

FOURTH FIVE-YEAR PLAN

**REPORT OF THE WORKING GROUP ON
STEEL AND METALLURGICAL
EQUIPMENT**

(JANUARY, 1965)

NG GROUP ON MACHINERY INDUSTRIES -

FOURTH FIVE-YEAR PLAN

**REPORT OF THE WORKING GROUP ON
STEEL AND METALLURGICAL
EQUIPMENT**

(JANUARY, 1965)

PLANNING GROUP ON MACHINERY INDUSTRIES

WORKING GROUP ON STEEL AND METALLURGICAL EQUIPMENT

FOURTH PLAN

Pursuant to the decision taken by the Planning Group for Machinery Industries, the Working Group on Steel and Metallurgical Equipment was formed under my Chairmanship. The composition of the Working Group is as follows:—

1. Shri N. Subrahmanyam, *Chairman*
Additional Secretary (Industry).
2. Shri K. M. George,
Managing Director,
Bokaro Steel Plant.
3. Shri G. Ramanathan,
Joint Secretary,
Department of Iron and Steel.
4. Shri A. N. Naik,
Chief Engineer,
Tata Iron & Steel Co.
5. Dr. M. N. Dastur,
Messrs M. N. Dastur and Company.
6. Shri T. R. Gupta,
Chairman, Heavy Engineering Corporation, Ltd.
7. Shri N. Krishnaswamy,
Industrial Adviser, DGTD.
8. Shri B. D. Malani,
General Manager,
M/s, Utkal Machinery, Ltd.
9. Dr. B. D. Kalelkar,
Deputy Director General, DGTD.
10. Dr. D. Swarup,
Chief, Industry & Minerals Division,
Planning Commission.
11. Shri Pitamber Pant,
Chief, Perspective Planning Division,
Planning Commission.
12. Dr. B. N. Bhargava,
O.S.D., Department of Industry.

(ii)

13. Shri. R. V. Raman,
Joint Secretary, Department of Industry. }
14. Shri O. N. Misra, Joint Secretary, } *Convenor*
Department of Industry. }

The Group was entrusted with the task of assessing the requirements of steel and metallurgical industries, of assessing the existing and proposed manufacturing facilities and then to suggest a programme for the development of machine building industries to sustain the development of metallurgical industries mainly from indigenous resources.

The Group met on several occasions and it was decided that except the rolling mill sections of metallurgical industries (excluding iron and steel), majority of the equipment is general purpose machinery or plate work equipment. The total quantum of equipment of the type this Group classified as metallurgical equipment for these industries was estimated to be small compared with the requirements of iron and steel industry. Therefore, it was decided not to specifically study metallurgical industries other than iron and steel industry.

In order to study the requirements of iron and steel industry and the availability of equipment from indigenous sources in sufficient details, the Working Group set up two Working Parties. One to assess the requirements of equipment for iron and steel industry during the decade 1965-66 to 1975-76 and other to assess the present and projected availability of indigenous equipment and to suggest the development programme for the machine building industry. The reports of these Working Parties are appended to this Report.

These Reports were discussed by the Working Group. Primarily based on the findings and recommendations given in these reports but modified as found desirable by the Working Group, the Report of the Working Group on Steel and Metallurgical Equipment has been prepared and is submitted herewith for the consideration of the Planning Group on Machinery Industries.

(Sd.) N. SUBRAHMANYAM,
Chairman.

CONTENTS				PAGES
1.	Introduction	..	..	1
2.	Demand	..	..	2
3.	Existing manufacturing facilities:			6—12
3.1.	Heavy machinery	..	..	6
3.2.	Technological structures	..	..	9
3.3.	Furnaces	..	..	9
3.4.	Structurals	..	..	10
3.5.	Electrical equipment	..	..	10
3.6.	General purpose machinery	..	..	11
4.	Programme of Development	..	..	13—19
4.1.	Heavy machinery	..	..	13
4.2.	Structurals	..	..	16
4.3.	Electrical equipment	..	..	17
4.4.	General purpose machinery .	..	..	17
4.5.	General services	..	..	18
5.	Organisations	..	..	20
6.	Specific recommendations	..	..	23
7.	Investment	..	..	25
8.	Raw materials	..	..	26
9.	Man power	..	..	28
Appendices				31-138

STEEL AND METALLURGICAL EQUIPMENT

1. INTRODUCTION

1.1. Iron and Steel occupy a pivotal position in the development of a country by virtue of its contribution to its industrial development. It is common knowledge that shortage of iron and steel has correspondingly a crippling effect on almost all economic activities. India has vast resources of raw materials for this industry along with a very rapidly growing market, making it ideally positioned for the development of this industry at a rapid pace.

1.2. However, our efforts to increase the domestic production of iron and steel, at the desired rate, get bogged down due to complete dependence on imported equipment for establishing any additional capacity. At present, the country is neither in a position to meet the requirements of machinery and equipment in any substantial degree, nor to provide other facilities like designing, engineering, erecting and operating the plants without external aid. Even though organisations in the country have been set up for providing designing, engineering and other facilities, it has not been possible to make full use of them because of dependence on external aid for the import of equipment. In view of the tremendous importance of this industry it is imperative that every effort is made to establish all possible facilities to ensure the development of this industry, at desired pace, without such crippling dependence on external aid. An attempt has been made to estimate the requirements of these facilities, to point out the difficulties that are impeding the progress and to suggest a feasible development programme.

2. DEMAND FOR PLANT AND MACHINERY

2.1. This report pertains to plant and machinery requirements of iron and steel plants. The estimates given in this report do not include the requirements of other metallurgical industries, alloy steel plants, small plants for the production of foundry grade pig iron, etc.

2.2. The Group's first efforts have been to assess the requirements of plant and machinery, to assess the existing and prospective indigenous manufacturing capacities and to derive from these a programme for augmenting the production of plant and equipment for metallurgical industries to the desired level.

2.3. In order to study these aspects in sufficient detail, the Group set up two Working Parties. The first Party's assignment was to assess the requirements of equipment for iron and steel industry during the period 1965-66 to 1975-76; while the second Party was entrusted with the task of assessing the present and projected availability of indigenous equipment and making suggestions regarding the development of indigenous machine building capacity. The reports of the two parties are reproduced in Appendices I and II respectively.

Requirements of plant and equipment

2.4. For assessing the requirements of plant and machinery, the first Party has assumed that the steel making capacity (ingot tonnes) will increase from 8.9 million in 1965-66 to 20 million by 1970-71 and to 30 million by 1975-76. Based on these assumptions, this Party assessed the total requirements of plant and equipment (excluding electricals and refractories) as approximately 1,768,890 tonnes and about 1,340,480 tonnes during the Fourth and Fifth Plans respectively. The Party has attempted to subdivide these total requirements in terms of castings, forgings, structurals, etc. according to weight and size. The quantum of complete equipment required also is spelt out. Besides giving the details of equipment specific to steel industry, the report contains a list of standard machinery, equipment, electrical equipment, refractories, transport equipment etc. that will be required by the steel industry. The report of the Party is appended to this Report.

2.5. The second Party also assessed the requirements of plant and machinery for iron and steel industry. This party assumed that the annual requirements of plant and machinery will be almost equivalent to the requirements assessed on the basis of additional steel manufacturing capacity to be

created by installing two one million ton steel plants every year during the decade 1965-75. On this basis, this Party concluded that it will be necessary to create heavy machining and fabricating capacity aggregating to about 180,000 tons per year, including heavy technological structurals of about 36,000 tons per year and in addition, a structural capacity aggregating to 200,000 tons per year to meet the requirements of steel plants.*

2.6. These two Reports were discussed by the Group and it was concluded that the annual requirements of plant and machinery may be assessed on the assumption of an average addition to steel making capacity of two million tons per annum over the next ten years. One million ton of this addition would be obtained by installing a new plant and another million ton by expansion of an existing plant. On this assumption and based on the information available in these two reports and elsewhere, average annual requirements for major groups of equipment were calculated. These estimates are given below in Table No. 2.1. It may be noted that these indicate only the order of magnitude, the actual requirements in any particular year may substantially vary from these figures.

TABLE 2. 1
Iron and Steel Industry

Approximate average annual requirements Fourth Plan

(tonnes/year)

Group of equipment	Total	Of type included in HMBP programme	HMBP* capacity
1	2	3	4
1. Coke oven and by-product plant	22,500	13,700	7,700
2. Sintering plant . . .	5,500	..	..
3. Blast furnace . . .	19,000	10,000	5,500
4. Refractory material plant .	3,000	..	..
5. Steel melt shop . . .	30,000	14,000	7,000

* Page 18. Report of the Second Party.

1	2	3	4
6. Rolling mills	55,000	46,000	34,500
7. Ancillary services	10,000	..	..
8. Crushing and grinding equipment	10,000	7,000	3,150
9. Cranes	11,000	9,000	6,570
10. Electrical and power equipment	25,000	..	..
11. Transport equipment	n.a.		
12. Pure structurals	150,000	..	..
13. Piping	12,000	..	..
14. General engineering equipment	5,000	..	..
Total (rounded)	360,000	10,000	65,000
Spare etc.	15,000	8,000	1,100
Total .	375,000	108,000	66,000

*Report by N. I. Babich pp: 12—15.

TABLE NO. 22.

Percentage distribution by weight of various sections in a million ton steel plant and distribution of various equipments in sections

Section	Percentage by weight in a million tonne plant	Percentage of various equipments by weight					Total
		Mechanical	Electrical	Pure Structural	Piping	Refractories	
1. Coke Ovens & Bye-Product Plant	18	22	6	3	*	69	100
2. Blast furnace plant	16	33	3	8	*	56	100
3. Steel Melting Shops	23	16	8	17	*	59	100
4. Rolling Mill Plant	27	43	15	37	*	5	100
5. Sintering Plant	2	44	12	22	*	22	100
6. Refractory Material Plant	1	38	12	18	*	32	100
7. Power Blower Station	3	52	33	15	*	..	100
8. Transport, Water Supply etc.	4	38	2	20	40	..	100
9. Auxiliary shops, mining, crushing equipment etc..	6	43	16	36	*	5	100
TOTAL	100	32	10	19	2(i)	37	100

(i) Only for transport, water supply and buildings; for the rest piping included in mechanical equipment.

*Weight of piping included in the weight of mechanical equipment.

3. MANUFACTURING CAPACITY—EXISTING

The second Party has assessed the availability of indigenous manufacturing capacity by disaggregating the total equipment into groups which are homogenous from the point of view of production in twenty-two broad groups. The report of the second Party has dealt in detail with the present status and future developmental plans for each group. The major categories along with their salient points, as accepted for recommendation by the Planning Group, are summarised below:—

3.1. *Heavy Metallurgical Machinery*

3.1.1. Heavy Machine Building Plant at Ranchi is the premier plant in India for the supply of this group of machinery. The annual requirements of this group of machinery will average out to approximately 108,000 tonnes per annum for the next ten years (See Table 2.1). The capacity of the Heavy Machine Building Plant is for the production of approximately 66,500 tonnes per annum, according to the detailed project report for this plant.

3.1.2. The production of this equipment is a very complex affair. After the order has been secured, appropriate design documentations will be obtained from USSR, translated into English, design Indianised, machinery drawings made, manufacturing technology chalked out and then the machining process begins. Thus, at least in the first few years of HMBP's operation, in case of a new order, fifteen to eighteen months may elapse between the placing of order and beginning of fabrication process. Most of these equipments remain on shop floor for two to three years before all machining on all parts can be completed. Thus it can be seen that if sufficient orders are placed on HMBP to keep it busy for the next five years, even though during 1970-71, the total weight of machinery being processed in various shops of HMBP may exceed 80,000 tonnes (of which metallurgical equipment will be 65,000 tonnes), the output of finished products may not exceed 38,000 tonnes* in any one year even as late as 1971†. Standardisation of plant and machinery is

* The total output of the plant will be 45,000 tonnes of which 38,000 tonnes will be for metallurgical industries.

† It is, however, expected that by 1973 a balance will be achieved in which the finished annual output will match the works in progress and the plant will be able to supply every year equipment sufficient for establishing a million ton steel plant. The total output of the plant at this time is expected to be 80,000 tonnes per year. This conclusion is based, however, on the assumption that HEC will have continuity of orders from now onwards.

very important, not only for expediting equipment design in the country but also for increasing the indigenous production and reducing the cost of production. Advance planning and placement of repeat orders will further expedite these developments and help the manufacturing firm to specialise in certain products.

The anticipated production programme for 1970-71 is summarised in Table No. 3.1.

TABLE NO. 3.1

Capacity of the HMBP for various types of equipment

No.	Groups of equipment	Annual output (in tons).
A. Iron & steel works		
1.	Coke Oven and bye-product equipment	7,700
2.	Blast furnace	5,500
3.	Steel making	7,000
4.	Crushing and grinding	3,150
5.	Cranes	6,570
6.	Rolling mill equipment	34,500
7.	Spare parts for metallurgical equipment	1,080
	Total equipment required by iron and steel works	66,500
B. Equipment for other branches of industry		
8.	Mining equipment	880
9.	Press forging equipment	1,360
10.	Excavators	4,950
11.	Heavy drills	5,500
12.	Miscellaneous heavy machine part and assemblies	1,810
	Total equipment for other branches of heavy industry.	14,500
	Grand Total of heavy machinery to be produced.	80,000

TABLE No. 3.2
Expected availability of steel plant equipment through HEC 1970-71

(Weight in tonnes—rounded)

Steel plant sections	Indigenous other than HEC			H.M.B.P.			Imports			Approximate total weight of equipment for 1 m. ton plant
	Equipment	T.S.	S.S.	Equipment	T.S.	S.S.	Equipment	T.S.	S.S.	
1. Blast furnace	5	13,645	15	2,500	4,000	600	350	50	70	21,235
2. Coke Oven	65	3,080	..	44,250	3,950	90	4,900	50	..	16,385
3. Steel melt shop	610	1,850	80	4,850	500	2,500	350	40	200	10,980
4. Rolling mill	..	..	..	15,000	..	..	31,000	..	..	46,000
TOTAL	680	18,575	95	26,600	8,450	3,190	36,600	140	270	94,600

TABLE No. 5

(Weight in tonnes—rounded)

Steel Plant sections	Equipment		Technological structures		Special Structures		Total		Grand Total
	Indigenous	Imported	Indigenous	Imported	Indigenous	Imported	Indigenous	Imported	
1. Blast furnace	2,505	350	17,645	50	615	70	20,765	470	21,235
2. Coke Ovens	4,315	4,900	7,030	50	90	..	11,435	4,950	16,385
3. Steel melt shop	5,460	350	2,350	40	2,580	200	10,390	590	10,980
4. Rolling mill	15,000	31,000	..	..	..	..	15,000	31,000	46,000
TOTAL	27,280	36,600	27,025	140	3,285	270	57,590	37,010	94,600

NOTES.—T.S. — Technological Structures — Structures which form part of equipment e.g. blast furnace shell and associated structurals.

S.S. — Special structures—cranes, conveyors etc.

The total weight shown here includes the weight of electrical and general engineering equipment also.

Source: Appendix C—Report of 2nd Working Party.

3.2. *Technological and associated structurals*

3.2.1. This Group includes diverse items like blast furnace shell, coke oven batteries, steel melting and other furnaces, certain equipment made of plates, gas pipes, stoves, storage tanks, etc., etc., and structurals, which, more or less, form part of main equipment or is required to erect/support them. It is estimated that demand for this group, comprising of plate work equipment and structurals would be of the order of 50,000 tonnes per annum.

3.2.2. Besides HMBP, Messrs. Utkal, Bridge & Roof, Burn & Co., K.C.P., A.V.B., Texmaco, etc., also can fabricate technological and heavy structurals. It is estimated that M/s. Utkal are in a position to supply approximately 4,000 tons/year of technological, structurals for blast furnace and by-product plant.* At present, HMBP has little capacity for the production of these items, however they have submitted a Preliminary Project Report to set up a shop with a capacity to fabricate 25,000 tons per annum of technological, associated and medium structurals. This is being processed with a view to establish the shop during the next 2-3 years, with USSR assistance for imported equipment. Its product output may therefore be expected to become available from the third year of the Fourth Plan.

3.3. *Furnaces*

3.3.1. Any shop set up to fabricate technological structurals can fabricate furnaces also. A number of licences have been issued for the manufacture of various furnaces including heating furnaces, annealing furnaces, soaking pits and other equipment. It is however felt that there still exists a gap between demand and supply and it will be necessary to increase the facilities to fabricate furnaces.

3.3.2. The main bottleneck, however, arise in respect of equipment design and engineering facilities. The second problem is the development of skills required for manufacturing and erecting these furnaces. It is felt that if manufacturing design facilities are established, there would be no difficulty in fabricating furnaces in sufficient quantities to meet out entire requirements

No definite figure for demand or supply is available.

*pp. 12—Report of the Second Party.

3.4. *Structurals*

3.4.1. *General purpose structurals.*—It is estimated that for the envisaged increase in the steel producing capacity, about 150,000 tonnes/annum of pure building structurals will be required. Any large structural plant can fabricate structurals for conveyors, other conveying equipment and for cranes also, provided designs are available.

3.4.2. The indigenous capacity for the fabrication of structurals is insufficient and in respect of heavy structurals, like those required in steel plants or heavy engineering plants, capacity is grossly inadequate compared to the demand.

3.4.3. *Specialised structurals.*—A million ton steel plant would require approximately 100 cranes. The total weight according to Babich report adds up to about 8,000 tonnes. For an annual increase of two million tonnes (both by new unit and expansion) the total demand, according to First Party's assessments, will be in the neighbourhood of 16,000 tonnes. Of course, the number and types of cranes required in a plant will vary according to any particular design.

3.4.4. At present HEC is the main firm which can manufacture heavy duty cranes, while there are several firms capable of fabricating medium and light duty cranes. In all ranges, and more particularly in heavy ranges, the present production is a fraction of country's requirements. According to present production programme of HEC, they will fabricate cranes with an aggregate weight of 6570 tonnes per annum when they achieve full capacity production.

3.4.5. Regarding conveyors, the position appears more comfortable. The annual requirements of steel industry are not expected to exceed 5,000 tonnes. However, since besides steel industry, various other sectors of economy also require large quantities of conveyors it will be necessary to take a comprehensive view before accepting self-sufficiency position.

3.5. *Electrical Equipment*

3.5.1. A note, appended to this report, deals in detail with the demand and indigenous availability of this group of equipment. By and large, it may be stated that with the capacity available under construction, and proposed for the manufacture of heavy electrical equipment, it should be possible to meet the total requirements of the iron and steel industry indigenously. Besides heavy electrical items, several ancillary equipments are required along with these electrical and power

plant equipment, e.g., electronic controls, instruments, etc. It is expected that Bharat Electronics Ltd., and the Precision Instruments Plants being established at Kotah and Kerala may be able to supply these instruments also. However, our Group does not have sufficient data to state to what extent these plants will meet the demand during the Fourth Plan period.

3.6. *General purpose machinery and equipment*

These items are dealt in great detail in the Second Working Party's Report. Only a few major items are discussed below:—

3.6.1. Turbo compressor is a major item of equipment in this group. The size and type required by this industry is such that it may very well be classified as an equipment specific to iron making industry. At present there is no capacity in the country for the manufacture of this equipment. Heavy Electricals Ltd., have offered to manufacture turbo-blowers at Ramachandrapuram plant in collaboration with Czechoslovakia.

3.6.2. *Transport Equipment.*—Electric locomotives are being manufactured by the Railway's Chittaranjan Locomotive Works, and diesel locomotives will be manufactured at their plant at Varanasi. Besides these two Railway plants, the Coal Mining Machinery Plant at Durgapur can manufacture small electric locomotives. The Railways are planning to manufacture locomotives suitable for their own use and in numbers required by them only. At present they have no plans to manufacture in excess of their own requirements, contrary to the assumption of the Second Working Party.*

3.6.3. For most of the general engineering items, machinery and equipment capacity exists in the country. But it does not cover all the sizes and types required in a steel plant nor is it known, that when viewed in the context of the requirements of all sectors of economy, if the capacity is sufficient to meet the entire demand.

For example, air separation plant (or specifically tonnage oxygen plant) comprises general engineering equipment like compressors, pressure vessels, valves, etc., but the sizes and specifications classify them beyond the scope of the present manufacturers' facilities. The complicated technology involved

*p. 17—Report of the Second Working Party.

also inhibits the production of such specialised equipment in various existing shops.

3.6.4. Very specific types of material handling equipment are required in the steel plants, *e.g.*, charging equipment, transfer cars, slag pot cars, buffer cars etc., etc. All such major equipments are scheduled to be manufactured in HMBP, while some private sector industries also are in a position to manufacture some of the equipments of comparatively smaller dimensions. No systematic survey of the existing capacity has been done. From the cursory information that is available, it is difficult to surmise that existing manufacturers will be able to meet the entire demand.

3.6.5. Similar situation exists in regard to machine tools. While the capacity for a number of varieties of machine tools is being established, it is doubtful that the actual production of heavy machine tool will meet the entire demand. A major portion of this demand was to be met by the Heavy Machine Tool Project at Ranchi. It is expected that this plant will go into production in 1965-66. During 1966-67 it will produce 22 machine tools and by 1970-71 the production is expected to be approximately 160 Nos. per annum.

The total contribution of this plant in the Fourth Plan period will be approximately 485 machine tools worth about Rs. 100 million.

4. PROGRAMMES FOR THE DEVELOPMENT OF ADDITIONAL MANUFACTURING CAPACITY

4.1. Heavy Metallurgical Equipment

4.1.1. HMBP is the main manufacturer of this group of equipment and according to present production planning of this plant, it can supply annually equipment required for a million ton steel plant, with almost 57% of it imported even as late as 1970-71. In respect of blast furnace and steel melting shop equipment, the imported content, by weight, in the equipment to be supplied by HMBP is anticipated to be approximately 12 and 6 per cent respectively by 1970-71., while in case of rolling mills, the imported content may be about 67 per cent*. Thus not only our total production of equipment is less than the anticipated requirements, but the indigenously fabricated equipments seem to have a very large imported content. One of the reasons for this dependence on imported components is that the Foundry Forge may not be in a position to supply the heavier castings and forgings required in the manufacture of rolling mills. Some of the imported equipment are those which are outside the scope of HMBP and for which indigenous capacity is not adequately developed, e.g., instruments. As the indigenous availability improves, the imported content will correspondingly decrease. The situation, however, needs the urgent attention of all concerned.

4.1.2. The Second Working Party has suggested that the capacity of HMBP should be increased to 120,000 to 130,000 tons per annum. In this process non-steel industry items like excavators, oil drilling rigs, etc., and lighter items, including smaller cranes, should be taken out from the production programme of the Ranchi plant.

4.1.3. Another project to manufacture 30,000 to 40,000 tons of metallurgical equipment, but in smaller sizes, should be planned.

4.1.4. As regards recommendation in para 4.1.2. above, this Group feels that for the present, the product mix of the plant should continue as outlined in the D.P.R. Rationalisation of the production, i.e., withdrawing of certain items and increasing the production of certain others should be attempted only after a few years' operational experience has been

*The imported content in the total weight of equipment will be as :

BF = 2%	SMS = 5%
CO = 30%	R.M. = 67%

gained. However, during this period, if HMBP can increase their output by farming out lighter components and utilising their facilities more fully for heavier components, this improvement should be actively pursued. Besides this arrangement, regarding any other steps to increase the capacity in this plant itself at present, the group has serious reservation.

4.1.5. Regarding recommendation in para 4.1.3., the Group has an open mind. It is felt that if this will be a specialised plant, say for only rolling mills for steel plants, rerollers and non-ferrous industry, it might be a very worthwhile venture. However, another plant with product mix similar to HMBP may not be desirable. As it is, it can be seen that equipment that would be fully installed by 1966, will be under-utilised for a few years and to add to physical manufacturing capacity at this stage may only mean a further increase in the extent of under-utilisation of this capacity, and this precisely is the result as can be seen from Table 5. The reasons for this need to be fully analysed, and on such an analysis should depend our further lines of action. One reason may be lack of orders. In that case, it will be meaningless for us to expand the capacity. Another reason could be lack of skills that are needed to get production out of equipment. In that case it will be better for us to concentrate our resources on making up this shortfall. Coupled with these considerations is the problem of changing technology and its effect on demand. For example, the possibility that continuous casting may replace to a certain extent blooming and slabbing mills cannot be ignored.

TABLE NO. 4.1.

*Build-up of Production of heavy equipment, as indicated
by the Second party*

Year	Ranchi production from existing capacity	Ranchi additional production from expansion	'New Ranchi'	Total
1	2	3	4	5
1966	9,800 (12)	..	..	9,800 (12)
1967	13,500 (17)	..	..	13,500 (17)
1968	18,300 (23)	..	..	18,300 (12)

1	2	3	4	5
1969	23,000 (29)	5,000 (12)	5,000 (12)	33,000 (16)
1970	29,000 (36)	8,000 (20)	8,000 (20)	45,000 (28)
1971	34,000 (43)	10,000 (25)	10,000 (25)	54,000 (34)
1972	38,000 (48)	15,000 (37)	15,000 (37)	68,000 (43)
1973	45,000 (56)	18,000 (45)	18,000 (45)	81,000 (51)
1974	52,000 (65)	23,000 (57)	23,000 (57)	98,000 (61)
1975	65,000 (81)	25,000 (62)	35,000 (87)	125,000 (78)
1976	80,000 (100)	40,000 (100)	40,000 (100)	160,000 (100)

NOTE.—Approximate percentage utilisation against installed capacity is shown in brackets.

