Profile No.: 11 **NIC Code: 29109**

MANUFACTURING OF SERVO MOTORS

1. INTRODUCTION:

Servo motors (or servos) are self-contained electric devices that rotate or push parts of a machine with great precision. Servos are found in many places: from toys to home electronics to cars and air-planes. If you have a radio-controlled model car, air-plane, or helicopter, you are using at least a few servos. In a model car or aircraft, servos move levers back and forth to control steering or adjust wing surfaces. By rotating a shaft connected to the engine throttle, a servo regulates the speed of a fuel-powered car or aircraft. Servos also appear behind the scenes in devices we use every day. Electronic devices such as DVD and Blue-ray DiscTM players use servos to extend or retract the disc trays. In 21st-century auto-mobiles, servos manage the car's speed: The gas pedal, similar to the volume control on a radio, sends an electrical signal that tells the car's computer how far down it is pressed. The car's computer calculates that information and other data from other sensors and sends a signal to the servo attached to the throttle to adjust the engine speed. Commercial aircraft use servos and a related hydraulic technology to push and pull just about everything in the plane.

The simplicity of a servo is among the features that make them so reliable. The heart of a servo is a small direct current (DC) motor, similar to what you might find in an inexpensive toy. These motors run on electricity from a battery and spin at high RPM (rotations per minute) but put out very low torque (a twisting force used to do work— you apply torque when you open a jar). An arrangement of gears takes the high speed of the motor and slows it down while at the same time increasing the torque. (Basic law of physics: work = force x distance.) A tiny electric motor does not have much torque, but it can spin really fast (small force, big distance). The gear design inside the servo case converts the output to a much slower rotation speed but with more torque (big force, little distance). The amount of actual work is the same, just more useful. Gears in an inexpensive servo motor are generally made of plastic to keep it lighter and less costly (see Figure 3 below). On a servo designed to

provide more torque for heavier work, the gears are made of metal (see Figure 4 below) and are harder to damage.

With a small DC motor, you apply power from a battery, and the motor spins. Unlike a simple DC motor, however, a servos spinning motor shaft is slowed way down with gears. A positional sensor on the final gear is connected to a small circuit board (see Figure 5 below). The sensor tells this circuit board how far the servo output shaft has rotated. The electronic input signal from the computer or the radio in a remote-controlled vehicle also feeds into that circuit board. The electronics on the circuit board decode the signals to determine how far the user wants the servo to rotate. It then compares the desired position to the actual position and decides which direction to rotate the shaft so it gets to the desired position.

2. PRODUCT & ITS APPLICATION:

Types of servo motors: Servos come in many sizes and in three basic types: positional rotation, continuous rotation, and linear.

Positional rotation servo: This is the most common type of servo motor. The output shaft rotates in about half of a circle, or 180 degrees. It has physical stops placed in the gear mechanism to prevent turning beyond these limits to protect the rotational sensor. These common servos are found in radio-controlled cars and water- and aircraft, toys, robots, and many other applications.

Continuous rotation servo: This is quite similar to the common positional rotation servo motor, except it can turn in either direction indefinitely. The control signal, rather than setting the static position of the servo, is interpreted as the direction and speed of rotation. The range of possible commands causes the servo to rotate clockwise or counterclockwise as desired, at varying speed, depending on the command signal. You might use a servo of this type on a radar dish if you mounted one on a robot. Or you could use one as a drive motor on a mobile robot.

Linear servo: This is also like the positional rotation servo motor described above, but with additional gears (usually a rack and pinion mechanism) to change the output from circular to back-and-forth. These servos are not easy to find, but you can sometimes find them at hobby stores where they are used as actuators in larger model air-planes.

3. DESIRED QUALIFICATIONS FOR PROMOTER:

Graduate in any discipline, preferably science.

4. MARKET POTENTIAL AND MARKETING ISSUES, IF ANY:

Servo motors and drives are used for automation in industrial processes has resulted in high throughput, less cost, low errors and less man-power requirement. Globally, development of efficient and advance automation technology, rise in adoption of energy-efficient international standards, growing ease of use and integration of motion control components in motors and drives, flourishing automotive industry, and advantages of servo motors and drives such as, high accuracy and speed, light weight machines, reduced size, increase in speed and higher torque are the prime growth drivers of global servo motors and drives market. In addition, increase in adoption of servo motors and drives for application in newer industrial vertical, and emerging economies such as China, India and others, will create new opportunities for global servo motors and drives market. However, volatile prices and availability of raw materials, availability of substitute motors, and complex manufacturing process are the key restraint for global servo motors and drives market. Geographically Asia Pacific dominated global servo motors and drives market, followed by North America. Asia Pacific is projected to have fastest growth, owing to rapidly increasing auto-mobile industry, rise in industrial sector, and growing investment in the manufacturing industry in developing nations such as China, and India in this region. Among all the applications, automotive & transport industry has the highest market share in global servo motors and drives market due to spur in automotive industry, innovation, and technical advancement in automotive industry. The medium voltage servo motors and drives is the market leader among all voltage groups of servo motors and drives, owing to its rising demand from industries such as metal, mining, power generation, and water & waste water treatment. Presently, 108 known companies producing servos worldwide

They are made classification as – Analog / Digital, Different operating voltages, plastic / metal body and gears, fast / slow, etc. in the Price range of $1 to $350.

