# Development of IDA Dipole Magnets

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# Outline

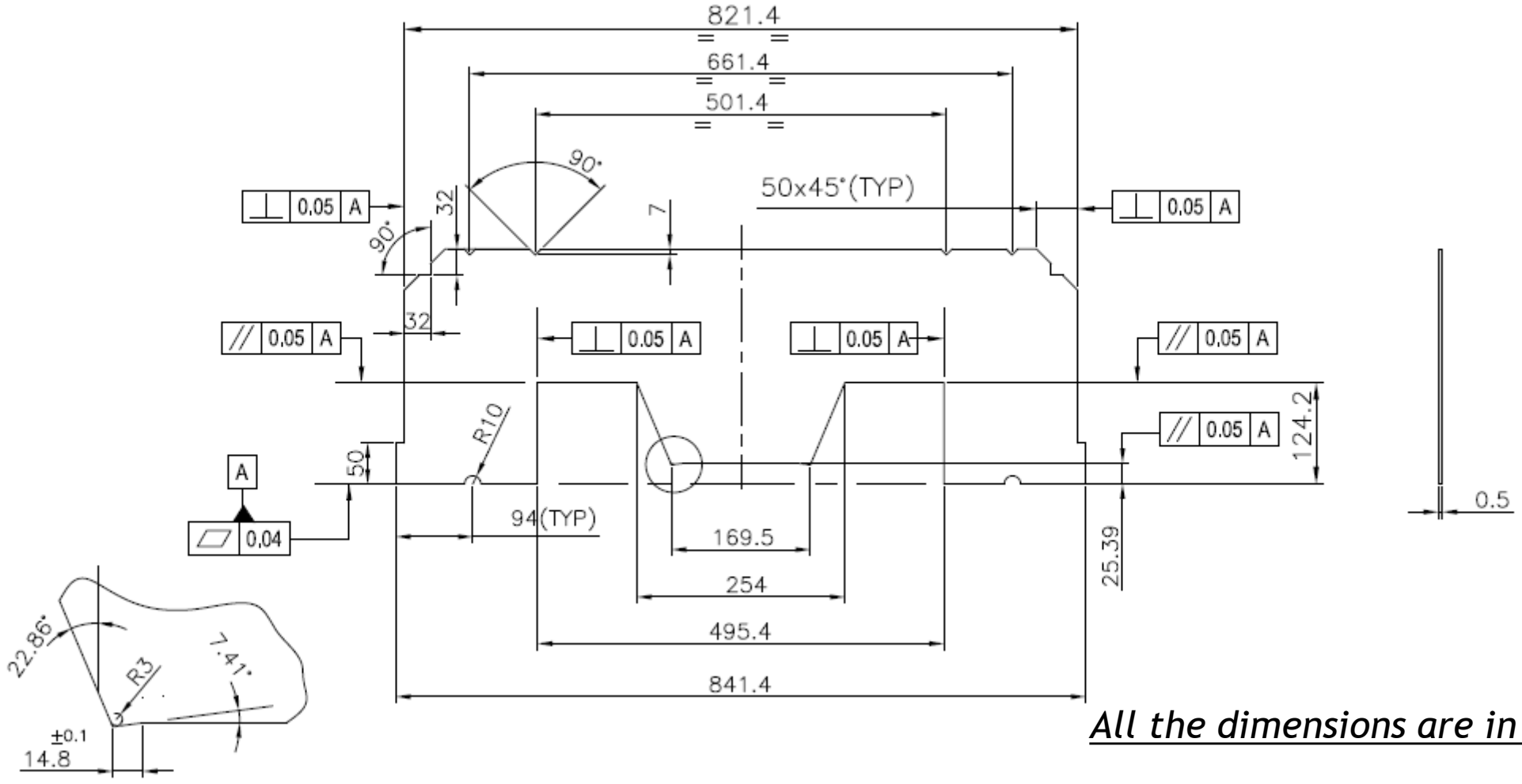
- Dipole Magnet Parameters
- Lamination Drawing
- Coil Winding & Joints
- Assembly sequence
- 2-D Drawings of Dipole Magnet
- Future Work

# Dipole Magnet Parameters

| S. No: | Parameter | Value |
|---|---|---|
| 1 | Steel Length | 6.1 m |
| 2 | No of turns | 4 turns per coil |
| 3 | No of coils | 2 |
| 4 | Conductor Size | 101.6mm×25.4mm with hole of diameter 12.7mm |
| 5 | Construction Material | Silicon Steel (as per standard IS:648 Grade: 50C700) |
| 6 | Lamination Thickness | 0.5 mm |
| 7 | Magnet Weight | 16 Tonnes Approx |
| 8 | Magnet Weight with coils | 18 Tonnes Approx |

# Magnet Lamination

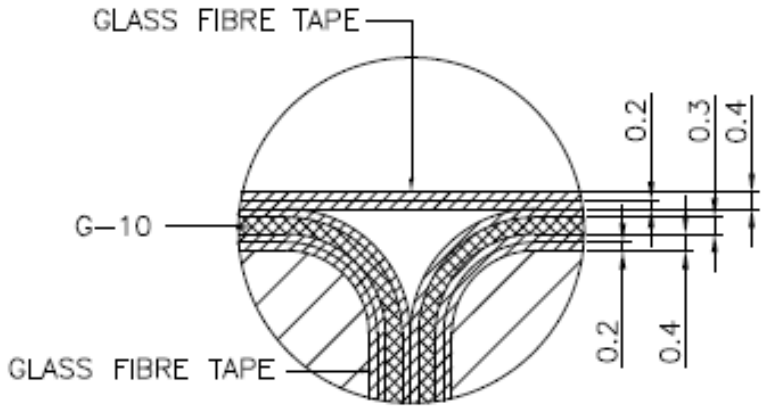
- Magnet Laminations (0.5mm Thickness) are made of Silicon Steel (as per standard IS:648 Grade: 50C700)
- Body Laminations will be die punched and the trimmed laminations (end packs) will be laser cut.

