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INTRODUCTION

GENERAL INFORMATION

This handbook describes parts and procedures used to prepare **ECOTEC** Race Engines used by GM Racing in professional sport compact drag racing, as well as engine, transmission, and chassis modifications designed for, sportsman-level drag racers and road racers.

This handbook is intended to be used by experienced and knowledgeable race engine and chassis builders. It does not cover basic engine blueprinting and assembly procedures, since it is assumed that the reader is already familiar with machining, measuring, and inspecting the components. Some of the procedures described require specialized tools and skills. If you do not have the appropriate training and equipment to perform these modifications safely, this work should be performed by other professionals.

There are of course, many other possible combinations of components and additional modifications that may produce equal or superior results. However, by using the combination of parts and procedures described in this handbook, an experienced engine builder can build a competitive and reliable **ECOTEC** Race Engine.

It is not the intent of these specifications to replace the comprehensive and detailed service practices explained in

the GM service manuals. GM service manuals are available from:

Helm Incorporated
PO Box 07130
Detroit, MI 48207

Observe all safety precautions and warnings in the service manuals. Wear eye protection and appropriate protective clothing. When working under or around the vehicle support it securely with jack stands. Use only the proper tools. Exercise extreme caution when working with flammable, corrosive, and hazardous liquids and materials.

PROGRAM HISTORY

The General Motors Sport Compact Drag Racing Program was kicked off at the 2001 International Auto Salon (IAS) in Long Beach, CA. During IAS, GM identified sport compact drag racing as the highest opportunity to gain awareness in the sport compact market. The first Chevrolet Cavalier and Pontiac Sunfire front-wheel-drive drag race cars were unveiled at the 2001 SEMA show, and, in February of 2002, GM Racing made their competitive debut in Palmdale, CA. Since then, the GM Racing team has won back-to-back championships in both the NHRA Hot Rod and ProFWD categories. In 2005, the team will campaign their ProFWD Chevy Cobalt in select NHRA and NDRA events and provide



Fig. 1

support to independent teams running their own **ECOTEC**-powered Chevy Cobalt drag cars.

WHY WE RACE

At GM, we race because it's where we came from and because it fuels our love for competition.

Racing has been part of the GM culture since auto pioneers like Louis Chevrolet relied on speed records and racing victories to launch his fledgling car company. GM has remained in racing for two basic reasons - to win on the track and win in the marketplace.

Racing is a compelling demonstration of the depth of GM's technical resources, the capabilities of its people and the performance, reliability, quality and safety of its products. The race track is the toughest of proving grounds to forge engineering, marketing and business skills into tangible results. Few, if any, environments can match racing's ability to build awareness and consideration of a manufacturer's products to new customers, while simultaneously solidifying the loyalty of current customers.

FIVE PILLARS GUIDE GM RACING'S INTEGRATED STRATEGY

It provides a **dynamic training ground** for GM engineers. In racing, decisions must be made at a rapid rate. You must be ready at all times, on time, and solve problems quickly and effectively. Racing's demands are the perfect venue in which to exercise the mind and expand abilities, improve teamwork and communication - and do it all without making excuses.

This leads to **technology transfer**. Racing is well known to have introduced improvements in the auto production industry in areas such as suspensions, brakes, engines, aerodynamics and safety - but there's also a transfer in technology through people who work in racing, then take those improved skills and knowledge to the production process. Likewise, the advanced technology and people involved in the mass production of vehicles has enhanced the development of race cars.

Human nature dictates that **people want to compete** - and win. There is a strong competitive spirit within GM, and success in racing produces a vibrant esprit de corps. GM is not a sponsor of racing - we are an active, engaged participant who produces the cars and the components, and provides the technology essential to the sport.

If racing did not already exist, auto manufacturers would invent it as the **perfect marketing platform**. Racing is a sport that's all about the product and the people, followed with cult-like passionate fans who buy cars and trucks at a higher and more loyal rate than the average consumer.

Grass roots racers and enthusiasts demand the best, and have made **GM Performance Parts** the leader in over the counter components and engine assemblies. GM's

approach, as a participant in racing, is to take responsibility to support the sport. Someone else might even build a motor that beats the factory team. But it's this democratization of racing that sets GM apart, and is the cornerstone of GM's total business approach.

LEGAL INFORMATION

This publication is intended to provide technical information on the GM **ECOTEC** engines, Hydra-Matic transmission, and Chevy Cobalt used in sport compact drag racing at the professional and sportsman level.

This handbook pertains exclusively to engines and vehicles which are used off the public highways. Federal law restricts the removal or modification of any part of a federally required emission control system on motor vehicles. Further, many states have enacted laws which prohibit tampering with or modifying any required emission or noise control system. Vehicles which are not operated on public highways are generally exempt from most regulations, but the reader is strongly urged to check all applicable local and state laws.

Many of the parts described or listed in this handbook are merchandised for off-highway application only, and are tagged with the following "Special Parts Notice":

SPECIAL PARTS NOTICE

This part has been specifically designed for Off-Highway application *only*. Since the installation of this part may either impair your vehicle's emission control performance or be uncertified under current Motor Vehicle Safety Standards, it should not be installed in a vehicle used on any street or highway. Additionally, any such application could adversely affect the warranty coverage of such an on-street or highway vehicle.

The information contained in this handbook is subject to change. General Motors also reserves the right to make changes at any time, without notice, in equipment, manufacturers, specifications, and materials, or to discontinue items.

The information in this publication is presented without any warranty. *All the risk for its use is entirely assumed by the user.* Specific component design, mechanical procedures, and the qualifications of individual readers are beyond the control of the publisher, and therefore the publisher disclaims all liability incurred in connection with the use of information contained in this publication.

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ORDERING PARTS IN THIS BOOK

Parts described in this book are from several sources. Many parts are available from aftermarket suppliers. The contact information for these suppliers is listed in a separate section of the book. Note that some parts may be available from additional sources.

There are three types of General Motors parts listed in this book. First are parts used in regular production vehicle. These are regular service and replacement parts, donated as 'GM' parts in this book. These parts are available through any GM dealer. See www.gmgoodwrench.com for more information and to locate a dealer near you.

The second type of GM parts shown are GM Performance Parts. These parts are available only through authorized GM Performance Parts dealers. Not all GM dealers are authorized to sell GM Performance Parts. For more information or to locate an authorized dealer, visit www.gmgoodwrench.com and click on GM Performance Parts. Please note that not all parts are listed on the GM Performance Parts website. Your authorized dealer has a more complete list. If your dealer is an authorized GM Performance Parts dealer and still cannot locate a GM Performance Part listed in this book, please e-mail GM Racing at gmsportcompact@aol.com.

The third type of parts listed in this book are available exclusively from GM Racing. These are typically low-volume parts for racing applications. All GM Racing Parts are for off-highway use only and are tagged with the "Special Parts Notice" shown previously in this book. GM Racing Parts are available only by e-mailing gmsportcompact@aol.com. Racing personnel will respond to you with additional ordering information and part availability. Please allow up to twelve weeks for delivery.

All part numbers are subject to change. Please contact the appropriate source for the most recent information.

BASE ENGINE OVERVIEW

The engine is the heart of a competition car. It must be capable of delivering full power reliably run-after-run on race day, at engine and vehicle speeds far in excess of those encountered in normal driving. Every part of a competition engine must be as nearly perfect as possible – the slightest failure can put you out of the running or even out of the race.

Since 1955, the Small Block Chevy has proven its versatility, durability, and performance potential with automotive performance enthusiasts. The **ECOTEC** engine has all the basic mechanical components to repeat this success. A sound base engine structure, excellent airflow capability, easy serviceability, compact size and low weight. These qualities, along with the very successful race program, demonstrate the **ECOTEC** is a driving force in the Sport Compact Segment. (Fig. 2)



Fig. 2

GM's **ECOTEC** engine has proven to be a reliable and competitive engine for use in the Sport Compact Drag Racing Series. It has also proven its superior durability in grueling five mile runs at the Bonneville Salt Flats with speeds over 300 MPH and in showroom stock endurance road racing competition. The number of stock components utilized in the race engine demonstrates the robust design of the **ECOTEC** engine.

The **ECOTEC**'s outstanding feature to performance enthusiasts is its impressive strength. GM Racing dynamometer tests confirm that major horsepower gains are possible with minimal modifications. For instance, when building an **ECOTEC** engine to the 400 hp power level, no modifications to the cylinder head, block, main girdle or crankshaft are required.

The production **ECOTEC** engine block is manufactured out of aluminum using a lost-foam casting process. This process allows for both a stronger and lighter part. Flanged, thin-wall iron cylinder sleeves are press-fit into a semi-floating aluminum support structure. The **ECOTEC** block is supported by a massive die-cast aluminum girdle/main cap assembly and structural oil pan for noise and vibration suppression. The main-cap structures are each supported with six fasteners. Extra-thick main bearings resist the differential thermal expansion of the nodular iron crank and aluminum block.

All **ECOTEC** blocks are cast with passages for piston-cooling jets and an oil cooler for high-output turbocharged applications. The fully-boxed block requires no windage tray, even on applications up to 600 horsepower. An auxiliary chain drives the water pump and balance shafts from the crank.

To reduce the risk of hot spots, pressure-cast, non-squish dished pistons are manufactured without valve reliefs. The symmetrical, barrel-faced moly-coated top ring fits in an

anodized ring-groove below a super-thin 3 mm top ring land, creating a low crevice volume for reduced emissions. The pistons deliver power through full-floating piston pins and powder-metal or forged steel connecting rods.

The **ECOTEC** twin-cam cylinder head uses low-friction hydraulic roller finger-followers, which have been proven reliable and effective up to 11,000 rpm. Head fastener placement permits cylinder head removal and installation without removing the camshafts. The camshafts are driven directly off the crank by a chain. The design includes provisions for future upgrading to variable cam phasing. The finger-follower design permits a light-weight narrow profile and reduced valve angles (the intake valve is 18 degrees from vertical and the exhaust valve 16 degrees).

The design of the intake manifold eliminates the need for variable-length intake runners and consideration has been made for conversion to gasoline direct-injection.

The **ECOTEC** engine management system uses a port-EFI design with cassette waste-spark ignition. An integral compression-sense ignition module eliminates the need for a cam position sensor.

The current 2.2L version of the **ECOTEC** is available in the following vehicles:

- Chevy – Cobalt, Malibu and Cavalier
- Pontiac – Grand Am and Sunfire
- Saturn – L-Series, Ion and Vue
- Opel/Vauxhal – Vectra, Zafira and Speedster.

The next several sections of this publication focus on performance modifications for the 2.2L **ECOTEC** engine installed in a 2005 Chevy Cobalt. The modifications shown could be performed on a number of GM vehicles.

See your local GM dealer for more information on ordering a vehicle equipped with the **ECOTEC** engine.

L61 PARTS LIST

The following pages are production parts lists for the 2.2L L61 and 2.0L LSJ engines. These part numbers can be ordered at your local GM dealers parts desk. Note that part numbers often change, particularly with model year. Please see your local GM dealer for the most up to date information.

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Engine Assembly—Gasoline (Goodwrench)	12601061
Data Dwg—Camshaft/Shaft Profile	90537665
Data Dwg—Camshaft/Shaft Profile	90537664
Installation—Engine Oil Pan Sealer	90537661
Chart—Fastener Torque	90537447
Data Dwg—A/Transmission Flex Plate	90578670
Block Assembly—Engine	12577755
Block Assembly—Engine	12577754
Block—Engine (Machining)	12577753
Block—Engine (Casting)	12581110
Sleeve—Cylinder	90537610
Bolt/Screw—Lower C/Case	11519783
Bolt/Screw—Lower C/Case	90537355
Pin—Lower C/Case Loc	90537102
Crankcase—Lower (Machining)	12583047
Crankcase—Lower (Casting)	12583046
Crankcase—Lower (Machining)	90537846
Crankcase—Lower (Casting)	12583046
Crankcase—Lower (Casting)	90537847
Bearing—Balancer Shaft Rear	12581395
Bearing—Balancer Shaft Rear	90537903
Plug—Engine Block Oil Gallery	11588949
Plug—Engine Block Oil Gallery	21000867
Plug—Engine Block Core Hole	11588547
Plug—Engine Block Oil Gallery	9421745
Bolt/Screw—Lower C/Case	11588733
Sealer—Lower C/Case	9985990
Bearing—Crankshaft/Shaft Upper	12581563
Bearing—Crankshaft/Shaft Upper	12578317
Bearing—Crankshaft/Shaft Lower	12581562
Bearing—Crankshaft/Shaft Lower	12578318
Lubricant—Crankshaft/Shaft Bearing	9986231
Lubricant—Crankshaft/Shaft Bearing	9986231
Head Assembly—Cylinder (W/ Valve)	12580077

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Head Assembly—Cylinder (Machining)	12580076
Head—Cylinder (Machining)	12580075
Head—Cylinder (Casting)	12580074
Head—Cylinder (Casting)	12601948
Seat—Exhaust Valve	13106720
Seat—Intake Valve	12587207
Seat—Intake Valve	13106721
Guide—Valve	12587276
Guide—Valve	90537248
Cap—Camshaft/Shaft Bearing	90537237
Cap—Camshaft/Shaft Bearing Rear	90537238
Bolt/Screw—Camshaft/Shaft Bearing Cap	11519970
Bolt/Screw—Camshaft/Shaft Bearing Cap	11588991
Bolt/Screw—Camshaft/Shaft Bearing Rear Cap	11516339
Pin—Camshaft/Shaft Bearing Rear Cap Loc	90537104
Seal Assembly—Valve Stem Oil	90537241
Spring—Valve	90537032
Retainer—Valve Spring	90537243
Key—Valve Stem	90354648
Arm Assembly—Valve Rocker	12565203
Arm Assembly—Valve Rocker	24100004
Lubricant—Valve Rocker Arm Pivot	9985007
Lubricant—Valve Rocker Arm	9274509
Lubricant—Valve Rocker Arm	9986231
Adjuster—Hydraulic Valve Lash	24100005
Lubricant—Hydraulic Valve Lash Adjuster	9274509
Lubricant—Hydraulic Valve Lash Adjuster	9986231
Lubricant—Hydraulic Valve Lash Adjuster	9985007
Lubricant—Hydraulic Valve Lash Adjuster	9274012
Plug—Cylinder Head Oil Gallery	11588547
Restrictor—Engine Block Oil Gallery	90537983
Fitting Assembly—Engine Cool Air BI Hose	90537387
Fitting Assembly—Engine Cool Air BI Hose	12589732
Stud—Exhaust Manifold	24418771
Stud—Exhaust Manifold	11589054
Stud—Intake Manifold	90537426
Valve—Exhaust	24454518
Valve—Intake	12575793
Lubricant—Valve	9986231

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Lubricant—Valve	9274509
Lubricant—Valve	9985007
Lubricant—Valve	9274012
Camshaft—Intake (Machining)	90537667
Camshaft—(Partial Machining)	24456025
Camshaft—(Partial Machining)	24456024
Camshaft—Intake (Casting)	90537312
Camshaft—Intake (Casting)	90537312
Camshaft—Exhaust (Machining)	90537666
Camshaft Assembly—Exhaust (Machining)	24456027
Camshaft Assembly—Exhaust (Machining)	24456026
Camshaft—Exhaust (Casting)	90537257
Camshaft—Exhaust (Casting)	90537257
Sealer—Camshaft/Shaft Bearing Rear Cap	9985552
Sealer—Camshaft/Shaft Bearing Rear Cap	9985460
Lubricant—Camshaft/Shaft	21494009
Lubricant—Camshaft/Shaft	9274076
Spark Plug Assembly	12599232
Pin—Cylinder Head Loc	90537102
Pin—Cylinder Head Loc	12594463
Gasket Assembly—Cylinder Head	24444091
Bolt/Screw—Cylinder Head	90537691
Plate Assembly—Cylinder Head Opening	12578144
Plate—Cylinder Head Opening	90537669
Seal—Cylinder Head Opening Plate (O—Ring)	12578146
Stud—Cylinder Head Opening Plate	11519137
Bolt/Screw—Cylinder Head	24407225
Bolt/Screw—Cylinder Head	11589328
Bracket—Engine Lift Front	12580020
Bracket—Engine Lift Front	12580020
Bolt/Screw—Engine Lift Front Bracket	12589311
Module Assembly—Powertrain Control (W/O Boot Program & Calibration & Operating System)	12564960
Data File—Powertrain Control Module Operating Sys	12589312
Data File—Powertrain Control Module Boot Program	12568020
Data File—Powertrain Control Module (W/ 2nd Mpu) Operating System	12587009
Bolt/Screw—Engine Lift Front Bracket	11589311
Bracket Assembly—Engine Lift Rear	90537236
Stud—Engine Lift Bracket	11514006

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Bolt/Screw—Engine Lift Rear Bracket	12589311
Module Assembly—Powertrain Control (W/O Boot Program & Calibration & Operating System)	12564960
Data File—Powertrain Control Module Operating System	12589312
Data File—Powertrain Control Module Boot Program	12568020
Data File—Powertrain Control Module (W/ 2nd Mpu) Operating System	12587009
Label—Engine Traceability	9128666
Label—Engine Identification	90572793
Crankshaft	90537273
Crankshaft—(Casting)	90537327
Seal Assembly—Crankshaft/Shaft Rear Oil	90325572
Lubricant—Crankshaft/Shaft Rear Oil Seal	9985406
Balancer Assembly—Crankshaft/Shaft	90537704
Bolt/Screw—Crankshaft/Shaft Balancer	11589123
Plate Assembly—A/Transmission Flex	12593689
Plate Assembly—A/Transmission Flex	12593689
Bolt/Screw—A/Transmission Flex Plate	90236536
Shaft Assembly—Balancer	90537566
Shaft—Balancer (Machining)	90537561
Bearing Assembly—Balancer Shaft Front	90537455
Lubricant—Balancer Shaft Front Bearing	9985705
Sprocket Assembly—Balancer Shaft	55354438
Bolt/Screw—Balancer Shaft Sprocket	11516347
Lubricant—Balancer Shaft	9986166
Lubricant—Balancer Shaft	9274509
Lubricant—Balancer Shaft	9274035
Shaft Assembly—Balancer	90537565
Shaft—Balancer (Machining)	90537560
Bearing Assembly—Balancer Shaft Front	90537456
Lubricant—Balancer Shaft Front Bearing	9985705
Sprocket Assembly—Balancer Shaft	55354439
Bolt/Screw—Balancer Shaft Sprocket	11516347
Lubricant—Balancer Shaft	9986166
Lubricant—Balancer Shaft	9274509
Lubricant—Balancer Shaft	9274035
Bolt/Screw—Balancer Shaft Bearing	11588712
Piston Assembly—(W/ Connecting Rod)	12589688
Piston Assembly	12589687
Piston	12589686

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Ring—Piston Compression Upper	90537700
Ring—Piston Compression Lower	90537563
Spacer—Piston Oil Ring Rail	90537705
Rail Assembly—Piston Oil Ring	90537701
Rod Assembly—Connecting	12992587
Rod—Connecting	24461541
Rod—Connecting (Forged W/ Cap)	90537815
Bushing—Connecting Rod	12578190
Bolt/Screw—Connecting Rod	90537293
Pin—Piston	90537291
Retainer—Piston Pin	90537376
Lubricant—Piston Pin	9986231
Lubricant—Piston Pin	9274509
Piston Assembly—(W/ Connecting Rod)	12589691
Piston Assembly	12589687
Piston	12589686
Ring—Piston Compression Upper	90537700
Ring—Piston Compression Lower	90537563
Spacer—Piston Oil Ring Rail	90537705
Rail Assembly—Piston Oil Ring	90537701
Rod Assembly—Connecting	24455133
Rod—Connecting	24455134
Bushing—Connecting Rod	12578190
Bolt/Screw—Connecting Rod	90537293
Lubricant—Piston Pin	9986166
Lubricant—Piston Pin	9274509
Pin—Piston	90537291
Retainer—Piston Pin	90537376
Bearing—Connecting Rod	12581561
Lubricant—Connecting Rod Bearing	9986231
Lubricant—Connecting Rod Bearing	9986231
Lubricant—Piston & Connecting Rod	9986231
Lubricant—Piston & Connecting Rod	9986231
Pan Assembly—Oil	12578193
Pan—Oil	12578194
Insert—Oil Pan Drain Plug Thread	11502608
Pipe Assembly—O/Pump Suction	12578195
Seal—O/Pump Suction Pipe (O Ring)	90537413
Sealer—O/Pump Suction Pipe	9908043

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Bolt/Screw—O/Pump Suction Pipe	90537789
Baffle—Oil Pan	12578196
Bolt/Screw—Oil Pan Baffle	11519133
Plug Assembly—Oil Pan Drain	11519933
Seal—Oil Pan Drain Plug (O Ring)	3536966
Plug—Oil Pan Hole	11052823
Sealer—Oil Pan Hole Plug	9908043
Bolt/Screw—Oil Pan	11900254
Bolt/Screw—Oil Pan	12589253
Sealer—Oil Pan	9982257
Pin—Oil Pan Loc	22531637
Cap Assembly—Oil Fill	12589430
Cap—Oil Fill	12589606
Seal—Oil Fill Cap (O Ring)	24100002
Lubricant—Oil Fill Cap Seal	9986231
Lubricant—Oil Fill Cap Seal	9986231
Tube Assembly—Oil Level Indicator	12599898
Seal—Oil Level Indicator Tube (O Ring)	90467275
Lubricant—Oil Level Indicator Tube Seal	9986174
Bolt/Screw—Oil Level Indicator Tube	11588710
Indicator Assembly—Oil Level	24428553
Seal—Oil Level Indicator (O Ring)	90529866
Filter Assembly—Oil	12580254
Filter—Oil	12579143
Seal—Oil Filter Cap (O Ring)	12580255
Lubricant—Oil Filter Cap Seal	9981704
Lubricant—Oil Filter Cap Seal	9986231
Oil—Engine	9986231
Oil—Engine	9986231
Cover Assembly—Engine Front (W/ O/Pump)	12584621
Gear Set—O/Pump	24434093
Gear—O/Pump	24437452
Gear—O/Pump Driven	24437451
Seat—Oil Press Relief Valve Spring	12582068
Spring—Oil Press Relief Valve	90537371
Valve Assembly—Oil Press Relief	90537357
Seal—Oil Press Relief Valve Spring Seat (O Ring)	11093042
Cover—W/Pump Acc Hole	90537266
Bolt/Screw—W/Pump Acc Hole Cover	11516422

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Seal—W/Pump Acc Hole Cover (O—Ring)	90537915
Seal—Crankshaft/Shaft Front Oil	12584041
Pin—Engine Front Cover Loc	22531637
Bolt/Screw—Engine Front Cover	11561752
Gasket—Engine Front Cover	24435052
Chain Package—W/Pump & Balancer Shaft	12576646
Chain Assembly—W/Pump & Balancer Shaft	90537370
Tensioner Assembly—W/Pump & Balancer Shaft Chain	90537300
Bolt/Screw—W/Pump & Balancer Shaft Chain Tensioner	11516425
Sprocket Assembly—Crankshaft/Shaft	24424758
Sprocket—Crankshaft/Shaft	90537301
Guide—Balancer Chain	90537369
Guide—Balancer Chain Adjuster	90537299
Bolt/Screw—Balancer Chain Adjuster Guide	11516425
Guide—Balancer Chain	90537336
Bolt/Screw—Balancer Chain Guide	11588522
Pump Assembly—Water	12586485
Pump Assembly—Water	12586486
Housing Assembly—W/Pump	12586487
Plug Assembly—Engine Block Cool Drain Hole	90537623
Cover—W/Pump	24467302
Seal—W/Pump Cover (O Ring)	24446365
Seal—W/Pump	12568096
Seal—W/Pump	24405897
Bolt/Screw—W/Pump Cover	11518063
Stud—W/Pump Cover	11518796
Gasket—W/Pump	24439799
Bearing Assembly—W/Pump Drive Shaft	12586488
Sprocket—W/Pump	90537298
Bolt/Screw—W/Pump Sprocket	11518061
Pump Assembly—Water	12586567
Pump Assembly—Water	12586568
Housing Assembly—W/Pump	12586569
Plug Assembly—Engine Block Cool Drain Hole	12586573
Gasket—W/Pump	24439799
Cover—W/Pump	12586571
Gasket—Engine Block Cool Drain Hole Plug	12586572
Seal—W/Pump Cover (O Ring)	24446365
Stud—W/Pump Cover	11518796

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Bolt/Screw—W/Pump Cover	11518063
Bearing Assembly—W/Pump Drive Shaft	12586570
Bearing Assembly—W/Pump Drive Shaft	12586488
Sprocket—W/Pump	90537298
Bolt/Screw—W/Pump Sprocket	11518061
Bolt/Screw—W/Pump	11589253
Bolt/Screw—W/Pump	11900262
Lubricant—Radiator Outlet Pipe Seal	9985406
Manifold Assembly—Intake	12587202
Gasket—Intake Manifold	24455112
Sensor Assembly—Map	16212460
Seal—Throttle Body	24455111
Connector Assembly—Evap Emission Canister Purge Pipe	24447064
Seal—Evap Emission Canister Purge Pipe Connector (O—Ring)	24447066
Seal—C/Case Vent Passage	12575851
Bolt/Screw—Evap Emission Canister Purge Pipe Connector	24447065
Plug—Intake Manifold Port Shipping	24467213
Bolt/Screw—Intake Manifold	11589303
Nut—Intake Manifold	11514516
Insulator Assembly—F/Injector	12571864
Insulator—F/Injector	12576332
Seal—F/Injector Insulator	12571865
Injector Assembly—M/Port Fuel (W/Fuel Rail)	12593230
Injector Assembly—M/Port Fuel	12582219
Retainer—F/Injector	12585749
Seal—F/Injection Fuel RI (O Ring)	12585750
Seal—F/Injector (O Ring)	12585751
Rail—M/Port F/Injection Fuel	12593231
Valve Assembly—Fuel Press Service	12568158
Cap Assembly—Fuel Press Service Valve	12568159
Material Spec	M54134
Material Spec	M53123
Process Spec	P10373
Cap Assembly—Fuel Press Service Valve	25532662
Harness Assembly—F/Injector Wiring	12582220
Lubricant—F/Injector Seal	9981704
Bolt/Screw—F/Injection Fuel Rail	11588713
Chain Pkg—Timing	12576601
Chain Assembly—Timing	24461834

L61 PARTS LIST	
DESCRIPTION	PART NUMBER
Tensioner Assembly—Timing Chain	12578209
Guide—Timing Chain	24449448
Bolt/Screw—Timing Chain Guide	11516425
Guide—Timing Chain	13104978
Bolt/Screw—Timing Chain Guide	11588522
Guide Assembly—Timing Chain	90537337
Guide Assembly—Timing Chain	12588387
Bolt/Screw—Timing Chain Guide	11518828
Sprocket—Camshaft/Shaft	90537632
Bolt/Screw—Camshaft/Shaft Sprocket	90537451
Nozzle—Timing Chain Oil	12577163
Bolt/Screw—Timing Chain Oil Nozzle	11516425
Plug—Timing Chain Guide Acc Hole	11588880
Cover Assembly—Camshaft/Shaft	12584083
Cover Assembly—Camshaft/Shaft	24426069
Cover—Camshaft/Shaft (Casting)	24426736
Insulator—Camshaft/Shaft Cover Bolt	11519782
Seal Assembly—Camshaft/Shaft Cover	12584084
Cable Assembly—Camshaft/Shaft Cover Ground	12576576
Stud—Camshaft/Shaft Cover Ground Cable	11519788
Bolt/Screw—Camshaft/Shaft Cover Ground Cable	11519141
Key—Crankshaft/Shaft Sprocket	24424855
Tensioner Assembly—Drive Belt	24430296
Bolt/Screw—Drive Belt Tensioner	11516354
Sensor Assembly—Knock	12567711
Bolt/Screw—Electric ICM Cover	11900247
Module Assembly—Electric Ignition Control	12580538
Decal—Engine Type	12577472
Pin—Trans Loc	90351708
Switch Assembly—Engine Oil Press	24577642
Sensor Assembly—Crankshaft/Shaft Position	12567712
Bolt/Screw—Crankshaft/Shaft Position Sensor	11588712

NOTES

LSJ PARTS LIST

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Engine Assembly-Gasoline (Goodwrench)	12592941
Chart-Fastener Torque	12588182
Block Assembly-Engine	12582705
Block Assembly-Engine	12582706
Block-Engine (Machining)	90537713
Block-Engine (Casting)	90537806
Block-Engine (Casting)	24413489
Sleeve-Cylinder	90537610
Bolt/Screw-Lower C/Case	90537355
Bolt/Screw-Lower C/Case	11519783
Pin-Lower C/Case Loc	90537102
Crankcase-Lower (Machining)	12583047
Crankcase-Lower (Casting)	12583046
Crankcase-Lower (Machining)	90537846
Crankcase-Lower (Casting)	12583046
Crankcase-Lower (Casting)	90537847
Bearing-Balancer Shaft Rear	12581395
Bearing-Balancer Shaft Rear	90537903
Plug-Engine Block Oil Gallery	11588949
Plug-Engine Block Oil Gallery	21000867
Plug-Engine Block Core Hole	11588547
Plug-Engine Block Oil Gallery	9421745
Pipe Assembly-Engine Oil Cooler Inl	12790785
Bolt/Screw-Lower C/Case	11518056
Bearing-Crankshaft/Shaft Upper	90537821
Bearing-Crankshaft/Shaft Upper	90537908
Bearing-Crankshaft/Shaft Lower	90537822
Bearing-Crankshaft/Shaft Lower	90537905
Bearing-Crankshaft/Shaft Upper	90537330
Bearing-Crankshaft/Shaft Upper	90537907
Bearing-Crankshaft/Shaft Lower	90537329
Bearing-Crankshaft/Shaft Lower	90537906
Sealer-Lower C/Case	9985990
Lubricant-Crankshaft/Shaft Bearing	9274963
Head Assembly-Cylinder (W/ Valve)	12591190
Head Assembly-Cylinder (Machining)	12591189

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Head-Cylinder (Machining)	12591188
Head-Cylinder (Casting)	55556574
Seat-Exhaust Valve	90537244
Seat-Intake Valve	55556421
Guide-Valve	90537248
Cap-Camshaft/Shaft Bearing	90537237
Seat-Intake Valve	12587207
Cap-Camshaft/Shaft Bearing Rear	90537238
Cap-Camshaft/Shaft Bearing Rear	12787763
Guide-Valve	12587276
Bolt/Screw-Camshaft/Shaft Bearing Cap	11588991
Bolt/Screw-Camshaft/Shaft Bearing Rear Cap	11518051
Pin-Camshaft/Shaft Bearing Rear Cap Loc	90537104
Lubricant-Valve Rocker Arm Piv	9985007
Restrictor-Engine Block Oil Gallery	90537983
Plug-Cylinder Head Oil Gallery	11101961
Plug-Cylinder Head Oil Gallery	11101951
Plug-Cylinder Head Core Hole	12791923
Plug-Cylinder Head Core Hole	11101971
Sealer-Camshaft/Shaft Bearing Rear Cap	9985552
Stud-Exhaust Manifold	11589054
Valve-Intake	12786696
Valve-Exhaust	12791961
Lubricant-Valve	9986166
Lubricant-Valve	9274509
Lubricant-Valve	9985007
Seal Assembly-Valve Stem Oil	90537241
Springing-Valve	90537032
Retainer-Valve Spring	90537243
Key-Valve Stem	90354648
Arm Assembly-Valve Rocker	24100004
Lubricant-Valve Rocker Arm Piv	9985007
Arm Assembly-Valve Rocker	12565203
Lubricant-Valve Rocker Arm	986166
Lubricant-Valve Rocker Arm	9274509
Adjuster-Hydraulic Valve Lash	24100005
Lubricant-Hydraulic Valve Lash Adjuster	9986166
Lubricant-Hydraulic Valve Lash Adjuster	9274509
Lubricant-Hydraulic Valve Lash Adjuster	9985007

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Camshaft-Intake (Machining)	12587985
Camshaft-Intake (Casting)	90537312
Camshaft Assembly-Exhaust (Machining)	12584363
Camshaft-Exhaust (Casting)	90537312
Adapter-Power Steering Pump Drive	24572945
Sealer-Power Steering Pump Drive Adapter	9985768
Spark Plug Assembly	12787099
Pin-Cylinder Head Loc	12594463
Gasket Assembly-Cylinder Head	55352039
Bolt/Screw-Cylinder Head	90537691
Bolt/Screw-Cylinder Head	24407225
Plate Assembly-Cylinder Head Opening	90537676
Plate-Cylinder Head Opening	90537669
Seal-Cylinder Head Opening Plate (O Ring)	26040230
Stud-Cylinder Head Opening Plate	11519137
Pin-Cylinder Head Loc	90537102
Bracket Assembly-Engine Lift Front	12592662
Bracket-Engine Lift Front	12583143
Bolt/Screw-Engine Lift Front Bracket	11518048
Bracket-Gen Adjuster	12584365
Bracket-Gen Adjuster	12584366
Bracket Assembly-Engine Lift Rear	12583150
Bolt/Screw-Engine Lift Rear Bracket	11518049
Bracket-Engine Lift Front	12583143
Bolt/Screw-Engine Lift Front Bracket	11518048
Label-Engine Identification	9128666
Label-Engine Identification	90572793
Crankshaft Assembly	12791966
Crankshaft-(Machining)	12790475
Crankshaft-(Casting)	55558925
Ring-Crankshaft/Shaft Position Sensor Reluctor	12786239
Bolt/Screw-Crankshaft/Shaft Position Sensor Reluctor Ring	90280051
Seal Assembly-Crankshaft/Shaft Rear Oil	90325572
Lubricant-Crankshaft/Shaft Rear Oil Seal	274963
Absorber-Crankshaft/Shaft Balancer	12583151
Bolt/Screw-Crankshaft/Shaft Balancer	11589123
Shaft Assembly-Balancer	24433721
Shaft-Balancer (Machining)	90537561
Bearing Assembly-Balancer Shaft Front	90537455

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Lubricant-Balancer Shaft Front Bearing	9985705
Sprocket Assembly-Balancer Shaft	90537295
Bolt/Screw-Balancer Shaft Sprocket	11518054
Lubricant-Balancer Shaft	986166
Lubricant-Balancer Shaft	9274509
Lubricant-Balancer Shaft	274035
Shaft Assembly-Balancer	24433720
Shaft-Balancer (Machining)	90537560
Bearing Assembly-Balancer Shaft Front	90537456
Lubricant-Balancer Shaft Front Bearing	9985705
Sprocket Assembly-Balancer Shaft	90537435
Bolt/Screw-Balancer Shaft Sprocket	11518054
Lubricant-Balancer Shaft	986166
Lubricant-Balancer Shaft	9274509
Lubricant-Balancer Shaft	9274035
Bolt/Screw-Balancer Shaft Bearing	11518449
Piston Assembly-(W/ Connecting Rod)	2755224
Rod Assembly-Connecting	12755162
Rod-Connecting	2791922
Rod-Connecting (Forged W/ Cap)	12755164
Pushing-Connecting Rod	12755166
Bolt/Screw-Connecting Rod	0537293
Lubricant-Piston Pin	9986125
Piston Assembly	12791210
Piston	12791211
Ring-Piston Compression Upper	12791499
Ring-Piston Compression Lower	2795681
Spacer-Piston Oil Ring RI	12795683
Rail Assembly-Piston Oil Ring	12795682
Pin-Piston	12791503
Retainer-Piston Pin	12755171
Bearing-Connecting Rod	90537332
Bearing-Connecting Rod	90537904
Lubricant-Connecting Rod Bearing	9986231
Lubricant-Connecting Rod Bearing	9986166
Lubricant-Piston & Connecting Rod	9986231
Lubricant-Piston & Connecting Rod	9986166
Pan Assembly-Oil	12584345
Pan-Oil	12787937

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Pan-Oil (Casting)	12787809
Baffle-Oil Pan	12787810
Bolt/Screw-Oil Pan Baffle	92150250
Pipe Assembly-O/Pump Suction	12787811
Seal-O/Pump Suction Pipe (O Ring)	90537413
Bolt/Screw-O/Pump Suction Pipe	92150370
Plug-Oil Pan Hole	11052823
Plug-Oil Pan Hole	12586366
Plug Assembly-Oil Pan Drain	11519933
Seal-Oil Pan Drain Plug (O Ring)	3536966
Insert-Oil Pan Drain Plug Thread	11502608
Label-Oil Pan Identification	12586536
Pin-Oil Pan Loc	22531637
Bolt/Screw-Oil Pan	11518049
Bolt/Screw-Oil Pan	11518058
Sealer-Oil Pan	9985990
Nozzle Assembly-Piston Oil	12791255
Nozzle-Piston Oil	12791256
Washer-O/Pump Suction Pipe Bracket	12791241
Body-Piston Oil Nozzle Ball Check Valve	12791242
Bolt/Screw-Piston Oil Nozzle	12791243
Tube-Piston Oil Nozzle	12794255
Springing-Oil Flow Ball Check Valve	12793931
Valve-Piston Oil Nozzle Ball Check	12791246
Cap Assembly-Oil Filter	12577268
Cap-Oil Filter	12573334
Seal-Oil Filter Cap (O Ring)	24100002
Lubricant-Oil Filter Cap Seal	9274963
Hose-Engine Oil Cooler Cool Inl	12786237
Hose-Engine Oil Cooler Cool Inl	12786238
Clamp-Engine Oil Cooler Hose	90573605
Clamp-Engine Oil Cooler Hose	90573612
Bolt/Screw-Engine Oil Cooler Thermostat Housing	11518049
Stud-Engine Oil Cooler	12794256
Cooler Assembly-Engine Oil	12585680
Cooler Assembly-Engine Oil	12786259
Switch Assembly-Engine Oil Press Indicator	24577642
Filter Assembly-Oil	12580254
Filter-Oil	12579143

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Seal-Oil Filter Cap (O Ring)	12580255
Indicator Assembly-Oil Level	24428553
Seal-Oil Level Indicator (O Ring)	90529866
Tube Assembly-Oil Level Indicator	12583153
Tube-Oil Level Indicator	12584344
Seal-Oil Level Indicator Tube	90467275
Bolt/Screw-Oil Level Indicator Tube	11518950
Lubricant-Oil Filter Cap Seal	9981704
Oil-Engine	9274963
Pump Assembly-Water	12586485
Pump Assembly-Water	12586486
Housing Assembly-W/Pump	12586487
Plug Assembly-Engine Block Cool Drain Hole	90537623
Cover-W/Pump	24467302
Seal-W/Pump Cover (O Ring)	24446365
Seal-W/Pump	12568096
Seal-W/Pump	24405897
Bolt/Screw-W/Pump Cover	11518063
Stud-W/Pump Cover	11518796
Gasket-W/Pump	24439799
Bearing Assembly-W/Pump Drive Shaft	12586488
Sprocket-W/Pump	90537298
Bolt/Screw-W/Pump Sprocket	11518061
Bolt/Screw-W/Pump	11518057
Bolt/Screw-W/Pump	11518052
Cover Assembly-Engine Front (W/ O/Pump)	12582069
Gear Set-O/Pump	24434093
Gear-O/Pump	24437452
Gear-O/Pump Driven	24437451
Seat-Oil Press Relief Valve Spring	12582068
Springing-Oil Press Relief Valve	90537371
Valve Assembly-Oil Press Relief	90537357
Seal-Oil Press Relief Valve Spring Seat (O Ring)	11093042
Cover-W/Pump Acc Hole	90537266
Bolt/Screw-W/Pump Acc Hole Cover	11516422
Seal-W/Pump Acc Hole Cover (O Ring)	90537915
Seal-Crankshaft/Shaft Front Oil	12580989
Cover Assembly-Engine Front (W/ O/Pump)	24450057
Gear Set-O/Pump	24434093

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Gear-O/Pump	24437452
Gear-O/Pump Driven	24437451
Seat-Oil Press Relief Valve Spring	90537361
Springing-Oil Press Relief Valve	90537371
Valve Assembly-Oil Press Relief	90537357
Seal-Oil Press Relief Valve Spring Seat (O Ring)	11093042
Cover-W/Pump Acc Hole	90537266
Bolt/Screw-W/Pump Acc Hole Cover	11518061
Seal-W/Pump Acc Hole Cover (O Ring)	90537915
Seal-Crankshaft/Shaft Front Oil	12580989
Pin-Engine Front Cover Loc	22531637
Bolt/Screw-Engine Front Cover	11518075
Gasket-Engine Front Cover	24435052
Chain Package-W/Pump & Balancer Shaft	12789019
Chain Assembly-W/Pump & Balancer Shaft	90537370
Tensioner Assembly-W/Pump & Balancer Shaft Chain	90537300
Socket-Crankshaft/Shaft	55557168
Guide-Balancer Chain	90537369
Bolt/Screw-Balancer Chain Guide	11588522
Guide-Balancer Chain Adjuster	90537299
Bolt/Screw-Balancer Chain Adjuster Guide	11516425
Bolt/Screw-W/Pump & Balancer Shaft Chain Tensioner	11516425
Guide-Balancer Chain	90537336
Housing Assembly-Engine Cool Thermostat	12592671
Cover-Engine Cool Thermostat Housing	12592672
Plug-Engine Cool Heater Hole	12789738
Seal-Engine Cool Heater (O Ring)	12789739
Bolt/Screw-Engine Water Outlet Adapter	11518062
Bolt/Screw-Engine Cool Thermostat Housing Cover	11518062
Adhesive-Water Outlet Plug	9985490
Seal-Water Outlet (O Ring)	90537379
Sealer-Heater Inl Pipe	9985768
Bolt/Screw-Engine Cool Thermostat Housing	11518063
Lubricant-Radiator Outlet Pipe Seal	9985406
Bolt/Screw-Engine Cool Thermostat Housing	11900171
Pipe Assembly-Engine Cool Air Bl	12584347
Pipe-Engine Cool Air Bl	12787097
Bolt/Screw-Engine Cool Air Bl Pipe	12797711
Fitting Assembly-Engine Cool Air Bl Pipe	12795420

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Bolt/Screw-Engine Clg Air Outlet Duct	92150975
Bracket-Engine Cool Air BI Pipe	12788167
Gasket-Engine Clg Air Outlet Duct	92150433
Washer-Engine Cool Air BI Pipe	12791944
Fitting Assembly-Engine Cool Air BI Pipe	12795420
Sender Assembly-Baro Press	12580698
Bracket Assembly-Baro Press Sensor	12584370
Bolt/Screw-Baro Press Sensor Bracket	11589084
Bolt/Screw-Engine Cool Air BI Pipe	11085673
Bolt/Screw-Intake Manifold	11610176
Insulator Assembly-F/Injector	12571864
Insulator-F/Injector	12576332
Seal-F/Injector Insulator	12571865
Chain Package-Timing	12577385
Chain Assembly-Timing	24461834
Tensioner Assembly-Timing Chain	24448509
Guide-Timing Chain	24449448
Bolt/Screw-Timing Chain Guide	11516425
Guide-Timing Chain	13104978
Bolt/Screw-Timing Chain Guide	11588522
Guide Assembly-Timing Chain	90537337
Bolt/Screw-Timing Chain Guide	11518828
Sprocket Assembly-Crankshaft/Shaft	24424758
Sprocket-Camshaft/Shaft	90537632
Bolt/Screw-Camshaft/Shaft Sprocket	90537451
Nozzle-Timing Chain Oil	12577163
Bolt/Screw-Timing Chain Oil Nozzle	11516425
Cover Assembly-Camshaft/Shaft	12797659
Cover-Camshaft/Shaft	12797794
Insulator-Camshaft/Shaft Cover Bolt	12789896
Seal Assembly-Camshaft/Shaft Cover	90537687
Plug-Timing Chain Guide Acc Hole	11519784
Stud-Camshaft/Shaft Cover Ground Cable	11518473
Key-Crankshaft/Shaft Sprocket	24424855
Bracket Assembly-Drive Belt Idler Pulley	12584364
Bolt/Screw-Drive Belt Idler Pulley Bracket	11518055
Bolt/Screw-Gen	11518051
Housing Assembly-Camshaft/Shaft Position Sensor	12600008
Housing-Camshaft/Shaft Position Sensor	12584372

LSJ PARTS LIST	
DESCRIPTION	PART NUMBER
Housing-Camshaft/Shaft Position Sensor (Casting)	12584374
Pin-Camshaft/Shaft Position Sensor Cplg	12584334
Shaft-Camshaft/Shaft Position Sensor	12584373
Seal-Camshaft/Shaft Position Sensor Housing Oil (O Ring)	12600009
Ring-Camshaft/Shaft Position Actr Press Accum Piston Cylinder Ret	12587190
Bushing-Camshaft/Shaft Position Sensor Shaft	12587191
Retainer-Camshaft/Shaft Position Sensor	12587192
Sensor Assembly-Crankshaft/Shaft Position	12789959
Bolt/Screw-Crankshaft/Shaft Position Sensor	11518062
Pin-Trans Loc	90351708
Bolt/Screw-Camshaft/Shaft Position Sensor	11519137

NOTES

ENGINE ASSEMBLY STOCK TO 250 HP



Fig. 3

The stock **ECOTEC** engine has proven reliable to 250 hp.(Fig. 3) Performance upgrades are available from GM Performance Parts and aftermarket companies. You can purchase upgraded components such as:

- Air Intake Systems
- Exhaust Systems
- Exhaust Headers
- Adjustable Cam Gears
- Nitrous Oxide Systems
- Supercharger Kits

ADJUSTABLE CAM GEARS



Fig. 4

An excellent way to optimize cam timing is to install GM Performance Parts Adjustable Cam Gears part number 88958613. (Fig. 4)

NITROUS OXIDE SYSTEMS



Fig. 5

With a stock cobalt, the maximum nitrous jet you should use is 75 hp. Nitrous Express offers a stand-alone kit which has been tested and proven to work well. The Nitrous Express Kit contains a single nozzle with a nitrous jet and a fuel jet. Use a pressure tap on the production fuel rail for the fuel jet's supply. (Fig. 5)

SUPERCHARGER



Fig. 6

GM Performance Parts has developed a bolt-on supercharger kit (part number 1780003) for the 2.2L **ECOTEC** engine. Fits 2003-2005 model year Cavalier and Sunfire. Also fits certain 2002 Cavalier and Sunfire equipped with Delphi fuel injectors. This kit contains all the components necessary for installation. (Fig. 6)

ECOTEC SUPERCHARGER INSTALLATION

Thank you for choosing GM Performance Parts as your high performance source. GM Performance Parts is committed to providing proven, innovative performance technology that is truly more than just power. GM Performance Parts are engineered, developed and tested by the factory to exceed your expectations for fit and function. To contact us call 1-800-GMUSEUS for the GM Performance Parts Authorized Center nearest you or visit our website at www.gmgoodwrench.com.

