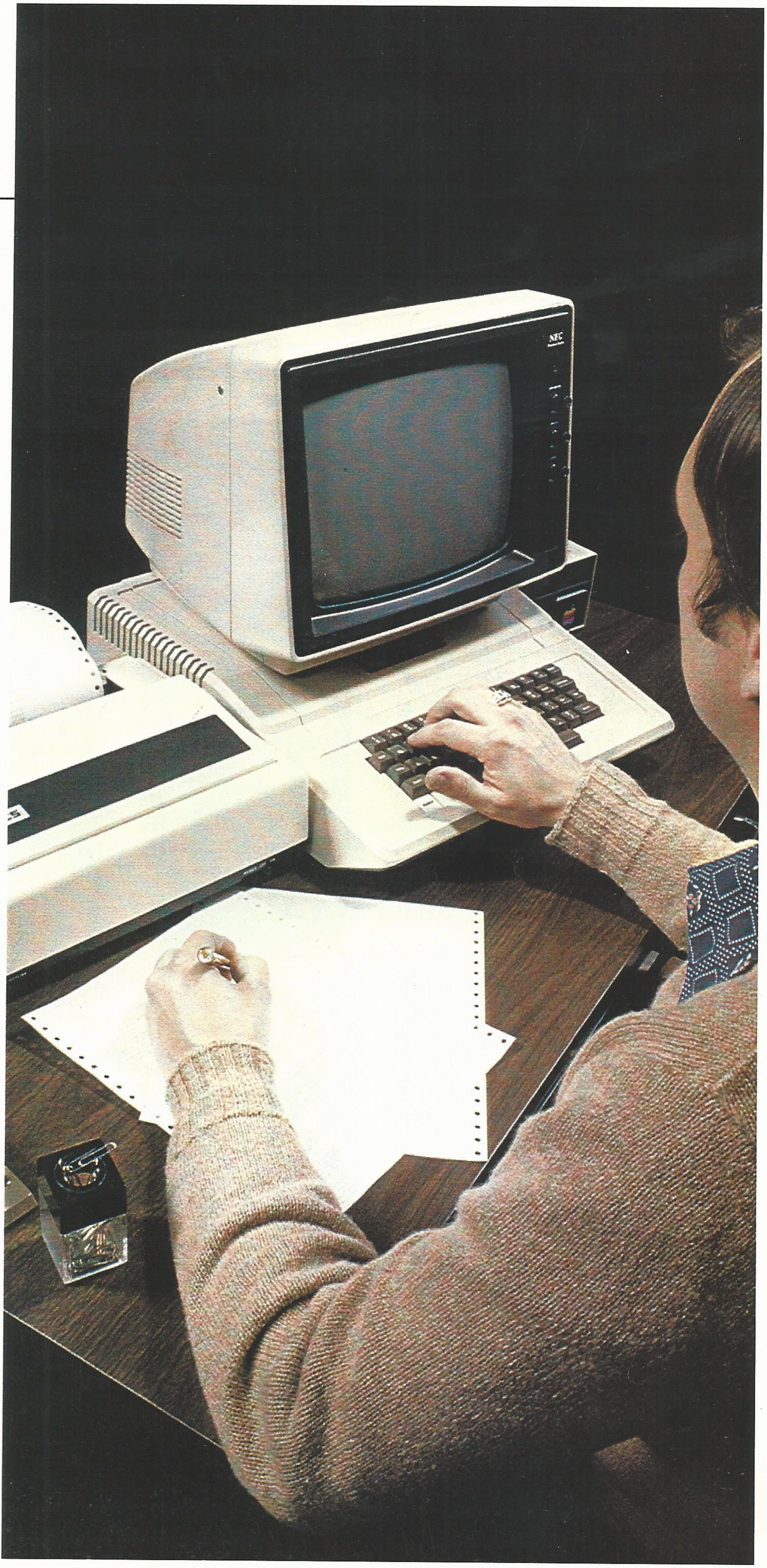
This service is offered free of charge and greatly simplifies pumping unit sizing based on modified API RPIIL calculations. It is only necessary for us to know a few basic facts about the well. With this information a complete and accurate system selection can be made.

A COMPUTE-A-SIZE Well Analysis of actual pumping conditions show peak torque reductions of as much as 60% when compared to conventional geometry units, and significant decreases in rod load stress and hp/kw demand at the prime mover. Increased permissible load ranges will also be evident.

Furnish us your well data on the attached card. You'll soon receive a COMPUTE-A-SIZE Well Analysis for comparison purposes.

We welcome all comments or questions about the TORQMASTER Pumping Unit. Write or call CMI.





DOUBLE REDUCTION GEAR REDUCERS

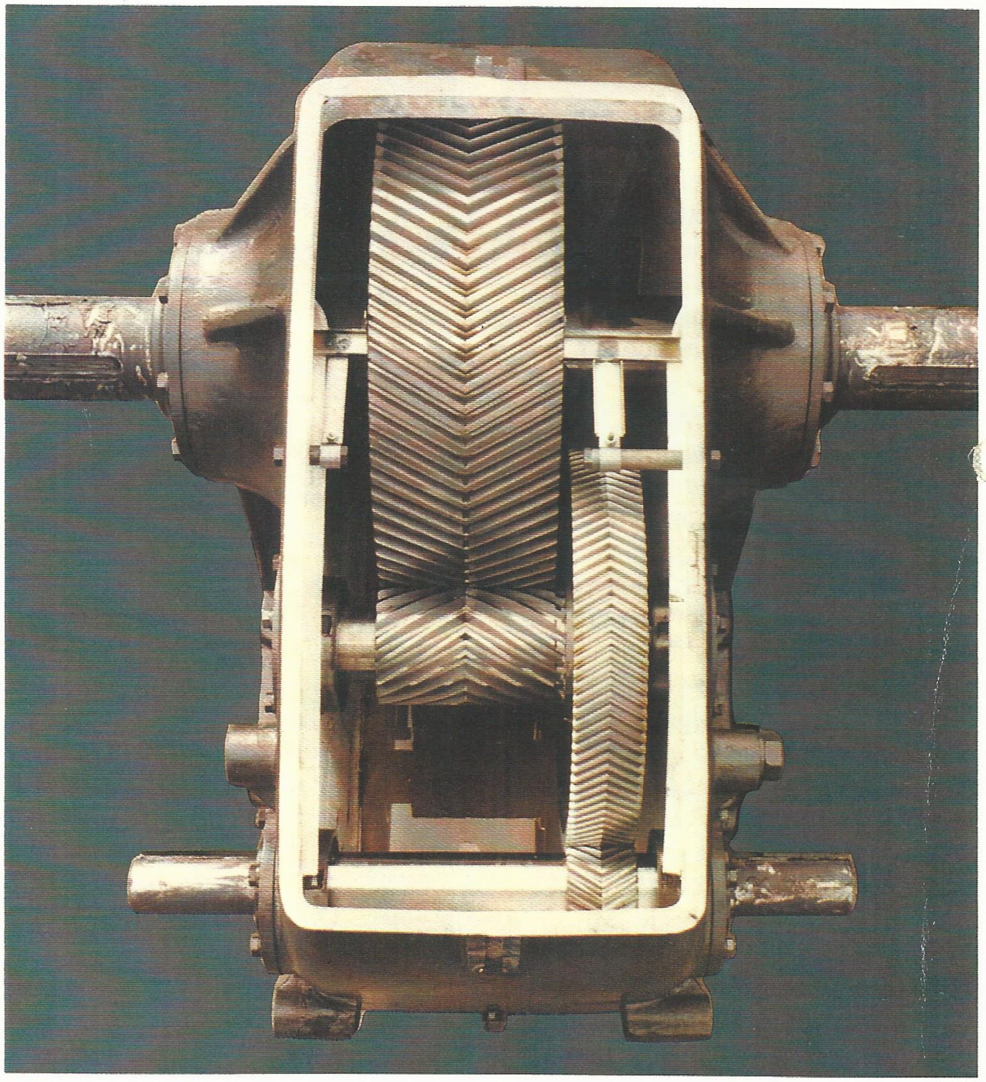
The TORQMASTER gear reducer has established a distinguished reputation for reliable, year-after-year performance on thousands of pumping units throughout the oilfield. Many of these gear reducers have been in continuous service since the early 1950's, with little more than required servicing.

Each of the TORQMASTER gear reducers, from 57D to 912D, utilize wide, ductile-iron herringbone gears. This oilfield-proven double reduction gear reducer is resistant to overload, has proven self-alignment capabilities and excellent flood lubricating characteristics. It's conservatively designed for a long, useful life and has always been the preferred type gear reducer.

The heavy-duty cast gear case is designed and built especially for oilwell pumping units. The wide, herringbone gears are made of ductile-iron and all pinions and shafts are made of heat-treated high alloy steel. Bearings, gears and pinions exceed API requirements to provide long life and efficient service. The slow speed shaft is mounted on tapered roller bearings and both the intermediate and high speed shafts float on straight roller bearings. All bearing seals are metal, do not deteriorate from wear, and cannot be destroyed by over lubrication. Positive lubrication of gears and bearings is assured with a positive flood lubrication system.

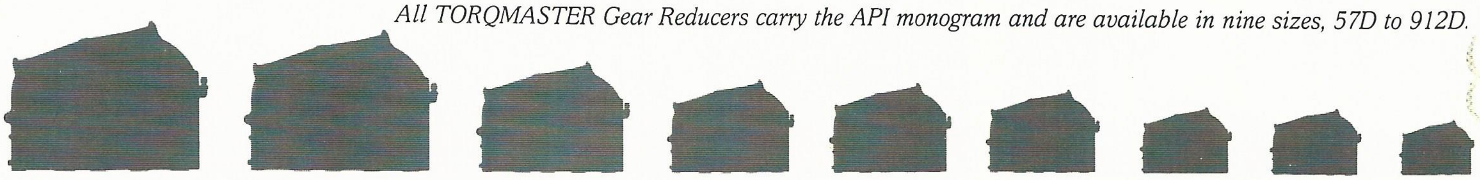
The TORQMASTER gear boxes are manufactured by CMI. All gears are cut to exacting standards on herringbone gear cutting machines and are used in all TORQMASTER Pumping Units. All gear cases are jig bored on the lastest computerized machining centers in our manufacturing facilities to the same demanding tolerances as the gears.

This painstaking attention to detail and quality craftsmanship assures optimum performance as long as basic and proper maintenance procedures are followed, and allows the TORQMASTER gear reducer to carry the official API monogram.

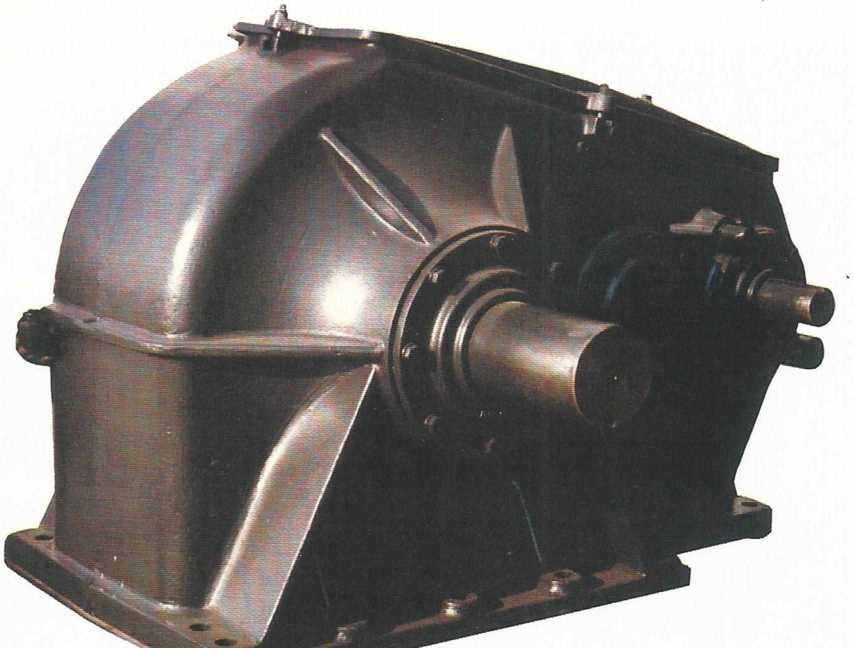


Wide, ductile-iron herringbone gears are resistant to overload, have self-alignment capabilities and an excellent flood lubricating system.

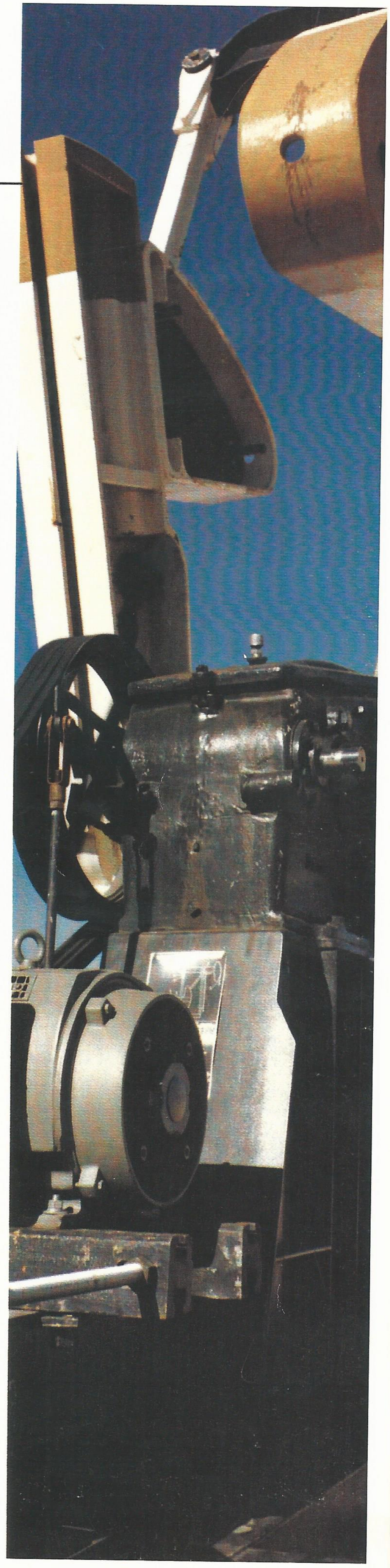
All TORQMASTER Gear Reducers carry the API monogram and are available in nine sizes, 57D to 912D.



912D 640D 456D 320D 228D 160D 114D 80D 57D



The heavy-duty cast gear case is designed and built especially for oilwell pumping units.



Double Reduction Gear Unit Specifications

912 D GEAR REDUCER
Rating: *912,000 In. Lbs. Peak Torque*
Gear Ratio: *30.11*
Crankshaft Dia.: *8*
Sheave: *56'' P.D.-10C*
36'' P.D.-10C
3 11/16'' Bore
Gearbox Oil Capacity:
165 Gallons Approx.

640 D GEAR REDUCER
Rating: *640,000 In. Lbs. Peak Torque*
Gear Ratio: *29.29*
Crankshaft Dia.: *8''*
Sheave: *50'' P.D.-8C*
30'' P.D.-8C
3 11/16'' Bore
Gearbox Oil Capacity:
130 Gallons Approx.

456 D GEAR REDUCER
Rating: *456,000 In. Lbs. Peak Torque*
Gear Ratio: *30.1*
Crankshaft Dia.: *7¾''*
Sheave: *48'' P.D.-6C*
36'' P.D.-6C
3 11/16'' Bore
Gearbox Oil Capacity:
60 Gallons Approx.

320 D GEAR REDUCER
Rating: *320,000 In. Lbs. Peak Torque*
Gear Ratio: *29.76*
Crankshaft Dia.: *7''*
Sheave: *36'' P.D.-6C*
24'' P.D.-6C
3 7/16'' Bore
Gearbox Oil Capacity:
40 Gallons Approx.

228 D GEAR REDUCER
Rating: *228,000 In. Lbs. Peak Torque*
Gear Ratio: *29.4*
Crankshaft Dia.: *6''*
Sheave: *36'' P.D.-4C*
24'' P.D.-4C
2 15/16'' Bore
Gearbox Oil Capacity:
35 Gallons Approx.

160 D GEAR REDUCER
Rating: *160,000 In. Lbs. Peak Torque*
Gear Ratio: *29.8*
Crankshaft Dia.: *6''*
Sheave: *30'' P.D.-3C*
24'' P.D.-3C
2 11/16'' Bore
Gearbox Oil Capacity:
30 Gallons Approx.

114 D GEAR REDUCER
Rating: *114,000 In. Lbs. Peak Torque*
Gear Ratio: *29.9*
Crankshaft Dia.: *5''*
Sheave: *24'' P.D.-3C*
2 1/8'' Bore
Gearbox Oil Capacity:
12 Gallons Approx.

80 D GEAR REDUCER
Rating: *80,000 In. Lbs. Peak Torque*
Gear Ratio: *29.84*
Crankshaft Dia.: *5''*
Sheave: *30'' P.D.-2C*
24'' P.D.-2C
2 1/8'' Bore
Gearbox Oil Capacity:
12 Gallons Approx.

57D GEAR REDUCER
Rating: *57,000 In. Lbs. Peak Torque*
Gear Ratio: *29.32*
Crankshaft Dia.: *5''*
Sheave: *30'' P.D.-2C*
24'' P.D.-2C
2 1/8'' Bore
Gearbox Oil Capacity:
11 Gallons Approx.

STRUCTURE AND MOUNTING

Two point mounting pads reduce installation cost.

The CMI TORQMASTER structure is a significant advanced design innovation, connecting two traditionally separate and independent structures — the sampson post and the gear reducer. This corrects a design problem found in conventional units known as the "wishbone effect."

