Chapter 2
Engine, clutch and transmission

Note: *Unless specifically mentioned in this Chapter, the information given for the 1982 750 Sabre applies to the UK VF750S-C, and that for the 1987 and 1988 700/750 Magnas applies to the UK VF750C-H and C-J respectively.*

Contents

Specifications

General

Capacity	
700 models	699 cc (42.6 cu in)
750 models	748 cc (45.6 cu in)
1100 models	1098 cc (67 cu in)
Bore	
700 and 750 models	70 mm (2.75 in)
1100 models	79.5 mm (3.13 in)
Stroke	
700 models	45.4 mm (1.79 in)
750 models	48.6 mm (1.9 in)
1100 models	55.3 mm (2.18 in)
Compression ratio	
700/750 models 1982 through 1986	10.5 to 1
700/750 models 1987 and 1988	10.2 to 1
1100 models	10.5 to 1
Engine weight (dry) - approximate	
700/750 models	85 to 87 kg (187 to 192 lbs)
1100 models	97 kg (213 lbs)

Camshafts

Cam lobe height - 1982 through 1984 700/750 models and all 1100 models	
Standard	35.355 to 35.495 mm (1.3911 to 1.3974 in)
Service limit	35.3 mm (1.39 in)
Cam lobe height - 1985 and 1986 700 models	
Standard	35.243 to 35.403 mm (1.3875 to 1.3938 in)
Service limit	35.2 mm (1.39 in)
Cam lobe height - 1987 700 models	
Standard	35.063 to 35.223 mm (1.3804 to 1.3867 in)
Service limit	35.0 mm (1.38 in)
Cam lobe height - 1988 750 model (except California)	
Standard	34.845 to 35.005 mm (1.3718 to 1.3781 in)
Service limit	34.8 mm (1.37 in)
Cam lobe height - 1988 750 model (California)	
Standard	34.562 to 34.722 mm (1.3607 to 1.3670 in)
Service limit	34.5 mm (1.358 in)
Camshaft runout	
1985 through 1988 700/750 Magna models	Less than 0.05 mm (0.002 in)
All other models	Less than 0.10 mm (0.004 in)
Camshaft bearing oil clearance -1982 through 1985 700/750 models	
Center journal	
Standard	0.030 to 0.091 mm (0.001 to 0.004 in)
Service limit	0.10 mm (0.004 in)
Inner and outer journals	
Standard	0.50 to 0.111 mm (0.002 to 0.004 in)
Service limit	0.12 mm (0.005 in)
Camshaft bearing oil clearance -1100 models	
Standard (all journals)	0.030 to 0.091 mm (0.001 to 0.004 in)
Service limit (all journals)	0.095 mm (0.0037 in)
Camshaft journal OD -1986 through 1988 700/750 Magna models	
Outer journal (A)	
Standard	23.949 to 23.970 mm (0.9429 to 0.9437 in)
Service limit	23.89 mm (0.941 in)
Center and inner journals (B and C)	
Standard	23.861 to 23.882 mm (0.9394 to 0.9402 in)
Service limit	23.80 mm (0.937 in)
Camshaft bearing holder ID - 1986 through 1988 700/750 Magna models Intake	
Standard	24.000 to 24.021 mm (0.9449 to 0.9457 in)

Service limit	24.05 mm (0.947 in)
Exhaust	
Standard	24.000 to 24.084 mm (0.9449 to 0.9482 in)
Service limit	24.11 mm (0.949 in)

Camshaft bearing oil clearance - 1986 through 1988 700/750 Magna models	
Outer journal (A) - intake and exhaust	
Standard	0.030 to 0.072 mm (0.0012 to 0.0028 in)
Service limit	0.10 mm (0.004 in)
Center and inner journals (B and C) - intake	
Standard	0.118 to 0.160 mm (0.0046 to 0.0063 in)
Service limit	0.20 mm (0.008 in)
Center and inner journals (B and C) - exhaust	
Standard	0.118 to 0.223 mm (0.0046 to 0.0088 in)
Service limit	0.25 mm (0.010 in)
Camchain length (at 13 kg/29 lbs)	
All 700/750 Sabres and 1982 through 1984 700/750 Magnas	
Standard	323.85 to 324.30 mm (12.750 to 12.767 in)
Service limit	326.12 (12.84 in)
1985 through 1988 700/750 Magna models	
Standard	342.90 to 343.35 mm (13.500 to 13.518 in)
Service limit	340.50 (13.405 in)
1100 models	
Standard	361.95 to 362.40 mm (14.250 to 14.269 in)
Service limit	364.90 mm (14.37 in)

Rocker arms

Rocker arm bore diameter	
Standard	12.000 to 12.018 mm (0.4724 to 0.4731 in)
Service limit	12.05 mm (0.474 in)
Rocker arm shaft outer diameter	
Standard	11.966 to 11.984 mm (0.4711 to 0.4718 in)
Service limit	11.93 mm (0.470 in)

Cylinder head

Maximum warpage	
All 700/750 Sabres, 1982 through 1984 700/750 Magna models	0.25 mm (0.010 in)
1985 through 1988 700/750 Magna models	0.10 mm (0.004 in)
1100 models	0.05 mm (0.002 in)

Valves, guides and springs

Intake valve stem OD	
Standard	5.475 to 5.490 mm (0.2156 to 0.2161 in)
Service limit	5.47 mm (0.215 in)
Exhaust valve stem OD	
Standard	5.455 to 5.470 mm (0.2148 to 0.2154 in)
Service limit	5.45 mm (0.214 in)
Valve guide ID - intake and exhaust	
Standard	5.500 to 5.515 mm (0.2165 to 0.2171 in)
Service limit	5.55 mm (0.219 in)
Valve stem-to-guide clearance	
Intake	
Standard	0.010 to 0.040 mm (0.0004 to 0.0016 in)
Service limit	0.08 mm (0.003 in)
Exhaust	
Standard	0.030 to 0.060 mm (0.0012 to 0.0024 in)
Service limit	0.10 mm (0.004 in)
Valve seat width - intake and exhaust	
Standard	0.99 to 1.27 mm (0.039 to 0.050 in)
Service limit	1.5 mm (0.06 in)
Valve spring free length - all 700/750 Sabre models, 1982 through 1984 700/750 Magna models	
Inner spring	
Standard	40.70 mm (1.60 in)
Service limit	39.35 mm (1.55 in)
Outer spring	
Standard	43.90 mm (1.73 in)
Service limit	42.43 mm (1.67 in)
Valve spring free length - 1985 through 1987 700 Magna models	
Inner spring	
Standard	39.49 mm (1.555 in)
Service limit	38.19 mm (1.504 in)
Outer spring	
Standard	44.61 mm (1.756 in)
Service limit	43.14 mm (1.698 in)

Valves, guides and springs (continued)

Valve spring free length - 1988 750 Magna model	
Inner spring	
Standard	41.43 mm (1.631 in)
Service limit	40.13 mm (1.580 in)
Outer spring	
Standard	45.31 mm (1.784 in)
Service limit	43.84 mm (1.726 in)
Valve spring free length - 1100 models	
Inner spring	
Standard	40.85 mm (1.608 in)
Service limit	39.45 mm (1.553 in)
Outer spring	
Standard	44.50 mm (1.752 in)
Service limit	43.10 mm (1.70 in)

Clutch

Friction plate thickness	
Standard	3.72 to 3.88 mm (0.147 to 0.153 in)
Service limit	3.5 mm (0.14 in)
Plain plate maximum warpage	0.3 mm (0.012 in)
Clutch spring free length - except 1983 750 Sabre and all 1100 models	
Standard	35.5 mm (1.40 in)
Service limit	34.0 mm (1.34 in)
Clutch diaphragm spring free height - 1983 750 Sabre and all 1100 models	
Standard - 750 model	3.9 mm (0.15 in)
Standard - 1100 models	4.6 mm (0.18 in)
Service limit - all models	3.6 mm (0.14 in)
Outer guide inner diameter - 700/750 models	
Standard	24.995 to 25.012 mm (0.9841 to 0.9847 in)
Service limit	25.08 mm (0.987 in)
Outer guide inner diameter - 1100 models	
Standard	29.995 to 30.012 mm (1.1809 to 1.1816 in)
Service limit	30.08 mm (1.184 in)
One-way clutch inner piece outer diameter - 1983 750 Sabre and all 1100 models	
Standard	57.755 to 57.768 mm (2.2738 to 2.2743 in)
Service limit	57.74 mm (2.273 in)
Outer center inner diameter -1983 750 Sabre and all 1100 models	
Standard	74.414 to 74.440 mm (2.9296 to 2.9307 in)
Service limit	74.50 mm (2.933 in)
Master cylinder bore diameter - 700/750 models	
Standard	14.000 to 14.043 mm (0.5512 to 0.5528 in)
Service limit	14.06 mm (0.554 in)
Master cylinder piston diameter - 700/750 models	
Standard	13.957 to 13.984 mm (0.5495 to 0.5506 in)
Service limit	13.94 mm (0.549 in)
Master cylinder bore diameter -1100 models	
Standard	15.870 to 15.913 mm (0.6248 to 0.6265 in)
Service limit	15.93 mm (0.627 in)
Master cylinder piston diameter -1100 models	
Standard	15.827 to 15.854 mm (0.6231 to 0.6242 in)
Service limit	15.80 mm (0.622 in)
Slave cylinder bore diameter	
Standard	38.100 to 38.162 mm (1.5000 to 1.5024 in)
Service limit	38.18 mm (1.503 in)
Slave cylinder piston diameter	
Standard	38.036 to 38.075 mm (1.4975 to 1.4990 in)
Service limit	38.02 mm (1.497 in)

Lubrication system

Oil pressure (at switch)	
700/750 models	64 ± 11 psi (4.4 ± 0.8 Bars) at 80°C/176°F
1100 models	71 ± 10 psi (4.9 ± 0.7 Bars) at 80°C/176°F
Oil pump rotor tip-to-outer rotor clearance	
Standard	0.15 mm (0.006 in)
Service limit	0.20 mm (0.008 in)
Oil pump outer rotor-to-body clearance	
Standard	0.15 to 0.22 mm (0.006 to 0.009 in)
Service limit	0.35 mm (0.014 in)

Oil pump rotor endfloat	
Standard	0.02 to 0.07 mm (0.001 to 0.003 in)
Service limit	0.10 mm (0.004 in)

Starter clutch

Driven gear OD - 700/750 models	
Standard	47.175 to 47.200 mm (1.8573 to 1.8583 in)
Service limit	47.16 mm (1.857 in)
Driven gear OD -1100 models	
Standard	54.170 to 54.200 mm (2.1327 to 2.1339 in)
Service limit	54.16 mm (2.132 in)

Cylinder block

Cylinder bore ID	
700/750 models	
Standard	70.000 to 70.015 mm (2.755 to 2.756 in)
Service limit	70.10 mm (2.76 in)
1100 models	
Standard	79.500 to 79.515 mm (3.1299 to 3.1305 in)
Service limit	79.60 mm (3.134 in)
Maximum ovality (out-of-round)	
700/750 models	0.10 mm (0.004 in)
1100 models	0.05 mm (0.002 in)
Maximum taper	0.10 mm (0.004 in)
Cylinder-to-piston clearance	0.010 to 0.055 mm (0.0004 to 0.0022 in)
Service limit	0.10 mm (0.004 in)

Pistons

Piston OD (measured 11 mm up from base of skirt)	
700/750 models	
Standard	69.960 to 69.990 mm (2.754 to 2.755 in)
Service limit	69.85 mm (2.750 in)
1100 models	
Standard	79.460 to 79.490 mm (3.1283 to 3.1295 in)
Service limit	79.35 mm (3.124 in)
Piston pin bore OD	
700/750 models	
Standard	18.002 to 18.008 mm (0.7087 to 0.7090 in)
Service limit	18.10 mm (0.71 in)
1100 models	
Standard	20.002 to 20.008 mm (0.7875 to 0.7877 in)
Service limit	20.06 mm (0.790 in)
Piston pin OD	
700/750 models	
Standard	17.994 to 18.000 mm (0.7084 to 0.7086 in)
Service limit	17.98 mm (0.708 in)
1100 models	
Standard	19.994 to 20.000 mm (0.7872 to 0.7874 in)
Service limit	19.98 mm (0.787 in)
Piston-to-piston pin clearance	
Standard	0.002 to 0.014 mm (0.0001 to 0.0006 in)
Service limit	0.04 mm (0.002 in)

Piston rings

Ring-to-groove clearance (top and second rings)	
Standard	0.015 to 0.045 mm (0.0006 to 0.0018 in)
Service limit	0.10 mm (0.004 in)
Top ring end gap	
Standard	
1982 750 model	0.10 to 0.30 mm (0.004 to 0.012 in)
1983-on 700/750 models	0.15 to 0.30 mm (0.006 to 0.012 in)
1100 models	0.20 to 0.35 mm (0.008 to 0.014 in)
Service limit	0.5 mm (0.02 in)
Second ring end gap	
Standard	
1982 750 model	0.10 to 0.30 mm (0.004 to 0.012 in)
1983-on models	0.20 to 0.35 mm (0.008 to 0.014 in)
Service limit	0.5 mm (0.02 in)

Piston rings (continued)

Oil control ring side rail end gap	
700/750 models	
Standard	0.2 to 0.9 mm (0.008 to 0.035 in)
Service limit	1.1 mm (0.04 in)
1100 models	
Standard	0.2 to 0.7 mm (0.008 to 0.028 in)
Service limit	0.9 mm (0.04 in)

Connecting rods and bearings

Connecting rod side clearance (all models)	
Standard	0.10 to 0.30 mm (0.004 to 0.012 in)
Service limit	0.4 mm (0.016 in)
Connecting rod piston pin bore ID	
700/750 models	
Standard	18.016 to 18.034mm (0.7093 to 0.7100 in)
Service limit	18.08 mm (0.712 in)
1100 models	
Standard	20.016 to 20.034 mm (0.7880 to 0.7887 in)
Service limit	20.08 mm (0.791 in)
Connecting rod crankpin bore ID - 700/750 models	
Size group 1	39.000 to 39.008 mm (1.5354 to 1.5357 in)
Size group 2	39.008 to 39.016 mm (1.5357 to 1.5361 in)
Size group 3	39.016 to 39.024 mm (1.5361 to 1.5364 in)
Connecting rod crankpin bore ID - 1100 models	
Size group 1	43.000 to 43.008 mm (1.6929 to 1.6932 in)
Size group 2	43.008 to 43.016 mm (1.6932 to 1.6935 in)
Crankshaft crankpin OD - 700/750 models	
Size groupA	35.992 to 36.000 mm (1.4170 to 1.4173 in)
Size group B	35.984 to 35.992 mm (1.4167 to 1.4170 in)
Size group C	35.976 to 35.984 mm (1.4164 to 1.4167 in)
Crankshaft crankpin OD -1100 models	
Size group A	39.992 to 40.000 mm (1.5745 to 1.5748 in)
Size group B	39.984 to 39.992 mm (1.5742 to 1.5745 in)
Connecting rod bearing oil clearance (all models)	
Standard	0.028 to 0.052 mm (0.0011 to 0.0020 in)
Service limit	0.08 mm (0.003 in)
Bearing insert thicknesses - 700/750 models	
Blue	1.502 to 1.506 mm (0.0591 to 0.0593 in)
Black	1.498 to 1.502 mm (0.0590 to 0.0591 in)
Brown	1.494 to 1.498 mm (0.0588 to 0.0590 in)
Green	1.490 to 1.494 mm (0.0587 to 0.0588 in)
Yellow	1.486 to 1.490 mm (0.0585 to 0.0587 in)
Bearing insert thicknesses -1100 models	
Brown	1.494 to 1.498 mm (0.0588 to 0.0590 in)
Green	1.490 to 1.494 mm (0.0587 to 0.0588 in)
Yellow	1.486 to 1.490 mm (0.0585 to 0.0587 in)

