

PropCalcPlus Propeller & Gearing Calculator

Enter data in Blue cells. Computed values will display in Green and Yellow cells.

315 HP				
BHP	315			
Max RPM	4500			
Gear ratio	1.21			
Displacement	3500	lbs	1588	kg
Strut drop (inches)	7.5	inches	0.6	ft
Waterline length	24	feet		
Desired cruise	25	knots	29	MPH
Desired max speed	42	knots	48	MPH

Required for blade loading calculation

Speed:Length Ratio	15.336			
Pounds per Shaft Horsepower available	11			
Hull Constant	150			

For planing hulls, where C= 150 for runabout, 190 for fast, 210 for race.

315 HP		
Gearbox Ratio	0.88	1.00
Engine Horsepower	315	
Engine R.P.M. (max)	4500	
Engine Torque ft/lb	368	

315 HP		
Gearbox Ratio	1.21	1.50
Engine Horsepower	315	
Engine R.P.M. (max)	4500	
Engine Torque ft/lb	368	

Enter gearbox ratios

SHP - Shaft Horsepower at gearbox output	306	
# of bearings between gearbox and propeller	1	
Percentage power loss due to shaft bearings	1.50%	

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# of bearings between gearbox and propeller	1	
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Shaft Horsepower at propeller	306	
Shaft HP to attain desired speed of 42 knots (48 MPH)	274	
Propeller RPM	5114	4500
Propeller Torque ft/lb	314	357

Shaft Horsepower at propeller	306	
Shaft HP to attain desired speed of 42 knots (48 MPH)	274	
Propeller RPM	3719	3000
Propeller Torque ft/lb	431	535

Approx maximum speed attainable (knots)	44	44
Approx maximum speed attainable (MPH)	51	51
Propeller Diameter in inches	11.8	12.8

Approx maximum speed attainable (knots)	44	51
Approx maximum speed attainable (MPH)	51	59
Propeller Diameter in inches	14.3	16.3

80% of max prop shaft rpm	4091	3600
Desired speed expressed as feet per minute	4255	4255
Desired speed / max prop shaft rpm to give prop feet per minute	1.04	1.18
Theoretical required prop pitch in inches	12.48	14.18
Estimated prop slip at required top speed	16.63%	16.63%
Required prop pitch for top speed	14.6	16.5

80% of max prop shaft rpm	2975	2400
Desired speed expressed as feet per minute	4255	4255
Desired speed / max prop shaft rpm to give prop feet per minute	1.43	1.77
Theoretical required prop pitch in inches	17.16	21.27
Estimated prop slip at required top speed	16.63%	16.63%
Required prop pitch for top speed	20.0	24.8

Maximum allowable Blade Loading for the onset of cavitation (PSI)

PSI = 1.9 * V_a * F_t^{0.08}

Gear Ratio Diameter (D) and Pitch (P)	0.88		1.00	
	D	P	D	P
Three blade propeller	12	15	13	17
Three blade Cupped propeller	12	14.25	13	16.15
Propeller for maximum speed	11	18	12	19
Two blade propeller	12	15	12	17
Four blade propeller	11	14	12	16

Gear Ratio Diameter (D) and Pitch (P)	1.21		1.50	
	D	P	D	P
Three blade propeller	14	20	16	25
Three blade Cupped propeller	14	19.00	16	24.00
Propeller for maximum speed	13	23	15	27
Two blade propeller	15	20	15	25
Four blade propeller	13	20	15	24

(1)
(1)
(2)

Approximate Speed

Propeller Pitch	15
Gear Ratio	0.88
MAX RPM	4500

Propeller Pitch	15
Gear Ratio	1.00
MAX RPM	4500

Propeller Pitch	15
Gear Ratio	1.21
MAX RPM	4500

Propeller Pitch	18
Gear Ratio	1.50
MAX RPM	4500

RPM	Shaft RPM	Theor MPH	10% Slip
1000	1136	16.14	15
1500	1705	24.21	22
2000	2273	32.28	29
2500	2841	40.35	36
3000	3409	48.42	44
3500	3977	56.50	51
4000	4545	64.57	58
4500	5114	72.64	65
5000	5682	80.71	73
5500	6250	88.78	80
6000	6818	96.85	87