This section provides general information on components and procedures that may be useful when installing or servicing an **ECOTEC** supercharger package. Please read this entire section before starting work.

The **ECOTEC** supercharger package was designed by GM to be a true performance bolt on package. When this package is properly installed, it looks like original factory equipment. The fact that the parts have been designed to GM standards ensures a quality product. All of the fasteners required for installation are included in the package. All of the service components for the package are available from any GM dealer. The package was designed to retain the use of cruise control, air conditioning and other vehicle options.

The Powertrain Control Module (PCM) calibration is a key factor in both performance and drivability. This supercharger package has its own unique calibration designed specifically for **ECOTEC** engines used in Chevrolet Cavaliers and Pontiac Sunfires. The package has been calibrated to GM standards, and the package is emission legal in all 50 states. As part of the calibration process for this package, the supercharged engine was tested on a dynamometer to develop the base fueling and spark requirements. All of this testing is necessary to develop a package that meets GM standards for performance, drivability, and durability.

It is not the intent of these specifications to replace the comprehensive and detailed service practices explained in the GM service manuals. GM service manuals are available from:

Helm Incorporated
PO Box 07130
Detroit, MI 48207

Observe all safety precautions and warnings in the service manuals when installing the **ECOTEC** supercharger package. Wear eye protection and appropriate protective clothing. When working under or around the vehicle support it securely with jack stands. Use only the proper tools.

Exercise extreme caution when working with flammable, corrosive, and hazardous liquids and materials. Some procedures require special equipment and skills. If you do not have the appropriate training, expertise, and tools to perform any part of this conversion safely, this work should be done by a professional.

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1. Disconnect the negative battery cable.

NOTE: Minimum of 92 octane fuel is required after this installation.

2. Vent radiator cap and drain coolant.
3. Remove air duct clamps and air duct. Save the clamps.



Fig. 7

4. Remove the air box at throttle body by removing metal hose clamps. Save the two clamps from the PCV hose. (Fig. 7)
5. Remove the IAT plug. Remove the vacuum hose from the fuel regulator to air box. (Fig. 8)



Fig. 8

6. Remove the upper radiator hose. Remove the lower clamp from under the car. (Fig. 9)



Fig. 9

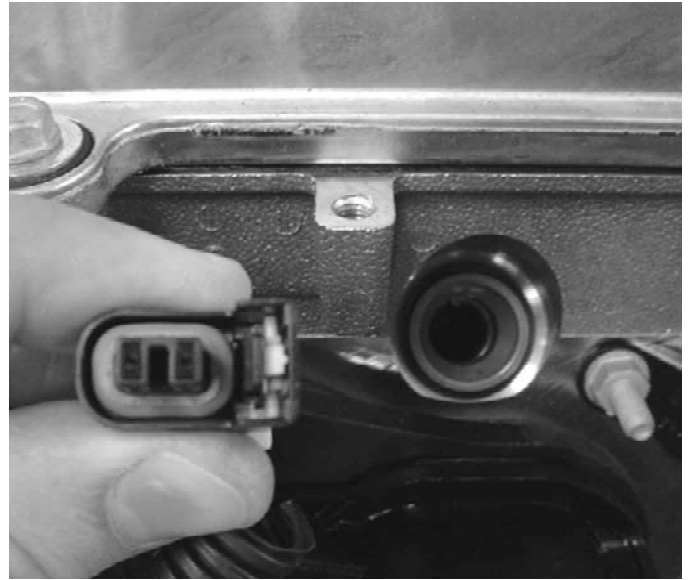
7. Remove the throttle cable and cruise control cable from the throttle body. Remove the cruise control cable from the cruise motor by twisting and pulling. Disconnect the ribbon from the cable. Remove the throttle/cruise cable bracket on top of the cam cover. Save this bracket. Replace the stud. (Fig. 10)

**Fig. 10**

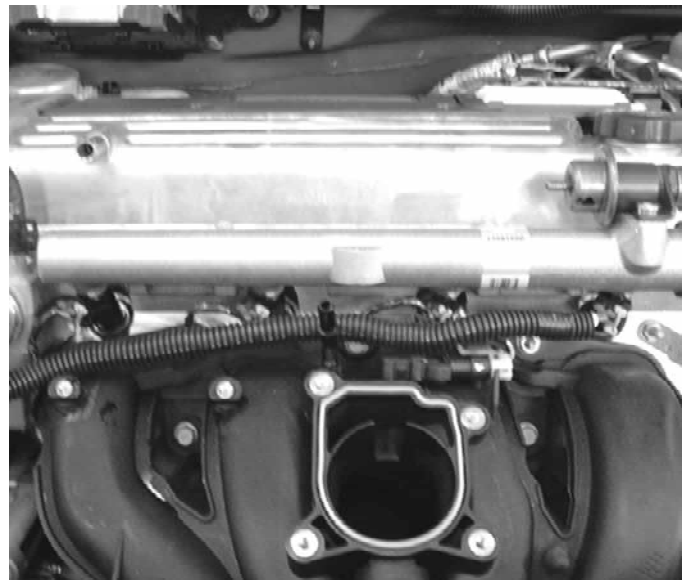
8. Unplug the two sensors from the throttle body. The throttle position sensor (TPS) has a lock. Reinstall this lock to keep from losing it. Remove the throttle body (four bolts). Set aside the throttle body with bracket. They will be reused. (Fig. 10)
9. Remove the fuel canister purge from the purge valve on the intake manifold. (Fig. 11)

**Fig. 11**

10. Remove the coil connection on top of the cam cover. (Fig. 11)
11. Remove the four wire connectors from the fuel injectors. Pull up the green tab and press in on the black tab and release the injector. Make sure that the red seals stay with the connector. (Fig. 12)

**Fig. 12**

12. Remove the two nuts from the fuel lines mounted to the left side of the cam cover and two studs from the front of the fuel rail. Remove fuel rail from cylinder head and set it aside, leaving fuel lines connected. Make sure the gray injector seats stay in the cylinder head.
13. Unplug the MAP sensor from the intake manifold. (Fig. 13)

**Fig. 13**

14. Remove the two bolts that hold the heater hose in place from the front of the intake manifold. (Fig. 14)



Fig. 14

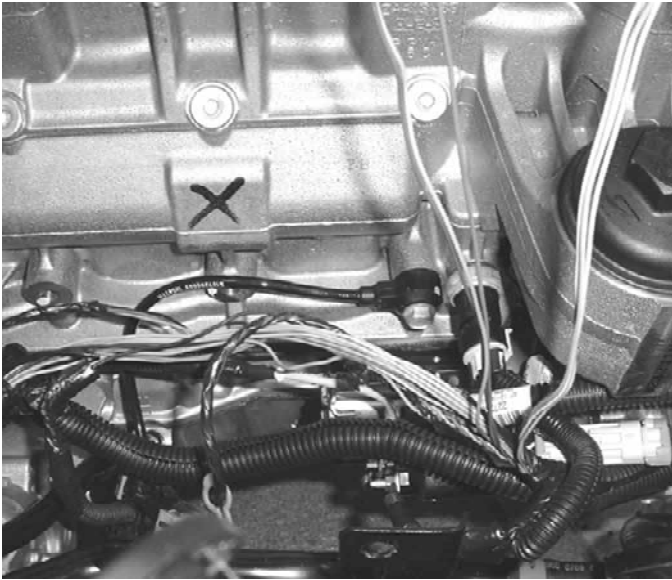


Fig. 15

15. Remove the bracket for the oil level tube and the attaching connector clips.
16. Remove the intake manifold bolts. Remove the intake and at the same time, remove the vacuum port from the brake booster line at bottom left of the intake. Remove the wire harness from the looms at underside of the manifold.
17. Remove the other end of the brake booster line from the tank and discard it.
18. Remove the two top outer studs at the intake flange on the cylinder head.
19. Remove the accessory belt. Use a 3/8" drive breaker bar for the tensioner. Turn it counter clockwise.
20. Remove all the electrical connections and the three mounting bolts from the generator. Remove the generator. (Fig. 15)
21. Remove and untie about 18" of the IAC and TPS sensor wires from wire the harness conduit. (Fig. 16) and (Fig. 17)



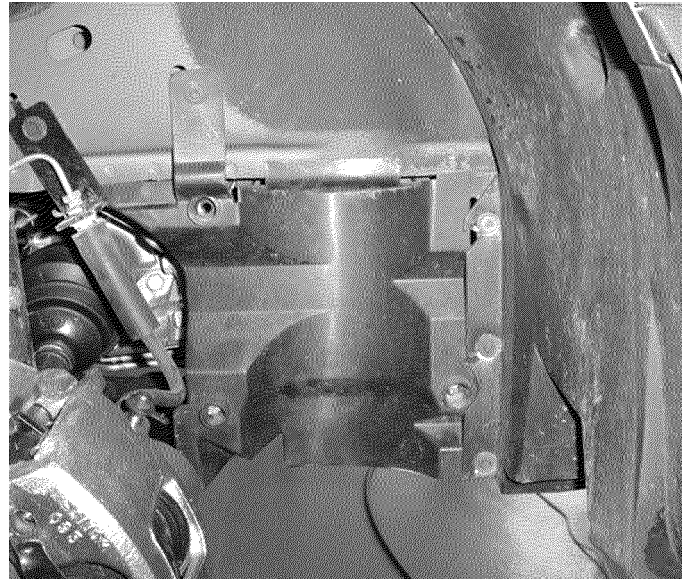
Fig. 16

**Fig. 17**

22. Use two feet of 13 mm diameter conduit to wrap the wires on the IAC and TPS sensor wires that you removed from the harness. (Fig. 18)

**Fig. 18**

23. Remove the right front wheel.
24. Remove six bolts, three plastic rivets (push pins) and three electrical harness clips from the splash shield. Remove the splash shield. (Fig. 19)

**Fig. 19**

25. Locate and remove the tensioner with 15 mm box end wrench. (Fig. 20)

**Fig. 20**

26. Reuse the tensioner bolt and install the new idler pulley into the same location. (Fig. 21)



Fig. 21

27. Tape off the intake ports, fuel injector holes, upper radiator hose, radiator fill cap, PCV and fuel fitting. (Fig. 22)

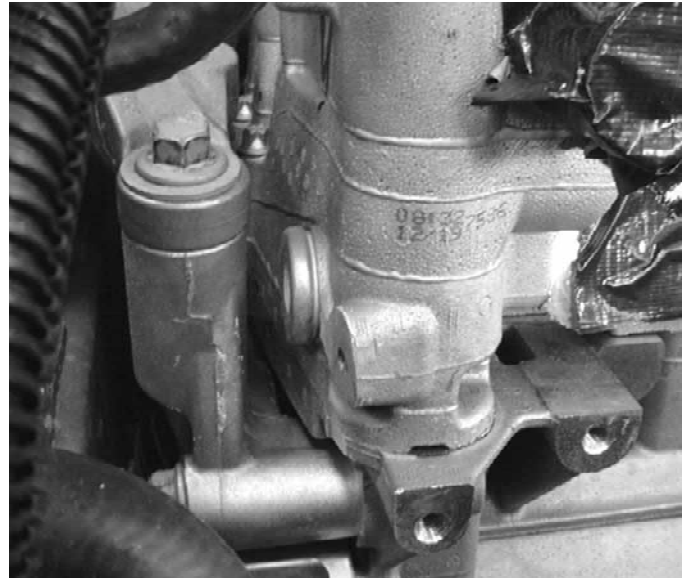


Fig. 23

29. Position the new generator bracket and lift hook assembly. (Fig. 24) shows the bolt painted yellow that must be ground down to clear the cylinder head when installed.

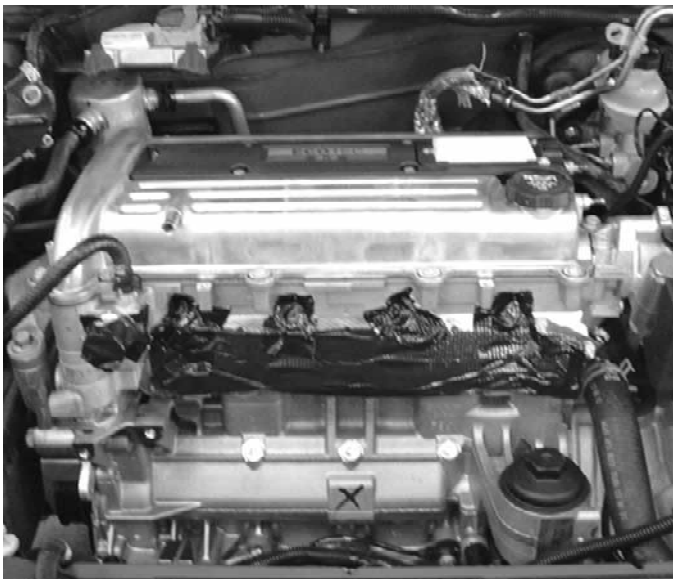


Fig. 22

28. Remove the front engine lift hook. The cylinder head must be modified to accept new belt tensioner to be installed later. (Fig. 23) shows the cylinder head boss that must be ground off.



Fig. 24

30. Install the bracket with the one bolt (part number 11518048) from the idler pulley to bracket (part number 11518048), and the second bolt (part number 11518051) from the bracket to the engine block.

31. Position the hydraulic tensioner on the engine to verify that the cylinder head casting was properly ground. If clearance is adequate install hydraulic tensioner using upper bolt (part number 11589147) and lower bolt (part number 11589312).

32. Loosen the starter wire bolt and reposition the wire. (Fig. 25)

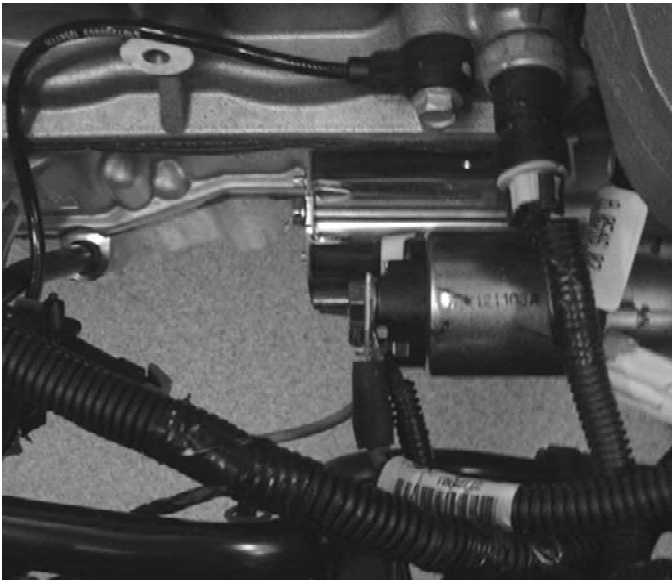


Fig. 25

33. Place the generator in position with new longer bolts. DO NOT mount at this time. Make all electrical connections. If you do not install all the electrical connections you cannot install the generator after the intake is installed.
34. Install the intake manifold support bracket using the two bolts (part number 11516342) supplied. (Fig. 26)

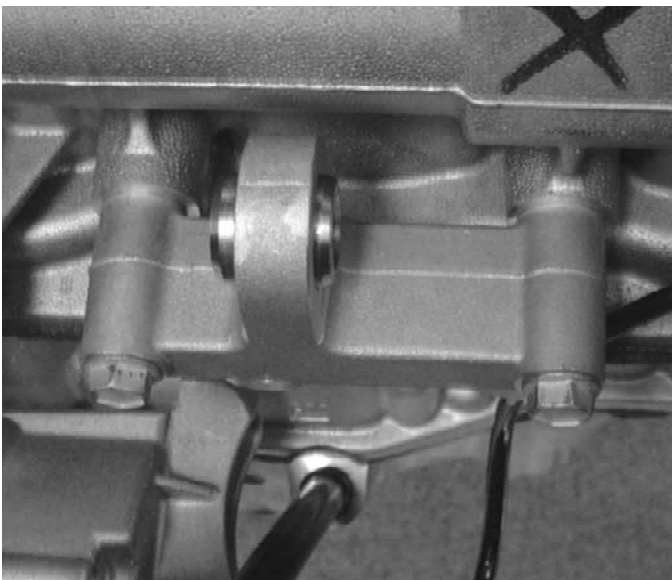


Fig. 26

35. Install five short intake manifold studs (part number 12590821) finger tight. Make sure the studs are seated. Locate and loosely install two long intake manifold studs (part number 12590822) in the remaining locations and make sure they seat to casting. If necessary use an M6 x 1.00 tap to clean out the holes

where the previous two short studs were located. When all studs seat correctly remove the two long studs. Tighten the remaining five bolts, DO NOT over tighten.

36. Position the intake manifold gasket and template (part number 12593902). Trim the gasket if necessary (Fig. 27) and (Fig. 28). After the gasket is trimmed, apply high temperature RTV to the front and back in the locations shown in (Fig. 29)



Fig. 27



Fig. 28

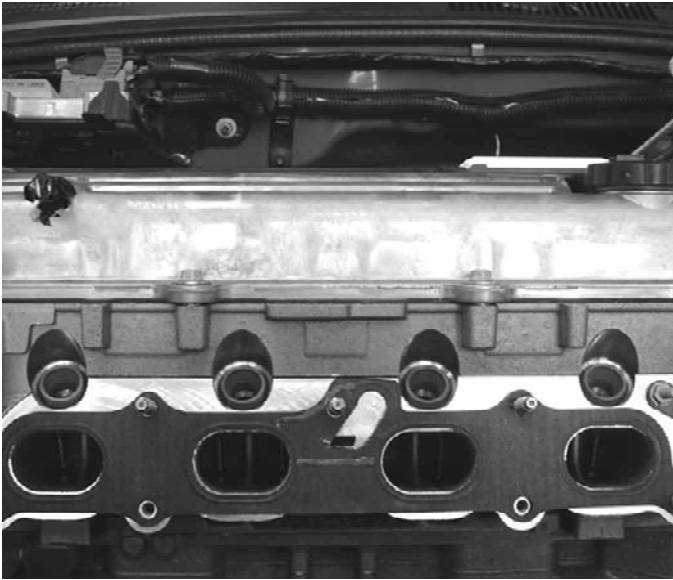


Fig. 29

37. Place the intake manifold in position and install the intercooler port caps (part number 15544596) and clamps (part number 11516226). (Fig. 30)

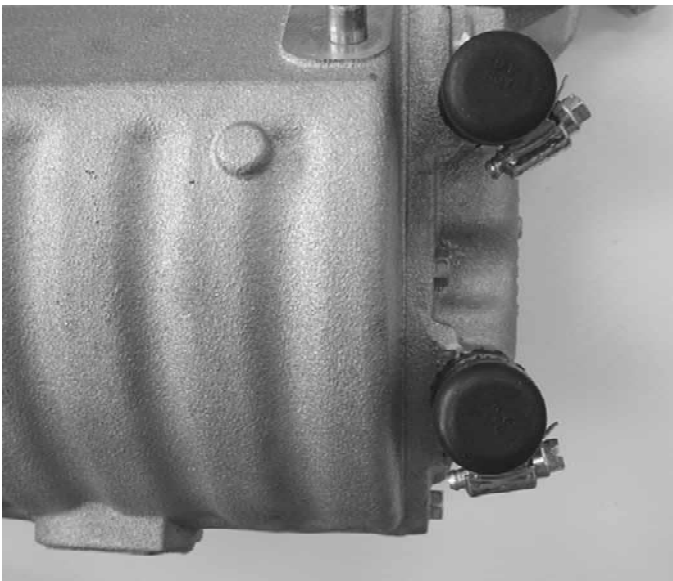


Fig. 30

38. Install the intake manifold on the cylinder head. Install and tighten the long studs into the open locations. Install the seven nuts and torque to 15 +/- 2 Nm.
39. Install the lower bolt through the lower support to the intake manifold.
40. Tighten all the generator bolts.
41. Position the throttle cable bracket as shown in (Fig. 31). Cut the bracket to the specifications of the template provided.



Fig. 31

42. Install the modified bracket to the oil level indicator bracket and tighten the bolts. Attach the bracket to side of the intake manifold using bolt (part number 11589299) and 4 mm thick washer (part number 12593677). Use one u-nut (part number 88961517) and bolt (part number 11588062) for the bracket to oil level indicator bracket.
43. Remove the metal clips from the fuel injectors. Remove the fuel injectors from the fuel rail. Be careful fuel may spill from the fuel rail.
44. Install new fuel injectors supplied with the electrical connector in the same orientation. Retainer clips snap into place.
45. Install the fuel rail to the cylinder head using original nuts and studs. Apply motor oil (5W-30) to the o-rings on each fuel injector.
46. Install two studs to the front of the fuel rail and two nuts to the side of cam cover.
47. Install the supplied fuel regulator hose (part number 12584337) from the port on the intake manifold using supplied clip (part number 10028454). Install the adjacent end to the regulator on fuel rail. (Fig. 32)

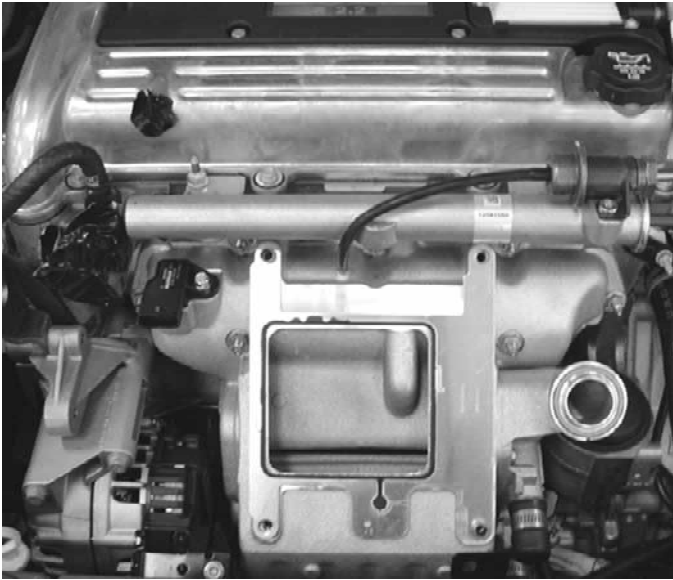


Fig. 32

48. Install the new radiator hose to the radiator. Rotate the engine inlet side of the radiator hose 3/8" off center clockwise at the engine to allow more clearance for the accessory drive belt. (Fig. 33)

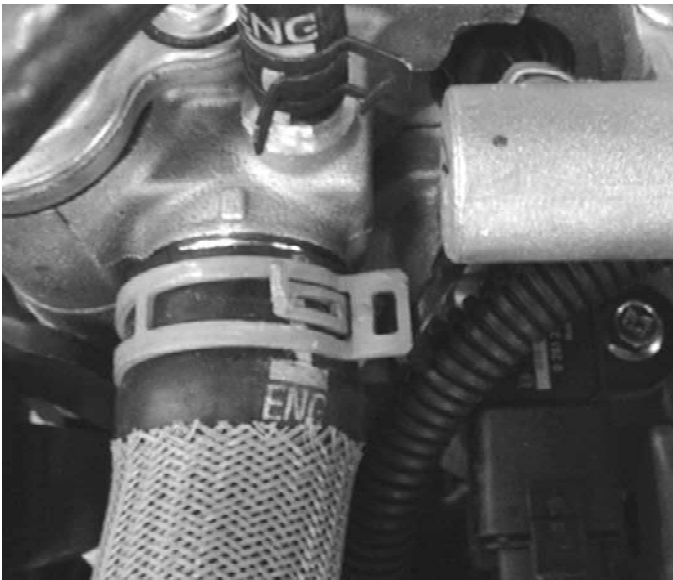


Fig. 33

49. Position supplied metal expansion plug (part number 12593906) (Fig. 34). Tap the plug into place. (Fig. 35)

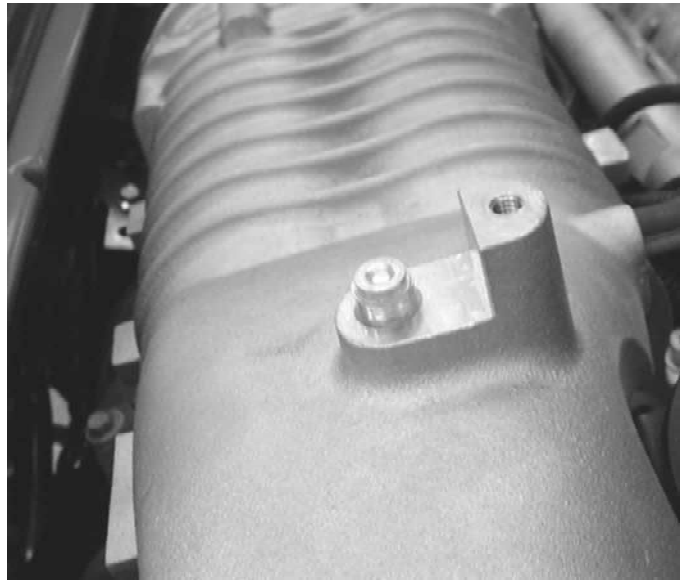


Fig. 34



Fig. 35

50. Install the supercharger gasket to the intake manifold. (Fig. 36)

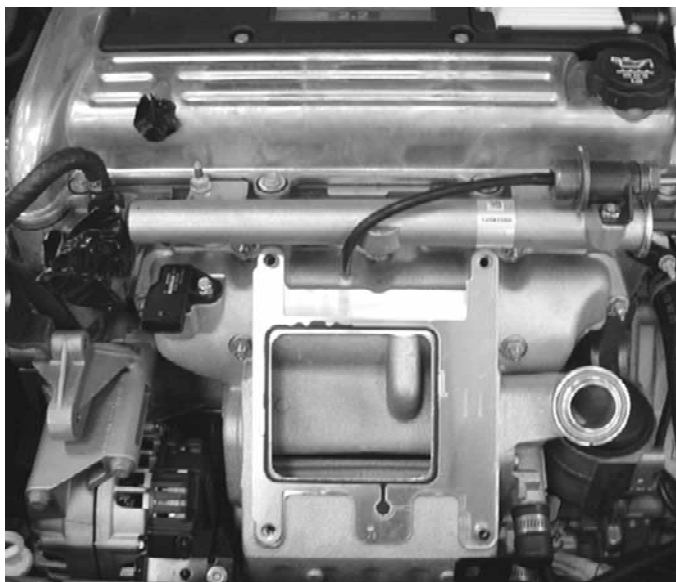


Fig. 36

51. Install the supercharger over the locating pins. Install four bolts (part number 11589214) finger tight. When viewing the car from the front, attach the heater hose bracket to the lower right bolt use the supplied flat washer (part number 12593677) and supplied bracket (part number 12594613).
52. Tighten all four bolts on supercharger to specification.
53. Install the J-nut (part number 11516076) on the heater hose bracket. Hand tighten the bolt (part number 11516757) into the J-nut. After the brackets are tightened, the metal heater pipe between intake manifold and coolant fans may have to be adjusted.
54. Use the 90 degree elbow from the original vacuum line and install it on the can. (Fig. 37) and (Fig. 38)

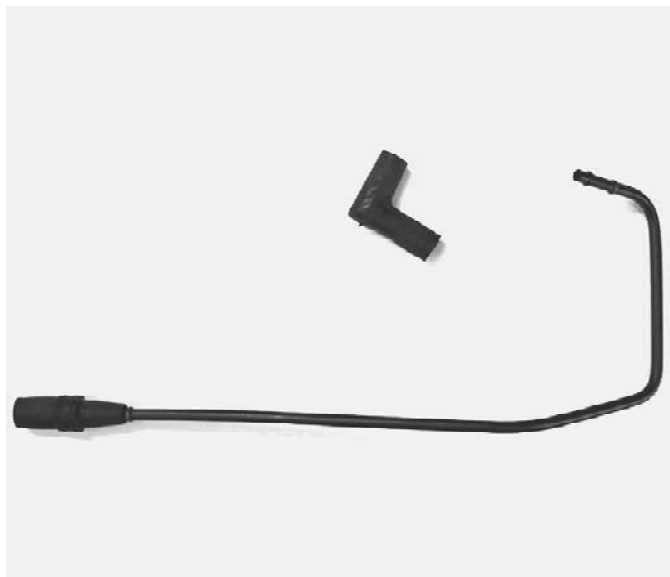
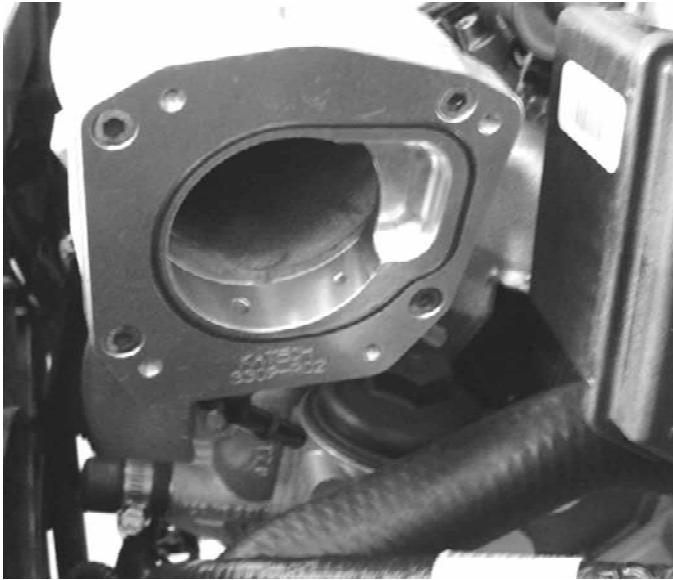


Fig. 37



Fig. 38

55. Position the rubber o-ring and throttle body adapter. Install the o-ring (part number 12593905) into the groove on the adapter (Fig. 39). This may be easier to do on a flat surface.

**Fig. 39**

56. Install the plastic tube from the original intake manifold on the throttle body adapter with self tapping screw.
57. Install the throttle body adapter on the supercharger using the four bolts (part number 12593676). (Fig. 40)

**Fig. 40**

58. Install the throttle and cruise cables on the throttle body. Install the throttle body to adapter using original bolts. (Fig. 41)

**Fig. 41**

59. Replace the connectors on the throttle body. (Fig. 42)

**Fig. 42**

60. Trim the rubber seal from the original air box, and install it trimmed on the throttle body. Trim the locating tabs from the perimeter of the air intake snorkel and install it with the original hose clamps.
61. Install a new purge line to the throttle body adapter plastic port. Then lower 90° fitting as necessary. Install the opposite end to purge valve.
62. For an automatic transmission, connect the remaining vacuum port on the throttle body adapter to the vacuum accumulator port. For a car with a manual transmission, cap the port.
63. Install the supplied PCV hose from the cam cover to the supplied fitting on the air intake snorkel.

- 64. Install a new brake boost line from the brake booster to the inlet port on the supercharger.
- 65. MAP sensor and IAT sensor connector change.
- 66. Locate the gray MAP sensor connector and remove the terminals with a small pointed tool. After the terminals have been removed, bend them back to allow them to snap into place in the new connector. Do not damage the terminals. Locate the supplied three wire black connector (part number 12110293) and insert the wires into the connector: the orange/black into location A, light green into location B, and gray into the location C. Install the connector lock. (Fig. 43)



Fig. 44



Fig. 43

- 67. Position the gray two wire IAT sensor connector (Fig. 44). Cut the wires close to the connector (Fig. 45). Strip the wire to prep for new terminals. Install the supplied blue seals (part number 12048087) onto each wire. Crimp as shown in (Fig. 46). Position the supplied black two wire connector (part number 12052641) and insert wires into the connector: light brown into location A and black into location B. Install the supplied connector lock (part number 12052634).



Fig. 45



Fig. 46

68. Locate wire harness (part number 12590818) and connect it to the four wire connector at the intake manifold next to the engines upper radiator hose. Plug in the two wire connector to the modified IAT sensor connector. Leave the three wire MAP sensor connector unplugged until the GM dealer has updated the PCM with the new calibration. After the new calibration is complete, install the three wire MAP sensor connection.

POWERTRAIN CONTROL MODULE RECALIBRATION

Important: The Product Information Label (part number 12593900) must be presented to dealer in order to receive the new calibration.

For the engine controls to function properly, the on-board Powertrain Control Module (PCM) must be calibrated after the GM Performance Parts **ECOTEC** Supercharger Kit (part number 17800003) has been installed. **Note: failure to recalibrate the PCM will result in voiding both the product and vehicle warranty. Warning: Driving the vehicle prior to receiving the new calibration is neither recommended nor approved by GM Performance Parts and will result in voiding both the product and vehicle warranty.**

GM Performance Parts recommends on-board recalibration be performed by an Authorized GM Dealership. This process may require a full day for service and must be scheduled in advance with an Authorized GM Dealership. During the recalibration process, the Authorized GM Dealership activates the supercharger kit warranty and validates the installation. The limited GM Performance Parts supercharger warranty will only be honored if the Authorized GM Dealership verifies proper installation and a properly maintained and fully operational GM Powertrain. In order for the dealership to access the new calibration, contact the Techline Customer Support Center (TCSC) at 1-800-828-6860. The dealer will be able to access the new calibration, GM part number 12590819 for Automatic Transmission / 12590820 for Manual Transmission, through the system.

Warning: Failure to install the supercharger kit properly and completely, failure to recalibrate the PCM or failing to maintain the full powertrain will void both the product and vehicle warranty. Warranty does not cover installation or installation related issues involving supercharger kit installed outside an Authorized GM Dealership.

69. Install the accessory drive belt.
70. Cut off one inch of coolant reservoir tank hose. Zip tie all hoses away from accessory drive belt. Make sure there is enough clearance when the engine is running. Check periodically to make sure that hoses are not rubbing against other components.
71. Affix "Premium Fuel Only" label to fuel door.

SUPERCHARGER PARTS LIST

PARTS LIST	
Part Description	Part Number
Supercharger Kit	1780003
Clamp - Fuel Pressure Regulator Hose-Intake Manifold End	10028454
Hose, Brake Booster	10358940
Nut - U-Nut Oil Level Indicator Tube Support	11507067
Nut - U-Nut Radiator Hose Support	11507067
Clamp - Coolant Hose Cap	11516226
Bolt/Screw - Intake Manifold Bracket-to-Engine Block	11516342
Bolt/Screw - Intake Manifold Bracket-to-Intake Manifold	11516506
Nut - Intake Manifold	11516076
Bolt/Screw - Radiator Hose Support	11516757
Bolt/Screw - Drive Belt Idler Pulley Bracket	11518048
Bolt/Screw - Generator Relocation Bracket	11518051
Bolt/Screw - Intake Manifold	11518062
Nut - Intake Manifold-to-Head	11518532
Bolt/Screw - Generator Relocation Bracket	11589134
Bolt/Screw - Drive Belt Tensioner	11589147
Bolt/Screw - S/C TO Intake Manifold	11589214
Bolt/Screw - Oil Level Indicator Tube	11589299
Bolt/Screw - Drive Belt Tensioner	11589312
Pin, Connector – Female	12048074
Connector Pin Seals	12048087
Lock-Connector - IAC Connector	12052634
IAT Connector Replacement	12052641
Map Connector Replacement	12110293
Zip Tie	12355066
Connector - PCV Tube	12581198
Tensioner Assembly - Drive Belt	12583180
Supercharger Assembly	12584331
Vacuum Hose - Fuel Pressure Regulator	12584337
Gasket - Supercharger Outlet	12584342
Manifold Assembly – Intake	12584348
Gasket - Intake Manifold	12584359
Bracket Assembly - Drive Belt Idler Pulley	12584364
Bracket - Generator Relocation	12584365
Tube Assembly - Intake Manifold-to-Fuel Regulator (LSJ Purge Valve Hose)	12584369
Brace - Intake Manifold	12586632

PARTS LIST	
Part Description	Part Number
Adapter - Throttle Body	12590814
Belt - Accessory Drive	12590815
Wire Assembly - Map Sensor	12590818
Data File – PCM Engine Calibration	12590819
Data File - PCM Engine Calibration	12590820
Stud - Intake Manifold	12590821
Stud - Intake Manifold	12590822
Bolt/Screw - Throttle Body Adapter (M6 X 20 mm Socket Head Cap Screw)	12593676
Washer - 17 mm OD For a M8 Bolt x 4 mm Thick	12593677
Sticker, Carb E/O	12593900
Template - Intake Manifold Gasket Cut Out	12593902
Instruction Cd	12593903
Injector Assembly – Fuel	12593904
Plug, Map Sensor	12593906
Gasket - Throttle Body Adapter Plate (O-Ring)	12593905
Template - Dip Stick Tube Support Bracket	12593907
Support - Radiator Hose	12594613
Cap Assembly - Cool Hose	15544596
Cable Assembly - Cruise Control	22688111
Hose Assembly - Radiator Inlet	22718761
Vacuum Fitting - Waste Gate	24507839
Air Duct	24575436
Premium Fuel Decal	25602518

ENGINE ASSEMBLY

250 HP TO 400 HP



Fig. 47

The **ECOTEC** engine is the perfect starting point for performance enthusiasts. Power levels of up to 400 horsepower can be achieved with the installation of connecting rods and pistons, a new head gasket and head bolts, adjustable cam gears and a nitrous oxide system or a turbo kit. No modifications to the cylinder head, block, main girdle or crankshaft are required. (Fig. 47)

CONNECTING RODS

We recommend that the connecting rods be upgraded because stock rods are not designed for power levels over 250 hp.

