

# **WELDING ELECTRODES**

## **1. INTRODUCTION:**

Welding is a fabrication or process that joins materials, usually metals by causing fusion. In welding melting of base metal takes place and a filler material is typically added to the joint to form a pool of molten material – the weld pool – that when cools, forms a joint that is usually stronger than the base material.

Welding electrodes are used in Arc welding process where the electrical current flows between electrode and base metal and electrical arc generate enough heat to melt both electrode and base metal. In this process electrode with flux coating is used. The electrode holder holds the electrode as that slowly melts away. Slag is formed from melting of flux that protects the weld puddle from atmospheric contamination.

## **2. PRODUCT & ITS APPLICATION:**

If the melting point of an arc welding electrode is less, it melts and fills the gap in the work piece. Such an electrode is called consumable electrode. In arc welding, to produce deep weld, consumable electrode is connected to the positive terminal of the power supply i.e., it is made as anode, while work piece is connected to the negative terminal of the power supply i.e., it is made cathode.

Welding electrode is normally made of mild steel with desired metal composition and it is available in different gauges, to suit the base metal thickness and properties.

There are electrodes used for joining the steel, alloy steel etc. i.e. for fabrication. These are also used widely for repairs of machines and equipment. Many Cast iron parts and worn out steel parts may be rebuild by depositing metal through arc welding process. For special applications, these electrodes are used to provide hard ware resistance metal surface viz hard facing of jobs etc.

## **3. DESIRED QUALIFICATIONS FOR PROMOTER:**

An engineering graduate preferably with mechanical or metallurgy background.

#### **4. INDUSTRY OUTLOOK/TREND**

The welding industry in India comprises various large, medium and small companies that manufacture welding consumables. Large international players such as ESAB India Limited, Bohler Welding Group, Ador Welding Ltd, Lincoln Electric Company Pvt Ltd, etc. compete with various medium and small companies located all around industrial and urban centers in India to provide services to end-user industries.

Welding stick electrodes dominated the welding consumables market in India with more than 55% share. Stick electrodes are primarily used in manual welding and they are low cost easy to use and flexible in most general purpose fabrication work to other types of welding consumables products. The welding electrode plants in unorganized sector with proper standard specification and approval process is likely to grow in unorganized sector for both stick and flux cored wire production. The Indian welding industry was dominated by low technology and very rare technological innovation. However, in recent years, the demand of automatic and semi-automatic welding production systems is rising.

However, demand for continuous welding wires and fluxes for MIG/ TIG welding are anticipated to rise significantly due to rapid industrial investments due to their efficient performance. In terms of revenue, flux cored wires is anticipated to be the fastest growing product segment during the forecast period. Factors such as lower wastage, suitability for automatic welding systems and higher productivity and better quality has led to wide usage. The Submerged Arc welding wires and fluxes segment is projected to witness moderate growth.

The technology trend of new welding techniques and machines and hence welding wire and their delivery system is likely to dominate in manufacturing sector. Technology such as Orbital TIG welding, robotic welding, and laser welding are

some of the latest technologies that have been introduced to meet precision welding requirements. Robotics and automation are increasingly being deployed by industries to achieve welding quality and improve productivity. Modern processes like Hot wire TIG, Activated TIG, Narrow groove SAW, Tandem SAW and GMAW, Pulsed GMAW, ESSC with high speed fluxes, laser and hybrid laser, friction stir, thick and thin section joining, exotic and refractory metal joining, invisible welding, and ultra-thin wires joining have been introduced.

## **5. MARKET POTENTIAL AND MARKETING ISSUES. IF ANY:**

It can be seen that welding electrodes are consumable and have vast application in all manufacturing activities and they are also ideal for repairs where welding is probably the only method of salvaging the broken or worn out metal parts.

