Aluminium Conductors
AAC, AAAC, ACSR

PRODUCT CODE (ASICC)	77429 and 77420
QUALITY AND STANDARDS	IS 398 (Part 1):1996
	IS 398 (Part 2):1996
	IS 398 (Part 4):1994
PRODUCTION CAPACITY	
QUANTITY	468 MT (per annum)
VALUE	Rs. 5,07,500
YEAR OF PREPARATION	2002 - 2003
PREPARED BY	Small Industries Service Institute Vikash Sadan College Square, Cuttack-753003 and Office of the Development Commissioner Small Scale Industries,Electrical and Electronics Division, 7th Floor, Nirman Bhavan, New Delhi - 110011

INTRODUCTION

Aluminium Conductors (i) All Aluminium Conducts (AAC) (ii) All Alloy Aluminium Conductors (AAAC), and (iii) Aluminium Conductors Steel Reinforced (ACSR) are used in Transmission and Distribution system to carry the generated electrical energy from generating station to end user.

The Electrical energy is normally generated at the power stations far away from the urban areas where the consumers are located. There is a large network of conductors between the generating stations and the consumer.

The network is called the Transmission and Distribution system. The Transmission system is to deliver bulk power from power stations to the load centres and large industrial consumers beyond the economical service range of the regular primary distribution lines where as distribution system is to deliver power from power sector or

substations to the various consumers. This transmission and distribution system can employ either overhead system or underground system. Transmission of power, overhead system mainly due to low cost and some other advantages ACSR generally used or transmission line and AAC and AAAC conductors for distribution of power carry out mostly the high voltage transmission. For transmission and distribution of electric power the conductor material used must have the following characteristics:

i) High conducting i.e. low specific resistance

ii) High tensile strength in order to withstand mechanical stress

iii) Low specific gravity in order to give low weight per unit volume

iv) Low cost in order to be used over long distance

v) Should not be brittle

Copper, Aluminium, Steel and Steel cored aluminium, galvanised steel conductors are generally employed for this purpose and preferably stranded in order to increase the flexibility (Solid wires, except of smaller sizes, are difficult to handle and when employed for long spans tend to crystallize at the points of support because of the swinging in winds. Stranded conductors usually have a central wire around which there are successive layers of 6, 12, 18, 24 wires. For 19 layers, the total number of individual wire is 3n (n+1). If the diameter of each strand is torn diameter of the stranded conductors will be (2n+1) d. In the process of manufacture adjacent layers are spiraled in opposite direction, so that the layers are bound together. This method of construction is called as Concentric Lay, out of above mentioned conducting materials, Aluminium is widely used due to its cheapness and many others comparative advantages over other conducting materials. However, owing to the fact that the line or co-efficient of expansion of aluminium is 104 times that of copper, the sag is greater in aluminium wire, therefore, steel cored Aluminium (ACSR) wire is used to compensate this property of Aluminium. The steel conductors used are galvanised in order to prevent rusting and electrolytic corrosion.

The AAC/AAAC/ACSR conductors for high voltage transmission have first replaced the bore copper conductors where copper is scarce and costly on the other hand EC grade Aluminium is easily available in India and as far as the electric properties are concerned, aluminium is equally good being lighter in weight and for same sage span length of the transmission could be increased in comparison to copper.

Keeping in view the simple technology involved AAC/ACSR/AAAC conductors up to 19 strand have been reserved for exclusive production in small scale sector. However,

Aluminium conductors up to 61 strand can be manufactured. Different types of aluminium conductors manufactured are:

i) All Aluminium stranded conductors (AAC)

ii) Aluminium conductors, aluminized steel reinforced

iii) Aluminium conductors galvanised steel reinforced (ACSR)

iv) All Aluminum Alloy stranded Conductors (AAAC)

v) Aluminium conductors galvanised steel reinforced for extra high voltage (400 kV or above) (ACSR)

Market Potential

India is a developing country with a fast growing population. The economic growth of the country and the demand for any essential items grows as a function of population. Electrical power

demand also grows as a function of population. In today's modern world the dependence on electricity is so much that it has become a part of our life. The ever increasing use of electric power for domestic commercial and industrial purposes necessitates to provide bulk electric power economically. Our present generation capacity is about 1,05,000 MW but projected demand by 2012 is 205000 MW that means an extra 1,00,000 MW has to be produced to meet the demand. The electrical energy is normally generated at the power stations far away from the urban areas where consumers are located. In order to evacuate this generated power at the door steps at end user, there is a large net work of Transmission and Distribution system including the Aluminium Conductors. ACSR conductors are generally used for transmission line and AAC and AAAC conductor for Distribution purpose. Due to massive rural electrification programme and the commitment of the Central and State Government to electrify each and every house in a remote village and also the reforms and efforts and to ensure electricity to all section of the society on demand, brighten the demand and scope of the conductors.

