Ein Bild, das Text, Schrift, Screenshot, Logo enthält.

Automatisch generierte Beschreibung

**Instructions**

* Teams are required to hand in a safety document for each individual prototype (e.g. teams using a booster motor and vehicle will be required to submit two documents). Prototypes that have not been elaborated in an approved safety document will not be allowed to be used at the competition.
* Complete all sections of this document, if a section is not applicable to your design state that in the document, do not remove the section.
* Remove all the instructions (red) from the document before submitting the document. Submit the .docx document such that feedback can be easily given.
* Information should be provided as concise as possible. It doesn’t have to be pretty.
* All datasheets and supporting documents should be added as appendix to this document, each datasheet should have a unique number for referencing.
* The deadline for first submission is 28 February 2025 at 23:59. The document will be reviewed by the scrutineers of the EHW and either approved or rejected with feedback. Teams have two weeks after receiving feedback to submit changes. Teams require an approved safety document to enter technical inspection for their prototype.
* Teams can submit their document before the deadline for early feedback.
* An approved safety document does not mean the prototype is rules compliant and approved for demonstration. Technical inspection will ultimately determine if a prototype is deemed safe enough for demonstration / testing. This document merely serves as an evaluation point during the year and helps teams to make changes if required to meet the rules.
* The safety document should be submitted before the deadline to the following google forms: [SFD Submission Forms](https://forms.gle/F2fjvbNVqosLPSxi7) with the document title: “[team name] Safety Document Submission”.
* For inquiries, please contact the technical EHW team at [technical@hyperloopweek.com](mailto:technical@hyperloopweek.com).

**Cover Page**The cover page must contain the following information:

* Title: Team name + Safety Document
* University name
* Prototype description (e.g. “Hyperloop Vehicle”)
* Awards / Categories you wish to participate in
* Contact information
* Document version number and date

# Prototype General Information

## Prototype Overview

* Provide a brief description (1 paragraph) of your prototype.
* Provide images / renders of your prototype indicating with arrows the critical sub-systems (M.2.) and main dimensions of the prototype.

Complete the information in the table below

|  |  |
| --- | --- |
| Prototype Mass: | 400 kg |
| Track: | Custom Track / EHC Infrastructure / No Track |
| Prototype High Voltage (max): | 600 VDC |
| Prototype Low Voltage (max): | 24 VDC |
| Energy Storage: | 2 kWh |
| Maximum Power: | 200 kW |
| Maximum Air Pressure Compressed Gas: | 5 bar |
| Maximum Fluid Pressure High-Pressure Fluids: | 20 bar |
| Number of Brakes: | 4 |
| Number of Magnets  (excl. propulsion): | 8 |
| Number of Motors: | 2 |

# Mechanical Systems Information

## General Mechanical System Information

### Mechanical System Overview

Provide a brief description (1 paragraph) describing each of the following sub-systems (if applicable):

* Magnetic Systems (1 paragraph per type)
* Braking System
* Compressed Gas & High-Pressure Fluid System
* Custom Track

### Custom Structural Parts

Provide information in the table below regarding your calculations demonstrating compliance with M.3. Provide proof (calculations or FEA analysis) in an appendix for each component including at least:

* Description of the worst-case load case.
* Calculation / Model assumptions (e.g. regarding fatigue).
* For FEA an image of the load-case.
* For FEA an image of the mesh.
* Calculations / FEA results.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Component Name** | **Sub-System** | **Material** | **Fatigue Considered?** | **Maximum Yield Stress Allowed** | **Maximum Yield Stress from Calculations** | **Calculation Appendix** |
| Caliper Connection Bracket | Braking System | Aluminum 7075-T6 | No | 200 Mpa | 80 Mpa | A.X |
| Magnet Support Beam | Levitation System | Steel S355 | Yes | 240 Mpa | 120 Mpa | A.X |
| Etc. |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

## Magnetic Systems Information

### Magnetic System Overview

Provide an overview of the use of permanent magnets on your prototype including:

* Strength of each magnet
* Location of each magnet on the prototype (feel free to use images)

### Permanent Magnets Storage and Handling

Provide a description of how you handle and store permanent magnets during the competition.

