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DESIGN OF AN EXHAUST MANIFOLD FOR A V8 HAYABUSA ENGINE

Abstract. *The pursuit of performance and exciting exhaust pulses noise is the main goal in amateur motorsports. In this sense, the exhaust manifold and its runners are one of most important components since it tunes the pressure waves that produces the heard sound and contributes to having the optimal cylinder filling of air-fuel mixture allowing greater performances. This work carries out the exhaust manifold design of V8 engine based on commercial Hayabusa motorcycle with a flat-plane crankshaft, aiming maximum power output at 9000 rpm. The development process consisted of seven main stages: (1) selection between 4x1 or 4x2x1 exhaust manifold geometries, (2) 1-D simulation to find the optimal relationship between tube diameter and length and audible experience, (3) market analysis to explore principle solutions, (4) design and drafting of geometries, (5) 3-D fluid dynamics simulation of the designed component, (6) 10 responses from motorsport enthusiasts to perform a sound comparison between the proposed sound and that of a Ferrari V8, (7) manufacturing using jigs, (8) validation of the completed design using a flow bench. As a result, an optimized geometry was developed for application to a V8 engine based on the Hayabusa motorcycle, achieving an acoustic profile reminiscent of Italian V8 engines. The primary ducts have a diameter of 38.1 mm and a length of 500 mm, which are key dimensions for maximizing power output at 9,000 rpm. This innovative design produces a sound comparable to that of Ferrari V8 engines with flat-plane crankshafts, as confirmed by a survey of motorsport enthusiasts, and provides a distinctive and unique experience in automotive performance. Additionally, manufactured using MDF jigs, as there is no need for repeatability in their use, resulting in low production costs. Use of tubes with a diameter of 38.1 mm and a length of 500 mm makes the exhaust manifold compact and lightweight, facilitating its future installation in a vehicle.*

Keywords: Exhaust manifold. V8 engine. Flat plane crankshaft.