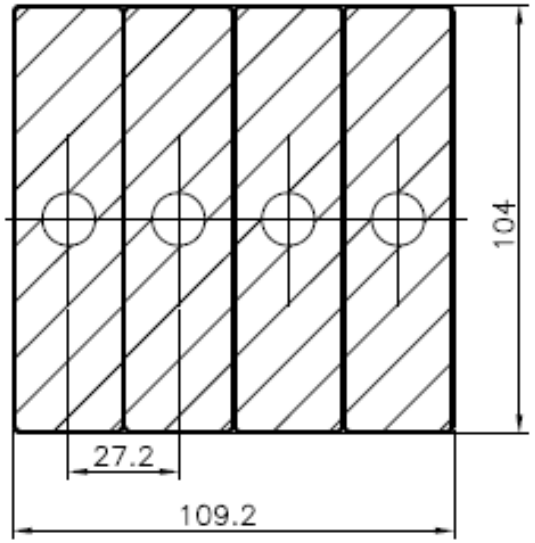



*All the dimensions are in mm*

# Coil Fabrication

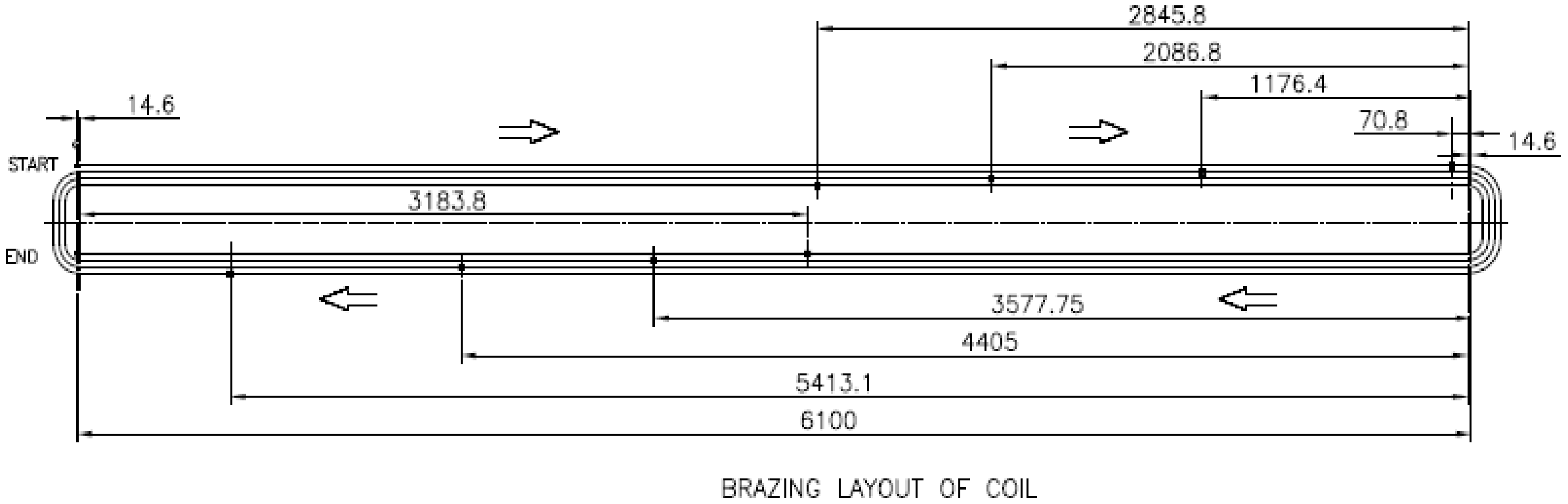
- Bare Copper conductor dimension (4”×1”) with hole 0.5 “ is selected
- Total number of turns in a coil: 4 Nos
- Conductor insulation will be carried out after winding and joint formation
- Conductor Insulation: 2 layers of Fibre Glass tape (Thickness 0.2 mm) in half overlap manner+G10 sheet(0.3mm)+fibre glass tape
- Coil Insulation: 2 layers of Fibre Glass tape (Thickness 0.2 mm) in half overlap manner