RPM	Shaft RPM	Theor MPH	10% Slip
1000	14.20	13	
1500	21.31	19	
2000	28.41	26	
2500	35.51	32	
3000	42.61	38	
3500	49.72	45	
4000	56.82	51	
4500	63.92	58	
5000	71.02	64	
5500	78.13	70	
6000	85.23	77	

RPM	Shaft RPM	Theor MPH	10% Slip
826	11.74	11	
1240	17.61	16	
1653	23.48	21	
2066	29.35	26	
2479	35.22	32	
2893	41.09	37	
3306	46.96	42	
3719	52.83	48	
4132	58.70	53	
4545	64.57	58	
4959	70.44	63	

RPM	Shaft RPM	Theor MPH	10% Slip
667	11.36	10	
1000	17.05	15	
1333	22.73	20	
1667	28.41	26	
2000	34.09	31	
2333	39.77	36	
2667	45.45	41	
3000	51.14	46	
3333	56.82	51	
3667	62.50	56	
4000	68.18	61	

See Speed Table and Diameter-HP-RPM worksheets (at bottom of screen) for more details.

Crouch's Planing Speed Formula

$$Kts = C / (LB/SHP)^{0.5}$$

Where :

Kts = Speed in knots = Boat speed, V

C = Constant chosen for the type of vessel being considered

LB = Displacement in pounds

SHP = Horsepower at the propeller shaft. $SHP = (BHP * 0.97) * (100 - (0.015 * \text{number of blades}))$

$$\begin{aligned} Kts &= C / (LB / SHP)^{0.5} \\ &= 150 / (3500 / 306)^{0.5} \\ &= 150 / (11.45647219)^{0.5} \\ &= 150 / 3.384741082 \\ &= 44.31653599 \\ &= 45 \text{ Knots} \quad (51 \text{ MPH}) \end{aligned}$$

Rules of thumb

- One inch diameter = 2.5 inches of pitch.
- Two inches extra pitch will cut engine rpm by 450.

Allowable Blade Loading Formula

$$PSI = 1.9 * V_a * F_t^{0.08}$$

Where :

PSI = The pressure, in pounds per square inch, at which cavitation is likely to begin.

V_a = The speed of water at the propeller in knots. Assume 96 percent of total boat speed.

F_t = The depth of immersion of the propeller shaft centerline (in feet).

