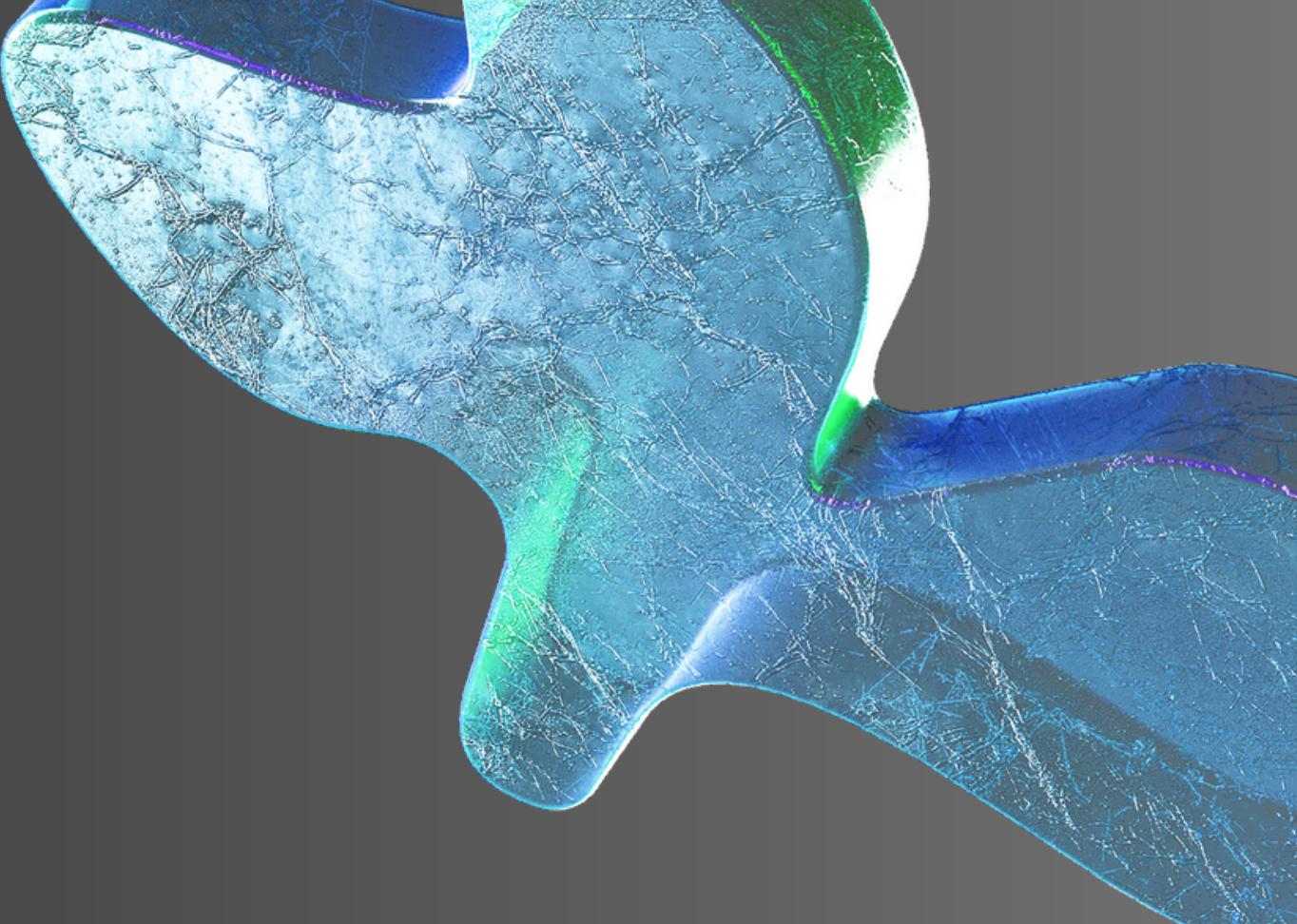


# 12th Inter-IIT Tech Meet IIT Madras

Solinas - Product Design Challenge

# Team 22



# TELESURGE MIX-PRO

Redefining Waste Agitation

- Integrated Pneumatic System
- Effortless Operation
- All-in-One Functionality
- Enhanced Maneuverability



# Key Highlights!

What makes us unique?

# Material Selection

The material for the telescopic shaft was chosen as Aluminium 6061 alloy after careful examination of its properties and our needs from a wide spectrum of choices.

## ALUMINIUM 6061

6061 aluminium alloy is a precipitation-hardened aluminium alloy, containing magnesium(1.0-1.6%), and silicon(0.4-0.8%) as its major alloying elements. Here are it's major advantages :

### SPARK RESISTANT

Aluminum 6061 is spark-resistant due to its non-ferrous composition and low-friction properties, minimizing the risk of sparks during mechanical actions. It prevents ignition, enhancing safety. In explosive atmospheres, such as chemical production, it reduces fire and explosion risks.

