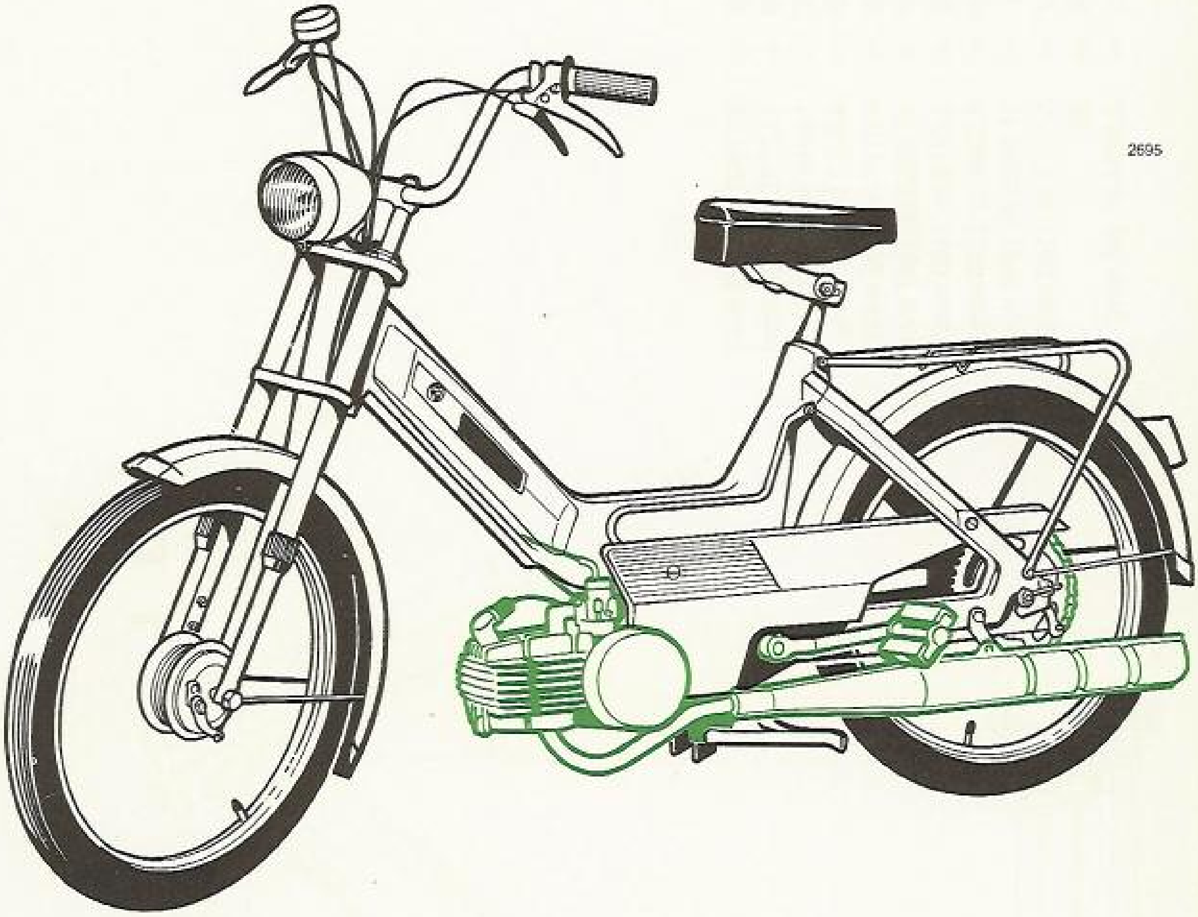
FRAME

Index

MAXI



Technical data

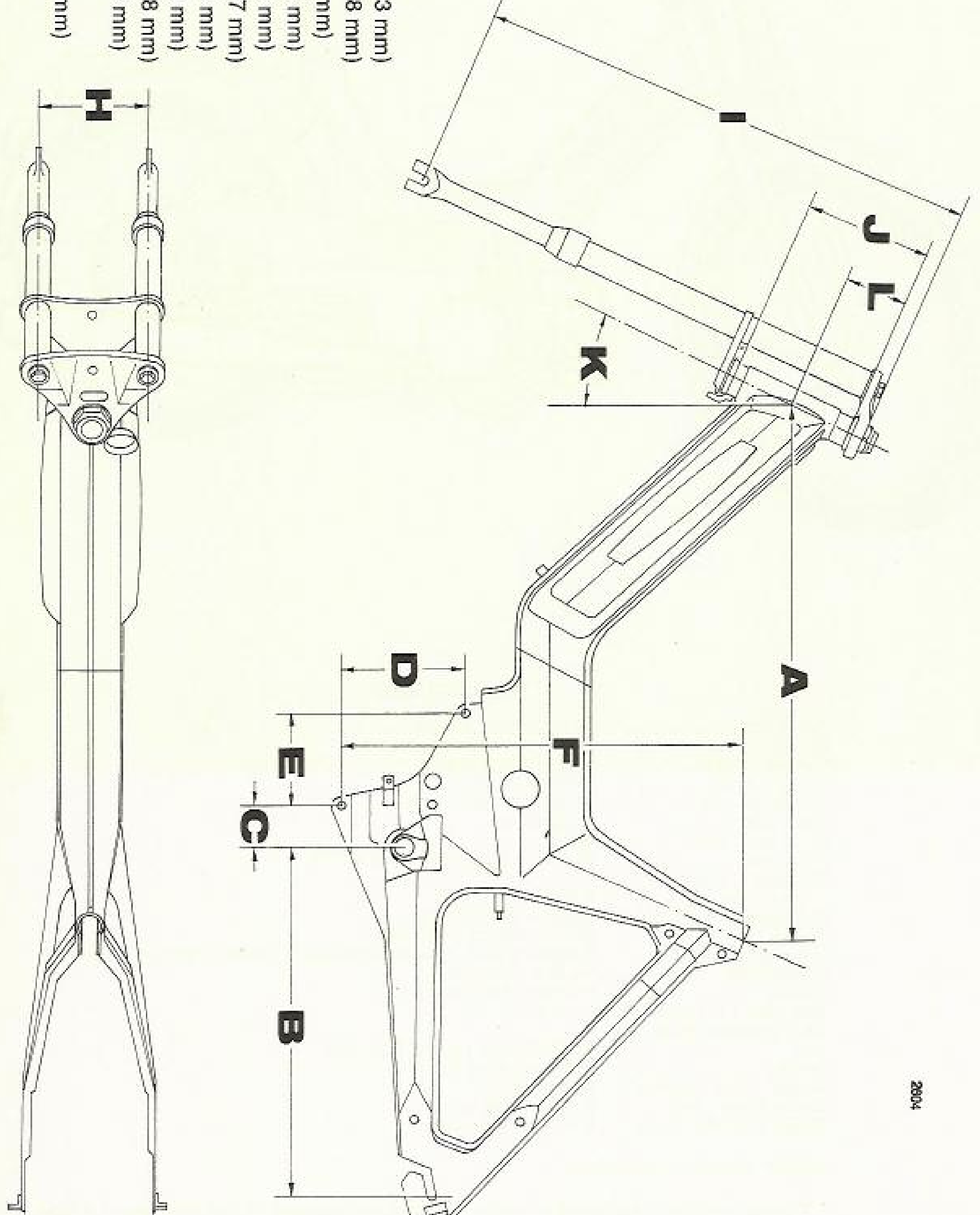
Wheel base	44.0944 in (1120 mm)
Ground clearance	3.9370 in (100 mm)
Overall length	66.9290 in (1700)
Overall width	27.1653 in (690 mm)
Maximum height	39.3700 in (1000 mm)
Seat height	Adjustable
Number of seats	Single
Fuel tank	Capacity 0.704 Imp. Gall. (3.2 l)
Unladen weight (ready for use)	85.995 lb (39 kg)
Permissable total weight	286.650 lb (130 kg)
Frame type	Die - pressed steel frame
Suspension, front	Unsprung fork, or telescopic fork - 1.9685 in (50 mm) travel
Suspension, rear	Rigid suspension
Wheels	Spoked, rim 2,00 x 17"
Tyre size front and rear	21" x 2.00
Tyre pressure front and rear	25.596/31.995 psi (1.8/2.25 atü)
Brakes	Internal brake shoes
Actual brake surface	8.06 sq in (52 cm²)
Brake drum disc	3.1496 in (80 mm)*
Width of brake lining	0.7884 in (20 mm)*

engine: Maxi-type, air stream.

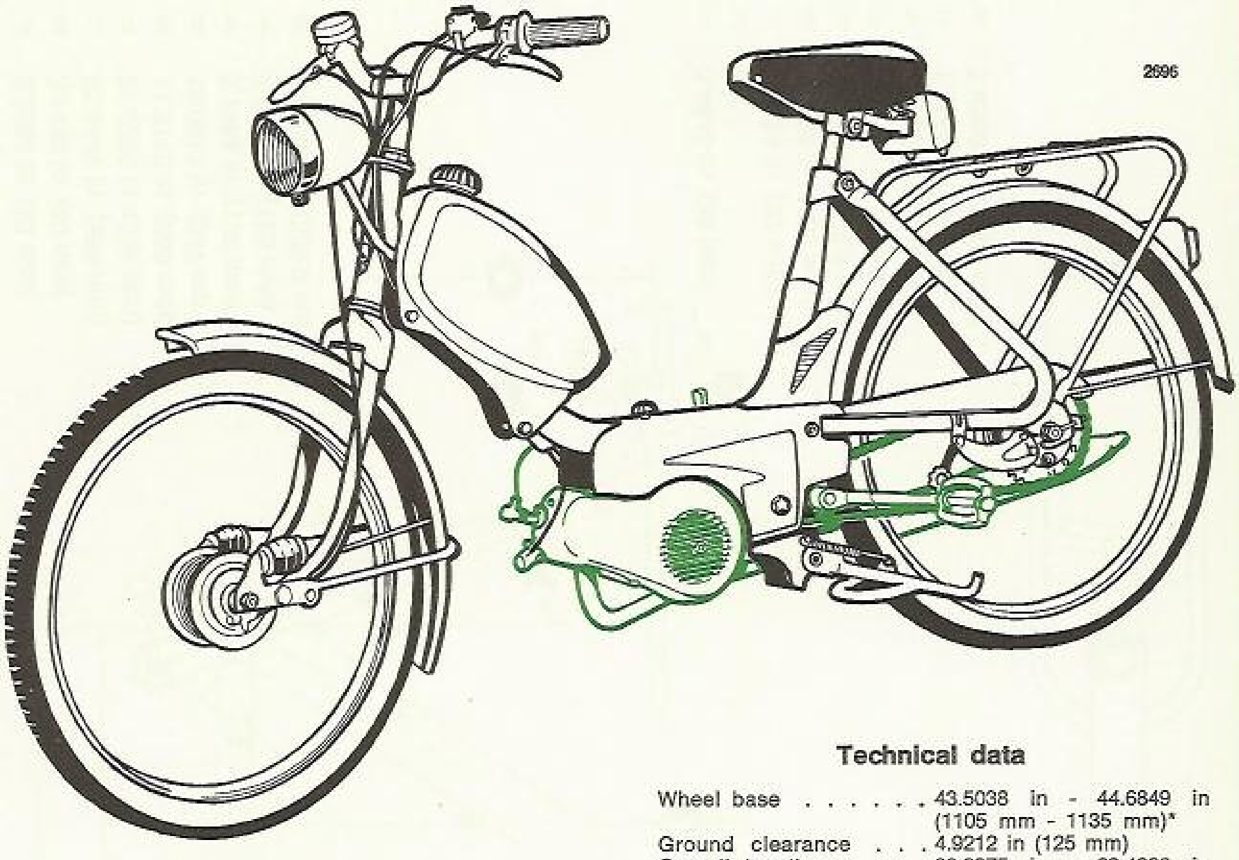
* Version with back pedalling — brake, brake drum diameter of the rear wheel 3.5433 in (90 mm). Width of brake lining 0.7086 (18 mm).

MAXI

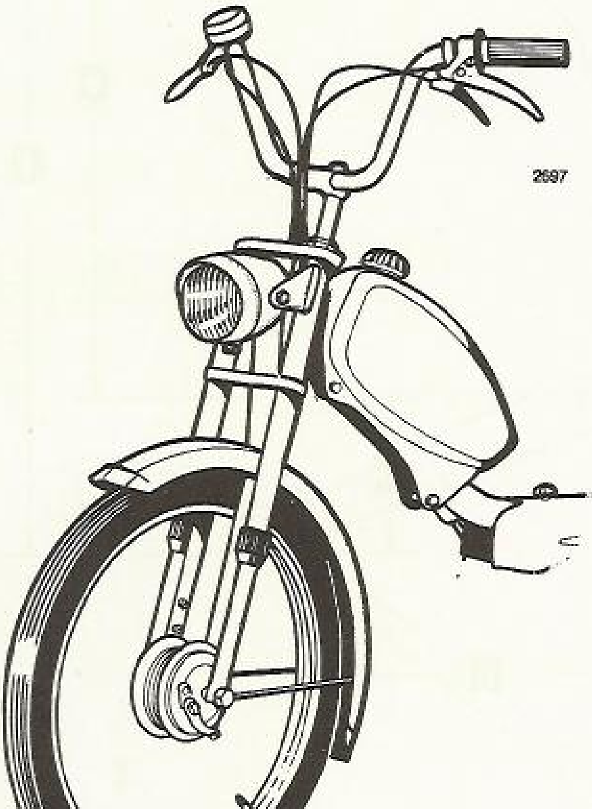
A = 23.7401 in (603 mm)
B = 15.2755 in (388 mm)
C = 1.6141 in (41 mm)
D = 4.9212 in (125 mm)
E = 4.0157 in (102 mm)
F = 17.5983 in (447 mm)
G = 5.5118 in (140 mm)
H = 4.7244 in (120 mm)
I = 21.9685 in (558 mm)
J = 5.5118 in (140 mm)
K = 23°
L = 2.5984 in (66 mm)



X 30



2696



2697

Technical data

Wheel base	43.5038 in - 44.6849 in (1105 mm - 1135 mm)*
Ground clearance	4.9212 in (125 mm)
Overall length	68.8975 in - 69.4880 in (1750 mm - 1765 mm)*
Overall width	24.0157 in - 25.1968 in (610 mm - 640 mm)**
Maximum height	38.1889 in - 39.3700 in (970 mm - 1000 mm)**
Seat height	Adjustable
Number of seats	Single
Fuel tank	Capacity 0.88 Imp. Gall. (4.0 l)
Unladen weight (ready for use)	87.979 lb - 97.020 lb (39.9 kg - 44 kg)*
Permissable total weight	286.650 lb (130 kg)
Frame type	Tubular
Suspension, front	Unsprung fork or rubber sprung, swinging fork spring travel 0.1968 in (5 mm)
Suspension, rear	Rigid suspension
Wheels	Spoked, rim 23 x 2
Tyre size front and rear	23'' x 2.00
Tyre pressure front and rear	25.596/31.284 psi (18/2.2 atü)
Brakes	internal brake shoes
Actual brake surface	8.06 sq in (52 cm²) Leleu-Hubs. 9.99 sq in (64.6 cm²) F. u. S. - Hubs.
Brake drum disc	3.1496 in (80 mm) Leleu - Hubs 3.5433 in (90 mm) F. u. S. - Hubs
Width of brake lining	0.7884 in (20 mm) Leleu - Hubs. 0.7480 in (19 mm) F. u. S. - Hubs.

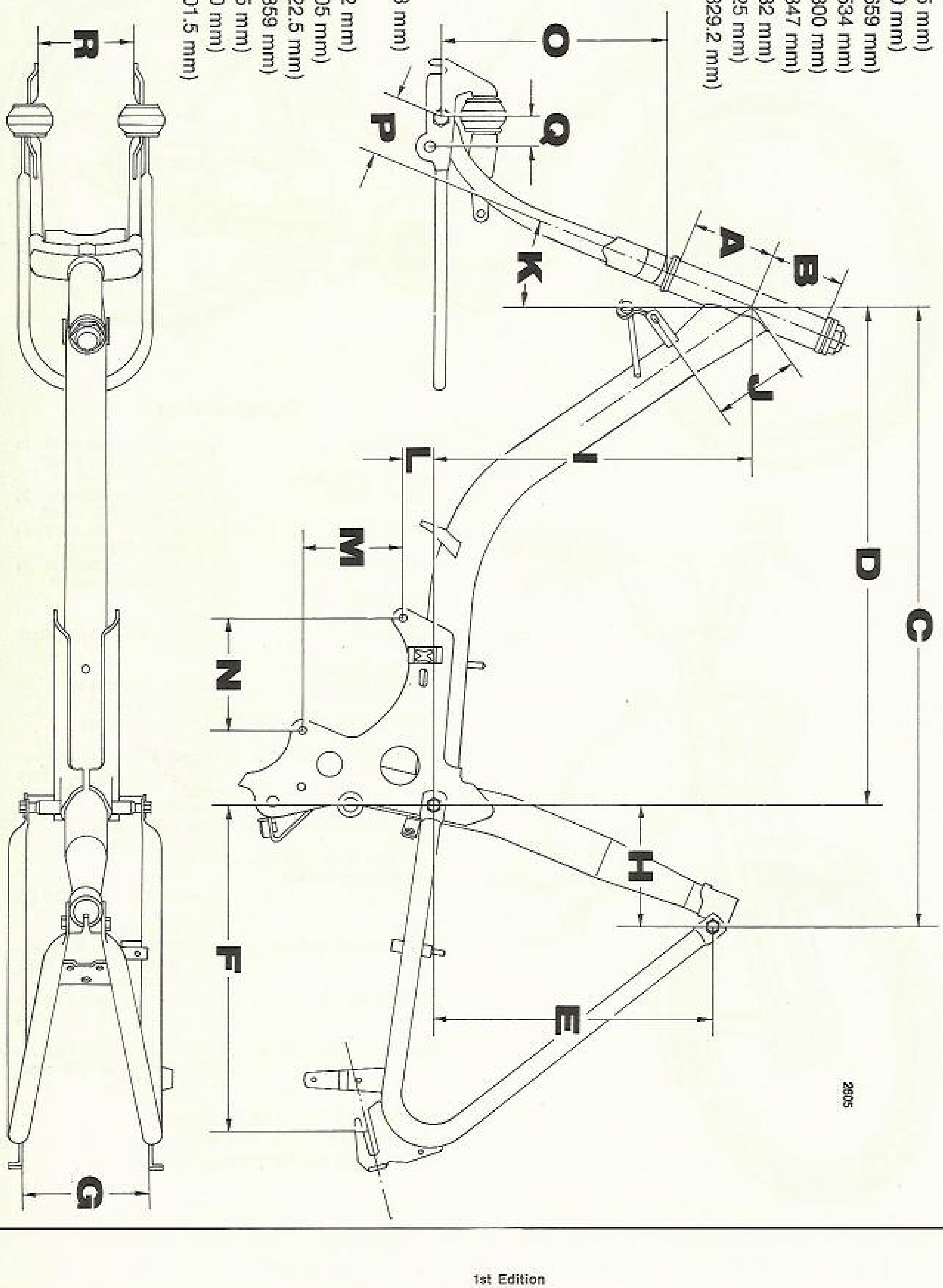
engine: X 30 A type or X 30-type

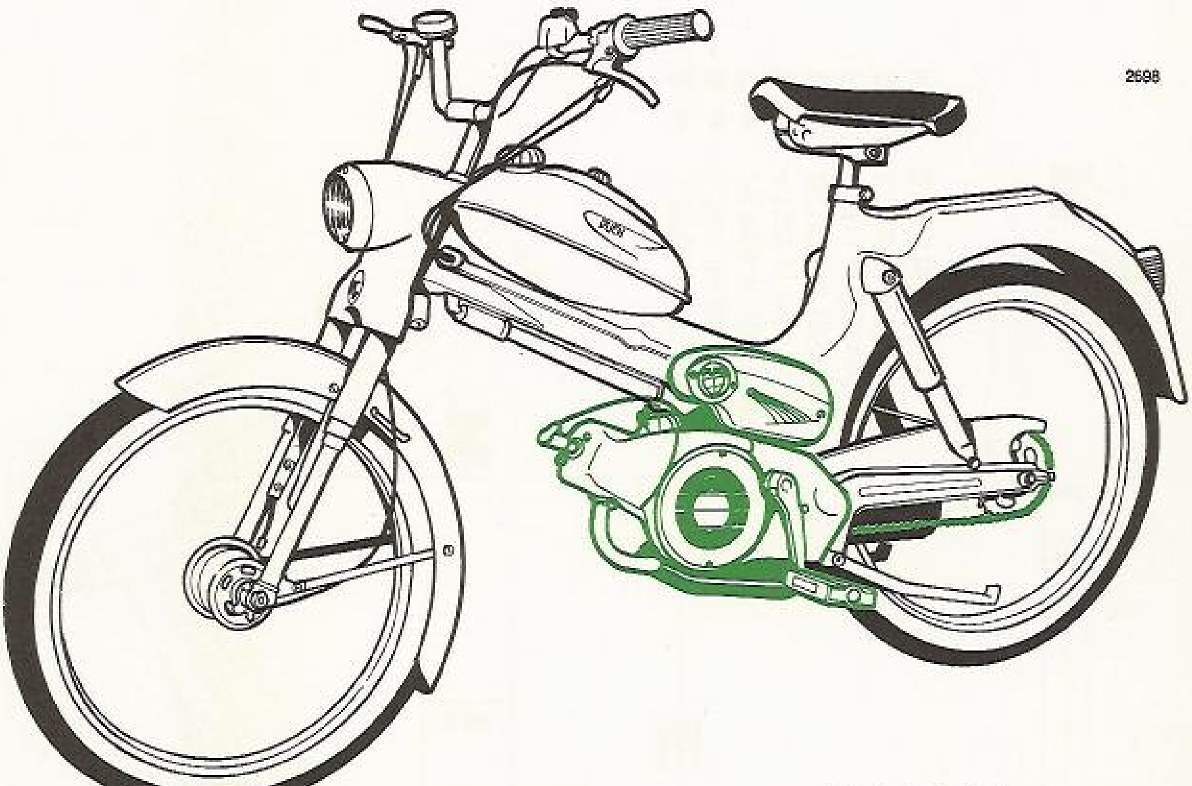
* depending on the fork fitted

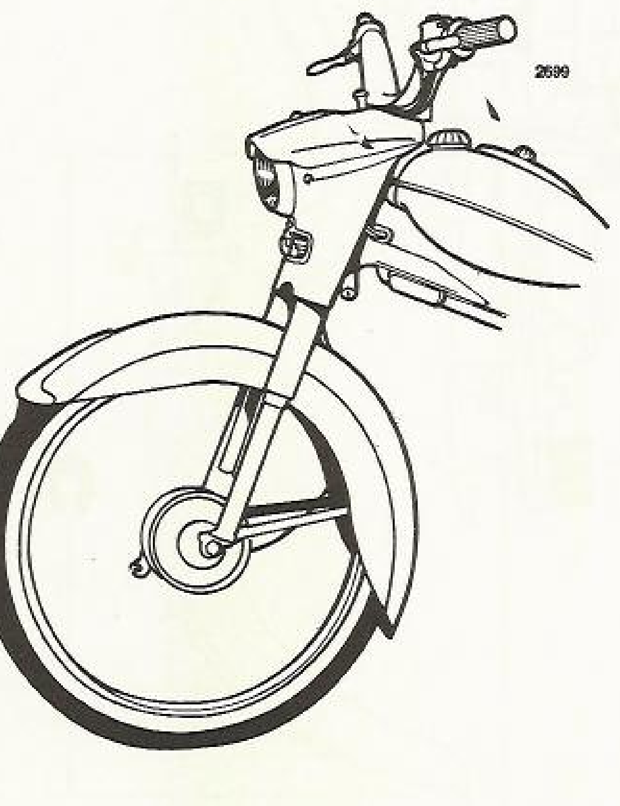
** depending on the handlebar fitted

X 30

A = 3.3464 in (85 mm)
B = 3.1496 in (80 mm)
C = 25.9449 in (659 mm)
D = 21.0235 in (534 mm)
E = 11.8110 in (300 mm)
F = 13.6613 in (347 mm)
G = 5.1968 in (132 mm)
H = 4.9212 in (125 mm)
I = 12.9606 in (329.2 mm)
J = 3.4645 in (88 mm)
K = 22°
L = 1.2598 in (32 mm)
M = 4.1338 in (105 mm)
N = 4.8228 in (122.5 mm)
O = 14.1339 in (359 mm)
P = 2.5590 in (65 mm)
Q = 1.9585 in (50 mm)
R = 3.9960 in (101.5 mm)





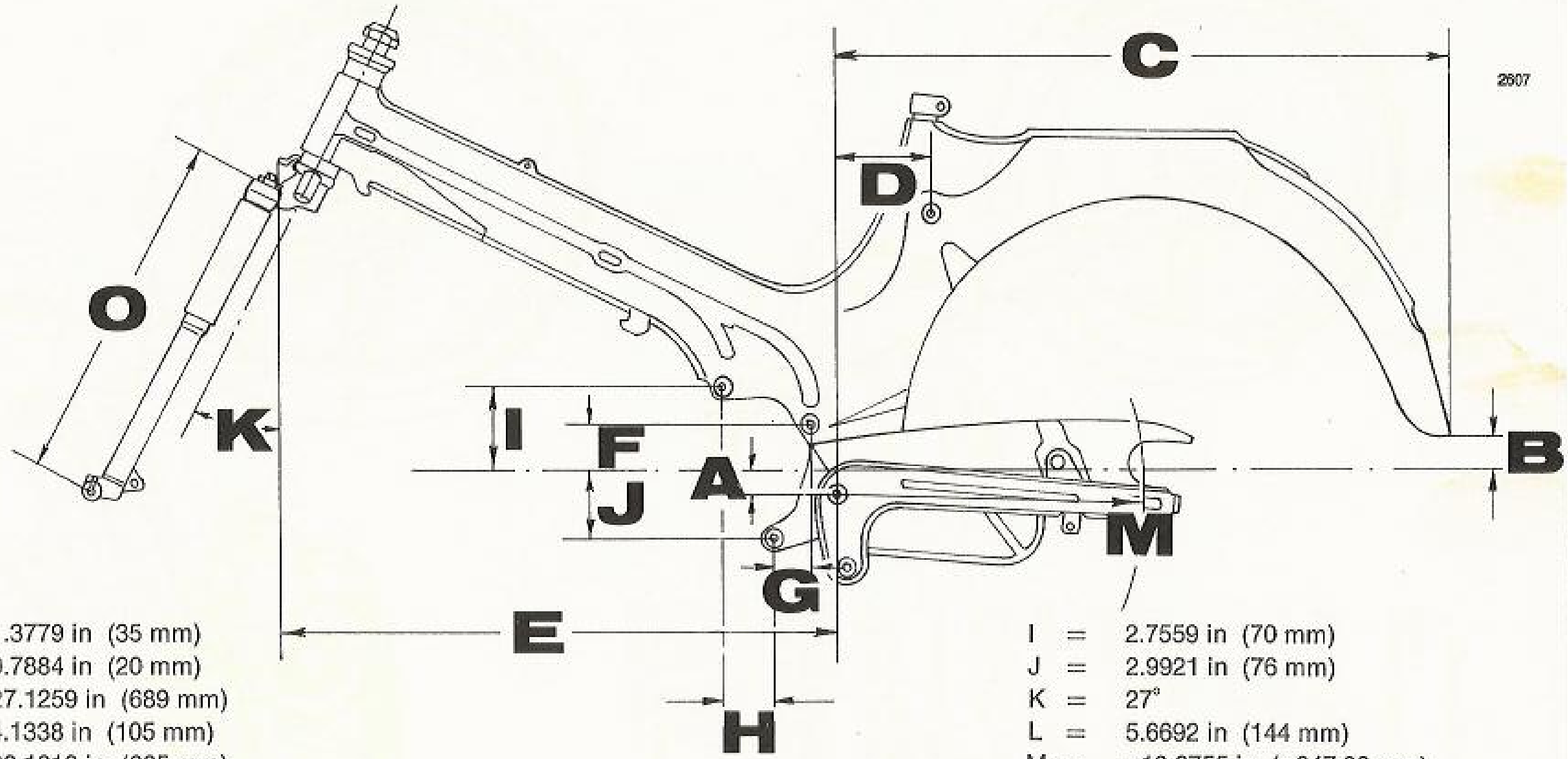


Technical data

Wheel base	46.4566 in (1180 mm)
Ground clearance	4.9212 in (125 mm)
Overall length	72.0471 in (1830 mm
Overall width	25.1968 in - 27.5590 in (640 mm - 700 mm) *
Maximum height	38.1889 in - 38.9763 in (970 mm - 990 mm)*
Seat height	Adjustable
Number of seats	Single
Fuel tank	Capacity 1.21 Imp. Gall. (5.5 l)
Unladen weight (ready for use)	112.455 lb (51 kg) MS 132.300 lb (60 kg) VS
Permissable total weight	308.700 lb (140 kg) MS 352.800 lb (160 kg) VS
Frame type	Die-pressed steel frame
Suspension, front	Telescopic fork - 2.3622 in (60 mm) travel
Suspension, rear	Independent with suspension unit, spring travel 3.3464 in (85 mm)
Wheels	Spoked, rim 23 x 2¼
Tyre size front and rear	23'' x 2.25
Tyre pressure front and rear	24.885/31.995 psi (1.75,2.25 atü)
Brakes	Internal brake shoes
Actual brake surface	9.30 sq in (60 cm²) MS 14.72 sq in (95 cm²) VS
Brake drum disc	3.5433 in (90 mm) MS 4.1338 it (105 mm) VS
Width of brake lining	0.7884 in (20 mm) MS 0.9852 in (25 mm) VS

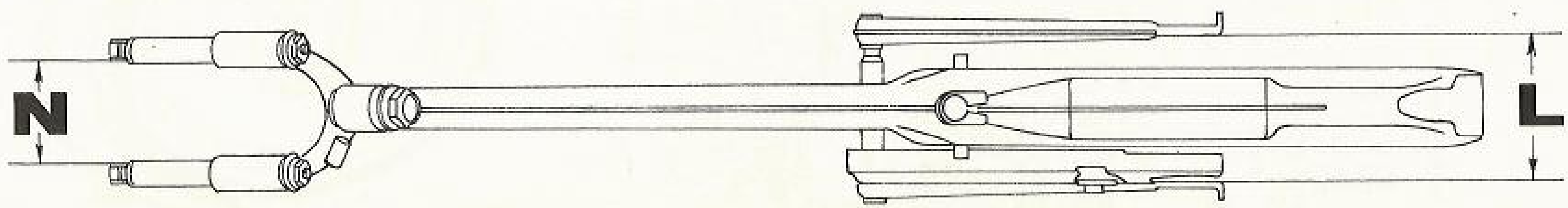
engine: MSV-type, MSA-type, VSD-type, V-type, or R-type.

* depending on the handlebar fitted.



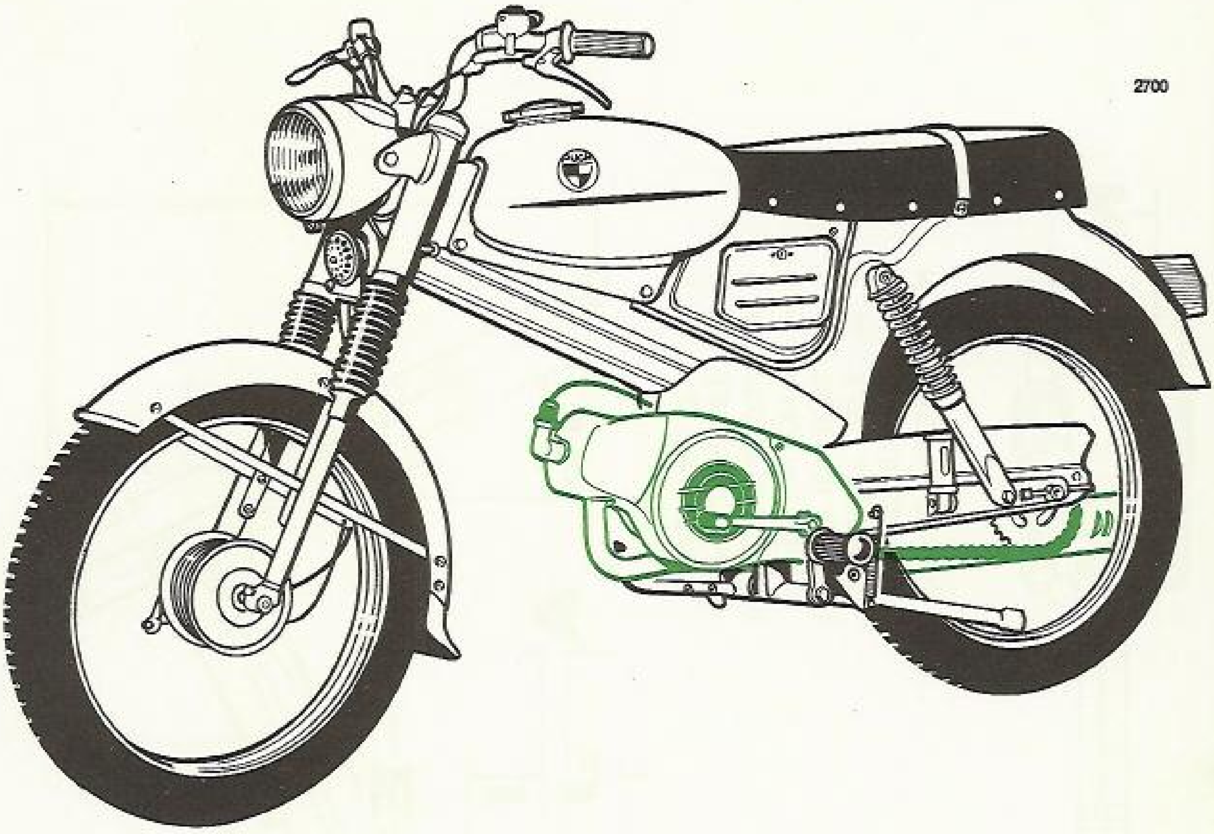
A = 1.3779 in (35 mm)
B = 0.7884 in (20 mm)
C = 27.1259 in (689 mm)
D = 4.1338 in (105 mm)
E = 26.1810 in (665 mm)
F = 1.1811 in (30 mm)
G = 1.1023 in (28 mm)
H = 2.9133 in (74 mm)

I = 2.7559 in (70 mm)
J = 2.9921 in (76 mm)
K = 27°
L = 5.6692 in (144 mm)
M = r 13.6755 in (r 347.36 mm)
N = 3.9370 in (100 mm) MS
4.7244 in (120 mm) VS
O = 15.7873 in (401 mm)



