



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

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 necessary 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 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.

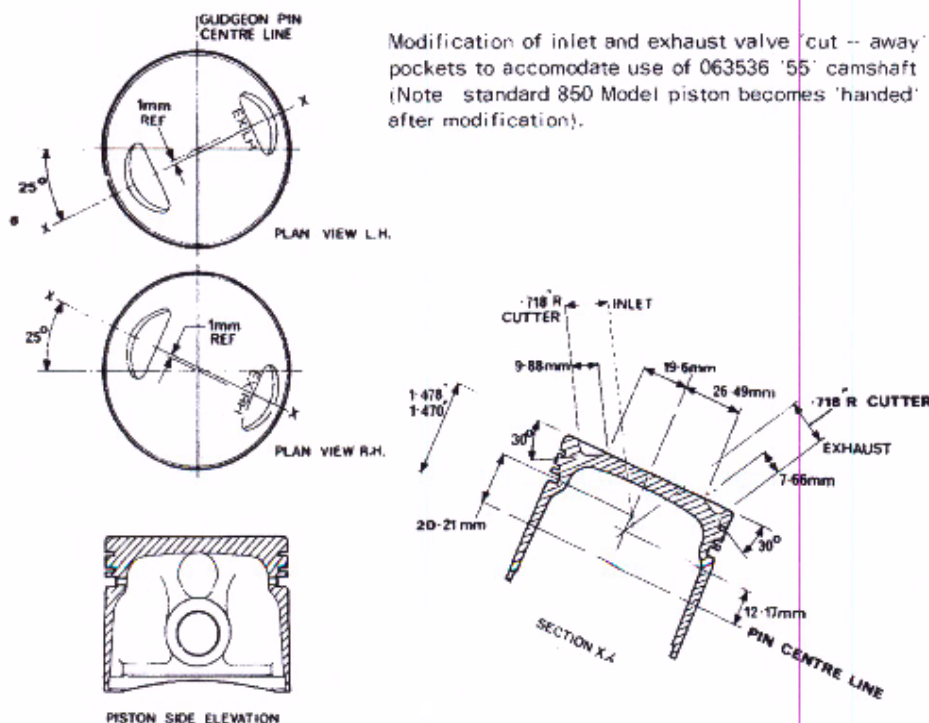


FIG. 1. PISTON CROWN MODIFICATION

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 ratio to 10:1, and to convert both inlet and exhaust ports to the shape to provide optimum power with flexibility.

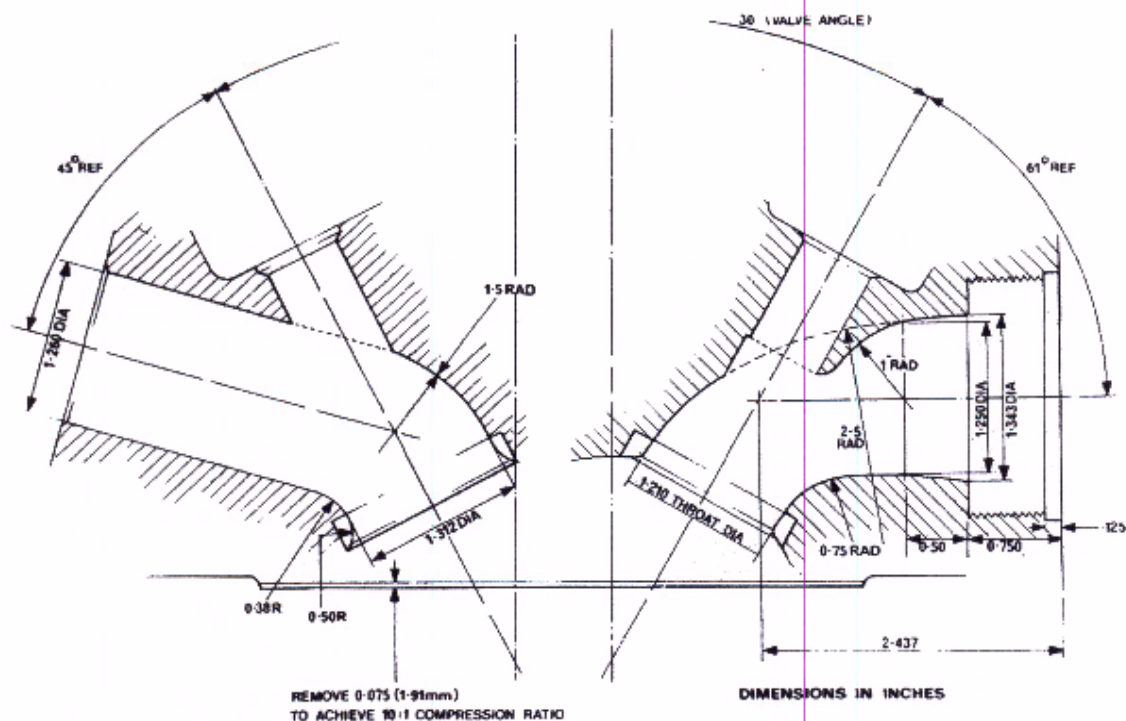


FIG. 2. CYLINDER HEAD MODIFICATION

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).

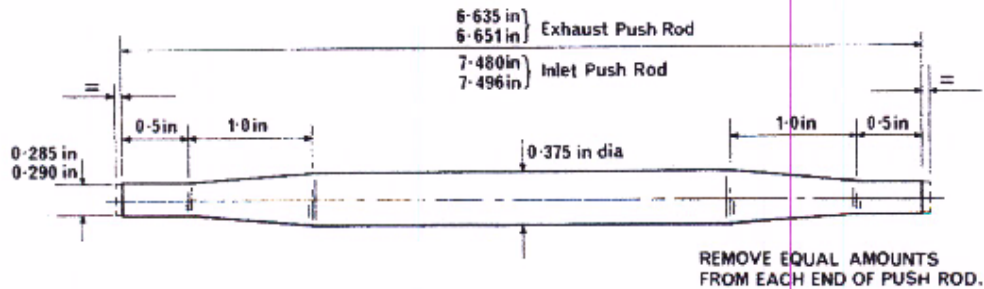


FIG. 3. PUSH ROD MODIFICATION

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 carburetors 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 is 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 RELEASE

N3/64

850 MODEL COMMANDO "STAGE TWO" ROAD RACING CONVERSION

Conversion from Standard Road Specification to 'Stage Two' Road Racing Condition.

