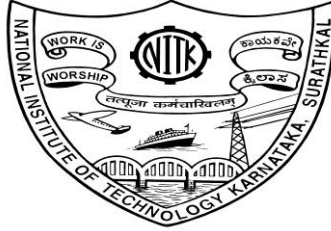# NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

DEPARTMENT OF MECHANICAL ENGINEERING
POST SRINIVASNAGAR, MANGALORE – 575 025 (D K)
Phone: (0824) 2474000.   Fax: (0824) 2474033
E- mail: info@nitk.ac.in   **Website: http://www.nitk.ac.in**

NOTICE INVITING QUOTATION

Notification. No: NITK/ME/SC/CSP/04   dated: 2/03/2023

Name of Goods	Customized Solar panel with inner re-volute controller mechanism
Estimated Amount:	₹ 2 lakhs
Time for Supply of item after release of Purchase order	7 (Days)
Document Download / Sale Start Date	2/03/2023
Clarification Start Date	2/03/2023
Clarification End Date	4/03/2023
Bid Submission Start Date	2/03/2023
Last Date for submission of bids	11/03/2023 **before 3.00 PM**
Bid Opening Date	13/03/2023 **before 3.00 PM**
Address for Submission of bids	Dr. Saurabh Chandraker Assistant Professor Dept. of Mechanical Engineering, National Institute of Technology Karnataka Surathkal, Mangalore - 575 025 E-mail: schandraker@nitk.edu.in Tel.: +91-8242473667 Mobile.: +91-9981640044

Notification No: NITK/ME/SC/CSP/04   dated: 2/03/2023

NOTICE INVITING QUOTATION (NIQ)

The National Institute of Technology Karnataka, Surathkal (in short – NITK, Surathkal) is an Institute Of National Importance Under Ministry of Education Govt of India, imparting Technical Education and engaged in Research Activities. It is proposed to procure the items for the departmental academic/research activities.

Sealed Quotations as per the Price Schedule given in this NIQ are invited for the following items subject to the terms and conditions, from the reputed manufacturers or its authorised dealers so as to reach on or before scheduled date and time. The quotations in   the firm's Business letter head should be address to the "Director, NITK, Surathkal". The envelope shall be superscribed with the Quotation Notification Number and the Name of the Goods for which quotation is submitted.

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Sd/-
HOD

Note: Institute shall not be responsible for any postal delay about non-receipt /non-delivery of the bids or due to wrong addressee.

SECTION-1
Terms and Conditions

1. The rates should be quoted for preferably FOR destination from supply within India.

2. The bidder shall indicate the excise duty exemption for the goods if applicable.

3. The rate quoted should be on unit basis. Taxes and other charges should be quoted separately, considering exemptions if any. The rate should be quoted in INR only

4. Rate quoted should be inclusive of Testing, commissioning and Installation of equipment and Training.

5. Payment: No advance payment will be made. Payment will be made only after the supply of the item in good and satisfactory condition and receipt of performance security by supplier.

6. Guarantee/Warrantee period should be specified for the complete period should be specified in section 3 of this tender document.

7. Period requirement for the supply and installation of item should be specified in section 3 of this tender document.

8. In case of dispute, the matter will be subject to Mangalore Jurisdiction only.

SCHEDULE OF REQUIREMENTS, SPECIFICATIONS AND ALLIED DETAILS
[To be filled up by the Department / Centre of NITK, Surathkal]

Item(s) Name to be Procured   :   Customized Solar panel with inner re-volute controller mechanism

Brief Specifications of the Item(s)   : Detailed Specification is attached below in Annexure-1
(Attach Additional Sheet if necessary)

Quantity   :   3 panel, 1 mechanism and 1 controller

Any other details / requirement   :

Warranty Period required   : 2 yr

Delivery Schedule expected
after placement of Purchase order
(in Weeks)   : 7 days

SECTION 3
PRICE SCHEDULE
[To be used by the bidder for submission of the quotation]

---

1.   Item Name   :

2.   Specifications
      (Conforming to Schedule of requirements
       Enclose additional sheets if necessary)   :

3.   Currency and Unit Price   :

4.   Quantity   :

5.   Item Cost (Sl No. 3 * Sl. No. 4)   :

6.   Taxes and Other Charges   :
      (i) Specify the type of taxes and duties
          in percentages and also in figures.
      (ii) Specify Other Charges in figures.

7.   Warranty Period   :
      (Conforming to the Schedule of
       requirements)

8.   Delivery Schedule   :
      (Conforming to the Schedule of requirements)

9.   Name and address of the Firm for   :
      placing purchase order

10.   Name and address of Indian authorized
      agent (in case of imports only)   :

Signature of the Bidder: _____

Name   and Designation: _____

Business Address   : _____

                        _____

Place: **Seal of the Bidder's Firm**
Date:

SECTION 4
CONTRACT FORM
[To be provided by the bidder in the business letter head]

1. <u>(Name of the Supplier's Firm)</u> hereby abide by the delivery schedule mentioned in this document for supply of the items if the purchase order is awarded.

