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## Product Contract

### 2.009 Purple Team

#### Mission Statement

Create an ergonomic and economic pedal-powered water pump to efficiently irrigate up to 2 acres of land in underdeveloped countries.

**Intended Customers:** Small scale farmers in northern districts of West Bengal province in India.

**Market:** Low cost, human powered irrigation pumps

Customer Need	Product Attribute(s)	Engineering Specification(s)
Ergonomic	recumbent seat and pedal design	seat with back support, pedals 2-4 feet from seat
	continuous cyclical motion	human powered rotary motion transmitted into linear motion for pumping mechanism
	comfortable and sustainable operation	user can easily provide 3 working hours on machine without major bodily strain
Economic	inexpensive	product costs \$100
		manufactured and assembled regionally
		robust design requires less precision

<b>Easy maintenance</b>	spare parts and materials are easily obtainable	manufactured and assembled regionally
	common fasteners	standard PVC piping connectors
		one size nuts and bolts where necessary
	obvious assembly procedure	simple, non-ambiguous interfaces and connections
<b>Intuitive user interface</b>	resembles a bicycle to target user	pedals similar in shape to bicycle pedals
	clear indication of input and output for installation	flow direction labels
<b>Durability</b>	robust to sediment in water flow	can pass particles less than 0.5 inches in diameter
	rugged construction for transport through rural landscape	surrounding structure constructed from robust materials, not easily deformable
	critical components have long life	moving part life of 3000 hours
	resistant to high moisture environment	constructed with materials that don't rot or rust
<b>Can be used on varying terrain</b>	Stability	base contacts terrain at only 3 points
<b>Provide irrigation to small scale farm</b>	Provide sufficient water to irrigate up to 2 acres of land	Pump 1.6 L/s at 3.2m head Pump 0.4 L/S at 12.5m head (see Figures 1 and 2 below)
	Pull water up from water sources below irrigation site	draw water from 7m depth
	Have sufficient delivery range	12m of output head

<b>Portability</b>	Lightweight	35 kg
	Compact	5 ft length – fold up into 3 ft length
		5 ft width and widest cross section

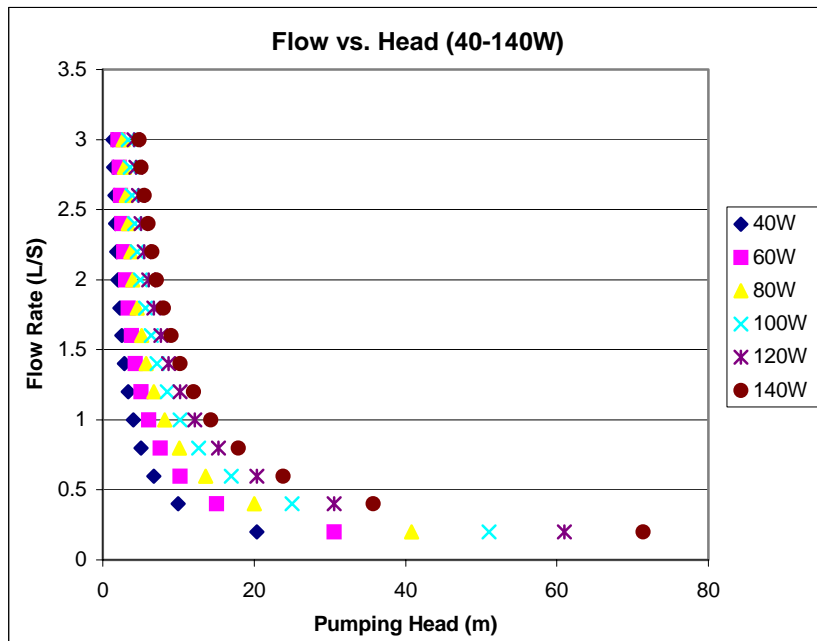


Figure 1: Target flow vs. head curves for various input powers; all assumed to operate at 100% efficiency.

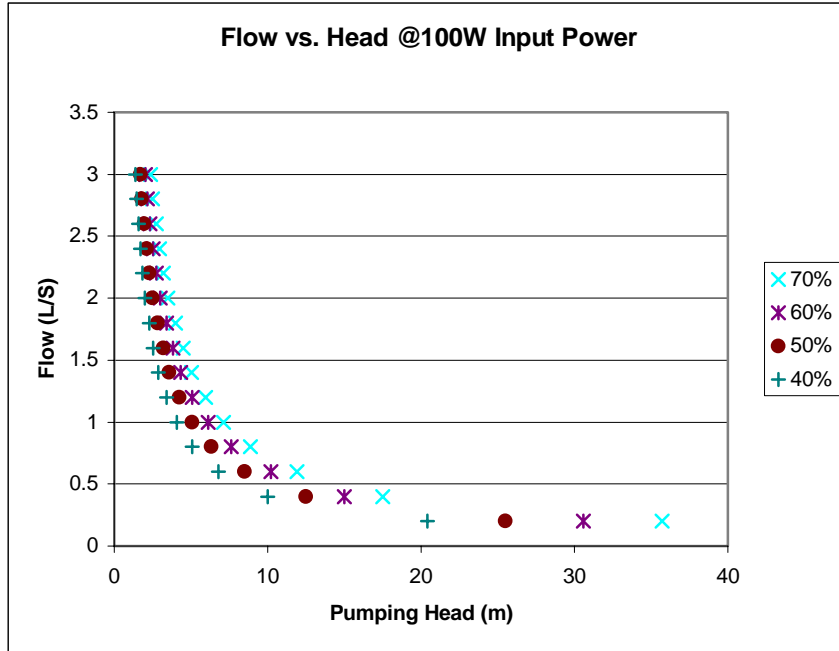


Figure 2: Target flow vs. head curves for various realistic pump efficiencies.

### Gantt Chart

	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21
Assembly Pres.	Blue	Blue	Blue	Blue				Grey	Grey						Grey	Grey	
Design Pump	Red	Red	Red	Red	Red			Grey	Grey						Grey	Grey	
Pump Details	Grey	Grey		Blue	Blue	Blue	Blue	Blue	Blue						Grey	Grey	
Design Power source	Red	Red	Red	Red	Red			Grey	Grey						Grey	Grey	
Power source details	Grey	Grey		Blue	Blue	Blue	Blue	Blue	Blue						Grey	Grey	
Design power transfer	Red	Red	Red	Red	Red			Grey	Grey						Grey	Grey	
Transfer details	Grey	Grey		Blue	Blue	Blue	Blue	Blue	Blue						Grey	Grey	
Test Power source + transfer	Grey	Grey				Red	Red	Red	Red	Red	Red				Grey	Grey	
Test Pump	Grey	Grey				Blue	Blue	Blue	Blue	Blue	Blue				Grey	Grey	
Assemble	Grey	Grey						Grey	Grey	Red	Red	Red	Red	Red	Grey	Grey	
Test Whole	Grey	Grey						Grey	Grey	Blue	Blue	Blue	Blue	Blue	Grey	Grey	
Technical Pres.	Grey	Grey						Grey	Grey			Red	Red	Red	Red	Red	Red