The 2.0L LSJ **ECOTEC** engine has forged steel rods similar to Small Block Chevy "Pink Rod." The forged steel rods are made of high quality material and have a cap screw 23 mm small end, and a full floating bronze bushing. These rods are available through GM under part number 12755126. These rods require GM Performance Parts piston set part number 88958634 to work with the stock 2.2L crankshaft. Alternatively, Eagle and Manley both offer a CNC machined



Fig. 48

H-Beam rod which is an exact replacement for the stock 2.2L rod. (Fig. 48)

PISTONS



Fig. 49

The stock 2.2L ECOTEC pistons have been tested to power levels approaching 300 hp. However these pistons should be replaced with a stock forged-type piston for applications over the 300 hp level. JE, Wiseco and Diamond offer pistons in various compression ratios that work for most applications. We recommend a compression ratio of 9:1 or less for blown gas applications, and 10-11:1 for normally aspirated with premium fuel. GM Performance Parts offers a stock replacement piston that is a direct drop in when used with the LSJ connecting rod. (Fig. 49)

INTAKE MANIFOLD

The factory intake manifold has been tested to the 350 hp level.

HEAD GASKET AND HEAD BOLTS

The stock head gasket is part number 24444091 and the head bolts are part number 11518066. The production head bolts are "Torque-to-Yield." It is important that these bolts are replaced each time they are removed and correctly installed to provide proper head gasket clamp loading. (Fig. 50)

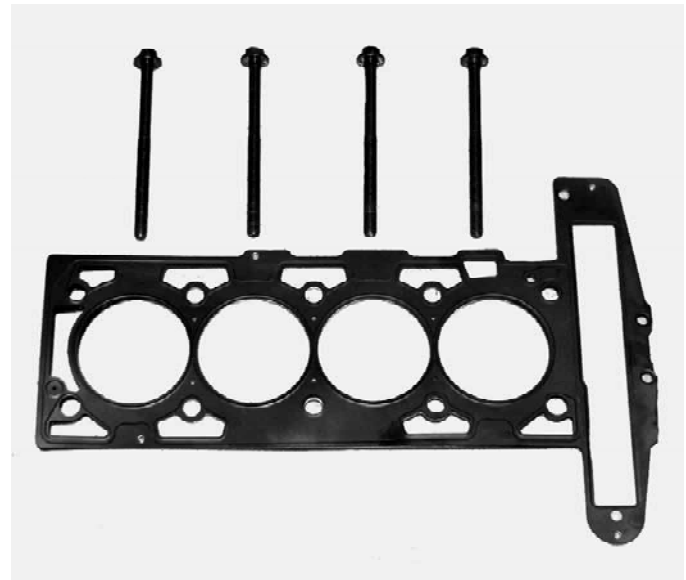


Fig. 50

VALVE SPRINGS AND RETAINERS



Fig. 51

Bates Engineering offers an up level stock replacement valve spring (part number ESGV0001) that fits in the stock cylinder head with no modifications. This spring uses production locks and retainers. The springs will increase the production valve train limiting speed to over 7500 RPM. The stock camshafts are good up to 400 hp with these valve springs and a power adder. (Fig. 51)

NITROUS OXIDE SYSTEMS



Fig. 52

With the engine upgrades listed in this section, the maximum nitrous jet you should use is 150 hp. Nitrous Express offers a stand-alone kit which has been tested and proven to work well. The Nitrous Express Kit contains a single nozzle with a nitrous jet and a fuel jet. Use a pressure tap on the production fuel rail for the fuel jet's supply. (Fig. 52)

TURBOCHARGERS



Fig. 53

Hahn RaceCraft currently offers a bolt-on turbo kit for the ECOTEC engine. It contains all the components necessary for installation. It has a Fuel Management Unit (FMU) which provides proper fuel delivery without the need to change engine calibrations. (Fig. 53)

HIGH PERFORMANCE PISTON AND ROD R&R PROCEDURE (COBALT)



Fig. 54

The following procedure describes the installation of up level connecting rods and pistons in your ECOTEC 2.2L engine. A base '05 Cobalt is used for the procedure. (Fig. 54)

CAUTION: All machined edges on this engine are razor sharp and extreme caution must be used when working on this engine.

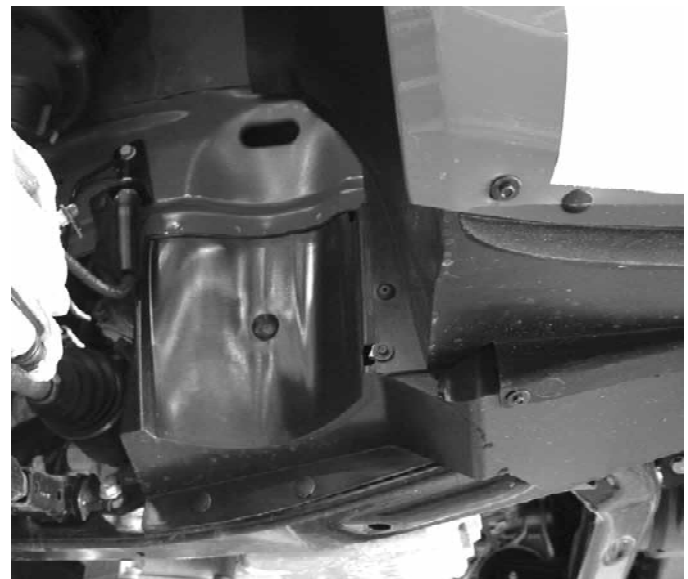
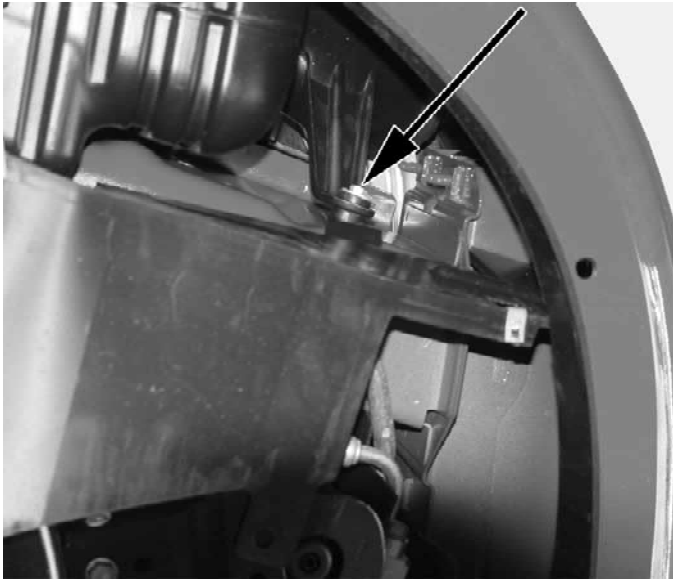
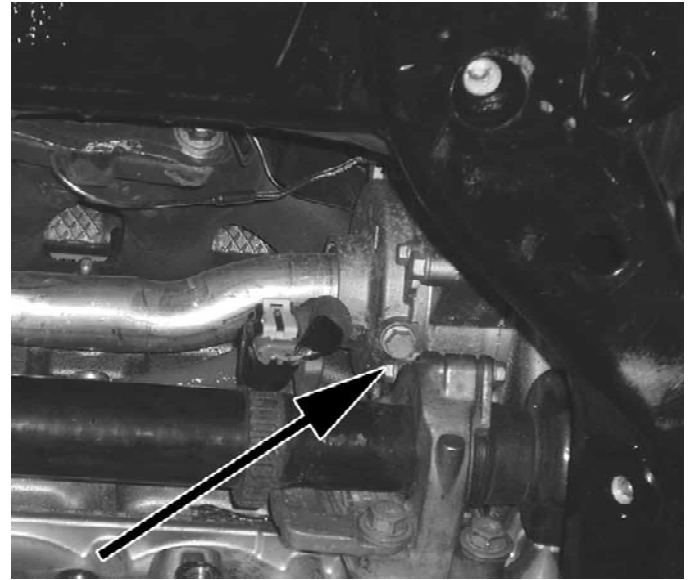


Fig. 55

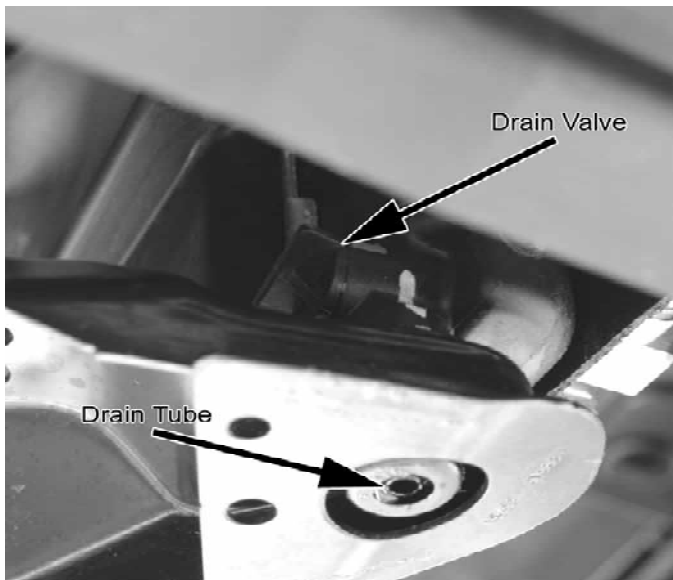
After removing the negative battery cable, remove the splash shield to expose the lower crank balancer pulley. (Fig. 55)

**Fig. 56**

On a Cobalt, a schroud fastener is hidden up on the frame extension. It can be accessed by partially removing the fender well fasteners and pulling back the fender well to reveal the fastener. Requires a 10 mm socket. (Fig. 56)

**Fig. 58**

The water pump coolant drain will remove the coolant from below the deck for head gasket service. (Fig. 58)

**Fig. 57**

Drain engine coolant and engine oil. This figure shows the location of the radiator petcock (It loosens counter clockwise) (Fig. 57)

**Fig. 59**

To remove the exhaust, remove the three exhaust nuts with a 15 mm deep universal socket. (Fig. 59)



Fig. 60

One fastener can be removed from above. (Fig. 60)



Fig. 62

Remove two stud bolts that secure the fuel rail. Remove the fuel rail. It's not necessary to disconnect the fuel line. Disconnect the single injector wiring harness and MAP connector. Set the rail and injectors by the coolant reservoir. (Fig. 62)



Fig. 61

It is important to remember to remove the HO2S (oxygen sensor) connector, so when you remove the head and exhaust manifold as an assembly, this won't hold you up. (Fig. 61)



Fig. 63

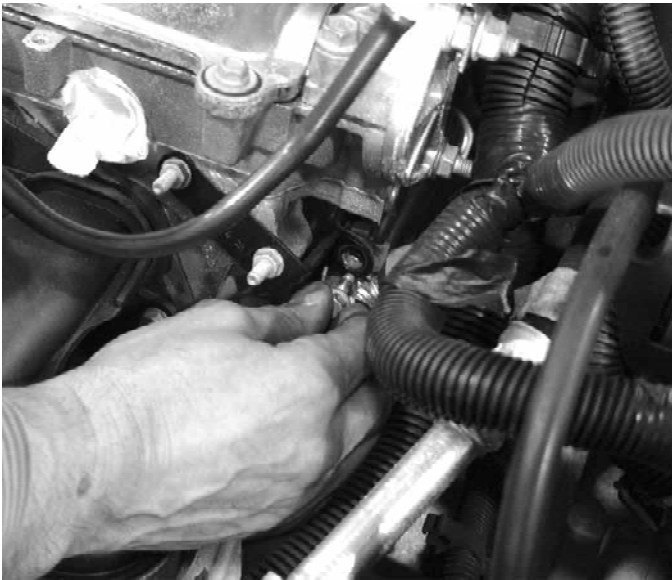
Cover the injector port prevent any debris from falling into the cylinder head. (Fig. 63)

**Fig. 64**

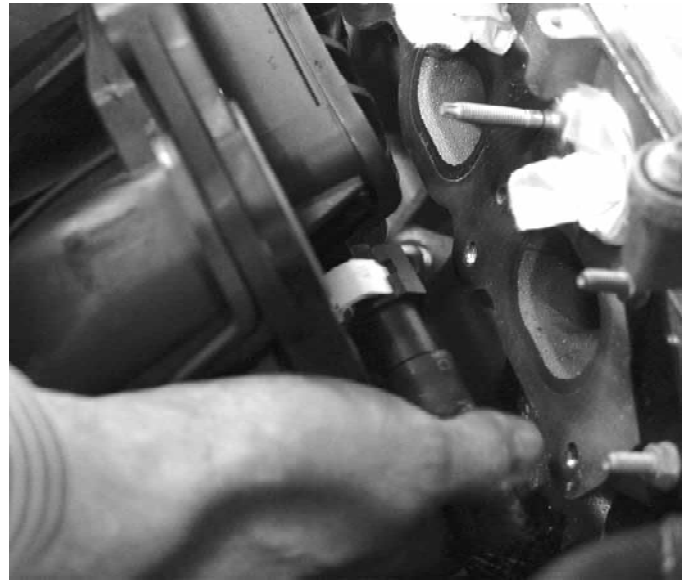
Remove the upper radiator hose at the cylinder head. (Fig. 64)

**Fig. 66**

Remove the dipstick tube bracket support bolt as shown. (Fig. 66)

**Fig. 65**

Remove the bolt shown to disconnect the coolant pipe from the head bracket. (Fig. 65)

**Fig. 67**

Remove the intake manifold fasteners and vacuum hoses. Pull the intake partially away from the engine, and unclip the white clip from the power brake vacuum hose. Slide this hose off the pipe and remove the intake. Cover the intake ports. (Fig. 67)

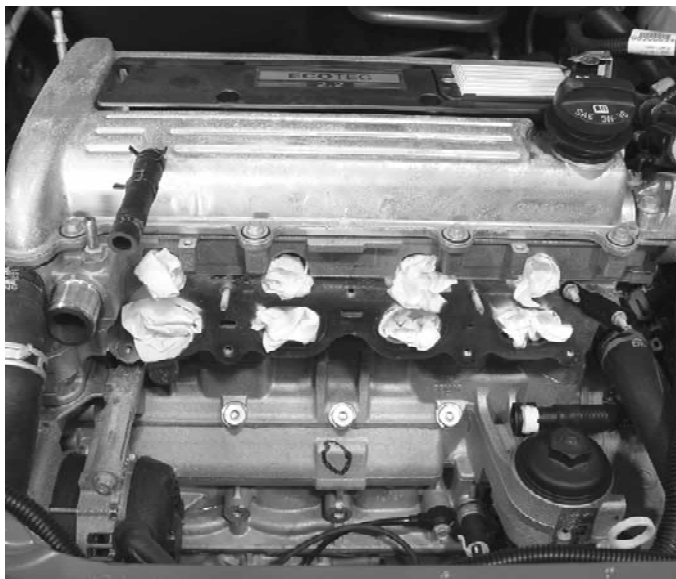


Fig. 68

Remove the fasteners that hold the coil cassette module to the valve cover. (Fig. 68)



Fig. 70

Remove the bracket, ground strap, and the electrical connector. Lift the cassette module from the engine valve cover. (Fig. 69 and Fig. 70)

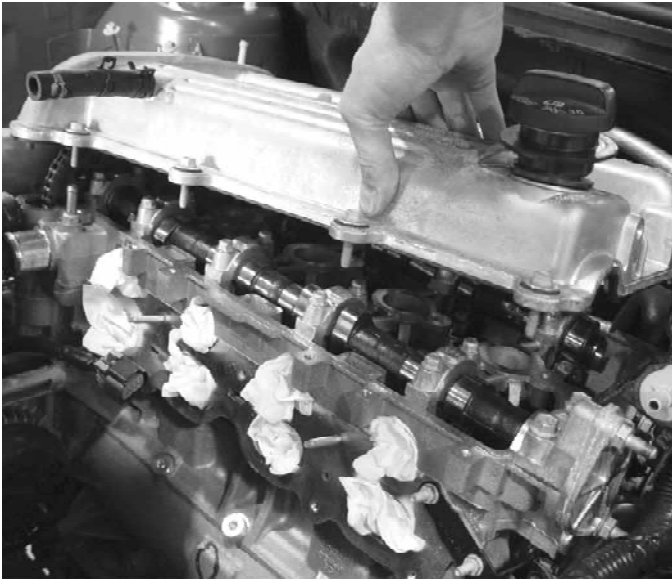


Fig. 69



Fig. 71

Remove the 13 mm nut and bracket that holds the evap solenoid support bracket to the head. (Fig. 71)

**Fig. 72**

Remove the valve covers by removing all fourteen fasteners around its perimeter and the fasteners under the coil module. (Fig. 72)

**Fig. 74**

Remove the bolt on the A/C compressor to drop the oil pan. (Fig. 74)

**Fig. 73**

Pry the dipstick tube out of the oil pan with a flat head screwdriver. (Fig. 73)

**Fig. 75**

Remove the bolts that connect the oil pan to the transmission. (Fig. 75)

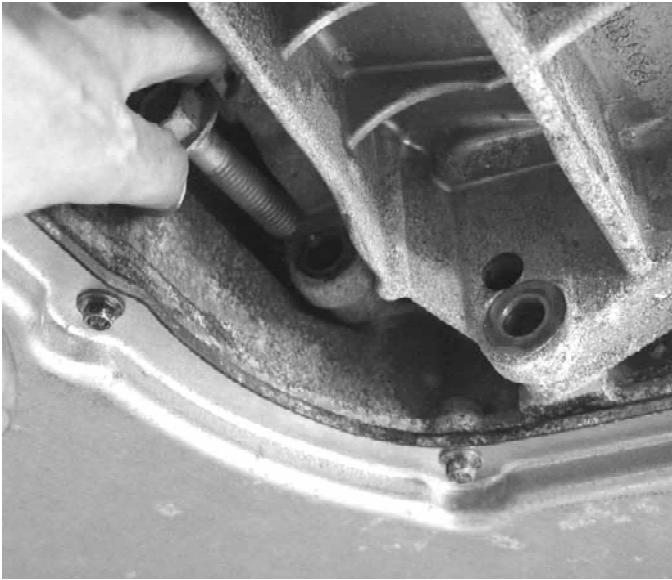


Fig. 76

The bolt shown above is easy to miss, so don't forget to remove this bolt as well. (Fig. 76)



Fig. 78

Use a pry bar in the pry point to remove the oil pan. (Fig. 78)



Fig. 77

Remove the remainder of the fasteners from the oil pan. (Fig. 77)

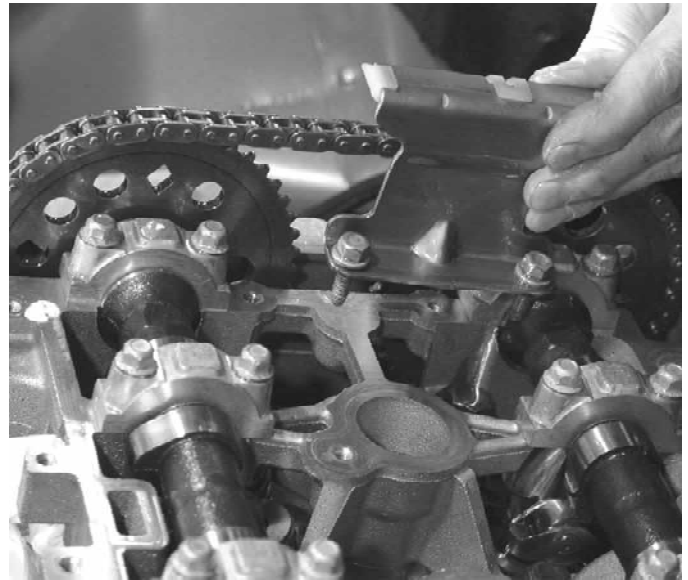
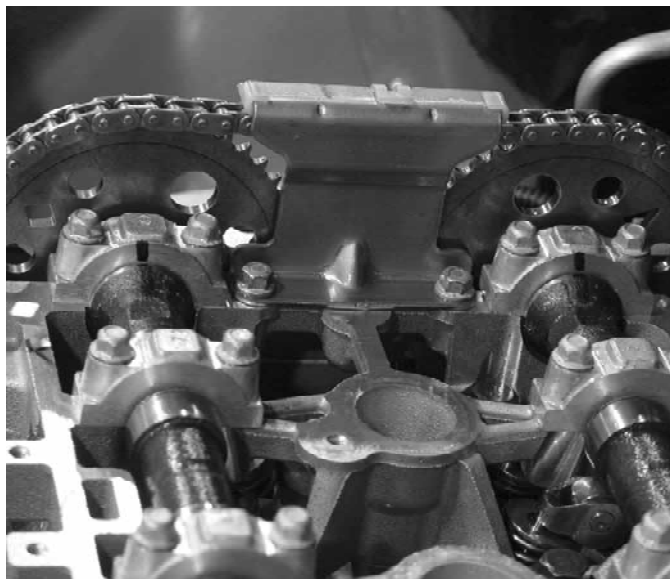


Fig. 79

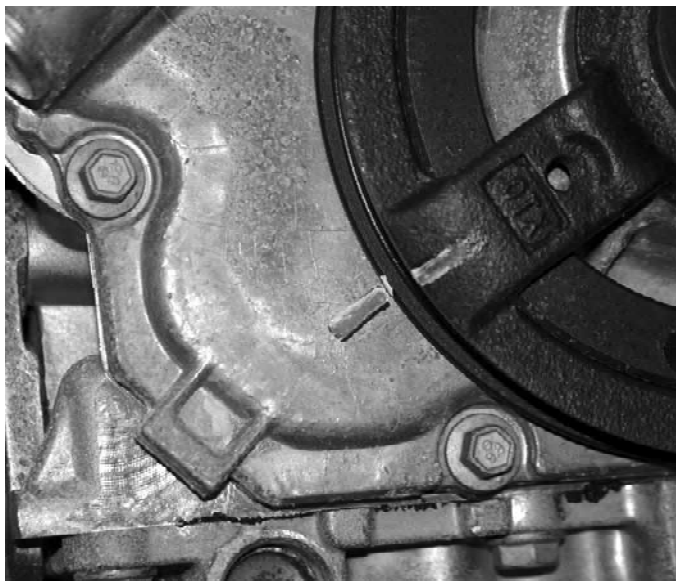
Remove the upper timing chain guide. (Fig. 79)

**Fig. 80**

Rotate the engine by hand to TDC. (Fig. 80)

**Fig. 82**

Mark cams to indicate TDC position. (Fig. 82)

**Fig. 81**

Using the crank bolt, mark the balancer and timing cover, this will make it easier to return to engine to TDC for reassembly. (Fig. 81)

**Fig. 83**

Use a 1 1/4" wrench to loosen and remove the hydraulic chain tensioner. (Fig. 83)

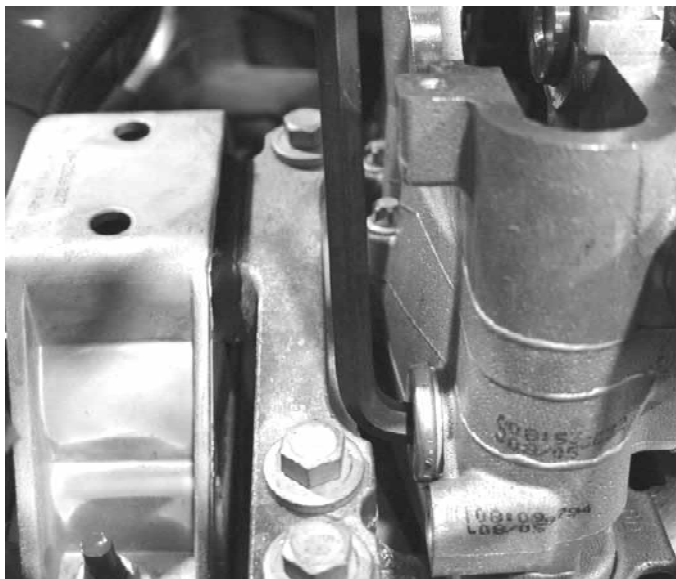


Fig. 84

Remove the chain guide bolt access plug. Use a shortened allen wrench to access the chain guide bolt. (Fig. 84)

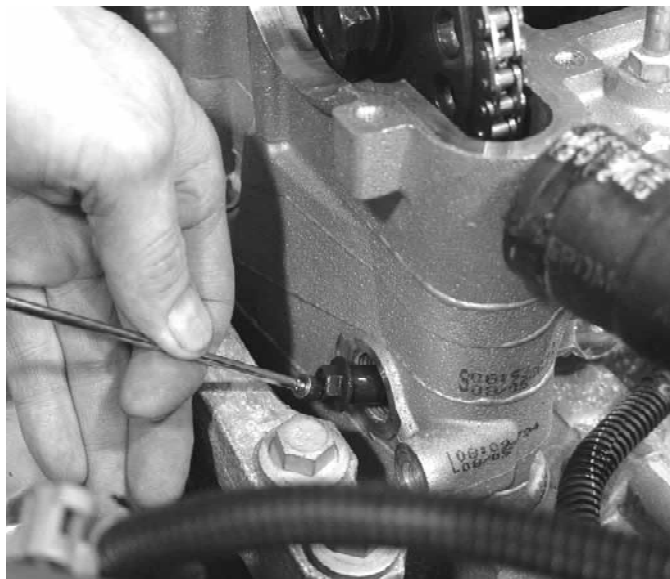


Fig. 86

To prevent the fastener from dropping in to the engine, use a magnet to remove it. (Fig. 86)



Fig. 85

Use a 1/4" drive 10 mm universal socket to loosen the fastener and remove the chain guide bolt. (Fig. 85)

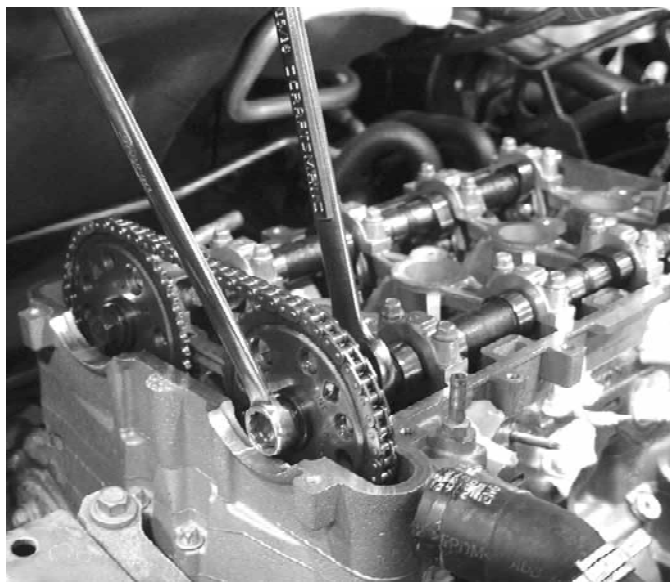
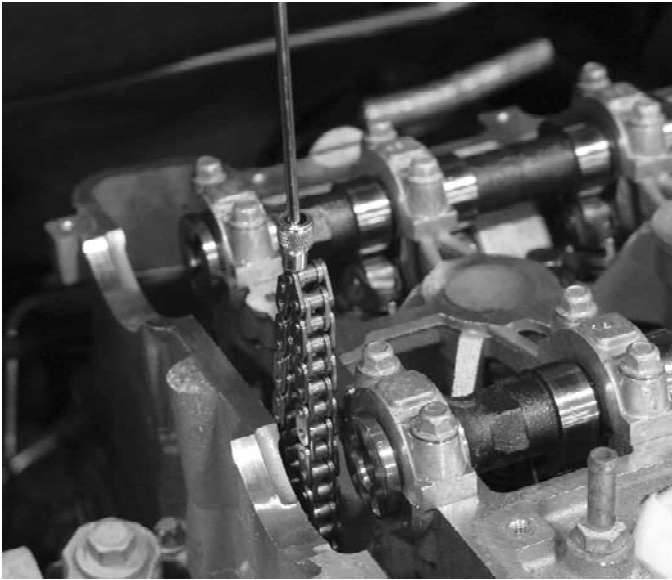


Fig. 87

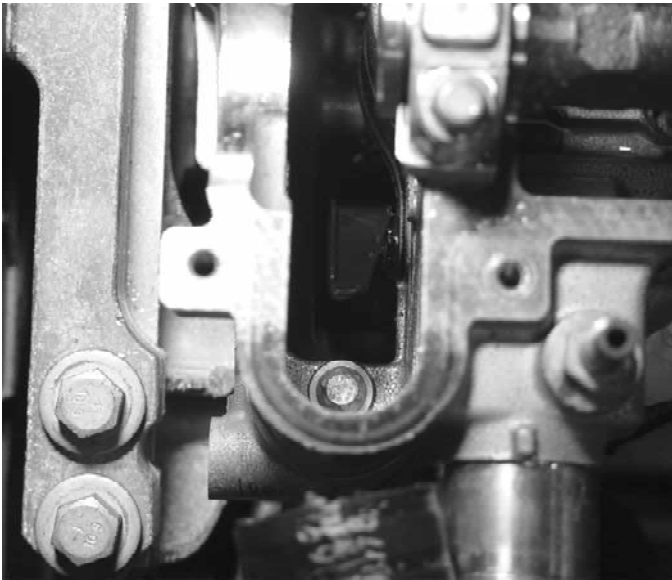
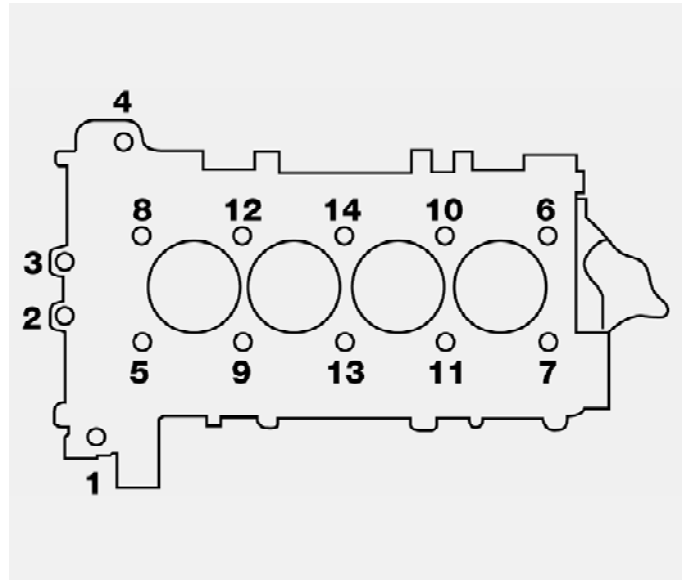
Use a 15/16" back up wrench and an 18 mm to remove the timing gear bolts. Do not use an impact to do this operation. Remove the timing gears. (Fig. 87)

**Fig. 88**

Use a magnetic rod to lower the chain onto the oil nub in the block. (Fig. 88)

**Fig. 90**

Remove the two torx head bolts shown in (Fig. 89) and (Fig. 90).

**Fig. 89****Fig. 91**

Continue to remove the rest of the fasteners on the head. Remove the outside torx first and then head bolts in a circular pattern from outside, in as to not warp the head. (Fig. 91)

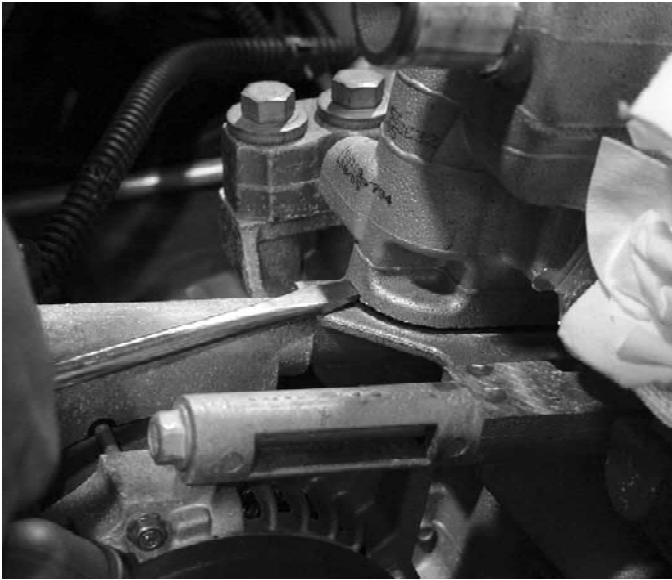


Fig. 92

When all of the head bolts have been removed, place a flat head screwdriver in the slot as shown above. Pry up on the head to loosen it from the block. Remove the head and exhaust manifold assembly, have someone help you with this task. Do not lay the cylinder head face down as valve damage may occur. (Fig. 92)



Fig. 94

Shown above is a rod cap fully removed from one of the connecting rods. (Fig. 94)

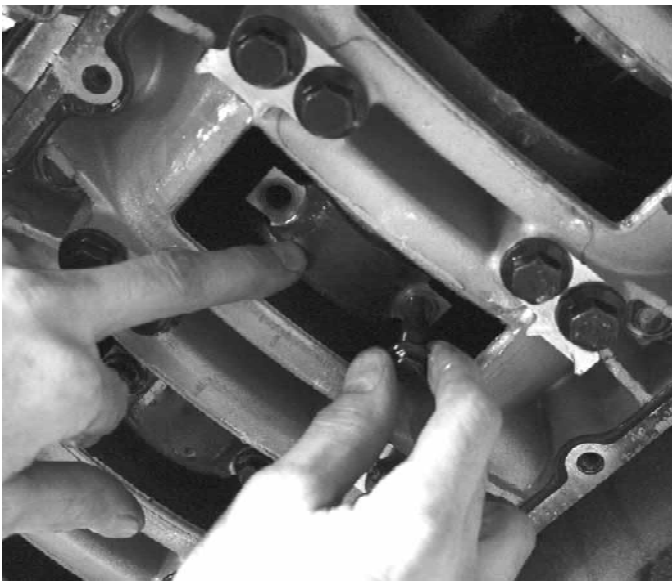


Fig. 93

Remove the rod caps on the connecting rods. (Fig. 93)

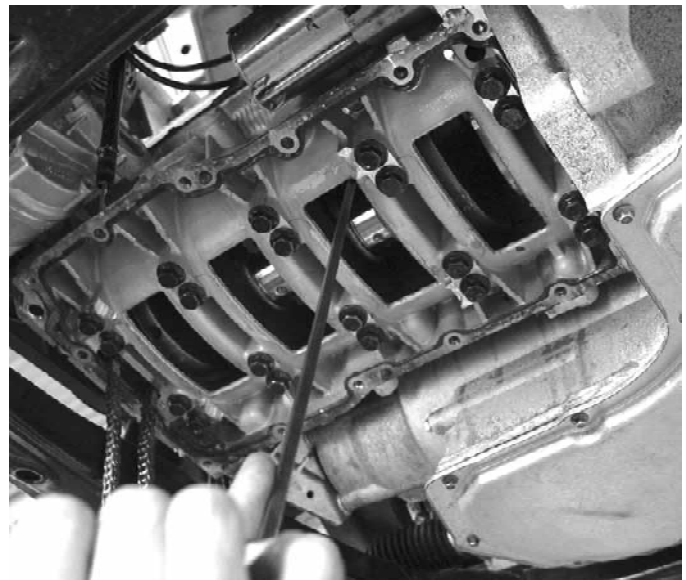


Fig. 95

When all of the rod caps have been removed use a long object (one that will fit in the cylinder and clear the crank, we used a long screwdriver) and push up on the piston until it is no longer flush with the block's surface. Remove the pistons from the block. (Fig. 95)

**Fig. 96**

The illustration above shows the new Diamond piston and LSJ (2.0L) connecting rod on the left and the stock piston on the right. (Fig. 96)

**Fig. 98**

NOTE: The oil ring support dimple must be installed as shown. Make sure the rings are free and not binding. (Fig. 98)

**Fig. 97**

Install the rings from the old pistons on to the new pistons in similar fashion. Remove the piston rings from the stock piston by unwinding as shown above. Rings are fragile so care must be taken. A ring expander tool can be used. (Fig. 97)

NOTE: Do not change the order or flip the rings over. Do one piston at a time. The rings must stay in the same cylinder as removed.

**Fig. 99**

If the old bearings are in good condition install them on the new LSJ (2.0L) rods. (Fig. 99)



Fig. 100

A sleeve is recommended for the piston installation, because the rings are thin and small. (Fig. 100)



Fig. 102

Install the rod caps, bearing tang to bearing tang. Torque to 18 lbs ft plus 100° with a torque angle meter. (Fig. 102)

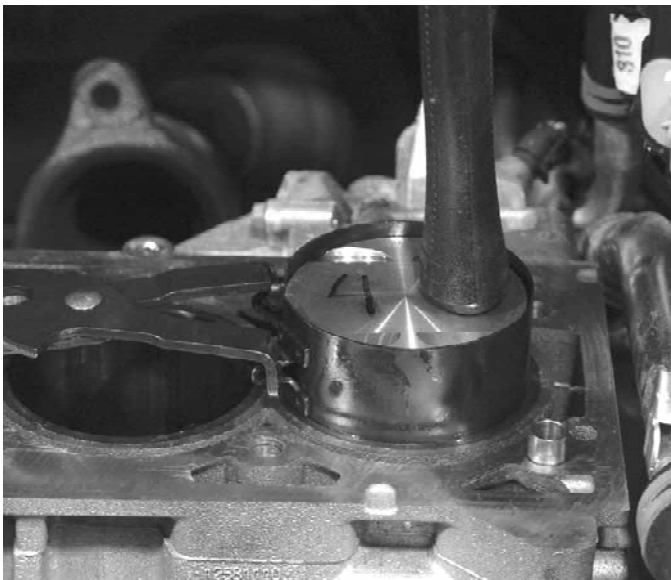


Fig. 101

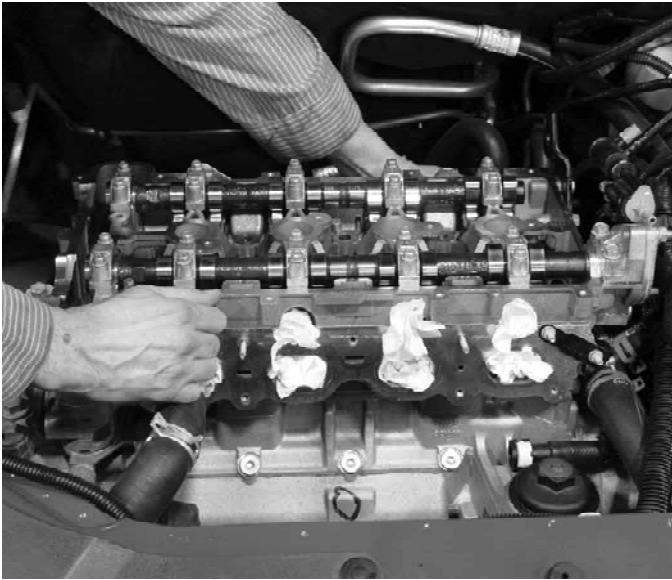
With journals one and four at the bottom dead center, install cylinder one and four assemblies. Rotate the crank to put journals two and three at the bottom dead center. Install assemblies two and three. When the piston is being pushed down in the bore, make sure to guide it carefully onto the rod journal. Do not nick the crank journal or rod end. (Fig. 101)

NOTE: Large valve reliefs are for the intake valves. Small valve reliefs are for the exhaust valves. Install pistons with large reliefs to front of vehicle.