Crankshaft and main bearings

Maximum crankshaft runout	0.03 mm (0.001 in)
Crankcase main bearing bore ID - 700/750 models	
Size group A	39.000 to 39.008 mm (1.5354 to 1.5357 in)
Size group B	39.008 to 39.016 mm (1.5357 to 1.5361 in)
Size group C	39.016 to 39.024 mm (1.5361 to 1.5364 in)
Crankcase main bearing bore ID -1100 models	
Size group I or 1	43.000 to 43.008 mm (1.6929 to 1.6932 in)
Size group II or 2	43.008 to 43.016 mm (1.6932 to 1.6935 in)
Crankshaft journal OD - 700/750 models	
Size group 1	35.992 to 36.000 mm (1.4170 to 1.4173 in)
Size group 2	35.984 to 35.992 mm (1.4167 to 1.4170 in)
Size group 3	35.976 to 35.984 mm (1.4164 to 1.4167 in)
Crankshaft journal OD -1100 models	
Size group 1	39.992 to 40.000 mm (1.5745 to 1.5748 in)
Size group 2	39.984 to 39.992 mm (1.5742 to 1.5745 in)
Main bearing oil clearance	
Standard	0.028 to 0.052 mm (0.0011 to 0.0020 in)
Service limit (all models)	0.08 mm (0.003 in)

Bearing insert thicknesses - 700/750 models	
Blue	1.506 to 1.510 mm (0.0593 to 0.0594 in)
Black	1.502 to 1.506 mm (0.0591 to 0.0593 in)
Brown	1.498 to 1.502 mm (0.0590 to 0.0591 in)
Green	1.494 to 1.498 mm (0.0588 to 0.0590 in)
Yellow	1.490 to 1.494 mm (0.0587 to 0.0588 in)
Bearing insert thicknesses -1100 models	
Brown	1.498 to 1.502 mm (0.0590 to 0.0591 in)
Green	1.494 to 1.498 mm (0.0588 to 0.0590 in)
Yellow	1.490 to 1.494 mm (0.0587 to 0.0588 in)

Transmission shafts

Ratios	
1st	2.294 to 1
2nd	
1986 1100 Magna	1.667 to 1
All other models	1.619 to 1
3rd	
1986 1100 Magna	1.286to1
All other models	1.292 to 1
4th	1.074 to 1
5th	1.897 to 1
6th (overdrive)	0.750 to 1
Gear backlash (except 1985 through 1988 700/750 Magna models)	
1 st gear	
Standard - 700/750 models	0.089 to 0.170 mm (0.0035 to 0.0066 in)
Standard -1100 models	0.089 to 0.179 mm (0.0035 to 0.0070 in)
Service limit - all models	0.24 mm (0.009 in)
2nd, 3rd, 4th, 5th, 6th gears	
Standard	0.068 to 0.136 mm (0.0027 to 0.0054 in)
Service limit	0.18 mm (0.007 in)
Gear inner diameter - 700/750 models	
M5, M6, C2, C3 gears	
Standard	28.000 to 28.021 mm (1.1024 to 1.1032 in)
Service limit	28.04 mm (1.104 in)
C1 gear	
Standard -1982 through 1986	24.000 to 24.021 mm (0.9449 to 0.9457 in)
Standard - 1987 through 1988	24.007 to 24.028 mm (0.9451 to 0.9459 in)
Service limit	24.04 mm (0.946 in)
C4 gear	
Standard	29.000 to 29.021 mm (1.1417 to 1.1426 in)
Service limit	29.04 mm (1.143 in)
Gear inner diameter -1100 models	
M5, M6, C2, C3, C4 gears	
Standard	31.000 to 31.016 mm (1.2205 to 1.2211 in)
Service limit	31.18 mm (1.228 in)
Gear bushing outer diameter - 700/750 models	
M5, M6, C2, C3 gears	
Standard	27.959 to 27.980 mm (1.1007 to 1.1016 in)
Service limit	27.94 mm (1.100 in)
C1 gear (except 1987 and 1988 models)	
Standard	23.959 to 23.980 mm (0.9433 to 0.9441 in)
Service limit	23.94 mm (0.943 in)
C4 gear	
Standard	28.959 to 28.980 mm (1.1401 to 1.1409 in)
Service limit	28.94 mm (1.139 in)
Gear bushing outer diameter -1100 models	
M5, M6, C2, C3, C4 gears	
Standard	30.950 to 30.975 mm (1.2185 to 1.2195 in)
Service limit	30.93 mm (1.218 in)
Gear bushing inner diameter - 700/750 models	
M5, C4 gears	
Standard	24.985 to 25.006 mm (0.9837 to 0.9845 in)
Service limit	25.04 mm (0.986 in)
C1 gear (except 1987 and 1988 models)	
Standard	20.16 to 20.37 mm (0.7937 to 0.8019 in)
Service limit	20.40 mm (0.803 in)

Transmission shafts (continued)

Gear bushing inner diameter -1100 models	
M5, C4 gears	
Standard	27.995 to 28.016 mm (1.1022 to 1.1030 in)
Service limit	28.05 mm (1.104 in)
Mainshaft outer diameter at M5 gear - 700/750 models	
Standard	24.959 to 24.980 mm (0.9826 to 0.9835 in)
Service limit	24.90 mm (0.980 in)
Countershaft outer diameter - 700/750 models	
At C1 gear	
Standard	19.98 to 19.993 mm (0.7866 to 0.7871 in)
Service limit	19.93 mm (0.785 in)
At C4 gear	
Standard	24.959 to 24.980 mm (0.9826 to 0.9835 in)
Service limit	24.90 mm (0.980 in)
Mainshaft outer diameter at M5 gear and countershaft outer diameter at C4 gear - 1100 models	
Standard	27.977 to 27.990 mm (1.1015 to 1.1020 in)
Service limit	27.92 mm (1.099 in)
Gear to bushing or shaft clearance - 700/750 models	
M5, M6, C1, C2, C3, C4 gears-to-bushing	
Standard	0.020 to 0.062 mm (0.0008 to 0.0024 in)
Service limit	0.10 mm (0.004 in)
M5, C4 bushings-to-shaft	
Standard	0.005 to 0.047 mm (0.0002 to 0.0019 in)
Service limit	0.06 mm (0.002 in)
C1 bushing-to-shaft (except 1987 and 1988 models)	
Standard	0.167 to 0.390 mm (0.0066 to 0.0154 in)
Service limit	0.10 mm (0.004 in)
Gear to bushing or shaft clearance -1100 models	
M5, M6, C2, C3, C4 gears-to-bushing	
Standard	0.025 to 0.066 mm (0.0010 to 0.0026 in)
Service limit	0.10 mm (0.004 in)
M5, C4 bushings-to-shaft	
Standard	0.005 to 0.039 mm (0.0002 to 0.0015 in)
Service limit	0.05 mm (0.002 in)
Countershaft spacer clearance (endfloat)	
700/750 models	0.3 to 0.4 mm (0.012 to 0.016 in)
1100 models	0.4 to 0.9 mm (0.016 to 0.035 in)
Countershaft spacer available thicknesses	
700/750 models except 1985-on Magnas	1.0 mm, 1.2 mm, 1.3 mm
1985 through 1988700/750 Magnas	0.85 mm, 0.90 mm, 0.95 mm, 1.05mm
1100 models	0.85 mm, 0.90 mm, 0.95 mm, 1.0 mm, 1.05 mm

Shift drum and forks

Shift fork end thickness	
Standard	6.43 to 6.50 mm (0.253 to 0.256 in)
Service limit	6.1 mm (0.24 in)
Shift fork bore ID	
Standard -1982 through 1985 models	14.000 to 14.021 mm (0.5511 to 0.5520 in)
Standard - 1986-on models	14.016 to 14.034 mm (0.5518 to 0.5525 in)
Service limit - all models	14.04 mm (0.553 in)
Shift fork shaft OD	
Standard - 1986-on 700/750 models	13.973 to 13.984 mm (0.5501 to 0.5505 in)
Standard - all other models	13.966 to 13.984 mm (0.5498 to 0.5505 in)
Service limit	13.90 mm (0.547 in)

Torque settings

	Mm	ft-ibs
Valve cover bolts	8 to 12	6 to 9.0
Camshaft sprocket bolts	18 to 20	13 to 14
Cylinder head/cam holder bolts		
6 mm	10 to 14	7 to 10
8 mm	21 to 25	15 to 18
9 mm		
1982 through 1984 700/750 models	33 to 37	24 to 27
1985 700 models	38 to 42	27 to 30
1986 through 1988 700/750 models	43 to 47	31 to 34
10 mm (1100 models)	48 to 52	35 to 38
Rocker arm shaft bolts or caps	45 to 50	33 to 36

Torque settings (continued)	Mm	n-ibs
Clutch center locknut		
1982 750 models	47 to 53	34 to 38
1983 through 1985 700/750 Sabres, 1983/84 700/750 Magnas	45 to 55	33 to 40
1985 through 1988 700/750 Magnas	62 to 68	45 to 49
1100 models	63 to 67	46 to 48
Clutch fluid line banjo bolts	25 to 35	18 to 25
Oil pump sprocket bolt (1985 through 1988 700/750 Magnas)	15 to 20	11 to 14
Starter clutch bolt	80 to 100	58 to 72
Starter clutch cover bolts	26 to 30	19 to 22
Alternator rotor bolt	80 to 100	58 to 72
Output gear case bolts		
6 mm bolts	10 to 14	7 to 10
Bearing holder bolts	30 to 34	22 to 25
8 mm standard/socket bolts	21 to 25	14 to 18
Crankcase bolts		
6 mm bolts	10 to 14	7 to 10
8 mm bolts	21 to 25	15 to 18
9 mm bolts (700/750 models)	30 to 34	22 to 25
10 mm bolts (1100 models)	43 to 47	31 to 34
Connecting rod bearing cap nuts	30 to 34	22 to 25
Engine oil drain bolt (in oil pan)	35 to 40	25 to 29
Engine oil drain bolt (in front cylinders)	10 to 14	7 to 10
Oil pressure switch	15 to 20	11 to 14
Engine mounting bolts		
8 mm bolts (1982 through 1986 models	20 to 30	14 to 22
8 mm bolts (1987 and 1988 700/750 models)	24 to 30	17 to 22
10 mm bolts	35 to 45	25 to 33
Subframe bolts (US 700/750 Sabres and 1982 through 1984 700/750 Magna models)		
8 mm bolts	20 to 30	14 to 22
10 mm upper bolts	70 to 80	51 to 58
10 mm lower bolts	30 to 40	22 to 29
Subframe bolts (UK VF750S-C models)		
8 mm bolts	20 to 30	14 to 22
10 mm bolts	60 to 70	43 to 51
Subframe bolts/nuts (1985 through 1988 700/750 Magna models, all 1100 models)		
Upper bolts	60 to 70	43 to 51
Lower bolts	35 to 45	25 to 33

General information

Refer to illustration 1.1

The engine is a four-stroke, liquid-cooled type with its four cylinders arranged in a 90° V configuration. This particular design is inherently smoother in its operation than in-line engines because the movement of the pistons in both cylinder banks tends to dampen out the other's vibrations. It also allows the engine to be designed narrower and more compact **(see illustration).**

To prevent overheating problems in the rear cylinder bank, the engine is liquid cooled. The coolant is circulated through passages surrounding the cylinder liners and valve area.

Dual overhead cams in each cylinder bank are driven off the crankshaft by link plate chains. The cams ride directly in the cylinder heads and are secured by upper cam holders. There are four valves per cylinder, two intake and two exhaust. Each pair of valves is operated by a single forked rocker arm, requiring only one cam lobe for each pair of valves. Each cam chain is kept tight by a self-adjusting tensioner, located between the cylinders within the loop formed by the chain.

The crankcase splits horizontally, and all four cylinders are integrated with the upper crankcase half in a single casting. The crankshaft rides in four plain main bearings and the firing order is determined by the position of the connecting rods on the crank.

The multi-plate clutch is hydraulically operated using a master cylinder mounted on the handlebars and a slave cylinder on the left side of the engine. All 1100 cc models and the 1983 VF750 Sabre are fitted with a diaphragm spring instead of the coil springs of the other models and also feature a one-way clutch unit. The one-way clutch is essentially a two-piece clutch center with a locking device and prevents rear wheel lockup under severe down shifting or engine braking conditions, by allowing the inner clutch plates to slip.

The 6-speed transmission is a traditional constant-mesh type incorporating an output gear assembly, driven off the countershaft, which transmits drive via the shaft to the rear wheel.

2 Operations possible with the engine in the frame

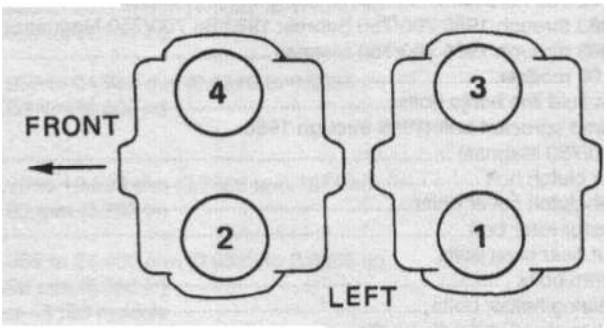
The components and assemblies listed below can be removed without having to remove the engine/transmission assembly from the frame. If however, a number of areas require attention at the same time, removal of the engine is recommended.

Valve cover, camshafts and rocker arms
Cylinder heads
Cam chain (ens/oners
Gearshift mechanism external components
Oil pump, relief valve and strainer
Clutch
Starter clutch
Starter motor
Alternator
Water pump

3 Operations requiring engine removal

It is necessary to remove the engine/transmission assembly from the frame, remove the output gear case and separate the crankcase halves to gain access to the following components.

Crankshaft
Main and connecting rod bearings
Pistons and connecting rods
Camshaft drive chains
Transmission shafts/gears
Shift drum/shift forks



1.1 Cylinder identification

4 Major engine repair - general note

1 It is not always easy to determine when or if an engine should be completely overhauled, as a number of factors must be considered.

2 High mileage is not necessarily an indication that an overhaul is needed, while low mileage, on the other hand, does not preclude the need for an overhaul. Frequency of servicing is probably the single most important consideration. An engine that has regular and frequent oil and filter changes, as well as other required maintenance, will most likely give many miles of reliable service. Conversely, a neglected engine, or one which has not been broken in properly, may require an overhaul very early in its life.

3 Exhaust smoke and excessive oil consumption are both indications that piston rings and/or valve guides are in need of attention, although make sure that the fault is not due to oil leakage. Refer to Chapter 1 and perform a cylinder compression check to determine for certain the nature and extent of the work required.

4 If the engine is making obvious knocking or rumbling noises, the connecting rod and/or main bearings are probably at fault.

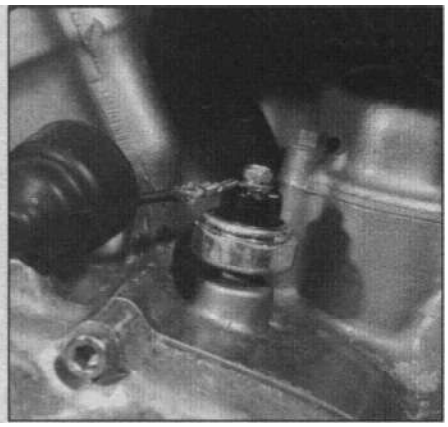
5 Loss of power, rough running, excessive valve train noise and high fuel consumption rates may also point to the need for an overhaul, especially if they are all present at the same time. If a complete tune-up does not remedy the situation, major mechanical work is the only solution.

6 An engine overhaul generally involves restoring the internal parts to the specifications of a new engine. During an overhaul the piston rings are replaced and the cylinder walls are bored and/or honed. If a rebore is done, then new pistons will also be required. The main and connecting rod bearings are usually replaced during a major overhaul. Generally the valve seats are serviced as well, since they are usually in less than perfect condition at this point. While the engine is being overhauled, other components such as the carburetors and the starter motor can also be rebuilt. The end result should be a like new engine that will give as many trouble-free miles as the original.

