AMC Straight-6 engine

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(Redirected from AMC Straight 6 engine)

The **American Motors Corporation (AMC) straight-6** family of engines was used by a number of AMC and Jeep vehicles from 1964 through 2006.

- For an outline of all engines used by AMC see
  Main article: AMC Engines

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195.6

American Motors' first straight-six engine was the 195.6 cu in (3.2 L). It was produced from 1958 through 1965 in both overhead valve (OHV) and "flathead" (L-head) side-valve versions.

Sometimes referred to as the **196** engine, this engine was originally designed by Nash in the 1930s as a flathead, and redesigned as an OHV engine in 1956. The flathead version was discontinued for 1956 and 1957, but reemerged in 1958 as the economy engine for the "new" Rambler American. When the engine was

changed to an OHV configuration the water pump was moved from the left side of the engine (driven by a shaft extending from the back of the generator) to the front above the timing chain. When the flathead model was reintroduced it also received the new water pump. Equipped with such high quality parts as forged crankshafts and connecting rods, these engines earned a reputation for remarkable durability. The flathead, however, was prone to the typical flathead problem of overheating under sustained heavy load. This was from the hot exhaust traveling through the cylinder block to the exhaust manifold.

American Motor introduced an aluminum block version of the OHV 195.6 cu in (3.2 L) engine in 1961. It was produced through 1964. This engine used cast iron cylinder liners and a cast iron head. The head is slightly wider on the right side than the cast iron block head. The heads will physically interchange, but the head designed for the cast iron block will need material added to its right side to properly seal on an aluminum block.

The 196 OHV requires more periodic maintenance than newer model engines. The head bolts must be re-torqued (retightening process) regularly. Factory service manuals recommend that head bolt torque be checked every 4,000 miles (6,437 km) and to re-torque them every 8,000 miles (12,875 km). With modern head gaskets this service interval can be extended to re-torque the bolts every 12,000 miles (19,312 km) miles, or every other year. The exact cause of the headbolts loosening over time is unknown, but it is believed that thermal expansion and contraction of the block, head, and bolts eventually causes the seal between the head and block to loosen. This maintenance is imperative to prevent the engine from running hot (the first sign of a blown head gasket) and thus warping or cracking the head. The cast iron liners in the aluminum block version can also shift if the head bolts are not properly torqued and the engine is run hot. If this process is not followed, then repairs will be necessary and replacement heads and aluminum blocks for these engines are now more difficult to find.

In compensation, this required maintenance is quite easy. Re-torquing the head and adjusting the valves typically takes under 45 minutes to complete, start to finish, and is done with only two open-end wrenches and a feeler gauge. Some skills are required, but it is not challenging, and adjusting the valves on a running engine (as is required) is today a rare pleasure.

Modern head gaskets usually come with a statement that "no re-torque or sealant is required". This "no re-torque" refers to the process when the early gaskets had to be retightened upon installation after the engine had been run for a short period at full operating temperature. This procedure was necessitated by the type of material used for the gaskets. This process was usually called "bedding in" the gasket. Today, all replacement 196 head gaskets are made of modern materials and do not need to be retightened after the initial installation. However, they still require re-torquing every 8,000-12,000 miles or every other year as noted previously.

It is imperative to use a sealant on all 196 head gaskets. Long-term experience of owners of cars with the 196 engine is that the gaskets need an additional sealant regardless of the gasket manufacturers recommendation. A brush-on shellac (such as "Indian Head" brand) or spray-on copper or aluminum sealer is all that is needed. Without the additional sealer the head gasket will seep a small amount oil into the water jacket and down the sides of the engine. Nevertheless, there seems to be a small amount of seepage on the right side even with sealer that is normal for this engine. This is likely due to the number of head bolts (15 - four around each cylinder plus one extra) and just adequate sealing surfaces - at least .25 inches (6 mm) wide in all areas, but not much more in most. On the L-head engines, the head also seals the intake tract on the right side of the engine.

The modern era I-6

The company designed an entirely new six cylinder for 1964, and was produced, albeit in a modified form, up until 2006.