Basis and Presumptions

i) The basis for calculation of production capacity has been taken on single shift basis on 75% efficiency.

ii) The maximum capacity utilization on single shift basis for 300 days a year. During first year and second year of operations the capacity utilization is 60% and

80% respectively. The unit is expected to achieve full capacity utilization from the third year onwards.

iii) The salaries and wages, cost of raw materials, utilities, rents, etc. are based on the prevailing rates in and around Cuttack. These cost factors are likely to vary with time and location.

iv) Interest on term loan and working capital loan has been taken at the rate of 16% on an average. This rate may vary depending upon the policy of the financial institutions/agencies from time to time.

v) The cost of machinery and equipments refer to a particular make / model and prices are approximate.

vi) The break-even point percentage indicated is of full capacity utilization.

vii) The project preparation cost etc. whenever required could be considered under pre-operative expenses.

viii) The essential production machinery and test equipment required for the project have been indicated. The unit may also utilize common test facilities available at Electronics Test and Development Centres (ETDCs) and Electronic Regional Test Laboratories (ERTLs) and Regional Testing Centres (RTCs).

Implementation Schedule

The major activities in the implementation of the project has been listed and the average time for implementation of the project is estimated at 12 months:

Sl. No.	***Activity***	***Period (in Months)***
1.	Preparation of project report	1
2.	Registration and other formalities	1
3.	Sanction of loan by financial institutions	3
4.	Plant and Machinery:	
	a) Placement of orders	1

	b) Procurement	2
	c) Power connection/ Electrification	2
	d) Installation/Erection of machinery/Test Equipment	2
5.	Procurement of raw materials	2
6.	Recruitment of Technical Personnel etc.	2
7.	Trial production	11
8.	Commercial production	12

Notes

1. Many of the above activities shall be initiated concurrently.

2. Procurement of raw materials commences from the 8th month onwards.

3. When imported plant and machinery are required, the implementation period of project may vary from 12 months to 15 months.

Technical Aspects

Process of Manufacture

The process of manufacturing of Aluminium Alloy Conductors (AAC), Aluminium Conductor Steel Reinforced (ACSR) and All Aluminium Alloy

Quality Control and Standards

Purity of aluminium for the items to be used in electrical and electronic industries shall be 99.9%. The quality of the Aluminium conductors produced can be controlled by sticky following the related IS specifications right from beginning of raw material:

1. Ensuring the correct quality of raw material as per IS 5484:1978 EC grade aluminium rods produced by continuous casting and rolling. The aluminium content shall not be less than 99.5% and copper conductors shall not be more than 0.04 per cent.

2. While manufacturing AAC, AAAC and ACSR Conductors strictly adhering to IS Specification.

a) IS 398 (Part 1): 1996 for AAC

b) IS 398 (Part 2): 1996 for ACSR (Galvanised Steel Reinforce)

c) IS 398 (Part 3) For Aluminium Conductors, Aluminized Steel, Reinforced)

d) IS 398 (Part 4): 1994 AAAC (Aluminium, Magnesium silica

e) IS 398 (Part 5) AC Galvanized high voltage (400 kV and above)

f) IS 7623: 1993 Lithium base grease for industrial purpose

g) IS 1778: 1980 Use of Reels and drums for wounding conductors.

The test to be carried out as per above mentioned IS Specification are enumerated in process flow chart of aluminium conductor manufacturing. Obtaining ISO certification can further boost the credibility of the unit.

Production Capacity (per annum)

Quantity : 468 MT

Value : Rs. 495,07,500.

Motive Power 150 KVA.

Pollution Control

The Government accords utmost importance to control environmental pollution. The small-scale entrepreneurs should have an environmental friendly attitude and adopt pollution control measures by process modification and technology substitution.

India having acceded to the Montreal Protocol in September 1992, the production and use of Ozone Depleting Substances (ODS) like Chlorofluore Carbon (CFCs), Carbon Tetrachloride, Halons and methyl Chloroform etc, need to be phased out immediately with alternative chemicals/solvents. A notification for detailed Rules to regulate ODS phase out under the Environment Protection Act, 1986 have been put in place with effect from 19th July 2000.

