COLT-ARROW RACING BULLETIN

I.
INTRODUCTION

This racing manual has been prepared as a guide for the customer who wants added performance or reliability from his Colt-Arrow engine or chassis. Included are tips and recommendations covering several different types of racing and all 4-engine sizes that have been produced to date. The procedures outlined in this manual have been worked out both at the race track and on the dynamometer as part of the Direct Connection's performance development program.

The Dodge Colt was introduced in 1971. See Figure 24-1. It was equipped with a 1600 cc (97.4 cubic inch) 4-cylinder, in-line engine with a chain driven, single overhead camshaft. The cylinder head is a hemispherical chamber design. The carburetor is a stages 2-barrel made by Mikuni-Kogyo Co. All the bolts used on the Colt-Arrow engines are metric sizes.

The 2-liter engine (2000 cc) was introduced in 1974. It is built on larger bore centers than the 1600 cc so that few parts are interchangeable between these 2 engines. Like the 1600 cc, the 2-liter engine is a 4-cylinder, single overhead camshaft, hemispherical combustion chamber design. In 1978 a larger version of the 2-liter engine was introduced at 2600 cc. It has a larger bore and stroke but is on the same bore centers.

In 1979 the 1400 cc engine was introduced in the Colt-Champ front-wheel drive cars. It is on a different bore center than the 1600 cc and few parts are interchangeable.

There are other versions of these 4 basic engine sizes that complicate the overall picture. In 1976 the Silent Shaft concept was introduced. There are silent-shaft versions of the 1600, 2000 and 2600. See Figures 24-2 24-3 and 24-4. There isn't a S.S. 1400 and all the 2600 are silent-shaft. In 1978 the MCA-Jet version was introduced. See Figure 24-5. This is a small third valve that is located right next to the spark plug in the combustion chamber. The jet valve assembly is screwed into the head similar to the spark plug but at the opposite angle. The jet valve is operated by a second adjuster on the intake rocker arm. There are MCA-Jet versions of all 4 engine sizes.

There are also different versions of the Colt-Arrow engines that are sold in Canada. These Canadian engines are usually different from the U.S. equivalents. They may not have silent shafts or they may not have the MCA-Jet. Because of complexity, we will not cover the Canadian options directly in the manual.

Engine	In³	Service I.D.	Bore x Stroke (mm)
1400	86.0	"J" Engine	74 x 82
1600	97.5	"K" Engine	76.9 x 86
2000	121.7	"U" Engine	84 x 90
2600	155.9	"F" Engine	91.1 x 98
1600	97.5	"Z" Engine	Above with Balance Shaft
2600	155.9	"W" Engine	D50 pickup only

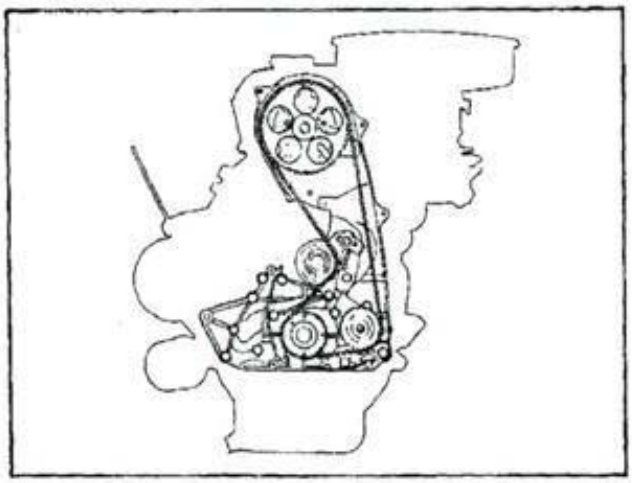

FIGURE 24-1

STANDARD 1600 ENGINE
(Belt Drive Cam Version)

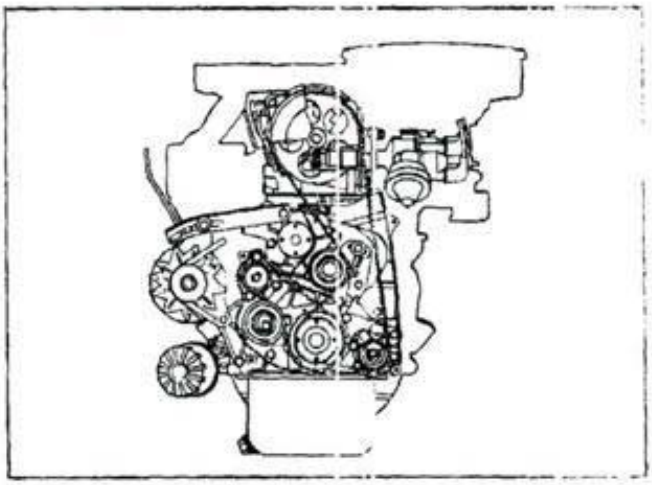

FIGURE 24-2

1600 ENGINE WITH SILENT SHAFT
(Timing Belt)

An overall look at the advertised horsepower ratings for the various engines is as follows. The numbers are overall averages and therefore are not exact for any particular year or option.

1400 cc	70 hp @ 5200 rpm
1600 cc	80 hp @ 5200 rpm
2000 cc	93 hp @ 5200 rpm
2600 cc	105 hp @ 5000 rpm

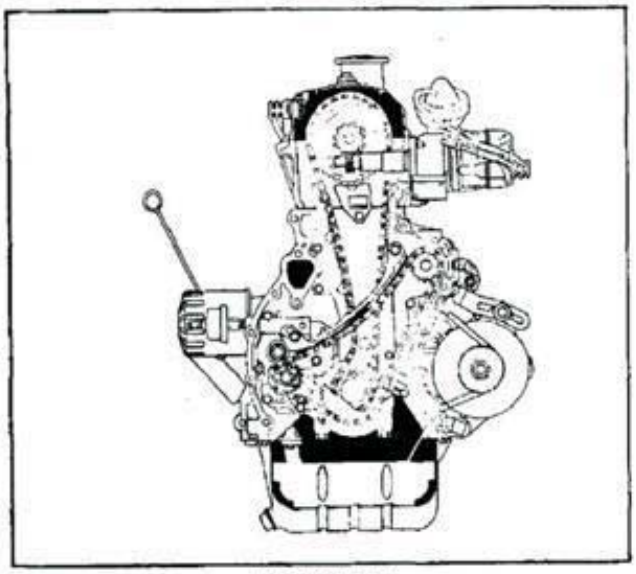

FIGURE 24-3

2000 and 2600 ENGINE WITH SILENT SHAFT
(Chain Drive)

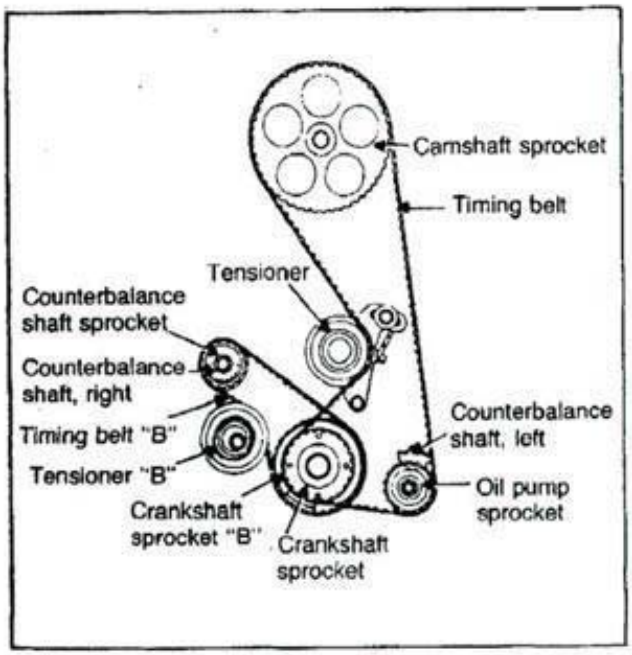

FIGURE 24-4

1600 BELT DRIVE SYSTEM

It is obvious from the engine complexity outlined above that this bulletin cannot cover all these different engines in detail. Therefore we strongly recommend that the proper service manual for your car be obtained before you start any modification. Then use this bulletin to supplement the information stated in the service manual. It covers both engine and chassis which will make it helpful in the later sections also.

