WHAT MAKES PLYMOUTH'S "HEMI" SO HOT?
PLYMOUTH'S "HEMI" ROCKS THE STOCK-CAR CIRCUIT

In the Spring of 1964, when three specially prepared Plymoulths placed 1, 2, 3 in the Daytona "500", then proceeded to gobble up virtually every competitor on stock-car track and drag strip, the impression began to spread that Plymouth had "pulled a fast one" on the industry, and come out with something entirely revolutionary.

PLYMOUTH BUILDS THE FIRST PRODUCTION "HEMI"

And those with even a reasonably good memory, who may not be able to reach that far back in racing lore, should still be able to recall that as far back as 1951 Chrysler came out with a development known as "FirePower".

This landmark in combustion engineering was billed as "the most powerful . . . the most efficient engine ever developed."

That marked the debut of what became known as the "Hemi". Like all startling inventions, on close examination, it appeared to be deceptively simple.

On the surface, it appeared that all Chrysler had done was to angle the top of the combustion chamber in each cylinder to permit the use of larger intake and exhaust valves, locate the spark plugs in a central position, and insure almost straight-through gas flow. But it wasn't all that easy.

MANY YEARS FROM DRAWING BOARD TO TEST TRACK

In fact, although the general public may not realize it, and may even find it impossible to credit five years of experimentation went into this one Chrysler development alone, from drawing board to test track.

And, before it was released to the public, this engine was put through more than one million miles of testing on dynamometers in the laboratory, and on all kinds of roads, under all sorts of weather conditions, in every section of the country.

This is the kind of painstaking thoroughness that Chrysler Corporation engineering has come to be synonymous with down through the years.

But the "Hemi" was expensive to build. It was distinctly not a low-price engine. So it was not introduced to the Plymouth line at that time because of its cost and weight.

THE "HEMI" WAS AHEAD OF ITS TIME

Transmissions and gear ratios posed another problem, and production of cars of a decade-and-a-half ago did not have the types of transmissions or gear metals that lent themselves easily to the performance demands of the new "Hemi".

And the problems of manifolding were anything but minor. In addition, the engine, with the metals available for block and head construction, didn't permit the most efficient power-to-weight ratios desirable.

And Plymouth engineering, in typical fashion to stay competitive, was finding new and better ways to manufacture powerful lighter engines.

But the "Hemi", for all its expensive construction and weight, has proved it could do several, highly desirable things that every car manufacturer wants his production models to be able to do. Among them the delivering of more horsepower and greater torque than conventional engines of comparable size.

"HEMI" PROVED EXCEPTIONAL IN MANY WAYS

It proved its exceptionally high volumetric efficiency. This, in very simple terms, is the ability of an engine to draw into the cylinder, and to mix and ignite, the largest mixture possible of air and fuel, so that it may be efficiently transferred into power. This is attained through the very large valves. Free-flowing intake and exhaust ports. The almost complete absence of carbon formation. The efficient valve timing. And the highly effective cooling system that completely surrounds the valve ports.

It also showed unusually high thermal efficiency. This is an engine's ability to utilize the heat energy available in the fuel mixture. The "Hemi" enjoys this extra-high efficiency because of
its complete combustion of fuel, the minimum heat loss through the surface of the chamber, and the short flame travel which significantly reduces the time required to effect combustion.

The "Hemi" also manifested superior combustion characteristics primarily due to the size and shape of the chamber, and the size and location of the valves and spark plug. This shape permits the widely separated valves, the location of the spark plug near the center of the compact, symmetrical chamber.

**"HEMI" VALVE DESIGN INCREASES VALVE LIFE**

Another engineering achievement responsible for the brilliant performance of the "Hemi" is its valve train. It can be modestly claimed as the finest ever designed for a push-rod V-8 engine.

The "Hemi" design also offers increased valve life through greatly decreased valve-operating temperatures. Valve durability is also noticeably increased due to the wide spacing of the valves in the rigid chamber dome, which minimizes valve-seat distortion. Small diameter stems help reduce valve train inertia; and valve heads have a special shape for minimum air flow resistance.