Under these circumstances, the Group hesitates to make any positive recommendation for establishing a plant at this stage with a pre-determined product mix. The Group fully recognised the necessity for additional capacity. However, the Group at present does not have sufficient information to suggest as to how, how much, where, when and of what nature this additional capacity should be established. It is our considered view that proper answer to this question can be furnished only when the full potentialities of FFP and HMBP are actually realised or more or less fully judged. By that time the design and organisational aspects would have also been mastered so that we know the realities and potentialities of such a shop under Indian conditions. It is recommended that the intervening period should be utilised not only for consolidating the position but also for a closer study and review of the problems. It is suggested that a Committee of experts be asked to undertake this specific study with the clear-cut objective of maximising the output of HMBP in the shortest possible time; to suggest the desirable alterations in

HMBP production programme and its timing; and to suggest how and when additional manufacturing facilities should be established. The Group endorses the proposal that at the appropriate time, items like excavators, drilling rigs, crushing and grinding equipment may be taken out of HMBP and manufactured in separate specialised plants designed to produce these individual items on as closely integrated a pattern as possible. In the meantime, all possible efforts should be put forth towards reaching the targeted capacities of production of different items, as set out in the D.P.R., as early as possible. The technical body suggested above could also consider what other items could properly be included in the new unit for manufacture in addition to the items proposed to be transferred from HMBP, Ranchi. Broadly speaking, the Group feels that while considering additional capacity, it may be divided into two main categories, *viz.*, (a) those requiring high investment and (b) those requiring complicated technology. HEC has and may continue to concentrate on facilities requiring high investment. For those requiring complicated technology, specialised plants may be established.

4.2. *Structurals*

4.2.1. (a) *Technological and Associated*.—As the situation exists today, HEC is planned to manufacture metallurgical equipment and to a certain extent associated structurals, while the only major fabricator of technological structurals is M/s. Utkal Machinery. The capacity available is far short of requirements. HEC is planning to establish a technological structural shop with an annual capacity of 25,000 tons. It may be noted that a technological structural shop can fabricate other kinds of general or even specialised structurals. Thus while making proposals for establishing fabrication capacity, a comprehensive view of total requirements is necessary. It is in these lights that this Group endorses the plans for establishing another heavy structurals plant in collaboration with VOEST. The Group would like to urge that not only the implementation of these projects be speeded up but steps should be taken to plan capacity for expansion of existing plants, *e.g.*, Tungabhadra Steel Works.

4.2.2. The Group also recommends that the fabrication capacity of M/s. Utkal and other fabricators should be utilised to the maximum extent for the manufacture of technological structures for steel industry.

4.2.3. The Group also recommends that a large plant specialising in the manufacture of cranes, specially in higher ranges, should be established.

4.2.4. *Pure Structural*s.—It is estimated that the average annual requirements of structural for steel plants will be about 200,000 tonnes. In order to make structural plants yield a better return, the tendency is to put up sophisticated plants which can fabricate besides general structural, specialised and technological structural also. Such plants require foreign collaboration (for their successful implementation), thereby causing delays. The Group feels that besides the schemes mentioned earlier, we should set up plants with an aggregate capacity of 100,000 tonnes per annum for the fabrication of pure structural. No great sophistication of products will be involved nor need there be a wide variety of product mix. These plants should be designed for facilities, primarily, to manufacture building structural for steel and other industrial plants. In case demand for these types of structural fails to keep the shops fully occupied they could, of course, undertake the fabrication of other structural also; e.g., conveyors, cranes, etc. It is suggested that one plant should be established at each of the sites proposed for new steel plants preceding it by appropriate period. It may be possible to establish such plant with little external aid. Since these plants will have a very favourable capital input output ratio and will have a short gestation period, thereby not only giving quick returns but effecting substantial foreign exchange savings, the Group feels these projects should be assigned top priority. The establishment of the proposed structural plant at Bokaro right at the commencement of the Bokaro Steel Project will be a very valuable permanent addition to capacity of this sort, apart from its taking care of Bokaro steel plant's own requirements of structural.

4.3. *Electrical Equipment*

From the information available, the Group is of the view that when the HEL plants reach their rated output, it should be possible to get most of the electrical equipment indigenously. Since another Group is studying this particular industry only, this Group has no specific recommendation to make, except to emphasise the necessity of speeding the implementation of these projects.

4.4. *General purpose machinery and equipment*

4.4.1. *Turbo Compressors*.—The Group recommends that the proposal of HEL to manufacture turbo compressors at the Ramachandrapuram plant be accepted and they be asked to establish these facilities expeditiously.

4.4.2. *Transport Equipment*.—The demand for industrial locomotives—both electrical and diesel—is not large enough to establish a new manufacturing facility. The possibility of their manufacture in Railway's Chittaranjan and DLW Plants should be explored or it may be combined with the production of shunters in Railway workshops. Another possibility is that the facilities at CMMP may be utilised for the manufacture of these locomotives along with the production of mine locomotives.

4.4.3. *Machine Tools*.—A Group is studying in detail the development programme for Machine Tools, including those required for steel industry. Therefore, this Group has no specific recommendations to make except that the Heavy Machine Tool Plant at Ranchi should be expeditiously established and studies should be undertaken to find out the most desirable method of increasing the production of machine tools required by steel industry, by establishment of another such unit or expansion of the one under construction at Ranchi.

4.4.4. *Material conveying equipment*.—Cranes, winches, hoists, tackles, etc., may be included in this Group. The existing and projected capacity is not sufficient to meet the demand. The Group feels that the demand is large enough to justify erection of a plant specialising in the manufacture of these items. It is suggested that an agency like T.C.B. (NIDC) may be asked to prepare a technical feasibility report on this group of equipment.

4.5. *General Services*

4.5.1. Certain sections of this plant, though comprising specific or general purpose equipment, lend themselves to specialisation. The Group feels that time has come to establish such facilities, without which it may not be possible to utilise indigenously manufactured equipment fully. As examples, a few cases are discussed below:

4.5.2. *Instruments*.—Instrumentation engineering is a highly specialised job. Generally, neither the main plant manufacturers nor the instrument manufacturers equip themselves to provide this service—at least in India it does not exist. In order to make full use of indigenous products required in instrumenting a complete plant, it will be necessary to establish this organisation on a priority basis. Whether this should be an independent organisation or associated with HEC or with the Public Sector Instruments Plants is a matter of detail.

4.5.3. *Oxygen Plant.*—The oxygen plant supplier may or may not be a manufacturer of any equipment going into the oxygen plant. However, it will be highly desirable to have an organisation which can supply complete plants on a turn-key basis.

4.5.4. *Lubrication Equipment.*—Again in this case the engineering is a very important aspect. The entire system may cover a variety of equipment and while it is not necessary for a firm to manufacture any or some equipment out of the total, the overall designing and engineering, the know-how to select right components and to supply and erect the whole are most important.

4.5.5. A detailed analysis may show that several such specialised sections may require agencies with specialised knowledge. It is necessary that a competent body is assigned the task to look into these aspects and suggest, how, when and where these facilities should be established.

5. ORGANISATION

5.1. Besides the physical manufacturing of machinery, equipment, etc., lots of other technical and associated activities take place after a Detailed Project Report for a steel plant is prepared and before the plant is ready for commissioning. As India is still deficient in many of these skills and know-how, good deal of these functions are done either abroad or with the aid of foreign experts in India. As and when the opportunity arose, organisations were formed and they either independently or with the help of collaborators for that particular project completed the job. After that, in most of the cases, these personnel were absorbed in some other capacities and the organisations were either wound up or assigned some limited responsibilities in connection with the functioning of that project alone.

5.2. The Group feels this is not a happy way of developing or utilising expertise. Moreover, now that we have a fairly clear idea about the development of the iron and steel industry, on a substantial scale, it becomes necessary that steps are taken to acquire and preserve expertise at different levels for specific functions. This can only be done if permanent organisations with specific field of activities are established, which will be continually assigned the specified functions for all projects (at least public sector) in future. It will be advantageous to encourage organisations specialising in specific sections of the steel plant providing all associated services. This might ensure the best possible designs for every section of the plant. Some of these are discussed below.

5.3. *Project implementing organisation*

This organisation will have three divisions—

- (i) Designing and engineering,
- (ii) Procurement,
- (iii) Erection.

5.3.1. The Designing and Engineering Division should possess the overall designs of the plant in all its details. It should be possible for this department to redesign, if necessary, any section of the plant to suit the manufacturing facilities in the country—of course, in consultation with the consultants. In consultation with consultants and major plant manufacturers, it should prepare a delivery and erection schedule.

5.3.2. The Procurement Division should keep up-to-date information about the manufacturing capacities in the country for all kinds of equipment required in a steel plant. It will be the responsibility of this organisation to place orders on various manufacturers to obtain all and sundry plants, machinery, equipment and material according to a pre-determined schedule.

5.3.3. *Erection Division*

Except for those plants or sections of plants which will be supplied by manufacturers on turn-key basis, this Division should be able to do the entire erection, either directly or through contractors.

5.3.4. It is understood that since all these three divisions will form part of one organisation, there will be free exchange of views and information between them and they will work as a single team.

5.3.5. It may be seen that good deal of work assigned to this organisation has to be done in continuous collaboration with the agency which prepared the detailed project report, and as such this organisation may be either an independent organisation or attached to the Central Design Bureau of Hindustan Steel Ltd. There are organisations in the private sector who render assistance in design, detailed engineering, procurement, erection and commissioning of industrial plants. Although organisations specialising in steel plant engineering are limited, it is felt that given opportunity and proper assistance these organisations along with strengthened C.D.B. of H.S.L. may make as self sufficient. Assigning the responsibility to HEC⁽¹⁾, the premier iron and steel plant manufacturers, has certain distinct advantages. It is difficult to see, at present, which will be a better alternative and as such, the Group has not made any definite recommendation.

5.4. *Main Plant manufacturers*

At the present stage, assigning the colossal job of designing, procurement and erection of every section of steel plant to one agency may become unmanageable. This burden to a great extent can be shared by manufacturers if they undertake to supply complete equipment, including purchased items, for any particular section of a steel plant. They may even

(1) Here a distinction is made between HEC and HMBP. HMBP is a manufacturing concern and its responsibility is only to supply complete equipment including purchased parts forming integral part of the equipment. HEC is not a manufacturing company but may play the role of steel plant supplier, may be even on turn-key basis.

be encouraged to supply the section on a turn-key basis. The services may be provided by the manufacturers themselves or with the assistance of specialised agencies or contractors. For this purpose the main manufacturers will have to create an organisation outlined above on a smaller scale for the sections of plants they intend to supply. At present HEC may be asked to concentrate mainly on the training of machine operators, skilled workers, etc., and of draftsmen. At the same time it should develop a "Design Bureau" on a modest scale, as suggested by Russian experts which may later develop into a Central Design Institute. The Bureau may, to begin with, concentrate on such items which will be supplied by HEC on turn-key basis and on individual items of equipment manufactured by them.

5.5. Main Plant Suppliers.

Certain firms are in a position to supply certain sections of the steel plants on turn-key basis, even though they have no manufacturing facilities. The Group feels that full use should be made of these agencies.

6. SPECIAL RECOMMENDATIONS

6.1. The Group attaches the utmost importance to maximisation of production from all existing machine building plants. It is recognised that since most of the major equipments will be fabricated for the first time in India, the buyer will be reluctant to have full confidence in these equipments. However, till these plants manufacture the first equipment, the second cannot follow; thus, in spite of all these reservations it will be necessary to ban the import of these equipment to the extent of indigenous availability.

The HMBP is organised for the manufacture of composite types of heavy machinery for the entire steel plant. Their design and technological organisations are capable of making detailed shop drawings to start with, from the designs obtained from elsewhere. From the very nature of equipments and the technology of manufacturing involved, these preliminaries, *i.e.*, translation of designs to shop drawings (after modifying them to suit Indian standard sections and sizes of raw materials), designing and preparation of jigs and fixtures, etc., take 18 to 21 months before manufacturing starts, which may take another 12 to 18 months, depending upon the type of equipment. If this order is repeated, no time will be required for the preliminaries and even the manufacturing time will be considerably reduced since jigs and fixtures will be all in position and manufacturing techniques would be progressively improving. But unless these repeat orders are there in advance, good deal of work may have to be repeated, thereby causing delays in production and reduction in the output of the plant. For sustained work to be carried out in a planned manner and for achieving optimum production standards, it will be necessary to have at least five years orders on hand and a perspective planning for ten years. Standardisation of plant and machinery will greatly contribute to the building up of the production in relatively shorter period. Unless standardisation is implemented expeditiously the dependence on external help may continue to be large. One point which we would stress at this stage is that since HMBP is set up according to Russian standards and they are willing to help us with designing and manufacturing of equipment, it will be expedient to adopt Russian designs, at least in the early stages. If the aiding countries, desirous to establish complete plants, are willing to supply detailed drawings for the equipment HMBP can fabricate, to this extent the manufacturing facilities at HMBP can be utilised. This is, however, likely to create complications in respect of tooling etc.

In order to progressively increase the percentage of Indian equipment in the steel plants, it is suggested that HMBP should be asked to start batch production of relatively simpler items to begin with for all future steel plants to come and to take the manufacture of major equipment progressively. Simultaneously, action should be taken to ban the imports of such items in respect of which the country is becoming self-sufficient. This approach will help rationalisation of production programme at HMBP also.

6.1.1. Whenever a Russian aided plant is established, we should insist that they should utilise the HMBP facilities to the maximum extent.

6.1.2. This way it may be possible, in due course, for HMBP to undertake the designing and manufacture of all major equipments required in a steel plant and obtain maximum output in relatively short period.

In this connection the Group would like to point out that the usual procedure for tendering etc., were not quite suitable as the stage for decision making with respect to indigenous manufacturers will have already passed when tenders on the basis of specifications required could be called for. Therefore, it is suggested that a coordinating agency at the highest level should be entrusted with the responsibility of taking a decision on indigenous manufacture at least two years in advance of setting up a steel plant. All the new plants in the Fourth Plan and later would have to be tied up in this manner with the programme of manufacture of HEC and other manufacturers in the private sector, even if that involves higher cost or some delays. Unless this was done, there is danger that the indigenous manufacturing facilities would remain substantially unutilised.

6.2. A competent body should be assigned the task of analysing the facilities at FFP and HMBP, its production programme and suggest, (a) how its capacity could be increased by marginal if any, investment and, (b) how and when additional capacity should be established. Since these plants have been established in collaboration with USSR and Czechoslovakia, their assistance in this study will be very beneficial. While making suggestions regarding additional capacity it will be necessary to keep in view the development of machine building capacity in the private sector. Actually an extensive and detailed study of indigenous capacity by competent specialists will be most helpful for obtaining a clear picture of indigenous capabilities.

7. INVESTMENT

7.1. It is estimated that the total investment on HMBP will be approximately Rs. 430 million and on Foundry Forge Project about Rs. 1,000 million. Of this total about Rs. 875 million will have been invested during the Third Plan, necessitating an expenditure of Rs. 555 million during the Fourth Plan.

7.2. As yet no studies have been undertaken to estimate the investment required for rationalisation of HMBP capacity. An *ad hoc* provision of Rs. 20 million is suggested.

7.3. Until the scope of the additional capacity is finalised, no estimates regarding the investment can be made. Based on preliminary ideas, an *ad hoc* provision of Rs. 200 million is suggested.

7.4. Other major schemes recommended and corresponding investments are listed below:

Fourth Plan Schemes

Project	Scope	Tonnes	(Rs. million)	
			Investment	F. E.
1. Structural Shop at Ranchi	Associated structurals	10,000	25	7.9
	Technological „	7,000		
	Medium „	8,000		
		25,000		
2. Heavy Structural Project	Includes technological structure like blast furnace shell, L. D. converters etc.	25,000 tonnes	45	15.0
3. Cranes	Includes medium structurals and mechanical equipment for cranes and hoists:	25,000 tonnes	110	30.0
4. Building structurals		25,000 tonnes	20	5.0

8. RAW MATERIALS

8.1. HMBP

HMBP will obtain castings, forgings, rolled products, components and equipment for its manufacturing programme. The requirements of these items at an output level of 80,000 tonnes per annum as envisaged in D.P.R. is estimated to be as follows:

Items	Tonnes/Year
1. Iron castings	18,062
2. Steel castings	30,366
3. Non-ferrous castings	567
4. Hammer and die forgings	16,807
5. Metal rolled Products	26,189
6. Springs	225
7. Rolls for rolling mills and roller tables	1,775
8. Pinion rolls	190
9. Fasteners	280
10. Bearings, including ball and roller bearings	776
11. Electrical equipment	3,460
12. Mis. finished products	1,210
13. Misc., basic and auxiliary	1,685
14. Electrodes	300
TOTAL	1,01,892

8.2. Foundry Forge Plant

The approximate raw material required for this plant at capacity production level are:

Raw material	Tonnes/Year
1. Grey iron	60,000
2. Steel & Steel scrap	150,000
3. Non-ferrous metals	1,000

8.3. *Structurals plants*

The requirements of these plants will be for rolled sections and plates. Since as yet the final product mix of each plant has not been finalised, it is not possible to estimate the requirements in detail. Roughly it may be stated that for the fabrication of various types of equipment in the suggested plants, the total requirements of rolled products would be of the order of 100,000 tonnes of which plates may constitute approximately 20,000 tonnes. It may be noted here that for the expansion of steel industry as assumed in this report, total equipment utilised for this purpose would require rolled products of the order of 200,000 tonnes per annum of which 25,000 to 30,000 tonnes will be plates.

9. MAN POWER REQUIREMENTS

9.1. HMBP

It is estimated that when HMBP is fully established, it will employ the following personnel. The present position also is indicated alongside.

Category	Ultimate Nos.	Present
1. Production workers	3175	
2. Engineers and technicians	960	
3. Office staff	434	
4. Others	193	
TOTAL	4763	4200

9.2. Foundry Forge.

The personnel employed in FFP upon its completion, and at present are estimated to be as—

Category	Ultimate	Present
1. Production workers	3938	
2. Engineers and technicians	898	
3. Office staff	431	
4. Others	2496	
TOTAL	7763	3139

9.3. Structural Plant, Ranchi.

The tentative estimates of staff for this project are—

Officers	33
Foremen	4
Supervisors	14
Technical staff (Draftsman etc.)	96
Production workers	484
Non-technical staff	113
TOTAL	744

9.4. Heavy Structural Plant (VOEST)

The breakdown of the personnel required in this plant when it will be operating at optimum designed level may be approximately as given below: —

Category	Nos.
1. Production and auxiliary workers .	1030
2. Engineers	150
3. Others	70
TOTAL	1250

APPENDIX I

Assessment of requirement of Plan and Equipment for Steel Plants in India during Fourth and Fifth Five-Year Plan periods.

The Working Group for Steel and Metallurgical Industries equipment at the meeting held on April 13th of 1964 set up two working parties. The first party was to study the requirements of steel works equipment between now and 1975-76. The second party was to assess the availability of equipment (existing and prospective).

2. The composition of the first working party was—

- (a) Shri R. P. Sinha, Chief Engineer,
Central Engineering & Design Bureau,
Hindustan Steel Limited. Convenor
- (b) Shri A. N. Naik,
Manager, Engineering & Development,
Tata Iron & Steel Company Ltd.
- (c) Dr. P. E. Mehta,
M.N. Dastur & Company Ltd.,
75/48, Chankyapuri,
New Delhi.
- (d) Shri G. Ramanathan,
Deputy Secretary,
Department of Iron & Steel.

It was desired that the Group should—

- (i) estimate the requirements of plant and equipment necessary for the steel development programme and replacement till 1975-1976. The outline for 1970-1971 is reasonably clear. For the Fifth Plan, the party may assume a rate of growth of about 2 million tonnes a year;
- (ii) estimate the requirements annually—
 - (a) by main units of plant required for steel works, e.g., coke ovens, blast furnaces, steel making and rolling facilities, taking into account technological trends, and
 - (b) by categories such as castings, forgings, fabricated steel work, auxiliary equipment, etc., each category being further subdivided into appropriate ranges (size, weight, etc.). The categories and ranges should be determined so as to be meaningful for the planning and establishment of manufacturing facilities (including related design engineering facilities) and so as to distinguish those falling under the scope of major manufacturing facilities such as HEC and HEL and others.

- (iii) indicate the types of equipment where standardisation dimensionally or otherwise, and/or rationalisation in range series is desirable and how this can be achieved;
- (iv) indicate the design, engineering and other associated facilities that will be necessary to secure the maximum utilisation of manufacturing facilities;
- (v) indicate the arrangements that may be necessary for continuous co-ordination between steel plant authorities and manufacturers in order to ensure that the needs of the steel development programme are met to the fullest extent and in the best manner possible by indigenous manufacturers.

3. The party had two series of meetings—the first at Jamshedpur on the 18th and 19th May, 1964 and the second at Calcutta on the 19th and 20th June, 1964.

4. The working party have, in the present report, attempted to estimate the requirements of Plant and Equipment by main units and by main categories as desired. But they have not attempted to distinguish what categories of products would properly fall under the scope of major manufacturing facilities by HEC and HEL; nor have they tried to indicate equipment where standardisation can be achieved or the design engineering and other associated facilities necessary to secure the maximum utilisation of manufacturing facilities. The Committee feel that such a meaningful assessment will be possible only after a closer study of manufacturing facilities are available. These points could be studied after the reports of the two Groups are integrated.

5. The Indian Steel Industry is expected to have an installed capacity of 8.9 million tonnes by the end of the Third Five Year Plan. For the Fourth Five Year Plan, the Steering Group have set a production target of 17.3 million tonnes. This would require an installed capacity of 20 million tonnes (approximately). This order of capacity can be achieved by expansion of existing Steelworks and installation of new Works in the following manner:

(Figures in Million Tonnes of Ingots/year.)

Steel Plant	End of 2nd Plan.	End of 3rd Plan.	End of 4th Plan.
Rourkela	1.0	1.8	2.5
Bhilai	1.0	2.5	3.5
Durgapur	1.0	1.6	3.0
Tisco	2.0	2.0	3.0
Iisco	0.8	1.0	2.0
New Steel Plants . . . . .	..	..	6.0
Total Capacity	5.8	8.9	20.0

Further, according to the target set by the Steering Committee, additional capacity of about 2 million tonnes of pig iron has to be planned.

The Group have not calculated the equipment requirements of the special steel development programme mainly for two reasons. Firstly, it had not the adequate data. Secondly, the requirements in relation to the overall programme tonnage-wise are likely to be small.

6. The working party have assumed that for the Fifth Five-Year Plan, the additional capacity to be installed would be 10 million tonnes (approx.). This is in line with the directive given to it. It has further assumed that of the 10 million tonnes, about 3.5 million tonnes would come from the expansion of existing works and the balance from new facilities.

7. This exercise is based on the above broad perspective of growth. The assessment of plant and equipment requirements is based on the experience of the construction of the million tonne plants at Bhilai, Rourkela and Durgapur and their expansions. It is also subject to the following general assumptions:—

- (i) Development of additional capacity of steel production is based on the requirements of end products, viz., 60% sections and the remaining as flat products.
- (ii) Blast Furnaces will be broadly standardised in the following sizes:—
 - (a) Furnaces with a working volume of 1000 cbm. (approx).
 - (b) Furnaces with a working volume of 1700 cbm. (approx).
 - (c) Furnaces with a working volume of 2000 cbm. (approx).
 In future, the latter two types are likely to predominate.
- (iii) In Steel Making, all developments will be by the L.D. process or one of its modifications.
- (iv) We have also taken into consideration the possibility that while the major part of production will be from primary mills as now, any balancing or marginal expansion programme will be achieved by continuous casting.

8. We have tried to estimate the requirements for maintenance of steel industries. In doing so, however, we have assumed that a part of this requirements will be met by the Steel works themselves.

9. The requirements of plant and equipment have been prepared in relation to the facilities required for their manufacture. These have been classified into castings, forgings, structural fabrication, electrical equipment, refractories and standard equipment (e.g., locomotives, pumps, etc.). Each category is further sub-divided into appropriate ranges (sizes, weight, etc.).

10. The total requirements of plant and equipment by categories and by units are given in Tables I, II-A and II-B, which follow.—

Table I summarises the requirements of Plant and Equipment (excluding refractories and electricals) for steel plants during the Fourth and Fifth Plan periods.

TABLE I

(Figures in tonnes)

Plant and Equipment	Fourth Plan	Fifth Plan
Castings (Grey Iron)	52,710	44,770
Castings(Steel)	166,580	105,900
Castings (Non-Ferrous)	3,320	3,050
Forgings	67,930	41,060
Structural Steel Fabrications	1,010,390	807,830
Standard Machinery, Equipments, Parts, etc.	467,960	337,870
Total	1,768,890	1,340,480

Table II-A gives detailed estimates of requirement of castings, forgings and fabricated Steel work required during Fourth and Fifth Plan periods departmentwise, viz., Coke Ovens and By-product Plants, Blast Furnace and Auxiliary Plants, Steel Making Plants, Rolling Mills and Services.

Table II-B gives the detailed requirements of the remaining items, viz., standard machinery, equipment and parts, electricals and refractories, for complete integrated steel plants, for the above plan periods.

TABLE II-A

Estimated requirements of castings, forgings and structural fabrication for steel plants during fourth and fifth five year plan periods.

I. COKE OVENS AND BY-PRODUCT PLANTS.

	Fourth Plan	Fifth Plan
	(tonnes)	(tonnes)
1. <i>Castings (Grey Iron)</i> —		
(i) Up to 1 t.	4,900	5,200
(ii) 1 t. to 10 t.	3,970	4,30
(iii) 10 t. to 100 t. . . . .	..	..
	8,870	9,500
2. <i>Castings (Steel)</i> —		
(i) Up to 1 t.	2,780	3,000
(ii) 1 t. to 5 t.	1,160	1,290
(iii) 5 t. to 90 t. . . . .	..	..
	3,940	4,290

	Fourth Plan	Fifth Plan
	(tonnes)	(tonnes)
3. Castings (Non-Ferrous)—		
(i) Up to 50 kg.	1,000	1,100
(ii) Above 50 kg.	160	190
	1,160	1,290
4. Forgings—		
(i) Up to 500 kg.	2,340	2,550
(ii) 500 kg. to 3 t. . . . .	..	..
(iii) 3 t. to 30 t. . . . .	..	..
	2,340	2,550
5. Structural Steel Fabrication—		
(i) Pure structures	20,720	17,160
(ii) Technological Structures.*	74,980	81,400
(iii) Plate and Vessel work—		
(a) Heavy (+ $\frac{3}{4}$ " plates)	910	900
(b) Light (- $\frac{3}{4}$ " plates)	12,570	11,580
	109,280	111,040
II. BLAST FURNACE AND AUXILIARY PLANTS.		
1. Castings (Grey Iron)—		
(i) Up to 1 t.	3,500	3,200
(ii) 1 to. to 10 t.	12,800	10,400
(iii) 10 t. to 100 t.	5,000	4,000
	21,300	17,600
2. Castings (Steel)—		
(i) Up to 1 t.	400	100
(ii) 1 t. to 5 t.	11,800	2,500
(iii) 5 t. to 90 t.	6,200	5,000
	18,400	7,600

*Structures forming part of metallurgical plant and equipment.