2. The item will be supplied conforming to the specifications stated in this document without any defect and deviations.

3. Warranty will be given for the period mentioned in this document and service will be rendered to the satisfaction of NITK, Surathkal during this period.

Signature of the Bidder: _____

Name   : _____

Business Address   : _____

                                          _____

Place :   **Seal of the Bidder's Firm**
Date :

Specification Details

Introduction:-

Design and modelling of Customized Solar panel with inner re-volute controller mechanism & having an opening and closing mechanism (Due to rotatory motion of shaft), other product details shown below.

Product Details

- Customized Solar Panel opening & closing mechanism parts are divided in to three parts.Total number of plates are nine, having circular groove connecting continuously to each other, while revolving get open and close vise versa, in hollow shaft having path for connecting wires from PN junction.(Note:- All dimensions is in millimeters)

1. Solar Panel Layers
2. Solar Panel Shape,Size & material
3. Re volute joints
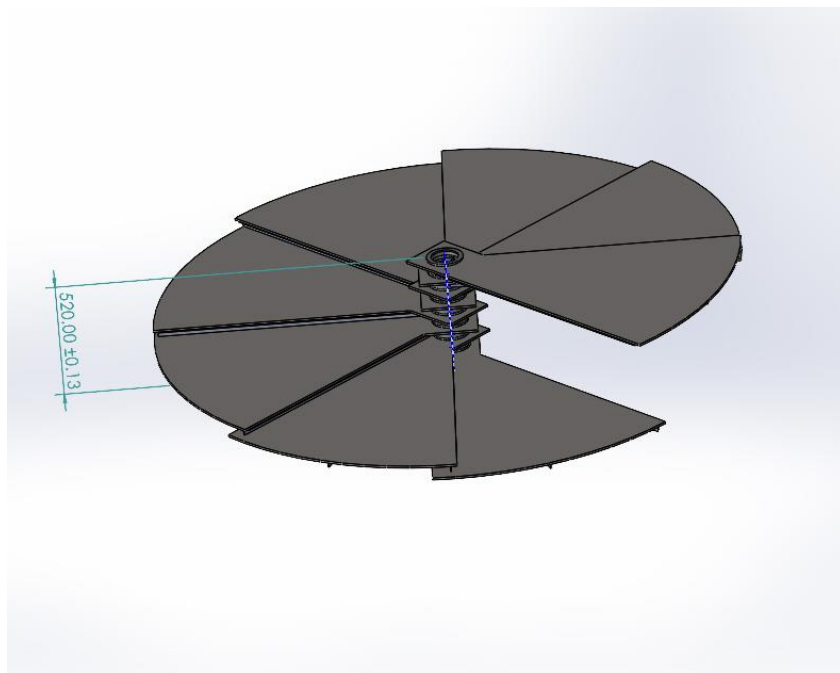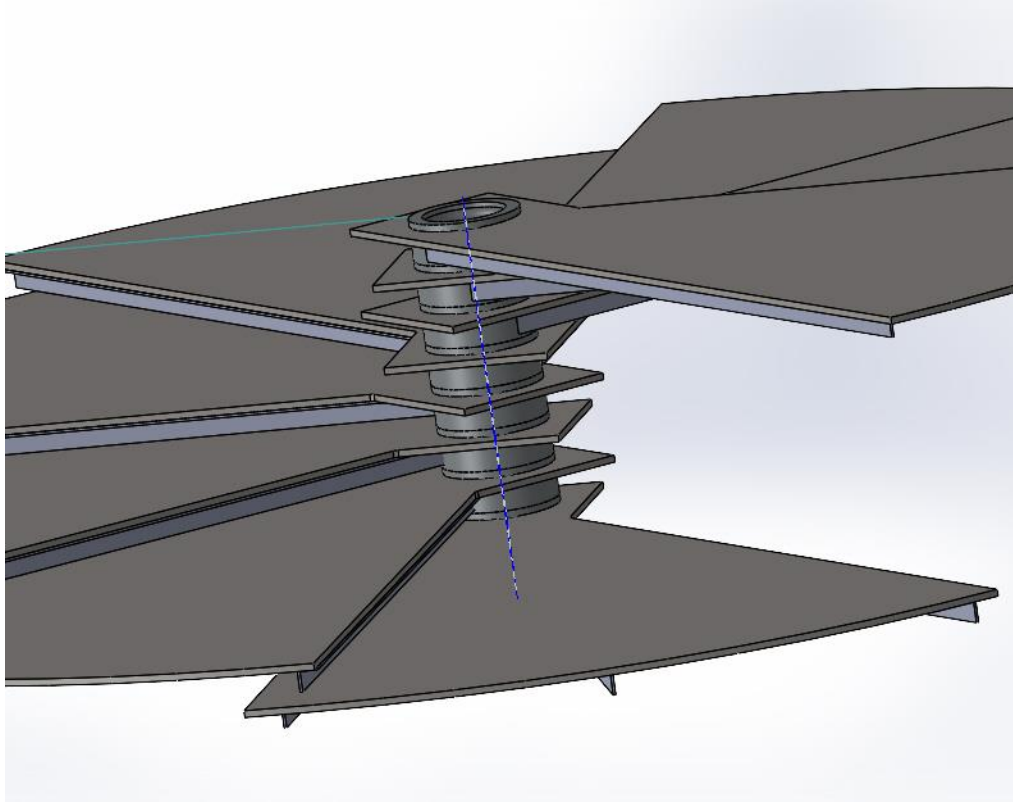4. Shaft
5. Balls
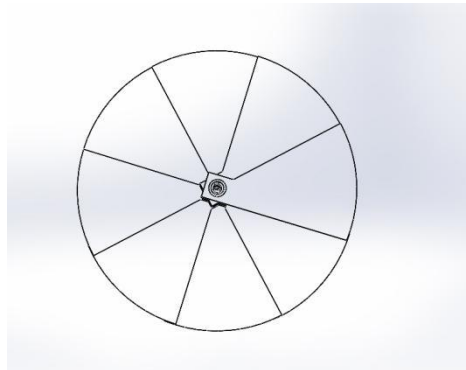
Figure:- Top View
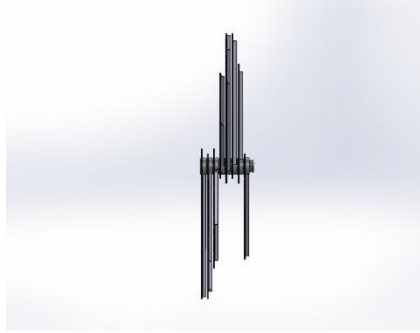
Figure:- Front View

