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Tractor Power for Power-Take-Off Driven Pumps

Michigan State University

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TRACTOR POWER FOR POWER-TAKE-OFF DRIVEN PUMPS



TRACTOR POWER FOR POWER-TAKE-OFF
DRIVEN PUMPS

By R. G White and E. H. Kidder¹

This bulletin has been prepared to make available to farmers, farm equipment and irrigation equipment dealers and irrigation system designers, information relative to the maximum dependable horsepower that can be delivered to the PTO shaft by the farm tractor engine. It is generally recognized that 80 per cent of the maximum belt or PTO horsepower output is a reasonable load for continuous PTO duty.

Irrigation pumping, however, usually represents a continuous heavy-duty loading extending from a period of several hours to many days. This continuous heavy-duty power demand makes it necessary to limit the design power requirement of the pump to not exceed 80 per cent of the maximum available belt or PTO horsepower output of the tractor engine.

This maximum of 80 per cent would apply only when the tractor engine is new or in good mechanical condition. A lower percentage should be used for older tractors. A percentage factor of 50 per cent or lower may be required when the tractor engine is in fair to poor mechanical condition.

Although the data in Table I deals specifically with tractor power available for the operation of the PTO driven irrigation pump, it will be reasonably applicable to other stationary PTO driven machines, such as hammer mills or feed grinders.

Speed Increasers

The American Society of Agricultural Engineers and the Society of Automotive Engineers have standard specifications for power take-off shaft revolutions per minute (rpm) and location. Two standardized power-take-off speeds, namely 540 \pm 10 and 1000 \pm 25 rpm have been specified. Irrigation pumps commonly operate above 2000 rpm, making it necessary for the pump manufacturer to supply some type of speed increaser between the tractor PTO shaft and the pump impeller shaft. The pump and

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speed increaser are commonly mounted as a unit on a two-wheel trailer hitched to the tractor drawbar (Figs. 1 and 2). The desired pump rpm is obtained through the use of spur gears, bevel gears or V-belts.

The speed increaser in Fig. 1 and 2 is of the spur gear type. The impeller shaft of the pump should be parallel to the PTO shaft.

PTO Shaft Alignment

Most tractor manufacturers adhere rather closely to ASAE and SAE standards for locating the power-take-off shaft spline and drawbar on their tractors. It is the responsibility of the pump manufacturer to provide a pump mounting and power shaft assembly that will safely and adequately transmit the power from the tractor to the pump.

Considerable care should be exercised to be sure that the power-take-off shaft is properly aligned. To eliminate as nearly as possible the variable speed of rotation and the resulting vibration, shock, and universal joint wear, the universal joint yokes on the telescoping portion of the PTO shaft should be in the same plane. CORRECT and INCORRECT alignment is shown in Fig. 3.

Tractor Power Available Through the PTO Shaft

The designer of PTO-powered irrigation systems may refer to Table I to determine the maximum PTO horsepower available from any given tractor for operating the pump. Table I includes most makes and models of farm tractors sold in the United States since 1961.

Information on tractors in the age group 1940 through 1955 may be obtained from M.S.U. Extension Bulletin No. 338, issued in 1956. Similar information for tractors in the age group 1956 through 1961 may be obtained from M.S.U. Miscellaneous Series Circular No. E-23, issued in April, 1962. Both publications may currently be obtained from the Agricultural Engineering Department at Michigan State University. They are no longer available through the M.S.U. Bulletin Office.

The maximum recommended horsepower available to the pump has been entered as 80 per cent of the maximum observed belt horsepower or 80 per cent of the maximum observed PTO horsepower, as determined by the Nebraska Tractor Test, unless otherwise indicated. Where the tractor engine must operate at less than rated engine rpm in order to obtain the standard PTO speed, the appropriate horsepower for that engine speed has also been shown.

Safety

The power-take-off shaft connecting the tractor and pump should be completely shielded. The pump manufacturer should provide this shielding. Non-removable shielding, free to rotate with the PTO shaft but which stops when a slight force is applied, usually provides adequate safety protection. V-belts and sheaves should also be shielded.

Since irrigation pumps and their power units are usually left unattended for long periods of time, it is desirable to install safety switches to stop the engine in case of high operating temperature, low oil pressure, or loss of prime of the irrigation pump.

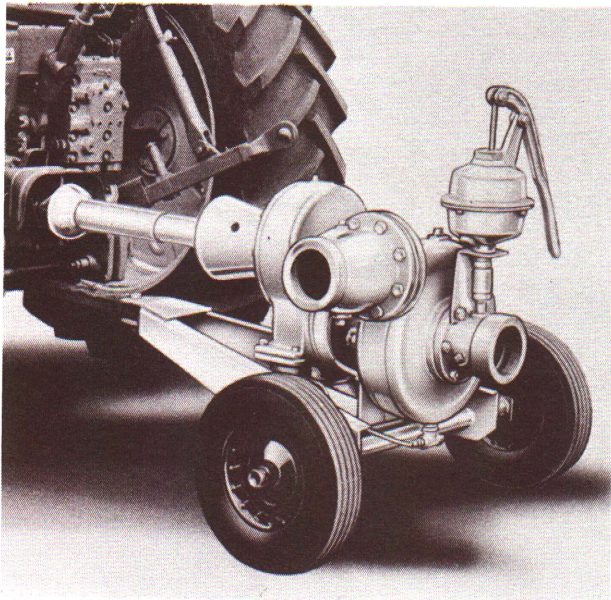


Fig. 1.—Trailer mounted PTO driven pump showing gear box.