Bear in mind that 15 years ago the original "Hemi" engine was acclaimed "the most powerful... the most efficient engine ever developed." It was the first American production version of an engine with a hemispherical combustion chamber, and still is.

**WHAT EVER HAPPENED TO THIS "WONDER ENGINE"?**

And, if the "Hemi" was all this good, what ever happened to it? Its stock production was discontinued because of numerous cost and weight factors.

Although it was "phased out" of production, the "Hemi" still remained in great demand for use as a drag-racing power plant for years after its production was discontinued in 1958.

As a matter of fact, demand for the "Hemi" persisted and increased so over the years from 1958 to 1963 that it was decided to produce it again in quantity in the Spring of 1964.

There is one big difference. The early "Hemi" was a passenger-car engine specially modified to make a racing engine out of it. The "Hemi" of today, the one you can buy at any Plymouth Dealer's for your new Plymouth, is a racing power plant modified to make it practical for use in a conventional passenger car.

And what happened with this new "Hemi"?

**THE "HEMI" BOUNCES BACK WITH A BANG**

Well, as we mentioned at the beginning of this booklet, it created a stir wherever it appeared in competition. Enough of a stir to make many a car buff wonder if it takes a "Hemi" to beat a "Hemi", it being admitted that if you want the utmost performance in a gasoline-burning combustion engine, you have to go to a hemispherical combustion chamber head.

The 1964 specially prepared "Hemi's" triumphs included the already mentioned 1, 2, 3 finish in the Daytona "500" of that year. The World Series of drag racing, both Spring and Winternationals the same year. And the speed record at Bonneville for closed stock cars in the Fall of the year, with "Grandpa" Norm Thatcher at the wheel.

**HERE'S WHAT MAKES THE "HEMI" TICK**

And the "Hemi" you can buy today excels its predecessors in almost every conceivable way. It is a beefed-up engine. It can take greater loads. It has strongly reinforced bearing caps. In short, it can take more of a beating, mile after mile, day after day, than ever before.

**Detailed cross-section of the reinforced bearing caps that help carry heavy loads.**

Broadly, its characteristics are these: It is of 426 cubic inches displacement, and is rated at 425 horsepower at 5000 rpm, and develops a torque of 490 lbs-ft at 4000 rpm.

It has twin 4-barrel carburetors, non-silenced low-restriction air cleaner, and low-restriction intake manifold and exhaust headers. And many of its internal components are patterned after those used exclusively in the "426" competition engines.

Mechanical tappets and push rods are of lightweight construction to reduce valve train inertia. The rocker arms are of forged steel for maximum strength and high-speed endurance, and are lubricated by oil metered into the rocker shafts through oil passages drilled in the cylinder heads.

Special heavy-duty chassis components provide the firm ride and handling precision one
expects from high-performance cars. Driveability has been given careful attention. Several features have been included to insure easy starting, normal handling in city traffic, and reliable service.

Typical of the special care that goes into the building of these engines are the following:
- Flushing and cleaning of all cylinder blocks in a special block washer operating at extra-high pressure.
- Select fitting of all engine bearings and other critical engine components to maintain required clearances.
- Regular power checks on a special dynamometer as required for statistical quality control.
- Disassembly and inspection of power-checked engines to insure a consistently high level of manufacturing quality.
- In addition, several special-purpose manufacturing and testing operations have been established expressly for the "Hemi", to insure maximum smoothness and service life under a wide range of driving applications.

For those who wish further details and exact specifications of just what makes this "Hemi" the greatest thing on wheels, they may be found in full at the back of this booklet.

THE "HEMI" FLEXES ITS POWERFUL MUSCLES

And in case all this accumulation of engineering-type data has sort of fogged up the issue of just what the "Hemi" will do, get this. Just how hot is this "Hemi"?

