

1983 Ford Mustang GT Engine Rebuild Summary

7/10/2017

Introduction:

During fall of 2007 the engine (~220k miles) developed a miss on one or more cylinders which became worse over a month or so. I pulled the engine December 2007 and determined that the intake manifold gaskets on both sides (middle cylinders) had slipped inwards during assembly (intake manifold gaskets replaced the prior year due to coolant leakage) causing an internal vacuum leak. The camshaft bearings had also disintegrated into the oil pan.

Machine work:

Plano Machine determined the cylinders needed to be bored to 4.020" (stock was 4.000"). This yields a new displacement of 304.6 CID.

Plano Machine performed the following:

Item	Notes
Degrease/clean/crack check block	Block condition was A-OK
Polish and grind crankshaft	Final journal diameter and bearing undersize unknown
Cylinder bore + hone	Bored 0.020" over stock
Balance lower rotating assembly	Sent off pistons, rings, rods, crankshaft, flywheel and damper to be balanced. Material removed from flywheel, damper, and crankshaft (heavier plug also added to crankshaft counterweights).
Block assembly	Freeze plugs, camshaft bearings
Assemble short block	Pistons, rings, rods, crankshaft, camshaft, bearings, rear main seal
Assemble heads and size push rods	Install heads/head gasket and rockers. Size pushrods for proper rocker-valve stem geometry. Determined 6.790" push rod (6.890" stock). Went with 6.800" CompCams Magnum rods.

- ◆ Engine kit – Plano Machine furnished the kit less camshaft and timing gear set.
- ◆ Pistons – Stock cast iron with 4 valve reliefs.
- ◆ Bearings – Stock (amount of undersize unknown).
- ◆ Rings – Stock except the top ring was a Moly ring.
- ◆ Connecting rods – Scat (35090P), 5.090" I-beam with ARP hardware. Resizing the connecting rods (plus new hardware) was roughly the same cost as a new set.

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Cylinder heads:

Edelbrock Performer RPM, non emissions SBF 60229:

- ◆ Valves – Stainless steel, one-piece, swirl-polished intake and exhaust valves with under-cut stems for increased flow.
- ◆ Combustion Chamber Volume – 60cc
- ◆ Valve Seat Machine Style – 3 angle
- ◆ Intake Valve Diameter – 1.900 in
- ◆ Exhaust Valve Diameter – 1.600 in
- ◆ Intake Runner Volume – 170cc
- ◆ Exhaust Runner Volume – 60cc

Dialog

Description: Ford SB Performer

Intake Valve

Test: 1.900 in Valves Per Port: 1

Pressure: 28.0 inH2O Data Points: 6

	Lift: in	Flow: cfm	Lift: in	Flow: cfm	
1	0.100	72.0	6	0.600	249.0
2	0.200	132.0	7	***	***
3	0.300	183.0	8	***	***
4	0.400	216.0	9	***	***
5	0.500	245.0	10	***	***

Notes: Data for EDL-60229/60329 Performer (and RPM)

Exhaust Valve

Test: 1.600 in Valves Per Port: 1

Pressure: 28.0 inH2O Data Points: 6

	Lift: in	Flow: cfm	Lift: in	Flow: cfm	
1	0.100	57.0	6	0.600	174.0
2	0.200	104.0	7	***	***
3	0.300	142.0	8	***	***
4	0.400	159.0	9	***	***
5	0.500	170.0	10	***	***

Notes:

Open... Save As... Calc Others Reset All OK Cancel

Enter a Description for this Cylinder Head Port Flow Data

Notes: I decided to go with a new set of cylinder heads rather than a rebuild of the stock Ford iron heads (D80E casting #). I looked at the Air Flow Research 1398 aluminum heads but decided to go with the Edelbrock Performer RPM 60229 heads for cost reasons. Using CompCams CamQuest6 software program and the Edelbrock and AFR port flow data (and the new camshaft), the peak HP was only about 8HP less with the Edelbrock heads.

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Compression ratio:

- ◆ 9.3:1 – Stock was 8.3:1 (Spreadsheet available)

Notes: Using an Edelbrock 7313 head gasket (smaller compressed volume) would have yielded a 9.5:1 compression ratio.

Camshaft, lifters, pushrods, and rockers:

- ◆ Camshaft – CompCams XTREME Energy (35-238-3 XE262H). “Excellent for a daily driver”; slight mild to choppy idle; good midrange torque; 1300-5600RPM.

