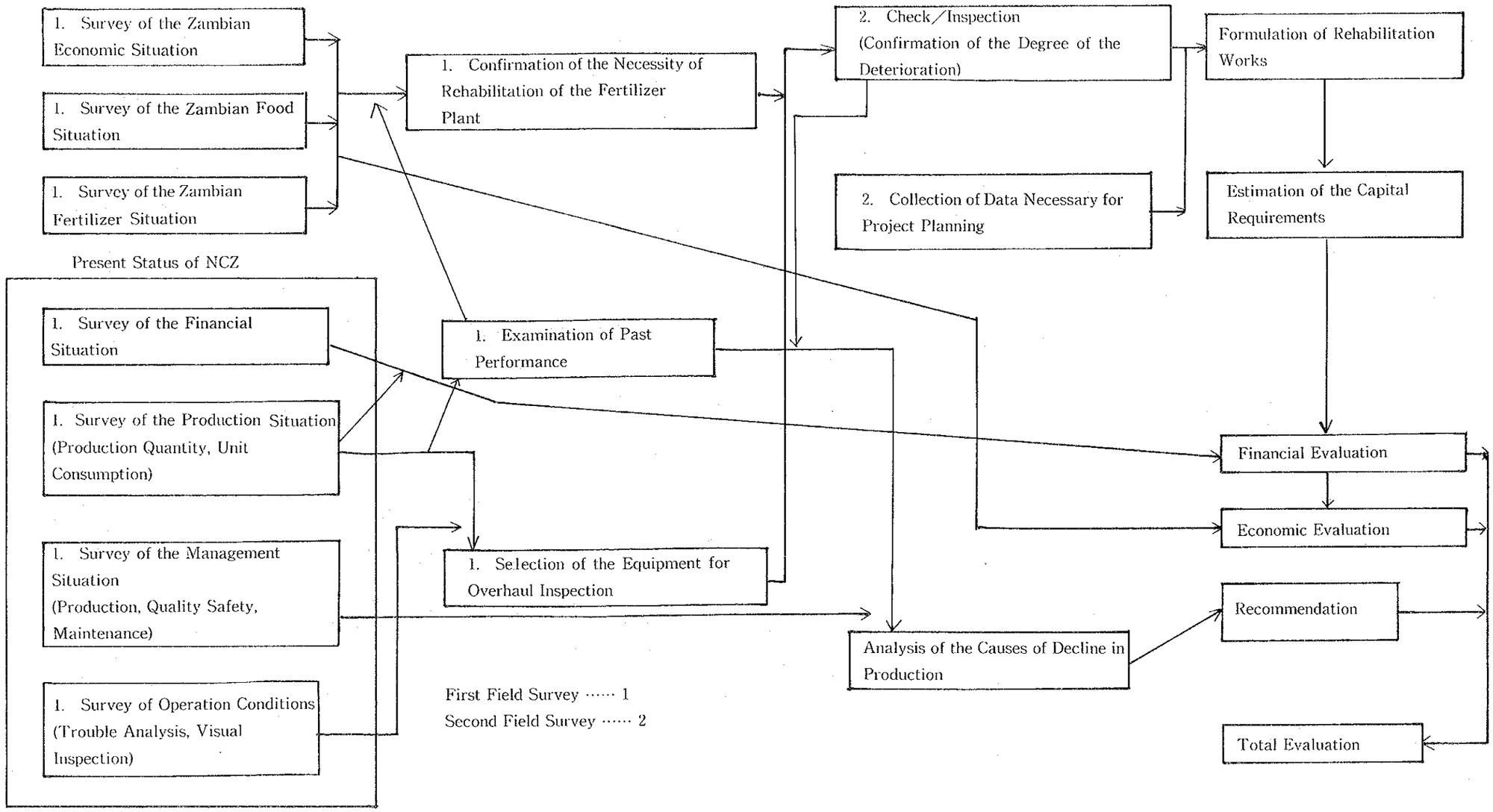
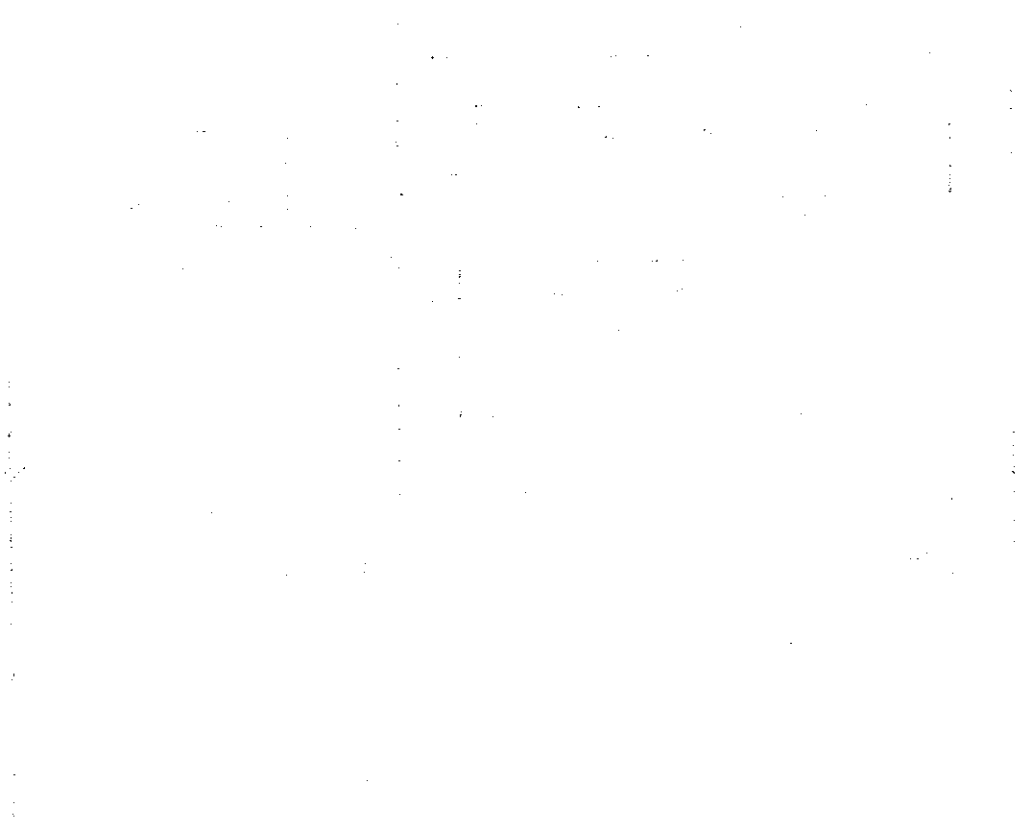
APPENDIX 1

PROGRAM OF SURVEY AND EVALUATION STUDY

Program of the Survey and the Evaluation





APPENDIX 2

MEMBERS OF THE FIRST AND SECOND SURVEY TEAM

MEMBERS LIST OF THE FIRST FEASIBILITY STUDY TEAM

1.	Mr. Katsuo ADACHI	Team Leader
2.	Mr. Takashi SUZUKI	Sub- Leader of Team
3.	Mr. Jiro WATANABE	Project Engineer
4.	Mr. Tadashi KIMURA	Process Engineer
5.	Mr. Keio HAMADA	Process Engineer
6.	Mr. Shigehiro KATO	Electric Engineer
7.	Mr. Teruyuki KITAGAWA	Techno - Economist
8.	Mr. Takumi INAOKA	Process Engineer
9.	Mr. Yoshio OHNO	Mechanical Engineer
10.	Mr. Kiyoshi YAMAGUCHI	Project Engineer
11.	Mr. Norio FUKUBAYASHI	Japan International Cooperation Agency

APPENDIX 3

ITINERARY OF THE FIRST AND SECOND SURVEY

ITINERARY FOR THE FIRST SURVEY TEAM

This team was divided into two groups -- one for examining production facilities and the other for studying the economy and market.

Members of the production facility examination group separately examined each production line they were assigned to study at NCZ and members of the economy and market study group visited various organizations for collecting various data and information.

The itinerary for the first surver team was as follows :

Date	Place of Visit	Remarks
Feb. 20 (Fri.)	Leave Tokyo	
22 (Sun.)	Arrive in Lusaka	
23 (Mon.)	Japanese Embassy	Courtesy call Explanation on the project
	NCDP (National Commission for Development Planning)	Coordination on the survey
	INDECO (Industrial Development Corporation Ltd.)	
24 (Tue.)	NCZ (Nitrogen Chemicals of Zambia)	Plenary meeting Explanation on the survey Coordination on the schedule Factory inspection
25 (Wed.)	NCZ	Reaffirmation of inspection plans and proceedings Separate inspection of facilities
26 (Thu.)	NCZ	Individual inspecion of production facilities Study on the outline of NCZ
	Government Printer	Collection of information on the economy
27 (Fri.)	NCZ	Inspection of individual facilities Study on NCZ financial status
28 (Sat.)		Sorting out collected data Internal coordination meeting
March 1 (Sun.)		