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Service Publications
20026 Progress Drive
Strongsville, Ohio 44136

We will first discuss the engine piece by piece and then cover race preparations and recommendations. Later we will discuss the chassis and suspension items.

II.
GENERAL PARTS INTERCHANGEABILITY AND DESCRIPTION

The engines will now be disassembled and discussed piece-by-piece as far as what is different, what is interchangeable, and what special parts are available. Later, we will assemble the pieces into packages which will be helpful in improving your engine's performance.

A. Block

The cylinder blocks are 5 main bearing, 4-cylinder in-line designs. The block replacement asembly includes main caps, bolts and various plugs. Each engine size uses a different block. The silent shaft versions also take a different block. The general block specifications are as follows:

Block	Bore Spacing	Block Height
1400 cc	82 mm	201 mm
1600 cc	87.5	230.2
2000 cc	101	251
2600 cc	101	251

To date all the blocks have proven adequate for the various racing purposes although the silent-shaft versions are not recommended for highly modified engines.

Only the 2.0 and 2.6 liter engines use the same main bearings. Each engine has main bearings available in .25, .50 and .75 mm undersizes. All standard bearings are tri-metal designs and have proved satisfactory for racing applications.

The 1979 and 1980 2.0 liter *and* 2.6 liter and '81-'82 2.6 L engines have smaller diameter main bearings (66 mm. to 60 mm.) which also makes these blocks unique.

The silent shaft used in the specially balanced versions of the three engines is a device for balancing the engine for added smoothness. The silent shaft engines are very smooth. Typical 4-cylinder engines are not. The "silent shaft" is actually 2 shafts — a left and a right. They are driven off the front of the crank like the camshaft but it uses a separate drive. See Figure 24-2 and 24-3. The 1600 cc. engine uses a cog belt while the 2.0 and 2.6 liter engines use chain drive. The 2 shafts are not the same in the 3 engines.

As mentioned earlier, the silent-shaft engines are not recommended for high-output racing purposes. This is not a strength consideration but a rotating weight problem. The balance shafts are tied directly to the crank and rotating at high speed represents a sizeable performance loss. We are developing a conversion kit to enable the racing use of the engine without the balance shaft, but to date we have no place to use it legally!

B. Heads

The standard cylinder head is an aluminum hemi, single overhead cam design on all 4 engines. All heads use valve seat inserts and pressed-in valve guides. Each engine has a different head except the 2.0 and 2.6 heads which have the same specifications and can be swapped. The MCA-Jet heads are different from the standard heads, but are built to the same specifications — value size, etc. See Figure 24-5. The head specifications are as follows:

Engine	Head Volume	Intake Valve	Exhaust Valve	Stem Diameter
1400	34 cc	34 mm	30 mm	6.6 mm
1600	38 cc	38 mm	31 mm	8 mm
2000	54 cc	43 mm	35 mm	8 mm
2600	57 cc	43 mm	35 mm	8 mm

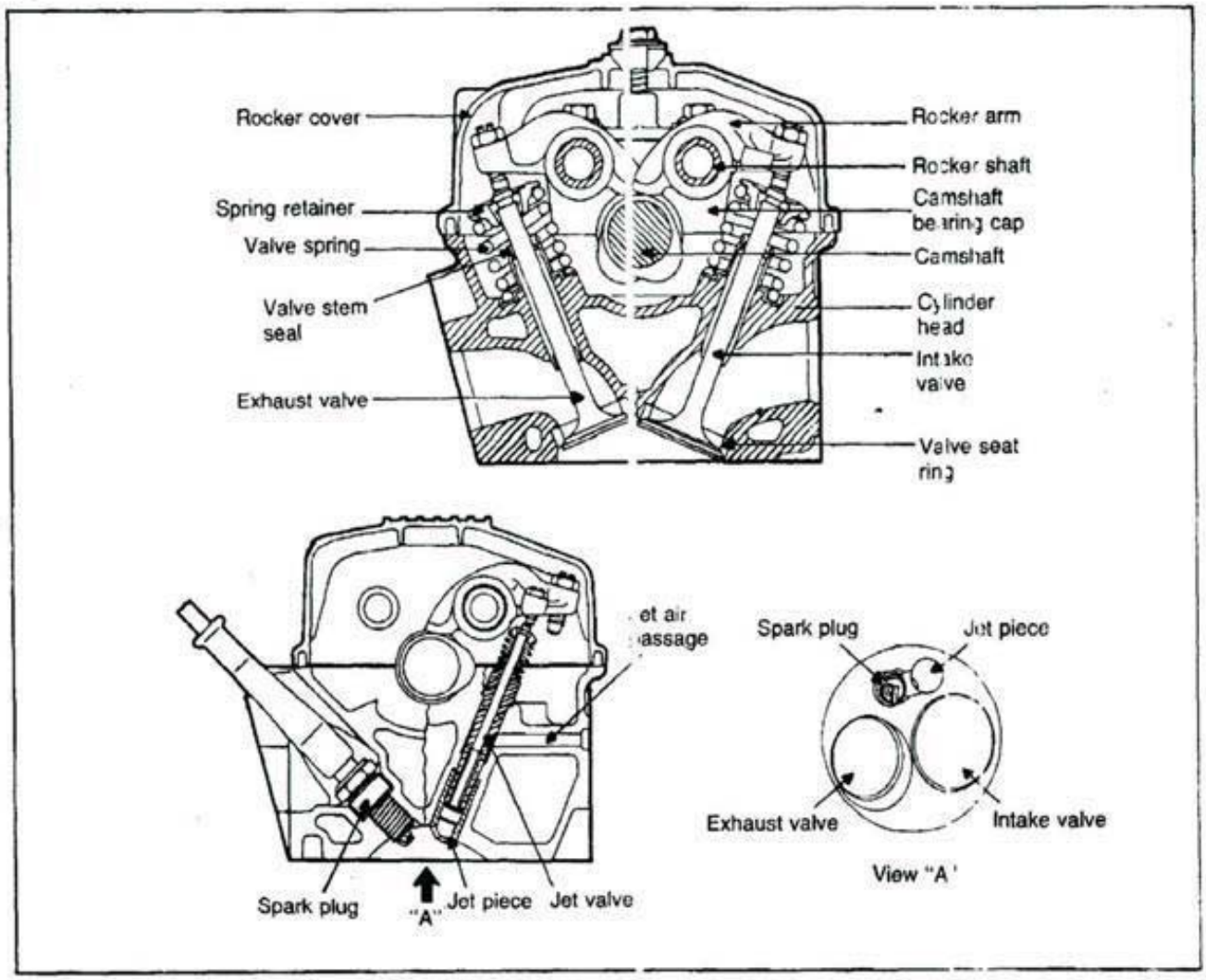

FIGURE 24-5

MCA-JET CYLINDER HEAD

The cylinder head is serviced as an assembly which includes the valve seats, valve guides and various studs. The "jet" which technically is a third valve is actually a valve, valve spring, and nozzle assembly and is threaded into the head like a spark plug. It is serviced only as a total "jet" assembly.

The head gasket varies for each engine. The MCA-Jet head uses the same gasket as the standard head.

Engine	Thickness	Part Number
1400	1.15 mm	MD030293
1600	1.35 mm	MD009451
2000	1.35 mm	MD020747
2600	1.25 mm	MD024514

The cylinder heads are all crossflow designs — intake on one side, exhaust on the other. The exhaust side causes some problems from a performance standpoint because the port-shape changes. In 1974 the port-shape changed from square to round. Headers are not interchangeable from the port-shape to the other. See Chart.