5. RAW MATERIAL REQUIREMENTS:

The Basic raw materials required for this project are Metal Gears, Gear material: Stainless steel & Brass, mainly Smallest Gear we need Size is very small, Low module, m=0.25, Small whole size. The others are PCB, PCB Size: 38 x 17.5 x 1.6 mm Box material: Aluminum, 3D - Print for Primary aim to check dimensional compliances between different parts. as • Shrinkage • Brittle • Tolerances between different moving parts • Decided on metal covers and gears 3D-printed plastic prototype, PCB part procurement, PCB CAD design, Metal gear CAD design, Metal box CAD design, PCB – multi-layered – glass fiber and Chip level components to be procured

6. MANUFACTURING PROCESS:

The manufacturing require two major divisions Management, 1.Electronics, 2.Mechanical.The main steps are assembly, design, (Mechanical & Electronics) and Mechanical Component manufacture. The other step is testing, • Shrinkage • Brittle• Tolerances between different moving parts • Decided on metal covers and gears.

The process requires high skill, high precision and detailed designing. The each division will work under sharp inspection of highly qualified persons.

7. MANPOWER REQUIREMENT:

The enterprise requires 15 employees as detailed below**:**

Sr. No.	**Designation of Employees**	**Monthly Salary ₹**	**Number of employees required**				
			Year-1	**Year-2**	**Year-3**	**Year-4**	**Year-5**
1	Chemist @ 12000	36000.00	3	3	3	4	4
2	Skilled workers @ 8000	24000.00	3	3	3	5	5
1	Manager @ 15000	30000.00	2	2	2	3	3
2	Accounts/Sales Asst @12500	25000.00	2	2	2	2	2
3	Office Boy @ 9000	18000.00	1	1	1	1	1
	Total	133000.00	11	11	11	15	15

8. IMPLEMENTATION SCHEDULE:

The project can be implemented in 4 months' time as detailed below:

Sr. No.	Activity	Time Required *(in months)*
1	Acquisition of premises	1.00
2	Construction (if applicable)	1.00
3	Procurement & installation of Plant & Machinery	2.00
4	Arrangement of Finance	2.00
5	Recruitment of required manpower	1.00
	Total time required *(some activities shall run concurrently)*	4.00

9. COST OF PROJECT:

The project shall cost ₹ 120.50 lacs as detailed below:

Sr. No.	Particulars	₹ in Lacs
1	Land	10.00
2	Building	35.00
3	Plant & Machinery	25.00
4	Furniture, Electrical Installations	3.00
5	Other Assets including Preliminary / Pre-operative expenses	2.50
6	Working Capital	45.00
	Total	**120.50**

10. Means of Finance :

The proposed funding pattern is as under:

Sr. No.	Particulars	₹ in Lacs
1	Promoter's contribution	30.13
2	Bank Finance	90.38
	Total	**120.50**

11. WORKING CAPITAL CALCULATION:

The project requires working capital of ₹ 45.00 lacs as detailed below:

Sr. No.	Particulars	Gross Amt	Margin %	Margin Amt	Bank Finance
1	Inventories	22.50	0.25	5.63	16.88
2	Receivables	11.25	0.25	2.81	8.44
3	Overheads	11.25	100%	11.25	0.00
4	Creditors	-		0.00	0.00
	Total	45.00		19.69	25.31

12.LIST OF MACHINERY REQUIRED:

Sr. No.	Particulars	UOM	Qtty	Rate (₹)	Value (₹ in
	Plant & Machinery / equipments				
a)	***Main Machinery***				
i.	Gear manufacturing division	NOS.	1	700000	7.00
ii.	Electronics division	Nos	1	600000	6.00
iii.	Metal Division	Nos	1	300000	3.00
IV	Testing Division	Nos	1	500000	5.00
V	Installation, erection electr.			200,000	2.00
VI	taxes and transportation			200000	2.00
	sub-total Plant & Machinery				**25.00**
	Furniture / Electrical installations				
a)	Office furniture	LS	1	200000	2.00
b)	Stores Almirah	LS	1	0	1.00
c)	Computer & Printer	L. S.	1	200000	2.00
	sub total				**3.00**
	Other Assets				
a)	preliminary and preoperative				2.50
	sub-total Other Assets				2.50
	Total				**30.50**

13. PROFITABILITY CALCULATIONS:

Sr. No.	Particulars	UOM	Year-1	Year-2	Year-3	Year-4	Year-5
1	Capacity Utilization	%	60%	70%	80%	90%	100%
2	Sales	₹. In Lacs	135.00	157.50	180.00	202.50	225.00
3	Raw Materials & Other direct inputs	₹. In Lacs	102.42	119.49	136.56	153.63	170.70
4	Gross Margin	₹. In Lacs	32.58	38.01	43.44	48.87	54.30
5	Overheads except interest	₹. In Lacs	11.01	11.70	13.07	13.48	13.76
6	Interest@ 10 % on 2.20 lakhs	₹. In Lacs	9.04	9.04	6.03	4.52	3.62
7	Depreciation	₹. In Lacs	17.50	12.50	8.75	6.25	5.63
8	Net Profit before tax	₹. In Lacs	**-4.97**	**4.78**	**15.59**	**24.62**	**31.30**

14. BREAKEVEN ANALYSIS:

The project shall reach cash break-even at 32.00 % of projected capacity as detailed below:

Sr. No.	Particulars	UOM	Value
1	Sales at full capacity	₹. In Lacs	225.00
2	Variable costs	₹. In Lacs	170.70
3	Fixed costs incl. interest	₹. In Lacs	17.38
4	BEP = FC/(SR-VC) x 100 =	% of capacity	32.00%