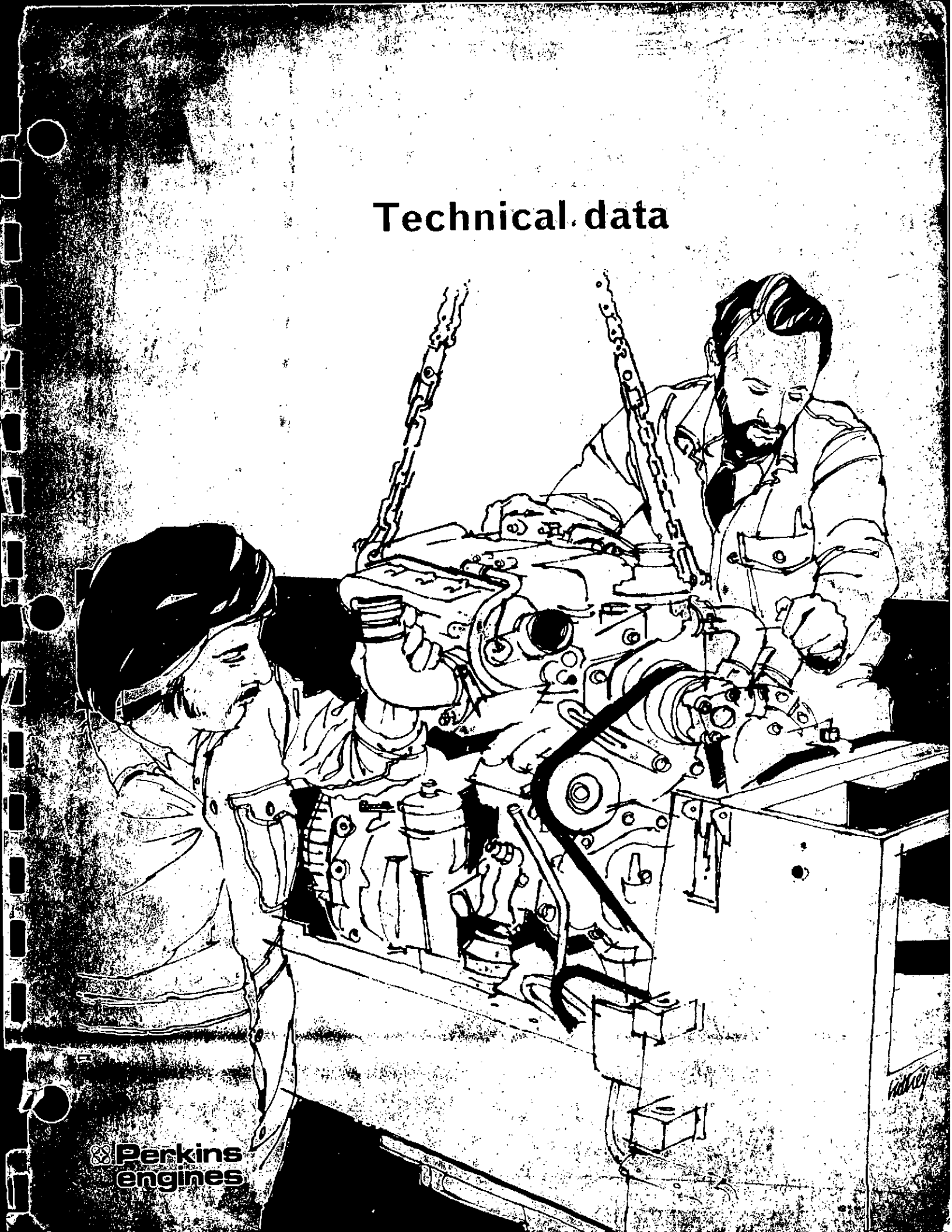
Technical data



Perkins engines

GENERAL INSTALLATION MANUAL

SECTION 16 — TECHNICAL DATA

CONTENTS

16.1 INTRODUCTION

This supplement to the General Installation Manual contains SECTION 16 — TECHNICAL DATA. It is being published separately to enable the contents to be updated regularly in the light of the latest available data, product improvements, etc.

It is envisaged that the supplement will be reissued at intervals of approximately 6 - 12 months.

All information given in this publication is substantially correct at the time of printing but is subject to alteration without notice or obligation.

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16.2. RATING STANDARDS AND CATEGORIES

16.2.1. Rating Standards

Gross and net ratings quoted by Perkins are normally to the following standards : –

		Gross Ratings			DIN Net Ratings	
		BS	SAE	Constant Speed	Vehicle	Industrial
		BS AU 141a: 1971	SAE J270 1 3.4	BS649 : 1958	DIN 70020	DIN 6270A/B
Total barometric pressure	kN/m²/mm(in)Hg	101,3/760 (29.92)	99,5/746 (29.38)	99,9/749 (29.50)	101,3/760 (29.92)	98,1/736 (29.00)
Vapour pressure	kN/m²/mm(in)Hg		1,3/10 (0.38)	2,0/15 (0.6)		1,3/10 (0.4)
Air inlet temperature	°C (°F)	20 (68)	29.4 (85)	29.4 (85)	20 (68)	20 (68)
Production tolerance	%	± 0, 5	± 0, 5	+ 5, – 0	± 5, 5	± 5, 0

NOTES :

(a) The following conditions also apply, but are not specified in the standards :

Maximum induction restriction

Naturally aspirated engines (measured at inlet to induction manifold) 305 mm (12 in) H_2O

Turbocharged engines (measured at turbocharger intake)

Maximum exhaust back pressure

Naturally aspirated engines (measured within 305 mm (12 in) of exhaust manifold 76 mm (3 in) Hg

Turbocharged engines (measured within 305 mm (12 in) of turbocharger exhaust outlet):

T6.3544 76 mm (3 in) Hg

TV8.640 38 mm (1.5 in) Hg

Fuel temperature (typical)

In-line engines { CAV - DPA fuel pump (measured at pump cambox) 54°C (130°F)
Bosch fuel pump (measured at outlet from pump) 55°C (131°F)

V8 engines with in-line pumps (measured at inlet to fuel pump) 35°C (95°F)

V8 engines with rotary pumps (measured at outlet from fuel pump) 55°C (131°F)

(b) SAE J270 does not define a production tolerance band. Perkins use +0/–5% to keep SAE J270 ratings in line as far as possible with BS Au 141a : 1971.

(c) Engines certified to BS Au 141a : 1971 comply with the strict smoke limit which is an inherent part of the standard.

(d) Both BS Au 141a : 1971 and SAE J270 define installed (or net) power output in addition to gross. Perkins quote gross outputs in preference to installed as fan power losses differ from one application to another.

16.2.2. Rating Categories

The basic Perkins engine rating categories are :

AU Automotive Rating

GR General Agricultural and Industrial Rating

HD Heavy Duty Agricultural and Industrial Rating

CS Constant Speed Rating.

The following abbreviations are also in current use : –

CH Combine Harvester Rating only.

MH Material Handling Rating only.

16.3. COLD STARTING

16.3.1. Cold Starting Performance

The coldest temperature at which an engine can be started depends upon the power and stamina of the batteries, the performance of the starter motor, the viscosity of the lubricating oil, the inertia of the flywheel, and whether or not a cold starting aid is used. Improvements in cold starting may be obtained by :

- Using oil of a lower viscosity.
- Increasing the cranking speed by fitting more powerful starter motors and larger batteries.
- Fitting a larger inertia flywheel.
- Fitting a starting aid (ether aids giving a lower starting temperature than the 'Thermostart').

The following temperatures are given as a guide to the cold starting requirements of different geographical locations :—

EUROPE (temperate)	−15°C (+5°F)
EUROPE (cold)	−21°C (−5°F)
SCANDINAVIA and AMERICA	−29°C (−20°F)
UNITED KINGDOM	−9°C (+15°F)

The following tables give the lowest temperature at which particular combinations of battery, starter motor, oil viscosity etc., will start the range of engines. The temperatures achieved are for engines fitted to manual gearboxes (with the clutch depressed if this gives an increase in cranking speed). Torque converter transmissions and certain designs of power take-off worsen cold starting performance by approximately 8°F (4°C).

Key to symbols in table :

STARTING AIDS :

U Unaided

T "Thermostart"

E Ether

X Excess fuel

OIL VISCOSITY : 5W SAE 5W
10W SAE 10W
20W SAE 20W

BATTERIES (Minimum performance)

Type	SAE 300 Amp discharge at 0°F (−18°C)		IEC 3 minute discharge at 0°F (−18°C)	
	5 sec Voltage	Minutes to 1 Volt/cell	5 sec Voltage	Amperes to 1 Volt/cell
A	9.00	5.0	8.50	385
B	9.50	7.0	8.00	520

STARTER MOTORS*

M45	Lucas M45, 12V
M50	Lucas M50, 12V
C12	CAV CA45F12, 12V
C24	CAV CA45F24, 24V
M127	Lucas M127, 24V
40MT	Delco Remy 40MT, 12V

*Equivalent starter motors :—

(Note : "Equivalent" means, in this context, giving the same cold starting performance. The motors are not necessarily physically interchangeable).

Lucas M45, 12V	Bosch EJD3 Delco Remy 20MT, 600 amp (curve no. C3534).
Lucas M50, 12V	CAV CA45F12 Bosch JD4 Delco Remy 20MT, 750 amp (curve no. C3553)
CAV CA45F12, 12V	Lucas M50 Bosch JD4 Delco Remy 20MT, 750 amp (curve no. C3553).
CAV CA45F24, 24V	Lucas M127

COLD STARTING DATA

ENGINE TYPE		4.108[a]				D3.152[a]				4.165[b]				4.203				D4.203[a]				4.236				6.247[e]			
FLYWHEEL (mk²) lb in² INERTIA (GD²) Kgm²		600 0,702				3000 3,512				890 1,042				3000 3,512				3000 3,512				2350 2,751				1350[f] 1,580[f]			
MINIMUM STARTING TEMPERATURE		STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR
°F	°C																												
35	2																												
32	0									U	10W	B	M50																
30	− 1																					U	10W	A	M45				
28	− 2																												
25	− 4																					U U U U	10W 10W 10W 10W	2B(S) B B B	C24 M45 M50 C12				
23	− 5																									U	20W	2A(P)	M50
21	− 6																									U	10W	2A(P)	M50
20	− 7													T	20W	A	M45	U U	20W 10W	A A	M45 M45	T U	10W 10W	A B	M45[d] C12[d]				
15	− 9	T	20W	A	M45	U	20W	A	M45					T	10W	A	M45[c]	U	10W	B	M45	T T T T	10W 10W 10W 10W	B A A 2A(S)	M45 M50 C12 C24				
10	−12					U	10W	A	M45									U T	10W 20W	B A	M50 M45	T T T	10W 10W 10W	B B 2B(S)	M50 C12 C24				
5	−15	T	10W	A	M45	T	10W	A	M45					T	10W	B	M45	U T T	5W 10W 10W	B A B	M50 M45 M45	T T	10W 10W	B B	M50[d] C12[d]	T	10W	B	M50
3	−16																												
0	−18	T T	10W 10W	A B	M50 M45					T	10W	B	M50					T	10W	B	M50	E	10W	2B(S)	C24	T	10W	2A(P)	M50
− 4	−20									T	5W	B	M50																
− 5	−21	T T E	5W 5W 10W	A B A	M50 M45 M45	T T T	5W 10W 10W	A A A	M45 M50 C12					T T	5W 5W	B B	M50 C12	T	5W	B	M50	E T E	10W 5W 10W	B B B	M50[d] C12[d] C12[d]				
− 8	−22																					E	5W	2B(S)	C24				
−10	−23					E E E	5W 5W 5W	B A A	M45 M50 C12					E E	5W 5W	B B	M50 C12	E	5W	B	M50	E E	5W 5W	B B	M50[d] C12[d]				
−15	−26	E	5W	B	M45	E E	5W 5W	B B	M50 C12																				
−20	−29	E	5W	A	M50					E	5W	2A(P)	M50													E	5W	2A(P)	M50

NOTES :

a On some agricultural applications, starting performance given is subject to the availability of a back-end arrangement that will suit the Lucas M50 starter motor.

b Provisional figures only.

c Flywheel inertia 1800 lb in² (mk²), 2107 Kgm² (GD²).

d Flywheel inertia 3500 lb in² (mk²), 4097 Kgm² (GD²).

e The maximum acceptable total inertia figure for the flywheel and starter ring gear assembly and clutch assembly is [illegible] lb in² (mk²), 1,990 Kgm² (GD²), which must NOT be exceeded.

f Includes the starter ring gear inertia.

(P) Batteries connected in parallel.

(S) Batteries connected in series.

COLD STARTING DATA

ENGINE TYPE		4.248				4.318				6.3544				T6.3544				V8.540				V8.640[b]				TV8.640[b]			
FLYWHEEL (MK²) lb.in² INERTIA (GD²) Kgm²		3000 3,512				3000 3,512				2200 2,575				Not yet finalised				2360 2,762				3450 4,039				3450 4,039			
MINIMUM STARTING TEMPERATURE		STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR	STARTING AID	OIL VISCOSITY	BATTERY	STARTER MOTOR
°F	°C																												
35	2																	U	20W	2A(P)	40MT								
32	0																												
30	− 1																												
28	− 2																									X	20W	2B(S)	M127
																										X	20W	2A(P)	40MT
25	− 4	U	10W	B	M45																								
23	− 5																					X	20W	2B(S)	M127				
																						X	20W	2A(P)	40MT				
21	− 6																												
20	− 7					U	20W	2B(P)	M50																				
15	− 9																	X	10W	2B(S)	M127								
																		X	10W	2A(P)	40MT								
																		X	10W	B	C12								
10	−12	T	10W	B	M45																								
		T	10W	A	M50	T	10W	2B(P)	M50																				
		T	10W	A	C12																								
5	−15	T	10W	B	M50																								
		T	10W	B	C12																								
3	−16																									XT	10W	2B(S)	M127
																										XT	10W	2A(P)	40MT
0	−18																												
4	−20																					XT	10W	2B(S)	M127				
																						XT	10W	2A(P)	40MT				
− 5	−21	T	5W	B	M50													XT	10W	2B(S)	M127								
		T	5W	B	C12													XT	10W	2A(P)	40MT								
− 8	−22	E	5W	B	M50																								
		E	5W	B	C12																								
−10	−23					E	5W	2B(P)	M50									XE	10W	2A(P)	40MT	XE	5W	2B(S)	M127	XE	5W	2B(S)	M127
																						XE	5W	2A(P)	40MT	XE	5W	2A(P)	40MT
−15	−26																									XE	5W	2B(S)	M127
																										XE	5W	2B(P)	40MT
−20	−29																	XE	5W	2B(S)	M127	XE	5W	2B(S)	M127				
																		XE	5W	2B(P)	40MT	XE	5W	2B (P)	40MT				

DATA NOT YET AVAILABLE FOR PUBLICATION.

FOR FURTHER INFORMATION REFER TO PERKINS GROUP APPLICATIONS ENGINEERING DEPARTMENT, PETERBOROUGH

NOTES :
b Provisional figures only.
(P) Batteries connected in parallel.
(S) Batteries connected in series.

16.3.2. Starter Pinion to Flywheel Ring Gear Speed Ratio

As a guide, the ranges of ratios recommended for particular engine types are as follows :—

Engine type	*Range of ratios*
4.108	7 — 9 : 1
D3.152	11.5 — 12.5 : 1
4.165	8.5 — 9.5 : 1
4.203 D4.203	11.5 — 12.5 : 1
4.236 4.248	12 — 13 : 1
6.247	11 — 13 : 1
4.318	10 — 12 : 1
6.3544 T6.3544 6.3724	12 — 13 : 1
V8.540	12 — 13 : 1
V8.640 TV8.640	11 — 12 : 1

16.4 COOLING SYSTEMS

16.4.1. Coolant Capacity (engine only)

Coolant capacities of the various engine types are as follows :—

Coolant Capacity	Engine Type				
	4.108	D3.152	4.165	4.203 D4.203	4.236 4.248
UK pt	6.0	8.5	11.0	10.5	16.5
US qt	3.6	5.1	6.6	6.3	9.9
litre	3,4	4,8	6,25	6,0	9,4

Coolant Capacity	6.247	4.318	6.3544 T6.3544 6.3724	V8.540	V8.640 TV8.640
UK pt	21.6	16.6	24.6	40.0	50.0
US qt	12.9	10.0	14.8	24.0	30.0
litre	12,25	9,5	14,0	22,7	28,4

16.4.2. Full Load Heat Rejection to Coolant

Total heat rejection to coolant is tabulated for the principal ratings under full load conditions at various speeds. Where water-type oil coolers are fitted the heat rejected by the lubricant is included in the total heat rejection figure.

For information on ratings not shown, reference should be made to Perkins Group Applications Engineering Department.

Key to Rating Categories :

AU Automotive Rating.
GR General Agricultural and Industrial Rating.
HD Heavy Duty Agricultural and Industrial Rating.
CS Constant Speed Rating.
CH Combine Harvester Rating only.
MH Material Handling Rating only.