CYLINDER HEAD EXHAUST PORT CHART

	1600	1600 Silent Shaft	2000	2000 Silent Shaft
1971	□		—	
1972	□		—	
1973	□		—	
1974 Early	0 CA.		0 CA.	
	□ Fed.		□ Fed.	
Late	0 CA.		0 CA.	
	0 Fed.		0 Fed.	
1975	0		0	
1976	0		—	0
1977	0	0	—	0

C. Crankshaft

Each engine uses a different crankshaft because of the different strokes. The main and rod bearings are tri-metal material and are available in .25, .50 and .75 mm. undersizes. Specifications are as follows:

Engine	Stroke	Main Journal Dia.	Rod Journal Dia.	Material
1400	82 mm	43 mm	42 mm	Cast
1600	86 mm	57 mm	45 mm	Forged
2000 (Up to '78)	90 mm	66 mm	53 mm	Forged
2600 ('78 only)	98 mm	66 mm	53 mm	Forged
2000 ('79-'80)	90 mm	60 mm	53 mm	Forged
2600 ('79-'82)	98 mm	60 mm	53 mm	Forged

The '79-'82 2.0 and 2.6 liter cranks won't fit the '78 and earlier engines and vice-versa.

The stock 1600 forged crankshaft is well suited for race engine applications. Early cranks were tuftrided, while later units were carbon-nitrided. One is as good as the other.

Stock bearings are a tri-metal design, and have proved satisfactory for racing.

D. Connecting Rods

The 2.0 and 2.6 liter engines use the same connecting rod (MD020855). The two smaller engines use different connecting rods. The rod specifications are as follows:

Engine	Length	Weight	Rod Journal Diameter	Pin Diameter
1400	131 mm	490 g	42 mm	18 mm
1600	153.7	630	45	19
2000	166	830	53	22
2600	166	830	53	22

Standard rod bearings are available in standard and .25, .50 and .75 mm. undersizes and are tri-metal material on all 4 engines.

E. Pistons

The pistons in all the engines are different because of differing bore sizes but they all are cast aluminum and have a dished design. Some pistons have an intake valve clearance notch. Piston specifications are as follows:

Engine	Bore Size	Weight	Deck Height
1400	74 mm	220 g	.2 mm below
1600	76.9	274	0
2000	84	382	0
2600	91.1	420	.8 below

Pistons are available in .25, .50, .75 and 1.00 mm overbore sizes. The following part numbers for the 1978-1979 engines is supplied for reference:

	1400 cc	1600 cc	2000 cc	2600 cc
Standard Bore	MD030322	MD009521	MD021192	MD024947
.25 mm Oversize	MD030390	MD009530	MD021001	MD025080
.50 mm Oversize	MD030391	MD009531	MD021002	MD025081
.75 mm Oversize	MD030392	MD009532	MD021003	MD025082
1.00 mm Oversize	MD030393	MD009533	MD021004	MD025083

Each engine's piston pin is different. See chart below for specifications.

Engine	Pin Length	Pin Diameter	Retaining System
1400	60 mm	18 mm	Press Fit
1600	64 mm	19 mm	Press Fit
2000	75 mm	22 mm	Press Fit
2600	79 mm	22 mm	Press Fit

All the oil rings on the pistons are 4 mm wide. All the compression rings have a width of 2 mm except for the 1400 cc engine which uses 1.5 mm wide compression rings.

F. Camshaft

All the engines use different camshafts but they are all single overhead cam designs. All cams have 5 load-bearing journals except the 1400 which has only 3. There are no cam bearings as such. The camshaft rides on solid aluminum surface which is machined into the head. Specifications are as follows:

Engine	Cam Duration	Cam Overlap	Lift
1400	247	36	8.8 mm
1600	248	37	9.2 mm
2000	264	39	10.0 mm
2600	264	45	10.5 mm

The above specifications are reflective of 1978-1979 production engines. There have been other camshafts used in earlier engines. The earlier 1600 cc engine used a chain-drive for the cam while the 1978-1979 1600 cc engine uses a belt-drive. See Figure 24-4. The 1400 cc engine has a 92-tooth belt while the 1600 has a 122-tooth belt. The 2.0 and 2.6 liter engine use chain-drive with 102 links in the chain.

G. Valve Gear

With the overhead cam design on each engine, the valve train consists of rocker arms, valves, valve springs, retainers, locks and seals. The 1400 cc. engine is totally different in the valve gear hardware department from the 3 other engines.

The valves and valve springs are unique to each engine except for the 2.0 and 2.6 which share the same pieces. The specifications and part numbers for the 1978-1979 engines follow:

Engine	Intake Valve Diameter	Length	Stem Diameter	Part Number
1400	34 mm	102.1	6.6	MD016460
1600	38 mm	105.9	8	MD000480
2000	43	112.8	8	MD020580
2600	43	112.8	8	MD020580

Engine	Exhaust Valve Diameter	Length	Stem Diameter	Part Number
1400	30 mm	100.9	6.6	MD016461
1600	31 mm	102.5	8	MD000481
2000	35 mm	111.7	8	MD020583
2600	35 mm	111.7	8	MD020583

Engine	Valve Spring Part Number	Load-Closed	Load Open (N @ mm)
1400	MD030570	230 @ 37.3	570 @ 28.5
1600	MD002500	290 @ 37.3	610 @ 28.1
	MD002501 Can.		
2000	MD022591	285 @ 40.4	730 @ 30.4
2600	MD022591	285 @ 40.4	750 @ 29.9

All the engines use valve spring retainers, locks, seals and valve spring seat, and all use the same hardware except for the 1400 cc. The steel valve spring seats are used to keep the spring from pounding directly on the softer aluminum of the cylinder head.

Part	1400 cc	All Others
Retainer	MD016432	MD008761
Locks	MD016433	MD008760
Seals	MD016430	MD000508
Valve Spring Seat	MD016495	MD000507

The rocker arms are quite confusing. The 2.0 and 2.6 liter engines use the same rockers however the MCA-Jet versions use unique intake rockers. Otherwise intake and exhaust rockers are the same. The same conditions hold true on the 1600 except the parts are different. The 1400 uses different intake and exhaust rockers. The Jet version of the 1400 uses two different intake rocker designs and two unique exhaust rockers. All the overhead cam rockers have the fixed end ride on the camshaft lobe and the adjustable end rides on the valve tip.

H. Intake Manifolds

All 4 engines use different aluminum intake manifolds but they are all of similar design — single plenum, 4 runners in a plane. Part numbers for actual manifolds change from year to year, in Canada and in California.

J. Oil Pump

All 4 engines use different oil pumps on the 1978-1979 models. The 1600 uses 2 different oil pumps — 1 for the silent shaft version and 1 without.

K. Exhaust Manifold

The Colt engines have fairly efficient exhaust systems due mainly to the well-designed 4 into 2 into 1 exhaust manifold. Headers for the Colt are available from several manufacturers including Hooker and JR. Larger diameter exhaust pipes and a low restriction muffler will help the overall engine output.

See later section for further details.

III.
ENGINE PARTS AND PREPARATION

In the following sections, we'll discuss the parts and pieces that are available for the various Colt engines for off-road performance activities. At the same time we'll make recommendations on using these parts. Since each engine is basically different, each one will be covered separately. Also development time has favored the older engine, so there are more parts available for the 1600. The racing governing bodies have classes (or factors) for 1600 and 2000 engines but until the 1979 2600 Arrow the big engine was pretty much ignored or uncompetitive. This "Fire Arrow" package is currently competitive in the "Production Class" in SCCA rallies.

For competition use, engines without the "Silent Shaft" and "MCA Jet" (3-valve) features have proved most satisfactory. "Silent Shaft" was introduced in 1976 on 2000 cc engines. In 1977 it was made standard on all 2000 cc engines, and some 1600 cc units (Colt "YB" models and Arrow GT). For 1978-1979 it is standard on all 2000 cc and 2600 cc engines and some 1600 cc engines (Arrow GT5-speed, and all Challanger/Sapporo models). The "MCA Jet" system was introduced in 1978, and is standard on all 1600 cc, 2000 cc, and 2600 cc engines.

