Technical Information
Bulletin No. 4

PREPARATION AND ASSEMBLY OF

TRIUMPH TIGER CUB

ENGINES

FOR MAXIMUM PERFORMANCE

A series of alternative components have now been made available for the Tiger Cub to provide a 'Conversion' condition, giving a 40% increase in overall B.H.P. output with a corresponding increase in road performance for those wishing to participate in sporting activities with their machines.

The conversion is regarded here as being applicable to a 1958 T20C (Competition version) but obviously the basic engine tuning applies to all the T20 range. A table giving recommended overall ratios with different available tyre and wheel conditions is appended at the end of the bulletin.
A detailed parts list of the above items is also appended which is based on a T20C Competition Cub basic specification, and any variation from this on a machine on which work is to commence must be taken into account when compiling the necessary spares requirements.

It will be assumed that a Tiger Cub Instruction Manual and a Tiger Cub Replacement Parts List is to hand before work commences on the machine, and any detailed work described therein will not be repeated here.

The components are available as follows :

For the Engine
Piston 9:1 CR complete with high duty piston rings.
Camshaft.
Cylinder head with large inlet port and inlet valve.
Stronger valve springs.
Carburetter adaptor.

For the Gearbox
Mainshaft high gear assembly.
Layshaft high gear 27/18T combination.

For the Primary Drive (for machines fitted with the $\frac{3}{8}$" pitch single or duplex chains)
Engine drive sprocket and spacer.
Clutch assembly complete. (See Section 2).
Primary chain $\frac{1}{2}$" pitch.

Rear Drive
Gearbox sprocket 19T.
Rear wheel sprocket 54T (for the range of rear wheel and gearbox drive sprockets available, see Table 2).

Exhaust System
Downswept exhaust pipe.
Exhaust pipe extension.

Carburetter assembly
Amal Type 376 $\frac{1}{16}$" choke.
Remote float bowl, rubber mounted, with associated fuel lines.

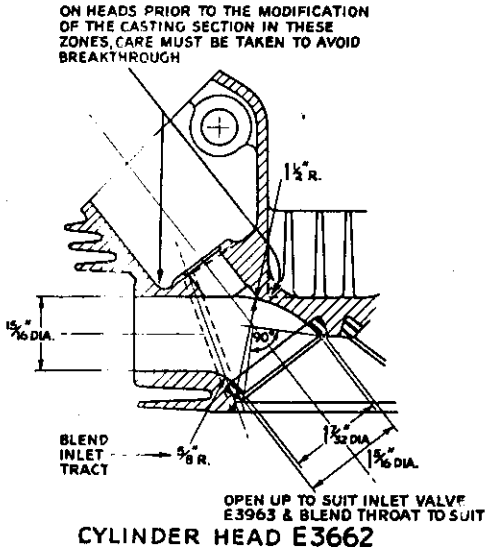
SECTION 1 ENGINE

Strip out completely as described in the Instruction Manual and examine for wear, fatigue, damage, or failure. Do not refit any components which are suspect, or all the work carried out on the machine will be wasted if later a failure is suffered as a result. Rebuild with new gaskets and washers throughout.

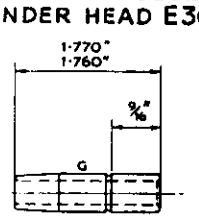
(a) Crankcase
If the machine is prior to engine No. 24090 strip out the flywheel assembly and fit the present specified big end liner which is of high duty material (VP3).
The flywheel timing side journal and bush should be examined for wear and the latest material (VP3) liner, Part No. E3655, fitted (standard equipment from engine No. 26276).
Rebuild the engine components into the crankcase as described in the Instruction Manual, ensuring that the primary inner cover is a good interference fit (.0027") in the crankcase. Fit the new camshaft to the "dots" as described for the standard camshaft, when the "High Performance" timing will be automatically achieved. Fit the new piston and rings, and a new barrel if there is the slightest signs of a "step" in the location of the top compression ring in the old cylinder barrel. In any case it is advisable to lightly scuff the surface of any used barrel before fitting new pistons and rings, to ensure suitable running in conditions are achieved.
Assemble the engine, oiling all the components separately and using oil liberally during the assembly process.