Date	Place of Visit	Remarks
March 2 (Mon.)	NCZ	Inspection of individual facilities Study on NCZ operation rates
	Bank of Zambia	Study on economic situation
3 (Tue.)	NCZ	Inspection of individual facilities Study on working conditions
	NAM Board	Fertilizer supply−demand plan
	Ministry of Commerce and Industry	Courtesy call
4 (Wed.)	NCZ	Inspection of individual facilities
	ZIMCO	Study on taxation system
5 (Thu.)	NCZ	Inspection of individual facilities Problems at factory
	Agricultural School of Zambia University	Study on agricultural situation in Zambia
6 (Fri.)	NCZ	Inspection of individual facilities Study on NCZ managerial setup
7 (Sat.)		Internal coordination meeting
8 (Sun.)		Compiling reports
9 (Mon.)	NCZ	Inspection of individual facilities Study on finacial situations
10 (Tue.)	NCZ	Inspection of individual facilities
	NCDP, Japanese Embassy	Explanation
	MAAMBA Collieries, Lusaka	Study on coal supply situation
11 (Wed.)	NCZ	Inspection of individual facilities
	MAAMBA Collieries, Mine	Coal mine inspection and study
12 (Thu.)	NCZ	Inspection of individual facilities
	Mount Makulu Research Center (Agricultural experimental center)	Study on agricultural situation
	The Development Bank of Zambia	Study on economic situation

Date	Place of Visit	Remarks
March 13 (Fri.)	NCZ	Plenary meeting Discussion on inspection/results
14 (Sat.)		Compiling discussion minutes
15 (Sun.)		Compiling reports
16 (Mon.)	NCZ	Inspection of individual facilities Confirmation of discussion minutes
17 (Tue.)	Japanese Embassy NCDP	Report on the first survey
18 (Wed.)	INDECO	Report on the first survey
	Leave Lusaka	
21 (Sat.)	Arrive in Tokyo	

ITINERARY FOR THE SECOND SURVEY TEAM

This team was divided into two groups -- one inspecting/examining machinery/equipment for rehabilitation and the other for planning rehabilitation field works.

Members of the machinery/equipment overhaul inspection group separately inspected machinery/equipment they were assigned to inspect and the rehabilitation works planning group visited NCZ and various contractors to carry out its studies.

The itinerary was as follows :

Date	Place of Visit	Remarks
Oct. 2 (Fri.)	Leave Tokyo	
4 (Sun.)	Arrive in Lusaka	
5 (Mon.)	Japanese Embassy	Courtesy call Explanation on the survey
	INDECO	
6 (Tue.)	NCZ	Plenary Meeting Explanation on the survey Coordination talks on proceedings Factory inspection

Date	Place of Visit	Remarks
Oct. 7 (Wed.)	NCZ	NCZ counterparts decided Consultative talks on inspection proceedings Machinery/Equipment inspection Rehabilitation work inspection
8 (Thu.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
9 (Fri.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
10 (Sat.)	NCZ	Machinery/Equipment inspection Preliminary study on contractors
11 (Sun.)		Internal coordination meeting Sorting out data
12 (Mon.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
13 (Tue.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
14 (Wed.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
15 (Thu.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
16 (Fri.)	NCZ	Machinery/ Equipment inspection
	Lusaka	Study on contractors and labour situation
17 (Sat.)	Lusaka	Study on contractors Sorting out study results
18 (Sun.)		Compiling reports Internal coordination meeting
19 (Mon.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
20 (Tue.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
21 (Wed.)	NCZ	Machinery/Equipment inspection
	Lusaka	Study on contractors Collection of data on erection works

Date	Place of Visit	Remarks
22 (Thu.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
23 (Fri.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
	Lusaka	Study on contractors
24 (Sat.)		Internal coordination meeting
25 (Sun.)		Compiling reports
26 (Mon.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
27 (Tue.)	NCZ	Machinery/Equipment inspection Rehabilitation work inspection
	Japanese Embassy	Explanation
28 (Wed.)	Lusaka	Study on contractors Compiling report
29 (Thu.)	NCZ	Plenary meeting Discussion on inspection results Compiling report
30 (Fri.)	NCZ	Confirmation of report contents
	Japanese Embassy NCDP, INDECO	Courtesy Call
31 (Sat.)		Sorting out data
Nov. 1 (Sun.)		Reviewing and confirmation of the report
2 (Mon.)	Japanese Embassy NCDP, INDECO, NCZ	Report on the second survey presented
	Leave Lusaka	
5 (Thu.)	Arrive in Tokyo	

APPENDIX 4

PLACES VISITED

Places which the Japanese survey mission visited during the first survey and the second survey

1. Japanese Embassy in Zambia
2. National Commission for Development Planning
3. Ministry of Commerce & Industries
4. Indeco, Ltd.
5. Nitrogen Chemicals of Zambia, Ltd.
6. Government Printer
7. Central Statistics Office
8. Bank of Zambia
9. NAM Board
10. ZIMCO
11. University of Zambia
12. Mount Makulu Research Station
13. Maamba Collieries, Ltd.
14. Ministry of Finance
15. Development Bank of Zambia
16. Minestone Ltd.
17. Electrical Maintenance Lusaka Ltd.
18. Behrens Ltd.
19. B. M. S. Engineering Ltd.
20. Drake & Gorham Ltd.
21. Apollo Enterprises Ltd.
22. Lewis Construction Ltd.
23. All-Metal Engineering Ltd.
24. Zambia Engineering & Contracting Co. Ltd.

APPENDIX 5

LIST OF DOCUMENTS PROVIDED TO SURVEY TEAM

List of Documents Provided to Survey Team

1) First Survey

	SUBJECT	PROVIDED BY
1.	The 3rd National - Development Plan (Annual Plan 1980)	INDECO
2.	NCZ, Background Information	NCZ
3.	Third National Development Plan (1979－1983)	Government Printing Office
4.	Zambia in Figures (1980 Edition)	Central Statistical Office
5.	Consumer Price Statistics (№ 2 Feb., 1981)	〃
6.	Zambia's Guide Line For The Next Decade	Government Printing Office
7.	Monthly Digest of Statistics (Apr. －Sep., 1980)	Central Statistical Office
8.	Manpower Survey (2nd Quarter, 1977)	〃
9.	Price Index of Building Materials (March, 1977)	〃
10.	Bank of Zambia 1979	Bank of Zambia
11.	Quarterly Financial and Statistical Review (1980)	〃
12.	NAM Board Annual Report 1978	NAM Board
13.	Fertilizer Stock Position 1981	〃
14.	Fertilizer Statistics 1981	〃
15.	Guide To The Completion of An Application For An Import License	Ministry of Commerce & Industry

16.	Law of Zambia	Government Printer
17.	Economic Report	〃
18.	Estimates of Revenue & Expenditure	〃
19.	Sales Analysis (1975－1981)	NCZ
20.	Depreciation & Amortization Rates	〃
21.	Statement of Cost of Production	〃
22.	Coal Purchased 1975－1980	〃
23.	Statement of Production	〃
24.	Lime Purchased 1975－1980	〃
25.	Catalysts Purchased 1975－1980	〃
26.	Schedule of Other Overheads	〃
27.	Percentage Calculation Used For Cost Calculation	〃
28.	Schedule of Other Expenses	〃
29.	Staff Welfare Expenses For the Year 1980/81	〃
30.	Production Forecast 1981－1986	〃
31.	Statement Showing Depreciation & Book Value of Plant & Machinery	〃
32.	Average Monthly Wages/ Salaries Rate	〃
33.	Organization Chart	〃
34.	Soil of Zambia	Mount Makulu Research Center
35.	Soil Profile Descriptions	〃

36.	Maamba Collieries Ltd.	Maamba Collieries
37.	Summary of Exploration Work	〃
38.	Conditions For Sale of Industrial Coal	〃
39.	Economic Report	Government Printer
40.	Estimates of Revenue & Expenditure	Government Printer
41.	Appraisal Report "Fertilizer Expansion Project"	Development Bank of Zambia
42.	Annual Report 1979, 1980	NCZ
43.	Assumptions	〃
44.	Computation of Other Direct Costs and Fixed Costs	〃
45.	Projected Cash Flow	〃
46.	Assumed Raw Material Costs & Consumption	〃
47.	Compution of Sales Value	〃
48.	Production Forecast (1981—1986)	〃

APPENDIX 6

MEMBERS OF THE ZAMBIAN COUNTERPART TEAM , NCZ

Members of the Zambian Counterpart Team,NCZ

1.	Mr. Kapihya	General Manager
2.	Mr. Seth	Works Manager
3.	Mr. Veedon	Chief Accountant
4.	Mr. Njolomba	Chief Engineer
5.	Mr. Kambobe	Production Manager
6.	Mr. Liayo	Technical Manager
7.	Mr. Athavale	Engineering Dept. Section Engineer
8.	Mr. Buch	Engineering Dept. Section Engineer
9.	Mr. Chola	Engineering Dept. Instruments Engineer
10.	Mr. Desai	Production Dept. Section Engineer
11.	Mr. Kafubula	Engineering Dept. Section Engineer
12.	Mr. Livaku	Engineering Dept. Staff of Fabrication Shop
13.	Mr. Mongia	Production Dept. Section Engineer
14.	Mr. Nyirenda	Engineering Dept. Staff of Machine Shop
15.	Mr. Philipose	Engineering Dept. Section Engineer
16.	Mr. Raimu	Engineering Dept. Section Engineer
17.	Mr. Setty	Production Dept. Section Engineer

APPENDIX 7

DESCRIPTION OF PROCESS

CONTENTS

1. Ammonia Plant

1.1 Coal Handling (Fig. 1 COAL HANDLING)

This is a system to produce coal dust from raw coal carried in by special freight cars from an open-cut coal mine and to feed the coal dust to the gasification system in the next process.