Well, in late September, 1965, the first '66 Plymouth Belvedere equipped with a street-version "Hemi" and driven by Bob Summers did two measured-mile runs at Bonneville Salt Flats at an average speed of 156.35 mph. This is a new Class B American closed-stock-car record.

In mid-season, Richard Petty returned to competition on the NASCAR circuit with his specially prepared Hemi-powered Belvedere, running only on short tracks of one mile or less. Yet in 14 races he qualified on the pole eight times, and in six of those times set a new qualifying lap record.

As a matter of fact, he set an unofficial world's record for a one-mile closed course, 116.260 mph, in this series of wins. Out of the 14 races, Petty took five 1sts, four 2nds, and two 3rds.

And before 1965 had ended, specially equipped Hemi-powered Belvederes had taken 13 firsts out of 18 USAC-sanctioned stock-car events, to give Belvedere the undisputed Manufacturers' Championship title for '65. And that included a victory in the Pike's Peak Hill Climb.

Not only did Norm Nelson, the "Great Dane", finish first in the USAC Championship point stand-
Then, in August of last year, at Palmdale, California, Shirley Shahan pushed her Hemi-powered "Drag-on Lady" to an S/SA top speed mark of 129.30 mph.

In October of last year Plymouth's "Hemi" was still making the competition eat its dust on the drag strips. At Long Beach the custom-built "Hemi-Cuda", campaigned by the Southern California Plymouth Dealers, became the quickest, fastest stock-bodied, stock-wheelbase drag machine going by doing a 168.53 mph top in 9.06 seconds.

You can buy this "Hemi" at your Plymouth Dealer's

How hot is Plymouth's "Hemi"? So hot that you may have lost sight of the fact that in the "Hemi" for 1966 we are again talking about a car you can buy in your Plymouth Dealer's showroom. This is a car built to sell to the performance-minded buyer.

So hot that the Plymouth engineers who built it glow all over with pride whenever the "Hemi" comes up for discussion. Plymouth's "Hemi" is just that good. Hot enough to have been chosen the proud pace car for the Daytona "500" this year.

How hot is Plymouth's "Hemi"? We think we've given you a pretty fair idea in this booklet. But you'll never really know until you've actually tried one. Why not ask your Plymouth Dealer for full particulars on this hot "Hemi" right now?

**SPECIFICATIONS**

**ENGINE**
- Type: 90°
- Number of Cylinders: 8
- Bore: 4.250"
- Stroke: 3.750"
- Compression Ratio: 10.25:1
- Piston Displacement: 426-cubic-inch
- Engine Output:
  - Horsepower: 425 hp @ 5000 rpm
  - Torque: 490 lb-ft @ 4000 rpm

**COMBUSTION CHAMBER SPECIFICATIONS**
- Combustion Chamber Volume: Min. 168 c.c. Max. 174 c.c.
- Distance from Top of Piston to Block Deck: .502 to .547".
- Maximum Variation between Cylinders: 30 psi

**CYLINDER NUMBERING**
- Left Bank: 1-3-5-7
- Right Bank: 2-4-6-8

**CYLINDER BLOCK**
- Material: Tin-Alloyed Cast Iron
- Cylinder Bore: 4.250"-4.252"
- Cylinder Bore Finish: 20 to 35 Micro Inches
- Tappet Bore Diameter: .9050"-.9058"

**INTAKE MANIFOLD**
- Material: Cast Aluminum
- Type: Double Level

**CRANKSHAFT AND MAIN BEARINGS**
- Type: Forged Counter Balanced, Shot Peened and Chemically Treated (Hardened journals)
- Bore: Tri-Metal - Copper-Lead Alloy with Steel Backing (MS-235)
- Diameter Main Bearing Journal: 2.7496-.7505
- Diameter Crankpin: 2.374-2.375
- Clearance: .0015 to .0025 (Selective Fit)
- End Play: .002" to .0085"
- Finish at Rear Seal
- Surface: Diagonal Knurling
- Interchangeable Bearings: Lower Nos. 1, 2, 4, 5
- Main Bearing Bolt Torque: 100 lb-ft
- Main Bearing Tie Bolt Torque: 45 lb-ft