(b) Cylinder Head
The cylinder head has been modified to the condition shown in the drawing below, but care must be taken to ensure that a break through does not occur in the zones indicated, on engines prior to the time when the head casting was built up in these areas. Before refitting the valves, the carburetter adaptor should be bolted up and the inlet port blended to give an almost constant section, free from sharp corners, bumps and waviness. A mirror finish is not essential, but the maximum smoothness is desirable. It will be found that the seat for the larger valve is adequate without resorting to blending in the auxiliary sphere in a new head, but if the head has been serviced at some time and had the seats recut, it will be found necessary to reblend the larger inlet port condition into the combustion sphere to remove any sharp changes of section.

Shorten the valve guides by 5/64" at the top end in the rocker cavity, to a dimension of $\frac{3}{16}$" from the top of the circlip groove as shown in the diagram to allow for the greater cam lift.
Fit the new inlet and original standard exhaust valve if it is satisfactory, together with the new valve springs and special bottom cups. Reassemble the head as described in the Manual. Note that the tappet clearance is 0.002" inlet, 0.004" exhaust, with "High Performance" camshaft.



CYLINDER HEAD E3662

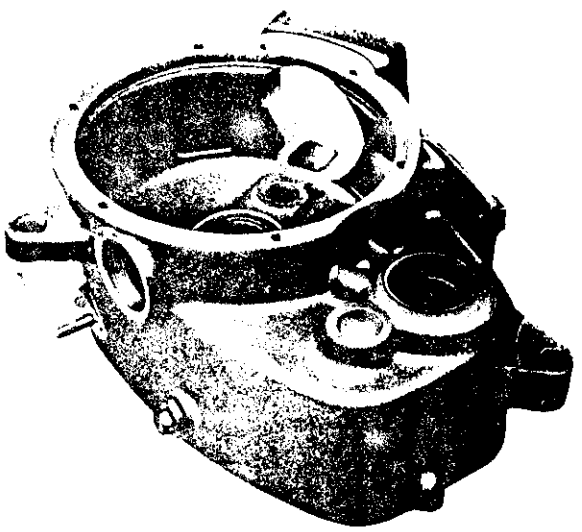


VALVE GUIDE E3208

TIMING (illustrated on right)
When the camshaft has been assembled into the camwheel using the specified key, the inlet/exhaust camshaft timing is automatically achieved, and assembly of this component into the engine as described in the assembly procedure in the Manual will provide the correct inlet/exhaust valve timing.
To achieve maximum power and flexibility, a maximum spark advance figure of 40° B.T.C. must be established. If the engine is prior to engine No. 22117 it is recommended that a distributor of the present standard type (range 24° engine) Lucas Part No. 40529A is fitted, and timing the engine at 16° ($\frac{1}{16}$") B.T.C. with the engine stationary, will automatically give the correct advance figure at peak power R.P.M.
Alternatively, the engine may be run with a degree disc bolted securely on to the engine drive shaft, with a pointer attached to the crankcase set to read 360° at T.D.C., and a stroboscope light triggered from the spark plug used to set the distributor at 40° B.T.C. from above 4,000 r.p.m.
Experience has shown that it is permissable to lock up the distributor advance mechanisms altogether and time the engine at 40° B.T.C. on fixed ignition.
It is also advisable to fit twin contact breaker springs to eliminate the possibility of flutter at high R.P.M.
For a wiring diagram suitable for running without lighting equipment refer to the diagram in the Tiger Cub Instruction Manual No. 5.

SECTION 2 PRIMARY DRIVE

If the engine is built to the conditions described in this bulletin it will be found that an overall drive ratio suitable for the power output cannot be achieved using either the $\frac{3}{8}$" pitch single or duplex chain conditions.
An 18/36 tooth combination is necessary, using the $\frac{1}{2}$" pitch primary chain as shown in the Parts List at the end of the Bulletin, giving a ratio of 2 : 1 primary drive in lieu of 2.53 : 1 with the 19/48 combination with the $\frac{3}{8}$" pitch chain condition.
These sprocket ratios are fixed due to the fixed centres of the engine driveshaft and gearbox mainshaft. It will be found necessary to change only the driveshaft sprocket and spacer, clutch housing and sprocket, drive plates and chain to convert machines subsequent to engine No. 35847, but the complete clutch assembly will be required on machines prior to engine No. 11621

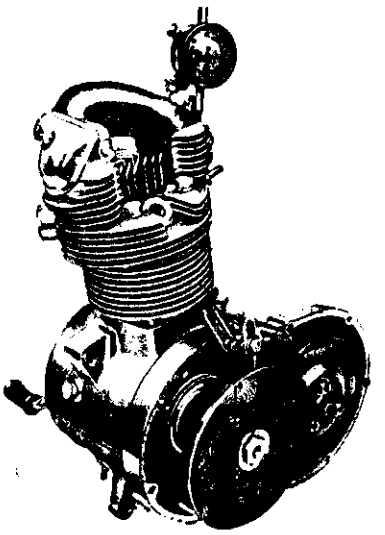


SECTION 3 GEARBOX

For High Performance competition work, a close ratio gearbox conversion is provided giving the following gearbox ratios.