The "wishbone effect" occurs when normal pumping forces, generated while the well load, form a lifting fatigue area at the base between the sampson post and the gear reducer. The forces generated from the angles formed by the crank and pitman, when lifting the well load, pull the gear reducer and the sampson post toward each other. Only the strength of the base beams and tiedowns keep the two parts from being pulled together. In most cases, fatigue failure results.

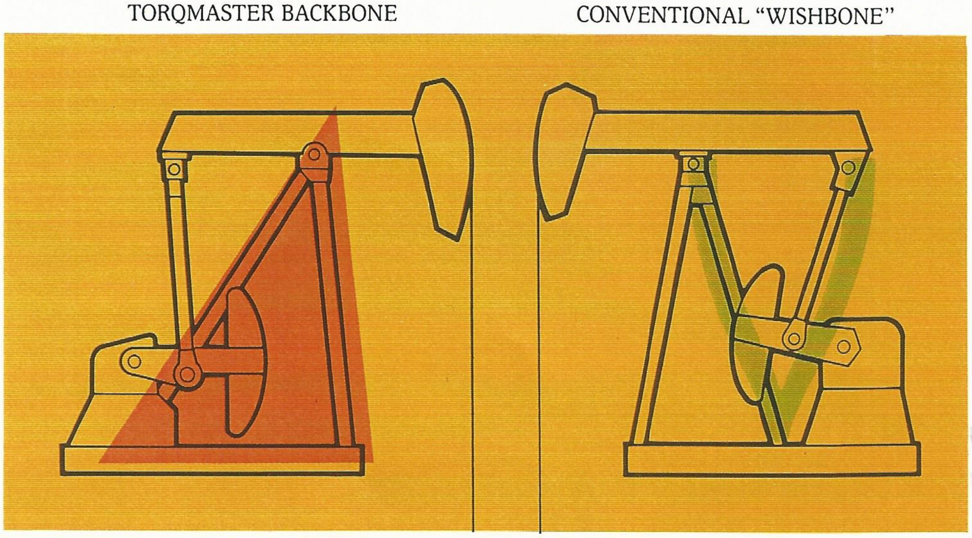
The TORQMASTER has a strong "backbone," created by connecting the rear leg of the sampson post directly to the bottom of the gear reducer. With this style of structure, forces are not transmitted down through the base frame of the pumping unit as they are in a conventional pumping frame structure and then back up to the saddle bearing through the sampson post. The TORQMASTER's backbone structure eliminates the need for extra-cost strongback options required on conventional units.

The TORQMASTERS's tripod sampson post is constructed of heavy W-beam for maximum strength, stability, and ease of erection. Walking beams, sampson posts, bases and other structural components are designed to exceed API requirements and carry the official API monogram.

Bases, Prime Mover Brackets.

Both wide and narrow configuration bases are available, as are high and low prime mover assemblies for electric motors and gas engines.

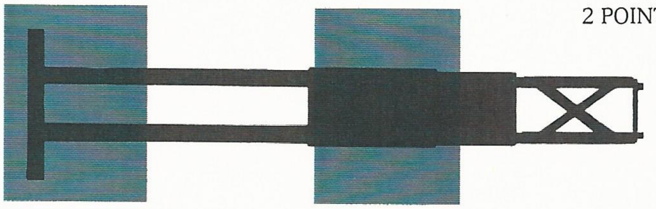
TORQMASTER BACKBONE CONVENTIONAL "WISHBONE"



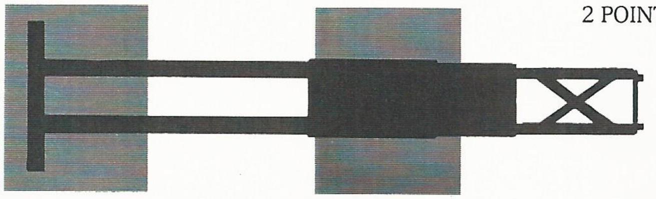
The TORQMASTER structure design eliminates weaknesses created by the "wishbone effect" in conventional units.

RECOMMENDED MOUNTING SYSTEMS

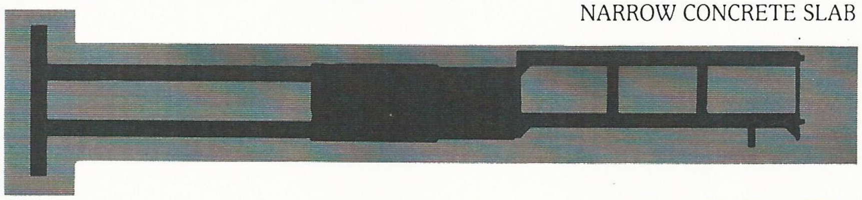
2 POINT FABRICATED STEEL PAD



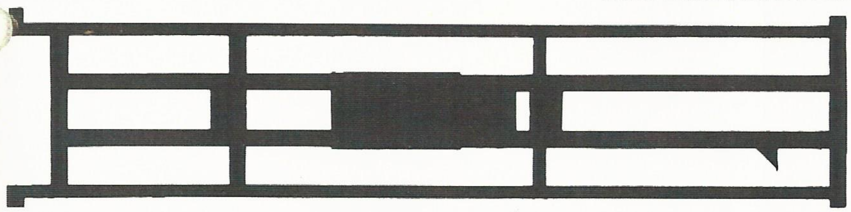
2 POINT CONCRETE PAD



NARROW CONCRETE SLAB



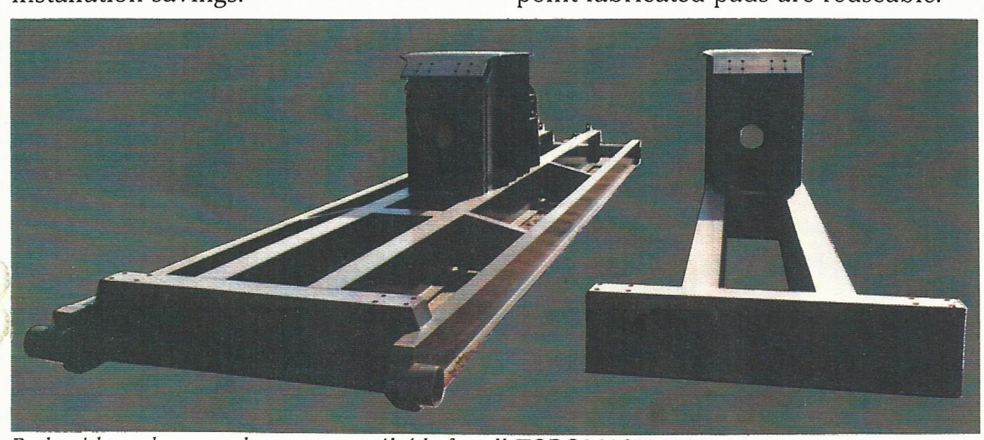
WIDE BASE STEEL FRAME



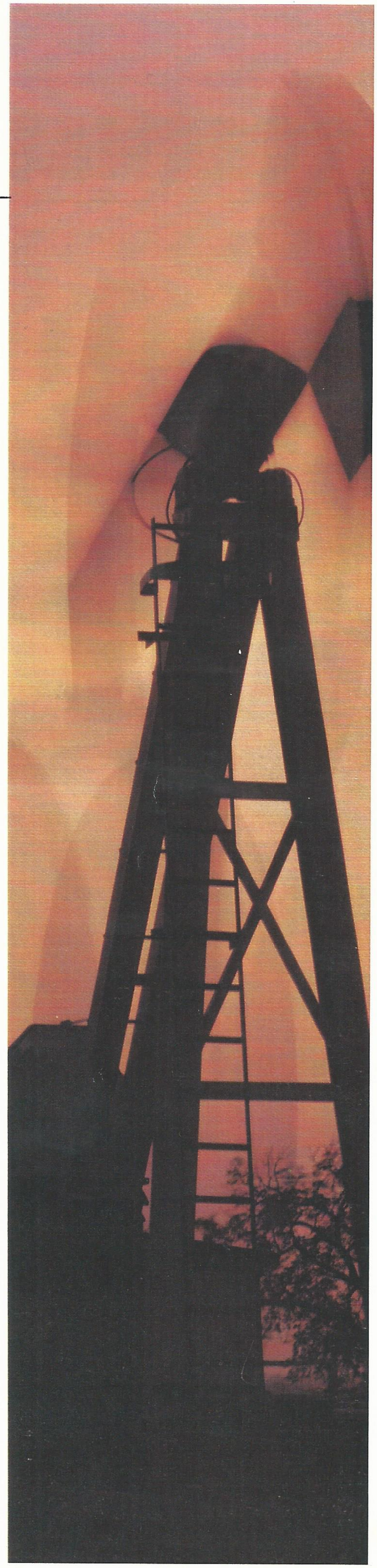
Two-Point Suspension.

Because of the TORQMASTER's unique structural design, which does not transmit forces through the base of the unit, TORQMASTER units can be set on two point suspension in lieu of full base slabs or fabricated wide base frames resulting in substantial installation savings.

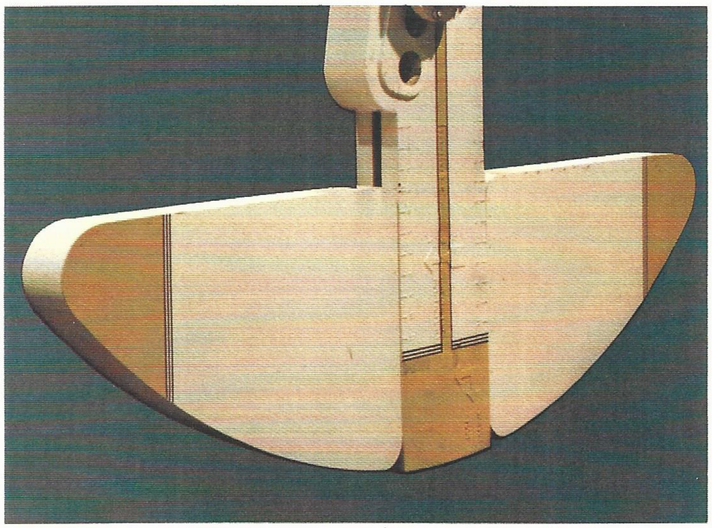
Fabricated steel two-point suspension pads are available from CMI Corporation. The pads can be filled with gravel or sand to add stability, while the bottom plate maintains a large surface area for bearing the operating weight of the pumping unit. Portable and inexpensive, these two-point fabricated pads are reuseable.



Both wide and narrow bases are available for all TORQMASTER Models.

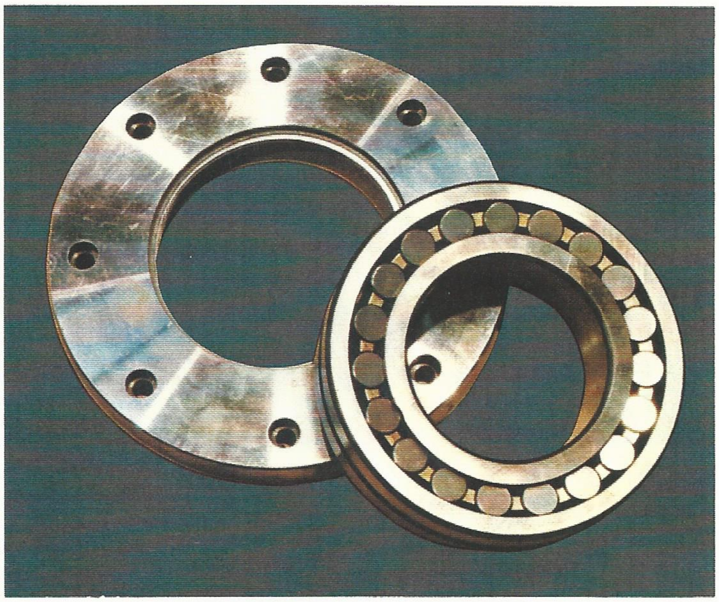


TORQMASTER FEATURES



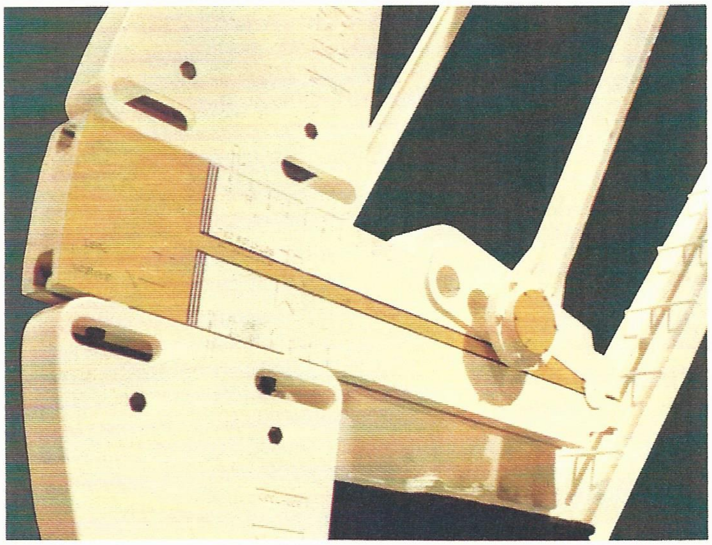
Counterweights

A wide range of counterbalance weights are available for the TORQMASTER. Due to the wide range of counterweights and auxiliary weights, an economical selection of counterbalance can be made.



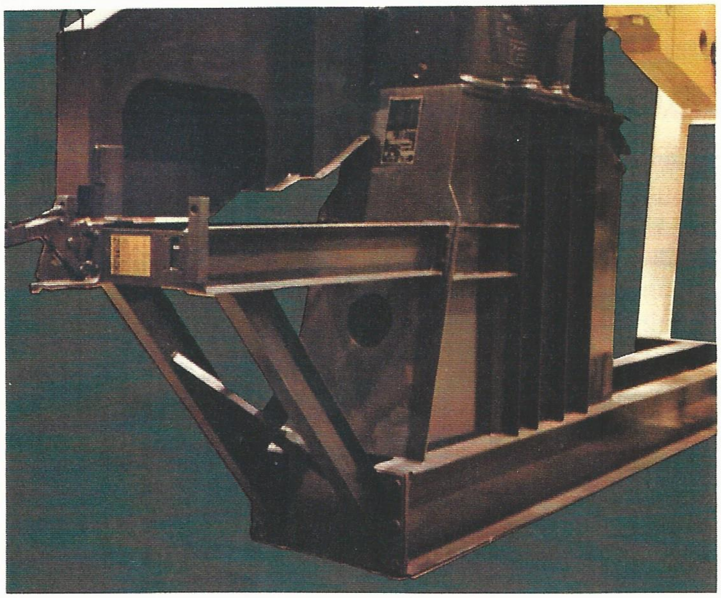
Bearings and Seals

TORQMASTER bearing assemblies are designed for long operational/B-10 life. Seals are non-friction, self-aligning steel seals, which cannot be blown out or damaged by over lubrication.



Counterweight Crank Arm

The TORQMASTER phased angle counterweight crank arm allows safe and easy movement of counterweights to alter counterbalance effect. Calibrated markings permit positive adjustment of counterweight and provisions are made on the crank arm for three different stroke lengths.



Prime Mover Brackets

High and low prime mover bracket assemblies are constructed of strong I-beam. Low prime assemblies are custom designed for the various gas engines. These bolted-on motor supports are easy to remove and change when necessary.

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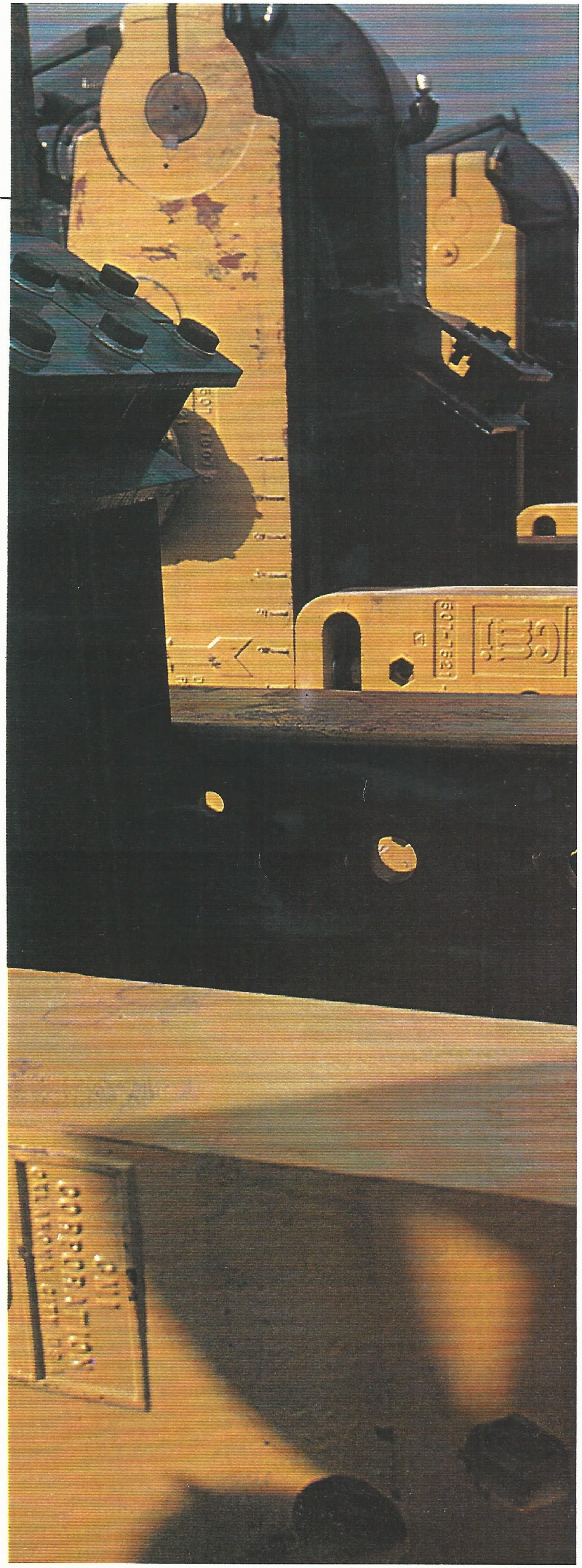
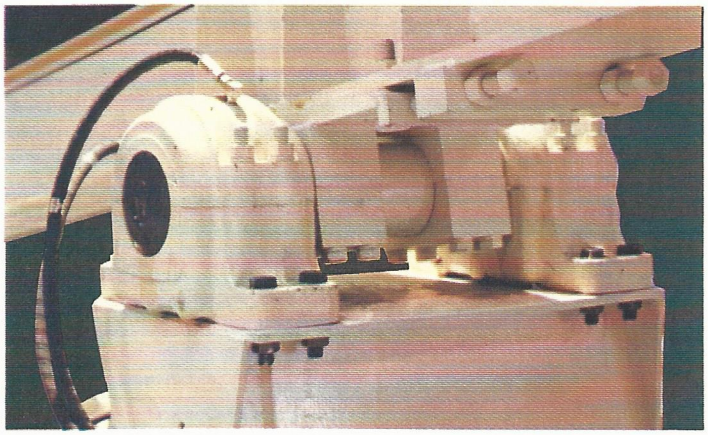
Horsehead

The horsehead has a one-piece arc plate, designed for strength and structural integrity. It is easily aligned with the polished rod and easily removed for safe well servicing by standard service trucks. Cranes are generally not required.