ALL DIMENSIONS ARE IN MM

# Coil Joints

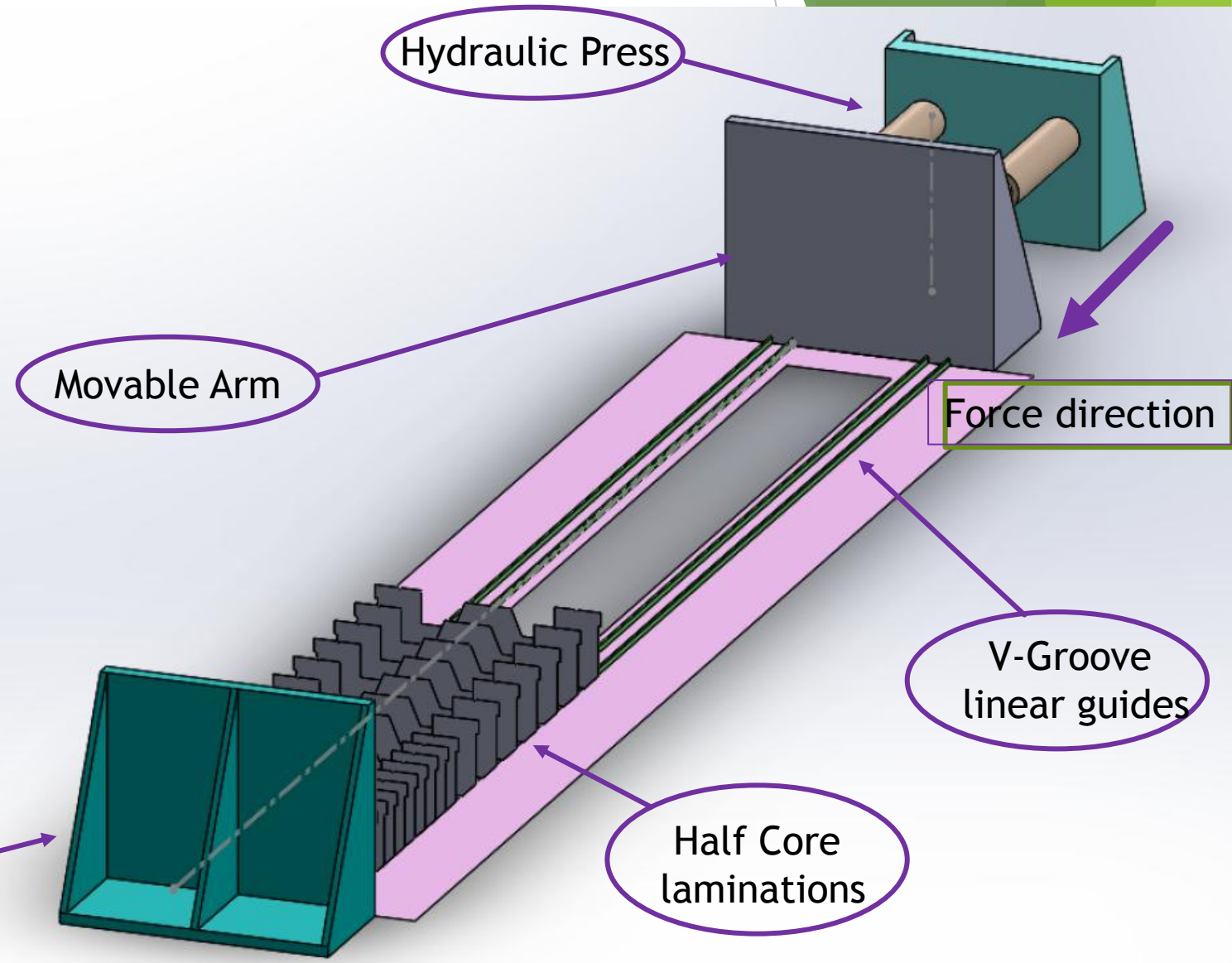



BRAZING LAYOUT OF COIL

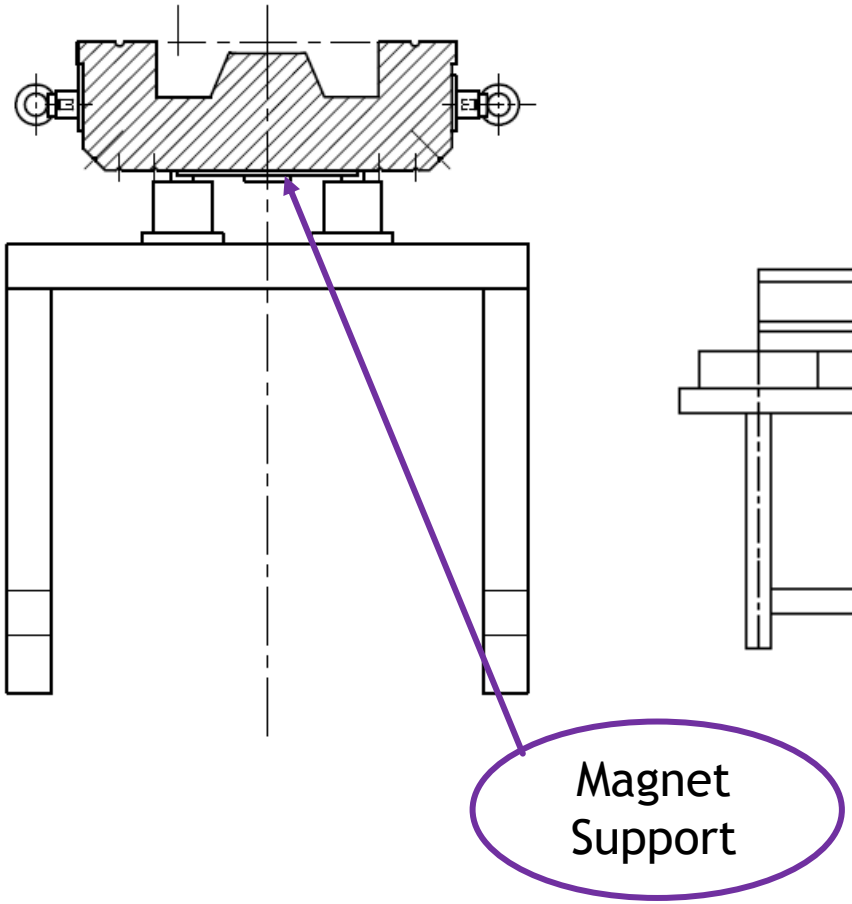
- Commercial available length of Copper OFHC conductor: 6.1 m
- Conductor requirement for Single coil requires 51 meters.
- Total Number of joints for a coil: 8 joints. (All joints in straight section)