Top	1.0 : 1
Third	1.2 : 1
Second	1.875 : 1
Bottom	2.72 : 1

The components necessary for this conversion are the mainshaft high gear and layshaft high gear giving an 18/27 tooth combination. The parts are listed separately at the end of the bulletin and are assembled with the rest of the original standard gears from the box to form the new assembly.
It may be necessary at this stage to fit the 19 tooth gearbox drive sprocket, if the wheel size chosen necessitates this to achieve the required ratio, in which case it is essential to provide chain running clearance at the crankcase at the zone to the rear of the flywheels.
This is incorporated in the crankcase casting with effect from engine No. 42865, but will have to be machined, with great care, avoiding break through on all earlier crankcases. It is worth investigating therefore, if the ratio cannot otherwise be achieved using other tyre, wheel and sprocket ratios instead, to avoid this eventuality.
Note also that with effect from engine No. 35847 a "gitts" type oil seal was introduced at the gearbox drive sprocket, and in consequence the new sprocket fitted must be machined to suit, otherwise damage will occur to the seal. Subsequent to this engine number fit T1513 range of sprockets.



SECTION 4 REAR DRIVE AND WHEEL SIZES.

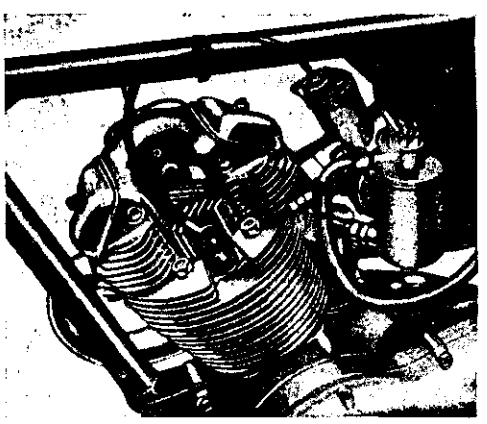
Having decided the wheel sizes to be used, the ratios given at the end of the bulletin should be studied to determine the sprockets required. For the basic machine considered here, a 1958 T20 Competition Cub, with 3.50" × 18" rear tyre equipment, at present fitted with a 16T gearbox drive sprocket, 46T rear wheel sprocket and $\frac{3}{8}$" duplex primary, an overall ratio change from 7.26 (std.) to 5.74 is required.
This ratio cannot be achieved using 18" rear tyre and the $\frac{3}{8}$" duplex chain. Therefore the 18/36, $\frac{1}{2}$" pitch chain is necessary.
The ratio can now be achieved using :

$$\frac{36}{18} \times \frac{54}{19} = 5.68$$

or alternatively

$$\frac{36}{18} \times \frac{48}{17} = 5.65$$

Therefore if the crankcase is prior to engine No. 42865, use the 5.65 ratio, giving a 17T gearbox drive sprocket, as clearance for a 19T is not provided. Further reference to the chart for other ratios will enable a choice to be made.
Remember the overall ratio required alters with the tyre size chosen, and this is known as the "equivalent ratio" to keep the engine revolutions turned, to distance travelled ratio constant.



Carburetter Float Bowl and Feed Pipe Layout using the later 'Kit' components

SECTION 5 CARBURETTER AND ASSOCIATED FEED

A $1\frac{1}{16}$" Choke type Amal 376 carburetter is used, fitted with a .106 needle jet and needle middle notch, 376/3 slide and 140 main jet, single feed banjo and remote float bowl, rubber mounted from a bracket attached to the frame as shown. A parts list is available and assembly should be as shown in the accompanying photograph.

SECTION 6 FRAME

1. There is at present available a 10" straight through extension suitable for fitting to the standard downswept T20 Cub exhaust pipe, E.3257 $1\frac{1}{16}$" diameter, and this gives maximum power coupled with maximum flexibility.
2. **Rear Chainguard**

For most of the sprocket ratios available it will be necessary to remove the chainguard to provide chain running clearance.