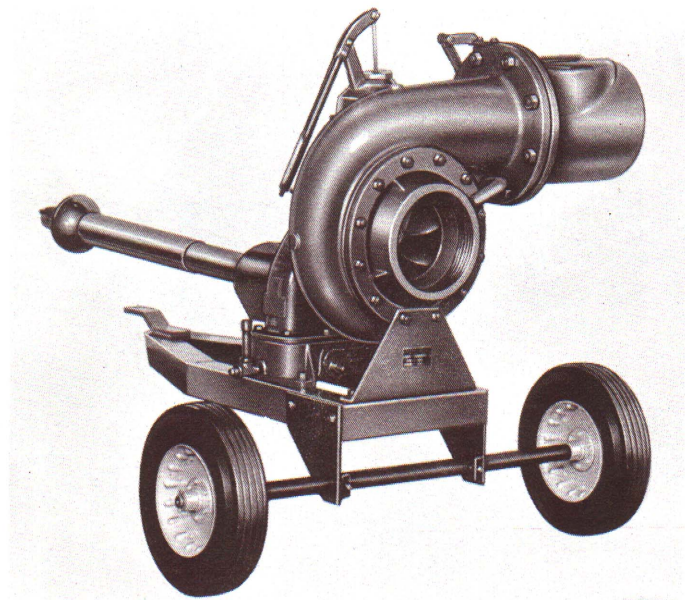


Fig. 2.—Trailer mounted PTO driven pump showing pump impeller.

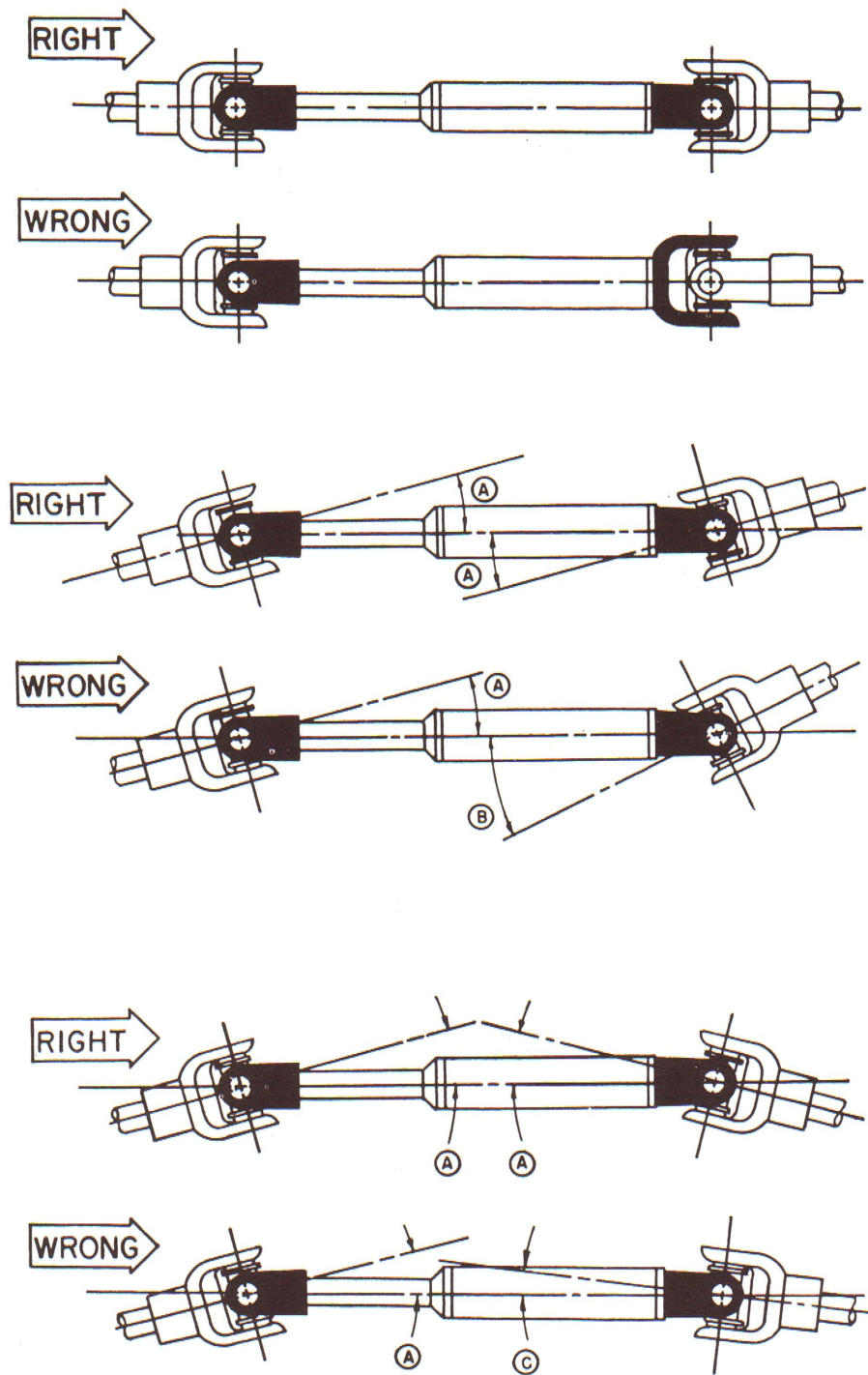


Fig. 3.—Correct and incorrect PTO shaft alignment.

TABLE I--TRACTOR HORSEPOWER AVAILABLE FOR
OPERATING PTO-DRIVEN IRRIGATION PUMPS.
(Including most tractor models available
1962 through 1970.)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
ALLIS-CHALMERS				
D-10 Series II & III	Gasoline	1,650	538	26.8
D-12 Series II & III	Gasoline	1,650	538	26.7
D-15 Series II	Gasoline	2,000	614	36.9
		1,760 (3)	540	33.9
D-15 Series II	L-P Gas	2,000	614	34.8
		1,760 (3)	540	31.7
D-15 Series II	Diesel	2,000	614	34.8 (4)
		1,760 (3)	540	31.7 (4)
D-17 Series III & IV	Gasoline	1,650	549	42.2
D-17 Series III & IV	L-P Gas	1,650	549	40.6
D-17 Series III & IV	Diesel	1,650	549	40.9
D-19	Gasoline	2,000	614	57.2
		1,760 (3)	540	52.2
D-19	L-P Gas	2,000	614	53.0
		1,760 (3)	540	47.9

1. The maximum recommended H.P. to be used in operating PTO-driven irrigation pumps is 80 per cent of the maximum observed belt H.P. (1958 and earlier) or 80 per cent of the maximum observed PTO H.P. (1959 and later) as shown in the Nebraska Tractor Tests Reports, unless otherwise stated.
2. Manufacturer's maximum recommended H.P. to be used in operating PTO-driven irrigation pumps.
3. Engine RPM at which a standard PTO speed of 540 ± 10 RPM or $1,000 \pm 25$ RPM is obtained.
4. Estimated figure.