Energy Conservation

With the growing energy needs and shortage coupled with rising energy cost, a greater thrust in energy efficiency in industrial sector has been given by the Government of India since 1980s. The Energy Conservation Act, 2001 has been enacted on 18th August 2001, which provides for efficient use of energy, its conservation and capacity building of Bureau of Energy Efficiency created under the Act.

The following steps may help for conservation of electrical energy:

i) Adoption of energy conserving technologies, production aids and testing facilities.

ii) Efficient management of process/manufacturing machineries and systems, QC and testing equipments for yielding maximum Energy Conservation.

iii) Optimum use of electrical energy for heating during soldering process can be obtained by using efficient temperature controlled soldering and de-soldering stations.

iv) Periodical maintenance of motors, compressors etc.

v) Use of power factor correction capacitors. Proper selection and layout of lighting system; timely switching on-off of the lights; use of compact fluorescent lamps wherever possible etc.

Financial Aspects

A. Fixed Capital

(i) Land and Building	**(Rs.)**
Land 2000 sq. mtrs. @ Rs. 150	3,00,000
Built up area:	
a) Working shed 30×20 = 600 Sq. mtrs. @ Rs. 1,000 per sq. mtrs.	6,00,000
b) Office, Store etc. 15×10 Mtrs	1,80,000

= 150 sq. mtrs @ Rs. 1,200/sq. mtr

Total **10,80,000**

Note: Alternatively on rental basis.

(ii) Machinery and Equipments

Sl. No.	**Description**	**Ind./ Imp.**	**Qty. (No.)**	**Price (Rs.)**
1.	Wire drawing machine 3 dies with spooling	Ind.	1 set	3,60,000
2.	Wire drawing machine 11 Dies	Ind.	1 Set	11,00,000
3.	High speed Tubular Stranding Machine	Ind.	1 Set	12,00,000
4.	Pinntle type multilayer stranding machine (61 strands)	Ind.	1 Set	24,00,000
5.	Pit type solution treatment furnace	Ind.	1 Set	2,25,000

6.	Pointing machine	Ind	1 Set	18,000
7.	Buff Welding machine	Ind.	1 Set	15,000
8.	Electric Crane IMT Cap.	Ind.	1 Set	16,000
9.	Ageing Furnace IMT/Chore	Ind.	1 Set	65,000
10.	Solution Tank	Ind.	1 Set	10,000
11.	Die Polisher	Ind.	1 Set	10,000
			Total	**54,19,000**

Testing Equipments

Sl. No.	**Description**	**Ind./ Imp.**	**Qty. (No.)**	**Price (Rs.)**
1.	Tensile Testing Machine	Ind.	1 Set	2,80,000
2.	Industrial Kiln brands with spot galvanometer	Ind.	1 Set	90,000
3.	Physical balance Micrometer etc.	Ind.	1 Set	18,000
4.	Torsion Testing equipment	Ind.	1 Set	50,000
5.	Wrapping Test equipment	Ind.	1 Set	10,000

6.	Other Misc.	Ind.	30,000
7.	Energy conservation facilities/equipment		10,000
8.	Electrification and installation charges @ 10% of cost of machine and equipment		5,41,900
		Total	**64,48,900**

(iii) Total Fixed Capital

Sl. No.	**Description**	**Ind./ Imp.**	**Qty. (No.)**	**Price (Rs.)**
1.	Total cost of machinery and equipment			64,48,900
2.	Cost of Moulds/Dies/ Other fixtures			30,000
3.	Cost of Office equipment/ working table etc.			30,000
			Total	**65,08,900**
(iv) Pre-operative expenses (Project cost/Non refundable deposit)				**1,100**
Total Fixed Capital (i+ii+iii+iv)				**75,90,000**

B. Working Capital (per month)

(i) Personnel

Sl. No.	Designation	No.	Salary (Rs.)	Total (Rs.)
1.	Manager	1	6,000	6,000
2.	Marketing executive	1	4,000	4,000
3.	Clerk-cum-Accountant- Store Keeper	1	2,500	2,500
4.	Peon	1	1,800	1,800
5.	Watchman	1	1,800	1,800
6.	Production Engineer	1	5,000	5,000
7.	Skilled workers	3	2,200	6,600
8.	Un-skilled workers/Helpers	4	1,800	7,200
				Total 34,900
	Perquisites @ 15% of salaries			5,235
				Total 40,135

(ii) Raw Material

Sl. No.	Description	Qty. MT	Rate/ MT (Rs.)	Price (Rs.)
1.	Aluminium Rod EC Grade	25	87,850	21,96,250
2.	Aluminium	10	92,750	9,27,500