A. The 1600 cc Engine

The complete C2 engine package, developed for both race and rally modification, increases output of the 1600 cc unit by 75% to approximately 140 HP. Higher outputs can be achieved with additional induction system modifications, higher ratio pistons, camshaft and header changes.

The discussion which follows presents each major system and subsystem of the engine, indicating modifications from stock configuration for a variety of high performance applications.

1. *Cylinder Head Assembly*

The C2 high-performance head (P3690497) is interchangeable with the stock unit. Intake valves (P3690498) are 1.575" (40 mm) diameter, exhaust valves (P3690499) are 1.299" (33 mm). Intake valves have a smaller stem diameter (0.283"/7.2 mm) than standard for reduced weight. Both intake and exhaust valves are tufftrided and exhaust valve stems are hard chrome plated. The intake port has been enlarged and contoured for improved air flow. Stock intake and exhaust manifolds can be used with the C2 head.

The complete C2 head set (P3690481) includes the C2 head, valves, and heavy-duty C2 dual valve springs, keepers, retainers and locks.

A sodium filled exhaust valve is also available (P3690493). These valves run cooler, retain their seal better under continuous high output conditions, and reduce the possibility of a hot exhaust valve causing detoration problems.

2. *Valve Train*

The valve train consists of rocker arms, valves, valve springs, and retainers. Utilizing C2 valve gear with titanium retainers and modified rocker arms will raise the valve float point to 8500 rpm.

Valve springs supplied with the C2 head consist of a double spring set that increases seat load to 74 lb. and open load to 170 lb. These springs are good for valve lifts to 0.420" (10.67 mm). An optional valve spring (P3614546) is available for lifts to 0.600" (15.24 mm). This optional spring increases open load to 215 lb., and consists of an inner and outer spring and a damper. (Note: If either high-performance spring is used with a stock head, it is necessary to machine around the valve guides so the C2 spring seat can be used.)

Valve Spring Retainers (P3690502) supplied with the C2 head are made of steel. Also available are optional titanium retainers (P3690494).

Rocker arms modified for lighter weight (P3690483) are offered for competition applications.

3. *Camshaft*

The high-performance C2 camshaft (P3690482) has a higher lift (0.378"/10 mm) 300° duration design, and can be used with either the stock or C2 head for street or rally use. (C2 dual valve springs should be used with this cam.)

Associated items which further help high engine speed capability include lightened rocker arms (P3690483) and titanium valve spring retainers (P3690494).

4. *Timing Chain and Sprockets*

The camshaft is chain driven, with sufficient adjustment on the chain tensioner to compensate for any head/block milling. Milling the head does change the cam centerline somewhat, since it reduces the distance between the cam and crankshaft.

5. *Cylinder Block*

The cylinder block is a 5 main bearing, 4 cylinder design capable of accepting race power outputs without problems. In addition to standard size main bearings, .25, .50 and .75 mm undersize units also are available.

The standard cylinder head gasket can be used for compression ratios up to 10.3:1. For compression ratios above 10.5:1, "O" ringing the block should be considered mandatory. Groove dimensions are:

I.D.	3.25"	(82.55 mm)
Width	0.041"	(1.04 mm)
Depth	0.030"	(0.76 mm)

Either 0.041" music wire or safety wire may be used in the grooves. The wire will contact the metal binding around the cylinder holes of the stock head gasket and make an excellent seal.

Compression ratios as high as 14:1 have been run with this arrangment. For compression ratios less than 10.5:1, head gasket sealing may be improved by cementing short pieces of 0.025" (.64 mm) copper wire to the block face of the head gasket (intake side) before installing the gasket. When the head is installed and torqued down, the wires will be compressed into the gasket material, increasing the unit loading in these areas, thereby resisting gasket blowout.

Compression ratio increases can be achieved by milling either the head or the block or both. Either piece can tolerate up to a 0.040" (1.02 mm) cut. The compression ratio will be increased by 0.9 with 0.040" milled off the head, and by 1.1 with 0.040" off the block. Flat top C2 pistons in combination with the 0.040" of *both* the head and block will increase the compression ratio to about 12.3:1. If the block is milled, remember to bolt the front cover on so that it is milled the same amount. When selecting compression ratios, consider the availability of high octane race fuel in your area.

Note: Milling the head or block surface for extra compression ratio also changes the cam timing or cam centerline. For each .020" (.51 mm) removed from the block or head surface, the cam timing is retarded 1 degree.

C2 high-performance connecting rods (P3690486) are tufftrided, utilize 9 mm bolts, and have the flash line hand ground. They should be used ONLY with the C2 piston set (P3690485). Rod bolts should be torqued to 32-35 ft. lb.

6. *Engine Motor Mounts*

Standard production motor mounts are too soft for any racing or high-performance use. Special C2 high-rate engine mounts (Front: P3690586/ Rear: P3690581) are available and should be used.

7. *Oil System*

The stock 1600 engine has a front sump oil pan with a capacity of 4.16 quarts (including 1.04 quarts in the oil filter). A 1 pint overfill is recommended for racing to help prevent the oil pickup from being uncovered, and to make up for oil trapped in the head

To minimize this trapped oil, the C2 head has a small orifice feeding the valve mechanism. The orifice, which includes a screen filter, is located in a threaded brass plug under the rear cam bearing cap. The orifice is small 0.032" (0.8 mm) and the screen fine, so small amounts of debris can stop oil flow. A clean engine is the best insurance, or the orifice can be drilled to 0.046" (1.2 mm) and the screen discarded. The orifice should be inspected at frequent intervals or, if the high capacity oil pump is not used, this plug can be removed leaving the head oiling circuit unrestricted.

The high capacity oil pump set (P3690490) includes a pair of longer pump rotors and a new front cover. It is recommended for race use, as is the oil cooler set (P3690489). The oil cooler set includes a bracket for mounting forward of the radiator, necessary hoses, a remote oil filter adapter, and an oil pump cover with two regulator valves.

A baffled oil pan (P3690488) is recommended for racing or rallying. It helps prevent oil from being thrown away from the pickup during hard cornering.

8. *Pistons*

Standard bore (3.03") pistons are of cast aluminum, of dished design with an intake valve clearance notch. Piston and pin assemblies and ring sets are available in standard size, (3.0276"/76.9 mm), and .25, .20, .75, and 1.00 mm oversize. The outside diameter of the piston should be checked at a point 0.079" (2 mm) above the bottom of the piston. The pistons to be used should be measured with a micrometer before the block is bored.

The C2 piston is a flat top, permanent mold, cast unit with valve reliefs. Special rings and rods are also available. C2 piston rings are thin (0.059"/1.5 mm), low tension and chrome plated for long life.

For rally use, C2 pistons can be used without modification and will increase the compression ratio to 10.3:1. The following modifications apply to race engines with most running above 7000 rpm:

Machine the #2 ring land to the same diameter as other ring lands. Hone piston pin bores to give 0.0008" to 0.0010" (0.020 to 0.025 mm) clearance with the piston pin to prevent galling. (Honed surface retains oil better than smooth diamond bored finish.) If head or block are milled, check piston-to-valve and piston-to-head clearance. Maintain at least 0.080 (2 mm) piston-to-valve clearance. C2 pistons have plenty of material in the area of valve notches so they may be cut as required.

9. *Connecting Rods*

The standard connecting rod has a 6.05" (153.7 mm) center-to-center length. Rod bearings are available in stock size, and .25, .50, and .75 mm undersize.

10. *Cooling System*

For engines that will be operated at high speeds, it is advisable to use a lower accessory drive ratio, allowing the generator and water pump to turn at slower speeds and thereby use less power. Large diameter water pump and alternator pulleys are available for this purpose in the C2 Pulley/Bolt Kit (P3690492), which reduce their speeds 15% and 20% respectively.