Demand for welding consumables is directly proportional to steel consumption in the country. End-use industries such as transportation, building & construction, oil & gas, and power are likely to drive the welding consumables market in India in the near future. Huge expansion of construction, shipbuilding and energy specifically wind power sectors in India will highlight the strong growth of Indian welding market. The demand for welding consumables in India is likely to experience strong growth owing to the advancements in technology and extensive growth of the end-use industries. The Indian welding consumables market is likely to rise from Rs. 30.88 bn in 2013 to Rs 45.37 bn by the end of 2020. Robust outlook of the infrastructure sector, welding consumables market is expected to grow at a CAGR 10-11% over next five years. Continuous electrodes would witness higher growth compared to Manual Electrodes.

The end user sector growth in Automobile and transportation has over 25% share of welding consumables. The construction/ infrastructure and power sector is expected to in terms of rate of growth, over the forecast period of 2014-2020. Other applications such as marine / ship building and general fabrication etc. are projected to rise at a moderate rate in the coming years.

In view of almost universal application and consumable nature, there is very good scope for a project of welding project. A good quality manufacturer will have very good scope of success.

## **6. RAW MATERIAL REQUIREMENTS:**

Main materials are mild steel viz low and medium carbon steels and alloy steel wire rods and flux materials like rutile sands and additive viz metal oxides and metal powder of nickel, manganese, iron, etc. and cellulose, lime stone, magnesium

## **7. MANUFACTURING PROCESS:**

Electrodes of different types are produced by drawing wires of different gauges from wire rods of 6 mm or 8 mm. The drawn Electrode quality wire of required size is first straightened in a straightening machine and cut to size and stored.

The flux as per the formulation is prepared in the dry blender and wet mixer. There are different types of coating fluxes applied for shielded arc electrodes, which have different results during the welding process. Viz cellulose coating generates a layer of gas to protect the weld zone; the coatings of mineral substances, which leave a layer of slag.

Then slug of flux material is made in the cylindrical form in the automatic slug press. Then slug is to be placed in the extrusion press and straight cut wires are fed where the extrusion press pushed the wire through slug and pressing that to provide uniform coating on wire. Flux coated core wire rod is passed on conveyor system and collected at the end. These flux coated rods are then sent to drying oven for drying purposes. After drying, it is the electrode batch undergoes sample are testing before packing and dispatch.

The process of continuous flux coated and flux core wire production systems that may be considered as product diversification. The process of production is similar

except that the flex coating/ filling requires in line flux curing ovens and core filled system requires metal strip forming in to a flux filled tube.

Welding electrodes should undergo regular sample/ batch testing for Mechanical, Metallurgical and chemical testing, and provision must be made for testing laboratory. For quality control tests to be conducted are Tensile Test, Hardness Test, Impact Test, Chemical Test, Bending Test, Microscope Test, Moisture content etc.

## **8. MANPOWER REQUIREMENT:**

The unit shall require highly skilled service persons. The unit can start from 8 employees initially and increase to 23 or more depending on business volume.

Sr. No	Type of Employees	Monthly Salary	No of Employees				
			Year 1	Year 2	Year 3	Year 4	Year 5
1	Skilled Operators	15000	4	9	15	15	15
2	Semi-Skilled/ Helpers	7000	9	12	24	24	24
3	Supervisor/ Manager	25000	1	1	2	2	2
4	Accounts/ Marketing	16000	1	2	2	2	2
5	Other Staff	7000	2	4	6	9	9
	TOTAL		17	28	49	52	52

## **9. IMPLEMENTATION SCHEDULE:**

The unit can be implemented within 6 months from the serious initiation of project work.

Sr. No	Activities	Time Required in Months
1	Acquisition of Premises	2
2	Construction (if Applicable)	2
3	Procurement and Installation of Plant and Machinery	2
4	Arrangement of Finance	2
5	Manpower Recruitment and start up	2

Total Time Required (Some Activities run concurrently)	6
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## 10. COST OF PROJECT:

The unit will require total project cost of Rs 161.02 lakhs as shown below:

Sr. No	Particulars	In Lakhs
1	Land	20.00
2	Building	30.00
3	Plant and Machinery	52.20
4	Fixtures and Electrical Installation	3.60
5	Other Assets/ Preliminary and Preoperative Expenses	5.00
6	Margin for working Capital	50.22
	<b>TOTAL PROJECT COST</b>	<b>161.02</b>

## 11. MEANS OF FINANCE:

The project will require promoter to invest about Rs 77.92 lakhs and seek bank loans of Rs 83.10 lakhs based on 70% loan on fixed assets.