### CORROSION RESISTANCE

Solid waste agitators operate in environments where they may be exposed to corrosive substances or aggressive chemicals/gases (eg. HCl, HF etc). Aluminum 6061's natural oxide layer provides excellent corrosion resistance, making it well-suited for such conditions.

### LIGHTWEIGHT

Aluminum 6061 is lightweight compared to many other metals. This is advantageous in applications where weight is a critical factor, as it allows for easier handling, installation, and reduces the overall load on the agitator system.



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### HIGH STRENGTH

While aluminum is lightweight, aluminum 6061 offers good strength, which is essential for a shaft handling the rigors of agitating solid waste. It provides the necessary structural integrity to withstand the forces involved in the agitation process. A good balance for corrosion resistance and strength.

### COST-EFFECTIVENESS

Aluminum is generally more cost-effective than some other materials with similar performance characteristics. This is a crucial factor in industrial applications where cost considerations are significant.

### NON-MAGNETIC

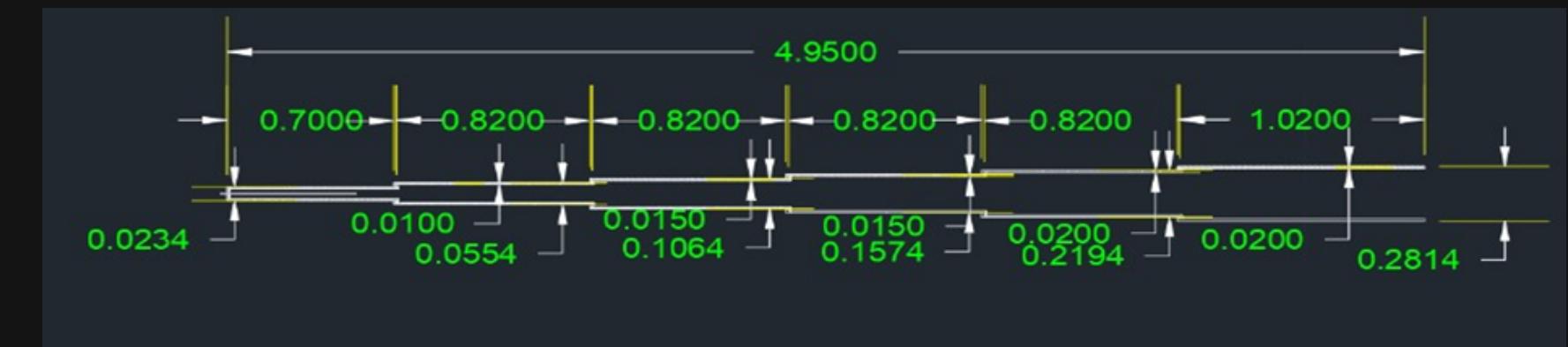
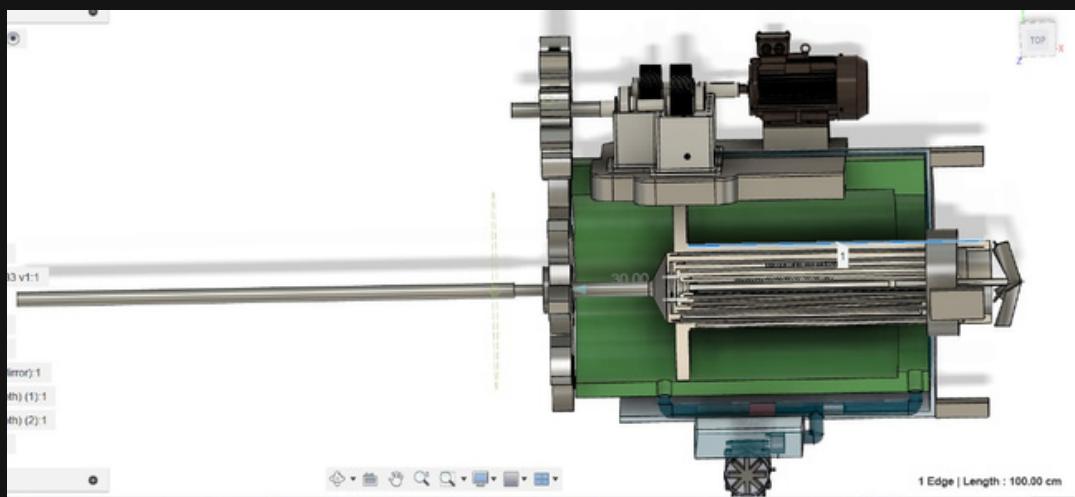
Aluminum is non-magnetic, which can be important in applications where magnetic interference needs to be minimized.