The following components will require replacement or modification.

1. Camshaft replacement to '4S' Racing specification.
2. Piston modification to Racing condition.
3. Cylinder head Conversion to Full Flow High Compression Racing Condition.
4. New Amal Velocity Stacks for Carburettors.
5. Push Rod modification.
6. Exhaust System

The Service Release details the alterations that are necessary to convert existing components to the 'Stage Two' Road Racing 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.

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April 1974

850 MODEL "STAGE TWO" ROAD RACING CONVERSION

The following table indicates the components that will require replacement or modification to achieve this stage of tune.

TECHNICAL DATA

Camshaft	–	'4S' Racing Camshaft, Part number 064858 (fitted to standard Camshaft Pinion timing marks)
Cylinder Head	–	Modified to provide 10.5:1 compression ration, and full flow porting.
Piston	–	Modify crown to provide increased 'valve drop'.
Push Rod	–	Shortened to maintain correct rocker geometry.
Carburettor, Manifold and Velocity Stacks	–	Replacement of existing carburettor and air filter equipment.
Valve Clearances	–	Inlet 0.016in. (0.4mm) Exhaust 0.016in. (0.4mm)
Ignition Timing	–	Contact Breaker 30° BTC @ 3000 RPM Fully advanced. Electronic Ignition 31° BTC. @ 5000 RPM Fully advanced.

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 064858. The head diameters of both the inlet and exhaust valves should be measured—ensure head diameters do not exceed 1.490 in. (37.85mm) inlet, and 1.302in. (33.07mm) exhaust. This will avoid any possibility of subsequent 'hook up' when using the new Camshaft in the higher engine R.P.M. range.

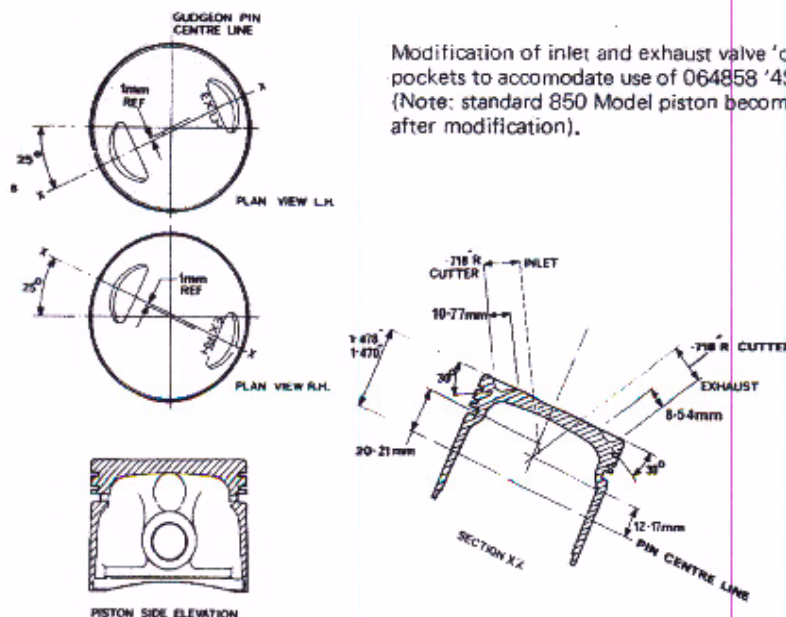
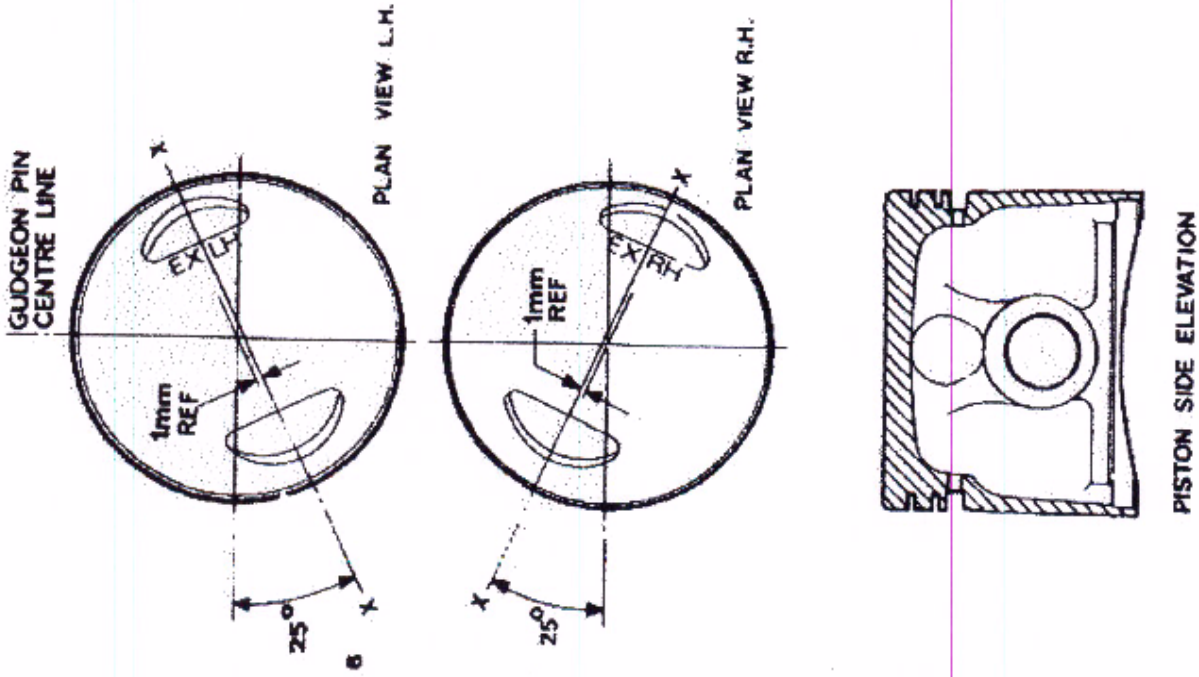


FIG. 1. PISTON CROWN MODIFICATION



Modification of inlet and exhaust valve 'cut-away' pockets to accommodate use of 064858 '4S' camshaft (Note: standard 850 Model piston becomes 'handed' after modification).