If production radiator hoses are used, it is desirable to install spring wire in the lower hose to increase collapse strength.

Use the production 13 psi radiator cap.

11. *Intake System*

The stock carburetor is a compound 2 bbl design in which the two throttle bores open separately. This creates a primary and secondary bore similar to a conventional 4 bbl. The primary throttle bore is 1.10"; the secondary bore 1.26". Standard jet sizes follow:

	Indent Mark	Size
Primary Pilot Jet	57.5	(.0375")
Secondary Pilot Jet	70	(.0709") M/T
Primary Main Jet	95	(.023")
Secondary Main Jet	180	(.024")

The stock manifold is an aluminum 2-barrel unit.

The high-performance intake system is a C2 twin Solex carburetor setup (P3690484), which includes 2 Mikuni-Solex, 44 PHH side draft, 2 bbl carburetors, cast aluminum manifold, gaskets, air cleaner, linkage, and installation hardware. The carburetors are also available without the other parts (P3690507).

The Solex carburetors are mounted horizontally, which creates a clearance problem between the rear carburetor air horn and the brake master cylinder bleeds. Possible solutions are to offset the master cylinder or mount the master cylinder inside the car, using a bell crank to operate it. Removing the air horns will provide master cylinder clearance.

Jetting for the C2 twin Solex carburetors:

Main Air Jet	#190
Main Jet	#155

Installing air horns or velocity stacks offers a performance gain over an air cleaner. Two lengths are available: 2"/50 mm (P3690495) and 3"/75 mm (P3690496). The shorter tunes the engine for maximum power at 7000 rpm; the longer for maximum power at 6500 rpm.

An intake manifold (P4007774) is also available which accepts two 2 bbl down draft carburetors.

12. *Exhaust System*

Due mainly to a well-designed 4-into-2-into-1 exhaust manifold, the 1600 engine has an effective exhaust system.

Headers are available from Hooker and other manufacturers. The bi-Y design is good for output gains over a wide engine speed range and is the choice for rally use. For continuous running above 7000 rpm a 4-into-1 type is recommended with the following specifications:

Primary Tubes		
I.D.	$1^{7}/_{16}$"	(37 mm)
Length	$30^{5}/_{16}$"	(770 mm)
Transition		
Length	$3^{9}/_{16}$	(90 mm)
Collector		
I.D.	2"	(50 mm)
Length	$28^{3}/_{8}$"	(720 mm)

Note: All 1971 through 1973 cylinder heads have rectangular exhaust ports. All 1974 through 1978 cars with the California emission system have round exhaust ports. Early 1974 cars with the Federal Emission system have rectangular exhaust ports while late 1974 Federal cars have round exhaust ports. The stud spacing on the exhaust side is different between the two port types so that headers are not interchangeable.

Larger diameter exhaust pipes and a low restriction muffler will further boost overall engine output.

13. *Ignition System*

Colt utilizes a typical battery-operated, single-point system. Points should be gapped at .018"-.022". The distributor has a total of 14 distributor degrees or 28 crank degrees built in. Standard specifications call for spark advance to be set at TDC at 700 rpm. An extra 5° initial timing helps performance. Maximum power spark advance is about 35° at 7200 rpm using Union Race or equivalent octane fuel. For higher compression ratios than the C2 package, or with non-race fuels, consider 28° to 32° total advance. Plugs should be gapped at .028"-.032" and used according to the following chart.

Plug Type & Make		Intended Use
NGK	**Champion**	
B6E	N5	Standard
B6ES	N5	Standard
BP6ES	N5	Standard
B7ES	N5	Moderate Racing
B8ES	N4	Circuit and High Speed Rally
B9E	N3	Circuit Racing
B10E	—	Circuit Racing

For additional performance and reliability, two ignition cable sets are offered: the 8 mm metal core wire set (P4120326) for race, and the 8 mm suppression wire set (P4120301) for rally and street. A high-energy coil and condenser package (P4120384), and vented-type distributor points (P4120385) with increased spring tension for longer life at higher engine speeds also are available.

14. *Transmission*

For transmission, clutch and flywheel information, please refer to the later section on chassis.

B. The 2000 cc Engine

Like the 1600 cc engine, the 2-liter unit is of 4-cylinder, single overhead cam design, with hemispheric combustion chambers. Few parts are interchangeable, however. Standard valves and ports are larger, connecting rod bolts are of equal size, and the oil pump has sufficient capacity for competition.

Performance preparation of the 2-liter should begin with line boring of the block main bearing housing. Approximately 5 pounds of excess metal can be removed from the flywheel, and all rotating and reciprocating parts then balanced. After balancing, cylinder ports should be enlarged slightly and polished, and valve seats blended in for maximum air flow. Milling of the cylinder head 0.040" (1.02 mm) will gain about one point in compression ratio. After selection of an appropriate camshaft, the engine should be built up carefully to check piston-to-valve clearance (0.060"/1.53 mm is adequate).

The engine should then be disassembled completely, cleaned carefully, and reassembled, checking bearing clearances with plasti-gauge, loc-titing nuts and bolts, and tightening each to torques called for in the Service Manual and later section.

All clearances in the engine should be to Service Manual specifications, preferably on the high side. Piston-to-cylinder-wall clearances are easily increased by honing the cylinder walls, but main and rod bearing clearances will be more difficult to adjust. Should crankshaft oil clearances be on the low side (though within specifications), exercise extreme care during engine break-in, with particular attention paid to oil temperature during the first few miles. Note: Different main bearing sizes on early and late engines.

For this reason (and others) oil pressure and temperature gauges should be installed.

Several approaches to remote-mount oil filter and oil cooler units are satisfactory. One common method is to make up a short pipe nipple with metric threads on one end to screw into the block and 1/2" NPT threads on the other end to screw into a widely-sold aluminum adaptor for the remote filter. Aluminum "AN" pipe-to-hose fittings and steel-braided aircraft hoses can be used throughout. Remote filter bases are widely available, and Chrysler's cooler (P3690956) provides more than adequate capacity.

Twin sidedraft 44 mm Solex Mikuni carburetors from the 1600 cc C2 engine package work well with the 2-liter. Venturi diameters can be increased from 34 mm to 38 mm, using a variety of main and air correction jets to calibrate the carburetors. A cold air box can be fabricated to enclose carburetor air intakes, with a flex hose run to a remote filter (probably in the plenum chamber, at the base of the windshield).

Hooker headers (P4120050) are available for the 2000 cc engine.

C. The 2600 cc Engine

Performance modification of the 2600 cc engine continues in the developmental stage, with individual competitors currently taking a wide variety of approaches. Of similar basic design to the 1600

cc and 2000 cc engines, the 2600 cc unit is equipped with the "Silent Shaft" and "MCA Jet" (3-valve) systems as standard. Crankshafts interchange with the 2-liter engine, as do rod and main bearings. The 1978 crank and the 1979-1982 crank do not interchange because of the difference in bearing diameters. They also have the same deck height. A stock 2-liter cylinder head will fit, eliminating the 3-valve setup.

D. The 1400 cc Engine

The 1400 cc engine is the newest engine. It shares nothing with the 1600 engine. To date there has been no performance development on this engine. The current rules are biased against it since in most cases the 1400 and 1600 engines run the same class virtually heads up. Obviously the 1600 will win — plus the development and parts are readily available for the 1600. Therefore since 1400 is only used in the Colt-Champ front-wheel drive cars which also use the 1600, the 1600 engine is recommended for performance applications.

E. Turbocharging

The Colt-Arrow engines are natural choices for turbocharging. With the efficient cross-flow head, plumbing for the turbocharger must cross from one side of the head to the other. This means that *either* the exhaust gases must be plumbed to the intake side of the head *or* the turbo's pressure must be plumbed to the carb-intake manifold. In general this is not a problem because there are several Colt turbo kits available. These kits have the plumbing worked out, turbo location selected, oiling and linkage suggestions.

