**Balloon Burst -NFPA Project Template**

**Objective:**

Understating fluid flow through different valve types and valve banks has crucial real-world utility and applications. Students will investigate pressure, flow, pressure drop and output of the pump while they explore various types of valves in the lesson. Grain silos, move a lot of bulk product quickly using air blast technology.

**Project Description**

Teams of students will be tasked with bursting balloons by using valves to create a system that can control fluid flow and release flow to inflate at least one balloon until it pops. Challenge students to create and explore multiple fluid flows through multiple configurations and determine which is most effective and efficient and end the project with the inclusion of proportional control valves, so students experiment with logic and control functions. Using simple plumbing parts and hose, teams can also design an advanced system that holds air in one balloon and pops another balloon.

Students should explore industry grade proportional control valves and an assortment of ball valves, relief valves, check valves, etc.

Important Formula for this lesson: Standard Cubic Feet per Minute: SCFM= (psi+14.7)\*Volume/14.7

**Materials:**

Projected cost is less than $500 for a class of 12-16 students.

* Shop Vac that can vacuum and be used as a blower.
* Garden hose or any form of tubing can be as an air conduit.
* Gauge or some way to measure the pressure.
* Valve configurations replicated by using simple plumbing parts – ball valves, relief valves, check valves, etc.
	+ Y adapter (replicating a ball valve) – Affix at the end of the garden hose /tubing to route air in either direction or start or shut off flow.
	+ Regulator – adjust air pressure. Acts as a relief valve if one end is closed.
	+ Check valve – hold the air inside the balloon.
* 1 PLC for controlling functions.

**Scoring Criteria (if applicable):**

Teams will have to build up flow to perform the movements and pop the balloon. Did it perform as intended? Can you hold air in one balloon and pop the other balloon?Which team can pop the balloon in the quickest time? How big can you inflate a balloon without bursting it? How quickly can you inflate to a certain size without bursting?

Test: Can you pop one balloon and not the other? Can you hold the pressure inside the balloon when it is disconnected from the pressure source?

Advanced option: add at least one stopping point 10 seconds in to require teams to demonstrate the system’s ability to restrict flow. Does temperature affect the burst pressure &/or fill time? Explore the absence of pressure using a standard vacuum. This is common in the packing industry and food packaging. Companies vacuum pack clothes, food, etc.

**NFPA Competencies (if applicable):**

Understand fluid power components and circuits.

**Educational Outcomes:**

Integration, Testing

**Implementation:**

Instructor to determine the final BOM and produce final documentation to create a kit of parts so that the project can be replicated.

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

* Early College

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

How many class hours are needed to complete the project?