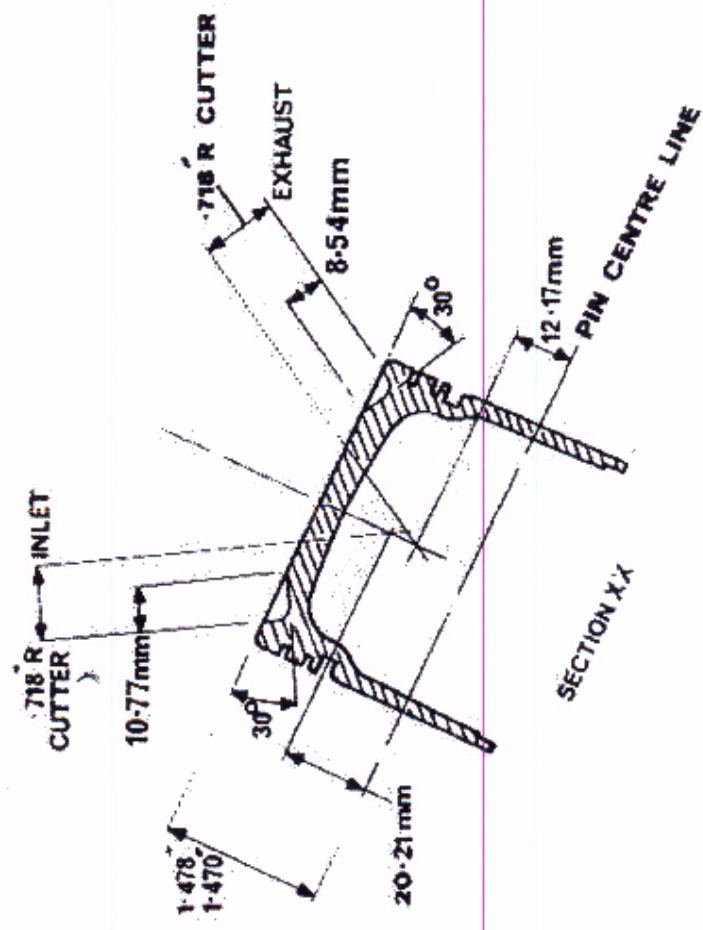


FIG. 1. PISTON CROWN MODIFICATION

2. CYLINDER HEAD

Modifications required to convert the standard 850 cylinder head 063830 to "Stage Two" Road Racing condition.

The diagram (Fig. 2) details the modifications that increase the compression ratio to 10.5:1 and to convert both inlet and exhaust ports to the shape to provide optimum power with flexibility.

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.

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

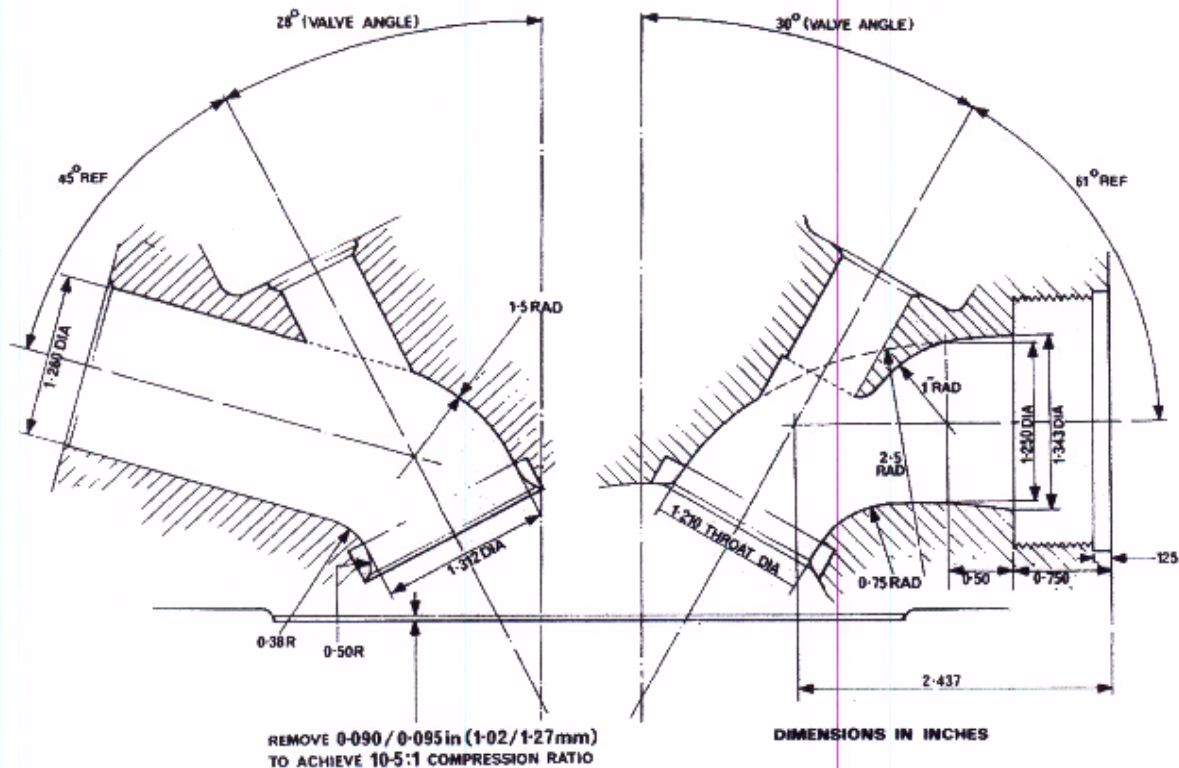


FIG. 2. CYLINDER HEAD MODIFICATION

Compression Ratio Adjustment

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

0.090/0.095in.(2.29mm/2.41mm) should be removed to achieve a compression ratio of 10.5:1 (note: push rod lengths should be amended as described in Section 3 to maintain rocker geometry).