Engine Type	Rating		Full load heat to coolant	Engine speed, rev/min									
	Category	Max. rating bhp at rev/min		1000	1500	2000	2250	2500	2600	2800	3000	3600	4000
4.108	AU	49/4000	BTU/min	700	1000	1250	1400	1540	1600	1720	1850	2300	2600
			kW	12,3	17,6	22,0	24,6	27,1	28,1	30,2	32,5	40,4	45,7
	GR	45/3000	BTU/min	700	1000	1250	1400	1540	1600	1720	1850	–	–
	CS	41.5/3000	kW	12,3	17,6	22,0	24,6	27,1	28,1	30,2	32,5	–	–
D3.152	GR	49/2500	BTU/min	630	850	1090	1200	1310	–	–	–	–	–
	CS	43/2250	kW	11,0	14,9	19,1	21,1	23,0	–	–	–	–	–
	HD	47/2250	BTU/min	650	880	1110	1200	–	–	–	–	–	–
			kW	11,4	15,5	19,5	21,1	–	–	–	–	–	–
4.165	AU*	70/3600	BTU/min	–	1239	1683	–	2200	–	–	2710	3360	–
			kW	–	21,8	29,6	–	38,5	–	–	47,5	59,0	–
	GR	62/3000	BTU/min	–	1250	1683	–	2133	–	–	2587	–	–
	CS	57/3000	kW	–	22,0	29,6	–	37,5	–	–	45,5	–	–
4.203	GR	61/2400	BTU/min	1200	1800	2220	2360	2420[a]	–	–	–	–	–
			kW	21,0	31,5	39,0	41,5	42,5	–	–	–	–	–
	MH	65/2600	BTU/min	1100	1620	2140	2330	2440	2520	–	–	–	–
			kW	19,3	28,5	37,6	41,0	42,9	44,3	–	–	–	–
				1000	1500	2000	2250	2500	2600	2800	3000	3600	4000
D4.203	GR	65/2300	BTU/min	880	1250	1560	1730	1750[b]	–	–	–	–	–
			kW	15,5	22,0	27,4	30,4	30,8	–	–	–	–	–
	HD	61/2100	BTU/min	880	1250	1560	1730	–	–	–	–	–	–
			kW	15,5	22,0	27,4	30,4	–	–	–	–	–	–
4.236	AU	82/2800	BTU/min	1140	1440	1720	1860	2010	2080	2200	–	–	–
			kW	20,0	25,3	30,2	32,7	35,3	36,6	38,7	–	–	–
	GR	81/2600	BTU/min	1080	1550	1960	2130	2290	2340	–	–	–	–
	CS	70/2250	kW	19,0	27,3	34,5	37,5	40,3	41,1	–	–	–	–
	HD	69/2200	BTU/min	1055	1560	1880	1940[c]	–	–	–	–	–	–
			kW	18,5	27,3	33,0	34,0	–	–	–	–	–	–
	HD	65/2200	BTU/min	970	1450	1770	1825[c]	–	–	–	–	–	–
			kW	17,0	25,5	31,0	32,0	–	–	–	–	–	–
6.247	AU*	101/3600	BTU/min	–	1970	2700	–	3470	–	–	4275	5250	–
			kW	–	34,5	47,3	–	60,8	–	–	75,0	92,3	–

Notes:

* Engine fitted with water-type oil cooler a Rated speed 2400 rev/min b Rated speed 2300 rev/min

c Rated speed 2200 rev/min d Charge cooled

Engine Type	Rating Category	Max. rating bhp at rev/min	Full load heat to coolant	Engine speed, rev/min 1000	1500	2000	2250	2500	2600	2800	3000	3600	4000
4.248	GR	84/2500	BTU/min	1100	1580	2030	2250	2460	–	–	–	–	–
			kW	19,3	27,8	35,7	39,6	43,3	–	–	–	–	–
	HD	78.5/2200	BTU/min	1170	1710	2820	2880[c]	–	–	–	–	–	–
			kW	20,5	30,0	49,5	50,5	–	–	–	–	–	–
4.318	GR	96/2200	BTU/min	1400	1965	2400	2600[c]	–	–	–	–	–	–
			kW	24,5	34,5	42,0	45,5	–	–	–	–	–	–
	HD	88/2000	BTU/min	1370	1940	2310	–	–	–	–	–	–	–
			kW	24,0	34,0	40,5	–	–	–	–	–	–	–

Notes:

* Engine fitted with water-type oil cooler a Rated speed 2400 rev/min b Rated speed 2300 rev/min

c Rated speed 2200 rev/min d Charge cooled

Engine Type	Rating		Full load heat to coolant	Engine speed, rev/min								
	Category	Max. rating bhp at rev/min		1000	1500	2000	2200	2250	2400	2500	2600	2800
6.3544 Standard	Without oil cooler :											
	AU	108/2800	BTU/min	1410	1830	2310	–	–	2830	–	–	3085
			kW	24,7	32,1	40,5	–	–	47,0	–	–	54,1
	GR	116/2600	BTU/min	1700	2270	2790	3000	3055	3195	3295	3400	–
	CS	98/2250	kW	29,8	39,8	48,9	52,6	53,5	56,0	57,7	59,6	–
	With water-type oil cooler :											
	AU*	108/2800	BTU/min	1410	1875	2460	–	–	2930	–	–	3455
			kW	24,7	32,9	43,2	–	–	51,4	–	–	60,6
	GR*	116/2600	BTU/min	1700	2320	2960	3220	3285	3465	3590	3720	–
	CS*	98/2250	kW	29,8	40,7	51,9	56,5	57,6	60,8	63,0	65,3	–
6.3544 Premium	Without oil cooler :											
	AU	124/2800	BTU/min	1460	1895	2370	2600	2655	2800	2880	3000	3145
			kW	25,6	33,2	41,5	45,5	46,5	49,1	50,5	52,5	55,1
	GR	122/2600	BTU/min	1600	2070	2595	2740	2835	2965	3045	3160	–
	CS	103/2250	kW	27,9	36,9	45,2	48,7	49,5	51,9	53,4	55,3	–
	HD	112/2250	BTU/min	1600	2070	2595	2740	2835	–	–	–	–
			kW	27,9	36,9	45,2	48,7	49,5	–	–	–	–
	With water-type oil cooler :											
	AU*	124/2800	BTU/min	1460	1925	2510	–	–	3040	–	–	3500
			kW	25,6	33,8	44,0	–	–	53,3	–	–	61,4
	GR*	122/2600	BTU/min	1590	2145	2735	2980	3040	3215	3330	3460	–
	CS*	103/2250	kW	27,9	37,6	48,0	52,3	53,3	56,4	58,4	60,7	–
	HD*	112/2250	BTU/min	1590	2145	2735	2980	3040	–	–	–	–
			kW	27,9	37,6	48,0	52,3	53,3	–	–	–	–
T6.3544	AU[d]*	155/2600	BTU/min	2170	3085	3825	4090	4185	4395	4530	4665	–
			kW	38,0	54,0	67,0	71,6	73,3	77,0	79,3	81,7	–
	GR*	145/2600	BTU/min	2530	3525	4335	4585	4660	4880	5055	5230	–
	CS*	129/2250	kW	44,3	61,7	75,9	80,3	81,6	85,4	88,5	91,6	–
	HD*	128/2250	BTU/min	2535	3085	4125	4335	4425	–	–	–	–
			kW	44,4	54,0	72,2	75,9	77,5	–	–	–	–
6.3724	Without oil cooler :											
	CH	121/2500	BTU/min	–	–	–	3080	–	3280	3365	–	–
			kW	–	–	–	54,0	–	57,5	59,0	–	–
	With water-type oil cooler :											
	CH*	121/2500	BTU/min	–	–	–	3300	–	3550	3665	–	–
			kW	–	–	–	57,9	–	62,3	64,3	–	–

Notes:

* Engine fitted with water-type oil cooler a Rated speed 2400 rev/min b Rated speed 2300 rev/min

c Rated speed 2200 rev/min d Charge cooled

Engine Type	Rating		Full load heat to coolant	Engine speed, rev/min								
	Category	Max. rating bhp at rev/min		1000	1500	2000	2200	2250	2400	2500	2600	2800
V8.540	AU*/GR*	180/2600	BTU/min	3060	4020	4800	—	5150	—	5500	5600	—
	CS*	154/2250	kW	53,8	70,7	84,4	—	90,6	—	96,7	98,5	—
	HD*	154/2400	BTU/min	3060	3415	4270	—	4480	4650	—	—	—
			kW	53,8	60,1	75,1	—	78,8	81,8	—	—	—
	CH*	192/2600	BTU/min	—	—	—	—	5450	5700	5875	5970	—
			kW	—	—	—	—	95,0	100	103	105	—
V8.640	AU*/GR*	215/2600	BTU/min	3700	4700	6100	—	6670	—	7020	7270	—
	CS*	182/2250	kW	65,1	83,0	107	—	117	—	123	128	—
	HD*	186/2400	BTU/min	3700	4590	5650	—	6040	6300	—	—	—
			kW	65,1	81,0	100	—	106	111	—	—	—
TV8.640	AU*/GR*	250/2600	BTU/min	3720	4720	6380	—	6920	—	7270	7900	—
	CS*	224/2250	kW	65,4	83,0	112	—	122	—	128	139	—
	AU[d]*	290/2600	BTU/min	3850	4890	7000	—	7520	—	7990	8500	—
			kW	67,7	86,0	123	—	132	—	140	149	—
	HD*	223/2400	BTU/min	3720	4720	6040	—	6400	6700	—	—	—
			kW	65,4	83,0	106	—	113	118	—	—	—

Notes :

* Engine fitted with water-type oil cooler

a Rated speed 2400 rev/min

b Rated speed 2300 rev/min

c Rated speed 2200 rev/min

d Charge cooled

16.4.3. **Water Pump Drive Ratios**

The pulley sizes and water pump drive ratios most commonly used on the Perkins engine range are as follows :—

Engine Type	Effective pulley diameter, ins (mm)		Water pump drive ratio
	Crankshaft	Water Pump	
4.108	5.625 (142,9) 5.625 (142,9) 6.50 (165,1)	4.50 (114,3) 4.00 (101,6) 4.50 (114,3)	1.25 : 1 1.406 : 1 1.44 : 1
D3.152	6.13 (155,7) 7.47 (189,7)	4.19 (106,4) 4.94 (125,5)	1.46 : 1 1.51 : 1
4.165	6.535 (166,0)	4.72 (120,0)	1.38 : 1
4.203	6.75 (171,4) 7.88 (200,1)	4.75 (120,6) 5.56 (141,2)	1.42 : 1 1.42 : 1
D4.203	7.00 (177,8)	4.25 (107,9)	1.65 : 1
4.236	6.34 (161,0) 6.44 (163,6) 7.50 (190,5) 7.50 (190,5)	5.25 (133,3) 5.25 (133,3) 5.75 (146,0) 5.25 (133,3)	1.21 : 1 1.23 : 1 1.30 : 1 1.43 : 1
6.247	6.00 (152,4)	6.00 (152,4)	1 : 1
4.248	7.5 (190,5)	5.75 (146,0)	1.30 : 1
4.318	6.625 (168,3) 6.625 (168,3)	5.125 (130,2) 4.50 (114,3)	1.29 : 1 1.47 : 1
6.3544	7.875 (200,0)	6.69 (169,9)	1.18 : 1
T6.3544	7.875 (200,0)	5.69 (144,5)	1.38 : 1
6.3724	7.875 (200,0)	6.69 (169,9)	1.18 : 1
V8.540	8.25 (209,5) 8.25 (209,5)	6.56 (166,6) 6.31 (160,3)	1.26 : 1 1.30 : 1
V8.640	7.81 (198,5)	7.81 (198,5)	1 : 1*
TV8.640	7.81 (198,5)	7.81 (198,5)	1 : 1

*Note :
Some early engines may have a water pump drive ratio of 1,33 x engine speed.

16.4.4. Radiator Water Flow

The following tables show water flow rates through typical pressurised radiator systems at normal operating temperature and with thermostat(s) fully open.

Engine Type	Water pump drive ratio	Flow Rate	Engine speed, rev/min									
			1000	1500	2000	2250	2500	2600	2800	3000	3600	4000
4.108	1.25 : 1	UK gal/min	4.5	7.1	9.8	11.6	13.3	14.2	15.1	16.0	19.1	21.2
		US gal/min	5.3	8.5	11.7	13.9	16.0	17.0	18.1	19.2	22.9	25.4
		Litre/min	20.5	32.0	44.5	52.5	60.5	64.9	68.5	72.9	87.1	96.8
	1.406 : 1	UK gal/min	5.0	8.0	11.0	13.0	15.0	16.0	17.0	18.0	21.5	23.9
		US gal/min	6.0	9.6	13.2	15.6	18.0	19.2	20.4	21.6	25.8	28.7
		Litre/min	23.0	36.0	50.0	59.0	68.0	73.0	77.0	82.0	98.0	109,0
	1.44 : 1	UK gal/min	5.1	8.2	11.3	13.3	15.4	16.4	17.4	18.4	22.0	24.4
		US gal/min	6.2	9.8	13.5	16.0	18.4	19.7	20.9	22.1	26.4	29.4
		Litre/min	23.6	36.9	51.2	60.4	69.6	74.8	78.9	84.0	100,0	111,0
D3.152	1.46 : 1	UK gal/min	4.8	7.2	9.7	11.1	12.1	—	—	—	—	—
		US gal/min	5.8	8.7	11.6	13.3	14.5	—	—	—	—	—
		Litre/min	22.2	32.8	43.4	50.2	55.0	—	—	—	—	—
	1.51 : 1	UK gal/min	5.0	7.5	10.0	11.5	12.5	—	—	—	—	—
		US gal/min	6.0	9.0	12.0	13.8	15.0	—	—	—	—	—
		Litre/min	23.0	34.0	45.0	52.0	57.0	—	—	—	—	—
4.165	1.38 : 1	UK gal/min	9.2	16.1	21.8	24.4	27.1	28.2	30.4	32.3	38.7	—
		US gal/min	11.1	19.3	26.2	29.3	32.5	33.8	36.5	38.8	46.5	—
		Litre/min	42.0	73.0	99.0	111,0	123,0	128,0	138,0	147,0	176,0	—

Engine Type	Water pump drive ratio	Flow Rate	Engine speed, rev/min									
			1000	1500	2000	2250	2500	2600	2800	3000	3600	4000
4.203	1.42 : 1 (Low position pumps)	UK gal/min	10.3	15.4	20.7	23.3	26.0	26.8	—	—	—	—
		US gal/min	12.4	18.5	24.8	28.0	31.2	32.2	—	—	—	—
		Litre/min	47.0	70.0	94.0	106,0	118,0	122,0	—	—	—	—
	1.42 : 1 (High position pump)	UK gal/min	8.4	12.5	16.7	18.7	20.9	21.8	—	—	—	—
		US gal/min	10.0	15.1	20.1	22.5	25.1	26.2	—	—	—	—
		Litre/min	38.0	57.0	76.0	85.0	95.0	99.0	—	—	—	—
D4.203	1.65 : 1	UK gal/min	11.9	18.0	24.0	27.1	30.1	31.2	—	—	—	—
		US gal/min	14.3	21.7	28.8	32.5	36.2	37.5	—	—	—	—
		Litre/min	54.0	82.0	109.0	123,0	137,0	142,0	—	—	—	—
4.236	1.21 : 1	UK gal/min	10.2	15.2	20.3	23.3	26.2	27.1	29.2	—	—	—
		US gal/min	12.2	18.3	24.4	27.9	31.5	32.5	35.0	—	—	—
		Litre/min	46.5	69.4	92.2	106,0	119,0	123,0	133,0	—	—	—
	1.23 : 1	UK gal/min	10.3	15.5	20.6	23.7	26.7	27.5	29.5	—	—	—
		US gal/min	12.4	18.6	24.8	28.4	32.0	33.0	35.6	—	—	—
		Litre/min	47.3	70.5	93.8	108,0	121,0	125,0	135,0	—	—	—
	1.30 : 1	UK gal/min	10.9	16.4	21.8	25.0	28.2	29.1	31.4	—	—	—
		US gal/min	13.1	19.6	26.2	30.0	33.8	34.9	37.6	—	—	—
		Litre/min	50.0	74.6	99.1	114,0	128,0	132,0	143,0	—	—	—
	1.43 : 1	UK gal/min	12.0	18.0	24.0	27.5	31.0	32.0	34.5	—	—	—
		US gal/min	14.4	21.6	28.8	33.0	37.2	38.4	41.4	—	—	—
		Litre/min	55.0	82.0	109,0	125,0	141,0	145,0	157,0	—	—	—
6.247	1 : 1	UK gal/min	16.5	24.9	38.3	43.1	48.0	49.9	53.9	59.4	73.9	—
		US gal/min	19.8	29.9	46.0	51.8	57.6	60.0	64.7	71.3	88.8	—
		Litre/min	75.0	113.0	174,0	196,0	218,0	227,0	245,0	270,0	336,0	—

Engine Type	Water pump drive ratio	Flow Rate	Engine speed, rev/min									
			1000	1500	2000	2250	2500	2600	2800	3000	3600	4000
4.248	1.30 : 1	UK gal/min	10.9	16.4	21.8	25.0	28.2	—	—	—	—	—
		US gal/min	13.1	19.6	26.2	30.0	33.8	—	—	—	—	—
		Litre/min	50.0	74.6	99.1	114,0	128,0	—	—	—	—	—
4.318	1.29 :1	UK gal/min	5.5	8.2	10.9	—	—	—	—	—	—	—
		US gal/min	6.6	9.8	13.1	—	—	—	—	—	—	—
		Litre/min	24.8	37.2	49.6	—	—	—	—	—	—	—
	1.47 : 1	UK gal/min	6.2	9.3	12.4	—	—	—	—	—	—	—
		US gal/min	7.5	11.2	14.9	—	—	—	—	—	—	—
		Litre/min	28.2	42.3	56.4	—	—	—	—	—	—	—
6.3544 6.3724	1.18 : 1 (High position pump, twin thermostats)	UK gal/min	16.7	24.9	33.2	37.4	41.6	43.3	46.6	—	—	—
		US gal/min	20.1	29.9	39.9	44.9	49.9	52.0	56.0	—	—	—
		Litre/min	76.0	113,0	151,0	170,0	189,0	197,0	212,0	—	—	—
	1.18 : 1 (Low position pump, twin thermostats)	UK gal/min	14.5	22.0	29.6	32.8	36.5	38.1	40.9	—	—	—
		US gal/min	17.4	26.4	35.1	39.4	43.9	45.7	49.1	—	—	—
		Litre/min	66.0	100,0	133,0	149,0	166,0	173,0	186,0	—	—	—
	1.18 : 1 (Low position pump, single thermostat)	UK gal/min	12.1	18.3	24.4	27.3	30.4	31.7	34.1	—	—	—
		US gal/min	14.5	21.9	29.3	32.8	36.5	38.0	41.0	—	—	—
		Litre/min	55.0	83.0	111,0	124,0	138,0	144,0	155,0	—	—	—
T6.3544	1.38 : 1 (High position pump, twin thermostats)	UK gal/min	19.8	29.5	39.4	44.4	49.3	51.3	55.2	—	—	—
		US gal/min	23.8	35.4	47.3	53.4	59.2	61.6	66.3	—	—	—
		Litre/min	90.0	134,0	179,0	202,0	224,0	233,0	251,0	—	—	—
	1.38 : 1 (Low position pump, twin thermostats)	UK gal/min	17.2	26.0	34.5	38.7	43.1	44.9	48.4	—	—	—
		US gal/min	20.6	31.2	41.5	46.5	51.8	53.9	58.1	—	—	—
		Litre/min	78.0	118,0	157,0	176,0	196,0	204,0	220,0	—	—	—
V8.540	1.26 : 1	UK gal/min	18.4	28.1	37.3	42.2	46.5	48.5	—	—	—	—
		US gal/min	22.1	33.7	44.8	50.6	55.8	58.2	—	—	—	—
		Litre/min	83.4	128,0	170,0	192,0	211,0	220,0	—	—	—	—
	1.30 : 1	UK gal/min	19.0	29.0	38.5	43.5	48.0	50.0	—	—	—	—
		US gal/min	22.8	34.8	46.2	52.2	57.6	60.0	—	—	—	—
		Litre/min	86.0	132,0	175,0	198,0	218,0	227,0	—	—	—	—
V8.640 TV8.640	1 : 1	UK gal/min	28.4	42.7	57.0	64.0	71.1	73.9	—	—	—	—
		US gal/min	34.1	51.3	68.4	76.9	85.3	88.8	—	—	—	—
		Litre/min	129	194,0	259,0	291,0	323,0	336,0	—	—	—	—

16.4.5. **Cooling Fans** Details of the fans commonly used on the Perkins engine range are as follows :—

