

INDIAN HYPERLOOP POD

COMPETITION 2020

Rules and Regulations

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1. Introduction

This document outlines the rules and logistics for the Indian Hyperloop Pod Competition 2020. The Competition is open to student teams interested in competing with their pods on the IITM Hyperloop Test Track.

The key rules for the Competition are :

- All pods must be self-propelled. There is no restriction on the mode of propulsion to be used by the teams in their respective pods.
- The competition will be judged on multiple criteria. Top Speed will not be the only deciding factor.
- The team with the most points at the end of the competition will be adjudged the winner of the Indian Hyperloop Pod Competition 2020.

2. General Information

- Only Student Teams are eligible to participate in the competition.
 - A student team is one that is comprised solely of undergraduate, graduate and/or doctoral students/candidates who are currently enrolled in a school/college/university as of 31 March 2020. Teams can consist of students from multiple schools/colleges/universities.
 - There is no restriction on the number of team members in a team.
- Teams who have previously built a pod for testing purposes or for any other competition are eligible to compete, provided their pod meets all the guidelines prescribed in this document.
- No human or animal shall ride in any pod or device used on the IIT Madras Hyperloop Test Track for the purpose of the competition.

3. Tentative Timeline

- 31 March 2020 - Intent to Compete Form Due
- 15 April 2020 - Design Package Due
- 21 April 2020 - List of Teams Qualified for the Finals announced
- 9-12 July 2020 - Finals at IIT Madras

4. Design Package

All teams have to submit a Design Package consisting of a PowerPoint Slide Deck (in PDF format) of no more than 50 slides.

The Design Package will include the following :

- Description of the Team with a list of all team members and associated advisors
- Design Description of the Pod. It has to include the following :
 - Pod Design Summary (Top Level)
 - Pod Dimensions
 - Pod Mass by Subsystem
 - Pod Payload Capability
 - Pod Materials
 - Pod Power Source and Consumption
 - Pod Navigation Mechanism
 - Pod Levitation Mechanism (if any)
 - Pod Propulsion Mechanism
 - Pod Braking Mechanism
 - Pod Stability Mechanism
 - Pod Aerodynamic Coefficients
 - Pod Magnetic Parameters (if any)
- Predicted Pod Thermal Profile
- Predicted Pod Trajectory with the following :
 - Speed vs Distance
 - Acceleration vs Distance
 - Speed vs Time
 - Acceleration vs Time
 - Temperature vs Time
- Pod Production Schedule
- Pod Cost Breakdown
- Sensor List and Location Map
- Description of Safety Features including :
 - Mechanisms to mitigate a complete loss of power
 - Fault Tolerance of Braking, Levitation and other subsystems
 - Single Points of Failure within the Pod
 - Implementation of the Pod-Stop Command
- Component and System Test Schedule before the Pod arrives at IIT Madras for the Competition

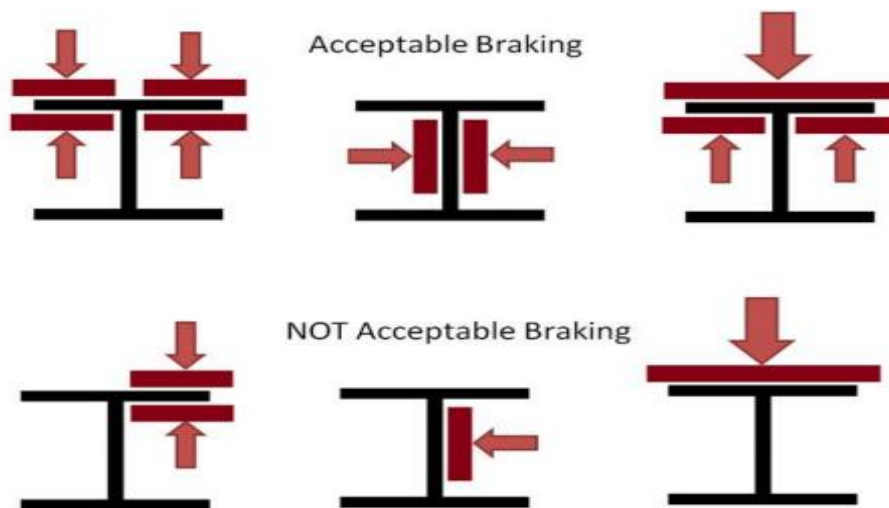
5. Pod Requirements

- The Mass of the Pod should not exceed 250 kg
- The Pod can be no shorter than 2 feet, and no longer than 15 feet
- The Pod has to be movable at low speeds when not in operation, either by physically pushing it, lifting it, or remotely controlling it

6. Safety Guidelines

The following are the Pod Safety Guidelines. In cases where the Pods do not comply with any guideline(s), an equivalent and reasonable level of safety has to be proven by the team.