### Permanent Magnets Coverage

Describe how the permanent magnets will be covered on the prototype. Show your calculations / models of the magnetic flux density at the surface of the cover and at 1 meter from the cover.

## Braking Systems Information

### Braking System Overview

Provide a description of your braking system and the working principle (max. 3 paragraphs). Describe how your braking system engages upon loss of any power / gas / fluid supply (M.19.)  
  
Provide detailed images / renders of your braking system (at least top view, side view, front view and isometric view). Explain/show how the major components are connected and provide calculations regarding the design of connections (safety factors, pre-tensions, locking mechanisms).

Provide schematics of your braking system including any gas / fluid / electrical systems.

### Emergency Braking Switches

Provide information below regarding your Emergency Braking Switches

|  |  |
| --- | --- |
| Switch Model / Name | Switch AB4323.1 |
| Switch Datasheet | See A.X |
| Switch Working Principle | Push Button |
| Switch Track Interface | Metal bar sticking out to engage with push button |
| Switch Location on Vehicle | Front of vehicle next to levitation magnet  (205 mm from front) |

Provide images / renderings showing the emergency braking switches on the track and on the vehicle. Explain how they are always triggered under different conditions (e.g. due to yaw, pitch, roll etc…).

### Emergency Braking System Calculation

Provide information below regarding your braking system and vehicle.

|  |  |
| --- | --- |
| Vehicle Mass | 400 kg |
| Vehicle Theoretical Top Speed | 15 m/s |
| 1 Independent Brake Force (avg.) | 5000 N |
| Emergency Braking Switch Location (from end of track) | 20 m |
| Total Track Length | 50 m |
| Vehicle Maximum Acceleration (forward) | 1.5 m/s2 |
| Calculated Vehicle Braking Distance  (1 independent brake used) | 17 m |

Provide your calculations showing compliance with M.17. Include all your assumptions, methods and results.

## Compressed Gas & High-Pressure Fluid Systems Information

### Compressed Gas & High-Pressure Fluid Systems Schematics

Provide schematics for all your Compressed Gas & High-Pressure Fluid Systems. Include a description of pressure relief valves or bypass systems in place to prevent overpressure in compressed gas circuits. Include details like: Trigger pressure thresholds, location of the relief valves (and justification).

### Compressed Gas & High-Pressure Fluid Systems Components

Complete the table below for all components in your Compressed Gas & High-Pressure Fluid Systems. Custom design components should be added to section 2.1.2.

|  |  |  |  |
| --- | --- | --- | --- |
| **Component Name** | **Pressure Rating** | **Max. Pressure during Operation** | **Datasheet Appendix** |
| Tubing from gas tank to regulator | 100 bar | 50 bar | A.X. |
|  |  |  |  |
|  |  |  |  |

## Custom Tracks Information

### Custom Track Overview

Provide a brief description of your custom track (max. 2 paragraph).

Provide images / renders / drawings of your custom track showing all outside dimensions (width, height, length).

### Custom Track End Stop

Provide your calculations showing compliance with M.31. Include your assumptions and calculation method.

# Electrical Systems Information

## Electrical Systems Overview

Give a description of the electrical system of the prototype (max. 2 paragraphs).

Complete the table below:

|  |  |
| --- | --- |
| **Energy Storage** |  |
| Number of Low Voltage Batteries | 2 |
| Number of High Voltage Batteries | 1 |
| LV Battery Min/Nominal/Max Voltage | 19.2V/22.8V/25.2V & 38.4V/45.6V/50.4V |
| HV Battery Min/Nominal/Max Voltage | 460.8V/547.2V/604.8V |
| Maximum HV Voltage | 600VDC |
| Total LV Battery Capacity | 0.5 kWh |
| Total HV Battery Capacity | 5 kWh |
| LV Battery Chemistry | 2x LiPo |
| HV Battery Chemistry | Li-Ion |
| Maximum LV Battery Current | 20 A |
| Maximum HV Battery Current | 200 A |
| **Levitation System** |  |
| Levitation Concept | HEMS |
| Number of Levitation Magnets | 6 |
| Number of Levitation Converters | 6 |
| Permanent Magnets? | Yes |
| Max Current (per magnet) | 5 A |
| **Guidance System** |  |
| Guidance Concept | Wheels |
| Number of Guidance Magnets | 0 |
| Number of Guidance Converters | 0 |
| Permanent Magnets? | N/A |
| Max Current (per magnet) | N/A |
| **Propulsion System** |  |
| Propulsion Concept | Rotary Motor |
| Number of Propulsion Magnets / Motors | 1 |
| Number of Propulsion Inverters | 1 |
| Permanent Magnets? | No |
| Max Current (per magnet) | 100 A |