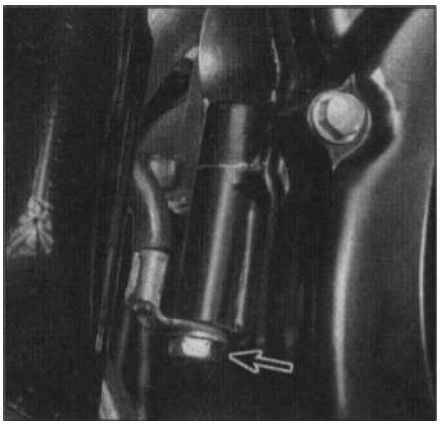
7 Before beginning the engine overhaul, read through the related procedures to familiarize yourself with the scope and requirements of the job. Overhauling an engine is not all that difficult, but it is time consuming. Plan on the motorcycle being tied up for a minimum of two weeks. Check on the availability of parts and make sure that any necessary special tools, equipment and supplies are obtained in advance.

8 Most work can be done with typical shop hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be replaced. Often a dealer service department or motorcycle repair shop will handle the inspection of parts and offer advice concerning reconditioning and replacement. As a general rule, time is the primary cost of an overhaul so it does not pay to install worn or substandard parts.

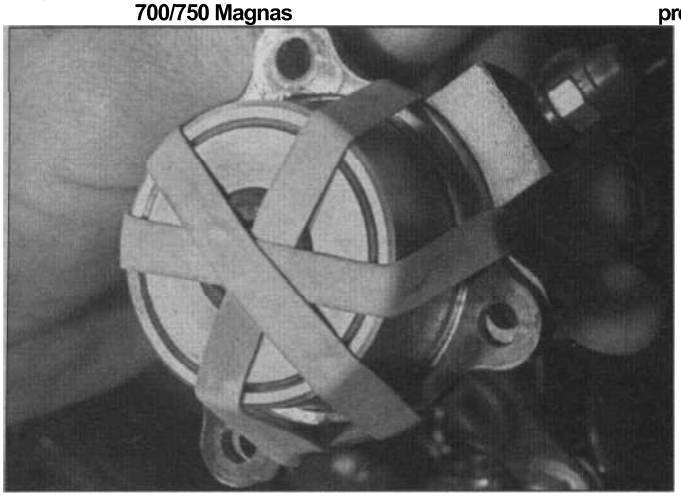
5.5 Engine left side rear cover is retained by three bolts on 1100 models and later 700/750 Magnas



5.15 Peel back its rubber cover and disconnect the wire from the oil pressure switch



5.16 Battery ground (earth) cable connection



5.17 Retain clutch slave cylinder piston with strong rubber bands

9 As a final note, to ensure maximum life and minimum trouble from a rebuilt engine, everything must be assembled with care in a spotlessly clean environment.

5 Engine - removal and installation

Note: *Engine removal and installation should be carried out ith the aid of an assistant; personal injury or damage could occur if the engine falls or is dropped. An hydraulic floor-type jack should be used to support and lower the engine to the floor if possible (they can be rented at low cost).*

Removal

Refer to illustrations 5.5, 5.15, 5.16, 5.17, 5.21, 5.22, 5.23a, 5.23b and 5.23c

1 Place the motorcycle on the main stand. On 1987 and 1988 700/750 Magnas (without a main stand), first remove the belly fairing (see Chapter 6), then support the machine with an auxiliary motorcycle stand to ensure it will not topple when the engine unit is removed.

2 Remove the seat (see Chapter 6) and main fuel tank (see Chapter 4).

3 Remove both the left and right side covers (see Chapter 6). Disconnect the negative battery lead.

4 Drain the engine oil (see Chapter 1).

5 Remove the engine left rear cover; it is retained by a single bolt on all 700/750 Sabre models and 1982 through 1984 700/750 Magna models (note the long collar inside the cover) and by three bolts on all 1100 models and 1985-on 700/750 Magna models **(see illustration).** Remove the gearshift lever and linkage (see Section 18).

6 Drain the coolant (see Chapter 1), then remove the water hose that runs between the water pump and subframe.

7 Remove the radiator (see Chapter 3).

8 Remove the exhaust pipes (see Chapter 4). **Note:** *The two rear head pipes need not be removed.*

9 Remove the air filter housing(s) and carburetors (see Chapter 4).

10 On 1984-on California models, detach the emission control system canister from the front lower frame brace.

11 On 1986 California models, detach the secondary air supply system reed valve blocks from each side of the rear cylinder bank. On 1986 through 1988 700/750 California models, detach the secondary air supply system air suction valve from the front of the oil pan.

12 Remove the thermostat and its housing (see Chapter 3).

13 Disconnect the crankcase breather tube from the air chamber/air filter housing, then disconnect its lower end from the rear of the crankcase.

14 On 1987 and 1988 700/750 Magna models, release the rear brake switch from its bracket on the engine right cover (see Chapter 8).

15 Pull the spark plug caps off the spark plugs and tie them to the frame top tubes. Disconnect the wiring harness that leads to the following components:

a) *Oil pressure switch* **(see illustration).**
b) *Pulse generators.*
c) *Alternator.*
d) *Starter motor.*
e) *Gearchange switch or neutral/OD switch (as applicable).*

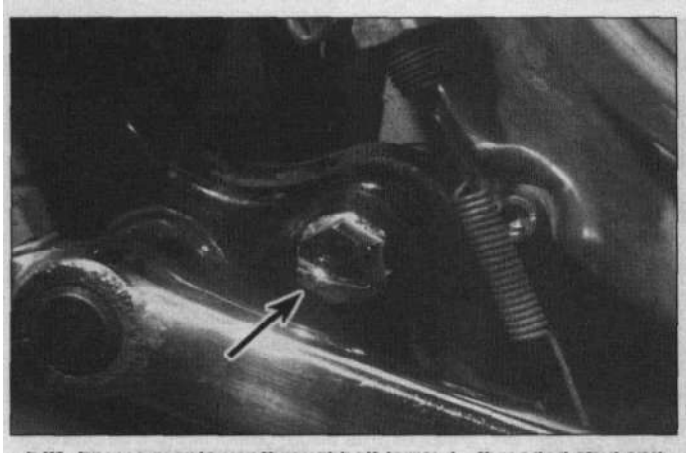
16 Disconnect the battery ground (earth) cable where it attaches to the engine, directly in front of the right swingarm pivot **(see illustration).**

17 Without disconnecting the clutch fluid line, remove the clutch slave cylinder from the engine. Once removed, the clutch lever should not be applied. To ensure this, place a wooden block between the lever and the handlebar grip and tie the lever tight to the block. Also, wrap strong rubber bands around the slave cylinder housing and piston to make sure the piston does not come out **(see illustration).**

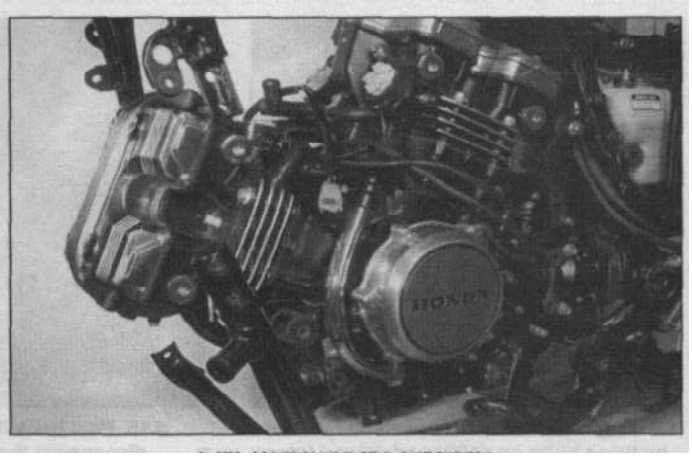
18 Remove the rear wheel and disconnect the driveshaft from the gearcase (see Chapter 6).

19 Position a jack under the engine oil pan; this will be used to support the engine once the mounting bolts have been removed. **Note:** *A piece of wood should be used between the jack and the oil pan to protect it and give a better grip.*

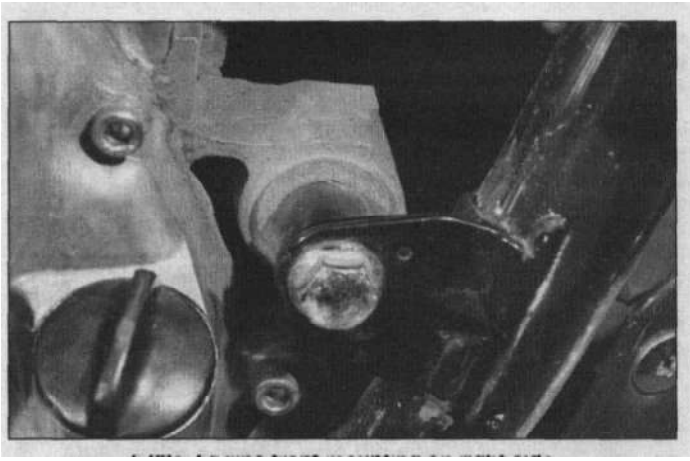
20 Remove the left footpeg (see Chapter 6). On 1100 Sabre models, also remove the rear brake pedal from its shaft.



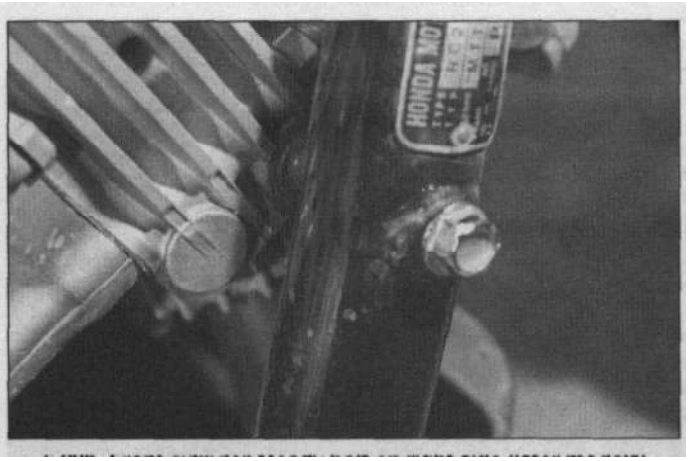
5.21 Engine rear lower throughbolt (arrow) - threaded stud and nuts on some models



5.22 Removing the subframe



5.23a Engine front mounting on right side



5.23b Front cylinder steady bolt on right side (later models)

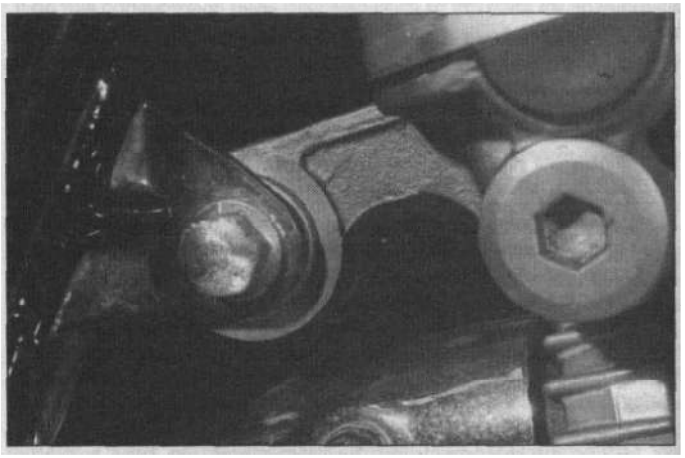
21 Remove the engine rear lower throughbolt or threaded stud and nuts (as applicable) **(see illustration).**

22 Remove the subframe-to-engine mounting bolt on the left side and then remove the subframe-to-main frame mounting bolts and remove the subframe **(see illustration).**

23 Raise the jack just enough to take the weight off the remaining engine mounting bolts and then remove them **(see illustrations). Note:** *You should have an assistant on hand to help you balance the engine on the jac hile these last two mounting bolts are removed.* Take note of the position of all collars, wire clamps and washers so that they can be returned to their original positions on installation.

24 The engine can now be lowered on the jack and removed from the left side of the frame. **Note:** *Lower the jack slowly and carefully and check all clearances as the engine is lowered. The engine may have to be pivoted slightly on the jack to clear the frame tubes.*

25 Remove any engine mount rubbers or bushings. Inspect them for wear or damage and replace them if necessary.



5.23c Engine rear upper throughbolt

Installation

26 Installation of the engine is essentially the reverse of the removal procedure, with the following notes:

a) When installing the engine in the frame, use the jack to align the mounting bolt holes to prevent damage to the bolt threads. Install all engine mounting bolts loosely until the subframe bolts are tightened. Then tighten all engine mounting bolts to their proper torque.

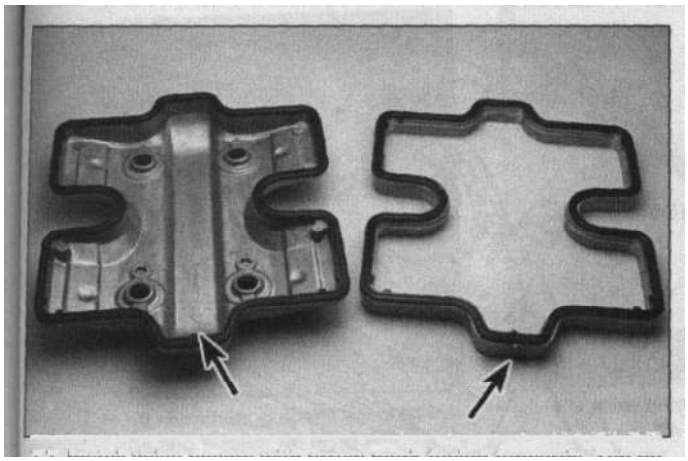
b) When installing components, be sure to refer to the appropriate Section or Chapter for the proper installation procedure.

c) Following installation, fill the crankcase with the proper amount and grade of oil (see Chapter 1).

d) Fill the cooling system with fresh coolant and bleed it of air (see Chapter 1).

e) Adjust the throttle cables and idle speed (see Chapter 1).

f) Set the cho e cable freeplay (see Chapter 4).



7.7 Install valve covers with arrow mark facing forwards. Tab on rear cover base must also face forwards

6 Engine disassembly and reassembly - general information

Note: *Refer to the 'Maintenance techniques, tools and working facilities' in the Introductory pages of this manual for further information.*

Disassembly

Before disassembling the engine, the external surfaces of the unit should be thoroughly cleaned and degreased. This will prevent contamination of the engine internals, and will also make working a lot easier and cleaner. A high flash-point solvent, such as kerosene (paraffin) can be used, or better still, a proprietary engine degreaser. Use old paintbrushes and toothbrushes to work the solvent into the various recesses of the engine casings. Take care to exclude solvent or water from the electrical components and intake and exhaust ports. **Warning:** *The use of gasoline (petrol) as a cleaning agent should be avoided because of the risk of fire.*

2 When clean and dry, arrange the unit on the workbench, leaving a suitable clear area for working. Gather a selection of small containers and plastic bags so that parts can be grouped together in an easily identifiable manner. Some paper and a pen should be on hand to permit notes to be made and labels attached where necessary. A supply of clean shop towels is also required.

3 Before commencing work, read through the appropriate section so that some idea of the necessary procedure can be gained. When removing various engine components it should be noted that great force is seldom required, unless specified. In many cases, a component's reluctance to be removed is indicative of an incorrect approach or removal method. If in any doubt, re-check with the text.

4 When disassembling the engine, keep "mated" parts together (including gears, cylinders, pistons, valves, etc. that have been in contact with each other during engine operation). These 'mated' parts must be re-used or replaced as an assembly.

5 Engine/transmission disassembly should be done in the following general order with reference to the appropriate Sections.