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
D-19	Diesel	2,000 1,760 (3)	614 540	53.6 51.9
D-21	Diesel	2,200	1,000	82.4
D-21 Series II	Diesel	2,200	1,000	102.2
160	Gasoline	2,250 2,160 (3)	562 540	32.3 (4) 31.8 (4)
160	Diesel	2,250 2,160 (3)	562 540	32.3 31.8
170	Gasoline	1,800 1,622 (3)	599 540	43.3 41.2
170	Diesel	1,800 1,622 (3)	599 540	43.2 40.5
175	Gasoline	2,000 1,622 (3)	666 540	50.0 (4) 43.7 (4)
175	Diesel	2,000 1,622 (3)	666 540	50.0 43.7
180	Gasoline	2,000 1,963 (3)	550 540	52.1 51.7
180	Diesel	2,000 1,963 (3)	550 540	51.2 51.1
185	Gasoline	2,200 1,964 (3)	605 540	59.9 (4) 56.6 (4)
185	Diesel	2,200 1,964 (3)	605 540	59.9 56.6
190	Gasoline	2,200 1,937 (3)	613 540	60.3 56.1
190	Diesel	2,200 1,937 (3)	613 540	61.8 57.9

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
190 XT	Gasoline	2,200 1,937 (3)	613 540	71.6 65.8
190 XT	L-P Gas	2,200 1,937 (3)	613 540	68.2 61.1
190 XT	Diesel	2,200 1,937 (3)	613 540	74.9 71.8
220	Diesel	2,200	1,000	108.8

DAVID BROWN

770 Selectamatic	Diesel	2,000 1,621 (3)	666 540	25.7 21.3
780 Selectamatic	Diesel	2,200 2,200 (3) 1,828 (3)	650 or 1,100 591 or 1,000 540 or 914	33.8 (2) 32.5 (2) 30.5 (2)
880	Diesel	2,200 2,000 (3) 1,828 (3)	650 or 1,100 591 or 1,000 540 or 914	32.3 30.9 28.7
880 Selectamatic	Diesel	2,200 2,000 (3) 1,828 (3)	650 or 1,100 591 or 1,000 540 or 914	33.8 32.5 30.5
990	Diesel	2,200 2,000 (3) 1,828 (3)	650 or 1,100 591 or 1,000 540 or 914	41.3 38.8 35.5
990 Selectamatic	Diesel	2,200 2,000 (3) 1,828 (3)	650 or 1,100 591 or 1,000 540 or 914	41.7 39.7 36.8
1200 Selectamatic	Diesel	2,300 2,000 (3) 1,828 (3)	679 or 1,150 591 or 1,000 540 or 914	52.2 48.5 44.4
3800 Selectamatic	Gasoline	2,200 2,000 (3) 1,828 (3)	650 or 1,100 591 or 1,000 540 or 914	31.3 29.8 28.1
4600 Selectamatic	Diesel	2,200 2,000 (3) 1,823 (3)	652 or 1,100 592 or 1,000 540 or 912	36.8 34.5 32.5

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
J. I. CASE				
841 CK	Gasoline	1,900 1,684 (3)	609 or 1,118 540 or 991	52.2 49.7
841 CK	L-P Gas	1,900 1,684 (3)	609 or 1,118 540 or 991	51.3 49.0
831 CK	Diesel	1,900 1,684 (3)	609 or 1,118 540 or 991	51.4 48.0
941 GP	Gasoline	1,800 1,684 (3)	577 or 1,059 540 or 991	69.0 67.1
941 GP	L-P Gas	1,800 1,684 (3)	577 or 1,059 540 or 991	68.7 66.4
931 CK	Diesel	1,800 1,684 (3)	577 or 1,059 540 or 991	68.3 66.3
1031	Diesel	2,000 1,692 (3)	1,182 1,000	81.4 74.5
1200	Diesel	2,000	1,000	95.9
470	Gasoline	1,750	533	26.5
470	Diesel	1,750	533	27.5
570	Gasoline	1,900 1,733 (3)	579 540	31.6 30.6
570	Diesel	1,900 1,733 (3)	579 540	33.0 31.5
770 Manual	Gasoline	1,900	538	45.1
770 Manual	Diesel	1,900	538	45.1
770 Power Shift	Gasoline	1,900	538	42.8
770 Power Shift	Diesel	1,900	538	45.4
870 Manual	Gasoline	1,900	538	56.8

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
870 Manual	Diesel	1,900	538	56.5
870 Power Shift	Gasoline	1,900	538	56.5
870 Power Shift	Diesel	1,900	538	56.4
970 Manual	Gasoline	1,900	538	68.0
970 Manual	Diesel	1,900	538	68.6
970 Power Shift	Gasoline	1,900	538	68.2
970 Power Shift	Diesel	1,900	538	68.2
1079 Manual, 1090 Manual	Diesel	2,000 1,870 (3)	1,069 1,000	80.6 77.2
1070 Power Shift, 1090 Power Shift	Diesel	2,000 1,870 (3)	1,069 1,000	80.2 79.0
1170	Diesel	2,100 1,870 (3)	1,123 1,000	97.5 94.5
1470 Traction King	Diesel	2,000	1,000	115.9

JOHN DEERE

820	Diesel	2,100	547 or 1,016	24.8 (2)
1020	Gasoline	2,500 2,067 (3)	651 or 1,210 538 or 1,000	31.1 28.5
1020	Diesel	2,500 2,067 (3)	651 or 1,210 538 or 1,000	31.1 28.8
1520	Gasoline	2,500 2,067 (3)	1,210 1,000	38.3 35.2
1520	Diesel	2,500 2,067 (3)	1,210 1,000	37.2 34.4