## High Voltage System Overview

### High Voltage Schematic

Insert a large (full page) schematic of the HV system. This schematic should focus on the components that are not within the HV Battery. Provide boxes and 1st level interfaces, when details will be provided later in this document. Some details of components within the HV Battery may be included for better understanding (ie HVCs).

Figure must include the following:

* Wire Size (AWG or mm2)
* Relative fuse location (end of wire vs middle)
* Fuse rating (Amperage and Voltage)
* Magnet / Motor Converters / Controllers (1st level interfaces...inputs & outputs)
* Magnets / Motors
* Inline connectors and interfaces for charging
* HVMP and relative current limiting resistor locations
* Show HV enclosures as dashed lines

The figure must include the following if not within the HV Battery:

* IMD
* DCDC converters if used
* Pre-charge and Discharge circuit
* MSD

Make your overview as precise and complete as possible, this will prevent follow-up questions regarding your HV system.

### Fusing Overview

Add all fuses used in the high voltage system to the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fuse Location** | **Current Rating** | **Voltage Rating** | **Interrupt Rating** | **Datasheet** |
| Main HV Battery Fuse | 500A | 1000V | 10.000 A | A.X. |
|  |  |  |  |  |
|  |  |  |  |  |

### Wire / Conductor Overview

Add all wires / conductors used in the high voltage system to the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Conductor Location** | **Size** | **Voltage Rating** | **Ampacity** | **Rating of fuse providing protection** | **Datasheet** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

### Connector Overview

Add all connectors used in the high voltage system to the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Connector Location** | **Ampacity** | **Voltage Rating** | **Includes Interlock** | **Accepted wire gauge** | **Wire gauge connected** | **Datasheet** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

## Shutdown Circuit

### Shutdown Circuit Schematics

Insert a large (full page) schematic of the shutdown circuit.

The schematic must include the following:

* All shutdown circuit switches/devices (indicate Normally Open or Closed)
* Safety interlocks associated to connectors or MSD
* BMS connection to shutdown circuit
* IMD connection to shutdown circuit (include path from output of IMD OKHS to shutdown circuit, additional detail may be provided in second figure)
* HVC coils including resistance of coil and voltage rating or economizer detail
* Pre-charge relay coil
* LV battery
* Fuse(s)
* Wire Size (AWG or mm2)
* Emergency Braking System Switches
* Emergency Braking System Relays

Make your overview as precise and complete as possible, this will prevent follow-up questions regarding your shutdown circuit.

### Insulation Monitoring Device (IMD)

Complete the information in the table below.

|  |  |
| --- | --- |
| Make / Model: | Bender IR12345 |
| Supply voltage: | 24VDC |
| Environmental temperature range: | 45..55°C |
| Self-test interval: | every 20 ms |
| High voltage range: | DC 0..10V |
| Set response value: | 30kΩ (500Ω/Volt) |
| Max. operation current: | 500mA |
| Approximate time to shut down at 50% of the response value: | 80s |
| Datasheet: | A.X. |

Include schematic showing how latching circuit for IMD operates. Also include the IMD status indicator (E.142.) in the figure.

Describe the location of the IMD.

Describe the location of the IMD indicator (E.142.).

Describe how the latched IMD fault can be reset.

Describe the manner in which the ground connections of the IMD are connected to the prototype.

### High Voltage Battery Management System (HVBMS)

Describe what faults/conditions will cause the BMS to open the shutdown circuit.

Describe the method used to latch the BMS fault and the triggering of the BMS Indicator light, include a schematic if appropriate.

Describe how the latched BMS fault can be reset.

### Shutdown Buttons

Provide the datasheet and general information of the shutdown buttons and provide an image / render / drawing indicating the location of the shutdown buttons on the prototype.

### Master Switches

Provide the datasheet and general information of the master switches and provide an image / render / drawing indicating the location of the master switches on the prototype.