	Fourth Plan (tonnes)	Fifth Plan (tonnes)
3. Castings (Non-Ferrous)—		
(i) Up to 50 kg.	150	100
(ii) Above 50 kg.	1,350	1,100
	1,500	1,200
4. Forgings—		
(i) Up to 500 kg.	20	20
(ii) 500 kg. to 3 t.	200	175
(iii) 3 t. to 30 t.	10	5
	230	200
5. Structural Steel Fabrications—		
(i) Pure structures	55,520	45,760
(ii) Technological structures	17,900	13,800
(iii) Plate and vessel work		
(a) Heavy ($+\frac{3}{8}$ " plates)	21,000	7,300
(b) Light ($-\frac{3}{8}$ " plates)	12,000	4,700
	106,420	71,560
III. STEEL MELTING SHOP AND AUXILIARY PLANTS.		
1. Castings (Grey Iron)—		
(i) Up to 1 t.	2,000	1,500
(ii) 1 t. to 10 t.	1,600	1,200
(iii) 10 t. to 100 t.	400	300
	4,000	3,000
2. Castings (Steel)—		
(i) Up to 1 t.	5,000	4,500
(ii) 1 t. to 5 t.	3,500	3,100
(iii) 5 t. to 90 t.	1,500	1,400
	10,000	9,000

	Fourth Plan (tonnes)	Fifth Plan (tonnes)
3. Castings (Non-Ferrous)—		
(i) Up to 50 kg.	35	28
(ii) Above 50 kg.	15	12
	50	50
4. Forgings—		
(i) Up to 500 kg.	480	400
(ii) 500 kg. to 3 t.	90	60
(iii) 3 t. to 30 t.	30	40
	600	500
5. Structural Steel Fabrications—		
(i) Pure Structures	180,440	148,720
(ii) Technological Structures	24,000	23,000
(iii) Plate and vessel work.		
(a) Heavy ($+\frac{3}{8}$ " plates)	7,000	6,000
(b) Light ($-\frac{3}{8}$ " plates)	26,000	23,000
	237,440	200,720
IV. ROLLING MILLS		
1. Castings (Grey Iron)		
(i) Up to 1 t.	1,370	1,040
(ii) 1 t. to 10 t.	4,110	3,130
(iii) 10 t. to 100 t.	8,210	6,260
	13,690	10,430
2. Castings (Steel)		
(i) Up to 1 t.	10,970	6,990
(ii) 1 t. to 5 t.	21,930	13,980
(iii) 5 t. to 90 t.	76,770	48,920
(iv) Above 90 t.	23,770	14,400
	133,440	84,290

	Fourth Plan (tonnes)	Fifth Plan (tonnes)
3. Castings (Non-Ferrous)—		
(i) Up to 50 kg.	300	250
(ii) Above 50 kg.	200	150
	500	400
4. Forgings—		
(i) Up to 500 kg.	12,630	7,270
(ii) 500 kg. to 3 t.	18,950	10,910
(iii) 3 t. to 30 t.	31,800	18,410
	63,380	36,590
5. Structural Steel Fabrication—		
(i) Pure structures	416,400	343,200
(ii) Technological structures.	52,480	26,630
(iii) Plate and vessel work		
(a) Heavy (+ $\frac{3}{8}$ " plates)	25,500	11,830
(b) Light (— $\frac{3}{8}$ " plates)	17,000	7,890
	511,380	389,550
V. SERVICES		
1. Castings (Grey Iron)—		
(i) Up to 1 t.	1,430	1,320
(ii) 1 t. to 10 t.	3,200	2,700
(iii) 10 t. to 100 t.	220	220
	4,850	4,240
2. Castings (Steel)—		
(i) Up to 1 t.	250	220
(ii) 1 t. to 5 t.	550	500
(iii) 5 t. to 90 t. . . . .	..	..
	800	720

	Fourth Plan (tonnes)	Fifth Plan (tonnes)
3. Castings (Non-Ferrous)—		
(i) Up to 50 kg.	110	110
(ii) Above 50 kg.	10	10
	<hr style="width: 50%; margin: 0 auto;"/> 120	<hr style="width: 50%; margin: 0 auto;"/> 120
4. Forgings—		
(i) Up to 500 kg.	1,100	1,000
(ii) 500 kg. to 3 t.	280	220
(iii) 3 t. to 30 t. . . . .	..	..
	<hr style="width: 50%; margin: 0 auto;"/> 1,380	<hr style="width: 50%; margin: 0 auto;"/> 1,220
5. Structural Steel Fabrication—		
(i) Pure structures	20,820	17,160
(ii) Technological Structures	17,200	11,200
(iii) Plate and vessel work		
(a) Heavy (+ $\frac{3}{4}$ " plates)	650	500
(b) Light ($-\frac{3}{4}$ " plates)	7,100	6,000
	<hr style="width: 50%; margin: 0 auto;"/> 45,770	<hr style="width: 50%; margin: 0 auto;"/> 34,860

TABLE II-B

*Estimated requirements of standard machinery equipment,
parts, electricals and refractories for steel plants during
fourth and fifth five year plan periods*

	Fourth Plan (tonnes)	Fifth Plan (tonnes)
1. (1) Standard Machinery, Equipment and Parts, etc.		
(i) Locomotives—		
(a) Above 70 tons	8,300	6,840
(b) Below 70 tons	1,570	1,850
(ii) Rolling Stock—		
(a) General purpose (4 wheeler open type, closed type, tank wagon etc.).	11,440	21,600

	Fourth Plan	Fifth Plan
	(tonnes)	(tonnes)
(b) Heavy duty (BOBS, BOX, BFR etc.)	22,940	24,300
(c) Special duty (hot metal cars, slag pot cars, ingot cars etc.).	49,530	39,480
	93,780	94,070
(iii) Compressors/Fans—	10,000	6,000
(iv) Pumps	7,220	5,280
(v) Machine Tools	15,000	13,000
(vi) Conveyors Idler Rollers and Belt Conveyors	26,130	20,410
(vii) Pipes.		
(a) C. I. Pipe	17,320	11,400
(b) Steel Tubes up to 6"	30,540	21,970
(c) Steel Pipes 8"-20"	31,530	20,440
(d) Steel Pipes above 20"	17,570	14,190
	96,960	68,000
(viii) Valves and fitting	20,180	17,260
(ix) Cranes—		
(a) 5 to 20 t.	19,500 (400/410 Nos.)	7,500 (170/175 Nos.)
(b) 21 to 60 t.	20,200 (218/222 Nos.)	13,600 (140/145 Nos.)
(c) 61 t. and above	26,050 (85/90 Nos.)	9,600 (28/32 Nos.)
(d) Special cranes (charger, stripper, soaker, mould handling and ladle cranes).	12,880 (55/60 Nos.)	6,100 (22/25 Nos.)
	78,630	36,800
(x) Power Plant—		
1. Steam Generators		
(a) Above 150 t/hr.	9,200	6,100
(b) Below 150 t/hr.	29,300	19,000
2. Turbo Blowers		
Above 3000 cbm/M (max. size 4500 cbm/ M)	4,500	3,100
3. Turbo-alternators		
(a) Above 10 MW	1,600	11,20
	44,600	29,320

	Fourth Plan (tonnes)	Fifth Plan (tonnes)
(xi) <i>Mining/Quarry Equipment—</i>		
(a) Iron Ore	36,000	24,300
(b) Limestone	16,900	9,650
(c) Dolomite	8,400	4,800
	61,300	38,750
(xii) <i>Miscellaneous (Gear Boxes, Bearings, etc.)—</i>	14,160	8,980
Total for Standard Machinery and Parts etc.	467,960	337,870
 (2.) <i>Refractories</i>		
(i) Fireclay	516,000	502,000
(ii) Silica	180,500	197,000
(iii) Basic	18,500	13,500
(iv) Others	53,000	43,000
	768,000	755,000

	Fourth Plan		Fifth Plan	
	No.	Installed capacity	No.	Installed capacity
2. Electrical				
(A) Electrical Power Distribution				
(i) Turbo-Alternators. (MW)				
(a) Up to 10 MW	8/12	100	8/10	70
(b) 10 MW to 30 MW	4/6	140	3/5	90
(ii) Power Transformers (MVA)				
(a) Above 10 MVA (132/33, 132/6.6 33/11 and 33/6.6 KV)	130/140	2,030	100/110	1,500
(b) 1 to 10 MVA (33/6.6, 6.6/ 0.4, 11/3.3 and 11/ 0.4 KV)	230/240	780	160/170	645
(c) Up to 1 MVA (6.6/0.4, 3.3/0.4 and 11/0.4 KV)	270/280	150	150	84

	Fourth Plan		Fifth Plan	
	No.	Installed capacity	No.	Installed capacity
<i>(iii) HT Switchgear (MVA)</i>				
(a) 33 KV (1000/2500 MVA).	200/220	25,200	220/230	28,000
(b) 11 KV (500/350 MVA)	150/170	2,420	25/35	460
(c) 6.6 KV (250/400 MVA)	1000/1200	5,100	1100/1300	5,500
(d) 3.3 KV (150MVA)	350/370	820	50/70	135
<i>(iv) LT Switchgear (MVA)</i>				
400 V (40 KV)	2500/3500	1,260	1250/1350	550
<i>(v) Cables (Km)</i>				
(a) HT & LT Ca-HT bles (+1KV)LT (-1KV)		450/500 100,000		450/500 75,000
Lighting, Control and Communication cables.		2550/2600		1400/1450
(vi) Lighting (installed transformer capacity (MVA).		330/340		300/425
<i>(vii) Communication (Nos.)</i>				
(a) PAX lines		4200/4300		2400/2600
(b) VHF stations		100/120		40/50
(c) Speaker and Mike stations.		450/470		440/460
(d) Carrier Communication stations.		25/35		10/20

B. Electrical Items for different units of steel plants.

<i>(i) Rotating Machines (in KW)</i>				
(a) Above 400 V	900/950	754,200	580/600	578,200
(b) 400 V	74600/74800	778,500	62000/62100	634,400
(c) D.C.	9000/9100	943,000	11400/11600	985,000
<i>(i) Rectifiers (in KW)</i>				
	700/720	471,800	900/920	409,800

	Fourth Plan		Fifth Plan	
	No.	Installed capacity	No.	Installed capacity
(iii) Cables (in KM)				
(a) D.C.		1800/2000		2300/2400
(b) Control		1900/2000		800/900
(iv) Motor Control Centres (Nos.)	800/850		600/650	
(v) D.C. Switchgear (Nos.)	5,400		6,700	
(vi) Instrumentation (in million rupees).	82		54	

11. (i) A list of Broad Sections of the various Plant Units covered in these assessments is given in Annexure 'A'.

(ii) A typical list of equipment for 1 million ingot ton steel per year integrated steel plant is given in Annexure 'B'.

(iii) A typical list of equipment for 1.5 million ingot ton steel per year integrated steel plant prepared by Messrs. M. N. Dastur & Co. (P) Ltd., is given in Annexure 'C'.

12. This report is not exhaustive. Like all estimates, its findings are approximate.

ANNEXURE A.

Sections of Plant Units covered in the statements of this Report

I. Coke ovens and by-product plants

- (1) Coal Handling and Coal Yard.
- (2) Battery with machines, and quenching unit.
- (3) Coke screening and handling.
- (4) Gas condensation unit.
- (5) Ammonia recovery unit.
- (6) Benzol recovery unit.
- (7) Tar distillation plant.
- (8) Sulphuric acid plant.
- (9) Benzol rectification unit.
- (10) Benzol hydrorefining (for Rourkela unit only).
- (11) Phenol rectification unit (Rourkela).
- (12) Effluent treatment and services units.

II. Blast Furnace and Auxiliary Units.

- (1) Blast Furnace Plant.
- (2) Gas Cleaning Plant.
- (3) Gas Holder.
- (4) Sintering Plant.
- (5) Material Handling Plant and Raw Material Stock Yard.
- (6) Slag Processing Plant.
- (7) Pig Casting Machine.

III. Steel Making Plants

- (1) Steel Melting Shop Proper.
- (2) Oxygen Plant.
- (3) Lime and Dolomite Calcining Plant.
- (4) Dolomite Brick Plant.
- (5) Stripper Yard.
- (6) Mould Preparation Bay.
- (7) Scrap Yard.

IV. Rolling Mills

- (1) Soaking Pits.
- (2) Primary Mills.
- (3) Slab Reheating Furnaces.
- (4) Plate Mills.
- (5) Hot Strip Mills.
- (6) Rail Mills.

- (7) Heavy Structural Mills.
- (8) Medium Section Mills.
- (9) Billet Mills.
- (10) Merchant Mills.
- (11) Rod Mills.
- (12) Skelp Mills.
- (13) Wheel and Axle Plants.
- (14) Sleeper Plants.
- (15) Electrical Sheet Mills.
- (16) Hot Strip Finishing Lines.
- (17) Continuous Pickling Lines.
- (18) Single Stand Cold Mills.
- (19) 5-Stand Cold Mills.
- (20) 4-Stand Cold Mills.
- (21) Degreasing Lines.
- (22) Batch Annealing Furnaces.
- (23) Single Stand Temper Mills.
- (24) Continuous Annealing Lines.
- (25) Twin-Stand Temper Mills.
- (26) Cold Sheet Finishing Lines.
- (27) Electrolytic Tinning Lines.
- (28) Continuous Galvanizing Lines.
- (29) Roll Grinding Shops.

V. *Services*

- (1) Central Maintenance Shops.
- (2) Foundries.
- (3) Power and Blower House.
- (4) Interconnecting Services.

ANNEXURE 'B'

*A typical list of equipment for a million ton steel plant **

1. Coke Ovens

(1) *Coal Handling Plant*

Electromagnetic conveying chutes (feeders) capacity up to 80 tons/hr.	48 Nos.
Bunker gates	48 „
Steel charging hoppers	5 „
Electromagnetic feeders—Cap (100 T/hr.)	5 „
40 mm Resonance screens—Cap (200 T/hr.)	3 „
Double roll crushers—200T/hr.	3 „
Hammer mills—Cap. 200T/hr. to crush down to 80% under 3 mm.	3 „
Hammer mills to crush down to 90% under 3 mm.	2 „
Feeders for coke breeze to roller mills—capacity 10 T/hr.	2 „
Smooth roller mills for Coke Breeze Crushing—Capacity 8 Tons/hr.	2 „
Electromagnetic feeders Capacity—0-75 Tons/hr.	16 „
Do. 0-20 Do.	2 „
Mixing machines (Blending works) 200 T/hr.	4 „
Oil Storage Tanks	2 „
Belt Conveyors—Total length	1,732 metres.
Chutes, Motors for the equipment and Gantries for Conveyors.	
TOTAL WEIGHT	1,012 tonnes.

(2) *Coke Oven Batteries*

Bracing Steel work	210 ovens.
Oven doors	420 Nos.
Charging hole frames	1050 „

*Based on Rourkela Steel Plant.

Inspection hole frames	500 Nos.
Tracks for coke oven machines	1,585 m.
Trolley wires for coke ovens machines.	

Structural Steel Work.

Rich Gas Heating Equipment

Gas main from By-Product to Coke Oven Plant.	
Gas isolating valves dia. 400 mm	6 Nos.
M.S. Gas Distribution Mains under the ovens	
Gas pre-heaters	3 "
Explosion flaps	6 "
Double seal pots	6 "
Nozzle pipings	432 "
Cast Iron Waste Gas Fittings	222 "
Reversing Winches	6 "
Cast iron connection boxes	444 "

Lean Gas Heating Equipment

Gas distribution main 1,100/900 mm.	
Gas isolating valves	6 Nos.
Explosion flaps	6 "
Double drain pots	6 "
Connecting pipes dia. 200 mm to gas distribution mains and connection boxes.	222 "
Gas Collecting Mains width 1,600 mm. (per S shaped).	6 "
Mild steel flare pipes	12 "
Ascension pipes	210 "
Equipment for smokeless charging	
Four gas mains from the collecting mains up to the connecting point to By-product Plant.	
Governors and meters	
Chimneys 90 m. height	3 Nos.
Blast Furnace Gas Mains	
Belt Conveyors	93

Passenger and goods lift for service bunker	2 Nos.
Charging car weighing machines	2 "
Equipment for heating up	
Drinking water and quenching water mains	
Motors and other structural work	
TOTAL WEIGHT	5,715 tonnes

(3) *Coke Oven Machines*

(i) Pusher Machines	4 Nos.
(ii) Coke guide and door extractors	4 "
(iii) Coal charging cars	4 "
(iv) Quenching cars	4 "
(v) Quenching cars locos	4 "
TOTAL WEIGHT	1,136 tonnes

(4) *Coke Quenching Plant*

(i) Quenching towers	3 Nos.
(ii) Quenching water tanks	2 "
(iii) Centrifugal Pumps 200 cbm/hr. 25 metre head.	6 "
(iv) Drainage pumps	2 "
(v) Single rail telpher grabs	2 "
(vi) Fixed travel beams for telpher	2 "
(vii) Wharf gate equipment (175 gates)	
(viii) Coke guide plates 175 metres	
TOTAL WEIGHT	265 tonnes

(5) *Coke Screening*

(i) Resonance screens each 200 tons/hr. for 100 mm.	2 Nos.
(ii) Double-roll crushers 60 tons/hr.	2 "
(iii) Classifying screens 200 tons/hr. each.	2 "
(iv) Portable vibrating feeder 50 tons/hr.	1 No.
(v) Capstan Plant for Coke Tracks	1 "

(vi) Dust Extraction Plant Consisting of:

(a) Centrifugal exhauster	1 No.
(b) Centrifugal Pump	1 „
(c) Dry separators	2 Nos.
(d) Wet Separators	2 „
(e) Stacks	2 „
(f) Water filter	2 Nos.
(g) Worm Conveyors	2 „
(h) Piping etc.	

(vii) Belt conveyors with necessary chutes, motors etc. 486 metres.

TOTAL WEIGHT 510 tonnes.

GRAND TOTAL 8,637 tonnes.

2. By-Product Plant

A. Gas Condensation:

1. Primary coolers, cooling area 2,350 m ² each.	6 Nos.
2. Electrostatic Tar Precipitators	6 „
3. Coke Oven Gas exhausters, capacity 4,900 Nm ³ /hr. delivery pressure 1000 mm WG, suction pressure-400 mm WG, with turbines and other accessories.	3 „
4. Manually operated overhead crane, capacity 2 tons.	1 No.
5. Final gas coolers of the direct type with spraying equipment and other accessories.	2 Nos.
6. Tube and shell coolers for Recycle water.	12 „
7. Centrifugal pumps of varying capacities for Tar, Ammonia liquor and water.	10 „
8. Ammonia liquor flushing tanks capacity 105 m ³ with tar boxes.	2 „
9. Condensate Pit tanks capacity 75 m ³ with all connections.	2 „
10. Storage tanks for ammonia liquor and tar of 700 m ³ capacity.	2 „
11. Ammonia stage washers, having throughput 35,000 Nm ³ /hr.	2 „
12. 6 Tube and shell intensive coolers for ammonia liquor.	16 „
13. Tank for enriched ammonia liquor capacity 60 m ³ .	1 No.

14. Centrifugal recycle pumps for stage washers. . .	18 Nos.
15. Ammonia distillation columns, capacity 800 m ³ /day, made of cast iron.	3 „
16. Condensers for the above, made of cast iron . . .	12 „
17. Plant coolers for the above, made of cast iron . . .	3 „
18. Tank for concentrated ammonia liquor of capacity 100 m ³ .	1 No.
19. Centrifugal pumps for ammonia liquor	4 Nos.
20. Structures, pipelines, valves, fittings and other accessories.	
TOTAL WEIGHT	2,700 tonnes.

B. Medium Pressure Gas Compressor Plant.

1. Coke Oven gas compressors, capacity 22,500 Nm ³ .hr. delivery pressure 14 atm.g. and with three compression stages.	5 sets.
2. Manually operated overhead crane, span 29 m . . .	1 No.
3. Compressed gas coolers, tube and shell type	10 Nos.
4. Structures, pipelines, valves, fittings and other accessories.	
TOTAL WEIGHT	800 tonnes.

C. Benzol Recovery Plant

1. Medium pressure benzol scrubbers, with bubble cap trays, separators and other accessories, with gas throughput 70,000 Nm ³ /hr. at 14 atm. g.	2 Nos.
2. Tanks for spent wash oil, wash oil and crude benzol, with capacities 50 to 300 m ³ .	6 „
3. Pipe still furnace, of heating surface 190 m ² with burners, electric fan, cast iron fixing plates and other accessories.	1 No.
4. Benzol distillation column of cast iron with bubble cap trays.	1 „
5. Oil/oil, vapour/oil, tube and shell heat exchangers	11 Nos.
6. Intensive coolers for tube and shell construction for wash oil.	10 „
7. Centrifugal pumps for wash oil, light oil, spent oil and other products.	13 „

8. Reciprocating compressors for fresh coke oven gas and recycle gas, electrically driven.	4 Nos.
9. Heat exchangers and preheaters of tube and shell type.	6 „
10. Reactors having a catalyst volume of 3 m ³ each .	2 „
11. Reciprocating pumps for benzol and water . . .	4 „
12. Stage evaporator with two external reheaters .	1 No.
13. Distillation column with boiler, heat exchanger, condenser and other accessories.	1 „
14. Redistillation columns with bubble cap trays, heat exchanger and other accessories.	2 Nos.
15. Condensers and final coolers for the above. . .	3 sets.
16. Centrifugal pumps, of varying capacities . . .	6 Nos.
17. Batch distillation columns, capacity 20 m ³ for toluene and xylene.	2 „
18. Condensers with distribution trays and other accessories.	4 Nos.
19. Centrifugal pumps for reflux, residue and feeding of these columns.	8 „
20. Centrifugal pumps for pure products of varying capacities.	10 „
21. Storage tanks for pure products	6 „
22. Structures, pipelines, valves, fittings and other accessories.	
TOTAL WEIGHT	1100 tonnes

D. Hydrogen Sulphide Recovery And Sulphuric Acid Plant

1. Medium pressure hydrogen sulphide scrubber with bubble cap trays, gas throughput 70,000 Nm ³ /hr.	1 No.
2. Tanks for enriched and spent potash solution with capacity 60 m ³ .	2 Nos.
3. Hydrogen sulphide distillation columns with bubbles cap trays, recycle heaters condensers, vacuum separators and other accessories.	3 sets.
4. Tube and shell heat exchangers	20 Nos.
5. Tube and shell type intensive coolers	8 „
6. Vacuum pumps with electric drive	2 „

7. Centrifugal pumps with varying capacities for enriched and spent potash solution and condensate.	8 Nos.
8. Evaporator with heating system and accessories. .	1 No.
9. Centrifugal for recovery of crystallized potash .	1 „
10. Vessels and tanks of varying capacities . .	5 Nos.
11. Centrifugal pumps for potash solution . .	3 „
12. Hydrogen sulphide combustion furnace . .	1 No.
13. Waste heat boiler	1 „
14. Converter with cooling arrangements . .	1 No.
15. Absorption tower	1 „
16. Acid coolers	4 Nos.
17. Blowers for hydrogen sulphide and air . .	4 „
18. Centrifugal pumps for acid and water . .	4 „
19. Reciprocating pumps for boiler feed water. .	2 „
20. Storage tank for sulphuric acid, capacity 300 m ³ .	1 No.
21. Structures, pipelines, valves, fittings and other accessories.	
TOTAL WEIGHT . . .	850 tonnes

E. Tar Distillation Plant

1. Pipe still furnace for tar, with heating surface of 330 m ² , steel tubes, gas burners and other accessories.	1 No.
2. Distillation column of cast iron with bubble cap trays, condensers and other accessories.	5 Nos.
3. Heat exchangers, tube and shell type	9 „
4. Tanks and vessels of various capacities . . .	15 „
5. Steam driven reciprocating pumps for tar . .	4 „
6. Centrifugal pumps for tar, reflux and water .	14 „
7. Tanks for pitch and oils	6 „
8. Mixing vessels with agitators, capacity 20 m ³ .	2 Nos.
9. Centrifugal pumps for tar, and tar products .	5 „
10. Coolers with agitators for anthracene oil with capacity 15 m ³ each.	6 „
11. Semicontinuous centrifuges with electric drive	2 „

12. Tanks for naphthalene and anthracene oil with capacity 40 m ³	Nos.
13. Vessels with agitators for phenol	4 ,,
14. Pumps for various tar oils and sodium phenolate.	8 ,,
15. Tanks and vessels for hot water and oils	4 ,,
16. Screw presses with charging arrangement for naphthalene	3 ,,
17. Crystallizers for naphthalene	3 ,,
18. Distillation columns of cast iron for naphthalene .	2 ,,
19. Heat exchangers of the tube in shell type	8 ,,
20. Centrifugal pumps for tar oils of varying capacity	10 ,,
21. Storage tanks for tar and oils, capacity 100 to 700 m ³ .	7 ,,
22. Centrifugal pumps of varying capacities for carbolic oil, sodium phenolate and soda lye.	8 ,,
23. Steaming column with bubble cap trays	1 No.
24. Carbonizing towers with grates	2 Nos.
25. Heat exchangers of the tube in shell type	8 ,,
26. Complete line shaft kiln	1 No.
27. Tanks and vessels of varying capacities	14 Nos.
28. Centrifugal pumps of the immersion type with vertical shafts.	8 ,,
29. Centrifugal pumps for feeding stills and reflux of varying capacities.	12 ,,
30. Structures, pipelines, valves, fittings and other accessories.	
TOTAL WEIGHT	1700 tonnes

F. Gas Conveying and other Auxiliaries

1. Coke oven gas boosters, capacity 40,000 Nm ³ /hr., suction pressure 200 mm WG., discharge pressure 3000 mm W.G. with turbine.	3 Nos.
2. Centrifugal pumps for cooling water, capacity 1600 m ³ /hr.	6 ,,
3. Air compressors of the reciprocating type electrically driven.	3 ,,
4. Structures, pipelines, valves, fittings and other accessories.	
TOTAL WEIGHT	600 tonnes
GRAND TOTAL	7,750 Tonnes

3. Blast Furnace Plant (3×1000 Tonnes Furnaces)

One Blast Furnace, Three Stoves, One dust catcher and all auxiliaries of capacity 1,000 tons/day

Description	Nos. reqd.	Wt. in Tonnes,
1	2	3
1. Scale car	1	55
2. Coke feeding and handling complete with electrics	1	111
3. <i>Charging equipment complete</i>		
(a) Skip hoist with electrics	1	352
(b) Bell and Hopper Assy. with electrics	1	125
(c) Stock line indicator equipment with electrics	1	4
4. <i>Blast Furnace</i>		
(a) Complete furnace shell	1	1008
(b) Complete furnace cooling system	1 set	146
(c) Furnace fittings and mountings	1 „	31
(d) Working and tapping platforms runners	1 „	456
(e) Cast house complete structural steel work	1 „	273
(f) Electrically operated mud gun	1	11
(g) Tap hole drill	1	1
(h) Down takes	1 set	70
(i) Bell valve	1	23
(j) Dust catcher	1	260
(k) Crude-gas mains, steam and compressed air lines, water mains	1 set	425
5. <i>Cranes and Handling Equipment</i>		
(a) Lift for personnel and loads 750 kgm. capacity	1	22
(b) <i>Cranes</i>		
(i) Winch house crane of capacity 20 tons	1	
(ii) Crab above throat of capacity 25 tons	1	
(iii) Two-motor crab over rope sheave platform of capacity 10 tons	1	55
(iv) Travelling crane for the cast house of 15 tons capacity	1	
6. <i>Storage sand and bunker Plant</i>		
(i) Ore loading bridge	1	464
7. Blower (turbo)	1	
	(120,000/160,000 NcbM/hr.)	