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
2020	Gasoline	2,500 2,067 (3)	651 or 1,210 538 or 1,000	43.1 38.7
2020	Diesel	2,500 2,067 (3)	651 or 1,210 538 or 1,000	43.3 39.4
2510 Power Shift	Gasoline	2,500 2,067 (3)	651 or 1,210 538 or 1,000	39.7 36.0
2510 Power Shift	Diesel	2,500 2,067 (3)	651 or 1,210 538 or 1,000	40.5 36.6
2510 Syncro-Range	Gasoline	2,500 2,067 (3)	651 or 1,210 538 or 1,000	43.0 38.6
2510 Syncro-Range	Diesel	2,500 2,067 (3)	651 or 1,210 538 or 1,000	44.0 39.4
2520 Power Shift	Gasoline	2,500 2,067 (3)	651 or 1,210 538 or 1,000	45.6 41.6
2520 Power Shift	Diesel	2,500 2,067 (3)	1,210 1,000	45.0 41.6
2520 Syncro-Range	Gasoline	2,500 2,067 (3)	651 or 1,210 538 or 1,000	48.1 42.6
2520 Syncro-Range	Diesel	2,500 2,067 (3)	1,210 1,000	49.0 44.7
3020 (Before '69)	Gasoline	2,500 2,067 (3)	1,210 1,000	51.3 47.5
3020 (Before '69)	L-P Gas	2,500 2,067 (3)	1,210 1,000	51.8 45.1
3020 (Before '69)	Diesel	2,500 2,067 (3)	1,210 1,000	52.2 47.4
3020 Syncro- Range (Before '69)	Gasoline	2,500 2,067 (3)	1,210 1,000	56.5 51.8

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
3020 Syncro- Range (Before '69)	L-P Gas	2,500 2,067 (3)	1,210 1,000	56.5 50.3
3020 Syncro- Range (Before '69)	Diesel	2,500 2,067 (3)	1,210 1,000	57.0 51.5
3020 Power Shift (After '68)	Gasoline	2,500 2,067 (3)	1,210 1,000	53.7 50.1
3020 Power Shift (After '68)	L-P Gas	2,500 2,067 (3)	1,210 1,000	53.6 (2) 47.2 (2)
3020 Power Shift (After '68)	Diesel	2,500 2,067 (3)	1,210 1,000	52.2 (2) 47.4 (2)
3020 Syncro- Range (After '68)	Gasoline	2,500 2,067 (3)	1,210 1,000	57.1 52.9
3020 Syncro- Range (After '68)	L-P Gas	2,500 2,067 (3)	1,210 1,000	56.8 (2) 50.2 (2)
3020 Syncro- Range (After '68)	Diesel	2,500 2,067 (3)	1,210 1,000	57.0 (2) 51.5 (2)
4000	Gasoline	2,200 1,894 (3)	1,161 1,000	77.3 (2) 70.5 (2)
4000	Diesel	2,200 1,894 (3)	1,161 1,000	77.5 71.1
4020 (Before '69)	Gasoline	2,200 1,894 (3)	1,161 1,000	70.5 64.0
4020 (Before '69)	L-P Gas	2,200 1,894 (3)	1,161 1,000	72.4 64.9
4020 (Before '69)	Diesel	2,200 1,894 (3)	1,161 1,000	72.9 66.9
4020 Syncro- Range (Before '69)	Gasoline	2,200 1,894 (3)	1,161 1,000	76.5 68.6

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to Pump(1)
4020 Syncro- Range (Before '69)	L-P Gas	2,200 1,894 (3)	1,161 1,000	75.7 67.4
4020 Syncro- Range (Before '69)	Diesel	2,200 1,894 (3)	1,161 1,000	75.9 69.5
4020 Power Shift (After '68)	Gasoline	2,200 1,894 (3)	1,161 1,000	76.5 70.0
4020 Power Shift (After '68)	L-P Gas	2,200 1,894 (3)	1,161 1,000	76.0 (2) 68.8 (2)
4020 Power Shift (After '68)	Diesel	2,200 1,894 (3)	1,161 1,000	76.7 71.9
4020 Syncro- Range (After '68)	Gasoline	2,200 1,894 (3)	1,161 1,000	77.3 70.5
4020 Syncro- Range (After '68)	L-P Gas	2,200 1,894 (3)	1,161 1,000	76.8 (2) 69.6 (2)
4020 Syncro- Range (After '68)	Diesel	2,200 1,894 (3)	1,161 1,000	75.9 (2) 69.4 (2)
4320 Syncro-Range	Diesel	2,200 1,894 (3)	1,161 1,000	93.2 86.4
4520 Power Shift	Diesel	2,200 1,904 (3)	1,156 1,000	97.9 92.4
4520 Syncro-Range	Diesel	2,200 1,904 (3)	1,156 1,000	98.7 92.2
4620 Power Shift	Diesel	2,200 1,904 (3)	1,156 1,000	108.0 (2) 100.8 (2)
4620 Syncro-Range	Diesel	2,200 1,904 (3)	1,156 1,000	108.0 (2) 100.8 (2)
5020 (Before '69)	Diesel	2,200 1,881 (3)	1,169 1,000	106.6 98.2
5020 (After '68)	Diesel	2,200 1,881 (3)	1,169 1,000	113.1 102.8
7020	Diesel	2,200	1,000	116.0 (2)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
CRAWLER SERIES				
1010C	Gasoline	2,500 1,620 (3)	833 540	28.7 18.0
1010C	Diesel	2,500 1,620 (3)	833 540	29.0 19.9
2010C	Gasoline	2,500 1,904 (3)	1,313 1,000	38.0 30.9
2010C	Diesel	2,500 1,904 (3)	1,313 1,000	38.2 32.4
DEUTZ				
D-2506	Diesel	2,100 1,890 (3)	600 540	16.6 (2) 15.4 (4)
D-3006	Diesel	2,300 2,070 (3)	600 540	23.4 (2) 22.1 (4)
D-4006	Diesel	2,150 1,888 (3)	615 540	27.6 (2) 25.2 (4)
D-5506	Diesel	2,300 2,070 (3)	600 or 1,000 540 or 900	44.0 (2) 41.1 (4)
D-6006	Diesel	2,300 2,020 (3)	615 or 1,000 540 or 878	52.8 (2) 48.6 (4)
D-9006	Diesel	2,300 2,120 (3)	585 or 1,000 540 or 923	76.8 (2) 72.7 (4)
FIAT				
415	Diesel	2,500 2,160 (3)	625 540	30.8 (2) 27.8 (4)
450 (Before '71)	Diesel	2,400 1,970 (3)	658 540	30.8 (2) 27.2 (4)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
450 (After '70)	Diesel	2,400 1,970 (3)	658 540	31.6 (2) 27.9 (4)
500	Diesel	2,600 2,160 (3)	650 540	35.2 (2) 31.2 (4)
550	Diesel	2,400 1,970 (3)	658 540	40.0 (2) 35.3 (4)
600	Diesel	2,400 1,970 (3)	658 540	43.2 (2) 38.1 (4)
615	Diesel	1,900 1,490 (3)	688 540	44.0 (2) 37.7 (4)
650	Diesel	2,200 1,973 (3) 1,830 (3)	649 or 1,115 582 or 1,000 540 or 928	46.0 (2) 42.8 (4) 40.8 (4)
750	Diesel	2,100 1,973 (3) 1,830 (3)	620 or 1,064 582 or 1,000 540 or 928	52.8 (2) 50.7 (4) 48.3 (4)