Figure:- Isometric view

Mass Properties of Product		
Sl no.	*Properties*	*Values*
1	Mass (g)	176542.06 Grams
2	Volume (mm^3)	0.079207981.31 m^3
3	Surface area (mm^2)	18.034974 m^2
4	Elements	1,Solar Plate 2,Shaft 3, Re volute 4, Balls
5	No. Of Solar Plates required	3
6	Centre of mass (*mm*)	X = 33 Y = 934 Z = 930
7	Principal axes of inertia and principal moments of inertia taken at the centre of mass (g × mm^2)	Ix = (0.64, 0.75, 0.16) Px = 48776547852.74 Iy = (-0.76, 0.65, 0.00) Py = 50009347310.31 Iz = (-0.11, -0.12, 0.99) Pz = 94437327909.33
8	Moments of inertia taken at the centre of mass and aligned with the output coordinate system (g × mm^2)	Lxx = 50009347310.31 Lxy = 0.00Lxz = 4833055069.64 Lyx = 0.00 Lyy = 50009347310.31 Lyz = 5604673860.03 Lzx = 4833055069.64 Lzy = 5604673860.03 Lzz = 93204528451.76
9	Moments of inertia taken at the output coordinate system (g × mm^2)	Ixx = 356953905046.68 Ixy = 5499651889.76Ixz = 10307187212.46 Iyx = 5499651889.76Iyy = 202963991210.92 Iyz = 159075292768.69 Izx = 10307187212.46 Izy = 159075292768.69 Izz = 247586775639.63

1) Solar Panel Layers

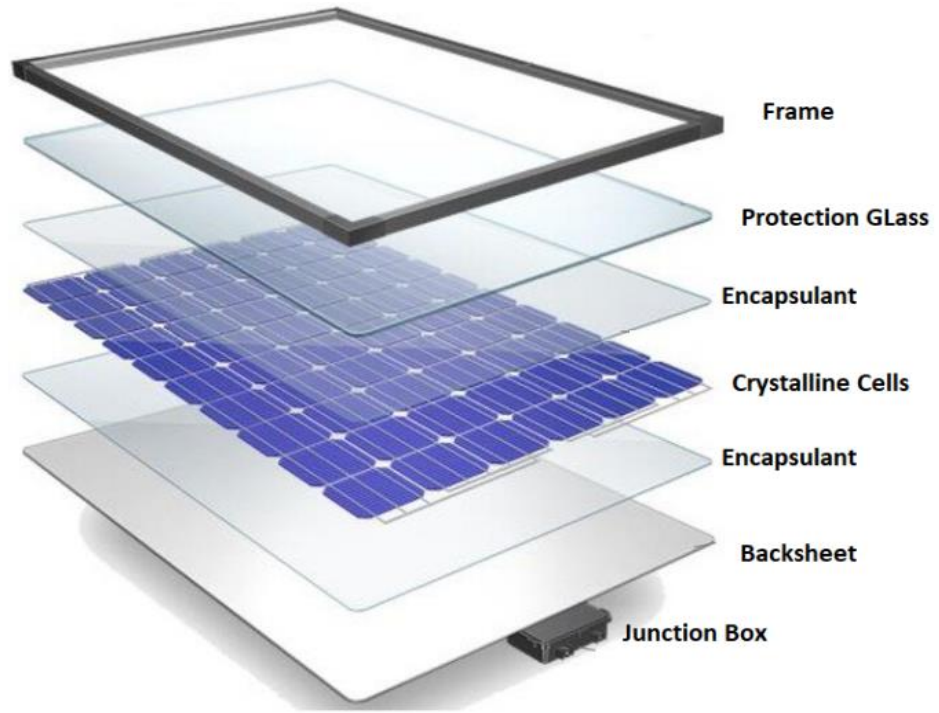Customize solar panel having combination of different layering materials.