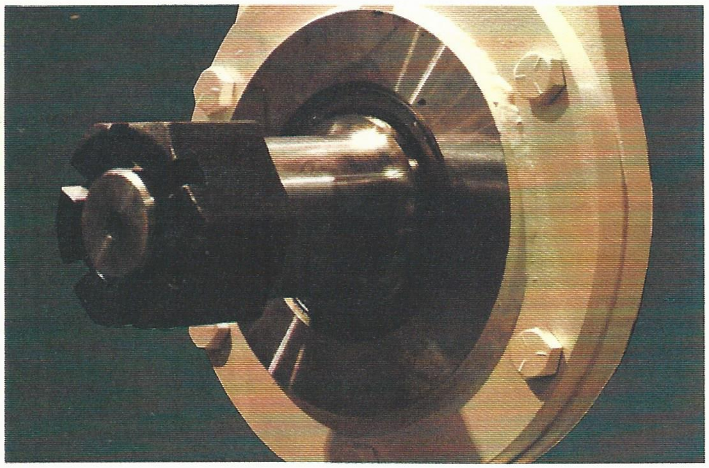


TORQMASTER FEATURES



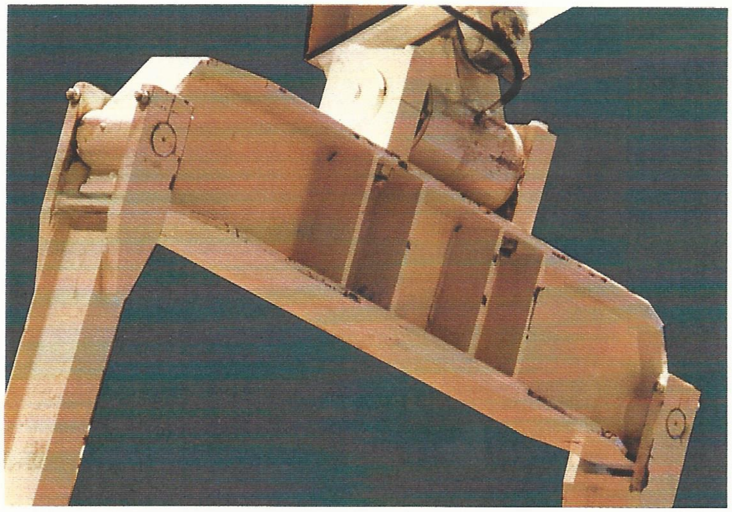
Center Bearing Assembly.

The TORQMASTER uses longlife, anti-friction roller bearings which are grease packed and sealed for trouble-free service and minimum maintenance. Ground level lubrication systems are furnished as standard equipment.



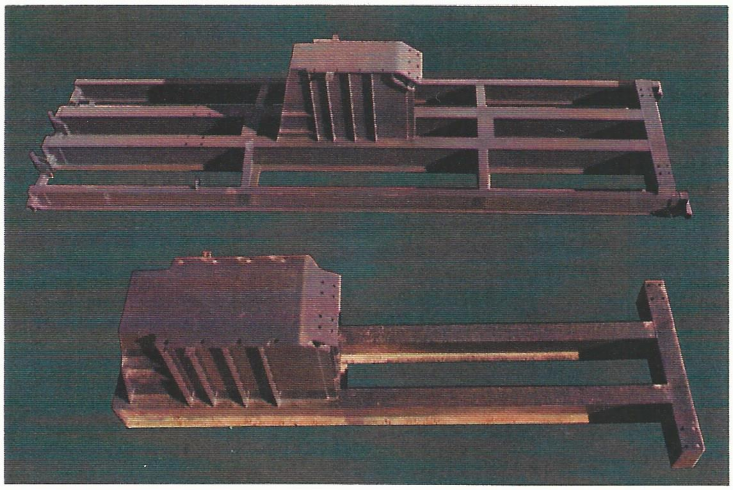
Wrist Pin Assembly.

Anti-friction, self-aligning roller bearings are used at the wrist pins and center bearing. CMI engineers insisted on conservative design, so these bearings are extra-durable and have long life characteristics. Lubricant is retained in the assemblies by snug-fitting steel-labyrinth seals capable of withstanding the misalignments encountered in field operations without wear, and cannot be over lubricated. The high alloy steel, machined wrist pins are secured in the cranks with lock nuts which can be tightened, removed or adjusted by conventional tools for proper alignment at the wellhead.



Equalizer Bearing Assembly.

The equalizer bearing assembly of the TORQMASTER consists of a machined cast housing, providing lateral and horizontal movement between the rear of the sampson post and the equalizer bearing. It contains heavy-duty cylindrical anti-friction roller bearings which provide an equalization of loads on pitmans and wrist pin bearings. Ground level lubrication system is furnished as standard equipment.

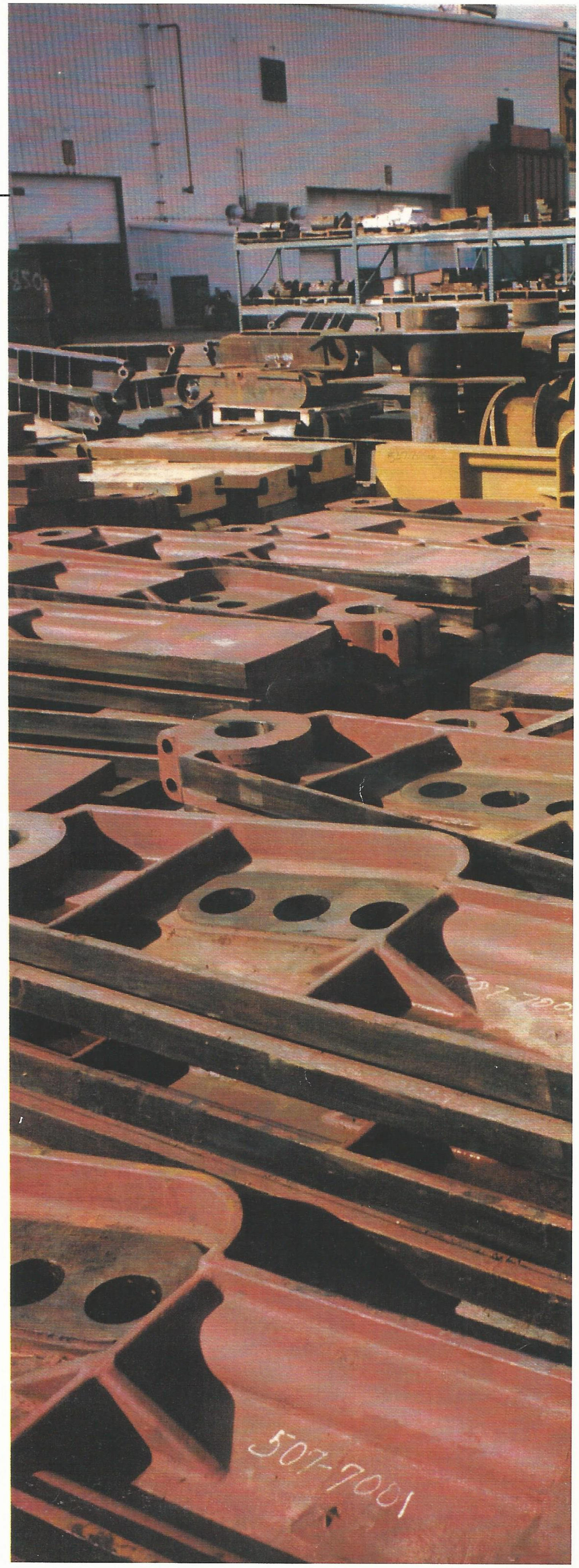


Bases

The wide skid bases and narrow "T" bases are fabricated from heavy W-beams for optimum strength and stability. No strongback options are necessary to prevent base fatigue, due to the TORQMASTER's unique backbone structural design.

Lubrication System.

A ground level lubrication system reaches all lube points and bearings on the unit for safe and convenient periodic relubrication.



CMI CORPORATION

CMI Corporation's committment to quality and aggressive research and development has garnered the Company a record of being one of the most innovative leaders in the industrial equipment fields. In its early years, CMI's development was based on building heavy equipment for the nation's roadbuilders. Today, CMI has emerged as a diversified corporation providing heavy construction equipment, energy recovery systems, mining tools and industrial weighing systems to the world. CMI is positioned to provide new, high quality Special Geometry TORQMASTER Pumping Units to a market which has been void of innovations in drilling or production equipment for the past twenty years.

At the forefront of engineering and manufacturing technology, CMI operates five manufacturing facilities throughout the US and a gear cutting plant in Ireland with total combined manufacturing area of almost one million square feet, and employs over 2,200 highly trained people.

We credit our successes to an old-fashioned commitment to craftmanship. Quality is evident in everything we manufacture.

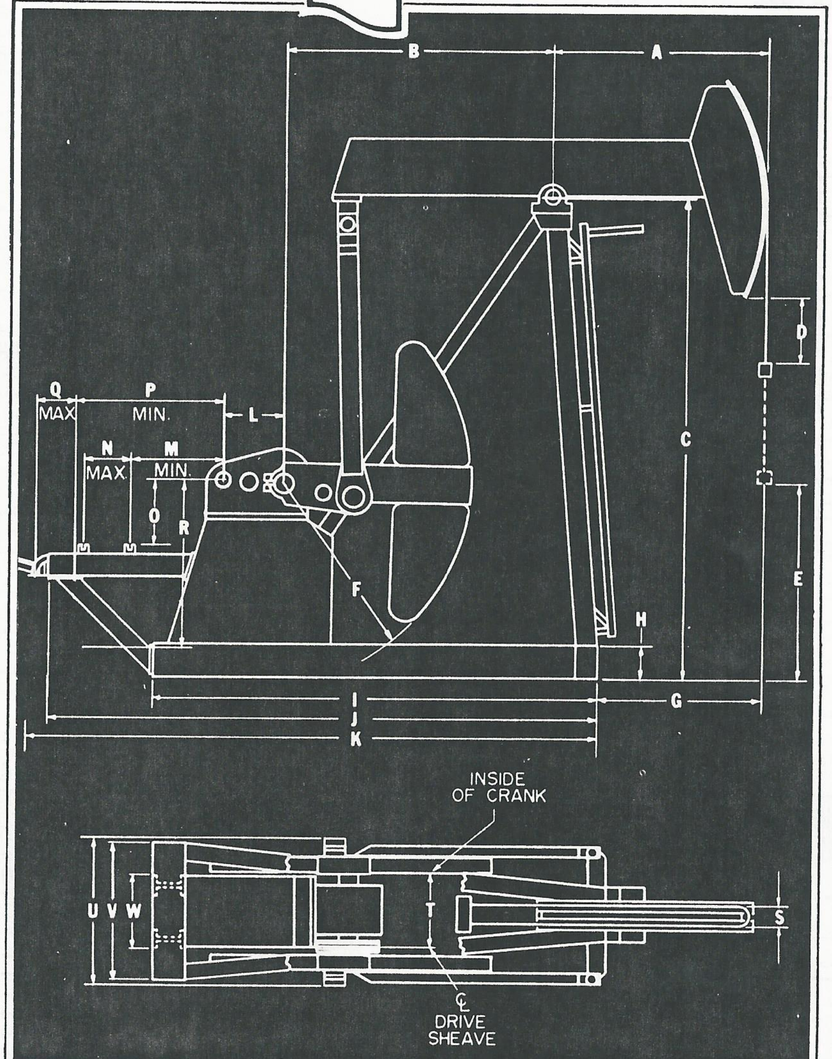
Corporate headquarters are in Oklahoma City, Oklahoma, adjoining a modern, over ¾ million square foot manufacturing facility on 400 acres where the latest machine centers, gear cutters and fabrication techniques produce the TORQMASTER Pumping Unit.

The TORQMASTER is marketed worldwide through authorized distributors and dealers. A complete list of dealers and additional information will be sent at your request.

We extend an invitation to visit our plants to see the TORQMASTER, inspect the facilities and gain a first-hand understanding of the capabilities CMI has available. We also welcome your questions or comments.

CMI'S ultra modern industrial complex in Oklahoma City contains over ¾ million sq. ft. of manufacturing facilities.

TORQMASTER™



SPECIFICATIONS/TORQUE FACTORS

MODEL SELECTION CHART

UNIT DESIGNATION	**912-305-192**	**912-365-168**	**640-305-168 912-305-168**	**912-427-144**	**640-365-144 912-365-144**	**640-305-144 912-305-144**
POL. ROD CAP. LBS.	30,500	36,500	30,500	42,700	36,500	30,500
STROKE LENGTH. IN.	192	168	168	144	144	144
CRANK ARM RADIUS	110"	110"	110"	110"	110"	110"
CRANK PIN BEARING	E	E	D	E	D	D
EQUALIZER BEARING	E	E	E	E	E	E
CENTER BEARING	E	E	D	E	D	D
STRUCTURE GROUP	VIII	VIII	VIII	VIII	VIII	VIII
WALKING BEAM	W36x210#	W36X210#	W36x170#	W36x210#	W36x170#	W36x170#
WIRE LINE HANGER	1⅜x12" CTRS.	1⅜x12" CTRS.	1⅜x12" CTRS.	1⅜x12" CTRS.	1⅜x12" CTRS.	1⅜x12" CTRS.
SUPP. STROKE LGTH.	153 & 117	133¾ & 102¼	133¾ & 102¼	114¾ & 87¾	114¾ & 87¾	114¾ & 87¾
UNIT DESIGNATION	**456-305-144**	**640-256-144**	**320-256-144 456-256-144**	**456-365-120**	**640-305-120**	**320-305-120 456-305-120**
POL. ROD CAP. LBS.	30,500	25,600	25,600	36,500	30,500	30,500
STROKE LENGTH. IN.	144	144	144	120	120	120
CRANK ARM RADIUS	95"	110"	95"	95"	110"	95"
CRANK PIN BEARING	D	D	D	D	D	D
EQUALIZER BEARING	E	D	D	E	D	D
CENTER BEARING	D	D	D	D	D	D
STRUCTURE GROUP	V	VII	IV	V	VII	IV
WALKING BEAM	W33x152#	W33x130#	W33x130#	W33x152#	W33x130#	W33x130#
WIRE LINE HANGER	1⅜x12" CTRS.	1⅜x12" CTRS.	1¼x12" CTRS.	1⅜x12" CTRS.	1¼x12" CTRS.	1¼x12" CTRS.
SUPP. STROKE LGTH.	114½ & 87¼	114¾ & 87¾	114½ & 87¼	95¼ & 72½	95½ & 73	95¼ & 72½
UNIT DESIGNATION	**320-256-120 456-256-120**	**228-213-120 320-213-120**	**320-305-100**	**228-256-100 320-256-100**	**228-213-100**	**160-173-100 228-173-100**
POL. ROD CAP. LBS.	25,600	21,300	30,500	25,600	21,300	17,300
STROKE LENGTH, IN.	120	120	100	100	100	100
CRANK ARM RADIUS	95"	95"	95"	95"	95"	78"
CRANK PIN BEARING	D	C	D	C	C	B
EQUALIZER BEARING	C	C	C	C	C	C
CENTER BEARING	D	C	D	C	C	C
STRUCTURE GROUP	IV	III	IV	III	III	II
WALKING BEAM	W33x130#	W30x108#	W33x130#	W30x108#	W30x108#	W24x84#
WIRE LINE HANGER	1¼x12" CTRS.	1⅛x12" CTRS.	1¼x12" CTRS.	1⅛x12" CTRS	1⅛x12" CTRS.	1"x9" CTRS.
SUPP. STROKE LGTH.	95¼ & 72½	95¼ & 72½	79½ & 60½	79½ & 60½	79½ & 60½	79½ & 60¾

