

# Engine Horsepower & Exhaust Flow Guide

## Engine Data

The data shown in this section is a collection of information gathered by Donaldson from various sources and should be used for estimating.

For exact information, consult your engine manufacturer.

Allis Chalmers  
Case  
Caterpillar  
Continental Motors  
Cummins  
Detroit Diesel  
Deutz  
Ford  
Hatz Diesel  
Hino  
Isuzu  
Iveco  
John Deere  
Kohler  
Kubota  
Lister  
Lombardini  
Mack  
Mercedes-Benz  
Mitsubishi  
MTU of North America  
Navistar  
Nissan  
Perkins  
Renault  
Same  
Teledyne  
Volkswagon  
Volvo  
Waukesha  
White Eng  
Yanmar

## Engine Exhaust Flow Rate Calculation

Exhaust flow rate may be calculated using the following formula. Exhaust temperature and intake airflow rate must be determined to calculate the exhaust flow rate. Exhaust temperature and manufacturers maximum backpressure may be approximated using the chart below.

$$\left( \frac{\text{Exhaust Temp. (°F)} + 460}{540} \right) \times \text{Intake Airflow (CFM)} = \text{Exhaust Flow}$$

Engine Type	Engine Temperature	Maximum Backpressure
Diesel 2-Cycle Naturally Aspirated	= 900°F	4" Hg
Diesel 2-Cycle Turbo	= 750°F	3" Hg
Diesel 4-Cycle Naturally Aspirated	= 1000°F	3" Hg
Diesel 4-Cycle Turbo	= 900°F	3" Hg
Gasoline (all types)	= 1200°F	4" Hg

Note: If you are spec'ing a dual muffler system divide engine's exhaust flow (CFM) by two

## Engine Airflow Calculations

CFM intake rate is available from the engine manufacturer. If CFM specifications are not available, use the volumetric efficiency calculation. A simple calculation for cfm is to multiple the horsepower of your engine by 2.5.

### 4-Cycle Engine Airflow Calculation

$$\left( \frac{\text{Engine Size (CID)} \times \text{RPM}}{3456} \right) \times \text{Volumetric Efficiency} = \text{Intake Airflow (CFM)}$$

### 2-Cycle Engine Airflow Calculation

$$\left( \frac{\text{Engine Size (CID)} \times \text{RPM}}{1728} \right) \times \text{Volumetric Efficiency} = \text{Intake Airflow (CFM)}$$

### Volumetric Efficiency

Engine volumetric efficiency ratings are best obtained from your engine manufacturer. Engines operating with electronic controls could have volumetric efficiency ratings of more than 2.0. Airflow on these engines should be verified by the engine manufacturer.

4 Cycle GAS Engine	Naturally Aspirated	= .70 - .80
2 and 4 Cycle DIESEL Engine	Naturally Aspirated	= .90
	Turbo*	= 1.50 - 3.00*

\* If VE rating is not available, Donaldson recommends using the highest value to insure proper airflow.



Engine Model	RPM	HP	-- Exhaust --	
			Intake Temp. (°F)	Flow (CFM)
<b>CONTINENTAL MOTORS CONTINUED</b>				
M330	2400		172	497
M363	2400	122	201	581
N56	2200		27	78
N62	2400		31	90
R513	2400		267	771
R572	2400		298	861
R602	2400	191	313	904
S749	2200		358	1034
S802	2200		392	1132
S820	2400	250	455	1314
T&B371	2400		193	558
T&B427	2400	133	241	696
U501	2400		260	751
V603	2800		313	904
Y112	2400	37	58	168
Y69	2400		37	107
Y91	2400	27	91	263