VZ

2700



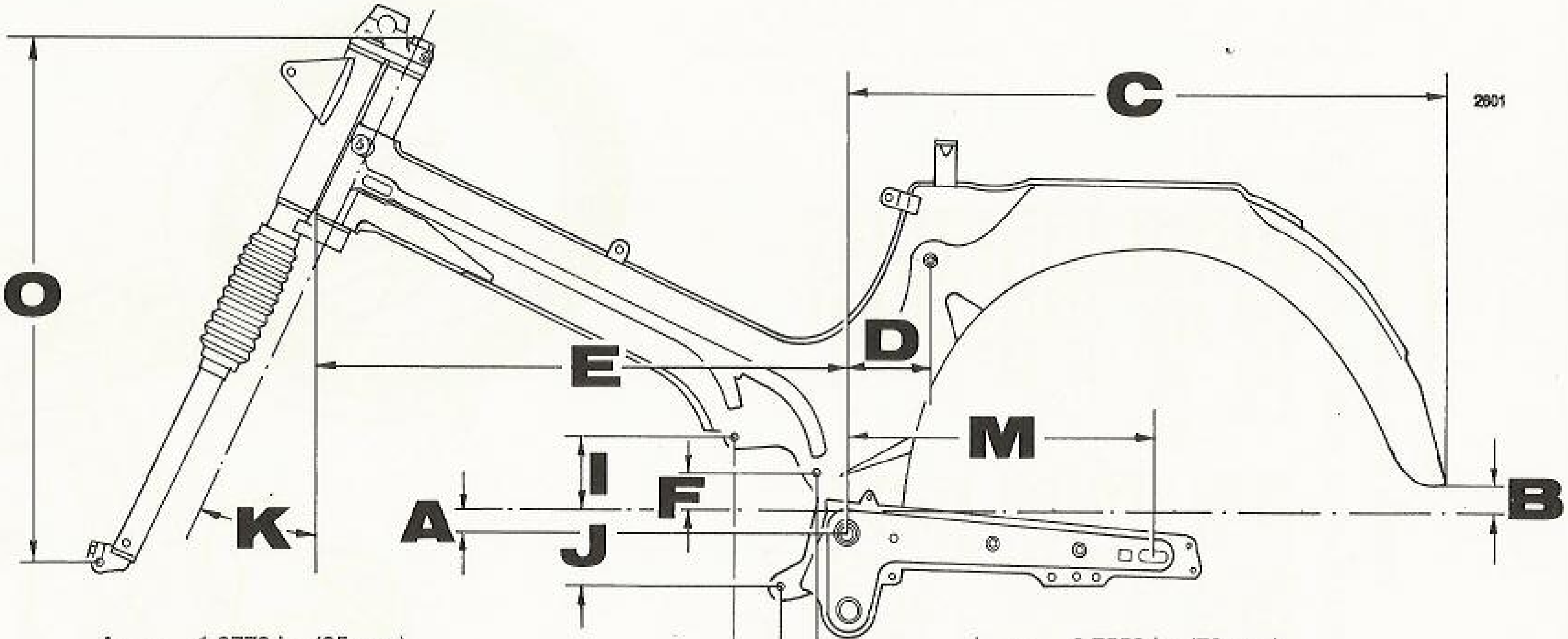
Technical data

Wheel base	46.4566 in (1180 mm)
Ground clearance	4.9212 in (125 mm)
Overall length	72.0471 in (1830 mm)
Overall width	26.7716 in (680 mm)
Maximum height	38.1889 in (970 mm)
Seat height	31.4960 in (800 mm)
Number of seats	Twin seat
Fuel tank	Capacity 2.31 Imp. Gall. (10.5 l)
Unladen weight (ready for use)	154.350 lb - 178.605 lb (70–81 kg)*
Permissable total weight	529.200 lb (240 kg)
Frame type	Die - pressed steel frame
Suspension, front	Telescopic fork - 3.543 in (90 mm) travel
Suspension, rear	Independent with suspension unit, spring travel 4.1338 in (105 mm)
Wheels	Spoked, rim 1,50 A x 17"
Tyre size front and rear	21" x 2,75
Tyre pressure front and rear, full load	28.440/35.550 psi (2.0/2.5 atü)
Brakes	Internal brake shoes
Actual brake surface	14.72 sq in (95 cm²)
Brake drum disc	4.1338 in (105 mm)
Width of brake lining	0.9852 in (25 mm)

engine: VSD-type, R-type, V-type** or M-type

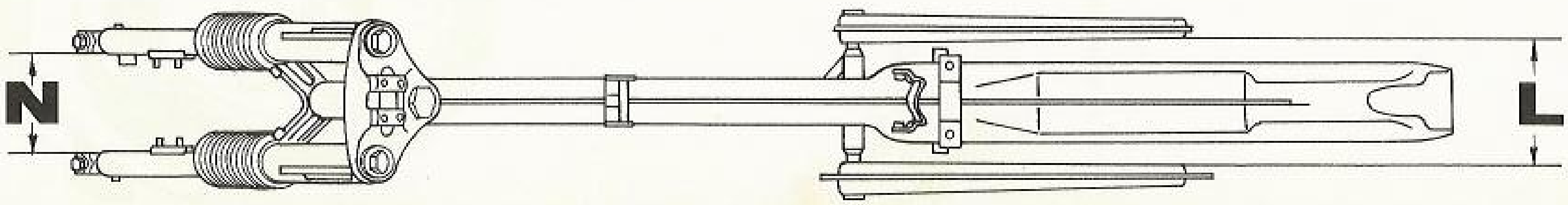
* according to the design of engine

** Air stream or fan cooled.



A	=	1.3779 in (35 mm)
B	=	2.9133 in (74 mm)
C	=	26.6929 in (678 mm)
D	=	4.1338 in (105 mm)
E	=	25.9449 in (659 mm)
F	=	1.1811 in (30 mm)
G	=	1.1023 in (28 mm)
H	=	2.9133 in (74 mm)

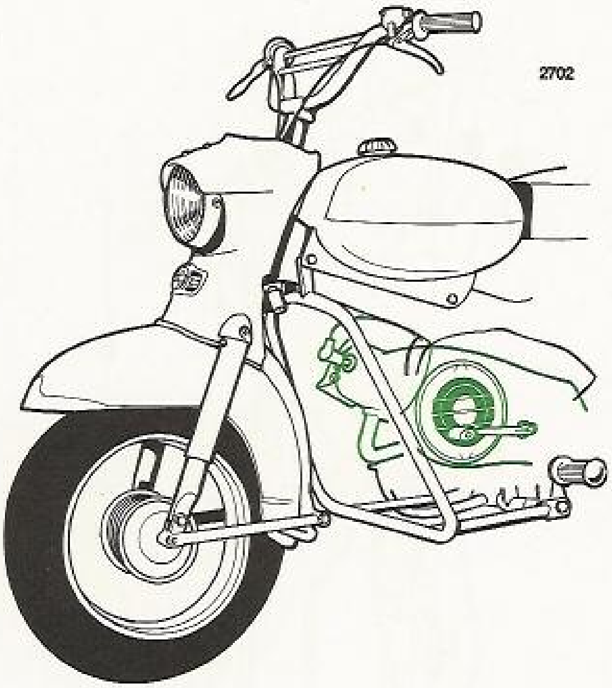
I	=	2.7559 in (70 mm)
J	=	2.9921 in (76 mm)
K	=	27°
L	=	5.9645 in (151.5 mm)
M	=	13.7401 in (349 mm)
N	=	4.7244 in (120 mm)
O	=	26.6338 in (676.5 mm)



DS/DSN

2701

2702



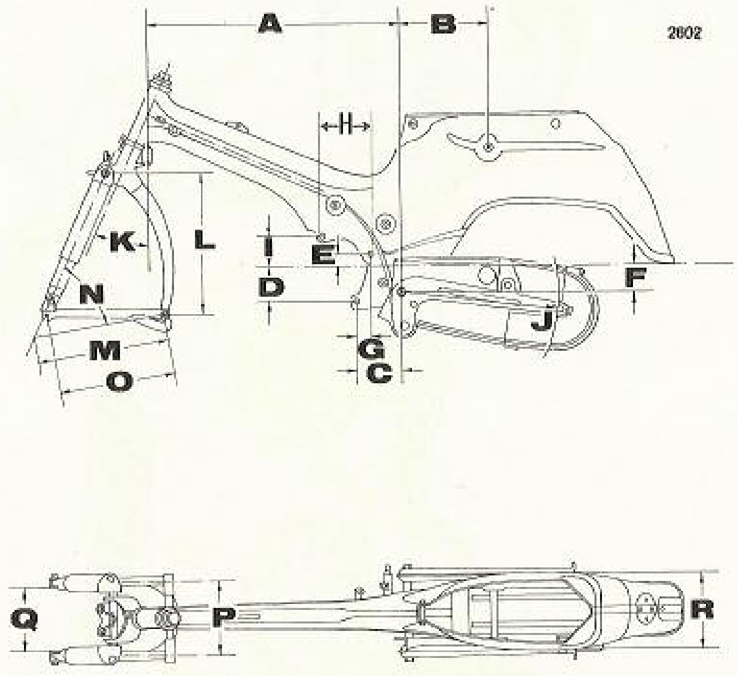
Technical data

Wheel base	45.2755 in (1150 mm)
Ground clearance	4.9212 in (125 mm)
Overall length	66.1416 in (1680 mm)
Overall width	23.6220 in - 26.7716 in (600 mm - 680 mm)*
Maximum height	37.4015 in - 40.1584 in (950 mm - 1020 mm)*
Seat height	30.7086 in (780 mm)
Number of seats	Twin seat
Fuel tank	Capacity 1.21 Imp. Gall. (5,5 l) DS; 2.31 Imp. Gall. (10.5 l) DSV
Unladen weight (ready for use)	149.940 lb – 158.760 lb (68 kg - 72 kg)**
Permissable total weight	485.100 lb (220 kg) DS; 507.150 lb (230 kg) DSV
Frame type	Die - pressed steel frame
Suspension, front	Independent with suspension units, 3.1496 in (80 mm) travel
Suspension, rear	Independent with suspension units, 3.3464 in (85 mm) travel
Wheels	Spoked, rim 2,15 x 12“
Tyre size front and rear	3,00 x 12“
Tyre pressure front and rear	28.440/31.995 psi (2.0/2.25 atü)
Brakes	Internal brake shoes
Actual brake surface	14.72 sq in (95 cm²)
Brake drum disc	4.1338 in (105 mm)
Width of brake lining	0.9852 in (25 mm)

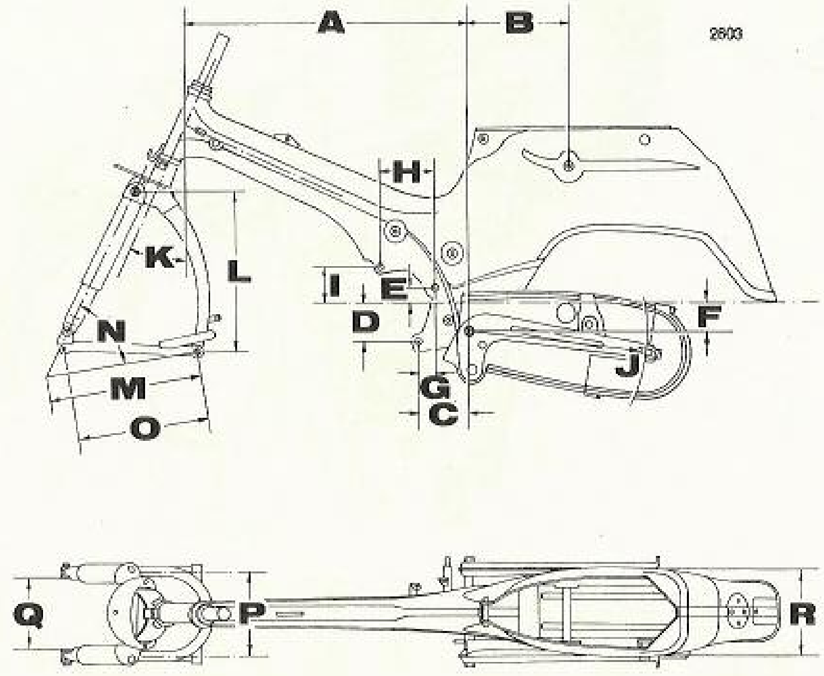
engine: VSD-type, V-type or R-type.

* depending on the handlebar fitted

** according to the design of engine

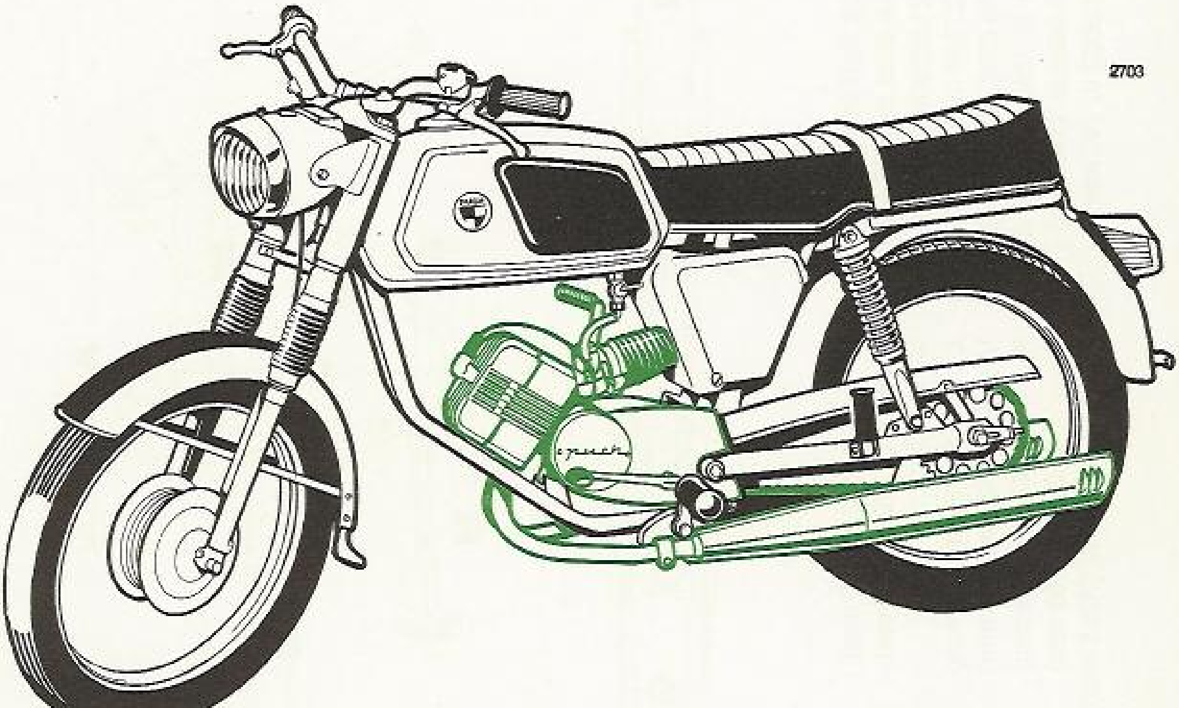


A =	22.4015 in (569 mm)	J =	r 13.6755 in (r 347.36 mm)
B =	7.6377 in (194 mm)	K =	24°
C =	4.8818 in (124 mm)	L =	12.2440 in (311 mm)
D =	2.9921 in (76 mm)	M =	10.4724 in (266 mm)
E =	1.1811 in (30 mm)	N =	66°
F =	1.9292 in (49 mm)	O =	10.4330 in (265 mm)
G =	1.1023 in (28 mm)	P =	5.3151 in (135 mm)
H =	4.0157 in (102 mm)	Q =	3.9370 in (100 mm)
I =	2.7559 in (70 mm)	R =	6.1810 in (157 mm)



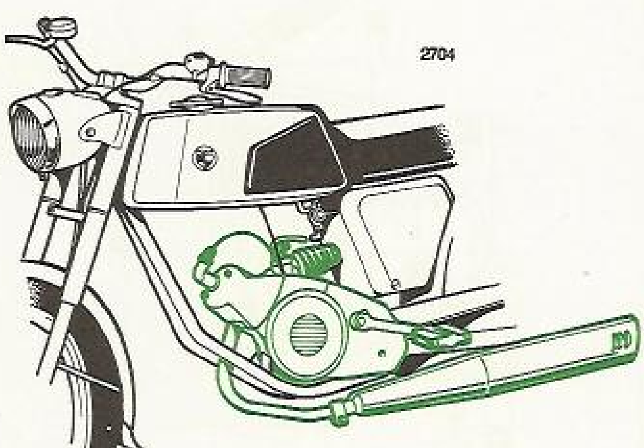
A =	22.4015 in (569 mm)	J =	r 13.6755 in (r 347.36 mm)
B =	7.6377 in (194 mm)	K =	24°
C =	4.8818 in (124 mm)	L =	9.1338 in (232 mm)
D =	2.9921 in (76 mm)	M =	10.6693 in (271 mm)
E =	1.1811 in (30 mm)	N =	64°
F =	1.9292 in (49 mm)	O =	10.4330 in (265 mm)
G =	1.1023 in (28 mm)	P =	5.3151 in (135 mm)
H =	4.0157 in (102 mm)	Q =	3.9370 in (100 mm)
I =	2.7559 in (70 mm)	R =	6.1810 in (157 mm)

M 50/M 50 SE



2703

2704

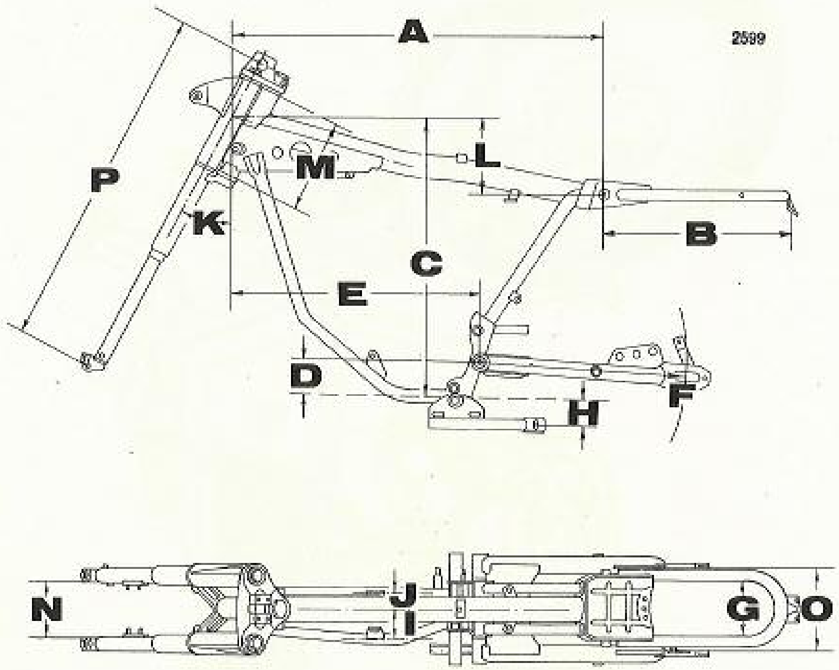


Technical data

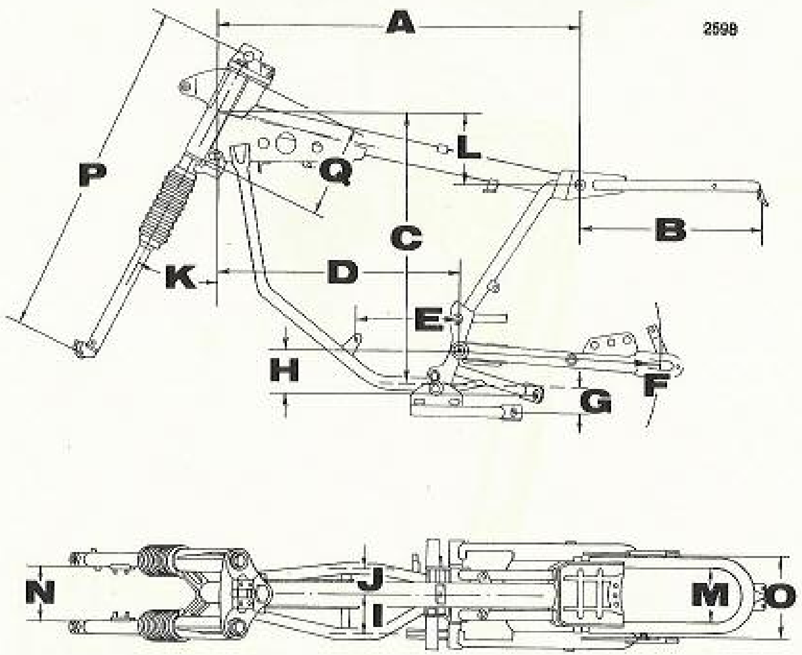
Wheel base	48.8188 in (1240 mm)
Ground clearance	5.9055 in (150 mm)
Overall length	74.8030 in (1900 mm)
Overall width	25.3936 in (645 mm)
Maximum height	39.3700 in (1000 mm)
Seat height	31.1023 in (790 mm)
Number of seats	Twin seat
Fuel tank	Capacity 1.98 Imp. Gall. (9.0 l) M 50. Capacity 2.42 Imp. Gall. (11.0 l) M 50 SE
Unladen weight (ready for use)	171.990 lb (78 kg) M 50 198.450 lb (90 kg) M 50 SE
Permissable total weight	529.200 lb (240 kg)
Frame type	Tubular
Suspension, front	Telescopic fork - 3.9370 in (100 mm) travel
Suspension, rear	independet with suspension units 3.9370 in (100 mm) travel
Wheels	Spoked, rim 1.50 A x 17"
Tyre size front and rear	21" x 2.75
Tyre pressure front and rear	28.440 / 35.550 psi (2.0 / 2.5 atü)
Brakes	Internal brake shoes
Actual brake surface	25.11 sq in (162 cm^2)
Brake drum disc	5.1181 in (130 mm)
Width of brake lining	1.1811 in (30 mm)

engine: V-type, air stream or fan cooled, or VSD-type.

M 50/M 50 SE

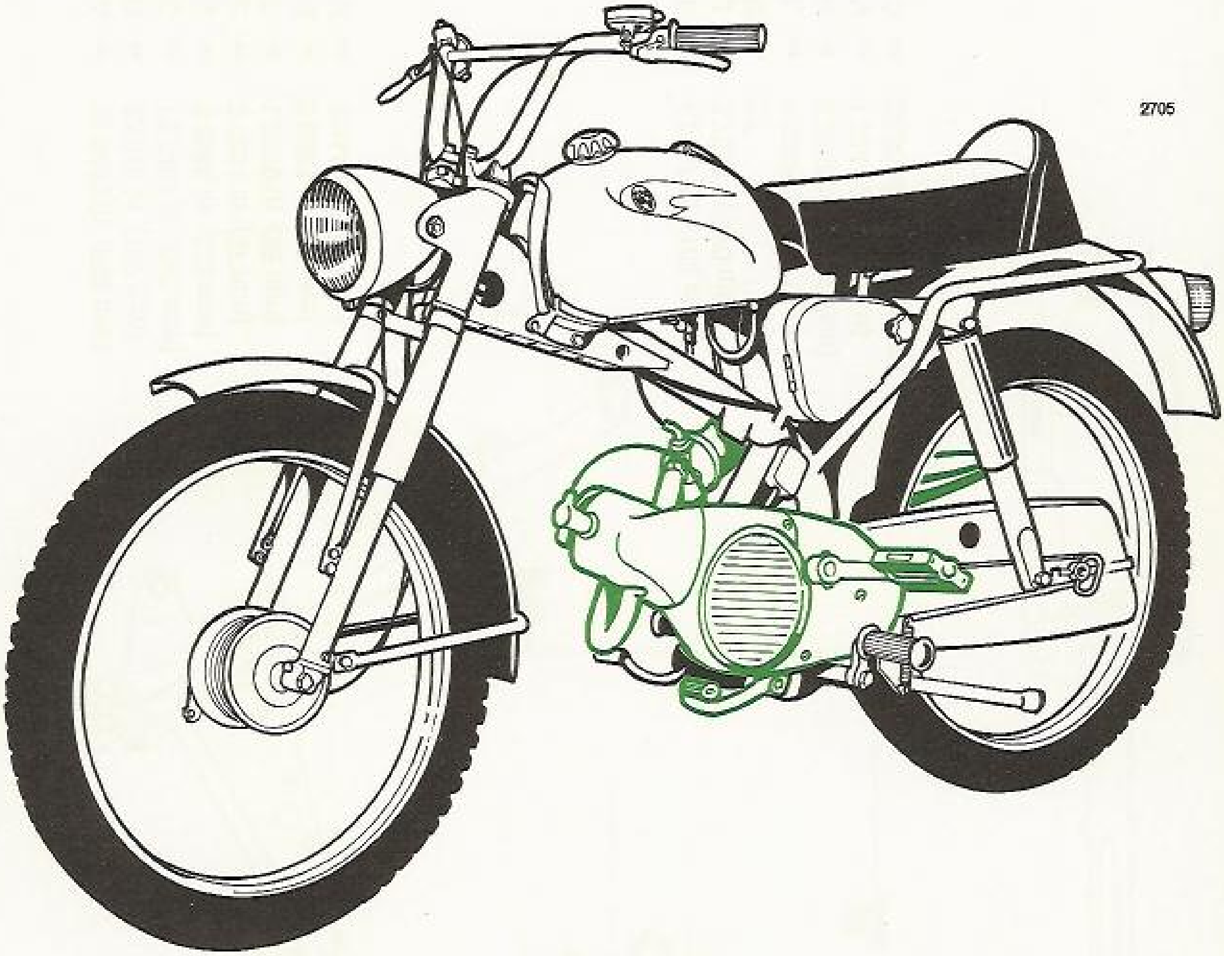


A =	28.7401 in (730 mm)	I =	2.3622 in (60 mm)
B =	16.0235 in (407 mm)	J =	1.3779 in (35 mm)
C =	21.6928 in (551 mm)	K =	28°
D =	2.7559 in (70 mm)	L =	5.3151 in (135 mm)
E =	19.0353 in (483.5 mm)	M =	7.4803 in (190 mm)
F =	r 17.1260 in (r 435 mm)	N =	4.6850 in (119 mm)
G =	4.5669 in (116 mm)	O =	7.2047 in (183 mm)
H =	1.8503 in (47 mm)	P =	27.7754 in (705.5 mm)



A =	28.3464 in (720 mm)	I =	3.4841 in (88.5 mm)
B =	16.0235 in (407 mm)	J =	2.2638 in (57.5 mm)
C =	22.6378 in (577 mm)	K =	28°
D =	18.6614 in (474 mm)	L =	6.3385 in (161 mm)
E =	8.0314 in (204 mm)	M =	4.5669 in (116 mm)
F =	r 17.1260 in (r 435 mm)	N =	4.6850 in (119 mm)
G =	1.8503 in (47 mm)	O =	7.2047 in (183 mm)
H =	3.5826 in (91 mm)	P =	28.1691 in (715.5 mm)
		Q =	7.4803 in (190 mm)

MC 50/60



Technical data

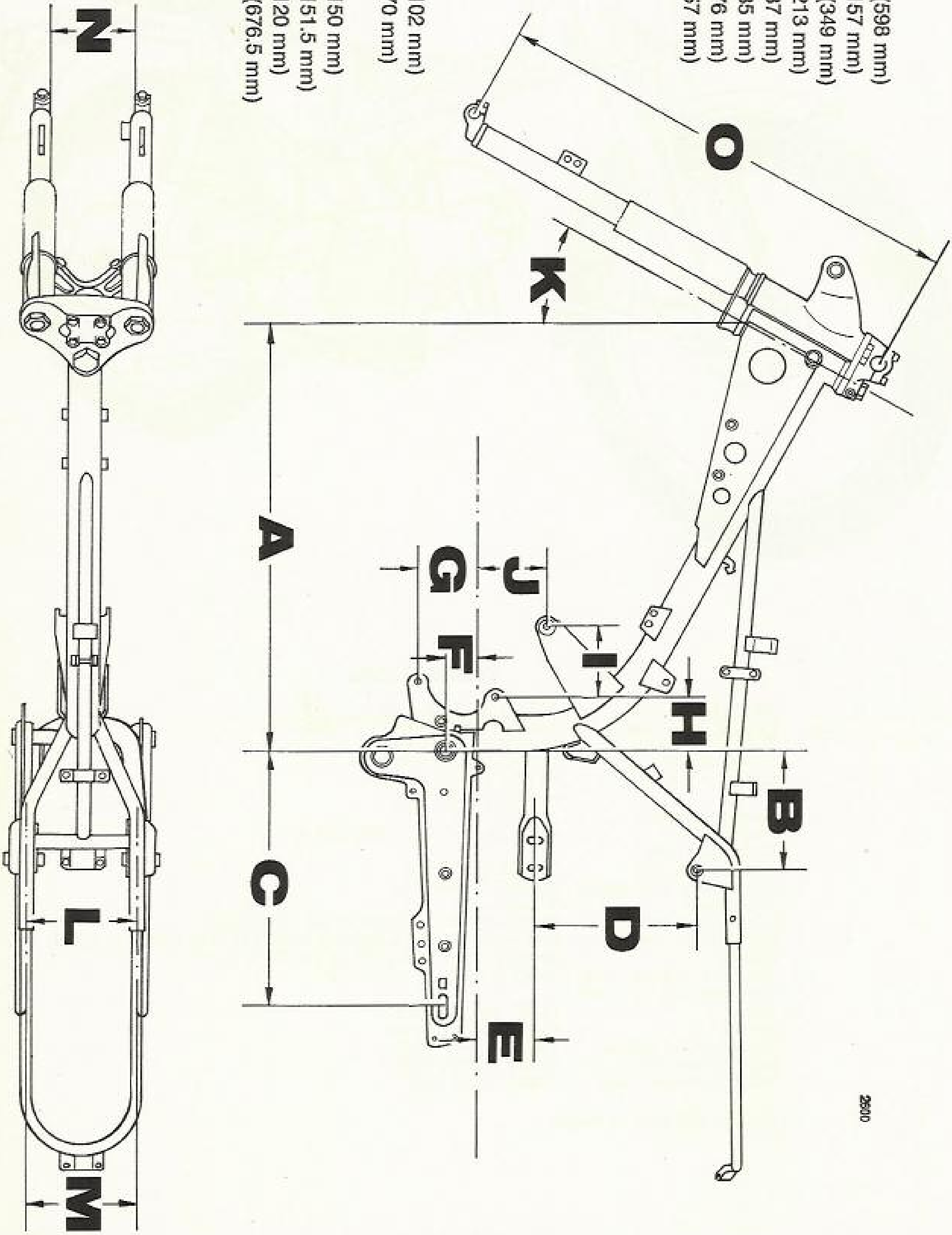
Wheel base	48.0324 in (1220 mm)
Ground clearance	8.6624 in (220 mm)
Overall length	74.8030 in (1900 mm)
Overall width	26.3779 in (670 mm)
Maximum height	40.1584 in (1020 mm)
	8.6624 in (220 mm)
Number of seats	Single
Fuel tank	Capacity 1.87 Imp. Gall. (8.5 l)
Unladen weight (ready for use)	163.170 lb (74 kg)
Permissable total weight	352.800 lb (160 kg)
Frame type	Tubular
Suspension, front	Telescopic fork - 3.3464 in (85 mm) travel
Suspension, rear	Independent with suspension units 4.1338 in (105 mm) travel
Wheels	Spoked, rim 1,50 A x 19" or rim 23" x 2½
Tyre size front and rear	2.50/2.75 x 19" or 23" x 2,25
Tyre pressure front and rear	27.018 psi (1,9 atü)
Brakes	Internal brake shoes
Actual brake surface	7.42 psi (47.5 cm²)
Brake drum disc	4.1338 in (105 mm)
Width of brake lining	0.9852 in (25 mm)

engine: VSD-type or R-type

MC 50/60

A = 23.5433 in (598 mm)
B = 6.1810 in (157 mm)
C = 13.7401 in (349 mm)
D = 8.3858 in (213 mm)
E = 3.4251 in (87 mm)
F = 1.3779 in (35 mm)
G = 2.9921 in (76 mm)
H = 2.2440 in (57 mm)

I = 4.0157 in (102 mm)
J = 2.7559 in (70 mm)
K = 27°
L = 5.9055 in (150 mm)
M = 5.9645 in (151.5 mm)
N = 4.7244 in (120 mm)
O = 26.6338 in (676.5 mm)



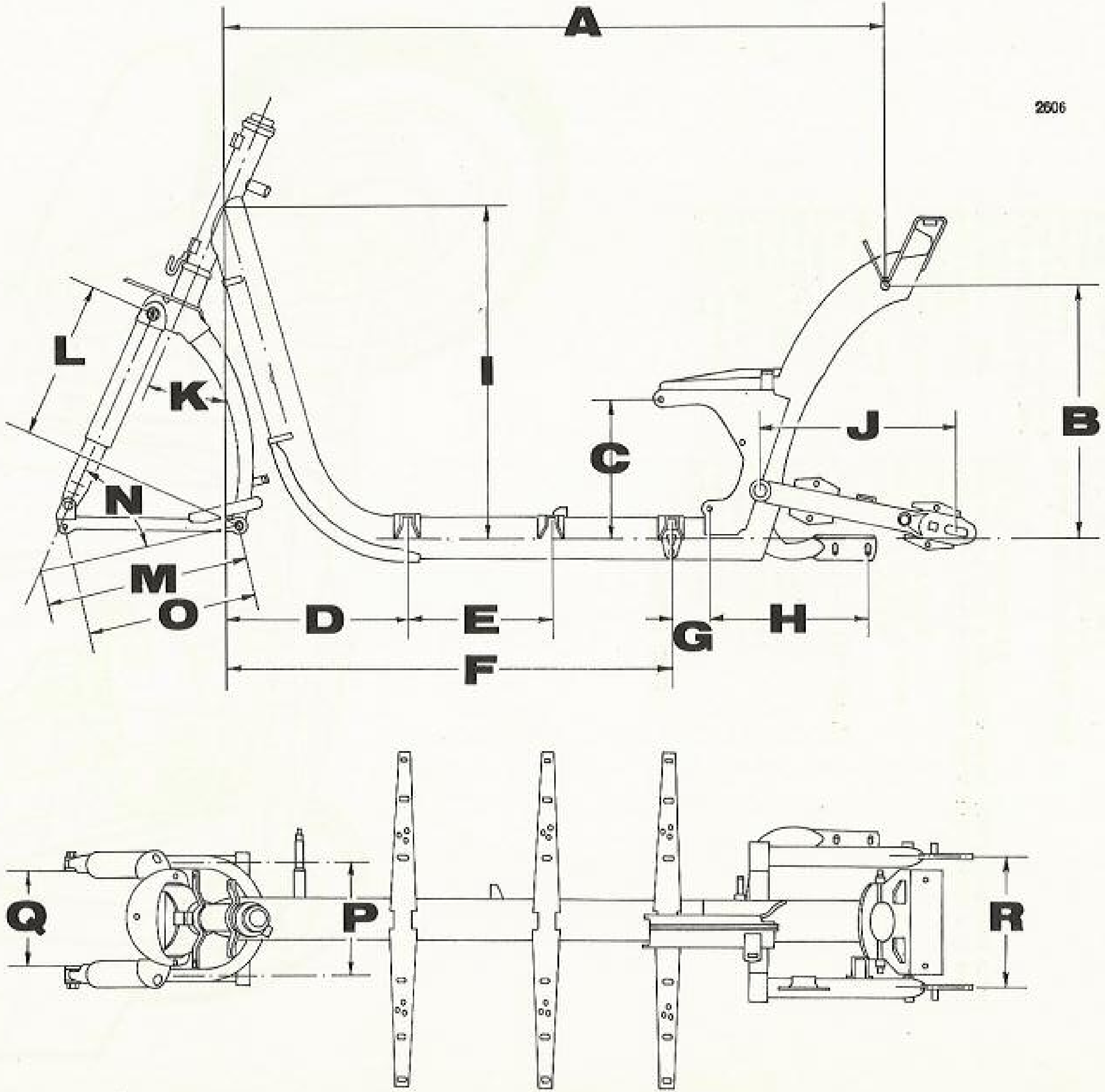
R50/60

Technical data

Wheel base	50.3936 in (1280 mm)
Ground clearance	6.2992 in (160 mm)
Overall length	70.8660 in (1800 mm)
Overall width	24.8031 in (630 mm)
Maximum height	38.5826 in (980 mm)
Seat height	30.7086 in (780 mm)
Number of seats	Twin seat
Fuel tank	Capacity 1.43 Imp. Gall. (6.5 l)
Unladen weight (ready for use)	176.400 lb (80 kg) 187.425 lb (85 kg) R 50 M
Permissable total weight	529.200 lb (240 kg)
Frame type	Tubular
Suspension, front	Independent with suspension units, 3.1496 in (80 mm) travel
Suspension, rear	Independent with suspension units, 4.3307 (110 mm) travel
Wheels	Spoked, rim 2,15 x 12"
Tyre size front and rear	3.00 x 12"
Tyre pressure front and rear, full load	28.440/31.995 psi (2.0/2.25 atü)
Brakes	Internal brake shoes
Actual brake surface	14.72 sq in (95 cm²)
Brake drum disc	4.1338 in (105 mm)
Width of brake lining	0.9852 in (2.5 atü)

engine VSD-type, MSA-type, R-type, V-type or M-type.