Sr. No	Particulars	In Lakhs
1	Promoters Contribution	77.92
2	Loan Finance	83.10
	<b>TOTAL:</b>	<b>161.02</b>

## 12. WORKING CAPITAL REQUIREMENTS:

Working capital requirements are calculated as below:

Sr. No	Particulars	Gross Amount	Margin %	Margin Amount	Bank Finance
1	Inventories	34.52	40	13.81	20.71

2	Receivables	37.92	50	18.96	18.96
3	Overheads	3.65	100	3.65	0.00
4	Creditors	34.52	40	13.81	20.71
	TOTAL	110.60		50.22	60.38

### 13. LIST OF MACHINERY REQUIRED:

Sr. No	Particulars	UOM	Quantity	Rate	Total Value
	<b>Main Machines/ Equipment</b>				
1	Multi stage Bull Block Wire drawing machine	Nos	2	300000	600000
2	Automatic Wire straightening and cutting machine	Nos	1	450000	450000
3	Flux mixing and blending	Nos	2	120000	240000
4	Flux Slug press Automatic	Nos	1	300000	300000
5	Flux Coating Extruder 350 T with conveyor	Nos	1	850000	850000
6	Grip End Sander machine	Nos	1	60000	60000
7	Baking Ovens 950 o C	Nos	2	450000	900000
8	Air handling and dust collection system for plant	Nos	1	150000	150000
9	Transport trolleys for Oven	Nos	8	30000	240000
10	Packing Station	Nos	1	300000	300000
11	Testing Lab	Nos	1	300000	300000
12	Metallurgical Microscope	Nos	3	150000	450000
13	Gen Workshop Machines for Maintenance	Nos	1	150000	150000
14	Packing machine	Nos	2	35000	70000
	Subtotal:				5060000
	<b>Tools and Ancillaries</b>				
1	Misc. equipment trolleys etc.	LS	1	120000	120000
2	Tools and gauges	LS	1	40000	40000
	Subtotal:				160000
	<b>Fixtures and Elect Installation</b>				
	Storage and transport bins and trolleys	LS	1	60000	60000
	Office Furniture	LS	1	20000	20000
	Telephones/ Computer	LS	1	30000	30000

	Electrical Installation	LS	1	250000	250000
	Subtotal:				360000
	Other Assets/ Preliminary and Preoperative Expenses	LS	1	500000	500000
	<b>TOTAL PLANT MACHINERY COST</b>				<b>6080000</b>

All the machines and equipment are available from local manufacturers. The entrepreneur needs to ensure proper selection of product mix and proper type of dies 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. Mayfair Machine Kraft Private Limited  
No. 5 A-9 Acre, Kothari Compound, SV Road, Thane-400610, Maharashtra, India
2. Deccan Dynamics  
No. 21, Deccan Estate, MAK India Mill Road Goldwins, Civil Aerodrome Post, Coimbatore - 641014, Tamil Nadu, India
3. General Electric  
Gala No. 4, Pooja Industrial Estate, Azad Nagar, Bhayendar East, Mumbai-401105
4. Omega Weld Rod System  
No. 1/455-G, Aachankulam Road Neelambur  
Coimbatore- 641062, Tamil Nadu, India
5. Shree Krishna Pharma Machinery  
No. 2, Vinayak Estate, Near Pharmatech, Changodhar, Changodar, Ahmedabad-382213, Gujarat, India