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 0.040in./0.050in. (1.02mm/1.27mm) must be allowed when the inlet valve is closest to the piston at 3°/5° A.T.D.C.

When using the 4S Camshaft for racing it is advisable to ensure the valve springs are in first class condition and if possible to use S & W or other specialist racing valve springs. To avoid the possibility of 'valve float', increase the loading of the exhaust valve springs by fitting two heat insulation washers, NM 23392, per valve instead of one. However it is essential to check that a coil binding condition does not occur at full valve lift.

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

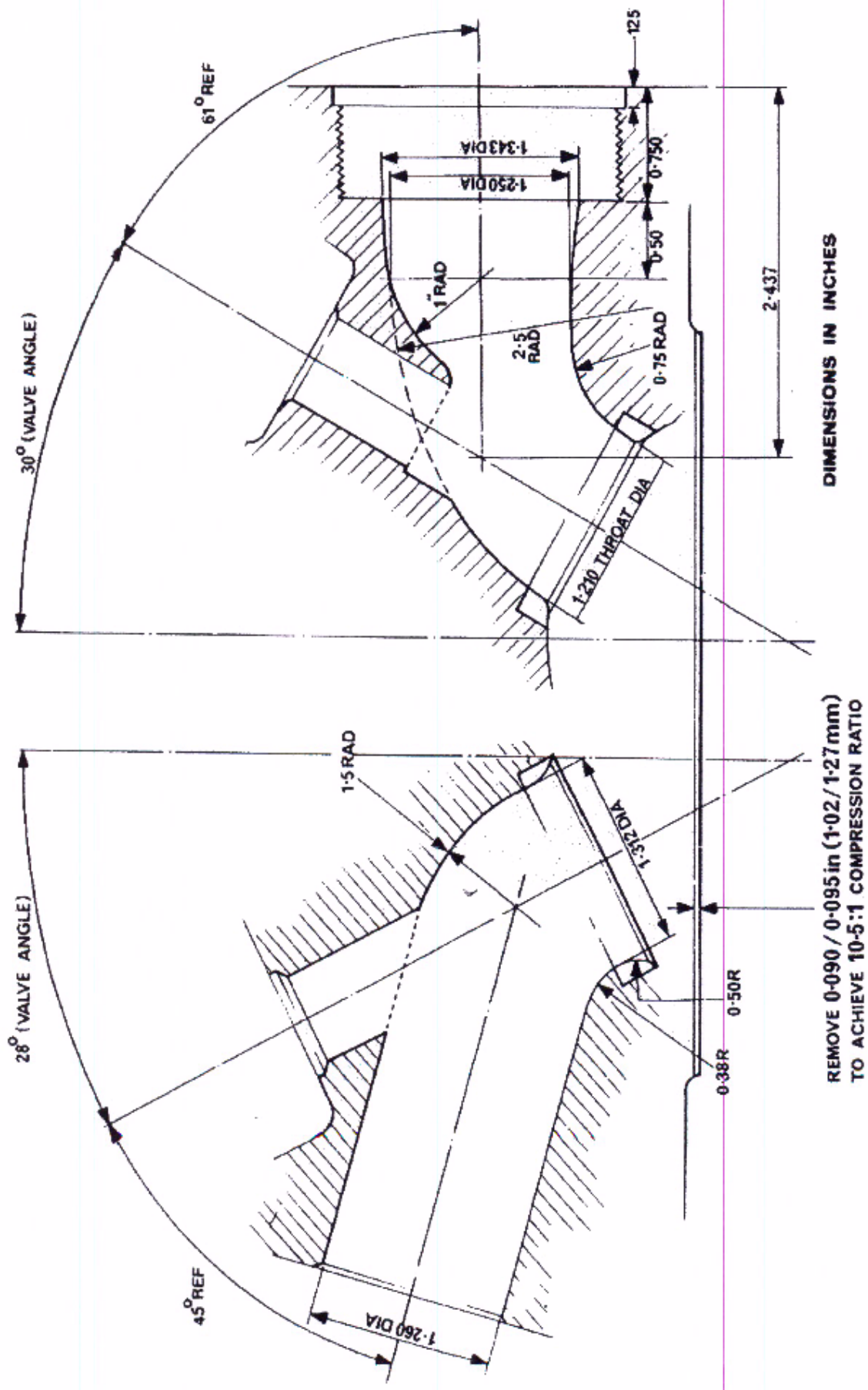


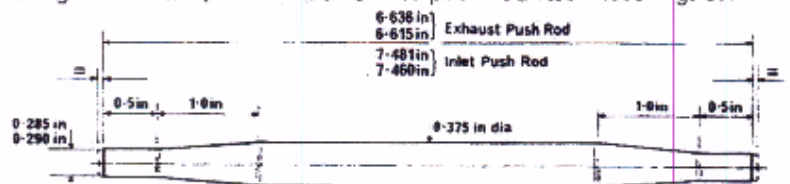
FIG. 2. CYLINDER HEAD MODIFICATION

Compression Ratio Adjustment

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

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 equal amounts of metal removed from each end of the push rods 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 only partially resting onto the taper run-out of the push rod itself (see Fig. 3).



4. CARBURETTORS

FIG. 3. PUSH ROD MODIFICATION

REMOVE EQUAL AMOUNTS FROM EACH END OF PUSH ROD.