Remove the valve covers (see Section 7)
Remove the camchain tensioners (see Section 8)
Remove the camshafts (see Section 9)
Remove the cylinder heads (see Section 10)
Remove the starter motor (see Chapter 8
Remove the ignition pulse generators (see Chapter 5)
Remove the starter clutch (see Section 13)
Remove the clutch (see Section 14)
Remove the e ternal gearshift components (see Section 17)
Remove the alternator rotor and stator (see Section 19)
Remove the water pump see Chapters)
Remove the oil pan and oil pump (see Sections 20 and 21)
Remove the output gear case (see Section 23)
Separate the crankcases (see Section 24)
Remove the crankshaft (see Section 28)
Remove the pistons and connecting rods (see Section 29)
Remove the transmission shafts (see Section 31)
Remove the shift drum and for s (see Section 32)

Reassembly

6 Reassembly is accomplished by reversing the general disassembly sequence.

7 Valve covers - removal and installation

Note: *The valve covers can be removed with the engine in the frame. If the engine has been removed, ignore the steps which do not apply.*

Removal

1 Place the motorcycle its stand, then remove the seat and both side covers.

2 Remove the fuel tank (see Chapter 4).

3 Drain the coolant and remove the radiator as described in Chapter 3. This is necessary to gain access to the front cylinder valve cover. **Note:** *The coolant can be re-used if it is drained into a clean container.*

4 On models where the ignition HT coils are mounted across the frame top tubes, and therefore prevent access to the rear cylinder, remove them and the plastic heat shield (see Chapter 5). Also release any wiring ties to improve access to the valve covers.

5 Remove all four spark plugs.

6 Remove all valve cover bolts from both cylinder banks and lift off both of the valve covers, plus the valve cover base from the rear cylinder.

Installation

Refer to illustration 7.7

7 Make sure the gasket surfaces of the cylinder head and the valve covers are clean. If the valve cover seal is damaged in any way replace it. Apply a smear of sealant to the cover seal and on 1987 and 1988 700/750 Magna models also to the half circle projections, then carefully install the covers. The valve covers should be installed with the cast arrow marks on the inside of the covers facing forward. Also, the cover base for the rear valve cover should be installed with the mark and the tab on the gasket to the front **(see illustration).**

8 Install the spark plugs, plastic heat shield, HT coils, wiring harness ties, radiator, fuel tank, side covers and seat.

9 Refill and bleed the cooling system as described in Chapter 1.

10 Start the engine and check that there are no oil leaks around the valve covers.

8 Camchain tensioner and guides - removal and installation

Note: *The camchain tensioner and guides can be removed with the engine in the frame.*

Note: *Be especially careful not to drop any parts into the crankcase. The minimal amount of work necessary to retrieve dropped parts will be removal of the oil pan and at worst separation of the crankcases.*

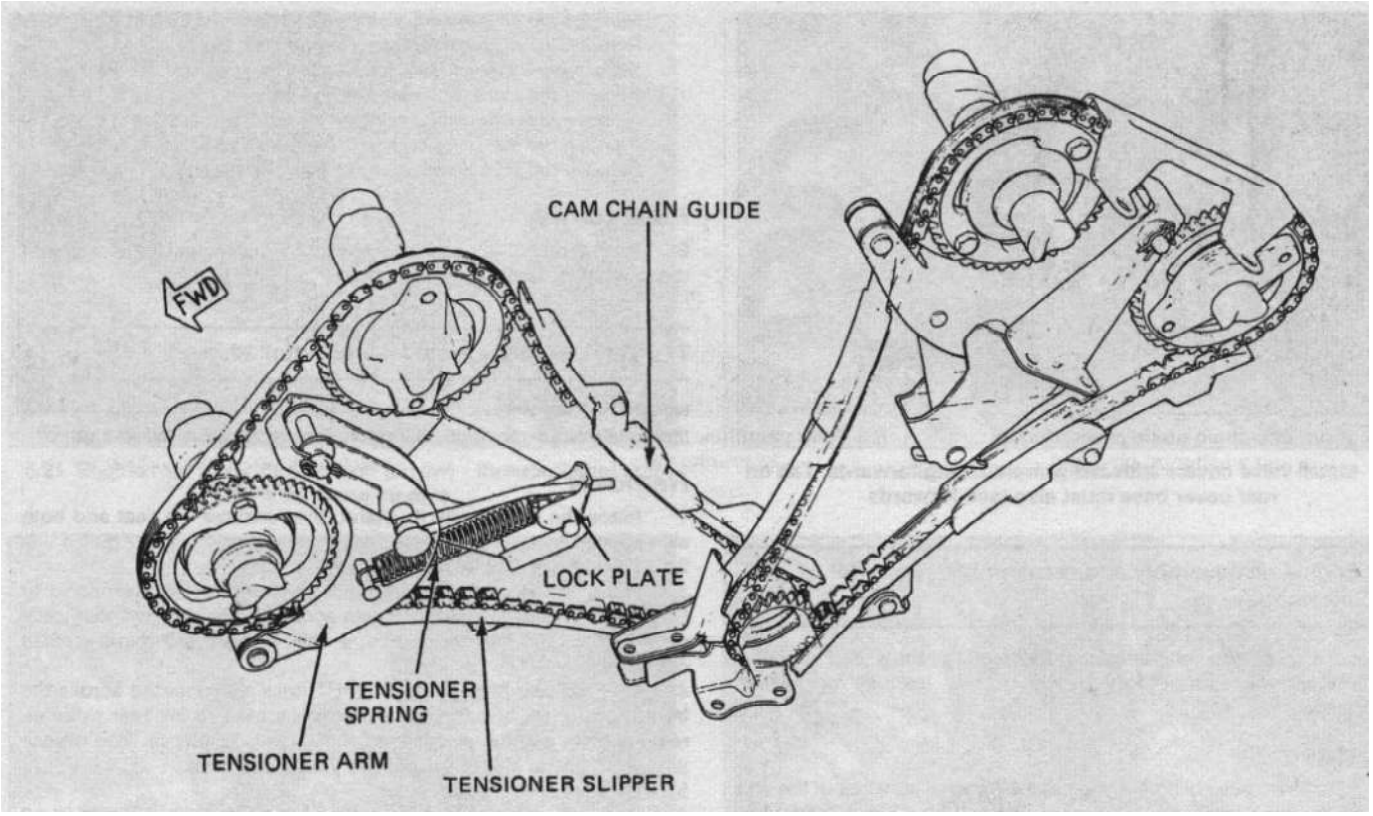
Removal

Cam chain tensioners and slippers

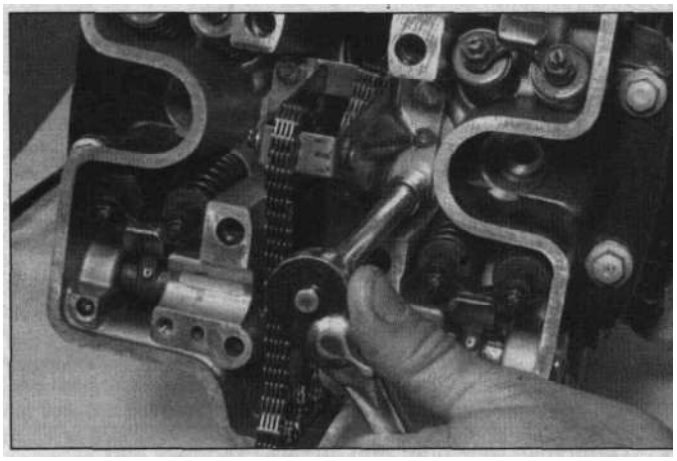
Refer to illustrations 8.2a, 8.2b and 8.2c

1 Follow Steps 1 to 14 of Section 9 to remove the camshafts.

2 Remove the cam chain tensioner base bolts and pull the tensioner base up. Then remove the clip and clevis pin that attaches the



8.2a Camchain and tensioner assembly



8.2b Remove tensioner base bolts to free it from the head ... tensioner arm to the slipper (see illustrations). Lift out the base, complete with tensioner arm.

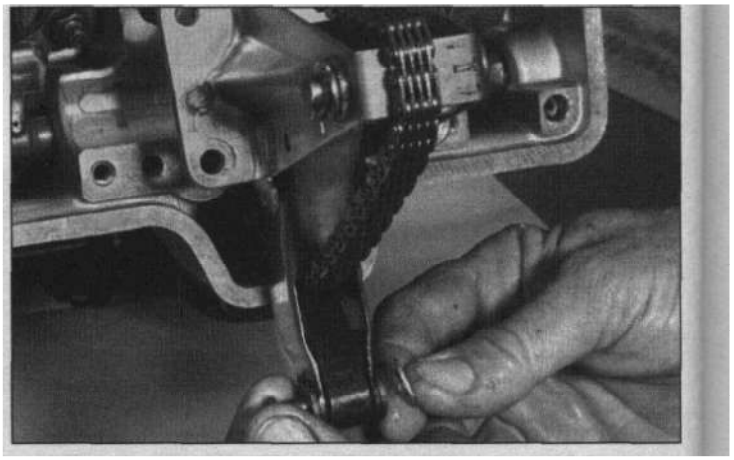
3 Gently pull the slipper out of its support in the crankcase.

Cam chain guides and slipper supports

Refer to *illustrations 8.5, 8.6 and 8.7*

4 Remove the cylinder heads (see Section 10).

5 The front cylinder bank chain guide is slipped over a pivot pin on the cavity wall and secured with a wire clip (see illustration). Insert a hooked piece of wire through the clip to keep it from falling and then push the clip out from the other side using a screwdriver. Carefully reach in and remove the washer from the pivot pin. Remove the guide from the pivot pin and lift it out.



8.2c ... then release slipper from tensioner arm

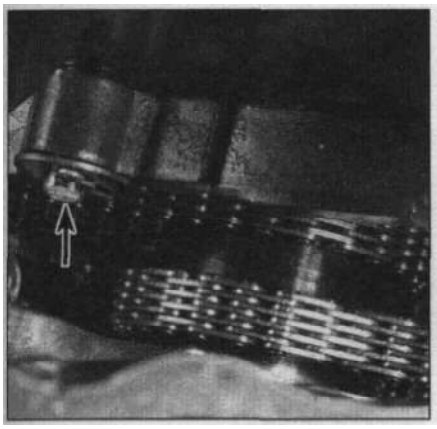
6 The rear cylinder bank chain guide is held by two mounting bolts. Slowly unscrew the bolts while lifting up on the guide to keep tension on the bolts. When the bolts are completely unscrewed, carefully lift the guide, with bolts, out of the cylinder cavity (see illustration).

7 The slipper support holders are also located in the crankcase cavity. Carefully loosen their mounting bolts until they are completely unscrewed, then use needle-nose pliers to pick the bolts and supports out (see illustration).

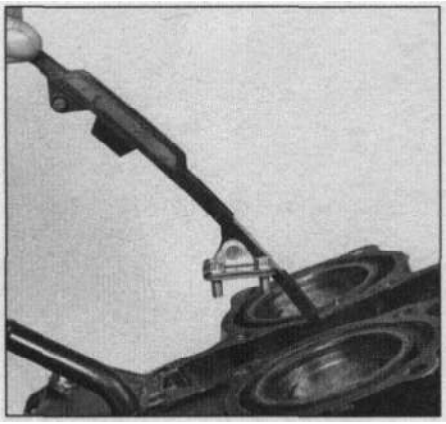
Installation

Cam chain guides and slipper supports

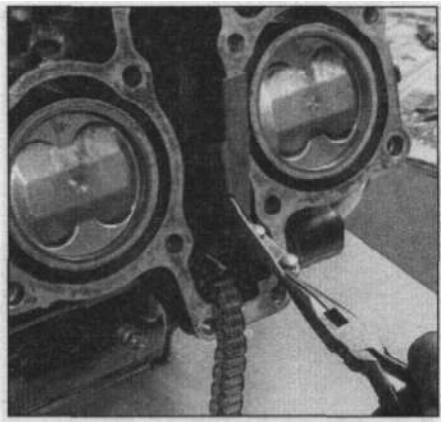
8 Apply thread locking agent to the slipper support holder bolts and insert them into the holder. Use needle-nose pliers to install the holder



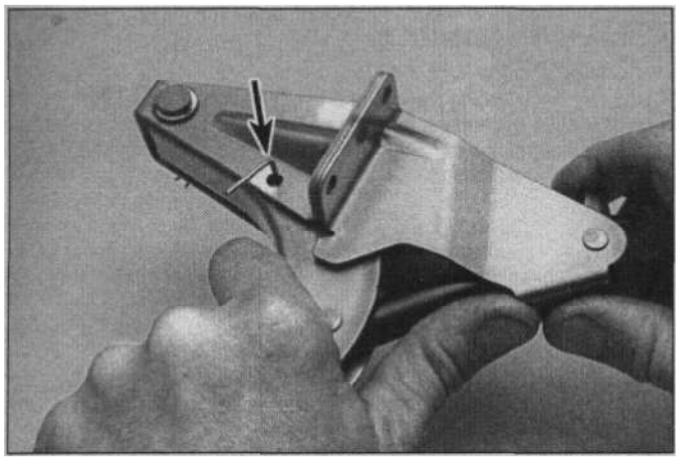
8.5 Front camchain guide is secured by clip and washer on pivot pin



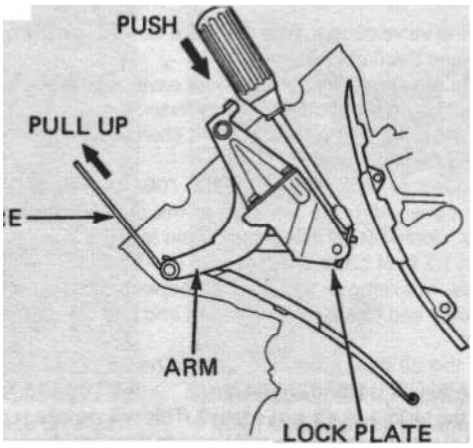
8.6 Rear camchain guide is bolted to crankcase



8.7 Pick slipper support holders out of crankcase once their bolts have been removed



8.13 Camchain pensioner locked in the Off position



8.16 Method of unlocking camchain tensioner

into place in the crankcase cavity. The bolts are most easily tightened using a socket with a swivel joint, while keeping the holder raised slightly to prevent the bolts from falling out.

9 Install the front cylinder bank chain guide onto the pivot pin. Carefully slip the washer over the pin. Then, again with a piece of hooked wire inserted through the clip, lower it into the cavity, set it in its hole and push it through with a screwdriver. Disconnect the wire from the clip.

10 Apply thread locking agent to the rear cylinder bank guide bolts and insert them into place on the guide. Then carefully lower the guide into place in the cavity. Tighten the bolts while keeping the guide raised slightly to prevent them from dropping out.

11 Install the cylinder heads.

Cam chain tensioners and slippers

Refer to illustrations 8.13 and 8.16

12 Insert the slipper's rounded end into the slipper holder in the crankcase. **Caution:** *The slipper end must be slotted into the holder (use a hand-held flashlight to check this) otherwise it will not be properly secured and engine damage will result.*

13 The cam chain tensioner should be locked to keep tension off the chain during installation of the camshafts and subsequent valve timing. A plate at the bottom of the tensioner rod locks the rod in place. Release this plate so the tensioner arm can be raised enough to insert a lock pin or piece of wire through the aligned holes in the arm and base **(see illustration).** This will keep the tensioner locked in the off position.

14 Place the tensioner base into position in the cylinder head and thread the chain over it. Do not install the tensioner base bolts yet. Attach the slipper to the tensioner with the clevis pin and clip.

15 Refit the camshafts and oil pipe (see Section 9).

16 Unlock the tensioner by holding pressure on the tensioner lock plate with a screwdriver, then pull up on the tensioner arm and remove the lock pin or piece of wire **(see illustration).** Slowly let the arm pull itself back into the cavity. After unlocking the tensioner, install and tighten the tensioner base bolts. Install the tensioner top guide.

17 Remove any rags from the cylinder head and install all components in a reverse of the removal procedure. Check the oil level and top up if necessary and set the valve clearances (see Chapter 1). Top up the coolant (see Chapter 1).