**CONNECTING RODS AND BEARINGS**
- Rod Type: Drop-Forged ""A"" Beam
- Length: 6.861"
- Weight: 1084 Grams
- (less bearing shells)
- Bearings: Tri-Metal - Copper-Lead Alloy with Steel Backing (MS-235)
- Diameter: 2.376" x .927"
- Clearance: .0015" to .0025"
- Side Clearance (2 rods): .009"-.017"

**CAMSHAFT**
- Drive: Double Roller Chain
- Bearings: Steel-Backed Babbit
- Number: 5
- Thrust Taken by: Cylinder Block
- Clearance: .001"-.003"

**CAMSHAFT BEARINGS**
- Journal Diameter (mean)
  - No. 1: 1.9985"
  - No. 2: 1.9825"
  - No. 3: 1.9675"
  - No. 4: 1.9515"
  - No. 5: 1.7485"
- Bearing Clearance: .001"-.003"

**TIMING CHAIN**
- (Special Roller Type)
- Adjustment: None
- Number of Links: 66
- Pitch: 1.956" Width: .86"

**VALVES**
- Intake Material: Silicon-Chrome XB
- Head Diameter: 2.290" Stem Diameter: .309"
- Stem-to-Guide Clearance: .002"-.004"
- Angle of Seat: .450"
- Lift: .460"
- Duration: 276°
- Lash (Cold): .030"

**VALVES**
- Exhaust Material: 21-4N Chrome-Manganese with Welded Stellite Face
- Head Diameter: 2.290"
- Stem Diameter: .308"
- Stem-to-Guide Clearance: .003"-.005"
- Angle of Seat: .450"
- Lift: .460"
- Duration: 276°
- Lash (Cold): .032"

**VALVE SPRINGS**
- Number: 16 (inner); 16 (outer)
- Free Length: 2.290" (inner); 2.290" (outer)
- Installed Height: Min. 1.83" Max. 1.89"
- Load When Compressed:
  - Valve Closed: Inner:.4753 @ 1.635" Outer: .102 @ 1.86"
  - Valve Open: Inner:.8696 @ 1.175" Outer:.179-1.189 @ 1.40"
- Valve Spring Diameter: Outer:.1090"
- Surge Damper: Spiral Type

**TAPPETS**
- Type: Mechanical
- Clearance (in block): .0010"-.0023"
- Body Diameter: .9035"-.9040"

**PISTONS**
- Type: Domed-Forged Aluminum
- Material: Extruded Aluminum Alloy
- Tin-Coated Clearance at Top of Skirt: .0025" to .0035"
- Weight: .843 Grams

**PISTON RINGS**
- Number of Rings per Piston: 3
- Compression: 2
- Oil: 1
- Ring Side Clearance:
  - Top Compression: .0015"-.003"
  - Second Compression: .0015"-.003"
- Oil Ring (Steel Rails): .0002"-.005"

*Due to the high overlap, long duration and high lift of the camshaft, special care must be taken to be sure each tappet is on the base circle of its cam lobe when clearance is set.*
**SPECIFICATIONS (cont’d)**

**CYLINDER HEAD**
- Material: Cast Iron
- Combustion Chamber: Hemispherical
- Valve Seat Run-Out (maximum): .002"
- Intake Valve Seat Material: Integral
- Intake Valve Seat Angle: 45°
- Intake Seat Width: .060"-.080"
- Exhaust Valve Seat Material: Integral
- Exhaust Valve Seat Angle: 45°
- Exhaust Seat Width: .050"-.070"
- Cylinder Head Gasket Material: Stainless Steel
- Cylinder Head Gasket Thickness When Compressed: .025"
- Cylinder Head Bolt Torque: 70-75 lb-ft

