

# Cylinder block

The **cylinder block** or **engine block** is a machined casting (or sometimes an assembly of modules) containing cylindrically bored holes for the pistons of a multi-cylinder reciprocating internal combustion engine, or for a similarly constructed device such as a pump. It is a complex part at the heart of an engine, with adaptations to attach the cylinder head, crankcase, engine mounts, drive housing and engine ancillaries, with passages for coolants and lubricants. The distance between the cylinder bores (midpoint to midpoint) cannot easily be changed since the machining facilities would require extensive modification. Instead, the bore (diameter) is commonly varied to obtain different engine displacements. This and the minimum thickness of material required between two cylinders are a limiting factor concerning the potential displacement because the bore to stroke ratio has to stay within certain limits. Engine blocks are usually made from cast iron or, in modern engines, aluminium and magnesium.

A *wet liner* cylinder block features removable cylinder bores which fit into the block by means of special gaskets and offer the advantage of being easily replaced without the need to re-machine the entire casting. Wet Liner designs are popular with European manufacturers, most notably Renault and Peugeot who continue to use them to the present.

The distance between the cylinder bores has led to a distinction between the V8 engine families the Detroit Big Three automakers (Ford, General Motors and Chrysler) have been building since the 1950s: There are **Small-block** and **Big-block** engines. These families differ in respect to the distance between cylinder bores, but not necessarily in engine displacement since the latter is defined by bore and stroke.

While the big-blocks have been less commonly used in recent years, the small-block families have grown in displacement and have now reached a level that was reserved for big-blocks in previous years (up to 7 litres of displacement in a Chevrolet Corvette). Even though the technology has greatly changed, basic specifications have been the same for fifty years<sup>[1]</sup>.



The cylinder block of a Ford 14 DOHC engine



The cylinder block of a United Kingdom Rover K-series 16 valve DOHC engine with *wet liner* cylinders

## Big block

A **big-block** engine is generally a North American V8 (though can be other cylinder arrangements) in a family of engines which generally have greater than 5.9 L (360 cubic inches) of displacement; factory engine sizes reached a peak of 8.2 L (500 cubic inches) in Cadillac's 1970s range. Since then manufacturers have responded to the need for superior engines, as well as the need to replace surviving worn-out, decades-old big-block racing engines which have been rebuilt too many times. In 2002 General Motors released the carbureted Chevrolet 572 crate engine (9.4L), available for installation in most vehicles with sufficient space under the hood, both in a 620 hp (460 kW) street version, which runs on premium gasoline, and a 720 hp (540 kW) version, which requires racing fuel. Mopar (Chrysler) recently released the 426 Hemi (7.0L), 472 (7.8L), 528 (8.7L) and 540 (8.8L) Hemi crate engines. As well as the 440 (7.4L) wedge crate engine. Both of these incorporate modern hardened metals, and can use unleaded gasoline.



A big-block Oldsmobile 400 cubic engine, which is capable of delivering 360 horsepower (270 kW) and 440 foot-pounds force (600 N·m) of torque.

Smaller V8 engines are known as small-blocks; some members of small-block engine families may exceed 7 L, blurring the distinction somewhat. The distinction came about in the early 1960s when the large full-size cars needed a bigger V8 than the smaller mid-size and compact cars. Before that, manufacturers normally had only one V8 engine line. A good example of a "Big-Small Block" is the Chrysler 360 LA engine.

The term is normally used only for engines from the "Big Three" (Ford Motor Company, General Motors, and Chrysler Corporation) since other companies often did not keep two V8 engine size families.

Big-block V8s were most commonly used in full-size and luxury cars, rather than performance vehicles. Thus, they were commonly tuned and built for smoothness and low-end power to get heavy cars rolling and effortlessly cruising. Many big-block engines were less technically sophisticated than their small-block counterparts, and their power-to-weight ratios were often lower.

However, they did see performance applications. Performance-tuned big-blocks were used in NASCAR racing, and homologation requirements saw these engines sold for road use. Because of NASCAR's 7 L engine size limit, many high-performance big-block engines, like the Chevrolet's 427, Ford's 429, and Chrysler's 426 Hemi engines, were built to this size. In the early 1960s, the explosion of the muscle car market saw performance big-blocks fitted to intermediate-size, 2-door sedans, coups, and sports cars. Some used derivatives of the racing engines, but in addition performance versions of former luxury motors were produced.

After the 1973 oil crisis, the big-block in passenger cars had a short future. By the end of the 1970s, they were no longer found. These engines remained in use in pickup trucks and other non-car uses. Currently, only GM offers big-block V8s in its trucks. Ford and Chrysler replaced their big-blocks with stretched V10 versions of their small-block engines in the early to mid 1990s. Today big-block engines are used primarily in racing. However, December 18, 2009 saw the production of the very last production big-block Chevy engine currently on the table to be made by General Motors.