Theoretical Speed Table

Propeller Pitch	15.0
Gear Ratio	0.88

Propeller Pitch	15
Gear Ratio	1.00

RPM	Shaft RPM	TS MPH	Slip %				
			10	20	30	40	50
600	682	9.68	8.72	7.75	6.78	5.81	5.81
700	795	11.30	10.17	9.04	7.91	6.78	6.78
800	909	12.91	11.62	10.33	9.04	7.75	7.75
900	1023	14.53	13.07	11.62	10.17	8.72	8.72
1000	1136	16.14	14.53	12.91	11.30	9.68	9.68
1100	1250	17.76	15.98	14.20	12.43	10.65	10.65
1200	1364	19.37	17.43	15.50	13.56	11.62	11.62
1300	1477	20.98	18.89	16.79	14.69	12.59	12.59
1400	1591	22.60	20.34	18.08	15.82	13.56	13.56
1500	1705	24.21	21.79	19.37	16.95	14.53	14.53
1600	1818	25.83	23.24	20.66	18.08	15.50	15.50
1700	1932	27.44	24.70	21.95	19.21	16.46	16.46
1800	2045	29.05	26.15	23.24	20.34	17.43	17.43
1900	2159	30.67	27.60	24.54	21.47	18.40	18.40
2000	2273	32.28	29.05	25.83	22.60	19.37	19.37
2100	2386	33.90	30.51	27.12	23.73	20.34	20.34
2200	2500	35.51	31.96	28.41	24.86	21.31	21.31
2300	2614	37.13	33.41	29.70	25.99	22.28	22.28
2400	2727	38.74	34.87	30.99	27.12	23.24	23.24
2500	2841	40.35	36.32	32.28	28.25	24.21	24.21
2600	2955	41.97	37.77	33.57	29.38	25.18	25.18
2700	3068	43.58	39.22	34.87	30.51	26.15	26.15
2800	3182	45.20	40.68	36.16	31.64	27.12	27.12
2900	3295	46.81	42.13	37.45	32.77	28.09	28.09
3000	3409	48.42	43.58	38.74	33.90	29.05	29.05
3100	3523	50.04	45.03	40.03	35.03	30.02	30.02
3200	3636	51.65	46.49	41.32	36.16	30.99	30.99
3300	3750	53.27	47.94	42.61	37.29	31.96	31.96
3400	3864	54.88	49.39	43.90	38.42	32.93	32.93
3500	3977	56.50	50.85	45.20	39.55	33.90	33.90
3600	4091	58.11	52.30	46.49	40.68	34.87	34.87
3700	4205	59.72	53.75	47.78	41.81	35.83	35.83
3800	4318	61.34	55.20	49.07	42.94	36.80	36.80
3900	4432	62.95	56.66	50.36	44.07	37.77	37.77
4000	4545	64.57	58.11	51.65	45.20	38.74	38.74
4100	4659	66.18	59.56	52.94	46.33	39.71	39.71
4200	4773	67.79	61.01	54.24	47.46	40.68	40.68
4300	4886	69.41	62.47	55.53	48.59	41.65	41.65
4400	5000	71.02	63.92	56.82	49.72	42.61	42.61
4500	5114	72.64	65.37	58.11	50.85	43.58	43.58
4600	5227	74.25	66.83	59.40	51.98	44.55	44.55
4700	5341	75.87	68.28	60.69	53.11	45.52	45.52
4800	5455	77.48	69.73	61.98	54.24	46.49	46.49
4900	5568	79.09	71.18	63.27	55.37	47.46	47.46
5000	5682	80.71	72.64	64.57	56.50	48.42	48.42
5100	5795	82.32	74.09	65.86	57.63	49.39	49.39
5200	5909	83.94	75.54	67.15	58.76	50.36	50.36
5300	6023	85.55	77.00	68.44	59.89	51.33	51.33
5400	6136	87.16	78.45	69.73	61.01	52.30	52.30
5500	6250	88.78	79.90	71.02	62.14	53.27	53.27
5600	6364	90.39	81.35	72.31	63.27	54.24	54.24
5700	6477	92.01	82.81	73.61	64.40	55.20	55.20
5800	6591	93.62	84.26	74.90	65.53	56.17	56.17
5900	6705	95.24	85.71	76.19	66.66	57.14	57.14
6000	6818	96.85	87.16	77.48	67.79	58.11	58.11