# Depth Capability

Our telescopic shaft, powered by precision pneumatics, offers unmatched versatility and here is its description :

- Retracts to 1m: Adapts to varying slurry levels with ease.
- Extends to 5m: Provides extensive reach for deep industrial waste agitation.
- Precision Control: Operators optimize performance with effortless length adjustments.
- Efficiency Boost: Streamlines operations, reducing downtime.
- Safety Focus: Minimizes accidents with controlled extension and retraction.

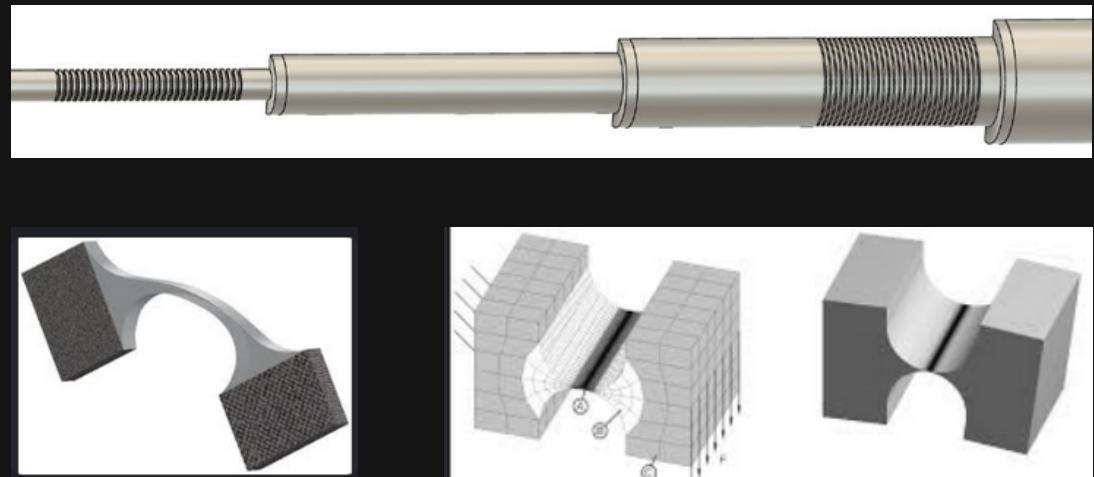


Embrace adaptability, efficiency, and safety with our telescopic shaft—setting new standards in industrial waste agitation.

# Ergonomics

The integration of ergonomic principles in our industrial waste agitator enhances overall performance, user satisfaction, and operational efficiency.

## Flexibility and Weight



- Usage of Compliant Mechanisms: Flexure Hinges in Middle Columns of the telescopic shaft incorporates flexibility.
- Use of Aluminium instead of Conventional Carbon-Steel makes it Light Weight

## User Friendly

- The control interface is designed with user-friendly buttons and displays, ensuring ease of operation.
- Intuitive controls minimize training requirements for operators, enhancing overall efficiency.

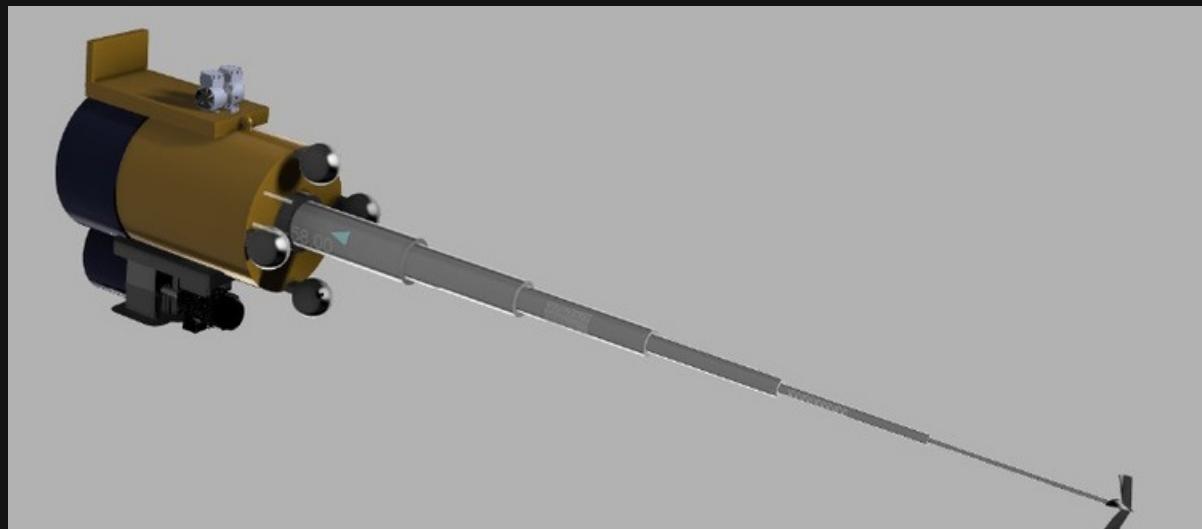
## Efficient Work Posture

- The telescopic shaft minimizes the need for operators to bend or stretch excessively, promoting a healthier work posture.
- Reduced physical strain contributes to increased productivity and employee satisfaction.