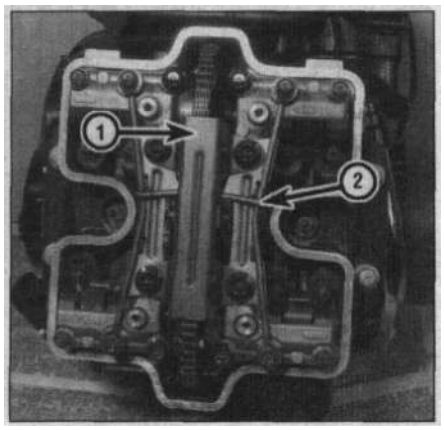
9 Camshaft and rocker arms - removal, inspection and installation

Note: *This procedure can be carried out with the engine in the frame. If the engine has been removed, ignore the steps which don't apply.*

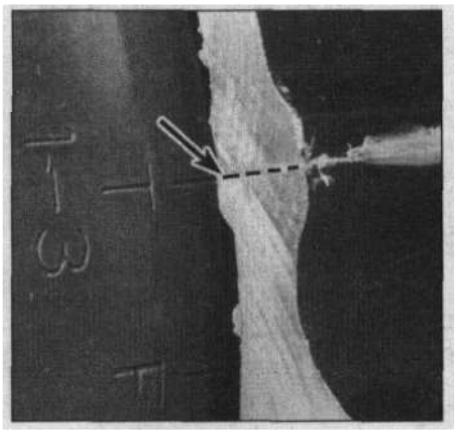
Camshaft removal

Refer to illustrations 9.4, 9.8a and 9.8b

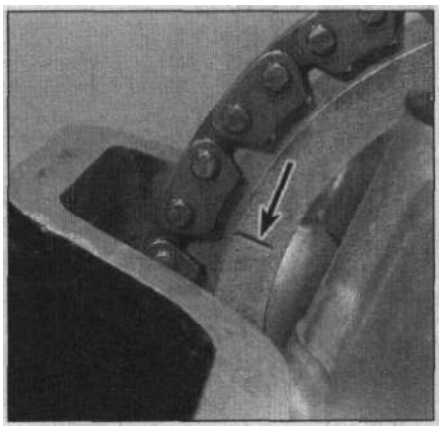
1 Drain the engine oil from the front cylinder head by removing the
front cylinder bank drain bolt (see Chapter 1 *'Engine oil and filter change').*



9.4 Camchain tensioner guide (1) is retained by four bolts. Note oil pipe (2)



9.8a With alternator T1.3 mark aligned with crankcase mating surface (all except 1987/88 models)...



9.8b ... both cam sprocket alignment marks should align with head surface

2 Remove the valve covers, plus the valve cover base from the rear cylinder bank (see Section 7).

3 Stuff clean rags down into the cylinder cavities to prevent bolts or other parts from being dropped into the cylinder.

4 Remove the bolts that retain the cam chain tensioner guide and lift the guide out **(see illustration).**

5 On all models except 1987 and 1988 700/750 Magnas, remove the alternator cover from the left side of the engine and rotate the alternator rotor clockwise until the cam chain is at its loosest point; it will have about 1/2 in of slack. Do the same on 1987 and 1988 700/750 Magna models, but remove the circular inspection cover set in the engine right cover and rotate the crankshaft end bolt counterclockwise (anticlockwise).

6 Remove the oil pipe mounting bolts. The oil pipe can now be removed by passing it under the cam chain.

7 Back off the valve adjustment screws. This will release tension on the camshafts during disassembly and prevent possible damage to the cam holders.

8 On all except 1987 and 1988 700/750 Magna models, rotate the alternator rotor until the T1.3 mark is aligned with the rear crankcase mating surface. On 1987 and 1988 700/750 Magna models, rotate the starter clutch bolt until the T1.3 mark aligns with the punch mark on the inspection cover aperture. In this position, the index marks on the camshaft sprockets should be in alignment with the top surface of the cylinder heads **(see illustrations).**

Note: *On early engines (circa 1982/83) the valve timing index marks were incorrectly marked on the front cylinder camshaft sprockets. It is recommended that you check the accuracy of these marks at this stage; if they do not exist, mark the sprockets level with the cylinder head surface using a fine-tipped felt marker to serve as a guide to reassembly.*

9 Remove the exposed cam sprocket mounting bolts. Then rotate the engine one complete turn until the T1.3 mark is again aligned and remove the other cam sprocket bolts. **Note:** *Take care that the cam chain in the opposite cylinder does not bind while rotating the crankshaft.*

10 Lift the cam sprockets off the camshaft shoulders and disengage the camchain from them.

11 Before removing the cam holders, mark their top surfaces with a felt marker pen for identification (eg, 1E to denote cylinder no. 1 exhaust cam holder).

12 Loosen the cam holder bolts evenly in a criss-cross sequence to prevent distortion, then lift off the holders. Retrieve the dowels if they are loose - on later models they are pressed into the holders.

13 Lift the camshafts out and remove the sprockets from them. Support the camchain over the tensioner.

14 Clean all of the parts with solvent and dry them thoroughly.

Camshaft inspection

Refer to illustrations 9.15, 9.16,9.17, 9.21 a, 9.21 b, 9.23 and 9.24 **Note:** *Before replacing the camshafts or the cylinder head and bearing caps because of damage, check with local machine shops speciali ing in motorcycle engineering work. In the case of the camshafts, it may be possible for cam lobes to be welded, reground and hardened, at a cost far lower than that of a new camshaft. If the bearing surfaces in the cylinder head are damaged, it may be possible for them to be bored out to accept bearing inserts. Due to the cost of a new cylinder head it is recommended that all options be explored before condemning it as trash!*

15 Inspect the cam bearing surfaces of the head and the bearing caps. Look for score marks, deep scratches and evidence of spalling (a pitted appearance). Check the camshaft lobes for heat discoloration (blue appearance), score marks, chipped areas, flat spots and spalling **(see illustration).**

16 Camshaft runout can be checked by supporting each end of the camshaft on V-blocks, and measuring any runout using a dial gauge **(see illustration).** If the runout exceeds the specified limit the camshaft must be replaced.

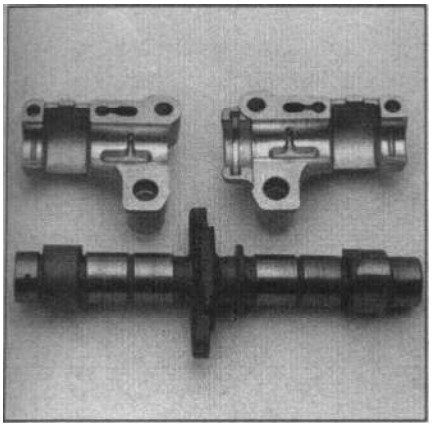
17 Measure the height of each lobe with a micrometer **(see illustration)** and compare the results to the lobe height service limit listed in this Chapter's Specifications. If damage is noted or wear is excessive, the camshaft must be replaced.

18 The camshaft bearing oil clearance is checked either by a product known as Plastigage or by direct measurement, depending on the model being worked on. If working on a 1986 through 1988 700/750 Magna model check by direct measurement (see Steps 19 and 24), and on all other models check using Plastigage (see Steps 20 through 24).

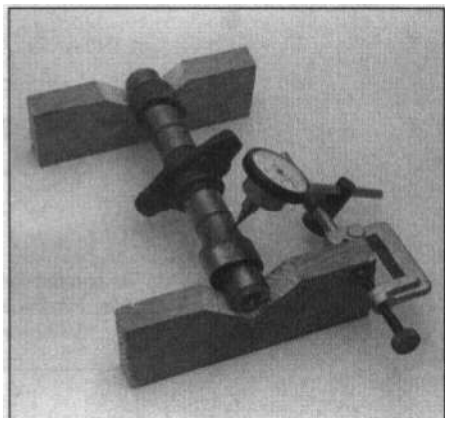
19 To check by direct measurement you will need a small hole gauge type micrometer. Fit the bearing holders to the head in their correct positions (do not install the camshafts). Tighten the retaining bolts to the specified torque in a criss-cross pattern. Measure the internal diameter of each bearing cap journal and compare the measurements obtained with the service limit given in the Specifications at the start of this Chapter. If any bore is worn beyond the service limit, the cylinder head and bearing holders must be repaired/replaced. The camshaft bearing oil clearance can then calculated by subtracting the camshaft bearing journal diameter from the bearing cap journal diameter (see Step 24).

20 If using Plastigage first clean the camshafts, the bearing surfaces in the cylinder head and the bearing holders with a clean, lint-free cloth, then lay the camshafts in place in the cylinder head.

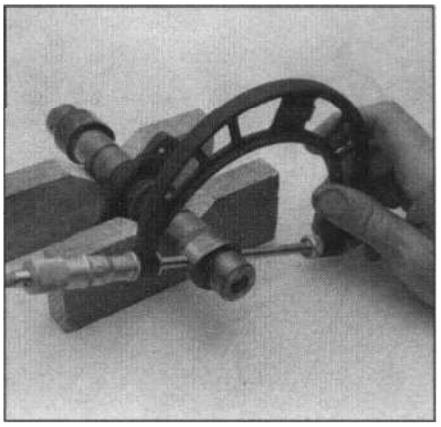
21 Cut strips of Plastigage and lay one piece on each bearing journal, parallel with the camshaft centerline. Make sure the dowels are installed in the cam holders and fit them in their proper positions;



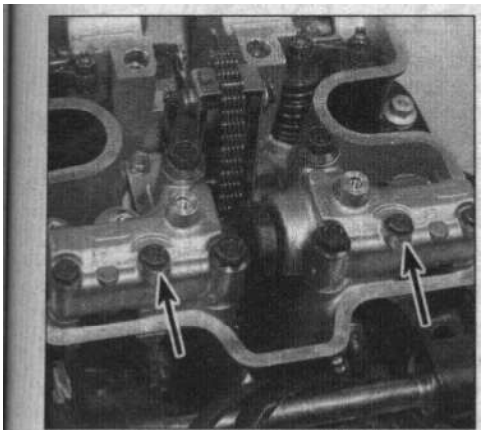
9.15 Check the cam bearing surfaces and camshaft for wear or damage



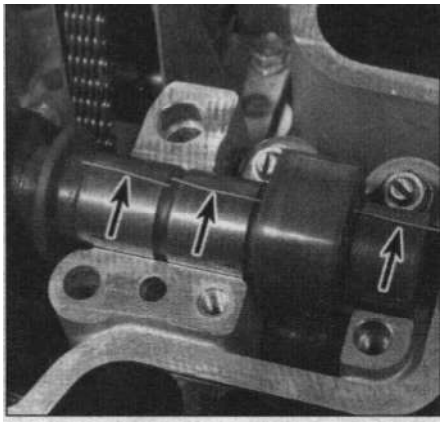
9.16 Measuring camshaft runout



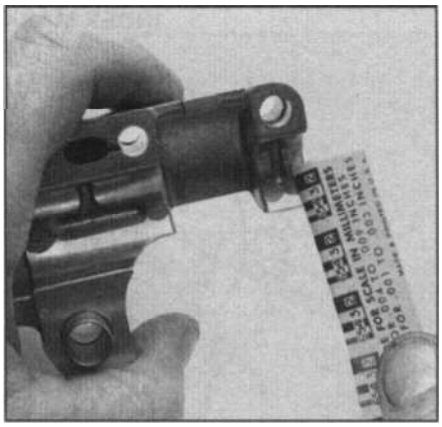
9.17 Measuring camshaft lobe height



9.21a Use shorter 6 mm bolts (arrows) in place of the oil pipe bolts when checking bearing oil clearance



9.21b Lay a strip of Plastigage on each camshaft journal



9.23 Measure the crushed Plastigage against the scale on the envelope

substitute shorter 6 mm bolts in place of the oil pipe mounting bolts when measuring the oil clearance **(see illustrations).** Ensuring the camshafts are not rotated at all, tighten the cam holder bolts to the specified torque in a criss-cross pattern.

22 Now unscrew the bolts in a criss-cross pattern and carefully lift off the cam holders, again making sure the camshafts are not rotated.

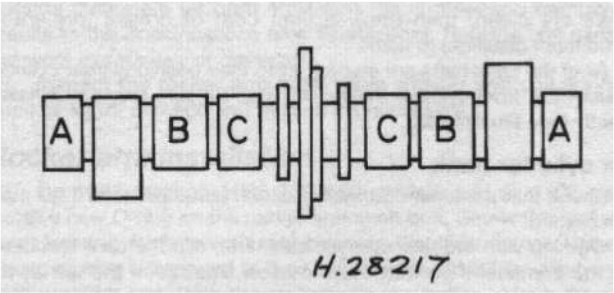
23 To determine the oil clearance, compare the crushed Plastigage (at its widest point) on each journal to the scale printed on the Plastigage container **(see illustration).**

24 Compare the results to this Chapter's Specifications. If the oil clearance is greater than specified, measure the diameter of the camshaft bearing journal with a micrometer **(see illustration).** If the journal diameter is less than the specified limit, replace the camshaft with a new one and recheck the clearance. If the clearance is still too great, replace the cylinder head and cam holders with new parts (see the Note at the start of this sub-Section). On early models the manufacturer does not specify a figure for camshaft journal wear; if the oil clearance is too great the camshafts must be replaced, and if still too great the cylinder head and cam holders must also be replaced.

25 Except in cases of oil starvation, the camchain wears very little. If the camchain has stretched excessively, which makes it difficult to maintain proper tension, remove and measure it as described in Section 26.

26 Check the sprockets for wear, cracks and other damage, replacing them if necessary. If the sprockets are worn, the camchain is also worn, and also the sprocket on the crankshaft. If wear this severe is apparent the camchain and all sprockets should be replaced.

27 Refer to Section 26 and examine the camchain guides for wear.



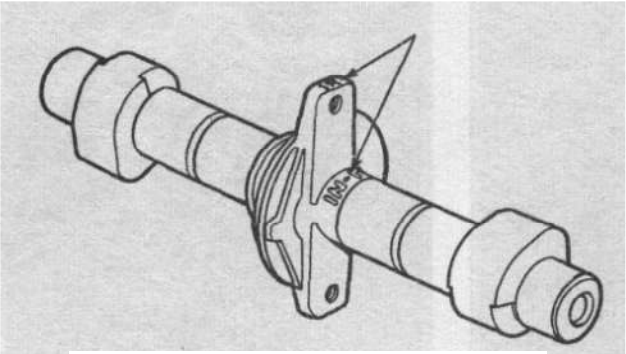
9.24 Camshaft journal identification for diameter measurement • 1986 through 1988 700/750 Magna models

A Outer journal **(see Specifications)**
B Center journal *C Inner journal (nearest sproc et)*

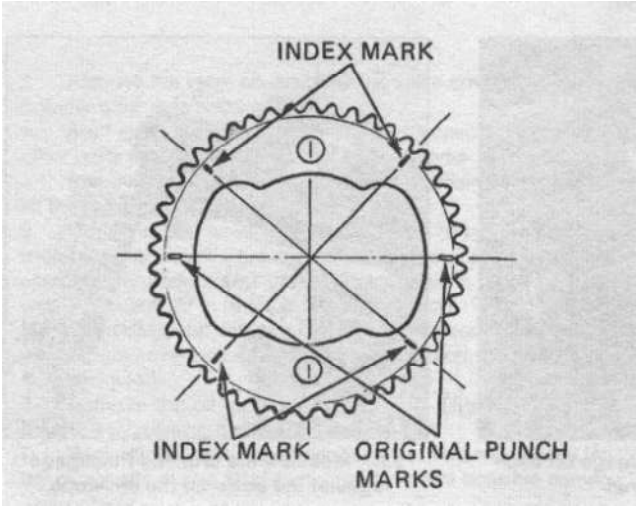
Camshaft installation

Refer to illustrations 9.29, 9.32, 9.36 and 9.38

Note: *If there is insufficient slack in the camchain to allow the sprockets to be mounted on the camshafts, refer to Section 8 and loc the tensioner in position.*