RPM	Shaft RPM	TS MPH	Slip %				
			10	20	30	40	50
600	600	8.52	7.67	6.82	5.97	5.11	5.11
700	700	9.94	8.95	7.95	6.96	5.97	5.97
800	800	11.36	10.23	9.09	7.95	6.82	6.82
900	900	12.78	11.51	10.23	8.95	7.67	7.67
1000	1000	14.20	12.78	11.36	9.94	8.52	8.52
1100	1100	15.63	14.06	12.50	10.94	9.38	9.38
1200	1200	17.05	15.34	13.64	11.93	10.23	10.23
1300	1300	18.47	16.62	14.77	12.93	11.08	11.08
1400	1400	19.89	17.90	15.91	13.92	11.93	11.93
1500	1500	21.31	19.18	17.05	14.91	12.78	12.78
1600	1600	22.73	20.45	18.18	15.91	13.64	13.64
1700	1700	24.15	21.73	19.32	16.90	14.49	14.49
1800	1800	25.57	23.01	20.45	17.90	15.34	15.34
1900	1900	26.99	24.29	21.59	18.89	16.19	16.19
2000	2000	28.41	25.57	22.73	19.89	17.05	17.05
2100	2100	29.83	26.85	23.86	20.88	17.90	17.90
2200	2200	31.25	28.13	25.00	21.88	18.75	18.75
2300	2300	32.67	29.40	26.14	22.87	19.60	19.60
2400	2400	34.09	30.68	27.27	23.86	20.45	20.45
2500	2500	35.51	31.96	28.41	24.86	21.31	21.31
2600	2600	36.93	33.24	29.55	25.85	22.16	22.16
2700	2700	38.35	34.52	30.68	26.85	23.01	23.01
2800	2800	39.77	35.80	31.82	27.84	23.86	23.86
2900	2900	41.19	37.07	32.95	28.84	24.72	24.72
3000	3000	42.61	38.35	34.09	29.83	25.57	25.57
3100	3100	44.03	39.63	35.23	30.82	26.42	26.42
3200	3200	45.45	40.91	36.36	31.82	27.27	27.27
3300	3300	46.88	42.19	37.50	32.81	28.13	28.13
3400	3400	48.30	43.47	38.64	33.81	28.98	28.98
3500	3500	49.72	44.74	39.77	34.80	29.83	29.83
3600	3600	51.14	46.02	40.91	35.80	30.68	30.68
3700	3700	52.56	47.30	42.05	36.79	31.53	31.53
3800	3800	53.98	48.58	43.18	37.78	32.39	32.39
3900	3900	55.40	49.86	44.32	38.78	33.24	33.24
4000	4000	56.82	51.14	45.45	39.77	34.09	34.09
4100	4100	58.24	52.41	46.59	40.77	34.94	34.94
4200	4200	59.66	53.69	47.73	41.76	35.80	35.80
4300	4300	61.08	54.97	48.86	42.76	36.65	36.65
4400	4400	62.50	56.25	50.00	43.75	37.50	37.50
4500	4500	63.92	57.53	51.14	44.74	38.35	38.35
4600	4600	65.34	58.81	52.27	45.74	39.20	39.20
4700	4700	66.76	60.09	53.41	46.73	40.06	40.06
4800	4800	68.18	61.36	54.55	47.73	40.91	40.91
4900	4900	69.60	62.64	55.68	48.72	41.76	41.76
5000	5000	71.02	63.92	56.82	49.72	42.61	42.61
5100	5100	72.44	65.20	57.95	50.71	43.47	43.47
5200	5200	73.86	66.48	59.09	51.70	44.32	44.32
5300	5300	75.28	67.76	60.23	52.70	45.17	45.17
5400	5400	76.70	69.03	61.36	53.69	46.02	46.02
5500	5500	78.13	70.31	62.50	54.69	46.88	46.88
5600	5600	79.55	71.59	63.64	55.68	47.73	47.73
5700	5700	80.97	72.87	64.77	56.68	48.58	48.58
5800	5800	82.39	74.15	65.91	57.67	49.43	49.43
5900	5900	83.81	75.43	67.05	58.66	50.28	50.28
6000	6000	85.23	76.70	68.18	59.66	51.14	51.14

Notes : TS = Theoretical Speed (MPH)

Modified PropCalc spreadsheet prepared by Paul Kane, Kane Custom Boats Ltd., Chelsea Quebec

18-04-2013 12:22

Building the Glen-L Hot Rod : <http://www.KaneCustomBoats.com>

DIAMETER-HP-RPM Formula

Finding diameter from HP and RPM
 (from Propeller Handbook by Dave Gerr)

Values for BHP (Brake Horsepower) , Engine RPM (RPM) and Gear ratio (RATIO)

BHP	315	Engine Brake Horsepower
SHP	306	Shaft Horsepower
RPM	4500	Engine RPM
RATIO	1.21	Gear Ratio
SRPM	5114	Shaft RPM

Diameter HP-RPM Formula

$$\begin{aligned}
 D &= 632.7 * \text{SHP}^{0.2} / \text{SRPM}^{0.6} \\
 &= 632.7 * 305.50417^{0.2} / 5113.63636^{0.6} \\
 &= 632.7 * 3.140533481 / 167.9723913 \\
 &= 1987.015534 / 167.9723913 \\
 &= 11.82941743 \\
 &= 12
 \end{aligned}$$

Prop Diameter for RPM

RPM	SRPM	Diameter	Diameter (rounded)
6000	4959	12.05	12
5500	4545	12.70	13
5400	4463	12.84	13
5300	4380	12.98	13
5200	4298	13.13	13
5100	4215	13.28	13
5000	4132	13.44	13
4400	3636	14.51	15
4000	3306	15.37	15
3000	2479	18.26	18
2000	1653	23.29	23

Prop Diameter for increased power levels

BHP		100	150	200	250	300	350	400
SHP		96	144	192	240	288	336	384
RPM	SRPM							
6000	4959	10	10	11	11	12	12	13
5200	4298	10	11	12	13	13	13	14
5000	4132	11	12	12	13	13	14	14
4400	3636	12	12	13	14	14	15	15
4000	3306	12	13	14	15	15	16	16
3000	2479	14	16	17	17	18	19	19
2000	1653	18	20	21	22	23	24	24