Replace the standard 32mm Amal concentric carburetors with Amal Concentric 1036 36mm choke carburetors. If 36mm carburetors are not available 34mm carburetors may be bored out to the correct size after removal of the brass spray tube. The 36mm carburetors should be fitted with racing velocity stacks available from Amal. (Racing "Air Tubes").

The total length from the open end of the velocity stack to the gasket face on the cylinder head should be 9.5" (240mm.) However some difficulty may be experienced with the carburettor bodies fouling the sub frame bracing plate on the Commando frame. If this is the case, shorten the manifolds just sufficiently so that the carburettor bodies clear the frame by 3/8" (9.5mm). Fabricate manifolds so that the carburetors can be remotely rubber mounted from the engine.

As running conditions and engine specifications vary so widely in competition engines a definite ruling cannot be given regarding carburation settings, however the following settings should be a fairly accurate starting point.

- 280 Main jets
- 106 Needle jets
- 3/4 Throttle valves
- Needles in centre position

Gradual taper from 36mm at carburettor end down to 32mm at cyl head end.

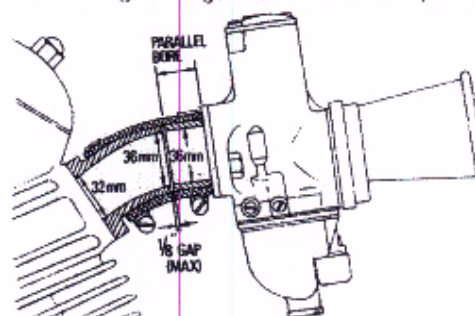


FIG. 4. CARBURETTOR MOUNTING

No. 1 manifold should measure 36mm bore at the carburettor end and then taper gradually and smoothly down to No. 2 manifold, 32mm bore at the other end. The gap between the two manifolds should not exceed 1/8" (32mm) to prevent the rubber fretting or bellowing into the ports.

On completion, it is 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. If the machine is to be ridden using standard gearing, great care should be taken not to exceed 7000 r.p.m. in top gear.

5. EXHAUST SYSTEM

Muffler/Silencer equipment—use the standard exhaust pipes supplied with the machine in conjunction with Roadster mufflers, part number 061978.

Megaphone equipment—use the suggested exhaust system based on the dimensions given Fig. 5 below. Fabricate from 1 1/2 in. (38 mm) internal diameter pipe, with reverse cone megaphones to the dimensions as shown. (20 SWG. MS.).

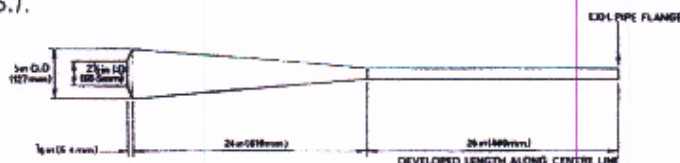


Fig. 5. EXHAUST SYSTEM

6. 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.

material without further difficulty following removal of material from the cylinder head both end caps are removed from each of the four push rods, and equal amounts of metal from each end of the push rods 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, a condition which may rest on the taper run-out of the push rod itself (see Fig. 3).

