

Cummins Water Spray System

Concept Generation and Selection

Group 17

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Table of Contents

I	Problem.....	1
	PROBLEM STATEMENT	1
	OBJECTIVE.....	1
II	Design Concept.....	1
III	Cost Analysis	2
IV	Conclusion	2
V	References.....	3

Table of Figures

FIGURE 1- EXAMPLE OF HOW THE SPRAY SYSTEM CAN BE UTILIZED.	1
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I Problem

Problem Statement

Cummins has a water spray system at their facilities to test engines. The one that they currently have is inefficient and not as robust as they would like. Our job is to design a new water spray system that is automated so that it increases the efficiency of their test.

Objective

The objective of this project is to design and manufacture an automated, efficient water spray system to be used in engine splash testing by Cummins, a diesel engine manufacturer for applications ranging from automotive to industrial construction equipment and power supplies. The design will feature pipes and nozzles in an array such that every area on the engine can be sprayed at the same time. It will also have an automation feature that allows for spray duration and frequency to be adjusted. The motivation behind this project is to reduce the need for human-system interaction resulting in more efficient testing with increased repeatability.

II Design Concept



Figure 1- Example of how the spray system can be utilized.

This design uses six nozzles per side with each nozzle having a valve connected to it to allow for each nozzle to be individually closed. This structure will be able to rotate about the stand and each nozzle will also be able to rotate. Each row of nozzles can move along the track and be held in place by set screws. The structure itself is two inverted t-junctions. The piping structure will run from the pump along the back of both sides of the nozzle structure. It will run perpendicular to the floor and end in a t-junction that is capped off at the ends. The hoses will be threaded into the pipe that runs from the nozzles.

III Cost Analysis

Part	Unit Price	Quantity	Part Total
1/2" x 18" Brass Threaded Pipe	15.41	1	15.41
1/2" x 24" Brass Threaded Pipe	20.60	4	82.40
1/2" x 36" Brass Threaded Pipe	30.92	4	123.68
1/2" x 48" Brass Threaded Pipe	41.14	2	82.28
Extended-Life Centrifugal Pump	399.17	1	399.17
5' Hose with Male-Female Fittings	26.66	12	319.92
5' Hose with Male-Male Fittings	29.32	2	58.64
Brass Plug Valve	18.68	12	224.16
Brass Tee-Junction	6.05	3	18.15
Brass Elbow Junction	5.16	4	20.64
Brass Square Spray Pattern Nozzle	9.47	12	113.64
Brass Pipe Cap	3.43	4	13.72
48" Framing Extrusion	18.24	10	182.40
L-Bracket	4.00	16	64.00
Total			1718.21

IV Conclusion

After discussing our design concepts further with our representatives at Cummins, we discovered that we were going well beyond what was expected. Since that meeting, we have eliminated the automated motion from our design. Also, due to a misunderstanding, our new design concept is capable of spraying the entirety of the engine simultaneously.

Our new finalized design features an array of six nozzles on both sides of the structure. These nozzles will have a square spray pattern and have been arranged such that all parts of the engine can be sprayed. Though the motion will not be automated, we have added certain features that allow for some adjustability to account for different sized engines. One feature is that the spray structure can be tilted to account for different shaped engines. Another feature is the ability of the nozzles to be tilted. Also, each row of nozzles can be slid along a track changing their vertical positions.

V References

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