

MANUFACTURING A.C MOTORS

1. INTRODUCTION:

Torque motors are designed to provide high starting torque and sloping characteristics (torque is highest at zero speed and decreases steadily with increasing speed), along with operating over a wide speed range. They also provide stable operation, especially in the low speed range or under a locked rotor condition. The torque produced by three phase Torque motor depends upon the following three factors. Firstly the magnitude of rotor current, secondly the flux which interact with the rotor of three phase. Torque motor and is responsible for producing emf in the rotor part of Torque motor, lastly the power factor of rotor of the three phase Torque motor. We propose to manufacture Single Phase and Three Phase Motors, Torque Motors, Flame Proof Motors.

We all know that without electricity, we cannot do any of our jobs. If we look into the world we live in, the major development in technology and civilization took place only after the introduction of electricity and electrical devices. Can we imagine a life without air conditioners/ceiling fans, lights, computers and communication devices and many more. So it is quite evident that electricity and electrical equipments play a vital role in every inch of our life. One such equipment which created a giant leap to the mankind in both domestic & industrial sectors is the "Motor". The usage of AC motors is much more prevalent than DC motors due to several practical reasons which we shall learn later on. A.C. Motors are playing a very vital role in everyday life, right from pumping water to overhead tank to modern robot's maneuvering arm. The main factor which lead to the adoption & wide usage in various fields is its flexibility and its huge variety which can be matched with almost any kind of demand. To know what are the different types of A.C.Motors available, to match it perfectly with the demand, it is highly essential to know about the different classifications of A.C.Motors.

2. PRODUCT & ITS APPLICATION:

Classification Based On Principle of Operation:

(a) Synchronous Motors: 1. Plain 2. Super

(b) Asynchronous Motors:

1. Induction Motors: (a) Squirrel Cage (b) Slip-Ring (external resistance).

2. Commutator Motors: (a) Series (b) Compensated (c) Shunt (d) Repulsion

(e) Repulsion-start induction (f) Repulsion induction

Classification Based on Type of Current:

1. Single Phase 2. Three Phase.

Classification Based On Speed of Operation:

1. Constant Speed. 2. Variable Speed. 3. Adjustable Speed.

Classification Based On Structural Features:

1. Open 2. Enclosed. 3. Semi-enclosed. 4. Ventilated. 5. Pipe-ventilated. 6. Riveted frame-eye.

1. Synchronous Motors & its Uses: These motors have the rotor (which is connected to the load) rotating at the same speed as the speed of rotation of the stator current. In other words, we can say these motors don't have slip with respect to the stator current. They are sometimes used not to drive the load but instead act as "synchronous condenser", to improve the power factor of the local grid to which it is connected to. These kinds of motors are used even in high precision positioning devices like modern robots. They can also act as stepper motors.

2. Asynchronous Motors & its Uses: The most common form of motor which is used in everyday life from pumping water up the overhead tank to power plant boiler feed pumps, these kind of motors rule. These motors are very flexible to use and matches the load demand almost for everything. The most widely used Induction Motors are very important for many industries due to their load bearing capacity and flexibility. These motors, unlike synchronous motors, slip when compared to the stator current field. They are generally used for various types of pumps, compressors and acts as prime movers for many types of machinery.

3. Single & Three Phase Motors and their Uses: The A.C.Motors can find their usage in 2 forms based on their power supply. The single phase motors are generally found their use in low power requirements/domestic appliances like ceiling fans, mixer grinders, portable power tools etc. The three phase motors are generally found for high power requirements like power drives for compressors, hydraulic pumps, air conditioning compressors, irrigation pumps and many more.

4. Constant, Variable & Adjustable Speed Motors: As already said, A.C.Motors is highly flexible in many ways including their speed control. There are motors which should be run at a constant speed for air compressors. Certain cooling water pumps driven by a.c.motors can be run at two or three speeds by just switching the number of poles used. If the number of poles is changed then the speed also changes. These serve best for sea water cooling pumps in marine engine room applications & many power plants. The speed of the motors can also be varied continuously by some electronic arrangements thus this can be suited for certain applications like a ship's cargo pump, whose discharge rate has to be lowered as per the terminal requirement.

5. Varied Structure Motors: These types of motors have different outer cage arrangements, depending upon the usage or any special industrial requirement. For motors used in gas and oil terminals, the casing must be of intrinsically safe, thus it may either have an enclosed casing or a pipe ventilated arrangement such that the sparks produced inside the motor does not cause a fire outside it. Also many motors are totally enclosed as it may be open to weather like those used in hydro-electric power plants.

