Norton

SERVICE RELEASE

N3/73 (Superseding N3/56)

850 MODEL COMMANDO
"STAGE ONE" HIGH PERFORMANCE MODIFICATIONS

Conversion from Standard Road Specification to High Performance Sports Condition.

The following components will require replacement or modification.

1. Camshaft replacement to 'SS' Sports specification.
2. Piston modification to Sports condition.
3. Cylinder head Conversion to Full Flow High Compression condition
4. New Amal Velocity Stacks for Carburettors.
5. Push rod modification.

The Service Release details the alterations that are necessary to convert existing components to High Performance Sports condition.

Sectioned drawings are provided to guide the enthusiast in achieving the optimum port shapes, together with the drawings illustrating the necessary alterations to Push rods and Piston Crown configurations to accommodate the increased compression ratio and valve opening.

For owners and riders wishing to fit Transistorised Electronic Ignition equipment, detailed fitting and set up instructions are provided in the Norton Villiers publication part number 065151 "Boyer Electronic Ignition" obtainable through Norton Spares outlets, or from the local Norton Distributor.

Warning

Although every attempt has been made to convey factory experience and recommendations in this publication Norton Triumph International Ltd. (or its representatives) do not guarantee that this conversion will result in the desired improvement in performance. In addition, owing to the greater stresses placed on the engine, and transmission parts, the manufacturers Guarantee (of replacement engine and transmission parts and associated labour) can no longer be applicable.

NORTON TRIUMPH INTERNATIONAL LTD., MACKADOWN LANE, KITTS GREEN, BIRMINGHAM 33 ENGLAND

Technical Data

Engine Number	Stamped on crankcase
Gearbox Number	Stamped on gearcase
Frame Number	Stamped on left side head lug
Cylinder bore (finished size)	2.8750″/2.8758″ (73.025mm/73.045mm)
Stroke	3.503″ (89mm)
Capacity	45.5 cu. in. (745cc)
Compression ratio	8.9 to 1
Ignition timing	28° B.T.D.C. (full advance)
Spark plug	N6Y
Spark plug gap	.023″-.028″
Contact breaker gap	.014″/.016″
Tappet clearance (cold) inlet	.006″
Tappet clearance (cold) exhaust	.008″
Valve spring free length (inner)	1.531″
Valve spring free length (outer)	1.700″
Piston ring gap (compression ring)	.013″
Push rod length assembled (inlet)	8.130″/8.166″
Push rod length assembled (exh'st)	7.285″/7.321″
Valve length (head to stem) Inlet	4.069″
Valve stem diameter (inlet)	.3095″/.3105″
Valve length (head to stem) exhaust	4.020″
Valve stem diameter (exhaust)	.3095″/.3105″
Rocker shaft diameter	.4985″/.4998″
Wrist pin diameter	.6868″/.6866″
Crankshaft journal diameter (drive side)	1.1815″/1.1812″
Crankshaft journal diameter (timing side)	1.1807″/1.1812″
Crankshaft journal diameter (con rod)	1.7505″/1.7500″
Camshaft bearing diameter (drive side)	.874″/.8735″
Camshaft bearing diameter (timing side)	.8735″/.8730″
Camshaft bush (bore size)	.875″/.8745″
Main roller bearing (drive side) single dot	30mm × 72mm × 19mm
Main ball single dot bearing (timing tide)	30mm × 72mm × 19mm
Intermediate shaft diameter	.5615″/.5610″
Intermediate gear (bush diameter)	.5627″/.5620″

GEARBOX

Mainshaft diameter (clutch end)	.8105″/.8095″
Mainshaft diameter (kickstart end)	.6248″/.6244″
Mainshaft ball bearing	$\frac{5}{8}$″ × $1\frac{9}{16}$″ × $\frac{7}{16}$″
Layshaft bearing	17mm × 40mm × 12mm
Layshaft diameter (clutch end)	.6692″/.6687″
Layshaft diameter (kickstart end)	.6855″/.6845″
Sleeve gear bush (OD)	.906″/.9053″
Sleeve gear bush (reamed *in situ*)	.81325″/.81200″
Layshaft bush (bore diameter)	.6875/.6865″
Clutch bearing	35mm × 62mm × 14mm

SPROCKETS

Engine	26 teeth
Clutch	57 teeth
Final drive (gearbox)	21 teeth or 19 teeth
Rear wheel	42 teeth

CHAIN SIZES

Front chain endless (triplex)	$\frac{3}{8}$″ × .225″ (92 pitches)
Rear chain (21 teeth sprocket)	$\frac{5}{8}$″ × .380″ (99 pitches)
Camshaft chain	$\frac{3}{8}$″ × .225″ (38 pitches)
Ignition chain	$\frac{3}{8}$″ × .155″ (42 rollers)
Rear chain (19 teeth sprocket)	$\frac{5}{8}$″ × .380″ (98 pitches)

CARBURETTER SETTINGS

Choke diameter	1.180″
Main jet size	220
Pilot jet size	25
Needle jet size	.106″
Throttle slide	3
Needle location	central notch

WHEEL BEARINGS

Left side front bearing	17mm × 40mm × 12mm
Right side front bearing	17mm × 40mm × 16mm
Left side rear bearing	17mm × 40mm × 16mm
Right side rear bearing	17mm × 40mm × 12mm

TORQUE WRENCH SETTINGS

Cylinder head bolts and nuts $\frac{3}{8}$″	360 inch lbs.
Cylinder head bolts $\frac{5}{16}$″ (2)	240 inch lbs.
All cylinder base nuts	240 inch lbs.
Con rod	300 inch lbs.
Rocker shaft cover plate bolt	100 inch lbs.
Gearbox inner cover nuts	140 inch lbs.
Cam chain tensioner nuts	180 inch lbs.
Oil pump stud nuts	180 inch lbs.
Banjo bolts	180 inch lbs.
Engine mounting bolts	300 inch lbs.
Alternator studs	120 inch lbs.

GEAR RATIOS

(21 teeth gearbox sprocket)	4.38	5.35	7.45	11.2
(19 teeth gearbox sprocket)	4.84	5.9	8.25	12.4
INTERNAL RATIOS	1:1	1.22:1	1.7:1	2.56:1

CAPACITIES

Gas tank	3.25 Imperial gallons (3.9 U.S. gallons) (14.7 litres)
Oil tank	5 Imperial pints (6 U.S. pints) (2.8 litres)
Gearbox	1 Imperial pint (1.2 U.S. pints) (.57 litre)
Primary chaincase	200 c.c (7 fluid ozs.)
Front forks	150 c.c (each leg)

1973 850 MODEL HIGH PERFORMANCE CONVERSION

Conversion to High Performance condition involves the following operations, achieved either by replacement, or conversion of the existing components as detailed below.