Figure:- Layers of PV Module

S No.	Layer Name	Description
1	Frame	Aluminium
2	Protecting glass	Ethylene Vinyl Acetate
3	Crystalline Cells	Mono crystalline Solar Panel
4	Back sheet	Carbon Fiber
5	Junction Box	IP68, 3 Bypass Diodes

Slotted solar power description		
SI No.	Specification	Value
1	Diameter of circular panel	2.808 m
2	Thickness of circular panel	0.04 m
3	Surface Area of circular panel	1.68 m^2
4	Volume of circular panel	0.0818 m^3
5	Weight of Circular panel for above configuration	14.565 Kg
6	1 Solar Cell power	4.5 watts
7	Number of solar cells used in single plate in circular panel	30
8	Total number of plates use in System	2
9	Total Number of solar cells used in model	30×2=60
10	Total maximum power output (watts)	60×4.5= 270Watts
12	Estimate Efficiency of Circular panel for above configuration	19%

Hexcel AS4C(carbon Fiber)		
S. No.	Properties	Values
1	Density	1.78 g/cc
2	Tensile Modulus	231 G Pa
3	Tensile Strength at Break	4654 M Pa
4	Elongation at Break	1.8%

Aluminium 7075 T6 Properties		
S. No.	Properties	Values
1	Density	2810 g/mm^3
2	Young's modulus (E)	71700 N/mm^2
3	Tensile Strength (σ_t)	572 N/mm^2
4	Elongation (ϵ) at break	11%
5	Poisson's ratio	0.33
6	Hardness Rockwell	87 HRB

Single Solar plate

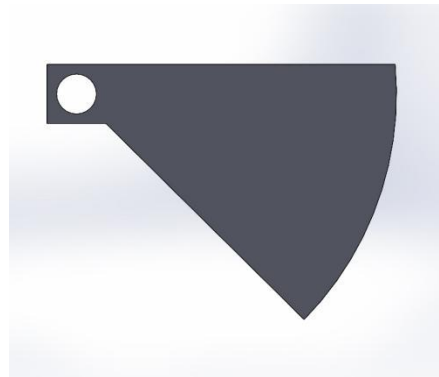|	Mass Properties of Single Plate	
S No.	Properties	Values
1	Mass (g)	14.565 Kg
2	Volume (mm^3)	8182781.41 cubic millimeters
3	Surface area (mm^2)	1682850.16 square millimeters
4	Thickness	40mm
	Material	Hexcel AS4C(carbon Fiber)
5	Outer Diameter	2808mm
6	Centre of mass (mm)	X = 734.63 Y = -242.52 Z = 5.00
7	Principal axes of inertia and principal moments of inertia taken at the centre of mass (g × mm^2)	Ix = (0.92, -0.40, 0.00) Px = 733876792.41 Iy = (0.40, 0.92, 0.00) Py = 1700444261.73 Iz = (0.00, 0.00, 1.00) Pz = 2434078298.29
8	Moments of inertia taken at the centre of mass and aligned with the output coordinate system (g × mm^2)	Lxx = 885069041.65 Lxy = -351110258.32 Lxz = 0.00 Lyx = -351110258.32 Lyy = 1549252012.49Lyz = 0.00 Lzx = 0.00Lzy = 0.00Lzz = 2434078298.29
9	Moments of inertia taken at the output coordinate system (g × mm^2)	Ixx = 1742106405.03Ixy = -2946115017.19 Ixz = 53500894.24 Iyx = -2946115017.19 Iyy = 9410314328.21Iyz = -17661926.71 Izx = 53500894.24 Izy = -17661926.71 Izz = 11151449709.85