In turbocharging, the performance is a function of the amount of boost used — the more boost, the more power *and* the more problems. The applications can be divided into two groups — up to 10 psi boost and over 10 psi boost. The first group is more realistically 6-8 psi boost in the inlet manifold and can be considered the dual-purpose applications. For these turbo applications, no engine modifications are required except good gasoline and restricted spark advance.

The over 10 psi boost is more likely to be 20 psi plus, and this group can be considered the serious racers. With this much boost, the engine's output can easily be doubled. Obviously with this much power, there are special considerations for the basic engine itself since it is by definition a race engine. The following parts and recommendations are suggested for the 1600 cc engine. The same recommendations can be used as a guide for the 2000 and 2600 engines.

1600 Turbo Parts & Tips

Engine based on C2 package — see Section IIIA above.

O-ring the block. The heads can be done instead, but every head that's to be used must be done which is more work and harder to do with equal accuracy.

.041" Stainless wire should be used .025" down Standard head gasket

Larger 7/16" head bolts (or studs) should be installed Bolts torqued to 75 lb. ft.

Turbo charger — TO4B58 Air Research Waste gate highly recommended

Forged-true 8:1 compression ratio pistons Actual CR 7 to 7.5

Carburetor — 500 cfm Holley 4412 list

22 psi gauge boost in manifold

22° maximum total spark advance

IV.
BLUEPRINTING SPECIFICATIONS

n disassembling the engine for blueprinting or general ebuilding, it is advisable to remove the pistons from the lock in the order No. 1, No. 4, No. 2, No. 3 thereby ninimizing amount of crankshaft rotation.

n preparation for block boring and/or honing, the outide diameter of the piston should be checked at a point 079" above the bottom of the standard piston or 1.38" bove and .43" below the piston pin hole center on the 2 piston.

'o prevent any distortion that might occur due to a emperature rise in the block during the boring operaion, the cylinders should be bored in a 2-4-1-3 or 3-1-4-2 equence. A similar sequence is suggested for the honng operation.

A. Clearances

Camshaft End Play	.002" to .0059"
Camshaft-to-Cap Clearance	.002" to .0035"
Rocker Arm-to-Shaft Clearance	.0005" to .0017"
Piston-to-Wall Clearance	.0008" to .0016" (Std. Piston) .002" to .003" (C2 Piston at 1.38" above piston pin hole center)
Piston Ring End Gap	.006" to .014"
Connecting Rod Side Clearance	.0039" to .0095"
Crankshaft Thrust Clearance	.002" to .0069"
Main Bearing Clearance	.00095" to .00307"
Rod Bearing Clearance	.00055" to .00283"
Pressed Pin (Pressed in Rod) Piston Pin Clearance in Piston	.0008" to .001"

Valve to Piston Clearance	.120" Min. Axial Direction .0280" Min. Radial Direction
Piston to Head Clearance	.065"
Firing Order	1-3-4-2
Valve Lash (Std. & C2 Cam)	.006" Intake Hot .010" Exhaust Hot .003" Intake Cold .007" Exhaust Cold .006" Jet Valve Hot
Valve Guide Clearance	.001" — .0022" Intake .002" — .0033" Exhaust
Cylinder Bore Out-of-Round	within .0008"
Cylinder Bore Taper	within .0008"

The above clearances are for the 1600 engine. The 2.0 and 2.6 liter engine are the same except for the following:

2000 and 2600 Camshaft End Play .004" — .008"
2000 and 2600 Piston Ring End Gap .0098" — .0177"

After the engine has been reassembled and run-in, the cylinder head bolts should be retorqued. Above specifications are in the English system. For metric numbers refer to Service Manuals.

B. Torque Specifications

	1600 cc	2000-2600 cc
Intake Manifold Bolts	11-14 lb.-ft.	
Exhaust Manifold Bolts	11-14 lb.-ft.	
Flywheel Attaching Bolt	94.5-101 ft.-lbs.	
Drive Plate (Auto)	83.5-90 ft.-lbs.	
Clutch Bolts	11-14 ft.-lbs.	
Crankshaft Sprocket Bolt	43-51 ft.-lbs.	
Starting Motor Attaching Bolt	14-22 ft.-lbs.	
Cylinder Head Bolt (Cold)	51-54 ft.-lbs.	65-72 ft.-lbs.
(Hot)	58-61.5 ft.-lbs.	
Cylinder Head Nuts	7-8.7 ft.-lbs.	
Camshaft Sprocket Bolt	43-57 ft.-lbs.	36-43 ft.-lbs.
Rocker Arm Nut	7-9 ft.-lbs.	
Rocker Cover Bolt	3.5-5 ft.-lbs.	
Rocker Stud Nuts	13-14.5 ft.-lbs.	
Spark Plugs	14.3-22 ft.-lbs.	18-21.5 ft.-lbs.
Main Bearing Cap Bolt	36-40 ft.-lbs.	
Connecting Rod Bolt Production Engine	23-25 ft.-lbs.	33-34.5 ft.-lbs.
C2 Engine	29-31 ft.-lbs.	N/A
Camshaft Bearing Cap	14-15 ft.-lbs.	13-14 ft.-lbs.
Oil Pan Bolts	4-6 ft.-lbs.	
Jet Valve	13.5-15.5 ft.-lbs.	

All the torque specifications for the 2000 and 2600 engines are the same as those for the 1600 engine *except* where specified. See Service Manual for metric torque specifications.

C. Temperature and Pressure

Engine oil recommended for rally and circuit racing is SAE #40 or #50. The C2 engine package requires 4½ U.S. quarts to fill with oil cooler installed, and 3½ U.S. quarts without oil cooler. An additional pint of oil will help prevent air sucking in the oil line during rough road rallies and will also provide a margin for heavy oil consumption in circuit racing. The following chart lists critical limits for engine temperatures and oil pressure during racing usage

Oil Pressure (lb/in²)	56 to 92
Oil Temperature (°F)	
(With oil cooler)	176 to 212
(Without oil cooler)	192 to 248
Water Temperature (°F)	190-220

D. Break-In Precautions

1. *Before Starting Engine*

Crank engine for 10 to 20 seconds with spark plugs removed to build up oil pressure. B7ES or N5 spark plugs should be used for the break-in cycle.

Note: Care must be taken to avoid air locking the oil line when the oil cooler and oil filter are installed. It is recommended that these parts be filled with oil before installation.

2 *Following Break-In*

Upon completion of engine break-in, the following items should be checked before the car is raced:

(1) Retorque cylinder head bolts

(2) Replace engine oil

(3) Replace oil filter

(4) Install spark plugs with correct heat range

(5) Readjust valve lash

3 *Engine Break-In Cycle*

The break-in cycle should be performed in the following order.

a. Start the engine and hold the engine speed at a steady 2500 to 3000 rpm until engine is warm or the engine temperature has reached 180 to 190 degrees. Shut engine off and allow to cool to room temperature.

b. Retighten cylinder head bolts and adjust the valve lash to the proper clearance.

c. Run the car through the following cycle:

Engine Speed	Time	
2000-3000 rpm	Rally	— 10-15 min. level road
	Circuit	— 2 laps
	Drag	— 5 dragstrip cycles
3500-5000 rpm	Rally	— 15 min. general highway*
	Circuit	— 2-4 laps
	Drag	— 5-10 dragstrip cycles
5500-6500 rpm	Rally	— 10 min. general highway*
	Circuit	— 2 laps
	Drag	— 5 dragstrip cycles

V.
SPECIAL CONSIDERATIONS FOR RACING

There are some items concerning racing engines that are unique or special enough to be covered separately. In some cases information that is needed doesn't fit in with the sections presented previously. Therein lies the reason for "special considerations".