Camshaft	–	Replacement of the existing camshaft with 063536 'SS' camshaft.
Piston (850cc)	–	Conversion to High Performance/High compression condition.
Velocity Stacks (for carburettor)	–	Replacement of existing air filter equipment with the alternative Amal components.
Push Rods	–	Modifications to accomodate the alterations to the cylinder head configurations.

For those wishing to convert the original pistons and cylinder head to the modified condition the following instructions are provided and should be carefully observed. Modifications are also necessssary to push rod lengths to compensate for the alteration to rocker geometry resulting from cylinder head gasket face removal.

Modification required to Existing Components

1. PISTON

Conversion of the standard 850 piston 063838 to sports condition involves deepening the valve 'Cut-away' pockets in accordance with the dimensions given in Fig. 1.

The cut-aways require re-machining to the amended conditions as shown to allow for the additional 'valve drop' created by the use of the new Camshaft 063536. The head diameter of both the inlet and and exhaust valves should be measured – ensure head diameters do not exceed 1·490in. (37·85mm) inlet, and 1·302in. (33·07mm) exhaust. This will avoid any possibility of subsequent 'hook up' when using 063536 Camshaft in the higher engine R.P.M. range.

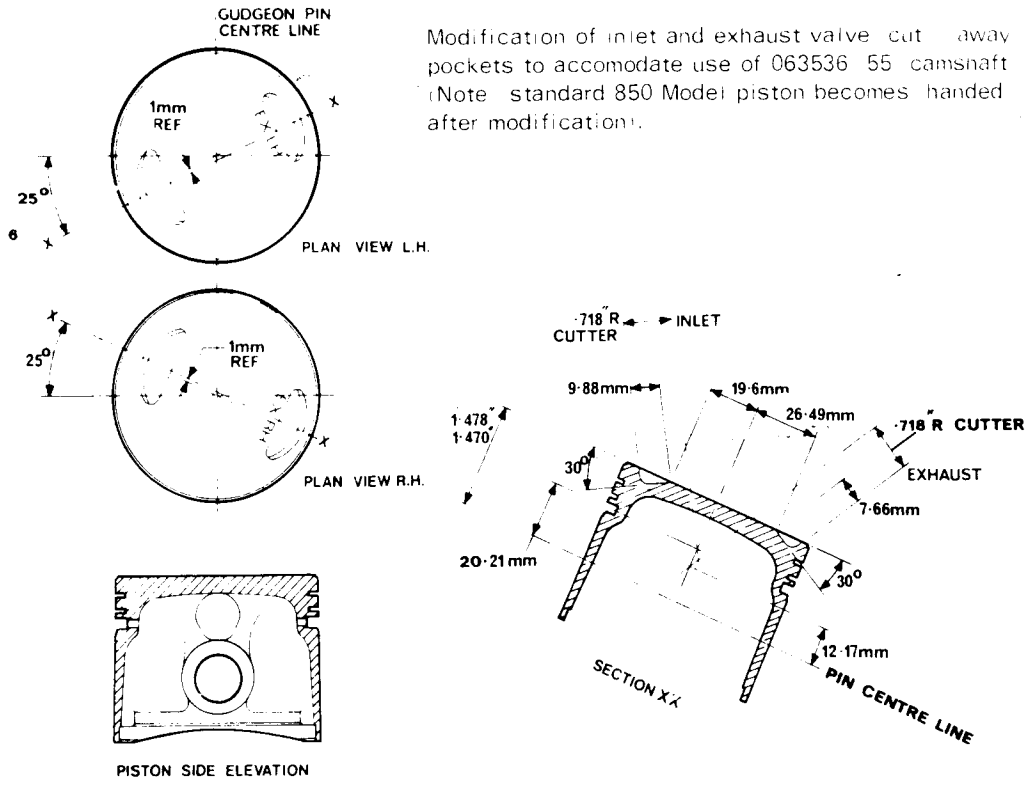


FIG. 1. PISTON CROWN MODIFICATION

Following modifications to both the pistons and the cylinder head, it is advisable to check the actual available 'valve drop' by placing modelling clay (Plasticine) into the valve clearance 'cut–aways' and rotating the crankshaft at least two complete revolutions. Measure the thickness of the modelling clay. A minimum clearance of 0·030in/0·040in (0·75mm/1·00mm) must be allowed when the inlet valve is closest to the piston at 3°/5° A.T.D.C.

2. CYLINDER HEAD

Modifications required to convert the standard 850 cylinder head 063830 to High Performance condition.

The diagram (Fig. 2) details the modifications that increase the compression ration to 10:1, and to convert both inlet and exhaust ports to the shape to provide optimum power with flexibility.