The raw coal carried in by freight cars is unloaded in a coal yard and stored in wet coal bunker by shovel cars and belt conveyors.

Central values of the raw coal are as follows (design specification).

Surface moisture	10% by weight
Ash content	17% by weight
Higher calorific value	8,000 Kcal/kg

The raw coal in the bunker, after being measured by a weighing feeder, enters the EBRO type rotary dryer for hot air drying to reduce its surface moisture to under 1% by weight.

The EBRO type rotary dryer is installed in a coal-burning hot air furnace. The hot air, after running outside the rotary dryer, is guided inside. After directly drying the raw coal, the hot air enters a multiclone dust collecter. Coal dust is thus separated and is returned into the system. Further the gas enters a wet scrubber, and the coal dust in the gas is separated. The separated coal dust is discharged as sludge and conveyed to the effluent treatment system, and the gas is discharged into the atmosphere.

Lime is added to the raw coal dried by the rotary dryer. The lime and raw coal together enter the Compeb Mill that pulverizes them and turns them into coal dust. The object of the lime addition is to regulate the ash melting temperature during the combustion at the gasification system.

The Compeb Mill is sealed with nitrogen. The seal gas enters the multiclone dust collector to separate coal dust. The separated coal dust falls into a pulverized-coal bunker. Further the gas enters the wet scrubber to separate coal dust in the gas. The separated coal dust is discharged as sludge and conveyed to the effluent treatment system, and the gas is discharged into the atmosphere.

The coal dust leaving the Compeb Mill is temporarily stored in the pulverized-coal bunker and then carried to the subsequent gasification system by a pneumatic conveyor (employing nitrogen gas) .

The coal dust in the pulverized-coal bunker is sealed with nitrogen. In addition, the equipment is so designed as to seal the system with nitrogen if the main process should stop.

Central values of the coal dust are as follows :

Pulverized coal size	More than 90% pass 90μ below
Moisture	Under 1% by weight
Bulk density	About 500 kg/m^3

1.2 Gasification (Fig. 2 GASIFICATION)

This is a system to partially burn the coal dust delivered by pneumatic conveyors from the coal handling system, in a gas generating furnace (gasifier)by a mixed gas of oxygen and steam, thus producing raw gas for ammonia synthesis.

The coal dust delivered by pneumatic conveyors from the coal handling system enters a screw feeder through a service bunker and a feed bunker, in which it is mixed with a gas composed of oxygen and steam, and is jetted into the gasifier furnace.

In the furnace, the coal dust is partially burned with oxygen and turned into a gas rich in carbon monoxide and hydrogen.The temperature in the furnace is about 1, 500°C, and the pressure in the furnace is about + 300㎜ Aq.

The gas has a general composition as follows :

Carbon dioxide	13%
Carbon monoxide	55%
Hydrogen	29%
Nitrogen	0.7%
Argon	0.5%
Methane	0.1%
Hydrogen sulphide	0.95%

Ash content (Fe_2O_3, SiO_2, Al_2O_3) in the coal dust has the melting point of 1,470°C and is melted in the furnace. A part of the melted ash runs down along the furnace wall and enters a seal tank through an immersion shaft. The melted ash is quenched with water and solidified, then continuously discharged by a chain conveyor installed at the bottom of the seal tank. A part of the ash becomes fly ash. Accompanied by gas, it runs through a radiation boiler and tubular boiler, then through a cooling washer and Theisen Washer (gas washer) . After being cleaned by wash water, the ash is finally delivered to the effluent treatment system together with the wash water.

Sensible heat of the gas leaving the gasifier is collected by generating 15 kg/㎠G steam by the radiation boiler and tubular boiler. The gas leaving the Theisen Washer gets rid of water by a water separator and is conveyed to the hydrogen sulphide removal system in the next process. An emergency shut-down equipment, a system which enables the equipment to automatically stop according to any abnormality of pressure and/or gas amount, is installed. This stops the supply of oxygen to the gasifier, blows nitrogen into the furnace and discharges the gas. The oxygen and nitrogen employed in the gasification system are delivered from an air separation equipment described later.

1.3 H_2S Removal (Fig. 3 H_2S REMOVAL)

This is a system which absorbs the hydrogen sulphide (H_2S) contained in the raw gas delivered from the gasification system using a special alkali solution containing anthraquinone disulphonic acid (ADA) and vanadate, and removes more than 99% of the hydrogen sulphide. The raw gas delivered from the gasification system enters the №1 and №2 absorbers, and the hydrogen sulphide in the raw gas is absorbed and removed by absorbent solution from the tower top. Wooden grates are installed inside the absorbers so as to maximize the contact area for the raw gas and absorbent solution. The desulphurized raw gas enters a mist separator. After the solution is separated, the raw gas is delivered to a raw gas holder.

The absorbent solution leaving the absorbers finishes its reaction in a reaction tank, gets mixed with air by a jet ejector and is delivered to an oxidizer where the hydrogen sulphide in the absorbent solution is oxidized by oxygen in the air and sulphur particles are floated. Oxidation reaction of hydrogen sulphide is as follows :

$$H_2S + 1/2\ O_2 \rightarrow S + H_2O$$

To remove moisture (H_2O) produced in this oxidation reaction, a part of the absorbent solution is drawn out of the absorbent circulation line and heated by solution heater. In the subsequent evaporator moisture is evaporated into the air.

On the other hand, the floated sulphur particles enter a filter press after being guided to a slurry tank along with a small amount of the absorbent solution, then separated from the absorbent solution. The absorbent solution is collected into a balance tank and the sulphur particles are melted by an autoclave remelter and delivered to a flaker. The flake shaped sulphur collected here has a purity of more than 99.9%.

1.4 Gas Purification

The raw gas stored in the raw gas holder is delivered to this system by a raw gas compressor, and purified for synthesizing ammonia.

(1) Primary Carbon Monoxide Conversion Section (Fig. 4 PRIMARY CO CONVERSION)

The raw gas delivered from the raw gas compressor enters a saturator where it comes into contact with hot water running down from the tower top and gets warmed up and saturated. After leaving the saturator, the gas is again mixed with hot steam in a saturator mist sepatator. After water drops are separated, the gas is heated by a primary shift preheater and then enters a primary shift converter where a reaction occurs as follows :

$$CO + H_2O \xrightarrow{\text{catalyst}} CO_2 + H_2$$

Most of the carbon monoxide (CO) in the gas is thus converted to carbon dioxide (CO_2) and hydrogen (H_2) that is useful for synthesizing ammonia. Incidentally, CO and CO_2 are poisonous for catalyst of ammonia synthesis.

The gas leaving the primary shift converter enters the carbonate CO_2 removal section in the next process through the primary shift preheater and No. 1 water heater.

The hot water running down from the saturator tower top is delivered to the No. 2 water heater of the secondary CO conversion section (described later) to be preheated and returned to this section to be further heated by the No. 1 water heater, then fed back to the saturator tower top.

In the CO conversion system, in which hot water (140°C to 190°C) is circulating, corrosion can be caused by the accumulation of impurities in the CO_2 or H_2S in the hot water.

To prevent the corrosion due to the possible accumulation of impurities, a part of the hot water is blown down.

(2) Carbonate CO_2 Removal Section (Fig. 5 CARBONATE CO_2 REMOVAL)

The gas from the primary CO conversion enters No. 1 carbonate reboiler and the sensible heat held in the gas is collected for heating the carbonate solution. After the water in the gas is separated by the No. 1 condensate separator, the gas enters a carbonate absorber where the carbon dioxide in the gas is absorbed by a hot potassium carbonate solution and the CO_2 concentration is reduced to about 1%.

The absorbent solution leaving the carbonate absorber is regenerated by a carbonate regenerator and fed back to the carbonate absorber tower top. The carbon dioxide in the absorbent solution is separated by the carbonate regenerator and discharged from a carbonate acid gas separator into the atmosphere. The gas leaving the carbonate absorber is separated from the carbonates by a carbonate mist separator and enters the secondary CO conversion section in the next process.

(3) Secondary CO Conversion Section (Fig. 6 SECONDARY CO CONVERSION)

The gas from the carbonate CO_2 removal runs through secondary shift preheaters A and B, is heated to the reaction temperature and enters a secondary shift converter. Here the amount of carbon monoxide which did not react in the primary conversion (about 5.7%) is further reduced to about 0.6%.

The gas leaving the secondary shift converter runs through secondary shift preheaters B and A and the No. 2 water heater, discharges the sensible heat caused by the reaction and enters the MEA CO_2 removal section in the next process.

(4) MEA $^{1}CO_2$ Removal Section (Fig. 7 MEA CO_2 REMOVAL)

The gas from the secondary CO conversion enter the MEA reboiler. The sensible heat held in the gas is collected for heating the MEA solution. With its condensates separated by No. 2 condensate separator, cooled by a gas after cooler, and with its condensates further separated by the No. 3 condensate separator, the gas enters the MEA absorber where the CO_2 in the gas is absorbed by the MEA solution and the CO_2

concentration is lowered to about 0.02%. The gas leaving the MEA absorber is separated from the MEA solution by the MEA mist separator and enters the CO removal section in the next process.