A. Grinding Production Head Ports

Grind intake and exhaust ports to increase air flow using the following procedures:

1. Stock removed from entire intake port surface should be not more than 0.5 mm (0.020"). Grind to about 35-S (surface roughness). Especially in hatched area, grind off indicated stock. See Figure 24-6.
2. Grind off indicated stock from hatched area of intake ports.
3. Area with * mark is thin: when grinding, use extreme care.
4. Grind intake manifold port inner surface smooth, to blend with cylinder head port inner surface.
5. Step 4 should be performed carefully so as not to damage valve seat ring surface or bottom of cylinder head.

B. Bellhousing Bolt Pattern

For certain applications, knowing the bolt pattern at the back of the blocks can be very helpful. It is shown in Figure 24-7.

C. Installation of 5-Speed Manual Transmission

For the 1971 through 1975 Dodge Colts that were equipped with the 1600 cc engine and the 4-speed, manual transmission, it may be desired to install a newer 5-speed, manual transmission. The following applies to this conversion.

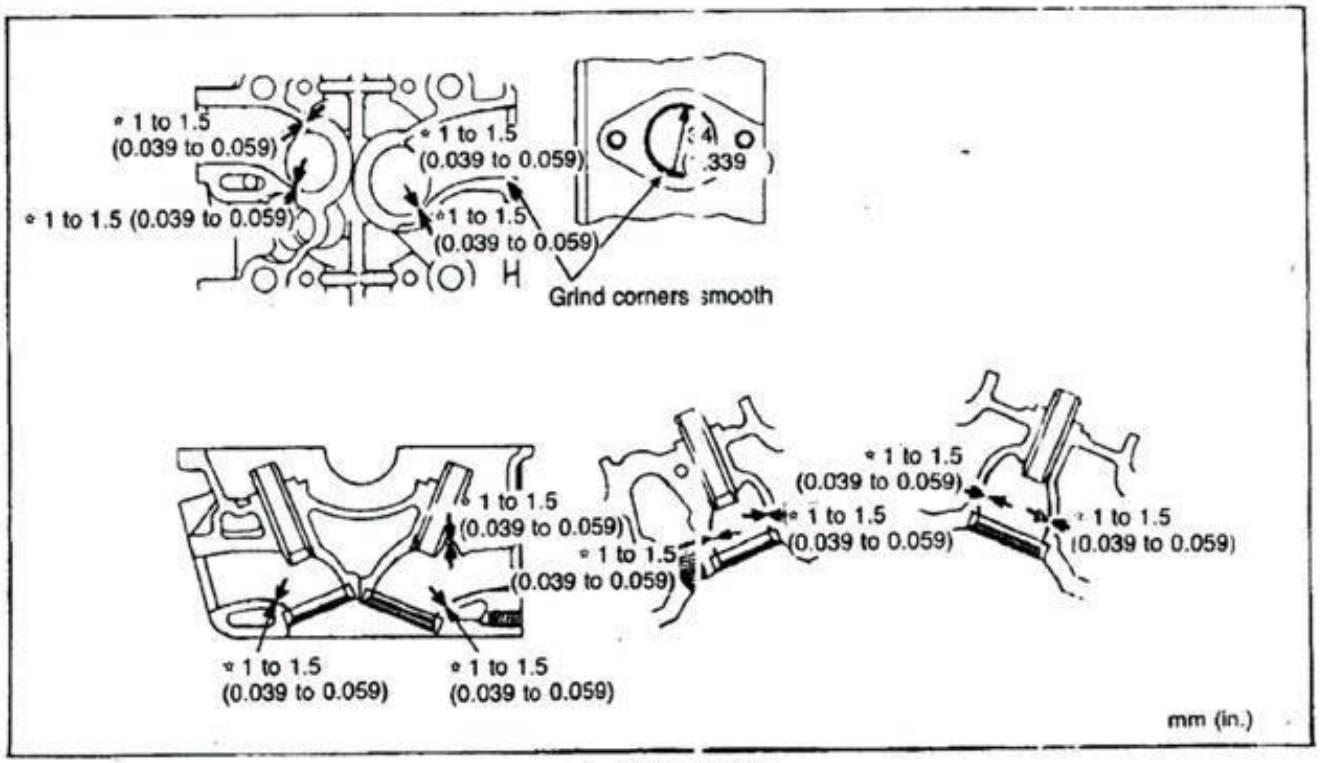

FIGURE 24-6

1600 CC HEAD PORTING

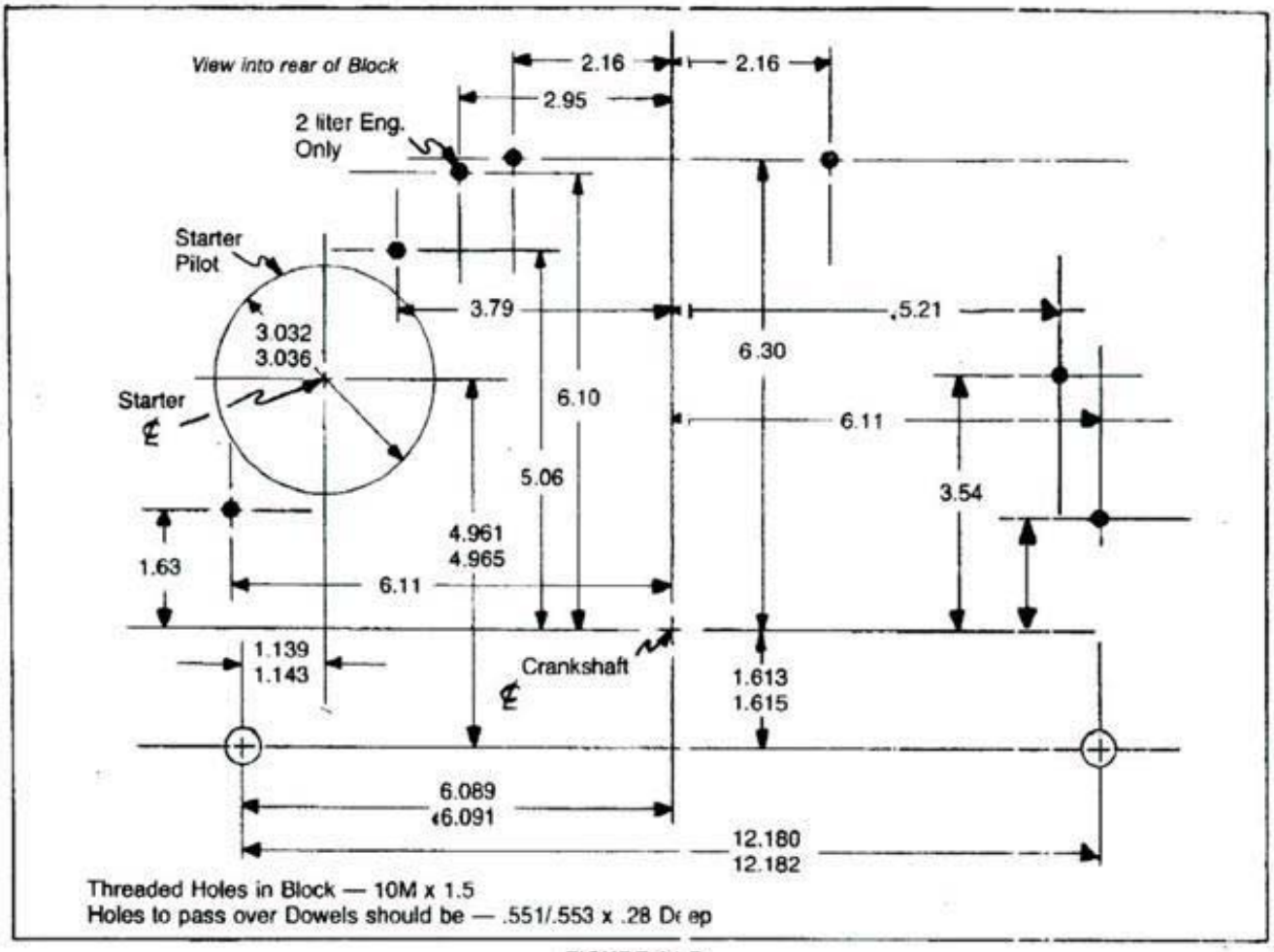

FIGURE 24 7

BELLHOUSING BOLT PATTERN
(All Dimensions in Inches)

5-Speed Transmission Description

The 1975 Part number for the 5-speed transmission is MD703342 and includes the complete transmission except the shift knob. A knob with the 5-speed shift pattern is available under Part Number MB012782.