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UNIT DESIGNATION	228-246-86	160-213-86 228-213-86 320-213-86	160-173-86	114-143-86	114-119-86	160-200-74 228-200-74
POL. ROD CAP. LBS.	24,600	21,300	17,300	14,300	11,900	20,000
STROKE LENGTH. IN.	86	86	86	86	86	74
CRANK ARM RADIUS	95"	78"	78"	68"	68"	78"
CRANK PIN BEARING	C	B	B	A	A	B
EQUALIZER BEARING	C	C	C	A	A	C
CENTER BEARING	C	C	C	A	A	C
STRUCTURE GROUP	III	II	II	I	I	II
WALKING BEAM	W30x108#	W24x84#	W24x84#	W24x68#	W24x68#	W24x84#
WIRE LINE HANGER	1⅛x12" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.
SUPP. STROKE LGTH.	68¼ & 52	68½ & 52¼	68½ & 52¼	66¾ & 48¾	66¾ & 48¾	58¾ & 45
UNIT DESIGNATION	**114-173-74 160-173-74**	**114-143-74 160-143-74**	**114-173-64 160-173-64**	**114-143-64 160-143-64**	**80-119-64**	**80-133-54**
POL. ROD CAP. LBS.	17,300	14,300	17,300	14,300	11,900	13,300
STROKE LENGTH. IN.	74	74	64	64	64	54
CRANK ARM RADIUS	68"	68"	68"	68"	54"	54"
CRANK PIN BEARING	A	A	A	A	A	A
EQUALIZER BEARING	A	A	A	A	A	A
CENTER BEARING	A	A	A	A	A	A
STRUCTURE GROUP	I	I	I	I	IA	IA
WALKING BEAM	W24x68#	W24x68#	W24x68#	W24x68#	W21x62#	W21x62#
WIRE LINE HANGER	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.
SUPP. STROKE LGTH.	57¼ & 42	57¼ & 42	49½ & 36¼	49½ & 36¼	46¾ & 30¾	39½ & 26
UNIT DESIGNATION	**57-119-54 80-119-54**	**57-76-54**	**80-133-48**	**57-109-48**	**57-95-48**	**57-89-42**
POL. ROD CAP. LBS.	11,900	7,600	13,300	10,900	9,500	8,900
STROKE LENGTH. IN.	54	54	48	48	48	42
CRANK ARM RADIUS	54"	54"	54"	54"	54"	54"
CRANK PIN BEARING	A	AA	A	AA	AA	AA
EQUALIZER BEARING	A	AA	A	AA	AA	AA
CENTER BEARING	A	AA	A	AA	AA	AA
STRUCTURE GROUP	IA	IB	IA	IB	IB	IB
WALKING BEAM	W21x62#	W18x35#	W21x62#	W18x35#	W18x35#	W18x35#
WIRE LINE HANGER	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.	1"x9" CTRS.
SUPP. STROKE LGTH.	39½ & 26	39½ & 26	35 & 23	35 & 23	35 & 23	30½ & 20

COUNTERBALANCE EFFECT CHART

UNIT SIZE	STROKE LENGTH	STRUCTURAL IMBALANCE	CBE WITH CRANKS ONLY	507-7521 &507-7522 MASTER C'WTS: ONE MASTER C'WT-CBE CHANGE/INCH MOVED	507-7521 &507-7522 MASTER C'WTS: ONE MASTER C'WT-MAXIMUM CBE	507-7523 507-7533 &507-7540 2" INSERT C'WTS: ONE 2" INSERT C'WT-CBE CHANGE/INCH MOVED	507-7523 507-7533 &507-7540 2" INSERT C'WTS: ONE 2" INSERT C'WT-MAXIMUM CBE	507-7524 1" INSERT C'WT: ONE 1" INSERT C'WT-CBE CHANGE/INCH MOVED	507-7524 1" INSERT C'WT: ONE 1" INSERT C'WT-MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM	507-7507 &507-7508 MASTER C'WTS: ONE MASTER C'WT-CBE CHANGE/INCH MOVED	507-7507 &507-7508 MASTER C'WTS: ONE MASTER C'WT-MAXIMUM CBE	507-7511 507-7532 &507-7539 2" INSERT C'WTS: ONE 2" INSERT C'WT-CBE CHANGE/INCH MOVED	507-7511 507-7532 &507-7539 2" INSERT C'WTS: ONE 2" INSERT C'WT-MAXIMUM CBE	507-7512 1" INSERT C'WT: ONE 1" INSERT C'WT-CBE CHANGE/INCH MOVED	507-7512 1" INSERT C'WT: ONE 1" INSERT C'WT-MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM
TM912-305-192	192	–1551	4351	6.617	619	3.054	284	1.527	142	10249	9.388	845	4.638	414	2.319	207	12723
TM912-365-168	168	–772	5972	7.561	707	3.49	324	1.745	162	12712	10.727	966	5.30	474	2.65	237	15539
TM912-305-168	168	–326	6344	7.561	707	3.49	324	1.745	162	13084	10.727	966	5.30	474	2.65	237	15911
TM912-427-144	144	435	8301	8.819	825	4.07	378	2.035	189	16163	12.513	1127	6.18	554	3.09	277	19460
TM912-365-144	144	649	8429	8.819	825	4.07	378	2.035	189	16291	12.513	1127	6.18	554	3.09	277	19588
TM912-305-144	144	649	8429	8.819	825	4.07	378	2.035	189	16291	12.513	1127	6.18	554	3.09	277	19588
TM640-305-168	168	–326	6344	7.561	707	3.49	324	1.745	162	13084	10.727	966	5.30	474	2.65	237	15911
TM640-365-144	144	649	8429	8.819	825	4.07	378	2.035	189	16291	12.513	1127	6.18	554	3.09	277	19588
TM640-305-144	144	649	8429	8.819	825	4.07	378	2.035	189	16291	12.513	1127	6.18	554	3.09	277	19588
TM640-256-144	144	–66	7714	8.819	825	4.07	378	2.035	189	15576	12.513	1127	6.18	554	3.09	277	18873
TM640-305-120	120	616	9949	10.58	990	4.884	454	2.442	227	19381	15.011	1352	7.416	664	3.708	332	23337
TM456-305-144	144	–86	3836	8.71	684	4.02	314	2.01	157	10355	12.358	927	6.104	454	3.052	227	13018
TM456-256-144	144	–516	3406	8.71	684	4.02	314	2.01	157	9925	12.358	927	6.104	454	3.052	227	12588
TM456-365-120	120	630	5343	10.468	823	4.832	378	2.416	189	13177	14.851	1115	7.336	546	3.668	273	16377
TM456-305-120	120	129	4842	10.468	823	4.832	378	2.416	189	12676	14.851	1115	7.336	546	3.668	273	15876
TM456-256-120	120	–39	4674	10.468	823	4.832	378	2.416	189	12508	14.851	1115	7.336	546	3.668	273	15708
TM320-256-144	144	–546	3320	8.586	675	3.962	310	1.981	155	9746	12.182	914	6.018	448	3.009	224	12370
TM320-305-120	120	93	4739	10.318	811	4.762	372	2.381	186	12461	14.639	1099	7.232	538	3.616	269	15615
TM320-256-120	120	–75	4638	10.468	823	4.832	378	2.416	189	12472	14.851	1115	7.336	546	3.668	273	15672
TM320-213-120	120	–47	4537	10.468	823	4.832	378	2.416	189	12371	14.851	1115	7.336	546	3.668	273	15571
TM320-305-100	100	622	6268	12.539	985	5.788	452	2.894	226	15653	17.791	1335	8.788	656	4.394	328	19486
TM320-256-100	100	439	5930	12.539	985	5.788	452	2.894	226	15315	17.791	1335	8.788	656	4.394	328	19148
TM320-213-86	86	721	4941	14.499	893	6.692	410	3.346	205	13442	20.572	1195	10.162	586	5.081	293	16753
TM228-213-120	120	–77	4442	10.318	811	4.762	372	2.381	186	12164	14.639	1099	7.232	538	3.616	269	15318
TM228-256-100	100	402	5815	12.36	971	5.704	446	2.852	223	15065	17.537	1316	8.662	646	4.331	323	18844
TM228-213-100	100	402	5815	12.36	971	5.704	446	2.852	223	15065	17.537	1316	8.662	646	4.331	323	18844
TM228-173-100	100	384	4017	12.48	769	5.76	352	2.88	176	11334	17.707	1028	8.748	504	4.374	252	14184
TM228-246-86	86	916	7314	14.609	1148	6.742	528	3.371	264	18247	20.727	1556	10.238	764	5.119	382	22713
TM228-213-86	86	684	4904	14.499	893	6.692	410	3.346	205	13405	20.572	1195	10.162	586	5.081	293	16716
TM228-200-74	74	1015	5921	16.854	1038	7.778	476	3.889	238	15802	23.913	1389	11.812	680	5.906	340	19992
TM160-173-100	100	373	4006	12.48	769	5.76	352	2.88	176	11323	17.707	1028	8.748	504	4.374	252	14173
TM160-213-86	86	670	4890	14.499	893	6.692	410	3.346	205	13391	20.572	1195	10.162	586	5.081	293	16702
TM160-173-86	86	670	4890	14.499	893	6.692	410	3.346	205	13391	20.572	1195	10.162	586	5.081	293	16702
TM160-200-74	74	999	5905	16.854	1038	7.778	476	3.889	238	15786	23.913	1389	11.812	680	5.906	340	19976

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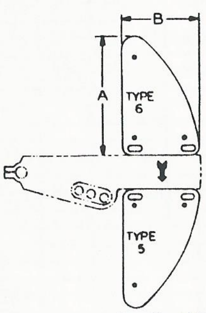
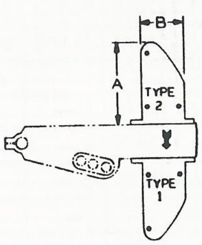
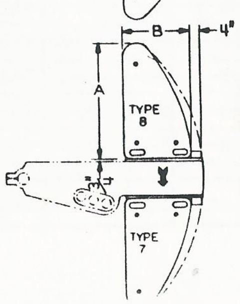
507-7576 &507-7577 MASTER C'WTS		507-7565 507-7567 &507-7568 2" INSERT C'WT		507-7566 1"INSERT C'WT			507-7501 &507-7502 MASTER C'WTS		507-7505 507-7531 &507-7538 2" INSERT C'WTS		507-7506 1"INSERT C'WT			507-7526 &507-7527 MASTER C'WTS		507-7528 507-7534 &507-7541 2" INSERT C'WTS		507-7529 1" INSERT C'WT		
ONE MASTER C'WT-CBE CHANGE/INCH MOVED	ONE MASTER C'WT-MAXIMUM CBE	ONE 2" INSERT C'WT-CBE CHANGE/INCH MOVED	ONE 2" INSERT C'WT-MAXIMUM CBE	ONE 1" INSERT C'WT-CBE CHANGE/INCH MOVED	ONE 1" INSERT C'WT-MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM	ONE MASTER C'WT-CBE CHANGE/INCH MOVED	ONE MASTER C'WT-MAXIMUM CBE	ONE 2" INSERT C'WT-CBE CHANGE/INCH MOVED	ONE 2" INSERT C'WT-MAXIMUM CBE	ONE 1" INSERT C-WT-CBE CHANGE/INCH MOVED	ONE 1" INSERT C'WT-MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM	ONE MASTER C'WT-CBE CHANGE/INCH MOVED	ONE MASTER C'WT-MAXIMUM CBE	ONE 2" INSERT C'WT-CBE CHANGE/INCH MOVED	ONE 2" INSERT C'WT-MAXIMUM CBE	ONE 1" INSERT C'WT-CBE CHANGE/INCH MOVED	ONE 1" INSERT C'WT-MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM
—	—	—	—	—	—	—	15.122	1290	8.03	680	4.015	340	17692	19.50	1560	11.876	948	5.938	474	25768
—	—	—	—	—	—	—	17.28	1475	9.176	778	4.588	389	21217	22.282	1783	13.57	1082	6.785	541	30445
—	—	—	—	—	—	—	17.28	1475	9.176	778	4.588	389	21589	22.282	1783	13.57	1082	6.785	541	30275
—	—	—	—	—	—	—	20.156	1720	10.704	908	5.352	454	26083	25.99	2080	15.83	1264	7.915	632	36847
—	—	—	—	—	—	—	20.156	1720	10.704	908	5.352	454	26211	25.99	2080	15.83	1264	7.915	632	36343
—	—	—	—	—	—	—	20.156	1720	10.704	908	5.352	454	26211	25.99	2080	15.83	1264	7.915	632	30022
—	—	—	—	—	—	—	17.28	1475	9.176	778	4.588	389	21589	22.282	1783	13.57	1082	6.785	541	25940
—	—	—	—	—	—	—	20.156	1720	10.704	908	5.352	454	26211	25.99	2080	15.83	1264	7.915	632	31286
—	—	—	—	—	—	—	20.156	1720	10.704	908	5.352	454	26211	25.99	2080	15.83	1264	7.915	632	30022
—	—	—	—	—	—	—	20.156	1720	10.704	908	5.352	454	25496	25.99	2080	15.83	1264	7.915	632	25515
—	—	—	—	—	—	—	24.18	2064	12.84	1088	6.42	544	29647	31.179	2495	18.99	1516	9.495	758	29788
—	—	—	—	—	—	—	19.907	1400	10.572	738	5.286	369	18302	25.67	1669	15.634	1014	7.817	507	26738
—	—	—	—	—	—	—	19.907	1400	10.572	738	5.286	369	17872	25.67	1669	15.634	1014	7.817	507	25294
—	—	—	—	—	—	—	23.923	1683	12.704	886	6.352	443	22727	30.848	2006	18.788	1218	9.394	609	32866
—	—	—	—	—	—	—	23.923	1683	12.704	886	6.352	443	22226	30.848	2006	18.788	1218	9.394	609	29927
—	—	—	—	—	—	—	23.923	1683	12.704	886	6.352	443	22058	30.848	2006	18.788	1218	9.394	609	25494
—	—	—	—	—	—	—	19.623	1380	10.42	728	5.21	364	17579	25.303	1645	15.41	998	7.705	499	21897
—	—	—	—	—	—	—	23.582	1659	12.522	874	6.261	437	21875	30.407	1977	18.52	1200	9.26	600	26463
—	—	—	—	—	—	—	23.923	1683	12.704	886	6.352	443	22022	30.848	2006	18.788	1218	9.394	609	22412
—	—	—	—	—	—	—	23.923	1683	12.704	886	6.352	443	21034	30.848	2006	18.788	1218	9.394	609	21092
—	—	—	—	—	—	—	28.658	2016	15.218	1062	7.609	531	27093	36.953	2403	22.506	1458	11.253	729	27559
—	—	—	—	—	—	—	28.658	2016	15.218	1062	7.609	531	24629	36.953	2403	22.506	1458	11.253	729	25032
39.061	2162	16.556	912	8.278	456	19070	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	23.582	1659	12.522	874	6.261	437	18953	—	—	—	—	—	—	—
—	—	—	—	—	—	—	28.249	1987	15.002	1048	7.501	524	22674	—	—	—	—	—	—	—
—	—	—	—	—	—	—	28.249	1987	15.002	1048	7.501	524	21102	—	—	—	—	—	—	—
33.623	1861	14.252	784	7.126	392	16178	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	33.388	2349	17.73	1238	8.865	619	24143	—	—	—	—	—	—	—
39.061	2162	16.556	912	8.278	456	19033	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33.623	1861	14.252	784	7.126	392	16167	—	—	—	—	—	—	—	—	—	—	—	—	—	—
39.061	2162	16.556	912	8.278	456	18562	—	—	—	—	—	—	—	—	—	—	—	—	—	—
39.061	2162	16.556	912	8.278	456	17193	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

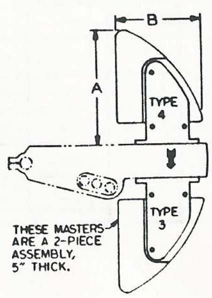
COUNTERBALANCE EFFECT CHART

UNIT SIZE	STROKE LENGTH	STRUCTURAL IMBALANCE	CBE WITH CRANKS ONLY	507-7545 &507-7546 MASTER C'WTS: ONE MASTER C'WT- CBE CHANGE/INCH MOVED	507-7545 &507-7546 MASTER C'WTS: ONE MASTER C'WT- MAXIMUM CBE	507-7548 507-7552 &507-7553 2" INSERT C'WTS: ONE 2" INSERT C'WT- CBE CHANGE/INCH MOVED	507-7548 507-7552 &507-7553 2" INSERT C'WTS: ONE 2" INSERT C'WT- MAXIMUM CBE	507-7547 1" INSERT C'WT: ONE 1" INSERT C'WT- CBE CHANGE/INCH MOVED	507-7547 1" INSERT C'WT: ONE 1" INSERT C'WT- MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM	507-7572 &507-7573 MASTER C'WTS: ONE MASTER C'WT- CBE CHANGE/INCH MOVED	507-7572 &507-7573 MASTER C'WTS: ONE MASTER C'WT- MAXIMUM CBE	507-7562 507-7570 &507-7571 2" INSERT C'WTS: ONE 2" INSERT C'WT- CBE CHANGE/INCH MOVED	507-7562 507-7570 &507-7571 2" INSERT C'WTS: ONE 2" INSERT C'WT- MAXIMUM CBE	507-7569 1" INSERT C'WT: ONE 1" INSERT C'WT- CBE CHANGE/INCH MOVED	507-7569 1" INSERT C'WT: ONE 1" INSERT C'WT- MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM
TM160-173-74	74	369	2900	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM160-143-74	74	369	2900	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM160-173-64	64	650	3574	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM160-143-64	64	650	3574	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM114-143-86	86	144	2321	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM114-119-86	86	144	2321	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM114-173-74	74	343	2874	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM114-143-74	74	343	2874	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM114-173-64	64	621	3545	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM114-143-64	64	621	3545	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TM80-119-64	64	231	1768	13.374	545	8.702	334	4.351	167	7291	40.669	1306	17.016	520	8.508	260	10120
TM80-133-54	54	442	2263	15.847	646	10.31	394	5.155	197	8808	48.19	1547	20.162	616	10.081	308	12159
TM80-119-54	54	442	2263	15.847	646	10.31	394	5.155	197	8808	48.19	1547	20.162	616	10.081	308	11851
TM80-133-48	48	582	2627	17.794	725	11.576	444	5.788	222	9976	54.11	1738	22.338	692	11.319	346	13045
TM57-119-54	54	442	2263	15.847	646	10.31	394	5.155	197	8808	48.19	1547	20.162	616	10.081	308	10307
TM57-76-54	54	307	2090	15.847	646	10.31	394	5.155	197	7447	—	—	—	—	—	—	—
TM57-109-48	48	408	2410	17.794	725	11.576	444	5.788	222	9759	54.11	1738	22.638	692	11.319	346	10749
TM57-95-48	48	408	2410	17.794	725	11.576	444	5.788	222	9314	—	—	—	—	—	—	—
TM57-89-42	42	537	2831	20.385	831	13.262	508	6.631	254	8703	—	—	—	—	—	—	—









