
Technical Specification of the 4-Axis Filament Winding Machine

- **Structural Elements** : Standard Aluminum Extrusions
- **Dimensions of the machine**
 - The length of the machine = 2.2m
 - Width of the machine = 1.8 m
 - Height of the machine = .6m
 - Table of a slightly bigger dimension required for mounting the machine. Table will not be provided along with the machine
- **Power Requirements**
 - Heating system for resin bath : 1500 W
 - Maximum power of all motors : 1500 W
 - Single Phase, 230 V, 50 Hz
- **Mandrel Specifications**
 - Maximum Diameter of mandrel supported: 200 mm
 - Speed: 0-60 RPM
 - 3-Jaw self-centering chucks (1 Number) and Tailstock are provided for mounting the mandrel
- **Carriage axis specifications**
 - Max Winding length supported: 1500 mm
 - Speed: 0-9 m/min
- **Cross carriage axis specifications**
 - Stroke length: 130 mm
 - Speed: 0-9 m/min
- **Payout Eye Specifications**
 - Traverse: 0 -360 degrees
 - Speed: 0-60 PRM

- **Resin Bath** : .5 Liter capacity water heated resin bath with temperature control
- **Spool Specifications**
 - Mounting arrangement for two spools
 - Filament Tension: Mechanical Tensioning using adjustable friction mechanism with belt
 - Dancing roller mechanism for fiber pull back.
- **Electronics** :
 - Mach3 - 4 axis motion controller with motor drivers and USB connection.
 - Safety protection system such as limit switches and emergency stop switches along with over voltage and over current protections will be provided.
 - HEPA filter for the intake and outlet of air
- **Software**: Winding Guru Software for generating winding patterns (Developed in house). Human Machine Interface (HMI) software for running the machine controller.
- **Features of Winding Guru Software**:
 - Helical Winding on cylindrical parts, e.g. pipes, drive shafts
 - Hoop winding and multi-stage hoop winding on cylinders parts
 - Helical geodesic winding on cylinders with dome ends (Dome , Elliptical, Tori-spherical)
 - Mandrel Model Generator (Circular cross section mandrels)
 - Winding simulation and pattern calculations –
 - i. Physical modeling
 - ii. List of all possible winding angles
 - iii. Variable winding angle
 - iv. Friction modeling
 - Filament path generation and Feed Eye Path generation
 - Output for control system in G-Code format
 - G-code optimization for filament winding machine
 - The computer to run the software is not included with the machine. A copy of the filament winding software and a dongle used to authenticate the system will be provided.
- **Safety Features**
 - a. Limit switches and mechanical stoppers provided for linear axes.



**Vashishtha
Research**

Vashishtha Research Private Limited,
Space Technology Innovation and Incubation Cell (STIC),
Indian Institute of Space Science and Technology (IIST),
Valiamala, Thiruvananthapuram 695547
Reg. Office: Dotspace, TC24/3088,
Kowdiar, Trivandrum 695003
GST No: 32AAGCV4993G1Z2

- b. Emergency Stop Switch will be provided at convenient place.



4-axis filament winding machine

Demo Video : <https://www.youtube.com/watch?v=kSRHpZk5BWM>