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Block The FA20E and FA20F engines had aluminium alloy, open-deck cylinder blocks with 86.0 mm bores and an 86.0 mm stroke for a capacity of 1998 cc. Within the cylinder bores, the FA20E and FA20F engines had cast iron liners. While the cylinder block had an open-deck design, Subaru claimed that lowering the water jacket achieved the same block stiffness as a semi-closed structure. In addition to preventing changes in bore shape, this design cooling around the deck surface and raised the knock limit. Connecting rods and pistons The FA20E and FA20F engines had diagonally split connecting rods with larger big end diameters relative to the EJ255 engine. Furthermore, the stem shape and tapering of the small end reduced connecting rod mass. According to Subaru, higher strength material for the connecting rod bolts enabled higher pressure to be withstood in the cylinders. Furthermore, the connecting rod bearings were made from a copper-based alloy.The FA20E and FA20F engines are understood to have cast aluminium pistons. A 'hybrid' coating is applied to the piston skirts to reduce friction, while the top of the pistons has a crown shape with a shallow dish-like cavity for stable combustion on start-up. Cylinder heads The FA20E and FA20F engines have a cast aluminium alloy cylinder head with chain-driven double overhead camshafts per cylinder bank. The four valves per cylinder – two intake and two exhaust – were actuated by roller rocker arms which had built-in needle bearings that reduced the friction that occurred between the camshafts and the roller rocker arms. The hydraulic lash adjuster – located at the fulcrum of the roller rocker arm – consisted primarily of a plunger, plunger spring, check ball and check ball spring. Through the use of oil pressure and spring force, the lash adjuster maintained a constant zero valve clearance.The cooling circuits for the FA20E and FA20F engines had a greater on cylinder head cooling relative to the EJ engines. According to Subaru, fuel efficiency was improved by reducing coolant flow volume and retaining higher oil temperatures at the cylinder block walls. Furthermore, the coolant flow rate within the cylinder head was increased and improved cooling around the spark plugs and injectors raised the knock limit for more reliable performance. Dual AVCS To optimise valve overlap and utilise exhaust pulsation to enhance cylinder filling at high engine speeds, the FA20D engine had variable intake and exhaust valve timing, known as Subaru's 'Dual Active Valve Control System' (D-AVCS). For the FA20E and FA20F engines, the intake AVCS had a mechanical intermediate locking mechanism similar to that in the normally aspirated FB engine to reduce emissions on start-up. The AVCS also had an integrated spooling valve that was independent of the oil-control solenoid. Garrett MGT2259S turbocharger Both the FA20E and FA20F engines were fitted with a twin-scroll Garrett MGT2259S turbocharger which, according to Subaru, was positioned under the engine for faster warm-up of the catalytic converter, better throttle response and a more compact exhaust system.For the FA20E engine in the SJ Forester XT, maximum boost pressure was 17.1 psi (1.18 bar), while maximum boost pressure for the Subaru V1 WRX's FA20F engine was 15.9 psi (1.10 bar), both these maxima apply at seat level.Notwithstanding these maxima, peak boost pressure for the V1 WRX could spike as high as 22 psi (1.52 bar) for up to two seconds before tapering. This additional boost pressure was not an 'overboost' function controlled by the ECU, but a result of the calibration. It is understood that the boost limit fuel cut was set around 4 psi above the boost target, though this would have to be sustained for over two seconds to cause a wastegate error code (P0244) to be logged in the ECU. Intake The FA20E and FA20F engines had a plastic intake manifold. Subaru described the intake ports for the FA20E and FA20F engines as having a 'tumble-promoting shape' while the port and valve shapes were designed to limit pressure loss upon valve opening while increasing swirl on closure. Upstream of each intake port, a metal partition acted as a tumble generator valve (TGV) to increase air tumble and create vortices within the combustion chamber. Injection and ignition The FA20E and FA20F engines had direct injection whereby fuel was injected directly into the combustion chamber by multi-hole, high pressure injectors (as opposed to port injection where fuel was injected in the intake port and mixed with air prior to entering the chamber). Driven by the left-hand intake camshaft, the high-pressure fuel pump pressurised the fuel to 15 MPa. Furthermore, roller lifters were used as contacts between the pump and camshafts to reduce friction; a pulsating damper was also integrated in the pump to reduce fuel pressure fluctuations. The FA20E and FA20F engines had direct ignition where an ignition coil with an integrated igniter was used for each cylinder. The iridium-tipped spark plug caps, which provided contact to the spark plugs, were integrated with the ignition coil assembly. For the FA20F engine, it is understood that the ignition coil connector had a locking mechanism for greater reliability.The FA20E and FA20F engines had compression ratios of 10.6:1. Exhaust The FA20E and FA20F engines had exhaust gas recirculation (EGR) systems in which the piping was integrated into the intake manifold. In addition to providing more uniform gas flow to the cylinders, a cooling circuit enabled greater exhaust gas volumes to be recirculated than occurred in the EJ engines. By using EGR, combustion temperatures were reduced such that the engine was less susceptible to knock and injection timing could be advanced. The exhaust manifold for the FA20E and FA20F engines was made from sheet metal and had hydroformed branch pipes. According to Subaru, the V1 WRX had a 'deeper, more powerful [exhaust] sound' because its exhaust system eliminated a chamber in the muffler and had shorter internal tubing. For the FA20E and FA20F engines, the volume of the catalytic converter was increased, while new air-fuel and oxygen sensors were introduced for greater accuracy in detecting gas concentration. Scavenger pump The FA20E and FA20F had a dedicated scavenger pump which operated independently of the oil pump and recovered oil collected in the catcher tank.

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