FORD

2000 4-spd. (Before '65)	Gasoline	2,000 1,486 (3)	727 540	26.9 19.9 (2)
2000 4-spd. (Before '65)	L-P Gas	2,000 1,486 (3)	727 540	22.8 16.8 (2)
2000 4-spd. (Before '65)	Diesel	2,000 1,486 (3)	727 540	25.4 20.2
2000 4-spd. (After '64)	Gasoline	1,900 1,484 (3)	692 540	24.5 21.1
2000 4-spd. (After '64)	Diesel	2,000 1,484 (3)	728 540	25.7 21.3
2000 5-spd. (Before '65)	Gasoline	2,200 1,734 (3)	685 540	28.6 22.2 (2)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
2000 5-spd. (Before '65)	Diesel	2,200 1,734 (3)	685 540	26.4 (4) 20.0 (4)
2000 6-spd.	Gasoline	2,000 1,810 (3)	597 540	24.5 23.4
2000 6-spd.	Diesel	2,000 1,810 (3)	597 540	25.6 24.0
2000 8-spd.	Gasoline	1,900 1,810 (3)	567 540	24.7 24.0
2000 8-spd.	Diesel	2,000 1,810 (3)	597 540	25.0 24.4
2000 S-O-S	Gasoline	2,200 1,750 (3)	679 or 1,257 540 or 1,000	27.5 22.6
2000 S-O-S	L-P Gas	2,200 1,750 (3)	679 or 1,257 540 or 1,000	26.1 21.6
2000 S-O-S	Diesel	2,200 1,750 (3)	679 or 1,257 540 or 1,000	25.2 21.0
2000 Super Dexta	Diesel	2,250 1,810 (3)	671 540	31.1 27.4
3000 4-spd.	Gasoline	2,100 1,484 (3)	764 540	31.3 24.5
3000 4-spd.	Diesel	2,000 1,484 (3)	728 540	31.6 25.4
3000 6-spd.	Gasoline	2,100 1,810 (3)	627 540	30.7 27.5
3000 6-spd.	Diesel	2,000 1,810 (3)	597 540	32.5 31.3
3000 8-spd.	Gasoline	2,100 1,810 (3)	627 540	30.3 27.7

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
3000 8-spd.	Diesel	2,000 1,810 (3)	597 540	31.4 29.9
3000 S-O-S	Gasoline	2,100 1,960 (3) 1,810 (3)	627 or 1,072 585 or 1,000 540 or 923	29.2 28.2 27.0
3000 S-O-S	Diesel	2,000 1,960 (3) 1,810 (3)	597 or 1,020 585 or 1,000 540 or 923	30.4 30.3 28.8
4000 4-spd.	Gasoline	2,000 1,486 (3)	727 540	35.8 26.5 (2)
4000 4-spd.	L-P Gas	2,000 1,486 (3)	727 540	33.6 24.8 (2)
4000 4-spd.	Diesel	2,000 1,486 (3)	727 540	31.9 23.2 (2)
4000 5-spd.	Gasoline	2,200 1,734 (3)	685 540	38.7 30.0 (2)
4000 5-spd.	L-P Gas	2,200 1,734 (3)	685 540	31.6 24.6 (2)
4000 5-spd.	Diesel	2,200 1,734 (3)	685 540	33.5 26.0 (2)
4000 8-spd. (Before '68)	Gasoline	2,200 1,810 (3)	656 540	37.0 34.1
4000 8-spd. (Before '68)	Diesel	2,200 1,810 (3)	656 540	37.4 33.4
4000 8-spd. (After '67)	Gasoline	2,200 1,810 (3)	656 540	41.7 37.7
4000 8-spd. (After '67)	Diesel	2,200 1,810 (3)	656 540	42.1 36.8
4000 S-O-S (Before '68)	Gasoline	2,200 1,960 (3) 1,810 (3)	656 or 1,123 585 or 1,000 540 or 924	36.3 34.4 33.3

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
4000 S-O-S (Before '68)	Diesel	2,200 1,960 (3) 1,810 (3)	656 or 1,123 585 or 1,000 540 or 924	36.5 34.7 33.3
4000 S-O-S (After '67)	Gasoline	2,200 1,810 (3)	656 540	40.1 36.4
4000 S-O-S (After '67)	Diesel	2,200 1,810 (3)	656 540	40.8 35.6
5000 Super Major	Diesel	1,700 1,473 (3)	623 540	38.0 34.3
5000 8-spd. (Before '68)	Gasoline	2,100 1,900 (3)	597 540	48.3 45.6
5000 8-spd. (Before '68)	Diesel	2,100 1,900 (3)	597 540	44.8 42.6
5000 8-spd. (After '67)	Gasoline	2,100 1,900 (3)	597 540	53.8 51.0
5000 8-spd. (After '67)	Diesel	2,100 1,900 (3)	597 540	53.8 51.3
5000 S-O-S (Before '68)	Gasoline	2,100 1,900 (3)	597 540	46.8 44.3
5000 S-O-S (Before '68)	Diesel	2,100 1,900 (3)	597 540	43.3 41.2
5000 S-O-S (After '67)	Gasoline	2,100 1,900 (3)	597 540	52.5 49.6
5000 S-O-S (After '67)	Diesel	2,100 1,900 (3)	597 540	53.2 51.2
6000 (1963-65)	Gasoline	2,300 2,225 (3) 1,730 (3)	558 or 1,034 540 or 1,000 540 or 1,000	49.8 48.8 39.5
6000 (1963-65)	Diesel	2,230 2,225 (3) 1,730 (3)	541 or 1,002 540 or 1,000 540 or 1,000	50.2 50.2 41.5