	Alloy ROD EC Grade			
3.	Galvanised Steel Wire	4	28,000	1,12,000
4.	Lubricants	LS	10,000	10,000
5.	Wooden Drums	LS	50,000	50,000
6.	Misc.		10,000	10,000
			Total	**33,05,750**

(iii) Utilities (per month) **(Rs.)**

Power 150 kWh units @ Rs. 4.60		77,211
Water 400 kilo liters @ Rs. 2.50/Kl.		1,000
	Total	**78,211**

(iv) Other Contingent Expenses (per month) **(Rs.)**

Postage, stationery and Telephone		1,000
Consumable Stores		2,000
Repair and Maintenance		5,000
Transport Charges		5,000
Advertisement and Publicity		2,000
Insurance		2,000
Misc. Expenditure		1,000
	Total	**18,000**

(v) Total Recurring Expenditure (per month)

40,135 + 33,05,750 + 78,211 +18,000 = **Rs. 34,42,096**

(vi) Working Capital (for 3 Months)

3 × 34,42,096 = Rs. **1,03,26,288**

C. Total Capital Investment

(i) Fixed capital		Rs. 75,90,000
(ii) Working Capital (for 3 Months)		Rs. 1,03,26,288
	Total	**Rs. 1,79,16,288**
	Say	**Rs. 1,80,00,000**

Financial Analysis

(1) Total Cost of Production (per year)	**(Rs.)**
Total Recurring expenditure	3,96,69,000
Depreciation on building @ 5%	54,000
Depreciation on Machinery and equipment @ 10%	5,60,700
Depreciation on furnace @ 20%	60,000
Depreciation on Mould and Fixtures @ 25%	7,500
Depreciation on office equipment @ 20%	6,000
Interest on total investment @ 16%	28,80,000
Total	**4,32,37,200**

(2) Turnover (per year)

Item	**Qty.**	**Rate (Rs.)**	**Value (Rs.)**
Aluminium Conductor	26 MT	90,000	23,40,000

Item	Qty.	Rate (Rs.)/MT	Value (Rs.)
AAC conductor	170 MT	1,05,000	1,78,50,000
ACSR	150 MT	1,05,000	1,57,50,000
AAAC	119 MT	1,12,500	1,33,87,500
Scrap	3 MT	60,000	1,80,000
Total	**468 MT**		**4,95,07,500**

The turnover has been calculated on the basis of weight taking average wire for different size of cable as per IS specification. Alternating the sale price can also be considered as per Km. of different size conductors.

(3) Net profit per year before Income Tax

= (Turnover _ total cost of production)

= Rs. 4,95,07,500 _ 4,32,37,200

= **Rs. 62,70,300**

(4) Net Profit Ratio

$$= \frac{\text{Net profit per year} \times 100}{\text{Turnover per year}}$$

$$\frac{4,95,07,500}{}$$

= **12.67%**

(5) Rate or Return

$$= \frac{\text{Net profit per year} \times 100}{\text{Total investment}}$$

$$= \frac{62,70,300 \times 100}{1,80,00,000}$$

= **34.84%**

(6) Break-even Point
(% of total production envisaged)

Fixed Cost	**(Rs.)**
Depreciation on machinery and equipment, tools and jigs and fixture and office equipment	6,34,200
Rent or Depreciation on Building	54,000
Interest on total investment	28,80,000
40% of Salary and wages	1,92,648
40% of other contingent expenses (Excluding rent and Insurance)	86,400
Total	**38,47,248**

B.E.P.

$$= \frac{FC \times 100}{FC + \text{Net profit}}$$

$$= \frac{38,47,248 \times 100}{38,47,248 + 62,70,300}$$

$$= \frac{38,47,24,800}{1,01,17,548}$$

= **38.45%**

Additional Information

a. The Project Profile may be modified/tailored to suit the individual entrepreneurship qualities/capacity, production programme and also to suit the locational characteristics, wherever applicable.

b. The Electrical Technology is undergoing rapid strides of change and there is need for regular monitoring of the national and international technology scenario. The unit may, therefore, keep abreast with the new technologies in order to keep them in pace with the developments for global competition.

c. Quality today is not only confined to the product or service alone. It also extends to the process and environment in which they are generated. The ISO 9000 defines standards for Quality Management Systems and ISO 14001 defines standards for Environmental Management System for acceptability at international level. The unit may therefore adopt these standards for global competition.

d. The margin money recommended is 25% of the working capital requirment at an average. However, the percentage of margin money may vary as per bank's discretion.

