
	CABLE SHARK ASSEMBLY OPERATING PROCEDURE						
	WC:	219	APPROVAL INITIALS:				
	REV:	2	LEAN	AS	SAFE		ND
	DATE:	5/6/24	PROD	CB	ENGR		DF
SPECIAL SAFETY INSTRUCTIONS:							
➤ Keep hands away from moving machinery.							
➤ Preventative Maintenance must be done before starting production							
➤ PPE Required: Safety Glasses, Cut Resistant Gloves, Earplugs/Muffs, Steel-Toed Boots/Shoes							
➤ PPH GOAL: 400							

Objectives

This SOP aims to guide the assembly of the Cable Shark product using a human-robot collaborative framework enhanced by Large Language Models (LLMs) for efficient and safe operations.

Introduction

This procedure outlines the steps for assembling the Cable Shark product using a collaborative approach between human operators and robotic systems. The framework utilizes LLMs to facilitate natural language communication for task management.

Component Specifications / Dimensions

1. Housing

- Dimensions
 - Length: X mm
 - Width: X mm
 - Height: X mm
 - Wall Thickness: X mm
- Features: Two screw holes (diameter: 4 mm) on each side for securing the housing. Internal grooves for accommodating the wedge and spring.



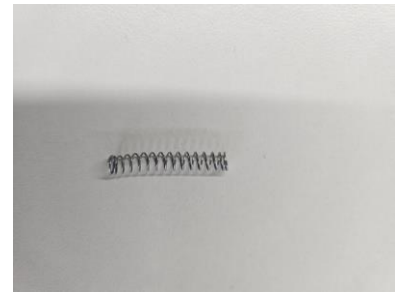
2. Wedge

- Dimensions
 - Length: X mm
 - Width: X mm
 - Height: X mm
- Features: Teeth facing inward with a pitch of xx mm. One side tapered to fit securely into the housing.



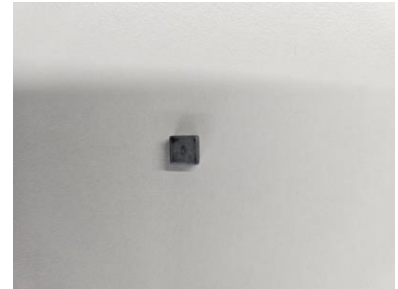
3. Spring

- Dimensions
 - Outer Diameter: X mm
 - Inner Diameter: X mm
 - Free Length: X mm
 - Wire Diameter: X mm
- Features: Compression spring



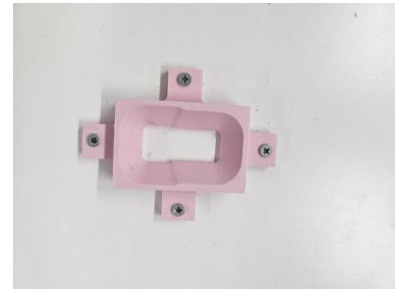
4. Cap

- Dimensions
 - Diameter: X mm
 - Height: X mm
 - Inner Diameter (groove): X mm
- Features: Groove to fit securely over the spring end. Smooth surface finish for a tight fit.

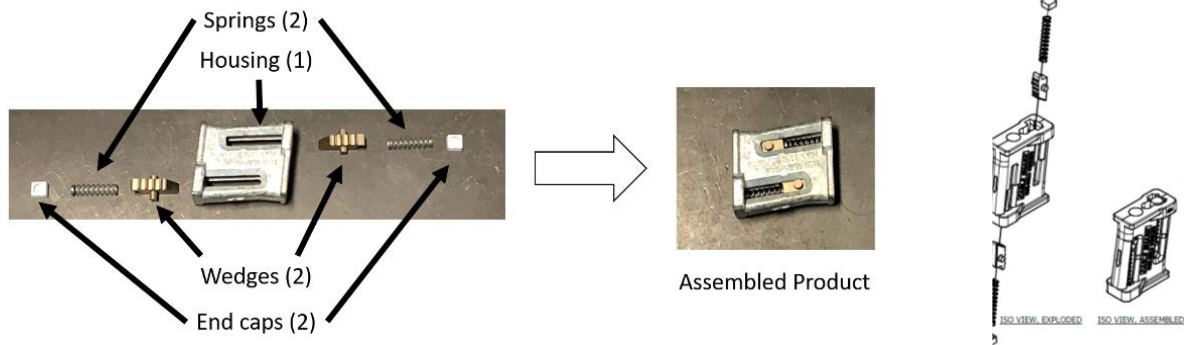


5. Assembly Holder

- Dimensions
 - Length: X mm
 - Width: X mm
 - Height: X mm
 - Groove Width: X mm
 - Groove Depth: X mm
- Features: Grooves and notches to hold the housing, wedge, spring, and cap in place during assembly. Non-slip base to prevent movement during assembly.



Component Assembly Instructions



Sequence: Housing -> Wedge -> Spring -> Cap

1. **Housing:** Place the housing on the assembly holder. Ensure that the internal grooves are oriented upwards to provide the correct alignment for subsequent components. The assembly holder should stabilize the housing and prevent any movement during the assembly process.
2. **Wedge:** Carefully insert the wedge into the housing. The teeth of the wedge should face inward, aligning with the internal grooves of the housing. Ensure that the tapered side of the wedge fits snugly into the grooves, providing a secure fit. This positioning ensures that the wedge locks into place and prevents any rotational movement.
3. **Spring:** Position the spring into the housing, placing it directly after the wedge. Ensure that the spring sits well within the housing and compresses slightly. This compression helps to secure the spring in place and provides the necessary tension for the assembly. Check that the spring is aligned properly and does not shift during the process.
4. **Cap:** Insert the cap over the spring, ensuring it fits correctly into the housing. Press the cap firmly to compress the spring further and secure it in place within the housing. The cap should lock into position, ensuring that the spring remains compressed and that the assembly is stable and secure. Ensure that the cap is flush with the housing and does not protrude.
5. **Assembly Holder:** Use the assembly holder to stabilize each component during the assembly process, ensuring precise placement and secure fitting.

Error Notification and Resolution

- The robotic system is equipped with sensors and an LLM module to monitor and manage the assembly process. If the robot encounters any errors, such as misaligned parts or missing components, it will immediately notify the human operator.
- Notifications will be delivered in clear, natural language messages generated by the LLM module, ensuring that human operators can quickly understand and address the issue. For example, if a spring is missing, the robot might say, "Spring component missing. Please place the spring in the housing."
- After the human operator resolves the error, they can instruct the robot to resume the assembly process from where it was interrupted. This ensures a continuous and efficient workflow, minimizing downtime and maintaining high productivity.

Example Commands for Human Operators

- To start assembly: "Start the assembly."
- To address a missing component error: "A component is missing. Please place the springs correctly."
- To resume after error resolution: "I've fixed the error. Resume assembly."

Safety

- During the assembly process, it is crucial for human operators to maintain a safe distance from the robot to prevent any accidents or injuries. The assembly area should be clearly marked, and operators should stay outside this zone when the robot is in operation.
- In case of any immediate danger, the emergency stop button should be pressed to halt all robotic operations instantly. The light in the e-stop button will turn off when released, and operations can only resume after the issue is resolved and the button is reset.