	1	2	3
HOT BLAST STOVES			
1. Hot blast stove shells complete with platforms, stairs and other structural steelwork		3	591
2. Stove mountings		3 sets	196
3. Hot blast main and bustle pipe		1	83
4. Necessary pipings for three stoves, cold blast main, mixed blast and blow off mains.			232
5. Stack of plate steel		1	85
PIG CASTING MACHINE			
<i>One 2-strand pig casting machine complete with all auxiliaries with a capacity of 100 tons/hr.</i>			
1. 2-Strand pig casting machine complete with structural steel parts, machinery equipment and auxiliaries with electrics		1	435 (409+8.5+16+1)
2. <i>Cranes and handling equipment</i>			
(i) Electric three-motor overhead crane with magnet of carrying capacity 10 Tons		1	
(ii) Hand-operated overhead crane of 7.5 tons capacity		1	
GAS CLEANING PLANT			
<i>Two units, each consisting of one gas washer and one precipitator</i>			
1. Gas washer with internal water spray devices, water piping and valves		2	
2. Electrostatic precipitator with internal equipment, water and steam piping and valves		2	520 (Items 1-6)
3. Manually operated goggle valves for raw gas		2	
4. Butterfly dampers		2	
5. Manually operated goggle valves for clean gas		2	
6. Selenium power packs with automatic voltage regulation		2	
7. Equipment for one additional compartment for cooling tower:			
(i) Propeller with fluid drive		1	
(ii) Hot water pump with electrics		1	
(iii) Cold water pump with electrics		1	

4. Steel Melting Shop

Description	Nos. reqd.	Wt. in tonnes
1	2	3
1. 80-ton open hearth furnaces (excl. refractories) complete	4	2176
Doors, controls, technological structure, burners etc. Remaining items.		
2. 1100-ton hot metal mixers (excl. Refractories) complete	2	502
Instruments, controls, drives, shafts, etc. Shell and other remaining items.		
3. 40/50-ton L.D. converters (excl. Refractories) complete	3	915
Controls etc. Remaining items		
4. 80-ton hot metal ladles	20	440
5. 50-ton mixer metal ladles	4	56
6. 90-ton teeming ladles	8	176
7. 50-ton teeming ladles	15	208
Stopper rods for items 6 & 7	240	14
8. Ladles stands (Pairs)	12	104
9. 6 cam slag pots of Hematite iron	30	232.8
10. Slag pot lifting rings	30	58
11. Hot metal cars for 80-ton ladles	17	595
12. Slag pot transfer cars	15	232.8
13. Converter pouring cars	3	180
14. Slag pot cars for use under the Open Hearth Fur- nace.	4	69.9
15. 90-ton ingot cars	60	1280
16. Scrap charging box transfer cars	40	310
17. Buffer cars	8	66
18. Scrap chute transfer cars	3	42
19. 10-Ton weight hoppers	6	28

	1	2	3
20. Gates for overhead bins			13
21. Handling system for additions			100.
22. Cast steel charging boxes	160		372.8
23. Scrap chutes for L.D. converter scrap charging	20		19
24. Charging boxes for fluxes	10		8
25. Weighbridge (50 tons)	1		13
26. Weighbridge (30 tons)	1		9
27. Weighing machines (80 tons)	2		22
28. Weighing machines (1 ton)	3		22
29. Ladle drying stands	8		48
30. Stopper rod driers	3		51
31. Pneumatic hammers	2		16.6
32. Floor chargers	2		150
33. Passenger and freight lift (10 tons)	1		42
34. Dolomite thrower	1		55
35. Rotary compressors	3		12

CRANES

Main and auxiliary trolleys with electrical equipment, air conditioning units, buffers, cable drum and wiring, flexible coupling and anti-friction bearings.

Bridge structure, carriage, cabin, long travel gear, mechanical parts, gear boxes and guards.

The above categories of manufacture applies to all the following cranes:

36. 130/32 tons teeming cranes	2		496
37. 80/20 tons teeming cranes	2		372
38. 80/20 tons hot metal cranes	2		340
39. 130/32 tons mixer metal cranes	2		380
40. 12/5 tons crane for handling scrap chutes	1		31
41. 12/5 tons crane for scrap charging to the converter	1		44
42. 40/8 tons Semi-portal crane	1		66

	1	2	3
43. 10-ton travelling crabs		5	48
44. 5-ton bracket cranes for open hearth furnaces		4	24
MOULD PREPARATION BAY.			
45. 20-ton dogging cranes		2	236
46. 10-ton travelling crabs		2	194
47. Mould cooling beds		2	695
48. Portable mould-wash spray guns and tar reservoirs		4 & 2	4.3
49. Mould cooling tank		2	26
STRIPPER YARD			
50. 40-ton stripper cranes		2	512
Screw pressure arrangement			
Remaining items			
51. 10-ton travelling crabs		2	20
52. Mobile compressor		1	1.3
SCRAP YARD			
53. 10/5 Ton crane		1	70
54. 10-ton semi-portal cranes.		2	60
SKULL CRACKER			
55. 50/10 ton crane		1	94
DOLOMITE BRICK PLANT			
Press, crushers			
Moulding press			
DOLOMITE BURNING PLANT			
Raw dolomite conveying and crushing system.			
Kilns and coolers.			
Burnt dolomite crushing and cooling system.			
LIME BURNING			
Vertical shaft kilns			
Burners			
OXYGEN PLANT			
Air compression and air separation system.			
Storage tanks, pipings, steel structures, etc.			
MATERIAL CONVEYING FACILITIES			

5. Rolling Mills Section

Main Equipment

1. Ingot buggy Total weight 220 tons

2. *One 1200 mm. high lift Blooming and Slabbing Mill comprising:*

Main mill stand with manipulators and universal spindles.

One 3000-ton hydraulic shear

Interconnecting Roller Tables

Three slab pushers with transfer cars.

TOTAL WEIGHT 4500 tons

3. *3.1 m. single stand 4-high plate mill*

This mill consists of the following main equipment:

Slab pusher

Slab Transfer

3.1 m. Single Stand 4-high mill stand

Vertical Edger

Slab turning and working roller table

Centering devices

Approach and runout roller tables

TOTAL WEIGHT 2800 tons

4. *Plate Finishing Line*

(a) *The finishing line for plates from 5 mm. to 20 mm thickness comprising:*

Crop shear

Hot plate levellers

Cooling beds

Inspection beds

Rotary side trimming and slitting shear

Cross cut shear

Approach and delivery roller tables.

(b) *The finishing line for plates from 20 mm to 38 mm. thickness comprising:*

One side shear

Castor bed

Marking carriage

Plate piler crane

Cold plate leveller

Approach roller and delivery roller tables

- (c) For plates above 38 mm. thickness, there is a flame cutting machine.

TOTAL WEIGHT (a+b+c) . . . 7000 tons

5. 1700 mm. wide Hot Strip Mill comprising

- One 2-hi scale breaker
- One 4-hi reversing stand
- One 4-hi non-reversing stand
- Six 4-hi finishing stands
- Connecting roller tables
- Two sub-floor coilers
- One piler

TOTAL WEIGHT 10400 tons

6. Strip Finishing Lines:

(a) One coil strip Finishing Line comprising:

Uncoiling machine, depiler, leveller, trimming and slitting shear, cross cut shear, plate piler, pinch rolls, coiler and intermediate roller tables.

(b) One Strip Trimming and Shearing Line, comprising:

Decoiler, depiler, cold plate levellers, rotary trimming and slitting shear, cross cut shears, shear depressing tables, plate turnover device, side piler, roller tables and weighing machines.

TOTAL WEIGHT (a+b) 2000 tons

7. One pickling plant comprising:

One coil ramp, one coil positioner, one uncoiling and straightening machine, one crop shear, one welder with stitcher, pinch roll units, looping pits, four pickling tanks with pumps and heat exchangers, two rinsing tanks, hot air dryer, dividing shear, side trimmer, oiler, roller table, two up-coilers and one coil conveyor, one mixing and proportioning unit with pumps, one continuous neutralisation plant, one vacuum crystallisation plant, one cooling tower and one boiler plant.

TOTAL WEIGHT 1555 tons

8. 1700 mm. Cold Rolling Mill, comprising:

Coil ramp, uncoiler, pinch roll unit, one 4-high stand, recoiler coil carriage and coil ramp.

TOTAL WEIGHT (incl. item 12) 1900 tons

9. 1200 mm. 4-hi Cold Reducing Mill, Comprising:

Coil ramp, uncoiler, pinch roller, 4 high stand, recoiler and accessories.

TOTAL WEIGHT (incl. item 13) 1605 tons

10. *Electrolytic Degreasing line, comprising:*

Coil ramp, coil buggy, uncoiler, welder, preliminary scrubber, cleaning cell, finishing scrubber, hot rinse tank, hot air dryer, pinch roll units, up-coiler and belt wrapper.

TOTAL WEIGHT 220 tons

11. *Annealing Plant, comprising:*

32 single stack annealing furnaces, 96 annealing bases, 96 protective hoods, 43 cooling hoods, connectors, two sheet annealing furnaces with six bases, protective atmosphere producer and storage unit.

TOTAL WEIGHT 1500 tons

12. *1700 mm. Skin-pass Mill, comprising:*

Coil ramp, uncoiler, 4-hi skin pass roll stand, recoiler and coil ramp and accessories.

TOTAL WEIGHT Included in item 8.

13. *1200 mm. Skin-pass Mill, comprising:*

Coil ramp, uncoiler, 4-hi skin pass roll stand, entry and delivery puller sets and recoiler and accessories.

TOTAL WEIGHT Included in item 9.

14. *Two Autobody Sheet Shearing Lines, each comprising:*

Coil ramp, coil buggy, uncoiler, pinch roll, side trimmer, scrap coiler, flying shear, runout conveyor, leveller, piler, oiler.

15. *Tinplate Shearing Line, comprising:*

Coil ramp, coil buggy, uncoiler, trimmer, scrap coiler, flying shear and piling device.

TOTAL WEIGHT (14+15) 460 tons

16. *Six Hot Dip Tinning Lines, each comprising:*

Entry pack conveyor, sheet feeder, magnetic electrolytic pickler, tinning machine, wet washer, dry cleaner, conveyors and pilers.

TOTAL WEIGHT 510 tons

17. *Lubrication system for mills.*

APPENDIX II

GOVERNMENT OF INDIA

MINISTRY OF INDUSTRY AND SUPPLY

DIRECTORATE GENERAL OF TECHNICAL DEVELOPMENT

1. There are several Reports submitted by various parties showing the capital equipment required for a one-million ton Steel Plant, or a 1.5 million ton Steel Plant. The Report submitted by Messrs. Dastur & Co. refers to the equipment required for 1.5 million ton Steel Plant. This is given in Annexure 'C' of the Report prepared by the Working Party under the Chairmanship of Mr. R. P. Sinha of the Central Engineering and Design Bureau. (This Report does not give the weights of the equipment.)
2. On the other hand, we have a Report received for the Rourkela Plant, which shows the complete list of mechanical equipment required for a 1 million ton Steel Plant as installed at Rourkela. This list is produced in our Report at Annexure 'A'. We have also considerable data regarding the equipment that was installed at Bhilai. This particular data regarding Bhilai Equipment is available in "group weights", and gives us a good chance of comparing and study by weight of equipment as supplied to Rourkela and Bhilai. The weight study shows that the weight of the equipment in the Rolling Mill, Blast Furnaces, Coke Oven and By-product Plants are varying, and generally the weight of Russian equipment is higher than the German equipment.
3. As far as the Structural side is concerned, *the total amount of Structure as reported in the Rourkela Report comes to 75,000 tons, against the total quantity of Structures required in Bhilai Plant being over 100,000 tons.* The preliminary rough study of these two reports show, that the equipment list prepared for Rourkela does not include all the structures, while in Bhilai Report even the structures required for all the Auxiliary shops are also included. So, for our Planning purposes, we are assuming, that the requirement of Structural for a 1 million ton Steel Plant, will be 100,000 tons. It is also noted that, while Bhilai has about 4,000 tons of Sintering Plant, Rourkela has no Sintering Plant. This particular equipment is, therefore, added by us in the Rourkela Report List, to show the total tonnage required for 1 million ton Steel Plant. The difference of 5,000 tons between the weight of the equipment in Bhilai and the equipment at Rourkela perhaps is partly covered by this weight of this Sintering Plant.
4. In our Report, we are not giving the details regarding the equipment supplied at Bhilai. The Report of Mr. Sinha's Working Party already gives the list of equipment for a typical one million ton Steel Plant in Annexure 'B'. Tonnages given in that Annexure 'B' of Mr. Sinha's Report also fairly compares with the tonnages in the Report for the Bhilai Plant particularly in the Rolling Mills side.

5. On the basis of these studies of various equipments given in these Annexures, and Reports regarding the 1 million ton Steel Plant, and 1.5 million ton Steel Plant, we have tried to arrive at a decision about "the grouping of equipment in weights" from the point of view of creating manufacturing capacities. It is remarked in this connection, that the tonnage of equipment even for a 1 million ton Steel Plant, will vary to some extent upon the particular design, particular pattern of production, particular method of production etc. But for our Planning Purposes the following analysis of the equipment on the "group basis" should be good enough for the processing of the case.

6. As discussed above, and after modifying Appendix "A" on the basis of study of the Report of Mr. Sinha's Working Party and after studying the Bhilai Report, the total list of mechanical items which will be required for a 1 million ton Steel Plant can be divided into the following categories:—

Sl. No.	Name of item	Total Weight in tonnage
1.	Coal Handling Plant	1,012
2.	Coke Oven Batteries	5,715
3.	Coke Oven Machine	1,135
4.	Coke Quenching Plant	265
5.	Coke Screening	510
6.	By-product Plant	7,750
7.	Blast Furnace Plant complete	13,808
8.	Steel Melting Shop	12,279
9.	Rolling Mill	*36,670
10.	Sinter Plant	4,000
11.	Piping	6,500
		89,644
	Pure Structural Steel work for Steel Mills	100,000
		189,644

*Bhilai figure for Rolling Mills comes to 46,000 tons. This tonnage usually depends on the pattern of end-products.

7. It will be noticed, that the weight of the *mechanical equipment, including technological structurals*, in 1 million ton Steel Plant, comes to 89,644 tons; and the *weight of the pure structurals comes to 100,000 tons*

8. The above figures do not include the weights of electrical equipment. *This does not include the weights of other purchased items either—like conveyors, weigh bridges, locomotives and host of other items.*

9. For the purposes of creating indigenous capacity, the above list has to be re-grouped as under:—

List of equipment required for Steel Plants

- (i) Heavy Machinery equipment proper.
- (ii) Composite machinery items *i.e.*, structural-cum-machinery units like cranes, etc.
- (iii) Heavy technological structurals like Blast furnace shells, stoves, Dust Catchers, Heavy Structural Units of Gas Cleaning Plant, etc.
- (iv) Light technological structurals like assession mains of coke ovens, all types of low pressure Gas Mains, electric static tar precipitators, low pressure gas mains of all types, by-product equipment like Naphthalenes scrubbers, Benzol Plant equipment, storage tank of various capacities etc.
- (v) Pure structural items like building columns, run-away girders, roof trusses, heavy storage bins etc.
- (vi) Steam generating and allied equipment.
- (vii) Electrical and power plant equipment.
- (viii) (a) Pumps of low capacity of 2,000 lt. per minute.
(b) Pumps of high capacity of over 2,000 lt. per minute.
(c) Acid pumps of all types.
(d) Hydraulic pumps and oil pumps.
- (ix) Conveyors of all types with belt width 300 to 600, 600 to 1,200 and over 1,200 mm.
- (x) (a) Winches power driven of all types up to 10 tons.
(b) Hoists rails of all types 2 to 5 tons.
(c) Tackles power driven one ton to 5 tons.
- (xi) Fans ventilators and conditioners of 500 to 15,000 m³/h.
- (xii) Welding equipment—all types of transformers and motor generator sets.
- (xiii) (a) Power driven transfer trucks, trollies, dump cars, etc.
(b) E.O.T. cranes medium 5 tons, 10 tons to 20 tons, 15 to 50 tons.
(c) Hand operator cranes/Jib-cranes—one to 5 tons.
(d) Mast cranes 1 to 5 tons.
- (xiv) Laboratory equipment and measuring instruments/equipments.
- (xv) (a) Machine tools (light)—lathe, drill, shaper, miller and grinder.
(b) Machine tools heavy/Verticle lathe, boring, heavy drilling machines, etc.
(c) Roll turning lathes of various capacities.

- (xvi) All types of re-heating furnaces, annealing furnaces, galvanizing units, etc.
- (xvii) (a) Electric locomotives.
(b) Diesel locomotives.
- (xviii) Valves—gas, air, water and steam valves of all types and pressures. We understand that H.E.L. are organised to manufacture many types of Valves. There are other indigenous manufacturers also in the field.
- (xix) Lubrication equipment required for centralized lubrication of Rolling Mills.
- (xx) Miscellaneous equipment like Road making and repairing equipment, motor repairing and maintenance and all types of non-standard items which are not included in above.

10. MANUFACTURING CAPACITY AVAILABLE

A. POWER AND ELECTRICAL EQUIPMENT:

The power and electrical equipment in a steel plant constitutes a very sizeable portion. *In terms of value this forms 15 to 20% of the total cost of steel mill machinery.* The bulk of the electricals falls within the scope of the Heavy Electricals (India) Ltd. although a variety of items forming the lighter items for which manufacturing facilities are being developed in the various privately-owned industries.

In the field of heavy electrical equipment manufacturing facilities are being created taking into account the overall requirements of the country including those required for the steel mills. Thus we are setting up in the public sector three major Heavy Electrical Plants at Bhopal, Hardwar and at Hyderabad. The Bhopal plant which has gone into production includes in its programme the manufacture of about 300,000 KW of industrial motors, 6.0 million EVA of power transformers and a variety of Control Gears and Switch Gears required for the power system distribution. The Bhopal unit also provides for the manufacture of rectifiers. The Hardwar plant on which the construction work has just begun will manufacture about 515,000 KW of electric motors. As explained by Shri Krishnamurthy in Annexure 'E' the manufacture of electric motors at the Hyderabad plant is oriented towards meeting the requirements of the Heavy Machine Building industry. *The requirements of Turbines and Turbo generators for the captive power plants in the steel mills are programmed for manufacture at Hyderabad plant.*

Expansion programmes in this sector also include additional manufacturing facilities for electric motors at the Hyderabad Plant and the setting up of a fourth Heavy Electrical Plant which, among other things, would include large industrial motors.

It is clear from the above that the development in the field of Heavy Electricals manufacture takes into account fully the requirements of the principal power and electrical equipment for the metallurgical plants.

For the lighter equipment which falls below the range of Heavy Electrical (India) Ltd., facilities are being created and are also being added to in a number of privately-owned industrial establishments and these will take care of the requirement of the distribution equipment power cables, LT Switch Gear, Lighting installations, etc.

X9 (D6,9) : 75.2.N6t
109247 / K6

In an earlier discussion on the question of indigenous availability of equipment for the Bokaro Steel Plant, Shri K. B. Mathur, Chairman, Heavy Electricals, had generally assured that it would be possible to meet the requirements of power and electrical equipment for Bokaro largely from indigenous sources and with reference to the delivery schedule demanded by Bokaro he had thought that about 40% of the total cost of the electrical equipment would have to come in the form of imported components. The developments in the field of manufacture of heavy electrical equipment generally confirms this view expressed by the Chairman, Heavy Electricals.

So far as Transformers, Switch Gears and a variety of electrical distribution equipment are concerned, the manufacture in this country has developed in such a way that the complete requirement during the 4th Plan Period for steel plants could be procured indigenously. In regard to the Rotating machines, however, Bhopal unit has stated manufacture this year in a small way and the Hardwar plant will go into manufacture early in 1965. Taking into account the gestation period needed for this industry for the development of full capacity in these plants it should be assumed that Hardwar and Bhopal together will be able to meet the demand of electrical drives for a two-million ton development from the year 1968-69 onwards. In this connection the Working Party would like to point out that while assessing the requirement of plant and equipment for steel mills by Shri Sinha's Working Party they have indicated a figure of 4.24 million KW of D.C. Rotating machines during the 5th Plan period. *This works out to an average of 423,000 KW of D.C. Rotating Machines per million ton steel plant. Compared with the figure of 96,000 KW indicated by Shri Krishnamurthy of Heavy Electricals—vide Annexure 'E'—the figure given in Sinha's Report appears excessively high.* A rough check has been made with the Bokaro Report of M/s M. N. Dastur & Co. and it is found that for the 1.5 million tons stage of Bokaro the total D.C. Rotating Machines was given as about 106,000 KW. *This Group, therefore, is of the view that for a million ton steel plant the quantity of D.C. Rotating Machines will be only about 100,000 KW.*

The Working Party have noted that the Heavy Electricals (India) Ltd. propose to include in the manufacturing programme at Hyderabad Turbo Blowers needed for the blast furnaces. As already stated this plant is designed for making smaller industrial turbines, the turbine itself forming roughly 40% of the cost of a complete Turbo Blower. The technology of manufacture of Turbo Blowers being allied to that of steam turbines, M/s Heavy Electricals are presently negotiating with their collaborators for the progressive production of the Blowers also at their Hyderabad plant. *The Working Group recommends that the studies in this regard should be completed quickly and a decision taken as there are no manufacturing facilities for the manufacture of this type of Turbo Blowers.*

B. MANUFACTURE OF HEAVY MECHANICAL EQUIPMENTS IN THE PUBLIC SECTOR:

The HEC is equipped to manufacture all the heavy machinery items required for the steel plants. Since the detailed scope of the work of HMBP is already included in the Detailed Project, we are not elaborating the same. Their capacity at its full production will be 80,000 tons per year of which 64,500 tons is for steel plants. The split-up of this capacity year-wise is shown in Appendix 'C' which is a very important Appendix of this Report and study of which will be helpful in understanding this Report.

C. MANUFACTURE OF HEAVY MECHANICAL EQUIPMENT IN THE PRIVATE SECTOR:

M/s Utkal Machinery Manufacturing Ltd. are also licensed for manufacturing heavy equipment required for supply to the steel mills. They have a licensed capacity of 12,000 tons per year. However, since they are engaged in the manufacture of diverse equipment like paper machinery, cement machinery, etc. it is reckoned that their contribution by way of supply of the equipment to steel plants will not exceed 4,000 tons of machinery per year. As they stand today they are equipped to manufacture only Blast Furnace Section and By-product units.

D. MANUFACTURING CAPACITY FOR MINOR ITEMS:

Apart from these two firms, there are many private sector factories supplying equipment like *cranes, technological structurals, conveyors, weight bridges, pumps, pure structurals and other items*. Our comments about these are given below in para 11 under various heads.

E. MANUFACTURING CAPACITY FOR BOILERS:

The position regarding the Boiler Industry is shown in Annexure 'D' where the production programme of factories licensed for the manufacture of Boilers and the progress made by them is shown quite clearly. From this, it will be seen that even in the field of Boilers, the requirement of Steel Industry could be met out of the existing and planned capacity for the manufacture of Boilers in the Public and Private Sector factories in the country. The major contribution that could be made in this field is by our Boiler Plant at Tiruchi, and by AVB Plant at Durgapur. The production of high pressure valves is also planned to be taken up in our Boiler Plant at Tiruchi. But there are a number of allied equipment required for installation on the steam generating equipment which are not yet properly planned and special thought will have to be given in creating the capacity for these items.