Engine bay of a 1968 Rambler American

First produced in 1964 and introduced as an option in the Classic and Ambassador in the middle of the 1964 model year, the 232 cu in (3.8 L) "Typhoon" in-line six was AMC's first modern six cylinder engine. It replaced the Nash 195.6 cu in (3.2 L) OHV I-6 in the Classic and Ambassador in 1965 (the first use of a six in the Ambassador since 1956). In 1966 a 199 cu in (3.3 L) version finally replaced the aging 195.6 cu in (3.2 L) OHV and L-head engines. To commemorate the engine's May 1964 introduction, 2,520 "Typhoon" cars were made on the Classic hardtop body. Each featured the new 232 six, Solar Yellow body paint, a Classic Black roof, and a distinctive "Typhoon" script in place of the usual "Classic" name. All other AMC options (except engine options) were available.

Both the 199 and 232 featured a 3.75 in (95 mm) bore, and either a 3.0 in (76 mm) or 3.5 in (89 mm) stroke. The 199 was discontinued in 1970; the 232 was offered alongside the 258 cu in (4.2 L) (made by using a 3.895 in (98.9 mm) stroke crankshaft and slightly taller block) during the 1970s, but was discontinued in 1979. Increasing emissions controls continued to rob the engine of power, making the smaller version inadequate as safety regulations also added weight to the vehicles it was required to push around.

AMC changed the deck height of the six in 1971, increasing it 1/8-inch to allow the longer stroke of the 258. This alters pushrod length on all engines built after 1971. The 232 was continued on the taller deck block by using the previous crankshaft with the slightly longer 199 rod.

199

The 199 cubic inch/3.3L (198.8cuin / 3,258cc) **199** was produced from 1965 through 1970.

Applications:

- Rambler Classic (1965-66, fleet cars only)
- Rambler American/AMC Rambler (1965-69)
- AMC Hornet (1970)
- AMC Gremlin (1970)

232

The 232 cubic inch/3.8L (231.9cuin / 3,801cc) **232** was produced from 1964 through 1979. Through 1970, the engine shared a deck height with the 199. Starting in 1971 AMC raised the deck height to produce the 258, and the 232 adopted the 199's longer connecting rods. Bore and stroke remained the same.

Applications:

- Rambler Classic (1964-1966)
- Rambler American/AMC Rambler (1964-1969)
- Rambler/AMC Marlin (1965-1967)
- Rambler/AMC Ambassador (1965-1970)
- Rambler/AMC Rebel (1967-70)
- AMC Javelin (1968-74)
- AMC Hornet (1970-77)
- AMC Gremlin (1970-78)
- AMC Matador (1971-74)
- AMC Pacer (1975-79)
- AMC Concord (1978-79)
- AMC Spirit (1979)
- Jeep CJ (1972-79)
- Jeep Cherokee (1974-79)
- Jeep Wagoneer (1965-1971)
- Jeep J series trucks (1965-1970)
- Jeep Commando (1972-1973)
- International Harvester Scout (1969-1971)

252

The 252 cu in (4.1 L) engine was produced by AMC's Mexican subsidiary Vehiculos Automotores Mexicanos (VAM) beginning in late 1971 or early 1972. This was similar to a 232 in stroke with a larger 3.91 in (99 mm) bore (252.15 cuin / 4,130 cc).

Output for 1972 Rally model:

- Horsepower 170 @ 4600 rpm
- Torque 240 @ 2300

Engine dimensions:

- CR 9.500 in (241.3 mm) (standard model was 8.5:1)
- Intake Valve Diameter 2.020 in (51.3 mm)
- Exhaust Valve Diameter 1.6755 in (42.56 mm)
- Pushrod Length 5.875 in (149.2 mm)
- Deck Height 9.424 in (239.4 mm)
- Bore 3.910 in (99.3 mm)

- Stroke 3.895 in (98.9 mm)

Applications:

- VAM Pacer AMC Pacer
- VAM Rally AMX and Rally GT Spirit
- VAM American and American Rally AMC Hornet and AMC Concord
- VAM Gremlin AMC Gremlin
- VAM Classic AMX and Brougham AMC Matador Coupe
- VAM Classic AMC Matador
- VAM Javelin AMC Javelin
- VAM Lerma

258

The 258 cu in (4.2 L) in-line six was produced from 1971 until 1990. It featured an undersquare 3.75 in (95 mm) bore and 3.895 in (98.9 mm) stroke; it was otherwise similar to the 199 and 232. Later 258 models (starting with the 1980 model year for California AMCs, 1981 for California Jeeps and 1982 for all other applications) are equipped with AMC's CEC system.