The MEA solution, which absorbed CO_2 in the MEA absorber, is heated by the MEA solution heat exchanger and delivered to the MEA regenerator for regeneration. The regenerated MEA solution is cooled by the MEA solution heat exchanger and further cooled by the MEA solution cooler, then fed to the MEA absorber tower top.

The carbon dioxide in the absorbent solution is separated by the MEA regenerator and discharged from the MEA acid gas separator into the air.

(5) Methanation CO Removal Section (Fig. 8 CO REMOVAL)

The gas from the MEA CO_2 removal section enters a caustic scrubber to decrease impure gasses like CO_2 by circulating caustic soda solution, is separated from the caustic soda solution by a caustic mist separator,gets heated a methanator preheater and enters a methanator.

Carbon monoxide is removed in the methanation process. The methanator is filled with a nickel base catalyst. This catalyst accelerates the reaction of CO and CO_2 with H_2 to produce methane (CH_4) and H_2O.

The gas leaving the methanator discharges sensible heat, caused by the reaction, to the methanator preheater, gets cooled by a methanator cooler, is separated from its condensates by the No. 4 condensate separator and is delivered to the ammonia synthesis system in the next process.

The gas has a composition as follows :

Hydrogen = 97.7%, Methane = 0.78%,
Nitrogen = 0.84%, Argon = 0.67%,
Carbon monoxide + Carbon dioxide ≦ 10ppm

1.5 Ammonia Synthesis (Fig. 9 AMMONIA SYNTHESIS)

This system to synthesize ammonia has a capacity of 95.3 T/D. It produces liquid ammonia exclusively.

The ammonia is synthesized, using the UBE ammonia synthesis catalyst, at a high pressure (340kg/㎠G) and high temperatures (400°C to 530°C) .

The converted gas is cooled by cooling water and NH_3 coolant. The synthesized ammonia is separated from the converted gas.

The ammonia synthesis reaction is an exothermic reaction with a formula as follows :

$$3H_2 + N_2 \rightarrow 2NH_3 + 11.8 \text{ Kcal/mol}$$

The ammonia synthesis converter is a self-heat-exchange type reactor and the catalyst is packed in the catalyst tubes which are arranged in the inner basket.

The reaction heat is utilized to preheat the synthesis gas through the wall of the catalyst tubes before the synthesis gas enters the catalyst tubes. The synthesis catalyst is composed of ferrous oxide (FeO) , ferric oxide (Fe_2O_3) and promoters and has no activity at first. To use the catalyst, therefore, one must activate it by reduction operation.

(1) Circulation System

The H_2 gas from the gas purification section and the N_2 gas from the air separation section are mixed at the ratio of 3 : 1.

These gases are compressed to 340 kg/㎠G by a synthesis gas compressor, and with most of the oil mist in them separated by an oil separator, are delivered into the tube side of an ammonia cooled condenser where they are mixed with recycle gas from the shell side of a cold exchanger. In the ammonia cooled condenser the recycle gas mixed with the raw gas is cooled to −10°C by ammonia coolant. (The ammonia coolant circulates from the shell side of the ammonia cooled condenser to an ammonia refrigerator.) Synthesized NH_3 in the recycle gas is thus condensed, and both the rest of the oil mist and a bit of moisture contained in the raw gas dissolve in the condensed ammonia solution. Then the cooled recycle gas runs to No. 2 ammonia separator, installed in the lower part of the cold exchanger, where the condensed ammonia is separated from the recycle gas. The recycle gas, containing about 23% ammonia, leaving the No. 2 ammonia separator runs through the tube side of the cold exchanger and cools the synthesis gas entering the tube side of the ammonia cooled condenser.

The recycle gas attains a temperature of about 25°C and a pressure of 320 kg/cm²G. Then it is directed to the synthesis converter after its pressure is raised to 340 kg/cm² G and its temperature to 35°C by a gas circulator.

Composition of the recycle gas is as follows :

Component	% by volume
Ammonia	2.30
Hydrogen	63.11
Nitrogen	22.65
Methane	6.26
Argon	5.68

The flow of the recycle gas is about 42,330Nm³/Hr. About 10% of the recycle gas is supplied to the upper nozzle of the synthesis converter so as to cool the converter wall while it goes downward through the annular space around the internal basket (inner assembly) .

The rest of the recycle gas runs through the shell side of the external heat exchanger, where it is preheated to 140°C by the synthesis converter outlet gas, and then supplied to the synthesis converter. A half of the recycle gas, 21,165 Nm³/Hr, enters from the lower part of the synthesis converter where it mixes with the above-mentioned wall cooling gas and runs upward. At first, when running through the internal heat exchanger inside the converter, the said half of the recycle gas cools the outgoing converted gas and runs upward along the outside of catalyst tubes. At this time it cools converted gas running inside the catalyst tubes. In order to regulate the temperature distribution in the catalyst tubes, this gas is mixed with and cooled by the rest of the preheated recycle gas. This cooling gas runs in through the nozzle on top of the converter.

All of the unconverted gas that has entered the converter runs in from the top of the catalyst tubes and runs down, thus performing the ammonia synthesis reaction, and then it runs through the above-mentioned internal heat exchanger.

The converted gas from the synthesis converter is delivered to a synthesis gas cooler. It has an ammonia concentration of about 17.5% and a temerature of about 330°C.

The synthesis converter outlet gas is so hot that it is cooled down to about 180°C by a synthesis gas cooler.

At this time low pressure steam is generated incidentally. This low pressure steam is consumed in the gas purification section. Then the converted gas runs through the tube side of the external heat exchanger, preheats the recycle gas and enters the tube side of a water cooled condenser.
When the gas runs through the water cooled condenser, it is cooled by cooling water and the ammonia is condensed. The condensed ammonia is separated by the No. 1 ammonia sepatator so that the ammonia concentration in the gas is reduced to about 9.85% and the temperature to about 35°C.

Also, a part of the gas is continuously purged into the atmosphere after the ammonia content is collected by cooling so as not to accumulate inert gas (CH_4 and Ar) in the circulation system. (The inert gas is contained in the raw gas.)

The remaining gas enters the shell side of the cold exchanger and gets cooled by the recycle gas. After that it mixed with the raw gas and runs to the ammonia cooled condenser. There ends the circulation system.

(2) Synthesis Start-up Heater

At the start-up from cold condition, heat must be supplied until the catalyst layer temperature can be adequately maintained by the heat of reaction.

A combustion furnace type start-up heater is installed beside the synthesis converter to heat the synthesis gas before it enters the converter.

(3) Liquid Ammonia System

The liquid ammonia separated by No. 1 and No. 2 ammonia separators has its pressure reduced to 20 kg/㎠G through level control valves and runs to a liquid ammonia flash tank.

Such gases as H_2, N_2, CH_4, Ar, etc. dissolved in the high pressure liquid ammonia are flashed during the expansion from 340kg/㎠G to 20kg/㎠G. The flash gas contains some ammonia, so after ammonia is recovered by cooling, uncondensible flash gas is purged to atmosphere along with the purge gas from the synthesis loop that is previously mentioned.

The ammonia with its pressure reduced is delivered to a liquid ammonia storage tank after its flow rate is measured.

1.6 Compression (Fig. 10 COMPRESSION)

Compressors are employed to compress the gas to the pressure required in each process. This section has four compressors as listed below.

(1) Raw Gas Compressor

This is to compress the raw gas in the raw gas holder to 28.2 kg/㎠G required for the gas purifcation.

Capacity : 14,300 Nm³/H, 4-stage, screw type,
Motor output : 2,400 kw.

(2) Nitrogen Gas Compressor

The nitrogen gas from the air separation is compressed to 25.5 kg/㎠G, mixed with synthesis gas and coveyed to the synthesis gas compressor.

Capacity : 2,850 Nm³/H, 3-stage,
Motor output : 530 kw,
Reciprocating horizontal opposed balance type.

(3) Synthesis Gas Compressor

This is to compress the make-up gas, composed of the synthesis gas from the gas purification mixed with the nitrogen gas from the nitrogen gas compressor, to 340 kg/㎠G required for ammonia synthesis.

Capacity : 11,730 Nm³/H,3-stage,
Motor output : 1,750 kw,
Reciprocating horizontal opposed balance type.

(4) Air Compressor

This is to compress the raw air to 4.8kg/㎠G to feed it to the air separation equipment.

Capacity : 22,000 Nm³/H, 4-stage,
Motor output : 2,300 kw,

Integral gear type centrifugal compressor.

1.7 Air Separation (Fig. 11 AIR SEPARATION)

This is a system to cool the air (−180°C), liquefy it and rectify it, thus separating its components into oxygen (O_2) and nitrogen (N_2).

The air induced through the air intake stack first enters an air filter, by which dust and soot in the air is removed, and then its pressure is raised up to the specified value by the air compressor, which discharges a required quantity of air.

This compressed air, after its condensed moisture has been separated by a water separator, is delivered into reversing heat exchanger.

The reversing heat exchanger is divided into an O_2 side and a N_2 side, each consisting of hot section and cold section.

Each hot section has passages installed as follows :

O_2 side	Raw air	Product O_2
N_2 side	Raw air	Product N_2 and impure N_2

There the raw air is cooled to about −115°C, while its reversing gas is heated from about −120°C to the ambient temperature.