A	=	34.4882 in (876 mm)
B	=	14.4094 in (366 mm)
C	=	7.6377 in (194 mm)
D	=	9.9999 in (254 mm)
E	=	8.2677 in (210 mm)
F	=	15.1574 in (385 mm)
G	=	1.8110 in (46 mm)
H	=	7.4803 in (190 mm)
I	=	19.0944 in (485 mm)
J	=	11.1023 in (282 mm)
K	=	26°
L	=	9.1338 in (232 mm)
M	=	10.6692 in (271 mm)
N	=	64°
O	=	10.4330 in (265 mm)
P	=	5.3151 in (135 mm)
Q	=	3.9370 in (100 mm)
R	=	6.8661 in (174.4 mm)

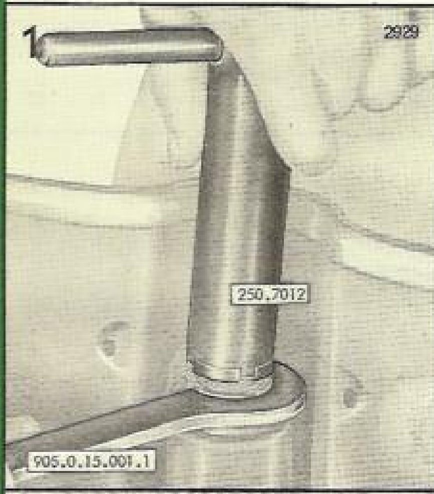


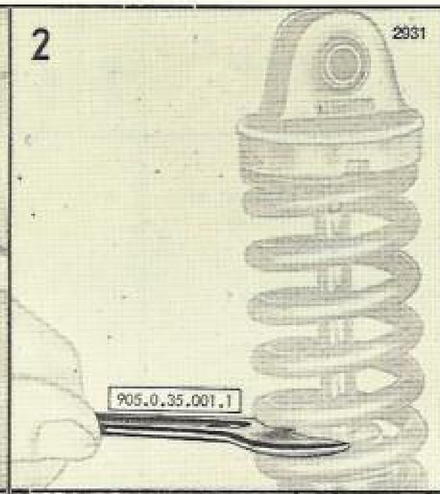
List of special tools

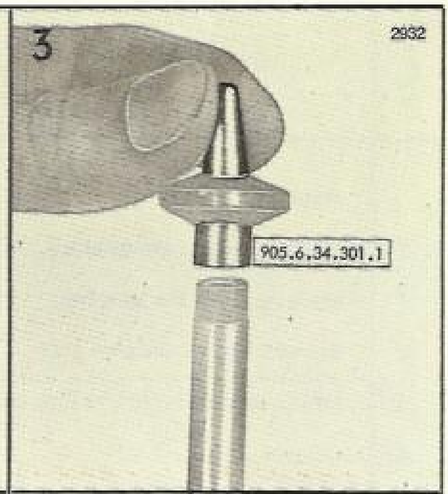
Figure - no.	DESCRIPTION	Part no.	Model								
			MAXI	X 30	MS	VS	DS	MC	VZ	R	M
	Assembly block	make yourself or obtain locally	x	x	x	x	x	x	x	x	x
1	Socket spanner for steering	250.7012			x	x	x			x	
1	Hook spanner for steering	905.0.15.001.1			x	x	x			x	
2	Spanner for suspension unit	905.5.35.001.1						x	x	x	x
3	Fitting sleeve for suspension unit	905.6.34.301.1						x	x	x	x
4	Oil gun	905.0.18.501.0						x	x		x
5	Sprocket spanner	905.6.35.404.0	x								
6	Wheel bearing press tool	050.7029			x						
	Wheel bearing press tool	make yourself			x						
6	Wheel bearing press tool	121.7029						x	x	x	
	Wheel bearing press tool	make yourself				x	x	x	x	x	
	Wheel bearing press tool	make yourself						x	x	x	
7	Fitting sleeve for seal, front and rear wheel	050.1000.0-W 42				x	x				
	Fitting sleeve for seal, front wheel	050.1000.0-W 42						x	x	x	
	Wheel bearing press tool	make yourself									x
	Press sleeve for F & S hub	make yourself		x							
	Centering tool	make yourself			x	x	x	x	x	x	x
8	Spoke spanner M3	905.6.35.401.2	x	x	x	x	x	x	x	x	x
8	Spoke spanner M3.5	905.6.35.403.2					x		x		x
	Adjusting spanner for wheel hub tapers	905.6.35.402.1	x	x							
9	Press tool for rubber mounting 27/14/54	905.1.34.301.0									x
10	Press tool for rubber mounting 22/10/33	make yourself			x	x	x				
10	Press tool for rubber mounting 25/12/38	make yourself						x	x		
11	Press tool for rubber mounting 16/8/17	make yourself			x	x	x			x	
11	Press tool for rubber mounting 16/8/28	make yourself					x	x	x	x	
11	Press tool for rubber mounting 18/10/20	make yourself						x	x	x	x
12	Press tool for stearing bearing rings	make yourself	x	x	x	x	x	x	x	x	x

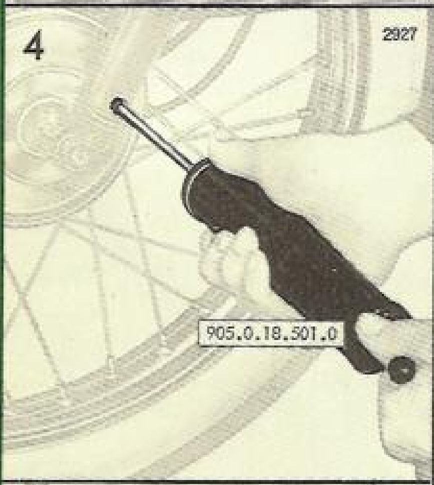
Per requirement we supply drawings for all tools enabling you to make the tools yourself.

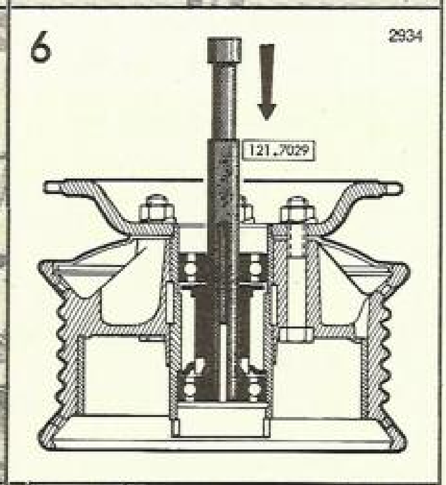
Special tools

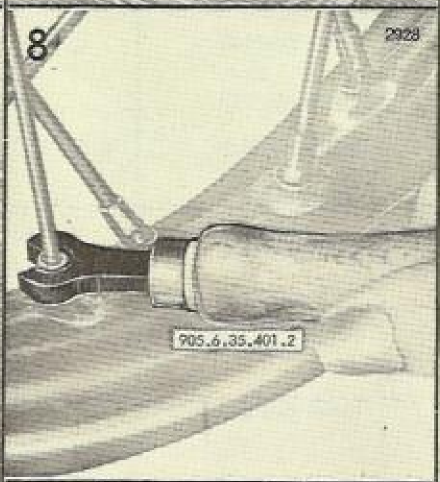


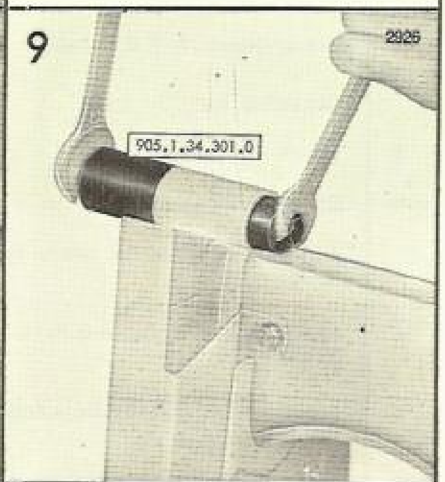


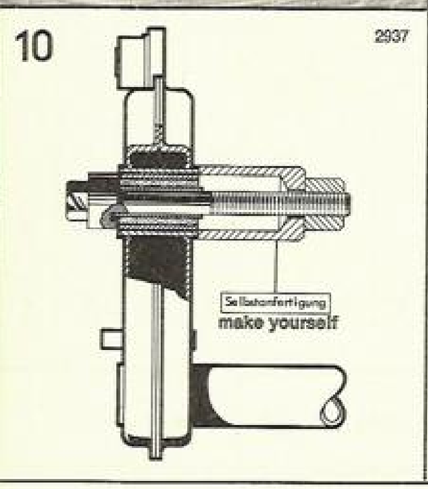


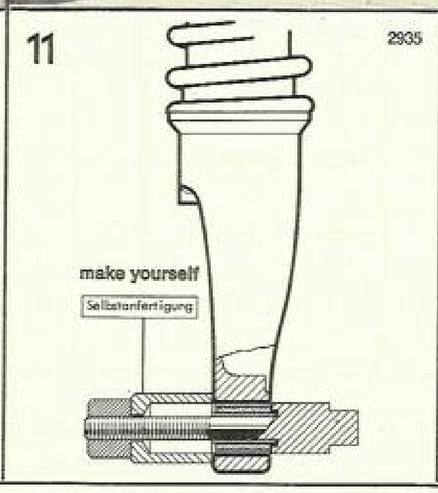


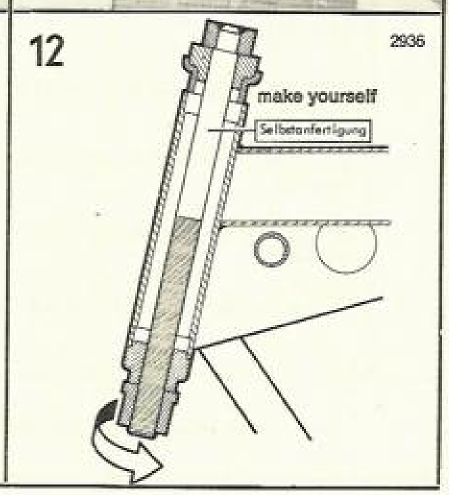












Removing engine from frame

M A X I

Take off left and right covers. Remove exhaust. Unclip airfilter from carburettor and remove. Push off fuel pipe. Loosen carburettor and take off. Unhook Bowden cable for starting clutch below operating lever. The short Bowden cable for the decompressor remains attached and is eventually removed on engine dismantling. Disconnect electrical cables on terminal strip. Open chain link and take chain off front sprocket. Unscrew engine fixing nuts. The engine is removed comlete with centre stand. Therefore, the machine must be placed or hung in an appropriate position. Remove engine fixing screws and take engine out of frame.

X 3 0

Take off left and right covers. Remove complete exhaust and air filter. Loosen and take off complete carburettor. Disconnect fuel pipe. Disconnect cables on terminal strip. Remove chain.

X 3 0 O N L Y

The decompressor Bowden cable is removed together with the coverhood from the decompressor after loosening the fixing screws. Unhook clutch Bowden cable from clutch lever. Take Bowden cable out of bearing and remove bearing. Unscrew the two engine fixing nuts. Unhook gear change Bowden cable from bearing (on frame) and take out upper engine fixing screw. Tip engine downwards and unhook Bowden cable from selector lever. Take out lower engine fixing screw and remove engine from frame.

X 3 0 A O N L Y

Disconnect starter clutch Bowden cable from lever on handlebar. This cable is connected to the operating lever in the housing cover. To remove engine, take Bowden cable out of both sleeves (from handlebar to decompressor actuator and from decompressor actuator to housing cover). Roll up cable and leave in housing cover. Remove only when dismantling engine. Unscrew both engine fixing nuts. Remove screws and take out of frame.

M S / V S

Remove complete pedals or kickstarters and kickstarter hub as applicable. Dismantle left engine cover, open chain link and remove chain. Disconnect cables on terminal strip. Remove foot gear lever from models with foot control. Disconnect clutch Bowden cable from actuating levers (does not apply for automatic models) and unhook complete cable from bearing. Remove petrol pipe, carburettor and exhaust.

For hand-changed models only:
Loosen bearing of selector Bowden cable and disconnect cable from actuating lever (roller).

For automatic models only:
Disconnect starter clutch Bowden cable from actuating lever on handlebar. This cable is connected to the operating lever inside the housing cover. To remove engine, take cable out of sleeve, roll up and leave housing. On pedal models, disconnect brake Bowden cable from the rear hub. On kickstarter models loosen lower engine fixing screw, disconnect brake cable and remove footrest holder including brake lever. Remove engine fixing screws and take engine out of frame.

V Z

On models with R-engines and some with V-engines first remove the two egg-shaped covers.

Removing engine from frame

Dismantle kickstarter and kickstarter hub (if fitted, pedals). On foot-controlled models remove foot control lever. Remove left motor cover, open chain lock and take off chain. Disconnect cables from terminal strip. Disconnect clutch Bowden cable from actuating lever and take complete cable out of bearing. Disconnect petrol pipe and remove carburettor and exhaust for hand controlled models only.

For hand-changed models only:

Loosen bearing of selector Bowden cable and disconnect cable from roller. Unscrew lower engine fixing screw, disconnect back brake Bowden cable and remove footrest holder including brake lever. Remove remaining engine fixing screws and take engine out of frame.

D S / D S N

Remove screen with foot boards and holder or safety bar as applicable after unscrewing engine screws from top and bottom of frame. Disconnect foot brake Bowden cable. On models fitted with foot-controlled VSD- or R-engines, remove foot control lever from engine. On models fitted with R-engine or, in some cases, with V-engines, first remove the two egg-shaped covers.

Remove kickstarter or kickstarter hub respectively. On models with V-engines take off foot change lever. Remove left engine cover, open chain link and take out chain. Disconnect electrical cables from terminal strip. Disconnect clutch Bowden cable from actuating lever and disconnect complete Bowden cable from bearing. Disconnect fuel pipe and remove carburettor and exhaust. Remove engine fixing screws and take engine out of frame.

M 50

Dismantle footchange lever. Remove left engine cover, open chain link and take out chain. Disconnect fuel pipe, loosen and remove carburettor. Remove cover on the left of intake box. Dismantle exhaust. Disconnect clutch Bowden cable from actuating lever and take complete engine out of frame.

M C 50/60

Remove kickstarter or kickstarter hub, pedals if fitted. Remove foot control lever and left engine cover. Open chain connector link and take out chain. Disconnect cable from terminal strip. Disconnect clutch Bowden cable from actuating lever and take complete Bowden cable out of bearing. Remove exhaust. Disconnect fuel pipe. Remove carburettor. Unscrew lower engine fixing screw, disconnect back brake Bowden cable and remove footrest holder including brakelever. Remove the two top engine fixing screws and take engine out of frame.

R 50/60

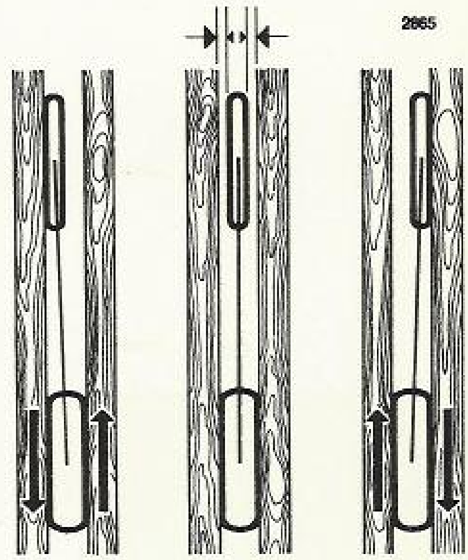
On these models the body must be removed first. Take off the two covers. Turn fuel tap to position "ZU" (closed) and take out rotary section to unseat the rod leading to the tap. Tip up bench seat and loosen fuel tank fixing screw. Turn fixing bracket. Disconnect fuel pipe and lift tank out of bodywork. Remove the two top and the two bottom body fixing screws. If fitted pull air filter hose out of body. Dismantle kickstarter and disconnect rear light and brake light connectors from terminal strip. Lift off body. Remove air filter and carburettor. Open chain link and take out chain. Disconnect cables from terminal strip. Disconnect connecting rod from selector lever. On automatic models, remove Bowden cable after loosening clamping screw on handlebar. Roll up cable and leave on engine. Disconnect clutch Bowden cable from clutch lever and take Bowden cable out of bearing. Remove exhaust. Unscrew engine fixing screws and take engine out of frame.

Frame, forks

Repairs to frames and forks are limited to replacing wear parts such as bearing rings, bushes and rubber mountings. Checks for fractures or twisting are only called for after accidents. Frames and forks used on most of our models are made from pressed steel and extensive repairs are therefore not possible. Such repairs are not even economical at the manufacturing plant because new parts are cheaper. Relining of frames or forks is possible only if no fractures or if no hidden damage to components is present. Note that all frames, particularly pressed-steel types are very prone to overheating during welding or heat treating. But, of course, small repairs may be undertaken on our frames.
Before stripping the vehicle check alignment of wheels as explained below.

Alignment of wheels

When ever fitting a rear wheel make sure that both wheels are in alignment, i. e. on riding the vehicle in straight ahead direction. Checking and adjusting is easily carried out in any workshop, e. g.



wrong right wrong

Fig. 1

Checking:

Put front wheel in straight ahead direction without propping the vehicle up. Lay two edged straight ledges of a length of approx. 98.425 in (2,5 meters) in a height of 3.937 in (100 mm) from ground against the rear wheel so that the ledges lie close against the tyre on front and rear side of the wheel. Thereafter ascertain whether the front wheel front and rear is in equal distance from the ledge (see middle illustration in fig. 1). Should the front wheel not be in the centre between the two ledges adjust the rear wheel.

Adjusting:

Loosen rear axle and adjust rear wheel as required by means of the two chain tensioners (see fig. 1 left and right).

Note: At any correction to the rear wheel always mind correct tension of driving chain. Further to the above said make sure that the wheels are vertical in the frame. Check both wheels using a plummet. Measure the distance from the plummet to the clinch at the top and bottom side of the wheel using a slide rule or measuring tape. If the measuring on both wheels results in unequal values the origin is mostly a disforted front fork or rear swinging arm. (See checking front fork group E or swinging arm group D.)

Frame, forks

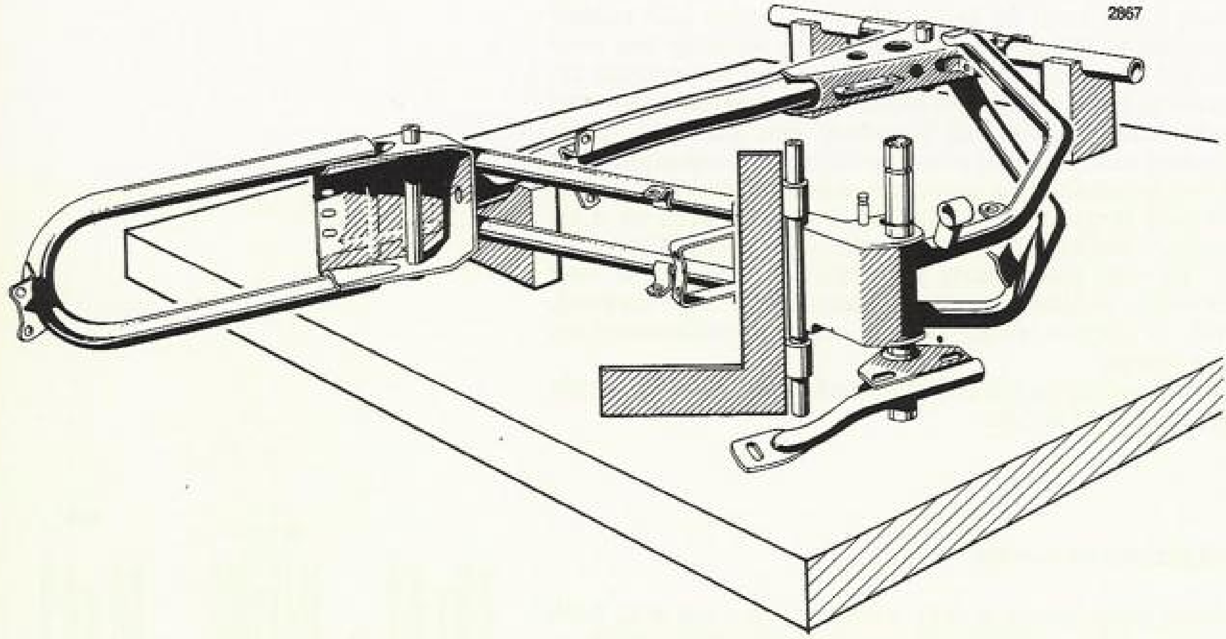
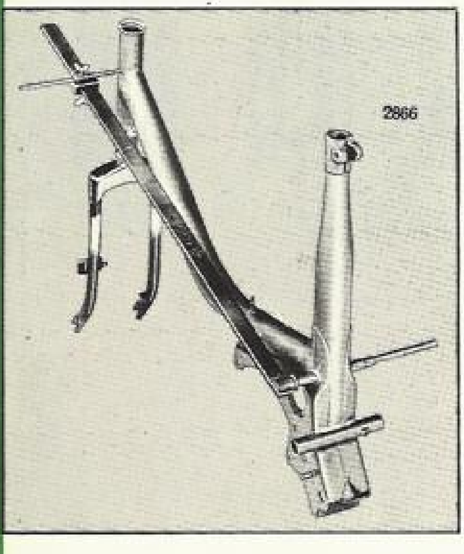


Fig. 2

Fig. 3



Checking the frame

Any signs of an accident call for a frame check. The manufacturing plant uses a special testing appliance having all important check points marked. Service shops must use a somewhat simpler method to check angle of steering head and fork bearings as illustrated in figure 2.

A easily made, simple unit enables checking of frame alignment after an accident. This unit is not an accurate measuring device but allows comparative measurements to be taken at various frame points in order to ensure correct alignment. Measure as described in the following paragraphs dealing with checking the steering head (figure 3).

Push checking unit completely into fork bearing bore. Move slider to centre of steering head and feeler up to the steering head. Clamp slider and feeler. Remove unit and insert into top end. Slider and feeler should remain fixed. The difference from left to right is now indicated at the same level of the steeringhead but on the opposite side. If the indicated difference is more than .3937 in (10 mm), (steeringhead approximately .1968 in [5 mm] off of centre) the frame is out of line and must be repaired or replaced as necessary.

Frame, forks

Similarly, the checking unit can be used to test seat downtube at steeringhead, from top to bottom bearing ring and frame end tube. A twisted steeringhead results in wrong feeler measurements, but if all measurements are taken this will show clearly. It is usually the fork rather than the steeringhead which is twisted.

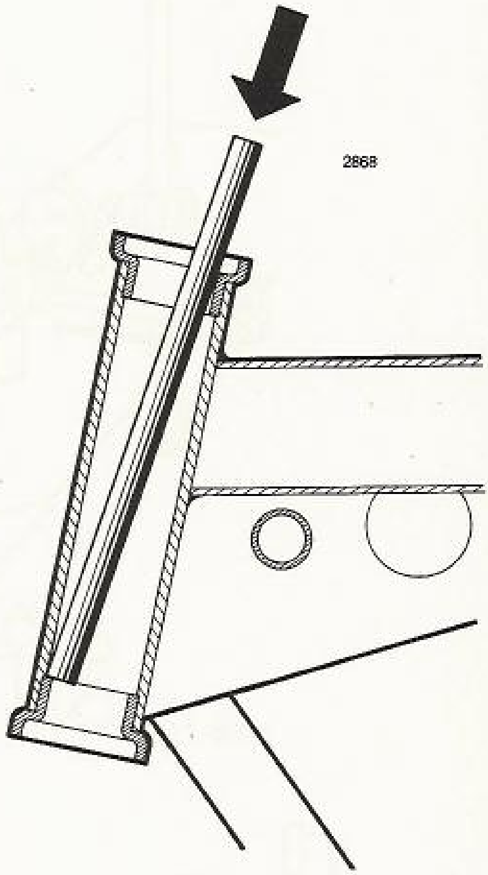


Fig. 4

Test measurements

Measuring steeringhead Maximum permissable difference from left to right	.3937 in (10 mm)
Measuring steeringhead Maximum permissable difference from top to bottom bearing ring	.0394 in (1 mm)
Measuring seat downtube Maximum permissable from left to right	.3937 in (10 mm)
Measuring frame end tube Maximum permissable difference from left to right	.5906 in (15 mm)

Replacing bearing rings on frame

The two bearing rings (steering head bearings) are knocked out as illustrated in figure 4. Figures 5 to 6 show fitting of bearing rings using a special tool (to be made up). With this tool, the bearing rings can be refitted using the spindle or a press. As mentioned in group "front wheel fork", bearing rings, taper and balls must be replaced together.

Fig. 5

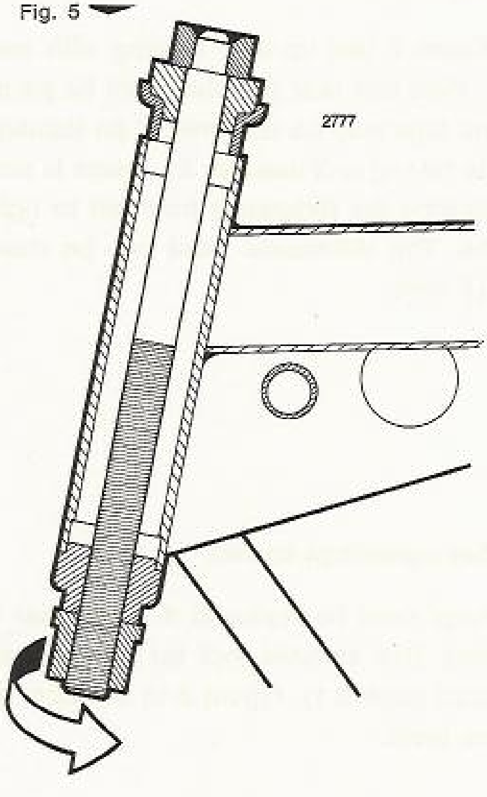
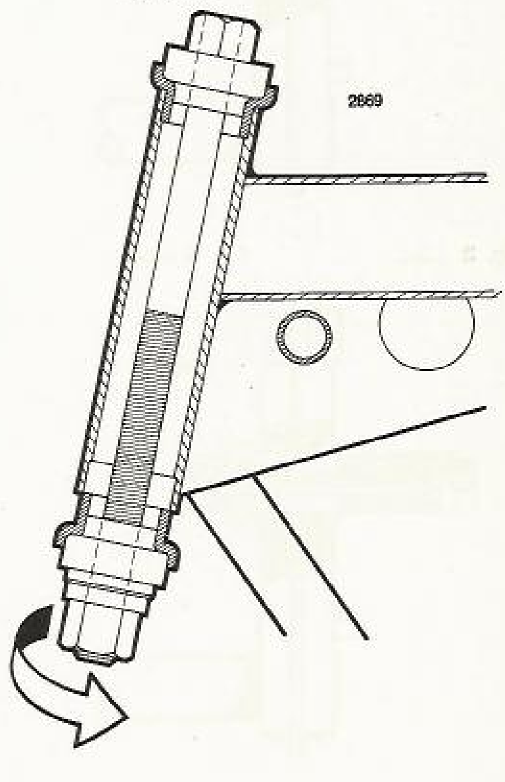


Fig. 6



Frame, forks

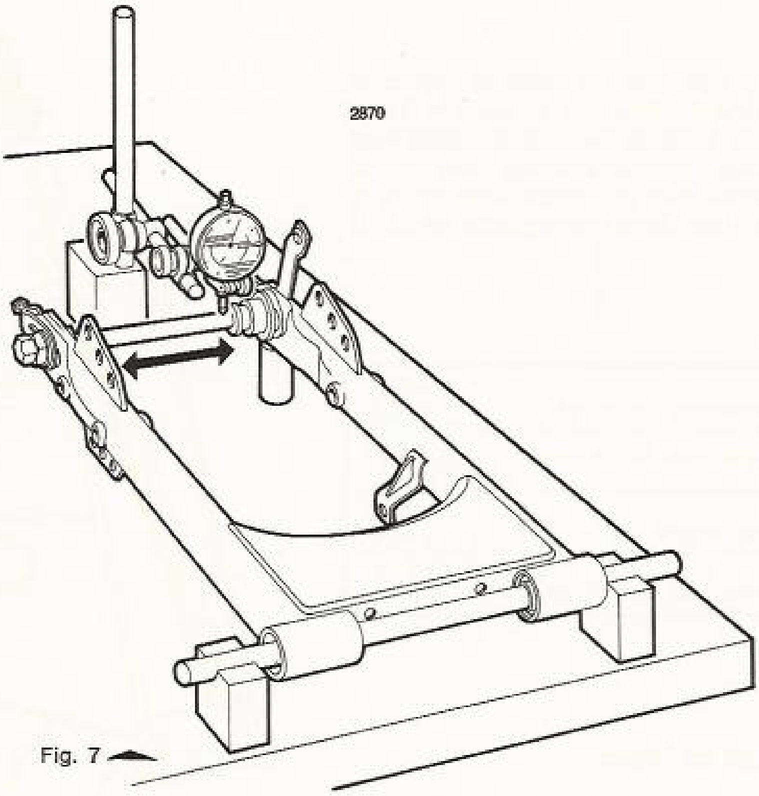


Fig. 7

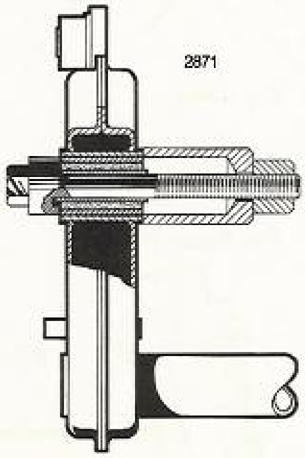
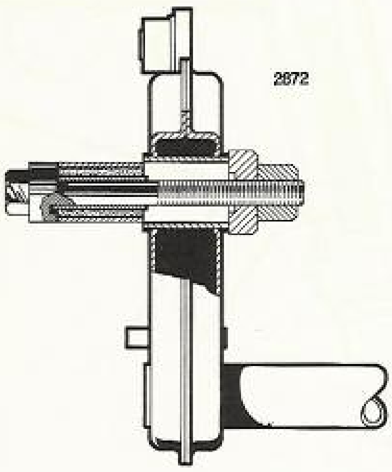


Fig. 8

Fig. 9



Checking of fork

As shown in figure 7 line up fork bearing with rear spindle holder. Font and rear spindles must be parallel. The two fork legs may be realigned if no damage is apparent. The testing unit used for the frame is also suitable for checking the difference from left to right on fork spindle. The difference must not be more than .1181 in (3 mm).

Replacing rubber mountings on fork

Rubber mountings must be replaced if the rubber is soft or deformed. Use suitable tool for pressing on and off (see chart page B 1). Figure 8 to 9 illustrates the use of these tools.

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Front wheel fork

Maxi and X 30 forks (figure 1)

The front fork on these models is a simple telescopic fork requiring no maintenance. Only the plastic guide bushes need lubricating. The spring is screwed at the bottom to the slider and is fixed on top to a threaded piece screwed into the spring. A rubber ring acts as stop on retracting and pervents hard knocking of the threaded part of the slider. A rubber shroud is fitted between sliding tube and fork leg for sealing. The two legs are welded to the fork yoke.

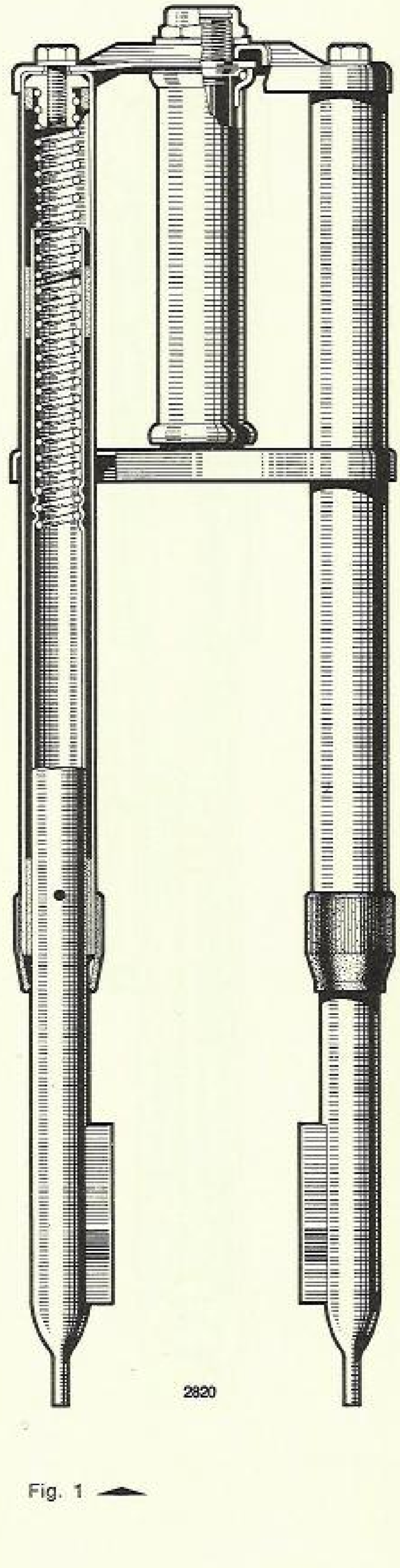

Fig. 1

Dismantling

Dismantling commences after removal of front wheel and mudguard. Remove hexagon screw on upper fork yoke. Pull out complete slider including spring, threaded portion, guidebushes and rubber shrouds. Use soft jaws to clamp slider at spindle end into vice. Unscrew spring clockwise out of thread. The two plastic guide bushes are slotted. Open slots to remove from bearing. The cover sleeve can now be taken out.

Checking

Carefully check all parts visually, replace plastic guide bushes, rubber stop and cover sleeve if necessary, check length or tension of spring.

Fork	spring wire	length of spring		spring tension 2.284 in (58 mm) tensioned	
	dia.	new	wear limit	new	wear limit
Maxi	.1181 in (3 mm)	7.244 in (184 mm)	6.889 in (175 mm)	121.27 ib (55 kp)	110.25 lb (50 kp)
X 30	.1181 in (3 mm)	7.244 in (184 mm)	6.889 in (175 mm)	121.27 lb (55 kp)	110.25 lb (50 kp)

Plastic guide bush

new	wear limit
1.0609 in (26.95 mm) dia	1.0433 in (26.5 mm) dia

Assembling

Proceed in reversed order to dismantling. Ensure plastic washer is fitted between spring to prevent retracting noise. Lubricate plastic guide bushes and springs on assembling.

Front wheel fork

M S, V S-F O R K S
(figure 2)

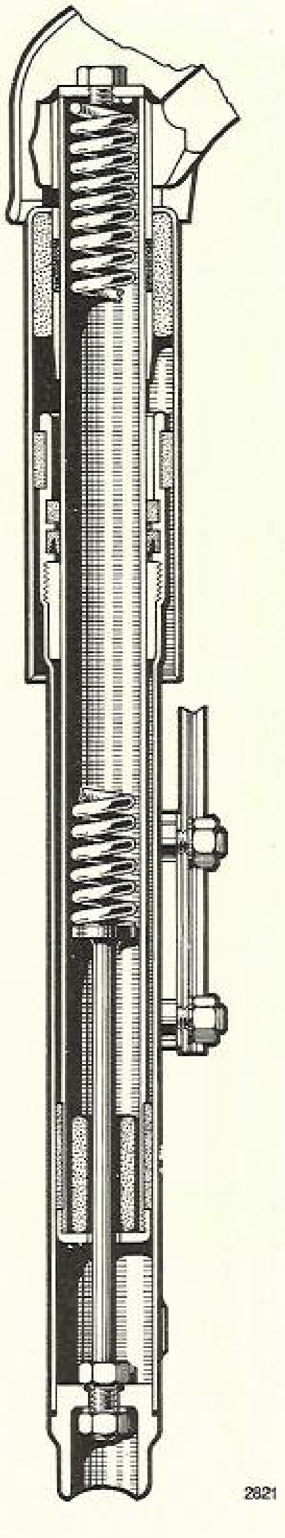

Fig. 2

The front fork on these models is of the oil filled, telescopic type. The spring is guided inside the fork leg with the top end free and the bottom end centered in the spring bolt. The fork is oil filled for easy movement of sliding tube at high frequencies and to prevent seizure of guide bushes.

A rubber spring holds the cover tube and acts as stop on retracting. Expansion stop is a rubber sleeve.

Dismantling

The fork legs are welded to the fork yoke. Remove complete fork or one or both sliders as required.

To remove complete fork, first dismantle the handlebar. Take out headlamp unit, disconnect lighting cables and unscrew drive from speedometer. Lift off headlamp carrier after removing fixing screw and forkshaft nut. Take off front wheel. Loosen clamping screws, disconnect brake cable and remove front spindle. Unscrew mudguard screws and extract mudguard bracket from slider. Turn slider 90 deg. and remove mudguard. Unscrew adjusting nut of steering bearing, lift off dust cover and taper, remove fork downwards. Do not loose balls of steering bearings. Use soft jaws to clamp fork in vice and proceed as described in the following paragraph "dismantling of sliding tube".

Assemble in reversed procedure. Replace worn bearing rings. Use new balls with new rings (21 of each). Press bearing rings home up to collar into frame tube. Do not fit if crooked.

If dismantling of sliders is called for, proceed as follows. Unscrew nut on bottom of slider and pull tube downwards until slotted sleeve with felt-strip insertions is visible. Unscrew slotted sleeve by holding slider by the inserted spindle. Take off slider. Open lower fork connection and remove spring bolt with rubber stop, spring and the two guide bushes. The cover tube with rubber buffer can be dismantled after extracting the slotted sleeves.

