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The Engineering Design Process of the V-Rod

The first step in the engineering design process is to recognize the need and purpose of designing a new product, in this case the Harley-Davidson V-Rod. Harley-Davidson fabricated this idea in Milwaukee in the mid 1990s and began the project P4 "digger." The company realized that it was losing business to motorcycles that were faster and wanted to regain this business. As a result, Harley-Davidson wanted to make a new bike that combined the looks of a Harley and the speed of a racing motorcycle.

To accomplish this task, the company gathered a large design team led by Willie Davidson. He gathered his team of engineers, designers, and stylers to begin working on the V-Rod. The team first looked to drag racing bikes to construct the engine for the V-Rod. Davidson's team wanted to look at the traits of the VR1000 engine of the racing bikes and modify the engine for use in the V-Rod. The team then came up with the idea to use the first liquid cooled engine in a motorcycle in order to make the revs of the engine higher and more efficient. After designing this new engine, they had to come up with a new shape of the bike's frame in order to handle the new engine. The frame not only had to hold the engine, but also had to have the stylish features of a typical Harley. They decided to test out a double curved frame that could satisfy both these needs. In addition to the engine causing needed modification of the frame, it also caused problems that needed fixing with the gas tank. First, the gas tank needed to be much larger than the typical Harley-Davidson tank of one gallon. It needed to be able to hold at least three gallons for effective use. However, with the engine and frame being so large, there was

little room for such a large tank. Another issue that came along with the oversize engine and frame was the radiator. The team had trouble getting proper airflow to the engine for sufficient cooling as a result of the front tire. To overcome this problem, the design team decided to make the radiator bigger and wider in order to produce more airflow. The exhaust also caused some problems as a result of the large engine. The team needed to implement an exhaust that was large and efficient enough to properly fit the frame and meet emissions standards. The designers on the team had come up with a number of ideas that in theory would have worked but were not producible.

After gathering information and comparing and brainstorming ideas, Willie Davidson and his team began attending to the flaws of the V-Rod. The first and main flaw that the team had to overcome was the engine. The first few prototypes of the engine were disappointing. As a result, the team called in engineers from Porsche to assist them on the engine design. Working with Porsche, the engineers working together to redesign the existing VR1000 engine in order for it to properly work in the V-Rod. The engine was ran in a machine that tested the engine on every terrain and in order for the engine to pass this test it needed to hold up for over 500 hours without overheating. Eventually, this engine design passed the 500 hour threshold and the engine was approved for the V-Rod. In addition to solving the problems of the engine, the team modified the gas tank to properly fit the design. The team made the tank out of plastic and molded it to fit perfect into the bike's frame, right under the seat. This design of the gas tank allowed for the tank to hold up to 4 gallons, meeting the requirement of a minimum of three gallons. After attending to the tank, the team solved the problems with the exhaust pipes. In order to maximize the volume of the pipes emitting the exhaust and keep the bike's stylish look

of a Harley, the design team took two exhaust pipes combined them into one and then once again split it into two. After attending to the major flaws of the V-Rod, the team made final prototypes and began testing them. They put the prototypes through test in many different conditions, such as bumpy roads, inclement weather, and extreme heat. The team wanted to see how the bike would hold up under these conditions. They also wanted to look at the bike's durability and drove the V-Rod for eight hours straight to see how it held up. After driving it for hours, the team idled the bikes to ensure the bikes did not overheat. They wanted it to hold up in parades since that was a signature Harley event. The final prototype eventually passed all these tests and the bike was ready to be put on the market. Harley-Davidson had a large unveiling event that displayed the bike for the first time to the public and officially put the bike on the open market.