

JUDGING CRITERIA

Manufacturing Design Challenge



Expo Fest: June 1, 2019

CLEAN WATER IN EXTREME CONDITIONS – MAKING A HUMAN-POWERED WATER FILTRATION PUMP

Overview

You are part of an entrepreneurial manufacturing team who is seeking to provide a solution to non-governmental organizations (NGOs) and disaster response organizations that have to operate where clean water is not available. Your task is to design, build and present a human-powered water filtration pump for use in areas where the only water source is contaminated, such as in a remote area in the wilderness or developing world or in a flooded area. Your potential clients will use your pumps to provide clean water to their response teams and the people they are helping.

Problem Statement: Clean water is often unavailable in developing countries, the wilderness, or in an area that is flooded or has had a disaster, and the human-powered water filtration pumps that are available are not durable or safe enough to use.

Solution Statement: Design and build a durable, safe to use, human-powered water filtration pump that gives the user the ability to pump and filter water from many sources, including those that are hard to reach or hazardous.

Criteria:

- The pump must be completely human-powered, i.e., the power of pumping must be done without any external help or machine. The pump may be held in any manner with any part of the body, and it should be capable of being operated by one person. ***For the final demonstration, only one person may operate the pump.***
- The pump may be made of any materials, but it must be simple to assemble and use, and it must be durable.
- The design **may** use 3D printed parts where possible. NOTE: It is possible that some parts that are machined for the prototype could be 3D printed in metal, if a metal 3D printer were available. Therefore, teams may explain in the final presentation that while a given part has been machined, they have CAD drawings for the part that could be 3D printed if the technology were available. 3D printed parts may also be used for prototypes during the design process.

- The pump must provide water at a flow rate of at least 4 liters per minute with the user exerting a moderate effort of approximately 30 to 45 pump strokes per minute. The faster the flow rate, the better, but only with the user operating the pump at a moderate rate and using moderate effort. ***For the final demonstration, you will need to show that your pump can filter 5 gallons (approximately 19 liters) of water in less than 5 minutes.***
- The pump must filter the water and send the output through a hose that will fit on or into the mouth of a clear plastic 2-liter bottle.
- The pump must be able to draw water from a source at least 10 feet away from and 5 feet below the pump--the design and prototype must include any hoses or other devices to meet this requirement, and it must include a screen or filter that blocks sediment and debris from entering the pump.

Constraints:

- The pump must be easily portable, so it must be able to be folded or disassembled and carried in a pouch that is no more than 2 feet long and 6 inches in diameter and weigh no more than 20 pounds (including all parts and the pouch).
- The pump must be able to use an off the shelf microfilter that will be provided to the team by Skills21. Teams may use one or two microfilters in their design, where two would be used to double the flow rate, if needed. The microfilter(s) must be in the prototype and must actually filter the water during the final demonstration. For planning purposes, use the Katadyn filter shown in this link: <https://www.rei.com/product/724044/katadyn-hikerhiker-probase-camp-replacement-element>

Other Elements to Consider:

- Safety
- Portability
- Durability against wide ranging environmental conditions
- Ease of assembly and use
- Weight
- Speed
- Material selection
- 3D printing capability

****** SAFETY NOTE: Throughout this challenge, teams should NOT test their water filtration pumps by drinking the water they have pumped and filtered.***