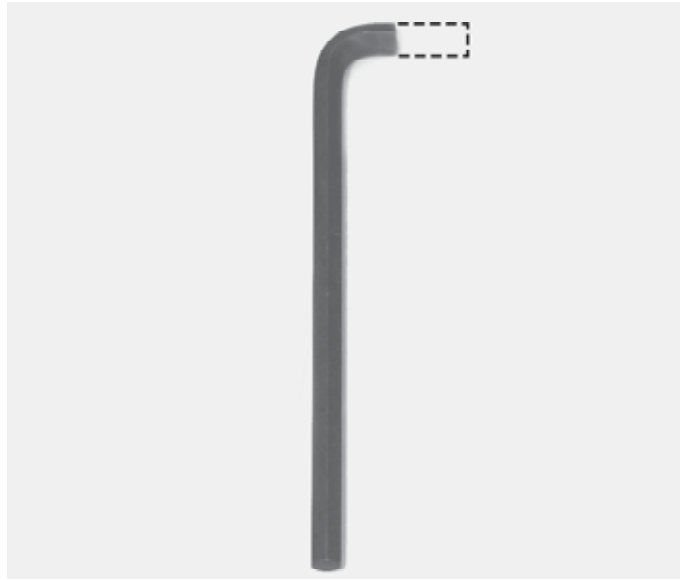


Fig. 103

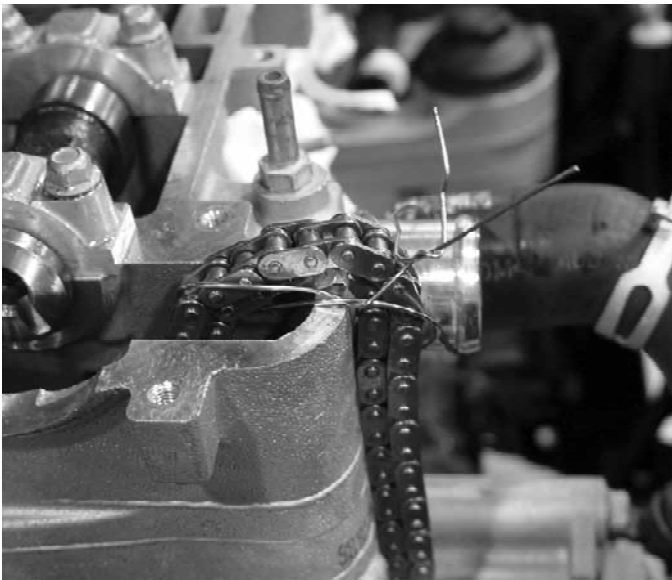
Rotate the crankshaft to drop the number one piston 1" below the deck, before setting the head on the block. This will keep the valves away from the pistons until the head is torqued. Piston shown at TDC. (Fig. 103)

**Fig. 104**

Install the head and exhaust manifold assembly. Insert the exhaust manifold studs into the pipe flange and place the head on dowels. Have someone help you with this task. (Fig. 104)

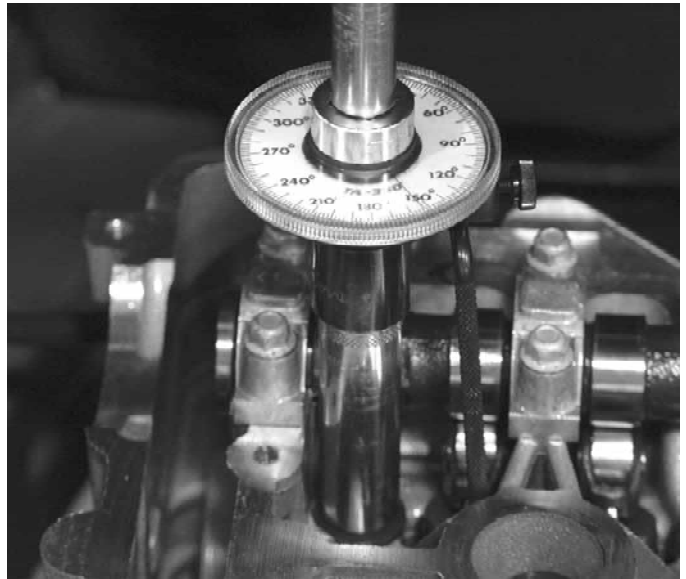
**Fig. 106**

Install the plug using a shortened 10 mm allen wrench. Rotate engine to TDC before installing the timing chain. (Fig. 106)

**Fig. 105**

Free up and support the timing chain before torquing down the head. (Fig. 105)

Install the guide bolt and torque it to specification.

**Fig. 107**

Install the head bolts using a torque angle meter and torque them to 22 lbs ft plus 155°. (Fig. 107)

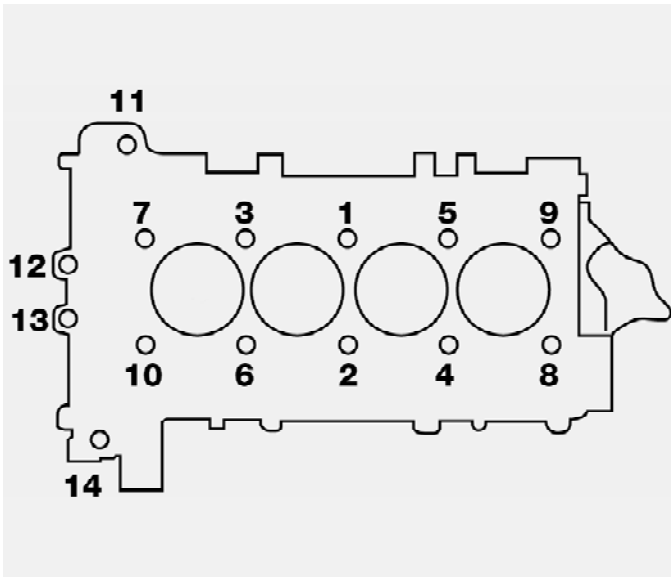


Fig. 108

After torquing the ten large fasteners in order shown to specification, install the four front torx head bolts (2 inside, 2 outside) and torque them to 18 lbs ft. (Fig. 108)

Using red locktite on the bolts install the timing gears. Torque the bolts to 70 lbs. Hold the cams as you remove the bolts.

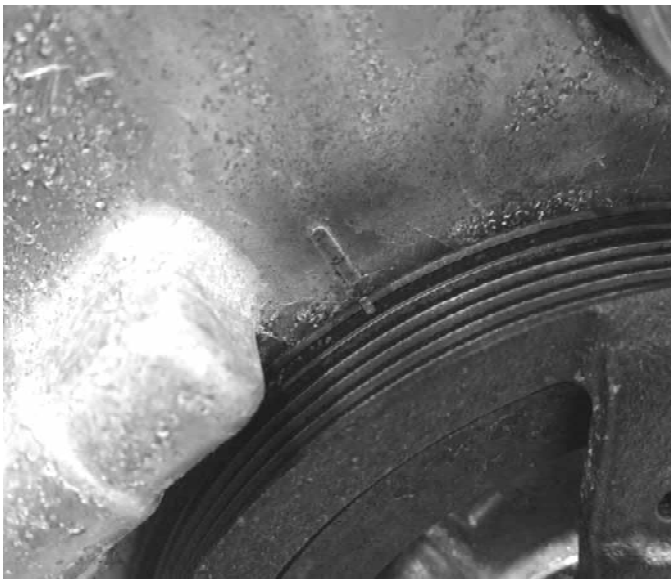


Fig. 109

After torquing the head bolts turn the engine back over to TDC. Check your marks and the production marks to confirm location. (Fig. 109)



Fig. 110

Compress tensioner to approximately 2 3/4" (slightly longer) then install. Install the tensioner making sure the grooves in the chain yoke are vertical. (Fig. 110)

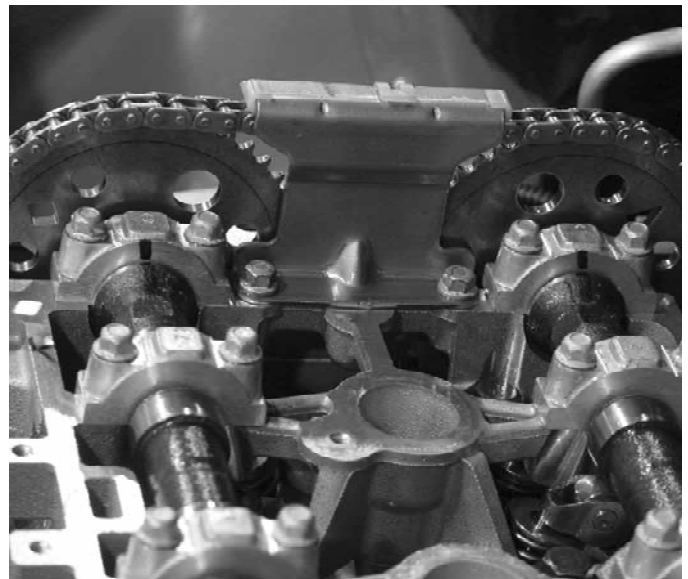


Fig. 111

Rotate the crank shaft two rotations and align all timing marks. (Fig. 111)



Fig. 112

Apply the appropriate sealer on the oil pan rails. Smear the sealer with your finger to make a uniform coating. (Fig. 112)



Fig. 114

Install A/C compressor bolt and torque to specifications (Fig. 114)

Install the exhaust manifold to the exhaust pipe nuts.



Fig. 113

When installing the pan, do not disturb the sealer by touching other parts of the engine. Align the pan dowels and install the bolts finger tight. Guide the dip stick tube into the pan as you install the lube o-ring. Install all the pan fasteners and torque to specifications. (Fig. 113)



Fig. 115

Reconnect the HO2S oxygen sensor as shown above. (Fig. 115)

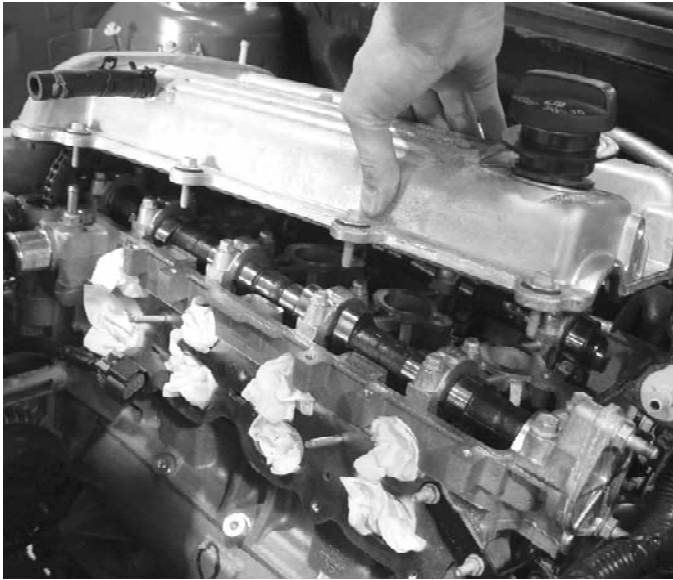


Fig. 116

Install the valve cover, ground strap and bracket and the coil cassette assembly with electrical connector. (Fig. 116)



Fig. 118

Install throttle body electrical connector. (Fig. 118)



Fig. 117

Lube o-rings and install the fuel rail. (Fig. 117)

Tighten the two stud bolts to specification and connect the rail wiring connector.

Install the brake vacuum hose onto the intake manifold and install the intake manifold to the cylinder head. Torque all fasteners to 89 lbs in.

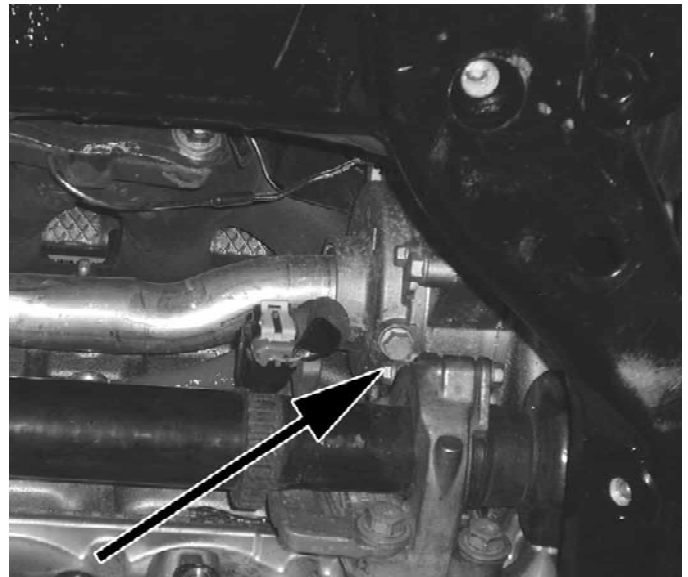


Fig. 119

Install the coolant pipe plug located on the bottom of the water pump. (Fig. 119)

Install the dipstick bracket bolt and check the oil drain plug for tightness. Remember to remove all the injector ports and intake port plugs and rags to allow proper assembly.



Fig. 120

Connect the upper radiator hose. (Fig. 120)

Add coolant and oil to the motor.

Install the air duct/air cleaner (motor will not run properly without this duct in place).

NOTE: Wire loom zip ties will break, the dealer may be able to supply new ones.

Fill cooling system. Air vents through the top of head coolant hose.

Start the engine and check the oil pressure. Turn off the engine and check the oil level. Add oil as necessary.

Install plastic engine shroud, wheel well fasteners and the wheel and tire.

Check for any leaks and then test the vehicle.

STOCK to 400 HP PARTS LIST

PARTS LIST		
DESCRIPTION	PART NUMBER	SOURCE
Stock Head Gasket	24444091	GM
Stock Head Bolts	11518066	GM
Stock Piston Rings	21018813 (4 req)	GM
LSJ Connecting Rods (less than 300 hp only)	12755162	GM
Piston set for LSJ Rods (less than 300 hp only)	88958634	GM Performance Parts
Performance Connecting Rod	various	Eagle/Manley
Performance Forged Pistons	various	Wiseco/JE/Diamond
Street Performance Wrist Pin	various	Manley/JE/Wiseco
Adjustable Cam Gears	88958613	GM Performance Parts
Nitrous Express Nitrous Kit	various	Nitrous Express
2.2L Supercharger Kit	17800003	GM Performance Parts
Hahn Racecraft Turbocharger Kit	—	Hahn Racecraft
Bates Engineering Valve Springs	ESGV0001	Bates Engineering
LSJ Piston Pin	12791503	GM
LSJ Piston Pin Retaining Clip	12755171	GM

NOTES

ENGINE ASSEMBLY

400 HP TO 600 HP

This engine package was developed for use in the Cobalt Phase5 vehicle. This engine has powered a Cobalt Phase5 drag car (2875 lbs without driver) to an E.T. of 11.92 @ 118 MPH with only 21 PSI boost.

This package adds a sleeved production block, CNC ported head and upgraded valve train.



Fig. 121

Typical dyno run 400-600 HP

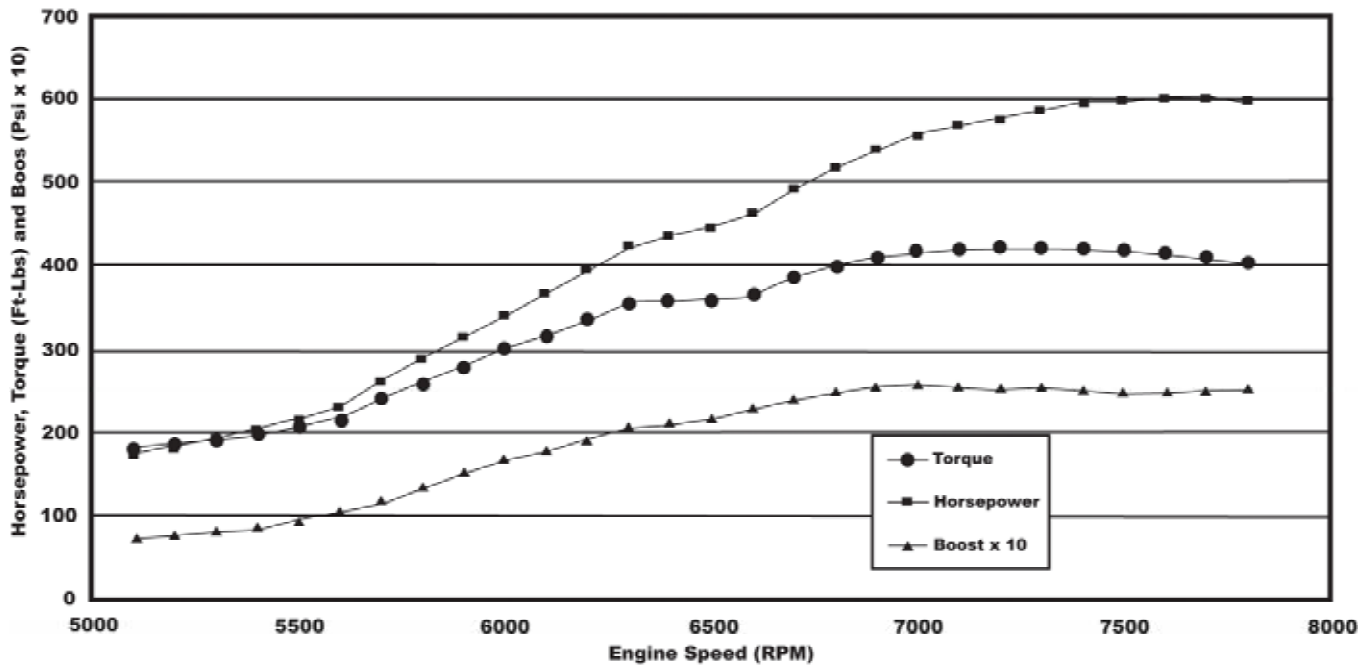


Fig. 122

ENGINE BLOCK

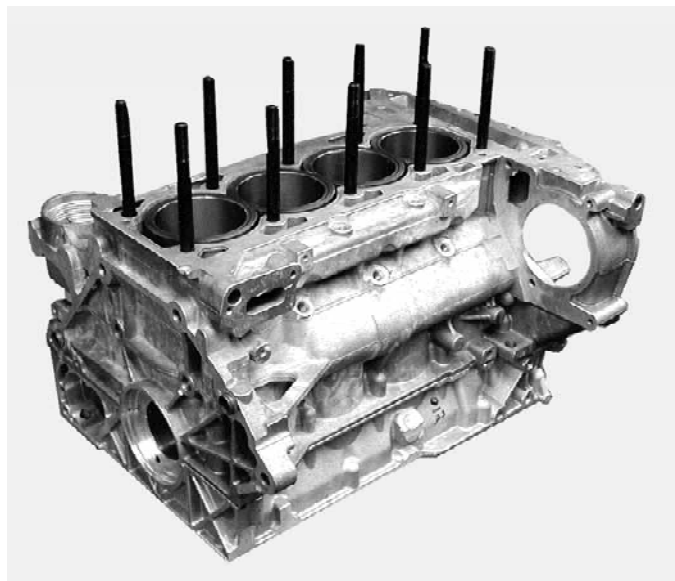


Fig. 123

The engine block is a production Original Equipment (OE) block casting with high strength liners installed. The production liners are machined out and thick-walled, nodular iron, high-strength liners are installed (part number 88958681). The stock bore size is maintained. For this application, the deck surface was machined flat to allow the use of the production head gasket, part number 24444091 (Fig. 123).

Stock replacement head studs for this package are available from both ARP (PN 231-4701) and Bates (part number ESGB0165).

ENGINE BLOCK MAIN GIRDLE



Fig. 124

No main girdle modifications are necessary. Production main bolts are sufficient for this application. It is important to replace the production main bolts after each use. (Fig. 124)

OIL PAN

The production OE oil pan is used on this engine. For road race or long term high RPM applications, we recommend an aftermarket pan. For applications where the engine is significantly “tilted” in the vehicle, it may be worthwhile to use an Accusump to maintain oil pressure under high load cornering and braking. Make sure to re-establish the oil level “full” mark on the dipstick. The existing mark will be incorrect.

CRANKSHAFT

The production 2.2L crankshaft has been run in drag race applications to over 550 hp with no durability issues.

An alternate solution is the Eagle 4340 forged crankshaft with timing ring (part number 2237245765R) and without timing ring (part number 2237245765). Eagle claims that this crankshaft is adequate to power levels over 600 hp.



Fig. 125

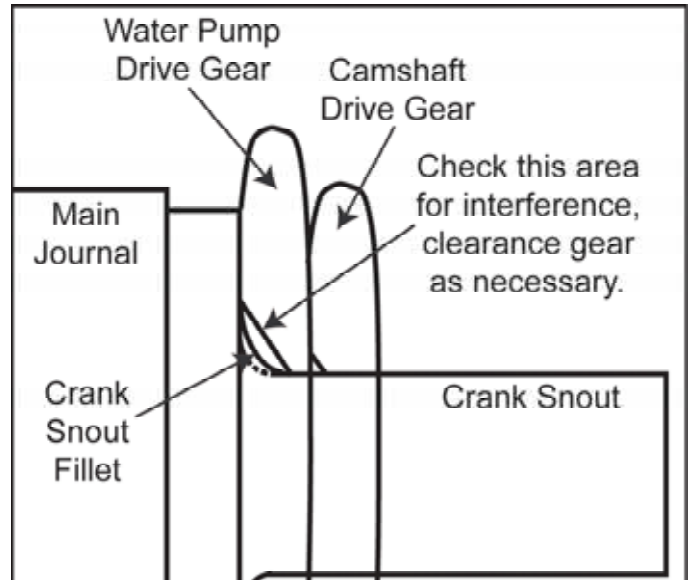


Fig. 126

ASSEMBLY TIP
 Check the water pump chain drive gear for interference on the front crank fillet.

CRANKSHAFT SPECIFICATIONS	
Part #	Eagle 2237245765R (This crank is available without a timing ring if a crank trigger is used.)
Material	4340 Forged Steel
Stroke	3.724
Rod Journal Size	1.9294
Main Journal Size	2.2038
Main Bearing Clearance	.0026 - .0028

CRANKSHAFT MAIN BEARINGS



Fig. 127

The recommended crankshaft main bearing is a production OE main bearing. The part number for this main bearing kit is #21018819. When using the production main bearings with an aftermarket crankshaft, check the clearance between the fillet radius of the crank and the bearing. Contact can cause premature engine failure. (Fig. 127)

CONNECTING RODS



Fig. 128

Eagle makes a stock replacement connecting rod for the 2.2L **ECOTEC** engine. This rod has been dyno-tested and vehicle-tested to 550 hp at 8000 RPM. (Fig. 128)

CONNECTING ROD SPECIFICATIONS	
Part #	CRS5765C3D
Type	H-Beam
Material	4340 Steel
Length	5.765"
Big End Diameter	2.0527"
Big End Width	.943"
Small End Diameter	.7874" + clearance
Total Weight	526 Grams
Rod-to-Piston Pin Clearance	.0010"
Rod Bearing-to-Crankshaft Journal Clearance	.0026 - .0032"

CONNECTING ROD BEARINGS

The production rod bearing is recommended for applications up to 600 hp. Make sure to check for clearance between the stock bearing and the fillet radius on the aftermarket crankshaft.

PISTONS



Fig. 129

The pistons used in this **ECOTEC** race engine are manufactured by WISECO. These pistons are a flat top, forged aluminum style piston. These pistons are designed to use the production 2.2L **ECOTEC** ring package. They are a direct replacement in the stock bore and should yield a compression ratio of 9:2 with the production head gasket. (Fig. 129)

PISTON SPECIFICATIONS	
Part #	CA—R8540
CR	9:1
Forging	AL
Bore	3.386"
Compression Height	1.028—26.11 mm
Pin Diameter	.7874—20 mm
Pin Length	2.250"
Top Ring Groove	1.2 mm
Second Ring Groove	1.5 mm
Oil Ring Groove	2.6 mm
Piston-to-Cylinder Clearance	.005 - .006"
Piston Pin-to-Piston Clearance	.0012"
Piston Ring End Gap	.016"

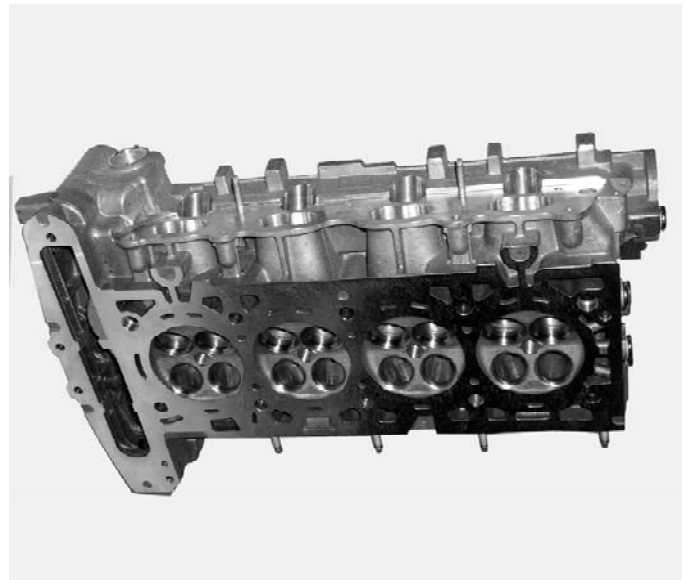


Fig. 130

For improved durability it is recommended to upgrade to the production supercharged 2.0L (LSJ) valves or, Ferrea (part number F1963P intake and F1961P exhaust) valves.

PISTON PINS

A high quality wrist pin is supplied with the piston kit from Weisco. The production 2.0 LSJ (23 mm) pin is adequate when using the LSJ 2.0L connecting rod.

PISTON RINGS

Stock 2.2L ECOTEC rings are recommended. For blown or nitrous application it is recommended to increase ring gaps to: .023" to .026" for top ring and .020" to .023" for second ring.

PISTON PIN LOCKS

These are single wire style locks. They are supplied with the pistons.

CYLINDER HEAD

The sportsman cylinder head part number 88958619 used to build this engine is a modified production OE head. The cylinder head has been prepared by Chapman Racing. This head is cast from aluminum using a lost foam process, it also features CNC Street porting for port to port consistency. (Fig. 130)

The spark plug holes have been modified to accept 3/4" reach spark plugs.

A complete competition valve job has been performed on the cylinder head using a Serti Head Machine with a Serti cutter # HP2022.

This head with production valves has been run to over 500 hp on gasoline with 25 lbs boost.

SPORTSMAN CYLINDER HEAD GENERAL DATA		
	Intake	Exhaust
Valve Head Diameter (in.)	1.400"	1.200"
Valve Stem Diameter (in.)	6 mm	6 mm
Valve Seat Angle (degrees)	45.0°	45.0°
Valve Spring Installed Height (in.)	1.210"	1.210"
Valve Spring Seat Pressure (lbs)	92	92
Spring Pressure Over Nose (lbs)	250 lbs @ .500 lift	250 lbs @ .500 lift

SPORTSMAN CYLINDER HEAD FLOW											
SPORTSMAN CYLINDER HEAD FLOW NUMBERS - PERFORMED ON A SUPERFLOW SF-1020 FLOW BENCH											
Intake Valve Test Data at 28.0 Inches of Water											
Valve Lift (in.)	0.050	0.100	0.150	0.200	0.250	0.300	0.350	0.400	0.450	0.500	0.550
Corrected Flow	45.5	91.2	131.6	169.5	202.4	235.0	257.2	267.0	273.1	276.3	280.8

SPORTSMAN CYLINDER HEAD FLOW											
SPORTSMAN CYLINDER HEAD FLOW NUMBERS - PERFORMED ON A SUPERFLOW SF-1020 FLOW BENCH											
Exhaust Valve Test Data at 28.0 Inches of Water											
Valve Lift (in.)	0.050	0.100	0.150	0.200	0.250	0.300	0.350	0.400	0.450	0.500	0.550
Corrected Flow	39.0	85.4	123.5	156.8	180.6	196.2	202.5	207.3	210.2	213.4	215.6

CYLINDER HEAD COVER

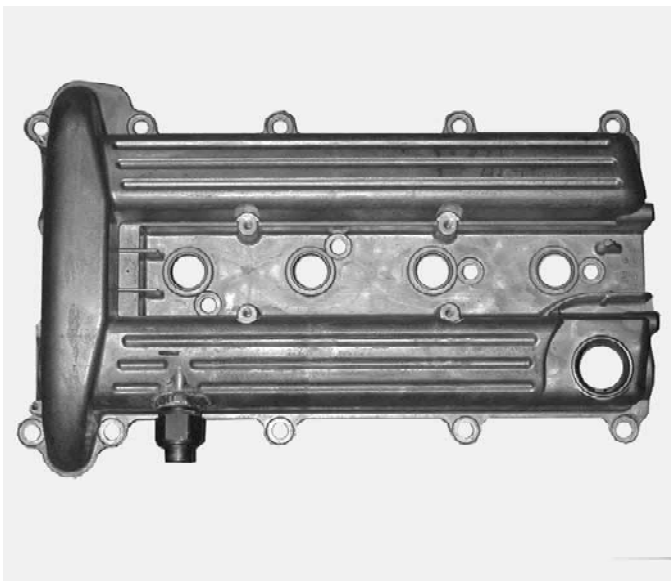


Fig. 131

The production OE cast aluminum cylinder head cover is used on most **ECOTEC** race engines. Since high RRM operation requires that the crankcase has more breathing capability, a breather provision has been added to the cylinder head cover. We recommended that at least a -12 AN breather line be used for highly boosted applications (Fig. 131)

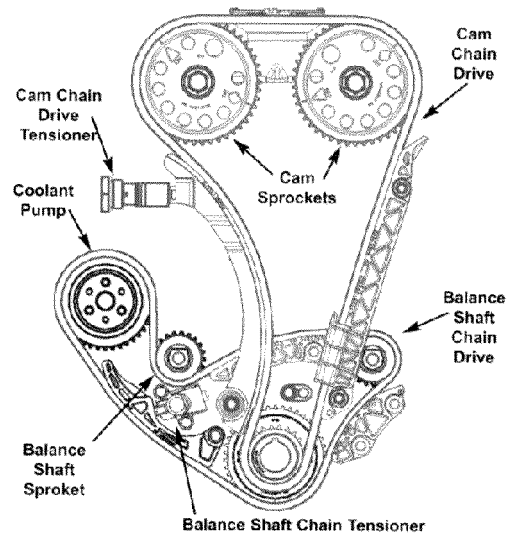


Fig. 132

VALVE SPRINGS AND RETAINERS



Fig. 133

Bates Engineering offers an up-level valve spring kit that will accept up to .500" valve lift. This spring does not require cylinder head modifications, but does require replacement of the spring seat and the retainers. (Fig. 133)

Part Numbers:

- Spring ESGV002
- Retainer ESGV0150
- Seat ESGV0065

CAMSHAFTS



Fig. 134

GM Performance Parts offers a matched pair of high performance cams (part number 88958636 and part number 88958637). These cams require the Bates race valve springs and retainers to avoid coil bind. (Fig. 134)

CAMSHAFT SPECIFICATIONS	
Intake	
Lobe Center	112° ATDC
Duration at .050 in. lift	222 Crank Degrees
Max Cam Lift	.274 In.
Net Valve Lift	.466 In.
Exhaust	
Lobe Center	119° BTDC
Duration at .050 in. lift	.222 Crank Degrees
Max Cam Lift	.274 In.
Net Valve Lift	.466 In.

LASH ADJUSTERS

Use of mechanical lash adjusters is recommended when using camshafts with more lift than production. Clearance of .005"—.007" is recommended between the roller and the cam.

INTAKE MANIFOLD

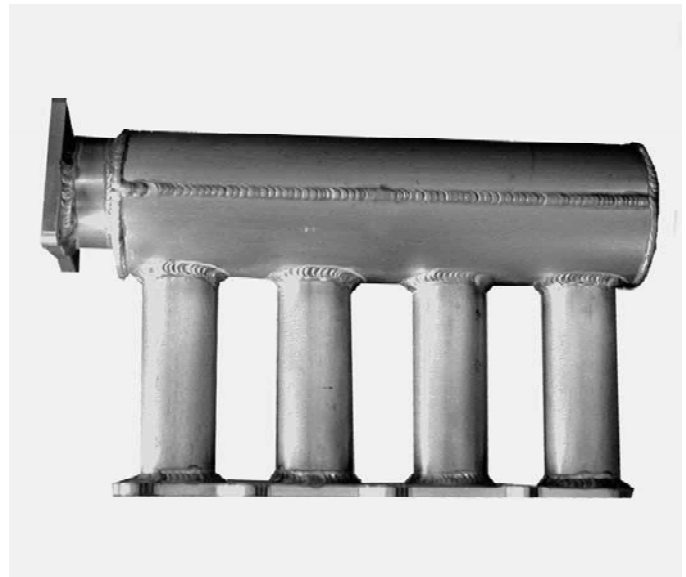


Fig. 135

The intake manifold developed for ECOTEC engine up to 600 hp for off-highway use is a sheet metal fabricated style intake manifold, part number 88958629. The intake manifold is manufactured by Bates Engineering in conjunction with GM Racing. The intake manifold is made from 6061 Aluminum and is completely TIG welded. The

intake manifold is used on the Phase5 drag cars and the Bonneville race cars. It also fits on a Cobalt, Cavalier or Sunfire with production engine location. It does not function properly with the production engine management system. (Fig. 135)

WATER PUMP

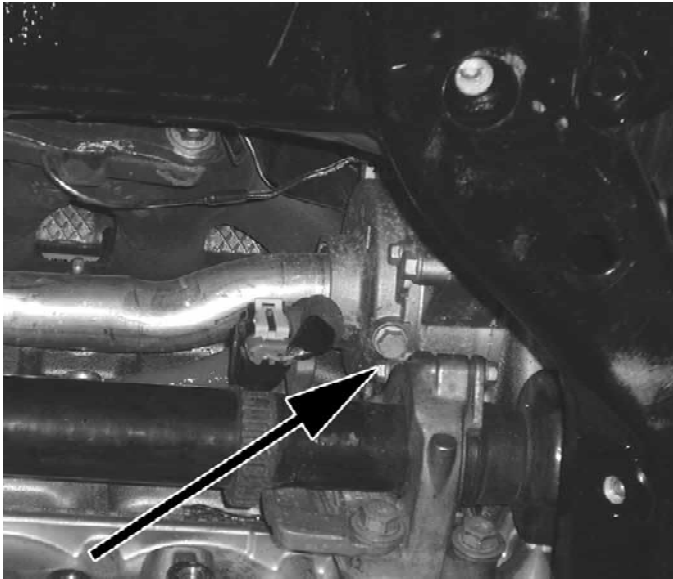


Fig. 136

The production OE water pump is used on the **ECOTEC** race engines. (Fig. 136)

OIL PUMP (WET SUMP)



Fig. 137

The production lubrication system is used on all wet sump **ECOTEC** race engines, including the OE gerotor-style oil pump. This oil pump supplies a constant 125 PSI at all engine speeds. (Fig. 137) The wet sump oiling system also can use a Moroso Accusump oil system. This system supplies an additional three quarts of oil, if the engine's oil pressure falls below 60 PSI.

In cases where extended periods of time are spent on the rev limiter (two step, occasional missed shifts), we recommend using Bates Engineering oil pump gears (part number ESGR0105). Extended periods of time on the rev limiter can cause the diameter of the crank pulley to grow due to interference with the crank keyway. This growth imparts a radial load in the gear which causes a failure. The use of the upgraded gear eliminates this failure mode.

400 HP TO 600 HP PARTS LIST

PARTS LIST		
DESCRIPTION	PART NUMBER	SOURCE
Production Engine block with High-Strength Sleeves	88958681	GM Performance Parts
Stock—replacement Head Studs	various	ARP/Bates Engineering
2.2L Stock—Crankshaft	90537273	GM
4340 Forged Crankshaft with Timing Ring	2237245765R	Eagle
4340 Forged Crankshaft without Timing Ring	2237245765	Eagle
Production Main Bearing Kit	21018819	GM
2.2L Stock—Replacement Connecting Rod	CRS5765C3D	Eagle
2.2L Stock—Rod Bearings	9986231	GM
Forged Aluminum Piston Kit with Wrist Pin and Pin Locks	CA—R8540	Weisco
Stock Head Gasket	24444091	GM
Stock Piston Rings	21018813	GM
2.0L LSJ Valves	Intake 12786696 Exhaust 12791961	GM
Replacement Valves	Intake F1963P Exhaust F1961P	Ferrea
CNC Sportsman—Ported Cylinder Head	88958619	GM Performance Parts
Stock—replacement Valve Springs	ESGV002	Bates
Valve Spring Kit	ESGV002/0150/0065	Bates Engineering
High Performance Cam Set	88958636/37	GM Performance Parts
Titanium Retainers	ESGV0150	Bates Engineering
Aluminum Fabricated Intake Manifold	88958629	GM Performance Parts
Moroso Accusump Oil System, Wet Sump	23900	Moroso
Bates Engineering Oil Pump Gears	ESGV0105	Bates Engineering
Fuel Injection Controller	Call for recommendation	Accel DFI or AEM
Production Main Bolts	11519783	GM
Neutral Balance Shafts	88958615	GM Performance Parts
Adjustable Cam Gears	88958613	GM Performance Parts

NOTES

ENGINE ASSEMBLY

600 HP TO 1000 HP

In 2002 this engine package was developed for use in the Hot Rod class. This is also the engine package that was used to exceed 243 MPH in a '05 Cobalt Coupe at the Bonneville Salt Flats, August 2004.

This package adds a fully race prepped cylinder block with H-11 main and head studs and one piece stainless steel cylinder sealing rings. It also includes a fully race prepped cylinder head. Additions to the cylinder head include o-ring receiver grooves and combustion chamber supports. There also is an upgraded crankshaft.



Fig. 138

Typical dyno pull 1000 HP Ecotec

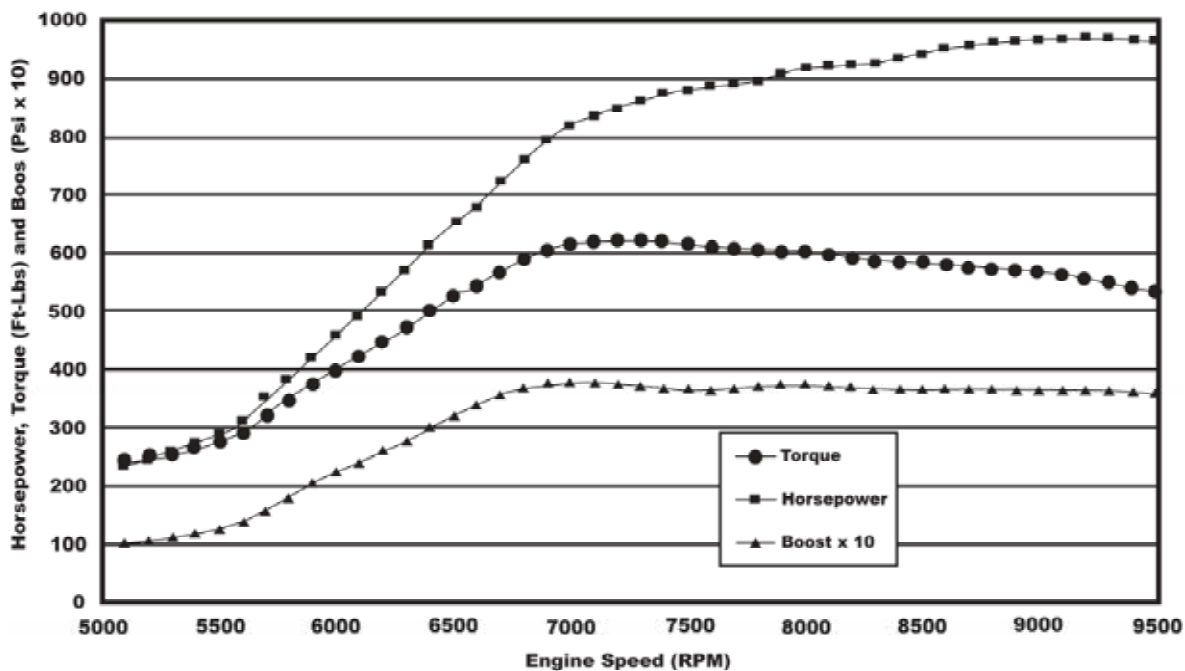


Fig. 139

ENGINE BLOCK

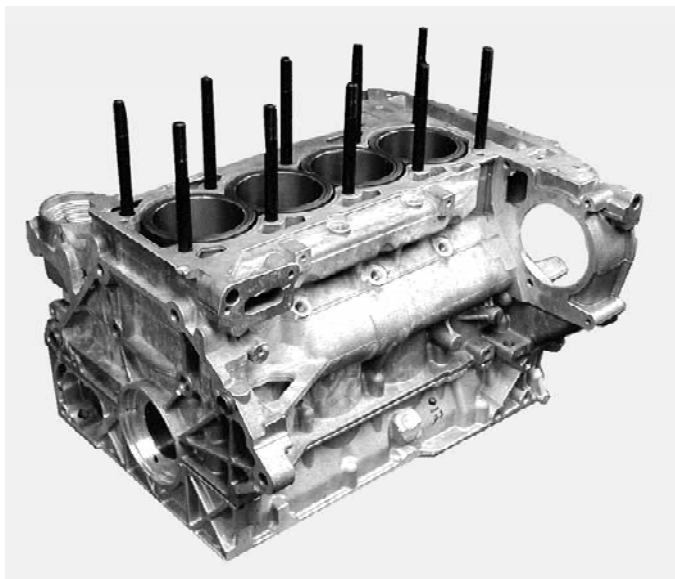


Fig. 140

The engine block used to build this engine is a production OE block. The engine block has been prepped by GM Racing. This production block is cast from aluminum using a lost foam process. There have been many modifications and checks made to the original production cylinder block including: (Fig. 140)

The ZYGLO system is used to check for cracks and imperfections in the engine block.

All oil gallery plugs are removed to clean and inspect all passages.

The stock cylinder sleeves are machined out and new nodular iron cylinder sleeves are installed. The cylinder sleeves are installed .006 protruding above the block deck. The cylinder sleeves are also press fit to .003".

The cylinder sleeves are machined to accept one piece o-rings. These o-rings are made of one piece .041" thick stainless steel. The o-rings are installed .012" protruding above the cylinder sleeves.

All cylinder head bolt holes are drilled and roll tapped to fit 1/2" thirteen studs.

H-11 1/2" thirteen head studs are installed into the block.

H-11 7/16" fourteen main studs are installed into the block.

The main journals are lined honed to 2.5225-2.5235.

The factory oil pressure sensor location hole is tapped to 1/4" pipe thread.

The factory crankshaft position location hole is tapped to -08 AN thread and plugged. The oil filter boss should be removed from the block. This can be done on a mill or with a sawzall. A female -10 AN fitting should be welded on the block. For wet sump applications, both oil in and oil out are used. For dry sump applications, plug the oil out hole.

The block deck is machined to fit larger cylinder head alignment dowels. The new dowels measure .675 in, .630 O.D., .515 I.D.

The front two oil galleries are plugged with 1/2" steel plugs or tap for 9/16-18" for threaded rod.

The head and main studs are installed using blue Loctite® and torqued to 8 ft lbs. After the studs are installed, before the Loctite® dries, main girdle and block deck plates are installed and torqued to 20 ft lbs. The Loctite® is allowed to dry for 24 hours.