9.29 Location of camshaft identification markings

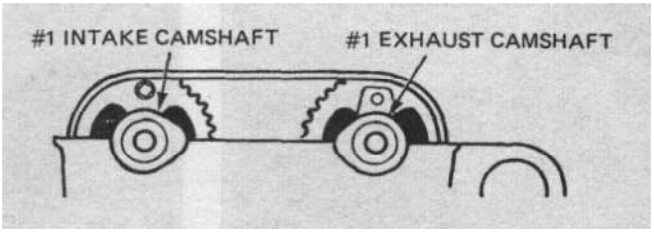


9.36 New front cylinder camshaft sprocket index marks (1982/83 models)

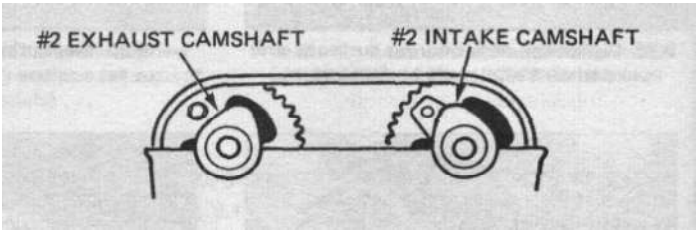
28 Make sure the bearing surfaces in the cylinder head and cam holders are clean, then apply a light coat of grease (preferably molybdenum disulfide) to them.
29 All of the camshafts are marked as to their positions (rear cylinder exhaust - ER, front cylinder intake - IF, etc). Be sure they are installed correctly **(see illustration).**

Rear cylinder bank

30 Check that the alternator/starter clutch (as applicable) T1.3 mark is still aligned.
31 Working with the rear cylinder bank first, slip the cam sprockets onto the camshafts so that their marked sides face the left of the engine. The inlet camshaft sprocket should be on the left side of its camshaft boss, and the exhaust sprocket on the right side of its camshaft boss.
32 Carefully pass the camshafts through the camchain and into position in the cylinder head bearing surfaces. On all 700/750 Sabres and 1982 through 1984 700/750 Magnas they should be positioned so the number 1 cylinder's lobes are parallel with the head surface and facing each other **(see illustration).** On all other models, position the camshafts so that their identification markings **(see illustration 9.29)** are facing upwards. Position the cam sprockets so their index marks are in line with the head surface and place the camchain onto the sprockets.
33 Place the cam holders into position (using the notes made on removal) and loosely install the bolts, noting their correct position **(see illustration 10.22).**



9.32 Rear cylinder bank camshaft installation positions as seen from No. 1 cylinder side (1982 through 1985 700/750 Sabre and 1982 through 1984 700/750 Magna models)



9.38 Front cylinder bank camshaft installation positions as seen from No 2 cylinder side (1982 through 1985 700/750 Sabre and 1982 through 1984 700/750 Magna models)

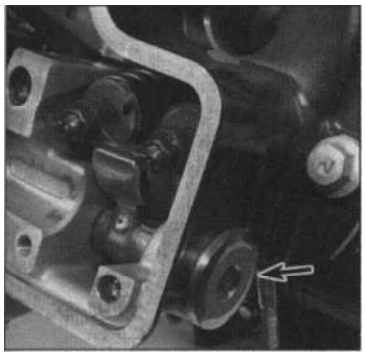
34 Place the cam sprockets onto the camshaft flanges and install the mounting bolts in the exposed holes finger-tight. Carefully rotate the engine making sure the camchain in the other cylinder back doesn't bunch up, and install the other sprocket bolts finger-tight.

Front cylinder bank

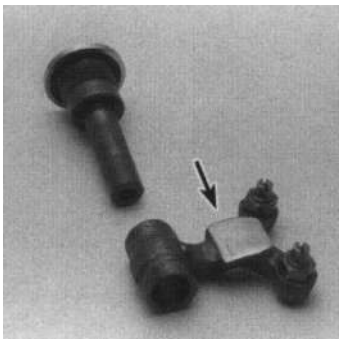
35 Rotate the engine until the T2.4 mark is aligned with the casing mark.
36 If on early models (circa 1982/83), index marks were neither found nor made on the front cylinder sprockets on removal, this must be done at this stage. These marks are made six teeth (or at a 45° angle) from the original indented index marks, using a scribe or permanent ink marker **(see illustration).**
37 Install the sprockets onto the camshafts so that their marked side faces the left of the engine and pass the camshafts through the chain into place in their cylinder head bearing surfaces. The inlet camshaft sprocket should be on the right side of its camshaft boss, and the exhaust sprocket on the left side of its camshaft boss.
38 On all 700/750 Sabres and 1982 through 1984 700/750 Magnas the lobes for cylinder no. 2 should be positioned as shown **(see illustration).** On all other models the camshaft identification markings must be facing upwards. The sprocket index marks should align with the head surface on all models.
39 Position the camchain on the sprockets. On 1985 through 1988 700/750 Magna models, Honda specify that there should be a total of 46 camchain link pins between the sprocket index marks when correctly positioned.
40 Place the cam holders into position (using the notes made on removal) and loosely install the bolts, noting their correct location **(see illustration 10.22).**
41 Place the cam sprockets onto the camshaft flanges and install the mounting bolts in the exposed holes finger-tight. Rotate the engine and install the other sprocket bolts finger-tight.

Both cylinder banks

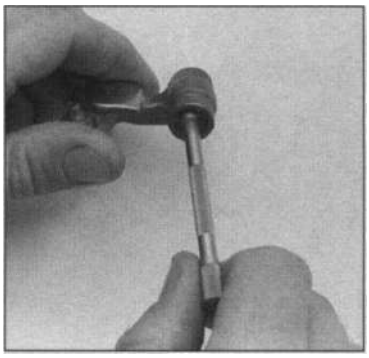
42 Make a final check that the sprocket and cam lobe positions are correct (see Steps 32, 37 and 38). If only one cylinder bank was



9.53 Rocker shaft is unscrewed from side of head on 1982 through 1985 700/750 models and all 1100 models



9.56a Inspect the cam lobe contact surface of the rocker arms for wear



9.56b Measure the rocker arm inside diameter...

worked on, remove the valve cover from the other cylinder bank and check that the valve timing marks align as specified above.

43 Remove each sprocket bolt in turn, apply thread-locking compound to its threads and tighten to the specified torque.

44 Rotate the engine until the camchain is at its loosest point and slip the oil pipe under the chain and into position. Install the oil pipe mounting bolts. Install the oil pipe in the other cylinder in the same manner.

45 Tighten the cam holder bolts evenly in two or three stages until the specified torque is reached; refer to the cylinder head/cam holder tightening sequence in illustration 10.22.

46 If the camchain tensioner was locked during installation of the chain, refer to Section 8 and release it. **Note:** *Ma e a chec (using a hand-held flashlight) that the bottom end of the tensioner slipper blade has remained in its holder socket - if it has popped out engine damage will result. Install the camchain tensioner guide.*

47 Remove the rags from the cylinders.

48 Adjust the valve clearances and install the valve covers and rear valve cover base as described in Chapter 1.

49 Refit all disturbed components in a reverse of the removal procedure.

50 Refill and bleed the cooling system as described in Chapter 1.

51 Top up the engine oil (see Chapter 1).

Rocker arm removal

Refer to illustration 9.53

52 Remove the camshafts, as described in Steps 1 to 13.

53 On 1982 through 1985 700/750 models and all 1100 models, remove the rocker arm shaft bolt **(see illustration).** Lift the rocker arm out of the cylinder head. Remove the wave washer and O-ring from the shaft bolt.

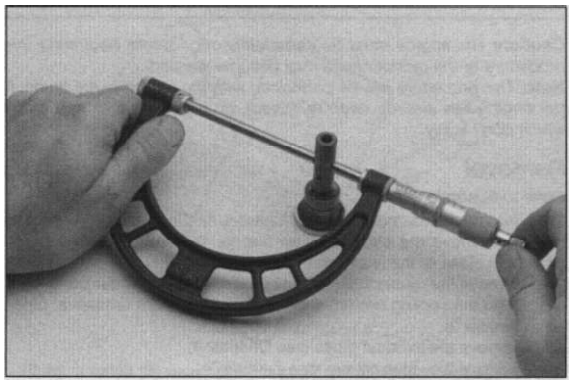
54 On 1986 through 1988 700/750 models, remove the rocker arm shaft cap and withdraw the coil spring. Thread a 10 mm diameter bolt into the end of the rocker shaft and pull on the bolt head with pliers to extract the shaft from the cylinder head. Remove the wave washer from the shaft and the O-ring from the cap.

55 Clean the parts, except for the O-ring, in clean solvent and dry them thoroughly.

Rocker arm inspection

Refer to illustrations 9.56a, 9.56b and 9.57

56 Check the camshaft lobe contact surfaces and the adjusting screw faces of the rocker arms **(see illustration)** for excessive wear, evidence of galling, chipping and cracks. Make sure the oil holes are not clogged, then measure the inside diameter of the rocker arm bore and compare it to the Specifications **(see illustration).** If any damage or excessive wear is evident, replace the rocker arms with new ones



9.57 ... and the shaft outside diameter

and check the camshaft lobes for scoring, chipping and flat spots.

57 Inspect each of the rocker arm shafts for wear, then measure their outside diameters (at both ends and the middle) and compare the results to the Specifications **(see illustration).** Replace any parts that — are worn excessively or damaged.

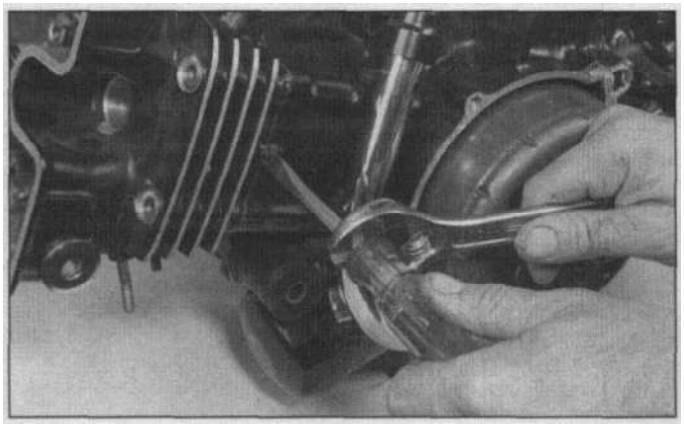
58 Inspect the rocker arm shaft wave washer and coil spring (as applicable) for damage and replace it if necessary.

Rocker arm installation

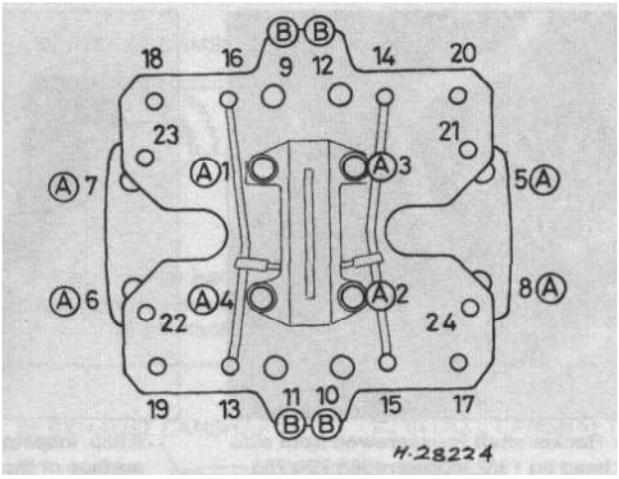
59 On 1982 through 1985 700/750 models and all 1100 models install a new O-ring on the rocker arm shaft bolt. Smear the rocker arm shaft bearing surface with molybdenum disulfide grease and apply thread locking compound to the shaft threads. Install the wave washer on the rocker arm. With the rocker arm in position, screw the rocker shaft into place, tightening it to the specified torque.

60 On 1986 through 1988 700/750 models, install the wave washer on the rocker arm and smear the shaft bearing surface with molybdenum disulfide grease. With the rocker arm in position, push the rocker shaft into place. Install the 6 mm cylinder head pin bolt in the corner hole of the cylinder head, and use a large flat-bladed screwdriver in the shaft end to rotate it so that the pin bolt passes fully down into the head casting. Leaving the pin bolt in position install the coil spring and cap, having applied thread locking compound to the cap threads and installed a new O-ring. Tighten the cap to the specified torque and remove the pin bolt.

61 Install the camshafts as described above.



10.11 Pry cylinder head off crankcase only at reinforced areas



10.22 Cylinder head/cam holder tightening sequence

10 Cylinder heads - removal and installation

Caution: *The engine must be completely cool before beginning this procedure or the cylinder head may become warped.* **Note:** *This procedure can be performed with the engine in the frame. If the engine has already been removed, ignore the preliminary steps which don't apply.*

Removal

Refer to illustration 10.11

1 Remove the carburetors (see Chapter 4). On 1986 700 California models, remove the secondary air supply system reed valve block from both sides of the rear cylinder bank.
2 Remove the carburetor rubber boots from the cylinder ports.
3 Drain the cooling system and remove the coolant crossover pipes (see Chapter 3).
4 Remove the exhaust pipes (see Chapter 4).
5 Remove the valve covers (see Section 7).
6 Remove the camshafts (see Section 9).
7 Remove the exterior oil pipe that runs between the two cylinder banks. Do not lose the metal washers used at the pipe banjo fittings.
8 Remove the rear upper engine mount bolt attached to the rear cylinder head.
9 Remove the camchain tensioner and slipper from both cylinder heads (see Section 8).
10 Remove the four cylinder head bolts located on the outside of the heads.
11 Using a pair of large screwdrivers or pry bars, carefully separate the head from the cylinders. Position the tools on opposite sides and pry only on the reinforced areas **(see illustration). Caution:** *Do not wedge the tool between the gasket surfaces and do not, under any circumstances, use e cessive force or the head and crankcase may be damaged.*
12 Remove the dowel pins (note how they are installed), then peel up the old head gasket.
13 Using a blunt gasket scraper or similar tool, remove any trace of old gasket material left on the cylinder. Clean the gasket surfaces of the head and cylinders with a solvent such as lacquer thinner or acetone.
14 For disassembly of the cylinder head components, refer to Sections 11 and 12. If the cam chain guides must be removed for further disassembly of the engine, refer to Section 8.

Installation

Refer to illustration 10.22

15 Install the dowel pins (with new O-rings) and lay the new head gasket in place. Never re-use the old gasket and do not use any type of gasket sealer. If the camchain guides were removed, install them at this stage (see Section 8).

A	*9 mm bolts/nuts (700/750 models), 10 mm bolts (1100 models)*	*B*	*8 mm bolts Others are 6 mm bolts*

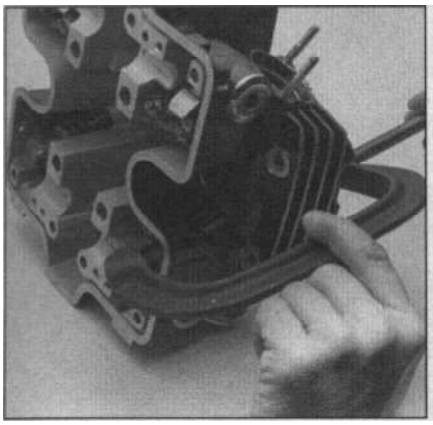
Note: 6 *mm bolts 17 through 20 are pin type on 1986 through 1988 700/750 models, plain on all others.* **Note:** 6 *mm bolts 21 through 24 only fitted to 1986-on* 700/750 *models*

16 Place the cylindr heads into position on the crankcase and feed the camchains through the center cavity.
17 Prior to installing the cylinder head bolts (nuts on 1987 and 1988 700/750 Magna models), the camchain tensioner should be locked to keep slack off of the chain during installation of the camshafts and subsequent valve timing (see Section 8).
18 Place the tensioner base into position in the cylinder head and thread the chain over it. Do not install the tensioner base bolts yet. Attach the slipper to the tensioner with the clevis pin and clip and insert the lower end of the slipper into its holder located in the crankcase cavity. **Caution:** *Engine damage will occur if the slipper end is not located properly in the holder socket.*
19 Repeat the tensioner locking and installation procedure on the other cylinder head.
20 Install the four outer cylinder head bolts (nuts on 1987 and 1988 700/750 Magna models), tightening them only lightly at this stage.
21 Install the camshafts. It is important that the procedure described in Section 9 be followed carefully as maintaining correct valve timing is critical. **Note:** *After the cam holders and sprockets, as well as the oil pipe, have been installed and the bolts tightened, unlock the cam chain tensioner (see Section 8).* After unlocking the tensioner, install and tighten the tensioner base bolts.
22 With the camshafts and camchain installed, refer to the tightening sequence and tighten the cylinder head/cam holder bolts and nuts evenly in two or three stages to the specified torque **(see illustration).**
23 The remainder of the cylinder head installation procedure is the reverse of the removal procedure, while taking note of the following.