1st Edition

Front wheel fork

Checking

Check all parts as described under "checking", page 3 and 4 for VZ and M 50 forks. See following chart for wear parts.

Fork		new	wear limit	permissable ovality
MS	bush upper	1.0885 in (27.65 mm) dia	1.0866 in (27.5 mm) dia	.0059 in (0.15 mm)
	bush lower	1.0118 in (25.70 mm) dia	1.0039 in (25.5 mm) dia	.0078 in (0.20 mm)
VS	bush upper	1.1673 in (29.65 mm) dia	1.1614 in (29.5 mm) dia	.0059 in (0.15 mm)
	bush lower	1.1024 in (28.00 mm) dia	1.0945 in (27.8 mm) dia	.0078 in (0.20 mm)

Fork	spring wire	length of spring		spring tension, 7.7950 in (198 mm) tensioned	
	dia	new	wear limit	new	wear limit
MS	.1220 in (3.1 mm)	10.3540+.0787 in (263 + 2mm)	9.6456 in (245 mm)	99.22 lb (45 kp)	88.20 lb (40 kp)
VS	.1220 in (3.1 mm)	10.3540+.0787 in (263 + 2mm)	9.6456 in (245 mm)	99.22 lb (45 kp)	88.20 lb (40 kp)

Assembling

Proceed in reversed order. Always replace gaskets and circlips. Replace springs in pairs or check to ensure correct spring loading.
The cover tubes are fixed to the fork legs by a rubber stopper. To fit, push rubber into cover tube and knock onto slider with a suitable length of piping. Do not lubricate rubber leg or cover tube will not hold.

Changing oil

An oil check is not possible. Remove oil and replace. To change oil, remove hexagon nut at bottom of slider. Push slider downwards to let the oil escape. Replace nut and washer. Remove hexagon screw on fork yoke to insert new oil.

V Z – M 50 f o r k (figure 3)

The front fork is of the telescopic type with hydraulic damper. Fork length and the steering head vary on different models. For design and operation see figure 3 to 5 and the following description.
It is the duty of the front fork to counteract uneven road surfaces as quickly as possible. The spring has the tendency to return the front wheel quickly to its original position. This causes vibration which is prevented or reduced by means of the hydraulic damper. The damper acts independently of the vibration frequency (fast succession of spring movements) to soften impact.

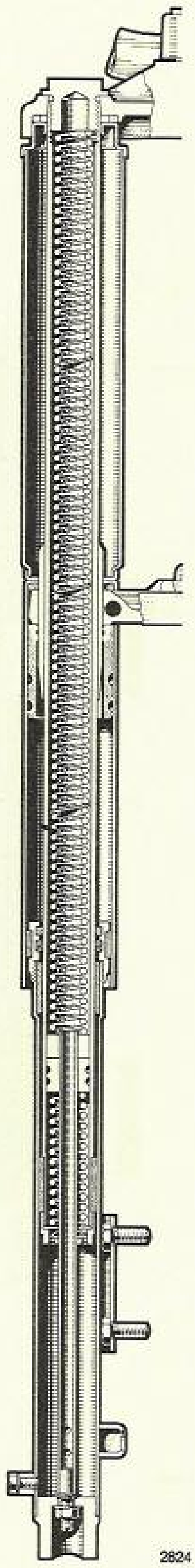

Fig. 3

Front wheel fork

A rubber spring holding the cover tube acts as stop on initial retraction. On expansion, a spring supports the hydraulic damper. However, this spring acts only on complete expansion, for instance when lifting up the front wheel.

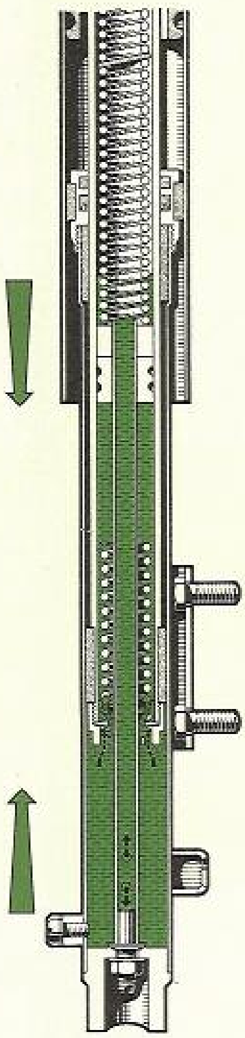

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Fig. 4

Design, operation

The shock absorber is fitted inside the stanchion or fork slider as the case may be and consists of a piston together with the damping tube and a valve positioned in the threaded part of the stanchion. The valve splits the shock absorber oil into two parts. The oil is pressed by the piston or slider as the case may be from the lower to the upper chamber or vice versa and this effect is utilised for damping.

Functioning of shock absorber on initial retracting
(figure 4)

The space above and below the valve is fitted with shock absorber oil. The valve is open and the oil flows through the holes in the threaded part from below to the space above the valve. The square section of these holes has been chosen to give fast retraction without jerking of the spring. The capacity of the sliding tube (larger diameter) is bigger than that of the stanchion. Therefore, part of the oil escapes to the space above the piston through holes provided at the lower end of the damping tube.

Functioning of shock absorber on expanding
(figure 5)

The space above and below the valve is fitted with shock absorber oil. The valve is closed. The oil is forced to escape through the holes in the stanchion between damping tube and threaded part into the space below the valve. This restricts the flow at expansion and prevents rapid movements or back feeds. The size of the oil holes has been established by many tests and must not be altered. Because of the lower capacity of the space above the valve, the space below is not completely filled. This causes a vacuum and the oil in the space above the valve is sucked back through damping tube and connecting hole.

Dismantling

The fork can be removed completely or one or both stanchions can be taken out of the fork yoke.
In the first case, dismantle the handlebar, loosen upper stanchion nut, loosen clamping screw on lower fork yoke and remove with lower fork yoke from steering head.

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In the second case, dismantle handlebar, loosen upper stanchion nut, loosen clamping screw on lower fork yoke and pull out complete leg downwards. If necessary insert front spindle or suitable rod and knock. Take springs upwards out of the stanchions and empty out oil. The damping tube with piston is screwed to the sliding tube. The fixing nut can be reached from below with a socket spanner. Note direction and washer.

Loosen holding nuts and remove sliding tubes.

Loosen lower stanchions, take out threaded part with valve, back feed springs and damping tube.

Remove holding nut and the two bushes from fork tube.

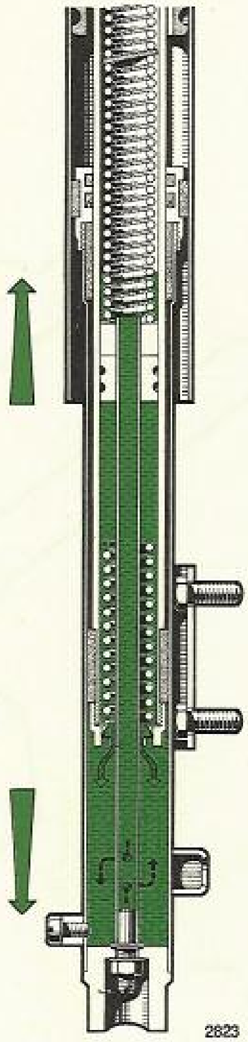


Fig. 5

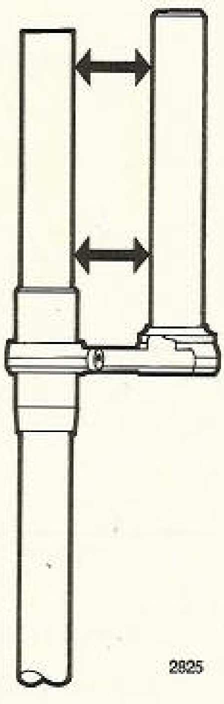
Checking

Check all parts visually, note particularly wear on sliding surfaces of piston and bushes. Wear on the stanchions causes oil losses.

Measure wear of piston and bushes.

	new	wear limit	permissable ovality
piston	.7874 in (20.00 mm) dia	.7795 in (19.80 mm) dia	.0078 in (0.20 mm)
bush – upper	1.1673 in (29.65 mm) dia	1.1614 in (29.50 mm) dia	.0059 in (0.15 mm)
bush – lower	1.1024 in (28.00 mm) dia	1.0945 in (27.80 mm) dia	.0078 in (0.20 mm)

Fig. 6



If fork damage is expected after an accident, stanchions and fork bushes must be checked.

Check stanchions by rolling the separated tubes on a flat surface. Any deformity will be obvious. Stanchions bent not more than .0787 to .1181 in (2 to 3 mm) can be straightened under a press. Anchor tube at both ends and apply pressure carefully. Replace stanchions if bent to more than .1181 in (3 mm). Check lower fork yoke with assembled stanchions. Stanchions must be parallel to the steering column figure 6 as well as from stanchion to stanchion figure 7. Deformed fork yokes must be replaced. Check upper fork yoke on flat surface – replace deformed yokes.

Front wheel fork

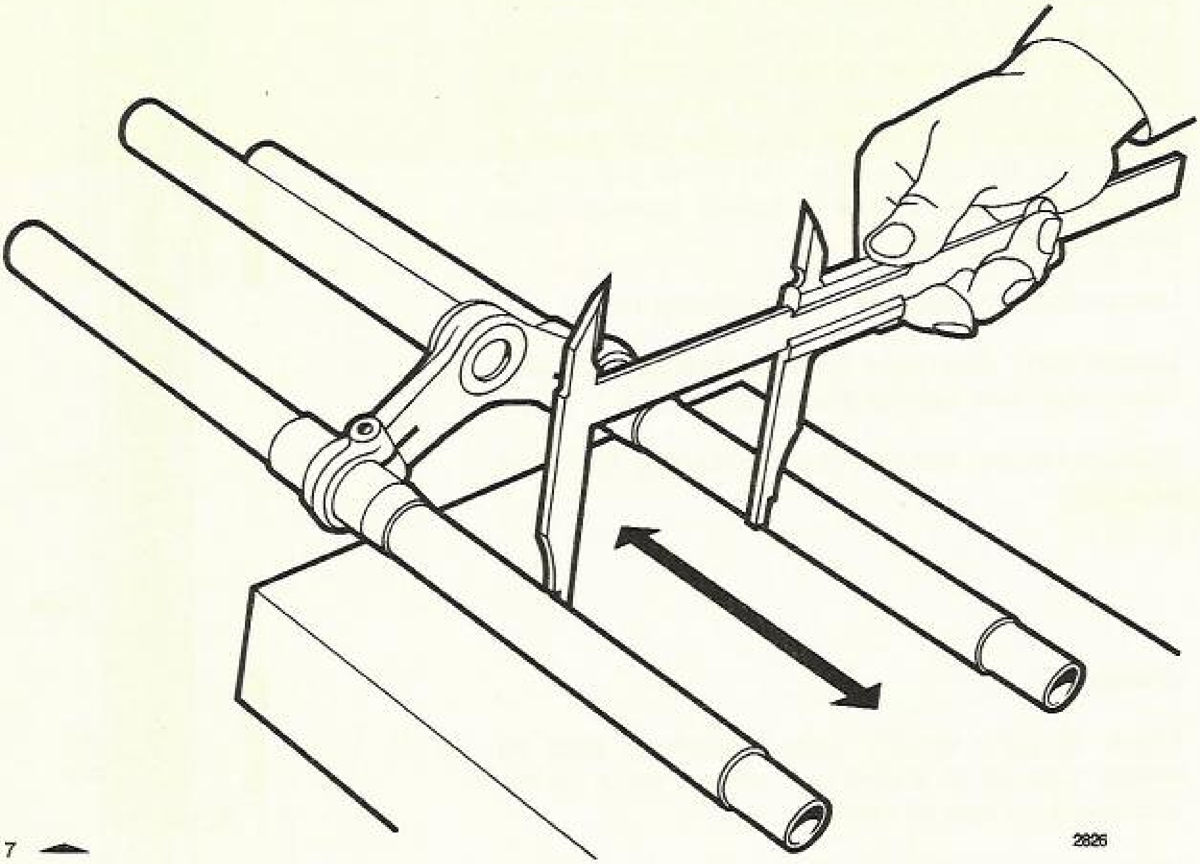


Fig. 7

Springs are checked with a spring balance and by measuring their length. Worn springs are of different length. The following chart quotes test values and wear limits. Check both springs if one only is replaced. The test value must be within the specified limit or both springs must be replaced.

Fork	spring wire	length of spring, in (mm)		spring tension, 39.4 in (100 mm) tensioned	
	dia	new	wear limit	new	wear limit
VZ	.1339 in (3.4 mm)	16.457–16.535 (418–420)	15.944 (405)	110.25 lb (50 kp)	99.22 lb (45 kp)
M 50	.1299 in (3.3 mm)	17.047–17.126 (433–435)	16.535 (420)	99.22 lb (45 kp)	88.20 lb (40 kp)

Assembling

The fork is assembled in reversed procedure to dismantling, noting the following points and testing instructions.

All parts must be cleaned thoroughly.

Use new gaskets.

Replace both springs together or check both springs together.

A piece of rubber holds the outer tubes (or short sleeves for the rubber gaiters) to the fork tubes. On assembly, push the rubber into outer tube and use a length of tubing to knock the rubber on to sliding tube. Do not oil rubber or stanchion since the rubber will not grip properly.

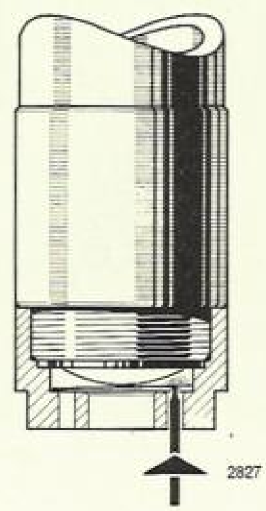


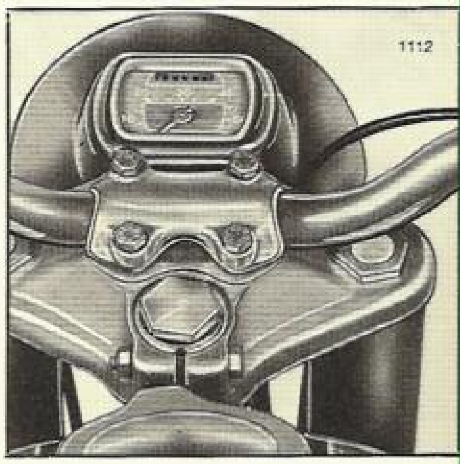
Fig. 8

Check functioning of damper valve after fitting the stanchion connection by pushing a wire through the holes of the connection to test movement of valve leaf (figure 8).

Tighten lower stanchion connection and check lower bush for easy turning.

Shorten bush as necessary. A tight bush causes loosening of stanchion connection during normal use. Check steering bearing before assembling. Insert greased balls into bearing ring – 21 balls per bearing. Damaged or worn bearings must be replaced completely – balls, rings and tapers. When replacing the steering bearings see group "frame" – page 3. Insert preassembled fork without fork yoke into steering head. Add upper bearing taper ring and cover washer. Slide fork yoke onto steering column and the two stanchion tubes. Tighten steering bearings. Fill with oil and tighten upper stanchion unit.

Fig. 9



The steering bearing play is adjusted after tightening the stanchion connections. Tighten connection until steering is tight and loosen by 1/4 to 1/2 a turn until steering moves freely and some play can be felt. Lock connection with clamping screw (figure 9). The two clamping screws for the stanchion tubes on the lower fork yoke are tightened only after fitting the wheel to permit lining up of the two fork yokes as necessary.

Front wheel fork

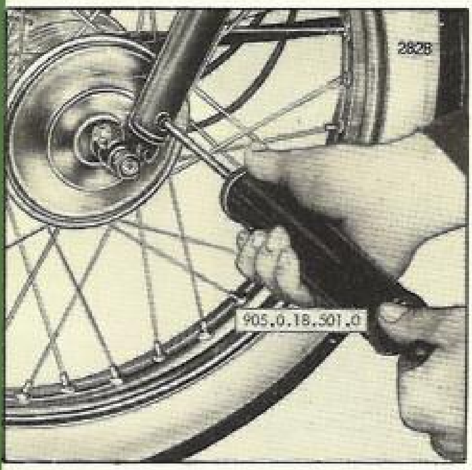


Fig. 10

Oil change

An oil check is not possible. Old oil must be removed and replaced. Remove oil by loosening upper fork stanchion nut and unscrewing stopper screw positioned on the side of the slider. Fill oil through top after removing stanchion nuts or at stopper screw with an oil gun part no. 905.0.18.501.0 – see figure 10. No vent holes are provided; therefore, when filling by oil gun the upper fork covers nuts must be loosened to prevent air build up.

The oil quantity is:

VZ fork	110 cc per leg
M 50 fork	115 cc per leg

use shock absorber oil SAE 5 – 10.

Suspension units

V Z-, M C-, R-50/60-, M 50 - s u s p e n s i o n u n i t s (figure 1)

The above models are sprung by suspension units of the two stage hydraulic shock absorber type. Basic design is the same. Only shape and size alter. When pressing together the chock absorbers reduce vibration of the rear wheel.

When removing the load the rear wheel is pushed to the original position by the springs. Without shock absorbers this would happen very suddenly and react by new retracting. The absorbers prevent this. The absorbing capacity increases with the frequency of vibrations to give comfortable riding at all times. The suspension unit is fitted with a rubber stop to prevent hard impact at complete retraction.

Design, Function

The shock absorber consists of an outer and inner cylinder. Between the two is the storage chamber and inside the inner cylinder is the working chamber. Working and storage chambers are connected by a floor valve. The valve is closed during retraction. The damping piston slides in the working chamber. This piston has flow holes closed by a further valve at expansion. The piston separates the working chamber.

Retraction of shock absorber (figure 2)

The working chamber is filled with oil. Retraction closes the floor valve. The pressure of the liquid opens the piston valve and the oil flows from the space below the piston to the space above. The holes in the piston have been selected to achieve fast retraction combined with sufficient absorbtion. Because of the piston rod the spaces above and below the piston have different capacities and part of the shock absorber oil flows to the storage chamber between inner and outer cylinder. Since the floor valve is closed, a separate exchange hole is provided on the inner cylinder.

Expansion of shock absorbers (figure 3)

The space below the piston is filled with oil. Since the piston valve is closed in this position, the oil is forced to flow to the space below the piston through a hole in the piston rod. Filling of the lower space takes time because of the restriction by the piston rod hole.

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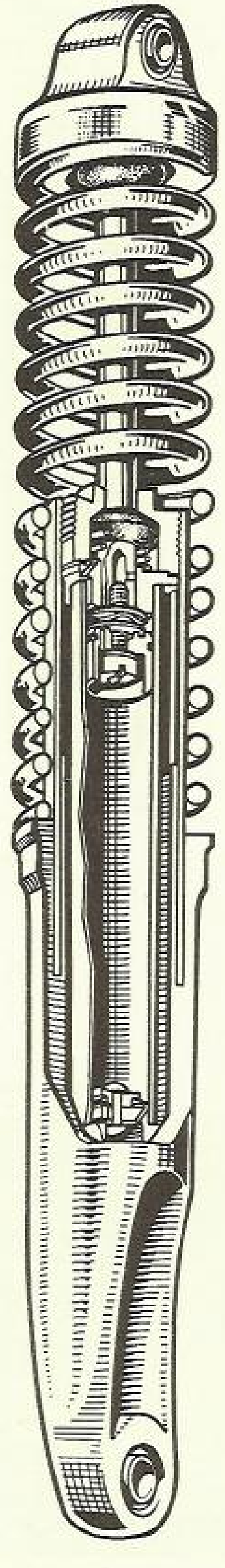


Fig. 1

Suspension units

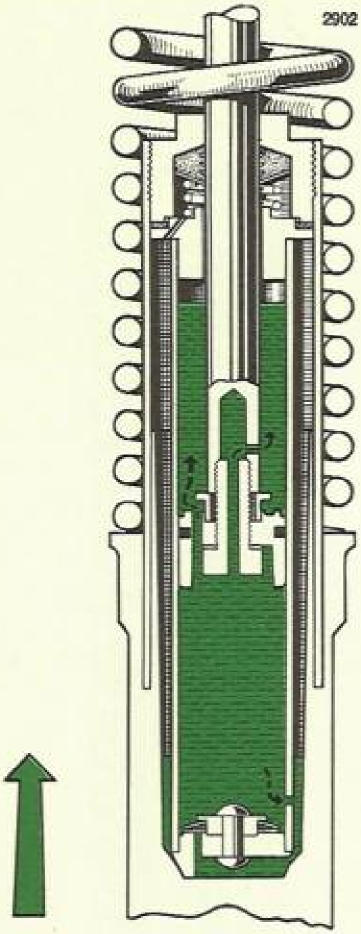


Fig. 2

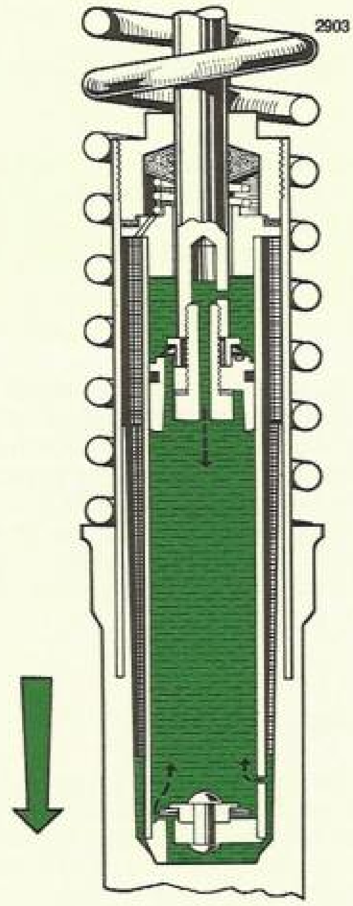
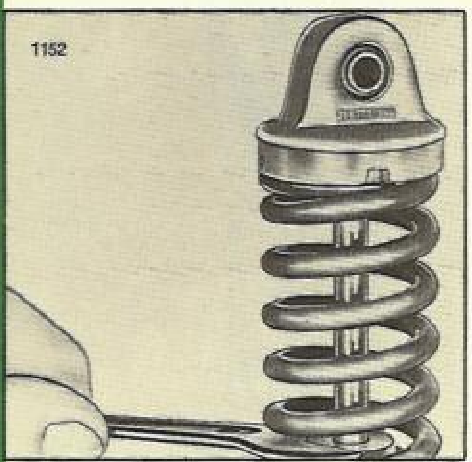


Fig. 3

Fig. 4



The slower flow damps the expansion to prevent knocks or back feeds. Because of the piston rod, less oil is forced out than could be taken by the lower space. A vacuum builds up opening the floor valve and oil is sucked from the storage chamber to complete exchange. Part of the oil escapes from the space above the piston along the piston rod, is caught by the special seal (labyrinth) and flows back to the storage chamber between outer and inner cylinder through a hole in the guide.

Dismantling of Suspension unit

To change oil, suspension unit must be dismantled. Intervals for oil change are specified in the operating instructions and on type sheets. Unscrew connection with special spanner part no. 905.0.35.001.1 – see figure 4. Some models require removal of protective sleeve after unscrewing fixing screws.

Pull head of suspension unit, including complete piston and threaded connector out of cylinder. Take off inner cylinder and empty out oil. For further dismantling clamp head of leg and remove piston fixing screw. All parts can now be removed from piston rod.

1st Edition

Suspension units

Checking

Check all parts visually. Check particularly for wear on inner cylinder and piston (sliding surfaces). Seals used for some time should be replaced. Labyrinth seal must have sharp sealing edges. Measure piston wear.

Piston

new	wear limit	permissable ovality
.6890 in (17.5 mm) dia	.6732 in (17.1 mm dia)	.0078 in (0.2 mm)

Check floor and piston valve for proper functioning and check valve surfaces. Springs must be checked with a spring balancer. If one spring only is replaced, check both springs. The difference must be within the limit specified in the following chart.

suspension units	spring wire	length of spring, in (mm)		spring tension, 2.834 in (72 mm) tensioned	
	dia	new	wear limit	new	wear limit
VZ, MC, R	.2559 in (6.5 mm)	6.4960–6.5750 (165–167)	6.2200 (158)	335.16 lb (152 kp)	313.11 lb (142 kp)
M 50	.2756 in (7.0 mm)	8.2677–8.3464 (210–212)	8.0315 (204)	324.13 lb (147 kp)	299.88 lb (136 kp)
R 50/60 rear	.2677 in (6.8 mm)	6.4960–6.5750 (165–167)	6.2200 (158)	429.97 lb (195 kp)	401.31 lb (182 kp)

Assembling the suspension units

Assemble in reversed procedure to dismantling. Note any wear. Always use new gaskets.
Fit labyrinth seal with fitting sleeve part no. 905.6.34.301.1 see figure 5. The labyrinth seal is marked "Öl Seite" and "unten", see figure 6. With the leg standing up, this marking must point downwards or the sealing lips are reversed and the leg will leak.

Oil quantity to be filled:

55 cc of shock absorber

oil SAE 5–10 per suspension unit.

The oil is filled into storage and working chamber. Ensure correct quantity. Insufficient oil causes an air lock which reduces the absorbing effect; too much and the leg will stick. The rubber mountings on top and bottom of legs are pressed on and off with a suitable tool. This tool can be made easily. Procedure is illustrated in figures 7 to 8. Soft or deformed rubber mountings cause annoying noises and must be replaced.

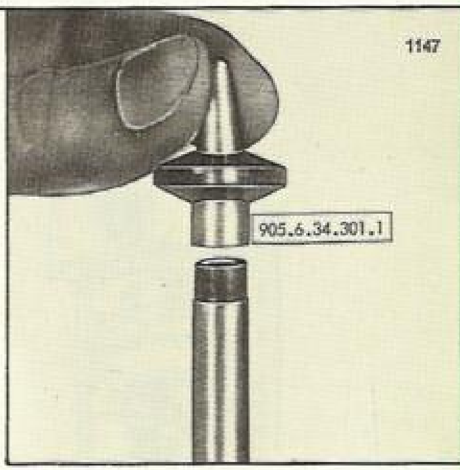


Fig. 5 ▲ Fig. 6 ▼

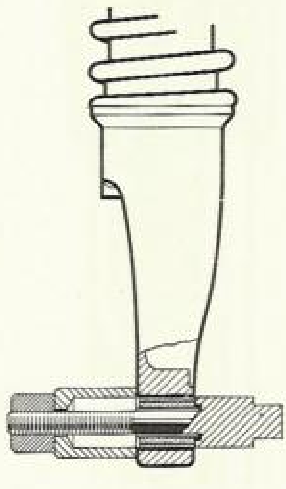
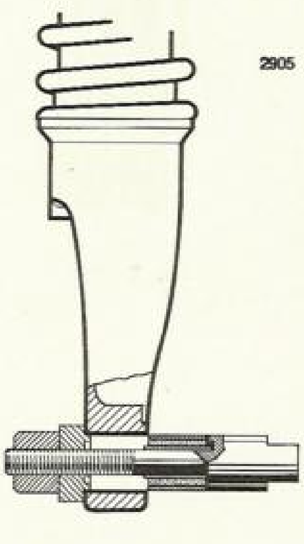


Fig. 7 ▲ Fig. 8 ▼



Suspension units

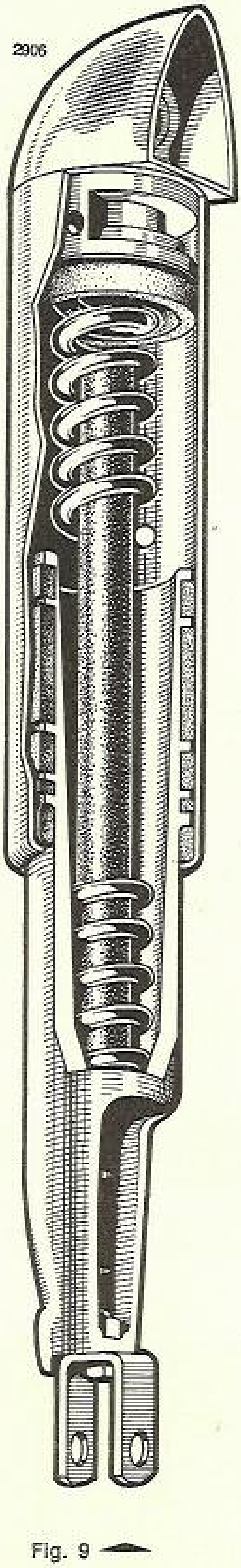


Fig. 9

MS-, VS- and DS-rear suspension units and R-50/60 and DS-front suspension units (figure 9)

All suspension units are of equal design and practically require hardly any maintenance. Only the felt rings need be lubricated from time to time. Rubber rings on top and bottom act as stops for retraction and expansion. 2-seater models are fitted with a rubber rod inside the rear springs for additional spring action.

To dismantle, take out screw holding suspension unit head and cover tube together. All parts can now be reached.

Check condition of plastic bush, felt rings and rubber rings. Replace badly worn plastic bushes and felt rings. Lubricate felt rings before assembling. Use acidfree lubricants.

Springs can be checked only with a spring balance. Values as follows. If only one spring is replaced, check both to establish equal tension. If not possible, replace both springs.

suspension units	spring wire	length of spring, in (mm)		spring tension, 2.5590 in (65 mm) tensioned	
	dia	new	wear limit	new	wear limit
DS, R 50/60 front	.1870 in (4.75 mm)	9.2913–9.3701 (236–238)	8.8580 (225)	198.45 lb (90 kp)	180.81 lb (82 kp)
MS, VS, DS-rear	.1968 in (5.0 mm)	7.8740–7.9527 (200–202)	7.5590 (192)	308.70 lb (140 kp)	286.65 lb (130 kp)

Use your own suitable tools to fit and remove rubber mountings. Procedure is illustrated in figures 7 to 8. Rubber mountings must be replaced if too soft or deformed.

1st Edition

Wheels, hubs

Hubs, Brakes

General

Glued-on linings are used on all brake shoes fitted to our machines. If linings are worn, replace complete shoes.

Oiled linings, usually due to over greasing of brake cam, must be cleaned with petrol or a similar degreasant. Roughen brake surfaces of brake drums with emery cloth prior to fitting new shoes.

The position of the brake lever is particularly important for a properly working brake. If fully actuated the brake lever position is to be max. 90 deg. (see figure 1 and 2). Upon wear of the linings the lever position changes. Correct the lever position as long as the wear of linings still allows readjusting (see wear limits page G 7). Readjust at the toothing between brake lever and brake cam.

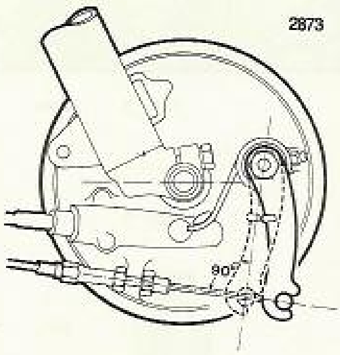
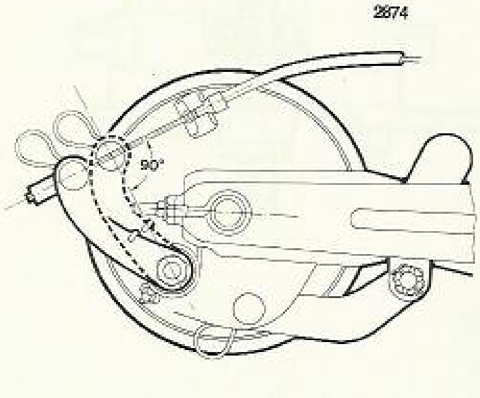


Fig. 1

If bearings of separate hubs are worn, replace complete sets consisting of bearing rings, tapers and balls.

Fig. 2



Hubs are greased for life. This means that the original grease filling is sufficient for approximately 6210 mph (10.000 kilometers) use. After this, hubs must be dismantled, cleaned and regreased. We should like to describe fitting and removing of wheel bearings in detail. Time and time again we find that complaints regarding faulty bearings are due to incorrect fitting. Such bearings are usually fitted under stress by useing incorrect tools or by using correct tools wrongly. Bearings must be fitted by applying pressure to inner and outer ring simultaneously. If not, the bearings will be under stress. This reduces the bearing life and replacement is soon necessary. On MS hubs and on rear wheel hubs of models VZ, MC and R50/60 it is absolutely necessary to counter press-in force for the second bearing or the distance sleeve will press onto the outer ring of the opposite bearing and both will be under stress. Easily made-up tools enable professional fitting and removing. We will gladly supply appropriate drawings on request.

Front wheel hubs (LELEU)

Dismantling:

Dismantle front wheel hubs as follows:
Clamp spindle counternut on speedometer end into vice using aluminium jaws.

Wheels, hubs

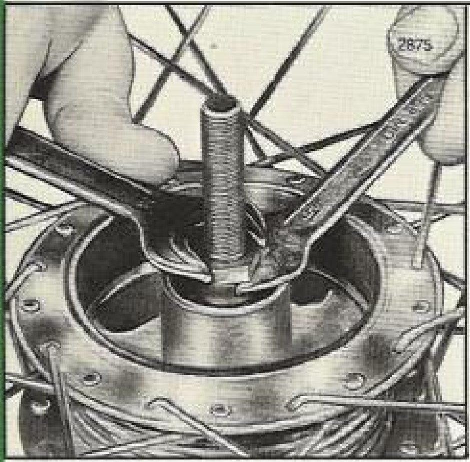


Fig. 3

Remove counternut and lift-off carrier plate with washer. Brake shoes are removed by disconnecting brake shoe springs with screwdriver. Unscrew counternut and adjusting taper and lift hub off axle.

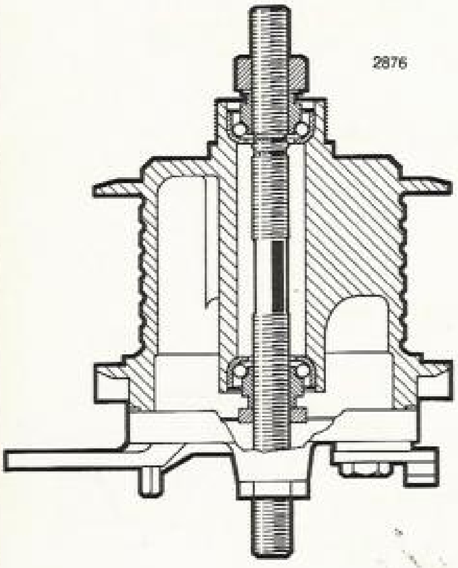
To replace bearings, take off bearing cover, remove balls (22 off) and pressout bearing rings. Use suitable tool to refit bearing rings.

Assembling:

Assemble in reversed procedure. Use special spanner part no. 905.6.35.402.1 to adjust tapers – see figure 3. A suitable press-on sleeve aids fitting of bearing covers. Adjust spindle play on drum side. The other taper is tightened on the spindle. The spindle is knurled to locate taper.

To adjust, tighten right taper until spindle movement is restricted. Loosen taper approximately 1/4 to 1/2 turn to ease movement without having any play, and then tighten counternut.

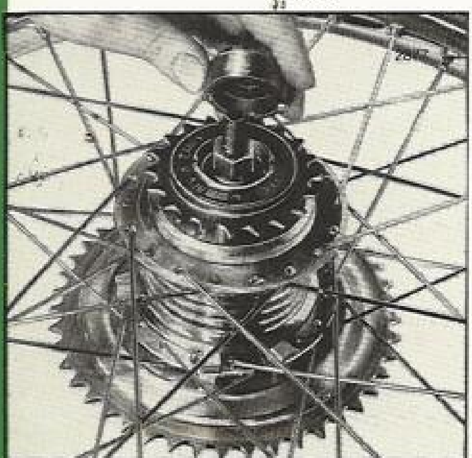
Fig. 4



Rearwheel hub (LELEU) – figure 4

Rear wheel hubs are dismantled similarly to front wheel hubs. In addition note the following pints: It is not necessary to dismantle complete hub to replace idling or drive chain sprockets. Unscrew complete idling sprocket with special tool part no. 905.6.35.404.0 (figure 5). Further dismantling is not advisable. Replace complete unit if necessary. The large sprocket is held by six screws and fitting is simple.