Diameter ins (mm)	Perkins Part No.	Crank or water-pump mounted ("C" or "W")	Pusher or Puller Type	No. of blades	Blade width ins (mm)	Blade pitch angle	Perkins performance Curve No.	Principal engine application
12 (305)	31257008	W	Puller	8	2.25 (57)	30°	2172/A	4.108
13 (330)	31257007	W	Puller	8	2.25 (57)	30°	2561/A	4.108
14 (356)	31257022	W	Puller	6	4.25 (108)	30°	1741/A	4.108
14 (356)	31257024	W	Pusher	6	4.25 (108)	30°	1741/A	4.108
14 (356)	31257136	W	Pusher	6	4.25 (108)	30°	2633/A	4.108
14 (356)	31257137	W	Puller	6	4.25 (108)	30°	2633/A	4.108, D3.152
14 (356)	31257144	W	Puller	5	2.625 (67)	40°	2753	4.108
15 (381)	31257017	W	Pusher	6	4.25 (108)	30°	2641	4.108, D3.152, 4.165, 4.203
15 (381)	31257021	W	Puller	6	4.25 (108)	30°	2641	4.108, D3.152, 4.165
15 (381)	31257033	W	Pusher	6	3.25 (82)	30°	2163/A	4.108, D3.152
15 (381)	31257034	W	Puller	6	3.25 (82)	30°	2163/A	4.108, D3.152
16 (406)	31257023	W	Puller	6	4.25 (108)	30°	1743/A	D3.152, 4.165, 4.203
16 (406)	31257025	W	Pusher	6	4.25 (108)	30°	1743/A	D3.152, 4.165
16 (406)	31257032	W	Puller	6	3.25 (82)	30°	2176/A	D4.203
16 (406)	31257429	W	Puller	6	2.875 (73)	39° 30'	2744	4.236
16.5 (419)	31257431	W	Pusher	6	2.875 (73)	39° 30'	2650	4.236
17 (432)	31257002	W	Puller	6	3.25 (82)	30°	1698/B	4.203, 4.236, 4.248
17 (432)	31257003	W	Pusher	6	3.25 (82)	30°	1698/B	4.203, 4.236
17 (432)	31257038	W	Pusher	6	4.25 (108)	30°	2177/A	4.203, 4.236
17 (432)	31257051	W	Puller	6	3.25 (82)	30°	1698/B	4.236, 4.248
17 (432)	31257052	W	Puller	6	4.25 (108)	30°	2177/A	4.236, 4.248
17 (432)	31257141	W	Puller	6	4.25 (108)	36°	2558/A	D3.152, D4.203
17 (432)	31258427	W	Puller	6	2.875 (73)	39° 30'	2179/A	4.236, 6.247, 4.248
18 (457)	31258115	W	Puller	6	3.25 (82)	30°	2560/A	4.236, 4.248
18 (457)	31258117	W	Puller	6	4.25 (108)	30°	2184/A	4.236, 4.248
18 (457)	31258121	W	Pusher	6	3.25 (82)	30°	2560/A	4.203, 4.236
18 (457)	31258148	W	Pusher	6	4.25 (108)	30°	2184/A	4.236, 4.248
18 (457)	31258176	W	Puller	6	3.75 (95)	40°	2743	6.247
18 (457)	31258189	W	Pusher	6	3.25 (82)	30°	2560/A	4.203, 4.236, 4.248, 4.318
19 (483)	31258147	W	Puller	6	3.25 (82)	30°	2557/A	4.236, 4.248
19 (483)	31258151	W	Pusher	6	4.25 (108)	30°	2185/A	4.236, 4.248
19 (483)	31258184	W	Puller	6	4.25 (108)	30°	2185/A	4.236, 4.248
19 (483)	31258196	W	Puller	6	4.25 (108)	30°	2185/A	6.3544, T6.3544, 6.3724
19 (483)	31258199	W	Pusher	6	4.25 (108)	30°	2185/A	6.3544, T6.3544

Diameter ins (mm)	Perkins Part No.	Crank or water-pump mounted ("C" or "W")	Pusher or Puller Type	No. of blades	Blade width ins (mm)	Blade pitch angle	Perkins performance Curve No.	Principal engine application
20 (508)	31258116	W	Puller	6	3.25 (82)	30°	1061/D	4.236, 4.248, V8.540
20 (508)	31258118	W	Puller	6	4.25 (108)	30°	1666/C	4.236, 4.248
20 (508)	31258122	W	Pusher	6	3.25 (82)	30°	1061/D	4.236, 4.248
20 (508)	31258137	C	Puller	6	3.25 (82)	30°	1061/D	6.3544
20 (508)	31258139	W	Pusher	6	4.25 (108)	30°	1666/C	4.236, 4.248
20 (508)	31258143	C	Puller	6	4.25 (108)	39°	2181/B	V8.540
20 (508)	31258153	W	Pusher	6	4.25 (108)	30°	2187/A	6.3544, T6.3544, V8.540
20 (508)	31258161	W	Puller	6	4.25 (108)	30°	2187/A	6.3544, T6.3544, V8.540
20 (508)	31258204	C	Puller	8	4.25 (108)	36°	3200	T6.3544
20 (508)	31258206	W	Pusher	6	3.25 (82)	30°	2187/A	6.3544, T6.3544
20 (508)	31258207	W	Puller	6	3.25 (82)	30°	2187/A	6.3544, T6.3544, 6.3724
20 (508)	31258208	W	Puller	6	3.25 (82)	30°	2757	6.3544, T6.3544, 6.3724
21 (533)	31258181	C	Puller	6	4.25 (108)	39°	2186/A	V8.540
22 (559)	31258155	W	Pusher	6	4.25 (108)	30°	2188/A	6.3544, T6.3544, V8.540
22 (559)	31258163	W	Puller	6	4.25 (108)	30°	2188/A	6.3544, T6.3544, V8.540, V8.640
22 (559)	31258173	C	Puller	6	4.25 (108)	39°	2190/A	V8.540, V8.640, TV8.640,
22 (559)	31258192	W	Pusher	6	4.25 (108)	30°	2188/A	6.3544, T6.3544, V8.540,
22 (559)	31258203	W	Puller	6	4.25 (108)	30°	2188/A	6.3544, T6.3544 6.3724, V8.540
24 (610)	31258146	W	Pusher	8	4.25 (108)	27° 30'	2740	T6.3544, V8.540, V8.640
24 (610)	31258165	W	Puller	6	4.25 (108)	30°	2434/A	V8.540, V8.640
24 (610)	31258172	W	Puller	8	3.25 (82)	27° 30'	2740	V8.540, V8.640
24 (610)	31258211	W	Pusher	6	3.25 (82)	30°	2434/A	6.3544, T6.3544
25 (635)	31258191	W	Puller	6	5.0 (127)	40°	2755	V8.540, V8.640
26 (660)	31258193	C	Puller	8	4.25 (108)	27° 30'	2760	V8.540, V8.640, TV8.640
26 (660)	31258197	W	Pusher	6	4.25 (108)	26°	2759	6.3544, T6.3544, V8.540, V8.640, TV8.640
26 (660)	31258198	W	Puller	6	4.25 (108)	26°	2759	6.3544, T6.3544, V8.540, V8.640, TV8.640

Fan performance

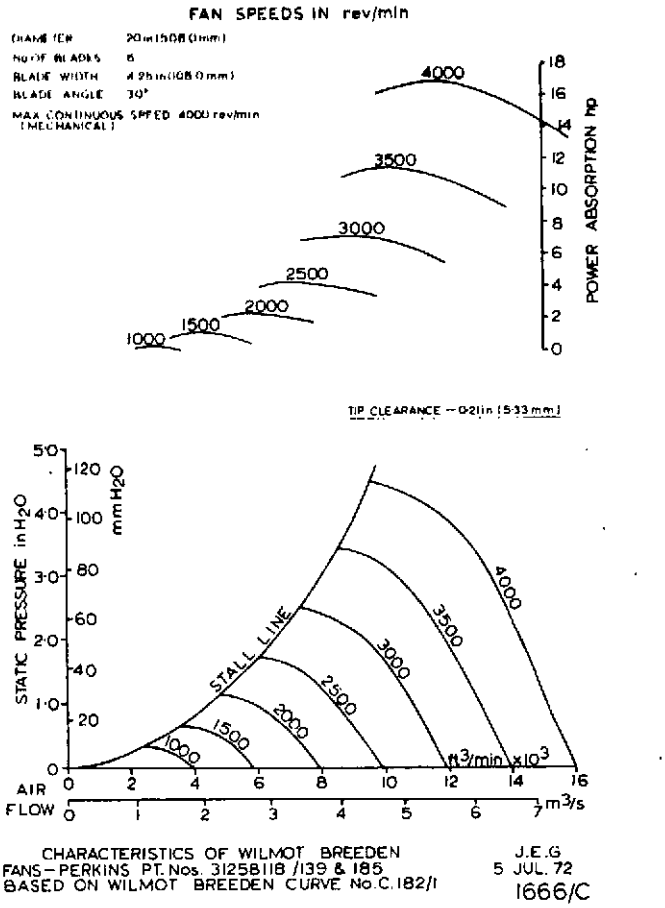
The performance characteristics of the cooling fans listed above, i.e. air flow, pressure and power absorption characteristics, are illustrated by the curves shown on the following pages. These are identified in the bottom right-hand corner by the Perkins curve number, as listed above, and are arranged in numerical order.

NOTE :

1. These performance curves are based on fan manufacturers' published data, which relates to test results obtained with the fan operating in a tunnel or duct, with relatively low tip clearance. In the working conditions which will apply in service, fan performance is likely to be significantly lower than indicated by the curves. In order to allow for this the air flow requirement, as derived from the radiation heat dissipation characteristics, should be increased by 15 to 20% before application to the fan performance curves.

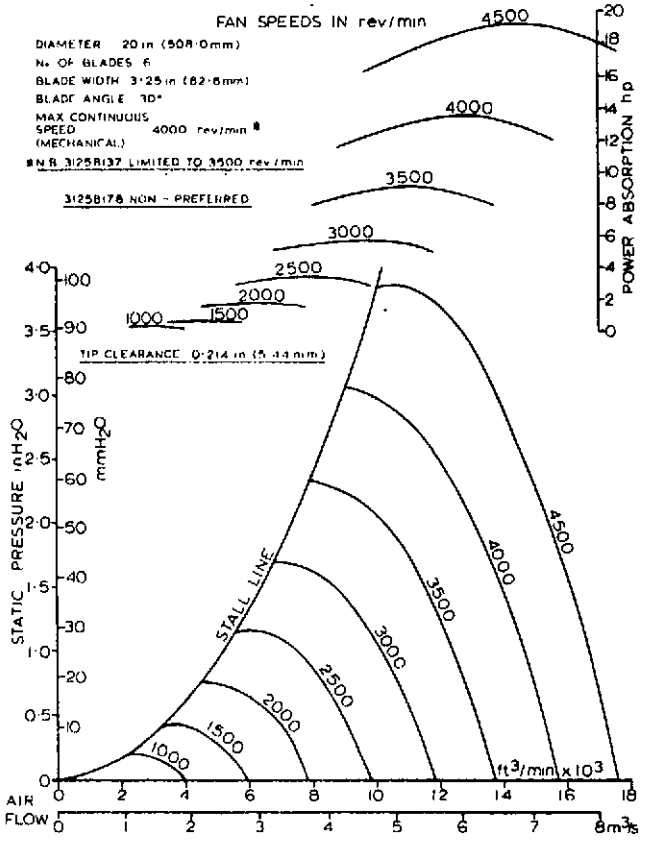
2. For a given installation the fan : engine drive speed ratio must be taken into account in determining specific fan performance characteristics.

Fan performance curves



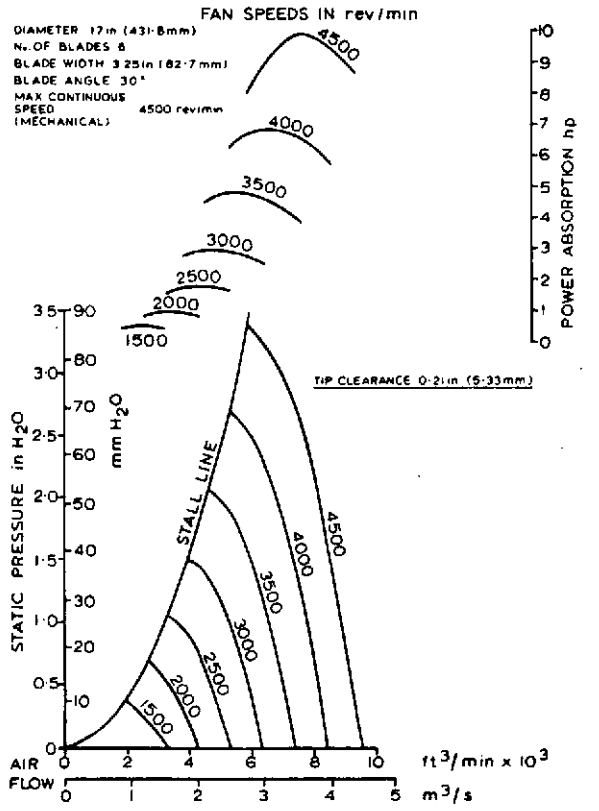
CHARACTERISTICS OF WILMOT BREEDEN FANS—PERKINS PT. Nos. 31258118 /139 & 185 BASED ON WILMOT BREEDEN CURVE No.C.182/1

J.E.G 5 JUL. 72 1666/C



CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT Nos 31258116,122 ,137, 178. BASED ON WILMOT BREEDEN CURVE No. C 214/2

J E G 12 AUG 72 1061/D

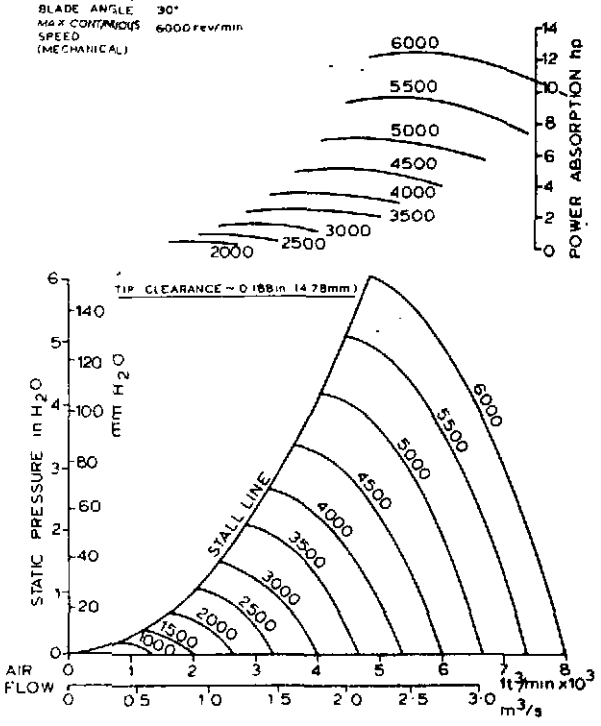


CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT. Nos. 31257001/2/3/6/45&51 BASED ON WILMOT BREEDEN CURVE No. C219. (2 SHEETS)

J.E.G 22 OCT. 71. 1698/B

FAN SPEEDS IN rev/min

DIAMETER 14in (355·6mm)
No OF BLADES 6
BLADE WIDTH 4·25in (108·0mm)
BLADE ANGLE 30°
MAX CONTINUOUS SPEED (MECHANICAL) 6000 rev/min

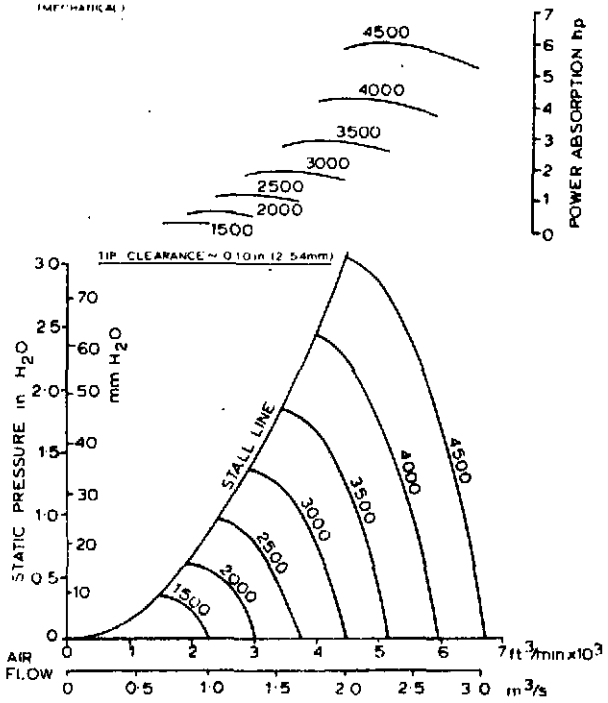


CHARACTERISTICS OF WILMOT BREEDEN FANS
PERKINS PT.Nos 31257022 & 024
BASED ON WILMOT BREEDEN CURVE No C340/1

J.E.G.
6 OCT. 71
1741/A

FAN SPEEDS IN rev/min

DIAMETER 15in (381·0mm)
No OF BLADES 6
BLADE WIDTH 3·25in (82·6mm)
BLADE ANGLE 30°
MAX CONTINUOUS SPEED (MECHANICAL) 4500 rev/min

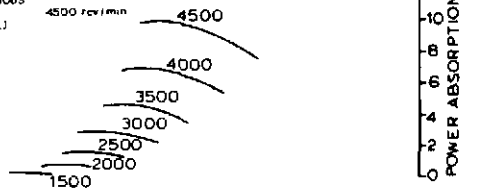


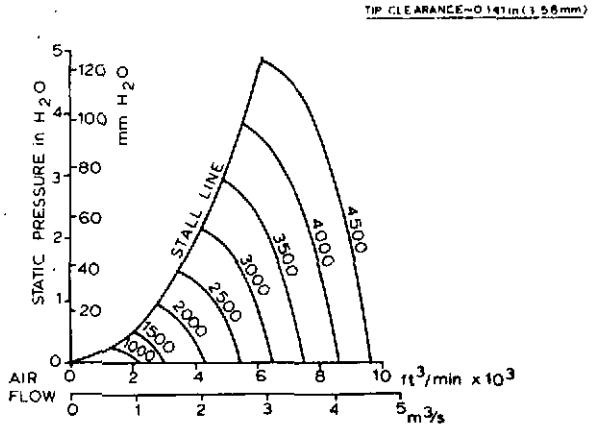
CHARACTERISTICS OF WILMOT BREEDEN FANS
PERKINS PT.Nos. 31257033 & 034
BASED ON WILMOT BREEDEN CURVE No.C.221
(2 SHEETS)

J.E.G.
8 OCT. 71
2163/A

FAN SPEEDS IN rev/min

DIAMETER 16in (406·4 mm)
No OF BLADES 6
BLADE WIDTH 4·25in (108·0mm)
BLADE ANGLE 30°
MAX CONTINUOUS SPEED (MECHANICAL) 4500 rev/min



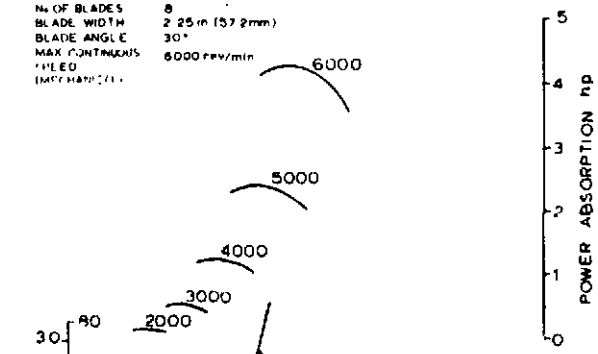


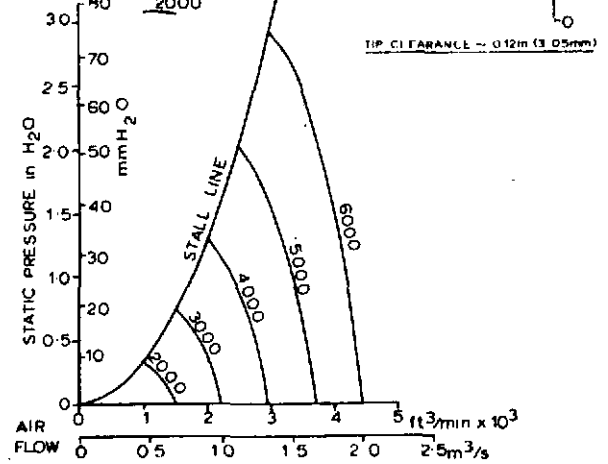
CHARACTERISTICS OF WILMOT BREEDEN FANS
PERKINS PT Nos 31257023 & 025
BASED ON WILMOT BREEDEN CURVE No C 141/1