The 5-speed transmission is interchangeable with the 4-speed transmission except for the transmission cross-member. The bellhousing bolt pattern is compatible with both the 1600 cc and 2000 cc engines. The overall length, shifter locations, input and output shaft splines are all the same on the 4-speed transmission. The only differences are the location of the rear mount attaching point and the speedometer gear location which are farther to the rear. The 4-speed speedometer cable is long enough to reach the new location.

It is necessary to exchange the 5-speed clutch release bearing and carrier for the comparable parts used with the 4-speed. The parts that come with the 5-speed are for the larger 2.0 liter clutch.

STOCK COLT PARTS NEEDED:
1971, 1972, early 1973

Key No.	Part No.	Name	Quantity
1	MA 180546	Plate	4
4	MB 006675	Bracket, Engine Support	1
	MB 006705	Insulator, Engine Support	1
	MF 450406	Washer, Lock	2
	MF 100080	Bolt	2
6	152472	Nut, 5/16-18 Self-Locking	4
7	181098	Bolt, 5/16-18 x 2½"	4

STOCK COLT PARTS NEEDED:
late 1973, 1974

Key No.	Part No.	Name	Quantity
1	MA 180546	Plate	4
2	MB 006682	Pad, Cushion	2
3	MA 180549	Spacer	4
4	MB 006675	Bracket, Engine Support	1
	MB 006705	Insulator, Engine Support	1
	MF 450406	Washer, Lock	2
5	181101	Bolt, 5/16-18 x 3"	4
6	152472	Nut, 5/16-18 Self-Locking	4

An early and late 1973 can be distinguished by the way the transmission cross-member attaches to the frame. On the early cars the cross-member bolts to brackets that are welded to the inboard side of the frame longitudinals, whereas on the later cars the cross-member bolts to the bottom of the frame longitudinals.

Installation Instructions

After installing the transmission to the engine, and attaching the new rear mount to the new cross-member, center the transmission in the floor pan tunnel, bolt the rear mount and cross-member to the transmission. Drill 11/32" holes up through the frame longitudinals corresponding to the holes in the ends of the cross-member. Bolt the cross-member to the longitudinals as shown in the attached sketch. See Figure 24-8.

The rubber insulators (2) cannot be used on 1971, 1972 and early 1973 cars because it would place the rear of the transmission too low, altering the prop shaft angles.

D. Rally

The basic C2, 1600 cc package has proven to be durable and raceworthy. It includes:

- — 10.3 to 1 C.R. pistons
- — Premium connecting rods
- — Cylinder head with larger ports and valves
- — Larger event camshaft
- — (2) Solex sidedraft carburetors
- — Bi-Y (4-2-1) exhaust header system
- — Windage Tray
- — Lightweight steel flywheel
- — H.D. clutch assembly

The recommended tire is made by Hakahakapilleta of Finland and works best on a 5½" rim.

For many rallies the 2000 engine is a better engine choice than the 1600. The rules don't allow as many changes on the 2.0 liter engine. See Section III-B.

For rallies that run the SCCA and "production class" the 2600 Arrow is the best choice. The engine is supposed to remain stock but even with the restriction the overall package seems to be very competitive.

E. SCCA — B Sedan

Use C2, 1600 package but substitute Forgedtrue hi ratio pistons, S-9 camshaft and Stahl individual tube headers. The 3.215-2.00-1.43-1.00, 4-speed and 3.24-1.96-1.34-1.00-.85, 5-speed are the best available transmissions. The recommended tires are the Goodyear low profile 21.0-0-13 W1, W2, W3 series used on 7" rims.

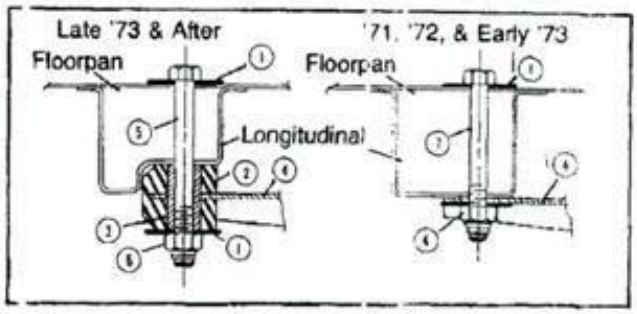

FIGURE 24-8

TRANSMISSION CROSS-MEMBER INSTALLATION — COLT-ARROW

F. IMSA Small Sedan

Use identical package as SCCA — B Sedan except tire choice. FWD only in 1983 (i.e. Champ-Colt hatchback).

G. Drag Racing

There are many classes in drag racing to race the Colt-Arrow engines from brackets to dragsters. The most likely classes are "Stock" and "Modified Compact." Each is covered in its separate section below.

1. *Stock Classes*

In "stock" classes the engine may be blueprinted to the minimum specifications, a "cheater" or blueprint cam may be installed but very little engine hardware is allowed to be changed. The following NHRA blueprint specifications apply to the Colt-Arrow engine in Stock (or Super Stock) classes:

ear	Engine	Min. Head cc.	Block Deck Height	Piston Dish	Head Gasket Thickness
71	1600 cc	35.0	.010" below	9.4 cc	.021"
72-'75	1600 cc	35.7	.000"	8.2	.050"
74-'77	2000 cc	49.8	.000"	3.2	.046"
76-'77	1600 cc	35.7	.000"	8.2	.046"
78-'79	1600 cc	35.5	.000"	8.2	.045"
78-'79	2000 cc	50.2	.000"	3.2	.043"
78-'79	2600 cc	50.2	.000"	12.0	.043"
79	1400 cc	31.3	.05" below	Flat	.040"

Refer to Bulletin #35 for more details on stock eliminator class racing.

2. *Modified Compact*

The most likely class to race the Colt-Arrow of the 4 Modified Compact classes is C/MC which is restricted to front engine cars only (and no rotary engines). This class is based on 18.5 pounds per cubic inch which would make a 1600 car (97.5 in^3) weigh 1804 pounds with driver and the 2000 car weigh 2266 with driver.

careful not to lock up the rear suspension. The idea is to build more control into the suspension, not make it inoperative.

There are 6" and 8" wide drag slicks that are very small in diameter (21.5" to 23") that work well on the Colt-Arrow type stockers. With the relatively slow quarter-mile trap speed and basically high engine speed, small diameter tires and large numerical axle ratios are required for best elapsed time performance.

J. Off-Road Mini Truck

The Colt-Arrow mini-truck (D50) comes with the 2000 cc engine standard and the 2600 engine with the Sport package. It can be set up similar to the 2000 and 2600 engines listed in earlier section for Off-Road racing. The Class 7 off-road event popular in the Southwest Section of the U.S.A. is for the small mini-pickups with 4-cylinder engines. With the chassis-roll cage, etc. setup — by the rules listed with the two governing bodies (SCORE and High Desert) and the 2.6 liter engine built to the rules — this is a very competitive vehicle.

VII. MISCELLANEOUS

A. Steering Wheel

For general performance enthusiasts a custom steering wheel, PN P3690557, is available. It is a smaller diameter, leather-type wheel with a thicker gripping section

B. Racing Suspension Hardware

Recently developed are racing suspension hardware for the Champ-Colt hatchback front-wheel-drive cars. These pieces include front struts, front and rear springs, etc. They are listed in the new D.C. catalog.

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G.R. Checkley

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