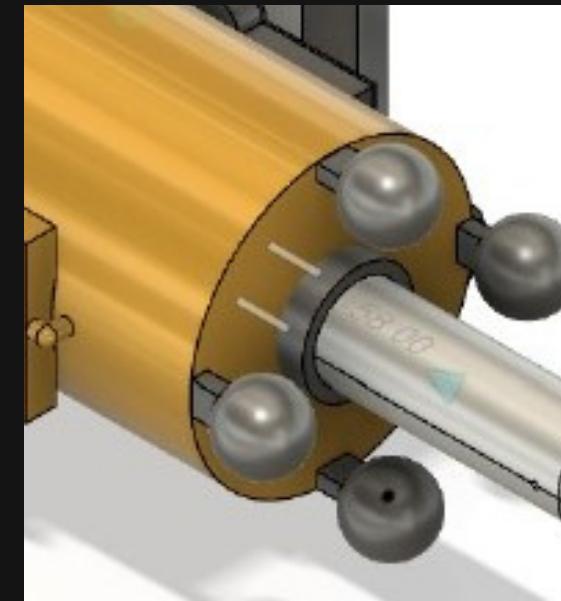
# Portability

Unlock unprecedented mobility with our innovative telescopic shaft. Designed for seamless portability, it transforms the landscape of industrial waste agitation:

## Compact Design



## Transportation Ease



- The telescopic shaft's collapsible structure allows for easy transportation, making it suitable for diverse job sites.
- Placing of motor, gearbox, compressor is compact enough to handle easily

- The telescopic shaft's collapsible structure allows for easy transportation, making it suitable for diverse job sites.
- Wheels, handles makes this product a trolley which can be easily transported by workers.

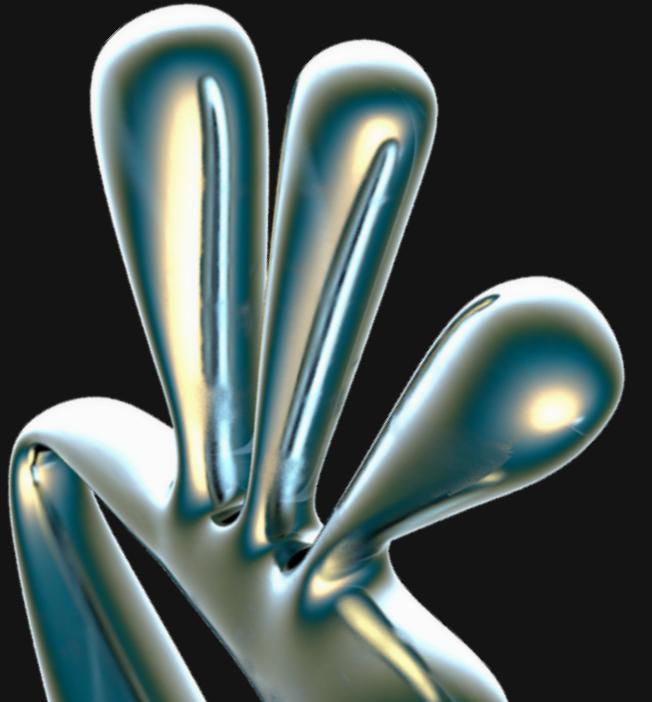
# Breaking it down!!

Schematic breakdown of the design and mechanism

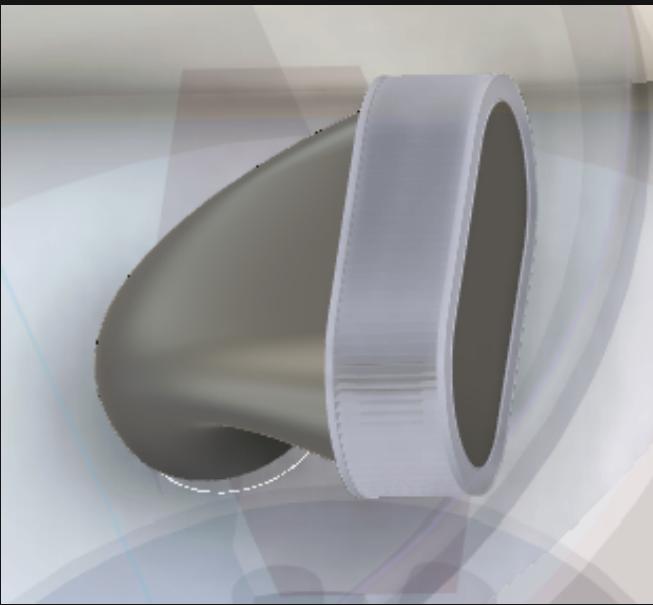
# TOOL BOX

- The tool box is designed for storing and carrying a variety of hand tools and power tools.