## Safety Systems

### High Voltage Active Light (HVAL)

Provide a general description of your HVAL including the flashing frequency of the red light, the trigger voltages and the location on the prototype (provide render).

Include a schematic showing the overall control circuit for the HVAL. The schematic should include all components from HV sense input to light. If team designed PCB is used with HV and LV circuits provide CAD rendering or photograph showing spacing for HV/LV separation. This schematic should show the control circuits for the HVAL which are responsible of voltage monitoring in both prototype and battery sides and the HVC state monitoring circuitry.

### Measurement Points

Provide the datasheet(s) of your measurement points and provide a render/image showing where they will be located on your prototype.

Provide the general information (voltage rating, current rating) and datasheet of the current limiting resistor that you will use for the high voltage measurement points.

### Manual Service Disconnect (MSD)

Provide general information (voltage rating, current rating) of your Manual Service Disconnect and the datasheet.

Provide an image/render showing the location of the MSD on the prototype.

### Discharge Circuit

Describe your discharge circuit and how it is controlled.

Provide an overview of the components in the discharge circuit (resistors, switches, relays, etc...) and provide their main specifications and datasheets.

What is the capacitance of the HV-bus? How long does it take to discharge to <60VDC? Show calculations.

Describe the location of the discharge circuit and provide a render of the location and main components.

## Low Voltage Battery

(complete this section (3.5) multiple times if you have multiple LV batteries on your prototype)

### LV Battery Overview

Provide a concise description of your low voltage battery design provide at least the following information by means of pictures / tables / schematics:

* The configuration of the LV battery
* The maximum, minimum and nominal voltage of the battery
* Description of the casing (material) and how it is mounted onto the prototype
* Fuse used for the low voltage battery, including datasheet

### LV battery Cells

Complete the information in the table below.

|  |  |
| --- | --- |
| Cell Make / Model / Style: | Kokam XYZ- pouch |
| Cell nominal capacity: | 5.4 Ah |
| Maximum Voltage: | 4.2 V |
| Nominal Voltage: | 3.7V |
| Minimum Voltage: | 2.8V |
| Maximum output current: | 20C for 10s |
| Maximum continuous output current: | 15C |
| Maximum charging current: | 5C |
| Maximum Cell Temperature (discharging): | 65°C |
| Maximum Cell Temperature (charging): | 55°C |
| Cell chemistry: | LiFePO4 |
| Datasheet: | A.X. |

Describe how cells are mounted in the LV battery container. Provide images to show mounting mechanism. In the case of pouch cells describe how the cell tabs are not mechanically loaded.

Describe how the electrical connections are made to the cells (welded/bolted/clamped)?  Define what kind of weld (resistance/laser), what kind bolt (copper w/deforming nut), material of clamp.  If bus bars are used what is the cross-sectional area and ampacity?  Provide images of the connections.

### LV Battery BMS

Describe the BMS that has been selected, for an off-the-shelf BMS provide the datasheet. If using custom designed BMS, provide schematics and renderings.

Provide details of the voltage measurement (accuracy, acquisition frequency, etc).

Describe how and where the voltage sense leads are overcurrent protected (fused). What size are the sense leads? What is their ampacity? If your sense leads are not fused, please reason why and how your system detects a malfunction of one of the measurements?

Provide details of the temperature measurement system (accuracy, acquisition frequency, etc). Give details of the temperature sensors used including the datasheet.

Provide images showing how and where the temperature sensors will be placed.

Complete the tables below with your BMS setpoints and response times.

|  |  |
| --- | --- |
| Max Cell Voltage: | 6.8V |
| Min Cell Voltage: | 4.2V |
| Max Temperature: | 60°C |
| Min Temperature: | -5°C |

|  |  |
| --- | --- |
| Time to detect an open wire in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect a short to supply voltage in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect a short to GND in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect an implausibility due to out of range in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect failure of digitally transmitted signals in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect an open wire in cell temperature monitoring and opening of the SDC: | 2s |
| Time to detect a short to supply voltage in cell temperature monitoring and opening of the SDC: | 2s |
| Time to detect a short to GND in cell temperature monitoring and opening of the SDC: | 2s |
| Time to detect an implausibility due to out of range in cell temperature monitoring and opening of the SDC: | 2s |
| Time to detect failure of digitally transmitted signals in cell temperature monitoring and opening of the SDC: | 2s |

## High Voltage Battery

### HV Battery Overview

Give a general description of your high voltage battery.