In each cold section, passages for reheated air are installed in addition to the above-mentioned passages. There the raw air is cooled from about −115°C to the saturation temperature (−172°C), and the reversing gas heated to about −120°C. The raw air passage has quite the same structure as that of the product O_2 or impure N_2 passage. It is designed to change over the passage at every set frequency so that the current may be reversed alternately. While the raw air is thus cooled in the reversing heat exchanger from the ambient temperature to the saturation temperature, condensible impurities in the air like steam and carbon dioxide are deposited on the heating surface of the reversing heat exchanger. The impurities deposited on the heating surface are reevaporated into the gas of the product N_2 or impure N_2 when it passes at the subsequent frequency, and then removed from the system.

So in the reversing heat exchanger, removal of steam and carbon dioxide in the air by condensation or solidification is performed simultaneously with discharge of the accumulated impurities. The system can thus be operated continuously.

Then the purified air enters the rectifier lower column.

A part of the raw air entering the rectifier lower column enters a liquefier, where a part of the air is cooled and liquefied by reverse gas and stays at the lower column bottom. The rest of the air breaks into two parts. One enters the cold end of the reversing heat exchanger, as mentioned before, and is heated to $-120°C$ and extracted from its central section. Then it joins the other part of the air which comes to the temperature of $-130°C$ to $-150°C$, and enters the expansion turbine through the filter before turbine.

The air which enters the expansion turbine is accelerated through a nozzle, gets adiabatically expanded from about 4.5 kg/㎠G to 0.35 kg/㎠G while turning the turbine, and gets cooled to $-170°C$ to $-180°C$ to generate the coldness required to operate the system. Such adiabatic expansion of compressed air is to obtain the necessary amount of coldness by converting a part of the energy held in the air into mechanical energy. That is, velocity energy of the air and energy by centrifugal force are absorbed by axial-flow impellers of the expansion turbine, and the absorbed energy is consumed in the work of making compressed air by the load blower and discharging air outside.

The air leaving the expansion turbine is blown into the middle section of the rectifier upper column.

The rectifier tower is a combined type, consisting of an upper column, evaporator-condenser section and lower column. As mentioned above, the raw air is mostly fed into the lower column but partially into the upper column.

Most of the air fed in the lower column is prerectified and divided into two separate groups, one being gas N_2 and liquid N_2, and the other being liquid air containing 36% to 40% O_2.

That is, while the air passes through the small holes of a perforated rectifying trays and comes into contact with the liquid flowing over the trays the air gradually becomes a gas rich in N_2 content, and at the top of the lower column, becomes a N_2 gas with the purity of over 99.9%.

This gas enters the main evaporation-condenser section of the rectifier tower, and except for the N_2 removed out of the rectifier tower, it is cooled and liquefied by liquid O_2 and recirculated back to the top of the lower column. A part of this liquid N_2 is fed to the upper column top through a liquid N_2 cooler (sub-cooler) as reflux. The rest of the liquid N_2 contacts the rising gas while running around over the rectifying trays and flowing down from upper stages to lower stages, with its O_2 content gradually increased, and becomes liquid air at the lower column bottom.

The liquid air accumulated at the lower column bottom is fed to the middle section of the upper column through a liquid air filter and a sub-cooler.

Two liquid air filters are installed and periodically changed over for use. The liquid air filters are filled with silicagel which absorbs and removes impurities in the air, such as acetylene and hydrocarbon, to prevent their accumulation and eliminate a possible cause for explosion.

The air to be rectified is thus fed into the upper column for the final rectification at pressures of 0.2−0.45 kg/㎠G.

The product N_2 at the upper column top runs through the sub-cooler and then through the reversing heat exchanger, returns to an ambient temperature, and leaves the system for the N_2 holder.

The impure N_2 at the upper part of the upper column runs through the sub-cooler and then through the reversing heat exchanger, returns to an ambient temperature, and leaves the system for discharge into the air through a silencer. A part of it branches at the upper stream of the silencer and is picked out as a sort of product.

The product O_2 at the upper column bottom runs through the reversing heat exchanger, returns to an ambient temperature, and leaves the system for the O_2 holder.

The system has a capacity as follows :

Product O_2 3,800 Nm^3/H, purity 98%
Product N_2 2,850 Nm^3/H, purity 99.99%
Impure N_2 5,000 Nm^3/H, purity 93%

* 1 Actual output of impure N_2 is 14,190 Nm^3/H.

2. Nitric Acid Plant (Fig. 12 NITRIC ACID)

This is a plant to produce 310 T/D of 55% nitric acid.

The plant may be roughly divided into two sections : one to oxidize ammonia with catalysts and subsequently cool the nitrous gas produced, and the other to oxidize and absorb the gas and bleach the nitric acid produced.

Air is compressed to 3.5 kg/㎠G by an air compressor. The air first enters an air filter, then a mixer, where it mixes with ammonia gas filtered by an ammonia filter and delivered in. The air compressor is driven by a recovery turbine, which expands preheated waste gas, and by a motor.

The mixed gas of air and ammonia is fed to a burner, where the ammonia is oxidized with catalyst. The catalyst is a combination of plantinum and platinum-rhodium alloy.

The reaction at the burner is expressed by the following formula :

$$4NH_3 + 5O_2 = 4NO + 6H_2O + 222 \text{ Kcal/g.mole}$$

Subsequently, a secondary reaction occurs as follows :

$$4NH_3 + 3O_2 = 6H_2O + 303 \text{ Kcal/g. mole}$$

The nitrous gas leaves the burner, at about 840°C, and discharges its sensible heat at a gas cooler below the burner. At the gas cooler outlet the nitrous gas is cooled to about 230°C, then at a tail gas heater it is heat-exchanged with waste gas running from No. 2 absorption tower, so that it is cooled to about 150°C, and by an economizer further to about 90°C.

Then the gas enters a condenser for heat exchange with cooling water, and its temperature becomes about 50°C. At this temperature most of the moisture contained in the nitrous gas is condensed in the condenser, and weak acid condensates are produced by absorbing a part of the oxidized nitrous gas. Weak acid condensates are also produced in the economizer and fed to the bottom of a separator, where they mix with the weak acid condensates produced at the condenser. The concentration of the condensates is about 20% (by weight) . These condensates are fed into the certain tray of No. 1 absorption tower which shows approximately the same concentration by a weak acid pump.

The nitrous gas leaving the condenser enters the bottom of an oxidation and bleaching tower, where it mixes with nitrogen dioxide and secondary air, which are ascending from the bleaching section at the bottom of this tower.

The oxidation of nitrogen monoxide is in accordance with the following formula :

$$2NO + O_2 = 2NO_2 + 25 \text{ Kcal/g. mole}$$

Since this reaction is exothermic, the nitrous gas is cooled by flowing the jacket section of the oxidation and bleaching tower, to remove the heat, before the gas is delivered to the oxidation space.

The nitrous gas proceeds to No. 1 and No. 2 oxidation towers for further oxidation and cooling. The oxidation of NO is accomplished in the range of 96 to 98%.

The gas rich in nitrogen dioxide (NO_2) rising through No. 1 absorption tower discharges a part of NO_2 to the acid on the tray so the concentration of the acid descending the tray increases.

The gas leaving the tower top then enters No. 2 absorption tower. This tower is supplied with pure water so as to absorb NO_2 in the gas ascending the tray.

The reaction of producing nitric acid is expressed by the following formula :

$$3NO_2 + H_2O = 2HNO_2 + NO + 35.4 \text{ Kcal/g. mole}$$

The NO produced in this reaction is oxidized between the trays and turned into NO_2. Thus the absorption, NO production, and NO_2 production by subsequent NO oxidation are carried out at all trays.

To remove the reaction heat from each tray, cooling water is supplied to the tower tube. Also, valves are installed for sampling.

The tail gas leaving No. 2 absorption tower undergoes heat exchange at a tail gas heater so as to raise its temperature to about 130°C. Then it enters a recovery gas turbine to expand to the reduced pressure of 0.05 kg/㎠G.

Absorption is made by supplying pure water in a demineralized water tank to the top of No. 2 absorption tower by a demineralized water pump. From the top of No. 2 absorption tower the pure water descends the trays successively. The pure water contacts the nitrous gas coming up from the tower bottom, absorbs NO_2 and produces the acid. The concentration of the acid at No. 2 absorption tower bottom is about 15% (by weight).

This acid is fed to the top of No. 1 absorption tower by a recycle acid pump. The acid concentration on the first tray (lower tray) of No. 1 absorption tower is 55% if the plant is normally operated and if the water quantity is properly controlled.

From the bottom of the No. 1 absorption tower, the acid is delivered to the upper tray of the bleaching section in the lower part of the oxidation and bleaching tower. The acid descends the tray, comes in contact with the secondary air supplied from the air compressor discharge pipe, and gets bleached. The air passing through the raw acid removes the dissolved NO_2, and later it mixes with nitrous gas in the middle section of the tower where oxidation reaction takes place. The bleached acid is gathered at the bottom of the oxidation and bleaching tower, and delivered into a product storage tank at the pressure held in the system.

The pure water, which is fed to a steam drum by feed water pump, is preheated at the economizer. By natural convection the pure water makes natural circulation from the steam drum to a gas cooler, and from the gas cooler to the steam drum, and during the circulation, steam is separated from water. A part of the saturated steam at the pressure of 14 kg/㎠G generated at this plant is used by the ammonia heater, and the rest of it is mostly conveyed to other plants.