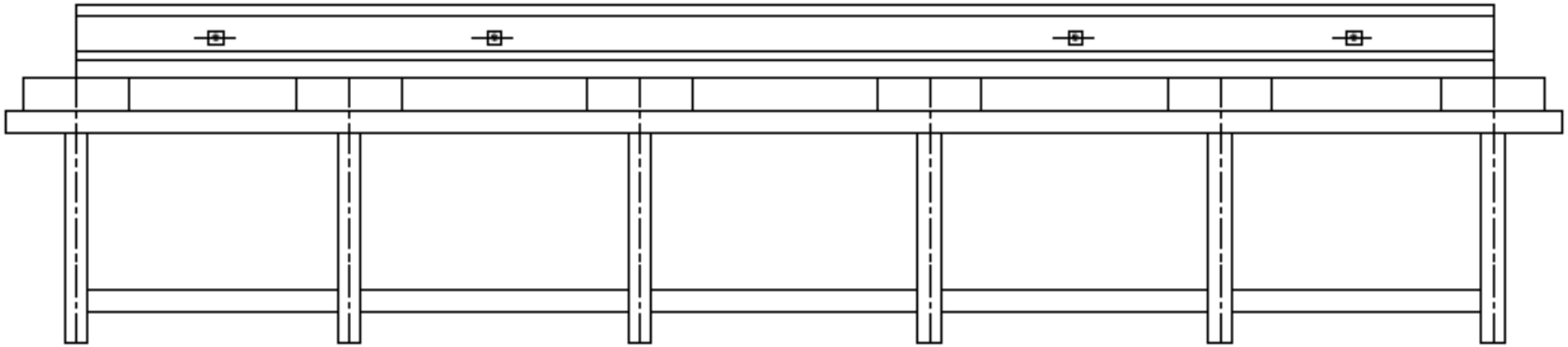
# Assembly of Half Cores

- Method of Assembly: Horizontal stacking
- Assembly of Half Core laminations shall be carried out on hydraulic stacker machine to achieve packing factor ~0.97.
- V-Groove linear guides single stroke length 6.1m are available commercially
- Guides will have inbuilt sagitta of 11 mm.
- Linear Guides are available in AISI carbon steel with top surface induction hardened

