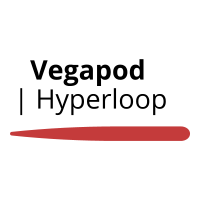
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**BRAKING SYSTEM FOR HYPERLOOP**

A REPORT PRESENTED BY

Team Vegapod

**Dream. Innovate. Build**

**Overview:**

Hyperloop Technology has been conceptualised as a High speed mode of transportation, travelling long distances at high speeds. Such Systems would require braking systems that can keep the inertia and Lateral forces under control – both safely and economically. As the Speed of the Pod increases, the concern for safety rises. Brake technologies play an important role on the safety of the vehicle’s operation. To avoid accident, the shorter of braking distance is better. Traditional brake systems don’t have enough capacity to ensure quick, accurate and synchronized braking requirements. Thus, development of new braking system with high reliability and light weight is a key requirement.

The braking methods used in Hyperloop can be classified into two types: Contact type braking and non-contact type braking. In Contact type braking, the created force is limited by the maximum force between the Guide Rails and the Brake Pads; however, this limitation does not exist in non-contact type braking. In non-contact type Braking, the maximum braking force is a function of the Instant velocity of the Pod.

With such high speeds, the risk factor increases drastically. In order to account for that, the braking is divided into Primary and Emergency-type Braking. The Primary Braking is applied in cases of Usual acceleration and braking commands execution. However, in events of emergency such as sudden depressurisation, Failure of Battery/power Supply, faults in on-board Electronic functioning, the emergency brakes will bring the pod to an instant halt.

This Report summarises the use of High Pressure Pneumatic Braking System in Hyperloop. Using Pneumatic Braking system, lies in the very own characteristics. It is a Fail to Safe system, both in Primary and Emergency Braking Conditions. Ease of control and command execution are some of its advantages over Hydraulic/ Electro-Hydraulic Braking Systems.

**Introduction:**

While traditional methods suffice normal, more traditional modes of transport, they are not feasible for Hyperloop vehicles due to the high amount of energy they need to absorb. Hence, a new method was required. For an initial baseline idea, let us consider Trains, or High-Speed Railway systems. These mostly use some form of friction brakes for locking in conjunction with another non-adhesion type system to handle deceleration at large speeds, like electromagnetic brakes which engage on the track to produce eddy currents. Other systems include non-conventional methods like Ceramic Particle Jetting, which ejects ceramic particles onto the track to avoid slip, slide or to aid in emergency braking.

**Motivation:**

The above methods, while being very effective, also add to the weight of the vehicle. One of the major goals for the team is to reach the highest possible speed on our vehicle, hence increasing the weight is not in the best interests of the team. The team hence took upon the challenge to design a braking system that could handle heavy decelerations and still be lightweight, without causing much wear on the running track.

**Objectives:**

The most ideal braking system would be Linear Induction Motor itself, operating in the reverse pole condition, but its application is limited to high speeds, and offers very low brake retention at low speeds. The team marked the following as the basic objectives for the Braking system:

* Low weight
* Low required power
* Low actuation time
* High Deceleration
* Low track wear
* Fail Safe
* Compact size

While the cutting-edge solutions such as Magnetic and Reverse thrusters produce high deceleration values and generate almost none to low heat, they are heavy. Weight was a huge factor in the design of our Hyperloop vehicle, and hence it was prioritised over the problem of heat dissipation. The team hence decided to go with conventional friction brakes, with a change in the actuation system. The team chose Pneumatics over Hydraulics for the low actuation time, as well as low weight, and the low power requirements.