Breaking it down!

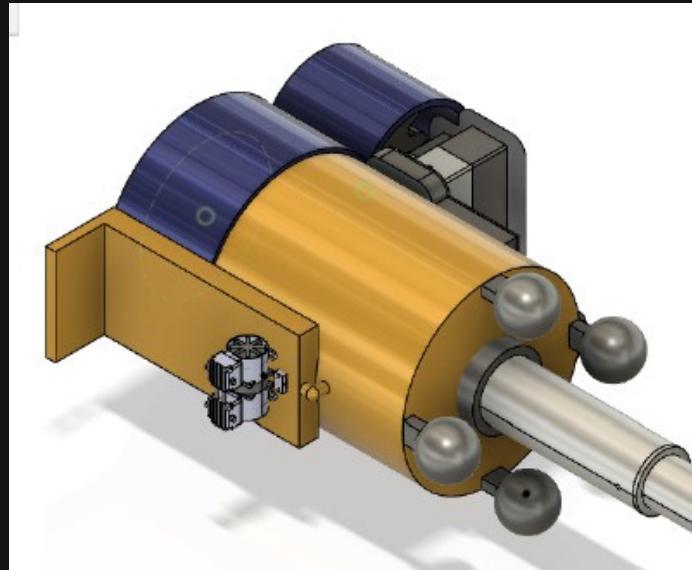


# AIR FILTERS



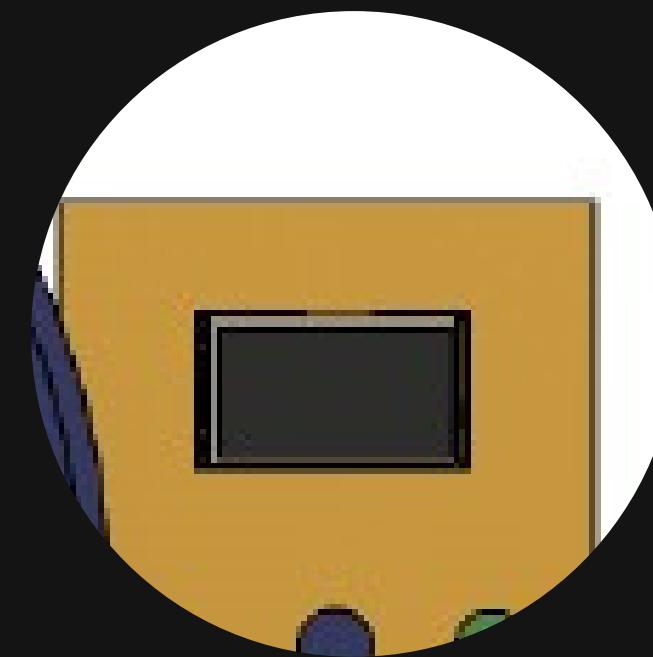
- Air filters are crucial components, preventing dirt and debris from entering the system and causing damage.
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# WATERPROOF COVERING



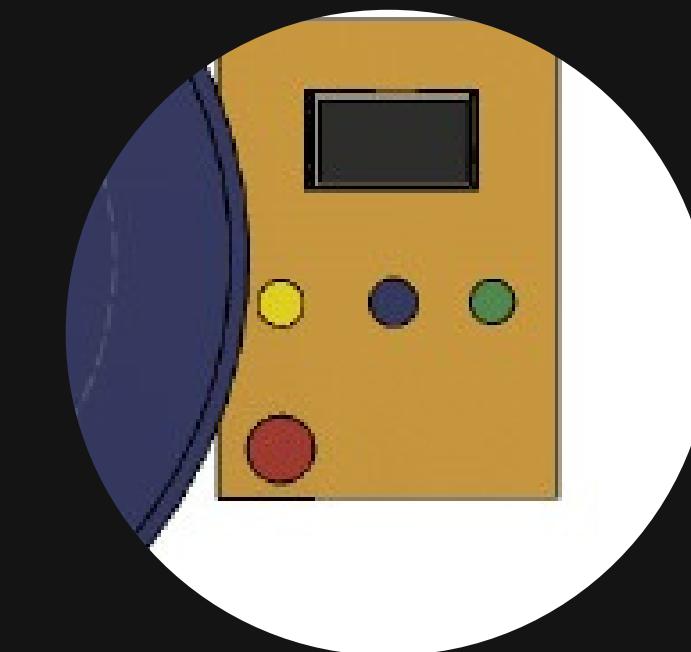
Waterproof coverings would help prevent damage and ensure the longevity of the system.