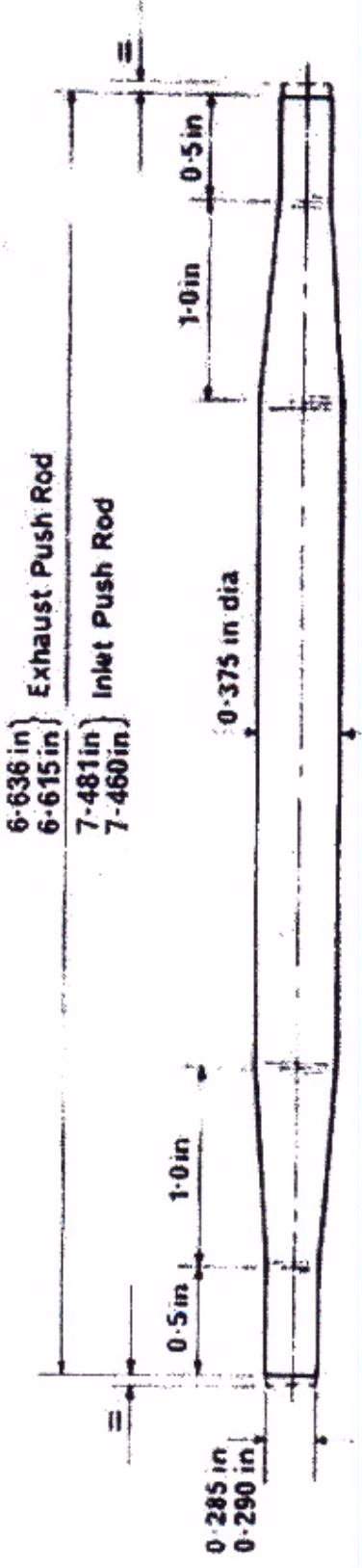


FIG. 3. PUSH ROD MODIFICATION

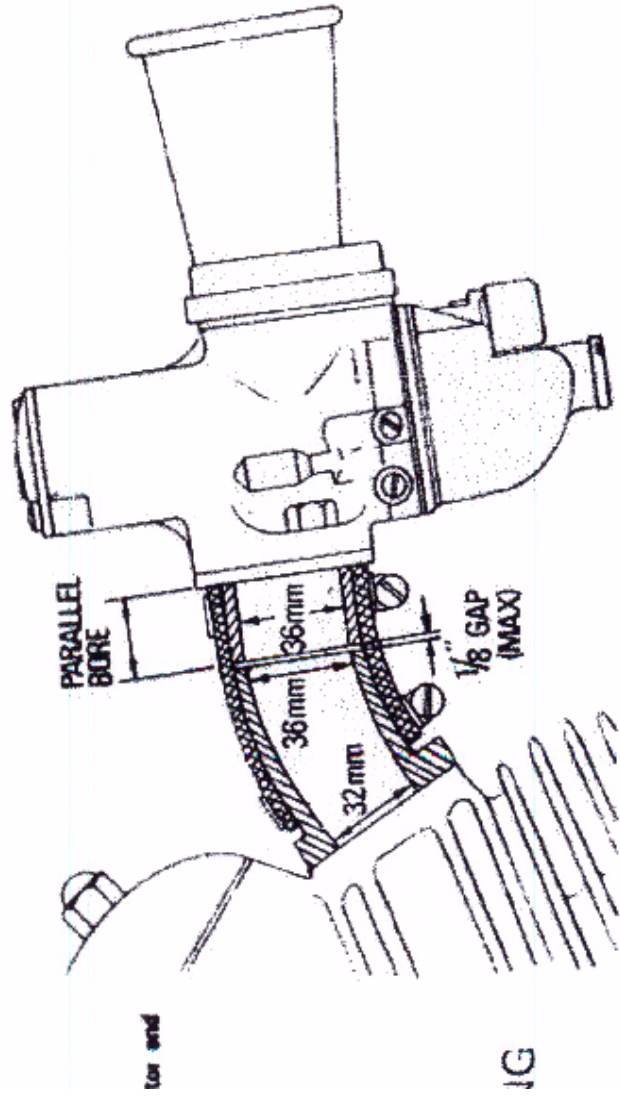
standard 32mm Amal concentric carburetors with Amal Concentric 1036 36mm choke. If 36mm carburetors are not available 34mm carburetors may be bored out to the diameter of the brass spray tube. The 36mm carburetors should be fitted with jets available from Amal. (Racing "Air Tubes").

length from the open end of the velocity stack to the gasket face on the cylinder head should be 100mm.) However some difficulty may be experienced with the carburetor bodies fouling the racing plate on the Commando frame. If this is the case, shorten the manifolds just sufficient to clear the carburetor bodies clear the frame by 3/8" (9.5mm). Fabricate manifolds so that the carburetors be remotely rubber mounted from the engine.

Conditions and engine specifications vary so widely in competition engines a definite rule can be given regarding carburation settings, however the following settings should be a fairly accurate guide.



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pipes supplied with the machine in conjunction

tem based on the dimensions given Fig. 5 below.
with reverse cone manaphones to the dimensions

ment—use the standard exhaust pipes supplied with the machine in conjunction , part number 061978.

-use the suggested exhaust system based on the dimensions given Fig. 5 below. 38 mm) internal diameter pipe, with reverse cone megaphones to the dimensions).).

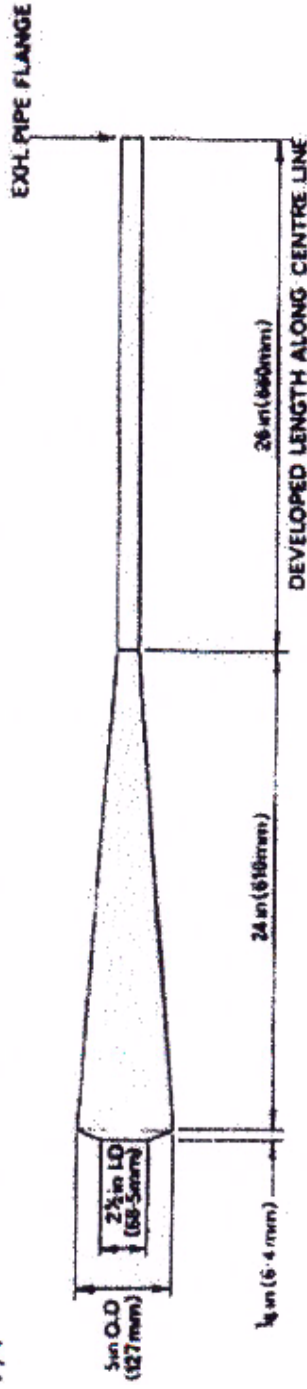
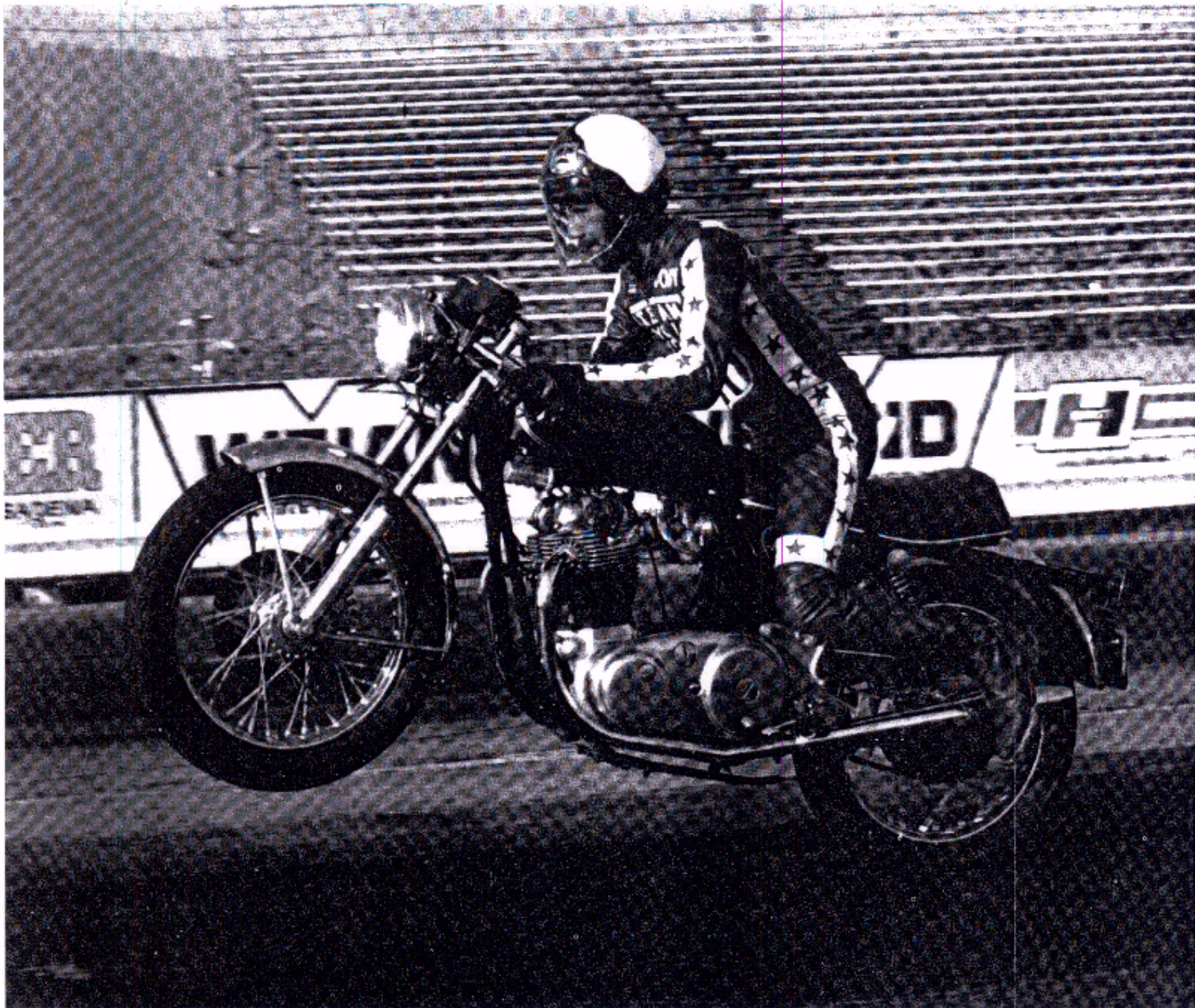