Parameter	Intake	Exhaust
Advertised Duration (degrees wrt crank at seats)	262°	270°
Duration at .050 lobe	218°	224°
Lobe Lift	0.309”	0.313”
Valve Lift	0.493”	0.500”
Open timing (.050)	3°	46°
Closed timing (.050)	35°	-2°
Open timing (seat)	25°	69°
Closed timing (seat)	57°	21°
Intake CL	106°	114
Lobe CLA (wrt camshaft)	110°	110°

Other valvetrain items include:

- ◆ Lifters – CompCams (832-16) hydraulic lifter set.
- ◆ Push rods – CompCams Magnum (7632-16) 6.800” hardened push rods (rod length determined at the machine shop for best rocker geometry using an adjustable PR tool).
- ◆ Rocker arms – CompCams Magnum (1442-16) 1.6:1 roller tipped rocker arms.
- ◆ Timing gear set – CompCams Magnum (2120) steel gear, double roller timing set.

Notes:

1. The firing order for this camshaft is the same as the Ford 351W and 1983 302HO engines. I could have chosen the CompCams 31-238-3 camshaft but would have had to change the spark plug wiring firing order from original.

2. Compatibility of the Edelbrock head furnished springs with the CompCams camshaft was confirmed with both Edelbrock and CompCams technicians. Both indicated that the camshaft/spring combination would play nicely with each other. The Edelbrock recommended camshaft (in their top end performer RPM power package) has specifications which are quite similar to the CompCams camshaft.

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Air/fuel systems:

- ♦ Intake manifold – Edelbrock (7121) Performer RPM aluminum intake manifold.
- ♦ Carburetor – Edelbrock (1406) Performer Series 600CFM carburetor.
- ♦ Fuel pump – Stock. Initially rebuilt Edelbrock (7125) high volume fuel pump (1796 rebuild kit) but replaced with stock due to oil leakage from the oil seal.

Notes: I had considered the 7521 RPM “air gap” manifold but for cost and cold weather drive-ability decided on the 7121.

Ignition:

- ♦ Ignition box – MSD 6A
- ♦ Distributor – MSD 8479 Pro-billet aluminum
- ♦ Coil – MSD Blaster II
- ♦ Wires – MSD 8.5mm Superconductor
- ♦ Spark plugs – Champion RC12YC (14mm x ¾”). Edelbrock recommends this plug in their cylinder head information.

Front end accessories:

- ♦ Water pump – Cardone 5523150H heavy duty
- ♦ Power steering pump and pulley – Napa pump and Ford pulley. Damaged old pulley so had to buy new one
- ♦ Radiator and fan clutch – New Autozone heavy duty radiator and fan clutch.
- ♦ Air pump – replaced air pump with AP pulley from Summit.

Transmission and mounting:

- ♦ Clutch, pressure plate, throw out bearing – With the increased engine torque, I had to go with a high performance clutch/pressure plate set (Series 2) from Zoom (HP47283-1). Clutch face material is Kevlar with coefficient of friction of 0.36. Zoom technician said this set was rated for 375-400 lb-ft of torque.
- ♦ Shifter – Summit 700006 short throw shifter for BW T5 with adjustable stops.
- ♦ Motor mounts, transmission mounts and bushings – Stock Autozone (Anchor) engine and transmission mounts (rubber). Energy suspension polyurethane transmission mount bushings. Couldn't find poly engine/transmission mounts for this application so went with stock.

Exhaust:

- ♦ Headers– MAC 1 1/2 industrial plated, equal length, shortie headers (#5028692)
- ♦ H-pipes – Summit (640725) 2 ½ off road pipes. Replaced MAC catalytic converter/hpipes
- ♦ Catback system – MAC “catback” system (#38692) with Dynomax turbo mufflers and MAC 2 ½” industrial plated “over the axle” exhaust pipes.

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Summary:

The CompCams Camquest6 engine simulation software using engine rebuild component specifications yielded the results below (extrapolated to 9.24:1 CR).

- ◆ Horsepower – 405HP at 6000RPM (336 at the brakes)
- ◆ Torque – 384 foot pounds at 5000RPM (319 at the brakes)

CamQuest6 - [Stang-upgrade4a.cqu]

File View Units Window Help

Cam Selection Data

Application
Usage: 4 - Auto - Excellent In Daily-Driver, Slight-Mild To Choppy Idle
Preferred Lifter Type: Hydraulic Vehicle Weight: 3000.00 lb
Additional Selection Criterion:
☒ Carbs Or Injection, No Computer Control ☐ Nitrous Injection
☒ EFI With Computer Control ☐ Forced Induction

Short Block
Short Block: Ford 302
No. Cylinders: 8 Bore: 4.020 in Stroke: 3.000 in
Total Volume: 304.6 ci Cylinder Volume: 623.97 cc