3. DESIRED QUALIFICATIONS FOR PROMOTER:

Graduate in any discipline.

4. INDUSTRY LOOK OUT AND TRENDS

The global electric AC motors market size was USD 78.6 billion in 2016. They are used in HVAC equipment that are installed in residential as well as commercial buildings. The escalating demand for HVAC systems is subsequently projected to increase the demand for AC motors over the forecast period. Furthermore, AC motors are also used in a variety of equipment, such as household appliances, and industrial equipment such as fixed cranes and conveyor belts.

The market is expected to witness significant growth, which is attributed to the augmented modernization and automation of industrial processes. Well-established oil & gas industry and power generation sector push the increased demand for industrial automation, for which these products act as key components in cost-saving.

5. MARKET POTENTIAL AND MARKETING ISSUES, IF ANY:

The global electric motor sales market size was estimated at USD 107.5 billion in 2016 and is expected to grow significantly, owing to their increased usage across a broad range of commercial, industrial, and residential applications in elevators, fans, refrigerators, compressors, pumps, and various other systems. They have high endurance (toward fluctuating voltages), low maintenance, low energy consumption, and longer operating life and are gaining much importance. Electric motors are extensively used in material handling equipment, household appliances, and so on. An unmitigated rise in fuel prices and the need to reduce air pollution have generated an inimitable preference for these vehicles in various countries. This is further anticipated to upsurge the demand over the forecast period. Low Voltage Motors – Market Data reports that \approx 44 million low voltage motors shipped in 2010. Revenue earned for the year 2008 was \$13,541.2, that of for 2009 - \$10,912.8, 2010 - \$12,471.9 2011 - \$14,975.0, 2012 - \$17,444.9, 2013 - \$20,121.9, 2014 - \$22,969.7, 2015 - \$26,068.6. THUS THE PROJECT HAS VERY GOOD SCOPE.

6. RAW MATERIAL REQUIREMENTS:

The major raw material required and their suppliers are: Silicon steel - Essar Steel, Hazira (Gujarat) (one of the largest steel producer in India), Gujarat Iron and steel company, Ahmedabad (Gujarat), Panchmahal steel Ltd, Panchmahal (Gujarat). Copper: Hindustan Copper Ltd, Khetri (Rajasthan), Sterlite Industries Ltd, Thoothukudi (Tamil Nadu). Aluminum : Bharat Aluminum Company (Balco), Jasugora (Odisha). Hindustan Aluminum Company (Hindalco), Alupuram (Kerala).

7. MANUFACTURING PROCESS:

Rotor

Main article: Rotor (electric)

In an electric motor, the moving part is the rotor, which turns the shaft to deliver the mechanical power. The rotor usually has conductors laid into it that carry currents, which interact with the magnetic field of the stator to generate the forces that turn the shaft. However, some rotors carry permanent magnets, and the stator holds the conductors.

Bearings

The rotor is supported by bearings, which allow the rotor to turn on its axis. The bearings are in turn supported by the motor housing. The motor shaft extends through the bearings to the outside of the motor, where the load is applied. Because the forces of the load are exerted beyond the outermost bearing, the load is said to be overhung.[54]

Stator

Main article: Stator

The stator is the stationary part of the motor's electromagnetic circuit and usually consists of either windings or permanent magnets. The stator core is made up of many thin metal sheets, called laminations. Laminations are used to reduce energy losses that would result if a solid core were used.

Air gap

The distance between the rotor and stator is called the air gap. The air gap has important effects, and is generally as small as possible, as a large gap has a strong negative effect on the performance of an electric motor. It is the main source of the low power factor at which motors operate. The air gap increases the magnetizing current needed. For this reason, the air gap should be minimal. Very small gaps may pose mechanical problems in addition to noise and losses.

Windings are wires that are laid in coils, usually wrapped around a laminated soft iron magnetic core so as to form magnetic poles when energized with current.

Electric machines come in two basic magnet field pole configurations: salient-pole machine and non-salient-pole machine. In the salient-pole machine the pole's magnetic field is produced by a winding wound around the pole below the pole face. In the non-salient-pole, or distributed field, or round-rotor, machine, the winding is distributed in pole face slots.[55] A shaded-pole motor has a winding around part of the pole that delays the phase of the magnetic field for that pole.

Some motors have conductors that consist of thicker metal, such as bars or sheets of metal, usually copper, although sometimes aluminum is used. These are usually powered by electromagnetic induction.