Figure:- Front view of Plate
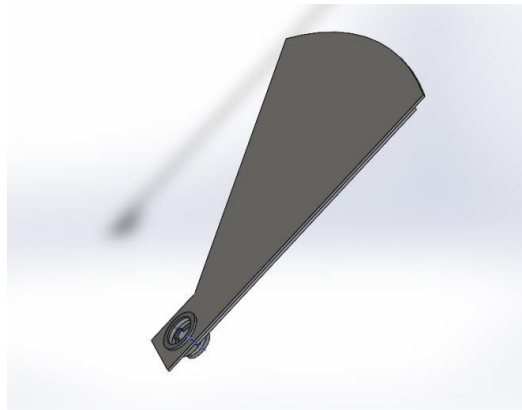
Figure:- Isometric view of Plate
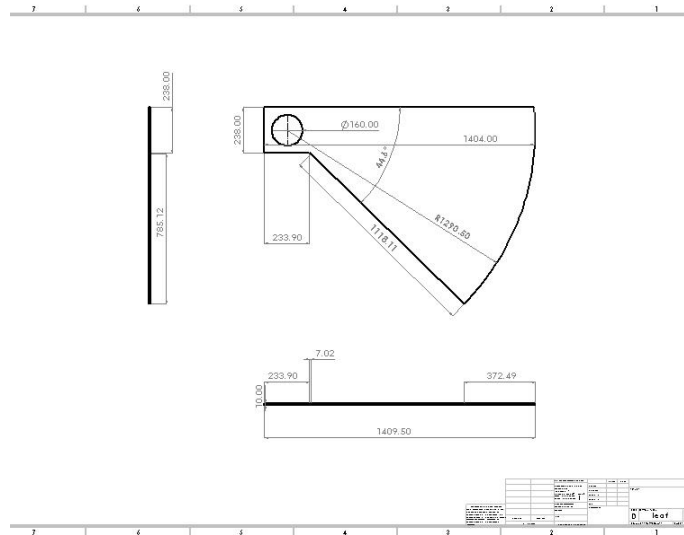