Engine bay of a 1980 AMC Spirit AMX with numerous emissions controls

Applications:

- AMC Hornet/Concord/Spirit/Eagle (1971–1988)
- AMC AMC Pacer
- AMC AMC Matador (1971–1978)
- AMC Gremlin and Spirit (1971–1983)
- International Harvester Scout & Light Duty trucks (1972-1974)
- Jeep CJ (1972–1986)
- Jeep Cherokee and Wagoneer (1972–1986)
- Jeep J series trucks (1971-1988)
- Jeep Wrangler (1987–1990)
- Jeep Commando (1972-1973)

282

The 282 cu in (4.6 L) engine was produced by AMC's Mexican subsidiary Vehiculos Automotores Mexicanos (VAM) beginning in late 1971 or early 1972. This was similar to a 258 in stroke with a larger 3.917 in (99.5 mm) bore (281.7cuin / 4,616cc).

Output for 1977 models:

- Horsepower 200 @ 4400
- Torque 280 @ 2200
- CR 8.00 in (203 mm)

Output for 1979 Standard models:

- Horsepower 132 @ 3800
- Torque 216 @ 2200
- CR 8.00 in (203 mm)

Output for 1979 S and GT models:

- Horsepower 172 @ 4200
- Torque 225 @ 2600
- CR 8.50 in (216 mm)

Output for 1982-83 models:

- Horsepower 129 @ 4000
- Torque 218 @ 1800
- CR 8.50 in (216 mm)

Engine dimensions:

- Intake Valve Diameter 2.020 in (51.3 mm)
- Exhaust Valve Diameter 1.6755 in (42.56 mm)
- Pushrod Length 5.875 in (149.2 mm)
- Deck Height 9.424 in (239.4 mm)
- Bore 3.917 in (99.5 mm)
- Stroke 3.895 in (98.9 mm)

Applications:

- VAM Pacer AMC Pacer
- VAM Rally AMX and Rally GT Spirit
- VAM American and American Rally AMC Hornet and AMC Concord

- VAM Gremlin AMC Gremlin
- VAM Classic AMX and Brougham AMC Matador Coupe
- VAM Classic AMC Matador
- VAM Javelin AMC Javelin
- VAM Lerma

4.0


Engine bay of a 1993 Jeep Grand Cherokee with 4.0 L

The 242 cubic inch "242 *or* 4.0 L *or* 4.0" straight-6, that was introduced in 1987, was an evolution of the 258 I-6 and the 150/2.5 L, AMC's straight-4.[1] It had the same 3.895 in (98.9 mm) bore as the 2.5 with a longer 3.414 in (86.7 mm) stroke giving it a displacement of 241.6 CID (3,959 cc).[2]

This American Motors Corporation legacy engine was redesigned by Chrysler to reduce noise, vibration, and harshness. The last in the line of the seven main bearing AMC inline sixes, the 4.0 is regarded as one of the best 4x4 off-road engines.[3] The 4.0 AMC six has many after market parts due to its longevity and durability. Many of these engines are known to go more than 300,000 miles (483,000 km) without rebuilding. [4]

The first 4.0 engines in 1987 had RENIX (Renault/Bendix) engine control systems, which were quite advanced for their time, but are now handicapped because there are very few scan tools which can be "plugged in" to a RENIX system for diagnosis. The RENIX also used a engine knocking sensor, which allowed the computer to know if pre-detonation was occurring, thus allowing the computer to make the appropriate changes to prevent this. RENIX systems have no "permanent" memory for the diagnostics system. Once the ignition switch is turned off any codes generated are lost, thus making it difficult to detect intermittent problems.