Fig. 5. EXHAUST SYSTEM

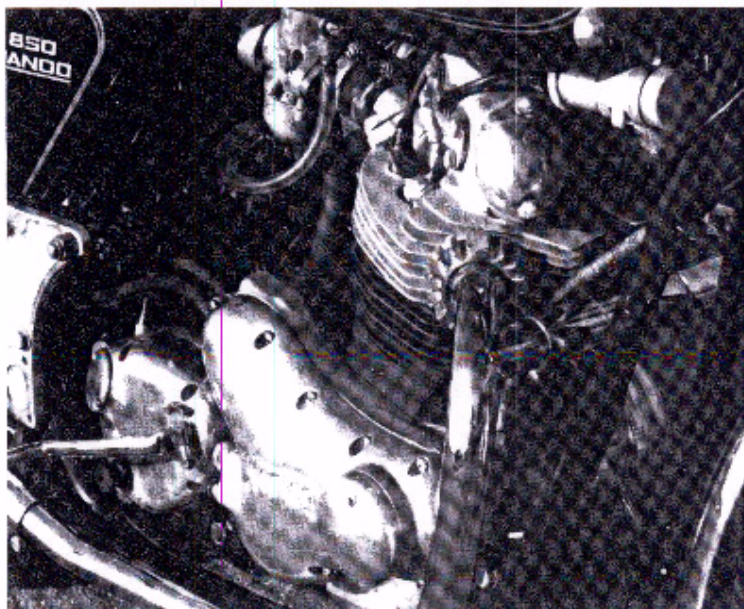
high tensile centreless ground bolts into sized and reamed crankcase boss and it holes is advised to ensure maintenance of maximum rigidity of assembly.



NORTON 850 HOP UP

An 11-second terror anyone can build

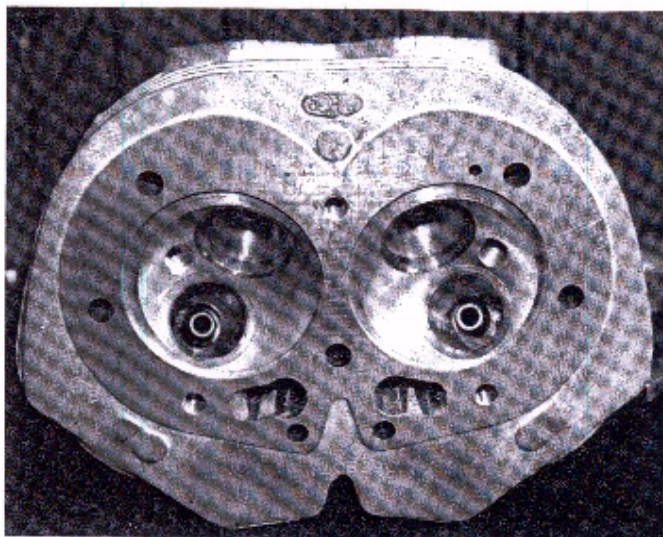
By Jody Nicholas



left. with us. Jerry flowed the standard set-up, the factory-recommended modifications with the 36mm Amal Concentrics, and then flowed the cylinder head to achieve maximum efficiency with his own 34mm Mikuni carburetor modification. Just for reference, here are some additional figures that will be of interest. They compare not only the standard, factory, and Branch Flowmetrics modifications, but some of the other popular and well-known cylinder head/carburetor combinations, as well.

Cu. ft. of air flow per sq.in. of valve area at .425 in. valve lift.

1. Standard Norton, 32mm Amal Concentrics: 46.8 cfm.
2. Factory modification, 36mm Amal Concentrics: 51.4 cfm.
3. Flowmetrics modification, 34mm Mikuni: 56.0 cfm.
4. Flowmetrics modification to Gary Scott's Triumph 750 flat track machine (.390 valve lift): 47.5 cfm.



Looking down the exhaust ports of the Norton 850 cylinder head. Note the smooth surface of the port on the left, after the factory-recommended modification, compared with the roughness of the right-hand port.



Jerry Branch, of Branch Flowmetrics, carefully checks the inlet valve opening while flow testing the factory-recommended modification using the 36mm Amal Concentric carburetor.