With the deck plates torqued to 105 ft lbs, the cylinders are honed until .005 piston to cylinder wall clearance is achieved.

ENGINE BLOCK MAIN GIRDLE

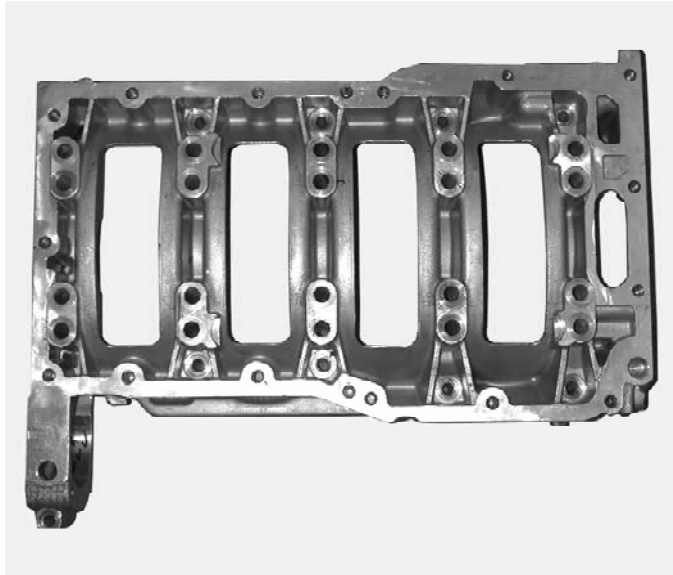


Fig. 141

The main girdle used in all ECOTEC engines is a production OE girdle. The main girdle has been modified by GM Racing. The modifications include: (Fig. 141)

The ZYGLO system is used to check for cracks and imperfections in the main girdle.

All main girdle stud holes have been reamed to .465" for the main girdle mounting studs.

OIL PAN

The production OE oil pan can be used on the wet sump ECOTEC race engines. If the engine is tilted significantly, be sure that a proper oil level is established. The indicator on the dipstick is not valid.



Fig. 142



Fig. 143

Stefs and Bates Engineering offer aftermarket pans for the ECOTEC which can be fabricated for your specific chassis. (Fig. 143)

When using the production oil pan for endurance applications, an oil accumulator is recommended. This helps eliminate short term loss of oil pressure due to an uncovered pickup. It also increases the oil capacity which helps oil temperature. For engines that are tilted forward and use a dry sump, there are three oil scavenging lines incorporated into the aluminum fabricated oil pan. One or two additional scavenge sections should be added to the front of the cylinder head.

CRANKSHAFT



Fig. 144

The crankshaft used on the **ECOTEC** race engine is a 4340 billet steel crankshaft. (Fig. 144) The crankshaft used to build this engine has been prepped by GM Racing. There have been many quality checks done on the crankshaft including:

- Checking for cracks and imperfections in the crankshaft with the MAGNAFLUX system.
- Checking for straightness.
- Indexing for stroke.
- Visually inspecting all oil passages and crankshaft journals.

ASSEMBLY TIP

Check the water pump drive gear chamfer for clearance on the front crankshaft fillet.

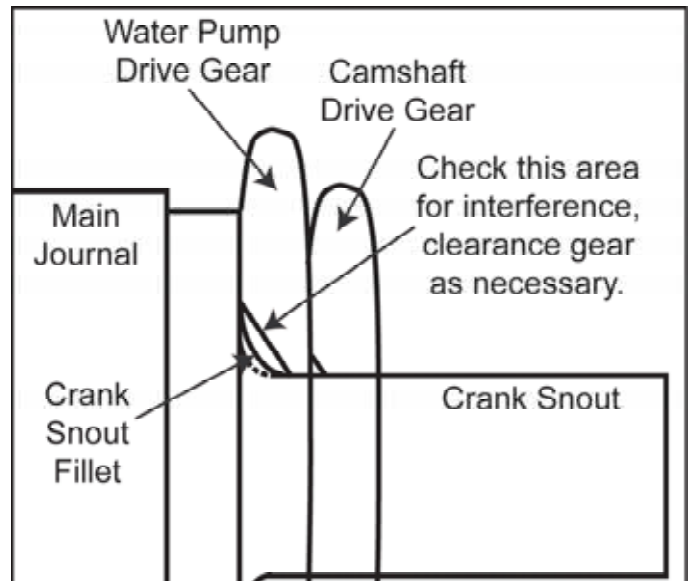


Fig. 145

- Measuring all rod and main journals for size and shape. (Fig. 145)
- Checking for balance, and rebalanced if necessary.
- The trigger wheel from the stock style crank has been removed. This requires an external trigger wheel and crankshaft position sensor.
- A MSD SB Chevrolet 4x crank trigger setup can be easily modified to work with the **ECOTEC**.

CRANKSHAFT SPECIFICATIONS	
Part #	88958620
Material	4340 Billet Steel
Stroke	3.505"
Rod Journal Size	1.8887"
Main Journal Size	2.2038"
Main Bearing Clearance	.0026 - .0028"

CRANKSHAFT MAIN BEARINGS



Fig. 146

The recommended crankshaft main bearing is a production OE main bearing. The part number for this main bearing set is #21018819. (Fig. 146)

CONNECTING RODS



Fig. 147

The recommended wrist pin clearance is .0012" to .0015". A billet steel connecting rod with a 22 mm small end is required for reliability at max power levels. Both Carrillo and Manley offer a high quality rod for this application. Both rods have been tested to 1000 hp and perform well. The Carrillo is an "H" beam design and the Manley is an "I" beam. Crower H beam 4340 connecting rods are offered through GM Performance Parts for applications up to 1000 hp. These

rods feature high quality rod bolts and bronze piston pin bushings. (Fig. 147)

CONNECTING ROD SPECIFICATIONS	
Part #	888958683
Type	H-Beam
Material	4340 Steel
Length	5.888"
Big End Diameter	2.0150-2.0155"
Big End Width	.943"
Small End Diameter	.866" plus clearance
Total Weight	655 Grams
Rod-to-Piston Pin Clearance	.0014"
Rod Bearing-to-Crankshaft Journal Clearance	.0026 - .0032"

CONNECTING ROD BEARINGS



Fig. 148

The recommended connecting rod bearing is a CLEVITE, part number #1663 H or HX. Crankshaft fillet clearance must be checked. (Fig. 148)

PISTONS



Fig. 149

The pistons used in the **ECOTEC** race engine are manufactured by JE PISTONS. These pistons are a flat top forged aluminum style piston. The pistons have been prepped by GM Racing. There have been modifications and checks made to the pistons supplied by JE PISTONS that include: (Fig. 149)

- Using the ZYGLO System to check for cracks and imperfections in the pistons.
- Completely deburring.

PISTON SPECIFICATIONS	
Part #	88958635
Forging	81 MD4
Bore	3.400"
Compression Height	1.055"
Pin Diameter	.866/22 mm
Pin Length	2.250"
Top Ring Groove	1.5 mm
Second Ring Groove	1.5 mm
Oil Ring Groove	4 mm or 3 mm (dry sump)
Piston-to-Cylinder Clearance	.005 - .006"
Piston Pin-to-Piston Clearance	.0012 - .004"
Piston Ring End Gap	Top Ring .030" 2nd Ring .024"

PISTON PINS



Fig. 150

C350 steel piston pins are used in **ECOTEC** race engines. The piston pins have been supplied by GM Racing. All pins are hand fitted to the connecting rods and pistons. The piston pin diameter is .866 in./22 mm. The wall thickness is .180" to .200" and the pins are made of C350 and are casidium coated. GM part number 88958682 (Fig. 150)

PISTON RINGS

The recommended piston rings are Total Seal. These rings are file to fit style rings. Contact Total Seal for their recommended ring pack for your application.

PISTON PIN LOCKS



Fig. 151

The recommended piston pin locks are single wire style locks. These locks are supplied with the piston assemblies. (Fig. 151)

CYLINDER HEAD

The cylinder head part number 88958640 that is used to build the 600-1000 hp racing engine is a modified production OE head. The cylinder head has been prepped by GM Racing. This head is cast from aluminum using a lost foam process. There have been many modifications and checks made to the cylinder head including:

- The ZYGLO system was used to check for cracks and imperfections in the cylinder head.

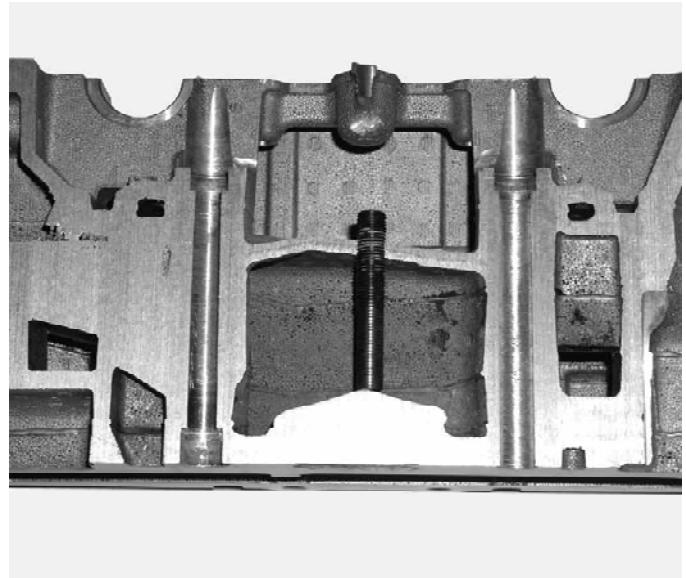


Fig. 152

- The cylinder head is matched to accept a support stud. This adds strength to the combustion chambers in the cylinders 1 and 4. (Fig. 152)
- The water jackets at each end of the cylinder head have been pinned for support.
- The head stud holes were drilled and reamed to .505".
- The cylinder head alignment dowel holes have been opened to .629".
- The head stud holes were spot faced to install step washers.

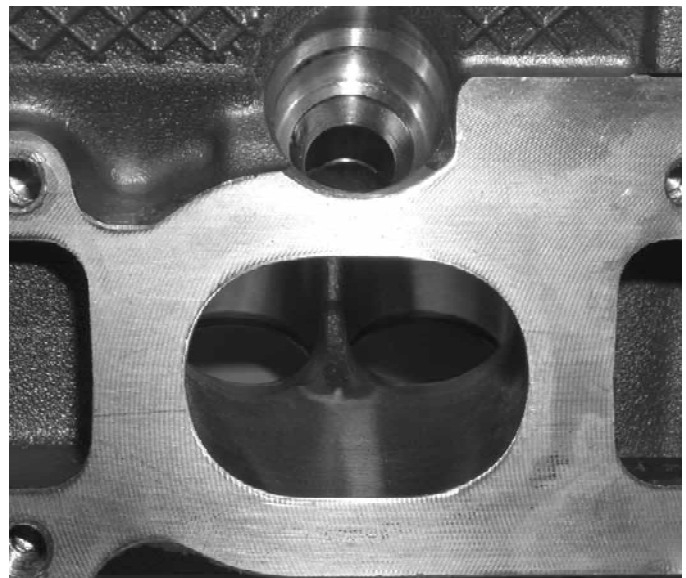


Fig. 153

- CNC Race porting for port to port consistency. (Fig. 153)
- A receiver groove was machined into cylinder head face.

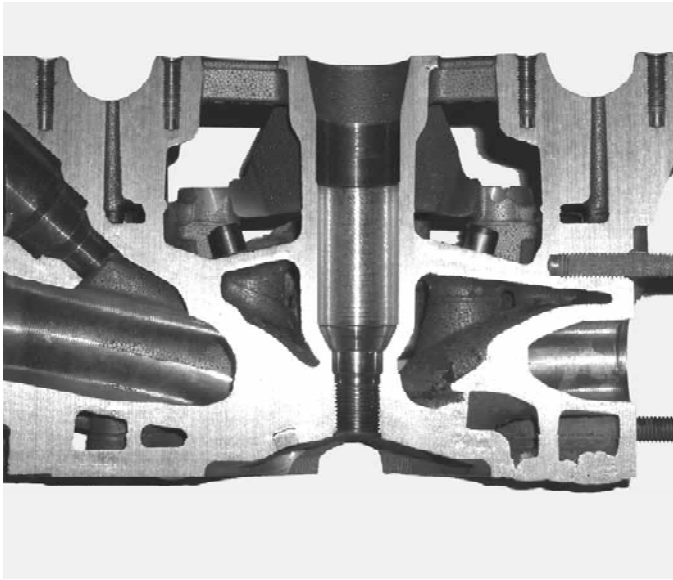


Fig. 154

- The spark plug holes were modified to accept 3/4" reach spark plugs. (Fig. 154)
- The valve spring seat pockets were machined by .040" on the intake and .060" on the exhaust. The diameter of the seats must be 1.150".

- The support struts and oil rails were hand checked for spring clearance.
- The exhaust side of the oil rail was drilled for spring oilers. The cylinder head is completely deburred and flow bench tested.
- A complete competition valve job was done on the cylinder head using a Serti Head Machine. Serti cutter # HP2022 was used.

RACE CYLINDER HEAD GENERAL DATA		
	Intake	Exhaust
Valve Head Diameter (in.)	1.400"	1.200"
Valve Stem Diameter (in.)	6.00 mm	6.00 mm
Valve Seat Angle (degrees)	45.0°	45.0°
Valve Spring Installed Height (in.)	1.210"	1.210"
Valve Spring Seat Pressure (lbs)	92	92
Spring Pressure Over Nose (lbs)	250 lbs @ .500 lift	250 lbs @ .500 lift

RACE CYLINDER HEAD FLOW (LOST FOAM)											
RACE CYLINDER HEAD FLOW NUMBERS – PERFORMED ON A SUPERFLOW SF-1020 FLOW BENCH											
Intake Valve Test Data at 28.0 Inches of Water											
Valve Lift (in.)	0.050	0.100	0.150	0.200	0.250	0.300	0.350	0.400	0.450	0.500	0.550
Corrected Flow	45.5	91.2	131.6	169.5	202.4	235.0	257.2	267.0	273.1	276.3	280.8

RACE CYLINDER HEAD FLOW (LOST FOAM)											
RACE CYLINDER HEAD FLOW NUMBERS – PERFORMED ON A SUPERFLOW SF-1020 FLOW BENCH											
Exhaust Valve Test Data at 28.0 Inches of Water											
Valve Lift (in.)	0.050	0.100	0.150	0.200	0.250	0.300	0.350	0.400	0.450	0.500	0.550
Corrected Flow	39.0	85.4	123.5	156.8	180.6	196.2	202.5	207.3	210.2	213.4	215.6

HEAD GASKET

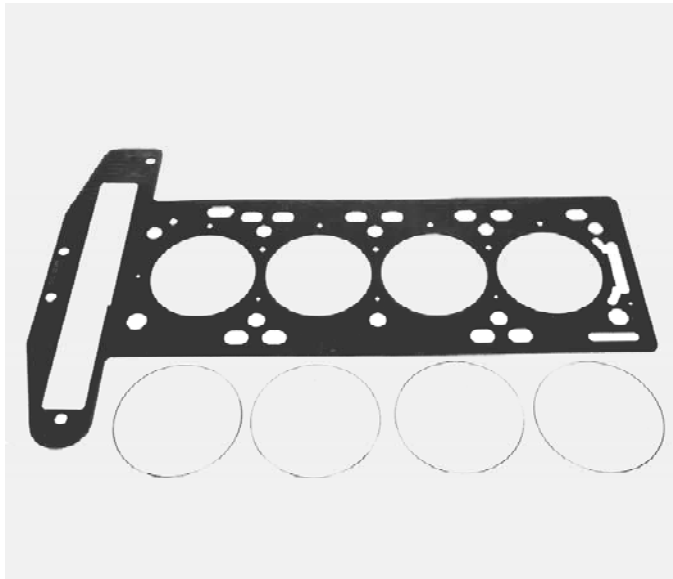


Fig. 155

A copper head gasket must be used with the stainless O-Rings to maintain proper cylinder sealing. (Fig. 155)

ROCKERS AND LIFTERS



Fig. 156

The production rocker arm is recommended for use on the intake. Bates Engineering offers an investment cast rocker arm which is used with the Bates Engineering solid lifter. The recommended lash is .005" at the valve. To adjust lash or roller to cam clearance, the bottom of the solid lash adjuster is machined down in a lathe until proper lash is achieved. For each .0025" machined off solid lash adjuster, .001" increase in lash or roller to cam clearance. (Fig. 156)

CYLINDER HEAD COVER

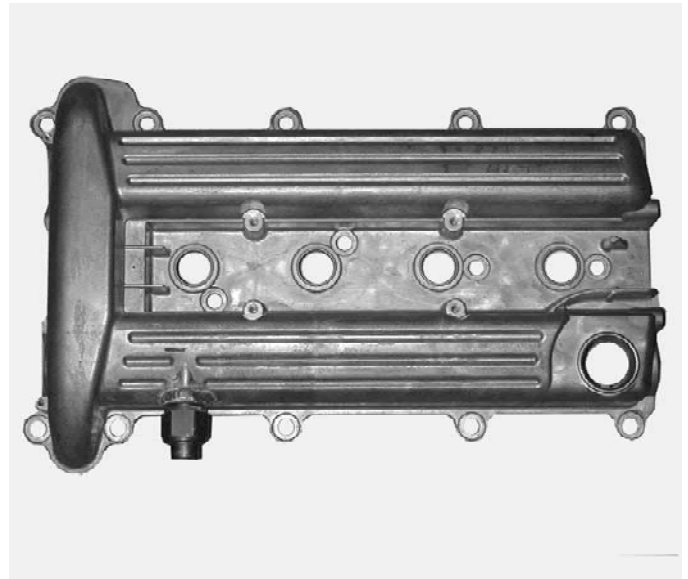


Fig. 157

The production OE cast aluminum cylinder head cover is used on most ECOTEC race engines. A breather provision is added to the cylinder head cover. A minimum of -12 hose is recommended. (Fig. 157)

CAMSHAFTS

GM Performance Parts offers a matched pair of high performance cams part number 88958636 and part number 88958637. These cams will perform well up to 1000 hp (9,500 RPM)

CAMSHAFT SPECIFICATIONS	
Intake	
Lobe Center	106° ATDC
Valve Closure	61.2° ABDC
Duration at .050 in.	247 Crank Degrees
Max Cam Lift	.294 In.
Net Valve Lift	.499 In.
Exhaust	
Lobe Center	110.0° BTDC
Duration at .050 in.	249 Crank Degrees
Max Cam Lift	.293 In.
Net Valve Lift	.499 In.

INTAKE MANIFOLD

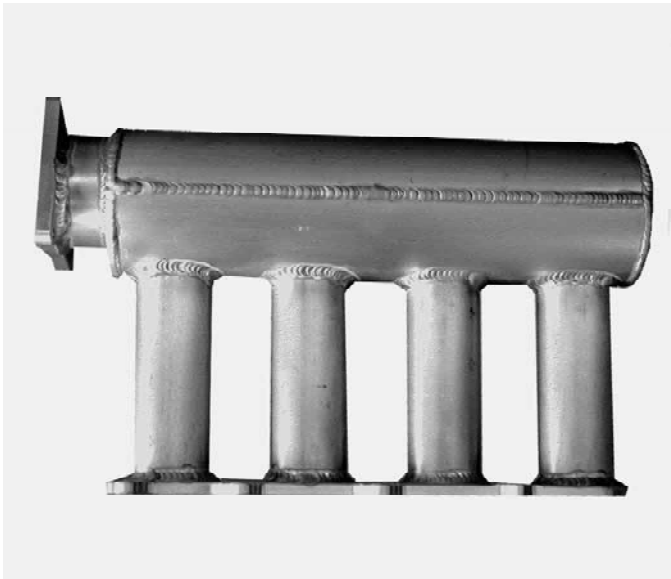


Fig. 158

The intake manifold developed for **ECOTEC** engine up to 1000 hp for off-highway use is a sheet metal fabricated style intake manifold. The intake manifold is manufactured by Bates Engineering in conjunction with GM Racing. The intake manifold is made from 6061 Aluminum and is completely TIG welded. The intake manifold utilizes a 75 mm OE throttle body from a GM 5.3L V-8 engine. This manifold is used on the Phase5 drag cars and the Bonneville race cars. It will also fit on a Cobalt, Cavalier and Sunfire with production engine location. It will not function properly with the production engine management system. (Fig. 158)

WATER PUMP

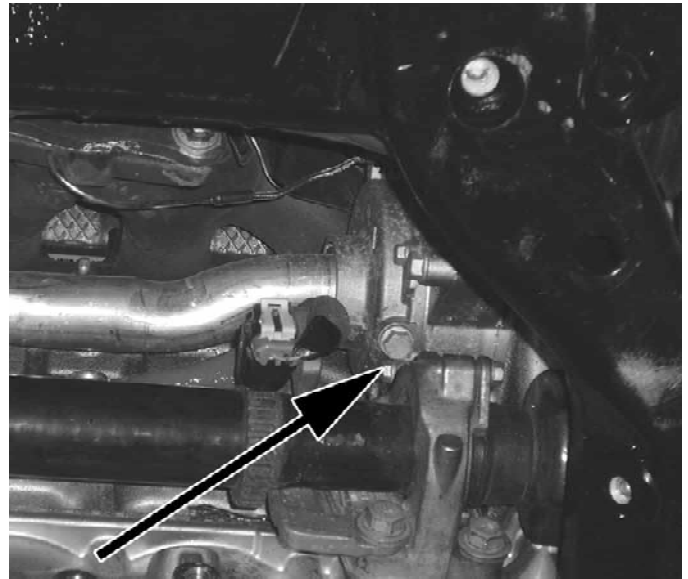


Fig. 159

The production OE water pump is used on the **ECOTEC** race engines. An electric water pump can also be used. This allows the water pump/balance shaft drive chain to be removed from the engine. **DO NOT** remove the water pump drive gear from the crank snout. It spaces out the cam drive gear the proper distance. (Fig. 159)

600 HP TO 1000 HP PARTS LIST

PARTS LIST		
DESCRIPTION	PART NUMBER	SOURCE
Race—Prepped Engine Block with Head and Main Studs	88958630	GM Performance Parts
Race—Prepped 4340 Billet Steel Crankshaft	88958620	GM Performance Parts
Production Main Bearing Kit	21018819	GM
Race Billet connecting Rods, use 22 mm Pin	888958683	GM Performance Parts
Connecting Rod Bearing	#1663H or HX	CLEVITE
Forged Aluminum Race Piston with Pin Locks	88958635	GM Performance Parts (JE)
High Strength 22 mm Wrist Pins	88958640	GM Performance Parts
Piston Rings	Call for Recommendation	Total Seal
Race—Prepped CNC—Ported Head	88958640	GM Performance Parts
High Performance Cam Set	88958636/37	GM Performance Parts
Aluminum Fabricated Intake Manifold	88958629	GM Performance Parts
Moroso Accusump Oil System, Wet Sump	23900	Moroso
Dry Sump Mechanical Fuel Pump	-1	DSR
Copper Headgasket Kit	88958614	GM Performance Parts
Billet Front Hub	88958631	GM Performance Parts
Race Valve Springs	CT1030	PSI
Titanium Retainers	KRERT001 (6 Degrees)	Trick Titanium
Race Valves	Intake F1963P Exhaust F1961P	Ferrea
Mechanical Lifter	Various	Crower/Jesel/ Bates Engineering
Billet rockers	Various	Bates Engineering/Jesel
Flywheel Bolts	88958684	GM Performance Parts
Tie Bars for head studs	88958685	GM Performance Parts
Valve Keepers	K10036	Ferrea
Production Oil Pan	12578193	GM
Aftermarket Oil Pan	Various	Stefs/Bates Engineering
Aftermarket Connecting Rods	Call	Carillo/Manley
Production Rocker Arm	12565203	GM
Cast Rocker Arm with Solid Lifter	—	Bates Engineering
5.3L V8 Throttle Body	17113647	GM
22 mm Steel Piston Pin	88958682	GM Performance Parts

NOTES

ENGINE ASSEMBLY

1000 HP TO 1400 HP

This package was developed for all out maximum performance applications. It is currently used for competition in the NHRA Hot Rod and Pro FWD race cars. This engine has propelled the '05 Gardella Racing Cobalt hot rod car to a 7.92 @ 184 MPH and the '05 Cobalt Pro FWD car to a 7.45 @ 199 MPH to date.

The main upgrades to this package are increased bore size, (from 3.400 to 3.500), LSJ sand cast cylinder heads, large intake manifold with a 90 mm throttle body and a Jesel cast rocker.



Fig. 160

Current Pro Race Engine Data

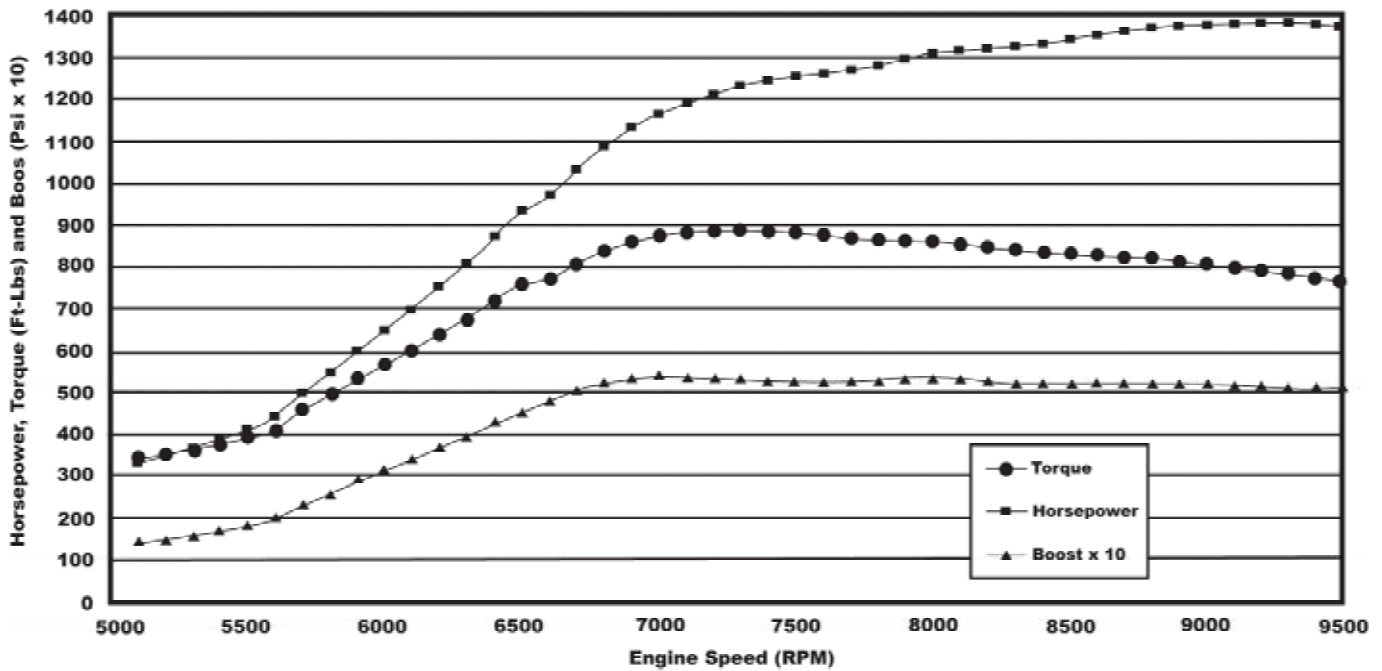


Fig. 161

ENGINE BLOCK

GM racing along with Bates Engineering developed a 3.500" Bore Race prepped ECOTEC block. This block has all the features of the 3.400" bore race block plus the following:

- 3.500" Bore size
- 3.835 I.D. and 3.915 O.D. one piece stainless O-ring.
- The increased bore size increases air flow capabilities of the cylinder head. It also increases engine displacement from 127.2c.u.in. (2.0L) to 134.8c.u.in. (2.2L)

OIL PAN



Fig. 162

There are three oil scavenging lines incorporated into the aluminum fabricated oil pan on the dry sump race engines. Aftermarket dry and wet sump oil pans are available from Bates Engineering for your specific application. For dry sump application, a minimum of three scavenge stages are required. In applications where a high engine tilt angle is used, a head (valve area oil drain) scavenge stage is recommended. (Fig. 162)

FLYWHEEL BOLTS

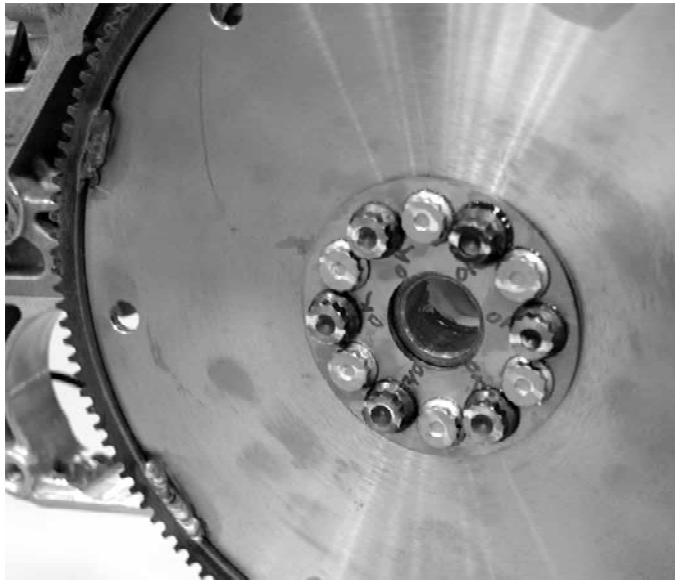


Fig. 163

Twelve 12 mm x 1.25 pitch, special flywheel bolts are required to clamp the flywheel to the crankshaft at these high power levels. The crank to flywheel interface in a high powered 4 cylinder engine is very critical. The use of high quality flywheel bolts is highly recommended. GM has worked with A-1 Fastener Co. to design a high quality bolt for this application. The GM part number for these bolts is part number 88958684. (Fig. 163)

CUSTOM PISTON SPECIFICATIONS	
Part #	See JE/Wiseco
Forging	81 MD4
Bore	3.500"
Compression Height	1.055"
Pin Diameter	.829"
Pin Length	2.250"
Top Ring Groove	1.5 mm
Second Ring Groove	1.5 mm
Oil Ring Groove	4 mm
Piston-to-Cylinder Clearance	.005 - .006"
Piston Pin-to-Piston Clearance	.0012"
Piston Ring End Gap	.016"

PISTON RINGS

The recommended piston rings for a 3.500" bore are Total Seal. These rings are file to fit style rings. Contact Total Seal for their recommended ring pack for your application.

PISTON PIN LOCKS



Fig. 164

The recommended piston pin locks are single wire style locks. These locks are supplied with the pistons. (Fig. 164)

CYLINDER HEAD

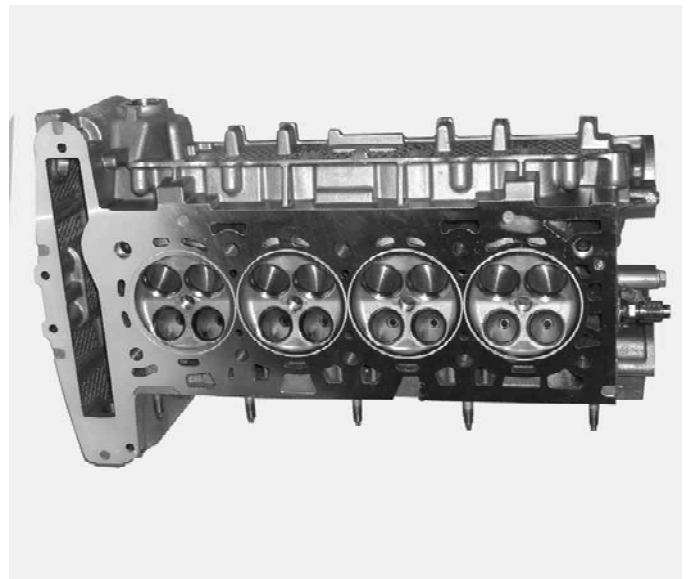


Fig. 165

For applications over 1000 hp GM Racing recommends the use of GM Racing part number XGH614. This is a CNC ported version of the LSJ 2.0L head. The LSJ head is sand cast aluminum. The head is machined with matching receiver groove for the 3.500" bore block. The LSJ cylinder head does not require chamber reinforcement (staking) like the lost foam head. There are bosses cast in the water jacket which support the No. 1 and No. 4 combustion chamber walls. (Fig. 165)

RACE CYLINDER HEAD GENERAL DATA		
	Intake	Exhaust
Valve Head Diameter (in.)	1.400"	1.200"
Valve Stem Diameter (in.)	6.0 mm	6.0 mm
Valve Seat Angle (degrees)	45.0°	45.0°
Valve Spring Installed Height (in.)	1.210"	1.210"

RACE CYLINDER HEAD GENERAL DATA		
	Intake	Exhaust
Valve Spring Seat Pressure (lbs) CT 1030 Installed at 4120	92	92
Spring Pressure Over Nose (lbs)	250 lbs @ .500 lift	250 lbs @ .500 lift

RACE CYLINDER HEAD FLOW											
RACE CYLINDER HEAD FLOW NUMBERS – PERFORMED ON A SUPERFLOW SF-1020 FLOW BENCH											
Intake Valve Test Data at 28.0 Inches of Water											
Valve Lift	0.050	0.100	0.150	0.200	0.250	0.300	0.350	0.400	0.450	0.500	0.550
Corrected Flow	43.1	86.3	125.4	165.5	204.2	233.5	254.1	269.6	281.2	224.4	288.7

RACE CYLINDER HEAD FLOW											
RACE CYLINDER HEAD FLOW NUMBERS – PERFORMED ON A SUPERFLOW SF-1020 FLOW BENCH											
Exhaust Valve Test Data at 28.0 Inches of Water											
Valve Lift	0.050	0.100	0.150	0.200	0.250	0.300	0.350	0.400	0.450	0.500	0.550
Corrected Flow	37.1	84.7	125.7	162.6	189.8	201.4	208.3	213.7	217.6	220.7	222.7

SPRINGS AND RETAINERS



Fig. 166

PSI part number CT1030 Dual valve springs are used in **ECOTEC** Racing cylinder heads. Trick Titanium has developed a titanium retainer to work with this spring and the 6 mm Ferrea valve and keeper. (Fig. 166)

VALVES AND LOCKS

High Quality 6 mm diameter stem valves are used in the race **ECOTEC** Engine. These valves are made by Ferrea. The intake valves are 1.40" diameter and made of stainless steel. The exhaust valves are 1.20" diameter and are made of Inconel. The part number F1963P for the intake and part number F1961P for the exhaust. Ferrea part number K10036 6 mm keepers are recommended.

ROCKERS AND LIFTERS



Fig. 167

Jesel makes a dual roller rocker designed for high boost applications. This rocker arm and lifter is recommended for applications of 42 PSI of boost. The recommended valve lash is .005 at the valve. The Jesel part numbers are OCF-81000 for the rocker, KLA 81500 is the standard length lash adjuster and KLA 81550 is the +.100" lash adjuster. (Fig. 167)

MECHANICAL TIMING CHAIN TENSIONER



Fig. 168

For applications where extended time will be spent on the rev limiter, it is recommended that the hydraulic chain tensioner be converted to a mechanical tensioner. Take 7/16-14 bolt and cut the head off for an overall length of 3.100" and radius. Then cut the end of the bolt. (Fig. 168)

Slot the threaded end for ease of adjustment. Drill and tap the end of the adjuster for 7/16-14 thread.

To adjust the timing chain tensioner turn the engine to TDC (cylinder number 4) and tighten the adjuster to finger tight. Bar the engine over until the timing chain slacks between the cam gears. The number 1 cylinder intake lobes should be pointing straight up. Take a straight edge and lay it across the top of the cam gears. Adjust the tensioner to give .250" chain deflection. Use silicone or an o-ring to seal the thread. Install the jam nut using silicone to hold it.

CYLINDER HEAD COVER



Fig. 169

The LSJ 2.0L race head requires a different head cover than the stock L61 cover. A breather provision is added to the cylinder head cover. A minimum of a -12 hose is recommended. If a dry sump oiling system is used, a hose is attached to the provision on the cover and this is connected to the dry sump oil tank above the oil level. (Fig. 169)

CAMSHAFTS



Fig. 170

All-out full race cams are available from Comp Cams. The intake cam part number is 8770 and the exhaust cam part number is 8771. (Fig. 170)

CAMSHAFT SPECIFICATIONS	
Intake	
Lobe Center	117° ATDC
Duration at .050 in.	259 Crank Degrees
Max Cam Lift	.300 In.
Net Valve Lift	.511 In.
Exhaust	
Lobe Center	117.0° BTDC
Duration at .050 in.	261 Crank Degrees
Max Cam Lift	.301 In.
Net Valve Lift	.512 In.

INTAKE MANIFOLD

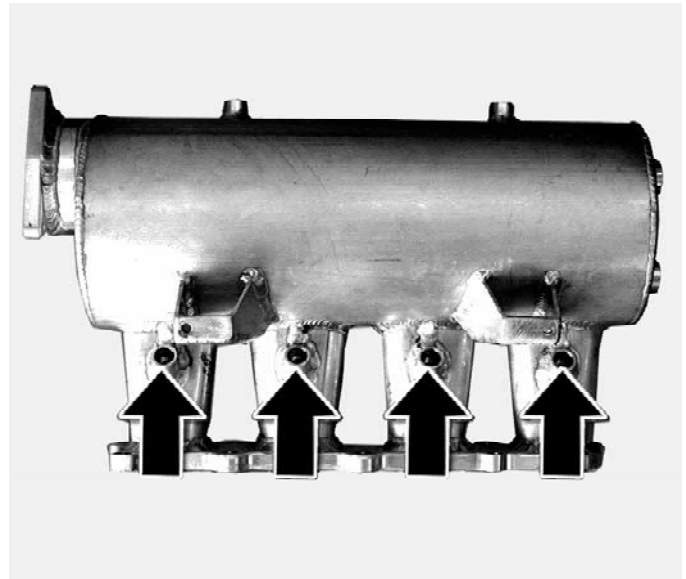


Fig. 171

The intake manifold used on the **ECOTEC PRO** race engine is a sheet metal fabricated style intake manifold. The intake manifold is manufactured by Bates Engineering in conjunction with GM Racing. The intake manifold is made from 6061 Aluminum and is completely TIG welded. The intake manifold utilizes a 90 mm throttle body from Acufab. This manifold uses larger, shorter, runners to improve high RPM performance. (Fig. 171)

NOTE: If the engine is producing more than 700 hp, provisions must be added to the intake manifold to add four additional fuel injectors.