Fig. 5



Front wheel hub (Fichtel & Sachs) – figure 6

Dismantling:

To dismantle, clamp spindle in vice using aluminium jaws. Remove nut holding speedo drive and take off speedo drive. Unscrew counternut (.1181 in – 3 mm thick) and remove notched disc and taper. Lift hub off spindle. Use screwdriver to press out dust shields. On brake shoe end, remove felt ring and washer sealing the dust shield. Bearing balls and rings can now be examined and replaced as necessary. If the carrier plate only needs removing do not remove counternut.

1st Edition

Wheels, hubs

Assembling:

Assembling commences in reverse procedure. Insert balls in layer of grease. Use sleeve to press on dust shields. Use adjusting spanner part number 905.6.35.402.1 for accurate adjustments of tapers. Adjust play on left hand side (opposite brake drum). Taper on right hand side is tightened and the spindle is knurled to locate taper. To adjust, tighten left taper until spindle movement is restricted. Loosen taper approximately 1/4 to 1/2 turn to ease movement without having any play. Fit washer and tighten counternut.

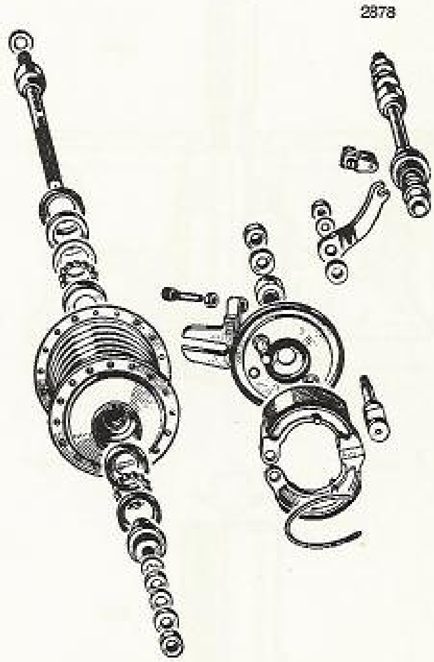
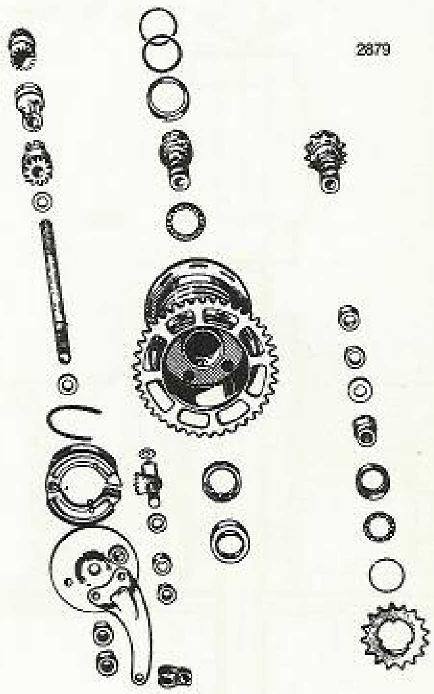


Fig. 6

Fig. 7



R e a r w h e e l h u b (Fichtel and Sachs) (figure 7)

Dismantling:

Clamp spindle counternut on drum end in vice using aluminium jaws. Remove counternut, notched disc and taper. Unscrew threaded section with sprocket, bearing ring and dust shield. Remove bearing ring and take hub out of spindle. Tap lightly from sprocket end on face of drive taper, thus pressing drive taper with clutch, bearing ring and dust shield out of hub. Use sleeve to press in dust shield. To replace ball bearing in threaded section (driver) remove dust shield with screwdriver. Remove circlip to take sprocket off threaded section. Proceed by clamping spindle to unscrew counternut and take off carrier plate and distance ring. To replace brake shoes, loosen and disconnect return spring with screwdriver.

Assembling:

Assemble in reversed procedure. Ensure accurate adjustments of tapers. The left taper is also driver and gearwheel for the brakes and is held on spindle (drum end) by a wire clip. This taper is not screwed to the spindle but must move freely to actuate brakes. Adjust right taper until spindle movement is restricted. Loosen a little (approximately 1/4 to 1/2 turn) to ease movement without any play. Ad washer and tighten counternut. When pressing home dust shield into threaded section (driver) to ensure free movement of bearing ring.

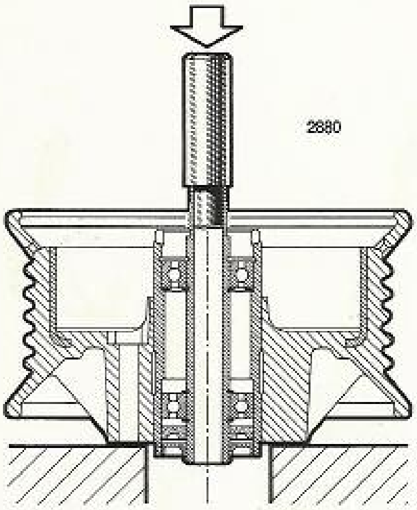


Fig. 8 ▲

Fig. 9 ▼

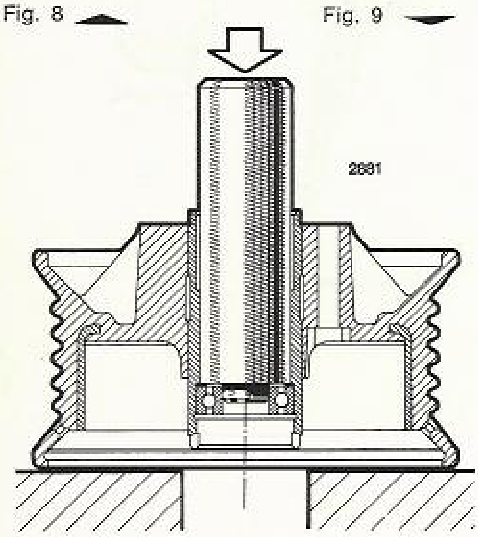
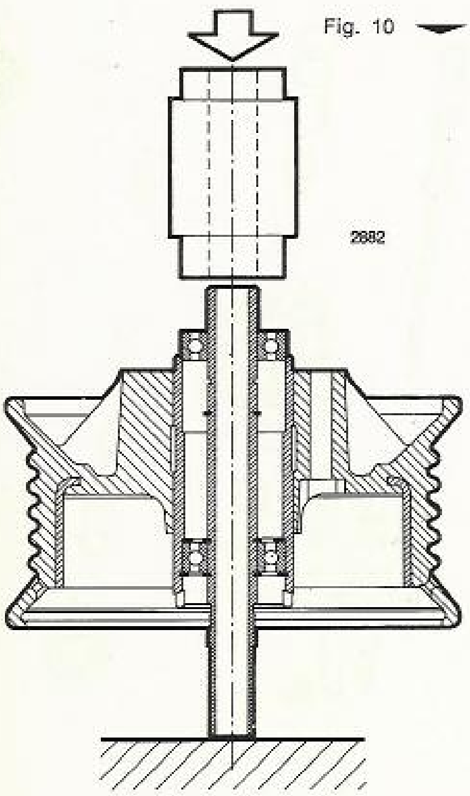


Fig. 10 ▼



Front and rear wheel hub VS

Dismantling:

Dismantle this hub from brake-plate end. First press off pressure ring from distance sleeve then lift out brake plate with brake shoes. At this stage all work on speedo drive and brakes can be carried out. In this case remove castellated nut, penetrate sealing ring on rubber part with a pointed punch and press out. Such sealing rings cannot be reused. After pressing out this sealing ring remove smaller circlip on distance sleeve. Use suitable tool to press distance sleeve out of hub from drum end – see figure 8. The drum end bearing is pressed out from other end with a suitable tool after removing the larger circlip (figure 9).

Speedo drive:

The speedo drive is fitted to the front brake plate. Dismantle as follows: Dismantle brake shoes from removed brake plate and press holding pin out of plate. Take out connector and driver speedo wheel. Remove sealing ring, driving speedo wheel and if necessary bush and washer.
On assembling, insert square end of driving spindle with circlip and washer into connector and then add the spring. Plastic washer on end of driven speedo wheel must seal properly. Number of teeth and pitch of speedo gears varies according to wheel size.

Wheel	Speedo wheel (driving)	Speedo wheel (driven)
12"	17 teeth	12 teeth, .4882 in (12.4 mm) dia
17"	17 teeth	12 teeth, .5157 in (13.1 mm) dia
21"	17 teeth	12 teeth, .5157 in (13.1 mm) dia
19"	22 teeth	12 teeth, .5157 in (13.1 mm) dia
23"	22 teeth	12 teeth, .5157 in (13.1 mm) dia

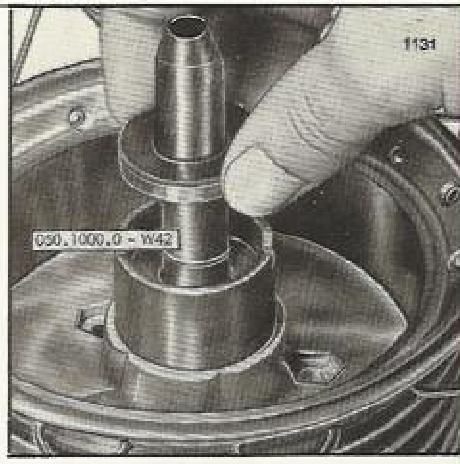


Fig. 11 ▲ Fig. 12 ▼

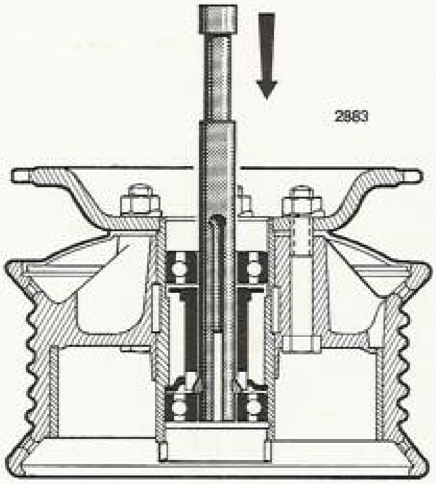
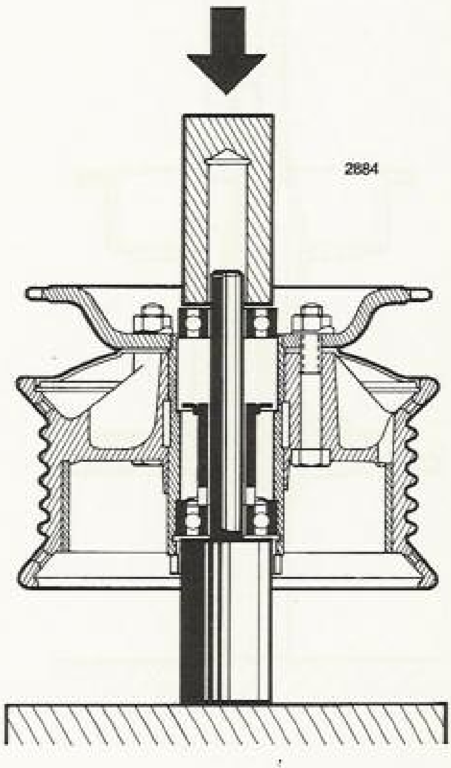


Fig. 13 ▼



Assembling:

Assemble in reverse procedure. Note the following points. Insert washer into right hub end, press in carrier plate and bearing and lock with larger circlip. Fit internal circlips to distance sleeve and push into bearing previously fitted (thread end). Push left end bearing onto distance sleeve and press home with suitable tool figure 10. This tool is used for front and rear hubs. The shorter end – .3858 in (9.8 mm) of tool is used for rear hubs and the longer end – .5512 in (14 mm) for front hubs. Fit remaining circlips and complete assembling of hub. Use sleeve part no. 050.1000.0-W 42 to fit sealing rings – see figure 11.

Note!

The special tools may also be used to knock bearings in or out. Proceed as described previously (for instance on spoked hubs, if no presses of sufficient capacity are available). Always replace circlips and sealing rings.

Rear wheel hubs VZ, MC and R 50/60

Dismantling:

Lift off brake plate including brake shoes. Remove pressure sleeve on right hand side and distance sleeve with sealing ring on left hand side. Remove circlip from right hand side. Extract right hand bearing from chain wheel end – figure 12 – using special tool part no. 121.7029. Remove centering disc. Turn hub over, insert reduced end of tool into distance sleeve, press out bearing and distance sleeve. Dismantling of hubs is not required to replace the sprocket.

Assembling:

Check and grease bearings. Replace worn parts and sealing rings. Assemble in reverse order. Note the following points. Insert guide washer into right hub side and press bearing home completely using special tool (make yourself), leave tool in bearing. Turn hub over. The tool can now counteract pressure applied to fit other bearing figure 13. Push distance sleeve with welded-on guide washer and then second wheel bearing onto .4528 in (11.5 mm) dia end of tool protruding from the left-hand side of the hub. This bearing is now pressed home with the press sleeve which is being part of the three part special tool (make your-

Wheels, hubs

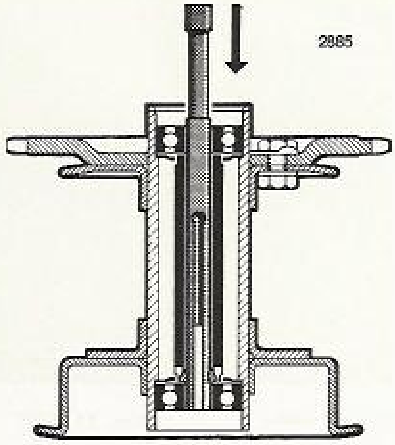
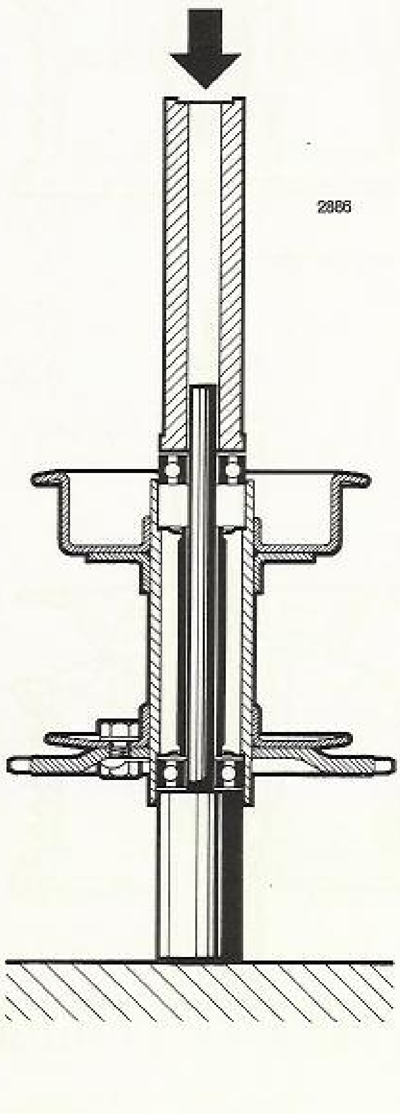


Fig. 14

Fig. 15



self). Remove tool out of bearings and distance sleeve in hub and fit large circlip to right hand side. The press sleeve must be used together with the tool only. The sealing rings are pushed onto the sleeves and pressed in.

MS-Hubs

Dismantling:

Lift off complete brake plate. All work on brakes can now be carried out. To dismantle hub further, remove sealing rings and intermediate bushes with cover-plates from either end. Use tool (part no. 050.7029) figure 14 to press out wheel bearing facing the recesses of distance sleeve. Remove guide washer and distance sleeve. Insert thinner end of press out sleeve (make yourself) into hub and press out bearing and cover washer.

Assembling:

Insert guide washer into one end of the hub and press home bearing with suitable tool (make yourself). Leave tool in bearing and turn over hub. The tool can now counteract pressure applied to fit other bearing. Push distance sleeve, guide washer and bearing onto .3740 in (9.5 mm) dia end of tool protruding from the hub. Slide larger diameter end of press sleeve onto guide and press second bearing home figure 15. Now, the tool can be removed out of bearings and distance sleeve in hub. Push sealing rings onto intermediate sleeves and fit with cover washers to either side. The intermediate sleeves are of different length. Fit longer to left hand side. Change of bearings calls for new sealing rings. Proceed in the same way for the basically identical rear wheel hub.

M 50 and M 50 SE

Dismantling:

Commence dismantling of hub from brake plate end. Remove nut from brake plate and take off plate and shims. Remove nut on sealing ring and press out distance sleeve and carrier plate and bearing from sealing ring side with suitable tool make yourself – see figure 16. Take out distance sleeve

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and use screwdriver to remove sealing ring. Remove circlips from both sides of bearing and use press sleeve (make yourself) to press out bearing. The brake shoes are dismantled after removing circlip and disconnecting brake spring.

Speedo drive:

Use screwdriver to press out sealing ring and lift off worm gear. Unscrew locating screw from outer side of carrier plate and take out threaded bush and worm screw. When reassembling the bush note that the locating hole must be aligned with the thread to locate the screw.

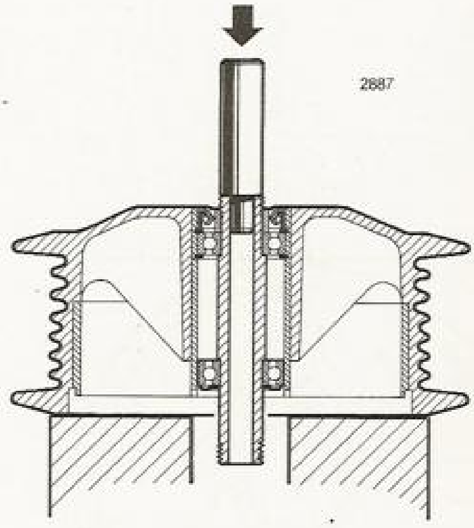
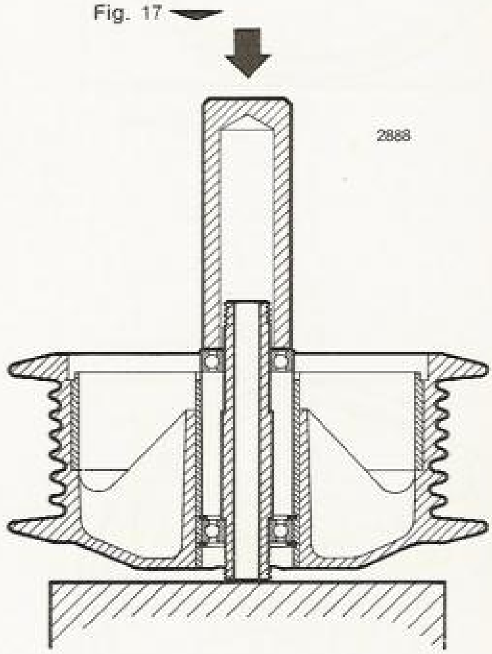


Fig. 16

Assembling:

Wheel bearings must be checked or regreased as necessary prior to assembling. Sealing rings and worn parts must be replaced. Assemble in reversed procedure. Use suitable tools to press in bearings – see figure 17. Dismantling and assembling of the rear wheel hub begins as described for front wheel hubs with the addition of the sprocket hub.

Fig. 17



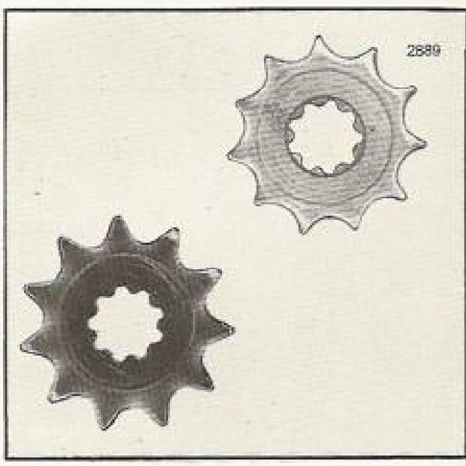
Sprocket hub:

Remove intermediate section and press out clamping section inwards. From the inside remove the dust shield and from the outside the circlip and bearing from inside to outside and vice versa to refit.

Wear limits.

Description	drum diameter		brake shoe pair assembled	
	nominal	wear limit	new	wear limit
Fichtel & Sachs hub	3.5430 in dia (90 mm ⌀)	3.5902 in dia (91.2 mm ⌀)	3.4960–3.5236 in dia (88.8–89.5 mm ⌀)	3.4252 in dia (87.0 mm ⌀)
LELEU hub	3.1500 in dia (80 mm ⌀)	3.1893 in dia (81.0 mm ⌀)	3.1103–3.1300 in dia (79.0–79.5 mm ⌀)	3.0394 in dia (77.2 mm ⌀)
MS hub	3.5430 in dia (90 mm ⌀)	3.5823 in dia (91.0 mm ⌀)	3.5040–3.5236 in dia (89.0–89.5 mm ⌀)	3.4252 in dia (87.0 mm ⌀)
VZ, DS, VZ, MS solid hub	4.1338 in dia (105 mm ⌀)	4.1732 in dia (106.0 mm ⌀)	4.0945–4.1142 in dia (104.0–104.5 mm ⌀)	4.0158 in dia (102.0 mm ⌀)
M 50 solid hub	5.1181 in dia (130 mm ⌀)	5.1377 in dia (130.5 mm ⌀)	5.0393–5.0787 in dia (128.0–129.0 mm ⌀)	5.0000 in dia (127.0 mm ⌀)

Fig. 18



Check sprockets visually. Figure 18 compares new and worn sprockets. The chain must be checked too. Replace chains which can be lifted when tensioned.

Wheels, hubs

Respoking and balancing

Respoking and balancing of spoked wheels is really fairly simple. However, many workshops cannot do this job. We describe this work in detail to enable anybody to respoke and balance a wheel.

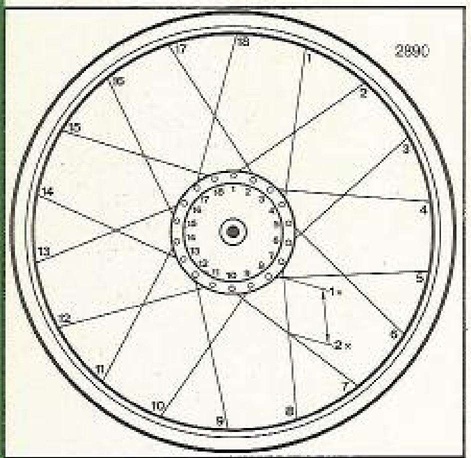
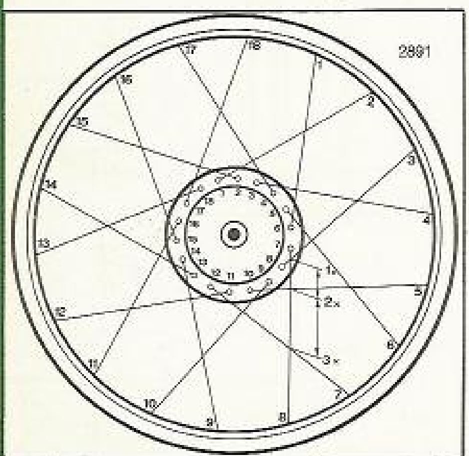


Fig. 19

Wheels on our models are either twice or three times crossed, e. g. each spoke crosses 2 or 3 other spokes. Respoking (correct sequence of spokes in hub and rim) requires knowledge of correct sequence and is described in the following. Balancing is sheer experience and is easier with heavier rims. Normally, spokes are hooked alternately from inside and outside to hub and rim. However, on many cast hubs (e. g. VS and VZ hubs) spokes are hooked from the outside only. This does not alter the spoke sequence however.

On 3-cross units (figure 20) first insert spoke from the outside into a hub hole countersunk to the outside. The second spoke is inserted to the inner side of hub collar into the sixth hole. The spoke direction is given automatically by the centre line oft the rim hols. Cross the inserted spokes and fit to rim into two holes following on one side of rim with nipples. Tighten nipples only enough to prevent spokes falling out. The next pair of spokes is not fitted to the holes immediately following on hub rim but, for 3-cross wheels, to holes 3 and 8, see figure 20. Spoke heads would not match alternately countersunk holes. The unused holes 2 and 7 are used to fit the final spokes. The third pair of spokes fit holes 5 and 10 and so on. On wheel rim, hook spokes into following holes of one rim side. First pair to holes 1 and 2, second pair to hole 3 and 4 and so on.

Fig. 20



Spoke sequence for respoking

Twice crossed wheels		3 times crossed wheels	
Hub hole	Rim hole	Hub hole	Rim hole
1 and 4	2 and 1	1 and 6	2 and 1
3 and 6	4 and 3	3 and 8	4 and 3
5 and 8	6 and 5	5 and 10	6 and 5
7 and 10	8 and 7	7 and 12	8 and 7
9 and 12	10 and 9	9 and 14	10 and 9
11 and 14	12 and 11	11 and 16	12 and 11
13 and 16	14 and 13	13 and 18	14 and 13
15 and 18	16 and 15	15 and 2	16 and 15
17 and 2	18 and 17	17 and 4	18 and 17

Wheels, hubs

Twice-crossed spokes are usually on smaller rim diameters and larger hub diameters. This calls for a different sequence. The chart on page G 8 indicates spoke sequences for twice- and 3-times crossed wheels. Figure 19 illustrates 2-cross spokes and figure 20 illustrates 3-cross spokes.

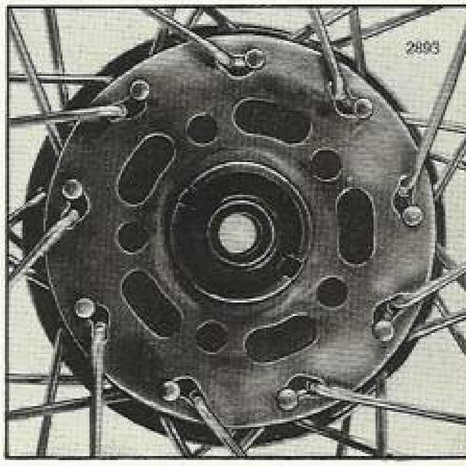
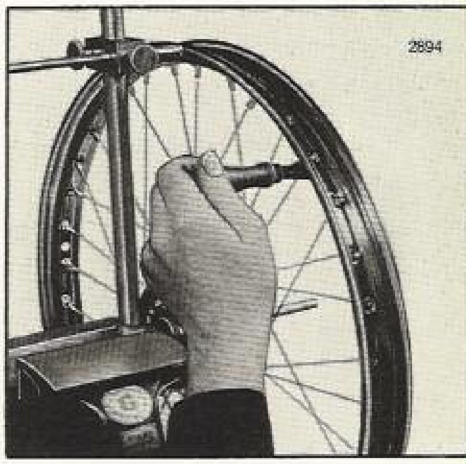


Fig. 21

Spokes can be fitted from one side only on certain hubs because of the brake drum – for instance MS hubs. Pairs of holes on such hubs are connected by slots (see figure 21). The centre of the slots is enlarged to take the spoke heads. Instead of inserting threaded end, hook on spoke head end and push to end of slots. Direction of spokes must be against slot or the head will disengage.

On such hubs it is more practical to respoke first the side having enclosed holes. Hub and rim are then at the right position and the direction of spokes is given automatically.

Fig. 22



After spoking tighten all nipples equally, approximately to base of slot in nipple head. If spokes are still very loose, tighten all nipples flush to spoke ends, or tighten all nipples by the same number of turns respectively. Repeat until all spokes are tensioned. Start tightening nipples with screwdriver matching nipple slot. For final tightening use special spoke spanner (see list of special tools, page B1) having a sqare to match the nipple. A device is required to balance the wheels, for instance an old fork having adjustable pins opposite rim ends. The unit already described for frame checking can also be used for balancing, see figure 22. If the gap between adjustable pin or pins and circumference of rim remains the same, the wheel is balanced.

Wheels, hubs

Fig. 23

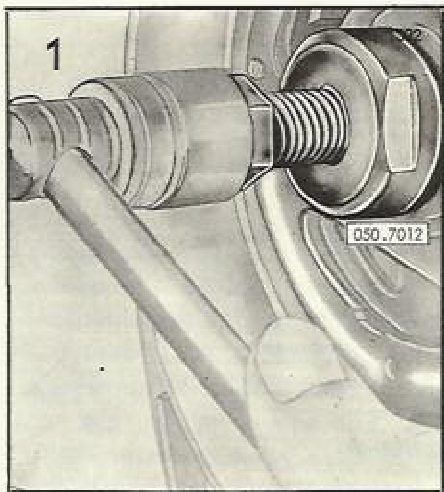
Apart from lining up rim and hub centre, balancing a wheel also includes correction of any twist of rim by retensioning certain spokes. If unsuccessful, loosen counter acting spokes a little. A strongly tensioned wheel can often be balanced by reducing the tension of the appropriate spoke a little providing the twist is only slight. Always start tensioning and loosening on the part having the biggest twist commencing alternatively to either side. The following spokes are loosened or tightened to a lesser extent. It is usually not possible to balance the rim welding.

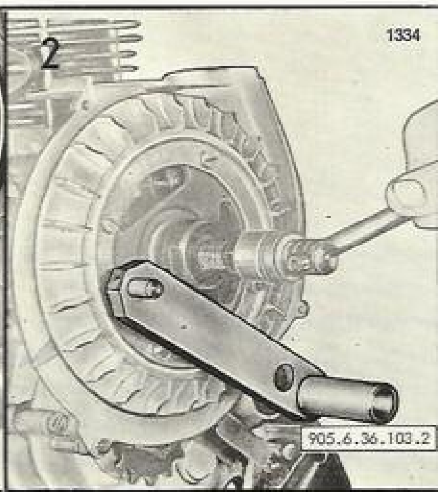
After balancing remove all spoke ends extending beyond nipple heads.

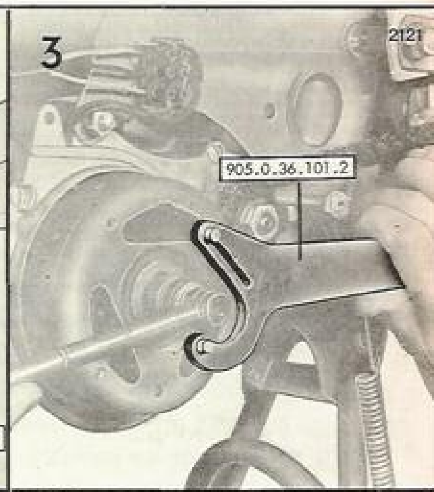
Even fractionally protruding spokes will damage the tube. Therefore, any burrs must be filed or ground down (figure 23). It is recommended that all respoked wheels be rebalanced after a few hours' riding. Spokes often settle during the first few hours' use.

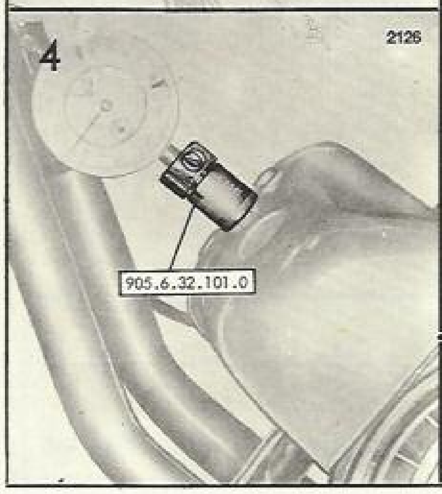
Index

Special tools — testing equipment









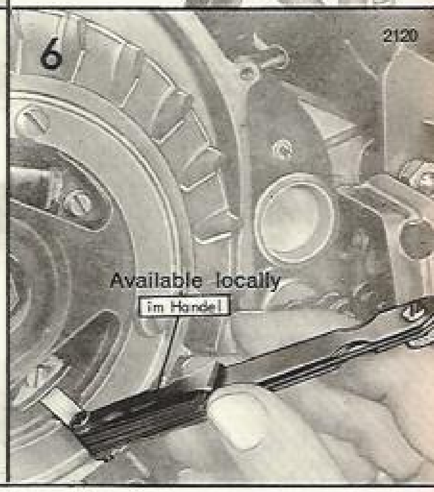


Fig.	DESCRIPTION	Part-number	ENGINE MODEL							
			X 30	X 30 A	MSV	MSA	VSD	R	V	M
1	Flywheel extractor	050.7012	x	x	x	x	x	x	x	x
2	Catch for flywheel	905.6.36.103.2			x	x	x	x	x	x
3	Catch for flywheel (chain-wheel holder)	905.0.36.101.2	x	x						
4	Adaptor for dial gauge	905.6.32.101.0	x	x	x	x	x	x	x	x
5	Dial gauge	obtain locally	x	x	x	x	x	x	x	x
	Timing extractor (Bosch EFAW 86 or 87)	obtain locally	x	x	x	x	x	x	x	x
6	Feeler gauge	obtain locally	x	x	x	x	x	x	x	x

Special tools — testing equipment

All the tools listed on the previous page must be available in every workshop. The testing equipment detailed below is not absolutely necessary but it does represent a useful addition to the standard workshop equipment, enabling a workshop to service the electrical installation properly. Many service stations already have this or similar equipment but have previously used it on cars only. The majority of servicing and adjusting operations described in this manual are carried out with Bosch testers, but other makes are, of course, just as suitable. However, since different manufacturers use varying designs it is always necessary to check the appropriate operating instructions.

List of testing equipment		
Ignition coil and capacitor tester	Bosch EFAW 106	1 684 483 005
Motor-cycle tester (no longer available)	Bosch EFAW 27	
Spark-plug tester	Bosch EFKE 2 K	
Spark-plug gauge (supplied with EFKE 2 K)	Bosch EFKE 5 A	
A. C. voltmeter (range, 10 volts)	Bosch EF 3492	1 697 235 021
Load resistor	Bosch EF 1289 and Bosch EFLM 2	
Revmeter (obtain locally) for example	Jaquet No. 620, mechanical, or Gossen, electrical	
Beam setter	Bosch 0 681 130 006 or 0 681 130 007	

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Ignition timing

GENERAL REMARKS

Break of magnetic flux (fig. 1)

A flywheel magneto gives maximum ignition performance only if the contact breaker opens at the precise moment the magnetic flux generated by the moving rotor reaches its peak. This moment of magnetic flux is established by the flywheel magneto manufacturer and quoted as the distance between the trailing edge of the magnetic poleshoe to the nearest edge of the ignition coil edge. This clearance must always be observed and it is called the „break gap" (see type sheets of operating instructions). The break gap is not the ignition timing but is related to the position of the contact breaker cam. The connection between break gap, contact gap and ignition timing must be considered every time the ignition is adjusted. Incorrect break gaps must always be corrected (wear of the rocker arm heel or wear of the contacts causes alteration of the break gap). Readjust by altering the contact gap; 0.05 mm either side of the specified limits is permissable in special cases. On unrestricted high-speed engines the contact gap must not be less than specified to prevent possible misfiring.

Recheck the break gap after altering the contact gap. Always consider the **ignition timing** when adjusting the contact gap.

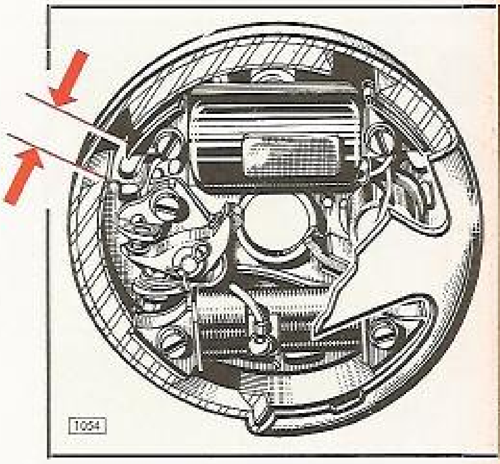
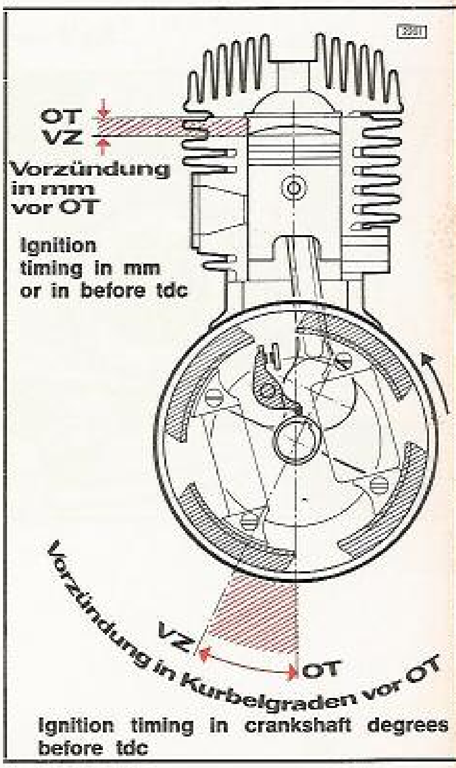


Fig. 1

Fig. 2



OT = tdc
VZ = timing

The ignition timing (fig. 2)

An engine reaches best efficiency (output, fuel consumption) only if the compressed air-fuel mixture in the combustion chamber is ignited within a very narrow time lag. Due to the low inflammability of the mixture and because the time lag narrows with increasing speed, it is necessary to ignite before the piston reaches top dead centre position. This ignition timing is ascertained for every model by the manufacturers and is based on field and test-bed trials. The timing is measured in mm and in of piston stroke before top dead centre (see data sheets). The engine output depends on correct ignition timing. Too far advanced timing causes the engine to knock and too far retarded timing reduces output. In both cases the engine overheats and starting difficulties arise because of a weak spark. Wear of contacts and rocker arm heel influence ignition timing and break gap. Readjustment is therefore necessary as part of the regular service.