MASTER COUNTERWEIGHTS

PART NUMBER	TYPE	DIM. A	DIM. B	DEAD WT.-	MAXIMUM ROTARY COUNTERBALANCE MOMENT, INCH-POUNDS, ON A CRANK ARM WITH A RADIUS OF: 54"	68"	78"	95"	110"
507-7545	2	27	16 1/2	415	16932	—	—	—	—
507-7546	1	27	16 1/2	415	16932	—	—	—	—
507-7572	4	43	34 3/4	1262	40538	58206	—	—	—
507-7573	3	43	34 3/4	1262	40538	58206	—	—	—
507-7521	6	38 3/8	26	585	—	30204	36054	45999	54774
507-7522	5	38 3/8	26	585	—	30204	36054	45999	54774
507-7555	7	47 1/4	32	916	—	39928	—	—	—
507-7556	8	47 1/4	32	916	—	39928	—	—	—
507-7507	5	47 1/4	32	830	—	—	48215	62325	74775
507-7508	6	47 1/4	32	830	—	—	48215	62325	74775
507-7576	4	55	34 7/8	1576	—	—	87263	—	—
507-7577	3	55	34 7/8	1576	—	—	87263	—	—
507-7501	5	60 5/8	40	1337	—	—	—	94071	114126
507-7502	6	60 5/8	40	1337	—	—	—	94071	114126
507-7526	6	68 7/8	49	1724	—	—	—	112129	137989
507-7527	5	68 7/8	49	1724	—	—	—	112129	137989

CMI CORPORATION

507-7521 &507-7522 MASTER C'WTS		507-7524 1" INSERT C'WT					507-7555 &507-7556 MASTER C'WTS		507-7511 507-7532 &507-7539 2" INSERT C'WTS		507-7512 1" INSERT C'WT		
ONE MASTER C'WT- CBE CHANGE/INCH MOVED	ONE MASTER C'WT- MAXIMUM CBE	ONE 2'' INSERT C'WT- CBE CHANGE/INCH MOVED	ONE 2'' INSERT C'WT- MAXIMUM CBE	ONE 1'' INSERT C'WT- CBE CHANGE/INCH MOVED	ONE 1'' INSERT C'WT- MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM	ONE MASTER C'WT- CBE CHANGE/INCH MOVED	ONE MASTER C'WT- MAXIMUM CBE	ONE 2'' INSERT C'WT- CBE CHANGE/INCH MOVED	ONE 2'' INSERT C'WT- MAXIMUM CBE	ONE 1'' INSERT C'WT- CBE CHANGE/INCH MOVED	ONE 1'' INSERT C'WT- MAXIMUM CBE	MAXIMUM CBE PERMISSIBLE WITH THIS C'WT SYSTEM
16.673	860	7.696	394	3.848	197	11084	26.107	1138	11.686	504	5.843	252	13505
16.673	860	7.696	394	3.848	197	11084	26.107	1138	11.686	504	5.843	252	13505
19.263	994	8.89	456	4.445	228	13030	30.162	1314	13.5	582	6.75	291	15826
19.263	994	8.89	456	4.445	228	13030	30.162	1314	13.5	582	6.75	291	14078
14.343	740	6.62	338	3.31	169	9362	22.458	978	10.052	432	5.026	216	11444
14.343	740	6.62	338	3.31	169	9362	22.458	978	10.052	432	5.026	216	11444
16.673	860	7.696	394	3.848	197	11058	26.107	1138	11.686	504	5.843	252	13479
16.673	860	7.696	394	3.848	197	11058	26.107	1138	11.686	504	5.843	252	13479
19.263	994	8.89	456	4.445	228	13001	30.162	1314	13.5	582	6.75	291	15797
19.263	994	8.89	456	4.445	228	13001	30.162	1314	13.5	582	6.75	291	14049

NOTES:
1. COUNTERBALANCE EFFECT WITH CRANKS ONLY INCLUDES STRUCTURAL IMBALANCE.
2. MAXIMUM COUNTERBALANCE EFFECT PERMISSIBLE INCLUDES STRUCTURAL IMBALANCE, COUNTERBALANCE CRANKS, MASTER WEIGHTS, AND INSERT WEIGHTS.
3. EXAMPLE: A TM228-246-86 WITH (2) 507-7501 & (2) 507-7502 MASTER WEIGHTS AND (4) 507-7505 INSERT WEIGHTS WILL HAVE A MAXIMUM CBE OF 21,662#

   7,314# + (4 × 2,349#) + (4 × 1,238#) = 21,662#

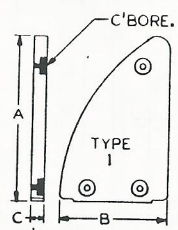
   TO CHANGE THIS TO A CBE OF 19186# COULD BE DONE BY EITHER:

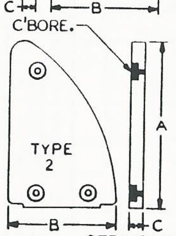
   A. REMOVING (2) 507-7505 INSERTS

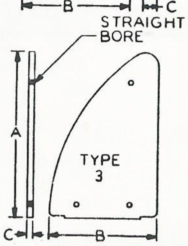
   21,662# – (2 × 1,238#) = 19,186#

   OR B. MOVING ALL (4) SETS OF WEIGHTS TOWARD THE GEARBOX SLOW-SPEED SHAFT BY 11.82 INCHES

   21,662# – 19,186# = 2,476# LESS CBE REQ'D.
   (4 × 33.388#/INCH) + (4 × 17.73#/INCH) = 204.472#/INCH
   2416#/(204.472#/INCH) = 11.82 INCHES







COUNTERWEIGHT INSERTS

PART NUMBER	TYPE	DIM. A	DIM. B	DIM. C	DEAD WT.-	MAXIMUM ROTARY COUNTERBALANCE MOMENT, INCH-POUNDS, ON A CRANK ARM WITH A RADIUS OF: 54"	68"	78"	95"	110"
507-7548	3	32 1/4	22 4/4	2	270	10368	—	—	—	—
507-7547	3	32 1/4	22 3/4	1	135	5184	—	—	—	—
507-7552	1	32 1/4	22 3/4	2	270	10368	—	—	—	—
507-7553	2	32 1/4	22 3/4	2	270	10368	—	—	—	—
507-7562	3	39 1/2	34 3/4	2	528	16170	23562	—	—	—
507-7569	3	39 1/2	34 3/4	1	264	8085	11781	—	—	—
507-7570	2	39 1/2	34 3/4	2	528	16170	—	—	—	
507-7571	1	39 1/2	34 3/4	2	528	16170	23562	—	—	—
507-7523	3	31	21	2	270	—	13865	16565	21155	25205
507-7524	3	31	21	1	135	—	6932	8282	10577	12602
507-7533	1	31	21	2	270	—	13865	16565	21155	25205
507-7540	2	31	21	2	270	—	13865	16565	21155	25205
507-7511	3	39 1/2	26 5/8	2	410	—	17700	23645	30615	36765
507-7512	3	39 12	26 5/8	1	205	—	8850	11822	15307	18382
507-7532	1	39 1/2	26 5/8	2	410	—	17700	23645	30615	36765
507-7539	2	39 1/2	26 5/8	2	410	—	17700	23645	30615	36765
507-7565	3	51 1/2	34 7/8	2	668	—	—	36834	—	—
507-7566	3	51 1/2	34 7/8	1	334	—	—	18417	—	—
507-7567	1	51 1/2	34 7/8	2	668	—	—	36834	—	—
507-7568	2	51 1/2	34 7/8	2	668	—	—	36834	—	—
507-7505	3	52 5/8	34 1/2	2	710	—	—	—	49608	60258
507-7506	3	52 5/8	34 1/2	1	355	—	—	—	24804	30129
507-7531	1	52 5/8	34 1/2	2	710	—	—	—	49608	60258
507-7538	2	52 5/8	34 1/2	2	710	—	—	—	49608	60258
507-7528	3	60 7/8	43 1/4	2	1050	—	—	—	68103	83853
507-7529	3	60 7/8	43 1/4	1	525	—	—	—	34052	41927
507-7534	1	60 7/8	43 1/4	2	1050	—	—	—	68103	83853
507-7541	2	60 7/8	43 1/4	2	1050	—	—	—	68103	83853

UNIT SIZE	CRANK ARM MAXIMUM ROTARY COUNTERBALANCE (MOMENT,) INCH-LBS
TM57-89-42	46693
TM57-95-48	46693
TM57-109-48	46693
TM57-76-54	46693
TM57-119-54	47693
TM80-133-48	47693
TM80-119-54	47693
TM80-133-54	47693
TM80-119-64	47693
TM114-143-64	88788
TM114-173-64	88788
TM114-143-74	88788
TM114-173-74	88788
TM114-119-86	88788
TM114-143-86	88788
TM160-143-64	88788
TM160-173-64	88788
TM160-143-74	88788
TM160-173-74	88788
TM160-200-74	170275
TM160-173-86	170275
TM160-213-86	170275
TM160-173-100	170275
TM228-200-74	170275
TM228-213-86	170275
TM228-173-100	170275
TM228-246-86	256189
TM228-213-100	256189
TM228-256-100	256189
TM228-213-120	256189
TM320-213-86	170275
TM320-256-100	256189
TM320-305-100	263409
TM320-213-120	256189
TM320-256-120	263409
TM320-305-120	263409
TM320-256-144	263409
TM456-256-120	263409
TM456-305-120	263409
TM456-365-120	263409
TM456-256-144	263409
TM456-305-144	263409
TM640-305-120	516058
TM640-256-144	516058
TM640-305-144	516058
TM640-365-144	516058
TM640-305-168	516058
TM912-305-144	516058
TM912-365-144	516058
TM912-427-144	521778
TM912-305-168	516058
TM912-365-168	521778
TM912-305-192	521778

DIMENSION CHART

UNIT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
TM912-305-192	230 1/4	158	269	22 1/2	45 5/8	110	201 1/2	16	256 1/2	293	420 1/2	52 7/8	14 3/4	25 1/2	48	81	86 3/4	94 1/2	12	59 3/16	43 7/8	76 3/4	102
TM912-365-168	201 1/2	158	269	22 1/4	70 3/8	110	172 3/4	16	256 1/2	293	420 1/2	52 7/8	14 3/4	25 1/2	48	81	86 3/4	94 1/2	12	59 3/16	43 7/8	76 3/4	102
TM912-305-168	201 1/2	158	269	22 1/8	70 3/8	110	172 3/4	16	256 1/2	293	420 1/2	52 7/8	14 3/4	25 1/2	48	81	86 3/4	94 1/2	12	59 3/16	43 7/8	76 3/4	102
TM912-427-144	172 3/4	158	269	22	95 1/8	110	144	16	256 1/2	293	420 1/2	52 7/8	14 3/4	25 1/2	48	81	86 3/4	94 1/2	12	59 3/16	43 7/8	76 3/4	102
TM912-365-144	172 4/4	158	269	22	95 1/8	110	144	16	256 1/2	293	420 1/2	52 7/8	14 3/4	25 1/2	48	81	86 3/4	94 1/2	12	59 3/16	43 7/8	76 3/4	102
TM912-305-144	172 3/4	158	269	22	95 1/8	110	144	16	256 1/2	293	420 1/2	52 7/8	14 3/4	25 1/2	48	81	86 3/4	94 1/2	12	59 3/16	43 7/8	76 3/4	102
TM640-305-168	201 1/2	158	269	22 1/8	70 3/8	110	172 4/4	16	256 1/2	293	420 1/2	44 7/16	23 1/4	34 1/8	48	89 1/2	95 1/4	94 1/2	12	57	43 7/8	76 3/4	102
TM640-365-144	172 4/4	158	269	21 7/8	95 1/8	110	144	16	256 1/2	293	420 1/2	44 7/16	23 1/4	34 1/8	48	89 1/2	95 1/4	94 1/2	12	57	43 7/8	76 3/4	102
TM640-305-144	172 3/4	158	269	21 7/8	95 1/8	110	144	16	256 1/2	293	420 1/2	44 7/16	23 1/4	34 1/8	48	89 1/2	95 1/4	94 1/2	12	57	43 7/8	76 3/4	102
TM640-256-144	172 3/4	158	269	22 3/8	95 1/8	110	144	16	256 1/2	293	420 1/2	44 7/16	23 1/4	34 1/8	48	89 1/2	95 1/4	94 1/2	12	57	43 7/8	76 3/4	102
TM640-305-120	144	158	269	47 1/2	94 3/8	110	115 1/4	16	256 1/2	293	420 1/2	44 7/16	23 1/4	34 1/8	48	89 1/2	95 1/4	94 1/2	12	57	43 7/8	76 3/4	102
TM456-305-144	172 1/2	136	232	21 5/8	58 1/8	95	147 1/8	16	221 3/4	263	350	38 7/8	20	37	39	80	64	79 1/2	12	47	35 1/4	66 3/4	89
TM456-256-144	172 1/2	136	232	22 1/8	58 1/8	95	147 1/8	16	222	263	350	38 7/8	20	37	39	80	64	79 1/2	12	47	35 1/4	66 3/4	89
TM456-365-120	143 3/4	136	232	47	57 5/8	95	118 3/8	16	221 3/4	263	350	38 7/8	20	37	39	80	64	79 1/2	12	47	35 1/4	66 3/4	89
TM456-305-120	143 3/4	136	232	32 1/8	72 5/8	95	118 3/8	16	222	263	350	38 7/8	20	37	39	80	64	79 1/2	12	47	35 1/4	66 3/4	88 1/2
TM456-256-120	143 3/4	136	232	32 1/8	72 5/8	95	118 3/8	16	222	263	350	38 7/8	20	37	39	80	64	79 1/2	12	47	35 1/4	66 3/4	88 1/2
TM320-256-144	172 1/2	136	232	22 1/8	58 1/8	95	147 1/8	16	222	263	350	33 5/8	23	40	39	87	64	79 1/2	12	42	35 1/4	66 3/4	81 1/2
TM320-305-120	143 3/4	136	232	32 1/8	72 5/8	95	118 3/8	16	222	263	350	33 5/8	23	40	39	87	64	79 1/2	12	42	35 1/4	66 3/4	81 1/2
TM320-256-120	143 3/4	136	232	32 1/8	72 5/8	95	118 3/8	16	222	263	350	33 5/8	23	40	39	87	64	79 1/2	12	42	35 1/4	66 3/4	81 [illegible]
TM320-213-120	143 3/4	136	232	31 3/4	73	95	120 1/2	16	220	261	348	33 5/8	26	42	39	87	64	79 1/2	12	42	32	66 3/4	79 1/2
TM320-305-100	120	136	232	53 1/8	72	95	94 5/8	16	222	263	350	33 5/8	23	40	39	87	64	79 1/2	12	42	35 1/4	66 3/4	81 1/2
TM320-256-100	120	136	232	52 5/8	72 3/8	95	96 3/4	16	220	261	348	33 5/8	26	42	39	87	64	79 1/2	12	42	32	66 3/4	79 1/2
TM320-213-86	102	122	201	36 1/8	72 1/4	78	79	16	197 1/8	242 1/4	326	33 5/8	22	42	39	87	64	79 1/2	9	42	32	54 3/4	79
TM228-213-120	143 3/4	136	232	31 3/4	73	95	120 1/2	16	220	261	348	31	27	38	39	88	64	79 1/2	12	36	32	66 3/4	71 1/2
TM228-256-100	120	136	232	52 5/8	72 3/8	95	96 3/4	16	220	261	348	31	27	38	39	88	64	79 1/2	12	36	32	66 3/4	71 1/2
TM228-213-100	120	136	232	52 5/8	72 3/8	95	96 3/4	16	220	261	348	31	27	38	39	88	64	79 1/2	12	36	32	66 3/4	71 1/2
TM228-173-100	118 1/2	122	201	21 1/2	72 5/8	78	95 1/4	16	197 1/8	242 1/4	326	31	23	34	32	88	73	62 1/2	9	36	32	66 3/4	71
TM228-246-86	103	136	232	67 1/4	72 1/8	95	79 3/4	16	220	261	348	31	27	31	39	88	64	79 1/2	12	36	32	66 3/4	71 1/2
TM228-213-86	102	122	201	36 1/8	72 1/4	78	79	16	197 1/8	242 1/4	326	31	23	34	32	88	73	62 1/2	9	36	32	66 3/4	71
TM228-200-74	87 3/4	122	201	48 3/4	71 7/8	78	64 3/4	16	197 1/8	242 1/4	326	31	23	34	32	88	73	62 1/2	9	36	32	66 3/4	71
TM160-173-100	118 1/2	122	201	21 1/2	72 5/8	78	95 1/4	16	197 1/8	242 1/4	326	29	25	38	32	73	73	62 1/2	9	33	32	66 3/4	68
TM160-213-86	102	122	201	36 1/8	72 1/4	78	79	16	197 1/8	242 1/4	326	29	25	38	32	73	73	62 1/2	9	33	32	66 3/4	68
TM160-173-86	102	122	201	36 1/8	72 1/4	78	79	16	197 1/8	242 1/4	326	29	25	38	32	73	73	62 1/2	9	33	32	66 3/4	68
TM160-200-74	87 3/4	122	201	48 3/4	71 7/8	78	64 3/4	16	197 1/8	242 1/4	326	29	25	38	32	73	73	62 1/2	9	33	32	66 3/4	68
TM160-173-74	89 1/4	99	168	21	66 3/8	68	60 3/8	16	173 1/4	206 3/4	301	29	13	31	35	63	47	49	9	33	32	54 3/4	67 1/2
TM160-143-74	89 1/4	99	168	21	66 3/8	68	60 3/8	16	173 1/4	206 3/4	301	29	13	31	35	63	47	49	9	33	32	54 3/4	67 1/2
TM160-173-64	77 1/4	99	168	31 1/2	66	68	48 3/8	16	173 1/4	206 3/4	301	29	13	31	35	63	47	49	9	33	32	54 3/4	67 1/2
TM160-143-64	77 1/4	99	168	31 1/2	66	68	48 3/8	16	173 1/4	206 3/4	301	29	13	31	35	63	47	49	9	33	32	54 3/4	67 1/2
TM114-143-86	103 3/4	99	168	31 1/2	54	68	74 7/8	16	173 1/4	206 3/4	301	22 7/8	19	31	35	69	47	49	9	26	25 3/4	54 3/4	58
TM114-119-86	103 3/4	99	168	31 1/2	54	68	74 7/8	16	173 1/4	206 3/4	301	22 7/8	19	31	35	69	47	49	9	26	25 3/4	54 3/4	58

NOTE: DO NOT USE ABOVE DIMENSIONS FOR FOUNDATION.
REQUEST FOUNDATION PLAN BLUEPRINT.