J E G
6 OCT 1971
1743/A

FAN SPEEDS IN rev/min

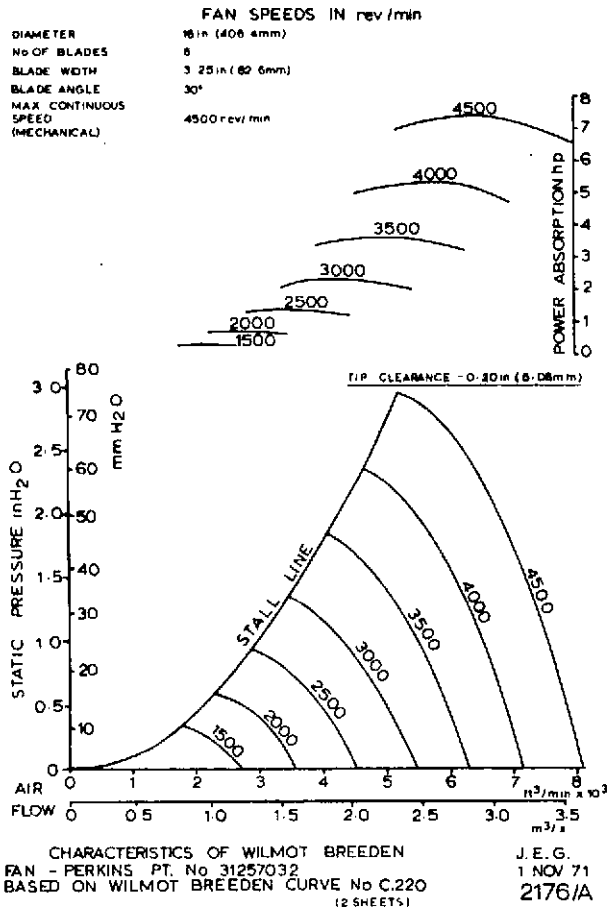
DIAMETER 12in (304·8mm)
No OF BLADES 6
BLADE WIDTH 2·25in (57·2mm)
BLADE ANGLE 30°
MAX CONTINUOUS SPEED (MECHANICAL) 6000 rev/min





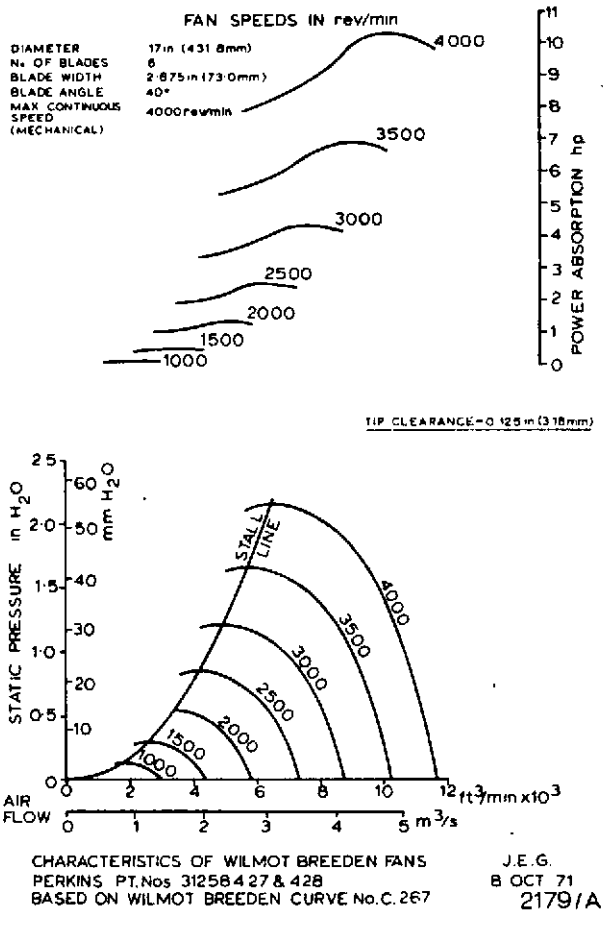
CHARACTERISTICS OF WILMOT BREEDEN FAN
PERKINS P.T Nos. 31257008 & 005
BASED ON WILMOT BREEDEN CURVE No C 203

J E G
19 JUL. 72
2172/A



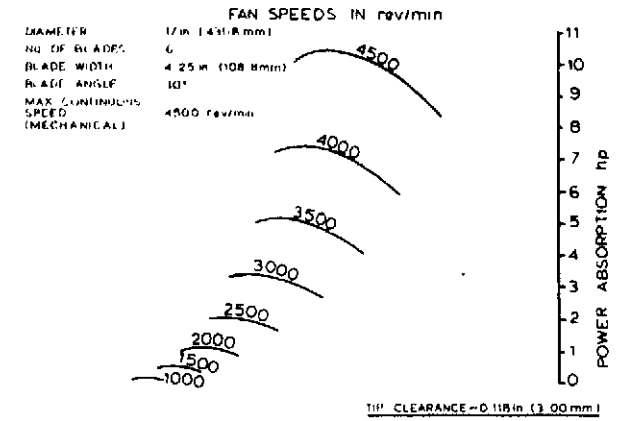
CHARACTERISTICS OF WILMOT BREEDEN
FAN - PERKINS PT. No 31257032
BASED ON WILMOT BREEDEN CURVE No C.220
(2 SHEETS)

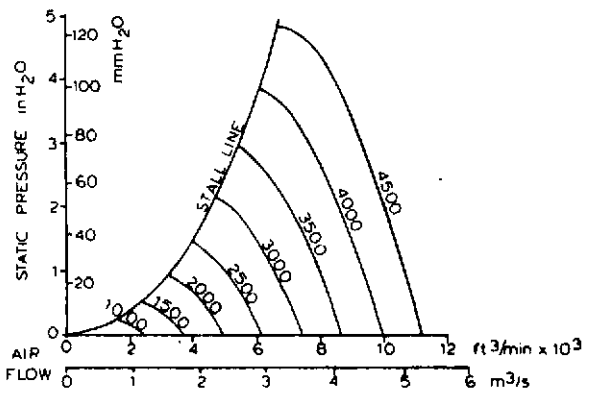
J. E. G.
1 NOV 71
2176/A



CHARACTERISTICS OF WILMOT BREEDEN FANS
PERKINS PT. Nos 31258427 & 428
BASED ON WILMOT BREEDEN CURVE No. C. 267

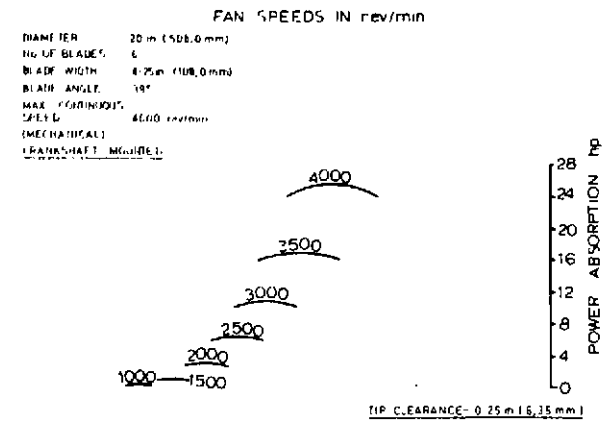
J.E.G.
8 OCT 71
2179/A

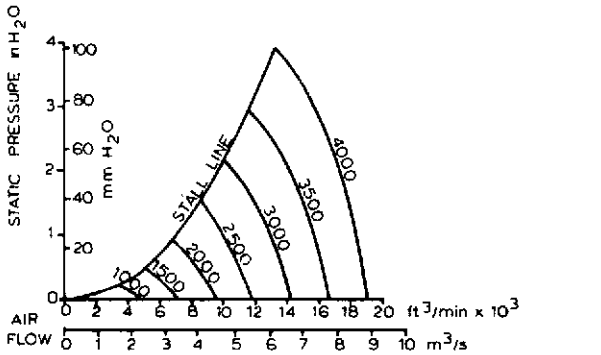




CHARACTERISTICS OF WILMOT BREEDEN
FANS - PERKINS PT Nos 31257038 & 052
BASED ON WILMOT BREEDEN CURVE No. C.142/2

J.E.G.
22 OCT. 1971
2177/A



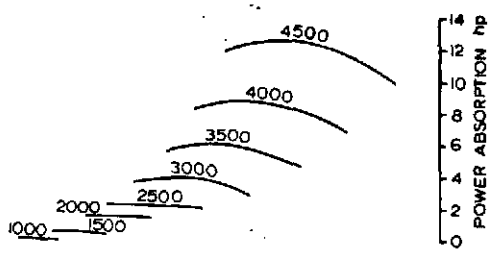


CHARACTERISTICS OF WILMOT BREEDEN
FAN - PERKINS PT No 31258143 BASED ON
WILMOT BREEDEN CURVE No C. 617/1.

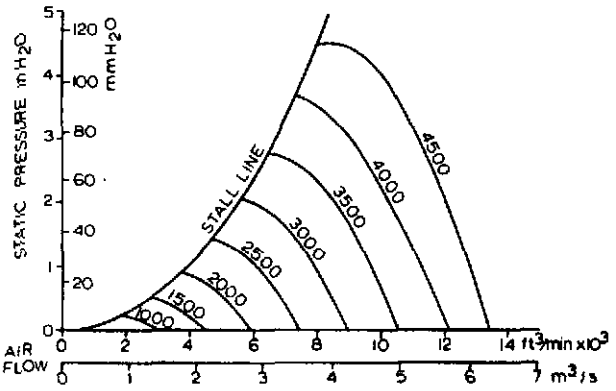
J.E.G.
19 SEP. 72
2181/B

FAN SPEEDS IN rev/min

DIAMETER 18 in (457·2 mm)
No. OF BLADES 6
BLADE WIDTH 4·25 in (108 0)
BLADE ANGLE 30°
MAX CONTINUOUS SPEED 4500 rev/min (MECHANICAL)



TIP CLEARANCE 0·24 in (6·10 mm)

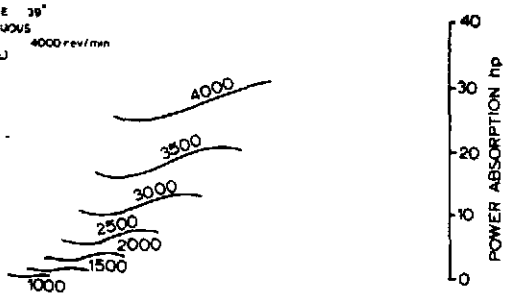


CHARACTERISTICS OF WILMOT BREEDEN FANS – PERKINS PT Nos 31258117 AND 148
BASED ON WILMOT BREEDEN CURVE No. C 159/2

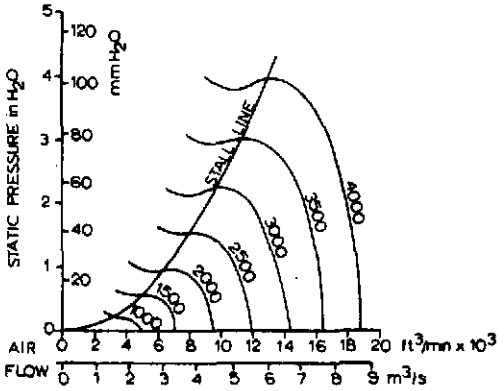
J.E.G.
7 OCT. 71
2184/A.

FAN SPEEDS IN rev/min

DIAMETER 21 in (533 4 mm)
No OF BLADES 6
BLADE WIDTH 4·25 in (108 0 mm)
BLADE ANGLE 39°
MAX CONTINUOUS SPEED 4000 rev/min (MECHANICAL)



TIP CLEARANCE 0·125 in (3·18 mm)

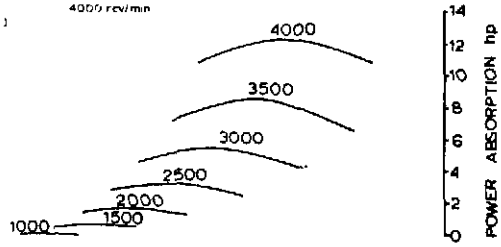


CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT. Nos. 31258152, 181 & 431
BASED ON WILMOT BREEDEN CURVE No C 389

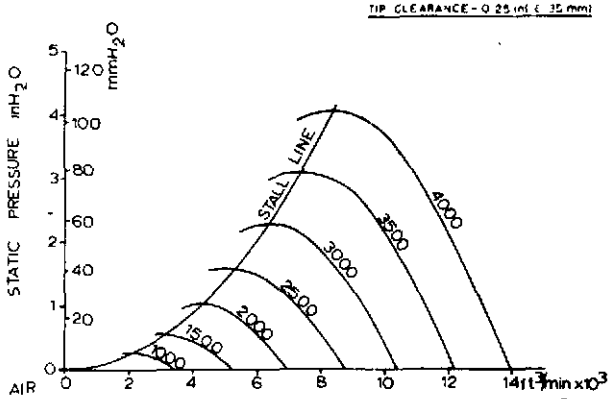
J.E.G.
11 OCT 1971
2186/A

FAN SPEEDS IN rev/min

DIAMETER 19 in (482 6 mm)
No OF BLADES 6
BLADE WIDTH 4·25 in (108 0 mm)
BLADE ANGLE 30°
MAX CONTINUOUS SPEED 4000 rev/min (MECHANICAL)



TIP CLEARANCE - 0·25 in (6·35 mm)

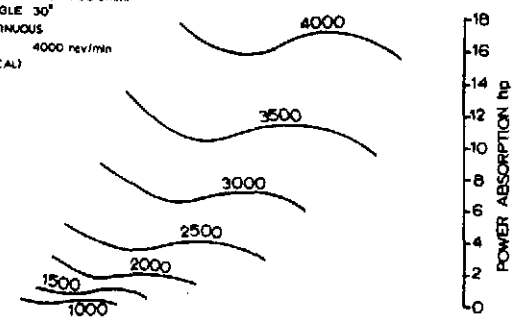


CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT. Nos 31258151 & 184
BASED ON WILMOT BREEDEN CURVE No. C.151/1

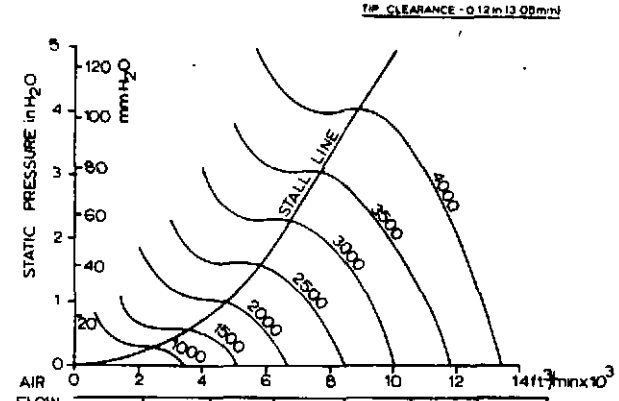
J.E.G
11 OCT 1971
2185/A

FAN SPEEDS IN rev/min

DIAMETER 20 in (508 0 mm)
No OF BLADES 6
BLADE WIDTH 4·25 in (108 0 mm)
BLADE ANGLE 30°
MAX CONTINUOUS SPEED 4000 rev/min (MECHANICAL)

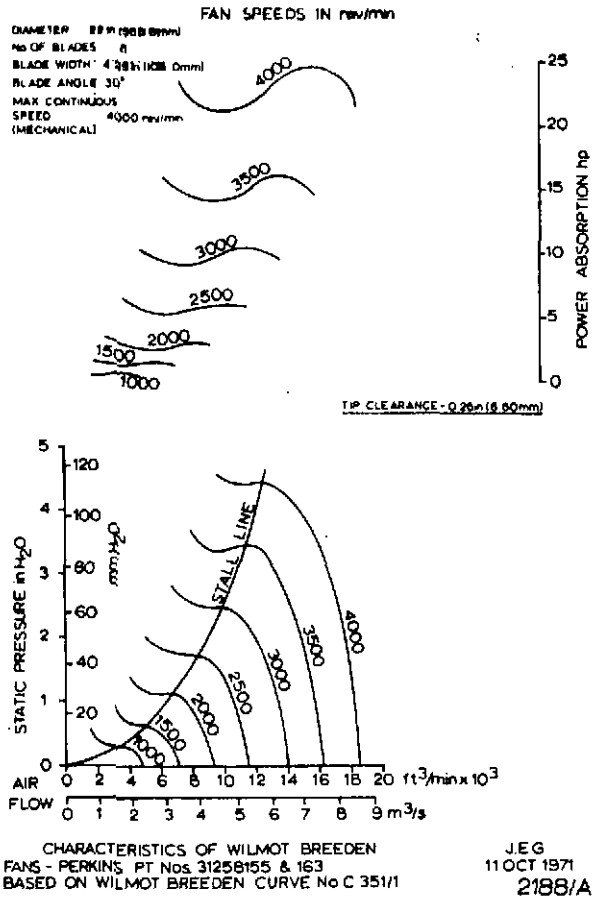


TIP CLEARANCE - 0·12 in (3·08 mm)



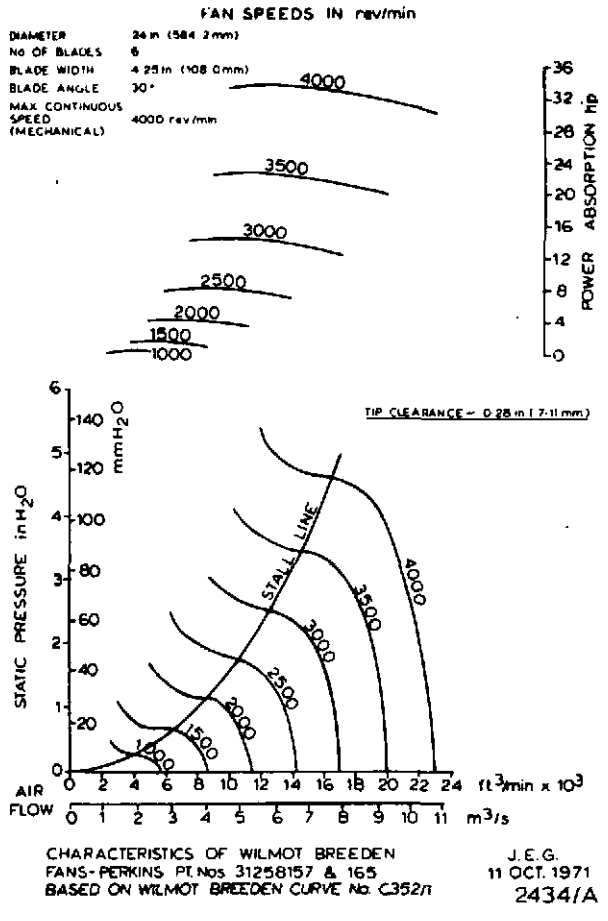
CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT. Nos 31258153 & 161
BASED ON WILMOT BREEDEN CURVE No. C 350/1

J.E.G
11 OCT 1971
2187/A



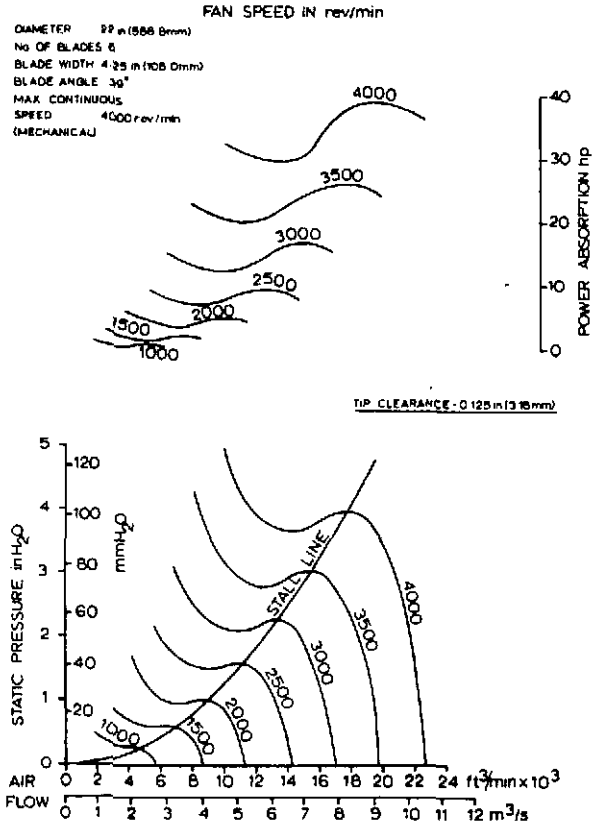
CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT Nos 31258155 & 163 BASED ON WILMOT BREEDEN CURVE No C 351/1

