JEEP 4.0 PERFORMANCE TECH SPECS

4.0 Engine Power Ratings

The Jeep 4.0 litre I6 engine is a pushrod overhead valve design with 2-valves/cylinder. The factory power ratings are as follows:

'87..... XJ: 173hp at 4500rpm, 220lbft @ 2500rpm, redline 5000rpm
'88-'90 XJ: 177hp at 4500rpm, 224lbft at 2400rpm, redline 5000rpm
'91-'95 XJ: 190hp at 4750rpm, 225lbft at 3950rpm, redline 5250rpm
'96-'99 XJ: 190hp at 4600rpm, 225lbft at 3000rpm, redline 5300rpm
'00-'01 XJ: 193hp at 4600rpm, 231lbft at 3000rpm, redline 5300rpm

'91-'95 YJ: 180hp @ 4750rpm, 220lbft @ 3950rpm, redline 5250rpm
'96-'99 TJ: 181hp @ 4600rpm, 222lbft @ 2800rpm, redline 5300rpm
'00-'06 TJ: 190hp @ 4600rpm, 235lbft @ 3200rpm, redline 5300rpm

'93-'95 ZJ: 190hp @ 4750rpm, 225lbft @ 3950rpm, redline 5250rpm
'96-'98 ZJ: 185hp @ 4600rpm, 220lbft @ 2400rpm, redline 5300rpm
'99-'05WJ:195hp @ 4600rpm, 230lbft @ 3000rpm, redline 5300rpm

The '87-'90 engines had Renix electronic multipoint fuel injection, electronic ignition, a single 51mm (2.0") throttle body, and a rather inefficient low port cylinder head.
In 1991 engines received Chrysler sequential MPFI, a larger 60mm throttle body, revised intake and exhaust manifolds, and a more efficient high port cylinder head. As a result, these engines produced 13hp more than their predecessors and gained the "High Output" designation.
In 1996 engines received noise, vibration, and harshness fixes. The blocks were stiffened with extra ribbing, a main bearing brace was added, and lighter cast aluminium pistons were introduced to reduce cold start piston slap. Engines also received revised camshaft timing for more low rev torque.
In 2000 a distributorless coil-on-plug ignition system was installed, intake and exhaust manifolds were revised, and a more efficient water pump was included.

Injectors

Some of those specs that are hard to find in any workshop manual.

The following is a list of the injectors used on the 4.0L since 1987 along with their rated static flow:

Model Year, ...Part #, ...Colour, ...Fuel Pressure, ...Static Flow,
'87-'90, ...53003956, ...Black, ...39psi, ...18.6lb/hr
'91-'93, ...33007127, ...Brown, ...39psi, ...21.0lb/hr
'94-'95, ...53030343, ...Tan, ...39psi, ...21.0lb/hr
'96-'98, ...53030778, ...Grey, ...49psi, ...23.3lb/hr
'99-'04, ...04854181, ...Blue tip, ...49psi, ...22.5lb/hr
'05-'06, ...53013690AA, ...Brown tip, ...49psi?, ...23.3lb/hr?

The injector flow rate varies as the square root of the pressure drop across the injector. The stock '91-'95 4.0 injectors are rated at 22lb/hr @ 43psi fuel pressure, so at 39psi they flow (sq. rt.(39/43) x 22.0 = 21.0)

Cylinder head

The stock cylinder head is cast iron and weighs 60lb. The valve head diameter is 1.91" intake/1.50" exhaust. Casting numbers are as follows:

Year.....Casting No
1987-90.....2686
1991-95.....7120
1996-99.....0630
2000-01.....0331

Cylinder head flow figures (cfm) at 28inH2O pressure drop are:

Non-HO head #2686 (Courtesy of Greg Friedman)

Valve lift (in)..... 0.2 ... 0.3 ... 0.4 ... 0.5 ... 0.6
Intake flow.... 122.0 168.0 186.0 189.0 192.0
Exhaust flow....88.0 114.0 130.0 134.0 138.0