WATER PUMP

**Fig. 172**

The production OE water pump is not used on the **ECOTEC** race engines. An electric water pump is used which permits the removal of the water pump/balance shaft drive chain. **DO NOT** remove the water pump drive gear from the crank snout. It spaces the cam drive gear out the proper distance. The Meziere WP 336 high flow electric water pump is recommended. This pump is rated at 55GPM. (Fig. 172)

OIL PUMP (WET SUMP)

**Fig. 173**

The production lubrication system is used on all wet sump **ECOTEC** race engines including the OE gerotor style oil pump. This oil pump supplies a constant 125 PSI at all Engine speeds. The wet sump oiling system also utilizes a Moroso Accusump oil system. This system supplies an additional four quarts of oil to the engine if the engines oil pressure should fall below 60 PSI. (Fig. 173)

NOTES

1000 HP TO 1400 HP PARTS LIST

PARTS LIST		
Race Billet Connecting Rods w 22 mm Pin	888958683	GM Performance Parts
Connecting Rod Bearing	#1663H or HX	CLEVITE
Forged Aluminum Race Piston with Pin Locks	88958634	GM Performance Parts (JE)
Piston Rings	Call	Total Seal
Race—Prepared 4340 Billet Steel Crankshaft	88958620	GM Performance Parts
Production Main Bearing Kit	21018819	GM
Flywheel Bolts	88958684	GM Performance Parts
Race Billet Connecting Rods with 22 mm Pin	88958683	GM Performance Parts
Connecting Rod Bearing	#1663H or HX	CLEVITE
Forged Aluminum Race Piston with Pin Locks	88958634	GM Performance Parts (JE)
High Strength 22 mm Wrist Pins	88958682	GM Performance Parts
Race—Prepped SAAB 2.0L Cylinder Head	XGH614	GM Racing
High Performance Cam Set	88958636/37	GM Performance Parts
Electric Water Pump	WP 366	Meziere
Throttle Body Intake	90 mm	ACCUFAB
3.500 Race Block	XGB615	GM Racing
3.500 Head Gasket / O-Ring Kit	XGH616	GM Racing
Race Intake Cam	113-000-9I 8770	Comp Cams
Race Exhaust Cam	113-000-9G 8771	Comp Cams
Roller Rocker	OCF-81000	Jesel
Jesel Lifter Short	KLA-81500	Jesel
Jesel Lifter Long (+.100")	KLA-81550	Jesel
Large Plenum Race Intake	88958686	GM Performance Parts
Int Valve	F1963P	Ferrea
Exh Valve	F1961P	Ferrea
Valve Spring	CT-1030	CV Products
Keeper	K10036	Ferrea
LSJ Valve Cover	12797659	GM

NOTES

CONTROL SYSTEMS

FUEL SYSTEMS



Fig. 174

Injector applications are as follows: (Fig. 174)

- 400 hp to 600 hp — Gas — Quantity of 4, 70 lbs an hour, RC high impedance
- 400 hp to 600 hp — Methanol — Quantity of 4, 160 lbs an hour
- 600 hp to 1300 hp — Methanol — Quantity of 8, 160 lbs an hour
- 1300 hp and up — Methanol — Quantity of 12, 160 lbs an hour

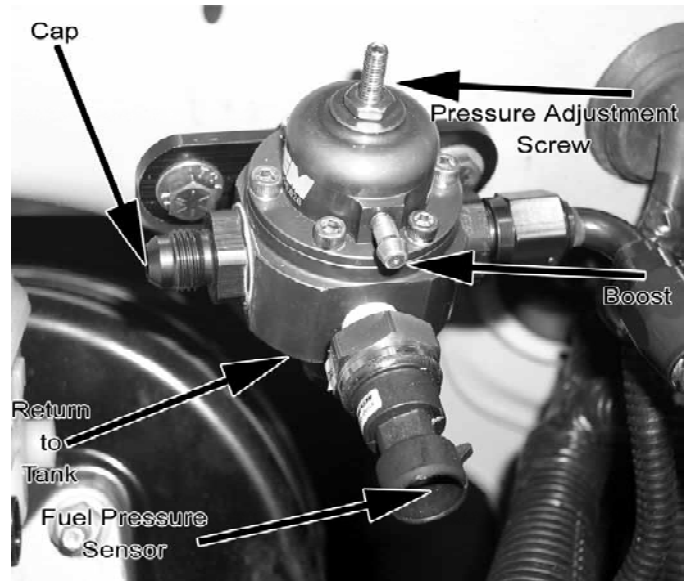


Fig. 175

AEM boost compensated fuel pressure regulator. (Fig. 175)



Fig. 176

Grass Roots: Aeromotive high pressure fuel pump with AEM fuel pressure regulator (Fig. 176)

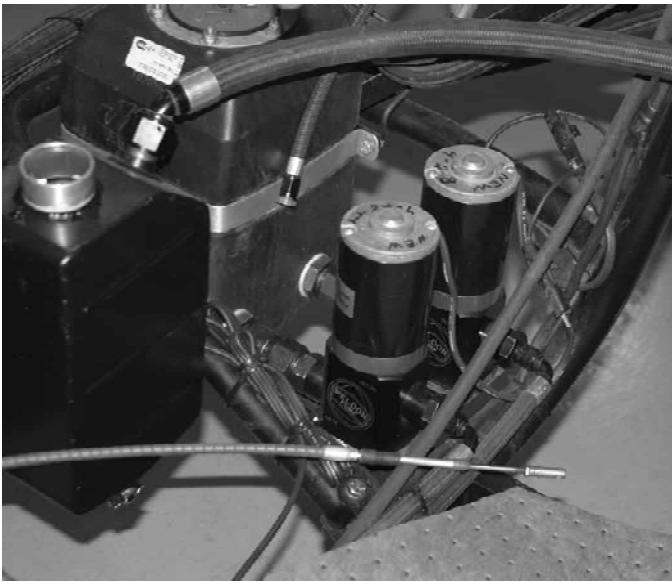


Fig. 177

Hot Rod Car: 2 Weldon 2345 high flow high pressure fuel pumps with Weldon 1021 fuel pressure regulator. Recommended base fuel pressure is 45 PSI static. (Fig. 177)

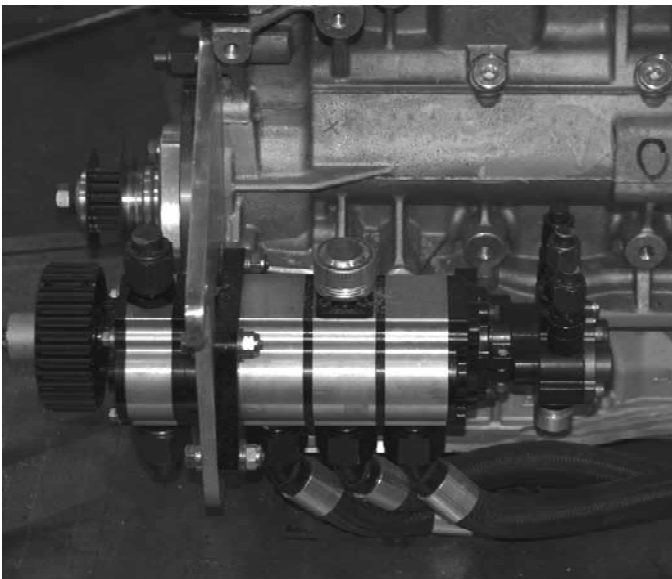


Fig. 178

Pro car: DSR -1 mechanical fuel pump driven off of dry sump oil pump with Weldon 1021 fuel pressure regulator. Recommended base fuel pressure is 75 PSI static. (Fig. 178)

Caution:

Utmost care must be taken with the fuel system components when using Methanol fuel. The fuel system must be flushed with a leaded race fuel after use.

ENGINE MANAGEMENT

- Value system: DFI system 7 for use with distributor

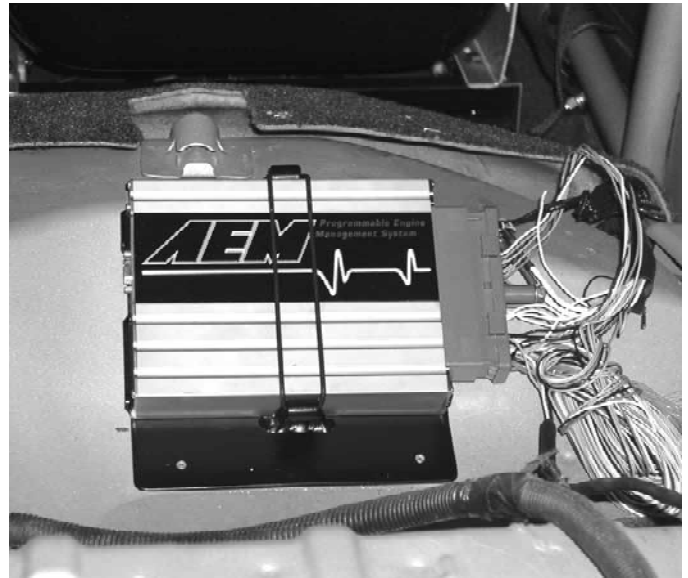


Fig. 179

- AEM Universal EMS for use with coil on plug (Fig. 179)

High end system:

- Pectel T-10
- Motec

IGNITION SYSTEMS

Distributor system:

Drag Race only

- MSD 75314 Programmable Digital 7
 - MSD 8261 Pro Power HVC II Coil
 - MSD 8498 **ECOTEC** Distributor
 - MSD 32769 8.5 mm Spark plug wire kit
- Endurance under 40 PSI Boost (Bonneville)
- MSD 7531 Programmable digital 7
 - MSD 8251 Pro Power HVC Coil
 - MSD 8498 **ECOTEC** Distributor
 - MSD 32769 8.5 mm Spark plug wire kit

COIL ON PLUG IGNITION

TURBOCHARGER



Fig. 180

CAMSHAFT POSITION SENSOR

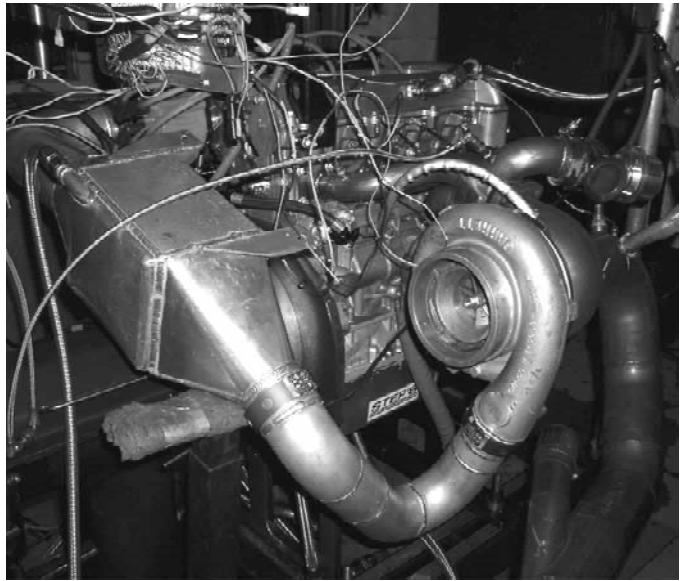


Fig. 182

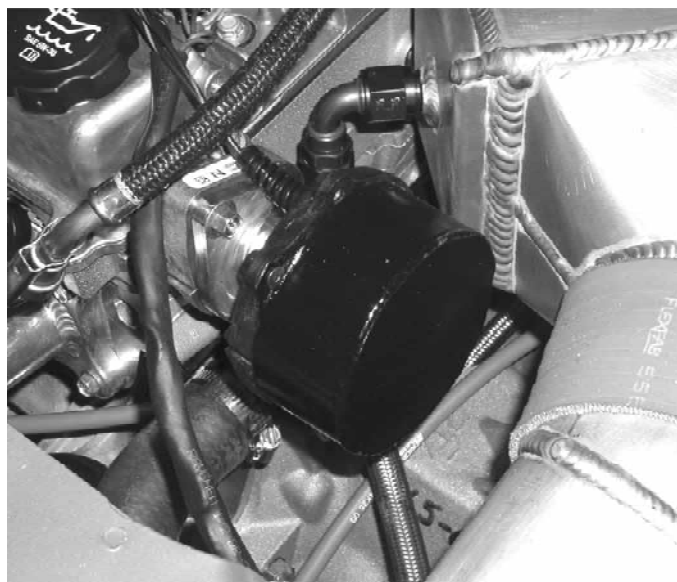


Fig. 181

MSD Distributor used for cam sync on DIS ignition. (Fig. 181)

DIS SYSTEM

Up to 600 hp On Gasoline

- MSD 62153 DIS 4 Plus
- MSD 8207 Blaster SS coils OR
- Honda CBR 1000 Coil on plug coils

The following list shows recommended baseline turbo for a given power level. Check with your preferred turbo dealer for specific turbo recommendations.

400 — 600 hp:

- Garrett GT 35R
- Turbonetics T3/T4 Hybrid
- Innovative SH50BB and GT61BB

600 — 1000 hp:

- Garrett GT 40R
- Turbonetics T4 Series
- Innovative GT76BB

1000 — 1200 hp:

- Garrett GT 42R
- Turbonetics Super T Series
- Innovative GT80BB

1200 — 1400 hp:

- Garrett GT 45R
- Turbonetics Y2K Series
- Innovative GTB83

BOOST CONTROLLER



Fig. 183

Innovative and MSD offer boost controllers specifically designed for drag racing. The Innovative controller changes boost and boost ramp rate based on which gear the transmission is in. (Fig. 183) The MSD system is based on time from vehicle launch.

Both systems output a P.W.M. signal that controls a solenoid to vary pressure on the top of the waste gate. This pressure change opens and closes the waste gate to vary engine boost as required.

Be sure that you have sufficient pressure on top of the waste gate to ensure that the waste gate will stay closed when high exhaust pressure is present. This may require you to limit the pressure going to the bottom of the waste gate. This can be done with a regulator or adjustable pressure blow-off valve in the line going to the bottom of the gate.

WASTE GATES

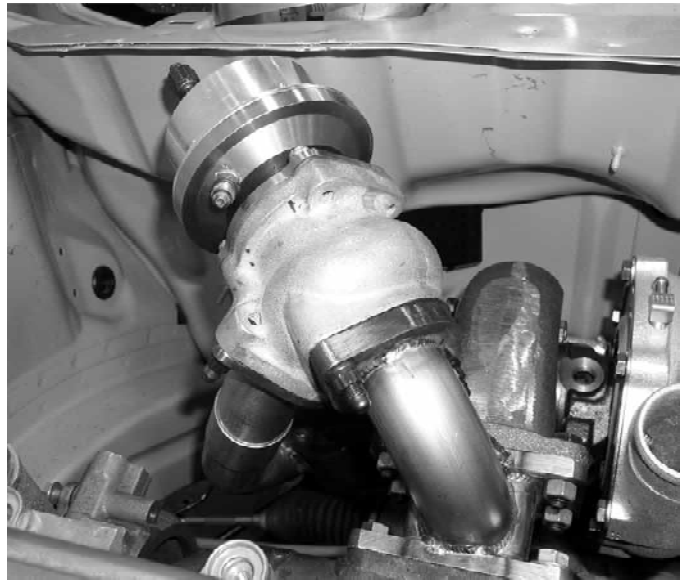


Fig. 184



Fig. 185

ECOTEC racing engines use the following waste gates:

- Innovative Indy Gate
- Tial 42 mm
- HKS 60 mm GTII

In front wheel drive drag racing boost control is critical. The waste gate(s) should be sized to enable the boost controller to reduce boost to a level low enough to control wheel spin in the lower gears.

In extreme conditions it may be necessary to utilize two waste gates. These gates should be plumbed in parallel.

INTERCOOLER



Fig. 186

Air to air and water to air intercoolers reduce the inlet charge temperature to improve performance and reduce spark knock sensitivity. (Fig. 186)

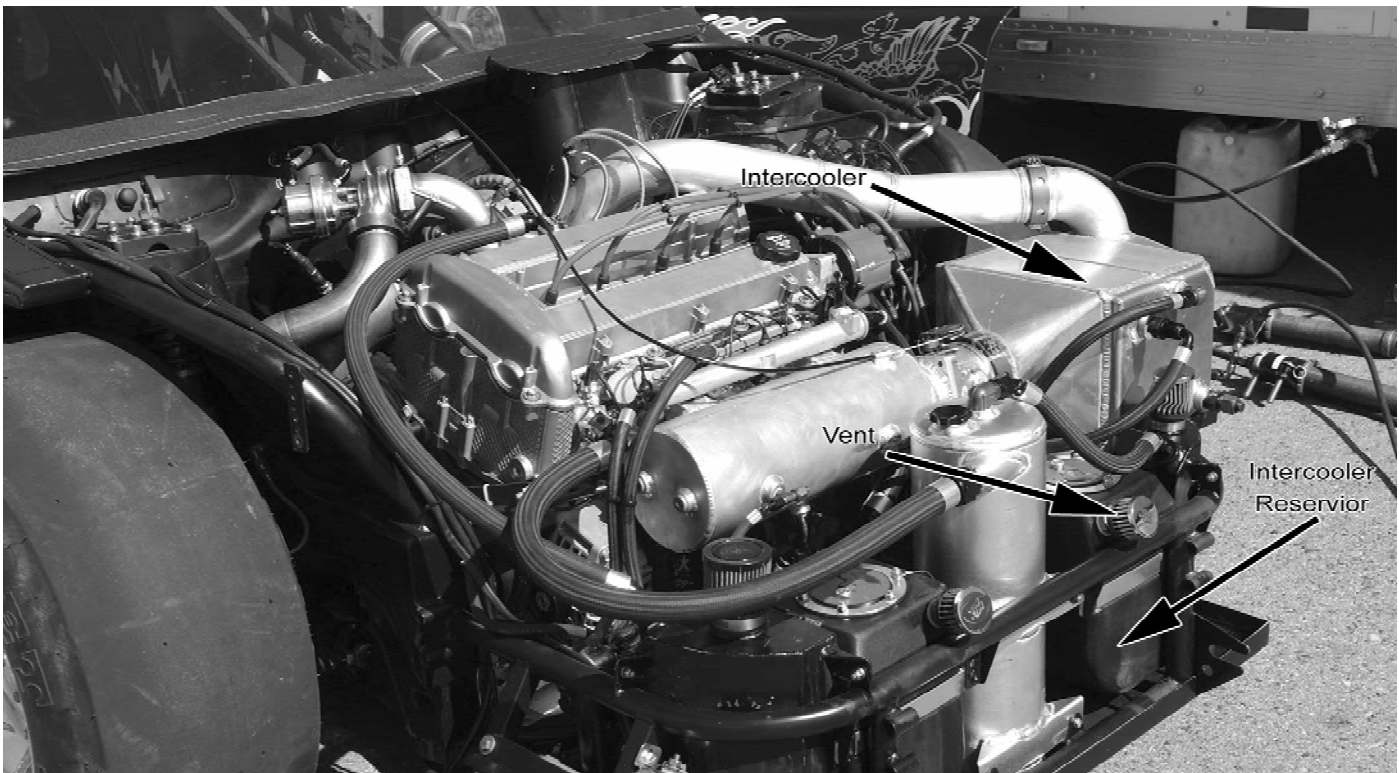


Fig. 187

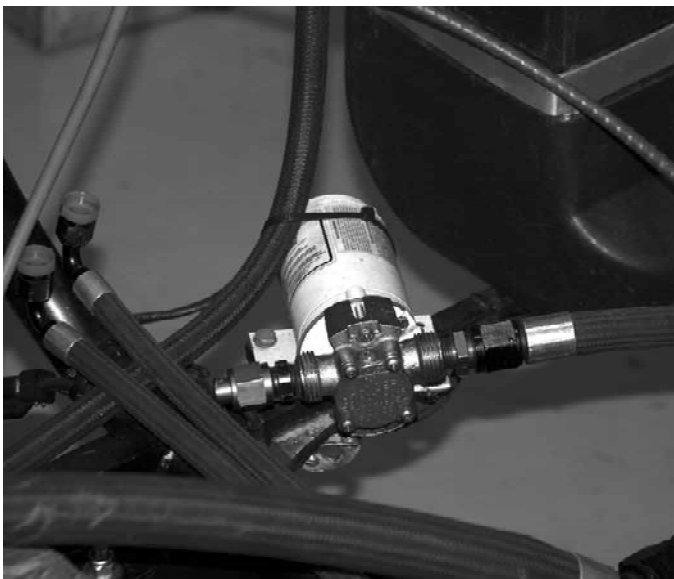


Fig. 188

Aftercooler circulating pump

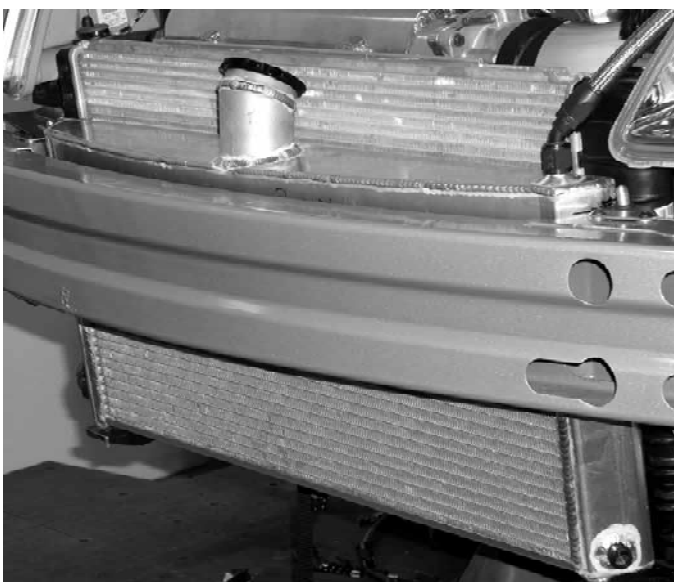


Fig. 189

For street application using a water to air intercooler it is recommended to also use an aftercooler.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS LIST			
Component Description	Ft.Lbs.	In.Lbs.	Lubricant
Cylinder Head Studs in Block	8	—	Blue Loctite
Cylinder Head Stud Nuts	105 3-steps	—	CDM
Crankshaft Main Studs in Block	8	—	Blue Loctite
Crankshaft Main Stud Nuts	65	—	CDM
Crankshaft to Block Peripheral Bolts	15	—	Oil
Balance Shaft Chain Guide Bolts	—	89	Blue Loctite
Balance Shaft Drive Sprocket Bolts	41	—	Red Loctite
Balance Shaft Retaining Bolts	—	89	Oil
Camshaft Bearing Cap Bolts	—	89	Oil
Intake Camshaft Rear Bearing Cap Bolt	18	—	Oil
Camshaft Cover Bolts	—	89	Oil
Camshaft Adjustable Sprocket Bolts	15	—	Red Loctite
Camshaft Sprocket Bolts	70	—	Red Loctite
Camshaft Timing Chain Tensioner	44	—	Oil
Timing Chain Guide Bolts	—	89	Oil
Connecting Rod Bolts	65	—	Molly
Crankshaft Damper Bolt (wet sump)	74+75°	—	Red Loctite
Cylinder Head Front Chain Case Bolts	18	—	Oil
Exhaust Manifold Nuts	13	—	DRY
Exhaust Manifold Studs to Cylinder Head	—	89	Dry
Flywheel Bolts	95 lbs ft	—	Red Loctite
Fuel Rail Bolts	—	89	Oil
Intake Manifold to Cylinder Head Bolts	—	89	Blue Loctite
Intake Manifold to Cylinder Head Nuts	—	89	Blue Loctite
Oil Drain Plug	18	—	Oil
Oil Filter Cap	18	—	Oil
Oil Pan to Engine Block	18	—	Silicone
Oil Pump Gear Cover Plate Screws	—	53	Blue Loctite
Oil Pump Pressure Relief Valve Plug	35	—	Blue Loctite
Oxygen Sensor to Exhaust Manifold	33	—	Anti Seize
Spark Plugs	15	—	Anti Seize
Throttle Body Studs to Intake Manifold	—	6	Blue Loctite
Throttle Body Bolts and Nuts	—	10	Blue Loctite
Throttle Position Sensor Screws	—	18	Blue Loctite
Timing Chain Cover Bolts	13	—	Oil
Timing Chain Guide Adjustment Bolt	—	89	Blue Loctite

TORQUE SPECIFICATIONS LIST			
Component Description	Ft.Lbs.	In.Lbs.	Lubricant
Timing Chain Guide Bolts	—	89	Blue Loctite
Timing Chain Guide Bolts Access Plug	30	—	Oil
Timing Chain Guide Fixed Bolt	—	89	Blue Loctite
Timing Chain Oil Nozzle Bolt	—	89	Blue Loctite
Timing Chain Tensioner Bolts	—	89	Blue Loctite
Water Pump Bolts	18	—	Oil
Water Pump Sprocket Bolts	—	89	Blue Loctite
Water Pump Cover Bolts	—	89	Blue Loctite
Trigger Wheel	15	—	Blue Loctite
Cylinder Head Posts	—	40	Blue Loctite
Flex Plate to Crank Bolts	—	—	—
10 mm x 1.5 x 20 and 3/8-24 x 7/8	70	—	Red Loctite
12 mm x 1.25 x .900"	95	—	Red Loctite
Alternator Belt Tensioner Bolt	40	—	Blue Loctite
Front Pulley to Hub Bolts Taper 5/16 Fine	20 24	—	Blue Loctite
Front Motor Mount	65	—	Blue Loctite
Front Mandrel Bolt 1/2	70	—	Red Loctite

4T65 RACING TRANSMISSION COMPONENTS



This handbook section illustrates parts and modifications that are used to transform a 4T65-E automatic transmission for Off-Highway drag racing. Starting with the heavy duty or supercharged application of the production transmission, the gearbox is modified into a three speed transmission with driver shift control utilizing an aftermarket performance torque converter. The changes have proven to be reliable behind a 600 hp engine and track proven behind a 1000+ hp **ECOTEC** engine.

The information contained in this section of the handbook has been provided by GM Powertrain in conjunction with GM Racing. The photographs shown are from a transmission that is configured for Sport Compact Drag Racing. This handbook attempts to illustrate the changes; however, it is not totally inclusive of all changes needed for a 1000+ hp application.

Extensive modifications have been developed by GM Racing/Hydra-Matic to keep this transaxle constantly performing at high horsepower levels.



Fig. 190

The rear view above shows the oil pan modifications, transbrake location, plumbing, the output speed sensor location and wiring. (Fig. 190)

TRANSBRAKE

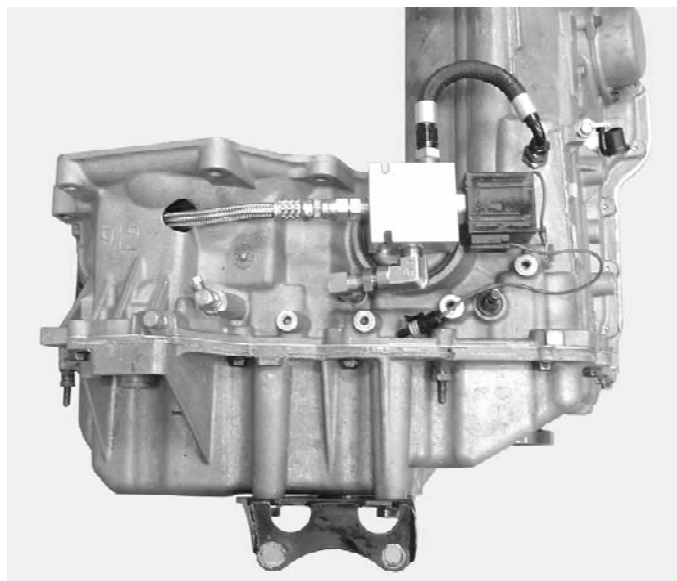


Fig. 191

The transmission brake is mounted externally on top of the transmission case and is operated with an on-off switch by the driver. A transmission brake may not be required on applications below 800 hp. (Fig. 191)



Fig. 192

The transbrake assembly is mounted externally above the reverse band servo cover and requires a 12 volt current to activate it. (Fig. 192)



Fig. 193

The major sub-assemblies of the transbrake are shown above. The check ball assembly is not shown. (Fig. 193)

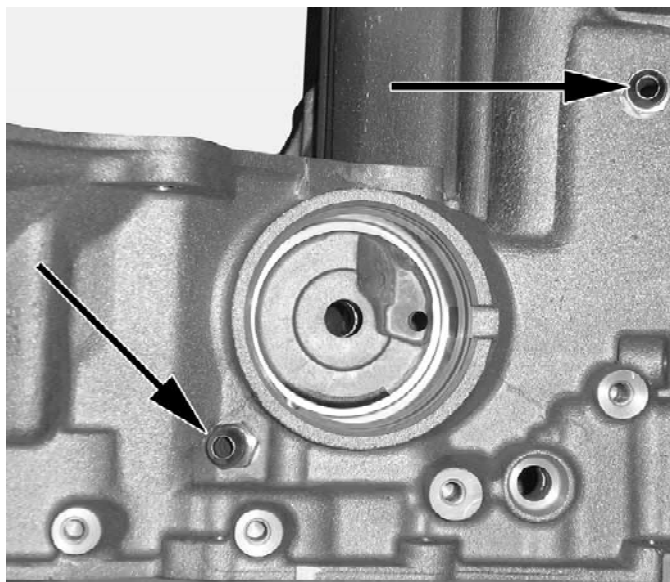


Fig. 194

The two fittings shown in the case are used for the transbrake system. The fitting in the lower left of the view is where low-1st gear oil is routed from the transbrake to apply the reverse band. When the transbrake is released, the oil is exhausted through the fitting shown in the upper right corner of the picture. (Fig. 194)



Fig. 195

A clearance hole through the case bell housing is provided for plumbing of the supply oil to the transbrake. (Fig. 195)



Fig. 197

This is the location of the transbrake pass-thru fitting on the case cover side of the case. Case ribbing is cut back to allow for clearance of the transbrake supply plumbing in this side of the case. (Fig. 197)

TRANSMISSION CASE



Fig. 196

This is the location of the transbrake pass-thru fitting on the torque converter side of the case. Oil is routed from this fitting through the hole in the top of the transmission bell. (Fig. 196)

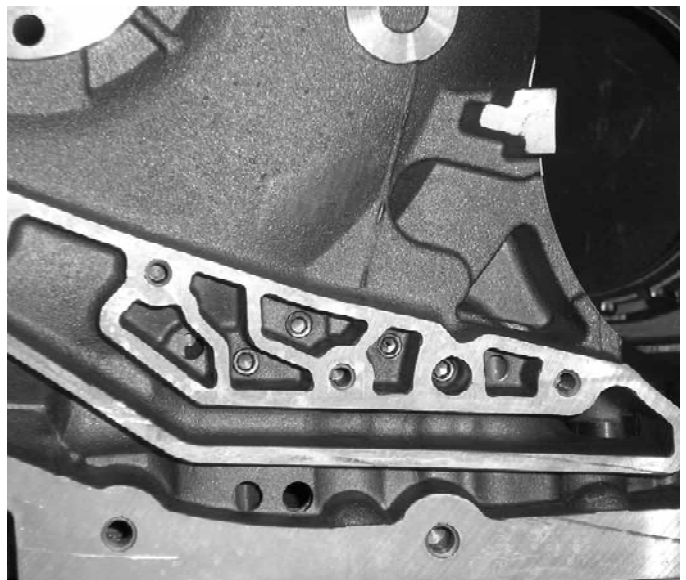


Fig. 198

Three passages are plugged in the lower part of the case because the 2-3 accumulator and the manual 2-1 servo are eliminated in the race unit. This allows two of these plugged passages to be drilled through for use as additional drain hole for the side cover cavity. The 1-2 accumulator is used in the race unit but the 2nd clutch feed oil to it, is reduced. (Fig. 198)

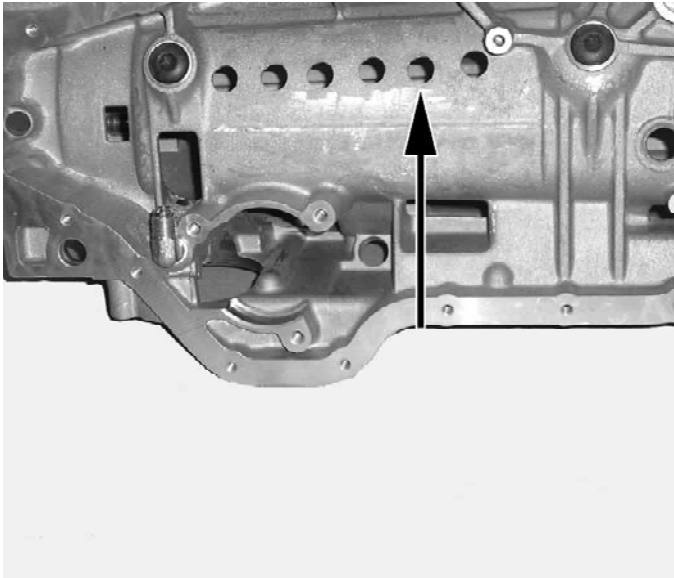


Fig. 199

Six additional oil drain holes have been added to the bottom barrel of the case. The thermal element is eliminated. A fitting is added for direct plumbing of forward servo oil from the lower accumulator housing. (Fig. 199)

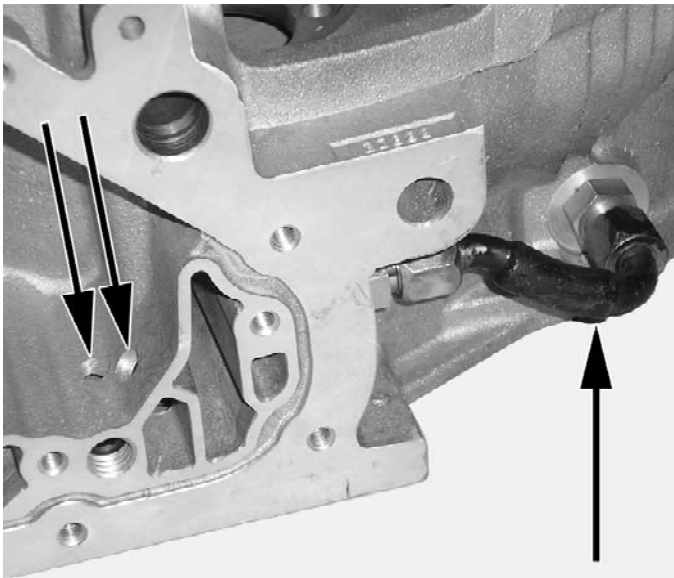


Fig. 200

The outlets of the additional side cover drain back holes in the case is shown above. The 3rd clutch oil passage is also plugged to keep oil from accumulating in the 2-3 accumulator cavity. Also shown is the transmission oil cooler loop. A transmission oil cooler is not required for this application. (Fig. 200)

STATOR SUPPORT



Fig. 201

The O.D. of the drive sprocket support (stator support) is cut to clear the 1" wide x 7/16" pitch drive sprockets. (Fig. 201)

TORQUE CONVERTER



Fig. 202

The torque converter is manufactured by Coan Transmissions & Converters as specified for each application. (Fig. 202)

INPUT SHAFT



Fig. 203

The race input (or turbine) shaft is shown above on the right. The race shaft has increased wall thickness and the torque converter seal groove has been removed. In addition, the diameter of the shaft where the two torque converter seals are seated, has been reduced. (Fig. 203)

OIL PUMP SHAFT



Fig. 204

The race pump shaft is on the top. This shaft is modified to fit inside the thicker walled turbine shaft. (Fig. 204)

DRIVE CHAINS



Fig. 205

Shown is the production dual Gemini chain and sprockets. (Fig. 205)



Fig. 206

The drive chain in the race unit is a 1" wide x 7/16" pitch chain with specially designed sprockets. (Fig. 206)

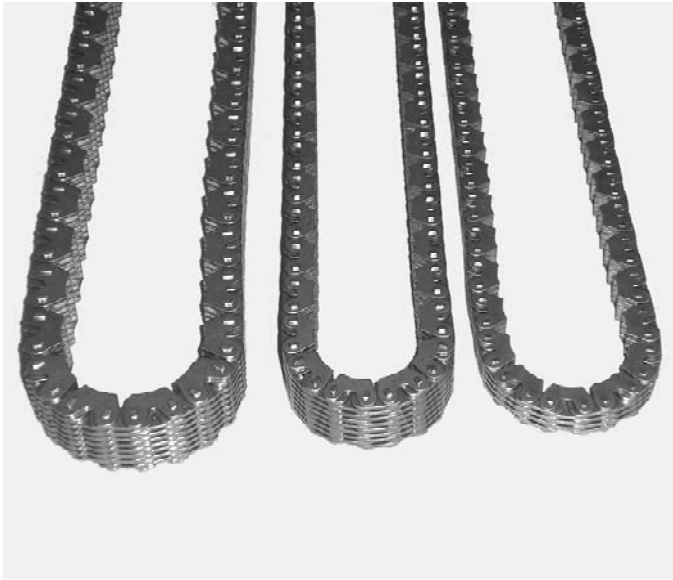


Fig. 207

The chain on the right (two required per transmission) is a production chain. The chain in the center, 1" wide x 3/8" pitch, was initially developed for the race unit, but was replaced by the 1" wide x 7/16" pitch chain on the left to handle the high horse power and torque. The 1" wide x 3/8" chain is excellent for applications up to 800 hp. (Fig. 207)

SECOND GEAR CLUTCH

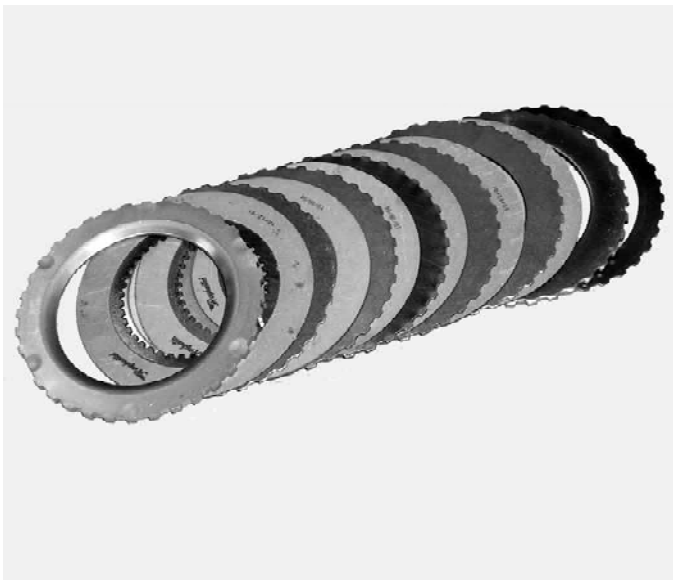


Fig. 208

The production 2nd clutch pack is used in the race unit. (Fig. 208)

THIRD GEAR CLUTCH

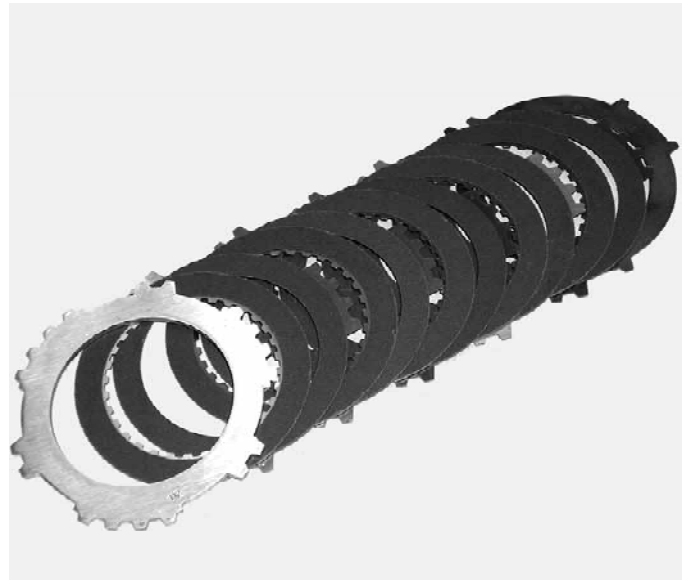


Fig. 209

The production 3rd clutch pack is not used in the race unit. (Fig. 209)

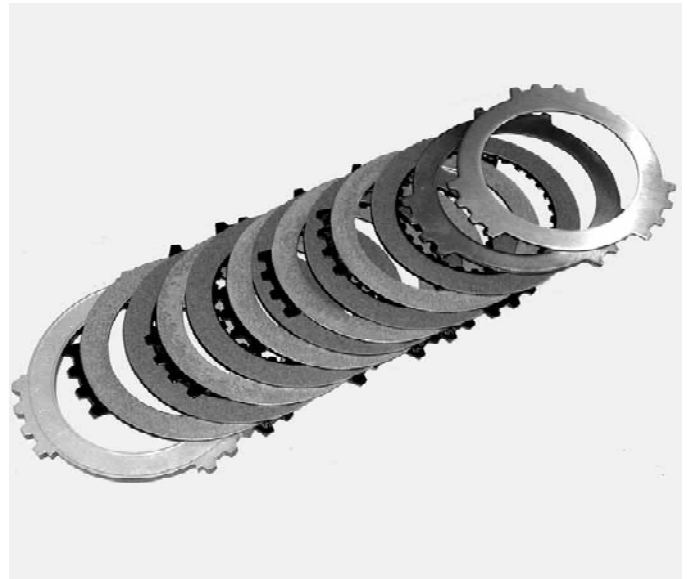


Fig. 210

The racing 3rd clutch pack is a specially designed Z-Pack 3rd clutch pack from Raybestos Powertrain. (Fig. 210)



Fig. 211

The race unit uses a specially designed backing plate from Raybestos Powertrain for the Z-Pack 3rd clutch. (Fig. 211)

SINGLE WRAP BAND



Fig. 212

The production reverse band is modified to be a single wrap band for quicker release of the transbrake. (Fig. 212)

OIL DAM



Fig. 213

The production oil lube dam has been modified so that it can be assembled with the 4.0 final drive components. (Fig. 213)

PLANETARY SET



Fig. 214

The input planetary carrier and reaction planetary carrier are stock V-8 application components. The gear sets are used without modifications. (Fig. 214)

SPRAGS



Fig. 215

The current production pawl type one-way clutches are used for 3rd and input without modifications. The one-way clutch on the left has the retainer removed to show internal components. (Fig. 215)

SUN GEAR AND SHAFT

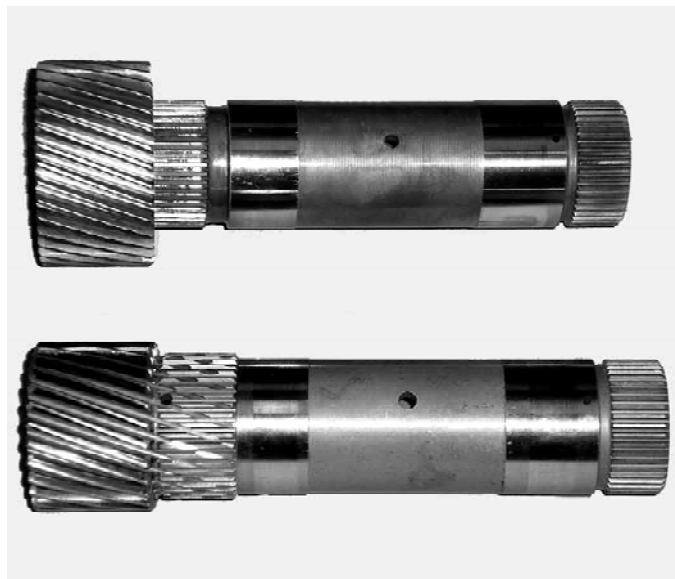


Fig. 216

The production sun gear and sun gear shaft on top is replaced by a one-piece design in order to package a final drive gear ratio change to 4.0. The one piece sun gear / sun gear shaft requires a revised park gear. (Fig. 216)

PARK PAWL GEAR



Fig. 217

The I.D. spline on the production park gear (component on the left) is enlarged to fit onto the one piece sun gear / sun gear shaft. (Fig. 217)

TORSEN® DIFFERENTIAL



Fig. 218

The production differential is replaced by a torque-biasing differential. The pinion carrier in the assembly is also replaced. The pinions in the carrier shown above are for a 4.0 final drive ratio. (Fig. 218)

ACCUMULATOR AND FORWARD SERVO



Fig. 219

Production differential and pinion carrier. (Fig. 219)