Ignition timing

Contact gap (fig. 3)

The next important point on servicing the ignition equipment is the adjustment or checking of the contact gap. The manufacturer of the ignition unit determines this gap (see type sheets) and it is measured with a feeler gauge (valve gauge); see figure 8.

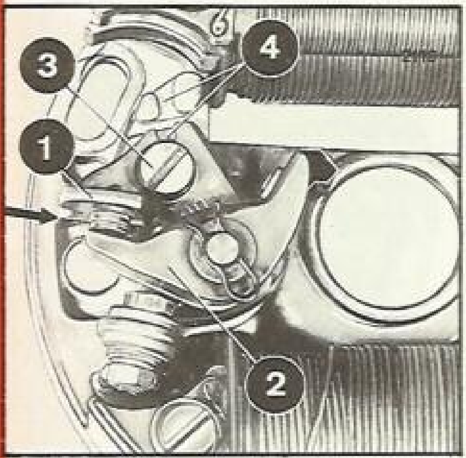
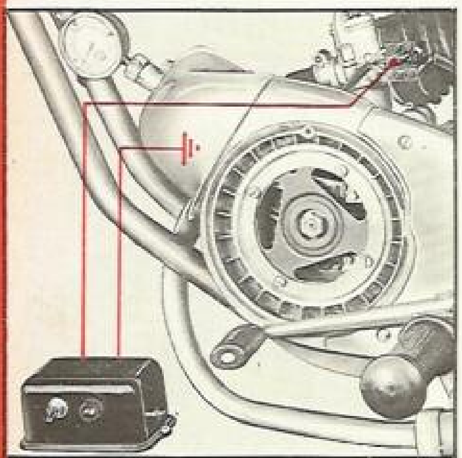


Fig. 3

The contact gap (see figure 3, arrow) is the distance between the fixed contact (figure 3/1 and the fully-opened moving contact figure 3/2). The moving contact is completely open just after top dead centre and gives the maximum contact gap.

The contact breaker is basically a switch contact opened by a cam at a certain position (ignition timing) and closed again. The contact material is highly resistant to mechanical and electrical wear. Both contacts are fixed to brackets; one, the fixed contact, is firmly connected to the baseplate and can be moved only to adjust the contact gap. The other, called the moving contact or rocker arm, moves on an axle fixed to the baseplate. A spring presses the rocker arm to the fixed contact and closes the contact breaker. Apart from the contact, the rocker arm also has a heel made from an insulating material. This heel glides on the rotor arm and actuates the rocker arm. Shape of cam and specified contact gap control the closing time of the contacts and are responsible for the proper functioning of the ignition equipment. Reduced contact gap or a lame contact spring prevents proper closing of the contacts at high speeds. Misfiring of modern high-revving engines is often caused by this.

Fig. 4



Conclusion: Only the correct relation of break gap, ignition timing and specified contact gap results in perfect functioning of an engine in all operating conditions. A faulty ignition coil or capacitor can cause incorrect ignition timing, misfiring of the engine and starting trouble.

The following facts give some idea of what is expected from the ignition equipment. A single-cylinder, two-stroke engine running at 6000 rpm requires 100 ignition sparks per second, or 360 000 per hour, each within a time of approximately 1/100th second. Modern production-line engines running at 10 000 rpm require as many as 600 000 sparks per hour. These factors, combined with the high compression ratio of modern engines, necessitates extremely accurate ignition timing. As little as .00787 in (.2 mm) out of specification often results in a noticeable output reduction.

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Ignition timing

The ignition timing, therefore, should be adjusted only with the help of a dial gauge and a unit to indicate opening of the contact optically or acoustically. (See checking and adjusting of the ignition.)

Checking and adjusting of the ignition

Break gap

Remove the sparking plug for easy turning of the engine. Connect one cable of the timing tester EFAW 86 or 87 to the short-circuit cable (black) of the flywheel magneto and the other to earth (see figure 4). If the tester EFAW 106 is used, connect the lower ignition timing terminal to the short-circuit cable (black) and the upper to earth (see figure 5).

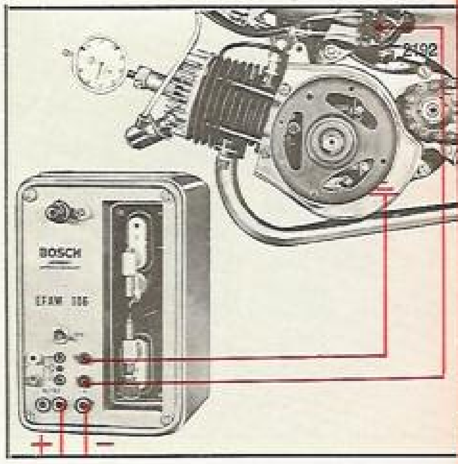
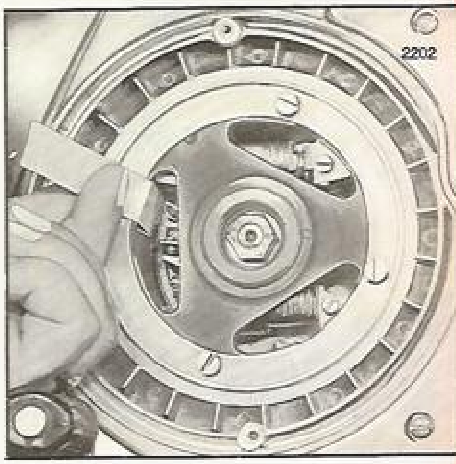


Fig. 5

Switch on the tester and move the flywheel (crankshaft) in the normal operating direction until the glow lamp lights up, thus indicating the opening of the contacts. (The tester EFAW 87 is equipped with a buzzer in addition to the glow lamp. The faint buzzing noise will increase as soon as the contacts are opening.) Check the break gap in this position. Use a cardboard strip of equal width to the break gap (see type sheet) and check through the face of the flywheel (see figure 6).

If necessary adjust the break gap by altering the contact gap to .01575 in (.4 mm) after checking the contacts (see figure 9) and recheck break gap and timing. Larger contact gap gives larger break gap and vice versa. Always check the break gap and timing after altering the contact gap. And a l w a y s bear in mind the timing while adjusting the break gap.

Fig. 6



Should the setting of the contact gap not give the correct break gap (contact gap too small), move the baseplate within the fixing slots to obtain the correct break gap setting. Check the contacts for wear (whether burned or pitted) before moving the baseplate. The fixing screws holding the baseplate are originally located in the centre of the slots to permit adjustment either way. The fixing screws and washers can sometimes prevent the full use of the slots. In this event use screws having a smaller head diameter.

Important note:

Moving the baseplate against the operating direction gives m o r e advanced ignition timing.

Moving in operating direction gives l e s s timing advance.

Ignition timing

Ignition timing

Screw adapter No. 905.6.32.101.0 with dial gauge into sparkplug thread on the cylinder head (fig. 8). Turn the flywheel in the operating direction until top dead centre is reached; then mark the dial gauge in this position by turning the clock face to zero.

Fig. 7

Connect the timing tester as described under the paragraph headed „Break Gap" and turn the flywheel in the operating direction until the contacts open. In this position the dial gauge must show the specified ignition timing (see data sheet) before top dead centre.

If the timing is out, adjust by altering the contact gap again. Loosen the fixing screw (fig. 3/3) and move the fixed contact (fig. 3/1) with a screwdriver inserted into the slots provided in the fixed contact and baseplate. Check with feeler gauge (fig. 9) at full-opened contact position.

Increasing the contact gap advances the ignition, decreasing it retards the timing. Separate adjustment of the three factors influencing the ignition is not possible. Moving the actual baseplate (coil plate) is usually unsuccessful (see paragraph headed „Adjusting the break of magnetic flux") and adjustments can be made only by altering the contact gap. However, this influences the timing and the break gap to the same extent.

Fig. 8

Therefore:
Less contact gap = more break of magnetic flux = less timing advance.
More contact gap = less break of magnetic flux = more timing advance.

One could presume that it is impossible to line up all the factors by thinking that one adjustment is correct but not the others. This is not so, however, since every setting has a tolerance limit (see data sheet). For instance, the MS 50 with its 25 mph (40 km/h) performance has an ignition timing of .0630 to .0787 in (1.6 to 2.0 mm); a break gap of .2756 to .4331 in (7 to 11 mm); and a contact gap of .1378 to 1772 in (.35 to 45 mm). The original factory adjustment positions the crankshaft key for the flywheel to give the correct timing at a contact gap of .01575 in (.4 mm).

Burning and wear of the contacts during normal use necessitates readjustment. Provided the flywheel magneto was originally adjusted correctly, any subsequent readjustment of the contacts will normally give the correct break gap and ignition timing automatically.

The following points could be the reasons for discrepancies.

a) Contact gap too large or worn rocker arm heel. The ignition can be adjusted properly after fitting a new set of contacts.

Ignition timing

b) movement of flywheel on crankshaft seating: This failure is usually due to a grease or oil film on the taper of the crankshaft. Always clean the seatings on the flywheel and crankshaft with a good degreasant before assembling. Even small traces of grease cause a loosening of the flywheel and subsequent damage to the crankshaft. Over or under tightening of the flywheel locknut can also cause loosening of the flywheel. The correct tightening torque is 21.73 to 25.35 ftlb (3 to 3.5 mkg).

c) Incorrect assembly of the baseplate: This can be caused only by an inexperienced fitter.

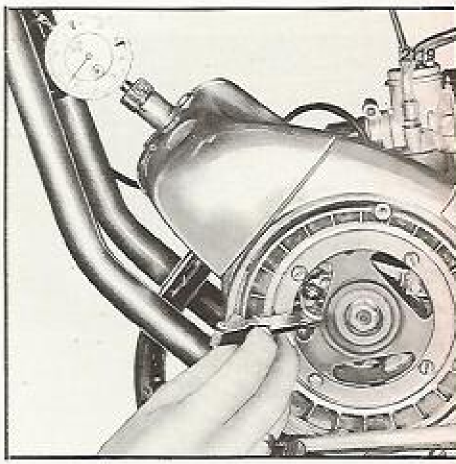


Fig. 9

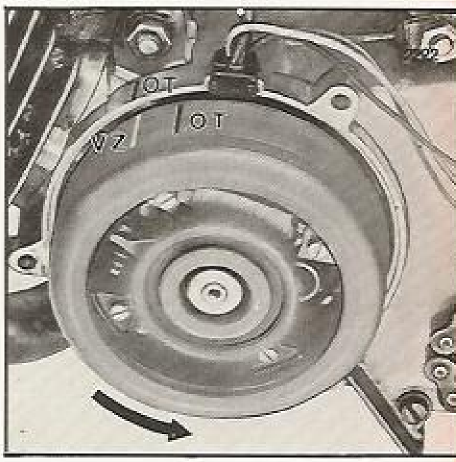
Checking the timing with a stroboscope

As with cars, ignition timing can be checked also with a stroboscope. A 6- or 12-volt battery (depending on the operating voltage of the stroboscope) is required as power supply.

The advantage of this checking method is the fact that it is possible to detect troubles which are otherwise difficult to find or which could easily be mistaken for something else – perhaps a carburettor fault. This is because such faults are detectable only on a running engine.

It is necessary to mark the housing and flywheel (fig. 10) before testing commences. One mark must be provided on the engine housing or on the housing cover. A second marking corresponding to the first should be made on the flywheel at the top-dead-centre position (find t.d.c. by unscrewing the sparking plug and inserting a suitable probe – such as a pencil). Add the advance marking from the t.d.c. mark on the flywheel quoted in crankshaft degrees before t.d.c. All flywheels have a diameter of 4.567 in (116 mm), permitting the measuring of degrees on the circumference because 4.567 in (116 mm) diameter equals 14.33 in (364 mm) circumference and, therefore, one degree equals .03976 in (1.01 mm). For instance, the advance of our M-type engine is 16 deg. before t.d.c. .03150 in (.8 mm piston travel before t.d.c.) and is marked simply .630 in (16 mm) before t.d.c. mark on the flywheel with a tape measure. After marking, connect the stroboscope according to figure 11. Start the engine and guide the flash to the t.d.c. marking on the housing. Because of the short duration of the flashes, the flywheel appears to stand still at all speeds. The ignition timing is visible from the mark on the flywheel as follows:

Fig. 10



OT = tdc
VZ = ignition timing

Advance mark corresponds exactly with marking on housing.

In this case the timing is properly adjusted. At higher speeds (4000 rpm or over) the advance mark on the flywheel moves somewhat away from the t.d.c. mark on the housing indicating less advance. This is due to a distortion of the magnetic field, is not more than 1–2 deg. and has been taken into consideration by the manufacturer.

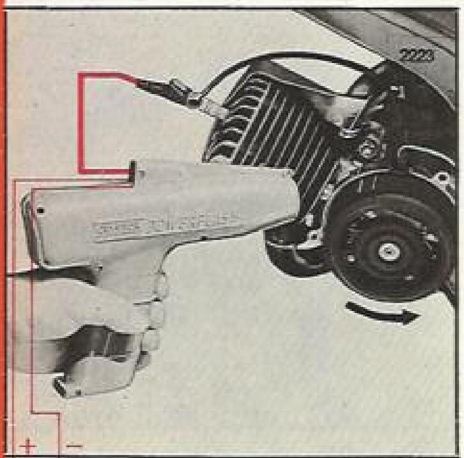


Fig. 11

Advance mark on flywheel is before mark on housing.

Not enough advance. Check the timing as described before and adjust as necessary – note the break gap and contact gap. If the checking indicates that everything is correct and the stroboscope still shows insufficient advance, the following could be the causes:

Inaccurate contact gap due to worn or damaged contacts. It is best to fit a new set of contacts since filing often results in non-alignment and promotes wear.

Resistance too high in the high-tension lead. Check the cable connection on the coil and on the plug connector. Coil and plug connector could be faulty. Check and test separately and replace if necessary. Troubles such as these lead to difficult starting of the engine.

Advance mark of flywheel moves constantly either way.

In this event you should note the following points: Very high speeds (overrevving the engine above the maximum rpm recommended by the manufacturer) can be one cause. The rocker arm ceases to function because of the limitations of the spring. Such cases are not to be classed as failures, of course. However, if this happens below the maximum permissible revolutions (check with revmeter) the contact spring is lame or the contacts or the rocker arm are loose.

Stroboscope works irregularly. The marks are not constantly visible. This indicates breakdown of an ignition component. For instance, coil or capacitor defect, plug, plug connector, HT lead and so forth. All likely parts must be carefully checked to rectify the trouble. Replace any faulty parts and check again.

Further testing possibilities.

If no timing tester is available check the timing with a cigarette paper as follows: A small strip of cigarette paper is inserted through the slots in the flywheel and held by the contacts. Turn the flywheel until the contacts just release the paper strip. This method is highly inaccurate and should be used only as a temporary measure.

Ignition timing

Ignition timing of MAXI engine

The position of the plug differs from all other models and the timing must therefore be quoted in crankshaft degrees before top dead centre. The flywheel has a mark „top dead centre" (figure 12, OT) from which the timing (VZ) can be measured with a flexible ruler. At top dead centre, the mark on the flywheel corresponds with the joint of the housing (figure 12). Timing values are listed in operating instructions, type sheets etc. Values are advance timing in degrees before top dead centre. For instance, the Maxi 25 mph (40 km/h) model has 16° to 18° advance timing. Adjust and check as follows.

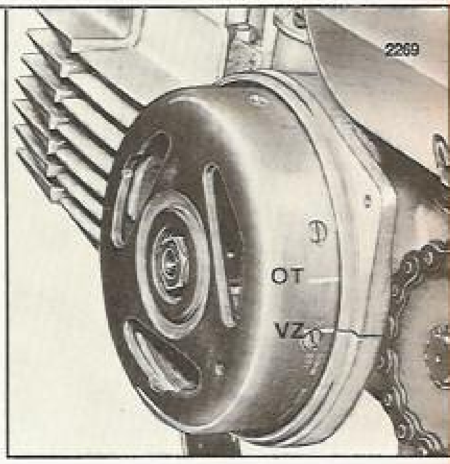


Fig. 12

Checking

Check timing with suitable tester, e. g. Bosch EFAW 87 (see B 3, B 4). Mark with pencil position at joint on flywheel at contact breaking point. The timing is correct if the pencil mark is within the advance timing from top dead centre mark.
Advance timing in crankshaft degrees can be measured directly on the circumference of the flywheel with a flexible ruler (fig. 13) because .0394 in (1 mm) circumference equals 1° crankshaft. Breaking point and gap of contacts must of course be checked too (see B 2–4).

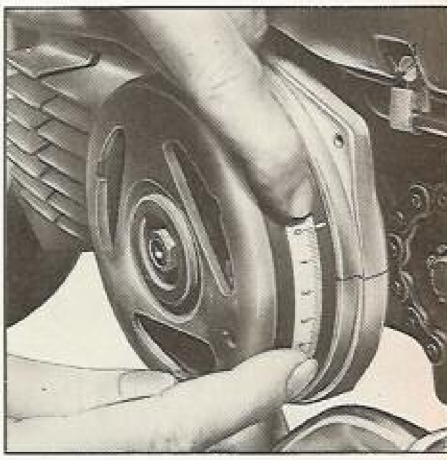
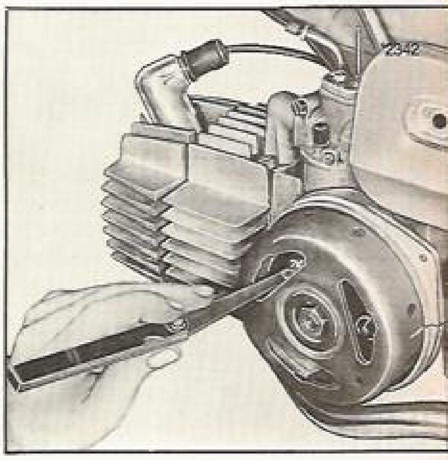


Fig. 13

Adjusting

If the checked timing is incorrect or if, for instance, new contacts are fitted readjustment is necessary. Proceed as follows:
Check contact gap (figure 14) and breaking point – see B 2–B 4.
Adjust as necessary.
Mark advance timing with pencil on flywheel (figure 13). Check timing and adjust by altering contact gap or moving magneto baseplate (figure 7). The contact gap may be increased or decreased by .00197 in (0.05 mm) from the specified value (.0157 in = 0.40 mm). Smaller gap gives less advance and larger gap more. Moving baseplate against engine rotation decreases advance. Check timing again after tightening base plate or fixed contact. If a new flywheel is fitted, the top dead centre must be marked. Turn piston to top dead centre and mark flywheel according to joint in housing. Top dead centre is best established by marking on flywheel at the end of the upward and beginning of downward movement and measuring the centre.

Fig. 14



Ignition timing

Spark plug

Spark plug

When in use the sparking plug has to cope with thermal, chemical and mechanical loads. The only maintenance jobs required are cleaning and readjusting of the electrodes. The plug electrodes on two-stroke engines tend to burn out relatively quickly and readjustment is necessary after 1000 to 2000 miles (1500—300 km). Many breakdowns are caused by the sparking plug and it should be checked **first** in all cases of ignition failure.

Oiled up plugs should be washed out in petrol and cleaned with compressed air.

Soot, oil carbon and lead deposits should be removed properly with the Bosch unit EFKE 2 K. Never use a wire brush! The Bosch tester has a dial adjustable to suit different electrode gaps and three different operating conditions. Yellow range indicates that the plug can be re-used. A plug working under pressure in the green range is useable, but plugs working only in the red range must be replaced. Detailed operating instructions are supplied with every plug tester. There is no plug tester on the market to detect lead deposits on the insulator, causing misfiring at higher temperatures during operation. But cleasing by sand-blasting with the Bosch tester effectively removes deposits and guarantees perfect functioning of the sparking plug.

Fig. 1

Fig. 2

Adjusting the electrode gap: The gap is correctly adjusted when the .01575 in (.4 mm) gauge (measure wire for round electrodes) can be pushed tightly between the electrodes (see fig. 2). The electrodes must be readjusted if the gap is greater than .01969 in (.5 mm).

Adjust only the earth electrodes. The material of the earth electrodes is chosen to allow easy adjusting. Do not apply any pressure to the central electrode nor to the insulator. A plug with a broken or cracked insulator cannot be re-used. It is therefore recommended that the electrodes be checked and adjusted with the Bosch sparking plug gauge EFKE 5 B (fig. 2).

The specified electrode gap of .01575 to .01969 in (.4 to .5 mm) is most important. The engine will stop at lower speeds if the gap is too large; and too small a gap leads to contamination of the plug and results in misfiring. A further important point is that the heat value of the sparking plug must be correct for the engine. Wrong values will cause engine failures.

Spark plug

Always use the specified sparking plug or an equivalent as indicated on the following chart:

Spark plug comparison list

BOSCH	CHAMPION	AC	AUTOLITE	KLG	LODGE	BERU
W 95 T 1	L 14	48	AE 42	F 20	CCAN 14	95/14/5
W 175 T 1	L 10	TC 45 L	AE 6	F 50 D	CM	175/14
W 225 T 1	L 7	42 FF	AE 22	F 80	HN	225/14
W 240 T 1	L 5	41 F	AE 3	PF 70	HNP	240/14
W 240 P 11 S	L 81	–	–	–	HH 14	240/14 S
W 260 T 1	L 5	–	–	F 100	–	260/14

All our models use standard sparking plugs with thread M 14 x 1.25 and 12.5 mm (½ in) reach.

Testing the electrical equipment

Testing the flywheel magneto

Testing the flywheel magneto mounted on the engine is impossible if the engine will either not start at all or not run properly. If no test equipment is available, check all components of the ignition equipment such as capacitor, contact gap, break gap and cable. If all parts are in order replace the ignition or lighting coil (note specified air gap between coil and flywheel .00591 to .00984 in .15 to .25 mm). The flywheel cannot be suspected if the ignition or the light circuits are working.

It is best to check the lighting coil while fitted to the flywheel magneto. Test specifications for all coils are available from Bosch. Check at maximum speed (see type sheet, output data) for a voltage of 6 to 7.5 volts. If no testers are available, check all components starting with the light bulb, cable, switch, back to the coil. If everything is in order, replace the lighting coil. A loss of magnetism on certain flywheel magnets is possible and results in a light output below specification. A remagnetising of the magnets will cure this contact your Bosch service station.

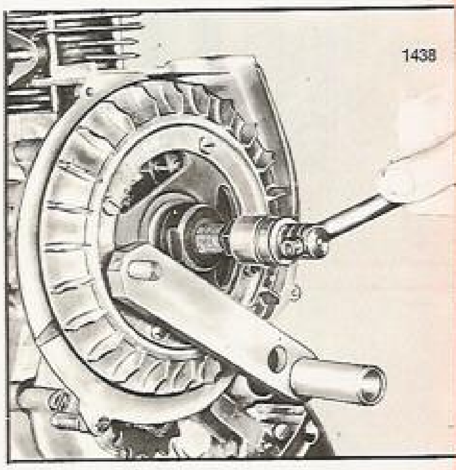


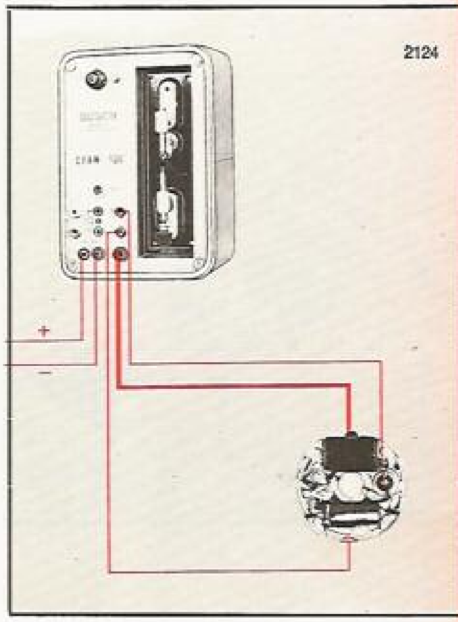
Fig. 1

Testing the installation with Bosch tester EFAW 106

Testing the built-in ignition coil or a separate ignition coil

To prevent demagnetising of the permanent magnets by battery currents, remove the flywheel with a suitable extractor before testing commences (fig. 1). Open the contact breaker by inserting a strip of insulation material (fig. 2). If the machine has a battery, disconnect the earth cable. Connect the test battery to the tester's battery terminals at the current polarity. Connect the HT lead of the tester (thick cable) to the HT connector of the ignition coil by using the connector EFAW 106/8. Connect the capacitor to terminal 15 and the earth to terminal 1.

Fig. 2



Switch on the tester. Separate ignition coils are tested according to figure 3. The testing time of an ignition coil with tester EFAW 106 must not exceed one minute. To test under operating conditions, warm up the coil by connecting to the lower left terminal insead of terminal 1. The warm-up time should not exceed 3 to 5 minutes. Repeat testing as described.

Separate ignition coils (type TJ) are tested by the same method. Connect terminals 15 and 1 to the same terminals on the coil.

Different ignition coils have different primary windings and a different test voltage (6 or 12 volt) must be used according to the following chart: Ignition coils

Testing the electrical equipment

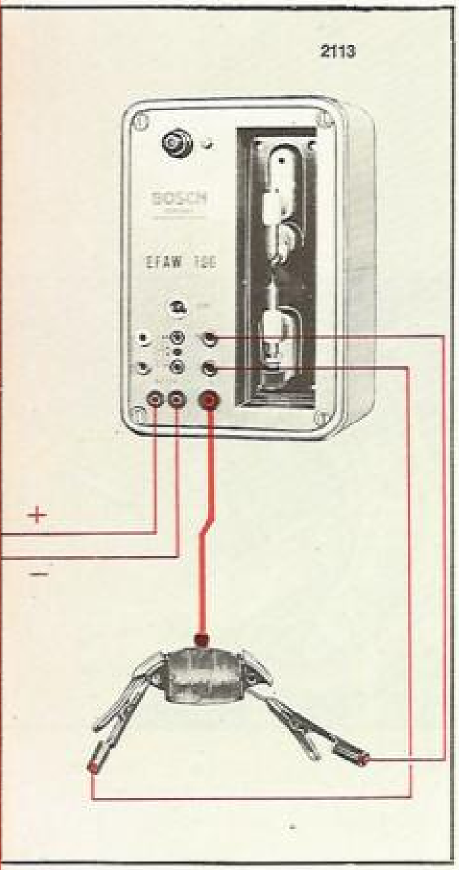


Fig. 3

Fig. 4

DESCRIPTION		Test voltage	Length of Spark
MZAN 3 Z 15 Z	2 204 210 011/14	12 Volt	.2362 in (6 mm)
MZAN 3 Z 17 Z	2 204 210 013	12 Volt	.2362 in (6 mm)
MZAN 3 Z 20 Z	2 204 211 029	6 Volt	.2362 in (6 mm)
TJ 6/6 (6/4)	0 222 002 011	6 Volt	.2362 in (6 mm)
	0 221 500 800	6 Volt	.2362 in (6 mm)

have the description marked on them according to fig. 4. If in doubt, compare the old coil with a similar new one from stock.

Note: The test battery must have an output of exactly 6 or 12 volts. Do not use discharged batteries!

It is important to check all ignition coils (especially those which are not plastic covered) for breakdown of the HT insulation. Clip a cable to the iron core of the ignition coil while the tester is switched on and move the other end of the cable over the surface of the windings (fig. 5). A spark will jump to the cable in the event of faulty insulation. Do not intentionally draw a spark from the HT connector since this could cause a leakage path. Sometimes all tests are positive on flywheel magnetos fitted with Alni or Alnico magnets despite the fact that no proper spark is generated. This means the magnets have been demagnetised and must by remagnetised at a Bosch service station.

Capacitor test (figure 6)

Connect the test battery to the battery terminals on the tester at the correct polarity. Connect the earth connector of the capacitor to the lower capacitor test terminal and insulated connector of the capacitor to the upper test terminal (the pair of terminals on the extreme left). The glow bulb lights up momentarily after switching on the tester (charging current). If the capacitor is in order the glow bulb lights up very intermittently. Flickering or a constant glow indicates a faulty capacitor. The capacitor is automatically discharged by switching off the tester and can be handled without any danger.

Insulation test of the high tension lead

Connect the HT lead to the earth terminal on the tester. Connect the test cable to the HT spark gap and move the test cable over the surface of the HT lead (see fig. 7). Sparks must jump on the HT spark gap. If sparks jump between the test cable and the HT lead, the insulation of the lead is damaged.

Testing the electrical equipment

Testing of spark plug connectors and other insulation components

A similar insulating test as described fort the HT lead can also be carried out on spark plug connectors and other insulation components (figure 7). Connect one HT cable to the lower left terminal and the other to the HT side of the HT spark gap. (These HT cables, complete with test probe, are available as extra accessories, part number EFAW 70/5).

Adjust the HT spark gap to 6 mm according to figure 7 and switch on the tester. Move the HT cable over the surface of the component. Sparks must jump over the HT spark gap without interruption. The insulation is faulty if there is misfiring or if no sparks jump over the gap, or if sparks jump to the insulation component. Such a spark plug connector or insulation component must be replaced.
A fault of suppressed spark plug connectors can be a much increased resistance value or an open circuit. The resistance can be measured with the Bosch tester EFAW 105 or with an Ohm-meter (1,000 or 5,000 ohms respectively). Open circuits can be detected with the Bosch tester EFAW 106 or with the Bosch test lamp EFAW 85.

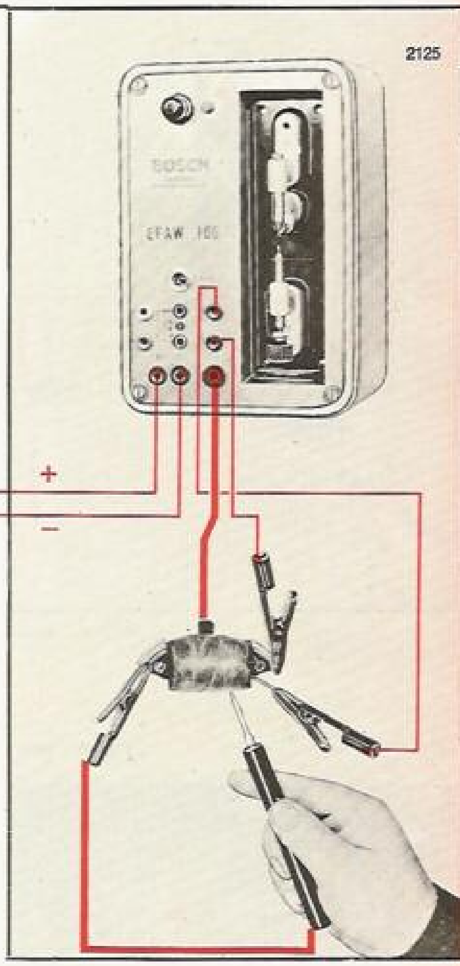
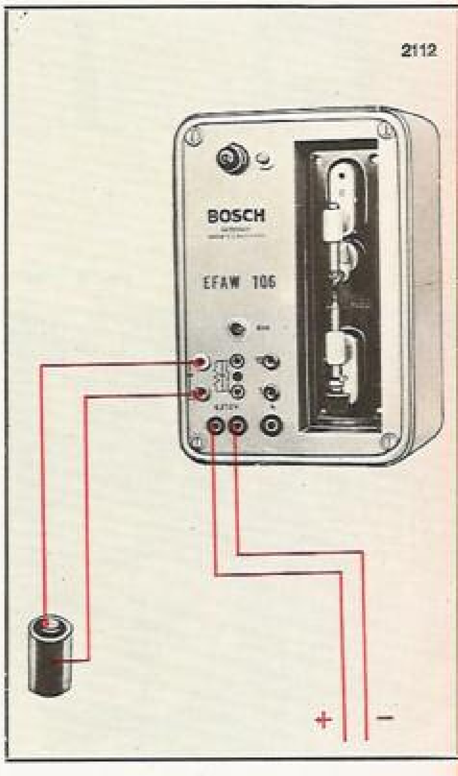


Fig. 5

Fig. 6



Testing the ignition equipment with Bosch tester EFMZ 1 A

Large workshops needing maximum test accuracy and having a regular large quantity of ignition coils to test can use the Bosch ignition coil tester EFMZ 1 A. This test method also checks the primary current. Complete test specification data is supplied with the tester. If all tests reveal reduced ignition or lighting output or the engine stops as soon as the lights are switched on, the possibility of flywheel trouble must be considered. Alni or Alnico magnets could be demagnetised or, in the case of Ferroxdur magnets, a wrong flywheel could have been used. Even wrong-type ignition or lighting coil could have been fitted. Nevertheless, this trouble must not be mistaken for the fault caused by an increased contact gap, giving a different break gap.

In this case check and adjust the break gap as necessary (see paragraph „Break Gap"). Equipment using Alni or Alnico magnets can be remagnetised with the Bosch magnetiser. This type of magnet can also lose some magnetism by incorrect handling (battery operated test lamp for ignition timing) except when a reduction of magnetism is required because the magnets are too strong. Ceramic-based magnets (dark material) cannot be magnetised and do not lose their magnetism. These ceramic magnets (made by sintering and pressing) are rather fragile and any direct blows should be avoided. High temperatures have an influence only above 400 deg. Centigrade.

Testing the electrical equipment

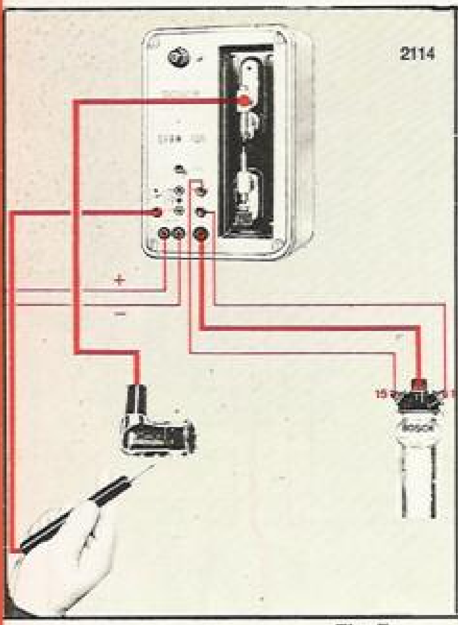


Fig. 7

Fig. 8

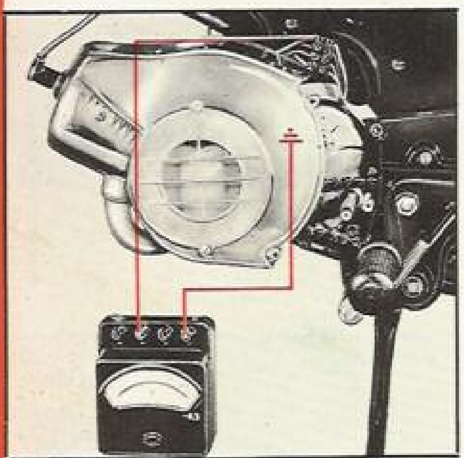
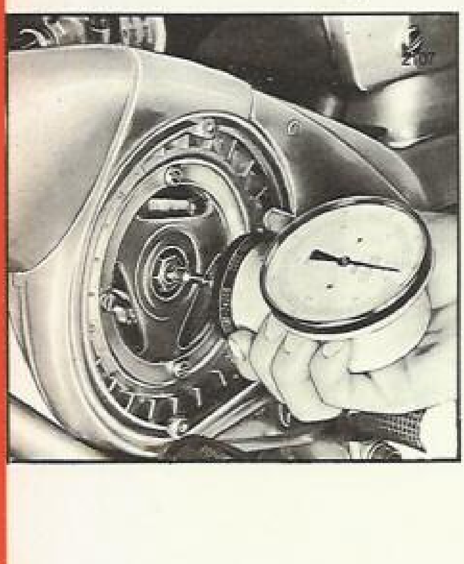


Fig. 9



Testing of lighting coil and stop light, parking light, charging coil, etc.