II. SOME COMMENTS ON THE MANUFACTURING CAPACITY AVAILABLE IN THE COUNTRY ON VARIOUS TYPES AND GROUPS OF MACHINERY.

(a) *Composite Machinery Items*.—Some of the items like Hot Metal Mixer, Heavy Overhead Cranes, part of Blast Furnaces where the machinery items go into the structurals, steel and iron laddles, etc, are included within the scope of HMBP. Utkal Machinery Ltd. is also organized to manufacture the above types of equipment.

(b) *Heavy Technological Structural Equipment*.—The Utkal Machinery is organized to manufacture this type of machinery, VOEST Plant at Wardha will be able to handle these types of jobs. HMBP is also organised to manufacture this.

(c) *Light Technological Structurals*.—There is shortage of capacity in particular line. Except Utkal and some selected units in the private sector others having smaller structural shops are not in a position to take up the work of these technological structurals. *It is because of this, that in the later part of the Report we have recommended establishing additional capacity for this type of fabrication and also recommended to give higher priority for the scheme submitted by Ranchi for establishing a 25,000-ton Structural Shop for producing Technological structurals.*

(d) *Pure Structural*.—The capacity in the pure Structural field is also limited and is fully booked. If we wish to create a capacity in the country for supplying to two steel plants, per year (from now onward when we refer to a steel plant we shall mean a "one million ton" steel plant) we shall need 200,000 tons of structurals per year only for supply to the new steel mills.

(c) *Pumps*.—The pumps of normal capacities are available in the country. However, the bigger pumps, oil pumps, acid pumps, etc., are not available and capacity will have to be created for these items.

(f) *Conveyors*.—There is sufficient capacity created in the country for the manufacture of conveyors. The two major manufacturers of conveyors are Elecon and Tata Frazers. The requirement of the Steel Plant will be only 3,000 tons of Conveyors per year which could easily be met from these plants.

(g) *Winches, Hoists and Tackles*.—The capacity in the country is not enough to produce power-driven Winches, Hoists, Tackles, etc. though the small capacities in this field do exist in the country.

(h) *Fans, Ventilators, Conditioners, etc.*—There is enough capacity existing in the country.

(i) *Welding Equipment*.—While some welding transformers are available in the country the capacity is not enough. The capacities for motor generators are being created. This item could be included in the plant, together with the programme for Hoists, Winches, etc.

(j) *Transfer-trucks, trollies, dump cars, etc.*—Capacities will have to be created for electric Transfer Trucks, Trollies, Dump Cars, special types of fire-fighting equipment etc.

(k) *E.O.T. Cranes—Light and Medium Type Cranes, Hand Cranes, Mast Cranes, etc.*—There is not enough capacity for the manufacture of medium and heavy cranes and particularly the Steel Mill cranes. Of course the HEC is expected to produce the steel mill cranes but even then there will be serious shortage in this field.

(l) *Laboratory equipment and Measuring Instruments*.—This has to be further studied even though quite a large number of laboratory equipments can be procured indigenously.

(m) *Machine Tools*.—While sufficient capacity exists for lighter machine tools, special attention will have to be paid for boosting up the production of heavy machine tools. The machine tools required for two Steel Plants may aggregate to about 300 machine tools. Special efforts should be made for the production of Roll Turning Lathes which are not at present planned for production in any of the machine tool plants proposed to be established in the Fourth Plan Period.

(n) *Furnaces*.—We have given a number of licences for the manufacture of various types of furnaces including the heating furnaces, annealing furnaces, the soaking pits and other equipment. The German, British and American manufacturers are already here in the country. The only thing is, that all of them will have to expand their activities two and three folds and build up their plants to cope up with the increased

demand for furnaces required for two steel plants per year by the end of the Fourth Plan period. It may be worth our while to call a meeting of the furnace manufacturers and take a stock of their capacities. We should check-up as to which of the designs are good in producing slab re-heating furnaces, bloom re-heating furnaces, electrical and gas-fired furnaces. If after this study we do not get confidence about the programme of these existing furnace manufacturers, perhaps we could plan a unit in the public sector for the production of furnaces. The same plant could perhaps also take up the production of galvanising plants, patenting furnaces, etc.

(o) *Electrical and Diesel Locomotives.*—It is taken for granted that the Railway Workshops would be in a position to cope up with the demand of diesel and electric locomotives required for the steel plants.

(p) *Valves.*—*Gas, Air, Water and Steam of all types of pressures.*—This is partly included in the Heavy Electrical projects and there is capacity available in the country for low pressure valves. *However, special types of goggle valves, water cooled two-way valves for furnaces, etc. can be included in the production of shops producing lighter type of technological structures.*

(q) *Lubrication Equipment.*—Lubrication equipment, required for centralized lubrication systems of the Rolling Mills, forms a very important element of the Steel Mill Equipment. *We shall have to have a special plant for producing this equipment.*

(r) *Miscellaneous Items.*—It is presumed that there is enough manufacturing capacity in the country. In any case, these are expected to be of low tonnages and can be left to private entrepreneurs to meet the demands of the steel industry from time to time.

12. From the report of Mr. R. P. Sinha's Working Party, who have assessed the requirements of the steel plants and equipment of the country during the fourth and fifth Plan periods, it is observed that our total requirements of steel plant come to approximately equal to two steel plants of one million ton capacity each per year. While Mr. Sinha's Working Party has shown, that the demand during the Fifth Plan might go down slightly, our assumption is, that the development in the Fourth Plan will be slower than what we have visualized and the spill over of the demand of the fourth plan into the fifth plan period, will keep up the demand for the equipment of the steel plant in the country at the rate of "equipment for two plants (with the capacity of one million tons each) per year". We have, therefore, in our report assumed that we will have to create manufacturing capacity in the country to supply two one-million ton steel plants per year. This will mean that we shall have to create heavy machining and fabricating capacity aggregating to about 180,000 tons per year, including heavy technological structurals of 36,000 tons per year; and in addition a structural capacity aggregating to 200,000 tons per year, to meet only the steel plant requirements. We should also note, that there will be a gestation period for the industry to attain its full capacity the period depending upon the type of industry, anywhere from three to ten years. The maturity of the orders placed on the manufacturing organizations, will be only after two to three years after the placement of the orders. Further, in the initial stages, a large import of components will have to be resorted to, to complete the complicated manufacturing programmes of the above industries.

13. The proposed production programme of the Heavy Machine Building Plant from 1966 to 1972, giving details of the production at

Ranchi, together with the imported components required for completing one million ton plant, and the tonnages of equipment that will have to be sub-contracted, have been shown in the Annexure 'C'. This was submitted by the representatives of the HEC, and which we understand has been discussed in detail with the Soviet Experts who are at present at Ranchi in connection with the drawing up of the Perspective Ten-Year Plan for the Heavy Machine Building Plant. In Annexure 'F', HEC has also given a very broad analysis of equipments for one million ton steel plant. This has already been commented earlier into details, while grouping the equipment.

14. The detailed study of Annexure 'C' submitted by the HMBP at Ranchi for the manufacture of heavy equipment will show that, though their ultimate capacity for manufacture of heavy equipment will be 80,000 tons of machinery per year, at this stage, they are in a position to draw the production programme only up to 1971-72. Between the years 1966-67 and 1971-72, they will be in a position to manufacture a total of 125,000 tons of equipments, together with 13,000 tons of imported materials, making a grand total of 138,000 tons of machinery that they will supply from their Works. This manufacturing capacity will again have to be matched largely by imports and installations of complete sections of steel plants, (the details of which have to be determined from year to year depending upon the type of installations to meet the end products), if we decide to give orders to Ranchi to co-ordinate and supply complete Steel Plants during the 4th Plan period.

15. During the 4th Plan Period, HEC will be able to contribute much more in the fields of Blast Furnace Complexes and Melting Shops, rather than in the field of Rolling Mills. Suppose an order for 3 complete Steel Plants (each with a capacity of one Million Tons) is given to HEC, to be delivered during the 4th Plan Period, they will manufacture in the next 6 or 7 years about 125,000 tons of machinery in their own Works. 13,000 Tons components will be imported by them, to sustain this production. Over and above this, they will sub-contract for supply of equipment from indigenous sources which will aggregate to about 55,000 tons. Over and above this, as written above, the major portions of Rolling Mills and such heavy sections of the Steel Plants will have to be imported during the 4th Plan Period. For executing orders for 3 Steel Plants, and for other work at H.E.C., such imports will aggregate to about 222,300 tons. *So, in order to make full use of H.E.C's capacities, they should not only be given orders for 3 complete Steel Plants, but also about 4 additional Blast Furnace Complexes with Coke-Ovens and By-Products and 4 additional Melting Shops for 4 Steel Mills.*

16. The total foreign exchange that will be required by HEC (including the foreign exchange required for imported rolling mills of the 3 Steel Plants proposed to be delivered by HEC) comes to Rs. 190 crores.

17. From an analysis of the reports submitted by HEC, it is learnt that starting with the Blast Furnace and Coke Oven manufacture, the production capacity will be progressively increased taking over manufacture of rolling mills, unit by unit, every year. Even in 1971-72 they will reach only 12,500 tons of production of rolling mills against the requirements of about 90,000 tons of rolling mills during that year (for 2 million tons plants per year). *This means that HMBP will contribute only 15% of total requirements for the rolling mills of the country, the rest being imported from abroad even in the last, year of the 4th Plan (or obtained from other sources to be created during the 4th Plan period).*

18. Though in the above paragraph we have tried to focus the attention on the gap that exists in the "Machining capacity" in the "rolling mill" side, we know that the pattern of the demand of equipment for the Steel Plant in the field of rolling mill by 1971-72 may change slightly. *It is quite possible, that by 1971-72, we shall be scrapping the use of the Blooming Mills, and would introduce the latest huge continuous Casting Machines.* This change which is already introduced by the U.S.S.R. is bound to come into this particular field even in this country. But even if this development takes place, the other Rolling Mills Structural Mills, Merchant Mills, Slab Mills, Plate and Sheet Mills, and the other special mill requirements will still have to be supplied by H.E.C. So, our demand of Rolling Mills, though may go down below 90,000 tons per year, as is visualized to-day, will not appreciably go down; and, therefore, additional capacity to meet this additional demand, will have to be set-up.

19. With the development of the L.D. process, the necessity for creating a capacity for manufacturing complete Oxygen Plants, assumes special emphasis. The L.D. process because of its low cost of production has definitely come to stay, and majority of the future steel melting units will be equipped on these lines. *It is, therefore, necessary that an independent unit manufacturing complete Oxygen Plants should be established. H.M.B.P., Voest Scheme, and other Plants, should be ready to deliver the technological structurals and shells for the Vessels of the L.D. Plants.*

20. Now the question arises as to how this gap could be filled in, for meeting the entire demand of the country for installing two Steel Plants per year (of one million ton capacity each).

21. We had discussed this point in our Working Group. One of the very important conclusions which we have arrived at, is the need for co-operation among the existing manufacturers in the country for supplying complete equipments in various Departments of Steel Plants.

22. As it is, Heavy Engineering Corporation are well equipped for fabricating the mechanical portion of the Blast Furnaces like the Charge Distributor, the Loading Mechanism, Bell Hoisting Winch, Big Bells, Small Bell Hoppers, Mud Guns and such mechanical equipments. While they have no capacity at present for manufacturing shells of Blast Furnaces, Skip Hoists Structures, Stoves, and other plate work required for completing the Blast Furnace unit. On the other hand, Utkal Machinery are already equipped for fabricating the Heavy Plate and similar work and have already taken up the work for supplying Blast Furnaces Shells and Stoves for Rourkela Plant as sub-contractors to the main German suppliers. They are also going to supply Heavy Structural and Heavy Plate Work and other equipment. If the Steel Ministry decides to give an individual order for one or two Blast Furnaces to Utkal Machinery, they will be in a position to make these Blast Furnaces, Structural, Plate Work etc. but almost 55% by value of the components and equipment of the Blast Furnaces will have to be imported by them from West Germany. We will have the problem of finding foreign exchange for giving to Utkal Machinery for completing their orders for such two Blast Furnaces.

23. On the other hand, if we give orders for the complete Blast Furnaces to H.E.C., they will have to go in search of capacity in the country or import the Heavy Plate & Structural Work, like Blast Furnace Shells etc. for which they are not equipped. This will show that the capacities created in both these units are quite complimentary to each other.

24. The same is true with respect of these indigenous capacities *vis-a-vis* complete By-product plants. Our rough estimates are that by this type of co-operation if an order for manufacturing complexes is placed to-day for say 4 or 6 complete Blast Furnace Complexes including Coke Ovens, By-product Plant, almost 85 to 90% of the equipment could be produced in the country from 1968-69 onwards, supplying at the rate of one complex per year for one steel plant of 1 million ton capacity. This will effect saving of foreign exchange of almost Rs. 9 to 10 crores per year for a 1 Million Ton Plant.

25. Utkal Machinery are already booked with orders for miscellaneous items from other sources for about 2 years for Heavy Plate and Structural work. If we wish to make use of their capacity for the Steel Industry, this is the time for us to give the orders for manufacture of complete Blast Furnaces Complexes as referred above. Since major designs may be supplied by H.E.C., perhaps orders for four Complexes of Blast Furnaces could be placed on H.E.C. They could sub-contract with the Utkal Machinery for supply of all the heavy and light type of technological structurals. Likewise orders for two Complexes could be placed on Utkal Machinery who would in turn sub-contract with H.E.C. for manufacture of machinery parts as per their designs. This is with the view to gaining experience of two independent designs from two different countries and also cover the requirement of Pig Iron production for which establishment of complete complexes are necessary. probably with a smaller capacity Blast Furnaces say 1000 tons each.

26. As far as the lighter technological structurals are concerned, already there is a proposal made by H.E.C. to establish a separate Structural Shop at Ranchi, which, if implemented at high priority, would come into operation by the time the deliveries of these Blast Furnace Complexes begin in 1968-69.

27. The total value of a Blast Furnace Complex which includes a Blast Furnace, Coke Oven, and By-product will come to anywhere between Rs. 12 and 13 crores. So, the delivery from these two units from 1968-69 could be considered to be at the rate of Rs. 12 to 13 crores per year of these items plus of course the part rolling mills and melting shop equipment that will be produced by H.E.C.

28. The other important Conclusions that we have arrived at are as under:—

I. The gestation period of putting up a very Heavy and Big Projects like H.E.C., is very long; and such big projects will show results, only after 5 to 7 years. Full capacity in such plants would be achieved perhaps only after 10 years or so.

II. Since we are planning to develop Heavy Foundry Forge capacity at Ranchi, and since we have decided to instal the 6,000 ton Press at Ranchi, it will be more logical for us to remove the 'smaller items' of equipment which were planned to be produced at Ranchi from the Production Programme of Ranchi, and include them in the production programme of some smaller machine building Plants to be established in the other States. For example, it is no use Ranchi concentrating on meeting the demand of Steel Equipment for the Steel Plants, and at the same time, trying to manufacture a few Excavators in their Plant. Excavator production could perhaps be transferred to some other plant. The same way, Oil Drilling Equipment or smaller Cranes and such items could be shifted from Ranchi to make room for building up heavier equipment at Ranchi, in greater tonnage.

III. The expansion of Heavy Machine Shop at Ranchi should be considered so that the machining capacity for producing Rolling Mills and other Heavy Equipment could be increased at Ranchi. *Even after taking into account the fact that we may introduce continued casting process in place of the Blooming Mills, the total tonnage required for Machining Rolling Mills and other heavy equipment will be substantially higher than 35,000 tons for which the present Heavy Machine Shop of Ranchi is designed. By expansion of Ranchi in this way, we shall be in a position to contribute more in the field of Rolling Mills and other heavy equipment. We recommend that the increased capacity may be planned at about 120,000 to 130,000 tons/year.*

IV. A second Ranchi type of Project will have to be started at some other place—not of the same size as Ranchi but with a modest size—and with a capacity of say 30,000 to 40,000 tons of machinery per year.

This smaller Public Sector Project could be conceived for the manufacture of smaller capacity Rolling Mills, to relieve Ranchi of the load of producing smaller Rolling Mills, like the Merchant Mills and other lighter Machinery. Other requirements of the Smaller Mills of the country, could also be then met from this Smaller Machine Building Plant.

V. While Ranchi is being planned for producing Steel Melting Equipment like Open Hearths etc., the new trend in our planning for Steel Mills as referred earlier will be more in the field of L. D. Vessels; where larger and larger capacity Vessels, will have to be produced in the country. While we are already contemplating to get these manufactured in a Public Sector Project in collaboration with VOEST: the main emphasis of that particular project being on "Heavy Structural", Ranchi may have to be loaded even with fabrication of Vessels for L.D. Convertors. Since the trend is to have bigger and bigger L.D. Convertors, the Heavy Press and Machinery capacity created at Ranchi will have to be harnessed for the manufacture of Vessels for L.D. Convertors.

Apart from the production of Coke Ovens, the production of By-product Plants, Blast Furnaces etc. will have to be boosted up.

We would, therefore, suggest that even after removing some of the smaller items from the Production Programme of Ranchi and introducing them in the production programmes of some of the other smaller public sector Projects in some places in the country, the other total capacity of Ranchi will have to be increased from 80,000 tons/year to at least 120,000 to 130,000 tons per year. This includes the ideas expressed in III above.

Likewise, enough manufacturing capacity should be established to meet the demands of lighter type of technological equipment including the by-product plant. We understand that the H.E.C. is submitting a proposal for a 25,000 tons structural shop to meet partially the demands of this type of equipment. This unit should be immediately established and should be advised to concentrate on the light type of technological equipment.

VI. Apart from this, we will have to have 6 smaller Projects each with a capacity to produce 6,000 tons to 10,000 tons per year of machinery and other lighter technological structures and equipment for contributing in the fields like By-product Plants, Blast Furnaces, Coke Ovens, Cranes, Laddles, Locomotives, etc. The production Programme

of these six units could be selected from 20 items of equipment listed in para 9 above. Some of these plants could be organised by the State Governments, but some of them could even be in the Private Sector. The main idea is that all these plants will seek their requirements of castings and forgings etc. from the 3 bigger Foundry Forge Shops that are being installed in the Public Sector. These Plants would have only the Pressure Vessel Shops and Machine Shops and Assembly Shops, and would bring designs from various sources in the World, and produce equipment as per the requirements of the Design Bureau of the Steel Ministry, and supply individual items for contributing in the completion of the Steel Plants. The same small plants could also contribute in the supply of equipment for other industries, each one specialising in selected lines.

VII. In order to meet the demand of 200,000 tons of pure structurals, we have to create at least 4 Public Sector projects (State Government owned Projects) for manufacture of heavy and medium structurals. These should be public sector projects since the private sector, has not come up with proper expansion of their plans and design organisations. These units can be started with a capacity of 20,000 to 25,000 tons of structurals per year.

29. Our recommendations in the nutshell form for meeting the additional demands of Metallurgical equipment for steel plant expansion, therefore, will be as follows:

(i) Expansion of Ranchi Heavy Machine Building Plant by increasing the manufacturing capacity from 80,000 tons per year to 120,000 or 130,000 tons per year.

(ii) To establish "Second Ranchi Unit" with a manufacturing capacity of 30,000 to 40,000 tons per year.

(iii) Immediate establishment of the 25,000 tons structural shop at Ranchi for partially meeting the light type of technological equipment structurals.

(iv) Six Plants mainly manufacturing medium weight steel Plant Machinery and equipment and light type of technological structurals, with capacities ranging from 6,000 to 10,000 tons per year. These must have capacity to increase the production at a later date to 20,000 tons per year.

(v) Immediate establishment of the heavy type of structurals as proposed to be put up in collaboration with VOEST.

(vi) Four more normal structural plants each with a capacity of 20,000 to 25,000 tons totalling a capacity of 100 thousand tons of structurals per year.

(vii) Manufacturing capacity to be set up for complete manufacture of large tonnage Oxygen Plants.

(viii) Separate unit for manufacturing of hoists of various types power driven winches and welding equipment.

30. The compressor and pump plant proposed under the Public Sector should be speeded up, and should be advised to manufacture all higher capacity pumps required for steel plants and compressors for Oxygen plants and Steel plants. They may include within their production programme some of the equipment like manufacture of Acid pumps, Hydraulic Pumps, low Pressure Gas Boosters, etc.

31. The Heavy Machine Tool Plant should be advised to manufacture Heavy Machine Tools required specially for steel industry. They should include in their production programme, Roll turning lathes, as there is no capacity at present in the country for this item. If necessary, the capacity of Heavy Machine Tool Plant could be increased to meet the requirements of steel industry.

32. We should note here, that the requirements of all the castings and forgings will be met from the Three Centrally run Foundry Forge Plants that are being set up. These Plants should be able to supply the Grey Iron steel and non-ferrous castings, and high carbon and alloy steel forgings.

33. Total Investment Costs for establishing the additional manufacturing capacity as proposed.

(i) The expansion of the Ranchi Project will be Rs. 24 crores with an imported machinery of Rs. 8 to 10 crores.

(ii) The "Second Ranchi Plant" to produce 30-40,000 tons per year will cost about Rs. 30 crores. Imported machinery being Rs. 12 crores (approximately). (We have not included Foundry Forge Capacity in this. If added, the total cost will be Rs. 75 crores, with an imported equipment of Rs. 30 crores).

(iii) The establishment of the 25,000 tons structural shop at Ranchi will be Rs. 3 crores with an imported component of Rs. 85 lakhs.

(iv) The Heavy Structural Shop proposed at Wardha in collaboration with VOEST will cost say about Rs. 5.5 crores with Rs. 250 lakhs of imported equipment.

(v) Four more structural plants of capacity 20-25,000 tons per year will cost about Rs. 16-18 crores with an imported component of Rs. 4-5 crores.

(vi) Six plants of 6-10,000 tons per year capacity will cost about Rs. 24 crores with an imported equipment of about Rs. 14 crores.

(vii) The large tonnage Oxygen Plant will cost about Rs. 3 crores with an imported component of Rs. 150 lakhs.

(viii) The compressor Pump Plant has already been sanctioned.

(ix) Separate unit for manufacturing of Hoists and other equipment will cost about Rs. 2 crores with Rs. 100 lakhs as the imported components.

(x) We have no figures for the Heavy Machine Tool Plant expansion as such to meet the special requirements of the Steel Plant. In any case, it is not expected to be beyond a total of Rs. 7 crores with an imported component of about Rs. 2 crores.

Our estimated total cost of installation of the entire manufacturing capacity mentioned above will be about Rs. 116.5 crores or say 120 crores with an imported equipment amounting to Rs. 46 or say Rs. 50 crores.

34. The average sale price of products proposed to be manufactured in our various above referred Plants could be taken as the following:—

(1) Pure Structural's will be Rs. 1700 per ton.

(2) Heavy and Light Technological structural's—Rs. 3,500 per ton.

- (3) Composite structural-cum-machinery units—Rs. 6,000 per ton.
 (4) Pure Heavy Machinery—Rs. 8,000 per ton.

35. For a Million Ton Steel Plant, we may need about 100,000 tons of pure structurals, 22,000 tons of heavy and light technological structurals, 6,000 tons of composite structurals-cum-machinery units and about 62,000 tons of Pure Heavy Machinery.

So, when we shall produce Two Complete Steel Plants in our Works as referred above, we shall produce machinery worth about Rs. 160 crores.

The Foreign Exchange required for maintaining above production, as out-lined in the above shops, in the Course of progressive manufacture in the 4th and 5th Plan Periods is not expected to increase more than 15% average, over the whole period. In the initial stages we may have to import as high as 30 per cent to 40 per cent of the components required for maintaining the production.

36. In the body of the Report, we have already mentioned, that if a Consortium approach is made, and orders for six Blast Furnaces are given to Heavy Machine Building Plant at Ranchi, and Utkal Machinery Rourkela, jointly and immediately, the contribution by these two firms for supplying these six Blast Furnace Complexes consisting of complete Blast Furnaces including Coke Oven Batteries and By-product Plants, will come to @ one Complex per year aggregating in value to about Rs. 12 crores per year from 1968-69 onwards. Over and above this, of course the H.M.B.P. will make small beginning in the field of Melting Shop manufacture and some machining of Lighter Rolling Mills. But this contribution will be very negligible in the year 1968-69.

37. In order to judge the contribution that H.M.B.P. and Utkal will make in saving for foreign exchange during the 4th Plan Period, we have given the data in a tabular form in Table No. 1. It may be seen from this Table No. 1, that the existing capacities at H.M.B.P., Ranchi and Utkal Machinery at Rourkela will contribute in producing Steel Equipment aggregating in value to about Rs. 121 crores during the 4th Plan period. The total foreign exchange that they will need for executing this production of Rs. 121 crores in these two Plants, will come to about Rs. 15½ crores (for imports of components and raw materials etc.).

38. In the same way, if our recommendations for expanding the capacity of Ranchi from 80,000 to 120/130,000 tons is accepted and implemented, and if we establish a "New Ranchi Project" at some other place in the country with a capacity of 30,000 to 40,000 tons of production of machinery per year, and if we establish the six smaller plants, as referred in the body of our Report, 4 Structural Plants, one Large Tonnage Oxygen Plant etc., as per our recommendations, by the end of the 5th Plan, we shall have the capacity to produce two complete Steel Plants per year (including all the equipment at the rate of about 85% to 90% of indigenous content). This will mean that all these plants—including Ranchi, New Ranchi, Utkal Machinery and all other Plants together will produce machinery at the rate of about Rs. 160 crores worth of machinery per year.

39. We have already pointed out in the previous paras of our Report that additional investment proposed by us will come to about Rs. 120 crores for establishing these New Plants. Ranchi has already planned to invest about Rs. 40 crores in the present H.M.B.P. Plant. Other

Private Sector Plants including Utkal Machinery, Conveyor manufacturing plants and others might have invested about Rs. 20 crores or so. So, the total investment that will have to be harnessed by us for supplying equipment to the Steel Plants, at the rate of *two Steel Plants per year*, will come to about Rs. 180 crores. This will give a production of machinery of about Rs. 160 crores per year by the end of the 5th Plan.