Provide a schematic of the electrical system within the HV Battery showing all electrical connection, HV and LV.

Insert a large image (top or nearly top view) of the complete accumulator assembly without cover.

Figure must include the following:

* Separation walls (both at cells and HV electronics sections)
* Attachment points to the prototype
* Cell segments
* HV electronics
* HVCs
* Main fuse
* Maintenance plugs
* Main power connector

(additional images may be needed to provide clear views of all elements)

Complete the information in the table below.

|  |  |
| --- | --- |
| # of Segments: | 5 |
| Cells per segment: | 15 |
| Cell configuration in segment: | 5S3P |
| Energy in segment: | 2.8MJ / 0.78 kWh |
| Mass of segment: | 10 kg |

Describe how maintenance plugs are implemented in between the segments.  If off the shelf components are used provide link to datasheet.

If custom components are used provide detailed images of them.

Describe how positive locking is provided for maintenance plugs such that they cannot unintentionally come loose.

Describe how maintenance plugs are designed such they cannot be installed or removed incorrectly.

### HV Battery Cells

Complete the information in the table below.

|  |  |
| --- | --- |
| Cell Make / Model / Style: | Kokam XYZ- pouch |
| Cell nominal capacity: | 5.4 Ah |
| Maximum Voltage: | 4.2 V |
| Nominal Voltage: | 3.7V |
| Minimum Voltage: | 2.8V |
| Maximum output current: | 20C for 10s |
| Maximum continuous output current: | 15C |
| Maximum charging current: | 5C |
| Maximum Cell Temperature (discharging): | 65°C |
| Maximum Cell Temperature (charging): | 55°C |
| Cell chemistry: | LiFePO4 |
| Datasheet: | A.X. |

Describe how cells are mounted in the HV battery container segments. Provide images to show mounting mechanism. In the case of pouch cells describe how the cell tabs are not mechanically loaded.

Describe how the electrical connections are made to the cells (welded/bolted/clamped)?  Define what kind of weld (resistance/laser), what kind bolt (copper w/deforming nut), material of clamp.  If bus bars are used what is the cross-sectional area and ampacity?  Provide images of the connections.

### HV Battery BMS

Describe the BMS that has been selected, for an off-the-shelf BMS provide the datasheet. If using custom designed BMS, provide schematics and renderings.

Provide details of the voltage measurement (accuracy, acquisition frequency, etc).

Describe how and where the voltage sense leads are overcurrent protected (fused). What size are the sense leads? What is their ampacity? If your sense leads are not fused, please reason why and how your system detects a malfunction of one of the measurements?

Provide details of the temperature measurement system (accuracy, acquisition frequency, etc). Give details of the temperature sensors used including the datasheet.

Provide images showing how and where the temperature sensors will be placed.

Complete the tables below with your BMS setpoints and response times.

|  |  |
| --- | --- |
| Max Cell Voltage: | 6.8V |
| Min Cell Voltage: | 4.2V |
| Max Temperature: | 60°C |
| Min Temperature: | -5°C |

|  |  |
| --- | --- |
| Time to detect an open wire in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect a short to supply voltage in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect a short to GND in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect an implausibility due to out of range in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect failure of digitally transmitted signals in cell voltage monitoring and opening of the SDC: | 2s |
| Time to detect an open wire in cell temperature monitoring and opening of the SDC: | 2s |
| Time to detect a short to supply voltage in cell temperature monitoring and opening of the SDC: | 2s |
| Time to detect a short to GND in cell temperature monitoring and opening of the SDC: | 2s |
| Time to detect an implausibility due to out of range in cell temperature monitoring and opening of the SDC: | 2s |
| Time to detect failure of digitally transmitted signals in cell temperature monitoring and opening of the SDC: | 2s |

### HV Battery Contactors (HVC)

Complete the information in the table below.

|  |  |
| --- | --- |
| Make / Model: | RelayCo DaBIG1 |
| Contact Current: | 345A |
| Contact Voltage: | 350V |
| Datasheet: | A.X. |

### HV Battery Pre-Charge Circuit

Describe your pre-charge circuit and how it is controlled. What is the bus capacitance? How long will it take to pre-charge? How does your system determine the end of the pre-charge process?