Figure:- Assembly with Re volute joint & Plate

Figure:- Dimensions of Plate

Re volute

| S. No.	Property	Specification
1	Material	Chrome Stainless Steel
2	Mass	6.634 Kg
3	Volume	850616 cubic millimeters
4	Surface area	107361 square millimeters
5	Center of mass	X= -5.76, Y=0.17, Z=0.42
6	Mass Density	7800 Kg/m^3
7	Elastic Modulus	2e+11 N/m^2
8	Yield Strength	172339000 N/m^2
9	Poisson's Ratio	0.28
10	Shear Modulus	7.7e+10 N/m^2
11	Length of Shaft	800mm
12	Outer Diameter	160mm
13	Inner Diameter	120mm
14	Principal axes of inertia and principal moments of inertia taken at the centre of mass ($g \times mm^2$)	Ix = (-0.01, 0.93, -0.36) Px = 17552766.74 Iy = (-0.03, 0.36, 0.93) Py = 17691078.83 Iz = (1.00, 0.02, 0.02) Pz = 26771924.00
15	Moments of inertia taken at the centre of mass and aligned with the output coordinate system ($g \times mm^2$)	Lxx = 26761663.47 Lxy = -224666.89 Lxz = -207055.53 Lyx = -224666.89 Lyy = 17575865.52 Lyz = -51187.53 Lzx = -207055.53 Lzy = -51187.53 Lzz = 17678240.58
16	Moments of inertia taken at the output coordinate system ($g \times mm^2$)	Ixx = 26763042.40 Ixy = -231332.43 Ixz = -223147.57 Iyx = -231332.43 Iyy = 17797054.53 Iyz = -50700.00 Izx = -223147.57 Izy = -50700.00 Izz = 17898454.53
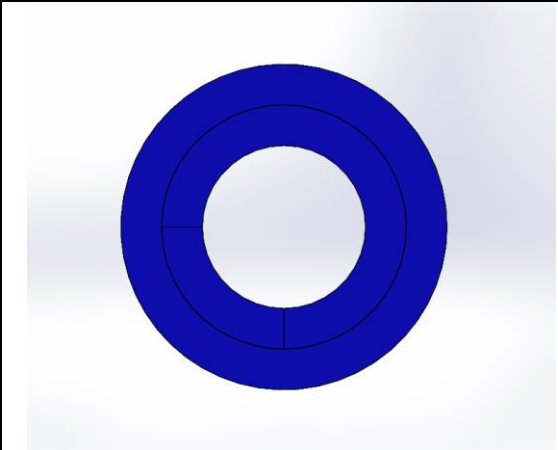
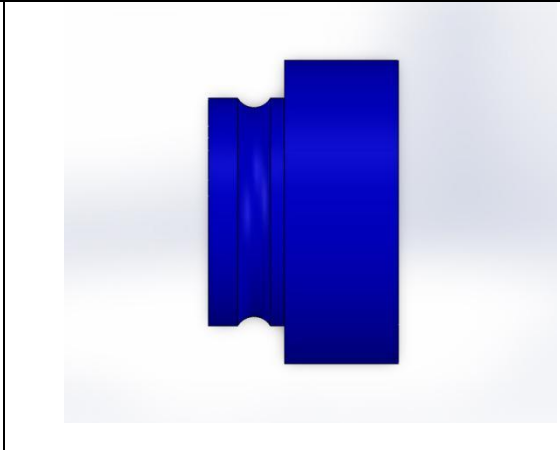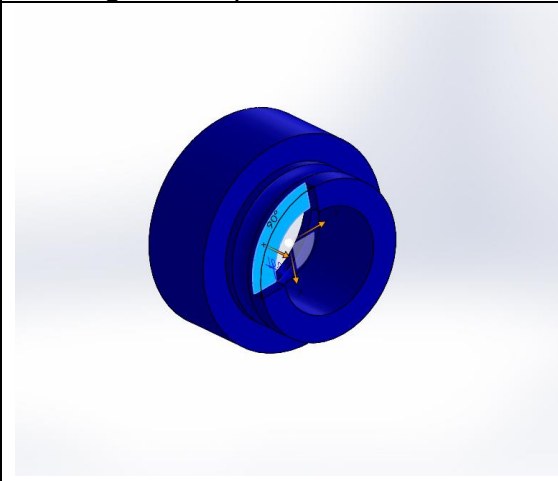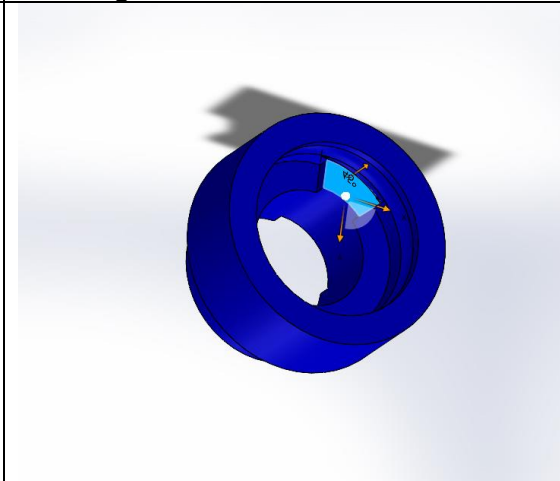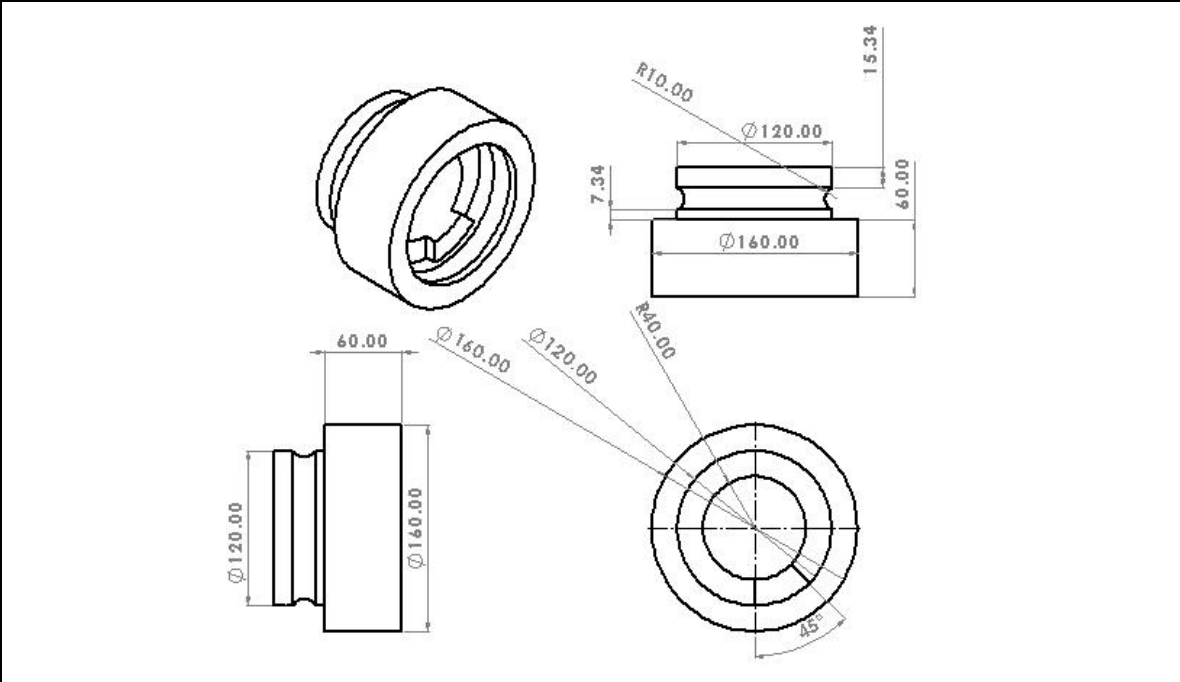|	
Figure:- Top view of Re-volute	Figure:- Front view of Re-volute
Figure:- Isometric view of Re-volute	Figure:- Isometric View back side of Re-volute