40. How the built-up will be effected during the 5th Plan period to achieve the rate of production of Rs. 160 crores worth of machinery per year, in the last year of the 5th Plan, is *not* shown yearwise. But we have tried to show the build-up of the production in tonnages, at Ranchi as well as by the expanded capacity of Ranchi, and at the works of the "New Ranchi" to be established at a new place, in a curve form. This curve can show the build-up of tonnage yearwise, during the 4th Plan and 5th Plan periods. This curve is shown in Table No. 2 (attached herewith). The total tonnage that will be achieved by 1976 in these two fully expanded plants, will come to 160,000 tons of machinery per year. This curve is worth studying from the point of view of gauging contribution that Ranchi will make during the periods of the 4th Plan and the 5th Plan.

DR. B. D. KALELKAR,
Dy. Director General (Engg.)
D.G.T.D. (Convener)

M. KRISHNAMURTHY,
CPO/HMBP, Heavy Engg. Corpn. Ltd.

B. D. MALANI,
Genl. Manager, Utkal Machinery Ltd.

V. KRISHNAMURTHY
Chief (P & D) Heavy Electricals Ltd.

NEW DELHI,
Dated 18th July 1964.

S. K. SINHA
Industrial Adviser (Engg.) D.G.T.D. (Out of India)

TABLE NO. 2

THE CURVE SHOWING THE BUILDING-UP OF PRODUCTION OF EQUIPMENT IN TONS PER YEAR IN THE H.M.B.P. AT RANCHI & AT NEW RANCHI PLANT.

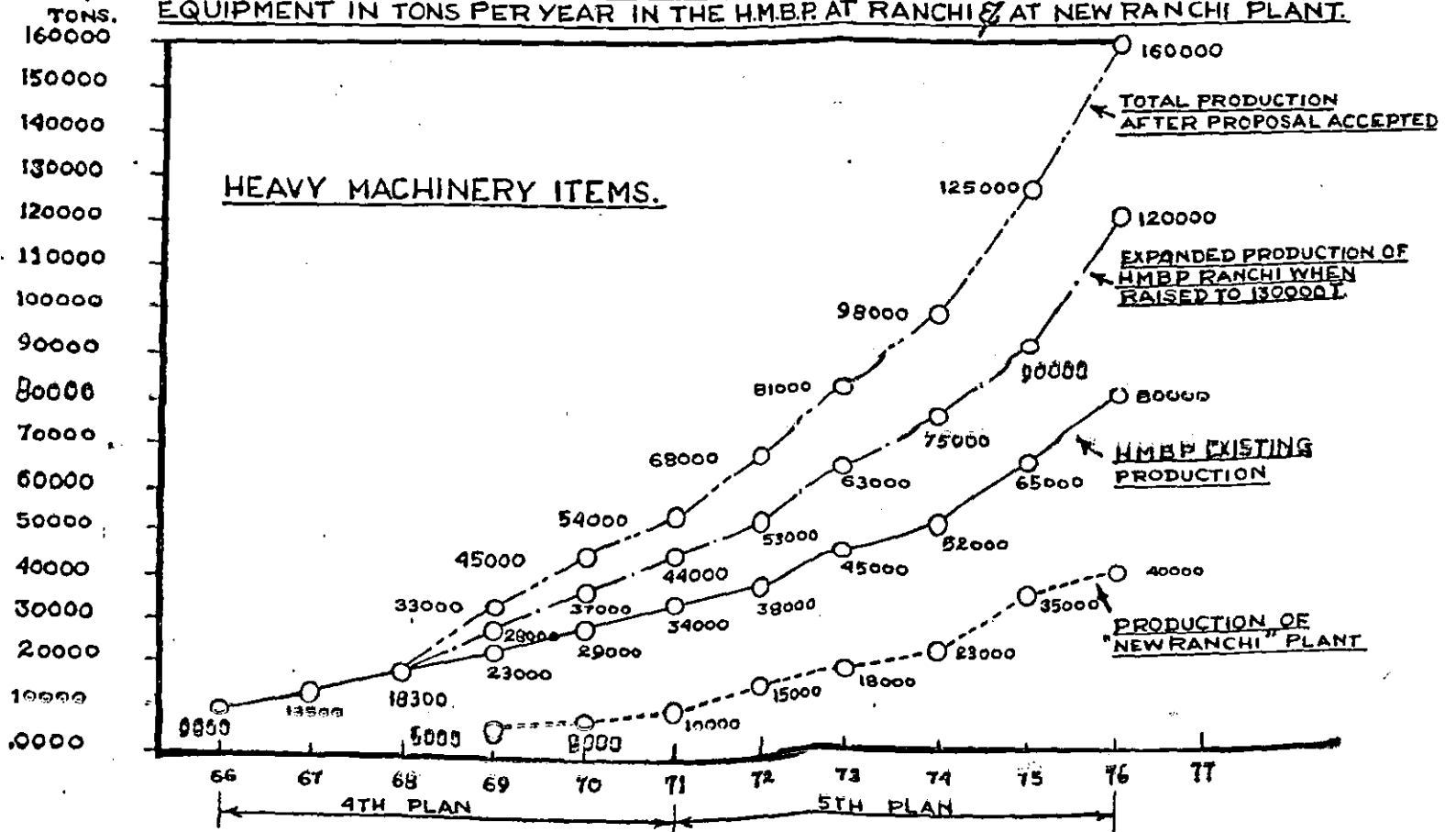


TABLE NO. 1

Total Production during the 4th Plan, Period (From existing capacities).

Sl. No.	Unit.	Manu- factured in Tons.	Cost in Rs. crores.	Imported Components		Total value of Production		Remarks
				Tons.	Cost in Rs. crores	Tons.	Cost in Rs. crores	
1.	Heavy Machine at Rs. 8,000/ton (RANCHI).	1,25,000	100	13,000	10.4	1,38,000	110.4	
2.	Heavy and Light Structural at Rs. 3,500/ton (UTKAL MACHI- NERY).	16,000	5.6	6,400 (40% im- ported).	5.12	22,400	10.72	If orders are placed on UTKAL by March, 1965 they can be expected to produce in the last 4 years of 4th plan.
TOTAL					15.52	1,60,400	121.12	

ANNEXURE 'A'

Equipment for the 1 Million ton Steel Plant at Rourkela

Coke Ovens

(1) Coal Handling Plant:

Local McNally & Kumardhubi combines complete section.	{	Electromagnetic conveying chutes (feeders) capacity upto 80 tons/hr.	48 Nos.
		Bunker gates	48 "
		Steel charging hoppers	5 "
		Electromagnetic feeders—Cap (100 T/hr.)	5 "
		40 mm Resonance screens Cap. 200 T/hr. .	3 "
		Double roll crushers—200 T/hr(HEC)	3 "
		Hammer mills cap.—200 T/hr. to crush down to 80% under 3 mm. (HEC).	3 "
		Hammer mills to crush down to 90% under 3 mm. (HEC).	2 "
		Feeders for coke breeze to roller mills capacity—10 T/hr.	2 "
		Smooth roller mills for coke breeze Crushing-Capacity—8.Tons/hr.	2 "
		Electro-magnetic feeders capacity—	
		0-75 tons/hr.	16 "
		0-20 "	2 "
		Mixing machines(Blending Works) 200 T/hr.	4 "
		Oil Storage Tanks	2 "
Belt Conveyors—Total length	1,732 metres.		
Chutes, Motors for the equipment and Gantries for Conveyors. Total weight. .	1,012 Tonnes.		

(2) Coke Oven Batteries:

Structural fabricators HEC	{	Bracing Steelwork for L	210
		Oven doors L	420 Nos.
HEC	{	Charging hole frames L	1,050 "
		Inspection hole frames L	
		Tracks for coke oven machines	1,585 m.
		Trolley wires for coke ovens machines	
L Structural fabricators.	{	Structural Steel Work	
		Motors and other structural work	

TOTAL WEIGHT 5,715 tonnes

Rich Gas Heating Equipment:

L	Gas main from by-product to Coke oven Plant.	
L HEC	Gas isolating valve dia. 400 mm	6 Nos.
	M.S. Gas Distribution Mains under the ovens	
	Gas pre-heaters	3 ,,
	Explosion flaps	6 ,,
	Double seal pots	6 ,,
L	Nozzle pipings	432 ,,
L	Cast Iron Waste Gas Fittings	222 ,,
HEC	Reversing Winches	6 ,,
L	Cast Iron Connection boxes	444 ,,

Lean Gas heating equipment:

	Gas distribution main 1,100/900 mm	
L HEC	Gas isolating valves	6 Nos.
	Explosion flaps	6 ,,
	Double drain pots	6 ,,
L	Connecting pipes dia. 200 to gas distribution mains and connection boxes.	222 ,,
L	Gas collecting mains width 1600 mm (pear SS shaped)	6 ,,
	Mild Steel flare pipes	12 ,,
	Ascension pipes	210 ,,
	Equipment for smokeless charging	
L	Four gas mains from the collecting mains upto the connection point to by-product Plant.	
	Governors and meters	
L	Chimneys 90 m height	3 ,,
	Blast Furnace Gas Mains	
L	Belt Conveyors. CMM, Elecon, Dynacraft, McNally, Tata and Others.	93 metres.
L	Passenger and goods lift for service bunker-OTIS & others.	2 Nos.
	Charging car weighting machines	2 ,,
	Equipment for test coal feeding of charging car at the battery end.	
	Equipment for heating up.	
L	Drinking water and quenching water mains	
	Motors and other structural work	

TOTAL WEIGHT

5,715 tonnes.

(3) *Coke Oven Machines:*

L	1. Pusher Machines. AEC, McNally and Kumardhubi.	4 Nos.
L	2. Coke guide and door extractors. HEC, McNally and Kumardhubi.	4 ,,
L	3. Colar charging cars HES, McNally and Kumardhubi.	4 ,,
L	4. Quenching cars HEC, McNally and Kumardhubi.	4 ,,
L	5. Quenching car locos. McNally and Kumardhubi.	4 ,,
TOTAL WEIGHT		1,135 tonnes.

(4) *Coke Quenching Plant:*

L	1. Quenching Towers	3 Nos.
L	2. Quenching water tanks. (Structural fabricators).	2 ,,
L	3. Centrifugal pumps 200 cbm/hr. 25 meter head (Kirloskar, Jyoti and others).	6 ,,
	4. Drianage pumps (Kirloskar, Jyoti and others).	2 ,,
	5. Single rail telpher grabs	2 ,,
	6. Fixed travel beams for telpher	2 ,,
	7. Warf-gate equipment (175 gates)	
	8. Coke guide Plates 175 meter	
TOTAL WEIGHT		265 tonnes.

(5) *Coke Screening:*

L	1. Resonance screens each 200 tons/hr. for 100 mm. (HEC).	2 Nos.
L	2. Double-roll crushers 60 tons/hr. (HEC, McNally, Utkal).	2 Nos.
L	3. Classifying screens—200 tons/hr. each (McNally, Utkal).	2 ,,
L	4. Portable vibrating feeder—50 tons/hr. (McNally and Kumardhubi).	1 ,,
	5. Capstan Plant for Coke Tracks	1 ,,
	6. Dust Extraction Plant consisting of	
	(a) Centrifugal exhauster	1
L	(b) Centrifugal Pump (Kirloskar, Jyoti and others).	1
	(c) Dry Separators	2
	(d) Wet Separators	2
	(e) Stacks	2

(f) Water filter	1
(g) Worm Conveyors	2
(h) Piping etc.	
7. Belt conveyors (Elecon, Dynacraft and Others) with necessary chutes, motors etc.	406 metres.
TOTAL WEIGHT	510 tonnes.
GRAND TOTAL	8,637 tonnes.

Equipment for the 1 Million ton Steel Plant at Rourkela

By-Product Plant

(Utkal in collaboration with Koppers)

	Description	Nos.	
A. Gas Condensation:			
	1. Primary Coolers, cooling area 2350 m each.	6	} JESSOP & Co. BURN & Co.
	2. Electrostatic Tar Precipitators	6	
	3. Coke Oven Gas Exhausters, capacity 4900 Nm ³ /hr. delivery pressure 1000 mm WG, suction pressure—400 mm WG, with turbines and other accessories.	3	
L	4. Manually operated overhead crane, capacity 12 tons.	1	
	5. Final gas coolers of the direct type with spraying equipment and other accessories.	2	
	6. Tube and shell coolers for Recycle water.	12	
L for water	7. Centrifugal pumps of varying capacities for Tar, Ammonia liquor and water.	10	
L	8. Ammonia Liquor, flushing tanks capacity 105 m ³ with tar boxes.	2	
L	9. Condensate Pit tanks capacity 75 m ³ with all connections.	2	
L	10. Storage tanks for ammonia liquor and tar of 700 m ³ capacity.	2	
	11. Ammonia stage washers, having throughout 35,000 Mm ³ /hr.	2	
	12. 6 tube and shell intensive coolers for ammonia liquor.	16	
L	13. Tank for enriched ammonia liquor capacity 60 m ³ .	1	
	14. Centrifugal recycle pumps for stage washers.	18	

	Description	Nos.	
	15. Ammonia distillation columns, capacity 800 m ³ /day, made of cast iron.	3	} UTKAL
	16. Condensers for the above, made of cast iron.	12	
	17. Plate coolers for the above, made of cast iron.	3	
L	18. Tank for concentrated ammonia liquor of capacity 100 m ³ .	1	
	19. Centrifugal pumps for ammonia liquor.	4	
L	20. Structures, pipelines, valves, fittings and other accessories.		
	TOTAL WEIGHT	2,700	tonnes.

B. Medium Pressure Gas Compressor Plant

	1. Coke Oven gas compressors, capacity 22,500 Mm ³ /hr. delivery pressure 14 atm. and with three compression stages.	5 sets	} UTKAL
L	2. Manually operated overhead crane Span 29 m (Jessop, Burn, Texmaco etc.).	1	
	3. Compressed gas coolers, tube and shell type.		
	4. Structures, pipelines, valves, fittings and other accessories.	10	
	TOTAL WEIGHT	800	tonnes.

C. Bensol Recovery Plant

	1. Medium pressure Benzol scrubbers, with bubble cap trays, separators, and other accessories, with gas throughput 70,000 Mm ³ /hr. at 15 atm. G.	2	} UTKAL
L	2. Tanks for spent wash oil, wash oil and crude Benzol, with capacities 50 to 300m ³ .	6	
	3. Pipe still furnace, of heating surface 190 m ² with burners, electric fan, cast iron fitting plates and other accessories.	1	
	4. Benzol distillation column of cast iron with bubble cap trays.	1	
L	5. Oil/oil, vapour/oil, tube and shell heat exchangers.	11	
	6. Intensive coolers of tube and shell construction for wash oil.	10	
	7. Centrifugal pumps for wash oil, light oil, spent oil and other products.	13	
	8. Reciprocating compressors for fresh coke oven gas and recycle gas, electrically driven.	4	
	9. Heat exchangers and reheaters of tube and shell type.	6	

	Description	Nos.	
L for water	10. Reactors having a catalyst volume of 3m ³ each.	2	} UTKAL
	11. Reciprocating pumps for Benzol and water.	4	
	12. Stage evaporator with two external reheaters.	1	
	13. Distillation column with boiler, heat exchanger condenser and other accessories.	1	
	14. Redistillation columns with bubble cap. trays, heat exchanger and other accessories.	2	
L for water	15. Condensers and final coolers for the above.	3 sets	
	16. Centrifugal pumps, of varying capacities.	6	
	17. Batch distillation columns capacity 20 m ³ for toluene and xylene.	2	
	18. Condensers with distribution trays and other accessories.	4	
	19. Centrifugal pumps, for reflux, residue and feeding of these columns.	8	
L L	20. Centrifugal pumps for pure products of varying capacities.	10	
	21. Storage tanks for pure products.	6	
	22. Structures, pipelines, valves, fittings and other accessories.		

TOTAL WEIGHT 1100 tonnes.

D. Hydrogen Sulphide Recovery and Sulphuric Acid Plant

L	1. Medium pressure hydrogen sulphide scrubber with bubble cap trays, gas throughout 70,000 Mm ³ /hr.	1	} UTKAL
	2. Tanks for enriched and spent potash solution, with capacity 60 m ³ .	2	
	3. Hydrogen sulphide distillation columns with bubble cap trays recycle heaters condensers, vacuum separators and other accessories.	3 sets	
	4. Tube and shell heat exchangers	20	
	5. Tube and shell type intensive coolers	8	
	6. Vacuum pumps with electric drive.	2	
	7. Centrifugal pumps with varying capacities for enriched and spent potash solution and condenser.	8	
	8. Evaporator with heating system and accessories.	1	
	9. Centrifugal for recovery of crystallized potash.	1	

	Description	Nos.	
	10. Vessels and tanks of varying capacities	5	} UTKAL
	11. Centrifugal pumps for potash solution	3	
	12. Hydrogen sulphide combustion furnace	1	
	13. Waste heat boiler	1	
	14. Converter with cooling arrangements	1	
	15. Absorption tower	1	
	16. Acid coolers	4	
L for water	17. Blowers for hydrogen sulphide and air	4	
	18. Centrifugal pumps for acid and water	4	
	19. Reciprocating pumps for boiler feed water.	2	
	20. Storage tank for sulphuric acid, capacity 300 m ³ .	1	}
L	21. Structures, pipelines, valves, fittings and other accessories.		

TOTAL WEIGHT 850 Tonnes

E. Tar Distillation Plant

	1. Pipe still furnace for Tar, with heating surface of 330 m ² steel tubes, gas burners and other accessories.	1	} UTKAL
	2. Distillation column of cast iron with bubble cap trays, condensers and other accessories.	5	
	3. Heat Exchangers, tube and shell type	9	
	4. Tanks and vessels of various capacities	15	
	5. Steam driven reciprocating pumps for tar.	4	
L for water	6. Centrifugal pumps for tar, reflux and water.	14	
L	7. Tanks for pitch and oils	6	
	8. Mixing vessels with agitators, capacity 20 m ³	2	
	9. Centrifugal pumps for tar, and tar products.	5	
	10. Coolers with agitators for anthracene oil with capacity 15 m ³ each.	6	
	11. Semicontinuous centrifuges with electric drive.	2	
L	12. Tanks for naphthalene and anthracene oil with capacity 40 m ³	4	
L	13. Vessels with agitators for phenol	4	
	14. Pumps for various tar oils and sodium phenolate.	8	
L	15. Tanks and vessels for hot water and oils.	4	
	16. Screw presses with charging arrangements for naphthalene.	3	
	17. Crystallizers for naphthalene	3	
	18. Distillation columns of cast iron for naphthalene.	2	
	19. Heat exchangers of the tube in shell type.	8	
	20. Centrifugal pumps for tar oils of varying capacity.	10	

	Description	Nos.	
L	21. Storage tanks for tar and oils capacity 100 to 700 m ³ .	7	} UTKAL
	22. Centrifugal pumps of varying capacities for carbolic oil, sodium phenolate and soda lye.	8	
	23. Steaming column with bubble cap trays	1	
	24. Carbonizing towers with grates.	2	
	25. Heat exchangers of the tube in shell type.	8	
L	26. Complete lime shaft kiln McNally, kumardhubi.	1	} UTKAL
	27. Tanks and vessels of varying capacities	14	
	28. Centrifugal pumps of the immersion type with vertical shafts.	8	
	29. Centrifugal pumps for feeding stills and reflux of varying capacities.	12	} UTKAL
L	30. Structures, pipelines, valves, fittings and other accessories.		
TOTAL WEIGHT . . .		1700	Tonnes

F. Gas conveying and other auxiliaries

	1. Coke oven gas boosters, capacity 40,000 m ³ /hr. suction pressure 200 mm WG discharge pressure 3000 mm W.G. with turbine.	3	} UTKAL
L	2. Centrifugal pumps for cooling water, capacity 1600 m ³ /hr.	6	
L	3. Air compressors of the reciprocating type electrically driven K.G. Khosla Kirloskar etc.	3	
L	4. Structures, pipelines, valves, fittings and other accessories.		
TOTAL WEIGHT . . .		600	Tonnes
GRAND TOTAL . . .		7750	Tonnes

Equipment for the one million ton steel plant at Rourkela Blast Furnace Plant

(3 × 1000 Tonnes Furnaces) } UTKAL in collaboration with G.H.H.

One Blast Furnace, Three stoves, one dust catcher and all auxiliaries, of capacity 1000 tons/day.

		Nos. required	Weight in Metric Tons.	
L	1. Scale Car	1	55	} UTKAL
	2. Coke Feeding and Handling complete with electrics	1	111	

		Nos. required	Weight in Metric tons.		
L	HEC	3. Charging Equipment Complete	1	} UTKAL	
		(a) Skip Hoist with Electrics	1		352
		(b) Bell and Hopper Assy. with Electrics.	1		125
		(c) Stock line Indicator Equipment with Electrics.	1		4
		4. Blast Furnace	1		
		(a) Complete Furnace Shell	1		1008
		(b) Complete Furnace Cooling system.	1 set		146
		(c) Furnace fittings and Moutings.	1 set		31
		(d) Working and Tapping Platforms, Runners.	1 set		456
		(e) Cast House complete structural steel work.	1 set		273
		(f) Electrically operated mud gun.	1HEC		11
(g) Tap Hole Drill	1	1			
(h) Down Takes	1 set	70			
(i) Bell valve	1HEC	23			
(j) Dust-Catcher.	1	260			
(k) Crude-gas Mains, steam and compressed Air Lines, Water, Mains.	1 set	425			
5. Cranes and Handlings Equipments:					
L		(a) Lift for personnel and loads—OTIS & others 750 kgs. capacity.	1	22	
Garden Reach Texamco Jessop, Burn New Standard HEC	}	(b) Cranes		} 55	
		(i) Winch house crane of capacity—20 tons.	1		
		(ii) Crab above throat of capacity 25 tons.	1		
		(iii) Two Motor Crab rope sheave platform of capacity 10 tons.	1		
		(iv) Travelling crane for the cast house of 15 tons capacity.	1		
6. Storage Yard and Bunker Plant:					
L		Ore Loading Bridge	1	464	
		7. Blower (Turbo) Davidson (120,000/160,000/ncbm/hr)			
TOTAL WEIGHT				3892 tons	

Equipment for the one million tons steel plant at Rourkela hot blast stoves

		Nos. required	Weight in Metric tons	
L for structural work.	1. Hot blast Stove shells complete with platforms-stairs, and other structural steel work.	3	591	} UTKAL

		Nos. required	Weight in Metric tons	
L partly	2. Stove Moutings . . .	3 sets	186	} UTKAL
	3. Hot Blast main and Bustle pipe	1	83	
	4. Necessary pipings for three stoves, cold blast main, clean gas main, mixed Blast and blow off mains.		232	
L	5. Stack of plate steel . . .	1	85	
TOTAL WEIGHT . . .		1177		

Equipment for the one million tons steel plant at Rourkela big casting Machine

One 2-strant pig-casting machine complete with all auxiliaries with a capacity of 100 tons/per hour

		Nos. required	Weight in Metric tons	
L	1. 2-Strand pig casting Machine complete with structural steel parts, machinery equipment and auxiliaries with electrics.	1	435 (409 8.5 + 16.1)	} UTKAL
L	2. Cranes and Handling equipment:			
	(i) Electric three-Motor over-head crane with magnet of carrying capacity 10 tons.	1		
	(ii) Hand operated over-head crane of 7.5 tons capacity.	1	Weight has been included in P.G. Machine 409/-	

*Equipment for the one million ton steel plant at Rourkela***Two units, each consisting of one gas Washer and one precipitator**

	Nos.	Weight requir- ed Metric Tons
	2	
1. Gas washer, with internal water spray devices, water piping and valves.	2	
2. Electrostatic precipitator with internal equipment, water and steam piping and valves.	2	Item I to 6 520 tons approx.
3. Manually operated Goggle valves for raw gas.	2	
4. Butterfly dampers	2	
5. Manually operated Goggle valves for clean gas.	2	
6. Selenium power packs with automatic voltage regulation.	2	
7. Equipments for one additional compartment for cooling tower:		
L	{ (i) Propeller with fluid drive	1
	{ (ii) Hot water pump with electrics	1
	{ (iii) Cold water pump with electrics.	1

Grand total=3892+1177+435+520=6024

Equipment for the one million ton steel plant at Rourkela steel melting shop

Sl. No.	Description	Number	Total Wt. tons
	1. 80-Ton open hearth furnaces (excluding refractories) complete	4	2,176
	2. 1100-ton Hot Metal Mixers (excluding refractories)complete.	2	
	3. 40/50-Tons •L.D. Converters (excluding refractories)complete.	3	502
L	4. 80-ton.s Hot Metal Ladles.	20	McNally 915
L	5. 50-ton.s Mixer Metal Ladles	4	& Kumar- 440
L	6. 90 -ton.s Teaming Ladles	8	dhubi 56 combined. 176

Sl. No.	Description	Number	Total Wt. tons
L	7. 50-tons Teaming Ladles	15	208
	Stopper rods for items 6 & 7 .	240	14
L	8. Laddles Stands	12(Pairs)	104
L	9. 6 Cu.m. Slag Pots of Hematite iron.	30	232.8
L	10. Slag pot lifting rings	30	58
L	11. Hot Metal Cars for 80 T Ladles HEC.	17	595
L	12. Slag Pot transfer cars HEC	15	232.8
L	13. Converter pouring cars	3	180
L	14. Slag pot cars for use under the HEC O.H. Furnace	4	McNally & 69.9
L	15. 90-tons Ingot Cars HEC	60	Kumardhubi 1280
L	16. Scrap charging box transfer cars HEC.	40	combined 310
L	17. Buffer cars	8	66
L	18. Scrap chute transfer cars	3	42
L	19. 10-ton weight hoppers	6	28
L	20. Gates for overhead bins	6	13
L	21. Handling system for additions		100
L	22. Cast Steel Charging Boxes	160	372.8
L	23. Scrap chutes for L.D. Converter scrap charging.	20	19
L	24. Charging boxes for fluxes	10	8
L	25. Weight bridge (50 tons)	1	Avery 13
L	26. Weight bridge (30 tons)	1	India 9
L	27. Weighing machines (80 tons)	2	Machinery. 22
L	28. Weighing machines (1 ton)	3	2
L	29. Ladle drying stands	8	McNally & 48
L	30. Stopper rod driers	3	Kumardhubi 51
	31. Pneumatic hammers	2	16.6
L	32. Floor chargers	2	150
L	33. Passenger and freight lift (10 tons) OTIS & others.	1	42
L	34. Dolomite thrower McNally and Kumardhubi.	1	5
	35. Rotary compressors	3	12
<i>Cranes</i>			
L	36. 130/32 tons teeming cranes	2	496
HEC	37. 80/32 tons teeming cranes	2	372
Texmaco	38. 80/20 tons Hot Metal cranes	2	340
Garden	39. 130/32-Ton Mixer metal cranes	2	380
Reach	40. 12/5 ton crane for handling scrap chutes.	1	31
Jessop Burn	41. 12/5 ton crane for scrap charging to the converter.	1	44
Richardson	42. 40/8 ton semi-portal crane	1	66
Cruddas			
New Standard.			