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
6000 Commander	Gasoline	2,430 2,225 (3) 1,730 (3)	590 or 1,092 540 or 1,000 540 or 1,000	53.0 49.9 41.3
6000 Commander	Diesel	2,430 2,225 (3) 1,730 (3)	590 or 1,092 540 or 1,000 540 or 1,000	53.5 52.2 43.6
8000, 8000 Dual Power	Diesel	2,300 1,935 (3)	654 or 1,189 550 or 1,000	84.6 75.5
9000 Dual Power	Diesel	2,200 1,935 (3)	1,137 1,000	105.0 100.8
HOLDER				
A 15	Diesel	2,600 2,108 (3)	666 540	11.2 (2) 9.8 (4)
AM 2	Diesel	2,300 2,105 (3)	590 540	18.4 (2) 17.4 (4)
AG 3, AG 35	Diesel	2,300 2,105 (3)	590 540	27.2 (2) 25.6 (4)
INTERNATIONAL HARVESTER				
Cub	Gasoline	1,800	1,800	8.3
140	Gasoline	1,400	541	18.4
404	Gasoline	2,000	542	29.4
404	L-P Gas	2,000	542	29.4 (2)
B414	Gasoline	2,000	545	29.2
B414	Diesel	2,000	545	28.8
424	Gasoline	2,000	545	29.6

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
424	Diesel	2,000	545	29.5
444	Gasoline	2,000	545	30.5
444	Diesel	2,000	545	29.5 (2)
504	Gasoline	2,200 1,971 (3)	603 540	37.0 35.2
504	L-P Gas]	2,200 1,971 (3)	603 540	35.5 33.0
504	Diesel	2,200 1,971 (3)	603 540	36.8 36.0
544	Gasoline	2,200 1,989 (3)	597 540	42.3 40.2
544	L-P Gas	2,200 1,989 (3)	597 540	42.3 (2) 40.2 (2)
544	Diesel	2,200 1,989 (3)	597 540	42.4 39.7
544 Hydrostatic	Gasoline	2,400 1,989 (3)	652 540	43.1 39.3
544 Hydrostatic	L-P Gas	2,400 1,989 (3)	652 540	43.1 (2) 39.3 (2)
544 Hydrostatic	Diesel	2,400 1,989 (3)	652 540	44.4 40.0
606	Gasoline	2,000	543	43.0
606	L-P Gas	2,000	543	43.0 (2)
606	Diesel	2,000	543	43.4
656	Gasolin e	1,800	1,004	51.1
656	L-P Gas	1,800	1,004	51.1 (2)
656	Diesel	1,800	1,004	49.2
656 Hydrostatic	Gasoline	2,300 1,989 (3)	624 540	52.6 48.6

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
656 Hydrostatic	L-P Gas	2,300 1,989 (3)	624 540	52.6 (2) 48.6 (2)
656 Hydrostatic	Diesel	2,300 1,989 (3)	624 540	52.8 49.7
706, 706-4 (Before '66)	Gasoline	2,300 2,071 (3)	565 or 1,106 532 or 1,000	59.1 55.0
706, 706-4 (Before '66)	L-P Gas	2,300 2,071 (3)	565 or 1,106 532 or 1,000	58.9 54.4
706, 706-4 (Before '66)	Diesel	2,300 2,071 (3)	565 or 1,106 532 or 1,000	57.9 53.8
706, 706-4 (After '65)	Gasoline	2,300 2,071 (3)	565 or 1,106 532 or 1,000	61.2 57.4
706, 706-4 (After '65)	L-P Gas	2,300 2,071 (3)	565 or 1,106 532 or 1,000	61.0 56.8
706, 706-4 (After '65)	Diesel	2,300 2,071 (3)	565 or 1,106 532 or 1,000	60.9 57.5
756, 756-4	Gasoline	2,300 2,071 (3)	565 or 1,106 532 or 1,000	61.2 (2) 57.4 (2)
756, 756-4	L-P Gas	2,300 2,071 (3)	565 or 1,106 532 or 1,000	61.0 (2) 56.8 (2)
756, 756-4	Diesel	2,300 2,071 (3)	565 or 1,106 532 or 1,000	60.8 (2) 57.4 (2)
806, 806-4	Gasoline	2,400 2,071 (3)	616 or 1,159 532 or 1,000	74.6 67.2
806, 806-4	L-P Gas	2,400 2,071 (3)	616 or 1,159 532 or 1,000	74.7 66.6
806, 806-4	Diesel	2,400 2,071 (3)	616 or 1,159 532 or 1,000	75.9 71.2
826, 826-4	Diesel	2,400 2,071 (3)	616 or 1,159 532 or 1,000	73.8 68.3