<b>CUMMINS</b>				
3B2.9	2500	56	115	311
4B3.9	2500	76	150	419
4BT	2500	105	289	750
4BT	2500	120	336	922
4BT3.9	2500	100	253	684
4BT3.9-G1	1800	86	147	357
4BT3.9-G2	1800	102	157	381
4BTA3.9	2500	120	298	751
6B5.9	2500	116	226	611
6BT	2500	190	590	1290
	2500	230	535	1531
	2300	230	520	1380
6BT5.9	2500	152	381	960
6BT5.9-G1	1800	135	224	564
6BT5.9-G2	1800	166	285	718
6BTA5.9	2500	180	449	900
6C8.3	2500		316	854
6CT	2300	250	570	1740
	2200	300	742	2140
	2000	275	590	1665
6CT8.3	2500		555	1398
6CTA8.3	2500	250	632	1592
C-160	2500	153	300	756
C-180	2500	173	350	881
C-190	2500	190	495	1247
FLEET 270	1600	270	710	1788
FLEET 300	1600	300	765	1927
	1600	300	710	1788
Formula 240	1800	240	630	1587
	1800	240	618	1556
Formula 270	1800	270	720	1813
Formula 300	1800	300	761	1917
	1800	300	745	1876
	1800	300	744	1874
Formula 315	1800	315	735	1851
Formula 350	1800	350	821	2068
	1800	350	800	2015
	1800	350	857	2158
Formula 400	1900	400	1060	2670
	1900	400	930	2428
	1900	400	986	2483
Formula 450	1900	450	1110	2898

Engine Model	RPM	HP	-- Exhaust --	
			Intake Temp. (°F)	Flow (CFM)
<b>CUMMINS CONTINUED</b>				
Formula L10-240				
	1900	240	522	1315
	1900	240	580	1461
	1900	240	585	1473
Formula L10-270				
	1900	270	556	1400
	1900	270	618	1556
	1900	270	606	1526
Formula L10-300				
	1900	300	609	1534
GNH-220-IP	1800	177	250	630
GNH-250-IP	1800	204	265	667
GV-12-525-IP	1800	408	580	1461
ISB	2500	185	578	1257
	2600	190	526	1250
	2500	205	508	1246
	2600	210	526	1313
	2500	225	510	1311
	2500	240	610	1456
	2500	245	610	1456
	2600	260	622	1592
	2500	275	620	1673
ISC	2400	225	708	1417
	2400	240	721	1485
	2400	260	743	1578
	2200	285	682	1531
	2200	300	688	1578
	2200	315	682	1686
	2200	330	693	1758
	2200	350	706	1841
ISL	2100	310	689	1682
	2100	330	708	1740
ISM	2100	280	777	1523
	1800	310	734	1528
	1800	330	773	1610
	2100	350	888	1778
	2100	370	918	1853
	2100	400	918	1853
	2100	425	855	1917
	2100	450	974	2030
	2100	500	940	2341
ISX	1800	400	1063	2036
	1800	450	1129	2218
	2000	475	1126	2504
	2000	500	1125	2633
	2000	600	1227	3202
KT-1150-C	2100	450	1130	2846
KT-2300-C	2100	900	2400	5956
KT-450	2100	450	1130	2741
KTA-1150-C	2100	600	1400	3526
	2100	525	1410	3499
KTA-2300-C	2100	1200	2900	7304
	2100	1050	2700	6800
KTA-3067-C	2100	1600	3760	9470
	2100	1350	3455	8701
KTA-525	2100	525	1425	3457
KTA-525-FORM				
	1900	525	1200	2911
KTA-600	2100	600	1400	3396
KTTA-19-C		650		900
KTTA-38-C		1350		900
KTTA-50-C		2000		900

Engine Model	RPM	HP	-- Exhaust --	
			Intake Temp. (°F)	Flow (CFM)
<b>CUMMINS CONTINUED</b>				
L10	1700	260	615	1300
	1700	280	640	1407
	1600	310	638	1470
	2100	270	670	1687
	2100	300	659	1660
M11	1600	280	615	1476
	1600	310	670	1390
	1600	350	760	1554
	1600	370	770	1641
	1600	400	840	1801
N-855-C	2100	220	460	1116
	2100	235	460	1116
N-927	1950	240	465	1154
	2100	260	495	1228
	2100	240	495	1228
N14	1800	330	1014	1997
	1800	400	1126	2354
	2100	350	1212	2254
	2100	370	1283	2474
	2100	460	1329	2737
	2100	500	1380	2984
	2100	525	1380	2984
	2100	410	1164	2614
	2100	435	1302	2639
	2100	550	1380	2984
	2100	525	1380	2984
NH-220	2100	212	470	1184
NH-230	2100	220	460	1159
NH-230S	1800	186	460	1159
NH-250-M	2100	240	460	1201
	1800	190	395	1105
	1800	200	395	995
	2100	210	460	1159
NHC-250	2100	240	460	1159
	2300	240	710	1788
NHC-250-D	2100	240	460	1159
NHD-230	2100	220	495	1247
NHF-240	2300	230	505	1272
NHF-265	2300	255	505	1272
NHH-250	2100	240	460	1159
NHHTC-335	2100	335	850	2062
NHTF-295	2300	295	710	1788
NT-335-M	1800	235	625	1632
	1800	265	650	1637
	2100	285	775	2024
	2100	335	800	2089
NT-380-M	2300	380	950	2481
	2000	253	700	1893
	2000	300	750	1889
	2300	320	900	2400
NT-855-C	2100	310	895	2221
	2100	280	860	2086
	2100	250	825	2001
	2100	335	920	2317
	2100	335	900	2267
	2100	280	820	2065
	2100	250	680	1687
	2100	310	835	2103
NTA-370	1950	335	810	1965
	2100	370	950	2305
NTA-400	2100	400	1000	2426
NTA-420	2300	420	1080	2720