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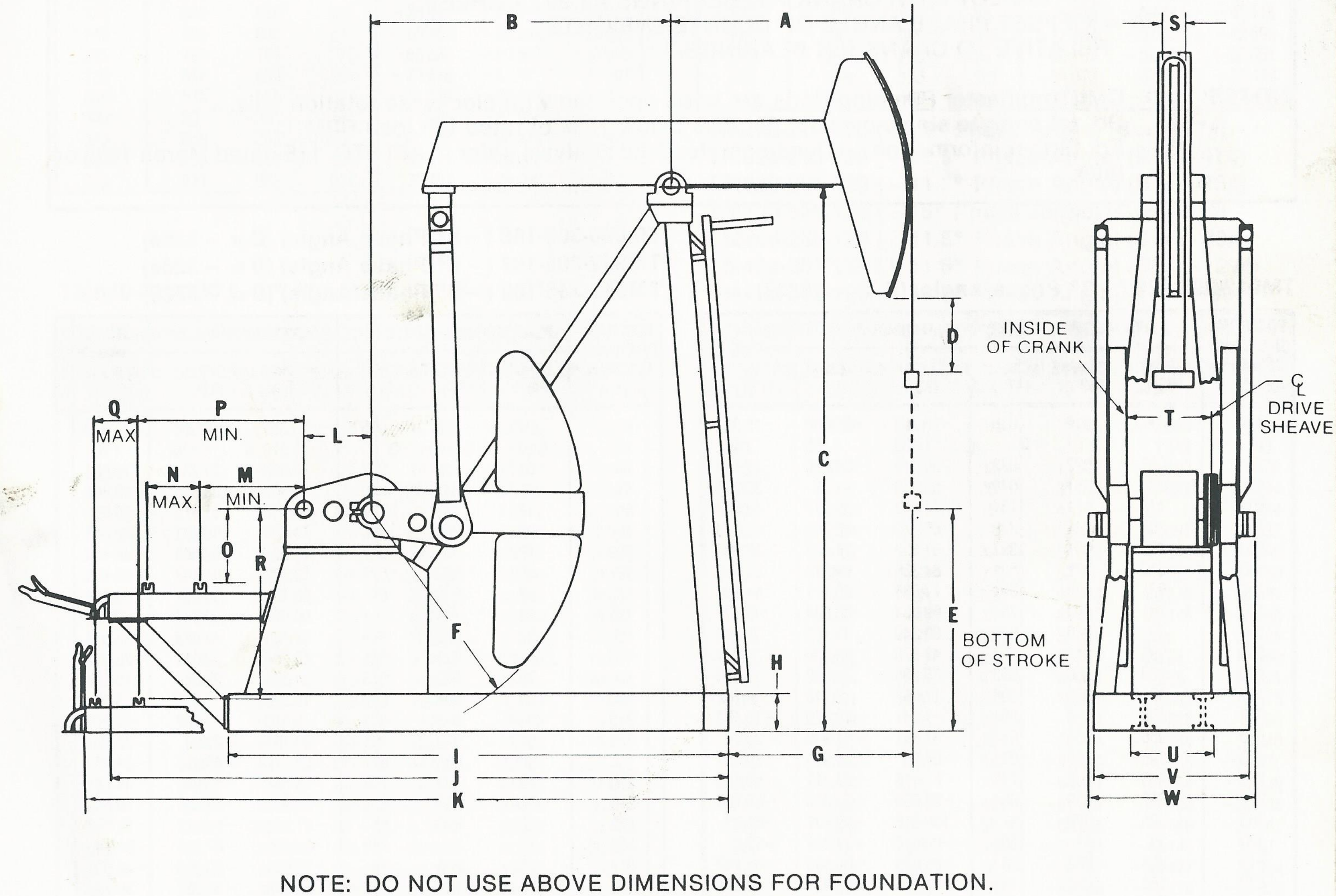
UNIT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
TM114-173-74	89 1/4	99	168	31 1/2	66 3/8	68	60 3/8	16	173 1/4	206 3/4	301	22 7/8	19	31	35	69	47	49	9	26	25 3/4	54 3/4	58
TM114-143-74	89 1/4	99	168	31 1/2	66 3/8	68	60 3/8	16	173 1/4	206 3/4	301	22 7/8	19	31	35	69	47	49	9	26	25 3/4	54 3/4	58
TM114-173-64	77 1/4	99	168	31 1/2	66	68	48 3/8	16	173 1/4	206 3/4	301	22 7/8	19	31	35	69	47	49	9	26	25 3/4	54 3/4	58
TM114-143-64	77 1/4	99	168	31 1/2	66	68	48 3/8	16	173 1/4	206 3/4	301	22 7/8	19	31	35	69	47	49	9	26	25 3/4	54 3/4	58
TM80-119-64	78 1/2	72	127	18 1/2	37 3/4	54	63 1/4	12	122 1/4	150 1/4	233 1/4	22 3/4	16	16	23 1/2	57 1/2	56	49	9	26	24	46 3/4	58
TM80-133-54	66 1/4	72	127	18 1/2	48	54	51	12	122 1/4	150 1/4	233 1/4	22 3/4	16	16	23 1/2	57 1/2	56	49	9	26	24	46 3/4	58
TM80-119-54	66 1/4	72	127	18 1/2	48	54	51	12	122 1/4	150 1/4	233 1/4	22 3/4	16	16	23 1/2	57 1/2	56	49	9	26	24	46 3/4	58
TM80-133-48	59	72	127	18 1/2	54 1/8	54	43 3/4	12	122 1/4	150 1/4	233 1/4	22 3/4	16	16	23 1/2	57 1/2	56	49	9	26	24	46 3/4	58
TM57-119-54	66 1/4	72	127	18 1/2	48	54	51	12	122 1/4	150 1/4	233 1/4	20	19	16	23 1/2	60 1/2	56	49	9	26	24	46 3/4	54 3/4
TM57-76-54	66 1/4	72	127	18 1/2	48	54	51	12	122 1/4	150 1/4	233 1/4	20	19	16	23 1/2	60 1/2	56	49	9	26	24	46 3/4	54 3/4
TM57-109-48	59	72	127	18 1/2	54 1/8	54	43 3/4	12	122 1/4	150 1/4	233 1/4	20	19	16	23 1/2	60 1/2	56	49	9	26	24	46 3/4	54 3/4
TM57-95-48	59	72	127	18 1/2	54 1/8	54	43 3/4	12	122 1/4	150 1/4	233 1/4	20	19	16	23 1/2	60 1/2	56	49	9	26	24	46 3/4	54 3/4
TM57-89-42	51 1/2	72	127	18 1/2	60 1/2	54	36 1/4	12	122 1/4	150 1/4	233 1/4	20	19	16	23 1/2	60 1/2	56	49	9	26	24	46 3/4	54 3/4



NOTE: DO NOT USE ABOVE DIMENSIONS FOR FOUNDATION.
REQUEST FOUNDATION PLAN BLUEPRINT.

TORQUE FACTOR CHART

CALCULATING NET TORQUE ON GEAR BOX FROM DYNAMOMETER CARD

(1) POS. OF CRANK = THETA = ANGULAR DISPLACEMENT OF THE CRANK PIN BEARING, MEASURED CLOCKWISE FROM THE 12 O'CLOCK POSITION, VIEWED WITH THE WELLHEAD TO THE RIGHT.
(2) POSITION IS EXPRESSED AS A FRACTION OF STROKE ABOVE LOWERMOST POSITION.
(3) TORQUE FACTOR = T/W; WHERE T = TORQUE ON PUMPING-UNIT REDUCER DUE TO POLISHED-ROD LOAD W.

NEGATIVE SIGN ON TORQUE FACTOR INDICATES A CLOCKWISE TORQUE ON CRANKSHAFT.

NET REDUCER TORQUE = TF (W-B) - M SIN (THETA + BETA)

- TF = TORQUE FACTOR AT THETA
- W = MEASURED POLISHED-ROD LOAD AT THETA
- B = TRUCTURAL IMBALANCE
- M = TFM(CB-B) / SIN(90 + BETA) = MAXIMUM ROTARY COUNTERBALANCE MOMENT.
  - TFM = TORQUE FACTOR AT 90 DEGREES
  - CB = MEASURED MAXIMUM COUNTERBALANCE EFFECT WITH CRANK PIN BEARINGS AT 90 DEGREES.
- BETA = OFFSET PHASE ANGLE OF COUNTERWEIGHTS RELATIVE TO CRANK PIN BEARINGS.

NOTES:
1. CMI Torqmaster Pumping Units are to be operated with clockwise rotation only.
2. Do not operate single-cylinder engines below 75% of rated full load RPM
3. For further information on Dynamometer Card analysis, refer to API STD. 11E dated March 1983 or later.

TM912-305-192 (–8° Phase Angle) (B = –1551#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES 192	153	117	LENGTH OF STROKE, INCHES 192	153	117
0	.017	.016	.015	–26.703	–20.668	–15.36
15	0.	0.	0.	1.736	1.755	1.44
30	.022	.022	.022	30.775	24.268	18.119
45	.082	.081	.079	56.456	44.22	32.985
60	.173	.171	.167	75.142	59.277	44.582
75	.283	.281	.276	85.226	68.265	52.078
90	.402	.401	.397	87.552	71.423	55.398
105	.519	.522	.521	84.355	69.917	55.035
120	.63	.638	.641	77.886	65.111	51.699
135	.731	.744	.751	69.654	58.034	46.022
150	.82	.836	.845	60.249	49.162	38.386
165	.895	.911	.921	49.375	38.406	28.904
180	.953	.966	.973	35.835	25.222	17.526
195	.99	.996	.998	17.562	8.915	4.262
210	.998	.995	.991	–7.441	–10.629	–10.483
225	.968	.958	.951	–37.881	–31.949	–25.64
240	.895	.886	.877	–66.86	–51.904	–39.582
255	.789	.783	.776	–87.416	–67.311	–50.668
270	.662	.659	.654	–98.069	–76.598	–57.794
285	.525	.525	.52	–100.518	–79.727	–60.53
300	.39	.39	.386	–96.478	–77.247	–58.9
315	.265	.263	.26	–86.845	–69.686	–53.142
330	.156	.154	.151	–71.895	–57.421	–43.598
345	.071	.069	.067	–51.71	–40.846	–30.752

TM640-305-168 (–8° Phase Angle) (B = –326#)
TM912-305-168 (–8° Phase Angle) (B = –326#)
TM912-365-168 (–8° Phase Angle) (B = –772#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES 168	133¾	102¼	LENGTH OF STROKE, INCHES 168	133¾	102¼
0	.017	.016	.015	–23.369	–18.088	–13.442
15	0.	0.	0.	1.519	1.536	1.26
30	.022	.022	.022	26.933	21.237	15.857
45	.082	.081	.079	49.407	38.698	28.867
60	.173	.171	.167	65.76	51.875	39.015
75	.283	.281	.276	74.584	59.741	45.575
90	.402	.401	.397	76.62	62.505	48.481
105	.519	.522	.521	73.822	61.187	48.163
120	.63	.638	.641	68.161	56.981	45.244
135	.731	.744	.751	60.957	50.787	40.276
150	.82	.836	.845	52.726	43.023	33.593
165	.895	.911	.921	43.209	33.611	25.295
180	.953	.966	.973	31.36	22.072	15.338
195	.99	.996	.998	15.369	7.802	3.73
210	.998	.995	.991	–6.512	–9.302	–9.174
225	.968	.958	.951	–33.151	–27.96	–22.439
240	.895	.886	.877	–58.512	–45.423	–34.64
255	.789	.783	.776	–76.501	–58.906	–44.341
270	.662	.659	.654	–85.823	–67.034	–50.578
285	.525	.525	.52	–87.967	–69.772	–52.972
300	.39	.39	.386	–84.431	–67.602	–51.546
315	.265	.263	.26	–76.001	–60.984	–46.507
330	.156	.154	.151	–62.918	–50.252	–38.154
345	.071	.069	.067	–45.253	–35.746	–26.913

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TM640-256-144 (−8° Phase Angle) (B = −66#)
TM640-305-144 (−8° Phase Angle) (B = +649#)
TM640-365-144 (−8° Phase Angle) (B = +649#)
TM912-305-144 (−8° Phase Angle) (B = +649#)
TM912-365-144 (−8° Phase Angle) (B = +649#)
TM912-427-144 (−8° Phase Angle) (B = +435#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	144	114¾	87¾	144	114¾	87¾
0	.017	.016	.015	−20.035	−15.507	−11.524
15	0.	0.	0.	1.302	1.317	1.08
30	.022	.022	.022	23.09	18.207	13.594
45	.082	.081	.079	42.357	33.177	24.748
60	.173	.171	.167	56.377	44.473	33.448
75	.283	.281	.276	63.942	51.217	39.072
90	.402	.401	.397	65.688	53.586	41.563
105	.519	.522	.521	63.289	52.457	41.291
120	.63	.638	.641	58.436	48.851	38.789
135	.731	.744	.751	52.259	43.541	34.529
150	.82	.836	.845	45.203	36.884	28.8
165	.895	.911	.921	37.044	28.815	21.686
180	.953	.966	.973	26.886	18.923	13.149
195	.99	.996	.998	13.176	6.689	3.198
210	.998	.995	.991	−5.583	−7.975	−7.865
225	.968	.958	.951	−28.421	−23.971	−19.237
240	.895	.886	.877	−50.163	−38.942	−29.698
255	.789	.783	.776	−65.586	−50.501	−38.015
270	.662	.659	.654	−73.578	−57.47	−43.361
285	.525	.525	.52	−75.416	−59.817	−45.414
300	.39	.39	.386	−72.385	−57.956	−44.191
315	.265	.263	.26	−65.157	−52.283	−39.871
330	.156	.154	.151	−53.941	−43.082	−32.71
345	.071	.069	.067	−38.797	−30.646	−23.073

TM640-305-120 (−8° Phase Angle) (B = +616#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	120	95½	73	120	95½	73
0	.017	.016	.015	−16.701	−12.926	−9.606
15	0.	0.	0.	1.085	1.097	.9
30	.022	.022	.022	19.247	15.177	11.332
45	.082	.081	.079	35.308	27.655	20.629
60	.173	.171	.167	46.994	37.072	27.881
75	.283	.281	.276	53.301	42.693	32.569
90	.402	.401	.397	54.755	44.668	34.646
105	.519	.522	.521	52.756	43.726	34.419
120	.63	.638	.641	48.71	40.721	32.333
135	.731	.744	.751	43.562	36.294	28.782
150	.82	.836	.845	37.68	30.746	24.007
165	.895	.911	.921	30.879	24.019	18.077
180	.953	.966	.973	22.411	15.774	10.961
195	.99	.996	.998	10.983	5.575	2.665
210	.998	.995	.991	−4.654	−6.648	−6.556
225	.968	.958	.951	−23.691	−19.982	−16.036
240	.895	.886	.877	−41.815	−32.461	−24.755
255	.789	.783	.776	−54.671	−42.097	−31.688
270	.662	.659	.654	−61.333	−47.905	−36.145
285	.525	.525	.52	−62.865	−49.862	−37.856
300	.39	.39	.386	−60.338	−48.311	−36.837
315	.265	.263	.26	−54.313	−43.582	−33.236
330	.156	.154	.151	−44.964	−35.912	−27.267
345	.071	.069	.067	−32.34	−25.546	−19.233

TM320-256-144 (−15° Phase Angle) (B = −546#)
TM456-256-144 (−11.5° Phase Angle) (B = −516#)
TM456-305-144 (−11.5° Phase Angle) (B = −86#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	144	114½	87¼	144	114½	87¼
0	.017	.016	.015	−20.026	−15.436	−11.409
15	0.	0.	0.	1.371	1.373	1.118
30	.022	.022	.022	23.221	18.246	13.551
45	.082	.082	.08	42.534	33.193	24.629
60	.173	.171	.167	56.566	44.465	33.27
75	.284	.281	.276	64.11	51.183	38.855
90	.402	.402	.397	65.813	53.53	41.327
105	.52	.523	.522	63.368	52.382	41.05
120	.631	.639	.642	58.475	48.761	38.553
135	.732	.745	.751	52.27	43.439	34.303
150	.82	.837	.846	45.196	36.773	28.587
165	.895	.912	.922	37.027	28.698	21.494
180	.954	.966	.974	26.864	18.807	12.992
195	.991	.996	.998	13.148	6.589	3.095
210	.998	.995	.991	−5.629	−8.038	−7.889
225	.967	.958	.95	−28.5	−23.979	−19.165
240	.895	.886	.877	−50.275	−38.896	−29.532
255	.789	.783	.775	−65.712	−50.418	−37.777
270	.661	.659	.653	−73.704	−57.369	−43.08
285	.525	.524	.52	−75.535	−59.713	−45.116
300	.39	.389	.386	−72.493	−57.856	−43.899
315	.264	.263	.26	−65.251	−52.188	−39.601
330	.156	.153	.151	−54.013	−42.993	−32.478
345	.071	.069	.067	−38.835	−30.565	−22.892