8. MANPOWER REQUIREMENT:

The enterprise requires 41 employees as detailed below:

Sr. No.	Designation of Employees	Salary Per Person	Monthly Salary ₹	Year-1	Year-2	Year-3	Year-4	Year-5
1	Production Manager	18,000	18000	1	1	1	1	1
2	Operators	12,000	60000	5	5	5	5	5
3	Helpers	10,000	150000	15	15	15	15	15
4	Admin Manager	15,000	30000	2	2	2	2	2
5	Accounts/Stores Assistant	12,500	50000	4	4	4	4	4
6	Office Boy	9,000	80000	5	5	5	5	5
	Total		458000	41	41	41	41	41

9. 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 <i>(some activities shall run concurrently)</i>	4.00

10. COST OF PROJECT:

The project shall cost ₹ 186.20 Lacs as detailed below:

Sr. No.	Particulars	₹ in Lacs
1	Land 1500 sq.mtr@ 1000	15.00
2	Building	28.00
3	Plant & Machinery	82.00
4	Furniture, Electrical Installations	5.00
5	Other Assets including Preliminary / Pre-operative expenses	8.20
6	Working Capital	48.00
	Total	186.20

11. MEANS OF FINANCE:

Bank term loans are assumed @ 75 % of fixed assets.

Sr. No.	Particulars	₹ in Lacs
1	Promoter's contribution	46.55
2	Bank Finance	139.65
	Total	186.20

12. WORKING CAPITAL CALCULATION:

Sr. No.	Particulars	Gross Amt	Margin %	Margin Amt	Bank Finance
1	Inventories	24.00	0.25	6.00	18.00
2	Receivables	12.00	0.25	3.00	9.00
3	Overheads	12.00	100%	12.00	0.00
4	Creditors	-		0.00	0.00
	Total	48.00		21.00	27.00

13. LIST OF MACHINERY REQUIRED:

The main Plant and machineries required are : Centre Lathe , Radial drill Machine, Bench Drill Machine, Shaper Stroke, Cylindrical Grinder C.D. Hydraulic Press, Hand Press, Double ended Grinder, Hacksaw Machine, Balancing Machine, Coil Winding Machine ,Hand Shear ,Air Compressor with Accessories, Oxygen Acetylene Cylinder with accessories.

A detail of important machinery is given below: Power Requirement: 500 HP

Sr. No.	Particulars	UOM	Qty	Rate (₹)	Value
					(₹ in Lacs)
	Plant & Machinery / equipments				
a)	Main Machinery				
i.	Rotor plant	NO	1	22.00	22.00
ii.	Bearing plant	NO	1	18.00	18.00
iii.	Starter and other parts plant	NO	1	13.00	13.00
b)	Ancillary machinery	L.S.	1	11.00	11.00
i.	Testing laboratory	NO	1	7.00	7.00
ii.	Installation, Electrification , taxes and transportation.	L.S.	1	11.00	11.00
	<i>sub-total Plant & Machinery</i>				82.00
	Furniture / Electrical installations				
a)	Office furniture	LS	1	200000	2.00
b)	Stores Almira	LS	1	100000	1.00
c)	Computer & Printer		L. S.	200000	2.00
	<i>sub total</i>				5.00
	Other Assets				
a)	preliminary and preoperative				8.20
	<i>sub-total Other Assets</i>				8.20
	Total				95.20

All the machines and equipment are available from local manufacturers. The entrepreneur needs to ensure proper selection of product mix and proper type of machines and tooling to have modern and flexible designs. It may be worthwhile to look at reconditioned imported machines, dies and tooling. Some of the machinery and dies and tooling suppliers are listed here below:

1. Kitra Industries - Copper Rotor Manufacturer
 7/1522, Dr Ambedkar Road,
 Variavi Bazar, Surat
 Gujarat – India

2. ABB Moter Barings
 Maneja Village,
 Bank Of Baroda Road,
 JD Nagar, Maneja, Vadodara,
 Gujarat 390013

3. Hifine Machine
 5, New India Estate, Inside Relief Hotel,
 Sanand Char Rasta, Sarkhej, Ahmedabad-382210, Gujarat
 Phone: 079 26891274, 079 26890274

4. Springboard Enterprises India Ltd.
 1st, 2nd & 3rd Floor, Plot No. 7, 8 & 9, Garg Shopping Mall,
 Service Centre, Rohini Sector 2, New Delhi – 110085, Delhi, India

5. Uday Enterprises
 Khasra No. 1108, Village Makanpur, Behind Indian Child School
 Opposite Janta Flat No. 433, Nyay Khand 1,
 Indirapuram, Ghaziabad - 201010, Uttar Pradesh, India
 Phone: +91-9212320224.