Engine Model	RPM	Intake HP	Intake CFM	-- Exhaust --	
				Temp. (°F)	Flow (CFM)
<b>KUBOTA</b>					
D1402-B.....2800.....31.....62	900.....156				
D3200-B.....2400.....66.....123	900.....310				
D600-B.....3600.....16.....35	900.....88				
D850-BW.....3000.....20.....41	900.....103				
DH850-B.....3600.....23.....49	900.....123				
S2800-B.....2600.....58.....116	900.....292				
V1100-B.....3000.....26.....55	900.....139				
V1702-B.....2800.....40.....77	900.....194				
V1902-B.....2800.....42.....83	900.....209				
V4300-B.....2400.....88.....164	900.....413				
VH1100-B.....3600.....31.....66	900.....166				
Z400-B.....3600.....11.....23	900.....58				
Z600-BW.....3200.....14.....29	900.....73				
ZB400-B.....3200.....10.....21	900.....53				
ZB600C-1-B.....3200.....14.....29	900.....73				
ZH600-B.....3600.....16.....33	900.....83				

<b>LISTER</b>					
HL3.....2500.....125.....900.....315					
HL4.....2500.....167.....900.....421					
HL6.....2500.....250.....900.....630					
HLT6.....2100.....300.....900.....756					
HR2.....2200.....73.....900.....184					
HR3.....2200.....110.....900.....277					
HRW2.....2200.....31.....74.....900.....186					
HRW3.....2200.....47.....110.....900.....277					
HRW4.....2200.....62.....146.....900.....368					
HRW6.....2200.....93.....220.....900.....554					
HRWS6.....2000.....102.....200.....900.....504					
LT1.....3600.....8.....24.....900.....60					
LV1.....3600.....9.....28.....900.....71					
LV2.....3600.....18.....55.....900.....139					
ST1.....3000.....10.....31.....900.....78					
TL2.....3000.....27.....74.....900.....186					
TL3.....3000.....40.....111.....900.....280					
TS2.....3000.....22.....61.....900.....154					
TS3.....3000.....33.....91.....900.....229					

<b>LOMBARDINI</b>					
10LD 400-2.....3000.....16.....34.....1000.....92					
10LD 400-2/B1.....3600.....18.....41.....1000.....111					
11LD 535-3.....3000.....33.....74.....1000.....200					
11LD 625-3.....3000.....38.....84.....1000.....227					
3LD 450.....3000.....10.....20.....1000.....54					
3LD 510.....3000.....11.....22.....1000.....59					
3LD 510/L.....2200.....8.....17.....1000.....46					
4LD 640.....3000.....14.....28.....1000.....76					
4LD 640/L.....2200.....10.....22.....1000.....59					
4LD 705.....2600.....15.....27.....1000.....73					
4LD 820.....2600.....18.....32.....1000.....87					
4LD 820/L.....2200.....14.....27.....1000.....73					
5LD 675-2.....3000.....29.....58.....1000.....157					
5LD 675-3.....3000.....44.....87.....1000.....235					
5LD 825-2.....2600.....34.....63.....1000.....170					
5LD 825-2/L.....2200.....27.....53.....1000.....143					
5LD 825-3.....2600.....52.....94.....1000.....254					
5LD 825-3/L.....2200.....40.....80.....1000.....216					
5LD 825-4.....2600.....67.....125.....1000.....338					
5LD 825-4/L.....2200.....54.....106.....1000.....287					
5LD 930-3.....2600.....54.....105.....1000.....284					
5LD 930-4.....2600.....72.....140.....1000.....379					
6LD 260.....3600.....5.....15.....1000.....41					