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
826, 826-4 Hydrostatic	Diesel	2,400 2,071 (3)	616 or 1,159 532 or 1,000	67.7 63.2
856, 856-4	Gasoline	2,400 2,071 (3)	616 or 1,159 532 or 1,000	74.6 (2) 67.2 (2)
856, 856-4	L-P Gas	2,400 2,071 (3)	616 or 1,159 532 or 1,000	74.7 (2) 66.6 (2)
856, 856-4	Diesel	2,400 2,071 (3)	616 or 1,159 532 or 1,000	80.4 75.4
1026 Hydrostatic	Diesel	2,400 2,071 (3)	616 or 1,159 532 or 1,000	90.0 88.6
1206, 1206-4	Diesel	2,400 2,071 (3)	1,159 1,000	90.1 85.3
1256, 1256-4	Diesel	2,400 2,071 (3)	616 or 1,159 532 or 1,000	92.9 90.7
1456	Diesel	2,400 2,071 (3)	1,159 1,000	105.4 101.8
CRAWLER SERIES				
500	Gasoline	2,000	980	29.8
500	Diesel	2,000	980	29.3
KRAMER				
KL-400	Diesel	2,300 2,122 (3)	585 540	26.1 24.9
KUBOTA				
L-200	Diesel	2,700 2,243 (3)	650 or 990 540 or 882	16.0 (2) 14.2 (4)
L-260	Diesel	2,600 1,969 (3) 1,812 (3)	775 or 1,330 587 or 1,007 540 or 926	19.2 (2) 16.1 (4) 15.1 (4)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
MASSEY-FERGUSON				
MF-25	Diesel	2,000	571	19.5
		1,890 (3)	540	19.0
MF-Super 90	Diesel	2,000	721	54.8
		1,497 (3)	540	46.2
MF-97	L-P Gas	1,600	720	80.8
		1,200 (3)	540	65.7
MF-97	Diesel	1,600	720	80.8
		1,200 (3)	540	65.2
MF-97-4	L-P Gas	1,600	720	81.2
		1,200 (3)	540	65.8
MF-97-4	Diesel	1,600	720	81.3
		1,200 (3)	540	65.3
MF-130	Gasoline	2,250	643	21.6 (4)
		1,890 (3)	540	19.0 (4)
MF-130	Diesel	2,250	643	21.6
		1,890 (3)	540	19.0
MF-135 (Before '69)	Gasoline	2,000	635	28.3
		1,700 (3)	540	26.0
MF-135 (Before '69)	Diesel	2,000	635	30.3
		1,700 (3)	540	27.9
MF-135 (After '68)	Gasoline	2,000	635	30.0
		1,700 (3)	540	28.3
MF-135 (After '68)	Diesel	2,000	635	30.0 (4)
		1,700 (3)	540	28.3 (4)
MF-150	Gasoline	2,000	635	30.3 (4)
		1,700 (3)	540	28.3 (4)
MF-150	Diesel	2,000	635	30.3
		1,700 (3)	540	28.3

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
MF-165 (Before '69)	Gasoline	2,000 1,700 (3)	635 540	37.5 34.9
MF-165 (Before '69)	Diesel	2,000 1,700 (3)	635 540	41.9 37.9
MF-165 (After '68)	Gasoline	2,000 1,700 (3)	635 540	41.5 38.6
MF-165 (After '68)	Diesel	2,000 1,700 (3)	635 540	41.5 (4) 38.6 (4)
MF-175	Gasoline	2,000 1,684 (3)	641 540	49.5 46.4
MF-175	Diesel	2,000 1,684 (3)	641 540	50.7 44.4
MF-180 (Before '69)	Gasoline	2,000 1,700 (3)	635 540	50.9 (4) 45.7 (4)
MF-180 (Before '69)	Diesel	2,000 1,700 (3)	635 540	50.9 45.7
MF-180 (After '68)	Gasoline	2,000 1,684 (3)	641 540	49.9 45.4
MF-180 (After '68)	Diesel	2,000 1,684 (3)	641 540	49.9 (4) 45.4 (4)
MF-1080	Diesel	2,000 1,718 (3)	629 540	65.0 59.0
MF-1100	Gasoline	2,200 2,000 (3)	594 or 1,100 540 or 1,000	72.2 66.9
MF-1100	Diesel	2,200 2,000 (3)	594 or 1,100 540 or 1,000	75.2 71.0
MF-1130	Diesel	2,200 2,000 (3)	594 or 1,100 540 or 1,000	96.4 93.9
MF-1150	Diesel	2,200 2,000 (3)	594 or 1,100 540 or 1,000	108.5 103.0

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
MINNEAPOLIS-MOLINE				
Jet Star Three	Gasoline	1,750	620	35.7
		1,525 (3)	540	33.0
Jet Star Three	L-P Gas	1,750	620	36.4
		1,525 (3)	540	33.8
Jet Star Three	Diesel	1,750	620	35.2 (2)
		1,525 (3)	540	32.6 (2)
U-302	Gasoline	1,900	673	44.7
		1,525 (3)	540	38.8
U-302	L-P Gas	1,900	673	44.6
		1,525 (3)	540	38.7
U-302	Diesel	1,900	673	44.0 (2)
		1,525 (3)	540	38.4 (4)
M-504, M-602, M-604	Gasoline	1,500	593	48.8
		1,366 (3)	540	46.0
M-504, M-602, M-604	L-P Gas	1,500	593	49.0
		1,366 (3)	540	45.9
M-504, M-602 M-604	Diesel	1,500	593	46.5
		1,366 (3)	540	43.1
M-670, M-670 Super	Gasoline	1,600	633	58.4
		1,366 (3)	540	52.9
M-670, M-670 Super	L-P Gas	1,600	633	59.3
		1,366 (3)	540	52.9
M-670, M-670 Super	Diesel	1,600	633	56.8
		1,366 (3)	540	50.0
G-705, G-707	L-P Gas	1,600	720	80.8
		1,200 (3)	540	65.7
G-705, G-707	Diesel	1,600	720	80.8
		1,200 (3)	540	65.2

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
G-706, G-708	L-P Gas	1,600 1,200 (3)	720 540	81.2 65.8
G-706, G-708	Diesel	1,600 1,200 (3)	720 540	81.3 65.3
G-900	Gasoline	1,800	995	78.2
G-900	L-P Gas	1,800	995	78.1
G-900	Diesel	1,800	995	78.2
G-950	Gasoline	1,800	995	77.6 (2)
G-950	L-P Gas	1,800	995	77.6 (2)
G-950	Diesel	1,800	995	77.6 (2)
G-1000	L-P Gas	1,800	536 or 995	88.6
G-1000	Diesel	1,800	536 or 995	88.6
G-1000 Vista	L-P Gas	1,800	536 or 995	88.8
G-1000 Vista	Diesel	1,800	536 or 995	88.8
G-1050	L-P Gas	1,800	536 or 995	88.0 (2)
G-1050	Diesel	1,800	536 or 995	88.0 (2)
G-1350	L-P Gas	2,200 1,805 (3)	658 540	108.0 (2) 95.0 (4)
G-1350	Diesel	2,200 1,805 (3)	658 540	108.0 (2) 95.0 (4)