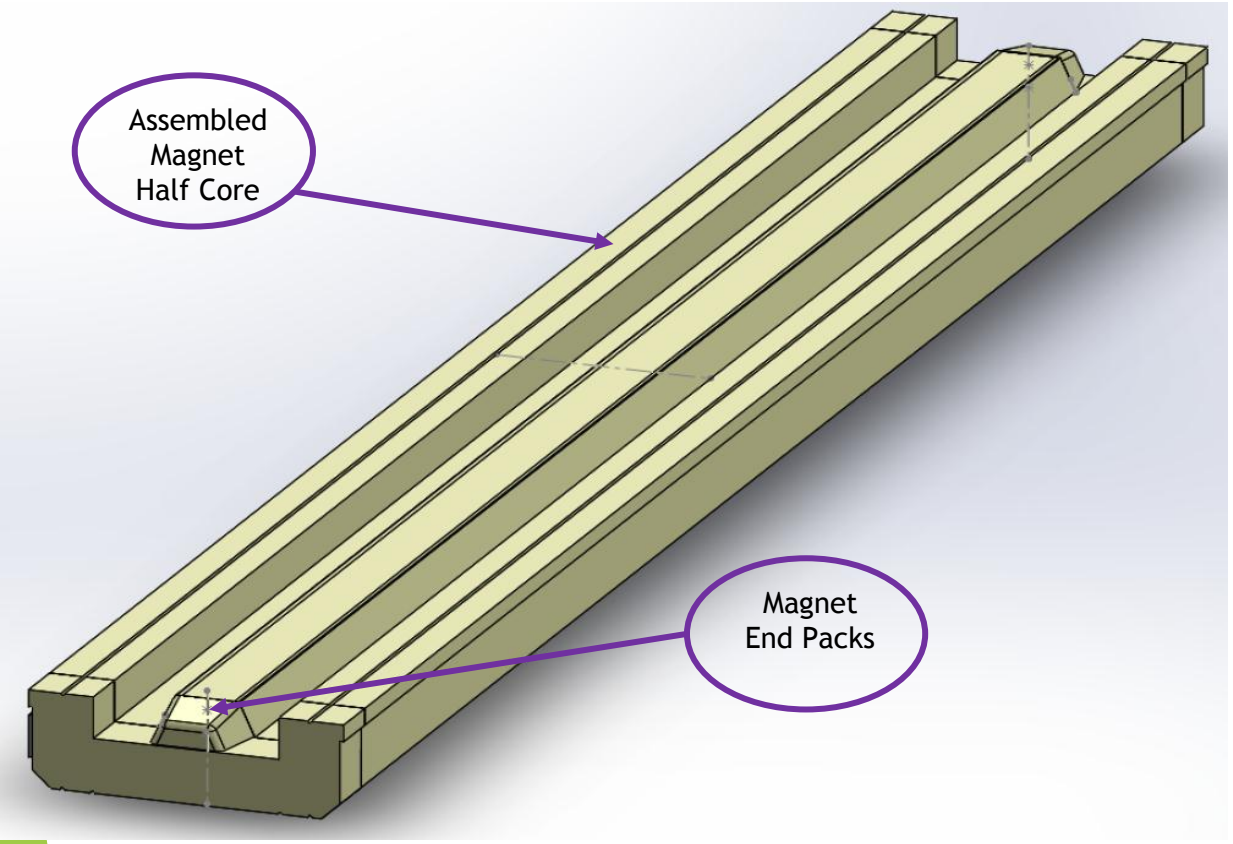


# Magnet Assembly Table

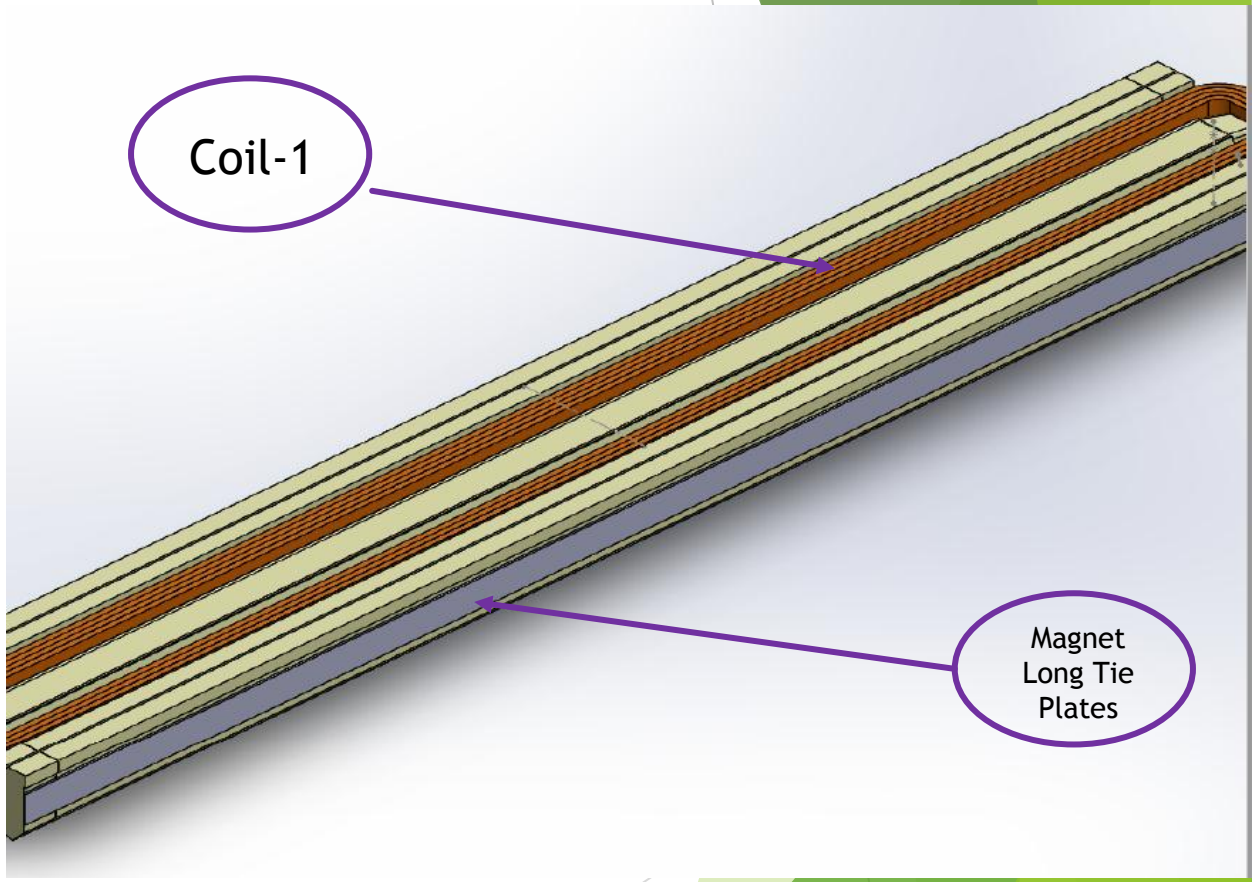


# Assembly of Dipole Magnet




Magnet Half Core (Length 6.1m)