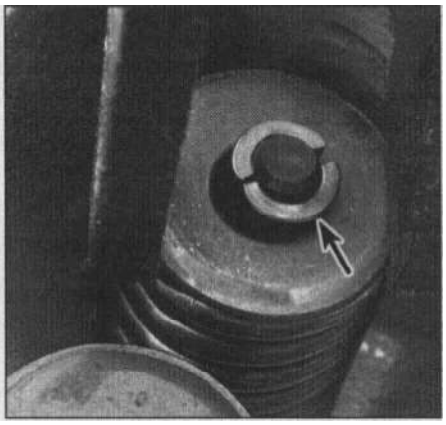
a) Use ne sealing washers on the external oil pipe union bolts.
b) Before installing the valve covers, adjust the valve clearances as described in Chapter 1.
c) Refill the cooling system as described in Chapter 1.
d) Fill the crankcase to the proper level with engine oil, referring to Chapter 1 if necessary.

11 Valves/valve seats/valve guides - servicing

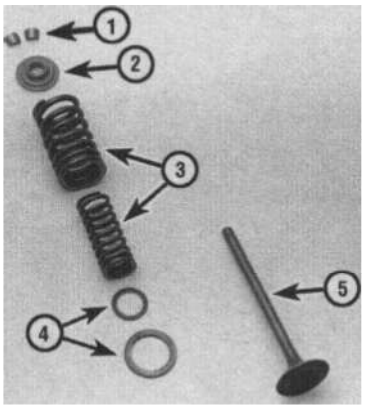
1 Because of the complex nature of this job and the special tools and equipment required, servicing of the valves, the valve seats and the valve guides (commonly known as a valve job) is best left to a professional.



12.7a Use a spring compressor to depress valve spring safely ...



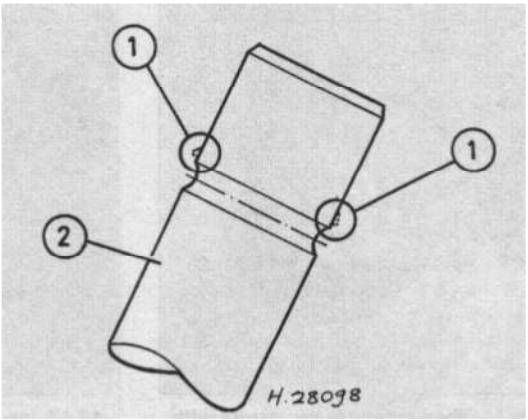
12.7b ... then remove keepers/collets (arrow) and release spring pressure slowly



12.7c Valve components

1 Keepers (collets)
2 Spring retainer
3 Valve springs
4 Spring seats
5 Valve

2 The home mechanic can, however, remove and disassemble the head, do the initial cleaning and inspection, then reassemble and deliver the head to a dealer service department or properly equipped motorcycle repair shop for the actual valve servicing. Refer to Section 12 for those procedures.
3 The dealer service department will remove the valves and springs, recondition or replace the valves and valve seats, replace the valve guides, check and replace the valve springs, spring retainers and keepers (collets) (as necessary), replace the valve seals with new ones and reassemble the valve components.
4 After the valve job has been performed, the head will be in like-new condition. When the head is returned, be sure to clean it again very thoroughly before installation on the engine to remove any metal particles or abrasive grit that may still be present from the valve service operations. Use compressed air, if available, to blow out all the holes and passages.



12.7d If valve (2) won't pull through guide, deburr area around keeper/collet groove (1)

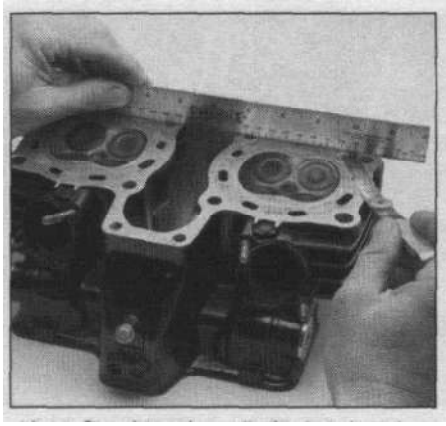
12 Cylinder head and valves - disassembly, inspection and reassembly

1 As mentioned in the previous Section, valve servicing and valve guide replacement should be left to a dealer service department or motorcycle repair shop. However, disassembly, cleaning and inspection of the valves and related components can be done (if the necessary special tools are available) by the home mechanic. This way no expense is incurred if the inspection reveals that service work is not required at this time.
2 To properly disassemble the valve components without the risk of damaging them, a valve spring compressor is absolutely necessary. This special tool can usually be rented, but if it's not available, have a dealer service department or motorcycle repair shop handle the entire process of disassembly, inspection, service or repair (if required) and reassembly of the valves.

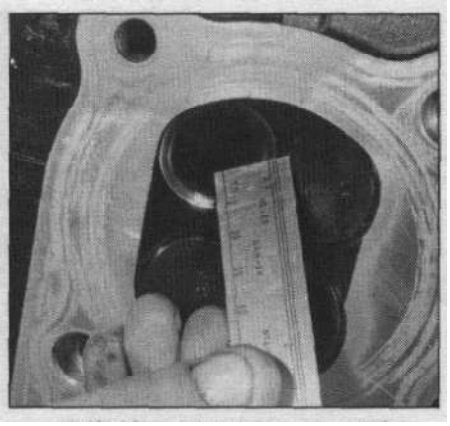
Disassembly

Refer to illustrations 12.7a, 12.7b, 12.7c and 12.7d

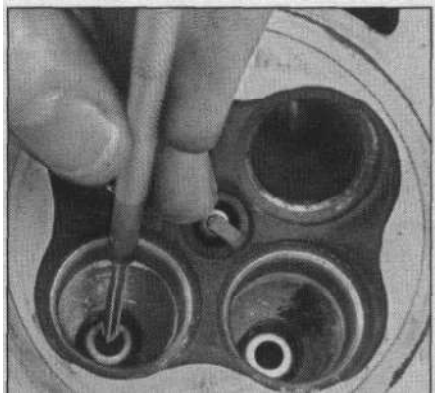
3 Remove the rocker arms if you haven't already done so (see Section 9). Store the components in such a way that they can be returned to their original locations without getting mixed up.
4 Before the valves are removed, scrape away any traces of gasket material from the head gasket sealing surface. Work slowly and do not nick or gouge the soft aluminum of the head. Gasket removing solvents, which work very well, are available at most motorcycle shops and auto parts stores.
5 Carefully scrape all carbon deposits out of the combustion chamber area. A hand held wire brush or a piece of fine emery cloth can be used once the majority of deposits have been scraped away. Do not use a wire brush mounted in a drill motor, or one with extremely stiff bristles, as the head material is soft and may be eroded away or scratched by the wire brush.
6 Before proceeding, arrange to label and store the valves along with their related components so they can be kept separate and reinstalled in the same valve guides they are removed from (labeled plastic bags work well for this).
7 Compress the valve spring on the first valve with a spring compressor, then remove the keepers (collets) and the retainer from the valve assembly. **Note:** *Take great care not to mark the cylinder head follower bore with the spring compressor.* Do not compress the springs any more than is absolutely necessary. Carefully release the valve spring compressor and remove the springs and the valve from the head. If the valve binds in the guide (won't pull through), push it back into the head and deburr the area around the keeper (collet) groove with a very fine file or whetstone **(see illustrations).**
8 Repeat the procedure for the remaining valves. Remember to keep the parts for each valve together so they can be reinstalled in the same location.
9 Once the valves have been removed and labeled, pull off the valve stem seals with pliers and discard them (the old seals should never be re-used), then remove the spring seats.
10 Next, clean the cylinder head with solvent and dry it thoroughly. Compressed air will speed the drying process and ensure that all holes and recessed areas are clean.
11 Clean all of the valve springs, keepers (collets), retainers and



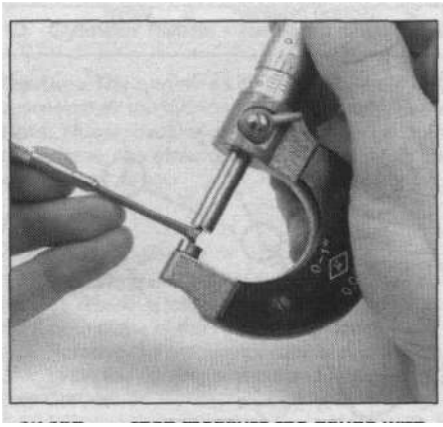
12.14 Checking the cylinder head gasket surface for warpage



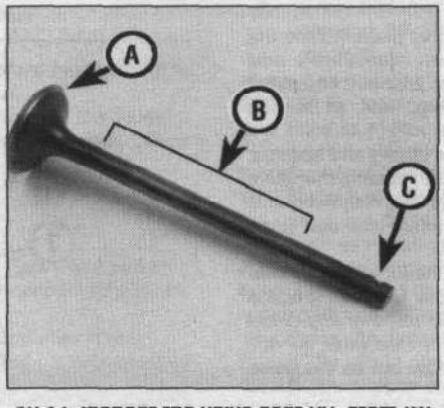
12.15 Measuring valve seat width



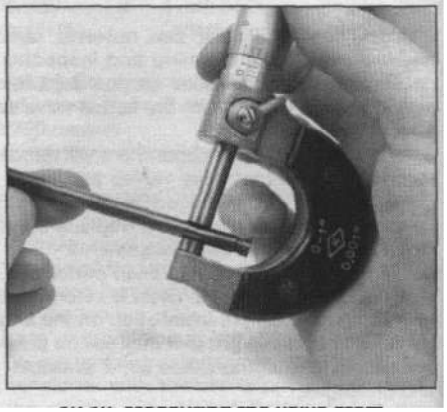
12.16a Use a small hole gauge to measure valve guide inside diameter...



12.16b ... then measure the gauge with a micrometer



12.17 Inspect the valve seat (A), stem (B) and keeper/collet groove (C) for damage



12.18 Measuring the valve stem outside diameter

spring seats with solvent and dry them thoroughly. Do the parts from one valve at a time so that no mixing of parts between valves occurs.

12 Scrape off any deposits that may have formed on the valve, then use a motorized wire brush to remove deposits from the valve heads and stems. Again, make sure the valves do not get mixed up.

Inspection

Refer to illustrations 12,14, 12.15, 12.16a, 12.16b, 12.17, 12.18, 12.19aand12.19b

13 Inspect the head very carefully for cracks and other damage. If cracks are found, a new head will be required. Check the cam bearing surfaces for wear and evidence of seizure. Check the camshafts and rocker arms for wear as well (see Section 9).

14 Using a precision straightedge and a feeler gauge, check the head gasket mating surface for warpage. Lay the straightedge lengthwise, across the head and diagonally (corner-to-corner), intersecting the head stud holes, and try to slip a feeler gauge under it, on either side of each combustion chamber **(see illustration).** The gauge should be the same thickness as the cylinder head warp limit listed in this Chapter's Specifications. If the feeler gauge can be inserted between the head and the straightedge, the head is warped and must either be machined or, if warpage is excessive, replaced with a new one.

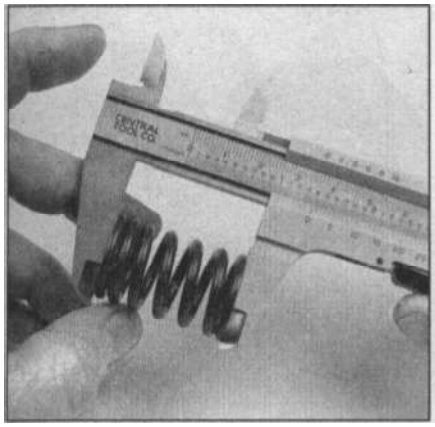
15 Examine the valve seats in each of the combustion chambers. If they are pitted, cracked or burned, the head will require valve service that's beyond the scope of the home mechanic. Measure the valve seat width and compare it to this Chapter's Specifications **(see illustration).** If it exceeds the service limit, or if it varies around its circumference, valve service work is required.

16 Clean the valve guides to remove any carbon build-up, then measure the inside diameters of the guides (at both ends and the center of the guide) with a small hole gauge and micrometer **(see illustrations).** Record the measurements for future reference. These measurements, along with the valve stem diameter measurements, will enable you to compute the valve stem-to-guide clearance. This clearance, when compared to the Specifications, will be one factor that will determine the extent of the valve service work required. The guides are measured at the ends and at the center to determine if they are worn in a bell-mouth pattern (more wear at the ends). If they are, guide replacement is an absolute must.

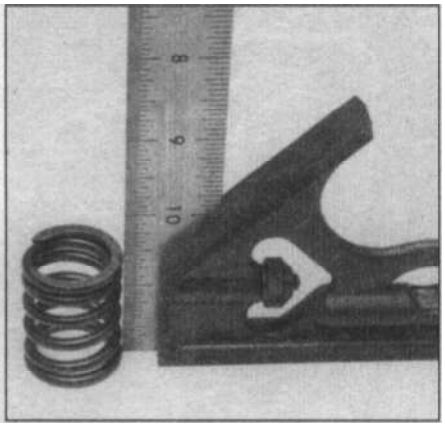
17 Carefully inspect each valve face for cracks, pits and burned spots **(see illustration).** Check the valve stem and the keeper (collet) groove area for cracks. Rotate the valve and check for any obvious indication that it is bent. Check the end of the stem for pitting and excessive wear. The presence of any of the above conditions indicates the need for valve servicing.

18 Measure the valve stem diameter **(see illustration).** By subtracting the stem diameter from the valve guide diameter, the valve stem-to-guide clearance is obtained. If the stem-to-guide clearance is greater than listed in this Chapter's Specifications, the guides and valves will have to be replaced with new ones.

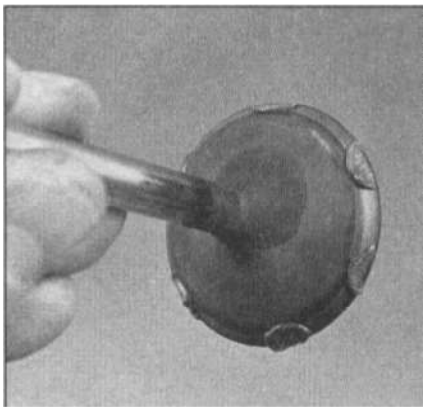
19 Check the end of each valve spring for wear and pitting. Measure the free length and compare it to this Chapter's Specifications. Any springs that are shorter than specified have sagged and should not be



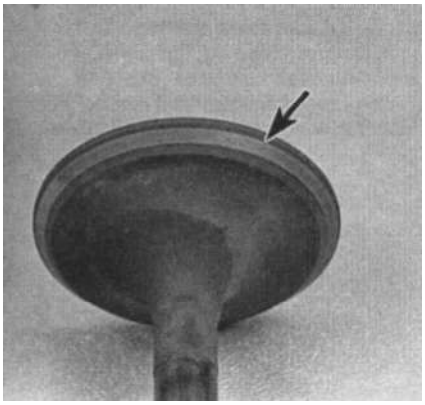
12.19a Measuring the valve spring free length



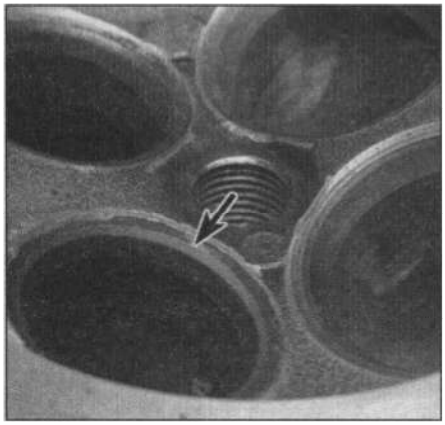
12.19b Measuring the valve springs for squareness



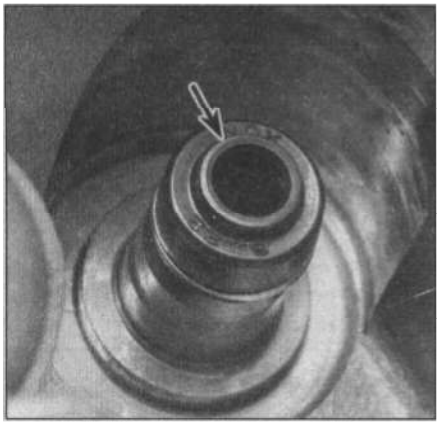
12.23 Apply valve lapping compound sparingly to the valve face



12.24a After lapping, the valve face should exhibit a uniform, unbroken contact pattern (arrow)...