3. Ammonium Nitrate Plant (Figs. 13, 14, 15, AMMONIUM NITRATE)

This plant is to produce ammonium nitrate (AN : NH_4NO_3) for fertilizer and blasting agent (ANBA) , using liquid ammonia and 55% (by weight) nitric acid as raw materials. It is roughly divided into four sections of neutralization, concentration, fertilizer prilling, and ANBA prilling.

(1) Neutralization

Liquid ammonia, manufactured at the ammonia plant and stored in the spherical tank, is pumped into this plant at a pressure of about 6 kg/㎠G. A part of this liquid ammonia is evaporated by air, and another part of it evaporated by steam. Both ammonia is thus turned into gas ammonia, and heated and fed into a neutralizer.

Nitric acid, another raw material, is manufactured at the nitric acid plant, and after being stored in a cone roof tank, is pumped into this plant at a pressure of about 3 kg/㎠G.

The nitric acid is ratio controlled with the gas ammonia and fed to the neutralizer. the neutralizer is filled with Raschig rings to facilitate the adequate neutralizing reaction of nitric acid with gas ammonia. The reaction solution is circulated through the neutralizer top—Raschig ring layer—bottom, by pump, but a part of the reaction solution is drawn out as neutralization solution and directed to an adjuster, where it undergoes primary pH adjustment. Then it is delivered to an adjustor tank for secondary pH adjustment. With the pH adjustment finished, the ammonium nitrate is filtered through an ammonium nitrate filter, to remove such impurities as iron hydroxide and flows to an ammonium nitrate solution tank. The concentration of ammonium nitrate in this tank is 74.4%. Since the neutralization reaction is exothermic, air is blown in to cool and concentrate the reaction solution.

(2) Concentration

The neutralized AN is directed to a preliminary evaporator, concentrated to the concentration of 96% by vacuum evaporation, then delivered to an interstage solution tank. To facilitate the evaporation of moisture in the AN solution, the AN solution is heated to 160°C by a preliminary evaporator reboiler with 14 kg/㎠G steam.

Vacuum is generated by steam ejectors. Water evaporated in the preliminary evaporator is condensed in the preliminary evaporator condenser and removed from there. The residual gas is sucked by the steam ejector.

(3) Fertilizer Prilling

The 96% AN solution delivered from the interstage solution tank is directed to a secondary evaporator, and further condensed to 99.5%, then fed to the head tank on the top of a fertilizer prilling tank.

At the secondary evaporator the AN solution is heated with 14 kg/㎠G steam and concentrated by removing moisture with air carried from a blower. The 99.5% AN solution leaving the head tank is sprayed into the prilling tower through prilling

nozzles at the bottom of the head tank and, during fall of about 50m, cooled and solidified by the air from the natural vent, and prilled into a spherical form.

A certain amount of the AN solution is constantly overflowed from the head tank, so as to keep the pressure on the prilling nozzle constant, thus keeping the prill diameter constant too. The prilled ammonium nitrate is conveyed to a fertilizer cooler by a belt conveyor at the bottom of the fertilizer prilling tower, cooled by a cold blast from 85°C to 30°C, and fed into a vibrating screen by a bucket conveyor, where it undergoes screening so that prills of 8 to 14 mesh are delivered to a fertilizer coating drum and the off-size prills are carried to a recovery tank for recovery.

The coating material (Nuflo−10) , which is applied in the fertilizer coating drum to prevent moisture absorption, is supplied to the hopper by a bucket conveyor and, after being measured by table feeder, delivered to the vibrating screen outlet chute section.

The coated ammonium nitrate is fed to a fixed screen and, after separation of the excess coating material, delivered to the fertilizer hopper for storage. Central values of the product are as follows :

Nitrogen	33.0% by weight min.
Moisture	0.5% by weight max.
Size (Tyler)	8 to 14 mesh for over 90%

(4) ANBA Prilling

The 96% AN solution delivered from the interstage solution tank in the concentrating section is fed into the head tank at the top of the ANBA prilling tower, then sprayed from the prilling nozzle and, during fall of about 60m, cooled and solidified by the air from the natural vent, and prilled into a spherical form.

A certain amount of the AN solution is constantly overflowed from the head tank so as to keep the prilling condition constant.

The prilled ammonium nitrate is conveyed to the ANBA dryer by a belt conveyor at the bottom of the ANBA prilling tower and dried by a hot blast and by hot water from the hot water tank, then carried by a bucket conveyor to the vibrator screen (1) , where it undergoes primary screening so that prills of 8 to 14 mesh are cooled by the ANBA cooler from 70°C to 30°C and the off-size prills are delivered to a recovery tank for recovery.

The cooled prilled AN is conveyed by a bucket conveyor to the vibrating screen (2) , where it undergoes a secondary screening so that prills of 8 to 14 mesh are fed to an ANBA coating drum and the off-size prills are delivered to a recovery tank for recovery. The coating material (Nuflo-10) , which is applied in the ANBA coating

drum to prevent moisture absorption, is measured by a table feeder and then fed into the vibrating screen outlet chute section by the vibrating feeder.
The coated ammonium nitrate is delivered to the ANBA fixed screen and, after separation of the excess coating material, fed to the ANBA hopper for storage.

Central values of the product are as follows :

Nitrogen	33.8% by weight min.
Moisture	0.5% by weight max.
Size (Tyler)	8 to 14 mesh for over 90%

4. Auxiliary Facilities

4.1 Water Intake Station (Fig. 16 WATER INTAKE)

This is a facility to take in industrial water required for this factory from the Kafue River about 3 km away and press-feed the raw water by pump to the water treatment equipment in the factory.

The water intake station installed along the Kafue River has three intake pumps, which are alternately operated, two for normal use and one for spare.

The capacity of the equipment is 500 ㎥/H.

4.2 Water Treatment (Fig. 16 WATER TREATMENT)

The raw water delivered from the water intake is fed to a precipitator, and sand and mud contained in the raw water are removed by coagulation and precipitation. To facilitate the coagulation and precipitation,the precipitator is provided with coagulant (aluminum sulphate) , alkali solution and assistant, which are slowly agitated. The coagulated and precipitated sand, mud and flocks are automatically discharged from Precipitator bottom by an air pressure discharge system.

The water from precipitator enters into a settling basin and then it is divided into 2 flows.

One part is fed to a valveless filter by pump, and the other is delivered to a cold water pond by natural flow-down as an addition to the cooling water circulating in the plant. The water fed into the valveless filter is filtered through sand layers, and turned into purified water with a turbidity of under 2° to be delivered to a filtrated water basin. A part of the purified water is delivered to various equipment as process water, while the remaining larger portion is fed to the demineralized water plant.

(1) Demineralized Water

Demineralized water is produced by removing matters dissolved in the raw purified water through a cation exchanger, a degasifier and an anion exchanger.

These equipment has a capacity of 39.6m³/H. Incidentally, cation resin is regenerated by sulphuric acid, anion resin by caustic soda. The equipment is designed to work 20 hrs. 50 min. for manufacturing demineralized water and 3 hrs. 10 min. for regenerating ion-exchange resin, and is automatically operated by timer and air - controlled system.

(2) Cooling Tower

The cooling water is collected in the hot water pond from each system and piece of equipment, and cooled at Cooling Tower, then resupplied to each system and piece of equipment.

The specification of Coolng Tower is as follows :

Type :	Single axial-flow fan type
Capacity :	3,400 m³/H
Number of cells :	2
Inlet temp.:	36°C
Outlet temp.:	28°C

4.3 Boiler (Fig. 17 BOILER)

This boiler generates steam by 13 T/H at a pressure of 32 kg/㎠G.

The steam is supplied to the inlet of each system and piece of equipment at one of three pressures of 30, 14, and 3.5kg/㎠G. The 30 kg/㎠G steam is mainly consumed in the gas refining equipment of the ammonia plant. The 14 kg/㎠G and 3.5kg/㎠G steams are made by reducing the pressure of the 30 kg/㎠G steam, and they are also generated at the gasification and nitric acid plants. They are mainly consumed in the ammonium nitrate plant. Coal is employed for the fuel. The furnace of the boiler has a travelling grate stoker. This boiler is a double barrel D type natural circulation boiler.

The furnace pressure control is of the equilibrium ventilation type. That is, the air for combustion is fed into the furnace by forced fans through an air preheater, and the combustion waste gas is heat-collected by an economizer and the air preheater, then exhausted to the chimney by an induced fan.

The boiler feed water is deaerated by a deaerator with steam and, after being added with boiler cleaning agents, raised in its pressure by a feed water pump, then supplied to the boiler drum through a flow control valve and the economizer.

4.4 Effluent Treatment (Fig. 18 EFFLUENT TREATMENT)

The waste water generated in the plant is treated in this system and then delivered to the special lagoon or the Kafue Council Sewage System. Also, a part of the waste water is reused after being treated.

The waste water is classified into four types (A, B, C, D) by the water quality, and systematically collected at this facility for treatment.

(1) A-Waste

This waste is delivered intermittently from the carbonate CO_2 removal equipment. The waste specification is as follows :

Quantity of waste	200m³/6 months
Content	Compound : 25 ppm, as $CaCO_3$

The delivered waste is stored in the A-effluent pond and then fed to an evaporation pond by pump. There the water is naturally evaporated and the compound remaining at the bottom is removed for abandonment.