Predicted Power/Torque

Cylinder Heads
Type: Ford SB Performer Port Flow
Valve Specifications:
Intake Valves/Port: 1 Exhaust Valves/Port: 1
Intake Valve Dia: 1.940 in Exhaust Valve Dia: 1.600 in

Compression
Compression Ratio: 9.00 Combustion Space: 78.00 cc

Induction
Manifold Type: 5.0L Edelbrock RPM II
Total Induction Airflow: 600.0 cfm
Forced Induction Specifications:
Blower Type: None Surge Choke Overspeed
Turbine Size: in Turbine A/R: ☒ ☒ ☒
Internal Ratio: Belt Ratio: Number Turbos: 1
Boost Limit: psi Intercooler Eff: None IC Press. Drop: None

Fuel
Fuel: Gasoline Nitrous: 0.0 HP

Exhaust
Exhaust Model: Small-Tube Headers, Mufflers W/O/Cat

Engine Output
Peak Horsepower: 400.0 HP @ 6000
Average Horsepower: 118.3 HP
Peak Torque: 380.5 ftlb @ 5000
Average Torque: 151.0 ftlb

CamQuest Component Recommendations

COMP CAMS Professional Cam Selection Simulation

Recommended Cams:

#	Fit	Part Number	Grind	Lifter	Rpm Range
1	Great Fit	31-218-2	268H	Hydraulic Lifter	1500 to 5500
2	Great Fit	31-238-3	XE262H	Hydraulic Lifter	1300 to 5600
3	Great Fit	31-418-3	275DEH	Hydraulic Lifter	2000 to 6000
4	Great Fit	31-670-4	H-274H	Hydraulic Lifter	2200 to 6400

Click on any cam shown above to display timing, specs, application data, and compatible accessories.

Application & Predicted Power:
Application: Automotive Engine Family: Ford 289-302 C.I. 8 cyl. 1963-1995
Bore: 4.020 in Stroke: 3.000 in Cylinders: 8 CID: 304.6 ci Weight: 3000.00 lb Forced Ind: No
Usage: 4 - Auto - Excellent In Daily-Driver, Slight-Mild To Choppy Idle Fuel Sys: Carb/Inj Nitrous: No

Specifications For Selected Camshaft: (for dual-profile cams, specs are high-speed lobe)
Part Number: 31-238-3 Grind: XE262H Selection Accuracy: Great Fit
Cam RPM Range: 1300 to 5600 Lifter Type: Hydraulic Lifter
Camshaft Family: XTREME Energy™ Hydraulic Flat Tappet Camshafts
Cam Description: Hydraulic-Excellent response, good mid-range, stock converter, 3.23-4.10 gear.

	Intake	Exhaust		IVO	IVC	EVO	EVC
Duration (0.050-inch):	218.0	224.0	Timing (0.050-inch):	3.0	35.0	46.0	2.0
Duration (seat-to-seat):	262.0	270.0	Timing (seat-to-seat):	25.0	57.0	69.0	21.0
Valve Lift (Std Rockers):	0.493	0.500	Lobe Centerline:	110.0			
Valve Lash	Hyd.	Hyd.	Intake CenterLine:	108.0			

Recommended Components And Accessories:
Recommended Torque Converter Stall RPM Range: 1700 to 2700 (Requires Complete Engine Simulation)

Complete K-Kit	Small SK-Kit	Cam & Lifter CL-Kit	Rocker-PushRod RP-Kit	Lifter Kit
31-238-3	SK31-238-3 [7]	CL31-238-3 [7]	RPM1431-16 [35,39]	832-16
Timing Set	Rocker Arms	Push Rods	Valve Springs	Steel Retainers
3230 [33]	1431-16 [35,56]	7831-16 [36]	942-16	768-16 [3]
Valve Locks	Valve Seals	Camshaft Break-In Lube		
601-16	602-16	159		

Additional Accessories
Installation Notes:
[3] Valve spring oil shield available.
[7] Stock springs cannot be used.
[33] Pre-'72 engines use part #3220.
[35] Part #4504 studs required for '78-present.

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Photos:

◆ Let's pull it!!



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◆ Almost out!!



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♦ That's the problem!!