MITSUBICHI

R 1500	Diesel	2,400	540, 816	11.5 (2)
R 2500, R 2500 H	Diesel	2,400	544, 835	19.6 (2)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
MUIR-HILL				
101 (Ford or Perkins)	Diesel	2,320 1,760 (3)	712 or 1,000 540 or 759	72.5 (2) 58.5 (2)
161	Diesel	2,300	1,000	104.0 (2)
NUFFIELD				
10/42	Diesel	2,000 1,430 (3)	775 540	31.2 24.9
4/60	Diesel	2,000 1,430 (3)	775 540	43.9 34.2
10/60	Diesel	2,000 1,430 (3)	775 540	44.3 34.5
NUFFIELD (LEYLAND)				
154 (540 rpm pto)	Gasoline	2,500 2,260 (3)	598 540	18.3 (4) 17.2 (4)
154 (1,000 rpm pto)	Gasoline	2,500 2,440 (3)	1,024 1,000	18.9 (4) 18.4 (4)
344	Diesel	2,200 1,812 (3)	656 540	37.6 (4) 36.0 (4)
384	Diesel	2,200 1,812 (3)	656 540	49.6 (4) 44.8 (4)
OLIVER				
500	Diesel	2,000 1,800 (3)	600 or 1,000 540 or 900	26.0 (2) 24.6 (4)
550	Gasoline	2,000 1,586 (3)	681 or 1,000 540 or 793	33.1 26.5 (2)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
550	Diesel	2,000 1,586 (3)	681 or 1,000 540 or 793	31.4 25.1 (2)
600	Diesel	2,200 2,000 (3) 1,800 (3)	660 or 1,100 600 or 1,000 540 or 900	38.6 (2) 37.4 (4) 33.8 (4)
770	Gasoline	1,750	540 or 1,000	40.0
770	L-P Gas	1,750	540 or 1,000	40.0 (4)
770	Diesel	1,750	540 or 1,000	39.0
1250, 1250-4	Gasoline	2,500 2,160 (3)	625 540	28.0 (2) 25.2 (4)
1250, 1250-4	Diesel	2,500 2,160 (3)	625 540	30.8 (2) 27.7 (4)
1255	Diesel	2,400	540	30.8 (2)
1355	Diesel	2,400	540	40.8 (2)
1450, 1450-4	Diesel	1,900 1,490 (3)	689 540	44.0 (2) 37.7 (4)
1550	Gasoline	2,200	550 or 994	42.7
1550	L-P Gas	2,200	550 or 994	42.7 (2)
1550	Diesel	2,200	550 or 994	42.8
1555	Gasoline	2,200	541 or 1,015	42.4 (2)
1555	L-P Gas	2,200	541 or 1,015	40.8 (2)
1555	Diesel	2,200	541 or 1,015	42.4 (2)
1600	Gasoline	1,900 1,740 (3)	590 or 1,008 540 or 923	45.2 40.9
1600	L-P Gas	1,900 1,740 (3)	590 or 1,008 540 or 923	45.2 (4) 40.9 (4)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
1600	Diesel	1,900 1,740 (3)	590 or 1,008 540 or 923	46.4 43.8
1650, 1650-4	Gasoline	2,200	550 or 994	50.2
1650, 1650-4	L-P Gas	2,200	550 or 994	50.2 (4)
1650, 1650-4	Diesel	2,200	550 or 994	53.0
1655, 1655-4	Gasoline	2,200	994	56.2
1655, 1655-4	L-P Gas	2,200	994	56.2 (4)
1655, 1655-4	Diesel	2,200	994	56.5
1750, 1750-4	Gasoline	2,400	984	64.2
1750, 1750-4	Diesel	2,400	984	64.0
1755, 1755-4	Gasoline	2,400	541 or 984	69.6
1755, 1755-4	Diesel	2,400	541 or 984	69.5
1800 Series B, 1800-4 Series B	Gasoline	2,200	1,004	64.6
1800 Series B, 1800-4 Series B	Diesel	2,200	1,004	61.6
1850, 1850-4	Gasoline	2,400	549 or 984	74.3
1850, 1850-4	L-P Gas	2,400	549 or 984	74.3 (4)
1850, 1850-4	Diesel	2,400	549 or 984	74.3

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
1855, 1855-4	Gasoline	2,400	984	78.9 (4)
1855 1855-4	L-P Gas	2,400	984	78.9 (4)
1855 1855-4	Diesel	2,400	984	78.9
1900 Series B	Diesel	2,200	1,004	78.8
1900-4 Series B	Diesel	2,200	1,004	80.5
1950, 1950-4	Diesel	2,400	549 or 984	84.6
1950-T, 1950-T-4	Diesel	2,400	984	84.2
1955, 1955-4	Diesel	2,400	549 or 984	86.5
2050, 2050-4	Diesel	2,400	984	95.0
2150, 2150-4	Diesel	2,400	984	105.2
SAME				
Delfino 32 2 RM, 4 RM	Diesel	2,060 1,800 (3)	618 540	23.5 (2) 21.5 (2)
Minitauro 2 RM, 4 RM	Diesel	2,000 1,980 (3)	600 540	39.0 (2) 36.5 (2)
Centauero 2 RM, 4 RM	Diesel	2,000 1,776 (3)	608 540	45.0 (2) 41.0 (2)
Leone 70 2 RM, 4 RM	Diesel	2,200 2,007 (3)	592 540	53.0 (2) 49.5 (2)

Model	Fuel	Rated Engine RPM	Power Take-Off RPM	Maximum Recommended H.P. to pump(1)
URSUS				
C-325	Diesel	2,000	549	19.7
C-335	Diesel	2,200	550	23.4
		2,160 (3)	540	23.8
C-350	Diesel	2,000	542	34.7
VERSATILE				
118	Diesel	3,000	1,111	108.0 (4)
		2,700 (3)	1,000	100.8 (4)
125	Diesel	2,800	1,037	132.0 (4)
		2,700 (3)	1,000	128.8 (4)
145	Diesel	3,000	1,111	144.0 (4)
		2,700 (3)	1,000	135.0 (4)
ZETOR				
2011	Diesel	2,000	545	17.0
3011	Diesel	2,000	542	26.9
4011	Diesel	2,000	542	38.8
50 Super	Diesel	1,650	571	39.6
		1,560 (3)	540	38.2
5511 Zetormatic	Diesel	2,200	596	40.7
		1,993 (3)	540	38.2

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