(2) B−Waste

This is continuously delivered from the gasification section. The waste specification is as follows :

Quantity of waste	232m³/H	
Content	SS (solid)	: 7,300ppm
	CN	: 1−13ppm, as $CACO_3$
	SCN	: 8−15 〃
	S	: 200−240 〃
	SO_4	: 150−300 〃

The delivered waste is fed into the settling pond, where it is separated by natural sedimentation. The supernatant is cooled by wash-water cooling tower and carried again to the gasification section. Meanwhile the solid content is drawn out from the settling pond bottom toghether with a part of the waste, and delivered to the special lagoon through a slurry tank.

The wash - water cooling tower is provided with cooling water as make - up water.

(3) C−Waste

This is delivered from the plants and room listed below :

- Ammonia Plant (except A−, B−, and D− Waste)
- Nitric Acid Plant
- Ammonium Nitrate Plant
- Analysis Room

The waste is collected into the C−effluent pond. Specifications of wastes from the plants and room are as follows :

- Ammonia Plant

Quantity of waste	26㎥/H (continuous) 0 − 22.5 ㎥/H (intermittent)
Content	Nil

- Nitric Acid Plant, Ammonium Nitrate Plant, Analysis Room

Quantity of waste	118 ㎥/H
Content	NH_4 & NO_3 : 0.1 − 0.3% as $CaCO_3$
pH	4 − 7

The waste gathered in the C−effluent pond is delivered to the neutralizer by pump, and neutralized by lime or sulphuric acid. The neutralized solution is fed to the balance tank by natural flow - down and, after the content concentration is controlled by the raw water, delivered with the following specification to the Kafue Council Sewage System for retreatment.

Quantity of retreatment water	220-250㎥/H
PH	6.0 −8.5
S^{--}	< 5ppm, as $CaCO_3$
SO_4^{--}	< 6ppm, as $CaCO_3$
SS	<30ppm
HCN & HSCN	< 2ppm, as $CaCO_3$
Oil & Grease	Nil
Nitrate	<1,500ppm, as $CaCO_3$

(4) D--Waste

This is delivered from the sections listed below :

- Compressor Section
- Air Separation
- Water Treatment

The waste is collected into D—effluent pond.Specifications of the wastes from the sections are as follows :

- Compressor Section and Air Separation

Quantity of waste	18. 1㎥/H
Content	

- Water Treatment

	Oil & Grease
Quantity of waste,	0. 6㎥/H,SS : 1%
and content	40 ㎥/H, SS : 0.1%
	103㎥/H, Nil

The waste colleted in the D-effluent pond is delivered to the neutralizer by pump to join C—waste and then undergoes treatment.

4.5 Instruments

NCZ plant's process instrumentation has been designed primarily aiming at the pneumatic system. Vertical-type compressors 310K05 (375N㎥/H × 7kg/㎠G × 3 units) and a dryer (dew point : −20°C) were initially set at section 310 for supplying air for the instrumentation, but after the construction of the new plant, these have been replaced with a set of two newly set compressors and the old dryer.

Control rooms are divided into eight places as follows by sections : 301, 302, 602, 303-311, 401, 501, 601 and 605.

Each control room is provided with a control panel ; and 301, 302 and 311 are equipped with a semi - graphic panel in order to facilitate control. 601 alone is provided with a desk-panel. Measuring factors built into the panel are,primarily, flow, temperature, pressure, liquid level, revolution, analysis, etc ; and each panel is equipped with various mearsuring devices, forming a great many loops between local instruments and panel instruments,in order to either indicate, record, control or signal these measuring factors.

The panel in each section is provided with a set of annunciators which indicates failures of the particular equipment both by giving an intermittent light and sounding either a buzzer or a ring.

There are two kinds of failure indications : light-degree failures (milky white)and serious (red), the latter being designed for announcing a dangerous stage of the equipment ; in

which case the particular equipment is urgently shut off, with various valves of the process automatically being closed or opened, in order to keep the plant safe. Light - degree failure indication is for announcing a warning sign before serious failure ; and if the cause of failure is promptly removed, the equipment concerned may be prevented from being stopped due to serious failure.

Control rooms are designed on an internal pressure explosion proof system by means of applying fine pressure by fans.

One of the main emergency shut-down systems is in the gasifier of section 302, as already mentioned before, the device of which is capable of oxygen supply stopping, nitrogen gas blowing and gas exhausting on detecting abnormal pressure or abnormal gas volume.

4.6 Electricals

Electric power for the NCZ factory is supplied from ZESCO at 6,600V and received at the 603S sub—station (capacity 15MVA x 2 systems). As detailed in the attached sub-station skeleton diagram, the power is sent unchanged at 6,600V from the sub-station to the control centers set at the following nine sections ;

301, 302, 310 (for sections 303-311)
401, 501
601 (plant side), 601 (river side)
701 (repair shop)
603 (to low-tension control center through a transformer)

From each high - tension control center electricity is supplied, in principle, to motors of 151 kw and above at the high - tension of 6,600V, except special motors, and to motors of 150 kw or less at the low - tension of 380V stepped down by a transformer.

Furthermore,electricity for lighting and instruments/control is supplied at 220V and 100V, respectively.

As an emergency power source, as shown in the attached specifications Table 1 and single-line diagram (Fig. 20) , a 375 KVA diesel-engine power generator is provided at section 603 and connected with the following ten control centers :

301, 302, 310, 401, 501, 601, 602 (boiler) ,
605, 701 and 603

Battery - powered back-up units are provided for control current for 603 sub-station receiving panel's instrumentation, for start-up of the diesel engine (emergency power source) , and for 309 and 310.

Rated power consumption is supposed to be 330,000KWH/D. The attached Table-2 shows a general view of motors by section, high-or low-tensions, kinds and around high-tension motors.