# SCREEN



Displays essential information including rpm , pressure , torque , toxicity , current and voltage ratings.

# BUTTONS

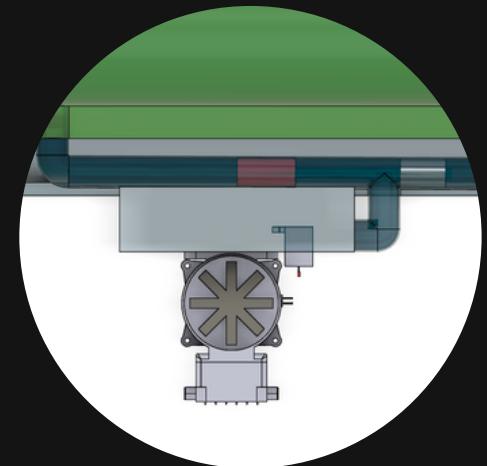


To make it user friendly the product involves only three operational switches.

- Power on/off
- Retraction / Contraction
- RPM Regulator (knob)

# Pneumatics

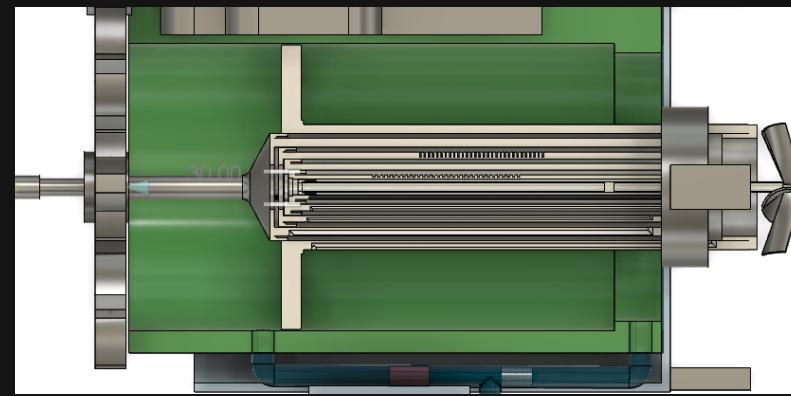
A pneumatic system for a telescopic shaft involves using compressed air to control the extension and retraction of the shaft.



**COMPRESSOR**

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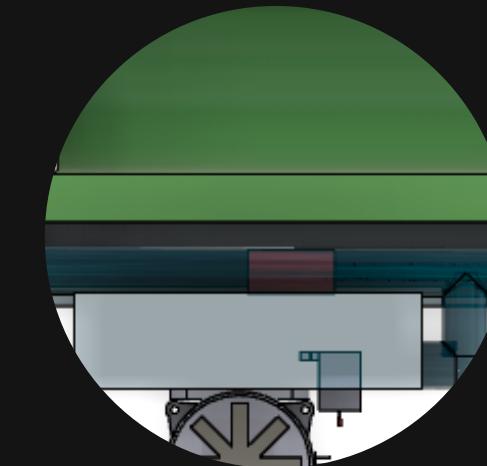
A compressor will be used to generate compressed air. It would take ambient air and pressurize it for use in the system.



**PNEUMATIC CYLINDER**

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The pneumatic cylinder is the actuator responsible for the linear motion of the telescopic shaft. It consists of a piston inside a cylinder that moves in response to the application or removal of compressed air.