Figure:- Dimension of Re-volute

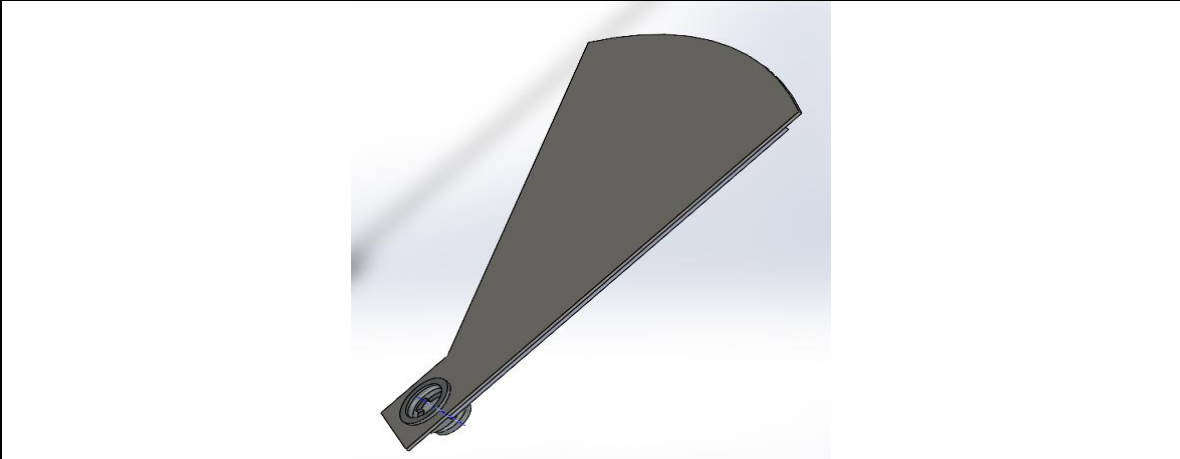Figure:- Assembly of Re-volute and Plate

Figure:- Isometric view
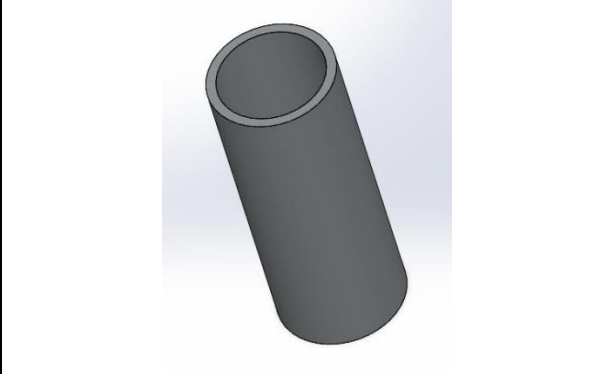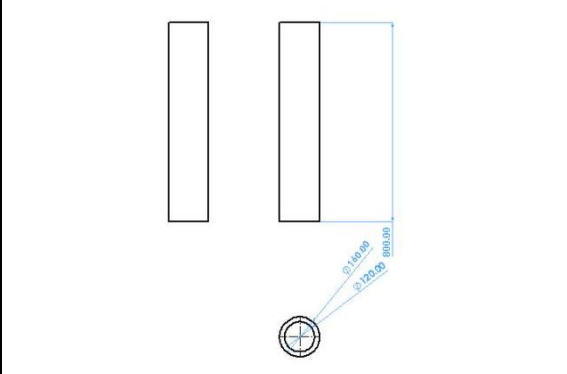

Figure:- Dimension of Shaft

Shaft Dimensions

T. No.	Property	Specification
1	Material	Chrome Stainless Steel
2	Mass	54.88 Kg
3	Volume	7037167 cubic millimeters
4	Surface area	721309 square millimeters
5	Center of mass	X= 0, Y=400, Z=00
6	Mass Density	7800 Kg/m^3
7	Elastic Modulus	2e+11 N/m^2
8	Yield Strength	172339000 N/m^2
9	Poisson's Ratio	0.28
10	Shear Modulus	7.7e+10 N/m^2
11	Length of Shaft	800mm
12	Outer Diameter	160mm
13	Inner Diameter	120mm
14	Principal axes of inertia and principal moments of inertia taken at the centre of mass ($g \times mm^2$)	Ix = (0.00, 1.00, 0.00) Px = 274449534.22 Iy = (0.00, 0.00, 1.00) Py = 3064686465.43 Iz = (1.00, 0.00, 0.00) Pz = 3064686465.43
15	Moments of inertia taken at the centre of mass and aligned with the output coordinate system ($g \times mm^2$)	Lxx = 3064686465.43 Lxy = 0.00 Lxz = 0.00 Lyx = 0.00 Lyy = 274449534.22 Lyz = 0.00 Lzx = 0.00 Lzy = 0.00 Lzz = 30646864
16	Moments of inertia taken at the output coordinate system ($g \times mm^2$)	Ixx = 11847071560.39 Ixy = 0.00 Ixz = 0.00 Iyx = 0.00 Iyy = 274449534.22 Iyz = 0.00 Izx = 0.00 Izy = 0.00 Izz = 11847071560