#### **14. PROFITABILITY CALCULATIONS:**



Sr. No	Particulars	UOM	Year Wise estimates				
			Year 1	Year 2	Year 3	Year 4	Year 5
1	Capacity Utilization	%	40	50	60	70	80
2	Sales	Rs Lakhs	454.98	568.73	682.48	796.22	909.97
3	Raw Materials & Other Direct Inputs	Rs Lakhs	414.19	517.73	621.28	724.83	828.37
4	Gross Margin	Rs Lakhs	40.80	51.00	61.20	71.40	81.60
5	Overheads Except Interest	Rs Lakhs	17.59	17.59	17.59	17.59	17.59
6	Interest	Rs Lakhs	11.63	11.63	11.63	11.63	11.63
7	Depreciation	Rs Lakhs	9.08	9.08	9.08	9.08	9.08
8	Net Profit Before Tax	Rs Lakhs	2.50	12.70	22.90	33.10	43.29

The basis of profitability calculation:

The Unit will have capacity of 1200 MT per year of welding electrodes sizes/ material grades. The sales prices of welding electrodes range from Rs 60 per Kg for MS electrodes to Rs 300 per kg depending on type, wire gauges, flux composition, metal grade and volumes. Continuous wire products with flux cored or coated wired for TIG/ MIG etc. process prices range from 600 per kg to Rs 1200 per kg for special alloys and flux compositions for critical applications.

The raw material cost ranges from 35 to 65 per kg for mild steel wire rods and that of carbon steel and stainless steel wire rods range from Rs 60 to 260 per Kg. The material requirements are considered with wastage/ scrap etc. of 10 % of finished products. The unusable scrap is sold at @ Rs 18 ~ 50 per Kg. and the income of same is added. Energy Costs are considered at Rs 7 per Kwh and fuel cost is considered at Rs. 65 per liter. The depreciation of plant is taken at 10 % and Interest costs are taken at 14 -15 % depending on type of industry.

## 15. BREAK EVEN ANALYSIS

The project is can reach break-even capacity at 37.55 % of the installed capacity as depicted here below:

<b>Sr. No</b>	<b>Particulars</b>	<b>UOM</b>	<b>Value</b>
1	Sales at Full Capacity	Rs Lakhs	1137.46
2	Variable Costs	Rs Lakhs	1035.47
3	Fixed Cost incl. Interest	Rs Lakhs	38.30
4	Break Even Capacity	% of Inst Capacity	37.55

## **16. STATUTORY/ GOVERNMENT APPROVALS**

The unit shall have to get state industrial unit registration from DIC, IEC Code for Export and local authority clearance. Depending on structure of finance the company shall need to register company with registrar of companies. The registration and approval for factory plan, safety for Fire etc. requirement, registration as per Labour laws ESI, PF etc. shall be required as per rules and applicability. Before starting the unit will also need GST registration for procurement of materials as also for sale of goods. As such there is no pollution control registration requirements, except installation of chimney/ blowers for heat treatment furnace / pickling line and ensure safe environment as per rules of factory safety. Solid waste disposal shall have to meet the required norms. Entrepreneur may contact State Pollution Control Board where ever it is applicable.

## **17. BACKWARD AND FORWARD INTEGRATION**

The machines and equipment offer scope for diversification in to producing the continuous flux cored and coated electrode range of products and also take up import substitution for welding electrodes by ensuring metal and flux compositions. The unit can also of other consumer and industrial wire products / components etc. by using the spare capacities and machine capabilities. As such there is not much scope for organic backward or forward integration.

## **18. TRAINING CENTERS/COURSES**

There are no specific training centers for wire drawing technology. There are training for dies and tools development run by several centers of excellence viz Indo German Tool Room at Ahmedabad, Rajkot, Chennai, and CTTC Bhubaneswar etc. shall be helpful.

The most important scope of learning is in new product design and development by associating with institutes like NID etc. Entrepreneur may also study the new product designs, product range, features and specifications of leading Brands / competitors across the world by scanning the Internet and downloading data. Viz. North American, Europe, China etc. markets.

Udyamimitra portal ( link : [www.udyamimitra.in](http://www.udyamimitra.in) ) can also be accessed for hand-holding 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.

Source:- Udyami Mitra/Sidbi