Engine Model	RPM	Intake HP	Intake CFM	-- Exhaust --	
				Temp. (°F)	Flow (CFM)
<b>LOMBARDINI CONTINUED</b>					
6LD 260/C.....1800.....5.....14.....1000.....38					
6LD 325.....3600.....7.....17.....1000.....46					
6LD 325/C.....1800.....7.....17.....1000.....46					
6LD 360.....3600.....8.....19.....1000.....51					
6LD 360 V.....3600.....8.....19.....1000.....51					
6LD 400.....3600.....8.....21.....1000.....57					
7LD 665.....3000.....15.....29.....1000.....78					
7LD 665/F.....3000.....15.....29.....1000.....78					
7LD 740/L.....3000.....16.....32.....1000.....87					
8LD 600-2.....3000.....26.....52.....1000.....141					
8LD 665-2.....3000.....29.....58.....1000.....157					
8LD 665-2/L.....2200.....22.....44.....1000.....119					
8LD 740-2.....2600.....29.....52.....1000.....141					
9LD 561-2.....3000.....26.....48.....1000.....130					
9LD 561-2/L.....2200.....18.....37.....1000.....100					

<b>MACK</b>					
E6.....NA.....350.....NA.....750.....1950					
E7.....NA.....300.....NA.....728.....1561					
.....NA.....350.....NA.....742.....1679					
.....NA.....400.....NA.....791.....1934					
.....NA.....427.....NA.....795.....2136					
.....NA.....460.....NA.....814.....2315					
.....NA.....310/330.....NA.....728.....1550					
.....NA.....330/355.....NA.....735.....1653					
.....NA.....355/380.....NA.....736.....1767					
E9.....NA.....500.....NA.....740.....3050					
EN291.....2800.....178.....900.....448					
EN331.....2800.....206.....900.....519					
EN402.....2800.....246.....900.....620					
EN438.....2600.....247.....900.....622					
EN540.....2400.....280.....900.....705					
EN707C.....2100.....306.....900.....771					
END465.....2600.....325.....900.....819					
END475.....2400.....280.....900.....705					
END5673C.....2100.....250.....600.....900.....1511					
END5864.....2300.....270.....850.....900.....2141					
END673E.....2100.....180.....400.....900.....1007					
END707.....2100.....200.....410.....900.....1033					
END864BC.....2450.....540.....900.....1360					
ENDT475.....2400.....460.....900.....1159					
ENDT673.....2100.....225.....600.....900.....1511					
ENDT675.....2100.....237.....625.....900.....1574					
ENDT676.....2100.....800.....900.....2015					
ENDT864A.....2300.....860.....900.....2166					
ENDT865.....2600.....325.....960.....900.....2418					
ENDT866.....2400.....275.....1050.....900.....2644					
ENDTF673.....2300.....665.....900.....1675					
ENDTF673C.....2200.....625.....900.....1574					

<b>MERCEDES-BENZ</b>					
OM314.....2800.....85.....170.....900.....428					
OM346.....2800.....427.....900.....1075					
OM352.....2800.....130.....260.....900.....655					
OM352A.....2800.....168.....336.....900.....846					
OM355.....2000.....200.....327.....900.....824					
OM360.....2500.....190.....308.....900.....776					
OM401.....2500.....195.....340.....900.....856					
OM402.....2500.....260.....340.....900.....856					
OM403.....2500.....325.....463.....900.....1166					
OM404.....2500.....430.....738.....900.....1859					
OM407.....2200.....240.....480.....900.....1209					
OM407A.....2200.....280.....560.....900.....1410					
OM407h.....2200.....240.....480.....900.....1209					