J.E.G 11 OCT 1971 2188/A



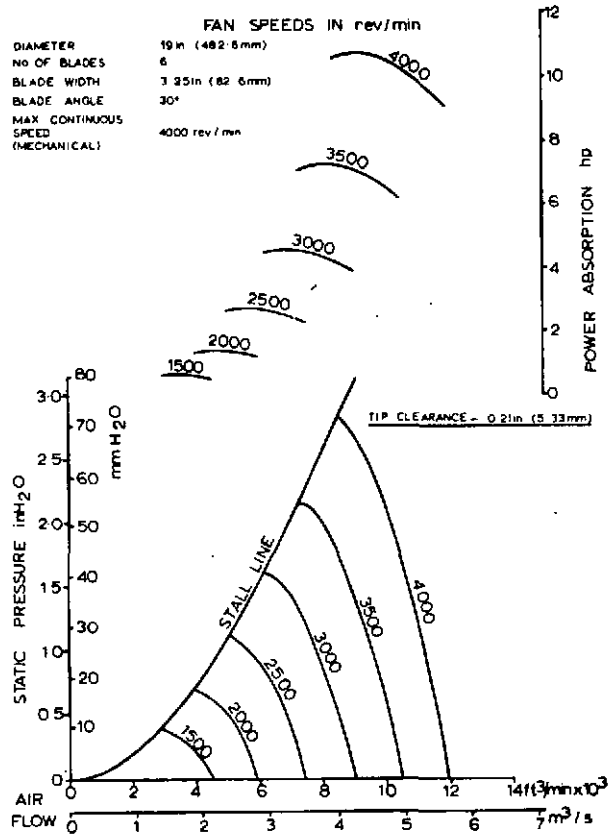
CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT Nos 31258157 & 165 BASED ON WILMOT BREEDEN CURVE No C352/1

J.E.G. 11 OCT. 1971 2434/A



CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT Nos 31258173 & 182 BASED ON WILMOT BREEDEN CURVE No C 393

J.E.G 11 OCT 1971 2190/A

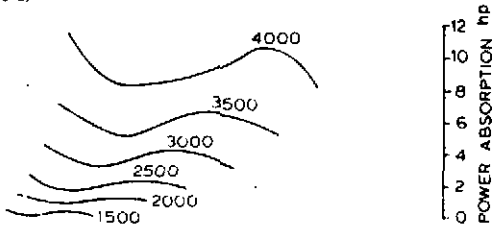


CHARACTERISTICS OF WILMOT BREEDEN FAN - PERKINS PT. No. 31258147 BASED ON WILMOT BREEDEN CURVE No. C. 217

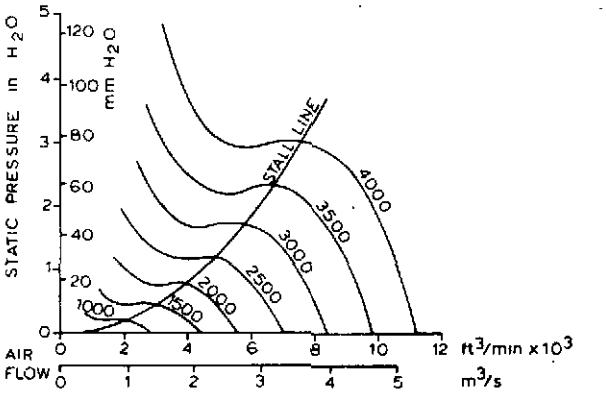
J.E.G 12 OCT. 1971 2557/A

FAN SPEEDS IN rev/min

DIAMETER	17 in (431 8mm)
No OF BLADES	6
BLADE WIDTH	4 25in (108 0mm)
BLADE ANGLE	36°
MAX CONTINUOUS SPEED (MECHANICAL)	4000 rev/min



TIP CLEARANCE = 0 125in (3 18mm)

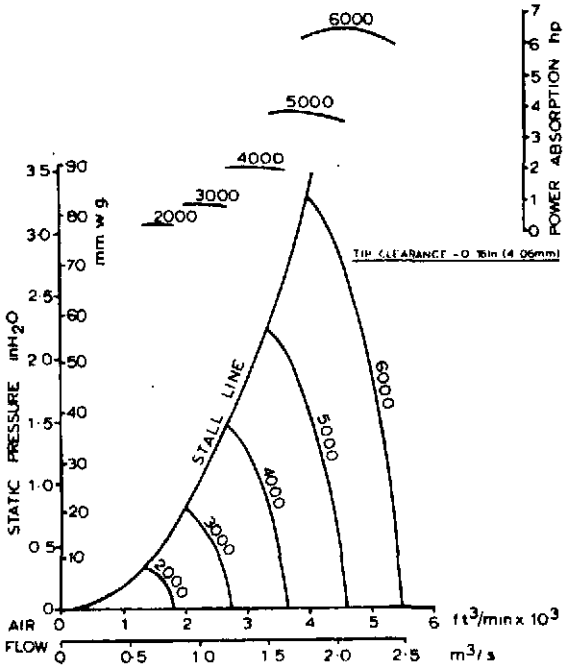


CHARACTERISTICS OF WILMOT BREEDEN FAN - PERKINS PT No 31257141
BASED ON WILMOT BREEDEN CURVE No C 450

J E G
12 OCT 1971
2558/A

FAN SPEEDS IN rev/min

DIAMETER	13in (330·2mm)
No OF BLADES	6
BLADE WIDTH	2 25in (57 2 mm)
BLADE ANGLE	30°
MAX CONTINUOUS SPEED (MECHANICAL)	6000 rev/min



TIP CLEARANCE = 0 16in (4 06mm)

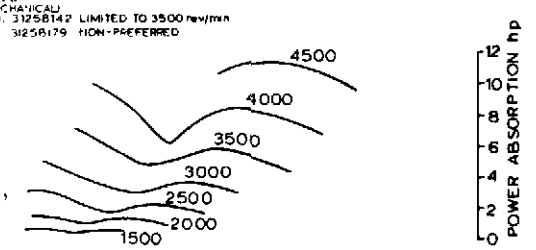
CHARACTERISTICS OF WILMOT BREEDEN FAN - PERKINS PT No 31257007
BASED ON WILMOT BREEDEN CURVE No C 204

J E G
12 OCT 1971
2561/A

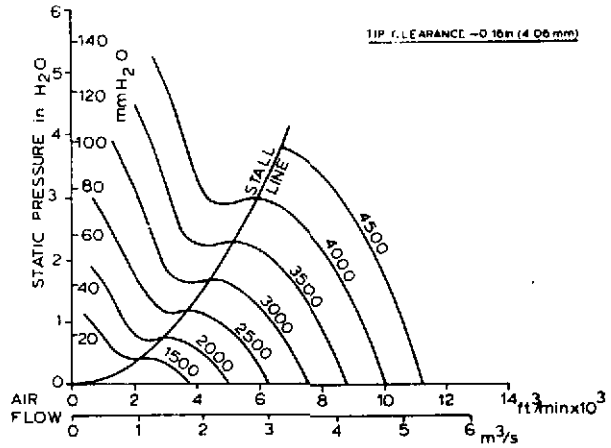
FAN SPEEDS IN rev/min

DIAMETER	18in (457 2mm)
No OF BLADES	6
BLADE WIDTH	3 25in (82 6mm)
BLADE ANGLE	30°
MAX CONTINUOUS SPEED (MECHANICAL)	4500 rev/min *

* N B. 31258142 LIMITED TO 3500 rev/min
31258179 NON-PREFERRED



TIP CLEARANCE = 0 16in (4 06mm)

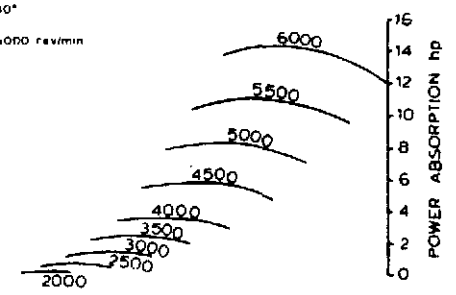


CHARACTERISTICS OF WILMOT BREEDEN FANS
PERKINS PT Nos. 31258115/121/142 & 179
BASED ON WILMOT BREEDEN CURVE No C 218/1
(2 SHEETS)

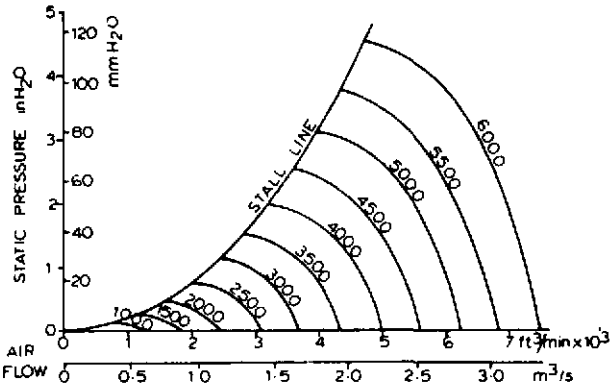
J.E.G
8 OCT 71
2560/A

FAN SPEEDS IN rev/min

DIAMETER	14in (355 6mm)
No OF BLADES	6
BLADE WIDTH	4 25 in (108 0mm)
BLADE ANGLE	30°
MAX CONTINUOUS SPEED (MECHANICAL)	6000 rev/min

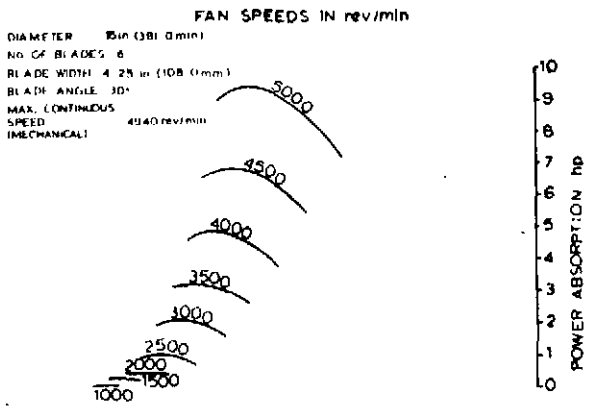


TIP CLEARANCE = 0 25in (6·35 mm)

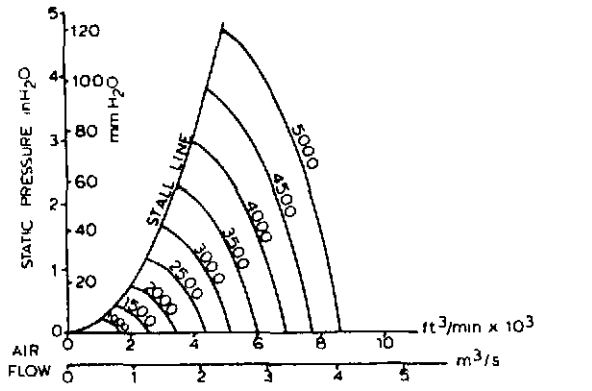


CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT Nos. 31257136 & 137
BASED ON WILMOT BREEDEN CURVE No. C 607/1

J.E.G.
22 OCT 1971
2633/A

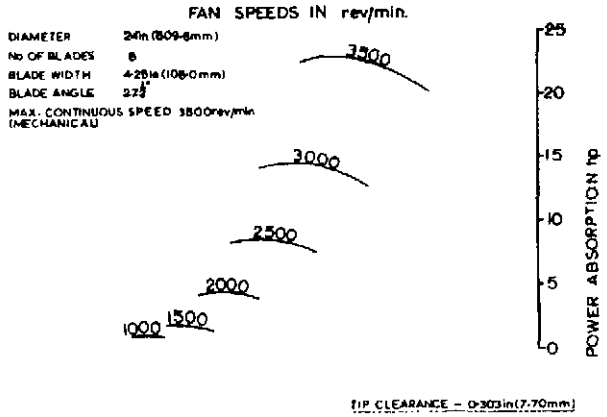


TIP CLEARANCE = 0.223in (5.66mm)

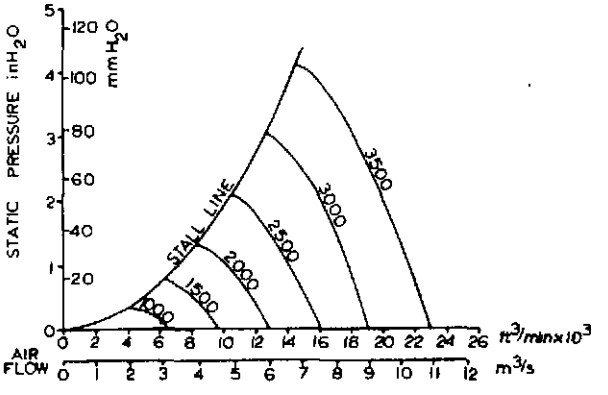


CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT. Nos 31257017 & 021 BASED ON WILMOT BREEDEN CURVE No C 140/2

J.E.G. 27 SEP. 71 2641

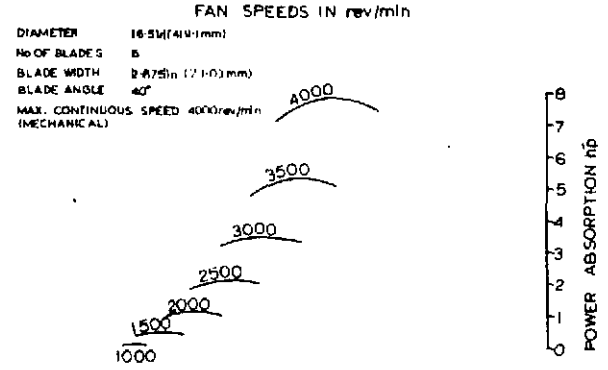


TIP CLEARANCE = 0·303in (7·70mm)

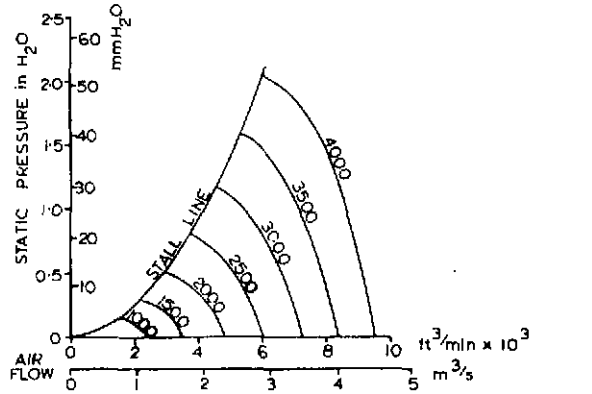


CHARACTERISTICS OF WILMOT BREEDEN FANS - PERKINS PT. Nos. 31258146 & 172 BASED ON WILMOT BREEDEN CURVE No. C.654

J.E.G. 5 APRIL 72 2740

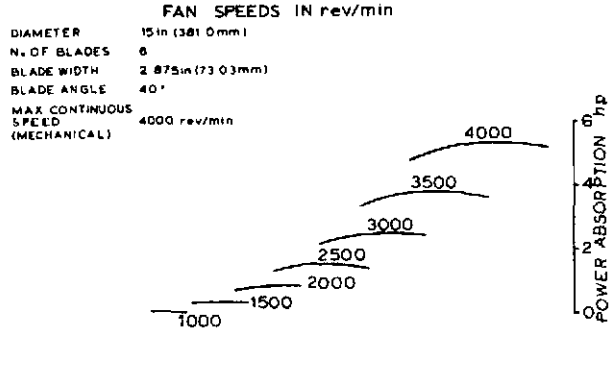


TIP CLEARANCE = 0·25in (6·35mm)

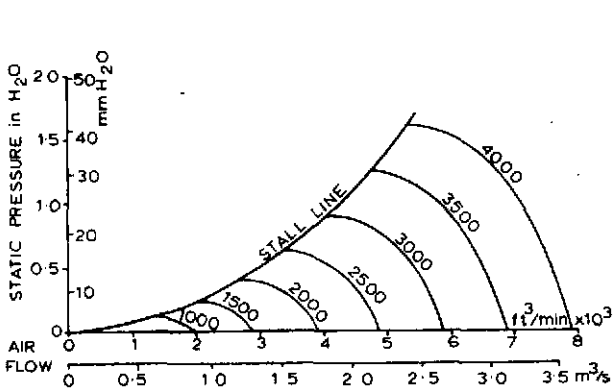


CHARACTERISTICS OF WILMOT BREEDEN FAN - PERKINS PT. No. 31257431 BASED ON WILMOT BREEDEN CURVE No.C.633

J.E.G 5 APRIL 72 2650



TIP CLEARANCE = 0·25in (6·35mm)

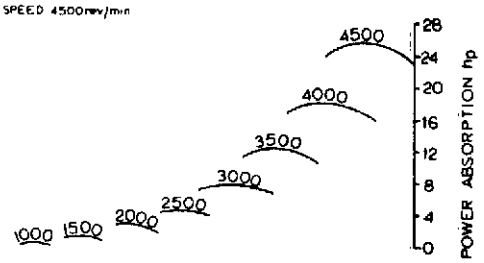


CHARACTERISTICS OF WILMOT BREEDEN FAN - PERKINS PT. No. 31257428 BASED ON WILMOT BREEDEN CURVE No. C 640

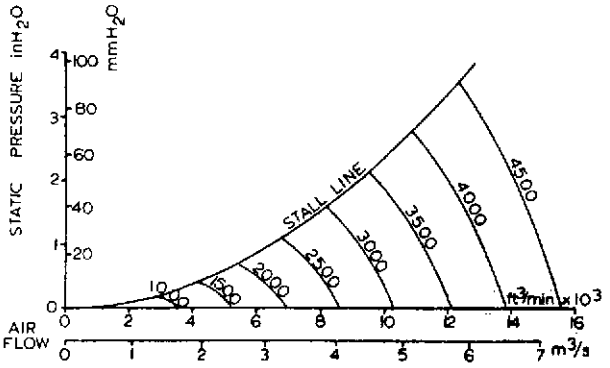
J.E.G 19 MAY 72 2741

FAN SPEEDS IN rev/min

DIAMETER 18in (457.2 mm)
No OF BLADES 6
BLADE WIDTH 3.75in (95.3mm)
BLADE ANGLE 40°
MAX. CONTINUOUS SPEED 4500rev/min (MECHANICAL)



TIP CLEARANCE - 0.25 in (6.35 mm)

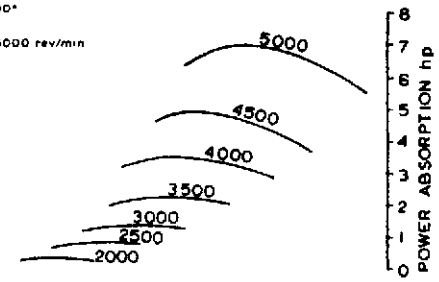


CHARACTERISTICS OF WILMOT BREEDEN FAN - PERKINS PT. No. 31258176 BASED ON WILMOT BREEDEN CURVE No.C.629

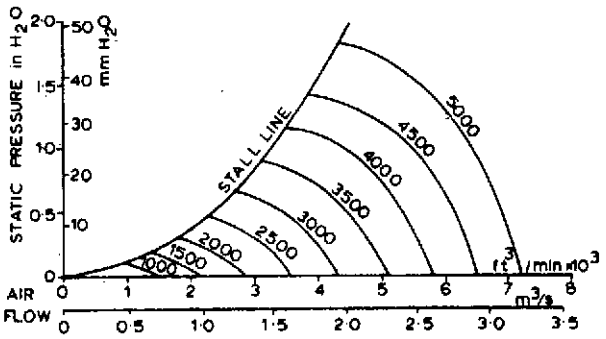
J.E.G. 5 APRIL 72 2743

FAN SPEEDS IN rev/min.