Fill in the following table for your precharge resistor:

|  |  |
| --- | --- |
| Make / Model: | ResistorsRUs 500R01W |
| Resistance: | 500Ω |
| Voltage: | 650V |
| Power: | 0.1W |
| Power @15sec: | 1W |
| Datasheet: | A.X. |

Fill in the following table for your precharge relay(s)

|  |  |
| --- | --- |
| Make / Model: | RelayCo ABCD876 |
| Contact Current Rating: | 1A |
| Contact Voltage Rating: | 750V |
| Datasheet: | A.X. |

Provide images / renderings showing the pre-charge components. Mark the parts in the renderings, if necessary.

Explain how the power sinking elements of the precharge circuit are cooled.

### HV Battery Enclosure and Materials

If you intent to make use of an alternative material for the HVBC provide your prove of equivalency in terms of strength and stiffness using calculations and other means such as results of material testing.

Insert a large image of the complete segment assembly. Describe segment materials and how design provides a safe environment from dropped tools. Provide datasheets for the materials used showing fire retardance compliancy.

Provide details of walls materials and thicknesses. If cooling openings are required provide details of how these openings are protected from dust.

Describe how the segments are fixed inside the container in all 3 directions. Provide loads paths and calculations of all elements.

Describe and Provide images of how the HVCs and the main fuse are attached to the container.

### HV Battery Charging

Explain how you intent to charge your battery. Will it be on board the prototype? With the battery removed? Explain how the IMD & BMS will be active and monitoring during the charging process.

## Inverters / Motor Controllers / Converters

Copy-paste the sub-sections below for each type of inverter / motor controller / Converter used.

### [Converter Name] Description

Provide a description of your inverter/motor controller/converter and describe important functions. Provide table with main parameters below:

|  |  |
| --- | --- |
| Motor controller type: | ABC Controller |
| Maximum continuous power: | 60kW |
| Maximum peak power: | 75kW for 10s |
| Maximum Input voltage: | 600VDC |
| Output voltage: | 250VAC |
| Maximum continuous output current: | 100A |
| Maximum peak current: | 200A for 5s |
| Control method: | PWM, analog signal... |
| Cooling method: | Air, water, ... |
| Auxiliary supply voltage: | 24VDC |
| Datasheet: | A.X. |

### [Converter Name] Wiring, Cables, Current Rating, and Connectors

Describe the wiring, cables, and connectors used with your converter, and provide the current rating and datasheet for each component.

## Electromagnets

Copy-paste the sub-sections below for each type of electromagnet used.

### [Magnet Name] Description

Provide a description of your magnet and provide images / renderings showing the complete assembly of the magnet including any internal components.

Include the following information for your magnet:

* Magnet principle (EDS/EMS etc…)
* Peak power
* Maximum continuous power
* Input Voltage
* Nominal current
* Peak current
* Cooling method
* Maximum force

For the connections between parts show the calculations of the connections and how they are prevented from coming loose due to vibrations if not using critical fasteners.

Provide a graph showing the current vs. lift and/or propulsion force at different gaps.

Describe what will be the maximum, nominal, and minimum gap you will operate your magnet at.

### [Magnet Name] Wiring, Cables, Current Rating, and Connectors

Describe the wiring, cables, and connectors used with your magnet, and provide the current rating and datasheet for each component.

# Control System Information

## State Machine Overview

Provide an image showing your state machine and all (possible) transitions between states and the required/formal conditions.

Provide a list of all your system critical signal which you will be monitoring (C.3., C.4.). Provide what the lower and upper bound are for each critical signal.

Explain how the activation of the propulsion system will be prevented while the emergency braking system is deployed.

## Communication System

Provide a description of your communication system and a schematic showing how all components on your ground station and prototype are connected to the communication system.

Explain how you will implement the required heartbeat signal that transitions the vehicle into an emergency state when communication is lost.

# Other Information

Use this section to provide additional information about your system that you deem relevant for the safety of your prototype.

1. Appendixes
   1. Appendix Name

Provide your appendixes below following the number scheme: [A.##. Appendix name].