Sl. No.	Description	Number	Total Wt. tons
	43. 10-ton travelling crabs . . .	5	48
	44. 5-ton bracket cranes for O.H. Furnaces.	4	24
	<i>M.P. Bay</i>		
	45. 20-ton dlogging cranes . . .	2	236
	46. 10-ton travelling crabs . . .	2	194
	47. Mould cooling beds . . .	2	695
	48. Portable mould-wash spray guns and tar reservoirs.	4&2	4.3
L	49. Mould cooling tank . . .	2	26
	<i>Stripper bay</i>		
L	50. 40-ton stripper cranes . . .	2	512
L	51. 10-ton travelling crabs . . .	2	20
	52. Mobile Compressor . . .	1	1.3
	<i>Scrap Yard</i>		
L	53. 10/5-ton crane . . .	1	70
L	54. 10-ton semi-portal cranes . . .	2	60
	<i>Skull cracker</i>		
	55. 50/10-ton cranc. . . .	1	94
	GRAND TOTAL WEIGHT . . .		12,279 tons.

Equipment for the one million ton steel plant at Rourkela

ROLLING MILL SECTION

Main Equipment

- L 1. Ingot Buggy (HEC) . Total weight 220 tons.
 2. One 1200 mm high lift blooming and slabbing Mill Comprising:

Main Mill stand with manipulators and universal spindles.

One 300 T hydraulic shear.

Interconnecting Roller Tables.

Three slab pushers with transfer cars

TOTAL WEIGHT . . . 4500 tons.

3.3.1 M. Single Stand Four High Plate Mill:

This mill consists of following main equipment:

Slab pusher.

Slab Transfer.

3.I M. Single Stand Four-high mill stand.

Vertical Edger.

Slab turning and working roller table.

Centring devices.

Approach and Runout roller.

TOTAL WEIGHT 2800 tons

4. Late Finishing Line:

(a) The finishing line for plates from 5 mm. to 20 mm. thickness, comprising:

Crop shear.

Hot plate levellers.

Cooling Beds.

Inspection Beds.

Rotary side trimming and slitting shear.

Cross cut shear.

Approach and delivery roller tables.

(b) The finishing line for plates from 20 to 38 mm thickness, comprising:

One side shear.

Castor bed.

Marking carriage.

Plate Piler crane.

Cold plate leveller.

Approach roller and delivery roller tables.

(c) For plates above 38 mm thickness there is a flame cutting machine.

TOTAL (a) plus (b) plus (c) . . . 7000 tons

5. 1700 mm wide hot strip mill, comprising:

One 2-hi scale breaker.

One 4-hi reversing stand.

One 4-hi non-reversing stand.

Six 4-hi finishing stands.

Connecting roller tables.

Two sub-floor coilers and one Piler.

TOTAL WEIGHT . . . 10,400 tons

6. Strip Finishing Lines.

(a) One coil strip finishing line, comprising:

Uncoiling machine, depiler, leveller, trimming and slitting shear, crosscut shear, plate piler, pick rolls, coiler and intermediate roller tables.

(b) *One strip trimming and shearing line*, comprising:

Decoiler.
 Depiler.
 Cold plate levellers.
 Rotary trimming and slitting shear.
 Cross cut shears.
 Plate turnover device.
 Side piler.
 Roller tables and weighing machines.

TOTAL WEIGHT 6 (a) and (b) 2000 tons

7. *One Pickling Plant*, comprising:

One coil ramp, one coil positioner, one uncoiling and straightening machine, one crop shear, one welder with stitcher, pinch roll units, looping pits, four pickling tanks with pumps and heat exchangers, two rinsing tanks, hot air dryer, diving shear, side trimmer, oiler, roller table, two up coilers and one coil conveyor;

One mixing and proportioning unit with pumps;
 One continuous neutralisation plant;
 One vacuum crystallisation;
 One cooling tower, and one boiler plant.

TOTAL WEIGHT 1555 tons

8. *1700 mm. cold Rolling Mill*, comprising:

Coil ramp, uncoiler, pinch roll unit.
 One 4 high stand, recoiler coil carriage and coil ramp.

TOTAL WEIGHT 1900 tons
 including
 item 12.

9. *Electrolytic Degreasing line*, comprising:

Coil ramp, coil buggy, uncoiler, welder, preliminary scrubber, cleaning cell, finishing scrubber, hot rinse tank, hot air dryer, pinch roll unit, up coiler and belt wrapper.

TOTAL WEIGHT 220 tons

10. *1200 mm. 4 hi cold reducing mill*, comprising:

Coil ramp, uncoiler, pinch roller, 1 high stand, recoiler and accessories.

TOTAL WEIGHT 1605 tons
 (inclusive of
 item 13).

11. *Annealing Plant*, comprising:

32 single stack annealing furnaces, 96 annealing bases, 96 protective hoods, 48 cooling hoods, connectors, two sheet annealing furnaces with 6 bases, protective atmosphere producers and storage unit.

TOTAL WEIGHT 1500 tons

12. 1700 mm Skin Pass Mill, comprising:

- Coil ramp
- Uncoiler
- 4 hi skin pass roll stand
- Recoiler
- Coil ramp and accessories

TOTAL WEIGHT (included with item 8)

13. 1200 mm Skin Pass Mill, comprising:

- Coil ramp
- Uncoiler
- 4 hit skin pass roll stand
- Entry and delivery puller sets
- Recoiler and accessories

TOTAL WEIGHT (included with item 9)

14. Two Autobody Sheed shearing lines, each comprising:

- Coil ramp
- Coil buggy
- Uncoiler
- Pinch roll
- Side trimmer
- Scrap coiler
- Flying shear
- Runout conveyor
- Leveller
- Piler
- Oiler

15. Tin Plate Shearing Line, comprising:

- Coil ramp
- Coil buggy
- Uncoiler
- Trimmer
- Scrap coiler
- Flying Shear
- Piling Device

TOTAL WEIGHT (items 14 and 15) 460 tons

16. 6 Hot Dip Tinning Lines, each comprising:

- Entry pock conveyor
- Sheet feeder.
- Magnetic conveyor
- Electrolytic Pickler
- Tinning machine
- Wet Washer
- Dry cleaner
- Conveyors
- Pilers

TOTAL WEIGHT 510 tons.

Equipment for the one million ton steel plant at Rourkela

A. Utility Piping (yard system, overhead for steam and oxygen)	
(1) Steel Pipes	2500 ton approx.
(2) Structural Steel for supports.	950 Do.
TOTAL	<u>3450 ton approx.</u>

B. Water Piping (yard system, underground for make-up water and Drinking water).	
(1) Make-up water steel pipes	2250 tons approx.
(2) Drinking water steel pipes.	800 tons approx.

C. *Note:* The above excludes steel pipes and supports in Main Plant Units for:

1. Coke Ovens.
2. By-product Plant.
3. Blast Furnaces and Gas Cleaning Plant.
4. Steel Melting Shop and Oxygen Plant.
5. Rolling Mills.
6. Power Plant.

*Equipment for the one million ton steel plant at Rourkela***STRUCTURAL STEEL WORK**

Sl. No.	Building/shop	Tonnage under 1 million ton stage	Tonnage under 1.8 million ton stage
1	2	3	4
1.	Rolling Mills	44,070	16,800
2.	Steel Melting Shop Buildings:		
	(a) Open Hearth & L.D. Bay	15,270	6,650
	(b) Mould Preparation Bay	1,440	880
	(c) Stripper Bay	623	880
	(d) Skull cracker	290	..
	(e) Scrap Yard	295	190
	(f) Ingot Yard	319	..
	(g) Dolomite Brick Plant	336	350

1	2	3	4
3.	Grey Iron Foundry	1,645	1,597
4.	Steam Power Plant	3,680	2,040
5.	Central Repair Shop	1,780	130
6.	Pig Casting Machine:		
	(a) Casting Bay]	600	500
	(b) Stock yard]		
7.	Coke Ovens	Not available.	2,500
8.	Blast Furnaces and Gas Cleaning Plant		
	TOTAL	75,448	

ANNEXURE 'B'

List of Major Equipment—Electric Power System

A. 132 K.V. Outdoor Receiving Station

1. Three 132 KV, 2,000 A, 6,000 MVA breakers.
2. Ten 132 KV, 2,000 A, isolators.
3. Six 121 KV station type lightning arresters.
4. One set busbars, metering and relaying equipment, control panels and auxiliaries.

B. Mills Area

Main Receiving Station

5. Two 132 KV, 2,000 A, isolators.
6. Six 121 KV station type lightning arresters.
7. Two 132/33 KV, 75 MVA transformers.
8. Twenty 33 KV, 3,000 A, 2,500 MVA breakers.
9. Forty-six 33 KV 3,000 A, isolators.
10. Two 33/o. 44 KV, 200 KVA transformers.
11. Busbars, metering and relaying equipment, control panel and auxiliaries.

Slabbing Mill Motor Room Substation

12. Six panels 33 KV, 2,500 MVA switchboard.
13. Two 33/6.6 KV, 15/20/25 MVA transformers.
14. One 33/13.2 KV, 15/20/25 MVA transformers.
15. Twenty-three panels 6.6 KV, 600 MVA switchboard.
16. One 440 volts, AC load-centre.
17. Two 230 volts, DC load-centres.
18. Metering and relaying equipment, control panel and auxiliaries.

Hot Strip Mill Motor Room Substation

19. Twelve panels 33 KV, 2,500 MVA switchboard.
20. Two 33/6.6 KV, 15/20/25 MVA transformers.
21. One 33/13.2 KV, 15/20/25 MVA transformers.
22. Seven panels 13.2 KV, 500 MVA switchboard.
23. Twenty-seven panels 6.6 KV, 600 MVA switchboard.
24. One 440 volts, AC load-centre.
25. Two 230 volts, DC load-centres.
26. Metering and relaying equipment, control panels and auxiliaries.

Cold and Finishing Mill Substation

27. Seven panels 33 KV, 2,500 MVA switchboard.
28. Three 33/6.6 KV, 15/20/25 MVA transformers.

29. One 33/13.2 KV, 15/20/25 MVA transformer.
30. Twenty-two panels 6.6 KV, 600 MVA main switchboard.
31. Eighteen panels 6.6 KV, 600 MVA pickling line sub-board.
32. Thirteen panels 6.6 KV, 600 MVA shear line sub-board.
33. Nineteen panels 6.6 KV, 600 MVA temper mill sub-board.
34. Two panels 13.2 KV, 500 MVA switchboard.
35. Ten 440 volts, AC load-centres.
36. Two 230 volts, DC load-centres.
37. Metering and relaying equipment, control panels and auxiliaries.

Soaking Pits Substation

38. Four 6.6 KV isolators.
39. One 440 volts, AC load-centre.
40. One 230 volts, DC load-centre.

Mills Pump House Substation

41. Three 6.6 KV isolators.
42. Three 6.6 KV, 5 MVA reactors.
43. Twenty-five panels 6.6 KV, 250 MVA switchboard.
44. One 440 volts, AC load-centre.
45. Metering and relaying equipment, control panels and auxiliaries.

C. Raw Materials Area.

Power House Substation

46. Thirteen panels 33 KV, 2,500 MVA switchboard.
47. Metering and relaying equipment, control panels and auxiliaries.

Raw Materials Area Substation

48. Two 33/6.6 KV, 15/20/25 MVA transformers.
49. Fifteen panels 6.6 KV, 600 MVA switchboard.
50. Metering and relaying equipment, control panels and auxiliaries.

Raw Water Treatment Plant Substation

51. Two 33 KV isolators.
52. Two 33/3 KV, 5 MVA transformers.
53. Twelve panels 3 KV, 200 MVA switchboard.
54. One 440 volts, AC load-centre.
55. Metering and relaying equipment, control panels and auxiliaries.

Blast Furnace No. 1 Substation

56. Two 6.6 KV isolators.
57. Two 6.6 KV, 5 MVA reactors.
58. Seven panels 6.6 KV, 250 MVA switchboard.
59. One 440 volts, AC load-centre.
60. One 230 volts, DC load-centre.
61. Metering and relaying equipment, control panels and auxiliaries.

Blast Furnace No. 2 Substation

- 62. Two 6.6 KV isolators.
- 63. Two 6.6 KV, 5 MVA reactors.
- 64. Seven panels 6.6 KV, 250 MVA switchboard.
- 65. One 440 volts, AC load-centre.
- 66. One 230 volts, DC load-centre.
- 67. Metering and relaying equipment, control panels and auxiliaries.

Blast Furnace Pump House Substation

- 68. Three 6.6 KV isolators.
- 69. One 440 volts, AC load-centre.

Coke Ovens Battery No. 1 and 2 Substation

- 70. Two 6.6 KV isolators.
- 71. Two 6.6 KV, 5 MVA reactors.
- 72. Eleven panels 6.6 KV, 250 MVA switchboard.
- 73. One 440 volts, AC load-centre.
- 74. One 230 volts, DC load-centre.
- 75. Metering and relaying equipment, control panels and auxiliaries.

Primary Crusher Substation

- 76. Seven panels 6.6 KV, 250 MVA switchboard.
- 77. One 440 volts, AC load-centre.
- 78. Metering and relaying equipment, control panels and auxiliaries.

Final Crusher Substation

- 79. Eight panels 6.6 KV, 250 MVA switchboard.
- 80. One 440 volts, AC load-centre.
- 81. Metering and relaying equipment, control panels and auxiliaries.

Coke Ovens Pump House Substation

- 82. Two 6.6 KV isolators.
- 83. Two 6.6 KV, 5 MVA reactors.
- 84. Thirteen panels 6.6 KV, 250 MVA switchboard.
- 85. One 440 volts, AC load-centre.
- 86. Metering and relaying equipment, control panels and auxiliaries.

By-product Plant Substation

- 87. Three 6.6 KV isolators.
- 88. One 440 volts, AC load-centre.

Ore Handling Plant Substation

- 89. Two 6.6 KV isolators.
- 90. One 440 volts, AC load-centre.

D. Oxygen Plant—SMS Area*Oxygen Plant/SMS Area Substation*

- 91. Four 33/6.6 KV, 15/20/25 MVA transformers.
- 92. Twenty-four panels 6.6 KV, 600 MVA switchboard.
- 93. One 440 volts, AC load-centre.
- 94. Metering and relaying equipment, control panels and auxiliaries

LD Steel-making Plant Substation

- 95. Sixteen panels 6.6 KV, 600 MVA switchboard.
- 96. One 440 volts, AC load-centre.
- 97. One 230 volts, DC load-centre.
- 98. One set metering and relaying equipment, control panels and auxiliaries.

LD Plant Pump House Substation.

- 99. Two 6.6 KV isolators.
- 100. Two 6.6 KV, 5 MVA reactors.
- 101. Ten panels 6.6 KV, 250 MVA switchboard.
- 102. One 440 volts, AC load-centre.
- 103. Metering and relaying equipment, control panels and auxiliaries.

Stripper Yard Substation

- 104. Two 6.6 KV isolators.
- 105. Two 6.6 KV, 5 MVA reactors.
- 106. Seven panels 6.6 KV, 250 MVA switchboard.
- 107. One 440 volts, AC load-centre.
- 108. One 230 volts, DC load-centre.
- 109. Metering and relaying equipment, control panels and auxiliaries.

Mould Yard Substation

- 110. Two 6.6 KV isolators.
- 111. One 440 volts, AC load-centre.

Tonnage Oxygen Pump House Substation

- 112. Two 6.6 KV isolators.
- 113. One 440 volts, AC load-centre.

Calcining Plant Substation

- 114. Two 6.6 KV isolators.
- 115. One 440 volts, AC load-centre.

Pig Casting Plant Substation

- 116. Two 6.6 KV isolators.
- 117. One 440 volts, AC load-centre.

E. Shops Area*Shops Area Substation*

- 118. Two 33/6.6 KV, 15/20/25 MVA transformers.

- 119. Fourteen panels 6.6 KV, 600 MVA switchboard.
- 120. Ten 6.6 KV, 5 MVA reactors.
- 121. Metering and relaying equipment, control panels and auxiliaries.

Structural Shop Substation

- 122. Four panels 6.6 KV, 250 MVA switchboard.
- 123. One 440 volts, AC load-centre.
- 124. Metering and relaying equipment, control panels and auxiliaries.

Steel Foundry Substation

- 125. Eight panels 6.6 KV, 250 MVA switchboard.
- 126. One 440 volts, AC load-centre.
- 127. Metering and relaying equipment, control panels and auxiliaries.

Iron Foundry Substation

- 128. Six panels 6.6 KV, 250 MVA switchboard.
- 129. One 440 volts, AC load-centre.
- 130. Metering and relaying equipment, control panels and auxiliaries.

Forge Shop Substation

- 131. Four panels 6.6 KV, 250 MVA switchboard.
- 132. One 440 volts, AC load-centre.
- 133. Metering and relaying equipment, control panels and auxiliaries.

Machine Shop Substation

- 134. Four panels, 6.6 KV, 250 MVA switchboard.
- 135. One 440 volts, AC load-centre.
- 136. Metering and relaying equipment, control panels and auxiliaries.

Electric Repair Shop Substation

- 137. Four panels 6.6 KV, 250 MVA switchboard.
- 138. One 440 volts, AC load-centre.
- 139. Metering and relaying equipment, control panels and auxiliaries.

Stores Substation

- 140. One 440 volts, AC load-centre.

Laboratory Building Substation

- 141. Nine Panels 6.6 KV, 250 MVA switchboard.
- 142. One 440 volts, AC load-centre.
- 143. Metering and relaying equipment, control panels and auxiliaries.

Administrative Building Substation

- 144. One 440 volts, AC load-centre.

G.S. Office Substation

- 145. Four panels 6.6 KV, 250 MVA switchboard.
- 146. One 440 volts, AC load-centre.
- 147. Metering and relaying equipment, control panels and auxiliaries.

Ingot Mould Foundry Substation

- 148. Four panels 6.6 KV, 250 MVA switchboard.
- 149. One 440 volts, AC load-centre.
- 150. Metering and relaying equipment, control panels and auxiliaries.

APPENDIX 17-1

List of Major Equipment—Power and Blower House

- 1. Four Boilers of 175 tons/hr. capacity complete with pulverisers, primary air fans, I.D. and F.D. Fans, economisers, air-preheaters mechanical dust collectors, chimneys, coal handling and ash handling plants and auxiliaries.
- 2. Two 30 MW turbo-alternators complete with condensers, condensate pumps, de-aerators, feed water heaters, feed pumps and auxiliaries.
- 3. One 10 MW back pressure turbo-alternator set and auxiliaries.
- 4. Three 4,250 N cu m/min capacity turbo-blower sets complete with condensers, condensate pumps and auxiliaries.
- 5. Two 13.2/33 kV, 40 MVA generator transformers.
- 6. One 13.2/33 kV, 12.5 MVA generator transformer.
- 7. Two 33/33 kV, 15/7.5/7.5 MVA 3-winding transformers.
- 8. Three 3,000/440 V, 250 KVA lighting transformers.
- 9. Four 3,000 V, 200 MVA, 16-panel switchboards.
- 10. Two 3,000/440 V, 1,500 KVA load-centres.
- 11. Twelve induced draft type cooling towers.
- 12. Six 94.5 cu b/min capacity circulating water pumps.
- 13. Three EOT Cranes, one 60/15 T, one 25 T, and one 15 T.

ANNEXURE C

Summary of the Production Programmes and Imports from 1966-1967 to 1971-72

Equipment	Indigenously procured Items to Match HMBP Production	Envisaged Production Programme in HMBP in Tons												Tonnage necessary for a 1 M.T. Steel Plant
		1966-67		1967-68		1968-69		1969-70		1970-71		1971-72		
		HM BP	IM-PORT	HM BP	IM-PORT	HM BP	IM-PORT	HM BP	IM-PORT	HM BP	IM-PORT	HM BP	IM-PORT	
Blast Furnace . . .	13700	2100 5200	3300 4000	4700 2600	5300 2000	6900 1400	6200 1100	21000						
Coke Ovens . . .	3100	2000 11200	3200 10000	3600 9600	4600 8600	6000 7200	7500 5700	16300						
Steel Melting shops . . .	1500	3200 6350	4500 5150	6000 3650	6700 2950	7500 2150	7800 1850	11200						
Rolling Mills . . .	..	500 45700	2500 43500	4000 42000	6000 40000	8500 37500	12500 33500	46000					
Total weight . . .	18350	8600 68450	13500 63650	18300 57850	22600 54550	28900 48250	34000 43150	95500						

Total production in HMBP during 1966-72 = 125000 tons.

Total imports for the manufacture of the equipments of a 1 M.T. Steel Plant per year during 1966-72 = 183600 tons.

Import necessary for completing 125000 tons Production in HMBP.

Import	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72
Castings and Forgings . . .	1290	1350	1830	1130	867	1020
Completing equipment . . .	860	1350	915	1130	578	680
TOTAL . . .	2150	2700	2745	2260	1445	1700

Total import during 1966-72 for completing 125000 tons=13000 tons.

Total weight of products from HMBP during 1966-72 =125000 + 13000=138000 tons.

State

Sl. No.	Description	Nos. necessary for 1 M. Ton Steel plant	Weight per unit	Total Weight in tons	Tonnage as per Bhilai steel Plant		PRODUCTION					
					Wt. in Tons		66-67			67-68		
					1 piece	Total	Qty.	Wt. in Tons.		QTY.	Wt. in Tons.	
								HM BP	IM-PORT		HM BP	IM-PORT
1	2	3	4	5	6	7	8	9	10	11	12	13
BLAST FURNACE												
1.	Scale car	4	55	220	60	240						
2.	Coke feeding and handling, complete with electrics	3	111	333	138	415	3	..	333	3	..	333
3.	Charging equipment complete with--											
	(a) Skip hoist with electrics	3	352	1056	100	300	3	350	706	3	700	356
	(b) Bell and hopper Assly. with electrics	3	125	375	170	510	3	250	125	3	300	75
	(c) Stock-line indicator with Electrics	3	4	12	3.33	10	3	4	8	3	4	8
4.	Blast Furnace complete with--											
	(a) Complete Furnace Shell	3	1008	3024	350	1050	..	..	..	..	..	..
	(b) Complete Furnace cooling system	3 sets	146	438	150	450	3	146	292	3	146	292
	(c) Furnace fittings and mountings	3 sets	31	93	50	150	..	..	..	..	..	..
	(d) Working and tapping platforms	3 sets	456	1368	300	900	3	456	912	3	456	912
	(e) Cast house complete structural steelwork.	3 sets	273	819	400	1200	..	..	..	..	..	..
	(f) Electrically operated Mud Gun	3	11	33	23	69	3	11	22	3	22	11
	(g) Tap hole drill	3	1	3	0.5	1.5	..	..	..	..	..	..
	(h) Down Comers	3 sets	70	210	60	180	..	..	..	..	..	..
	* (i) Bell valve	3	23	69	20	60	3	..	69	3	..	69
	(j) Dust Catchers	3	260	780	330	990	..	..	..	..	..	..
	(k) Crude gas mains, steam and compressed air lines, water mains	3 sets	425	1275	466	1400	..	..	..	..	..	..

ment

PROGRAMME												Procured indi- gen- ously
68-69			69-70			70-71			71-72			
Wt. in Tons			Wt. in Tons			Wt. in Tons			Wt. in Tons			
QTY.	HM BP	IM- PORT	QTY.	HM BP	IM- PORT	QTY.	HM BP	IM- PORT	QTY.	HM BP	IM- PORT	
14	15	16	17	18	19	20	21	22	23	24	25	26
Import												
3	..	333	3	100	333	3	150	183	3	150	183	..
3	700	356	3	950	106	3	1000	56	3	1000	56	..
3	325	50	3	335	40	3	355	20	3	355	20	..
3	10	2	3	10	2	3	10	2	3	10	2	..
..	..	..	..	..	..	..	..	..	..	..	..	3024
3	292	146	3	438	..	3	438	..	3	438	..	..
3	..	..	..	..	..	..	..	..	..	..	..	93
3	912	456	3	912	456	3	1368	..	3	1368	..	..
..	..	..	..	..	..	..	..	..	..	..	..	819
3	28	5	3	28	5	3	28	5	3	28	5	..
..	..	..	..	..	..	..	..	..	..	..	..	3
..	..	..	..	..	..	..	..	..	..	..	..	210
3	59	10	3	59	10	3	59	10	3	59	10	..
..	..	..	..	..	..	..	..	..	..	..	..	780
..	..	..	..	..	..	..	..	..	..	..	..	1275

1	2	3	4	5	6	7	8	9	10	11	12	13
5. Cranes and handling equipment												
(a) Lift for personnel and loads												
		3	22	66	6	18	3	..	66	3	..	66
(b) Cranes												
*(i) Winch house crane of capacity 20 tons												
		3	58	174	..	..	3	129	45	3	139	35
*(ii) Crab above throat cap. 25 tons												
		3	80	240	..	..	3	80	160	3	80	160
*(iii) Two motor crab over throat sheave platform of cap. 10 tons												
		3	40	120	..	..	3	40	80	3	40	80
*(iv) E.O.T. crane cap. 15 tons for cast house												
		3	85	165	39.3	118	3	120	45	3	130	35
6. Storage Yard and Bunker Plant												
Ore Loading Bridge												
		3	464	1392	1100	3300	3	..	1392	3	392	1000
7. Plower (Turbo) Imported												

EQUIPMENT FOR HOT BLAST STOVES

1. Hot Blast Stove Shells complete with platforms stairs, and other structural steel work												
		9	591	5311	400	3600	..	..	..	..	..	..
2. Stove mountings sets												
		9	186	1674	200	1800	9	186	488	9	558	116
3. Hot Blast Main and Bustle Pipe												
		3	83	249	60	180	..	..	..	..	..	..
4. Necessary pipings for three stoves, cold blast main, clean gas main, mixed Blast and blow off mains 3 sets												
		3 sets	232	696	110	330	..	..	..	..	..	..
5. Stack of plate steel												
		3	85	225	75	225	..	..	..	..	..	..
Pig Casting Machine												
1. 2-Strapd Pig Casting Machine with complete structural steel parts, machinery equipment and auxiliaries with electrics												
		1	435	435	750	750	1	435	100	1	350	85

14	15	16	17	18	19	20	21	22	23	24	25	26
3	..	66	3	..	66	3	..	66	3	..	66	..
3	149	25	3	154	20	3	169	15	3	169	15	..
3	160	80	3	200	40	3	200	40	3	200	40	..
3	80	40	3	80	40	3	100	20	3	100	20	..
3	140	25	3	150	15	3	150	15	3	150	15	..
3	892	500	3	892	500	3	800	592	3	1000	392	..
..	..	..	..	..	..	..	..	..	..	..	..	5319
9	558	116	9	558	116	9	558	116	9	558	116	1000
..	..	..	..	..	..	..	..	..	..	..	..	249
..	..	..	..	..	..	..	..	..	..	..	..	696
..	..	..	..	..	..	..	..	..	..	..	..	255
1	370	65	1	390	45	1	390	45	1	390	45	..