DIAMETER 14in (355,6mm)
No. OF BLADES 5 ASSYMETRIC (ALUMINIUM)
BLADE WIDTH 2.625in (66,7mm)
BLADE ANGLE 40°
MAX CONTINUOUS SPEED (MECHANICAL) 5000 rev/min



TIP CLEARANCE 0.25in (6,35mm)

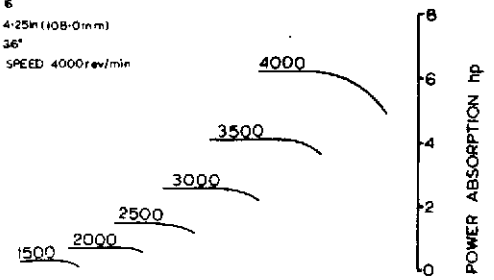


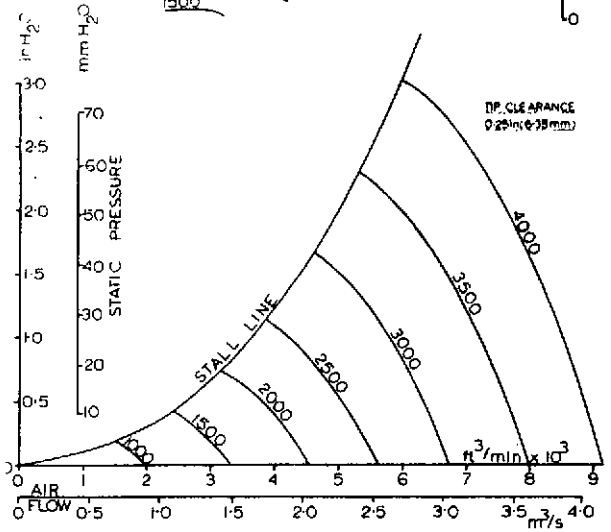
CHARACTERISTICS OF WILMOT BREEDEN FAN PERKINS PT.Nos. 31257144 BASED ON WILMOT BREEDEN CURVE No.C 609/1

J.E.G 18 OCT 72 2753

FAN SPEEDS IN rev/min

DIAMETER 16in (406.4mm)
No.OF BLADES 6
BLADE WIDTH 4.25in (108.0mm)
BLADE ANGLE 36°
MAX. CONTINUOUS SPEED 4000rev/min (MECHANICAL)



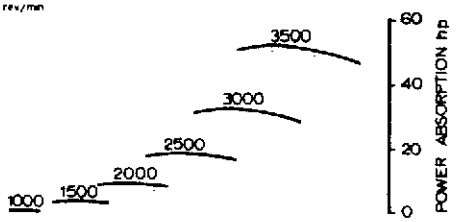


CHARACTERISTICS OF WILMOT BREEDEN FAN-PERKINS PT. No. 31257139 BASED ON WILMOT BREEDEN CURVE No C.530/1

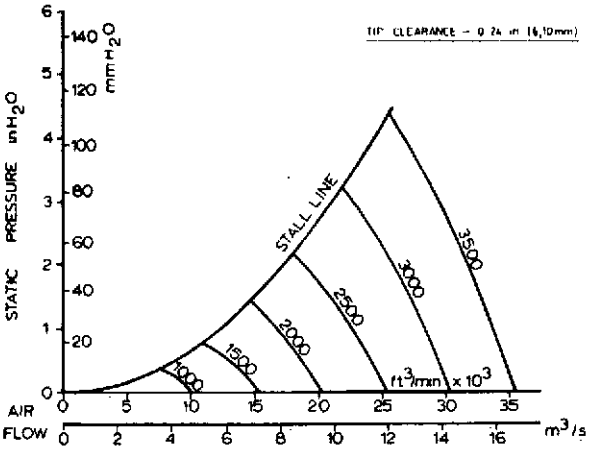
J E G 5 APRIL 72 2744

FAN SPEEDS IN rev/min

DIAMETER 25 in (635,0 mm)
No OF BLADES 6
BLADE WIDTH 5 in (127,0 mm)
BLADE ANGLE 40°
MAX CONTINUOUS SPEED (MECHANICAL) 3500 rev/min



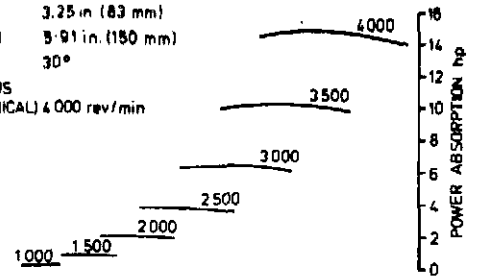
TIP CLEARANCE - 0.24 in (6,10mm)

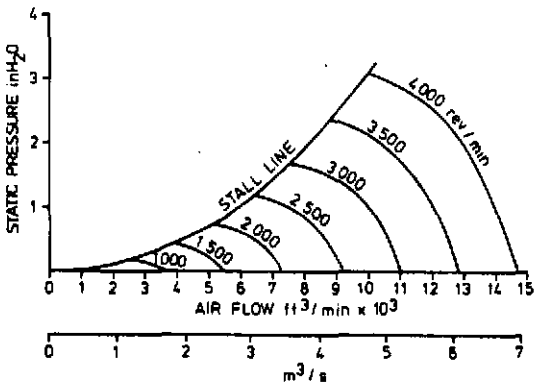


CHARACTERISTICS OF WILMOT BREEDEN FAN - PERKINS PT No 31258191 BASED ON WILMOT BREEDEN CURVE No C 699

J.E.G. 15 MAY 73 2755

DIAMETER 20 in (508 mm)
No OF BLADES 6
BLADE WIDTH 3.25 in (83 mm)
BLADE LENGTH 5·91 in. (150 mm)
BLADE ANGLE 30°
MAX. CONTINUOUS SPEED (MECHANICAL) 4 000 rev/min

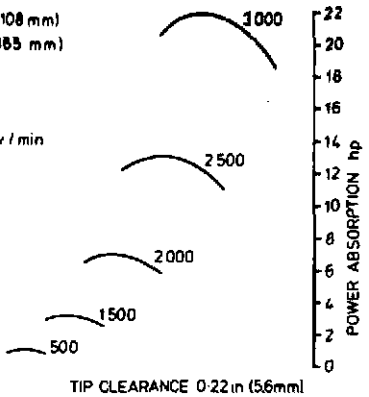




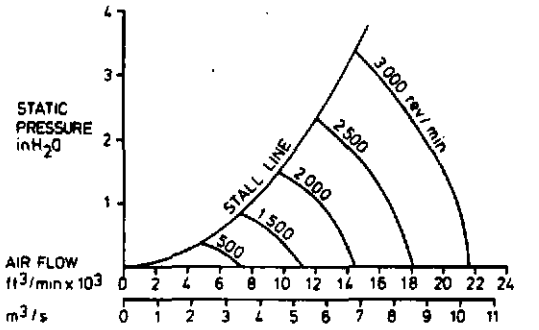
CHARACTERISTICS OF WILMOT BREEDEN FAN
PERKINS PT Nos.31258208 & 188.
BASED ON WILMOT BREEDEN CURVE No. C564/1

B R
5 APR 77
2757

DIAMETER 28 in (660 mm)
No OF BLADES 8
BLADE WIDTH 4.25 in (108 mm)
BLADE LENGTH 6.5 in (165 mm)
BLADE ANGLE 27·5°
TYPE SPIDER
MAX CONTINUOUS OPERATING SPEED (MECHANICAL) 2 600 rev / min



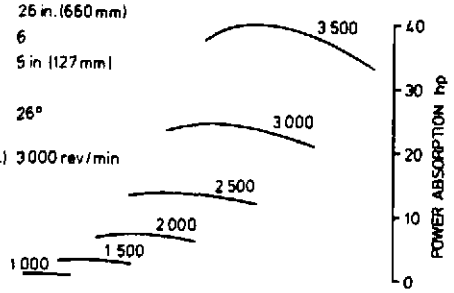
TIP CLEARANCE 0·22 in (5.6mm)

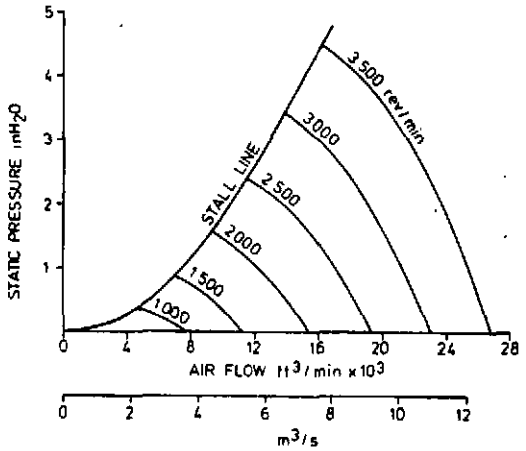


CHARACTERISTICS OF WILMOT BREEDEN FAN
PERKINS PT. No 31258193
BASED ON WILMOT BREEDEN CURVE No C655/1

BR.
4 APR 77
2760

DIAMETER 26 in. (660 mm)
No. OF BLADES 6
BLADE WIDTH 5 in (127 mm)
BLADE LENGTH
BLADE ANGLE 26°
MAX CONTINUOUS SPEED (MECHANICAL) 3000 rev/min

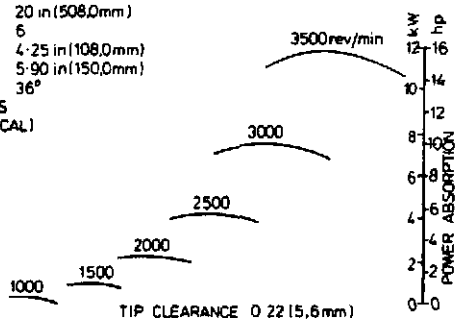




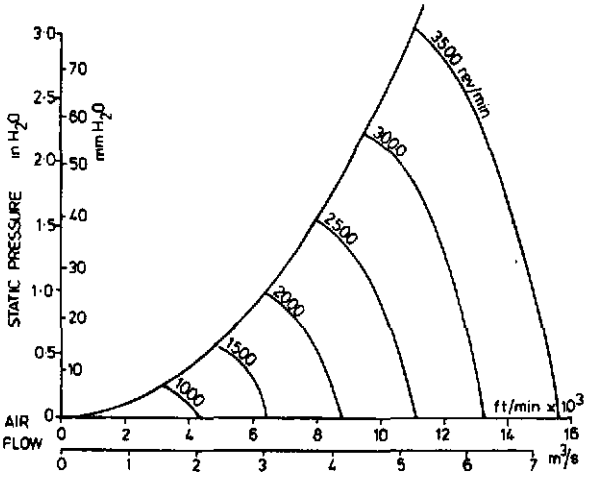
OPERATING CHARACTERISTICS - WILMOT BREEDEN
FAN PERKINS PT No 31258197/ 31258198
BASED ON WILMOT BREEDEN CURVE No C594.

B.R
5 APR 77
2759

DIAMETER 20 in (508.0mm)
No OF BLADES 6
BLADE WIDTH 4·25 in (108.0mm)
BLADE LENGTH 5·90 in (150.0mm)
BLADE ANGLE 36°
MAX.CONTINUOUS SPEED (MECHANICAL)



TIP CLEARANCE 0·22 (5,6mm)



CHARACTERISTICS OF WILMOT BREEDEN
FAN – PERKINS PT. No. 31258204
BASED ON WILMOT BREEDEN CURVE No. C 250

I.J.
5 AUG. 74
3200

16.5 CRANKSHAFT THRUST LOADING

Unless otherwise stated the thrust loadings shown in the tables apply to both forward or rearward movement of the crankshaft.

Engine type		4.108[a]	4.108[b]	D3.152	4.165	4.203	D4.203	4.236	6.247
Maximum permissible CONTINUOUS thrust load on the crankshaft (as experienced with a typical torque converter transmission)	lbf N	370 1646	185 823	340 1490	295 1312	340 1490	355 1579	480 2135	485 2157
MAXIMUM permissible thrust load on the crankshaft (as experienced during conventional clutch operation).	lbf N	495 2202	280 1246	490[c] 2180	445 1980	490 2180	490[c] 2180	760[c] 3381	725 3225

Engine type		4.248	4.318	6.3544	T6.3544	6.3724	V8.540	V8.640	TV8.640
Maximum permissible CONTINUOUS thrust load on the crankshaft (as experienced with a typical torque converter transmission)	lbf N	480 2135	480 2135	480 2135	480 2135	480 2135	425 1890	For information contact Perkins Group Applications Engineering Dept.	
MAXIMUM permissible thrust LOAD ON THE CRANKSHAFT (as experienced during conventional clutch operation)	lbf N	760[c] 3381	760 3381	760 3381	760 3381	760 3381	785 3492		

Notes :
(a) Crankshaft palm pushed into block.
(b) Crankshaft palm pulled out of block.
(c) The maximum thrust load may be increased up to 1112 lbf (4950 N) for tractor applications rated at 2000 rev/min.

16.6. EXHAUST SYSTEMS

Typical full load exhaust gas temperatures and flow rates for various engine ratings are tabulated below. For further information, and for other ratings not shown, please refer to Perkins Group Applications Engineering Department.

Engine Type	Rating bhp/rev/min	Temperature[a] °F	°C	Gas flow[b] ft³/min	m³/min	Back pressure[c] ins (mm) Hg	kN/m²
4.108	49/4000	1200	650	270	7,6	3 (76)	10,2
	45/3000	1150	620	220	6,2	3 (76)	10,2
	31/2000	815	435	135	3,9	3 (76)	10,2
D3.152	49/2500	1075	580	265	7,5	3 (76)	10,2
	47/2250	1110	600	245	6,9	3 (76)	10,2
4.165	70/3600	1150	620	385	10,9	3 (76)	10,2
4.203	65/2600	1090	590	315	9,0	3 (76)	10,2
D4.203	65/2300	1110	600	340	9,7	3 (76)	10,2
4.236	82/2800	1220	660	475	13,5	3 (76)	10,2
	81/2600	1290	700	465	13,2	3 (76)	10,2
	76/2250	1200	650	425	12,0	3 (76)	10,2
6.247	101/3600	1200	650	575	16,3	3 (76)	10,2
4.248	84/2500	1200	650	450	12,8	3 (76)	10,2
	78.5/2200	1110	600	420	12,0	3 (76)	10,2
4.318	96/2200	1210	655	465	13,2	3 (76)	10,2
6.3544	124/2800	1290	700	710	20,1	3 (76)	10,2
T6.3544	155/2600[d]	975	525	850	24,1	3 (76)	10,2
V8.540	180/2600	1150	620	1080	30,5	3 (76)	10,2
V8.640	215/2600	1255	680	1275	36,1	3 (76)	10,2
	197/2250	1210	655	1055	29,9	3 (76)	10,2
TV8.640	290/2600[d]	870	465	1840	52,1	1.5 (38)	5,1
	250/2600	915	490	1780	50,4	1.5 (38)	5,1
	236/2250	905	485	1500	42,5	1.5 (38)	5,1

NOTES :

a) Exhaust gas temperature measured at exhaust manifold outlet for naturally aspirated engines, and at turbocharger outlet for turbocharged engines.

b) Exhaust gas flow rate against the maximum permissible back pressure for the specific engine type.

c) Exhaust back pressure should be measured within 12 in (305 mm) of either :
the exhaust manifold outlet flange on naturally aspirated engines,
or
the turbocharger outlet flange of turbocharged engines.
BS AU 141a : 1971 certification has been obtained at these back pressures, and to exceed them may invalidate the certificate.

d) Charge cooled.

16.7. FUEL SYSTEMS

16.7.1. Fuel Specification

The fuel oil must have a Cold Filter Plugging Point (CFPP) below the anticipated minimum ambient operating temperature. (CFPP is now replacing the "Cloud Point" criterion previously quoted). The fuel oil should also meet one of the following specifications, or local standards of comparable severity.

U.K.	U.S.A. Federal	U.S.A. ASTM	GERMANY
BS 2869 : 1967 Class A1 or A2	VV-F-800a Grades DF-A* DF-1* and DF-2	D975-66T Numbers 1D* and 2D	DIN 51601 : 1967

NOTE :
*Although approved these fuels will result in some loss of power.

ITALY	FRANCE	SWITZERLAND	SWEDEN
CUNA-Gas oil NC-630-01 (1957)	J.O.14/9/57 Gas oil	Federal Military Specification 9140-335-1404 (1965)	S.I.S. 15 54 32 1966

16.7.2. Low Pressure Fuel System

Vehicles :

The fuel lift pump should not be more than 3 ft (1m) above the lowest fuel level possible in the fuel tank.

With the engine running at full load rated speed, the depression at the inlet to the fuel lift pump should not exceed 4 in (100 mm) Hg. If this limit is exceeded Perkins Applications Engineering should be consulted.

Other applications :

The fuel lift pump should not be more than 6 ft (1.8 m) above the lowest fuel level possible in the fuel tank.

With the engine running at full load rated speed, the depression at the inlet to the fuel lift pump should not exceed 5 in (127 mm) Hg. If this limit is exceeded Perkins Applications Engineering should be consulted.

Low Pressure Fuel Pipe Sizes

In general, pipe sizes as tabulated below should be used.

	BUNDY TUBE				NYLON TUBE (TECLON)			
	Outside Diameter		Inside Diameter		Outside Diameter		Inside Diameter	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm
Engine up to and including 4,95 litre (302 in³) capacity with fuel filter located close to engine.	(a) Feed pipe from fuel tank to lift pump							
	0.250	6,35	0.194	4,93	0.310	7,87	0.210	5,33
Engines up to and including 4,95 litre (302 in³) capacity with fuel filter located away from engine	(b) Return pipe from engine to tank.							
	0.313	7,95	0.257	6,53	0.373	9,47	0.263	6,68
Engines from 4,95 litre (302 in³) to 8,20 litre (500 in³) capacity	0.313	7,95	0.257	6,53	0.373	9,47	0.263	6,68
Engines from 8,20 litre (500 in³) capacity and above	0.375	9,53	0.319	8,10	0.50	12,7	0.375	9,53
Engines up to and including 8,20 litre (500 in³) capacity	0.250	6,35	0.194	4,93	0.310	7,87	0.210	5,33
Engines from 8,20 litre (500 in³) capacity.	0.313	7,95	0.257	6,35	0.373	9,47	0,263	6,68

Water Trap

A water trap should be fitted in the fuel supply to the engine lift pump. CAV sedimenters with either glass or metal bowls (2656021) and 2656088 respectively) are suitable for all engine types. The small AC Delco water trap (30451) should only be used with the 4.108, D3.152 and D4.203 engines.

Fuel Oil Filter

Twin filters should be used where it is required to keep maintenance to a minimum, or the fuel is badly contaminated.

16.8. INDUCTION SYSTEMS

16.8.1. Air Requirements for Engine Breathing

(Note : Compressor air requirements should be added to these flow rates if piped into the induction system).