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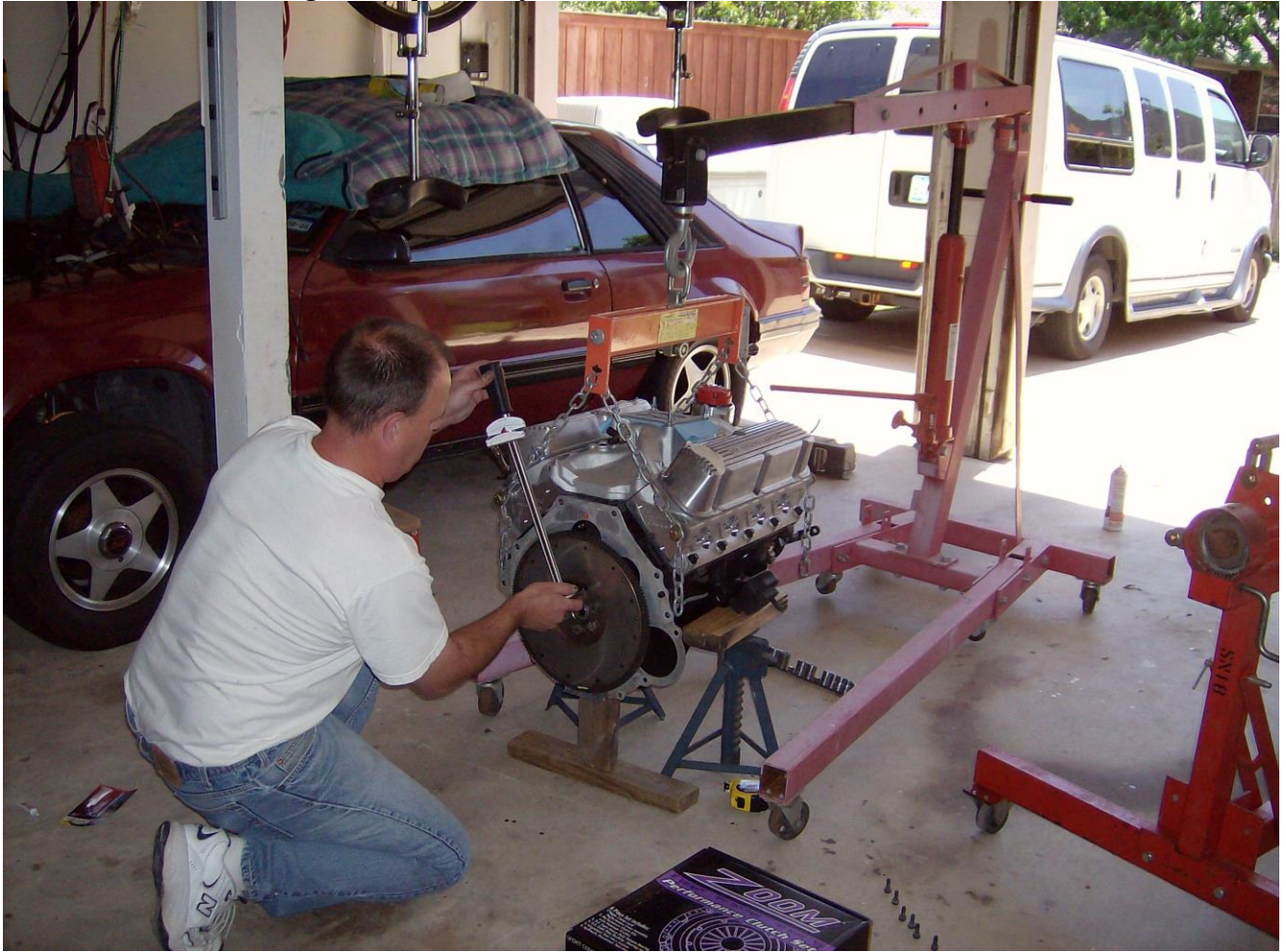
- ◆ Another problem (camshaft bearings)



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◆ Rebuild stage - Torque the flywheel



