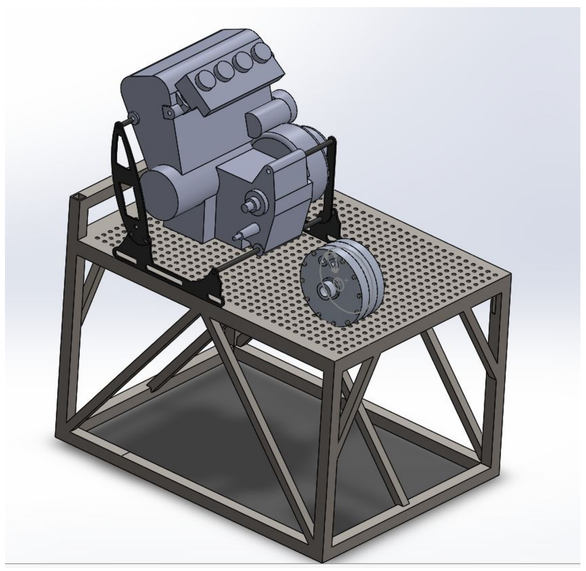
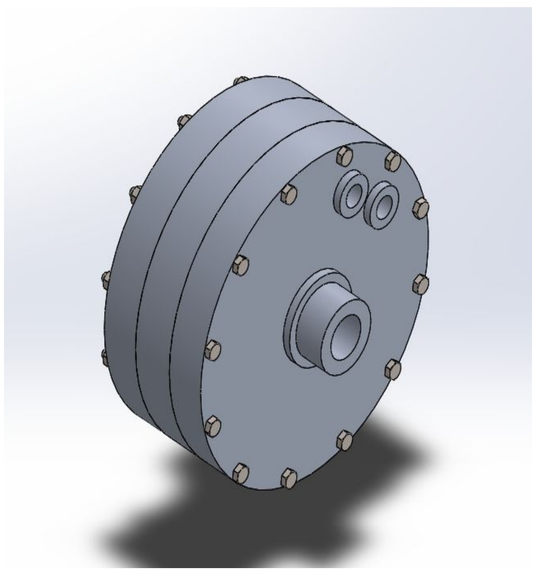
Internal Combustion Engine Test Stand

Talon Birdsong, Adam Brown, Jonathan Dina, Brian Holm, Jeremiah Putnam

Project Description: The Stand

The goal of the project is to create an Internal Combustion Engine Test Stand by which the FSAE Team as well as the University can use to test and demonstrate a functioning engine. The stand will use a water brake system as the load for the engine. An arm is attached to the water brake with a load sensor attached to it to give readings for torque. An axial hall effect sensor will be used to collect rotations per minute. These two values can be combined to give a reading of horsepower. The Stand will accommodate smaller scale engines 710cc and under.