Engine type	Air requirement	Engine speed, rev/min								
		1000	1500	2000	2250	2500	2600	2800	3600	4000
4.108	ft³/min	27	40	52	59	65	68	73	93	102
	m³/min	0.76	1.13	1.47	1.67	1.84	1.93	2.07	2.63	2.89
D3.152	ft³/min	39	57	77	86	95	–	–	–	–
	m³/min	1.10	1.61	2.18	2.44	2.69	–	–	–	–
4.165	ft³/min	39	56	74	84	92	97	105	135	–
	m³/min	1.10	1.59	2.09	2.38	2.60	2.75	2.97	3.82	–
4.203	ft³/min	50	71	92	102	110	113	–	–	–
	m³/min	1.42	2.01	2.61	2.89	3.12	3.20	–	–	–
D4.203	ft³/min	51	78	104	117	120[a]	–	–	–	–
	m³/min	1.44	2.07	2.94	3.31	3.40	–	–	–	–
4.236	ft³/min	62	88	112	125	141	147	157	–	–
	m³/min	1.76	2.49	3.17	3.54	3.99	4.16	4.45	–	–
6.247	ft³/min	65	92	120	135	150	156	167	205	–
	m³/min	1.84	2,62	3.4	3.82	4.36	4.42	4.73	5.82	–
4.248	ft³/min	64	91	120	137	152	–	–	–	–
	m³/min	1.81	2.58	3.40	3.88	4.30	–	–	–	–
4.318	ft³/min	71	105	140	154[b]	–	–	–	–	–
	m³/min	2.01	2.97	3.96	4.36	–	–	–	–	–
6.3544	ft³/min	91	132	176	196	216	224	238	–	–
	m³/min	2.58	3.74	4.98	5.55	6.12	6.34	6.74	–	–
T6.3544	ft³/min	90	170	275	312	354	370	–	–	–
	m³/min	2.55	4.81	7.79	8.83	10.02	10.48	–	–	–
6.3724	ft³/min	129	195	273	313	353	370	–	–	–
	ft³/min	–	–	–	210[b]	227	–	–	–	–
V8.540	m³/min	–	–	–	5.95	6.43	–	–	–	–
	m³/min	3.67	5.53	7.73	8.86	10.0	10.48	–	–	–
V8.640	ft³/min	151	220	307	350	393	411	–	–	–
	M³/min	4.28	6.23	8.69	9.91	11.13	11.64	–	–	–
TV8.640[c]	ft³/min	150	312	485	580	660	685	–	–	–
	m³/min	4.25	8.83	13.73	16.42	18.69	19.40	–	–	–

NOTE :

(a) This value corresponds to an engine speed of 2300 rev/min.

(b) This value corresponds to an engine speed of 2200 rev/min.

(c) Figures quoted apply to non-charge cooled ratings. For charge cooled automotive rating (290 bhp at 2600 rev/min) the air requirement is increased by approximately 6 ½ %).

16.8.2. Air Filters

Perkins classify air filters into three duties. The choice of duty depends upon the engine type, the dust concentration in which it will operate, and the service life required. The following recommendations are given as a guide, but in any application, particular circumstances may override these recommendations.

NORMAL DUTY	For use on metalled roads in countries with a temperate climate.
MEDIUM DUTY	For use on and off highway in temperate and drier climates.
HEAVY DUTY	For use in very heavy dust conditions such as is found in quarries etc.

The following makes and types of filter are approved, provided that the air flow capacity is sufficient. Reference should be made to Perkins Group Applications Engineering Department, Peterborough, in respect of filters not listed.

Normal Duty (a)	Medium Duty (b)	Heavy Duty (b)
AC DELCO	AC DELCO Cyclone (fitted with end seal plate)	COOPERS Cooper-King
COOPERS	BURGESS Triphase	DONALDSON Donaclone
FRAM	COOPERS	FARR Autopamic
PUROLATOR	DONALDSON Cyclopac	FARR Rotopamic
MANN & HUMMEL	FARR Unipamic	GKN FARR Autopamic
	GKN FARR Unipamic	GKN FARR Rotopamic
	LOCKER Air-Maze (Centrimaze CD type)	
	MANN & HUMMEL Piclon	MANN & HUMMEL Pico-Zyklon
	UNITED NOVO Triphase	

Notes :

(a) Normal Duty filters are often single stage units without a type name or conforming to a set design pattern. Certain filters from the makers listed have been approved, and Perkins Group Applications Engineering Department should be consulted for details.

(b) Some oversize Medium Duty filters are also approved for Heavy Duty use — Perkins Group Applications Engineering Department should be consulted for details. Any filter can however be safely used in a lower duty category.

16.8.3. Inlet Restriction

The following table shows the maximum allowable depression at the engine for CLEAN oil bath and dry element air filters. It also shows the depression at the engine at which DIRTY dry elements must be replaced.

Depression		Engine types	
		4.108, D3.152, 4.165, 4.203, D4.203, 6.247, 4.318, T6.3544, V8.640, TV8.640	4.236, 4.248, 6.3544, 6.3724, V8.540
Clean(a)	in H_2O	12	12
	mm H_2O	305	305
Dirty	in H_2O	22	26
	mm H_2O	559	660

Note :

BS AU 141a : 1971 Certification has been obtained with a 12 in (305 mm) H_2O depression at the induction manifold and to exceed it may invalidate the certificate.

For dry element filers only it is strongly recommended that a restriction indicator be fitted, as it enables maximum life to be obtained from the filter element without exceeding the engine restriction limits. Without an indicator the filter must be serviced at fixed periods. However, dust conditions vary so much that this results in either premature element renewal or loss in engine power and efficiency due to excessive induction restriction. Details of restriction indicators suitable for Perkins engines are given below.

	Engine types	
	4.108, D3.152, 4.165, 4.203, D4.203, 6.247, 4.318, V8.640, TV8.640	4.236, 4.248, 6.3544, 6.3724, V8.540
Part Number	2651852	2651851
SETTING in H_2O mm H_2O	18[a] 457	22[a] 558

Note :

(a) The restriction indicator is set at a depression of 41 in (102 mm) lower than that allowed at the engine to allow for losses of pressure in the connecting trunking.

16.8.4. Charge Air Cooler Restriction — T6.3544 Vehicle Applications

Boost pressure in the induction manifold at maximum power output must not be less than 22 in (562 mm) Hg.

To enable this requirement to be met, cooler restriction should be within the following limits: —

Maximum — 3 in (75 mm) Hg
Minimum — 1 in (25 mm) Hg

A further restriction of 1 in (25 mm) is allowed for associated air pipes before and after the cooler.

The limits for total charge cooler and pipe restriction are therefore:

Maximum — 4 in (100 mm) Hg
Minimum — 2 in (50 mm) Hg

Note: These figures supersede those shown in the General Installation Manual, para 15.4.5. (page 217)

16.9. LUBRICATION

16.9.1. Oil Specifications

Any oil which meets the approved specifications tabulated below may be used, provided that it is of the correct viscosity.

Engine type	Oil Specification				
	MIL-L-2104B	MIL-L-46152	MIL-L-2104C	MIL-L-45199B or Series 3	MIL-L2104B and MIL-L-45199B
4.108	*	*	*		*
D3.152§	*	*	*		*
4.165		*	*		*
4.203	*	*	*		*
D4.203	*	*	*		*
4.236§	*	*	*		*
6.247	*	*	*		*
4.248§	*	*	*		*
4.318§	*	*	*		*
6.354§	*	*	*		*
T6.3544			*	*	*
6.3724	*	*	*		*
V8.540§	*	*	*		*
V8.640§		*	*		*
TV8.640			*	*	*

Note :

§For naturally-aspirated diesel engines in high load factor applications, e.g. heavy duty earthmoving equipment, only MIL-L-2104C should be used.

Approved lubricating oil brands and types

Some oils which meet the above specifications are listed. Other oils which conform to these specifications are of course also suitable.

Oil Specification	B.P. Vanellus	CASTROL Deusol	DUCKHAMS Fleetol	ESSO Essolube	MOBIL Delvac	SHELL Rimula/ Rotella
MIL-L-2104B	Vanellus	CRI	HDX	HDX	1200	Rot. SX
MIL-L-46152	—	CRB	—	—	1200	Rot. TX
MIL-L-2104C	—	CRD	—	D3HP	1300	Rim. CT
MIL-L-2104B and MIL-L-45199B	S3	CRD	3	D3HP	1300	Rim. CT

Oil viscosity

Recommended viscosity grades for different ambient temperatures are as follows :—

Ambient temperature range		Oil Viscosity — SAE Number						
°F	°C							
0 to 30	−18 to −1	5W/20	10W	10W/30				
30 to 80	−1 to 27			10W/30	20W/20	20W/40	20W/50	15W/40
80 and over	27 and over			10W/30		20W/40	20W/50	30

The lubricating oil must have a viscosity index of 80 or more.

16.9.2. Oil Temperature

The normal maximum permissible lubricating oil temperature measured in the main oil pressure rail or at the oil filter head, is 121°C. For applications in which the engine never operates at its maximum speed for more than one hour at a time, however, this temperature may be increased to 132°C.

Oil Coolers

The 6.247, 6.3544, 6.3724, T6.3544 and V8 engine types have integral oil coolers which are adequate for tropical conditions provided that the radiator is capable of keeping the coolant temperature within our specified limits.

For the other engine types the installation should be designed so as to allow air to flow freely over the engine lubricating sump and filters. If a cooling test shows an oil cooler to be necessary, Perkins Applications Engineering should be contacted to ensure a satisfactory installation.

16.9.3. Lubricating Oil Pump Delivery

As an aid to lubricating oil cooler selection, typical maximum oil delivery rates are tabulated below for engines not fitted with integral oil coolers.

Engine type	Flow rate	Engine speed, rev/min								
		1000	1500	2000	2250	2500	2600	2800	3600	4000
4.108	UK gal/min	1.3	1.9	2.5	2.8	3.2	3.3	3.5	4.8	5.0
	US gal/min	1.6	2.3	3.0	3.4	3.8	3.9	4.2	5.7	6.0
	Litre/min	5.9	8.6	11.4	12.9	14.5	14.8	16.0	21.6	22.7
D3.152	UK gal/min	2.1	3.2	4.1	4.7	5.2	—	—	—	—
	US gal/min	2.5	3.8	5.0	5.6	6.3	—	—	—	—
	Litre/min	9.5	14.3	18.8	21.1	23.6	—	—	—	—
4.165	UK gal/min	3.0	4.9	6.7	7.4	8.2	8.7	9.4	11.6	—
	US gal/min	3.6	5.9	8.0	8.9	9.8	10.4	11.2	13.9	—
	Litre/min	13.8	22.2	30.6	33.9	37.2	39.8	42.8	52.8	—
4.203/ D4.203	UK gal/min	3.1	4.7	6.2	6.9	7.7	8.0	—	—	—
	US gal/min	3.7	5.6	7.4	8.3	9.2	9.6	—	—	—
	Litre/min	14.1	21.4	28.1	31.3	35.1	36.3	—	—	—
4.236/ 4.248	UK gal/min	3.4	5.1	6.8	7.6	8.5	8.8	9.6	—	—
	US gal/min	4.1	6.1	8.2	9.1	10.2	10.7	11.5	—	—
	Litre/min	15.5	23.2	30.9	34.6	38.6	40.2	43.6	—	—
4.318	UK gal/min	5.8	8.7	11.6	12.8[a]	—	—	—	—	—
	US gal/min	7.0	10.4	13.9	15.3	—	—	—	—	—
	Litre/min	26.4	39.5	52.6	57.9	—	—	—	—	—
6.3544/ 6.3724	UK gal/min	5.1	7.5	9.0	10.1	11.2	13.0	14.2	—	—
	US gal/min	6.1	9.0	10.8	12.1	13.5	15.6	17.1	—	—
	Litre/min	23.2	34.1	40.9	46.0	51.1	59.1	64.6	—	—

NOTE:
(a) This value corresponds to an engine speed of 2200 rev/min.

16.9.4. By-Pass Oil Filters

The following by-pass filters are approved for use with the 4.108 engine: —

FRAM F43P (with .078 in (1.98 mm) orifice)
NEFCO F1117 (with .076 in (1.93 mm) orifice)

For information regarding the use of by-pass filters with other engine types, please refer to Perkins Group Applications Engineering Department, Peterborough.

16.9.5. General Information

Oil pressure

Normal pressure for a warm engine within the operating speed range is 30 to 60 lbf/in² (207 to 414 kN/m²).

Oil consumption

Oil consumption varies with engine condition, type and condition of lubricating oil, engine duty and operating temperatures. It will not normally exceed 1% of the fuel consumption.

16.10 POWERED AUXILIARY DRIVES

16.10.1 P.T.O. from Front of Crankshaft (Axial and Belt Drives)

For information regarding the amount of power and torque available through axial and belt drives from the front of the crankshaft, please contact Perkins Group Applications Engineering Dept.

16.10.2. Gear Driven P.T.O. from Timing Case

Power and torque available through gear driven P.T.O's are as tabulated below.

NOTE :
The power and torque values shown are the maximum intermittent values recommended, and neither should be exceeded at any speed.

Engine Type	P.T.O. Position	Side of engine	Direction of rotation (viewed from front of engine)	Power available		Torque available	
				hp	kW	lbf ft	Nm
4.108	Off fuel pump gear	Left	Anti-clockwise	21	16	46	62
D3.152 Industrial	Off camshaft gear	Right	Anti-clockwise	17[a]	13	45	61
				21[b]	16	45	61
D3.152 Agricultural	Off idler gear	Right	Clockwise	8	6	10	14
4.203	Below fuel pump	Left	Clockwise	46	34	87[c]	118[c]
	Off camshaft gear	Right	Clockwise	18	13	50	68
D4.203	Below fuel pump	Left	Clockwise	14	10	30	40
4.236/4.248 Industrial	Single P.T.O.:						
	Below fuel pump	Left	Clockwise	12[d]	9	24	33
				50[e]	37	105	142
	Twin P.T.O. :						
	Below fuel pump	Left	Clockwise	50	37	105	142
	Off camshaft gear	Right	Anti-clockwise	10	7	21	28
4.236/4.248 Agricultual	Off camshaft gear	Right	Anti-clockwise	8[f]	6	10	14
				12[g]	9	15	20
4.318	For information contact Perkins Group Applications Engineering Dept.						
6.3544/T6.3544/6.3724	Auxiliary drive shaft	Left	Anti-clockwise	18	13	55	75
V8.540	Off idler gear	Left	Clockwise	9	7	15	20
V8.640/TV8.640	Off idler gear	Left	Clockwise	17	13	[h]	[h]

NOTES :

* Available simultaneously.

a Unbushed camshaft.

b Bushed camshaft.

c If both P.T.O. positions are used simultaneously, torque through lower idler gear must not exceed 87 lbf ft (118 Nm).

d Pressure die cast timing case.

e Gravity die cast timing case.

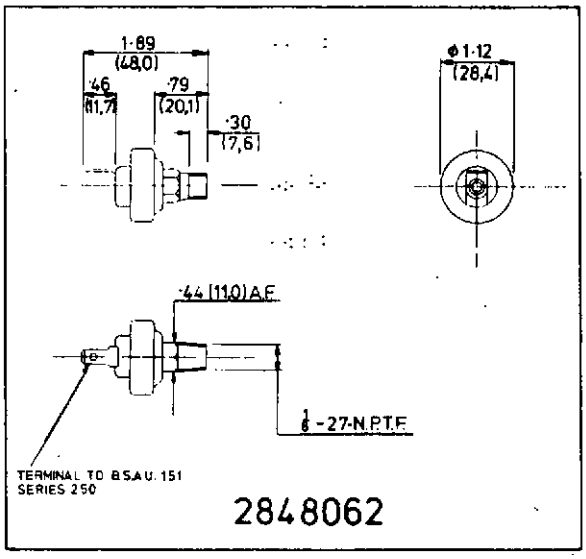
f Cast iron camshaft gear.

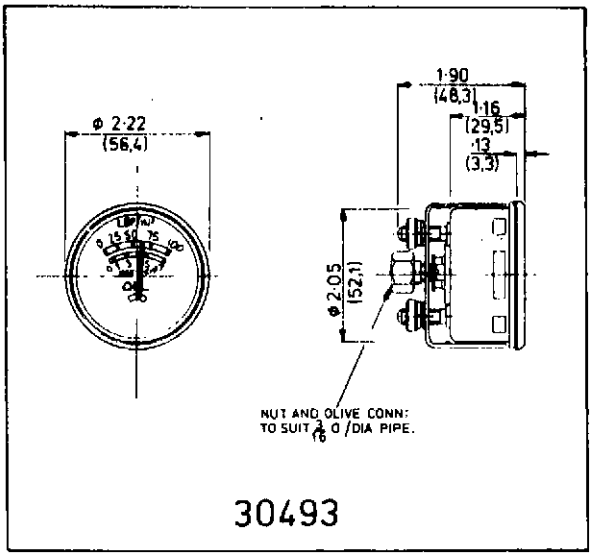
g Steel camshaft gear.

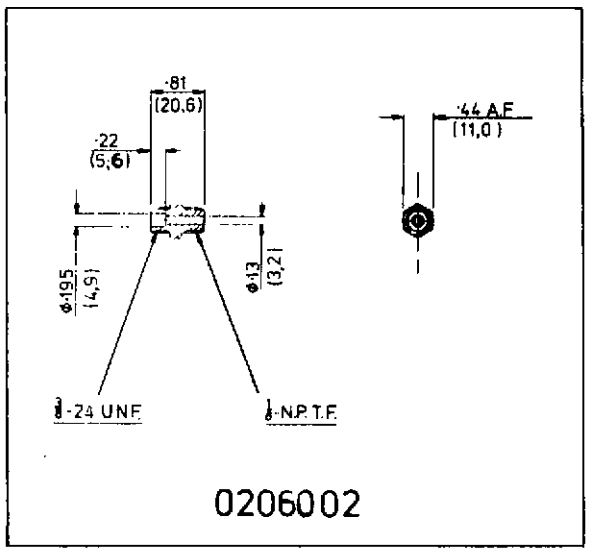
h Dependent upon pump type ; power limitation specified must not be exceeded.

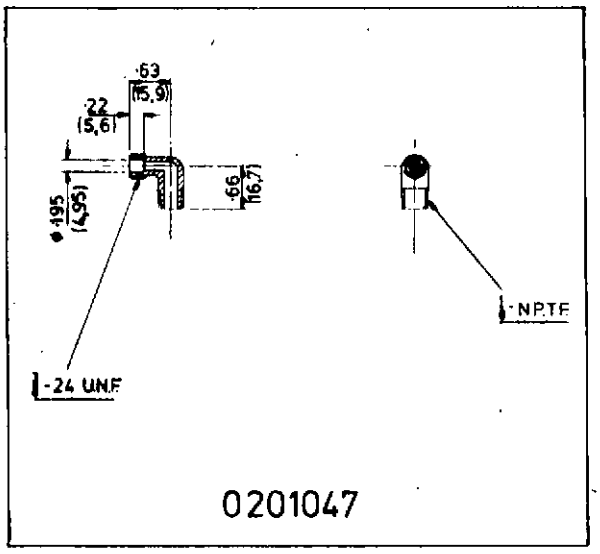
16.11. CONTROLS AND INSTRUMENTATION

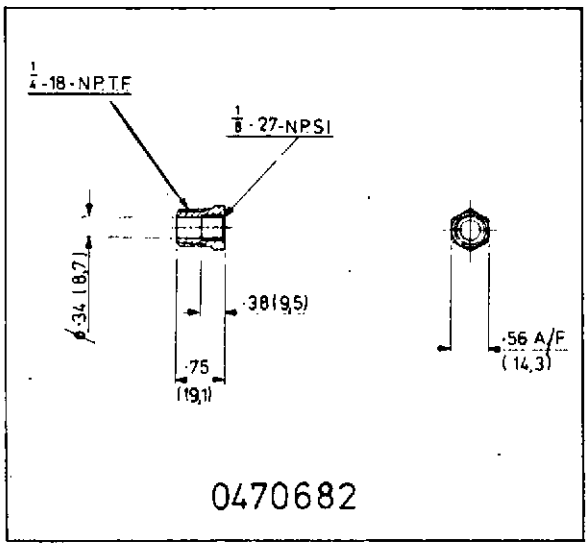
16.11.1. Oil Pressure Indicators and Connectors.