## Ford

Ford does not categorize its engines using the big/small block nomenclature. Rather, Ford literature distinguishes engine by its series, or family. Enthusiasts unaware of this fine point will nonetheless classify the larger families as big block engines. Third-party equipment vendors, following suit, have adopted the practice as well.[2]

- Ford FE series – this family includes engines as small as 332 ci.
- Ford 385 series – successor to the FE and MEL families
- Ford Super Duty engine – Ford's heavy truck engine (401/477/534)
- Ford MEL engine – Ford's Mercury/Edsel/Lincoln big block engine series

## General Motors

- Chevrolet Big-Block engine
- Cadillac V8 engine

## Chrysler

- Chrysler B engine
- Chrysler RB engine
- Chrysler Hemi engine

## Small block

A **small-block** engine is generally a North American V8 (though can be other cylinder arrangements) in a family of engines which generally have less than 6 liters (360 in<sup>3</sup>) of displacement, although some derivatives have grown larger (up to 427 in<sup>3</sup>, 7.0 L). A 505in<sup>3</sup>, 8.3 L V10 is produced by Chrysler, a derivative of the LA engines. Larger families of engines are called big-blocks. The distinction came about in the late 1950s when the large full-size cars needed a bigger V8 than the smaller mid-size and compact cars – though consumers wanted a V8 under the hood, the recession of the late 1950s provided some of the earliest American awareness of fuel economy. Prior to that point, manufacturers normally had only one V8 engine line.

The term is normally used only for engines from the "Big Three" (Ford Motor Company, General Motors, and Chrysler Corporation) since the other companies did not keep two V8 engine size families. However, it is sometimes used for the more modern and compact V8s produced by others, such as Studebaker.

The term "block" refers to a piston engine cylinder block, which is the lower portion of a piston engine containing the pistons and cylinder bores.

Although a small-block V8 generally has a smaller displacement than the equivalent big-block, a small-block engine can be built to develop significant amounts of power. Additionally, many small-block engines were more advanced technologically than their big-block counterparts, and were much lighter and smaller. Innovations such as aluminium heads and blocks generally came first to small-blocks. From a new car buyer's standpoint, they tended to offer an acceptable compromise between horsepower and economy, so they were a popular option instead of the basic I6 or V6 engine base model. Because of their attractive combination of popularity (and therefore low-cost availability) coupled with good performance, good fuel economy and light weight, they were often preferred in racing and sporting applications. Many hot rods and custom cars are fitted with small-block V8s, particularly the GM (Chevrolet) 350 engine and the Ford 351 Windsor.

There are some cases in which small-blocks seem to encroach upon big-block displacements; in these cases it is most important to keep in mind that small-block and big-block refer to engine *families*, not simply displacements. For example, engines ranging from the 4.8 L Vortec 4800 to the 7.0 L LS7 are all GM small block V8s, and share the same general external dimensions. The LS7 achieves enormous displacement by having a very large bore and stroke in the same compact block as previous small-blocks, but has very little space between cylinders. This would not be

acceptable in a truck engine, and was not possible forty years ago. As a result, 7.0 L is a displacement ordinarily reserved for big-blocks, which can achieve it with fewer compromises in reliability and less engineering effort. A 7.0 L big block, like the 427 Chevy first seen in 1966 Corvettes, is a much larger engine externally and shares external dimensions with engines ranging from the 6.5 L 396 to the 8.1 L Vortec 8100.

## Ford

Ford does not categorize its engines using the big/small block nomenclature. Rather, Ford literature distinguishes engine by its series, or family. Enthusiasts unaware of this fine point will nonetheless classify the smaller families as small block engines. Third-party equipment vendors, following suit, have taken up the practice as well.[2]

- Ford Y-block family (1954–1962)
- Ford Windsor or 90 degree family (1962–2001)
- Ford 335 series (AKA Ford Cleveland engine, also erroneously referred to as "mid block", because some variants mate to the bell housings for larger displacement families.) (1970–1982)
- Ford Modular engine

## GM

General Motors small-block V8s include:

- GM Small-Block engine – Generation I chevy small-block 1955–2003
- Oldsmobile V8 engine – Oldsmobile small-block 1964–1990
- GM LT engine – Generation II small-block
- LT5 – DOHC 4-valve small-block from Lotus/Mercury Marine
- GM Premium V engine – Cadillac Northstar and derived engines
- GM LS engine – Generation III and IV small-block

## Chrysler

Chrysler Corporation small-blocks include:

- Chrysler A engine – (1956–1966) first generation small-block
- Chrysler LA engine – (1964–) second generation small-block
- Chrysler PowerTech engine – (1999–) Jeep-developed replacement for LA
- Chrysler Modern Hemi engine – (2002–)

## See also

- Monobloc engine
- Head gasket
- Freeze plug
- crankshaft

## External links

- Cylinder block highlight: Hypervideo showing construction and operation of a four cylinder internal combustion engine courtesy of Ford Motor Company <sup>[3]</sup>
- cylinder block manufacturing process videos <sup>[4]</sup>