Addresses of Machinery and Equipment Suppliers

Wire Drawing Machine

1. M/s. Hind Engineering Works

   2, Kundan Lane, Liluah, Howrah-711204.

2. M/s. New Bishbakrtima Mechanical Works (P) Ltd.

   24/5, Brindaban Mullick Lane, Kadamtala, Howrah-711 101

3. M/s. Bharat Engg. Works

   243, Chittaranjan Avenue, Kolkata.

4. M/s. Pipalia Engineering Works (P) Ltd.

   Post Pipalia Kalan, Dist. Pali, Rajasthan-306307

5. M/s. Golden Engineering Industries

   8797, Shidipura, Rani Jhansi Road,

   New Delhi-110 005.

6. M/s. Sampat Engineering Ltd. Deora Avenue, Mithakhati Road, Navarangpura, Ahmedabad-380009, Tel. No. : 6425082, 440794

7. M/s. Super Cable Machines India Pvt. Ltd.

Choudhury Villa, 1, Shastri Nagar, Ahmedabad_382440.

8. M/s. Prem Udyog Pvt. Ltd.

Station Road, Vatva,

Ahmedabad_382440

9. M/s. Nihar Engineering and Sons 11/1, Kundan Lane, Liluah, Howrah-711204

Wire Stranding Machine

10. M/s. Wood Packers

53, Maulana Abul Kalam Azad Road, 2nd Floor, Howrah-711101

11. M/s. Prop. Cand. (India) Ltd.,E-91, Ambabari, Jaipur-302 012.

12. M/s. Hindustan Wire Netting Co. Pvt. Ltd. 55-57, Nagadevi Cross,

Mumbai.

13. M/s. Baba Engineering Works,1-1-531/A/2131/ Gandhinagar, Bakaram,Hyderabad-500 380.

14. M/s. Nehru Engineering and Sons Liluah, 11/11, Kundan Lane, 9611,

Howrah-711209

15. M/s. Super Cable Machines India Pvt. Ltd. Super Nagar, Mangli areas,

Ajmer-305203,

Testing Machin

16. M/s. Bluestar Ltd.7 Hart Street, Kolkata. Tel: 2480131

17. M/s. Scientific Testing India

    2/5, Phase-II, DSIDC Campus,New DIC, Bus Depot, Nanda Nagari,

    Delhi-110 093.

18. M/s. Hargolal and Sons, Ambala Cantt, Haryana, 133 001.

19. M/s. Oriental Science, Apparatus Workshop

    Jawaharlal Nehru Marg, Ambala - Cantt., Haryana _ 133001.

Welding Machine

20. M/s. Pipalia Engg. Works

    Prem Nagar, Pipala,

    Rajasthan.

21. M/s. Hargolal and Sons

    Ambala Cantt., Haryana

Other Misc. Machinery

22. M/s. Devendra Industries

    230, Village Nanglisakrwati, Najafgarh, New Delhi-110 043.

23. M/s. Sampat Heavy Engineering Company

    4B and C, Arehana Industrial Estate, Opp. Ajit Mills,

    Ahmedabad-360 023.

24. M/s. Hind Engineering Works

    2, Kundan Lane, Liluah,

    Howrah

25. The National Small Industries Corporation Ltd.

    Link Road, Cuttack

Furnance

26. M/s. Wesman Engineering Co. Ltd.

Wesman Centre, 8, May Fair Road, Kolkata-19

Tel: 2405320, 2816406,

Fax: 8050, 2816402,

E.Mail: furnace@wesman.com, Web. www.qwesman.com

Raw Material Suppliers

1. M/s. NALCO

Aluminium Rods and Alloys Rods, NALCO House, Nayapalli, Bhubaneswar.

2. M/s. Bharat Aluminium Co. Ltd. Chattarjee International Centre, 33A, Jawaharlal Nehru Row, Kolkata-71, Tel: 5576/5661

3. M/s. Aluminium Corporation of India Ltd.,

7, Camel House Street, Kolkata.

4. M/s. HINDALCO Industrial Ltd.

Birla Building, T/1, R.N. Mukherjee Road,

Kolkota-1. Phone: 2200764.

Steel Metal

1. M/s. Steel Metal

15, Brabowne Road, Kolkata-1.

2. M/s. Modi Industries Ltd. Modinagar, U.P. _ 34833510.

3. M/s. Vijay Steel, Tamando, NH-5, Bhubaneswar