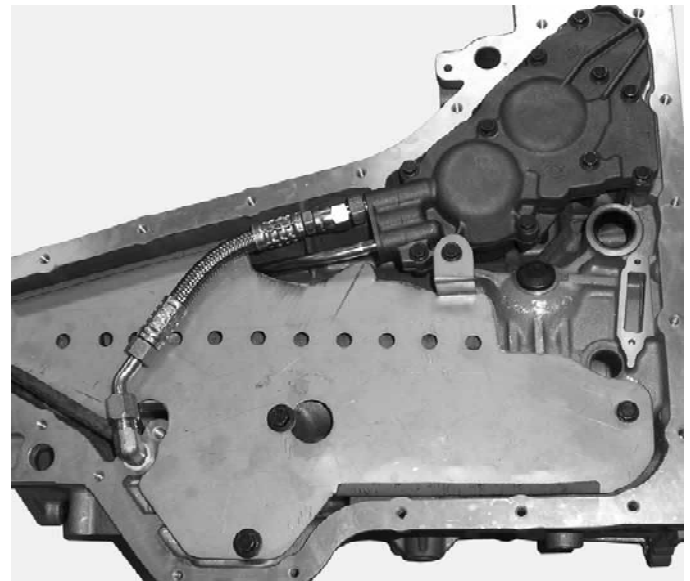


Fig. 221

Shown is the race unit with the lower accumulator assembly, oil baffle plate, and forward servo plumbing installed. Note that the thermal element and manual 2-1 servo assembly are missing along with the oil pick up tube and oil level indicator stick. The lower accumulator assembly does not contain the 2-3 accumulator components. (Fig. 221)

RACE OUTPUT FLANGES



Fig. 220

The race output flanges were designed to work with Porsche 930 CV joints. (Fig. 220)

MODIFIED FLUID PICK-UP



Fig. 222

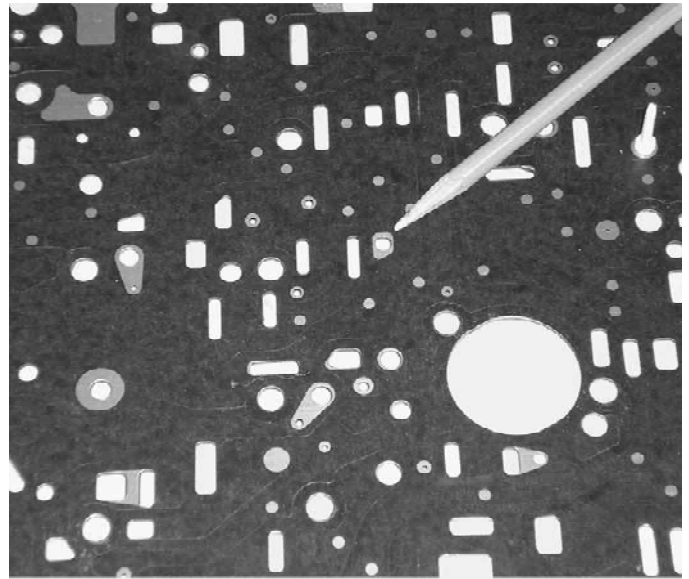
The race unit fluid pick-up tube has been designed to work with a deep angled pan. The production filter is not used. A fine mesh screen is used on the inlet to filter the transmission fluid. (Fig. 222)

RACE TRANSMISSION PAN 22°**Fig. 223**

This deep oil pan has been designed designed to work with a 22° rotation of the powertrain in the vehicle. When installed in the vehicle, the bottom of the pan is horizontal. (Fig. 223)

MODIFIED TUBE AND INDICATOR**Fig. 224**

A production Grand Prix, Bonneville, Monte Carlo, etc. transmission fill tube is shortened at the fill end and lengthened at the pan end to accomodate the deeper pan. The locking dip stick is a shortened production 4L65-E GM light-duty pickup trucks fluid dip stick. (Fig. 224)

SEPARATOR PLATE**Fig. 225**

Only modification to the valve body separator (spacer) plate is to enlarge the #2Y or #33 (input clutch feed) hole to a diameter of 0.160 inches. (Fig. 225)

VALVE BODY**Fig. 226**

Shown above is one of the two modifications to the race unit valve body. The fluid through the #5 reverse servo check ball is re-routed to act as a check valve so that when the transbrake is applied, the reverse oil does not leak through the manual valve. (Fig. 226)

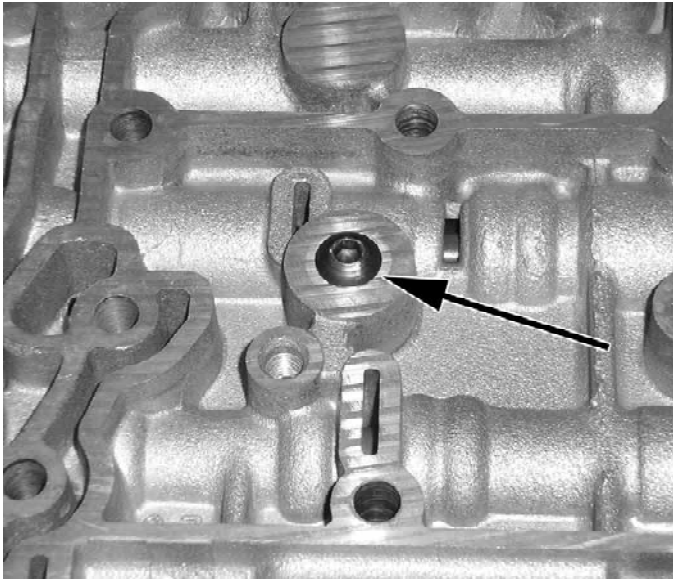


Fig. 227

The other modification to race unit valve body is the plugging of the torque converter clutch oil port to the pressure switch manifold (PSM). The PSM is eliminated from the race unit. (Fig. 227)

PRESSURE REGULATOR

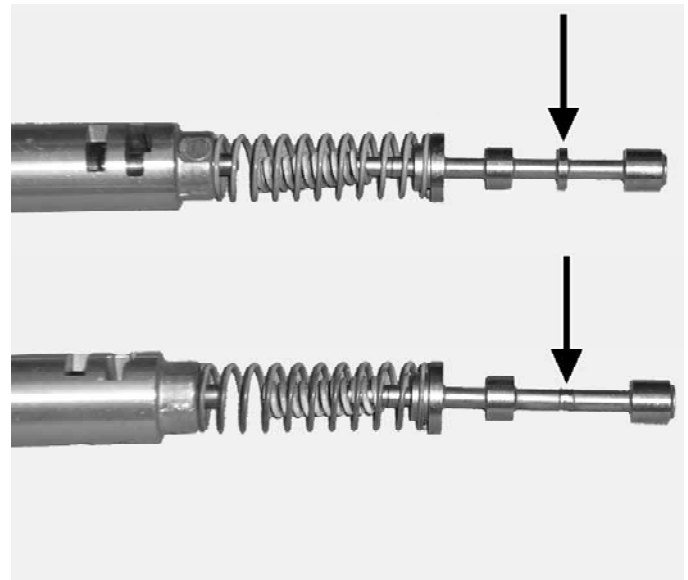


Fig. 229

The second modifications to the pressure regulator assembly is the removal of the middle spool of the pressure regulator valve. By removing the spool, oil flow to the converter is never interrupted. (Fig. 229)

CASE COVER



Fig. 228

A spring has been added between the line boost valve and the valve bore plug. It has to maintain a 300 PSI line pressure. (Fig. 228)

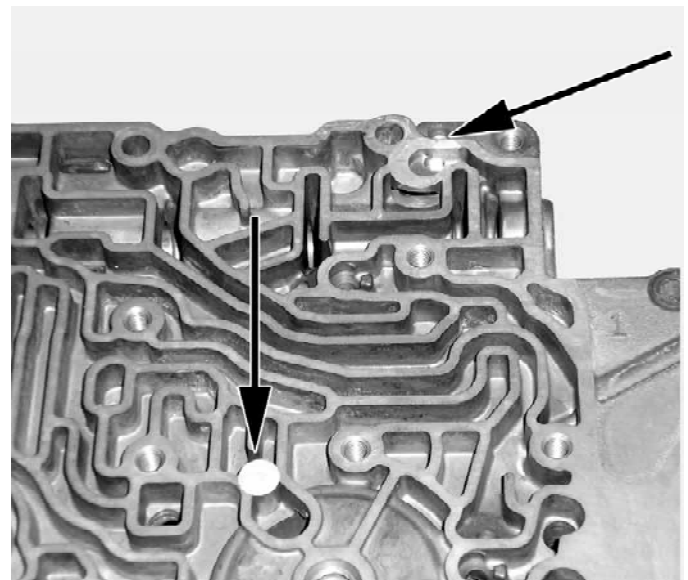


Fig. 230

Shown above are two modifications to the race unit case cover (channel plate). Shown in the upper right corner is the rerouting for the #5 reverse servo check ball. Also shown is the plug in the 4th clutch oil passage to 3-4 accumulator. (Fig. 230)

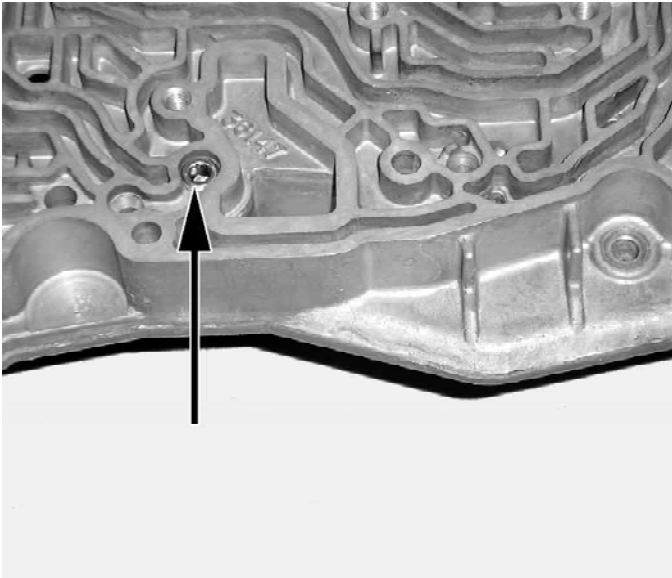


Fig. 231

The torque converter blow-off valve is removed and is plugged in the case cover. (Fig. 231)

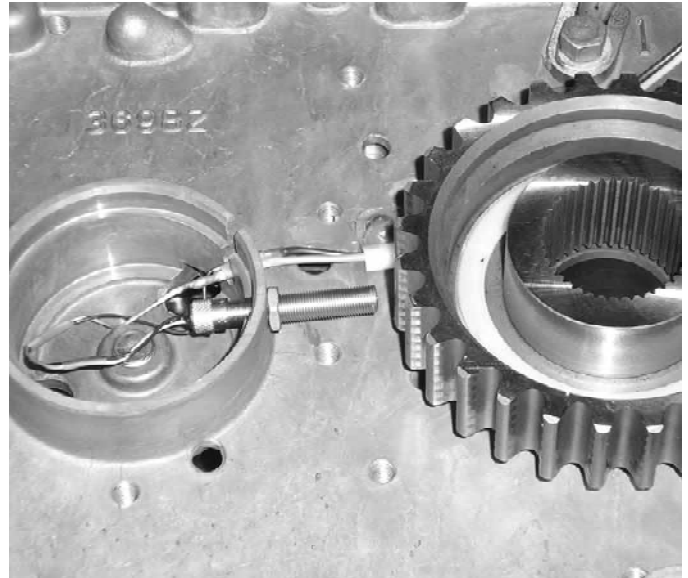


Fig. 233

A closer view showing the Honeywell magnetic pickup (input speed sensor) mounted in the 3-4 accumulator bore with the 1" drive sprocket positioned on the case cover. The 3-4 accumulator piston pin bore is plugged because the 3-4 accumulator components are not used in the race unit because it is a three speed transmission. (Fig. 233)

SHIFT CONTROLS



Fig. 232

Shown above is the case side of the case cover with the plumbing used to supply the trans brake with low-1st gear oil. A 1" drive sprocket and the wire leads from the input speed sensor are also shown. The production input speed sensor is removed and its bore plugged. (Fig. 232)



Fig. 234

4T65E SHIFT ALGORITHM

The 4T65E transmission is shifted with two shift solenoids. The ground sides of the solenoids are pin A and pin B in the pass through connector. Pin E requires switched 12V. The shift algorithm of the 4T65E is:

SHIFT ALGORITHM OF THE 4T65E		
	Solenoid A	Solenoid B
1st gear	on	on
2nd gear	off	on
3rd gear	off	off
4th gear	on	off

An easy and cheap way to shift the 4T65E is with two toggle switches. The toggle switches need to switch ground to pins A and B in the pass through connectors. To operate the transmission turn both switches on. This will put the transmission in 1st gear. To shift into 2nd gear shut off the switch to solenoid A off. To shift into 3rd gear shut off the switch to solenoid B. For 4th gear turn the switch for solenoid A back on.

SHIFT CONTROLLERS

TCI and CompuShift offer automatic shift controllers that will operate the 4T65E Transmission. These are excellent choices for street strip applications.

An inexpensive alternative for drag racing and occasional street use is the MSD Programmable shift controller part number 7559. (Fig. 234) This controller was developed to shift a Lenco type transmission. With a little ingenuity it can easily be adapted for use on the 4T65E transmission.

Two relays are needed to convert the system for this application. The MSD controller needs two inputs a: Launch / Reset and Shift Override. The Launch / Reset button resets the controller to first gear both in electrical outputs and in the shift sequence. The Shift Override button manually up-shifts the controller. In first gear the controller

does not output a signal. When the 1-2 shift is made it turns on a 12v signal. When the 2-3 shift is made another 12V signal is turned on. Since the solenoid needs a ground to activate, relays are needed. Ground should be connected to the input of two relays. The Normally Closed output of the 1st relay should be connected to pin A on the transmission pass through connector. The normally closed output of the 2nd relay should be connected to pin B of the transmission pass through connector. One side of the coil of each relay should be connected to ground. The 1st shift output from the transmission controller should be connected to the other side of the coil of the 1st relay. The 2nd shift output from the transmission controller should be connected to the other side of the coil on the 2nd relay. The normally open side of the relay can be used for gear indicator lights. Two lights can be connected to power and the other side of the lights connected to the normally open side of the first and second relays.

When the transmission is in 1st both lights will be off, in second the 1st light will turn on and in 3rd the second light will come on.

- MSD Programmable Shift Controller PN 7559 (Fig. 234)

TRANSMISSION FLUID INFORMATION

Fluid Type: GM Dexron® III (part number 9985912) or Allison Transmission Fluid: TranSynd™. TransSynd™ is a fully synthetic automatic transmission fluid that is used in the 4T65 race transmissions for Sport Compact Drag Racing.

Fluid Quantity: Fluid fill quantity will depend on the oil pan configuration and whether the torque converter is dry. Past experience has shown that about twelve quarts are added to the 4T65 transmission with a dry torque converter. Always check the fluid level at operating temperature and while the engine is idling. Do not overfill - keep the level below the spinning components of the transmission to reduce foaming of the fluid. Track experience has found that checking the oil level at engine idle and in first gear with brakes applied produces a consistent readable oil level indication on the dip stick.

NOTES

4T65E PERFORMANCE TRANSMISSION PARTS LIST

PARTS LIST		
DESCRIPTION	PART NUMBER	SOURCE
4T65—E Assembly for Race Applications only	CPT700	GM Racing
1"x7/16" Sprocket/Chain Set, (Ratio 1) 28 tooth drive, 32 tooth driven, 7/16" Chain, Drive Sprocket support Assy.	CPT701	GM Racing (4M Sprocket, BW Chains)
1"7/16" Sprocket/Chain Set, (Ratio 2) 29 tooth drive, 31 tooth driven, 7/16" Chain, Drive Sprocket Support Assy.	CPT702	GM Racing
1"x3/8" Sprocket/Chain Set, (Ratio 1) 33 tooth drive, 37 tooth driven, 3/8" Chain, Drive Support Assy.	CPT703	GM Racing
1"x3/8" Sprocket/Chain Set, (Ratio 2) 35 tooth drive, 35 tooth driven, 3/8" Chain.	CPT704	GM Racing
LINK ASM—DRV (7/16" Pitch Chain)	CPT705	GM Racing
LINK ASM—DRV (3/8" Pitch Chain)	CPT706	GM Racing
SHAFT ASM—TURBINE (Input Shaft Assembly) Turbine Shaft and Sleeve (800 hp application)	CPT707	GM Racing
SHAFT ASM—TURBINE (Input Shaft Assembly) Turbine Shaft and Sleeve and pump shaft (1200 hp application)	CPT708	GM Racing
3rd Gear Clutch Pack	CPT709	Raybestos Z-Pack (Version 2's P/N: RZP003)
Differential and Final Drive Assembly 3.29 incl. Torsen, pinion gears, pins	CPT710	GM Racing
Differential and Final Drive Assembly 3.29 without gears & pins	CPT711	GM Racing
Differential and Final Drive Assembly 4.0 incl Sun and Park Gears Sun gear and Sun gear shaft GEAR—PARK	CPT712	GM Racing
930 CV Output Flange RH	CPT713	GM Racing
930 CV Output Flange LH	CPT714	GM Racing
Adapter Plate — ECOTEC to 4T65	CPT715	GM Racing (Bates)
Template for Bell—housing pattern	CPT716	GM Racing
4T65—E CASE Assembly w/ increased bell—housing wall thickness	CPT717	GM Racing
Torque Converter		Coan
Planetary Assembly	24225850	GM Service Part
Tech Manual 4T65	—	Service Manual

NOTES

COBALT PHASE5

INTRODUCTION



Fig. 235

Cobalt Phase5 is a high-performance race car chassis built with many factory stock production parts, most with minor or no modifications. This package was designed for Sportsman Class Racing. The development vehicles built run in the high 11's at over 120 MPH with 22 PSI of boost.(Fig. 235)



Fig. 236

POWERTRAIN

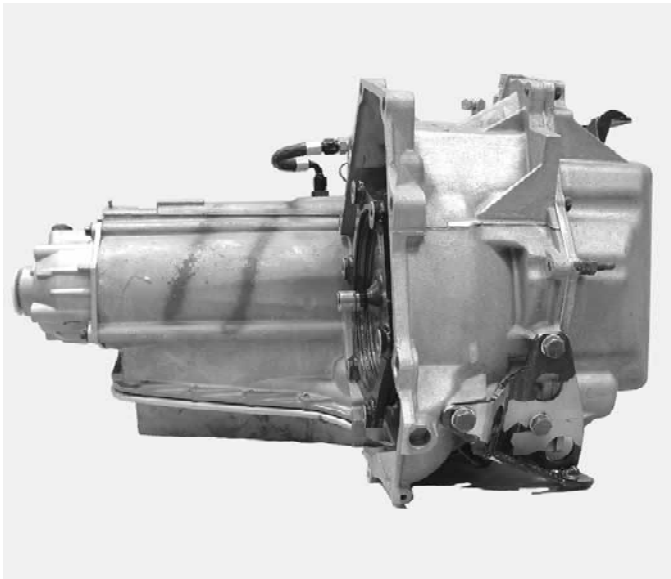


Fig. 237

The powertrain is a 550 hp **ECOTEC** 4-cylinder turbo with a modified 4T65 transmission. (Fig. 237)

ENGINE INSTALLATION



Fig. 238

Four solid engine mounts are used at the engine and transmission. These mounts tilt the engine forward in the chassis for proper alignment with the axles when the vehicle is lowered. GM part number CPT618, CPT619, CPT620 and CPT621 (Fig. 238)



Fig. 239

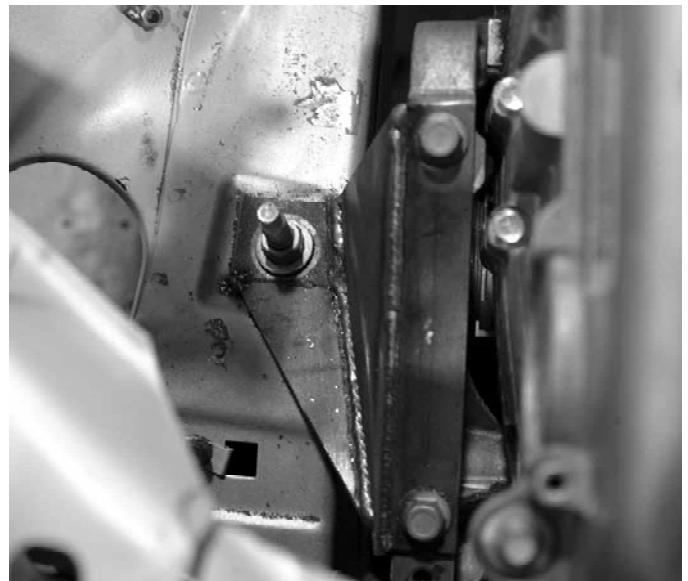


Fig. 240

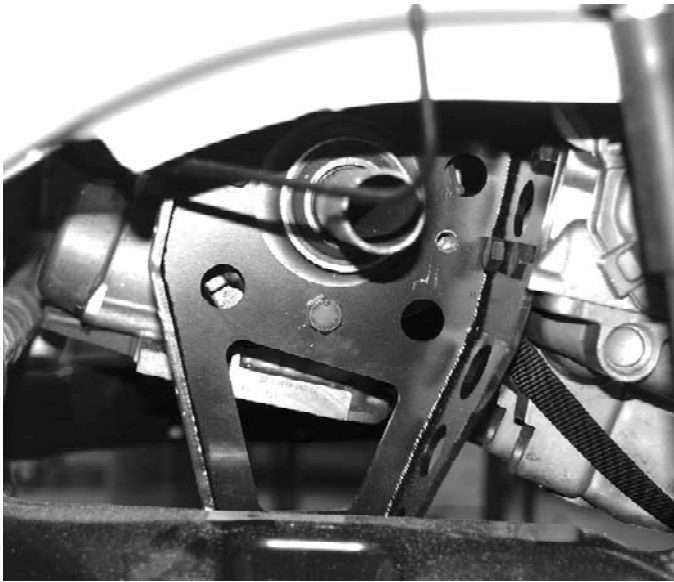


Fig. 241

The 4T65 Cobalt/**ECOTEC** mounts are used on the powertrain. A plate to adapt the **ECOTEC** engine to the 4T65 transmission completes the powertrain mounting setup. (Fig. 241)

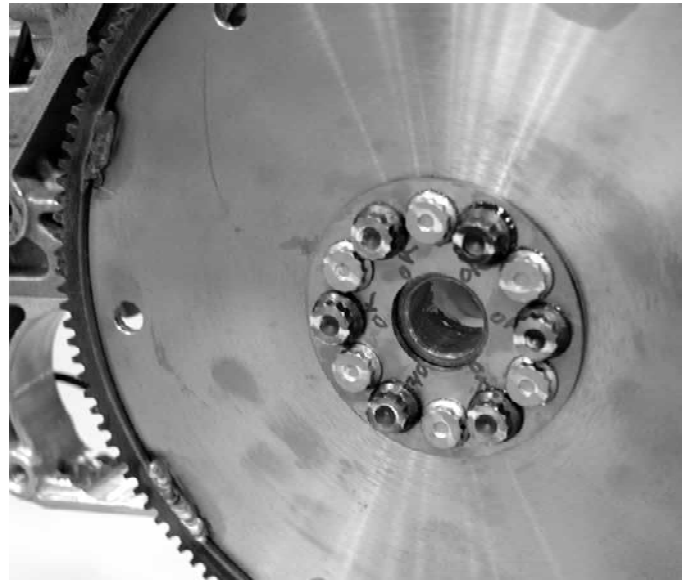


Fig. 243

Mounting the flex plate to the crank is critical. Use NEW factory bolts (GM part number 90236537) or ARP bolts part number 203-2802 with Red Loctite. Use 7/16 fine ARP flex plate bolts (part number 200-2802) to secure the torque converter to the flex plate. The Bates flex plate has one tight tolerance bolt hole and five with extra clearance. Install and “snug” the tight tolerance bolt first. Be sure the torque converter is against the flex plate before turning over the engine and installing the next bolt. A high-strength flex plate for this package is available from Bates Engineering (part number ESGR0500). (Fig. 243)



Fig. 242

When installing the adapter plate on the engine, the production dowels must be shortened to ensure the adapter plate sits flush on the engine block. We recommend using 7/16” studs for the transmission side of the adapter plate. This makes the assembly process much easier. Make sure there is enough clearance between the block, oil pan, and surrounding area before installing the transmission. Install the transmission blanket on the transmission BEFORE installing the transmission on the engine. (Fig. 242)

A transmission safety blanket is used on the Cobalt Phase5 Race Car. This is required safety equipment per NHRA/

COOLING SYSTEM

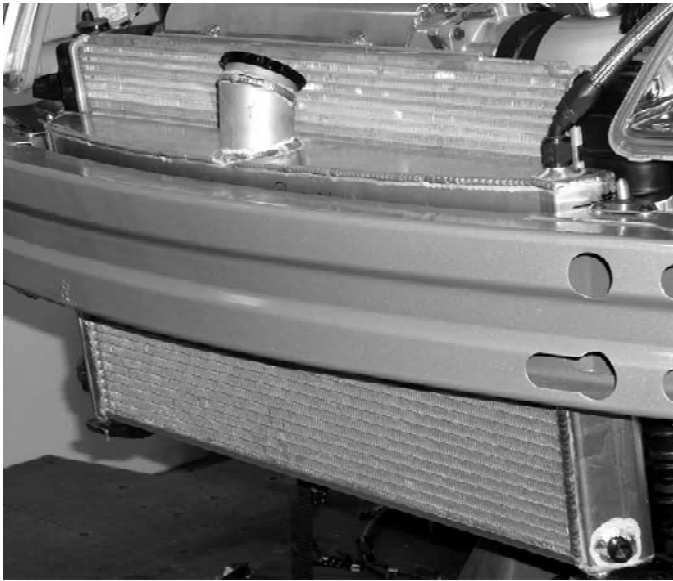


Fig. 244

The Cobalt Phase5 cooling system uses the stock **ECOTEC** water pump with a modified plumbing to clear the transmission adapter plate. For racing applications, remove the thermostat for maximum flow. (Fig. 244)

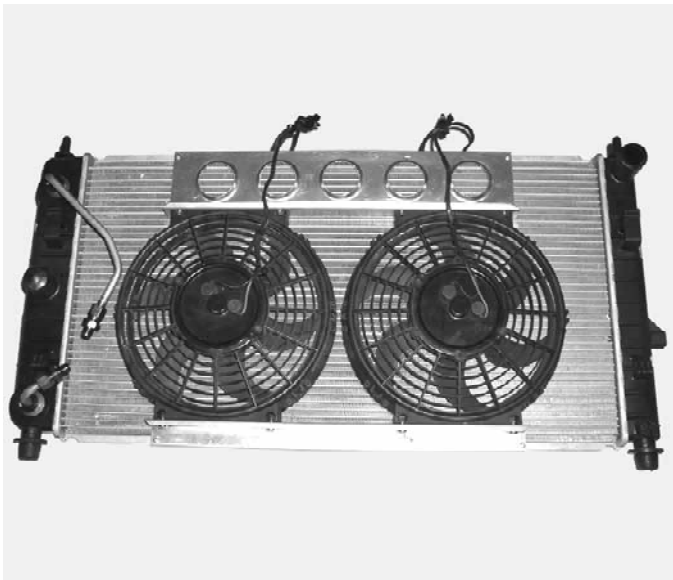


Fig. 245

The stock radiator is more than adequate with the stock electric cooling fan. No special modifications are necessary to achieve proper cooling system performance. Install a temperature controlled switch (with a manual override) for the fan. (Fig. 245)



Fig. 246

The lower production radiator mounts can be maintained. Modify upper mounts as shown. This will allow the radiator to tilt forward and provide enough space for the intake manifold. (Fig. 246)



Fig. 247

Use the production coolant bypass system to cool the turbo. The water should run through the turbo and heater core in series. (Fig. 247)



Fig. 248

Move the coolant expansion tank to the passengers side fender well. Install a “T” in the radiator return line to allow for cooling system filling. (Fig. 248)

FUEL SYSTEM

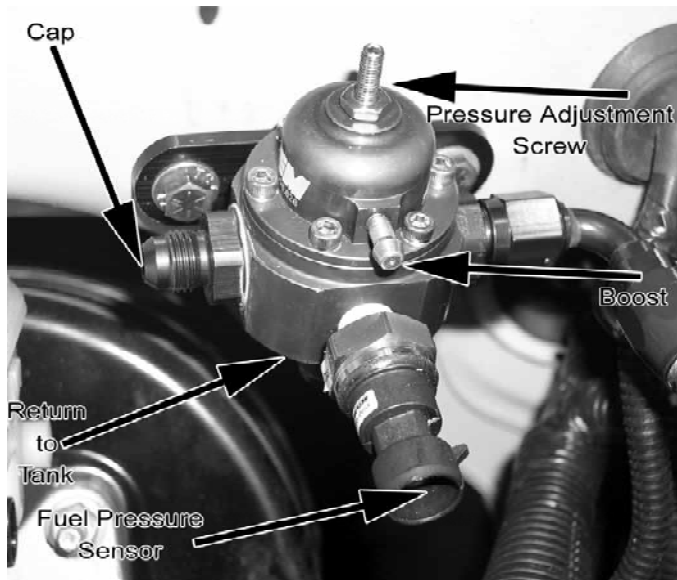


Fig. 249

The Cobalt Phase5 has port fuel injection and a turbocharger, which require a special fuel pump and pressure regulator. As boost rises, the fuel injector needs more pressure to overcome the increasing pressure in the intake manifold and spray the proper amount of fuel. The special regulator has a boost pressure sensing line which allows the regulator to increase fuel pressure by one pound for every pound of boost. This keeps differential pressure constant across the injector. (Fig. 249)

FUEL PUMP

To choose a fuel pump for blown applications use the following rule:

- Flow in GPH = hp times .7 at Base Fuel Pressure + Desired Boost.
- For example, if you expect the engine to reach 600 hp at 28 PSI boost and you plan to run 60 PSI of base fuel pressure, your pump must be capable of AT LEAST 420 lbs/HR fuel flow at 88 PSI.
- SX and Weldon make excellent pumps for these applications.



Fig. 250

The stock fuel line bundle can be used for fuel supply and return. Adapting AN fittings to the factory lines is the preferred method. (Fig. 250)

FUEL TANK



Fig. 251



Fig. 252



Fig. 253

Modify the production fuel tank to provide a pickup and return for the performance fuel system. In the Cobalt, remove the fuel sender assembly. Add two holes to the bottom of the sender reservoir. This assures that the aftermarket fuel pump has adequate inlet flow. Modify the production fuel sender assembly. (Fig. 253)

ELECTRICAL SYSTEM

The electrical system is very complicated and should be modified by an expert. Some of the items that must be considered are:

- MSD/Distributor
- AEM Controller
- Fuel Pump
- Transmission/Transbrake
- Gauges
- Nitrous Control/Turbo Control
- Engine/ Vehicle Sensors
- Injectors

The Cobalt has a Body Control Module (BCM) that controls all of the electrical components in the car (except the engine and transmission). The BCM continues to function if an aftermarket powertrain controller is installed.

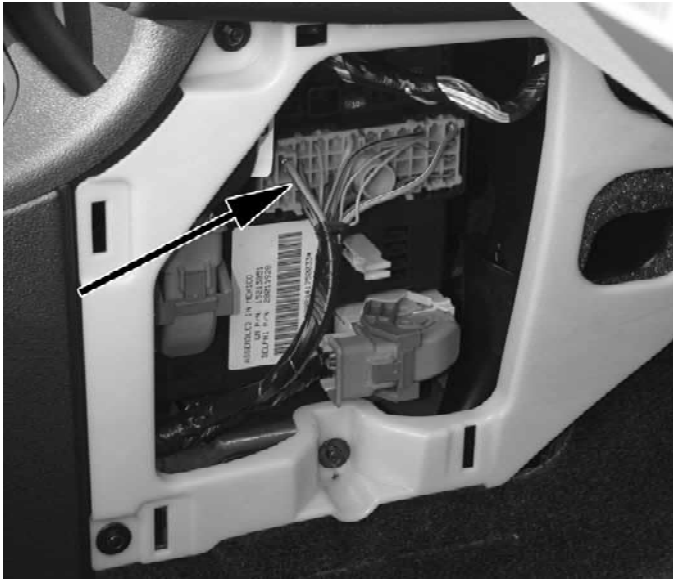


Fig. 254

The dashboard will not function because it receives information from a production ECM. If the battery is relocated, connect the 10 gauge wire that runs back to the trunk to the newly relocated battery. Be sure to fuse this line. A 50 amp fuse should be sufficient. (Fig. 254)



Fig. 255

Relocate the production under hood fuse box to the driver side fender. This makes powertrain removal easier and adds room for the intercooler and induction system. (Fig. 255)

The ignition switch can still be used to control switched power. Use a low current switched circuit from the production electrical system and use this signal to control a high current relay. This allows for control of many components from the production switch.

SWITCHES

An ideal mounting location for the electrical control switches is behind the shifter. Three switches are needed: Starter, Fuel Pump and Fan/Intercooler. Use high quality, 30 amp switches. An alternate method is to mount a switch panel on the roll cage.

EXHAUST SYSTEM



Fig. 256

One of the keys to success in FWD drag racing is boost control. The waste gate is a major key to making this work. It is critical to use a large enough waste gate to reduce the boost enough to control vehicle wheel spin. (Fig. 256)

Waste gates are available from Tial, Turbonetics and Innovative. Contact a technical expert at one of the listed manufactures for proper waste gate application information.

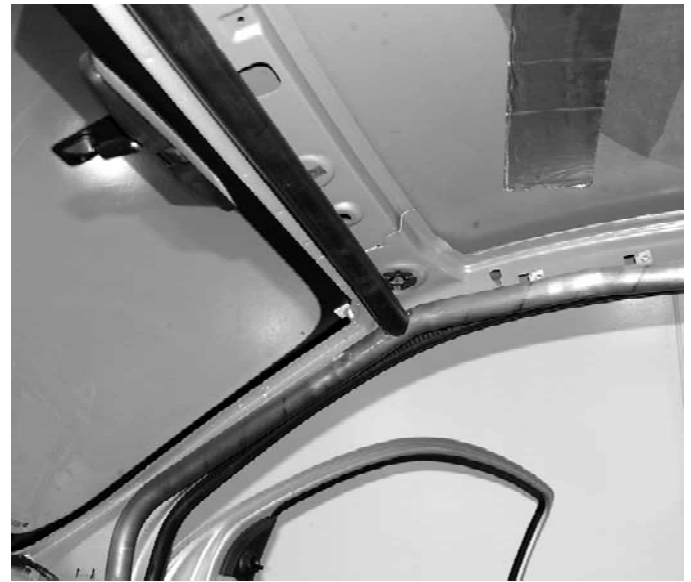
The waste gate should be plumbed into a minimum of a 3" exhaust pipe. The exhaust pipe exit should be as short as possible, without compromising vehicle components due to heat.

CHASSIS SAFETY MODIFICATIONS

ROLL BAR KIT

**Fig. 257**

A waste gate adapter is available from GM Racing part number CPE719, which is inserted between the exhaust manifold and turbo. (Fig. 257)

**Fig. 259****Fig. 258**

The Hahn Racecraft Manifold is a good choice for a turbo exhaust manifold for a 500 hp **ECOTEC**. It is a short, log-type manifold that offers good flow and excellent packaging. It uses a T03 turbo flange which is adequate for this power level. (Fig. 258)

**Fig. 260**

The tubular chassis is safety checked and certified as is any other race car chassis. The six-point roll cage kit is available from Roush Industries (part number 30-412-0019). (Fig. 260)

SEAT BELT HARNESS

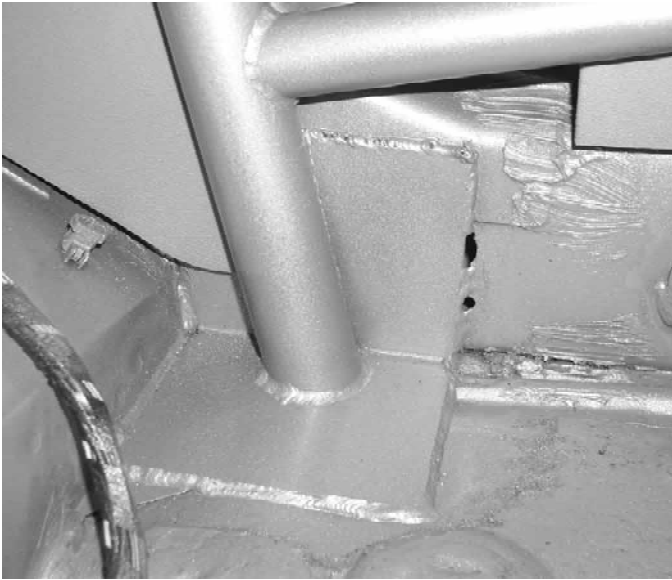


Fig. 261

We recommend that at least an 1/8" steel plate be welded to the uni-body to attach the cage. This minimizes the risk of the cage puncturing the uni-body in case of a rollover. (Fig. 261)



Fig. 263

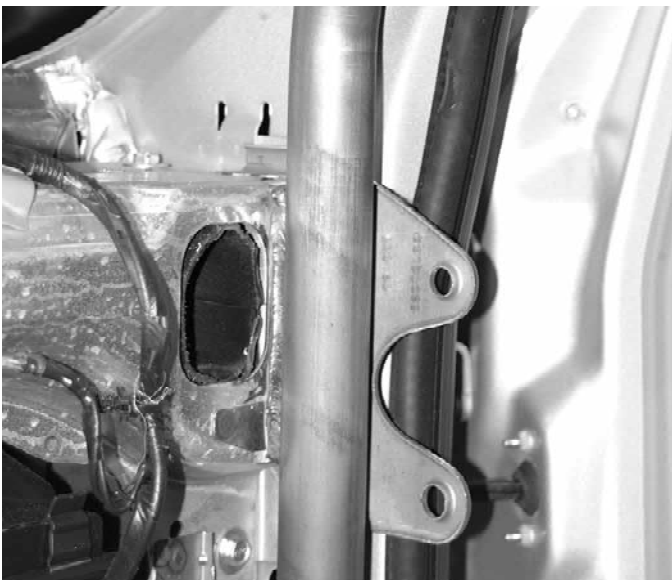


Fig. 262

To increase the strength of the cage, weld the front down tubes that go through the dash, directly to the steel dash crossbrace. (Fig. 262)

SFI high density foam roll bar padding is suggested on all bars that may contact body parts in case of an accident.



Fig. 264

A six-point (or greater) restraint system is recommended. Install brackets for the lap belts as shown. Install the shoulder belts to the cross bar of the roll cage. If the belts are wrapped around the bar, be sure to provide a way to restrain the belts from moving side to side on the bar. The six-point straps can be mounted to the floor using eyelets and snap in belt ends. (Fig. 264)

BE SURE TO FOLLOW MANUFACTURERS RECOMMENDED INSTALLATION PROCEDURES ON ALL SAFETY EQUIPMENT.

SEATING



Fig. 265

Aftermarket racing seats should be mounted to the floor with custom brackets available from Roush Industries. (Fig. 266)



Fig. 267



Fig. 268



Fig. 266

Production seat sliders, modified for the aftermarket seats can also be used. The production seats and brackets are removed and stands are welded to the sliders. The seats are then mounted to the stands. (Fig. 267) and (Fig. 268)

THROTTLE PEDAL ASSEMBLY



Fig. 269

The production Cobalt has a fly-by-wire system. A replacement pedal assembly is required for a cable driven throttle. Roush Industries offers a direct replacement throttle pedal assembly that bolts to the production mounts. (part number 30-412-0020) (Fig. 269)



Fig. 270

The dash is drilled to install a tube through which the throttle cable can pass. (Fig. 270)



Fig. 271

STEERING WHEEL



Fig. 272

There are currently no available aftermarket steering wheel adapters. To install a racing wheel on the Cobalt, we recommend buying and fabricating a steel adapter plate using the production spline insert that comes in the stock steering wheel. This adapter can then be fitted to currently available steering wheel adapters. (Fig. 272)

GAUGE PANEL



Fig. 273



Fig. 274

The production gauge panel does not function when the ECM is removed from the vehicle. The production dash can be modified to house five 2 1/6" gauges. We recommend the following gauges: (Fig. 273) and (Fig. 274)

- Oil Pressure
- Fuel Pressure
- Water Temperature
- Boost
- Voltage

We also recommend a tach with shift light and a large indicator light with a 30 PSI oil pressure switch to protect the engine from major damage if there is an oil pressure problem.

SHIFTER

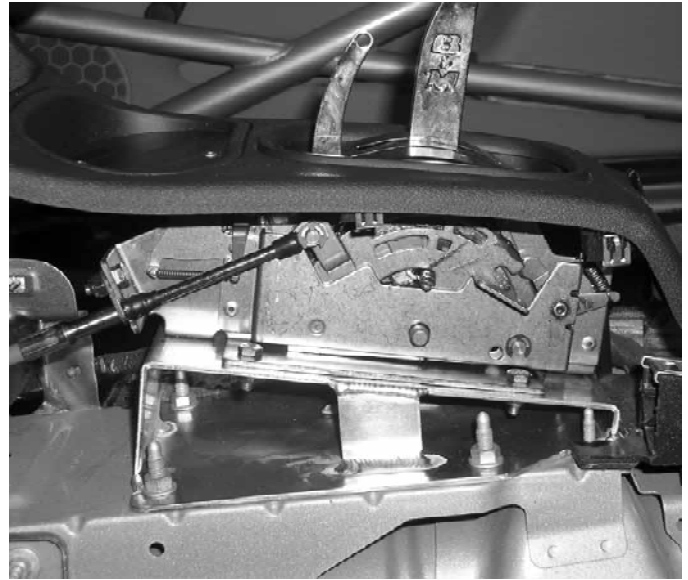


Fig. 275

A B&M Pro Ratchet Shifter is recommended. A 10 ft B&M shift cable is needed. (Fig. 275)

GM Racing Shifter Installation Kit (part number CPT617) includes:

- Shifter Mounting Bracket
- Shift Cable Mounting Bracket for 4T65E
- Shifter Beauty Plate.