Coil Assembled in magnet Half core

*Coil will be epoxy potted with core*

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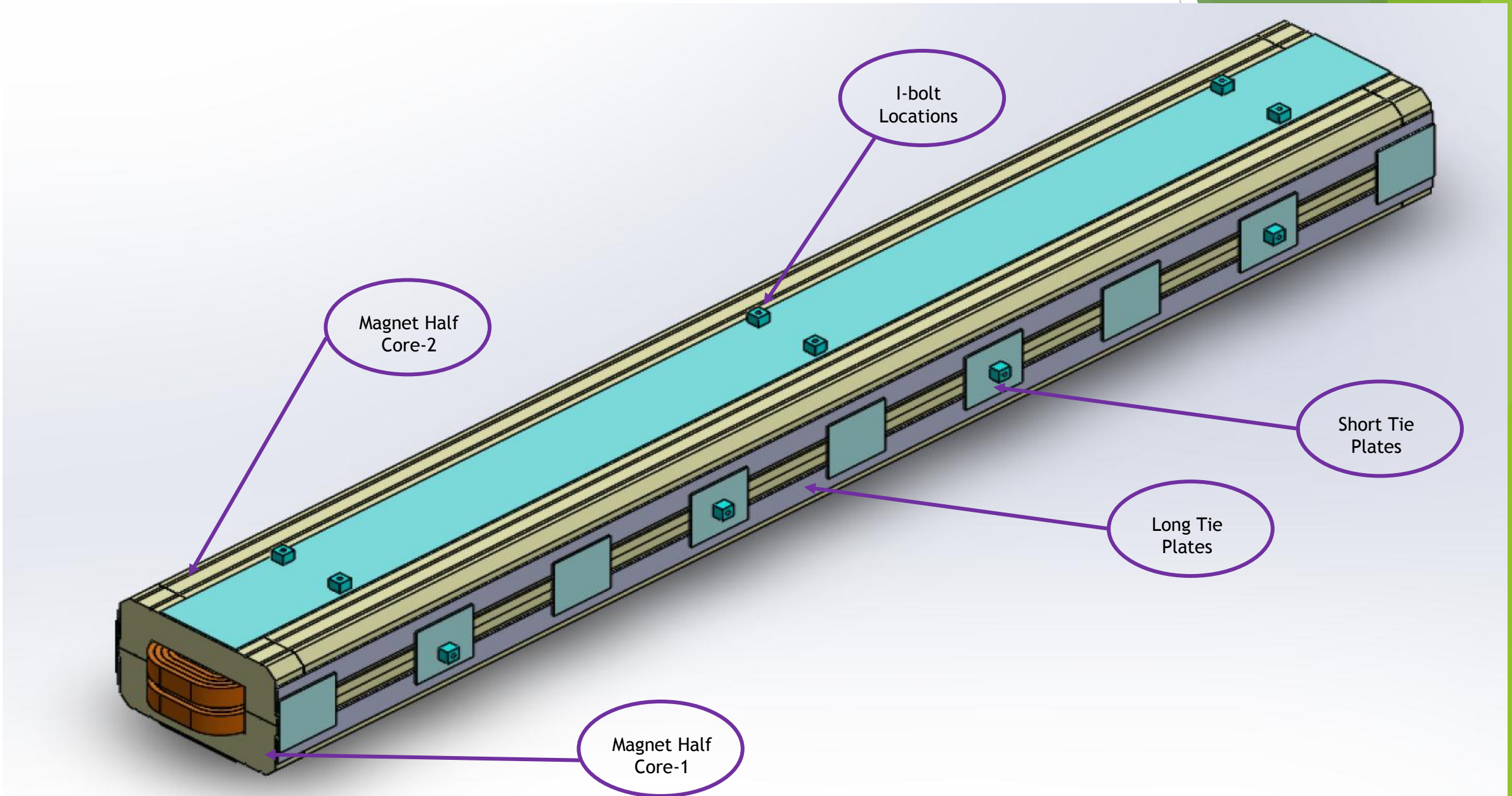
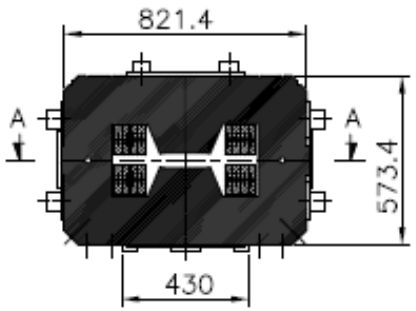
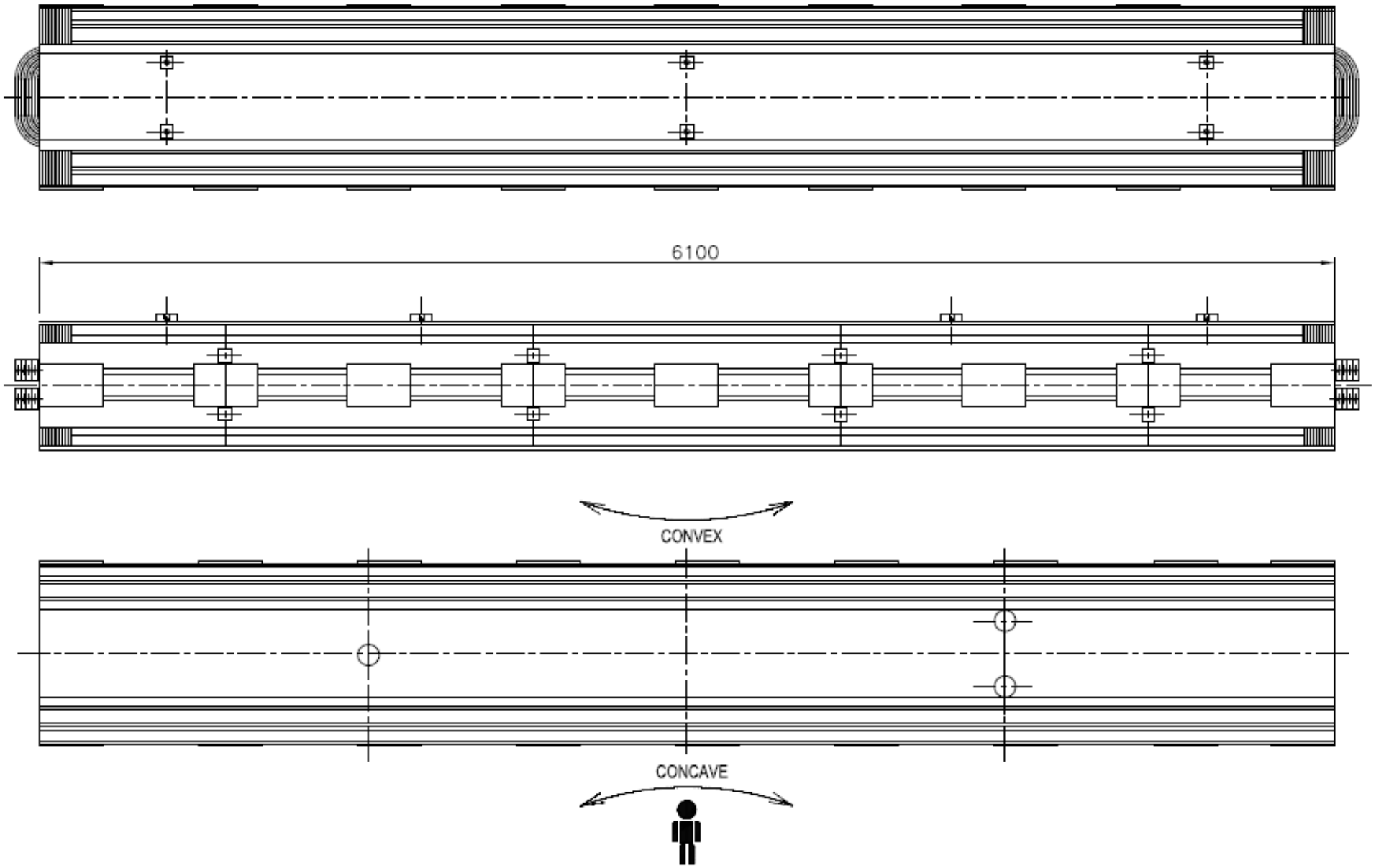