SECTION 7 OVERALL DRIVE RATIOS

From experience it will be found most useful to remember that the optimum engine r.p.m./road speed relationship is 90 m.p.h. at 6,800 r.p.m. Final choice of ratios is a matter of experience, and will depend on the type of circuit or event, and the weight and size of the rider.

TABLE 1

ENGINE REVOLUTIONS PER MINUTE

Gear Ratios	4.32	4.59	4.77	4.95	5.14	5.32	5.4	5.58	5.76	5.95	6.12	6.3	6.53	6.75	7.0	7.2	7.47	7.55	8.0
	4.84	5.1	5.3	5.5	5.7	5.9	6.0	6.2	6.4	6.6	6.8	7.0	7.25	7.5	7.75	8.0	8.3	8.6	8.9
	4.8	5.05	5.25	5.45	5.65	5.85	5.95	6.15	6.34	6.53	6.73	6.93	7.18	7.43	7.67	7.92	8.22	8.5	8.82
M.P.H. 20	1296	1363	1416	1471	1515	1576	1603	1660	1712	1767	1820	1872	1940	2008	2074	2140	2220	2300	2380
25	1620	1703	1770	1838	1906	1970	2003	2075	2140	2208	2275	2340	2425	2510	2592	2675	2775	2875	2975
30	1944	2044	2124	2206	2287	2364	2404	2490	2568	2650	2730	2808	2910	3012	3111	3210	3330	3450	3570
35	2268	2385	2478	2574	2668	2758	2805	2905	2996	3092	3186	3276	3395	3514	3629	3745	3885	4025	4165
40	2592	2726	2832	2942	3050	3152	3206	3320	3424	3534	3640	3744	3880	4016	4148	4280	4440	4600	4760
45	2916	3066	3186	3309	3431	3546	3606	3735	3852	3975	4095	4212	4365	4518	4666	4815	4995	5175	5355
50	3240	3407	3540	3677	3812	3940	4007	4150	4280	4417	4550	4680	4850	5020	5185	5350	5550	5750	5950
55	3564	3748	3894	4045	4193	4334	4408	4565	4708	4859	5006	5148	5335	5522	5703	5885	6105	6325	6545
60	3888	4089	4248	4413	4575	4728	4809	4980	5136	5301	5460	5616	5820	6024	6222	6420	6660	6900	7140
65	4212	4429	4602	4780	4955	5122	5209	5395	5564	5742	5916	6084	6305	6526	6740	6955	7215	7475	7735
70	4536	4770	4956	5148	5337	5516	5610	5810	5992	6184	6373	6552	6790	7028	7259	7490	7770	8050	
75	4860	5111	5310	5516	5716	5910	6011	6225	6420	6626	6826	7020	7275	7530	7777	8025			
80	5184	5452	5664	5884	6100	6304	6412	6640	6848	7068	7280	7488	7660	8032					
85	5508	5792	6018	6251	6481	6698	6812	7055	7276	7509	7735	7956	8245						
90	5832	6132	6372	6618	6862	7092	7212	7470	7704	7951	8190								
95	6156	6473	6726	6986	7243	7486	7613	7885	8132										
100	6480	6815	7080	7355	7625	7890	8015												

3.25" × 16" Rear Tyre
3.50" × 18" Rear Tyre
3.00" × 19" Rear Tyre

TABLE 2

Overall Gear Ratio using 18/36 Combination ½" Pitch Primary.

Gearbox Sprockets	Rear Wheel Sprockets 46	48	50	52	54	56	58	Recommended Ratios
13 Teeth	7.07	7.38	7.7	8	8.3	8.6	8.91	
14 Teeth	6.58	6.85	7.15	7.44	7.42	8.0	8.3	3.25" × 16" 18/46 5.1
15 Teeth	6.13	6.4	6.66	6.94	7.20	7.47	7.74	3.50" × 18" 16/46 5.7
16 Teeth	5.75	6.0	6.25	6.5	6.75	7.0	7.25	3.00" × 19" 17/48 5.6
17 Teeth	5.42	5.65	5.88	6.12	6.35	6.58	6.82	
18 Teeth	5.12	5.33	5.56	5.78	6.0	6.22	6.45	(i.e. all have the same equivalent ratio giving 6,800 r.p.m. at 90 m.p.h.)
19 Teeth	4.84	5.06	5.26	5.47	5.68	5.90	6.12	

For intermediate Gear Ratios, Multiply by the factor as shown.