Fig. 276

FRONT SUSPENSION

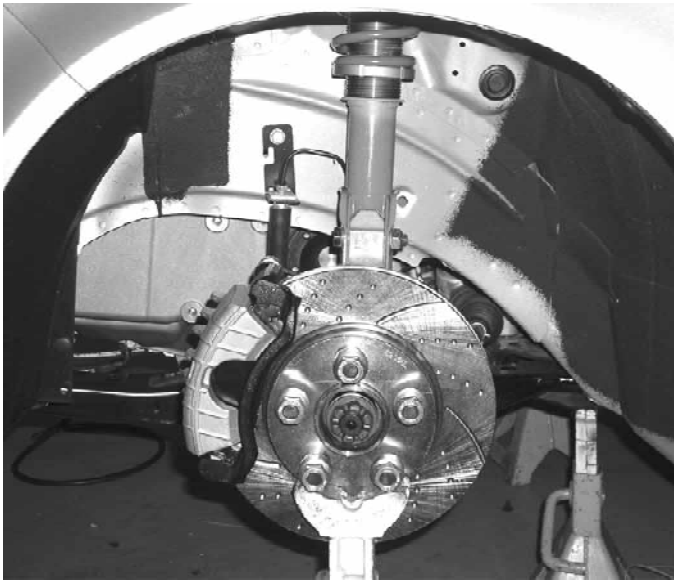


Fig. 277

The front suspension consists of the following components: (Fig. 277)

- 98-9002 Grand Am Uprights



Fig. 278

- Adjustable KYB Struts (Fig. 278)
- Ground Control Coil Over Kit (Fig. 278)
- Bates Engineering Hub and Stub Shaft
- Ground Control Camber Caster Plate



Fig. 279

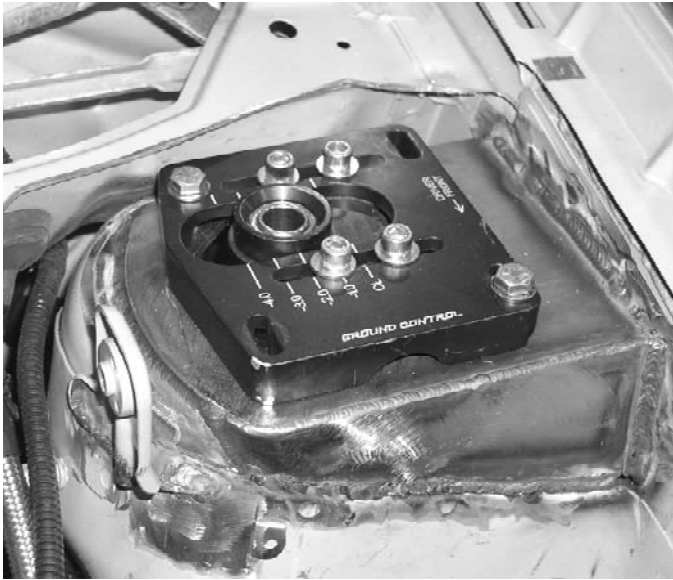
The factory steel lower control arms are modified with the following: (Fig. 279)

- Bolt on Captured Spherical Ball Joint
- Steel Rear Bushing with Captured Spherical Rod Ends
- Delrin Bushing Inserts for Front Mounting Point
- Welded Structural Support Brace



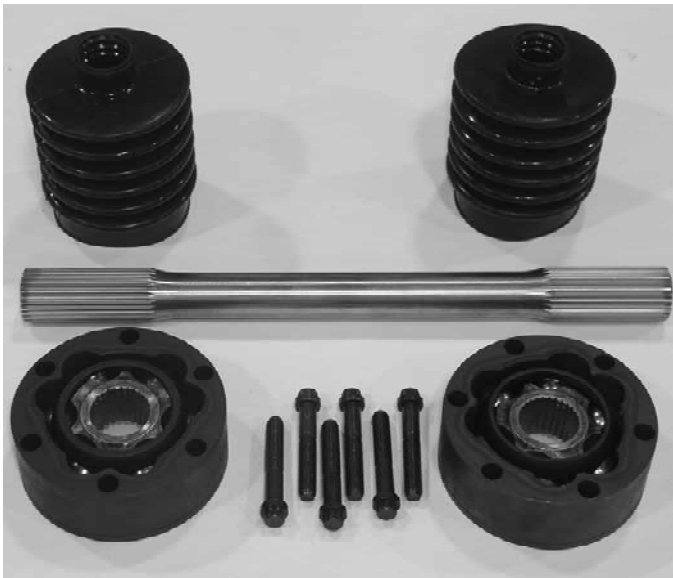
Fig. 280

Adjustable camber/caster weldments are installed in the shock towers. These are available from GM Racing. (Fig. 280)

**Fig. 281**

The shock towers receive the Ground Control Camber/Caster Plates to complete the front suspension. (Fig. 281)

HALF SHAFTS

**Fig. 282**

The half shaft components shown are available from Bates Engineering. 930 CV joints are recommended. (Fig. 282) Contact Bates Engineering for your application. 300M and Aeromet 100 axles are also available from Bates Engineering.

**Fig. 283**

OUTPUT FLANGES

930 CV output flanges for the 4T65-E transmission are available from GM Racing. (part number CPT713 (RH) and CPT714 (LH))

STEERING SYSTEM

**Fig. 284**

The production rack is retained. (Fig. 284)

REAR SUSPENSION



Fig. 285

A quick release steering wheel is used for ease of entry. The steering wheel can be fitted with buttons for shifting the transmission. (Fig. 285)

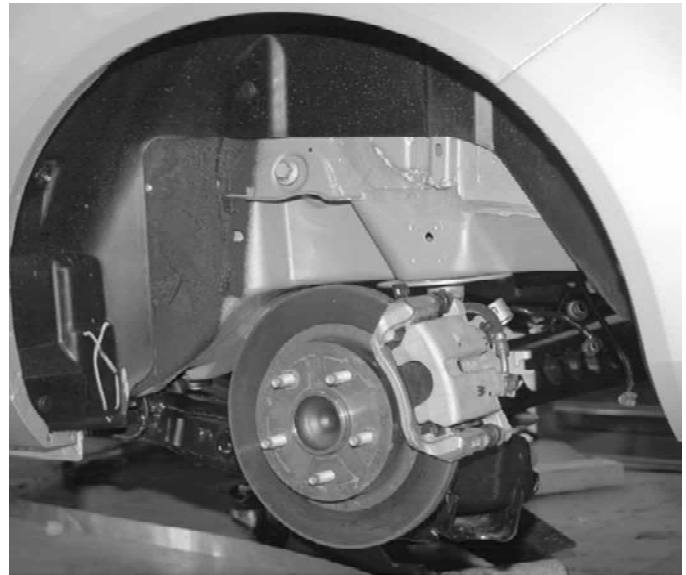


Fig. 287

Although not required for drag-strip application, A Cobalt SS Suspension Kit with five lug hubs and disc brakes may be installed in base (Non SS) option level Cobalts. The wheel bolt pattern can be changed by installing oversize studs. This allows for a wider wheel selection. The wheel stud pattern is 5 by 4.5 in. An upgraded sway bar is also included. (Fig. 287)



Fig. 286

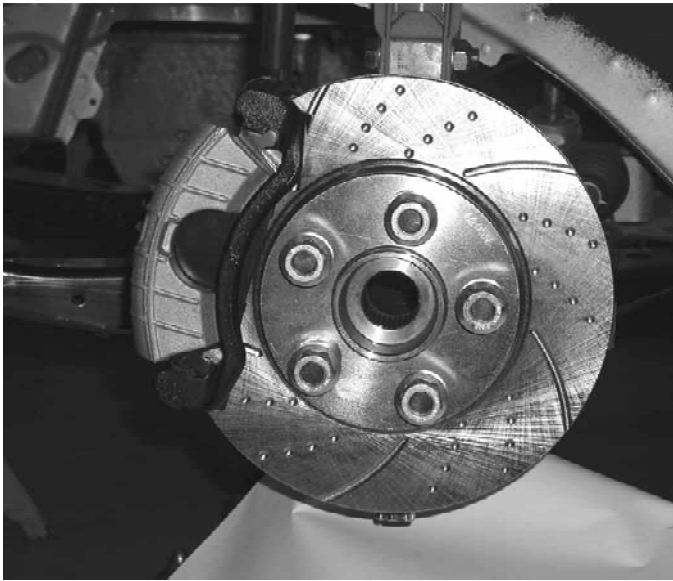
The electric steering assist must be removed because inputs required for its proper operation are not available with aftermarket engine controllers. (Fig. 286)



Fig. 288

Adjustable Walker Evans rear shocks with remote reservoir are available. These shocks work with production hardware (metric fasteners) and are a bolt in. (Fig. 288)

BRAKES

**Fig. 289**

The front brakes used on the Phase5 Cobalt are Grand Am calipers and rotors. (Fig. 289)

**Fig. 290**

Grand Am drive hubs are also used. Mark Williams 5/8" fine thread studs with 11/16" shank work well with most wheel combinations. (Fig. 290)

**Fig. 291**

The rear brakes on this car are stock Cobalt drum brakes. The hubs are re-drilled for more common wheel bolt circle. A line lock is plumbed into the rear brakes and is only used for burnouts. (Fig. 291)

**Fig. 292**

The master cylinder is a production unit. It is used with an adjustable proportioning valve so that rear braking can be reduced if lockup occurs. The power brake booster is retained and the production check valve performs well at keeping boost out and vacuum in. (Fig. 292)

Unless the vehicle is equipped with ABS, no modifications are necessary. If equipped with ABS, this unit should be removed for off-road use.

The front brakes should be plumbed as one system and the rear brakes as a separate system. It is recommended that an adjustable proportioning valve be installed to properly setup brake bias from front to rear.

HOOD



Fig. 293

A carbon fiber hood from RK Sport is used on this Cobalt race car. Hood pins are used to hold the hood down. The OE safety latch is still retained. (Fig. 293)

NOTES

PHASE5 PARTS LIST

PARTS LIST		
DESCRIPTION	PART NUMBER	SOURCE
Cobalt ECOTECH 4T65 Powertrain Mount 1	CPT618	GM Racing
Cobalt ECOTECH 4T65 Powertrain Mount 2	CPT619	GM Racing
Cobalt ECOTECH 4T65 Powertrain Mount 3	CPT620	GM Racing
Cobalt ECOTECH 4T65 Powertrain Mount 4	CPT621	GM Racing
Production Bolts, Flex Plate to Crank	90236537	GM
Flex plate Bolts, Torque Converter to Flex Plate	200-2802	ARP
Bates Engineering Flex Plate	ESGR0500	Bates Engineering
Switches	Various	Various
Waste Gates	Various	Tial, Turbonetics, Innovative
Waste Gate Adapter	CPE719	GM Racing
Hahn Racecraft Exhaust Manifold	—	Hahn Racecraft
6—Point Roll cage kit	30-412-0019	Roush Industries
Racing Seat Floor Mounts	—	Roush Industries
Throttle Pedal Assembly	30-412-0020	Roush Industries
Race Seat	—	Recaro
Race Belts	—	Schroth
Steering Wheel	—	Sparko
Gauges	various	various
Shifter Installation Kit	CPT617	GM Racing
Race Prepped A Arm — LF	CCC622	GM Racing
Race Prepped A Arm — RF	CCC623	GM Racing
Fabricated Ball Joint Replacements	CCC624	GM Racing
Replacement Rear A Arm Bushing	CCC625	GM Racing
Knuckle to Spherical Adapter	CCC626	GM Racing
Adjustable Camber Caster Weldment L	CCC627	GM Racing
Adjustable Camber Caster Weldment R	CCC628	GM Racing
Grand Am Uprights	R 18060674 L 18060675	GM
Adjustable Struts	Call	KYB
Coilover Kits	Call	Ground Control
Camber Caster Plates	Call	Ground Control
930 CV Output Flanges	R CPT713 L CPT714	GM Racing
930 CV Joint	—	Bates Engineering
Uplevel (300m and Aeromet 100) Axles	—	Bates Engineering

PARTS LIST		
DESCRIPTION	PART NUMBER	SOURCE
Adjustable Rear Shocks	—	Waker Evans
Grand Am Drive Hubs	—	GM (service)
Airbags, RR Suspension	—	Airlift
Automatic Ratchet Shifter		B&M
Fuel Pump	Call	SX/Weldon

COBALT GRAND AM CUP (ST CLASS) RACING SERIES



Fig. 294

The Grand Am Cup Series and its' sister series the Grand American Rolex Sportscar Series, is North America's premier platform for endurance road racing. The cars that compete in Grand Am Cup are production-based, uni-body cars running in two classes: Grand Sport (GS) and Sport Touring (ST). (Fig. 294)

The Chevrolet Cobalt SS Grand Am Cup program was introduced in November of 2004 with a goal to create three complete race-ready cars to compete in the first race of the season, the Grand Am Cup 200 at Daytona International Speedway. The ST class Cobalts were designed and developed by GM Performance Division and Powell Motorsports. The plan is to race these three cars in the 2005 Grand Am Cup season, with the goal of winning the ST Class championship and elevating Chevrolet's reputation for road racing excellence.



Fig. 295

Chevrolet Cobalt SS Supercharged General Specifications		
	Production Vehicle	Grand Am Cup Vehicle
Body Type	2-Door Coupe	2-Door Coupe
Body Construction	Steel Body with Plastic Fascias	Steel Body with Plastic Fascias, Carbon Fiber Brake Ducts, Hood, Trunk, and Full Steel Roll Cage
Curb Weight	2930	2450
Engine	2.0L Supercharged	2.0L Supercharged
Est. Horsepower	205	235
S/C Pulley Diameter	84 mm	77.9 mm
Intercooler Radiator	Single Pass	Dual Pass Griffin
Exhaust	Catalyst and Muffler	Cat Delete with Corsa Cat Back
Coil Over Front	McPherson Strut	Ohlins External Reservoir Coil Over Shocks with Adjustable Ride Height, Damping, Camber, and Caster
Front Lower Control Arm	Bowtie Front/Rubber Rear Bushings	Delrin Bowtie Front Bushing, and Spherical Joint Rear Bushing
Front Drive System	4.05 Final Drive Limited Slip Differential (Optional)	4.45 Final Drive Limited Slip Differential, with Custom Half Shafts, Pontiac G6 Knuckle, Hub and Bearing
Transmission	Production	Production Manual with 4.45 Final Drive
Clutch	Production	Production
Shifter	Production	B&M Aluminum
Front Roll Bar	24 mm	Removed
Rear Suspension	Beam Axle	Drilled/Sleeved Beam for Roll Stiffness Adjustment, with Relocated Shock Mounts, Coil Over Conversion
Brakes	Production	Production with Pagid RS-14 Pads
Wheels and Tires	All Season Radial P215/45ZR18 on 18x7 Cast Aluminum Wheels	Hoosier Racing Tire P225/45ZR17 on 17x8 Forged Wheels

POWERTRAIN



Fig. 296

2.0L supercharged engine power modifications include: (Fig. 296)



Fig. 298

Low restriction air filter. (Fig. 298)

SUPERCHARGER PULLEY



Fig. 297

The Bolt-on pulley kit allows for a quick change of the supercharger pulley at the racetrack (77.9 mm pulley is used). A belt change is also required. Changing the belt allows the tensioner pulley to maintain proper belt tension. (Fig. 297)



Fig. 299

The Grand Am Cup Cobalts have a smaller pressed-on 77.9 mm pulley. The production Cobalt SS Supercharged pulley is 84 mm. (Fig. 299)

AFTERCOOLER

The Chevrolet Cobalt SS Supercharged has a unique integrated air-to-water aftercooler system. The system works with a Laminova heat exchanger that is built into the intake manifold. The air passes over coolant filled tubes which reduces intake charge temperature. The Grand Am Cup Cobalts run at full boost for over two straight hours, creating more demanding air charge cooling needs.

The Performance Division team and the GM Powertrain teams developed an alternative routing of the fluid passages in the Laminova system, which reduce flow restrictions and work with the aftercooler radiator described above.



Fig. 300

GM Performance Division worked with Griffin Radiator to develop a more effective aftercooler fluid radiator for use in the Grand Am Cup Cobalts. This radiator is mounted in front of the current engine coolant radiator and replaces the current aftercooler radiator and the A/C condenser. This radiator is designed for serious enthusiasts that will allow the car to be operated at a high power output for extended periods of time. It requires the removal of the air conditioning system. (Fig. 300)

CORSA EXHAUST

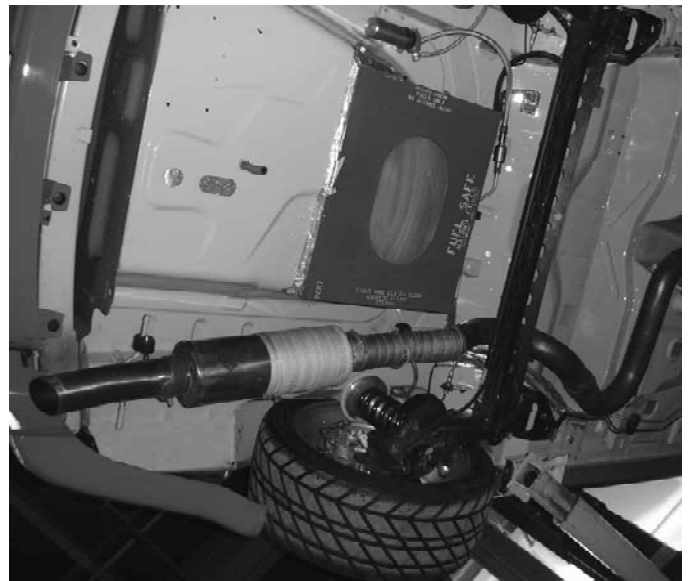


Fig. 301



Fig. 302

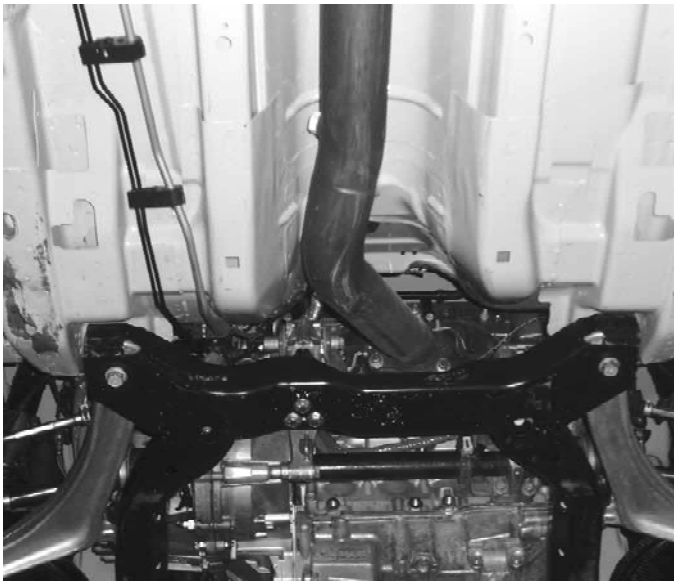


Fig. 303

Corsa has designed and fabricated a full 3" stainless steel exhaust for the Grand Am Cup Cobalts. The Grand Am Cup Cobalts have relocated engines and cat delete tubes which hook up to the Corsa cat back exhaust. The larger diameter tubing and attenuator keep noise at low decibels while still retaining high power outputs.(Fig. 301, Fig. 302, Fig. 303)

4.45 FINAL DRIVE LSD TRANSMISSION

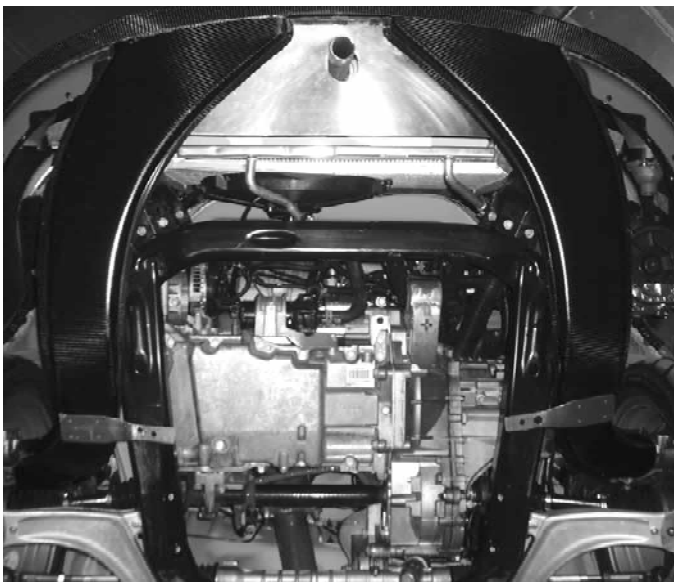


Fig. 304

This is a stock Cobalt SS Supercharged transmission with a larger diameter ring gear to increase final drive from a stock 4.05 to a higher acceleration 4.45. There are no other changes than the final drive. (Fig. 304)

B&M ALUMINUM SHIFTER

The Grand Am Cup teams have installed a heavy duty B&M aluminum shifter. This improves durability under extreme use and brings the shifter farther forward in the car to allow for good elbow room when highly bolstered racing seats are used.



Fig. 305

HALF SHAFTS

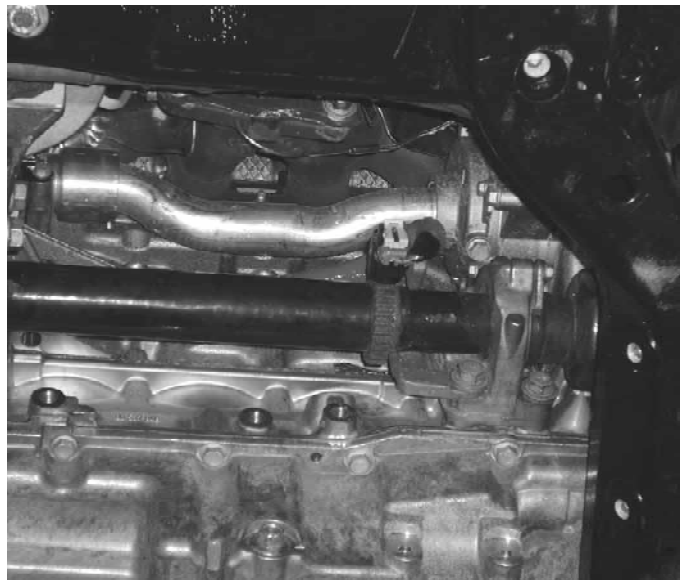


Fig. 306

The Saturn Ion support bearing is used to help with torque steer. The Vehicle Speed Sensor (VSS) signal is picked up from the Saturn style external reluctor wheel and pick-up. (Fig. 306)

CHASSIS



Fig. 307



Fig. 309

A custom fabricated roll cage is used in the stock Cobalt chassis to add some stiffness, but primarily to offer driver protection. This roll bar is tied into the vehicle structure at many points, but does not extend into the trunk area. (Fig. 307, Fig. 308, Fig. 309)

FRONT SUSPENSION



Fig. 308



Fig. 310

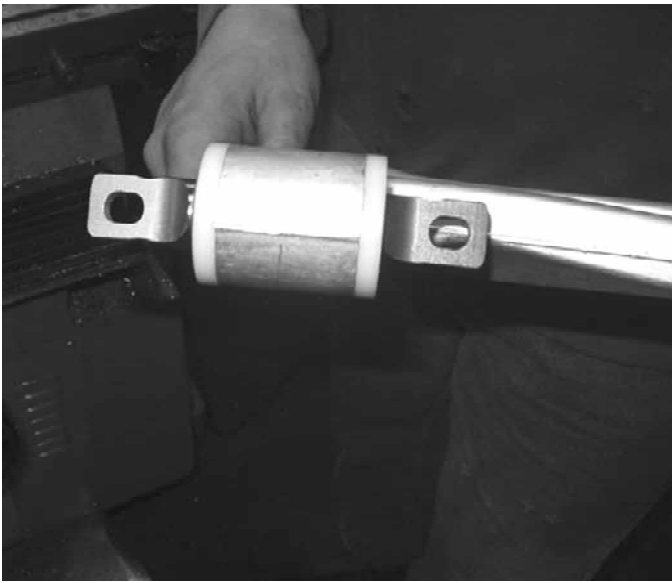


Fig. 311

In road racing, suspension travel is much higher than any situation you will see on the roads. Under heavy cornering loads with sticky tires the Grand Am Cup Cobalts, which already have lowered ride heights, need to have a completely free suspension. GM Performance Division designed lower control arms with Delrin front "Bowtie" bushings and steel spherical joint rear bushings. These arms were built by Powell Motorsports for use in the Grand Am Cup Cars. (Fig. 311)



Fig. 312

Custom front wheel drive suspension corners (custom axle shafts, G6 knuckle, Grand Am bearing and hub, smaller diameter springs, ext. reservoir shocks, camber/caster plates) (Fig. 312)

In addition to the Lower Control Arm (LCA) modifications described above, the major difference between the stock

Cobalt SS and the Grand Am Cup Cobalts are the front suspension corners.

For the front wheel drive Cobalt to handle the stress of repeated 200 mile races under full load at all times, many of the front suspension parts needed to be bulked up.

The production Cobalt knuckles were replaced with knuckles from the Epsilon platform (higher weight) vehicles (Chevy Malibu, Pontiac G6). With this replacement, new brake caliper mounts were fabricated to fit the production Cobalt brakes to the Epsilon knuckle.

The wheel hub and bearing from the Pontiac Grand Am was used for its strength and more common wheel bolt pattern. This allows the use of a wider range of aftermarket race wheels.

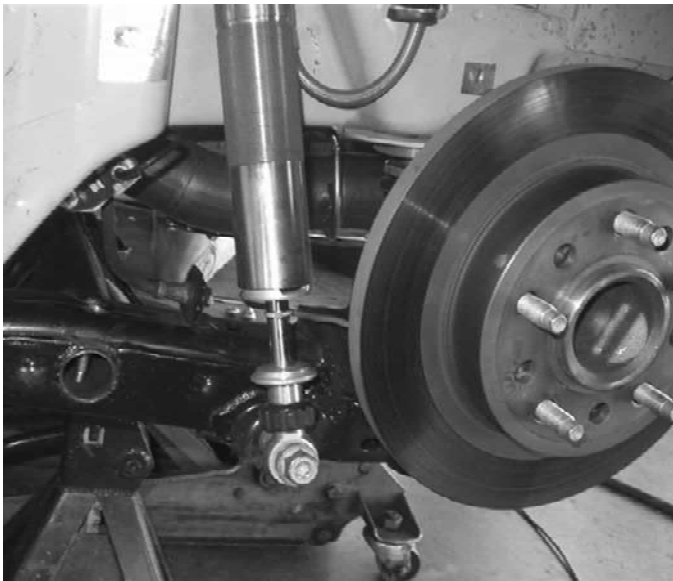
Although the tooth count was the same between the GMX130 car wheel bearing and the Cobalt Driveshaft outer bell, the pressure angle was not. Using Castrol Optimol upgraded wheel bearing grease and a custom splined barstock built by Pratt and Miller, the GMX130 outer bell and the Cobalt inner bell can be connected.

The stock coil-overs were replaced with Ohlins double adjustable external reservoir shocks with adjustable perch spring seats. These allow the proper settings of bound and rebound damping rates, and the adjustable seat allows the easy swapping of spring rates and ride heights to get corner weights in proper adjustment as well.



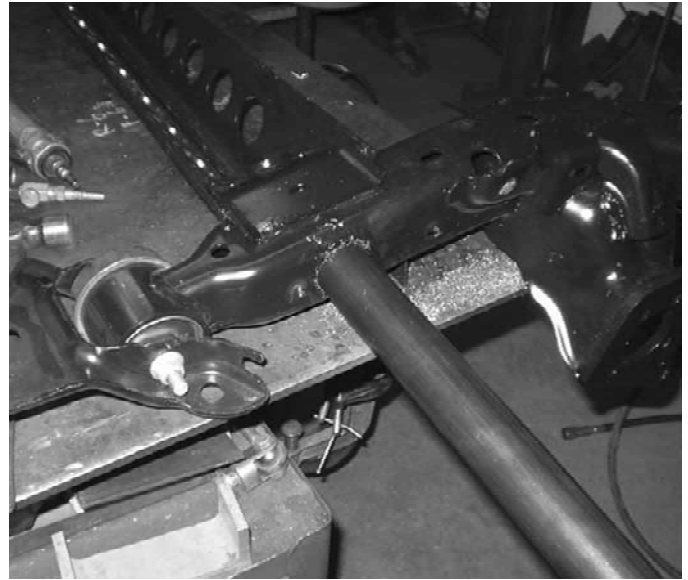
Fig. 313

In the front, the Ground Control Camber Caster plates were modified at the upper wheel house mounts. These let the teams determine the best static negative camber and positive caster alignments for each track.

**Fig. 314****REAR SUSPENSION****Fig. 315**

Modified Rear Suspension (hole sawed, welded in tube, adjustable roll bar sleeving, relocated shock mount, coil over conversion) (Fig. 315)

The shock mount was moved forward 1/2" to accommodate the smaller 17" tires and coil over conversion for the rear suspension.

**Fig. 316**

The stock beam axle in the Cobalt has a welded-in sway bar that tucks under the perforated beam axle. This setup is not adjustable. A main sleeve with bolt-in sway tubes with different wall thickness was developed to allow the car to have tunable rear roll stiffness. (Fig. 316)

BRAKES

Stock front caliper mounts are used with different spindles. Factory rubber brake hoses have been replaced with braided high performance brake lines throughout.

The Grand Am Cup Cobalts have stock brake apply systems, with larger 23.8 mm (also Epsilon) vs. 22.2 mm stock master cylinders, steel braided brake lines, and Pagid RS-14 brake pads.

**Fig. 317**

CARBON FIBER BRAKE DUCTS

STEERING



Fig. 318

Brake cooling becomes an important issue in a 200 mile race. Therefore GM Performance division worked with Crawford Composites to develop cooling ducts to funnel air from the front of the vehicle to keep the brakes cool under the most severe use. These use factory mountings.



Fig. 320

The factory rack is raised off the cradle to help with bump steer. Aluminum spacer blocks are used to raise rack. Appropriately sized bolts must be checked for proper length into cradle. (Fig. 320)

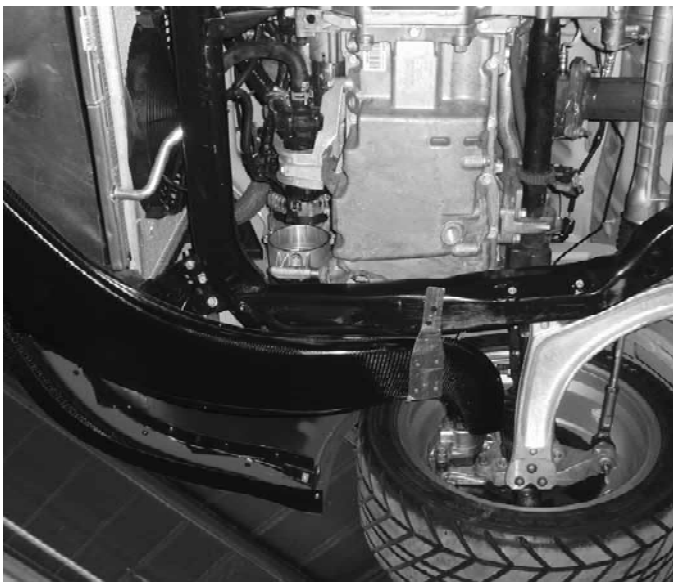


Fig. 319

The Antilock Brake System was retained and can be modified to turn on and off as required by the driver. (Fig. 319)



Fig. 321

Quick release steering wheel is used. This allows easier entry and exit to the race car. (Fig. 321)

BODY



Fig. 322

CARBON FIBER PANELS

GM Performance Division and Crawford Composites designed carbon fiber body parts for the Chevrolet Cobalt SS Supercharged to bring the car down to its competition weight. All these parts are production replicas with less weight to lower the center of gravity and the total curb weight. These are designed to be used with hood pins for the hood and spring clips for the trunk.

Parts are built by and available from:

Crawford Race Cars LLC

(704) 483-8726

ccomposites@bellsouth.net



Fig. 323



Fig. 324

The interior is removed and only necessary items required for racing are retained. (Fig. 324)

COBALT ACCESSORIES

PARTS LIST		
Description	Coupe Part Number	Sedan Part Number
Brushed Aluminum Pedal Covers — Automatic Transmission	12499875	12499875
Brushed Aluminum Pedal Covers — Manual Transmission	12499876	12499876
Shift Knob — Wood	12499766	12499766
Shift Knob — Satin Nickel	12499512	12499512
Interior Trim Kit — Burl Wood with heated seats	n/a	12499858
Interior Trim Kit — Burl Wood without heated seats	n/a	12499513
Interior Trim Kit — Satin Nickel with heated seats	12499862	12499860
Interior Trim Kit — Satin Nickel without heated seats	12499861	12499859
Chevrolet Wheel Center Caps — (4)	17800089	17800089
16" Cast Chrome Wheels (4 pack)	17800578	17800578
Low Rise Rear Spoiler — arrival blue metallic	12499794	12499787
Low Rise Rear Spoiler — ultra silver metallic	12499795	12499788
Low Rise Rear Spoiler — lack	12499796	12499789
Low Rise Rear Spoiler — victory red	12499797	12499790
Low Rise Rear Spoiler — primer	12499798	12499790
High Rise (SS) Rear Spoiler — arrival blue metallic	12499801	n/a
High Rise (SS) Rear Spoiler — ultra silver metallic	12499802	n/a
High Rise (SS) Rear Spoiler — black	12499803	n/a
High Rise (SS) Rear Spoiler — victory red	12499804	n/a
High Rise (SS) Rear Spoiler — prime	12499805	n/a
Side Mirror Skull Cap — rally yellow	12499543	12499543
Side Mirror Skull Cap — ultra silver metallic	12499549	12499549
Side Mirror Skull Cap — victory red	12499547	12499547
Side Mirror Skull Cap — summit white	12499545	12499545
Side Mirror Skull Cap — arrival blue metallic	12499546	12499546
Side Mirror Skull Cap — Sunburst orange metallic	12499548	12499548
Chrome Door Handles — Set of 2	17800002	n/a
Chrome Door Handles — Set of 4	n/a	12499959
Stainless Steel Exhaust tip	12499351	12499351
Chrome Grille Kit	12499902	12499902
Chrome Bodyside Moldings	17801031	17801031
These and more Cobalt accessories are available to order from your local Chevrolet dealer. Please see your dealer for additional information.		

NOTES

COBALT RACING BODY COMPONENTS

PARTS LIST		
DESCRIPTION	PART NUMBER	SUPPLIER
Cobalt Hotrod FWD Front Clip — Fiberglass	30-047-0092	Roush Industries (734) 779-7385
Cobalt Hotrod FWD Front Clip — Carbon Fiber	30-047-0093	Roush Industries (734) 779-7385
Cobalt Pro FWD Front Clip — Fiberglass	30-047-0094	Roush Industries (734) 779-7385
Cobalt Pro FWD Front Clip — Carbon Fiber	30-047-0095	Roush Industries (734) 779-7385
Cobalt Dashboard — Fiberglass	30-071-0049	Roush Industries (734) 779-7385
Cobalt Dashboard — Carbon Fiber	30-071-0050	Roush Industries (734) 779-7385
Cobalt Pro Stock Body	CCS-0591	GM Racing (262) 877-2171

NOTES

SUPPLIERS

SUPPLIERS LIST			
SUPPLIER	WEB ADDRESS	PHONE NUMBER	Component
Accufab	www.accufabracing.com	(909) 930-1753	Throttle Body
AEM	www.aempower.com	(310) 484-2322	Engine Management
Aeromotive	www.aeromotiveinc.com	(913) 647-7300	Fuel Systems
Air Lift/Easy Street	www.airliftcompany.com	(800) 248-0892	Airbags
ARP	www.arp-bolts.com	(805) 339-2200	Fasteners
ATI	www.atiperformanceproducts.com	(800) 284-3433	Crank Dampers
Autometer	www.autometer.com	(815) 899-0801	Gauges
B&M	www.bmracing.com	(818) 882-6422	Shifter
Bates Engineering	—	(714) 545-0159	Engine and Suspension Components
Big Stuff	www.bigstuff3.com	(248) 887-7072	Engine Management
Carrillo	www.carrilloind.com	(949) 498-1800	Connecting Rods
Chapman Racing Heads	www.chapmanracingheads.com	(801) 292-3909	Cylinder Parts
Coan Converters	www.coanracing.com	(765) 456-3957	Torque Converters
Cometic	www.cometic.com	(800) 752-9850	Stock Crank Bolt
Comp Cams	www.compcams.com	(800) 999-0853	Cams
Compushift	www.compshift.com	(310) 465-0220	Transmission Controller
Corsa	www.corsaperf.com	(900) 486-0999	Exhaust
Crower	www.crower.com	(619) 661-6477	—
CV Products	www.cvproducts.com	(800) 448-1223	Valve Springs
DFI	www.accel-dfi.com	—	Engine Management
Diamond Racing Pistons	www.diamondracing.net	(877) 552-2112	Pistons
Eagle	www.eaglerod.com	(662) 796-7373	Connecting Rods
Ferrea	www.ferrea.com	(888) 733-2505	Valves and Valve train
General Motors Performance Parts	www.gmgoodwrench.com (click on performance parts)	GM Performance Parts	GM Performance Parts
General Motors Racing	www.gmtunersource.com	gmsportcompact@aol.com	GM Racing Parts and technical assistance
General Motors Goodwrench	www.gmgoodwrench.com	Local Dealer	Production Parts
Ground Control	www.ground-control.com	(530) 677-8600	Camber Caster Plates
Hahn Racecraft	www.hahnracecraft.com	(630) 553-6830	Turbos
Hansen Racing Engines	—	(805) 933-0391	Engine Building
HKS	www.hksusa.com	(310) 491-3300	Waste Gates
Innovative	www.innovativeturbo.com	(805) 526-5400	Turbos, Waste Gates and Intercoolers
JE	www.jepistons.com	(714) 898-9763	Pistons and Rings

SUPPLIERS LIST			
SUPPLIER	WEB ADDRESS	PHONE NUMBER	Component
Jesel	www.jesel.com	(732) 901-1800	Valvetrain Components
Kroyer Racing Engines	www.kroyerengines.com	(702) 651-2071	Engine Building
KYB	www.kyb.com	(630) 620-5555	Struts
Manley	www.manleyperformance.com	(732) 905-3366	Connecting Rods
Mickey Thompson East Coast	www.mickeythompson tires.com	(330) 928-9092	Tires
Mickey Thompson West Coast	www.mickeythompson tires.com	(951) 817-0101	Tires
Moroso	www.moroso.com	(203) 458-0542	Engine Components
Motegi Racing Wheels	www.motegiracing.com	(866) 466-8344	Wheels
MSD	www.msddignition.com	(915) 857-5200	Ignition, Shift Controller and Boost Controller
NGK	www.ngksparkplugs.com	(877) 473-6767	Spark Plugs
Nitrous Express	www.nitrousexpress.com	(940) 767-7694	Nitrous
Performance Solutions	www.pswiringplus.com	(310) 422-0908	Coils
Precision Products Performance Center	www.pppcenter.com	(800) 421-9150	Wrist Pins
Precision Turbos	www.precisionturbo.net	(219) 996-7832	Turbos
PSI FI Motorsport	www.psifimotorsports.com	(215) 262-8874	Engine Management and Turbo Kits
RC Engineering	www.rceng.com	(310) 320-2277	Fuel Injectors and Replacement Parts
Recaro	www.recar-nao.com	(248) 364-3818	Racing Seats
Raybestos	www.raybestosproducts.com	(765) 362-3500	Transmission Clutches
RK Sport	www.rksport.com	(800) 214-8030	Body Kits and Suspension Components
Roush Racing	www.roushperformance.com	(734) 779-7385	Engines and Electrics
Saturn Motorsports	www.saturnmotorsports.com	(877) 443-2683	Saturn Parts
SCE Gaskets	www.scegaskets.com	(888) 427-5381	Head Gaskets
Schroth	www.schroth.com	(888) 536-8550	Safety Equipment
Shaver Specialties	www.shaverengines.com	(310) 370-6941	Engine Building
Sonny Bryant	—	(714) 535-2695	Crankshaft
Stef's Performance	www.stefs.com	(732) 367-8700	Oil Pans and T-Washers
Taylor Motorsports	www.taylormotorsports.com	(714) 630-7875	Trans Blanket
TCI	www.tciauto.com	(662) 224-8972	Transmission Cooler
Tingley Racing Engines	—	(562) 201-0197	Engine Builder
Total Seal	www.totalseal.com	(632) 587-7400	Piston Rings
Trick Titanium	www.tricktitanium.com	(248) 588-9433	Spring Retainers
Turbo's By Garrett	www.turbobygarrett.com	—	Turbos
Turbonetics	www.turboneticsinc.com	(805) 584-1913	Turbos, Waste Gates and Intercoolers

SUPPLIERS LIST			
SUPPLIER	WEB ADDRESS	PHONE NUMBER	Component
UMI Racing	www.umiracing.com	(800) 275-1615	Engine Management
Walker Evans Racing	www.weracing.com	(888) 933-7223	Shocks
Weldon	www.weldonracing.com	(440) 232-2282	Fuel Systems
Wiseco	www.wiseco.com	(440) 951-6660	Pistons

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