	1	2	3	4	5	6	7	8	9	10	11	12	13
2. CRANES AND HANDLING EQUIPMENT													
(i) Electric Three-Motors overhead crane with magnet of carrying capacity 10 tons			1	45	45	35	35	1	35	10	1	45	10
(ii) Hand operated overhead crane of 7.5 tons capacity			1	15	15	15	15	...	...	...	...	...	...
<i>Two units each consisting of one gas washer and one precipitator</i>													
1. Gas Washer, with internal water spray devices water piping and valves													Indigenous
2. Electro static precipitator with internal equipment, water and steam piping and valves	6												Imported
3. Manually operated goggle valves for raw gas	6	5	30	5	30	6	30	...	6	30	...		
4. Butterfly dampers	6	6	36	6	36	6	36	...	6	36	...		
5. Manually operated goggle valves for clean gas	6	5	30	5	30	6	30	...	6	30	...		
6. Selenium power packs with automatic voltage regulation	6												Imported
<i>7. Equipments for one additional compartment for Cooling tower</i>													
(i) Propeller with fluid drive	3												Imported
(ii) Hot water pump with electrics	3												Imported
(iii) Cold water pump with electrics	3												Imported
Total weight			21000	18500			2100		5200		3300		4000

14	15	16	17	18	19	20	21	22	23	24	25	26
----	----	----	----	----	----	----	----	----	----	----	----	----

1	45	10	1	40	5	1	40	5	1	40	5	...
...	...	...	...	...	...	...	...	...	...	...	...	15

6	30	...	6	30	...	6	30	...	6	30	...	...
6	36	...	6	36	...	6	36	...	6	36	...	...
6	30	...	6	30	...	6	30	...	6	30	...	...

4700	2600		5300	2000		5900	1400		6200	1100		13700
------	------	--	------	------	--	------	------	--	------	------	--	-------

1	2	3	4	5	6	7	8	9	10	11	12
7. Belt conveyor with necessary chutes, motors 406 etc. . . . metres											
<i>By-product plant</i>											
*Main component parts for disintegrating and rectifying towers . . .											
	...	7750	7750	...	300	7450	...	450	7300	...	
Total weight in tons 2000 11800 . . . 3200 10000 . . .											

Total weight of equipment required for 1 million ton steel plant in tons . . . 16300 Tons.

Note.—Items marked with asterisks are included in D.P.R.

13	14	15	16	17	18	19	20	21	22	23	24
...	...	...	...	...	...	...	...	...	...	...	Complete set.
700	7050	...	1000	6750	...	1500	6250	...	2150	5600	...
3600	9600	...	4600	8600	...	6000	7200	...	7500	5700	3100

13	14	15	16	17	18	19	20	21	22	23	24
...	...	...	...	...	...	...	...	...	...	...	372.8
...	...	...	...	...	...	...	...	...	...	...	19
...	...	...	...	...	...	...	...	...	...	...	8
import											
import											
import											
import											
...	...	...	...	...	...	...	...	...	...	...	148
...	...	...	...	...	...	...	...	...	...	...	16.6
50	100	2	75	75	2	175	25	2	125	25	
import											
import											
470	76	2	450	46	2	470	26	2	470	26	
300	40	2	320	20	2	320	20	2	320	20	
350	50	2	365	15	2	370	10	2	370	10	
28	3	1	28	3	1	28	3	1	28	3	
40	4	1	40	4	1	40	4	1	40	4	
60	6	1	60	6	1	61	5	1	61	5	
40	8	5	42	6	5	44	4	5	44	4	
...	...	1	...	...	1	...	...	1	...	...	24
106	50	1	210	26	1	220	16	1	230	6	
154	40	2	164	30	2	174	20	2	184	10	
...	...	...	...	...	...	...	...	...	...	...	26

1	2	3	4	5	6	7	8	9	10	11	12	
<i>Stripper bay</i>												
*50. 40 T stripper crane .		2	256	512	2	...	512	2	200	312	2	
*51. 10 T EOT Cranes .		2	10	20	2	15	5	2	15	5	2	
52. Mobile Compressor .		1	1	1.3	1	...	...	1	...	...	1
<i>Scrap yard</i>												
*53. 10/5 T EOT Crane .		1	70	70	1	50	20	1	60	10	1	
54. 10 T Semi-portal crane		2	30	60	2	30	30	2	50	10	2	
<i>Skull cracker</i>												
*55. 50/10 Ton EOT Crane		1	94	94	1	50	44	1	70	24	1	
TOTAL WEIGHT		11200			3200			4500				
<i>Rolling Mills.</i>												
*Rolling Mill Equipment	46000			300 45700			2500 43500					

Note.—Items marked with asterisks are included in D.P.R.

13	14	15	16	17	18	19	20	21	22	23	24
300	212	2	400	112	2	470	52	2	490	22	
17	3	2	18	2	2	18	2	2	18	2	
...	...	1	...	...	1	...	...	1	...	...
65	5	1	65	5	1	65	5	1	65	5	
55	5	2	55	5	2	55	5		55	5	
80	14	1	84	10	1	90	4	1	90	4	
6000	6700		7500			7800					1,550
4000	42000	6000	40000	8500	37500	12500	33500				

ANNEXURE 'D'

Boiler Industry

3rd Plan target ... Rs. 29 crores/year by 1965/66

Approx. Break-up

(i) Industrial boiler .. Rs. 9 crores/yr.

(ii) Thermal Station boiler .. Rs. 20 crores/yr.

Sl. No.	Name of firm	Type of boiler	Annual capacity		Remarks
			No.	Value	
				Rs.	
1.	Texmaco, Calcutta (Combustion Engg., USA).	(a) Lancashire/Cornish/Economic Vertical. (Industrial)	50	25 lakh	Vertical—100 lb./in. pressure; 250 to 9,000 lb. of steam per hour. Lancashire—upto 250 lb./in. ² pressure; 10,200 lbs. of steam per hour @ 212° F. Cornish—150 lb./in. ² pressure; 3,790 lb. of steam per hour @ 212° F. Economic—225 lb./in. ² pressure; 24,000 lb. of steam per hour @ 212° F.
		(b) Watertube boilers (Industrial).	25	125 lakh	Upto 400 lb./in. ² pressure; upto 75,000 lb. of steam per hour. (In production)
2.	Walchandnagar Industries, Dist. Poona (Skoda, Czechoslovakia).	Watertube boiler (Industrial).	6	30 lakh	Upto 400 lb./in. ² pressure; upto 75,000 lbs. of steam per hour. (In production)

3. K.C.P., Madras (Fives CAIL, France).	Watertube boiler (Industrial).	6	30 lakh	Upto 400 lb./in. ² pressure; upto 75,000 lb. of steam per hour. (In production)
4. I.S.G. Yamunanagar (John Thompson, U.K.)	(a) Watertube boiler (Industrial).	20	100 lakh	Upto 400 lb./in. ² pressure; upto 75,000 lb. of Steam per hour.
	(b) Thermal Stn. boiler.	1	60 lakh	Upto 30 Megawatt at present; 650 lb./in. ² pressure. (In production for Industrial Boiler. Ready to accept order for thermal).
5. A.V.B., Durgapur (Babcock and Wilcox, UK).	(a) Watertube boiler (Industrial).	15	107 lakh	Pressure upto 1,000 lb./in. ² 600 lb. to 75,000 lb. of steam per hour. Upto 100 Megawatt at present; Can go upto higher range. (In production)
	(b) Thermal Stn. boiler.	2	200 lakh	
6. Nestler Boilers, Bombay (Standard Kessel, West Germany).	Package type boilers & baby boilers.	-	25 lakh	From 250 lbs. to 9,000 lbs. of steam per hour. (In production)
7. Structural Engg. Co. Bombay (Cochran & Co., UK).	(a) Vertical boiler (Industrial).	200	100 lakh	From 250 lb. to 9,000 lbs. of Steam per hour.
	(b) Horizontal boiler (Industrial).			From 4,800 lbs. to 27,500 lbs. of steam per hour. (C.G. taken—expected to go in production by end of 1964).

Sl. No.	Name of firm	Type of boiler	Annual Capacity		Remarks
			No.	Value	
					Rs.
8.	Karan Chand Thapar and Bros., Calcutta. (Steinmuller, West Germany).	(a) Package type (Industrial). (b) Industrial boilers (c) Thermal Stn. boiler.	} 200 70 ..	} 270 lakh	Upto 20 tons of steam per hour; 250 lb./in ² pressure. 20 to 70 tons of steam per hour; 450 lb./in ² pressure. Upto 30 Megawatt—but may go upto 50 M.W. or little above by 1970/71 (C.G. taken—expected to be in production by 1965).
9.	National Steel Equipment Co., Bombay (Wansor Construction De Matenal, Belgium).	Industrial boiler	30	15 lakh	From 150 lbs. to 5,000 lbs. of Steam per hour; working pressure ranging from 75 lb./in ² onwards. (C.G. taken—expected to be in production by end of 1964.)
10.	Industrial and Agricultural Co., Bombay. Siller and Jammer (West Germany).	Flue tube boilers (Industrial).	..	12 lakh	15,000 kg./hour. (C.G. recently cleared—Accepted order for supply of boilers—Expected to go in production by end of 1964.)
11.	Public Sector Plant at Tiruchi, Madras (Techno Export, Czechoslovakia).	Thermal Station boilers.	40,000 tons/yr. including bought out items (1st stage).	1,800 lakh	Upto 660 tons of Steam per hour—200 Megawatt. Plant to come into production by end of 1964 or early 1965. First two boilers likely to be delivered by March, 1966.

ANNEXURE 'E'
Heavy Electricals (India) Limited
New Delhi

The Power & Electrical Equipment required for the setting up of a Steel Plant could be broadly divided into the following groups:—

- (i) Boilers for Steam Generation.
- (ii) Turbo Generators for Power Generation.
- (iii) Turbo Blowers for Blast Furnaces and other uses.
- (iv) Various AC & DC Electric Drives including Motor-Generator Sets for operation with the Mills.
- (v) Starting & Control System for the Drives.
- (vi) Rectifier Equipment.
- (vii) Power & Distribution Transformers.
- (viii) Metal Clad Switch Gear both for High Voltage and for Low Voltage.
- (ix) Completing items such as Electro Magnets, Limit Switches, Selsyn Motor System, etc.

2. The position regarding the indigenous availability of these Equipment in the Fourth Plan period is discussed below:—

(i) *Boilers for Steam Generation.*—For the one million ton production stage in Bhilai, three Boilers of 150 tons per hour capacity each operating at 40 atm., 450°C have been installed. The size of the Boilers in a Steel Plant would depend upon whether it will have its own Captive Power Plant or not. Boilers of the size of 150 tons capacity can be manufactured by M/s. A.V.B., Durgapur and M/s. I.S.G., Jagadhri (Yamuna Nagar) and the Plant being set up at Jamshedpur by Thaper-Steinmullers. Boiler manufacturing capacity will also be available at the Public Sector Unit at Tiruchi but in this Plant it is proposed to concentrate on Boilers of larger sizes viz., 250 tons capacity and above.

(ii) *Turbo Generators.*—Steam Turbines and Turbo Generators of sizes 12 MW, 25 MW and 55 MW will fall within the production range of the Heavy Power Equipment Plant at Ramachandrapuram (Hyderabad). This Plant is designed to meet the demands arising in the country for such Turbo sets. The manufacture of 12 MW Turbo set will start in the second half of 1965 and the requirement of Steel Mills can be delivered from early 1967 onwards.

(iii) *Turbo Blowers.*—The Turbo Blowers consist of two parts—viz., Steam Turbines and Blowers. For the Size of the Blast Furnaces installed at Bhilai, Steam Turbines having an output of 10,000 KW have been provided for driving the Blowers. As stated earlier these Turbines fall within the range of manufacture at the Heavy Power Equipment Plant, Ramachandrapuram (Hyderabad). Deliveries of these Turbines could be effected from early 1967. In regard to the Blowers manufacturing capacity has not yet been developed so far in any of the factories. In view of the fact that the technology of manufacture of Turbo Blowers is allied to that of Steam Turbines, Heavy Electricals have proposed the inclusion within the scope of manufacture of the Ramachandrapuram Plant the production of Turbo Blowers for Steel Mills

and other large Industrial uses. From our analysis, we feel that the production of Turbo Blowers could best be developed at the Ramachandrapuram Plant as the facilities that will be provided for the manufacture of smaller Turbines could be used to a large extent for Turbo Blowers. There is likely to be a steady demand for these Blowers and it is essential that specific provision should be made for this item in the Machinery programme. The manufacture of Turbo-Blowers at the Ramachandrapuram (Hyderabad) Unit is being considered in its second stage of development. The Deptt. of Iron & Steel have indicated to the Heavy Electricals certain preferred sizes of Blowers and the feasibility of manufacturing these sizes of being examined in consultation with the collaborators. As there will be some time lag between the commencement of manufacture of Turbines and Blowers it may be necessary to import for the first few sets the Blowers from the Collaborators' Works to match with the Turbines that may be made in India.

(iv) *AC & DC Electrical Drives and Generators.*—A Steel Plant calls for a variety of Electrical Drives and Generators AC-Synchronous, Induction Squirrel Cage with different dutycycles and of sizes ranging from fractional horse power to 12,500 KW, D.C. Motors and Generators upto 4,500 KW which include Motor-Generator Sets also. In the million ton stage of Bhilai, the total installed capacity of the Electrical Drives is of the order of 195,000 KW broken up as follows:—

(a)	AC Motors	— Above 150 KW	80 Nos.	75,000	KW
(b)	AC Motors	— Below 150 KW	3400 Nos.	24,000	KW
(c)	DC Motors	— Above 20 KW	250 Nos.	95,000	KW
(d)	DC Motors	— Below 20 KW	80 Nos.	1,000	KW
TOTAL			3810 Nos.	1,95,000	KW

The above list includes some of the most complicated Motor Generator Sets with Three, Four and sometimes even Five Units coupled together. The division of the AC and DC Motors between the smaller and higher ranges correspond generally to the division of manufacturing facilities between the H.E.(I)L. and the privately owned factories. In regard to the larger sizes which form the bulk in a steel mill and which are the complicated items, the estimated demand will be about 330 Motors totalling to 170,000 KW for a million ton Steel Mill as in Bhilai. If the aim is to provide facilities for an annual installation of 2 million tons of steel mill equipment the demand for Electrical Drives and Generators in the higher ranges of AC & DC will be of the order of 600 pieces annually totalling to about 310,000 KW. The Total installed capacity that will be available in the sanctioned schemes of Bhopal and Hardwar for this range of equipment will be about 740,000 KW. The Hardwar Plant, which will have a production capacity of 515,000 KW annually, is being designed to meet essentially the requirements of the Steel Mills and to provide the Electricals to match with the production programme of the Heavy Machine Building Plant, Ranchi. M/s. Associated Electrical Industries of U.K. who are assisting us in the Bhopal Plant is also an experienced firm in Steel Mill Electricals and it will be possible for Bhopal to draw this know-how from AEI when needed. In fact, we had planned for a substantial production at Bhopal for meeting Bokaro's requirements.

While the manufacture of Electric Motors at Bhopal has already commenced, production of Motors is expected to start at the Hardwar Plant from the end of 1965 or early 1966 starting from the smaller

sizes. Large and complicated equipment such as those required for mill drives. Motor Generator Sets could be expected from this Plant from the end of 1967.

In regard to AC Motors below 150 KW and DC Motors below 20 KW no difficulty is anticipated in meeting these Demands; the privately owned industrial units are equipped to meet this demand.

In this connection a question may arise whether the capacities available at Bhopal, Hardwar and the private units will be enough to meet the country's requirements of Motors will include other essential demands such as for cement mills, sugar mills and other industrial uses.

The Working Group on Power have assessed the overall requirement of Electrical Motors—both big and small—in the Fourth Plan period and have made recommendations regarding the additional capacity to be provided in the Fourth Plan. What we would like to bring out here is that the special requirement of Electrical Machines for Steel Mills are being provided for.

As already stated that Motor manufacturing programme at Hardwar is orientated meeting the full requirements of Heavy Machine Building Plant and hence it may be taken that the requirements of Electric Motors and Motor Generator Sets for Steel Mills will be the first charge on the capacity being developed at the Hardwar Plant.

(v) *Control System for the Drives.*—The scope of manufacture at Hardwar and at Bhopal include the starting and control equipment for the Electrical Machines. The Motors supplied from these Plants will, therefore, be complete with their respective controls. There may, however, be some special control systems that may be needed to suit individual requirements in the steel mills which could not be manufactured in these Plants. There are a number of such items but in terms of their value, they may not be substantial. It will be difficult to single out these items at the present stage of this examination. Many of these Special Controls will fall within the definition of "Industrial Electronics" and are not within the scope of manufacture of Electrical Equipment. It may be necessary to develop facilities for the manufacture of these Special Controls used extensively in Steel Mills.

(vi) *Rectifier Equipment.*—The Bhopal Plant is equipped for the manufacture of the larger sizes of Rectifier Equipment. A number of privately owned industries are also taking up this line of manufacture. No difficulty is, therefore, anticipated in regard to meeting the requirements of Rectifiers for the Metallurgical and Chemical Factories in the Fourth Plan.

(vii) *Power Transformers, Distribution Transformers and Switch Gear.*—Adequate capacity is being developed in the country for meeting the requirements of Transformers and Switch Gear. The Transformers are comparatively in the smaller ranges and are already being produced in India. The High Voltage Switch Gear requirements will be most in 11 or 6.6 KV depending upon the design of the power system. In this connection it may be pointed out that the Project Report for the Bokaro Steel Plant provide for 11 KV Switch Gear with a rupturing capacity of 600 MVA. Presently no manufacturer in India supplies 11 KV Switch Gear with this high rupturing capacity. It was not also clear whether such high rupturing capacities are necessary. A.E.I.'s design that is being adopted at Bhopal goes up to 350 MVA at present. It is proposed to take up the manufacture of a 11 KV Switch Gear of

500 MVA rating in the course of the next two/three years. It is also possible that M/s. Tata Merlin and Gerin, who are setting up a unit for the manufacture of Switch Gear may be able to offer Switch Gear of high rupturing capacity.

(viii) *Completing Items.*—There are a variety of completing items listed on the "Electrical" side which are required in a Steel Plant. Part of them are available in the country. A more detailed examination will, however, be necessary on these items to ensure that manufacturing facilities are provided in the Fourth Plan. In terms of value, however, these completing items will not be sizeable.

General.—We have not included under the "Electricals" the Electric Melting Furnaces as they may fall under a different category.

Dated 2nd July, 1964.

(Sd.) V. KRISHNAMURTHY,
Chief, Planning & Development

ANNEXURE F

NOTE

We have broadly analysed the Mechanical and Electrical Equipments required for a one million ton plant into following categories under the conditions mentioned below:

- (a) While making the classification, separate lists and tonnages are not indicated for want of time. Subsequent lists will follow showing these.
- (b) All tonnages are based on Bhilai Steel Plant figures.
- (c) All structurals directly going into the equipments are shown as machinery items. Pure building structurals are not included in this list.
- (d) All electrical items are not shown separate and wherever they are directly mounted on equipment, their tonnage is included in the mechanical items.

*Metallurgical equipments required for One Million tone plant and production capacity Indigenous VIS-A-VIS
Foreign Imports for the year 1966-72 (5 years)*

Sl. No.	Broad Classification of Equipments	Total tonnage or other forms of indication	Cost	Names of indigenous manufacturers	Year	Actual production	Import components for col.7	Indigenous components for Col. 7& 8	Total Col. 7, 8 & 9	Balance tonnage reqd. for 1m.T. Plant.	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
1.	Blast Furnaces . . .	21,000	..	(1) H.M.B.P.,	1967	21,100	210	5,200	7,510	13,700	
				H.E.C.Ltd.	1968	3,300	330	4,000	7,630	13,700	
				(Only machinery components.)	1969	4,700	470	2,600	7,770	13,700	
					1970	5,300	530	2,000	7,830	13,700	
					1971	6,900	690	1,400	8,990	13,700	
				(2) UTMAL Mainly structural components.	1972	6,200	620	1,100	7,920	13,700	
2.	Coke Ovens . . .	16,300	..		1967	2,000	200	11,200	13,400	3,100	
					1968	3,200	320	10,000	13,520	3,100	
					1969	3,600	360	9,600	13,360	3,100	
					1970	4,600	460	8,600	13,660	3,100	

			1971	6,000	600	7,200	13,800	3,100	
			1972	7,500	750	5,700	13,950	3,100	
3. Steel Melting Shops	. . .	11,200	H.M.B.P.,	1967	3,200	320	6,350	9,870	1,500
			H.E.C. Ltd.	1968	4,500	450	5,150	10,100	1,500
			(Only machi-	1969	6,000	600	3,650	10,250	1,500
			nery compo-	1970	6,700	670	2,950	10,320	1,500
			nents.)	1971	7,500	750	2,150	10,400	1,500
				1972	7,800	780	1,850	10,450	1,500
4. Rolling Mills	. . .	46,000	(1) H.M.B.P.	1967	500	50	45,700	46,250	..
			H.E.C. Ltd.	1968	2,500	250	43,500	46,250	..
			(only Machi-	1969	4,000	400	42,000	46,400	..
			nery compo-	1970	6,000	600	40,000	46,600	..
			nents).	1971	8,500	850	37,500	46,850	..
				1972	12,500	12,50	33,500	47,250	..

Different Items of Mechanical equipment categorywise as obtained from Bhilai list

Sl. No.	Items	Nos./sets	Approx. tonnage	Cost	Availability from			Remarks
					H.M.B.P.	Indigenous	Import	
1.	Pump (Low capacity)	. . . . .	196					
2.	Pump (High capacity)	. . . . .	231					
3.	Acid pump	. . . . .	41					
4.	Conveyors	. . . . .	metre					
5.	Tanks (by products and water)	. . . . .	124					
6.	Trippers	. . . . .	8					
7.	Winches	. . . . .	7					
8.	Hoists	. . . . .	210					
9.	Tackles	. . . . .	242					
10.	Trolley	. . . . .	97					
11.	Fans, ventilators, conditioners	. . . . .	1559					
12.	Bin gates and screw feeders	. . . . .	318					
13.	Welding equipment	. . . . .	99					
14.	Transfer trucks	. . . . .	85					

15.	E.O.T. cranes light	82
16.	Do. medium	174
17.	Do. Heavy	28
18.	Hand operated cranes Jick cranes light	108
	medium	382
19.	Laboratory equipments and measuring instru- ments/equipments.	493
20.	Coke oven equipments	2375
21.	By-products other than tanks	186
22.	Valves	735
23.	Machine tools light	617
24.	Machine tools heavy	879
25.	Furnace with transfer	46
26.	Misc. items	5196
27.	Casting and forging for blast furnace	464
28.	Laddles	80
29.	Pig casting machine	1 set (52 items)
30.	Ore bridge	1

Sl. No.	Items	Nos/sets.	Approx. tonnage	Cost.	Availability from		Remarks
					H.M.B.P.	Indigenous Import	
31.	Slag laddle car sprinkling installation with 14 items	1set					
32.	Electric Loco.	1					
33.	Diesel Loco.	24					
34.	Road making and Repairing equipments	12sets					
35.	Tar Preparatory installations	1set					
36.	Roll turning machine	14					
37.	Motor repair and maintenance	2					
38.	Boiler with accessories and turbines	9					
39.	Chemical purification plant	1set					
40.	Platforms and dump cars	173					
41.	Trucks and tractors	90					
42.	Fire-fighting cars	2					

Note.—All electrical equipments required for the above which will either be procured from H.E.L., Indigenous sources or imported are included in the above items.

PRINTED IN INDIA BY THE MANAGER GOVT. OF INDIA PRESS, COIMBATORE 1

