**NFPA Project Template**

**Hydraulic Power Unit Exercise**

Hydraulics moves heavy things with precision. If an object moves linearly, or rotates, fluid power can move it. What problem can you solve? What functions can you perform?

**Objective**:

In entertainment or automation related applications, engineers practice similar methods of sizing fluid power components, testing flow rates, and programming logic to control the movement or operation of life-like characters or animals often seen in theme park attractions.

Example: JURASSIC WORLD The Ride at Universal studios. The Indominus Rex was a project that fluid power manufacturer, Peninsular Cylinder Company provided components for and collaborated with the design engineers who built this project.

[https://www.youtube.com/watch?v=3yDkR\_cDVlU](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3D3yDkR_cDVlU&data=05%7C02%7Csscaccianoce%40nfpa.com%7Ce29212383881480bcc3708dc60988015%7C8b344b837d5a424195766fcc0e39beb5%7C0%7C0%7C638491455368715795%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C0%7C%7C%7C&sdata=8MF7le5foeCMn5CmOSoVEPMSY6kyZlFbeAm%2BJcmdsj8%3D&reserved=0)

**Project Description**

A team of students will be tasked with designing a system using a hydraulic power unit as the power source, to create a basketball “shot clock”, by compiling four-inch squares on a display board. Each square will be programmed to move independently using hydraulic cylinders and a pixel display will be used to change numbers and time on the board. What calculations are needed to select the appropriate size components? What materials are needed to mount and support the selected components for optimal performance? How can different flow rates impact performance?

**Materials**:

* Hydraulic Power Unit  - $300
  + It will need to be attached and/or mounted to something.
* Determine the number of programmable pixel display segments based on project design and desired resolution. They should be around 4-inches.
  + 7-12 is common in industry applications. An alarm clock is 7 segments. An alphabet display is 12. It continues up to 1080+ for screens on TV and laptops.
* The number of display segments will dictate the number of valves or cylinders.
  + Example: 12 display segments needs at least 12 valves and 12 cylinders
* 1 plc
  + Note that inputs/outputs should match the number of display segments. Example: 12 display segments needs a minimum of 12 inputs and outputs.

**Scoring Criteria (optional):**

Advanced option: Complete the full movement of the display board in a specified period of time. Teams will have to build up or restrict flow to perform the movements and complete the cycle. Did it perform as intended? Did reach the point that it was supposed to?

Example: Complete the movement cycle in one minute. Did the shot clock properly count down?

**NFPA Competencies (if applicable):**

Understand fluid power benefits and limitations.

Conceptual and theoretical understanding of fluid power laws and principles (including energy transfer and power efficiency)

Appropriately size components in fluid power systems

Integrate sensing and electronic control functions with fluid power components and systems.

**Educational Outcomes:**

Digital logic programming.

**Implementation:**

What is the knowledge level? High school or early college.

What is the cost per number of students/teams of students served?

How many class hours are needed to complete the project?