14. 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	144.00	168.00	192.00	216.00	240.00
3	Raw Materials & Other direct inputs	₹. In Lacs	114.00	133.00	152.00	171.00	190.00
4	Gross Margin	₹. In Lacs	30.00	35.00	40.00	45.00	50.00
5	Overheads except interest	₹. In Lacs	12.48	13.26	14.82	15.29	15.60
6	Interest	₹. In Lacs	13.97	13.97	9.31	6.98	5.59
7	Depreciation	₹. In Lacs	57.40	41.00	28.70	20.50	18.45
8	Net Profit before tax	₹. In Lacs	-53.85	-33.23	-12.83	2.23	10.36

The basis of profitability calculation:

The growth of selling capacity will be increased 10% per year. (This is assumed by various analysis and study, it can be increased according to the selling strategy.)

Energy Costs are considered at Rs 7 per Kwh and fuel cost is considered at Rs. 65 per litre. The depreciation of plant is taken at 10-12 % and Interest costs are taken at 14 -15 % depending on type of industry.

15. BREAK-EVEN ANALYSIS:

The project shall reach cash break-even at 42.37 % of projected capacity as detailed below:

Sr. No.	Particulars	UOM	Value
1	Sales at full capacity	₹. In Lacs	240.00
2	Variable costs	₹. In Lacs	190.00
3	Fixed costs incl. interest	₹. In Lacs	21.19
4	BEP = $FC/(SR-VC) \times 100 =$	% of capacity	42.37%

16. STATUTORY / GOVERNMENT APPROVALS

As per the allocation of business rules under the Constitution, labour is in the concurrent list of subjects. It is dealt with by the MOLE at the Central and Departments of Labour under State Governments in respective States / UTs.

Further, other Ministries of the Government of India have also enacted certain statutes relating to safety aspects of substances, equipment, operations etc. Some of the statutes applicable in the manufacturing sector are discussed below:

The Manufacture, Storage and Import of Hazardous Electronic Rules (MSIHC), 1989

These MSIHC Rules are notified under the Environment (Protection) Act, 1986. These rules are aimed at regulating and handling of certain specified hazardous chemicals. The rules stipulate requirements regarding notification of site, identification of major hazards, taking necessary steps to control major accident, notification of major accident, preparation of safety report and on-site emergency plan; prevention and control of major accident, dissemination of information etc. These rules are notified by the Ministry of Environment and Forests (MOEF) but enforced by the Inspectorates of Factories of respective States / UTs in the manufacturing sector. Entrepreneur may contact State Pollution Control Board where ever it is applicable.

17. BACKWARD AND FORWARD INTEGRATIONS

Both forward and backward integration for any Electrical Industry are strategies to gain better control over the supply chain, reduce dependency on the suppliers and increase their competitiveness. The two strategies can help companies reduce their dependency on suppliers and increase their influence over the customers. The benefits of these strategies can be big. Both impact the bottom line directly. Integration happens if a company moves upward or downward in its supply chain. Starting from the suppliers from whom the raw

materials are obtained, the chain moves downstream towards the distributors and the retailers. If the suppliers' power is very high, it can create financial burdens for the company. Suppose the number of suppliers of a company is low, then the control in their hands would be low. The burden in that case will fall upon company's shoulders. Its expenditure on raw materials will be high.

18. TRAINING CENTERS AND COURSES

There is no such training required to start this business but, basic Electrical or IC bachelor's degree is plus point for enterpriser. Promoter may train their employees in such specialized institutions to grow up the business. There are few specialised Institutes provide degree certification in chemical Technology, few most famous and authenticate Institutions are as follows:

1. Department of Electrical LD College of engineering
No.120, Circular Road, University Area, Navrangpura,
Opposite Gujarat University, Ahmedabad, Gujarat 380015
2. MIT College of Engineering, Pune
Gate.No.140, Raj Baugh Educational Complex,
Pune Solapur Highway,
LoniKalbhor, Pune – 412201
Maharashtra, India

Udyamimitraportal (link : www.udyamimitra.in) can also be accessed for handholding services viz. application filling / project report preparation, EDP, financial Training, Skill Development, mentoring etc.

Entrepreneurship program helps to run business successfully is also available from Institutes like Entrepreneurship Development Institute of India (EDII) and its affiliates all over India.

Disclaimer:

Only few machine manufacturers are mentioned in the profile, although many machine manufacturers are available in the market. The addresses given for machinery manufacturers have been taken from reliable sources, to the best of knowledge and contacts. However, no responsibility is admitted, in case any inadvertent error or incorrectness is noticed therein. Further the same have been given by way of information only and do not carry any recommendation.