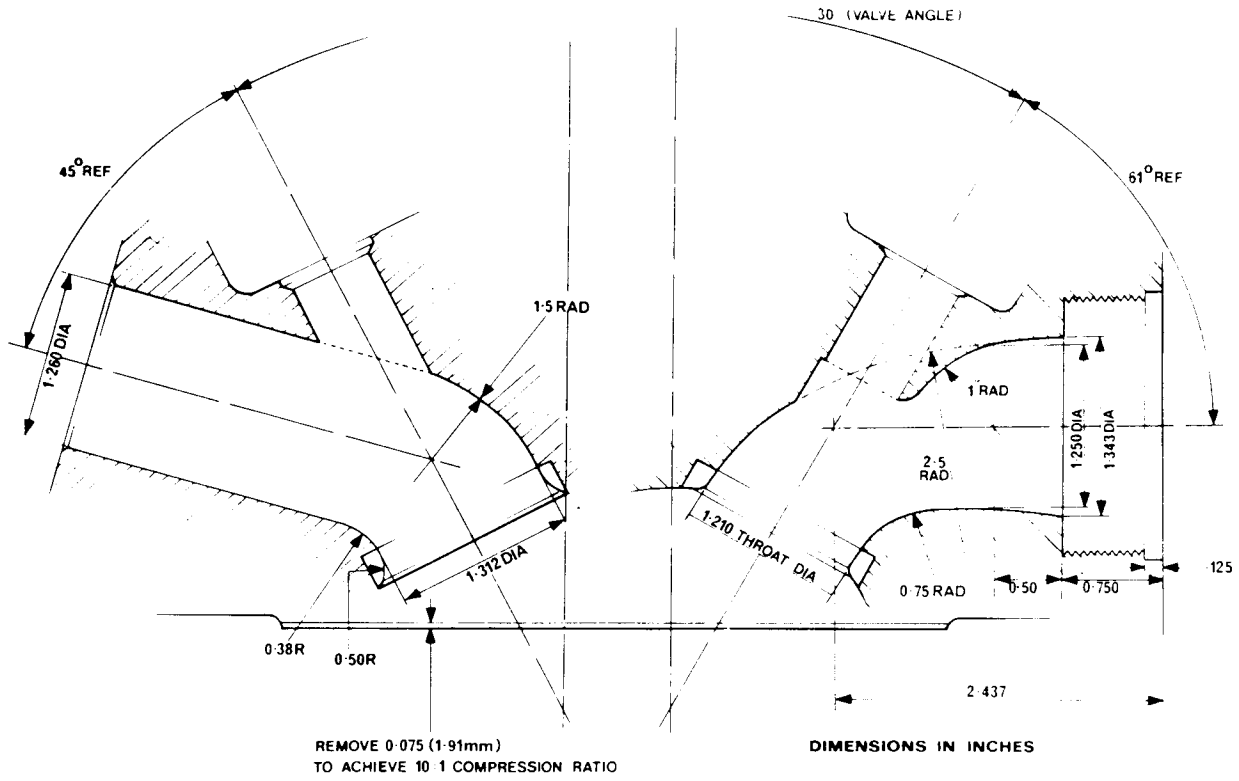


FIG. 2. CYLINDER HEAD MODIFICATION

A high degree of polish in the inlet and exhaust ports is not essential. Consistent shape and port sectional area is far more important for gas flow than highly polished sidewalls.

Removal of excess material in the Inlet and Exhaust port areas should be undertaken using a rotary file, or similar equipment. Particular care must be taken not to damage valve seat inserts and valve seatings when blending the ports from within the combustion sphere area.

The removal of material from the cylinder head gasket face should be entrusted to specialists in this field, who have the equipment designed to maintain correct depth of cut with absolute flatness and truth during this operation.

If in any doubt whatsoever, the total operation should be undertaken only by specialist machinists engaged in this type of work.

3. PUSH RODS

In order to maintain correct rocker geometry following removal of material from the cylinder head gasket face both end caps are removed from each of the four push rods, and 0.037in (0·95mm) of metal removed from each end of the push rod prior to replacement of the end caps. Do not remove all the metal from one end only of the push rod as this may result in the end caps not re-seating properly, and partially resting onto the taper run–out of the push–rod itself (see Fig. 3).

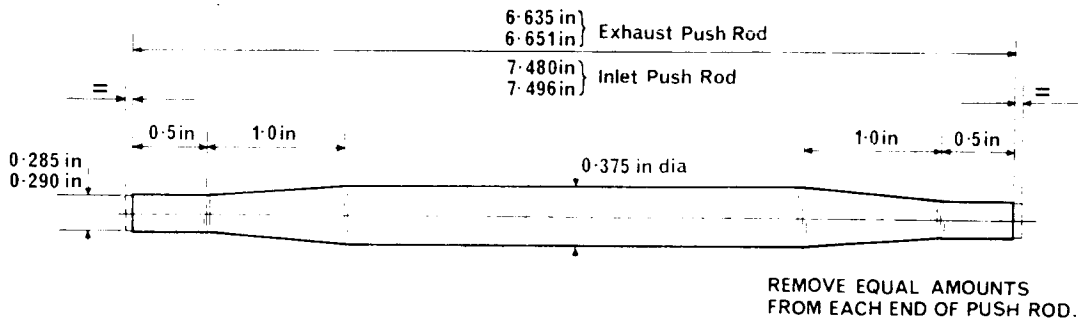


FIG. 3. PUSH ROD MODIFICATION

4. IGNITION TIMING

Contact Breaker	30° B.T.C. Max. Advance @ 3000 r.p.m.
Electronic Ignition	31° B.T.C. Max. Advance @ 5000 r.p.m.
Inlet	0·008in. (0·2mm)
Valve Clearance	'SS' Camshaft Part No. 063536
Exhaust	0·010in. (0·25mm)

5. CARBURETTORS

Standard 32mm carburettors as supplied with the machine give optimum performance utilising Amal Bell Mouth Velocity Stack.

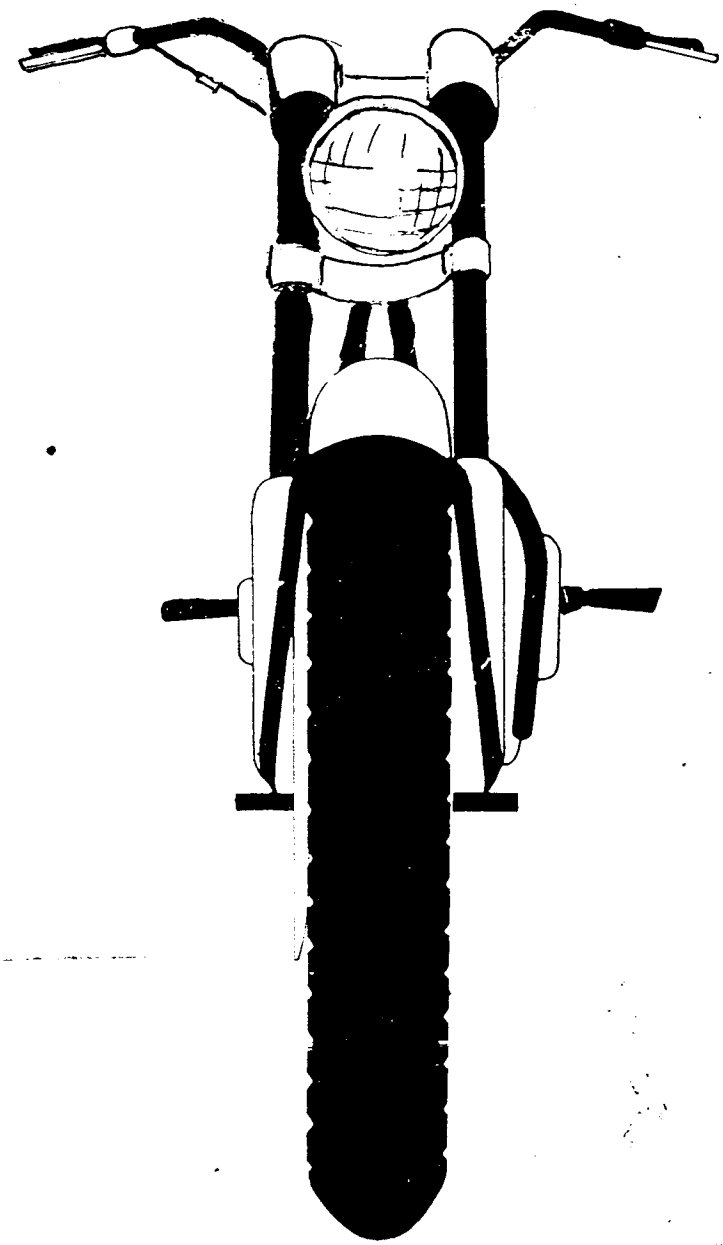
Further detailed information is provided to assist in any subsequent incorporation of Electronic Ignition equipment. Norton Villiers Publication part number 065151 "Boyer Electronic Ignition" is available through normal Norton Service Channels.