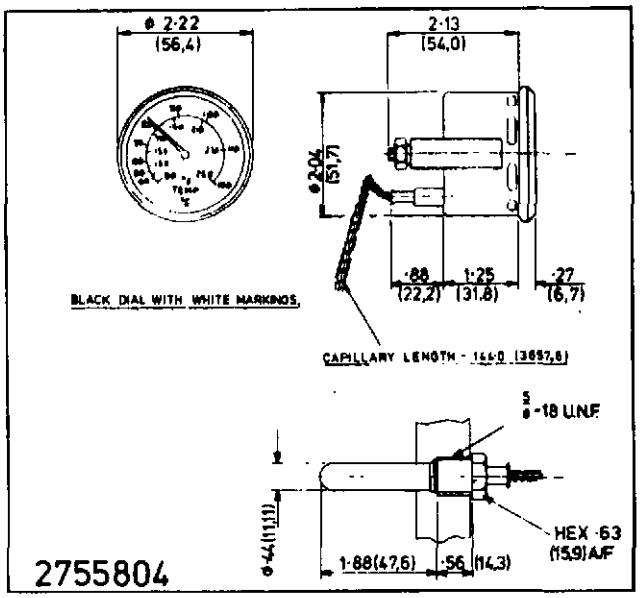


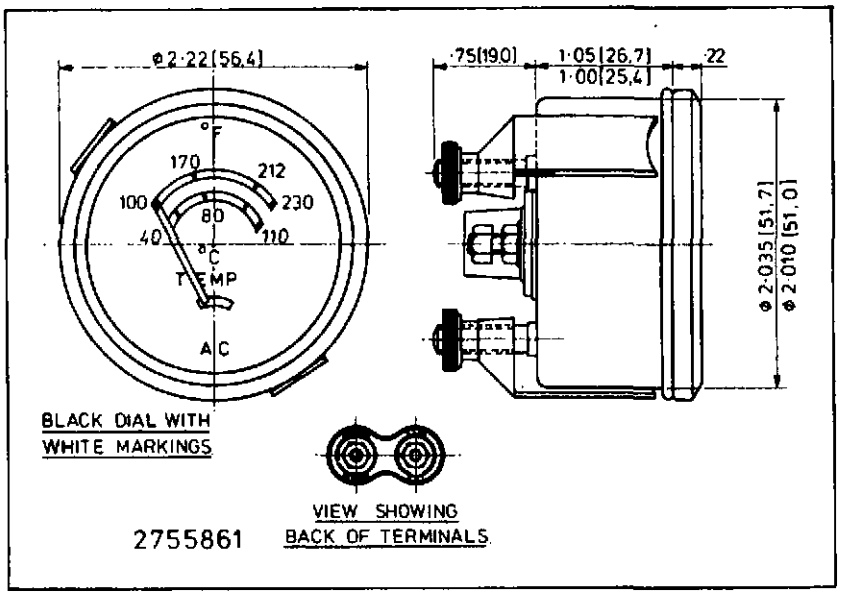


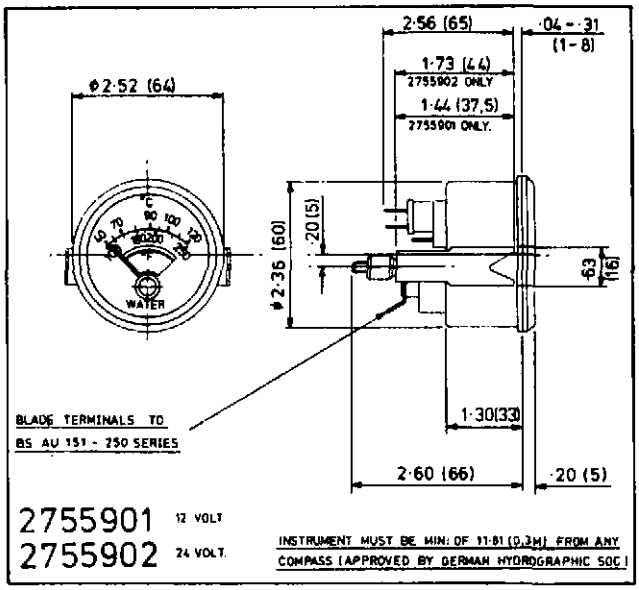




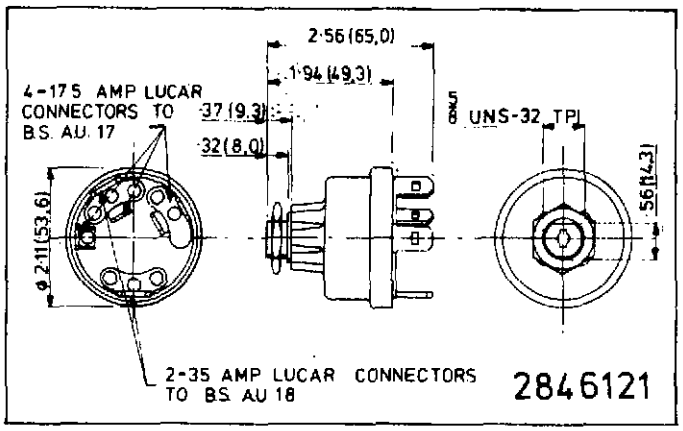
16.11.2. Coolant Temperature Gauges

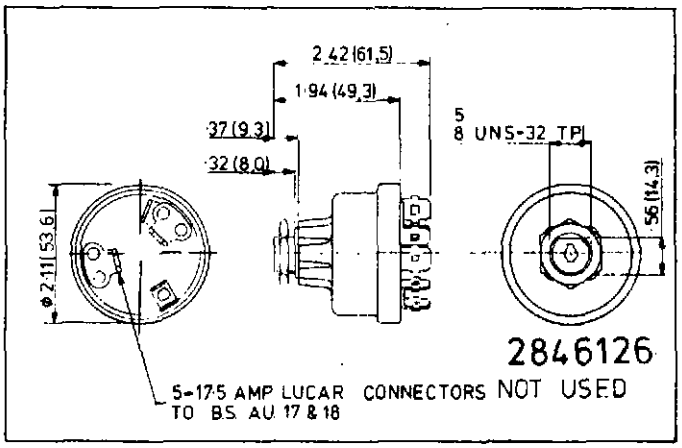


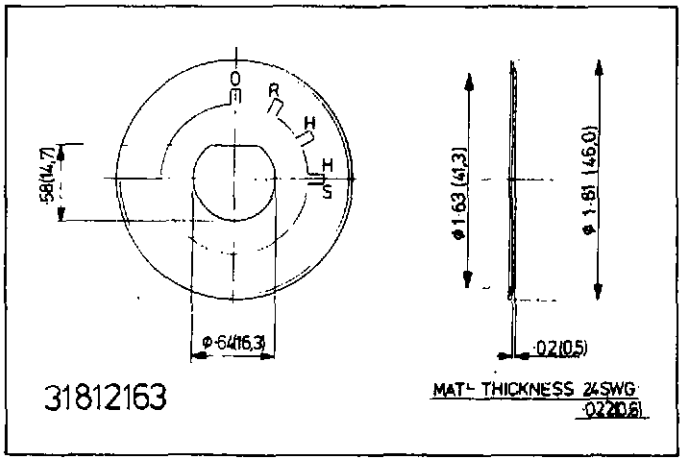


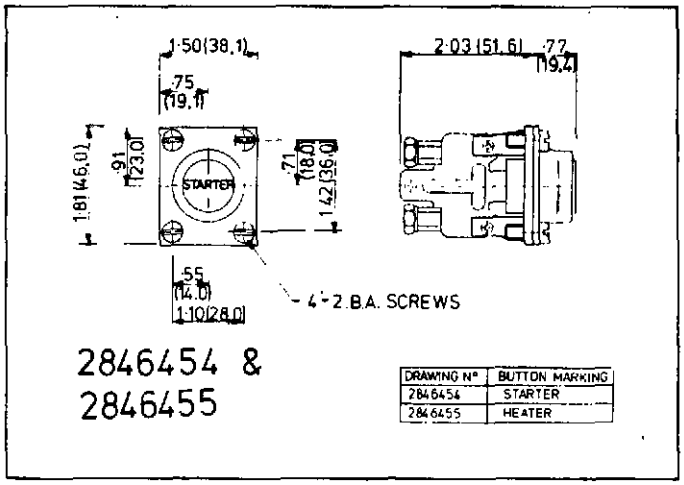


16.11.3. Engine Heater/Starter Switches









NOTES :

a) Also available as a sealed unit and/or incorporating private lock.

b) Also available as a sealed unit incorporating private lock.

16.12. ENGINE DIMENSIONS AND WEIGHTS

Typical bare engine dimensions and weights are tabulated below.

Engine Type		Overall dimensions of bare engine			
		Length ins (mm)	Width ins (mm)	Height ins (mm)	Dry weight lbf (kgf)
4.108	Vehicle	23,1 (587)	19,4 (493)	25,2 (639)	321 (146)
	Industrial	23,2 (590)	19,1 (485)	25,7 (653)	330 (150)
	Agricultural	23,2 (589)	19,1 (484)	25,2 (639)	330 (150)
D3.152		24,0 (610)	20,7 (526)	31,1 (791)	458 (208)
4.165	Vehicle	25,8 (655)	25,7 (653)	32,7 (830)	440 (200)
	Industrial	25,8 (655)	25,7 (653)	32,7 (830)	442 (201)
4.203		28,2 (715)	19,4 (493)	29,4 (746)	484 (220)
D4.203		28,2 (715)	19,4 (493)	29,4 (746)	495 (225)
4.236	Vehicle	28,8 (731)	20,6 (522)	32,0 (813)	594 (270)
	Industrial	28,8 (731)	20,7 (525)	32,1 (816)	594 (270)
	Agricultural	30,6 (778)	20,4 (519)	28,4 (722)	548 (249)
6.247		35,4 (900)	24,8 (630)	28,0 (711)	609 (277)
4.248		30,6 (778)	20,4 (519)	28,4 (722)	548 (249)
4.318		31,5 (800)	22,1 (560)	33,9 (860)	814 (370)
6.3544	Vehicle	36,6 (930)	25,0 (635)	33,3 (845)	957 (435)
	Industrial	38,0 (965)	25,1 (637)	35,4 (900)	957 (435)
	Agricultural	38,0 (965)	25,1 (637)	33,3 (845)	957 (435)
T6.3544	Vehicle	36,8 (935)	28,8 (732)	33,6 (853)	979 (445)
	Industrial	36,8 (935)	29,3 (743)	30,7 (780)	979 (445)
	Agricultural	39,1 (992)	27,2 (690)	40,7 (1033)	979 (445)
6.3724		38,0 (965)	25,1 (637)	33,3 (845)	957 (435)
V8.540	Vehicle	36,7 (933)	32,7 (830)	38,2 (970)	1338 (608)
	Industrial	36,7 (933)	32,7 (830)	35,5 (902)	1338 (608)
	Agricultural	38,6 (980)	32,7 (830)	29,7 (755)	1371 (623)
V8.640	Vehicle	40,6 (1030)	32,7 (830)	39,1 (992)	1600 (727)
	Industrial	40,6 (1030)	32,7 (830)	39,1 (992)	1604 (729)
	Agricultural	40,6 (1030)	32,7 (830)	39,1 (992)	1725 (784)
TV8.640	Vehicle	42,1 (1050)	32,8 (832)	38,9 (988)	1652 (751)
	Industrial	41,3 (1070)	32,8 (832)	38,6 (980)	1659 (754)
	Agricultural	42,1 (1070)	32,8 (832)	38,9 (988)	1780 (809)

16.13. CONVERSIONS AND FORMULAE

Note: The units set in bold type are to the SI standard.

EXACT CONVERSION	WHOLE NUMBER CONVERSION (within 0,5% accuracy)
POWER	
1 bhp = 1,01387 PS, ch or CV	70 bhp = 71 PS, ch or CV
1 bhp = 0,7457 **kW**	70 bhp = 52 **kW**
TORQUE	
1 lbf ft = 0,138255 kgf m	72 lbf ft = 10 kgf m
1 lbf ft = 1,35582 **N m**	74 lbf ft = 100 **N m**
SPECIFIC FUEL CONSUMPTION	
1 lb/bhp h = 447,387 g/PS h	1 lb/bhp h = 447 g/PS h
1 lb/bhp h = 608,277 **g/kW h**	1 lb/bhp h = 608 **g/kW h**
FUEL CONSUMPTION (mile/gal)	
a mile/UK gal x **b** litre/100 km = 282,481	**a** mile/UK gal = $\frac{282}{\textbf{b}\text{ litre/100 km}}$ For example: 14,1 litre/100 km = $\frac{282}{14,1}$ mile/UK gal = 20 mile/UK gal or: 28,2 mile/UK gal = $\frac{282}{28,2}$ litre/100 km = 10 litre/100 km
a mile/US gal x **b** litre/100 km = 235,215	**a** mile/US gal = $\frac{235}{\textbf{b}\text{ litre/100 km}}$
LUBRICATING OIL CONSUMPTION	
a mile/UK pt x **b** litre/1000 km = 353,102	**a** mile/UK pt = $\frac{353}{\textbf{b}\text{ litre/1000 km}}$
a mile/US qt x **b** litre/1000 km = 588,038	**a** mile/US qt = $\frac{588}{\textbf{b}\text{ litre/1000 km}}$
SPEED	
1 mile/h = 1,60934 **km/h**	62 mile/h = 100 **km/h**
1 ft/s = 0,3048 **m/s**	23 ft/s = 7 **m/s**
1 ft/min = 0,00508 **m/s**	197 ft/min = 1 **m/s**
1 mile/h = 1,466667 ft/s	30 mile/h = 44 ft/s
1 km/h = 0,277778 **m/s**	90 km/h = 25 **m/s**
MASS	
Note: Weight is the downwards force that a mass exerts as a result of gravity. In British units an engine weighing 500 lbf has a mass of 500 lb. In metric units an engine weighing 500 kgf has a mass of 500 kg. In SI units however the kgf is replaced as a unit of force by the Newton. This means we have to be more precise and quote engine mass instead of weight.	
1 lb = 0,453592 **kg**	22 lb = 10 **kg**
1 cwt = 50,8023 **kg**	1 cwt = 51 **kg**
1 ton = 1,01605 **tonne**	60 ton = 61 **tonne**
1 ton = 1016,05 **kg**	1 ton = 1016 **kg**
VOLUME AND CAPACITY	
1 yd^3 = 0,764555 $\textbf{m}^3$	30 yd^3 = 23 $\textbf{m}^3$
1 ft^3 = 0,0283168 $\textbf{m}^3$	106 ft^3 = 3 $\textbf{m}^3$
1 UK gal = 4,54609 **litre**	22 UK gal = 100 **litre**
1 US gal = 3,78541 **litre**	10 US gal = 38 **litre**
1 UK pt = 0,568261 **litre**	100 UK pt = 57 **litre**
1 US qt = 0,946353 **litre**	19 US qt = 18 **litre**
1 in^3 = 16,3871 cm^3	3 in^3 = 49 cm^3
1 in^3 = 0,0163871 **litre**	61 in^3 = 1 **litre**

EXACT CONVERSION	WHOLE NUMBER CONVERSION (within 0,5% accuracy)
PRESSURE	
1 lbf/in² = 0,070307 kgf/cm²	100 lbf/in² = 7 kgf/cm²
1 lbf/in² = 6,89476 **kN/m²**	10 lbf/in² = 69 **kN/m²**
1 in H_2O = 0,249089 **kN/m²**	4 in H_2O = 1 **kN/m²**
1 mm H_2O = 0,00980665 **kN/m²**	102 mm H_2O = 1 **kN/m²**
1 in Hg = 3,38639 **kN/m²**	10 in Hg = 34 **kN/m²**
1 mm Hg = 0,133322 **kN/m²**	75 mm Hg = 10 **kN/m²**
LENGTH	
1 mile = 1,60934 **km**	62 mile = 100 **km**
1 ft = 0,3048 **m**	23 ft = 7 **m**
1 in = 25,4 **mm**	2 in = 51 **mm**
HEAT FLOW	
1 Btu/min = 0,2519967 kcal/min	79 Btu/min = 20 kcal/min
1 Btu/min = 17,58426 **W**	2 Btu/min = 35 **W**
1 Btu/min = 0,01758426 **kW**	57 Btu/min = 1 **kW**
MOMENT OF INERTIA	
Note 1: MOMENT OF INERTIA is **mass x RADIUS of gyration²** (mk²). FLYWHEEL EFFECT is **mass x DIAMETER of gyration²** (GD²) and is four times greater than the moment of inertia. In Europe the flywheel effect is called the moment of inertia. Hence what the Europeans call the moment of inertia is four times greater than what we, in Britain, call the moment of inertia and the conversion given below takes this into account.	
1 lb in² (mk²) = 0,00117056 **kgm²** (GD²)	854 lb in² (mk²) = 1 **kgm²** (GD²)
Note 2: The moment of inertia may also be expressed in derived units of **force length time²**. With these units there is not a factor of four difference between British and European units and a straight conversion is used.	
1 lbf in s² = 1,152125 kgf cm s²	20 lbf in s² = 23 kgf cm s²
*Note 3: The conversion from **mass length²** units i.e. mk² and GD² units, to **force length time²** units* is as follows:	
1 lb in² (mk²) = 0,002590079 lbf in s²	386 lb in² (mk²) = 1 lbf in s²
1 lb in² (mk²) = 0,00298409 kgf cm s²	335 lb in² (mk²) = 1 kgf cm s²
1 kg m² (GD²) = 2,5492905 kgf cm s²	20 kg m² (GD²) = 51 kgf cm s²
FORCE	
1 lbf = 4,44822 **N**	9 lbf = 40 **N**
1 lbf = 0,453593 kgf	22 lbf = 10 kgf

USEFUL FORMULAE

POWER — TORQUE

bhp = $\frac{\text{torque (lbf ft)} \times \text{engine rev/min}}{5252}$

PS = $\frac{\text{torque (kgf m)} \times \text{engine rev/min}}{716}$

kW = $\frac{\text{torque (Nm)} \times \text{engine rev/min}}{9549}$

POWER — b.m.e.p.

bhp = $\frac{\text{Swept volume (in}^3\text{)} \times \text{b.m.e.p. (lbf/in}^2\text{)} \times \text{engine rev/min}}{792000}$

PS = $\frac{\text{Swept volume (litre)} \times \text{b.m.e.p. (kgf/cm}^2\text{)} \times \text{engine rev/min}}{900}$

kW = $\frac{\text{Swept volume (litre)} \times \text{b.m.e.p. (kN/m}^2\text{)} \times \text{engine rev/min}}{120000}$

TORQUE — b.m.e.p.

Torque (lbf ft) = $\frac{\text{b.m.e.p. (lbf/in}^2\text{)} \times \text{swept volume (in}^3\text{)}}{150.8}$

Torque (kgf m) = $\frac{\text{b.m.e.p. (kgf/cm}^2\text{)} \times \text{swept volume (litre)}}{1.257}$

Torque **(N m)** = $\frac{\text{b.m.e.p. (kN/m}^2\text{)} \times \text{swept volume (litre)}}{12.57}$

SPECIFIC FUEL CONSUMPTION — FUEL LEVEL and POWER OUTPUT

sfc (lb/bhp h) = $\frac{\text{fuel level (mm}^3\text{/stroke)} \times \text{number of cylinders} \times \text{engine rev/min}}{\text{bhp} \times 18150}$

sfc (g/PS h) = $\frac{\text{fuel level (mm}^3\text{/stroke)} \times \text{number of cylinders} \times \text{engine rev/min}}{\text{PS} \times 40}$

sfc **(g/kW h)** $\frac{\text{fuel level (mm}^3\text{/stroke)} \times \text{number of cylinders} \times \text{engine rev/min}}{\text{kW} \times 40}$

CALORIFIC VALUE OF FUEL OIL

18400 Btu/lb 10200 kcal/kg 42800 **kJ/kg**

AIR DENSITY (BS AU 141a : 1971 conditions)

0.0752 lb/ft³ 1.205 **kg/m³**