The 1987 RENIX 4.0 made 173 hp (129 kW) and 220 lb·ft (298 N·m) of torque. In 1988 the 4.0 received higher flowing fuel injectors, raising output to 177 hp (132 kW) and 224 lb·ft (304 N·m). In comparison, "this engine made more power than the Ford 302 V8, Chevy 305 V8, Chrysler 318 V8, as well as any of the 6 cylinder engines the Japanese were putting in their trucks... and it had comparable or better fuel economy."[5]

Chrysler bought AMC in 1987 and continued to produce the 4.0 straight six. In 1991 Chrysler redesigned the RENIX engine control computer and raised the intake ports approximately 1/8-inch (3.175 mm) for a better entry radius. Chrysler also enlarged the throttle body and redesigned the intake and exhaust manifolds for more efficiency, and the fuel injectors were once again replaced with higher flowing units. The camshaft profile was also changed. The net result was an engine that made 190 hp (142 kW) and 225 lb·ft (305 N·m) of torque. Badging on most Jeeps equipped with this engine read "4.0 Litre HIGH OUTPUT." The new cam profile combined with altered computer programming eliminated the need for an EGR valve and knock sensor, but made the engine more sensitive to alterations, especially where emissions are concerned.

Small changes were made to the cylinder head for the 1995 model year. In 1996, the engine block was redesigned, and a new strengthened unit was then used. The new block made use of more webbing cast into the block, and a stud girdle for added rigidity of the crankshaft main bearings. The cylinder head was again

changed around 1998 to a lower flowing, more emissions-friendly design. Engines installed in 1999 Grand Cherokees carried the *Power Tech* name, which had been used intermittently in prior years. The name was subsequently passed on to 4.0s in all Jeep models.

Output as of 2004 was 190 hp (142 kW) at 4600 rpm with 230 lb·ft (312 N·m) of torque at 3000 rpm.

The 4.0 is probably the most recognizable and longest-running Jeep powerplant in the brand's history. It was discontinued at the end of the 2006 model year as the redesigned 2007 and onward the JK Jeep Wranglers use Chrysler's 3.8 L OHV V6. However, it is foreseeable that this engine may be made for many more years in the People's Republic of China, where a slightly modified version of the XJ Jeep Cherokee with 2.5 and 4.0 engines is still being produced.

This engine was used in the following vehicles:

- 1987–2001 Jeep Cherokee
- 1993–2004 Jeep Grand Cherokee
- 1987–1990 Jeep Wagoneer
- 1987–1992 Jeep Comanche
- 1991–2006 Jeep Wrangler

Rod Lengths

1964-71:

- 199 CID (3.3 L) - 6.125 in (155.6 mm)
- 232 CID (3.8 L) - 5.875 in (149.2 mm)

1972-2006:

- 232 CID (3.8 L) - 6.125 in (155.6 mm)
- 242 CID (4.0 L) - 6.125 in (155.6 mm)
- 258 CID (4.2 L) - 5.875 in (149.2 mm)

- The cubic in displacement is different from the 1990-95 and 1996-2006 I6 by 2 ci. From 90 through 95 the bore was 3.88 in and stroke of 3.44. In 1996 the bore was the same but the stroke changed to 3.41 in. Mathematically it comes out to the true 242 ci for 1996-2006 but the 1990-95 are 244ci. Both equal to 4.0 liters though (most likely due to varying methods of rounding numbers)*

See also

- AMC Straight-4 engine

- AMC V8 engine
- AMC Engines
- AMC and Jeep transmissions
- List of Chrysler engines
- Allpar's 4.0 page (http://allpar.com/mopar/40.html)

References

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2. ^ Jeep (2000). "XJ 4.0L sec9 page115" (Print and pdf). *Service Manual 2000 Jeep Cherokee*. DiamlerChrysler. "bore x stroke = 3.875 x 3.414 in"
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4. ^ [1] (http://www.cherokeeforum.com/showthread.php?t=17463) JeepCherokeeForum.com - retrieved August 29, 2009
5. ^ "The Jeep 4.0 liter PowerTech Straight-Six Engine" by Allpar.com (http://www.allpar.com/mopar/40.html) , retrieved 5 April 2009.