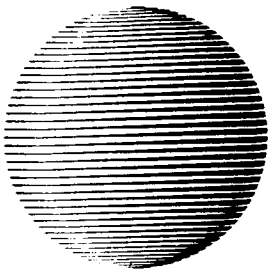
Note

The fitting of oversized high tensile centreless ground bolts into sized and reamed crankcase boss and rear engine mounting bolt holes is advised to ensure maintenance of maximum rigidity of assembly.

On completion, it emphasized that the engine should be run only on a minimum of 100 Octane grade fuel. Also due to the increased efficiency and immediate response of the modified engine unit, great care must be taken not to over-rev the engine in the intermediate gears.

SERVICE TOOLS

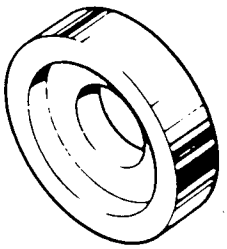




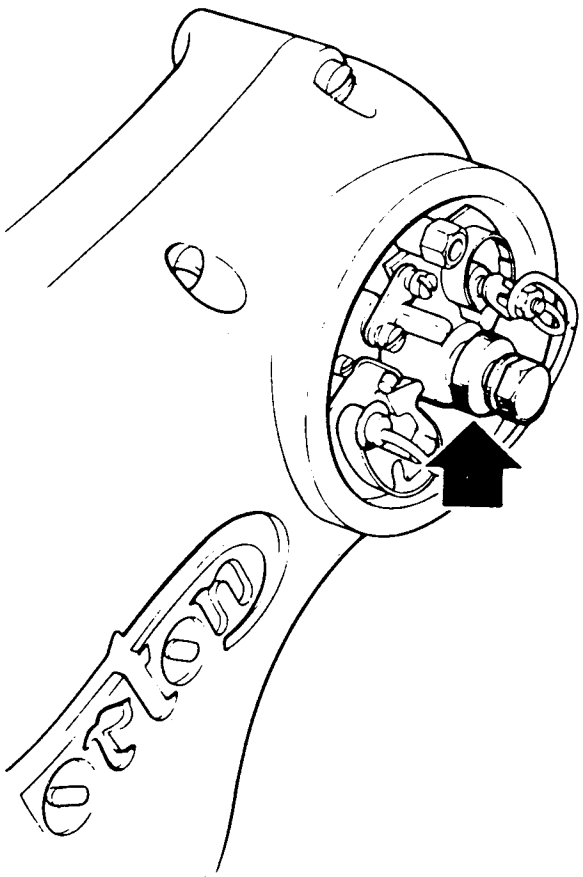
NORTON SERVICE TOOLS

PART No.	PAGE No.	DESCRIPTION
064297	1	ENGINE SPROCKET/CLUTCH HUB/ CAM SPROCKET PULLER
060949	2	AUTO ADVANCE LOCKWASHER
060999		CLUTCH SPRING COMPRESSION TOOL
064298	3	SLIDE HAMMER-ROCKERSPINDLE/ AUTO ADVANCE
061015	4	CLUTCH LOCK TOOL
061359		CONTACT BREAKER OIL SEAL TOOL
NM 12093	5	BOX SPANNER GEARBOX SPROCKET NUT/CRANKCASE FILTER
ET 2003		TIMING PINION EXTRACTOR
063964	6	VALVE GUIDE EXTRACTOR AND INSERTER
063965		PEG SPANNER WHEEL BEARING LOCKRINGS/MASTER CYLINDER END PLUG
064292	7	DRIFT AND HANDLE SET - CRANK-SHAFT/CONTACT BREAKER OIL SEALS
063968	8	EXHAUST PIPE LOCKRING SPANNER
063969		VALVE SEAT FACE CUTTER
063971	9	ISOLASTIC BUFFER ASSEMBLY TOOL
064622		STRAP WRENCH
063970	10	EXTRACTOR MAIN BEARING RACE

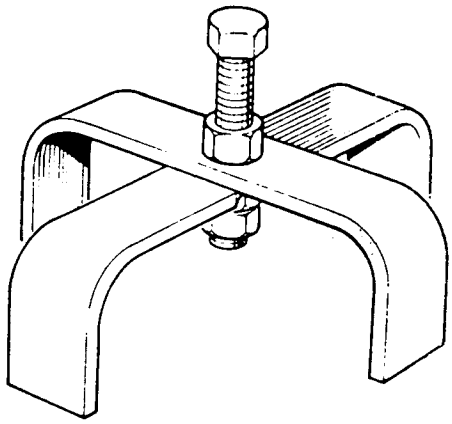
060949 Auto-advance lockwasher



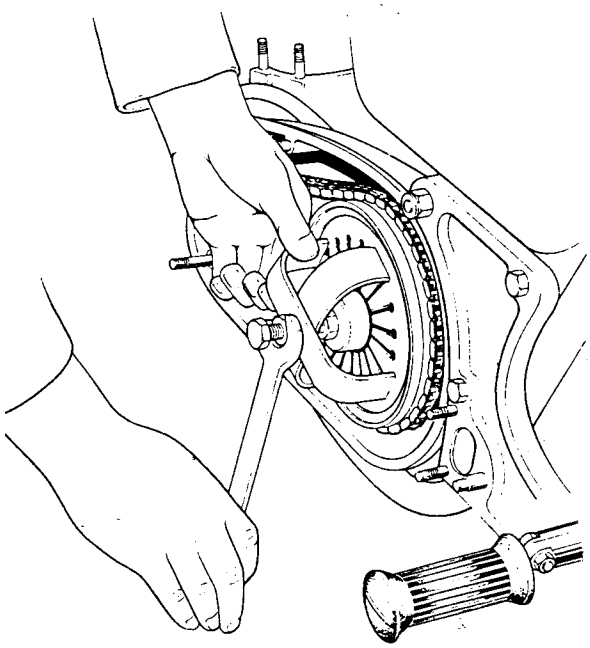
Remove centre bolt from auto-advance mechanism and withdraw washers. Fit the lockwasher with the cut-away side toward the point cam and replace centre bolt with washer . Turn points cam to the full anti-clockwise position and hold while tightening centre bolt. Proceed to set ignition timing in the usual manner. When removing the lockwasher, be sure that the advance mechanism is free and lubricated.



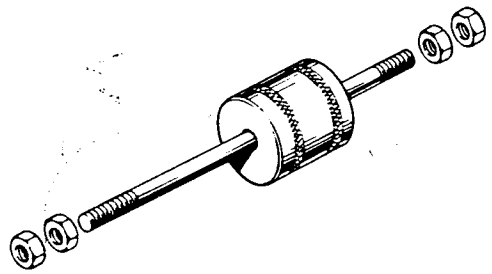
060999 Diaphragm clutch spring compression tool



Remove outer primary cover, release clutch adjustment locknut and remove threaded clutch adjuster. Screw centre bolt of tool into spring centre until well engaged. Tighten nut just under bolt head until the spring is free to turn. Do not overtighten this nut or the spring may be damaged. Peel the circlip from the groove around the outside of the spring and lift out the spring. Unless the spring is to be replaced shortly, release the tension of the withdrawal tool.