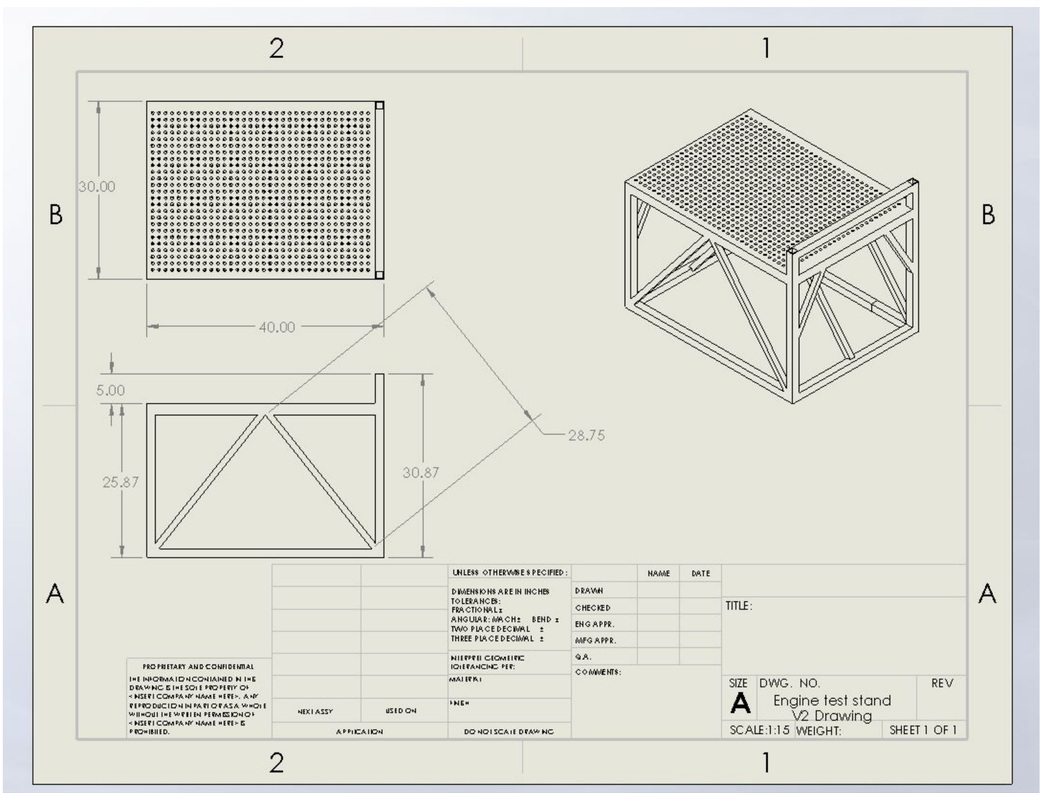


Project Justification:

The Justification behind this project is to give future students of GCU the necessary tools needed to be successful in more areas of engineering. The stand can be used in class environments as a learning tool in current or future course in the engineering program. The stand will also help the Canyon Motorsports club be more competitive by allowing for on the spot tuning.

Project Specifications

- Stand:
  - Made from 1018 steel
  - 1 ½ “, 13 gauge square tube
  - Weighs: 105 Lbs.
  - Dimensions: 31.5” x 40.75” x 32”
  - Chain Driven system
  - Adjustable Engine mounting
  - 12 Gauge steel chain guard
- Water brake:
  - Made from 6061 T6 Aluminum
  - CNC Machined from round stock
  - Maximum Speed: 6500 RPM
  - Maximum Flow Rate: 4,400 in^3/min.
  - Draws water from a standard spigot
  - Custom seals waterproof the system
  - ⅜-18 NPT thread Pattern



Project Functional Requirements:

Ability to handle 70ft lbs with a factor of safety of 1.5
Ability to handle at up to 120 hp with a factor of safety of 1.5
Ability to hold up to a 710cc engine
Ability to fit through an IBC rated door
Must have fire prevention measures
Must be capable of supporting the weight of the engine with a high factor of safety
Must be able to handle the power and torque output produced by a motorcycle engine.
Capable of reading HP, RPM, and torque

Engineering Standards:

The EPA provides an extensive code of federal regulations by which engine testing is required to Follow. Standards for noise, hazardous materials, and emissions will be followed to reduce or prevent harm to users during testing. Set of codes and requirements outline the proper ventilation need when welding in a confined space or building. Important for the construction of the stand as welding will be used for most of the construction. The team must understand that an internal combustion engine can be a source of potential fire danger from either a spark or from the exhaust exiting the engine. Also, circuit breakers for overcurrent protection are required to have household and similar installations. For security protection of high-voltage alternating-current in the circuit breakers.

Design Process:

In the early stages the group met with each other and the customer to understand what the task is in more detail. with this information the group was able to start doing research and coming up with design concepts. When a decision had to be made about a design concept the group compared the different possibilities using research and engineering principles to make the most effective decision. Once the major concepts were decided on the team went to work designing the stand, water brake and electrical components. During the design process some changes were made after meetings with the customer and mechanical analysis was done. The group discussed how these changes should be made and made a decision as a group. priorities during the design process included functionality, safety, cost and time to manufacture.

Data Summary

The data that would have been collected from this stand would include carry weight, resonance value for the stand, as well as torque and rotations per minute.
There are different procedures to collect these values and also requires working electrical systems to calibrate the torque and RPM measurements.
An adjustable tuning fork can be used to find what the resonant frequency of the stand is.
Other data includes hysteresis of the stands sensors and maintenance schedules due to some components being able to wear out on this stand.