- All Pods must have structural safety factors of atleast 2 for reasonable load cases like acceleration, deceleration, levitation, etc.
- Battery discharge rates must be within the manufacturers' specifications
- The Battery Pack must be isolated in cases the temperature rises above the specified limits
- All compressed gas must be limited to pressures of 300 bar
- All high pressure gas systems must have relief valves
- Flow directions through the relief valves must be oriented for the safest possible outcome
- Teams shall not cause the Track to increase in temperature by more than 20° C. In case of Levitating Pods, this will be used to determine maximum stationary hovering durations
- Safety-critical elements of the Braking System shall be redundant
- Cryogenic Liquids must not be used
- Pod Designs must be compatible with the Track tolerances as outlined in this document
- Through a remote command, Pods must be able to stop safely
- Besides an emergency "foam pit", no braking system will be provided on site. Pods are responsible for their own braking systems
- Any material in contact with the Track shall be designed to wear as opposed to stick/slip and shall be of a lower hardness than the Track
- All braking operations must be self-reacted and symmetric about the Track

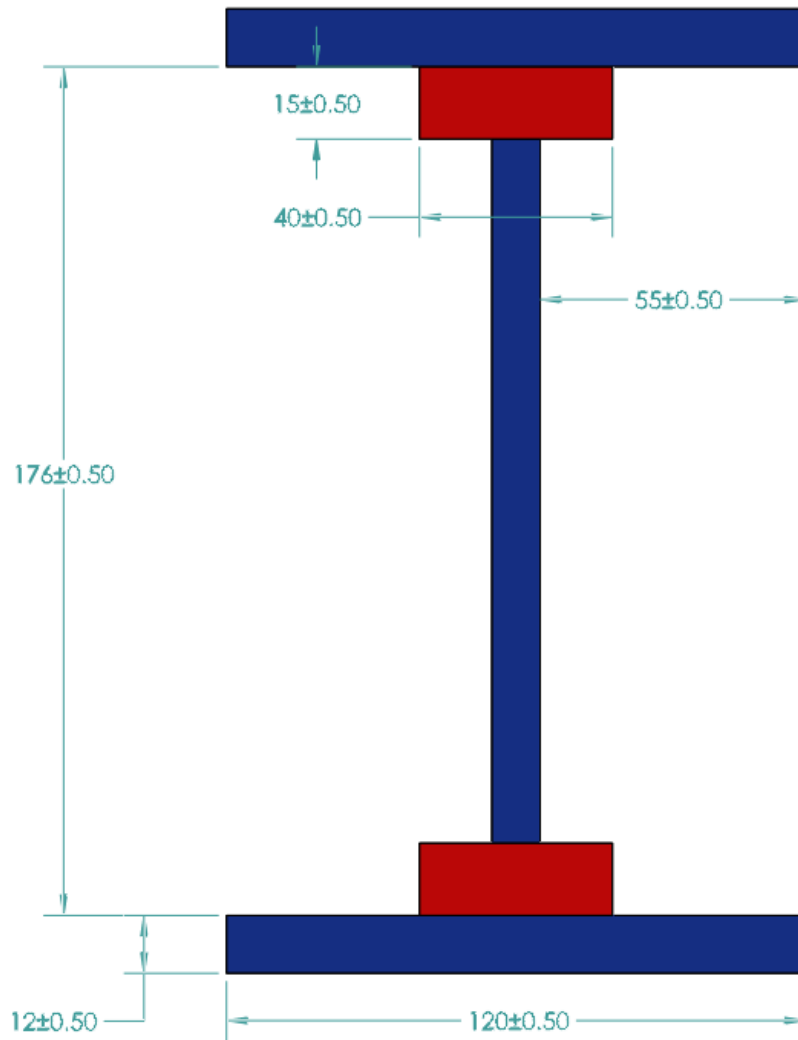


7. Pod Transport and Lifting Guidelines

- Each Pod needs a method to move around either on a cart or on its own wheels
- If the Pod is hand-lifted, the maximum allowable weight per person shall be limited to 20kg. Clearly marked lifting points for each person are required
- Pods cannot be hand-lifted by more than 6 people at a time
- Before being placed on the Hyperloop Test Track, Pods need to demonstrate basic low-speed motion, including braking and levitation (if implemented) on a separate Test Track of 25m length with dimensions identical to the actual Test-Track

8. Track Specifications

- Length - 500 m
- Radius of Curvature - Greater than 20 km at all points
- Instantaneous Bends - Less than 0.2° in Pitch and 0.1° in Yaw
- Material - Aluminium 6061
- Every 10m, a 5 cm wide Reflective Tape will be available on both sides of the Test Track. The tapes will be located on the ground, extending to a height of 4 feet above the ground



All dimensions in mm

- The Blue Section is the cross Section of the Test Track.
- The Red Section is the "Prohibited Zone" - No Part of the Pod can be inside the Red Zone at any time - during the Testing Phase as well as during the Final Pod Run.

9. Judging Criteria

All Pods will be judged on the basis of 9 different criteria as follows :

- Propulsion
- Braking
- Stability
- Power Systems
- Structures and Aerodynamics
- Controls and Communications
- Speed
- Design and Aesthetics
- Costing and Planning

Further details will be intimated to the teams that qualify for the Final Stage, to be held in IIT Madras from 9-12 July 2020.