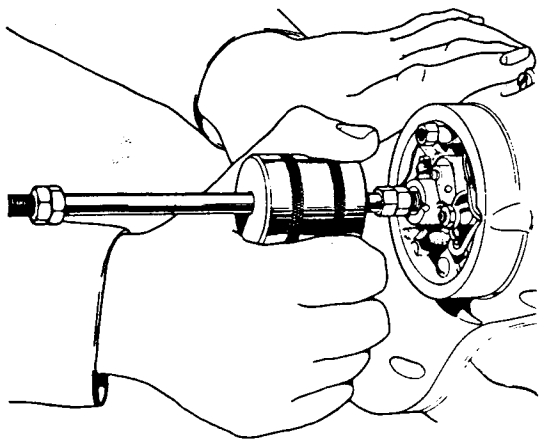


064298 Slide hammer



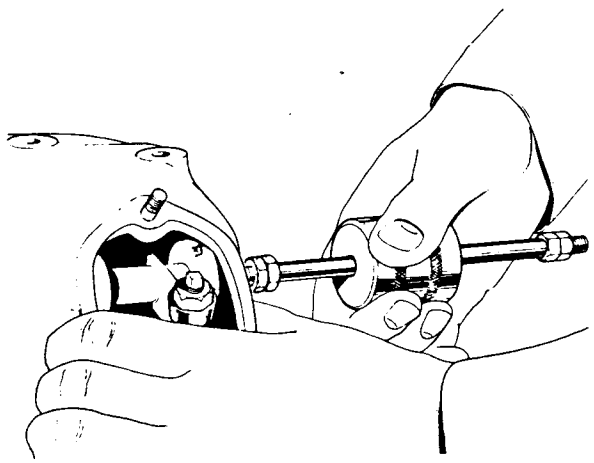
This tool removes the auto-advance cam and also the rocker spindles.

a) To remove the auto-advance cam, take out the centre bolt and washer from the auto-advance mechanism. Insert the correctly threaded end of the slide hammer rod into the auto-advance mechanism, ensure at least 3/8 in. (9.5 mm) thread engagement, tightening into position using the rod locknut. Grasp the sliding weight firmly in the hand and slide back sharply several times to deliver a series of blows on the slide hammer rod outboard nuts. The auto-advance cam will be dislodged easily by this method.

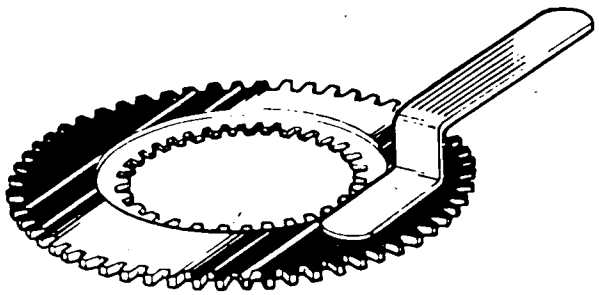


(b) To remove rocker spindle, take off the sealing plate, locking plate and gaskets, screw the slide hammer rod at least 3/8in. (9.5 mm) into the spindle and use the slide hammer as described.

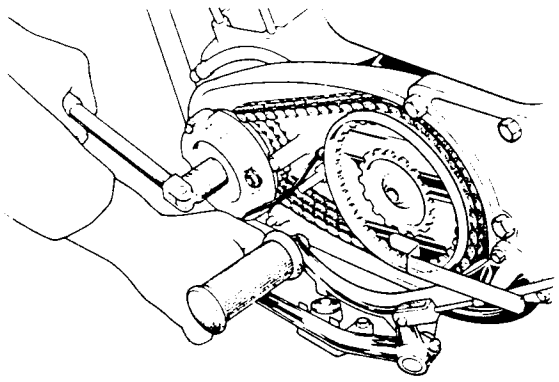
It will be appreciated that a range of adaptors can be made, by the individual fitter, for this tool to suit many other extractor applications.



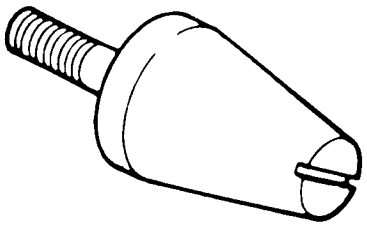
061015 Clutch lock tool



To lock the clutch with the spring removed, remove the pressure plate and the first two (or more) plates. Slide the tool into position in the clutch, making sure that full contact is made on all inner and outer splines. Engage fourth gear and apply rear brake to prevent engine from turning while removing alternator nut, oil pump drive nut, etc.



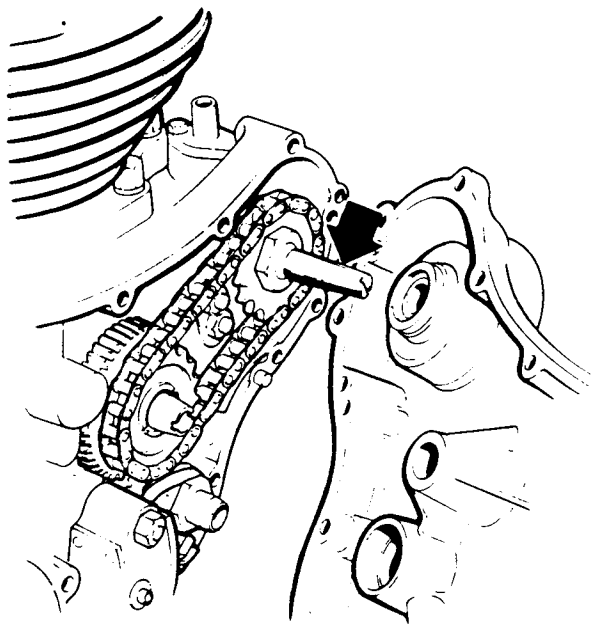
061359 Contact breaker oil seal guide



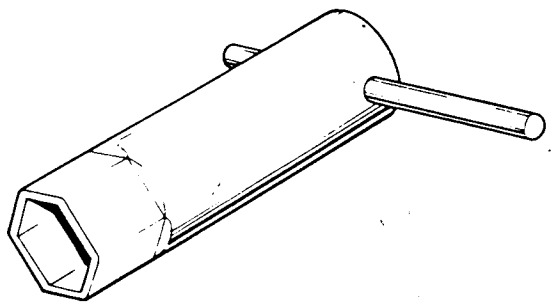
(included in the tool kit of each Norton Commando)

To prevent damage to the contact breaker oil seal in the timing cover, the seal guide should be used whenever the timing cover is to be replaced.