Ported non-HO head #2686

Valve lift (in)..... 0.2 ... 0.3 ... 0.4 ... 0.5 ... 0.6
Intake flow.... 124.0 183.0 197.0 207.0 216.0
Exhaust flow....87.0 113.0 138.0 153.0 159.0

HO head #7120 & #0630 (Courtesy of John Brown)

Valve lift (in)... 0.1 ... 0.2 ... 0.3 ... 0.4 ... 0.5 ... 0.6
Intake flow.... 66.0 128.0 179.0 206.0 209.0 209.0
Exhaust flow. 55.0 100.0 120.0 136.0 141.0 141.2

HO head #0331

Valve lift (in)..... 0.1 ... 0.2 ... 0.3 ... 0.4 ... 0.5 ... 0.6
Intake flow..... 59.4 122.6 171.1 201.1 214.3 218.4
Exhaust flow...47.1 93.4 123.3 140.9 147.0 149.7

Ported big valve 2.02/1.60 HO head

Valve lift (in)... 0.1 ... 0.2 ... 0.3 ... 0.4 ... 0.5
Intake flow.... 73.9 142.4 197.8 229.8 247.0
Exhaust flow. 65.3 114.0 135.9 146.3 157.1

The early '87-'90 non-HO heads have low intake ports that flow rather poorly. The later HO

heads have higher intake ports that flow more air by allowing a straighter shot into the cylinders. The '91-'95 HO heads with casting no.7120 have the highest intake and exhaust port airflows, especially at lower valve lifts where it is most important, and are the best for performance. The '96-'99 0630 heads are almost identical except that they don't have a port for the coolant temp. gauge sending unit. The '00 and later HO heads with casting no.0331 have smaller exhaust ports to produce a faster warm-up of the catalytic converter and improve emissions, but performance also suffers because the ports don't flow as well as those of the 7120 and 0630 castings.

Intake manifold

The '91-'99 intake manifold is aluminium and has equal length 24cm (9.5") long runners. The runners are rectangular with internal dimensions of 1.625" x 1.375" and a cross sectional area of 2.234 sq. in. (14.4 sq. cm). The '00-'06 intake manifold has smaller diameter curved runners with internal dimensions of 1.53" x 1.26" and a cross sectional area of 1.928 sq. in. (12.4 sq. cm), and is clearly designed to produce more torque at lower rpm. The distance from the intake valve to the port opening is 3.5" (9cm), making the total distance 13" (33cm) from the manifold plenum wall to the intake valve.
For a given intake manifold design, the cross-sectional area of the runner and the runner length affect the location of an engine's torque peak in the RPM band. According to the Helmholtz tuning model and the formula shown here, the intake runner area and length are tuned to resonate and produce an inertial supercharging effect at 5000rpm for the '91-'99 engine and 4650rpm for the '00-'06 engine. That's very close to peak horsepower rpm for all High Output 4.0L engines.

Exhaust manifold

The same design principles for the intake manifold also apply to the exhaust manifold. The cross-sectional area of the primary header pipe affects the location of an engine's torque peak in the RPM band. The pipe length generally will not change the peak torque or the RPM at which it occurs. A length change has the effect of improving the torque on only one side of the peak by "borrowing" it from the other side. A shorter pipe improves torque after the peak (reduces it at lower RPM), preventing the torque curve from falling off so quickly as speed increases. A longer pipe extends the torque curve backwards to improve the engine's flexibility, at the expense of after-peak torque.
The stock exhaust manifold and the Borla header have a primary pipe internal diameter of 1.375" and a cross sectional area of 1.49 sq. in. Using this formula:

Peak Torque RPM = [Primary Pipe Area (sq. in) X 88200] / Cylinder Volume (cu. in.)

the stock exhaust manifold and the Borla header are tuned to a peak torque of 3265rpm. That's right at the peak torque rpm of the 4.0 engine.

Block Casting Numbers

Year.....Casting No. .....Part No.
1987.....53005535 (8933002665)....83503400
1988-90.....53005535 (8933002665)....83505110
1991.....53008405.....4626155

1992.....53008405.....4638959
1993.....53008405.....4728988
1994-95.....53008405.....4778882
1996-99.....53020569.....4883025
2000-01.....53010449AA.....5013166AB