Balls Dimension

<table>
<tr><td colspan="3" align="center">**Mass properties of ball.1**</td></tr>
<tr><td>*S no.*</td><td>*Specification*</td><td>*Values*</td></tr>
<tr><td>1</td><td>Density</td><td>7800 kg/m^3</td></tr>
<tr><td>2</td><td>Material</td><td>Chrome Stainless Steel</td></tr>
<tr><td>3</td><td>Mass</td><td>16.73 g</td></tr>
<tr><td>4</td><td>Radius</td><td>16mm</td></tr>
<tr><td>5</td><td>Volume</td><td>$2144.66 \ mm^3$</td></tr>
<tr><td>6</td><td>Surface area</td><td>$804.25 \ mm^2$</td></tr>
<tr><td>7</td><td>Centre of mass: (mm)</td><td>X = 0.00
Y = 70.00
Z = 0.00</td></tr>
<tr><td>8</td><td>Principal axes of inertia and principal moments of inertia taken at the centre of mass $(g \ \times mm^2)$</td><td>Ix = (1.00, 0.00, 0.00) Px = 428.25
Iy = (0.00, 1.00, 0.00) Py = 428.25
Iz = (0.00, 0.00, 1.00) Pz = 428.25</td></tr>
<tr><td>9</td><td>Moments of inertia taken at the centre of mass and aligned with the output coordinate system $(g \ \times mm^2)$</td><td>Lxx = 428.25 Lxy = 0.00 Lxz = 0.00
Lyx = 0.00 Lyy = 428.25 Lyz = 0.00
Lzx = 0.00Lzy = 0.00Lzz = 428.25</td></tr>
<tr><td>10</td><td>Moments of inertia taken at the output coordinate system $(g \ \times mm^2)$</td><td>Ixx = 82397.17 Ixy = 0.00 Ixz = 0.00
Iyx = 0.00 Iyy = 428.25 Iyz = 0.00
Izx = 0.00 Izy = 0.00 Izz = 82397.17</td></tr>
</table>
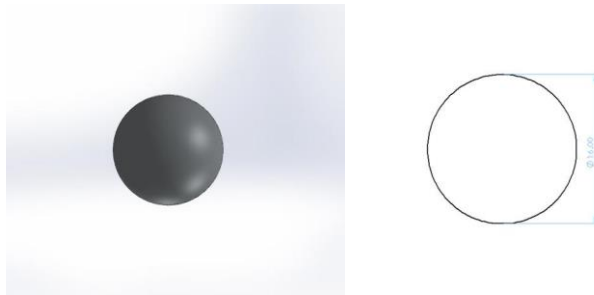
Figure:- Front view of ball

Controller Requirement Description

S No.	Properties	value
1	Unit power supply rated voltage	24 VCD (20.4 to 26.4 VCD)
2	Unit power supply current consumption	660mA or less
3	Operating environment	Ambient temp. -5 to 55°C
4	Ambient operating humidity	10 to 95 %
5	Ambient storage temperature	-25 to +70°C
6	Vibration resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz with amplitude of 3.5 mm, 8.4 to 150 Hz, acceleration

		of 9.8 m/s^2 100 min each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)
7	Shock resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz with amplitude of 3.5 mm, 8.4 to 150 Hz, acceleration of 9.8 m/s^2 100 min each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)
8	Applicable standards	EU: EN 61326, RCM, KC Registration, UL
9	How many axis tracking	2
10	In build features	• Universal Motion Controller up to 5 Axes • Delta Tau's Pmac2 Technology • Powerful Axes Controller CPU • Embedded Pc104 Computer • Compact Operator Panel and Soft PLC IEC 1131 • Front panel with a flat screen • F-keys and keyboard for easy programming
11	Hardware interface	• IN/OUT 32 Inputs 12 - 30V, Opto-Isolated sourcing • AMP 1 +/10V Axes – Command Signal, AMPENA • FLG 1 LIMIT +, LIMIT-,HOME, USER inputs • STP Pulse-Direction Interface for Axes 1 – 4 • ENC1..ENC4 4 x RS422 Encoder Input 5V, max 10MHz Frequency • ENC 5 / HW1 1 x RS422 Encoder Input 5V, max 10MHz Frequency (for 5th Axes or Hand-Wheel)