Engine Model	RPM	Intake HP	Intake CFM	-- Exhaust --	
				Temp. (°F)	Flow (CFM)
<b>MERCEDES-BENZ CONTINUED</b>					
OM407hA.....2200.....280.....560.....900.....1410					
OM421.....2300.....216.....432.....900.....1088					
OM422.....2300.....280.....560.....900.....1410					
OM422A.....2300.....330.....660.....900.....1662					
OM422LA.....2300.....375.....750.....900.....1889					
OM423.....2300.....355.....710.....900.....1788					
OM423LA.....2100.....470.....940.....900.....2367					
OM424.....2300.....420.....840.....900.....2116					
OM424A.....2300.....530.....1060.....900.....2670					
OM424LA.....2300.....615.....1230.....900.....3098					
OM616.....3600.....67.....134.....900.....337					
OM617.....3600.....82.....164.....900.....413					
OM636.....3500.....40.....95.....900.....239					

<b>MITSUBISHI</b>					
S12A-PT.....1800.....660.....1620.....900.....4080					
S12A-PTA.....1800.....850.....2080.....900.....5239					
S12A-PTK.....1800.....900.....2190.....900.....5516					
S12N-PT.....1800.....1000.....2440.....900.....6145					
S12N-PTA.....1800.....1130.....2750.....900.....6926					
S12N-PTK.....1800.....1230.....3000.....900.....7556					
S12U-PTA.....1200.....3100.....7910.....900.....19921					
S12U-PTK.....1200.....3300.....8400.....900.....21156					
S16N-PT.....1800.....1320.....3210.....900.....8084					
S16N-PTA.....1800.....1500.....3670.....900.....9243					
S16N-PTK.....1800.....1620.....3960.....900.....9973					
S6A-PT.....1800.....330.....810.....900.....2040					
S6A-PTA.....1800.....425.....1020.....900.....2569					
S6A-PTK.....1800.....450.....1100.....900.....2770					
S6B-PT.....1800.....260.....640.....900.....1612					
S6B-PTA.....1800.....320.....780.....900.....1964					
S6B-PTK.....1800.....360.....880.....900.....2216					
S6N-PT.....1800.....500.....1240.....900.....3123					
S6N-PTA.....1800.....565.....1380.....900.....3476					
S6N-PTK.....1800.....615.....1480.....900.....3727					
S6U-PTA.....1200.....1550.....3960.....900.....9973					
S6U-PTK.....1200.....1650.....4200.....900.....10578					
S8N-PT.....1800.....660.....1620.....900.....4080					
S8N-PTA.....1800.....750.....1840.....900.....4634					
S8N-PTK.....1800.....810.....1980.....900.....4987					

<b>MTU OF NORTH AMERICA</b>					
12V-396-TB-83.....1845.....1560.....3919.....3338					
12V-396-TB-93.....1845.....1200.....4534.....3862					
12V-396-TC-82.....1745.....1300.....2902.....2472					
8V-396-TB-83.....1845.....1050.....2436.....2075					
8V-396-TB-93.....1845.....1800.....2944.....2508					
8V-396-TC-82.....1745.....870.....1864.....1588					

<b>NAVISTAR</b>					
4-196.....3800.....86.....162.....1150.....483					
6.9 L.....3000.....170.....330.....1000.....892					
7.3 LT (T444).....2600.....190.....605.....753.....1359					
7.3 L.....3000.....175.....349.....1000.....944					
9.0 L (DV550).....2800.....185.....410.....1050.....1146					
C-200.....2500.....74.....109.....1150.....325					
C-221.....2600.....90.....124.....1150.....370					
C-263.....2800.....109.....160.....1150.....477					



Engine Model	RPM	HP	-- Exhaust --	
			Intake Temp. (°F)	Flow (CFM)

### TELEDYNE CONTINUED

W2-1235	3600	30	68	58
W2-880	3600	20	44	37
W4-1770	3000	35	72	61
WD1-340	3000	7	18	15
WD1-350	3000	8	20	17
WD1-430	3000	10	24	20
WD1-450	3400	10	26	22
WD1-660	3000	15	38	32
WD1-670	3000	16	40	34
WD1-750	3000	17	43	37
WD2-1000	3000	21	52	44
WD2-860	3000	19	48	41
WI-145	4000	4	8	7
WI-145V	3600	4	8	7
WI-185	3600	5	10	9
WI-185V	3600	5	10	9
WI-340	3600	9	20	17
WI-390	3600	11	22	19
WI-588	3600	16	34	29