TM228-213-120 (−15° Phase Angle) (B = −77#)
TM320-213-120 (−11.5° Phase Angle) (B = −47#)
TM320-256-120 (−11.5° Phase Angle) (B = −75#)
TM320-305-120 (−15° Phase Angle) (B = +93#)
TM456-256-120 (−11.5° Phase Angle) (B = −39#)
TM456-305-120 (−11.5° Phase Angle) (B = +129#)
TM456-365-120 (−11.5° Phase Angle) B = +630#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	120	95¼	72½	120	95¼	72½
0	.017	.016	.015	−16.665	−12.845	−9.494
15	0.	0.	0.	1.14	1.143	.93
30	.022	.022	.022	19.322	15.183	11.276
45	.082	.082	.08	35.393	27.621	20.494
60	.173	.171	.167	47.07	37.	27.684
75	.284	.281	.276	53.348	42.591	32.332
90	.402	.402	.397	54.765	44.544	34.389
105	.52	.523	.522	52.73	43.588	34.159
120	.631	.639	.642	48.659	40.575	32.081
135	.732	.745	.751	43.495	36.146	28.545
150	.82	.837	.846	37.608	30.6	23.788
165	.895	.912	.922	30.811	23.88	17.886
180	.954	.966	.974	22.354	15.65	10.811
195	.991	.996	.998	10.941	5.483	2.575
210	.998	.995	.991	−4.684	−6.688	−6.565
225	.967	.958	.95	−23.716	−19.954	−15.948
240	.895	.886	.877	−41.835	−32.366	−24.575
255	.789	.783	.775	−54.681	−41.954	−31.435
270	.661	.659	.653	−61.331	−47.739	−35.848
285	.525	.524	.52	−62.855	−49.689	−37.542
300	.39	.389	.386	−60.324	−48.143	−36.53
315	.264	.263	.26	−54.297	−43.427	−32.954
330	.156	.153	.151	−44.946	−35.776	−27.026
345	.071	.069	.067	−32.316	−25.434	−19.049

TORQUE FACTOR CHART

TM228-213-100 (– 11.5° Phase Angle) (B = + 402#)
TM228-256-100 (– 15° Phase Angle) (B = + 402#)
TM320-256-100 (– 11.5° Phase Angle) (B = + 439#)
TM320-305-100 (– 11.5° Phase Angle) (B = + 622#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE, INCHES			TORQUE FACTOR (3) LENGTH OF STROKE, INCHES		
	100	79½	60½	100	79½	60½
0	.017	.016	.015	−13.911	−10.723	−7.925
15	0.	0.	0.	.952	.954	.777
30	.022	.022	.022	16.13	12.674	9.413
45	.082	.082	.08	29.546	23.057	17.108
60	.173	.171	.167	39.293	30.887	23.11
75	.284	.281	.276	44.534	35.554	26.99
90	.402	.402	.397	45.717	37.184	28.708
105	.52	.523	.522	44.018	36.387	28.515
120	.631	.639	.642	40.619	33.871	26.781
135	.732	.745	.751	36.309	30.174	23.828
150	.82	.837	.846	31.395	25.544	19.858
165	.895	.912	.922	25.721	19.935	14.931
180	.954	.966	.974	18.661	13.064	9.024
195	.991	.996	.998	9.133	4.577	2.15
210	.998	.995	.991	−3.91	−5.583	−5.48
225	.967	.958	.95	−19.798	−16.657	−13.313
240	.895	.886	.877	−34.923	−27.019	−20.515
255	.789	.783	.775	−45.647	−35.023	−26.241
270	.661	.659	.653	−51.198	−39.851	−29.925
285	.525	.524	.52	−52.47	−41.48	−31.34
300	.39	.389	.386	−50.357	−40.189	−30.494
315	.264	.263	.26	−45.327	−36.252	−27.509
330	.156	.153	.151	−37.52	−29.865	−22.561
345	.071	.069	.067	−26.977	−21.232	−15.902

TM160-173-100 (– 15° Phase Angle) (B = + 373#)
TM228-173-100 (– 15° Phase Angle) (B = + 384#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE, INCHES			TORQUE FACTOR (3) LENGTH OF STROKE, INCHES		
	100	79½	60¾	100	79½	60¾
0	.019	.019	.018	−14.755	−11.48	−8.569
15	0.	0.	0.	−.244	−6E-03	.051
30	.019	.019	.018	14.671	11.591	8.666
45	.075	.075	.073	28.025	21.984	16.421
60	.162	.161	.158	37.968	29.978	22.567
75	.27	.269	.264	43.61	34.932	26.653
90	.388	.388	.384	45.276	36.904	28.607
105	.505	.509	.508	44.028	36.439	28.647
120	.617	.626	.629	40.988	34.206	27.117
135	.719	.733	.74	36.94	30.729	24.329
150	.81	.827	.837	32.208	26.258	20.478
165	.887	.905	.915	26.659	20.754	15.623
180	.949	.962	.97	19.68	13.937	9.739
195	.988	.995	.997	10.175	5.439	2.83
210	.999	.996	.993	−2.946	−4.808	−4.891
225	.97	.962	.955	−19.027	−16.035	−12.859
240	.9	.891	.883	−34.362	−26.568	−20.211
255	.794	.789	.783	−45.214	−34.712	−26.078
270	.667	.666	.661	−50.837	−39.648	−29.883
285	.531	.532	.529	−52.181	−41.372	−31.404
300	.396	.397	.394	−50.175	−40.192	−30.663
315	.271	.27	.268	−45.305	−36.395	−27.79
330	.161	.16	.158	−37.723	−30.185	−22.963
345	.075	.074	.072	−27.473	−21.763	−16.43

TM228-246-86 (– 11.5° Phase Angle) (B = + 916#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE, INCHES			TORQUE FACTOR (3) LENGTH OF STROKE, INCHES		
	86	68¼	52	86	68¼	52
0	.017	.016	.015	−11.941	−9.204	−6.802
15	0.	0.	0.	.817	.819	.667
30	.022	.022	.022	13.845	10.879	8.079
45	.082	.082	.08	25.36	19.791	14.685
60	.173	.171	.167	33.727	26.511	19.836
75	.284	.281	.276	38.225	30.517	23.166
90	.402	.402	.397	39.24	31.916	24.641
105	.52	.523	.522	37.782	31.232	24.476
120	.631	.639	.642	34.865	29.073	22.987
135	.732	.745	.751	31.165	25.9	20.453
150	.82	.837	.846	26.947	21.925	17.045
165	.895	.912	.922	22.077	17.11	12.816
180	.954	.966	.974	16.017	11.213	7.746
195	.991	.996	.998	7.839	3.928	1.845
210	.998	.995	.991	−3.356	−4.792	−4.704
225	.967	.958	.95	−16.993	−14.298	−11.427
240	.895	.886	.877	−29.976	−23.191	−17.608
255	.789	.783	.775	−39.18	−30.061	−22.524
270	.661	.659	.653	−43.945	−34.206	−25.686
285	.525	.524	.52	−45.037	−35.603	−26.9
300	.39	.389	.386	−43.223	−34.496	−26.174
315	.264	.263	.26	−38.905	−31.117	−23.612
330	.156	.153	.151	−32.205	−25.634	−19.365
345	.071	.069	.067	−23.155	−18.224	−13.649

TM160-173-86 (– 15° Phase Angle) (B = + 670#)
TM160-213-86 (– 15° Phase Angle) (B = + 670#)
TM228-213-86 (– 15° Phase Angle) (B = + 684#)
TM320-213-86 (– 15° Phase Angle) (B = + 721#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2) LENGTH OF STROKE, INCHES			TORQUE FACTOR (3) LENGTH OF STROKE, INCHES		
	86	68½	52¼	86	68½	52¼
0	.019	.019	.018	−12.7	−9.881	−7.376
15	0.	0.	0.	−.21	−5E-03	.044
30	.019	.019	.018	12.628	9.977	7.46
45	.075	.075	.073	24.122	18.923	14.135
60	.162	.161	.158	32.681	25.803	19.424
75	.27	.269	.264	37.537	30.068	22.942
90	.388	.388	.384	38.972	31.766	24.624
105	.505	.509	.508	37.897	31.365	24.658
120	.617	.626	.629	35.281	29.443	23.341
135	.719	.733	.74	31.796	26.45	20.941
150	.81	.827	.837	27.723	22.602	17.626
165	.887	.905	.915	22.947	17.865	13.448
180	.949	.962	.97	16.939	11.996	8.383
195	.988	.995	.997	8.758	4.682	2.436
210	.999	.996	.993	−2.536	−4.139	−4.21
225	.97	.962	.955	−16.377	−13.803	−11.068
240	.9	.891	.883	−29.577	−22.868	−17.397
255	.794	.789	.783	−38.918	−29.879	−22.447
270	.667	.666	.661	−43.758	−34.127	−25.722
285	.531	.532	.529	−44.915	−35.612	−27.031
300	.396	.397	.394	−43.189	−34.596	−26.394
315	.271	.27	.268	−38.997	−31.327	−23.92
330	.161	.16	.158	−32.471	−25.982	−19.766
345	.075	.074	.072	−23.648	−18.732	−14.142

CMI CORPORATION

TM114-119-86 (−14° Phase Angle) B = +144#)
TM114-143-86 (−14° Phase Angle) B = +144#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	86	66¾	48¾	86	66¾	48¾
0	.019	.018	.017	−12.657	−9.49	−6.727
15	0.	0.	0.	.037	.228	.22
30	.02	.02	.019	13.103	10.039	7.15
45	.078	.077	.075	24.788	18.822	13.386
60	.167	.165	.161	33.441	25.57	18.339
75	.278	.274	.268	38.271	29.737	21.648
90	.397	.395	.389	39.575	31.361	23.236
105	.516	.518	.515	38.301	30.886	23.252
120	.629	.635	.636	35.446	28.869	21.95
135	.731	.743	.748	31.692	25.749	19.576
150	.821	.836	.844	27.322	21.75	16.299
165	.897	.912	.921	22.218	16.864	12.199
180	.955	.967	.974	15.884	10.914	7.309
195	.991	.996	.998	7.505	3.692	1.695
210	.998	.994	.991	−3.604	−4.759	−4.432
225	.967	.958	.951	−16.774	−13.812	−10.641
240	.896	.887	.878	−29.289	−22.261	−16.33
255	.792	.786	.778	−38.406	−28.887	−20.891
270	.667	.663	.657	−43.377	−33.019	−23.891
285	.532	.53	.525	−44.759	−34.557	−25.121
300	.397	.395	.391	−43.218	−33.663	−24.551
315	.271	.269	.265	−39.134	−30.531	−22.252
330	.161	.159	.155	−32.63	−25.317	−18.358
345	.075	.073	.071	−23.746	−18.199	−13.076

TM160-200-74 (−15° Phase Angle) (B = +999#)
TM228-200-74 (−15° Phase Angle) (B = +1015#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	74	58¾	45	74	58¾	45
0	.019	.019	.018	−10.926	−8.501	−6.346
15	0.	0.	0.	−.181	−4E-03	.038
30	.019	.019	.018	10.864	8.583	6.417
45	.075	.075	.073	20.752	16.279	12.16
60	.162	.161	.158	28.115	22.199	16.711
75	.27	.269	.264	32.293	25.867	19.737
90	.388	.388	.384	33.527	27.328	21.184
105	.505	.509	.508	32.603	26.983	21.213
120	.617	.626	.629	30.352	25.33	20.08
135	.719	.733	.74	27.354	22.755	18.016
150	.81	.827	.837	23.85	19.444	15.164
165	.887	.905	.915	19.741	15.369	11.569
180	.949	.962	.97	14.573	10.32	7.211
195	.988	.995	.997	7.534	4.027	2.095
210	.999	.996	.993	−2.181	−3.561	−3.622
225	.97	.962	.955	−14.089	−11.874	−9.522
240	.9	.891	.883	−25.445	−19.674	−14.966
255	.794	.789	.783	−33.481	−25.705	−19.311
270	.667	.666	.661	−37.645	−29.36	−22.128
285	.531	.532	.529	−38.64	−30.637	−23.255
300	.396	.397	.394	−37.155	−29.763	−22.706
315	.271	.27	.268	−33.549	−26.951	−20.579
330	.161	.16	.158	−27.934	−22.352	−17.004
345	.075	.074	.072	−20.344	−16.115	−12.167

TM114-143-74 (−14° Phase Angle) (B = +343#)
TM114-173-74 (−14° Phase Angle) (B = +343#)
TM160-143-74 (−14° Phase Angle) (B = +369#)
TM160-173-74 (−14° Phase Angle) (B = +369#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	74	57¼	42	74	57¼	42
0	.019	.018	.017	−10.888	−8.163	−5.786
15	0.	0.	0.	.032	.196	.189
30	.02	.02	.019	11.271	8.636	6.15
45	.078	.077	.075	21.323	16.191	11.515
60	.167	.165	.161	28.767	21.996	15.776
75	.278	.274	.268	32.922	25.581	18.623
90	.397	.395	.389	34.044	26.978	19.988
105	.516	.518	.515	32.948	26.569	20.002
120	.629	.635	.636	30.492	24.834	18.882
135	.731	.743	.748	27.263	22.151	16.84
150	.821	.836	.844	23.503	18.71	14.021
165	.897	.912	.921	19.113	14.507	10.494
180	.955	.967	.974	13.664	9.389	6.287
195	.991	.996	.998	6.456	3.176	1.458
210	.998	.994	.991	−3.1	−4.094	−3.812
225	.967	.958	.951	−14.429	−11.882	−9.154
240	.896	.887	.878	−25.196	−19.15	−14.048
255	.792	.786	.778	−33.039	−24.85	−17.972
270	.667	.663	.657	−37.315	−28.404	−20.552
285	.532	.53	.525	−38.503	−29.727	−21.61
300	.397	.395	.391	−37.178	−28.958	−21.12
315	.271	.269	.265	−33.664	−26.264	−19.142
330	.161	.159	.155	−28.07	−21.779	−15.792
345	.075	.073	.071	−20.427	−15.656	−11.249

TM114-143-64 (−14° Phase Angle) (B = +621#)
TM114-173-64 (−14° Phase Angle) (B = +621#)
TM160-143-64 (−14° Phase Angle) (B = +650#)
TM160-173-64 (−14° Phase Angle) B = +650#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	64	49½	36¼	64	49½	36¼
0	.019	.018	.017	−9.424	−7.066	−5.009
15	0.	0.	0.	.027	.169	.164
30	.02	.02	.019	9.756	7.475	5.323
45	.078	.077	.075	18.456	14.014	9.967
60	.167	.165	.161	24.899	19.039	13.655
75	.278	.274	.268	28.496	22.141	16.119
90	.397	.395	.389	29.467	23.351	17.301
105	.516	.518	.515	28.518	22.997	17.313
120	.629	.635	.636	26.392	21.495	16.343
135	.731	.743	.748	23.597	19.172	14.576
150	.821	.836	.844	20.343	16.194	12.136
165	.897	.912	.921	16.543	12.557	9.083
180	.955	.967	.974	11.827	8.126	5.442
195	.991	.996	.998	5.588	2.749	1.262
210	.998	.994	.991	−2.684	−3.543	−3.3
225	.967	.958	.951	−12.489	−10.284	−7.923
240	.896	.887	.878	−21.808	−16.575	−12.159
255	.792	.786	.778	−28.597	−21.509	−15.555
270	.667	.663	.657	−32.298	−24.585	−17.789
285	.532	.53	.525	−33.327	−25.73	−18.705
300	.397	.395	.391	−32.18	−25.065	−18.28
315	.271	.269	.265	−29.138	−22.733	−16.569
330	.161	.159	.155	−24.296	−18.851	−13.669
345	.075	.073	.071	−17.681	−13.551	−9.736

TORQUE FACTOR CHART

Model TM80-119-64 (–14° Phase Angle) (B = +231#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	64	46¾	30¾	64	46¾	30¾
0	.019	.017	.016	–9.409	–6.496	–4.056
15	0.	0.	0.	.259	.396	.304
30	.022	.022	.021	10.253	7.345	4.641
45	.082	.081	.078	19.188	13.562	8.549
60	.175	.171	.165	25.749	18.341	11.677
75	.289	.283	.274	29.308	21.289	13.797
90	.412	.406	.396	30.109	22.413	14.838
105	.533	.53	.524	28.907	22.003	14.859
120	.647	.65	.647	26.485	20.437	13.989
135	.749	.758	.76	23.374	18.027	12.374
150	.837	.85	.856	19.786	14.947	10.133
165	.91	.924	.931	15.644	11.232	7.356
180	.964	.974	.98	10.623	6.825	4.117
195	.995	.999	1.	4.249	1.681	.519
210	.997	.992	.988	–3.767	–4.09	–3.277
225	.963	.952	.944	–12.887	–10.079	–7.02
240	.892	.88	.87	–21.51	–15.621	–10.404
255	.79	.78	.759	–28.011	–20.036	–13.121
270	.666	.659	.649	–31.789	–22.891	–14.929
285	.533	.527	.518	–33.033	–24.039	–15.681
300	.399	.393	.385	–32.098	–23.502	–15.324
315	.273	.267	.26	–29.206	–21.362	–13.874
330	.162	.157	.152	–24.432	–17.709	–11.407
345	.075	.071	.068	–17.791	–12.674	–8.062