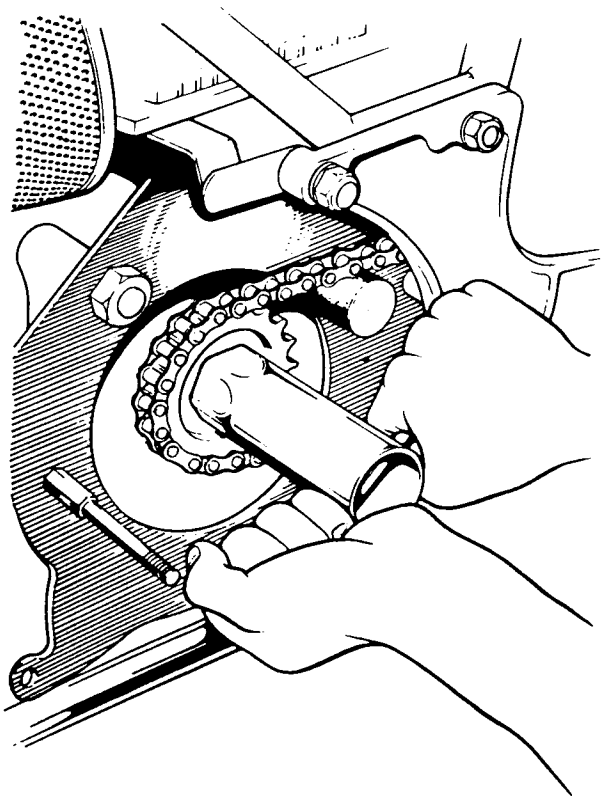
The guide is screwed into the end of the camshaft as far as possible and covered with a light film of oil. Inspect the seal for wear, cracks, and proper seating in timing cover; apply a thin film of oil to its sealing lip. Carefully align the timing cover with the camshaft (and guide) and the end of the crankshaft and push into position. Unscrew guide and withdraw. Continue assembly and retime ignition in normal manner.



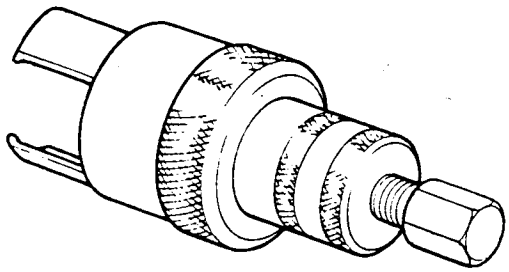
NM 12093 Box spanner



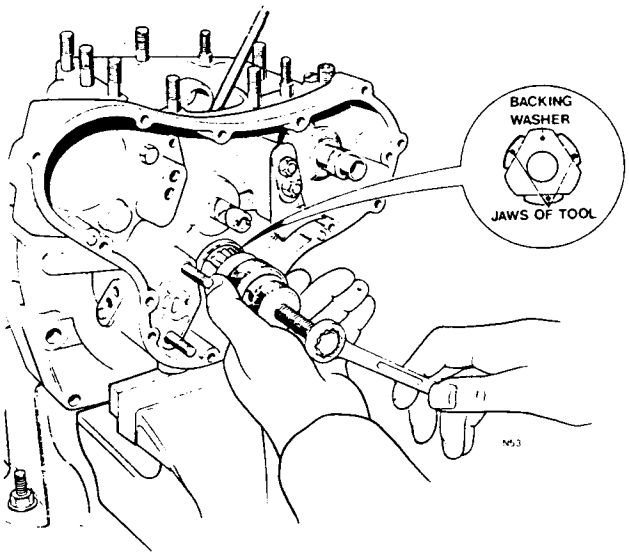
Made to B.S.F./B.S.W. 1in. form with section 1½in. across flats. This spanner is especially made to remove the large nut securing the countershaft sprocket and also fits the large sump plug/strainer fitted to certain models. When removing the countershaft sprocket nut, remember that this nut has a left-hand thread and must be replaced very tightly – 80ft. lbs. torque.



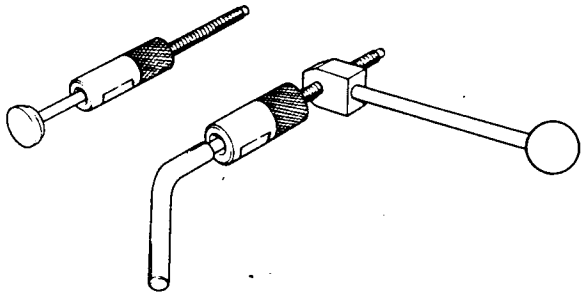
ET 2003 Timing pinion extractor



Fit the extractor over the timing end of the crankshaft and engage the three claws behind the pinion gear. Tighten the large outer knurled ring as firmly as possible. Screw in the large bolt to extract the pinion.

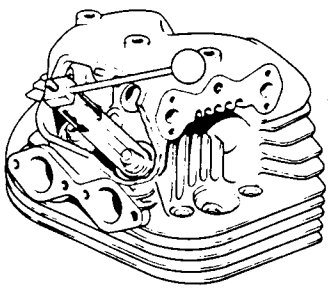


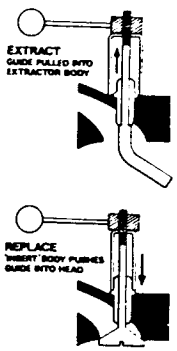
063964 Valve guide extractor and inserter



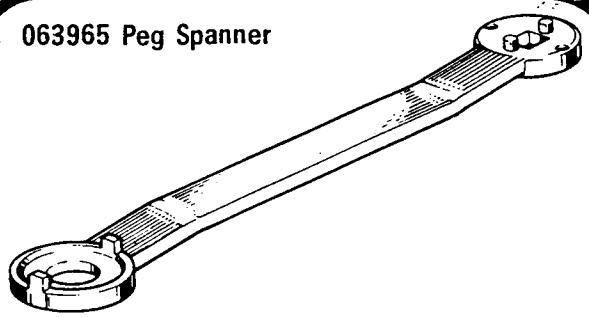
To remove valve guides (assuming that head has already had rockers and valves removed), heat head to about 150 to 200° C. From the outside of head, place the adaptor marked "EXTRACT" hollow end down over the guide. Fit the long threaded stem with the cranked handle through the guide from the combustion chamber. Screw the handle down the threaded portion of the stem and the guide will be pushed from the head into adaptor portion of the tool. Repeat the process for other guides.