**ENGINE LUBRICATION**
- Pump Type: Rotary Full Pressure
- Pump Capacity: **5 qts** (add 1 quart with filter change)
- Pump Drive: Camshaft
- Oil Pressure: 1000 rpm - 8 psi (hot) 45-65 psi (cold) @ 40-50 mph
- Oil Filter Type: Full-Flow

**FUEL PUMP**
- Type: Mechanically Operated
- Diaphragm Type
- Pressure: 6-8 psi

**CARBURATOR**
- Type: Two, 4-bbl Downdraft
- Model: AFB-4139S Front
- AFB-4140S Rear
- Throttle Bore
  - Primary: 1 3/4"
  - Secondary: 1 1/2"
- Main Venturi
  - Primary: 1 3/4"
  - Secondary: 1 1/2"
- Idle Speed (engine hot): 750 rpm
- Idle Mixture (both screws open): 1.2 turns

**IGNITION SYSTEM**
- Distributor Type: Double Breaker, Automatic Advance
- Basic Timing: 12° B.T.C.
- Advance—Centrifugal: 0° @ 1000 rpm (Crankshaft Degree @ 1400 rpm @ Engine rpm): 17° @ 2800 rpm
- Advance Automatic—Vacuum (Distributor Degrees @ Inches of Mercury): 0° @ 6" to 9" 4.5° to 7.5° @ 12" 8.25" to 11" @ 15"
- Breaker Point Gap: .014" to .019"
  (use dwell meter for final setting)

**Dwell Angle**
- One Set Points: 31°-32°
- Both Sets Points: 37°-42°

**Breaker Arm Spring**
- Tension: 17 to 21.5 oz.
- Rotation: Counterclockwise

**Spark Plugs—Type:** N-9Y
- **Size:** 14MM 3/4" Reach
- **Gap:** .035"

**Firing Order**
- 1-8-4-3-6-5-7-2
- Coil PN 2444242
- Primary Resistance: 70-80Ω
- 1.65-1.79 Ohms
- Secondary Resistance: 70-80Ω
- 1.41-1.55 Ohms
- 9400-11700 Ohms
- 9200-10600 Ohms
- Ballast Resistor
- Resistance @ 70-80°F 0.5 to 0.6 Ohms
- Current Draw (coil & ballast resistor in circuit)
- Engine Stopped: 3.0 Amps
- Engine Idling: 1.9 Amps

**CLUTCH**
- Free Play Adjustment: 1/2" Min.; 3/4" Max.

**REAR AXLE**
- Axle Shaft End Clearance: .013 Min.; .023 Max.
- Ratio: 3.23 Automatic
- 3.55 Manual

**TORQUEFLITE TRANSMISSION**
- Line Pressure: 90 psi @ 1000-1100 rpm
- SIN (engine): Only oils labeled “For Service MS” should be used.
- NOTE: SAE 30 is recommended for acceleration trials.

**TRANSMISSION FLUID**
- Manual: SAE 80-90 Gear Oil
- TorqueFlite: Use Automatic Transmission Fluid Type “A” Suffix “A”

**CAPACITIES—Transmission**
- Manual—Four-Speed: 7½ pts
- TorqueFlite: 18 pts

**BOLT & NUT TORQUE SPECIFICATIONS**
- Cylinder Head Bolts: 70-75 lb-ft
- Main Bearing Bolts: 100 lb-ft
- Main Bearing Cross Bolts: 45 lb-ft
- Connecting Rod Bolts: 100 + 5 lb-ft
- Torque Converter Plate to Converter Screws: 65 lb-ft
- Torque Converter Plate to Crankshaft: 110 lb-ft
- Intake Manifold: Has three different torque requirements depending upon location of manifold bolts—refer to Service Bulletin

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**Cutaway of portion of the “Hemi” showing the bewildering complexity of the automotive power plant that is accepted by many car enthusiasts as “the most powerful ... the most efficient engine ever developed.”**

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*Check oil level indicator (dip stick) and change if necessary to correspond to correct level. Maintaining proper oil level is necessary during acceleration trials.

†Uses new, special-hardened cylinder-head bolt washers.