Standard Ratio Gears		Close Ratio	
Top	1 : 1	Top	1 : 1
Third	1.3 : 1	Third	1.2 : 1
Second	2.0 : 1	Second	1.875 : 1
Bottom	3.0 : 1	Bottom	2.72 : 1

Equivalent ratio is the ratio that would be required to give the same r.p.m./m.p.h. relationship, using a different size rear tyre, **not** the ratio obtained when simply fitting a different size wheel.

$$\text{Overall ratio} = \frac{\text{clutch sprocket teeth no.} \times \text{Rear wheel sprocket teeth no.}}{\text{Engine drive sprocket teeth no.} \times \text{Gearbox drive sprocket no.}}$$

$$\text{Equivalent Ratio} = \frac{\text{Overall ratio} \times \text{R.P.M. of tyre used when calculating overall ratio}}{\text{New tyre size revs per mile}}$$

TABLE 3

Tyre equipment available and revs/mile chart.

Tyre Size	Universal	Racing
3.50" × 19"	822	829
3.00" × 19"	811	815
3.25" × 18"	820	829
3.50" × 18"	803	823
3.25" × 16"	892	—

TABLE 4

The following gearbox drive sprocket and rear wheel sprockets are available.

Gearbox Drive Sprocket		Rear Wheel Sprocket	
Prior to Engine No. 35847 (Utilising Felt Washer)	For use with neo-prene oil seal after Engine No. 35847		
13 Teeth T1488	13 Teeth T1555/13	46 Teeth W1320	
14 " T1489	14 " /14	48 " W984/48	(note special small headed bolts W. 1322 are reqd. for this sprocket.)
15 " T1339	15 " /15	50 " W1074	
16 " T1369	16 " T1513/16	52 " W1075	
17 " T1081	17 " /17	54 " W1076	
18 " T1204	18 " /18	56 " W1077	
	19 " T1568	58 " W1078	

HOW TO USE THE TABLES

After considering the type of course or event in which the Cub is to be used, refer to chart 1 giving engine R.P.M. against road speed.

Remember the optimum to aim for, for open flat road racing circuits is the ratio giving 90 m.p.h. at 6,800 r.p.m.

This will have to be "adjusted" to suit the particular event, rider, conditions, etc.

From the ratio chosen using Chart 1, relative to the particular tyre and wheel size being used, refer to Table 2 for the final drive sprocket combination to give that ratio.

Table 1 is calculated using Universal tyre equipment. When using racing tyres, to obtain the overall ratio more accurately, refer to Table 3.

Multiply the ratio obtained with the Universal tyre by :—

$$\frac{\text{Universal tyre revs/mile.}}{\text{Revs per mile of new tyre.}}$$

Then refer to Table 2 for suitable sprockets, using this new ratio obtained.

To obtain the accurate Engine R.P.M. with the new racing tyre. Multiply the R.P.M. given on the Chart for the original Universal Tyre by :—

$$\frac{\text{Revs per mile of new racing tyre}}{\text{Original Universal tyre revs/mile}}$$

This will give the actual engine R.P.M. at the road speed indicated on the chart, using alternative tyre equipment.

HIGH PERFORMANCE
CONVERSION COMPONENTS AVAILABLE FOR THE
TRIUMPH Tiger Cub

(T20C COMPETITION)

The undermentioned parts list details the necessary items required to convert the T20 to the 'High Performance' condition, and relates to the basic T20C (Competition) Cub only.