To insert valve guides, heat the head to about 150° - 200C. Place the long stem with the conical fitting at the end into the cylinder head so that the conical fitting aligns with the valve seat and the long threaded portion projects out through the rocker box. Lightly oil the guide outer surface and guide bore. Slide the new valve guide, tapered end first, onto the stem, followed by the adaptor marked "INSERT", hollow end first. Fit the handle and screw home to push the guide fully into the head. Repeat for the other guides.





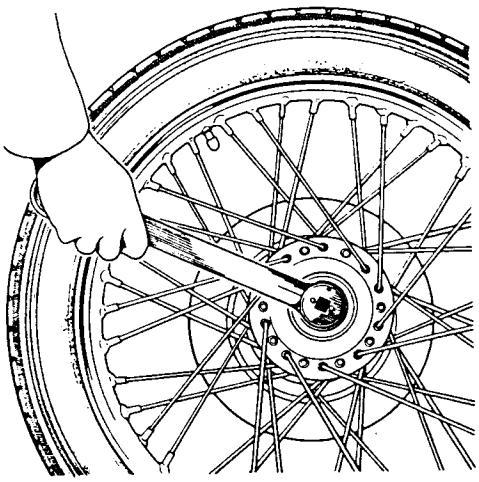
063965 Peg Spanner

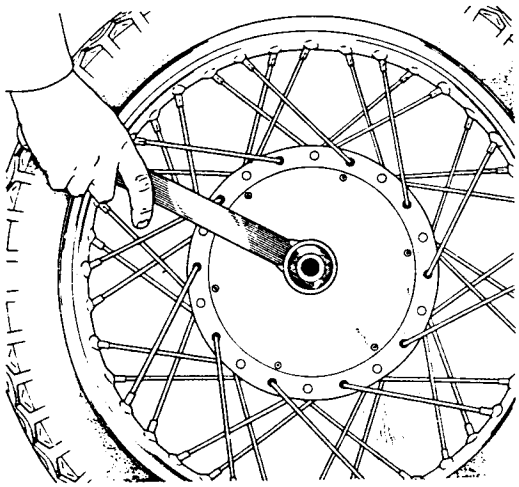


This tool removes and refits wheel bearing lockrings; also the end plug from the disc brake caliper. Use the large round end with square-faced pegs for removal of the rear wheel bearing lockring. (This ring has a left hand thread).

Use the other end and smaller set of pegs to remove the retaining ring for the front wheel bearing lockring (right hand thread).

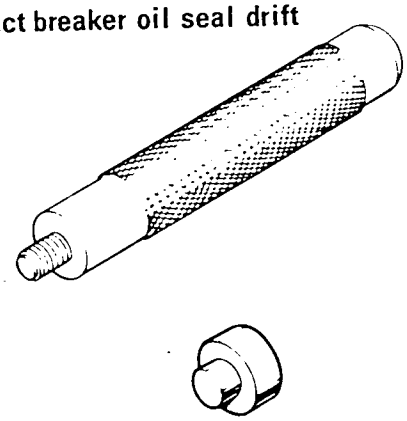
The larger pegs and squared hole are for removal and fitting of the disc brake caliper end plug, in conjunction with a suitable extension and torque spanner. This operation is best undertaken with the caliper in situ on the fork leg. The recommended torque setting for the plug is 26lb/ft. torque.





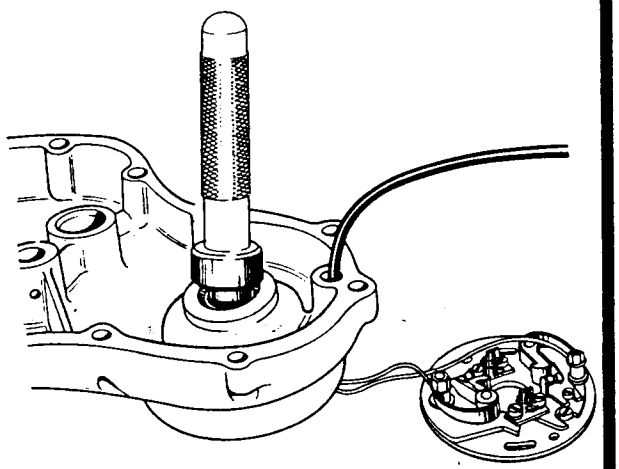
064292 Drift and handle set

Contact breaker oil seal drift



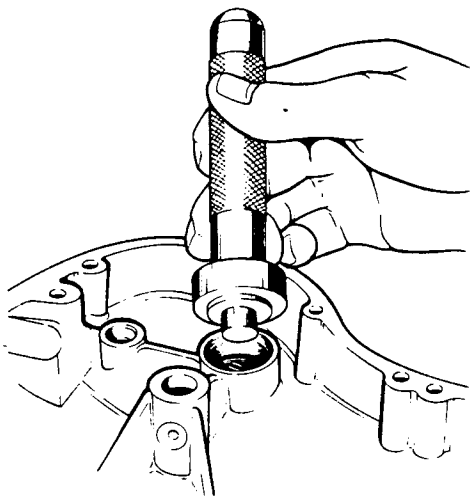
This set includes 063966 contact breaker seal drift and 063967 crankshaft oil seal drift which are no longer available separately. The same handle is used for both drifts which are drilled and tapped to accept this.

For fitting contact breaker oil seals in timing cover - This should be used when fitting contact breaker oil seals to ensure proper positioning of the seal and to prevent the seal being damaged during assembly. The drift is drilled and tapped on the back surface to accept the handle. To fit the oil seal, lightly oil the boss into which the seal fits and place the seal into position with the spring lip facing away from the timing cover. Place the drift in position and press or tap the seal down firmly.

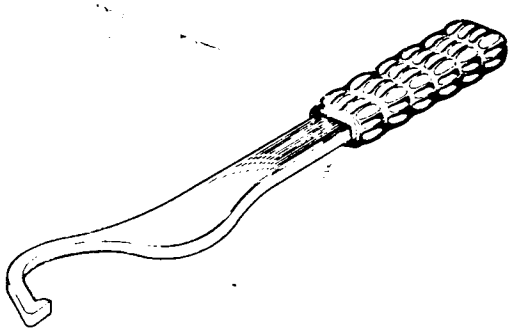


Crankshaft oil seal drift

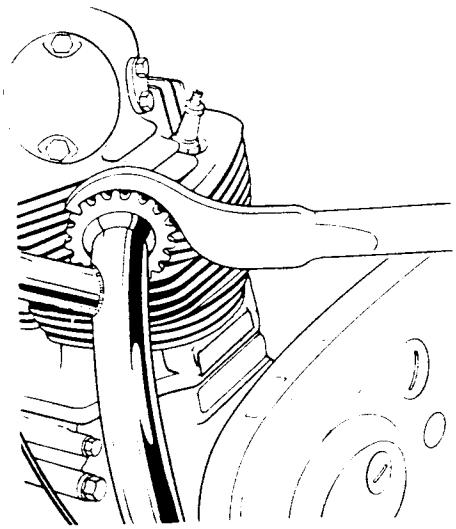
For fitting crankshaft oil seals in timing cover - This drift should be fitted with the handle and used in the same manner as 063966 (see previous paragraph); however, this seal must be positioned so that the spring and lip side faces into the timing cover boss.