Model TM57-76-54 (–14° Phase Angle) (B – +307#)
Model TM57-119-54 (–14° Phase Angle) (B = +442#)
Model TM80-119-54 (–14° Phase Angle) (B = +442#)
Model TM80-133-54 (–14° Phase Angle) (B = +442#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	54	39½	26	54	39½	26
0	.019	.017	.016	–7.941	–5.482	–3.423
15	0.	0.	0.	.218	.334	.257
30	.022	.022	.021	8.653	6.199	3.917
45	.082	.081	.078	16.193	11.446	7.215
60	.175	.171	.165	21.731	15.479	9.854
75	.289	.283	.274	24.735	17.967	11.644
90	.412	.406	.396	25.41	18.916	12.523
105	.533	.53	.524	24.396	18.569	12.54
120	.647	.65	.647	22.352	17.248	11.806
135	.749	.758	.76	19.727	15.214	10.443
150	.837	.85	.856	16.698	12.615	8.552
165	.91	.924	.931	13.203	9.479	6.208
180	.964	.974	.98	8.965	5.76	3.475
195	.995	.999	1.	3.586	1.418	.438
210	.997	.992	.988	–3.179	–3.451	–2.765
225	.963	.952	.944	–10.876	–8.506	–5.925
240	.892	.88	.87	–18.153	–13.183	–8.78
255	.79	.78	.769	–23.64	–16.909	–11.073
270	.666	.659	.649	–26.828	–19.319	–12.599
285	.533	.527	.518	–27.878	–20.287	–13.234
300	.399	.393	.385	–27.089	–19.835	–12.933
315	.273	.267	.26	–24.649	–18.029	–11.709
330	.162	.157	.152	–20.619	–14.946	–9.627
345	.075	.071	.068	–15.014	–10.696	–6.804

Model TM57-95-48 (–14° Phase Angle) (B = +408#)
Model TM57-109-48 (–14° Phase Angle) (B = +408#)
Model TM80-133-48 (–14° Phase Angle) (B = +582#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	48	35	23	48	35	23
0	.019	.017	.016	–7.072	–4.882	–3.049
15	0.	0.	0.	.195	.297	.229
30	.022	.022	.021	7.706	5.52	3.488
45	.082	.081	.078	14.421	10.193	6.425
60	.175	.171	.165	19.353	13.785	8.776
75	.289	.283	.274	22.028	16.001	10.37
90	.412	.406	.396	22.63	16.846	11.152
105	.533	.53	.524	21.726	16.537	11.168
120	.647	.65	.647	19.906	15.36	10.514
135	.749	.758	.76	17.568	13.549	9.3
150	.837	.85	.856	14.871	11.234	7.616
165	.91	.924	.931	11.758	8.442	5.528
180	.964	.974	.98	7.984	5.13	3.095
195	.995	.999	1.	3.194	1.263	.39
210	.997	.992	.988	–2.831	–3.074	–2.463
225	.963	.952	.944	–9.686	–7.576	–5.276
240	.892	.88	.87	–16.167	–11.74	–7.819
255	.79	.78	.769	–21.053	–15.059	–9.861
270	.666	.659	.649	–23.892	–17.205	–11.22
285	.533	.527	.518	–24.828	–18.067	–11.786
300	.399	.393	.385	–24.124	–17.664	–11.518
315	.273	.267	.26	–21.951	–16.056	–10.428
330	.162	.157	.152	–18.363	–13.31	–8.573
345	.075	.071	.068	–13.371	–9.526	–6.059

Model TM57-89-42 (–14° Phase Angle) (B = +537#)

POSITION OF CRANK, DEGREES (1)	POSITION OF RODS (2)			TORQUE FACTOR (3)		
	LENGTH OF STROKE, INCHES			LENGTH OF STROKE, INCHES		
	42	30½	20	42	30½	20
0	.019	.017	.016	–6.173	–4.261	–2.661
15	0.	0.	0.	.17	.26	.2
30	.022	.022	.021	6.726	4.818	3.045
45	.082	.081	.078	12.588	8.897	5.609
60	.175	.171	.165	16.893	12.032	7.66
75	.289	.283	.274	19.228	13.967	9.052
90	.412	.406	.396	19.753	14.704	9.735
105	.533	.53	.524	18.964	14.435	9.748
120	.647	.65	.647	17.376	13.408	9.178
135	.749	.758	.76	15.335	11.827	8.118
150	.837	.85	.856	12.981	9.806	6.648
165	.91	.924	.931	10.263	7.369	4.826
180	.964	.974	.98	6.969	4.478	2.701
195	.995	.999	1.	2.788	1.103	.34
210	.997	.992	.988	–2.472	–2.683	–2.15
225	.963	.952	.944	–8.455	–6.613	–4.605
240	.892	.88	.87	–14.112	–10.248	–6.825
255	.79	.78	.769	–18.377	–13.145	–8.608
270	.666	.659	.649	–20.855	–15.018	–9.794
285	.533	.527	.518	–21.671	–15.771	–10.288
300	.399	.393	.385	–21.058	–15.419	–10.053
315	.273	.267	.26	–19.161	–14.015	–9.102
330	.162	.157	.152	–16.028	–11.618	–7.483
345	.075	.071	.068	–11.672	–8.315	–5.289

GEARBOX CHART

CMI CORPORATION

Double Reduction Gear Unit Specifications

912 D GEAR REDUCER

Rating: *912,000 In. Lbs. Peak Torque*
Gear Ratio: *30.11*
Crankshaft Dia.: *8"*
Sheave: *56" P.D.-10C*
36" P.D.-10C
3 11/16" Bore
Gearbox Oil Capacity:
165 Gallons Approx.

640 D GEAR REDUCER

Rating: *640,000 In. Lbs. Peak Torque*
Gear Ratio: *29.29*
Crankshaft Dia.: *8"*
Sheave: *50" P.D.-8C*
30" P.D.-8C
3 11/16" Bore
Gearbox Oil Capacity:
130 Gallons Approx.

456 D GEAR REDUCER

Rating: *456,000 In. Lbs. Peak Torque*
Gear Ratio: *30.1*
Crankshaft Dia.: *7¾"*
Sheave: *50" P.D.-6C*
36" P.D.-6C
3 11/16" Bore
Gearbox Oil Capacity:
60 Gallons Approx.

320 D GEAR REDUCER

Rating: *320,000 IN. Lbs. Peak Torque*
Gear Ratio: *29.76*
Crankshaft Dia.:*7"*
Sheave: *36" P.D.-6C*
24" P.D.-6C
3 7/16" Bore
Gearbox Oil Capacity:
40 Gallons Approx.

228 D GEAR REDUCER

Rating: *228,000 IN. Lbs. Peak Torque*
Gear Ratio: *29.4*
Crankshaft Dia.:*6"*
Sheave: *36" P.D.-4C*
24" P.D.-4C
2 15/16" Bore
Gearbox Oil Capacity:
35 Gallons Approx.

160 D GEAR REDUCER

Rating: *160,000 IN. Lbs. Peak Torque*
Gear Ratio: *29.8*
Crankshaft Dia.:*6"*
Sheave: *30" P.D.-3C*
24" P.D.-3C
2 11/16" Bore
Gearbox Oil Capacity:
30 Gallons Approx.

114 D GEAR REDUCER

Rating: *114,000 In. Lbs. Peak Torque*
Gear Ratio: *29.9*
Crankshaft Dia.: *5"*
Sheave: *24" P.D.-3C*
2 1/8" Bore
Gearbox Oil Capacity:
12 Gallons Approx.

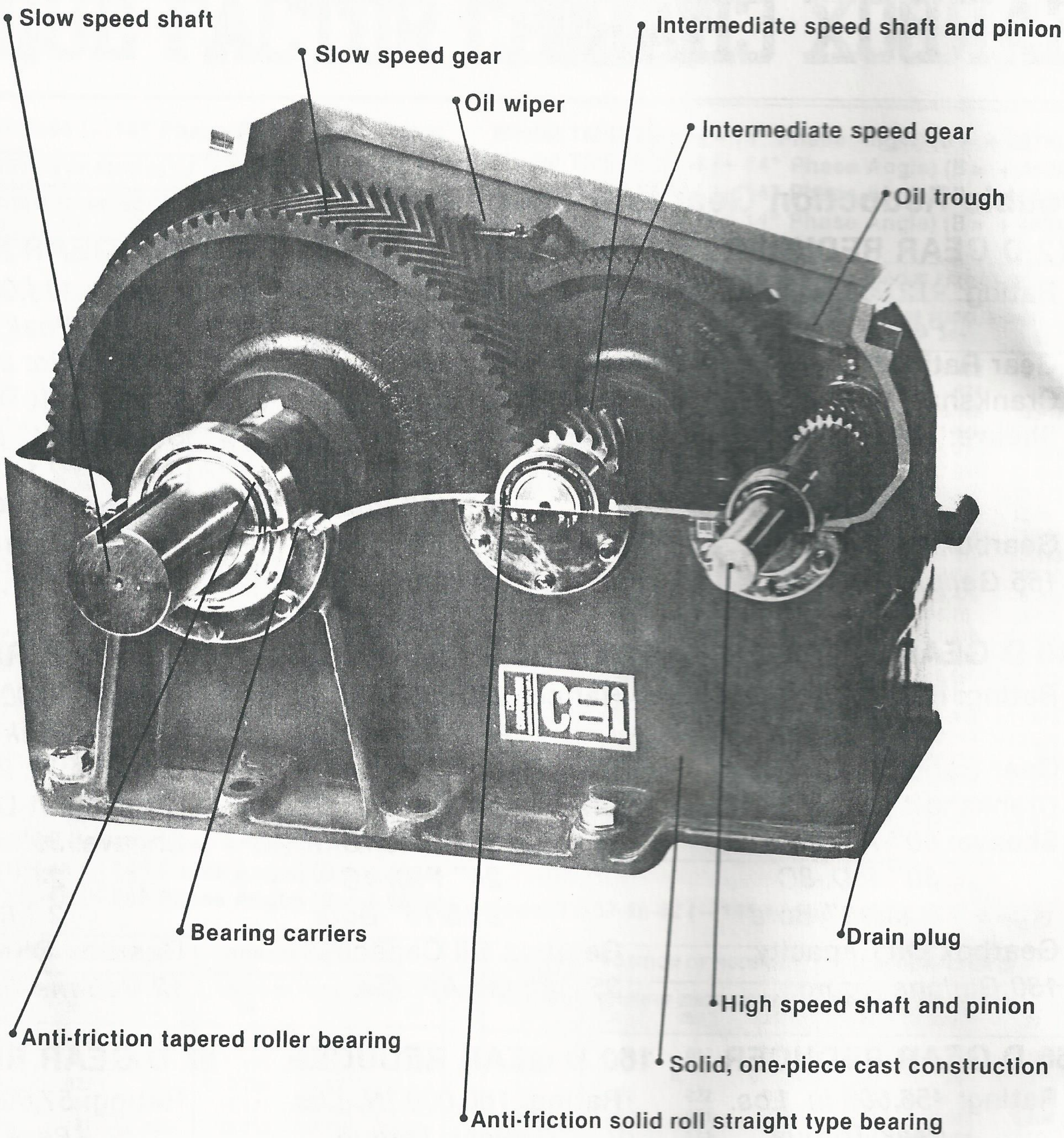
80 D GEAR REDUCER

Rating: *80,000 In. Lbs. Peak Torque*
Gear Ratio: *29.84*
Crankshaft Dia.: *5"*
Sheave: *30" P.D.-2C*
24" P.D.-2C
2 1/8" Bore
Gearbox Oil Capacity:
12 Gallons Approx.

57 D GEAR REDUCER

Rating: *57,000 In. Lbs. Peak Torque*
Gear Ratio: *29.32*
Crankshaft Dia.: *5"*
Sheave: *30" P.D.-2C*
24" P.D.-2C
2 1/8" Bore
Gearbox Oil Capacity:
11 Gallons Approx.

NOTES:
1. Consult factory before operation at less than 5 strokes per minute.
2. Do not operate single-cylinder engines at less than 75% of rated full-load RPM. Change sheave(s) if less strokes per minute are desired.

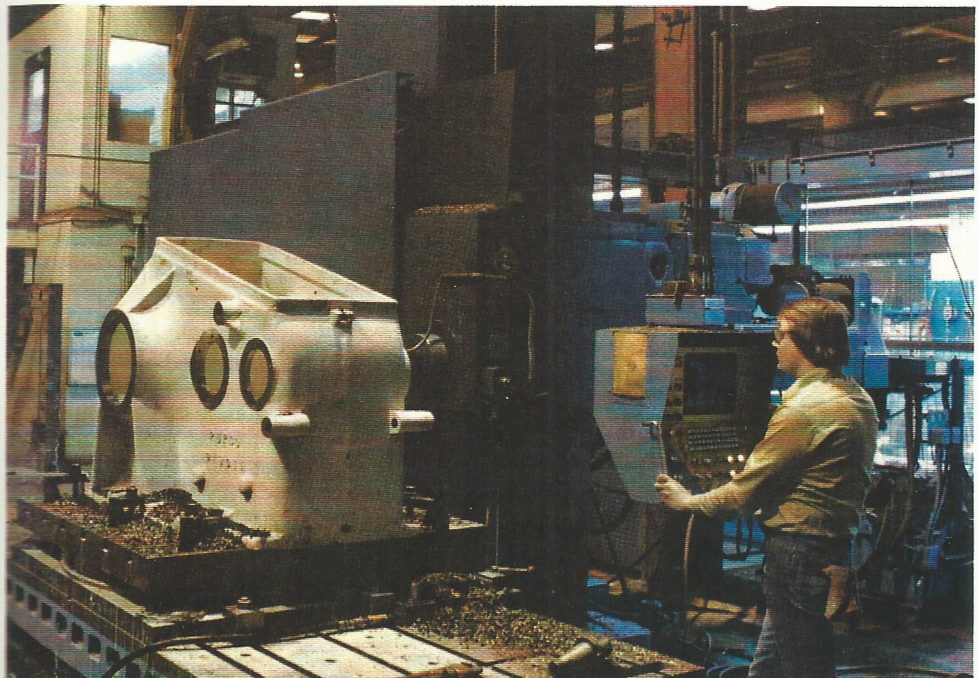


CMI CORPORATION
P.O. Box 1985/Oklahoma City, OK 73101
(405) 787-6020 / Telex: 74-7167

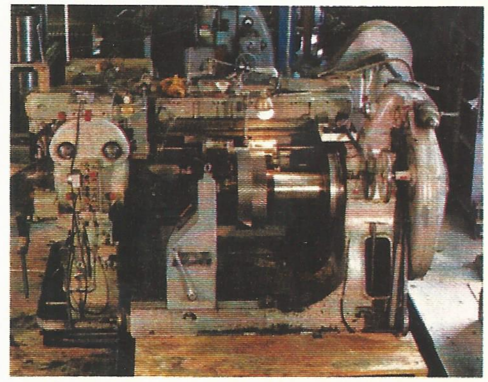
All information contained herein is general in nature and is not intended for specific application purposes. CMI reserves the right to make changes in specifications shown herein or add improvements at any time without notice or obligation. Illustrations include optional equipment.

LITHO USA STF B 12.5M 12/83

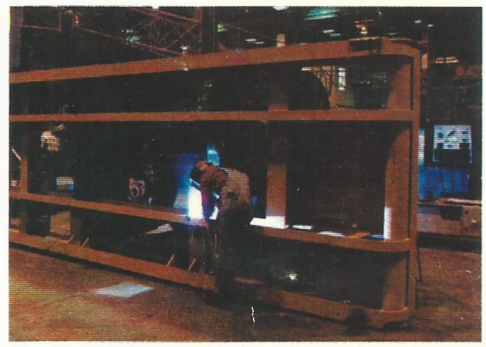
CMI CORPORATION
OKLAHOMA CITY, U.S.A.



eavy-duty cast gear cases are jig-bored on the latest CNC machine centers.



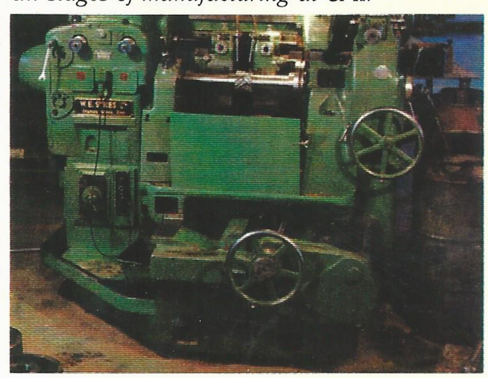
Wide, ductile-iron herringbone gears, cut by CMI, are used exclusively in the Torqmaster gear reducer.



Quality craftsmanship is evident throughout all stages of manufacturing at CMI.

CMI'S six manufacturing facilities have a combined area of nearly one million square feet.

The sturdy Torqmaster structure is designed and built to exceed API Standard 11E specifications.



Complete gear cutting capabilities assure CMI that rigid quality requirements are met.

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Petroleum Equipment Division
Oilwell Pumping Units and Specialized Oilfield Equipment

CMIOIL Corporation
Petroleum Exploration and Production

Gramco Wellhead Division
Christmas Tree and Valve Assemblies

Automated Division
Pavement Construction/ Rehabilitation Equipment and Production Systems

Mining Equipment Division
Thin Seam Reclaimers and Blast Hole Drills

Weighing Equipment Division
Truck, Industrial and Animal Weighing Systems

Bid-Well Division
Bridge Deck and Slope Paving Equipment

Load King Division
Heavy Hauling Units and Trailers

ENCON Systems, Inc.
Solid Waste-to-Energy Conversion Systems

CMI Distributor Group
New and Used Construction Equipment Distribution

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