### VOLKSWAGON

026.2	2200	70	140	1150	417
068.5	4000	48	90	900	227
068.A	4000	60	120	900	302
075.1	4000	75	145	900	365
126A	2000	45	90	1150	268

### VOLVO

D45BPP	2300	75	195	900	491
TD100G	2000	223	460	900	1159
TD100GPP	2000	223	460	900	1159
TD120HP	2000	286	575	900	1448
TD121G	2000	284	575	900	1448
TD45B	2200	90	235	900	592
TD61A	2500	154	330	900	831
TD61AP	2500	165	350	900	881
TD61AW	2500	162	350	900	881
TD71A	2200	189	360	900	907
TD71AP	2200	192	360	900	907
TD71AW	2400	190	360	900	907
TID100KPP	2000	249	515	900	1297
TID121KP	2000	343	695	900	1750
TID121LP	1800	401	800	900	2015
TID71A	2200	216	380	900	957
TID71AP	2200	209	400	900	1007

Engine Model	RPM	HP	-- Exhaust --	
			Intake Temp. (°F)	Flow (CFM)

### WAUKESHA

190DLC	2800	84	128	109
197DLC	2800	91	208	177
197DLCS	2800	131	320	273
D317D	2400	118	285	243
D317DS	2400	142	340	290
F1197D	1800	258	620	528
F1197DS	1800	400	960	818
F1197DSI	2400	462	1100	937
F1905DS	1200	397	860	733
F1905DSI	2200	514	1015	865
F2896D	1200	415	804	685
F2896DS	1200	695	1032	879
F2896DSI	1200	877	1305	1112
F475D	2400	182	440	375
F475DS	2400	216	520	443
F674D	2200	226	540	460
F674DS	2200	229	550	469
H1077D	2400	346	630	537
H1077DS	2400	522	1080	920
H1077DSI	2400	557	1190	1014
H866DS	2300	384	920	784
L1616D	2400	520	940	801
L1616DS	2400	785	1680	1431
L1616DSI	2400	836	1850	1576
L5100D	1200	830	1420	1210
L5100DS	1200	1232	2170	1849
L5100DSI	1200	1375	2560	2181
L5790D	1200	905	1710	1457
L5790DS	1200	1235	2600	2215
L5790DSI	1200	1754	3080	2624
LRDCS	1200	695	1032	879
NKDC	1200	297	566	482
NKDCS	1200	390	860	733
P2154D	2200	592	1420	1210
P2154DS	2200	1017	2450	2087
P2154DSI	2200	1077	2600	2215
VLRD	1200	905	1710	1457
VLRDS	1200	1235	2600	2215
VRD232	2200	68	160	136
VRD283	2200	76	180	153
VRD310	2400	106	255	217
WAKD	1800	258	530	451
WAKDS	1800	400	810	690

Engine Model	RPM	HP	-- Exhaust --	
			Intake Temp. (°F)	Flow (CFM)

### WHITE ENG

D-2000	2600	70	120	102
D-2300	2400	137	117	117
D-2300T	2400	211	180	180
D-3000	2800	110	193	164
D-3000T	2600	130	280	239
D-3300T	1800	175	149	149
D-3400	2400	210	179	179
D-3400T	2400	333	284	284
D-4800	2400	260	221	221
D-4800T	2400	400	341	341
D-4800TA	2400	400	341	341
D-4800TAH	1800	431	367	367
G-1600	2400	102	87	87
G-2000	2800	84	120	102
G-2300	2400	130	111	111
G-3000	2800	130	181	154
G-3400	2400	210	179	179

### YANMAR

12LAAL-DT	1800	1060	2772	900	6981
3T95LE	2800	51	114	900	287
4HAL	1800	110	260	900	655
4T95LE	2800	68	150	900	378
4T95LTE	2800	85	208	900	524
6HAL	1800	165	390	900	982
6HAL-DT	1800	330	837	900	2108
6HAL-HT	1800	264	692	900	1743
6HAL-T	1800	209	512	900	1289
6LAAL-DT	1800	530	1370	900	3450
6T95LE	2800	102	233	900	587
6T95LTE	2800	128	314	900	791
8LAAL-DT	1800	705	1800	900	4533