# Magnet 2D drawings



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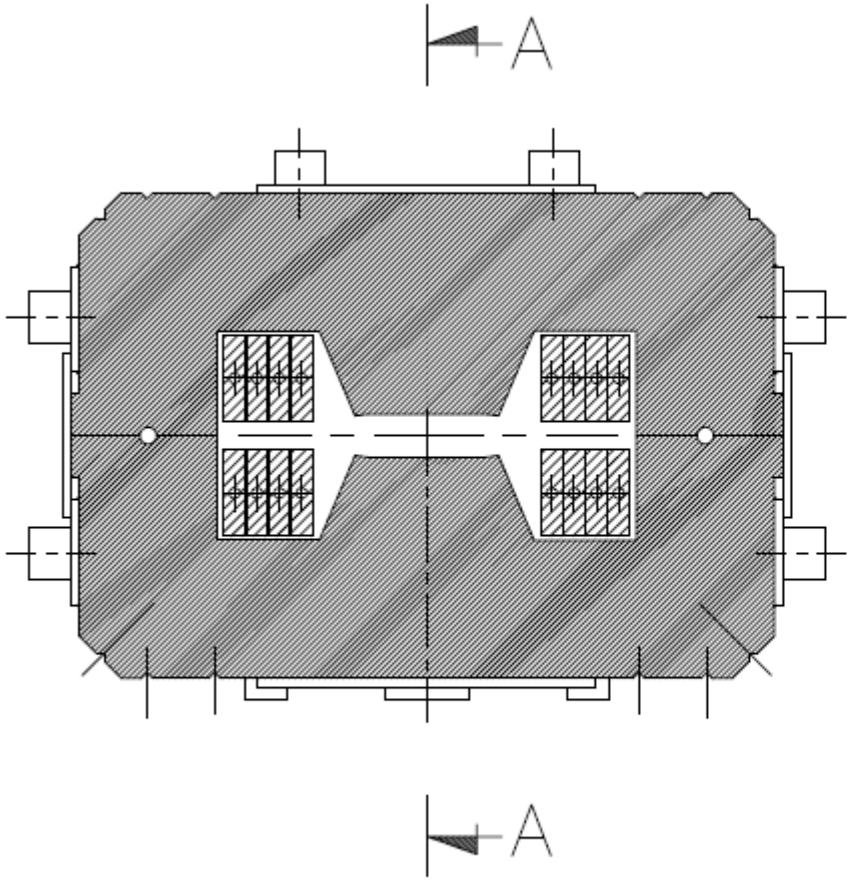