12.24b … and the seat should be the specified width (arrow) with a smooth, unbroken appearance



12.27 Install new valve stem seals (arrow) on the guides

re-used. Stand the spring on a flat surface and check it for squareness **(see illustrations).**

20 Check the spring retainers and keepers (collets) for obvious wear and cracks. Any questionable parts should not be re-used, as extensive damage will occur in the event of failure during engine operation.

21 If the inspection indicates that no service work is required, the valve components can be reinstalled in the head.

Reassembly

Refer to illustrations 12.23, 12.24a, 12.24band 12.27

22 Before installing the valves in the head, they should be lapped to ensure a positive seal between the valves and seats. This procedure requires coarse and fine valve lapping compound (available at auto parts stores) and a valve lapping tool. If a lapping tool is not available, a piece of rubber or plastic hose can be slipped over the valve stem (after the valve has been installed in the guide) and used to turn the valve.

23 Apply a small amount of coarse lapping compound to the valve face, then slip the valve into the guide **(see illustration). Note:** *Ma e sure the valve is installed in the correct guide and be careful not to get any lapping compound on the valve stem.*

24 Attach the lapping tool (or hose) to the valve and rotate the tool between the palms of your hands. Use a back-and-forth motion rather than a circular motion. Lift the valve off the seat and turn it at regular intervals to distribute the lapping compound properly. Continue the lapping procedure until the valve face and seat contact area is of uniform width and unbroken around the entire circumference of the valve face and seat **(see illustrations).**

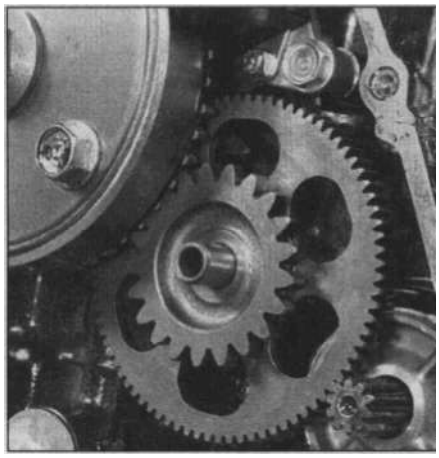
25 Carefully remove the valve from the guide and wipe off all traces of lapping compound. Use solvent to clean the valve and wipe the seat area thoroughly with a solvent soaked cloth.

26 Repeat the procedure with fine valve lapping compound, then repeat the entire procedure for the remaining valves.

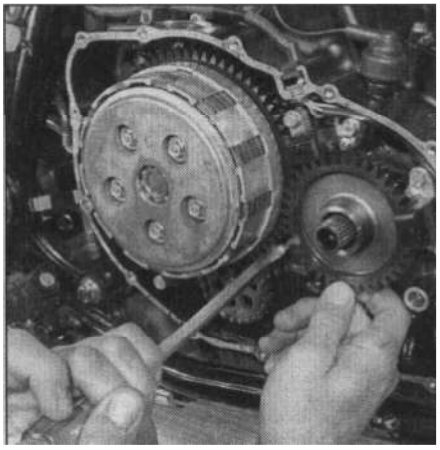
27 Lay the spring seats in place in the cylinder head, then install new valve stem seals on each of the guides **(see illustration).** Use an appropriate size deep socket to push the seals into place until they are properly seated. Don't twist or cock them, or they will not seal properly against the valve stems. Also, don't remove them again or they will be damaged.

28 Coat the valve stems with clean engine oil, then install one of them into its guide. Next, install the springs and retainer, compress the springs and install the keepers (collets). **Note:** *Install the springs with their tightly wound coils at the bottom (ne t to the spring seat).* When compressing the springs with the valve spring compressor, depress them only as far as is absolutely necessary to slip the keepers (collets) into place. Apply a small amount of grease to the keepers (collets) to help hold them in place as the pressure is released from the springs. Make certain that the keepers (collets) are securely locked in their retaining grooves.

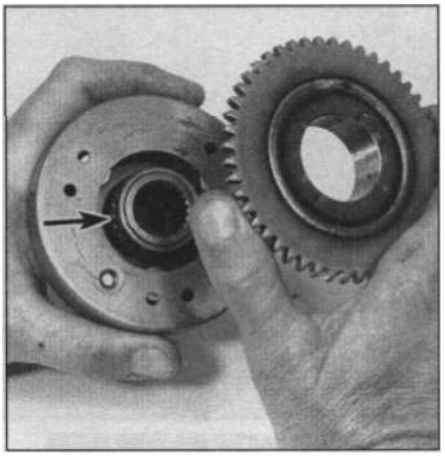
29 Support the cylinder head on blocks so the valves can't contact the workbench top, then very gently tap each of the valve stems with a



13.5 Extract its shaft, and maneuver the starter idler gear out of the casing



13.9 Taking the load off the primary drive gear so that it can be pulled off the crankshaft splines



13.10 Detach the driven gear and needle bearing (arrow) from the starter clutch

soft-faced hammer. This will help seat the keepers (collets) in their grooves.

30 Once all of the valves have been installed in the head, check for proper valve sealing by pouring a small amount of solvent into each of the valve ports. If the solvent leaks past the valve(s) into the combustion chamber area, disassemble the valve(s) and repeat the lapping procedure, then reinstall the valve(s) and repeat the check. Repeat the procedure until a satisfactory seal is obtained.

13 Starter motor clutch and primary drive gear - removal, overhaul and installation

Note: *The starter motor clutch can be removed with the engine in the frame.*

Removal

Refer to illustrations 13.5 and 13.9

1 Drain the engine oil (see Chapter 1).

2 On all models remove the rear brake pedal, and on 1100 Magna models also remove the right footpeg.

3 Remove the right crankcase cover bolts. There are two different size bolts, so make a note of their location or store them in the old gasket when this has been removed. Note that one of the cover bolts secures the rear brake light switch on 1985 through 700/750 Magna models.

4 Tap the crankcase cover gently with a soft-faced hammer to break the gasket seal, then pull it away from the engine. Do not pry between the gasket sealing surfaces, as damage and eventually oil leaks will occur. Discard the old gasket and remove the dowels for safekeeping if they are loose.

5 Pull the starter idler gear shaft out of the casing and remove the idler gear **(see illustration).** The shaft should simply pull out - it may even pull out as the casing is removed.

6 Remove the starter clutch bolt from the crankshaft end. The crankshaft will have to be locked to allow the bolt to be loosened. This can be achieved in one of several ways.

a) *Have an assistant hold the alternator rotor with a strap wrench around its periphery, or the Honda service tool described in Section 19.*

b) *On 1987 and 1988 700/750 Magna models the Honda sprag-type gear holder tool (part no. 07724-0010100) can be used to lock the primary drive gear and clutch housing.*

c) *If the engine is in the frame, shift the transmission into sixth gear and have an assistant sit on the bike ith the rear brake held on firmly (refit pedal temporarily if removed).*

7 If the starter clutch is to be disassembled, the three starter clutch cover bolts should also be broken loose at this time (while the alternator is being held). Do not remove these bolts yet.

8 Withdraw the starter clutch assembly and thrust washer from the crankshaft splines, taking care not to knock the ignition system pulse generators.

9 Use a screwdriver engaged in the teeth of the clutch housing gear to take the load off the primary drive gear. The primary drive gear can then be pulled off its shaft **(see illustration).**

Overhaul

Refer to illustrations 13.10, 13.12 and 13.15

10 Remove the starter driven gear and needle bearing from the starter clutch **(see illustration).**

11 Inspect the rollers of the needle bearing for smooth operation and replace it if necessary.

12 Remove the three bolts from the starter clutch cover and lift off the cover **(see illustration).**

13 Remove the clutch rollers, plungers and springs.

14 Check the rollers and plungers for excessive wear, scratches or score marks and replace them if necessary.

15 Inspect the inner and outer surfaces of the starter driven gear for scratches and score marks. Also measure the outer diameter of the driven gear and compare it with the service limit Specifications at the beginning of this Chapter **(see illustration).**

16 Inspect the splines of the starter clutch cover. Any component which is not in good condition should be replaced with a new one.

17 To begin reassembly, install the springs into their bores in the starter clutch, then install the plungers into their bores and retain them by installing the rollers.

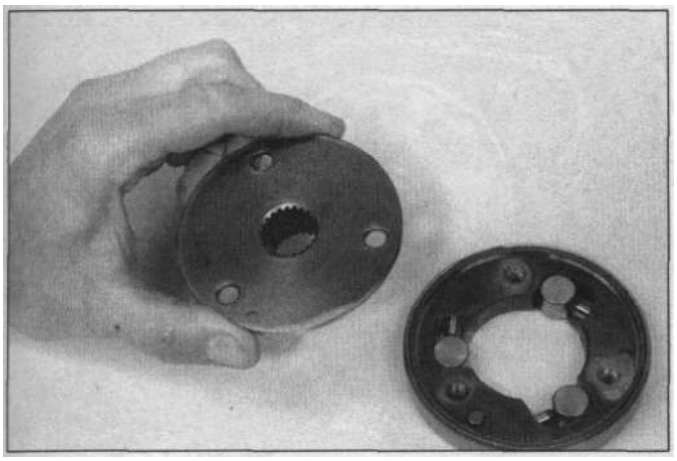
18 Install the starter clutch cover onto the starter clutch. Be sure the dowel pin in the starter clutch is aligned with the hole in the cover, then tighten the cover bolts to the specified torque. **Note:** *A liquid locking agent should be applied to the bolt threads prior to installation.*

19 With the starter clutch positioned with the cover down, insert the needle bearing into place. Install the starter driven gear by depressing it into the starter clutch while turning it counterclockwise (anticlockwise).

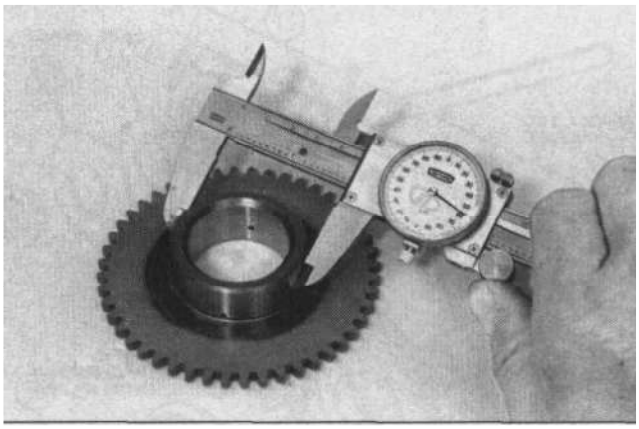
Installation

Refer to illustration 13.20

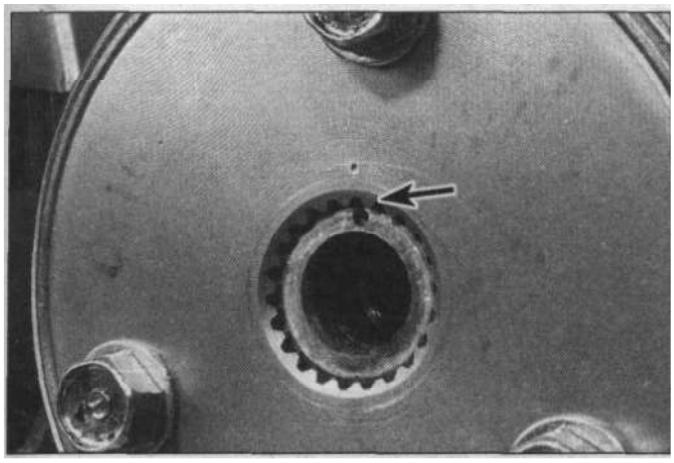
20 Installation is the reverse of the removal procedure with the following notes. *a) It is easier to install the starter idler gear and shaft after installation of the primary drive gear but before installation of the starter clutch.*



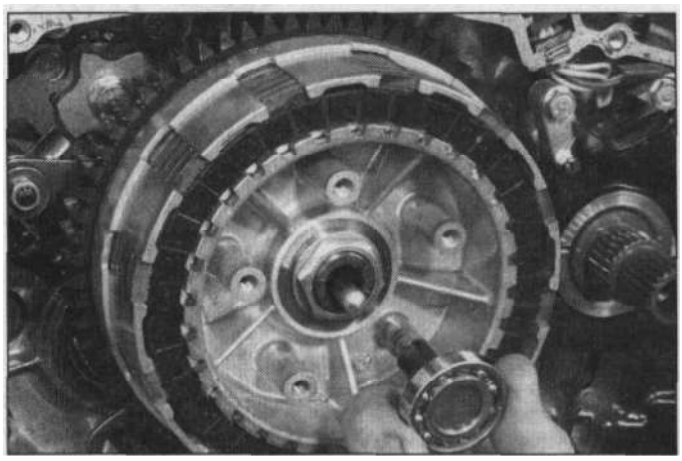
13.12 Remove the three bolts to separate the starter clutch



13.15 Measuring the starter driven gear outside diameter



13.20 Align punch marks on crankshaft and starter clutch on installation



14.7 Removing clutch lifter guide and release bearing

b) When installing the starter clutch on the crankshaft, be sure that the punch marks on the clutch and shaft are aligned ***(see illustration).***

c) The alternator rotor will again have to be held stationary while the starter clutch bolt is tightened to the specified torque.

d) Install a new gasket, using a dab of grease to stick it to the crankcase hile the cover is installed. Be sure the longer bolts are reinstalled in their original places.

e) Refill the crankcase with the proper amount and grade of oil. Refer to Chapter 1 if necessary.

14 Clutch - removal, inspection and installation

Note: *This procedure can be performed with the engine in the frame. If the engine has already been removed, ignore the preliminary steps which don't apply.* **Note:** *Do not operate the clutch lever after removal of the bolts as this will cause difficulty in reassembling the clutch.*

Removal

Refer to illustrations 14.7, 14.11 a, 14.11b, 14.12 and 14.13

1 Drain the engine oil (see Chapter 1).

2 On all models remove the rear brake pedal, and on 1100 Magna models also remove the right footpeg.

3 Remove the right crankcase cover bolts. There are two different size bolts, so make a note of their location or store them in the old gasket when this has been removed. Note that one of the cover bolts secures the rear brake light switch on 1985 through 1988 700/750 Magna models.

4 Tap the crankcase cover gently with a soft-faced hammer to break the gasket seal, then pull it away from the engine. Do not pry between the gasket sealing surfaces, as damage and eventually oil leaks will occur. Discard the old gasket and remove the dowels for safekeeping if they are loose.

5 Remove the starter clutch and primary drive gear as described in Section 13.

All 700/750 models except the 1983 750 Sabre

6 Remove the five bolts which retain the clutch pressure plate. Loosen these bolts gradually, one turn at a time each, following a crisscross pattern, until the pressure from the springs has been released. With the bolts removed, lift out the springs.

7 Lift off the clutch pressure plate, along with the lifter guide and release bearing **(see illustration).**

8 Pull out the lifter rod extending from the clutch center.

9 Remove the clutch plates. These can be removed either all at once or one at a time.

10 On 1987 and 1988 models knock back the lockwasher tabs from the clutch center locknut.