All coils mentioned generate an alternating current by induction. The resulting AC voltage can be measured under load from consumers, test resistor or light bulbs. Check the voltage with Bosch voltmeter EF 3492 or a similar frequency independent AC voltmeter. Connect the meter according to figure 8 to the circuit to be tested. Rev the engine to the required speed and read the meter. The speed is checked with a standard mechanical (e. g. Jaquet, fig. 9) or electrical (e. g. Gossen) revmeter and must be constant during testing. Electrical revmeters must be suitable for magnetos and must not represent any additional load on the installation or measured values become incorrect. Figure 10 shows the method of connecting up the Gossen electrical revmeter already mentioned. This revmeter must not be connected to terminal 15 as specified in the operating instructions but to the light terminal (yellow) and the lights must be switched on. The selector switch must be on position marked "2-cylinder two-stroke".

All measurements must be taken at normal operating temperature. Let the engine warm up for approximately 10 minutes because the readings would be somewhat higher on a cold engine. Bosch issue lists of test values requiring coils to be measured under load from test resistors EF 1289 or Bosch EFLM 2 at given testing speeds. These test resistors can be replaced by a variable resistor or the load can be made up with light bulbs. The lists also indicate the exact method of testing; for instance, certain additional coils can be measured only if the lighting coil is under load.

The simplest method is as follows: Rev up the engine to maximum permissable speed (see type sheet), switch on all consumers (except horn and stop light) and check output voltage (fig. 8). The voltage must be 6 to 8 volts. If a consumer such as horn, stop light or headlamp flasher is fed from a separate coil, a voltage of up to 10 volts is permissable and sometimes necessary because of the short times involved. Figure 11 illustrates a unit having a separate stop-light coil (fig. 11/2) fitted above the lighting coil (fig. 11/1). In this instance, the stop light is fed a high voltage at daytime with the lights switched off and a lower one at night with the lights on. This means the stop light is brighter in daylight and less bright at night, an advantageous effect. This voltage difference is entirely due to the different loading when the lights are switched on.

1st Edition

Testing the electrical equipment

There is a vast difference in the output of different installations to suit the legal requirements in various countries – ranging from 15 to 35 watts – and the fitting of additional coils depends on the required consumers. All installations look very similar, but coils and flywheels have different specifications. Interchanging invariably leads to wrong output voltages and ignition troubles. Therefore, it is most important to fit the correct parts (note Bosch part number, see fig. 4) and a check before testing is always recommended.

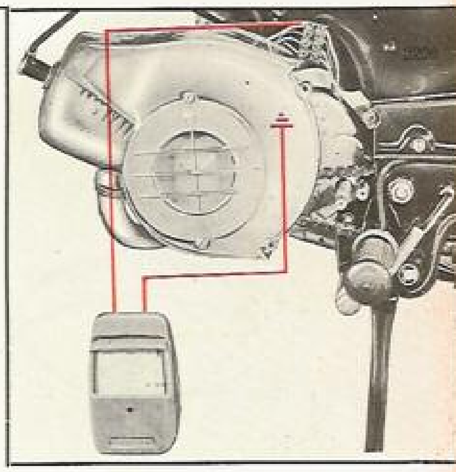
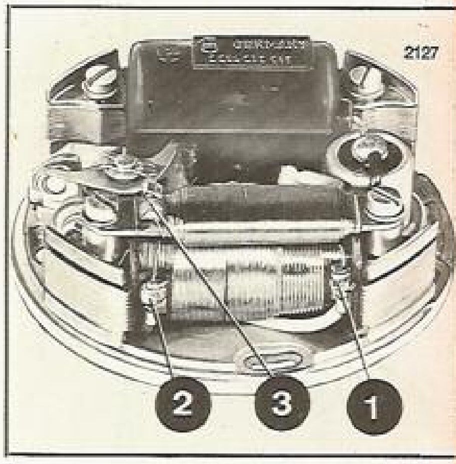


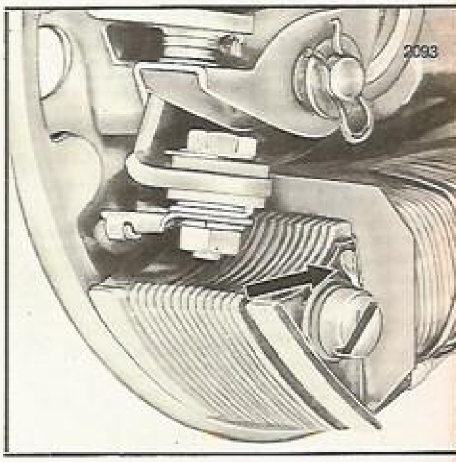
Fig. 10

Fig. 11



It has already been mentioned that all current consumers must be switched on before the voltage is measured. However, this does not apply in all cases. Flywheel magneto units according to design, have a number of different output circuits; this is directly contrary to battery installations which have only one. Each coil with its consumer is a circuit. A connection exists between all circuits because of the common flywheel magneto. If, during measuring, any consumer is switched on or off the voltage alters in all other circuits and gives different readings. Since most testing is carried out because of the possibility of too high a voltage, it stands to reason that all consumers must be switched on because maximum load gives highest voltage values. Additional coils with their own poleshoes fitted above the lighting coil give the highest voltage readings if the light circuit is switched off. Additional coils without their own poleshoes (see fig. 11/3) need the light circuit switched on to give the outpout. These latter additional coils (fig. 11/3) are increasingly used for the tail-light circuits because the tail-light bulbs cannot burn out due to peak voltages generated by switching the headlight circuit, corroded contacts or lame springs. The separate tail-light circuit feed by induction from the light coil is operational if current flows in the light coil. All these points must be considered when testing.

Fig. 12



Testing the electrical equipment

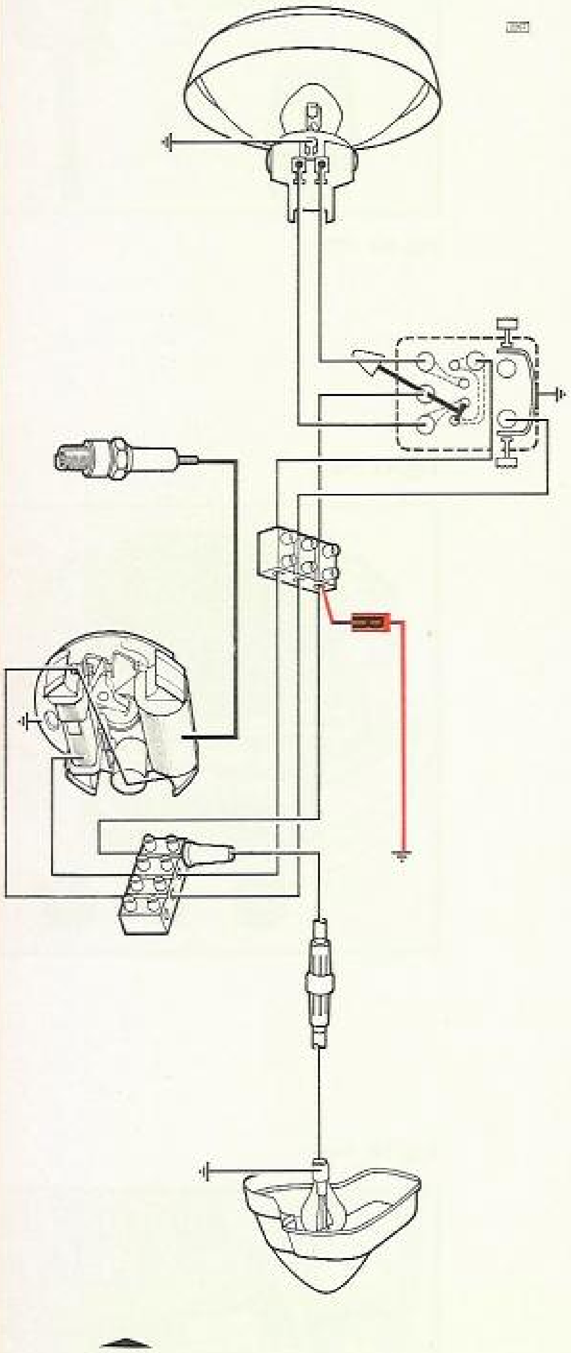


Fig. 13

Replace the coil if **insufficient** or no output voltage is obtained unless the winding wire soldered to the iron core has become detached (figure 12). In this case re-solder the wire with an acid-free soldering medium. If the obtained voltage is correct when testing with a load resistor but the light output is insufficient, the fault must be in the wiring or the bulb. Check the bulb with the test battery. If the bulb lights up follow the appropriate supply cable and check for open or short circuit, especially on sharp bends or buckles. A short circuit to earth can be readily detected by disconnecting the cable on either end and connecting a battery-operated test lamp to cable and earth. The lamp lights in the event of a short circuit (rock the handlebars in case of intermittant contact).

If **too high** a voltage is measured or the bulbs keep burning out it is likely to be due to overvoltage. Check at maximum speed and with all consumers switched on except the horn and stoplight. Check all switch and bulbholder connections, clean and replace as necessary. Bad contact can cause over voltage and can lead, in particular, to the burning out of the stop light. If all this has been checked, the fault must be in the magnets. Ceramic-based magnets (Ferroxdur) can sometimes cause an overvoltage because the magnetism is too high. The magnetic properties of this type of magnet alter only at very high temperatures (400 to 500 deg. Centigrade). Therefore, one of the following steps must be taken to reduce the output voltage:

a) Increase the specified air gap between lighting coil and flywheel. The specified gap of .00591 to .00984 in (.15–.25 mm) gives maximum output and increasing the gap reduces the output by 1 to 1.5 volts. This is normally sufficient to prevent the bulbs from burning out. Naturally, the output voltage must be checked after increasing the gap. The output must not be less than 6.3 volts measured at nominal engine speed (see data sheet). Adjusting the air gap is described under paragraph E „Repairing the Flywheel Magneto“.

b) An additional resistance must be connected to the light circuit if the method described under (a) does not remedy the fault. Practical experience has shown that a resistor of 18 to 20 ohms and 5-watt capacity is sufficient. This resistor is available for repairs under item No. 330.1.57.010.2.

1st Edition

Testing the electrical equipment

The resistor is made from standard resistance wire and inserted into the heat-resistant insulating tube. The total length depends on the wire used. If you prefer, you can make the resistor yourself. The method of fitting is shown in the wiring diagram (fig. 13) and it is connected to the headlight or tail light depending on type.

Testing winding short circuit

This fault is hard to detect because a short circuit of one or a few windings shows at normal operation only by reducing the light output and by warming up the light coil. A complete short circuit takes place at a much later date.

The fault is best detected by using a short circuit tester (crawler), normally used to test dynamo armatures and installed in many workshops (fig. 14). Short circuiting lighting coils will heat up very quickly. Do not touch earth with insulated winding wire. Compare voltage output with a new lighting coil. Values for coils cannot be specified because of the many different testers available. Generator coils or units with separate ignition coil can be tested only by this method or with the clamping and driving device EFLM 4A on a dynamo test bench.

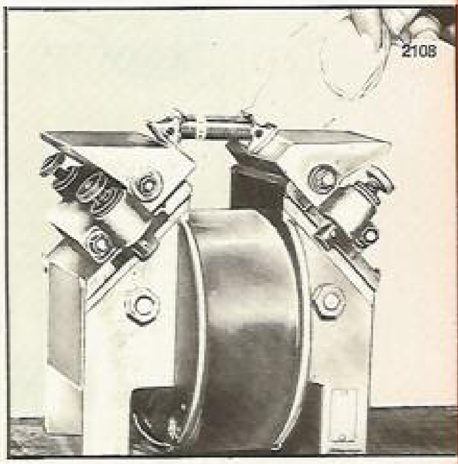
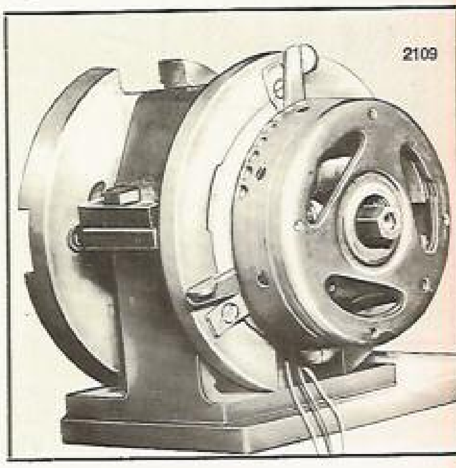


Fig. 14

Fig. 15



Testing complete flywheel magnetos on a test bench

Flywheel magnetos can be tested under operating conditions or on a test bench by using the clamping and driving device EFLM 4A = 0.681.221.002 (fig. 15). The appropriate driving shafts and adaptor flanges must be ordered seperately. The maximum driving speed must not exceed the nominal speed of the vehicle engine. The ignition coil is loaded by means of an HT spark gap. The capacitor is tested before mounting the flywheel magneto or during repair. Test with the Bosch test lamp with built-in rectifier EFAW 85 or with the ignition tester EFAW 106. Adjust the contact and break gaps and replace faulty contacts. This limits any fault to the actual ignition coil and is rectified by replacing the coil. Check again after rectifying and, at the same time, check the output of the lighting coils. Test in accordance with the specified values as described in paragraph „Testing While Fitted to Engine".

Testing the electrical equipment

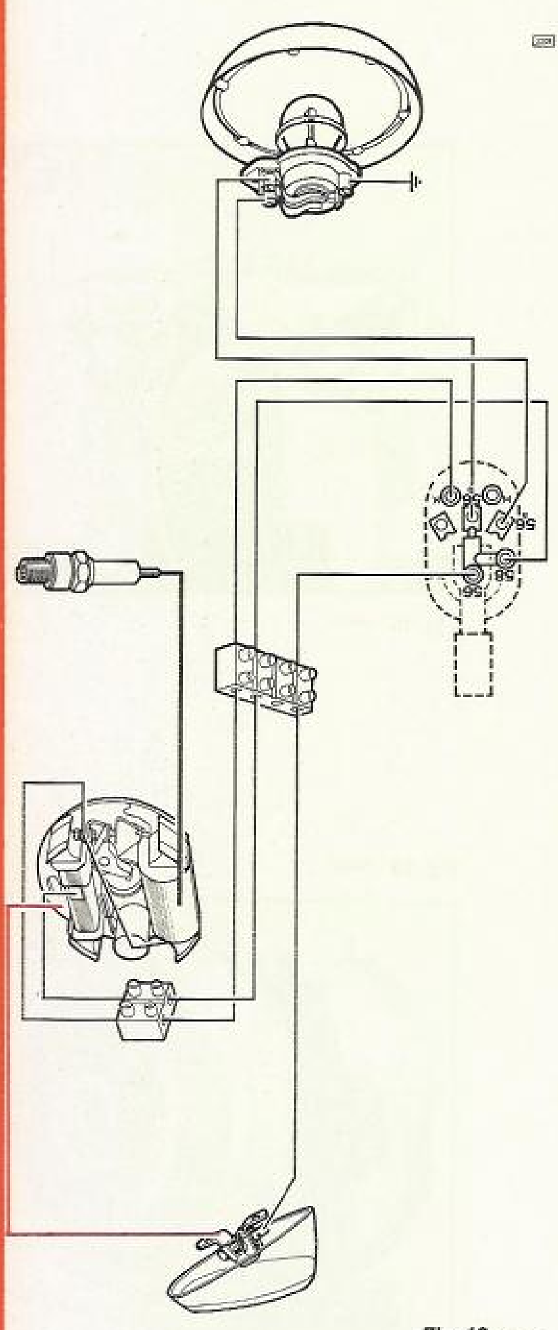


Fig. 16

Fault finding

Always begin checking from the simplest point. For instance, if a light does not work check first the bulb and next the current supply (coil, see testing – or, if fitted, battery). After this check the switch by bridging the contacts with a length of cable – for instance, terminal 51 (input) to 56a. The engine must be running, of course. As a last resort do the time-consuming check of the wiring. For example, disconnect the yellow cable from the terminal block near the flywheel magneto and from terminal 51 in the headlamp. Connect a separate cable temporarily into the circuit (see fig. 16). If the light output is correct, check the original cable carefully or replace. A possible but rare fault can be a bad earth connection on the stop or head lamp. Check by connecting a test cable (.0984 in = 2.5 mm square section) from generator earth to lamps. Use terminal 31 in the headlamp. The light will get considerably brighter as soon as the connection is made. Rectify the fault by cleaning the fixing surfaces (remove rust or paint and grease stightly).

Switch failure – most common fault

Oxidation is the most common fault on switches. On the headlight dipswitch this can result in voltage peaks by delaying the switching action (gap between main and dipped beams). Voltage peaks cause the tail light to burn out. Rectify by loosening the switch mechanism and the contact bridge or by slightly regreasing the contacts with contact grease. Oxidation of the headlamp contacts assists an increase of voltage at higher speeds and causes the stop light bulb to burn out.

In either case, dismantle and clean the switch. Regrease slightly all contacts with a special contact grease. D o n o t use normal grease.

Badly corroded switches or switches with lame springs must be replaced.

1st Edition

Repairing the flywheel magneto

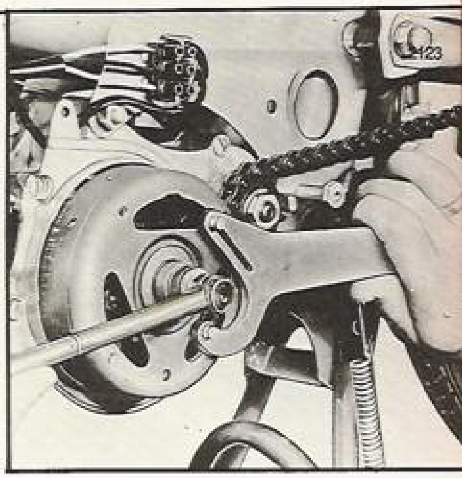
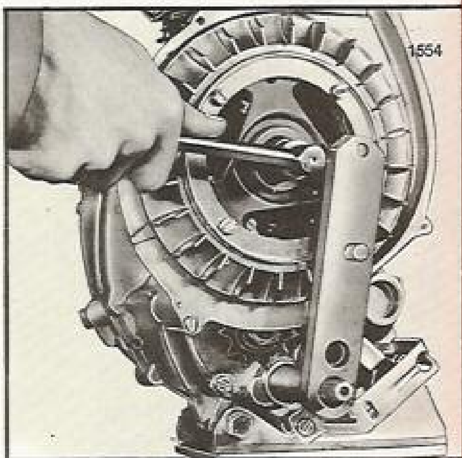


Fig. 1 ▲ Fig. 2 ▼



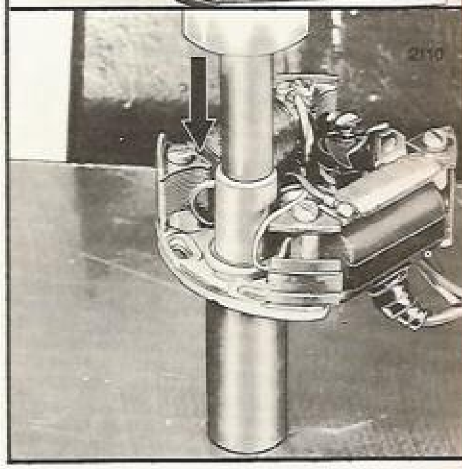
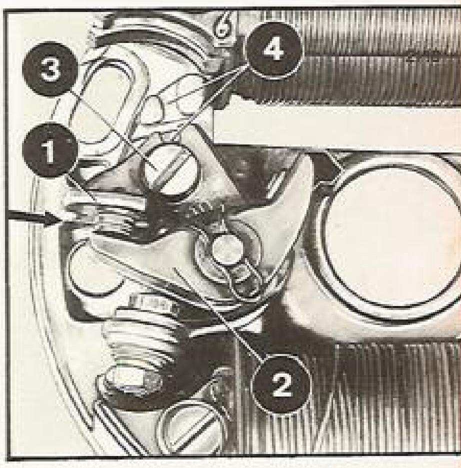


Fig. 3 ▲ Fig. 4 ▼



Repairing the flywheel magneto

Remove the fan and flywheel with extractor item no. 050.7012 and a holding bracket (see lift of special tools) suitable for the particular engine type (fig. 1 and 2). Fix the holding bracket to withstand the pulling action.

Disconnect cables, remove the spark-plug connector (units with built-in ignition coil only) and take away the baseplate after removing the three fixing screws.

Replacing ignition and lighting coils
(flywheel removed)

Unscrew the coil fixing screws and remove the coil. On ignition coils, first unsolder the connecting cable to the capacitor.

Fit the new coil and tighten fixing screws slightly. On ignition coils solder the connecting cable back to the capacitor.

Replacing the contact-breaker set (flywheel removed)

Contacts are always replaced in a set. New contacts must be fitted if the old contacts are worn or burned (fig. 4, arrow), if the rocker arm heel (fig. 4/2) is worn, if the bearing bush is worn or if the rocker arm or spring is lame or damaged. Unscrew the contact-breaker cable. Note the sequence of the insulating washers on the connecting bracket of the fixed contacts (fig. 4/1). Take off the rocker arm after removing the spring clip; unscrew the fixed contact (fig. 4/3) and check the bearing axle.

Fit the replacement parts in reverse order. Before assembling, grease the bearing bush, bearing axle and felt with Bosch grease 1 v 4 — but no grease or oil must touch the contacts (resulting in burning). Hold the fixing screw when fitting the spring to prevent jamming the rocker arm.

Fit the baseplate and connect the cable and spark-plug connector.

Repairing the flywheel magneto

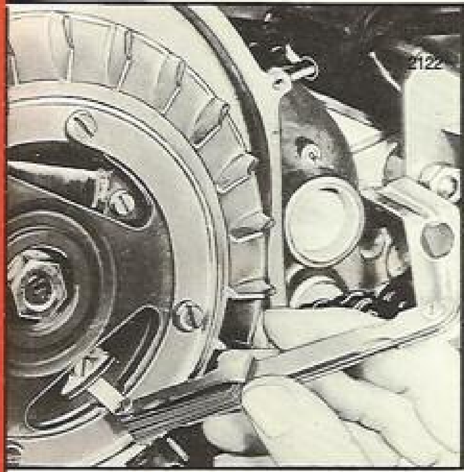
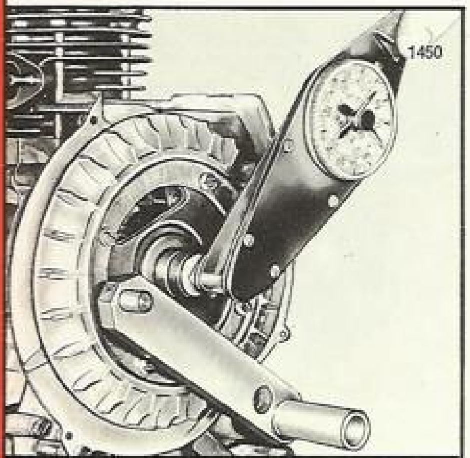


Fig. 5 Fig. 6



Fit the flywheel (degrease mounting surfaces properly) and check the air gap between the coils and flywheel if any coil has been replaced (fig. 5). The air gap should be .00591 to .00984 in (.15 to .25 mm) and must be checked. Maximum output is guaranteed only if the specified air gap is maintained, although it may be increased slightly if the output voltages are too high. To correct the air gap, tap the armature with a suitable piece of wood or plastic while the fixing screws are hand tight. If the air gap is correct, tighten the coil fixing screws properly and recheck the air gap.

Use a torque wrench to tighten the fixing screw of the flywheel (fig. 6). The holding bracket must be fixed to withstand a pulling action. The correct tightening torque is 21.73 to 25.35 ftlb (3 to 3.5 mkg).

Assemble fan.

Wiring diagrams

Wiring diagrams

Many service mistakes happen because the wiring diagrams are not known. The appropriate wiring diagram is included in the operating instructions (data sheet) supplied with every machine.

The following wiring diagrams apply basically to all our models, the only differences being in switches, headlamps and the like. Further variations are, of course, possible. Only knowledge of the wiring diagram enables correct installation and helps the fitter to understand the functioning of the equipment on the machine. The following list explains the cable color code.

Cable colours

Cable colours

Description		Colour
Light	56	yellow
Light	56	yellow / red
Light	56a	white
Light	56b	yellow / black
Headlamp indicator		blue
Stop light		green
Tail light	58	grey
Parking light		black
Parking light		grey
Headlight flasher		blue
Headlight flasher		black
Ignition coil (earth)	1	black
Ignition coil	15	blue
Short circuiting (earth)		black
Ignition switch (earth)		black

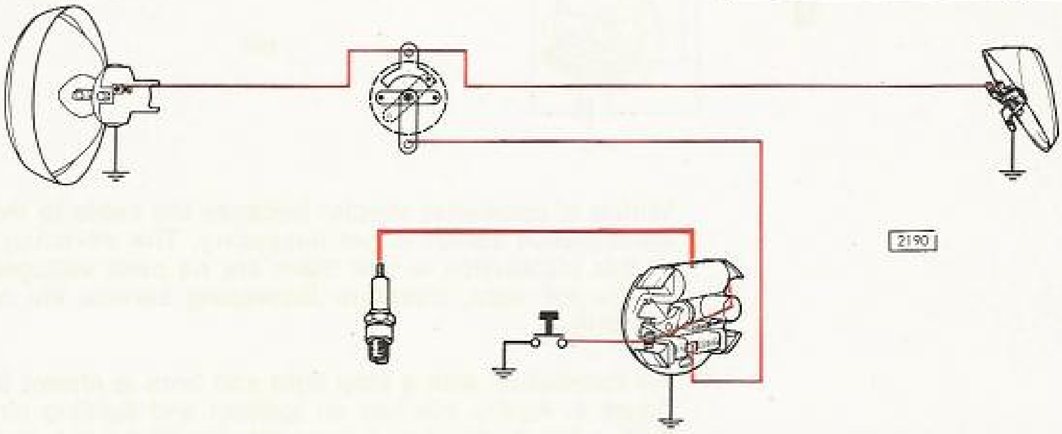


Fig. 1

Figure 1 shows a very simple installation as used, for instance, on our MOFA models. The flywheel magneto has one ignition and one lighting coil. The headlight is constantly dipped (single filament bulb) and is controlled by a one-way switch. The primary circuit of the ignition coil is short-circuited to switch off the engine (connected to earth).

Fig. 2

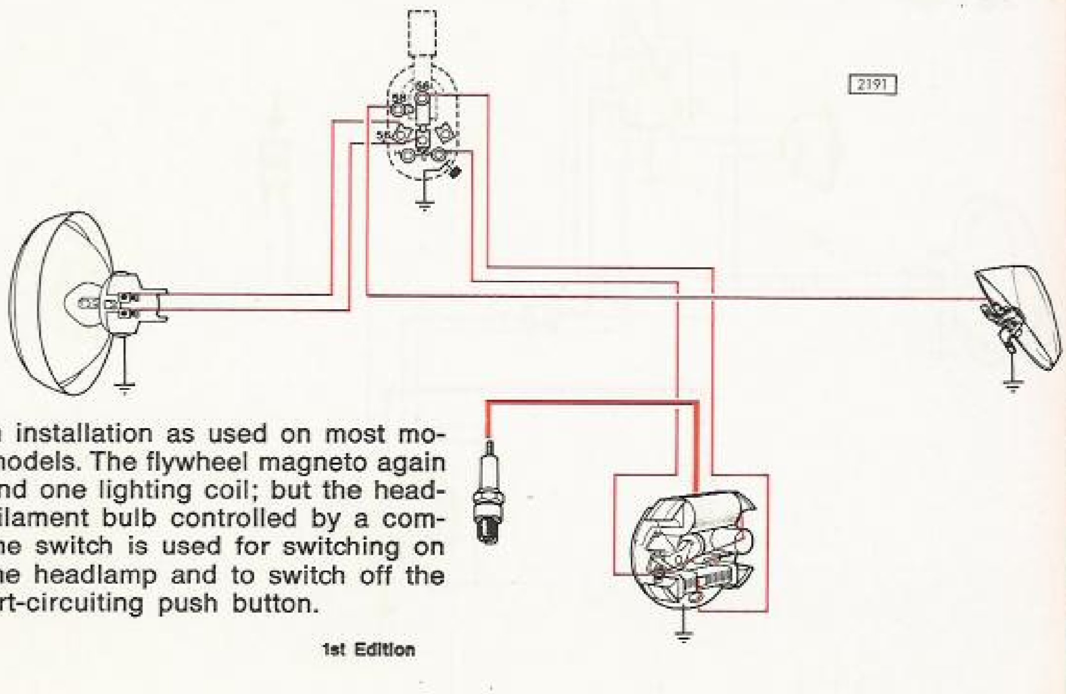


Figure 2 shows an installation as used on most moped and mockick models. The flywheel magneto again has one ignition and one lighting coil; but the headlamp uses a two-filament bulb controlled by a combination switch. The switch is used for switching on and off, dipping the headlamp and to switch off the engine with a short-circuiting push button.

Wiring diagrams

Figure 3 shows the same installation as figure 2 but with two separate lighting circuits. The second, for the tail light, is fed inductively. The coil for the tail light has no poleshoes and is mounted above the actual lighting coil. The voltage required for the tail light is generated only if the headlight is switched on. When the headlight is switched off only a small voltage is induced, giving a very weak glow in the tail lamp.

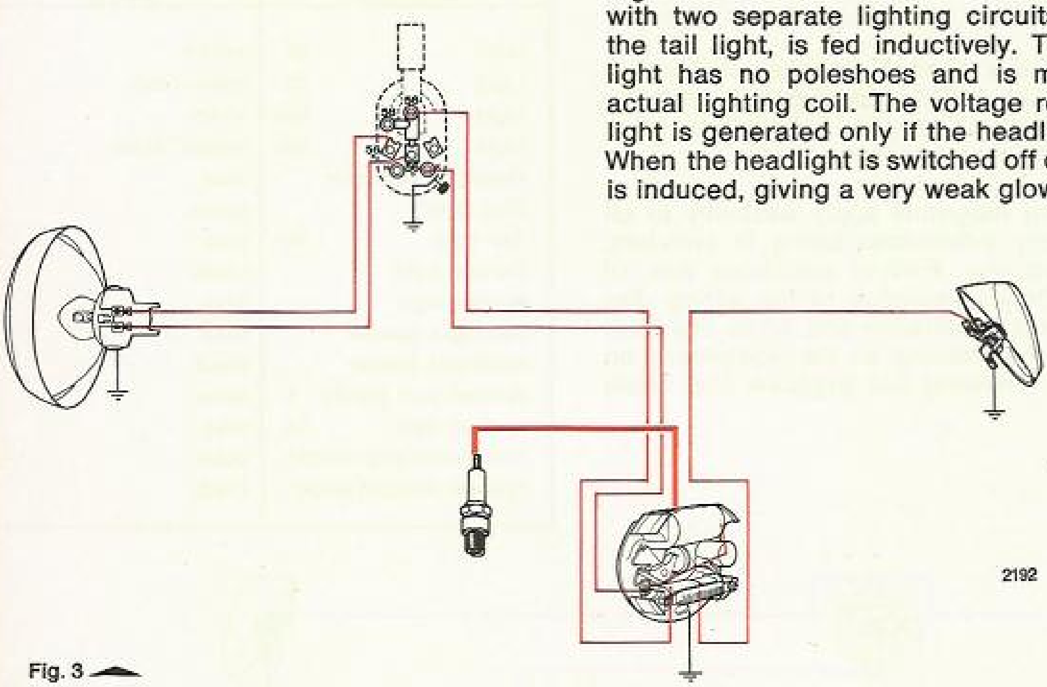
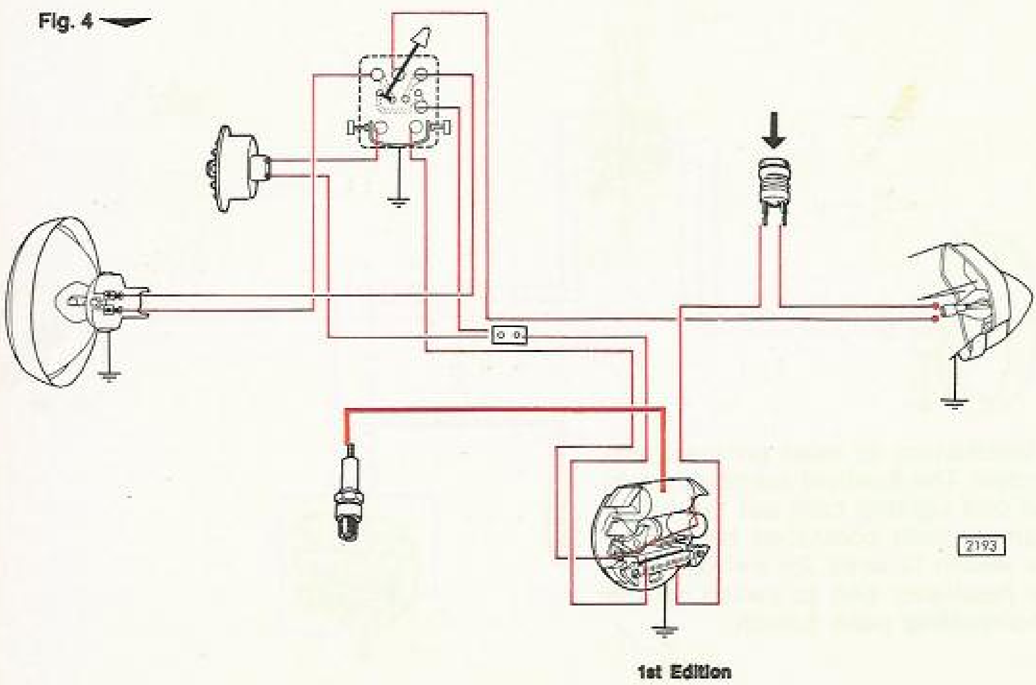


Fig. 3

Wiring is somewhat simpler because the cable to the combination switch is not necessary. The advantage of this installation is that there are no peak voltages to the tail light, therefore increasing service life of the bulb.

An installation with a stop light and horn is shown in figure 4. Again, this has an ignition and lighting circuit – but it also has a separate circuit for the stop light. The stop light coil has its own pole shoe and functions independently of the headlight coil below. The stop light is controlled by an switch operated by the rear brake pedal. The horn is connected to the lighting circuit and is operated by a push-button connection to earth (built into the combination switch).

Fig. 4



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Wiring diagrams

Figure 5 is a similar installation to fig. 4 but has a headlight indicator and an earth switch operated by an ignition key to swich off the engine and as an anti-theft device. The headlight indicator is a small bulb connected to the headlight supply and, therefore, lights up as soon as the headlight is switched on.