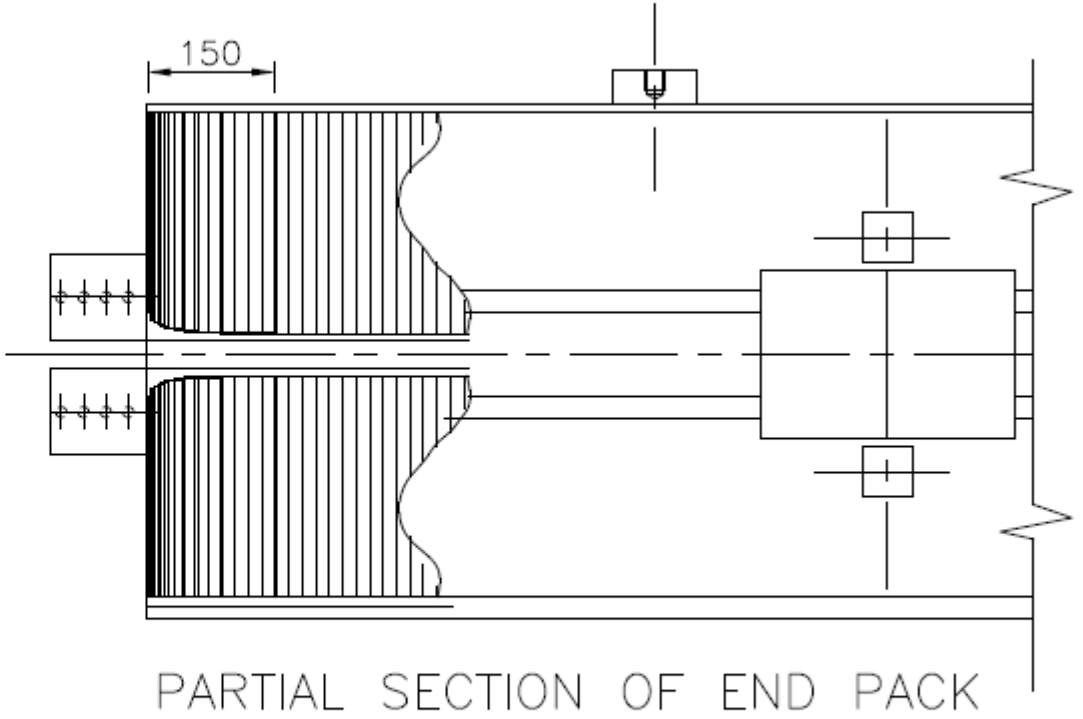

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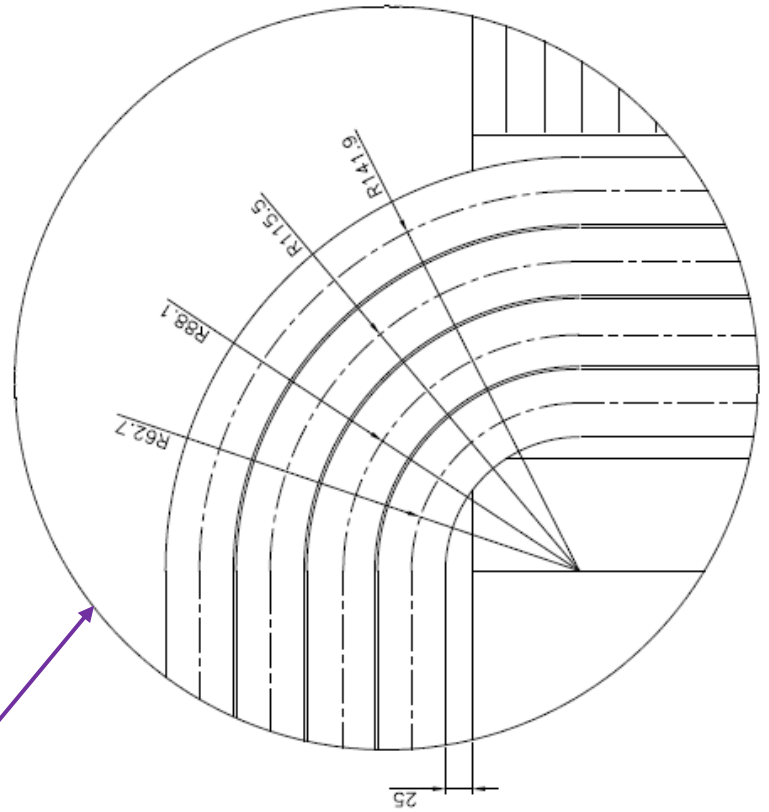
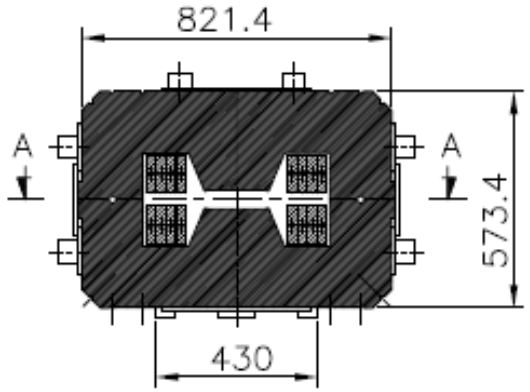
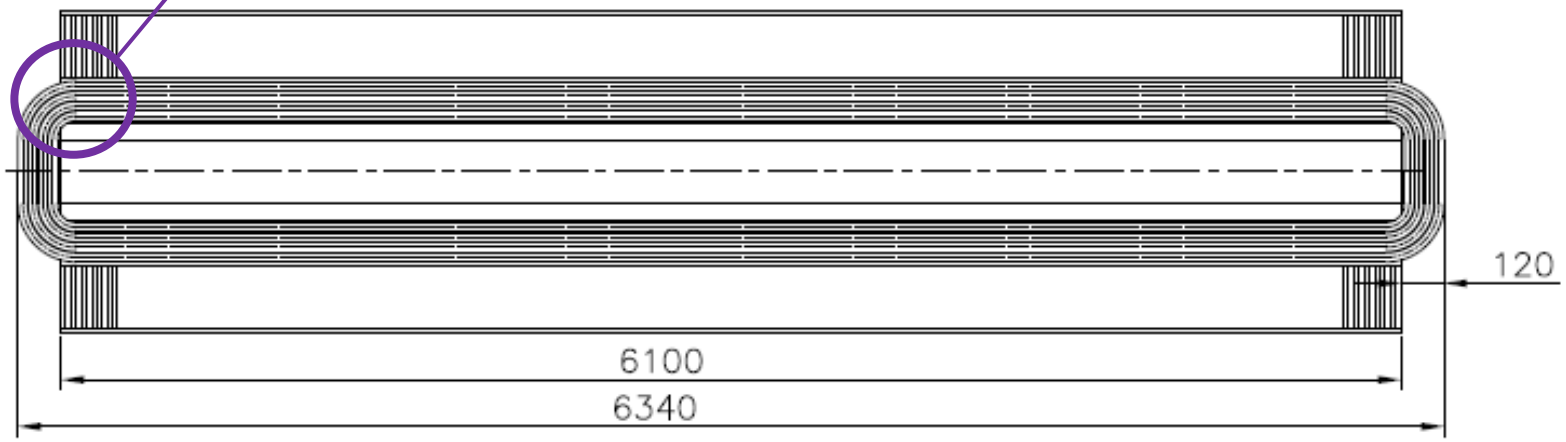



Coil Bending Details




CROSS SECTION PLAN A-A

# Magnet Qualification Testing

**Core Qualification**

- Dimension measurements shall be performed for Magnet body Laminations & Trimmed Laminations. Qualification will be based on GO & NO GO Gauge

**Coil Qualification**

- Hydrostatic pressure test at 15 bar will be carried out to detect leakages.
- Water flow rate will be measured in the coil to ensure no key stoning has occurred.
- Coil Resistance and inductance measurements

**Integrated Magnet Qualifications**

- Hipot testing for coils 5 KV@ < 5μ A
- Ring Test for coils at 200 Volts
- Coil Resistance and inductance measurements
- Long run (8 hours) Coil thermal tests for temperature rise

*Magnetic measurements are not listed here but they will also be carried out*

# Future Work

- Magnet Coil end design is under progress

# Thank You