**CONTROL VALVE**

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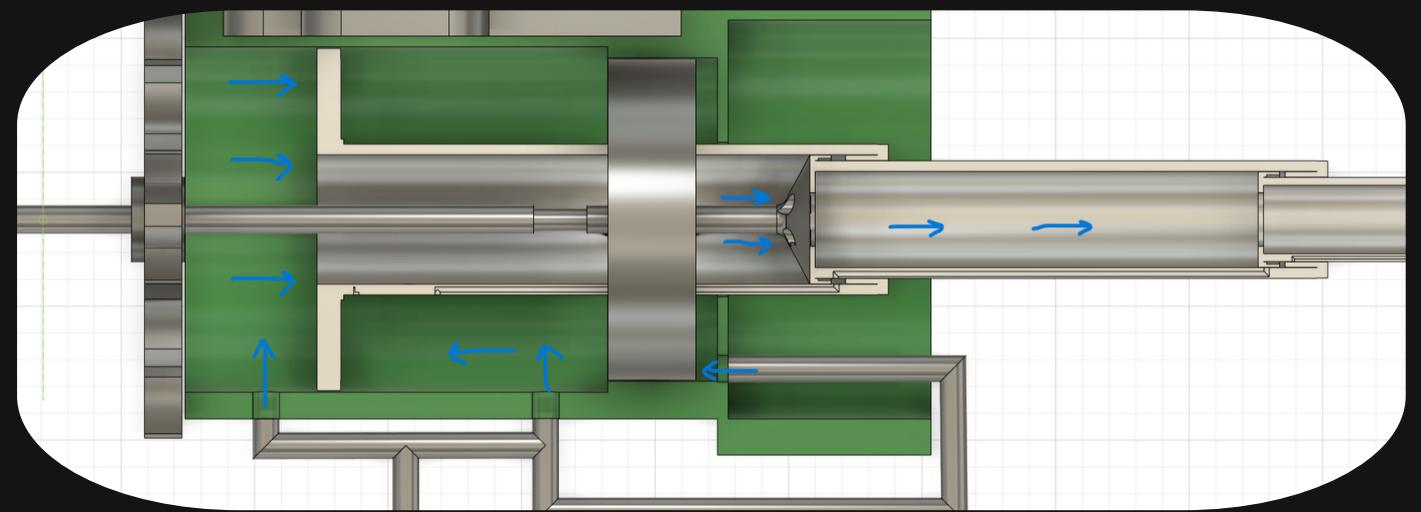
**Breaking it down!**

# Pneumatics

## Working Principle

### TELESCOPIC SHAFT EXTENSION

When compressed air is directed into one side of the pneumatic cylinder, it pushes the piston, causing the telescopic shaft to extend.



### TELESCOPIC SHAFT RETRACTION

When the direction of the compressed air is reversed (by manipulating the control valve), the air pushes the piston in the opposite direction, causing the telescopic shaft to retract.

Breaking it down!

# Pneumatics

## Pressure Regulation and Control

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### PRECISE PRESSURE CONTROL

The pressure of the compressed air and the control of its flow are critical for the precise control of the telescopic shaft. Pressure regulators will be used to maintain a consistent pressure level.