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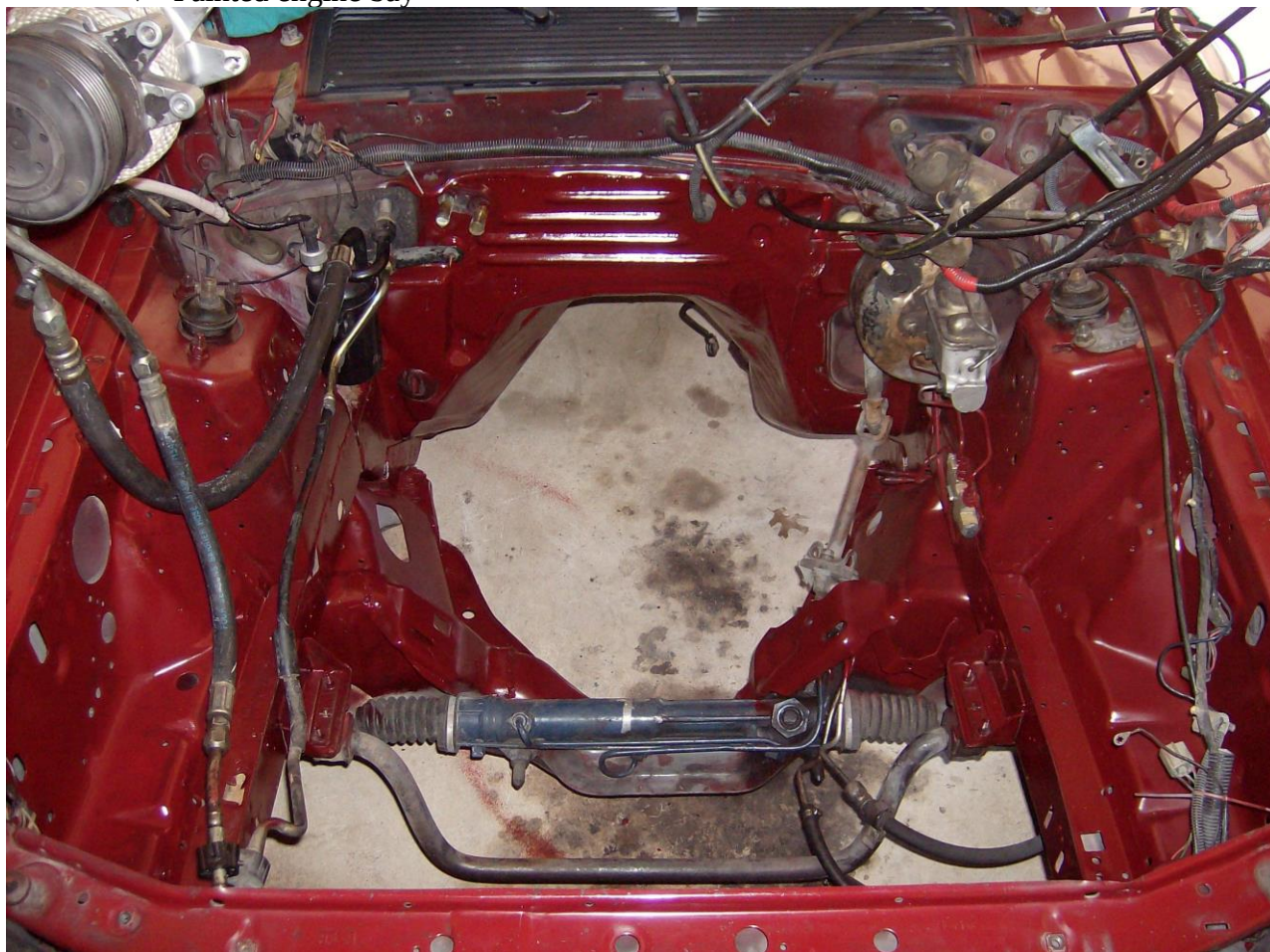
◆ Ready to put in!!



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◆ Painted engine bay



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◆ It's in!!



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♦ Almost there



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◆ It runs!!



WS320539.WMA

The sound is attached in a WMV file

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◆ Let's drive it!!



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- ◆ Time for the next project ... make the car look as good as the engine!



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- ◆ Ready to paint in my own small garage with a stupid pole!



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- ◆ Follow up 2015! This shot is prior to buffing out the clear coat. While it looks nice in a picture, an eyeball view shows my shoddy clear coating skills (runs, orange peel, etc.). Back was the worst because that is where I started. The front parts got a lot better but still required a lot of gentle care.



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Buffing/detailing in 2015:

- January: Color sand and buff rear quarters/top
 - Had to do a second pass on the rear half. Finished about mid-March.
- March: Deck
- End of May: Doors
- July/August: Windshield area and cowl
- September: Hood and front fenders
- December: Body side moldings installed.



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Final Touch's:

- New 2.5TR Rack/Pinion-Tight Front end (June 2015)
- Brake system overhaul (July 2015)
- American Muscle wheel/tire package. Sumitomo HTRZ 245ZR45-17 (April 2016)



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Interior:

- Fixed/repaired drivers seat floor pan fractures (December 2016)
- Dynamat on floor and Dynaliner at firewall (January 2017)
- New carpeting and floor mats (January 2017)
- Clean up rear seat (January 2017)



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Suspension:

- BBK Subframe Connectors (January 2017)
- Energy Suspension sway bar bushings and end link kit (July 2017)



The END!!!