5. Flowmetrics modification to Warner Riley's Harley-Davidson, 96-cu.-in., fuel-burning Bonneville record holder with a 44mm Mikuni carburetor and .475-in. maximum valve lift: 47.6 cfm.
6. Standard Kawasaki Z-1 with 28mm Mikuni carburetors and .325-in. valve lift: 44.4 cfm.
7. Flowmetrics Kawasaki Z-1 modification, using the standard 28mm Mikunis, which set the records at Daytona in 1973: 54.6 cfm.
8. Harley-Davidson XR-750 racing engine with 36mm Mikuni carburetors at .450 valve lift: 56.8 cfm.

The following charts are labeled and show the standard, factory modification and Branch Flowmetrics modification for the Norton 850 Commando.

VALVE LIFT IN INCHES	AIR FLOW IN CU. FT./MIN.		
	No. 1	No. 2	No. 3
.050	14.8	16.0	16.2
.100	32.5	32.1	33.6
.150	48.0	48.1	48.7
.200	59.9	61.3	63.2
.250	67.4	71.0	74.3
.300	74.8	77.9	83.6
.350	78.8	84.2	91.7
.400	81.1	88.8	96.9
.450	82.8	91.6	100.3
.500	83.9	93.4	102.7

No. 1 Standard Norton 850 cylinder head with 32mm Amal carburetors with short (standard) velocity stacks. Max. velocity: 179 ft./sec. at .425 in. valve lift.

No. 2 Norton 850 with factory-recommended porting changes and 36mm 173 ft./sec. at .425 in. valve lift.

No. 3 Flowmetrics Norton 850 cylinder head modification with 34mm Mikuni carburetors. Max. velocity: 215 ft./sec. at .425 in. valve lift.

VALVE LIFT IN INCHES	AIR VELOCITY IN FT./SEC.		
	No. 1	No. 2	No. 3
.050	161	174	177
.100	177	174	183
.150	174	173	177
.200	163	166	172
.250	147	153	162
.300	135	140	151
.350	122	129	142
.400	110	120	132
.450	100	110	122
.500	90	100	111

No. 1 Standard Norton 850.

No. 2 Factory modification w/ 36mm Amal carburetor.

No. 3 Flowmetrics modification with 34mm Mikuni carburetor.

This chart gives the air velocity in ft./sec. at the valve seat at all valve lifts. These are complete system checks: carburetor, inlet manifold, cylinder head and inlet valve in place.

850 HOP UP

SPECIFICATIONS

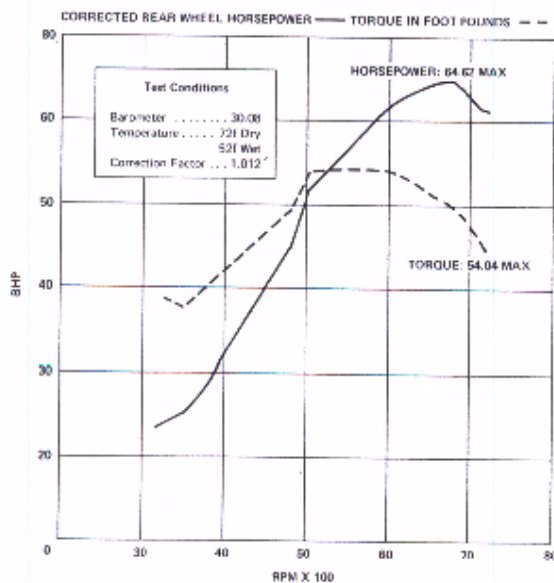
List price	N.A.
Suspension, front	telescopic fork
Suspension, rear	swinging arm
Tire, front	4.10-19
Tire, rear	4.10-19
Engine, type	OHV vertical Twin
Bore x stroke, in., mm	3.03 x 3.50, 77 x 89
Piston displacement, cu. in., cc	.55, 828
Compression ratio	10.0:1
Claimed bhp @ rpm	(see text)
Claimed torque @ rpm ft./min.	4375 @ 7500
Carburetion	(2)36mm Amal concentric
Ignition	coil and battery
Oil system	gear pump, dry sump
Oil capacity, pt.	.6
Fuel capacity, U.S. gal.	2.7
Recommended fuel	premium
Starting system	run and bump
Air filtration	none

POWER TRANSMISSION

Clutch	multi-plate, wet; diaphragm spring
Primary drive	triplex chain (3/8 x .225)
Final drive	single-row chain (5/8 x 3/8)
Gear ratios, overall:1	
5th	none
4th	4.84
3rd	5.90
2nd	8.25
1st	12.40

DYNAMOMETER TEST HORSEPOWER AND TORQUE

ENGINE SPEED	BHP	TORQUE
3180	23.30	38.49
3510	25.07	37.52
3940	31.16	41.54
4820	45.28	49.34
5040	51.72	53.89
5480	56.38	54.04
5920	60.90	54.02
6130	62.58	53.61
6570	64.49	51.55
6800	64.62	49.91
7010	61.52	46.09
7230	61.22	44.47



DIMENSIONS

Wheelbase, in.	57.4
Seat height, in.	31.0
Seat width, in.	10
Handlebar width, in.	.22
Footpeg height, in.	12.9
Ground clearance, in.	5.8
Front fork rake angle, degrees	.28
Trail, in.	4.36
Curb weight (w/half-tank fuel), lb.	419
Weight bias, front/rear, percent	47/53

PERFORMANCE

Top speed (actual @ 7380 rpm), mph	114.21
Computed top speed in gears (@7500 rpm), mph	
5th	none
4th	116
3rd	95
2nd	68
1st	45
Mph/1000 rpm, top gear	15.5
Engine revolutions/mile, top gear	3886
Acceleration, zero to:	
30 mph, sec.	2.9
40 mph, sec.	3.2
50 mph, sec.	4.0
60 mph, sec.	4.4
70 mph, sec.	5.2
80 mph, sec.	5.9
90 mph, sec.	6.9
100 mph, sec.	8.5
Standing one-eighth mile, sec.	7.38
terminal speed, mph	94.14
Standing one-quarter mile, sec.	11.82
terminal speed, mph	114.21