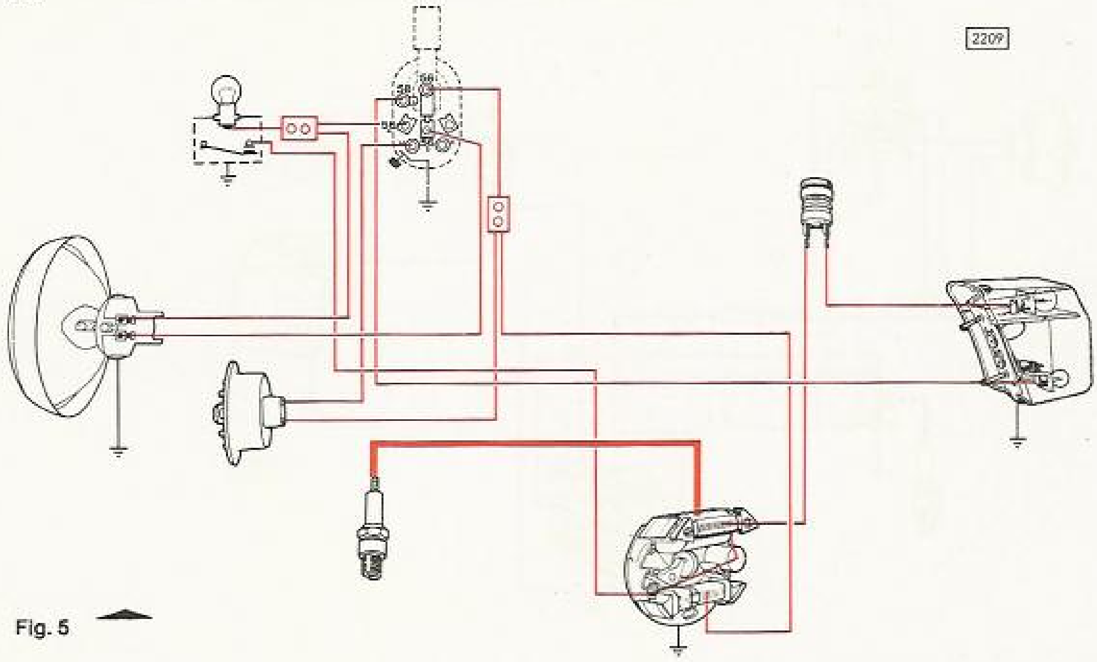
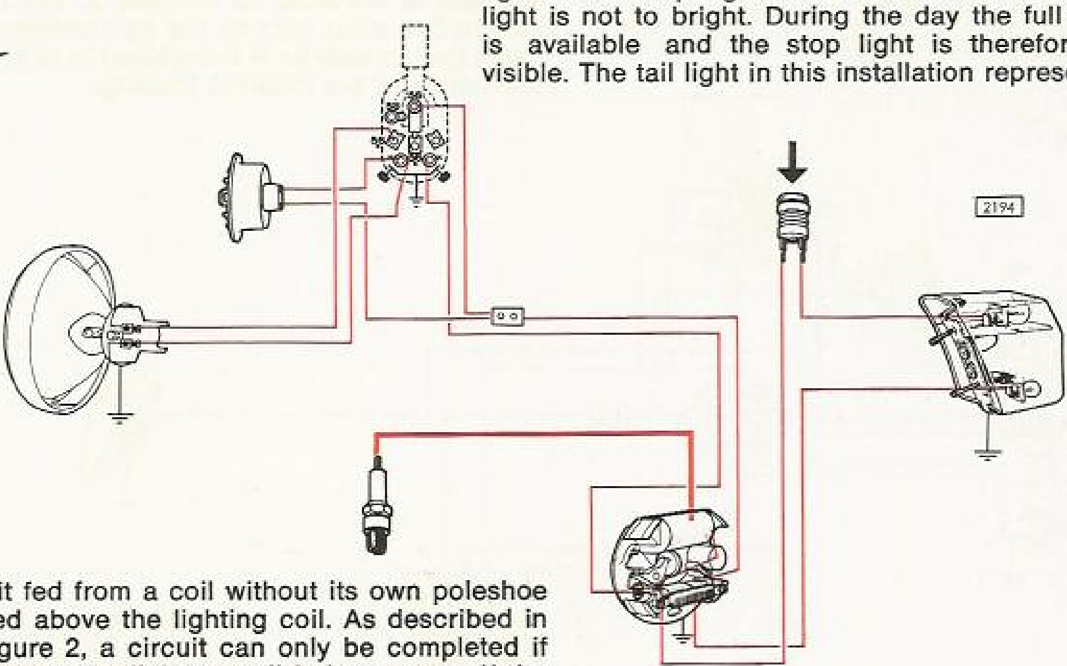


Fig. 5

Figure 6 illustrates an installation with three separate lighting circuits. The first is based on a normal lighting coil with its own poleshoe, feeding the headlamp and the horn. The second, for the stop light, is fed from a coil wound over the normal lighting coil. If the lighting coil is loaded (at night) the output voltage of the stop light coil is reduced and the stop light is not to bright. During the day the full voltage is available and the stop light is therefore more visible. The tail light in this installation represents the third circuit fed from a coil without its own poleshoe and situated above the lighting coil. As described in detail in figure 2, a circuit can only be completed if current flows in the lighting coil below – e. g. if the light is switched on. The tail light is connected directly because no switch is necessary.

Fig. 6



Wiring diagrams

Figure 7 shows an installation with separate ignition coil and three lighting circuits. The separately-mounted ignition coil is fed by a generator coil similar to a lighting coil. Of the three lighting circuits, the first is for the headlamp and horn as described in figure 6. The tail light is the second circuit and is fed from a separate coil fitted above the lighting coil. This coil

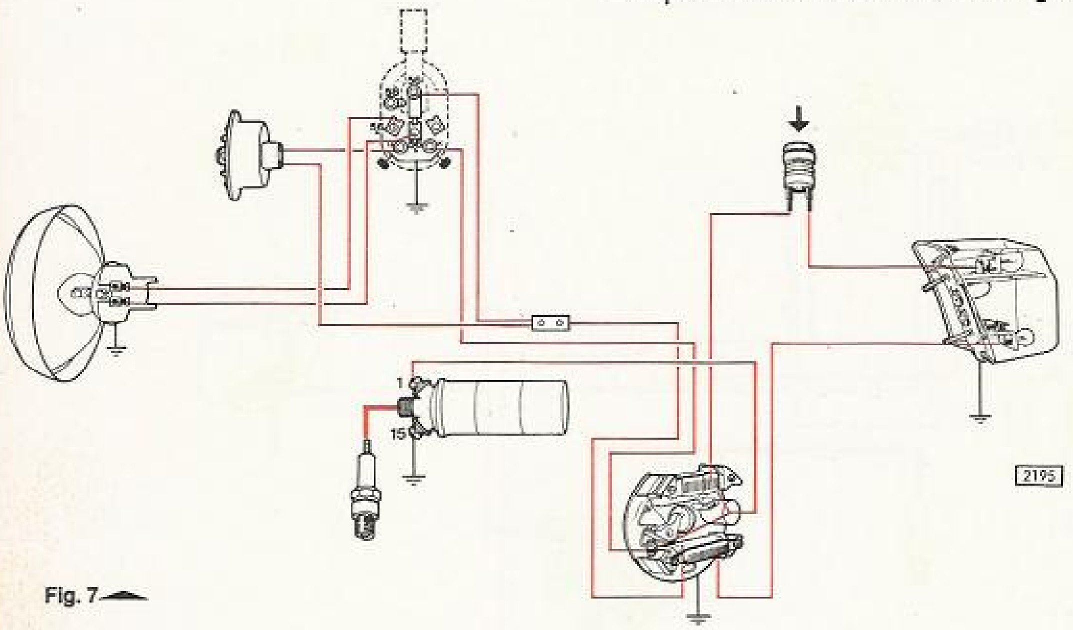
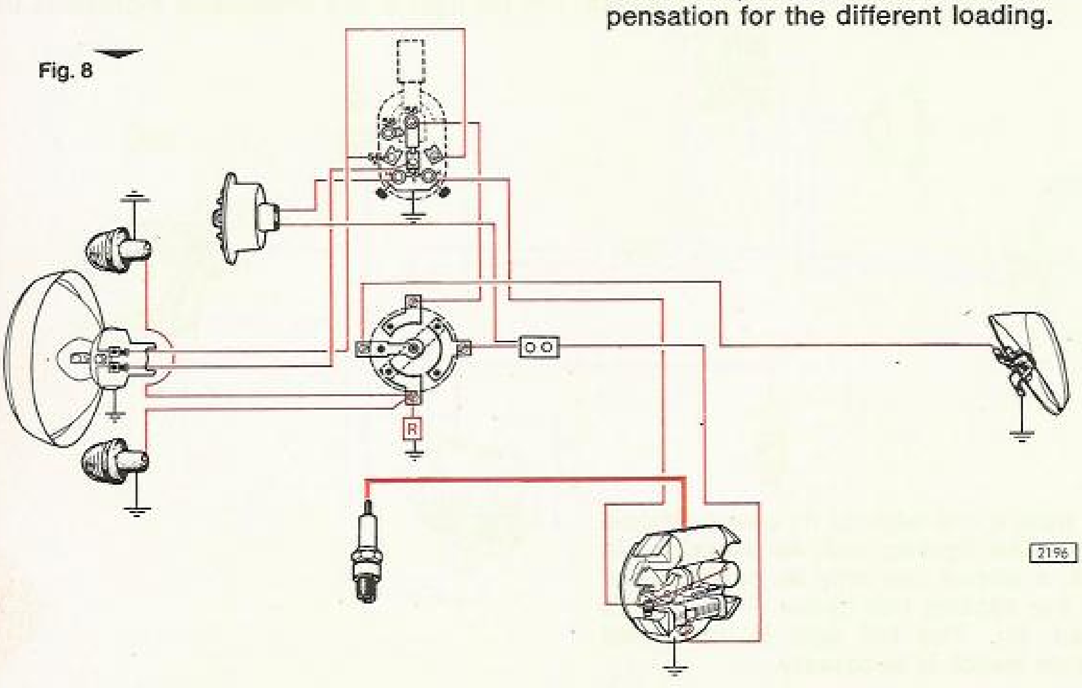


Fig. 7

has no poleshoe and functions as described in figures 2 and 6. The third circuit is for the stop light and is fed from a separate coil fitted above the generator coil.

Town lights are added to the installation in figure 8. The rest is the same as in figure 2. The headlight is switched to town light by the light switch and, at the same time, a resistor R is switched in to provide compensation for the different loading.

Fig. 8



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Wiring diagrams

Figure 9 again shows an installation with separate ignition coil and three lighting circuits. One feeds separately the town light and the tail light. The main lighting coil supplies the headlamp; town and tail lights work even if the headlamp is switched on. The brake light coil fitted above the main lighting coil feeds the stop light and horn. A combination switch is used to switch on and off the lights and, also, to operate the horn and to cut out the engine. A separate switch is used to dip the headlight.

Fig. 9

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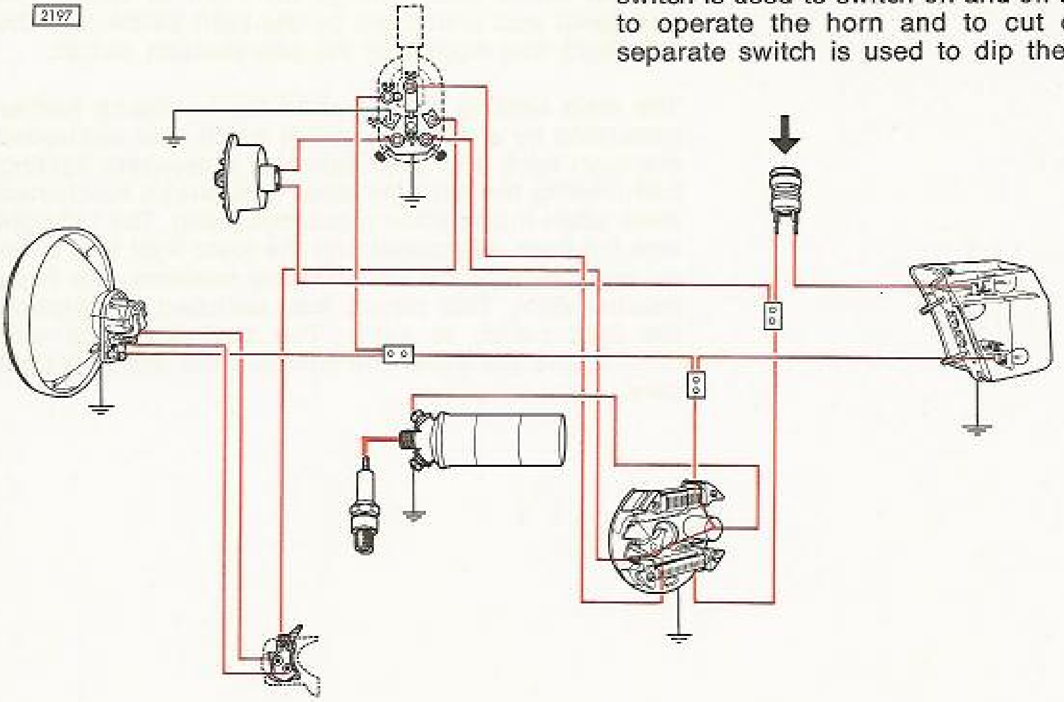
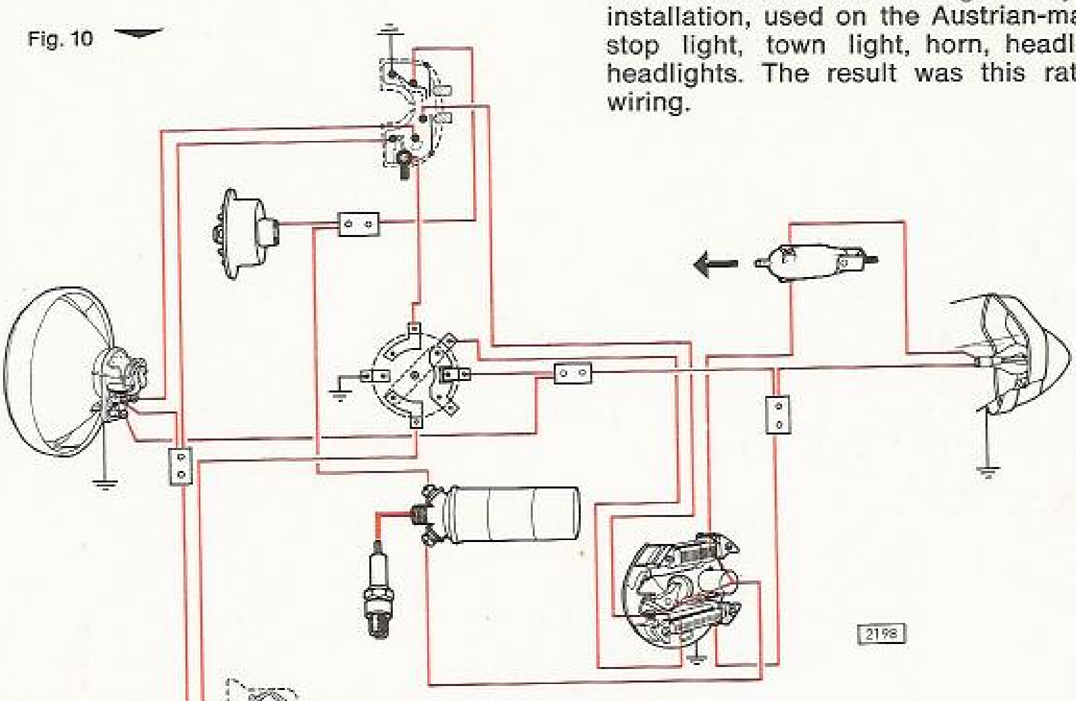


Figure 10 shows an installation which is no longer used. It caused a great deal of difficulty to service stations because it was not generally understood. The installation, used on the Austrian-made DS 60R, had stop light, town light, horn, headlamp flasher and headlights. The result was this rather complicated wiring.

Fig. 10



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Wiring diagrams

The ignition circuit was from the generator coil to a separate ignition coil. The terminal (15) on the ignition coil is normally connected directly to earth, but in this instance it was connected through the combination switch to earth. The horn was added to this circuit. The earth contact in the combination switch was opened by pressing the horn push button and current would flow through the horn to earth. The headlamp was controlled by the light switch and the headlight was dipped by the combination switch.

The main lighting coil supplied the headlamp flasher controlled by a separate switch which also controlled the town light. The town light had a separate lighting coil feeding the tail light also. This circuit functioned even when the headlamp was operating. The tail light was fed from this circuit and the town light had to be on together with the headlamp to conform with legal requirements. This circuit was switched off through the light switch to earth. The stop light coil was fitted above the generator coil and fed the stop light only.

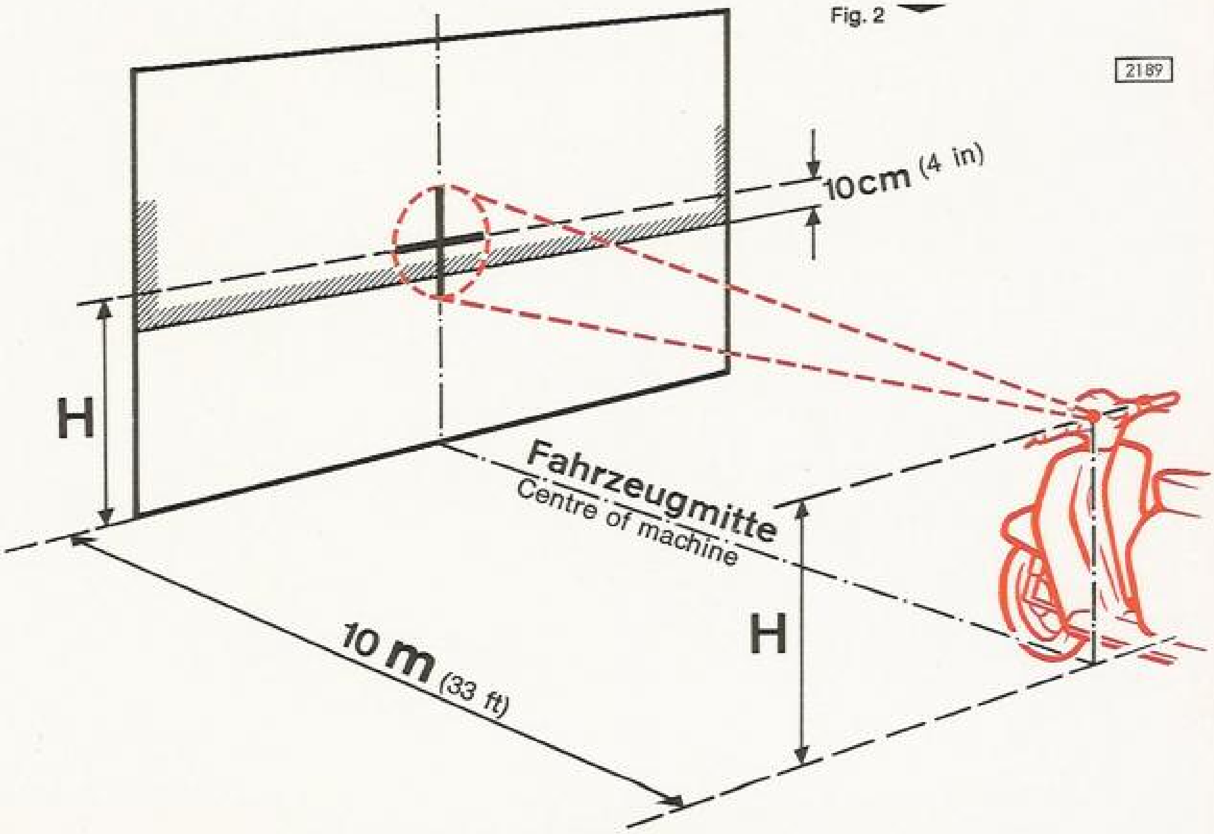
Headlight beam alignment

Adjusting and checking the headlights

Headlights can be adjusted against a wall or with a beamsetter. In either case the machine must be loaded by one person. The adjusting specification for most countries are: The cut-off line between dark and light (at dipped position) must drop 10 (5) cm (4 resp. 2 in) in a distance of 10 (5) meters (33 resp. 16.5 ft). If the headlamp is fitted more than 95 cm (37.4 in) above ground, the cut-off line should drop 15 cm (6 in) in 10 meters (33 ft). Adjustments in countries with different legislation must be made accordingly. Figure 2 shows the method of adjustment against a wall. Mark a horizontal line (H) on the wall at the same height as the centre of the headlight. The difference between the marked line and the cut-off line with a dipped light gives the beam drop in cm (figure 2). The headlight is adjusted quicker, more accurately and anywhere in the shop with a commercial beamsetter (figure 1). The beam drop can be read directly. Bosch offer a choice of two sets, parts no. 0.681.120.006 and 0.681.130.007. The latter has a built-in lux meter to check the light intensity in lux at the same time.

Fig. 1

Fig. 2



Headlight beam alignment

VARIOUS

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Tightening torques for engines

Description	MAXI	X 30	X 30 A	MSV	MSA	VSD	R	V	M		
Cylinder head	6,5 (0,9)			7,2 (1,0)	7,2 (1,0)	7,2 (1,0)		7,2 (1,0)			
Cylinder head		7,2 (1,0)	7,2 (1,0)				7,2 (1,0)		8,7 (1,2)		
Nut for flywheel, taper 1 : 5	23,3 (3,5)	23,3 (3,5)	23,3 (3,5)	23,3 (3,5)	23,3 (3,5)	23,3 (3,5)	23,3 (3,5)	23,3 (3,5)	23,3 (3,5)		
Nut for flywheel, taper 1 : 10		15,9 (2,2)	15,9 (2,2)	15,9 (2,2)		15,9 (2,2)					
Nut for clutch fixing		16,6 (2,3)		16,6 (2,3)		16,6 (2,3)	16,6 (2,3)	16,6 (2,3)	16,6 (2,3)		
Nut for centrifugal clutch	19,5 (2,7)		19,5 (2,7)		19,5 (2,7)						
Nut for layshaft		36,2 (5,0)	36,2 (5,0)	36,2 (5,0)	36,2 (5,0)	36,2 (5,0)	36,2 (5,0)		36,2 (5,0)		
Nut for layshaft								19,5 (2,7)			
Nut for sprocket fixing		36,2 (5,0)	36,2 (5,0)	36,2 (5,0)	36,2 (5,0)	36,2 (5,0)	36,2 (5,0)	36,2 (5,0)	36,2 (5,0)		
Bearing bolt for starter sprocket								21,7 (3,0)			
Starter stop screw				14,5 (2,0)	14,5 (2,0)	14,5 (2,0)	14,5 (2,0)	14,5 (2,0)			
Housing screws	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)		
Housing cover screws	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)	5,8 (0,8)		
Screw for engine fixing	23,2 (3,2)			23,2 (3,2)	23,2 (3,2)	23,2 (3,2)	23,2 (3,2)	23,2 (3,2)	23,2 (3,2)		
Screw for engine fixing		18,8 (2,6)	18,8 (2,6)	18,8 (2,6)		18,8 (2,6)					
Pedal fixing				5,1 (0,7)	5,1 (0,7)	5,1 (0,7)	5,1 (0,7)	5,1 (0,7)	5,1 (0,7)		

Torque values in ft/lb (mkp)

Torque values quoted on pages A 1 and A 2 are required regularly charts on page A 3 and A 4 quote all torque values.
The conversion factor from mkp to ft/lb: 1 mkp = 7.233 ft/lb.
The conversion factor from ft/lb to mkp: 1 ft/lb = 0.138 mkp.

Torque values for frame

Description	MAXI	X 30	MS/VS	DS	MC	VZ	R	M		
Pedal fixing	5,1 (0,7)	5,1 (0,7)								
Front telescope holder, top				16,6 (2,3)			16,6 (2,3)			
Front telescope holder, bottom				10,9 (1,5)			10,9 (1,5)			
Independent front-fork bearing				16,6 (2,3)			16,6 (2,3)			
Independent rear-fork bearing			23,2 (3,2)	23,2 (3,2)	28,9 (4,0)	28,9 (4,0)		23,3 (3,5)		
Mudguard fixing brackets	4,3 (0,6)	4,3 (0,6)	4,3 (0,6)		4,3 (0,6)	4,3 (0,6)		4,3 (0,6)		
Rear telescope holder, top			16,6 (2,3)	16,6 (2,3)	16,6 (2,3)	16,6 (2,3)	16,6 (2,3)	18.1 (2,5)		
Rear telescope holder, bottom			15.9 (2,2)	15.9 (2,2)	14,5 (2,0)	14,5 (2,0)	15.9 (2,2)	18.1 (2,5)		
Spar connection, top			43,4 (6,0)		43,4 (6,0)	43,4 (6,0)		43,4 (6,0)		
Spar connection, top M 19.5 x 1			36,2 (5,0)							
Handlebar fixing	19,5 (2,7)	19,5 (2,7)	19,5 (2,7)	19,5 (2,7)						
Handlebar cover fixing					10,1 (1,4)	10,1 (1,4)		10,1 (1,4)		
Twistgrip fixing to bar/hexagon screw		2,9 (0,4)	2,9 (0,4)	2,9 (0,4)	2,9 (0,4)	2,9 (0,4)		2,9 (0,4)		
Twistgrip fixing to bar/cheesehead screw	5,8 (0,8)		5,8 (0,8)	5,8 (0,8)						
Headlamp bracket fixing							32,6 (4,5)			
Headlamp fixing	6,5 (0,9)	6,5 (0,9)			6,5 (0,9)	6,5 (0,9)		6,5 (0,9)		
Sprocket attachment (cast-aluminium hub)			10,9 (1,5)	10,9 (1,5)	10,9 (1,5)	10,9 (1,5)	10,9 (1,5)	14,5 (2,0)		
Sprocket attachment (steel hub)			11,6 (1,6)							
Brake cam fixing	5,1 (0,7)	13,0 (1,8)	13,0 (1,8)	13,0 (1,8)	13,0 (1,8)	13,0 (1,8)	13,0 (1,8)	13,0 (1,8)		
Rear spindle fixing	19,5 (2,7)	19,5 (2,7)	19,5 (2,7)	19,5 (2,7)	19,5 (2,7)	19,5 (2,7)	19,5 (2,7)	19,5 (2,7)		

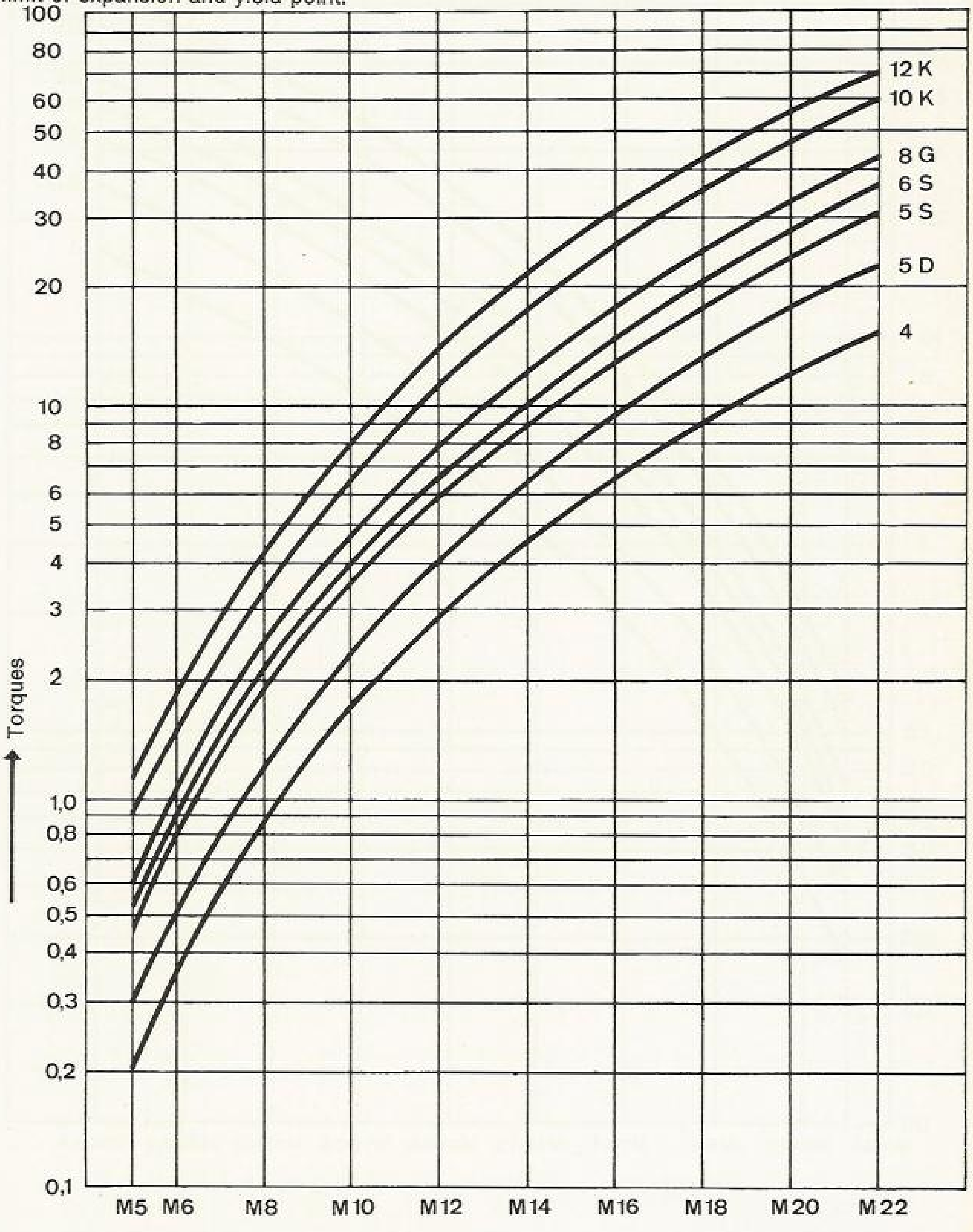
Torque values in ft/lb (mkp)

Torque chart

Required torques for metric threads according to DIN standards.

Logarithmic curve of required torques for standard threads.

The minimum tensile strength of the screws (DIN – standardization) is quoted in numbers and letters, e.g. "5 S" indicates a tensile strength of at least 50 kp/mm² (1 kp/mm² = 0,6350 tons/in²) "12 K" indicates a tensile strength of 120 kp/mm². E.g. the letters "S" or "K" refer to a certain limit of expansion and yield point.

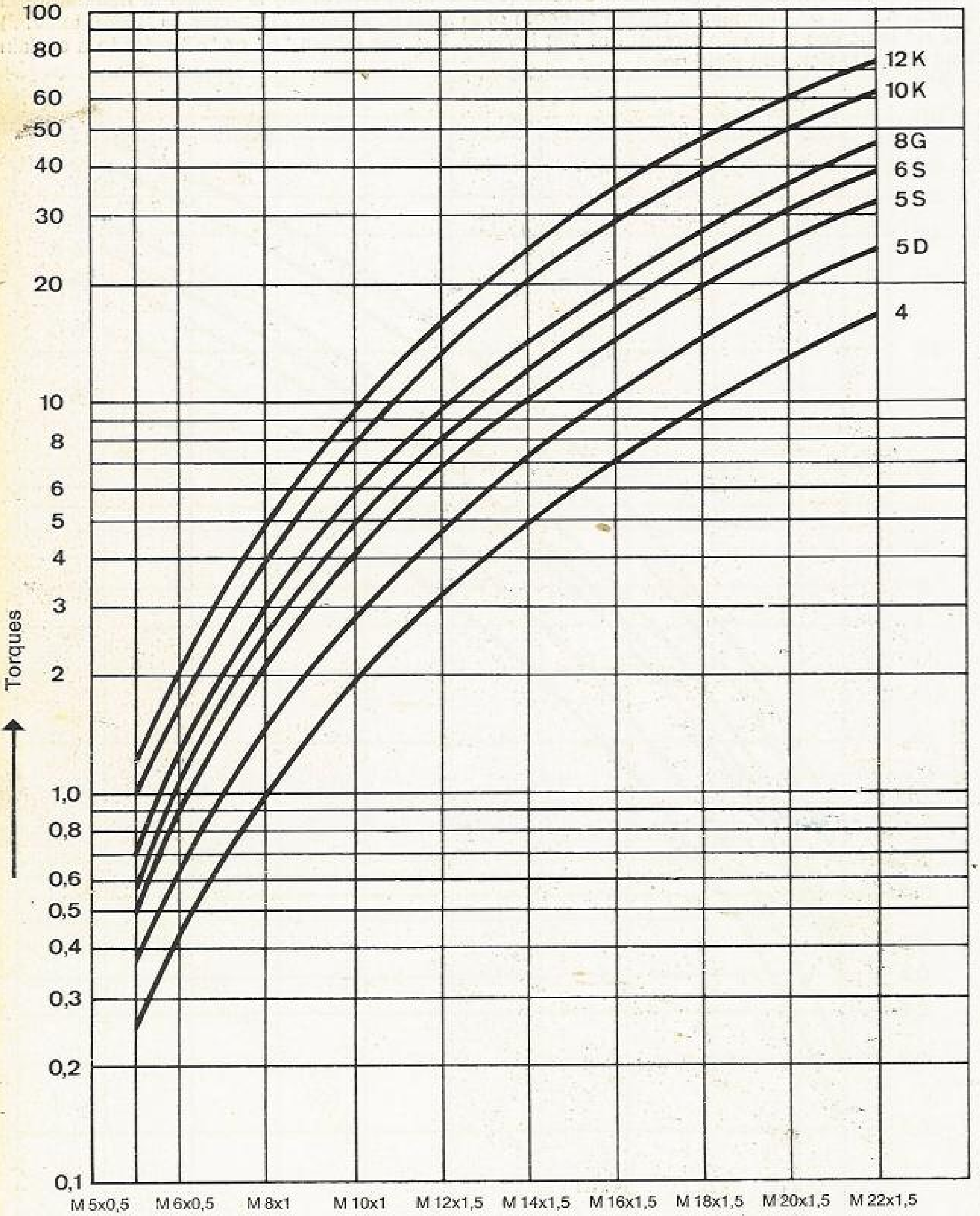


Torque values in mkp

1 mkp = 7.233 ft/lb = 86.9 in/lb

Torque chart

Required torques for metric threads according to DIN standards logarithmic curve of required torques for fine-pitch thread.



Torque values in mkp 1 mkp = 7.233 ft/lb / 86.9 in/lb

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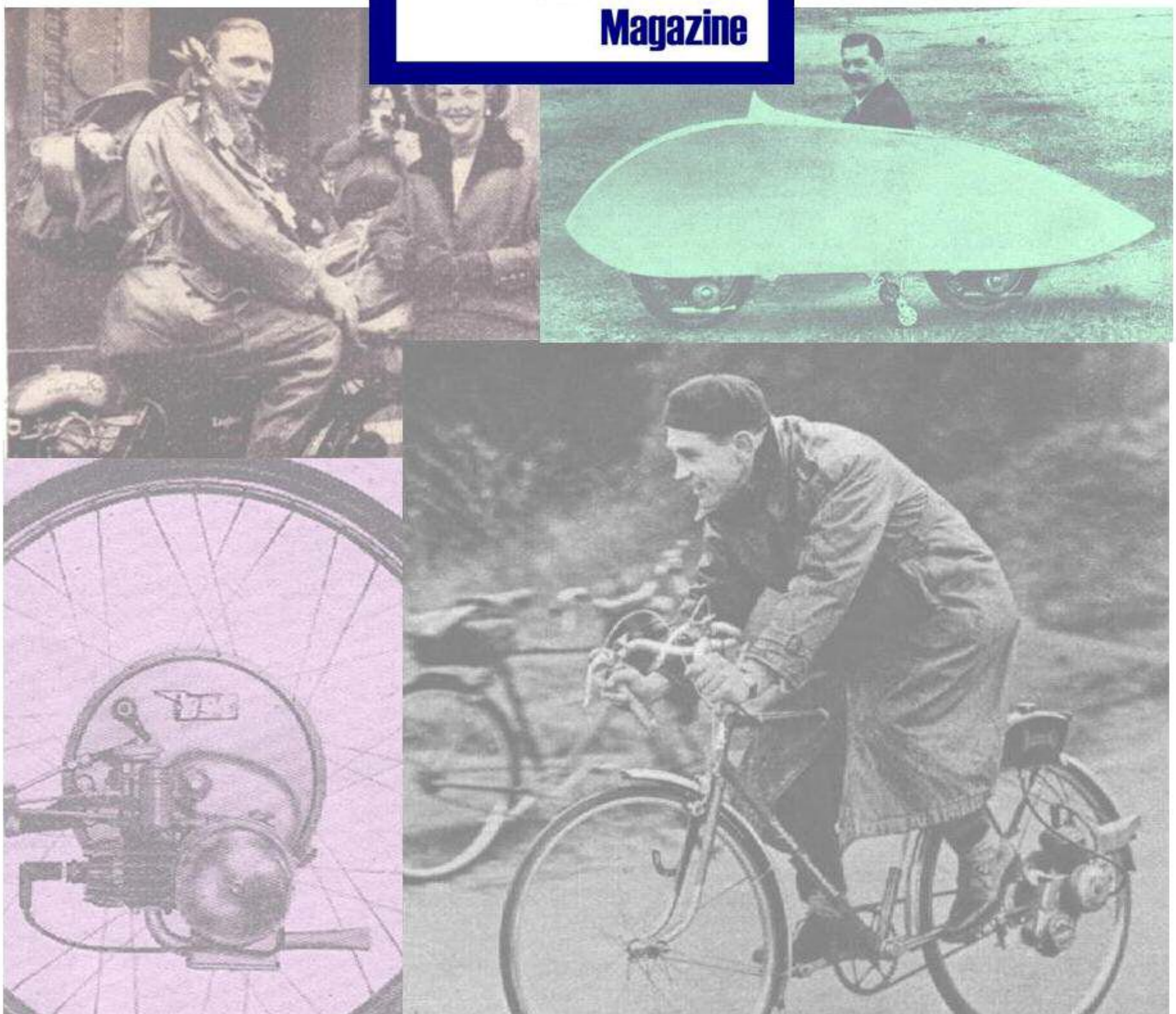

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