New Items	Description	No. Off	Replaces	No. Off	Remarks
ENGINE					
CP172	Piston Assembly. 9 : 1 complete with rings, gudgeon pin, circlips, etc.	1	CP141	1	
					Theoretical Valve Timing Tappets set to zero adjustment I.O. 59° E.O. 85° I.C. 81° E.C. 55°
E3959	Compression Ring, Top	1	E656	1	
E3960	Compression Ring, 2nd	1	E3048	1	
E3961	Oil Control Ring	1	E3387	1	
E3962	Camshafc	1	E3183	1	
E4050	Cylinder Head	1	E3662 } E3957 }	1	NOTE : E3662 Cylinder Head fitted to machines after T.20 45086 can be converted by the owner as the casting was then modified to allow a greater inlet port bore.
E3208	Valve Guides	2	E3208	2	NOTE : The latest condition of these guides are shortened $\frac{1}{64}$" to $\frac{1}{16}$" from the top of the circlip groove to the top face to allow greater rocker movement with the E3962 camshaft. Now standard on all Cubs from Engine No. 45312.
E3963	Inlet Valve	1	E3146	1	
E3965	Valve Spring, Inner	2	E3214	2	
E3966	Valve Spring, Outer	2	E3215	2	
E3964	Cup, Bottom	2	E3213	2	
E3986	Adaptor, Carb. to Head	1	E3954	1	
E4051	Joint Washer	1	E3250	1	
W103	Nut, Carb. adaptor Stud	2	F874	1	
GEARBOX					
T1568	Sprocket Gearbox 19T	1	T1513/16	1	If this sprocket is required to obtain the chosen ratio, note that from Eng. No. 42865 sufficient clearance has been provided on the standard crankcase, otherwise the clearance will have been provided.
T1565	Mainshaft High Gear Assy. (27T)	1	T1514	1	
T1594	Layshaft High Gear Assy. (18T)	1	T1091	1	
PRIMARY DRIVE	The following components may not be required if the chosen ratio can be obtained using the existing 19/48 $\frac{1}{2}$" Duplex chain already on the machine (see tables in this Bulletin giving $\frac{1}{2}$" pitch 18/36 combination, and a similar table for the $\frac{3}{8}$" Duplex chain at the end of this components list).				
E3581	Sprocket Engine 18T	1	E3912	1	(To suit $\frac{1}{2}$" pitch Primary chain).
W954	Distance Piece Sprocket	1	E3913	1	
T1341	Clutch Complete ... ... Consisting of :—	1	T1493	1	(To suit $\frac{1}{2}$" pitch Primary chain).
T1343	Clutch Housing and Sprocket (36T) complete ...	1	T1509	1	
T1294	Driving Plates ... ... (All other components common to both T1341 and T1493 clutches)	3	T1503	3	
D338	Chain Primary $\frac{1}{2}$" pitch 48 links	1	D382	1	
CARBURETTER					
376/217	Amal type 376, $1\frac{1}{4}$" choke ("chopped off" float chamber, and complete with single base feed banjo). *Note:* The Part No. 376/217 excludes the Remote Float Chamber as under : Float chamber (remote) 14/620 complete with single top feed banjo and special top nut 14/369 and E3989 mounting rod (2BA)	1	ZENITH 17 MX	1	
E4052	Bolt Carb. to adaptor	2	Addit.		
S25—3	Washer, bolt, carb. to adaptor	2	Addit.		
F4547	Float chamber bracket Assy.	1	Addit.		To be welded to frame top tube $6\frac{1}{4}$" forward of centre line of seat tube on drive side.
E3987	"METALASTIC" mounting	1	Addit.		
E4054	Bolt, metalastic mounting	2	Addit.		
E4053	Washer, metalastic mounting	2	Addit.		
T1017	Nut, metalastic mounting	2	Addit.		
H745	Nut, Float chamber mounting rod	3	Addit.		
F4541	Petrol pipe assy., carb. to float bowl		Addit.		
F4553	Petrol Pipe Assy., tank to float bowl	1	F4470	1	
D420	Throttle Cable	1	D406	1	
ADDITIONAL ITEMS IF REQUIRED					
E3257	Exhaust Pipe (downswept)	1	E3883	1	
E3967	Extension (Scraight through) Exhaust Pipe ...	1	E3840	1	
R49 (or equiv.)	Spark Plug	1	HN F80 or N7	1	
	For sprocket sizes and Part Nos. see this Bulletin, Table 4.				
D341	Chain, Rear, $\frac{1}{2}$" pitch 116 links	1	D277	1	
E4048	Plug, gearbox, gear indicator boss	1	E3280	1	To be fitted to seal gearbox when indicator cable is removed

Table 2 (continued)

Overall Gear ratio using 19/48 Teeth combination $\frac{1}{2}$" Pitch Primary Rear Wheel Sprockets							
Gearbox Sprockets	46	48	50	52	54	56	58
13 Teeth	8·94	9·32	9·7	10·0	10·5	10·9	11·3
14 Teeth	8·3	8·65	9·0	9·4	9·75	10·0	10·5
15 Teeth	7·75	8·07	8·4	8·75	9·1	9·45	9·8
16 Teeth	7·25	7·57	7·9	8·2	8·54	8·85	9·18
17 Teeth	6·84	7·14	7·43	7·72	8·03	8·32	8·65
18 Teeth	6·45	6·74	7·0	7·3	7·58	7·87	8·16
19 Teeth	6·12	6·38	6·55	6·9	7·18	7·45	7·73

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