### DIVERSE CONTROL VALVE OPTIONS

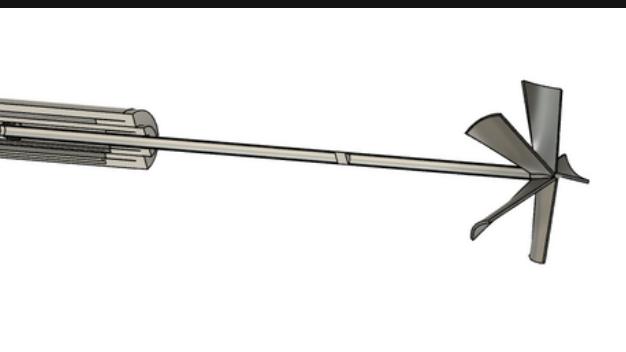
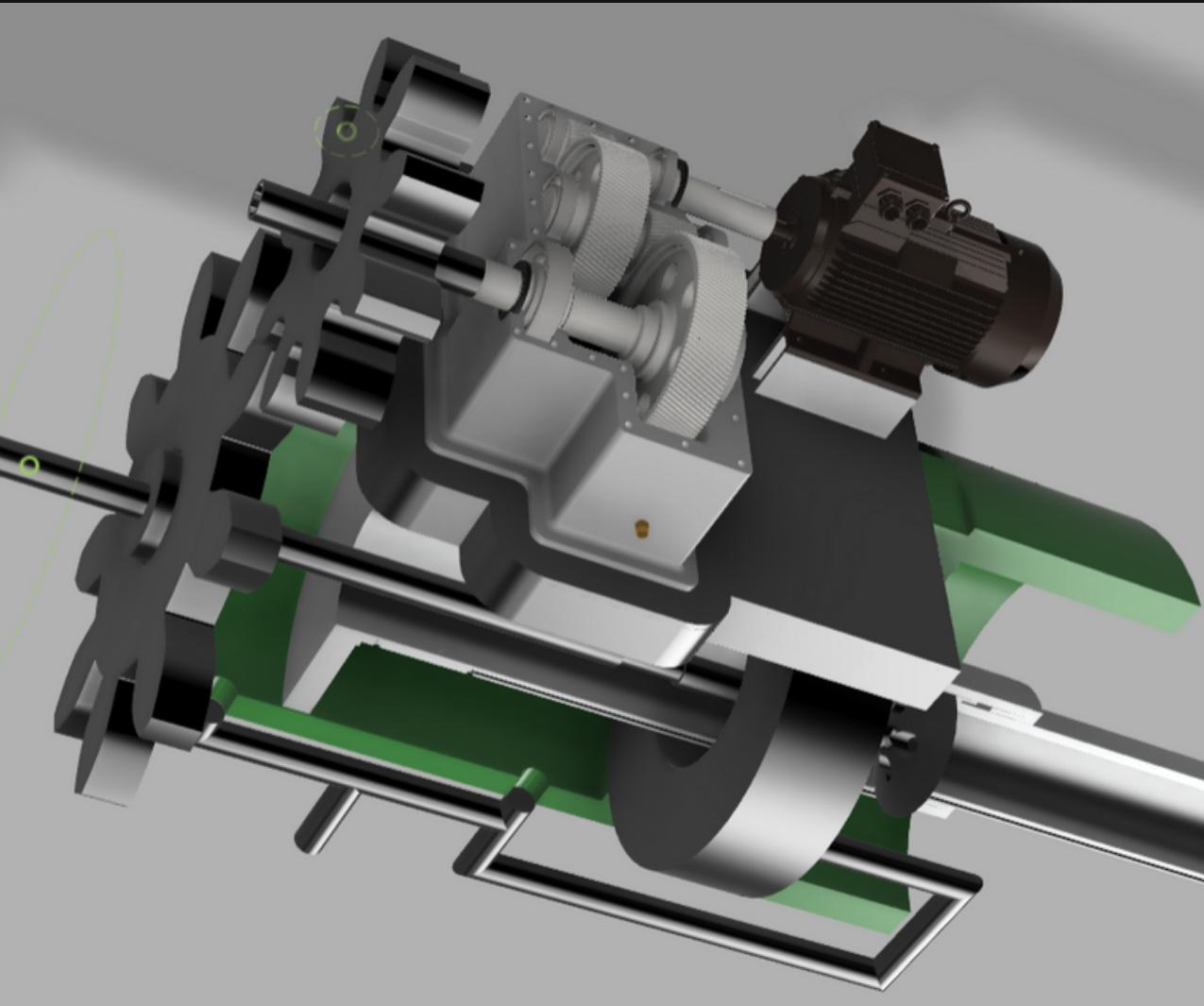
The control valve can be a manually operated valve or an automated valve controlled by an electronic system. Proportional valves or servo valves may be employed for more precise control.

**Breaking it down!**

# Motor Set-up

Sophisticated motor setup with Aluminum 6061 components, ensuring durability and spark resistance for versatile industrial applications.

- A 2-3 HP Motor is employed according to the RPM (100) and Torque requirements (150Nm).
- A Gear-Reducer ratio (1:8) has been used to reduce the rpm and use the high torque for agitation.
- A Gear arrangement is done to transmit motion between 2 parallel shafts and make the system more compact.
- Impeller is attached to the end of the shaft.



Breaking it down!

# Bill of Materials

Item Description	Quantity	Unit	Price per Unit (INR)	Total Cost (INR)	Additional Notes
Induction Motor (2-3 HP)	1	Each	₹12,500	₹12,500	
Gearbox (1:8 ratio)	1	Each	₹12,500	₹12,500	
Compressor	1	Each	₹20,000	₹20,000	Pressure Range: 80-120 Psi
Gears (40cm)	1	Each	₹6,500	₹6,500	
Gears (20cm)	1	Each	₹4,000	₹4,000	
Aluminium 6061 Cylindrical Columns	0.0215	m³	₹1,382	₹1,382	Volume: 0.0215 m³
Compressor Pipes	3	meters	₹1,000 per meter	₹3,000	Lengths: Vary
LED Screen	1	Each	₹4,000	₹4,000	
Push Buttons	3	Each	₹150 each	₹450	
5cm Long Steel Shaft	2	meters	₹2,000 per meter	₹4,000	Length: 2 meters
Waterproof Seals	2	Each	₹75 each	₹150	
Valves	1	Each	₹250	₹250	
Linear Bearing	1	Each	₹650	₹650	
Ball Bearings	6	Each	₹75 each	₹450	
Impeller (15-20 cm diameter)	1	Each	₹6,500	₹6,500	Inner Diameter: 2.5 cm
**Total Cost (INR)**	-	-	-	**₹96,832**	-

**Total Lumpsum Cost of Telesurge Mix-Pro : Rs. 97,000**

A large industrial gas turbine engine, likely a GE90, is shown from a low angle. The nacelle has been removed, exposing the intricate internal components of the engine. The fan stage is visible at the front, followed by the compressor, combustor, and turbine stages. The engine is mounted on a green metal frame, and various pipes and sensors are visible in the background.

Thank you