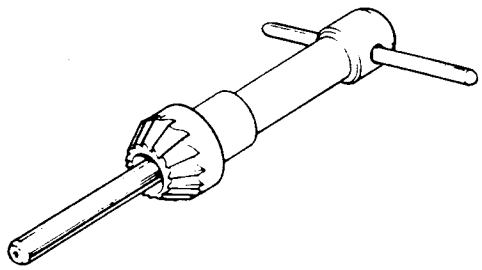
063968 "C" spanner for exhaust pipe lockrings



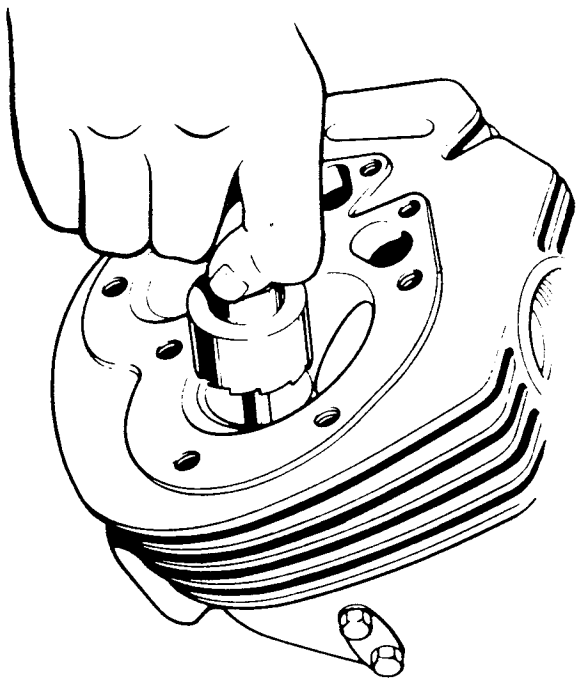
This tool is designed so that the lockrings securing the exhaust pipes can be tightened properly. Fit a tab washer 062412 to the exhaust lockring, place a sealing washer in the exhaust port, and place the exhaust pipe in position in the port. Engage the lockring in the threads and screw in handtight. Fit the "C" spanner into the fins and tighten the lockring as firmly as possible using a smooth, even pressure.



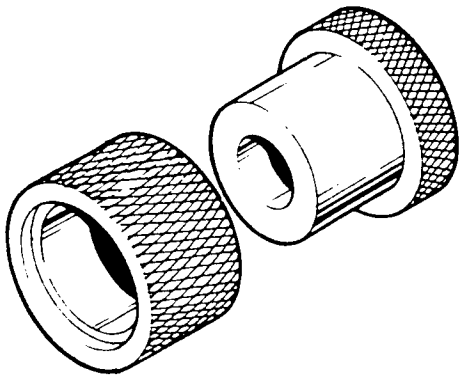
063969 Valve seat face cutter



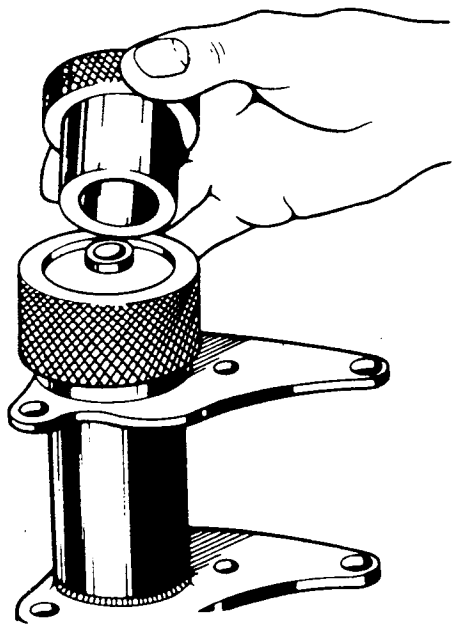
If, when the valves are removed, the valve seats are found to be excessively burnt or pitted, they must be recut to restore a smooth, even face before new valves are ground in. The most important part of cutting new faces is to remove as little metal as possible while removing all traces of burnt material. Pass the cutter into the valve seat with the pilot into the valve guide. Using firm, even pressure to avoid chatter, take the first cut for about 90° to 120°. Repeat until the faces are free of any pitting. Thoroughly clean the combustion chamber and port areas. Repeat for other burnt seats and grind in valves normally.



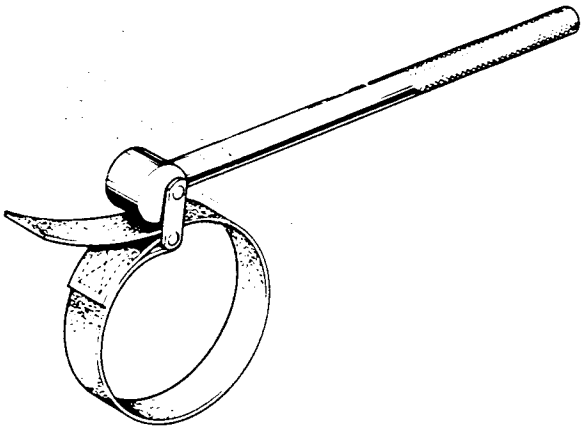
063971 Front Isolastic assembly tool



To compress and fit the rubber bushes in the front Isolastic engine mounting, clean the large tube and place on end on a workbench. Place the tapered collar over the end of the tube, paint the edge of the rubber bush with a rubber lubricant (do not use grease or other petroleum based lubricants - they will rot the rubber), and insert into the open end of the tapered collar.
Fit the drift part of the tool and press the bush into the tube. Turn the tube over and drop the spacer with rubber buffers in place into the tube. Fit the second rubber bush into the tube using the tool. The assembly is now ready to be refitted to the motorcycle.



064622 Strap wrench



This multi-purpose tool releases and secures: fork oil seal retaining collars and full-flow oil filter. The strap wrench also holds the clutch housing for use in conjunction with service tool 061015 whilst the power unit is out of the frame. For releasing or securing operations the tool is used in one order of assembly for slackening (see illustration below) and reverse order for tightening. Pass the strap around the part to be held, thread through the stirrup and take up almost all the slack. Apply pressure to the handle so that the stirrup end of the lever (formed as a 'T') forces against the strap, thus gripping tightly on the part to be released or secured.
To use the tool for holding the clutch, assemble as in the foregoing text with the strap around the clutch housing outboard of the sprocket teeth. Insert clutch lock tool 061015, then prevent the clutch turning by holding the strap wrench handle.