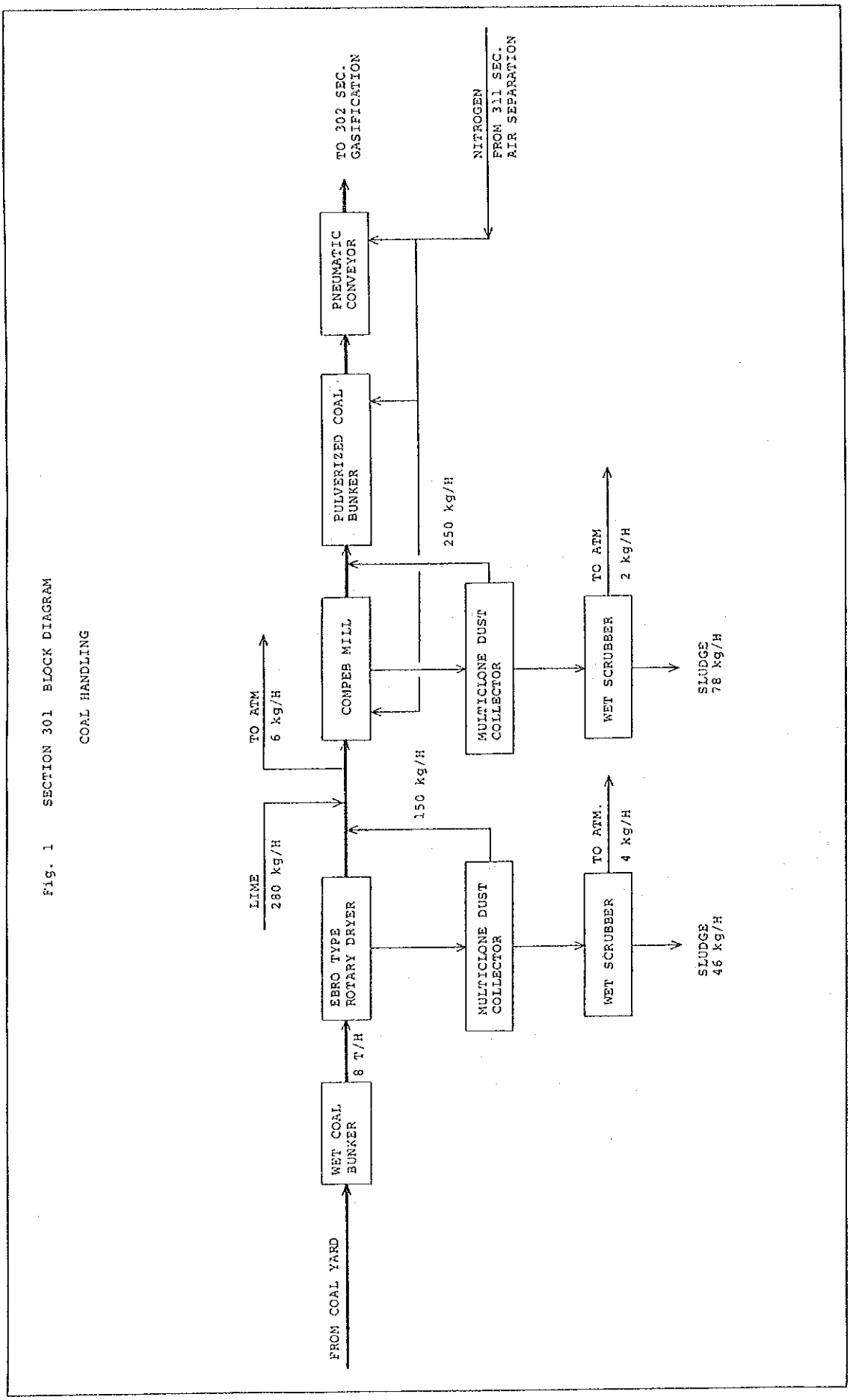


Fig. 1 SECTION 301 BLOCK DIAGRAM

COAL HANDLING

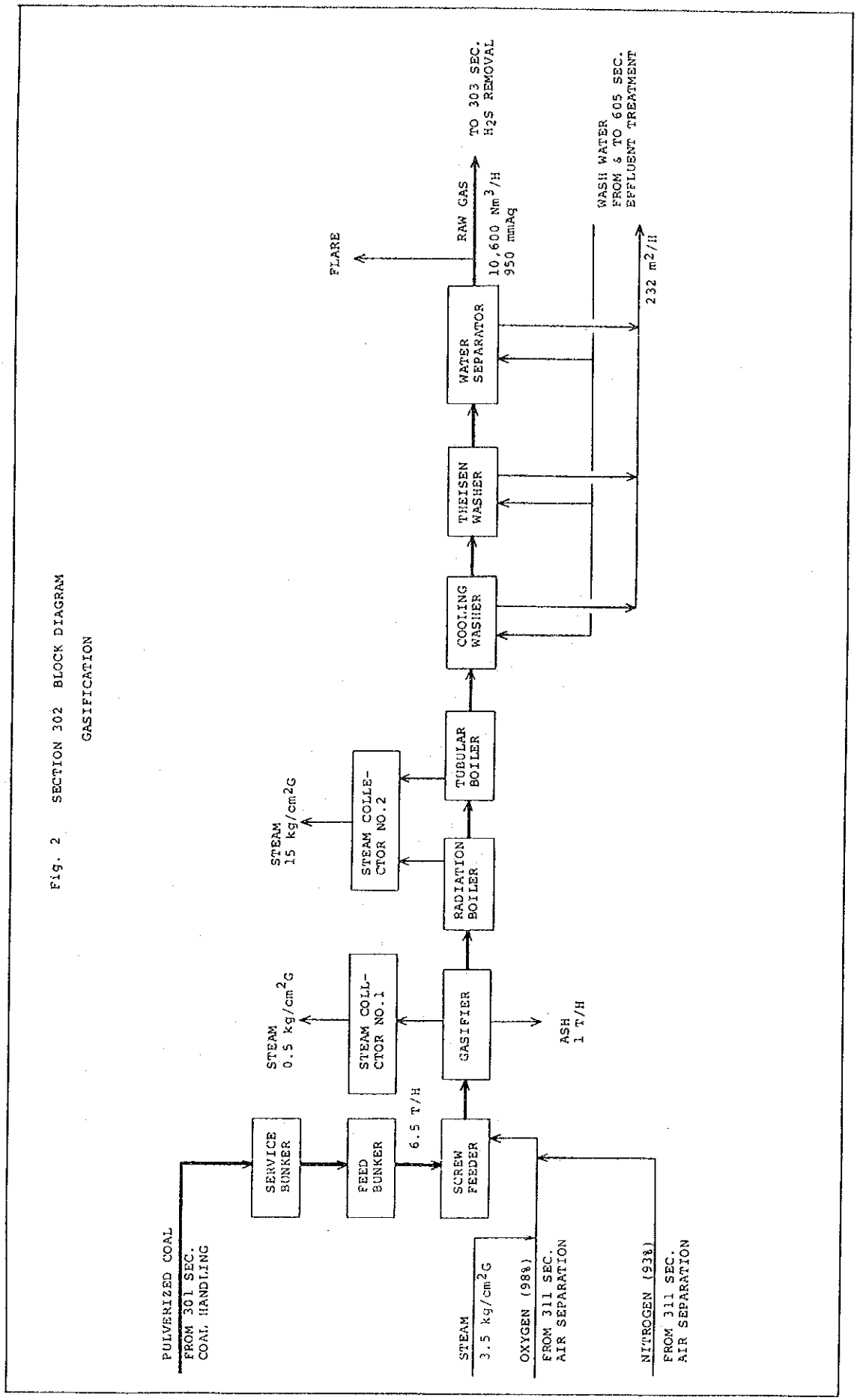


Fig. 2 SECTION 302 BLOCK DIAGRAM
GASIFICATION
PULVERIZED COAL
FROM 301 SEC.
COAL HANDLING
SERVICE BUNKER
FEED BUNKER
6.5 T/H
SCREW FEEDER
STEAM
3.5 kg/cm2G
OXYGEN (98%)
FROM 311 SEC.
AIR SEPARATION
NITROGEN (93%)
FROM 311 SEC.
AIR SEPARATION
GASIFIER
ASH
1 T/H
STEAM COLL-
CTOR NO.1
STEAM
0.5 kg/cm2G
RADIATION BOILER
STEAM COLLE-
CTOR NO.2
STEAM
15 kg/cm2G
TUBULAR BOILER
COOLING WASHER
THEISEN WASHER
WATER SEPARATOR
FLARE
RAW GAS
10,600 Nm3/H
950 mmAq
TO 303 SEC.
H2S REMOVAL
WASH WATER
FROM & TO 605 SEC.
EFFLUENT TREATMENT
232 m2/H

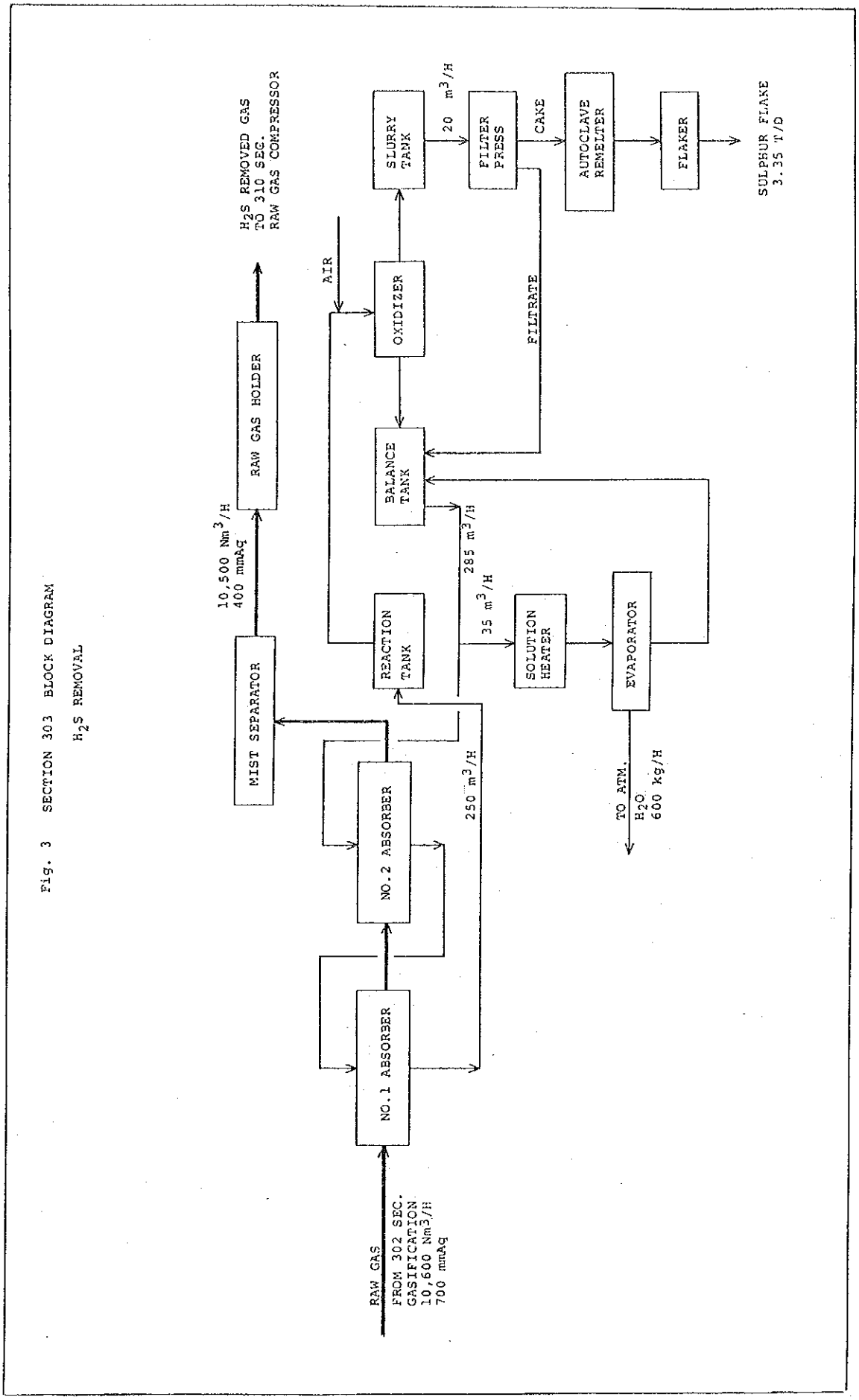


Fig. 3 SECTION 303 BLOCK DIAGRAM

H_2S REMOVAL

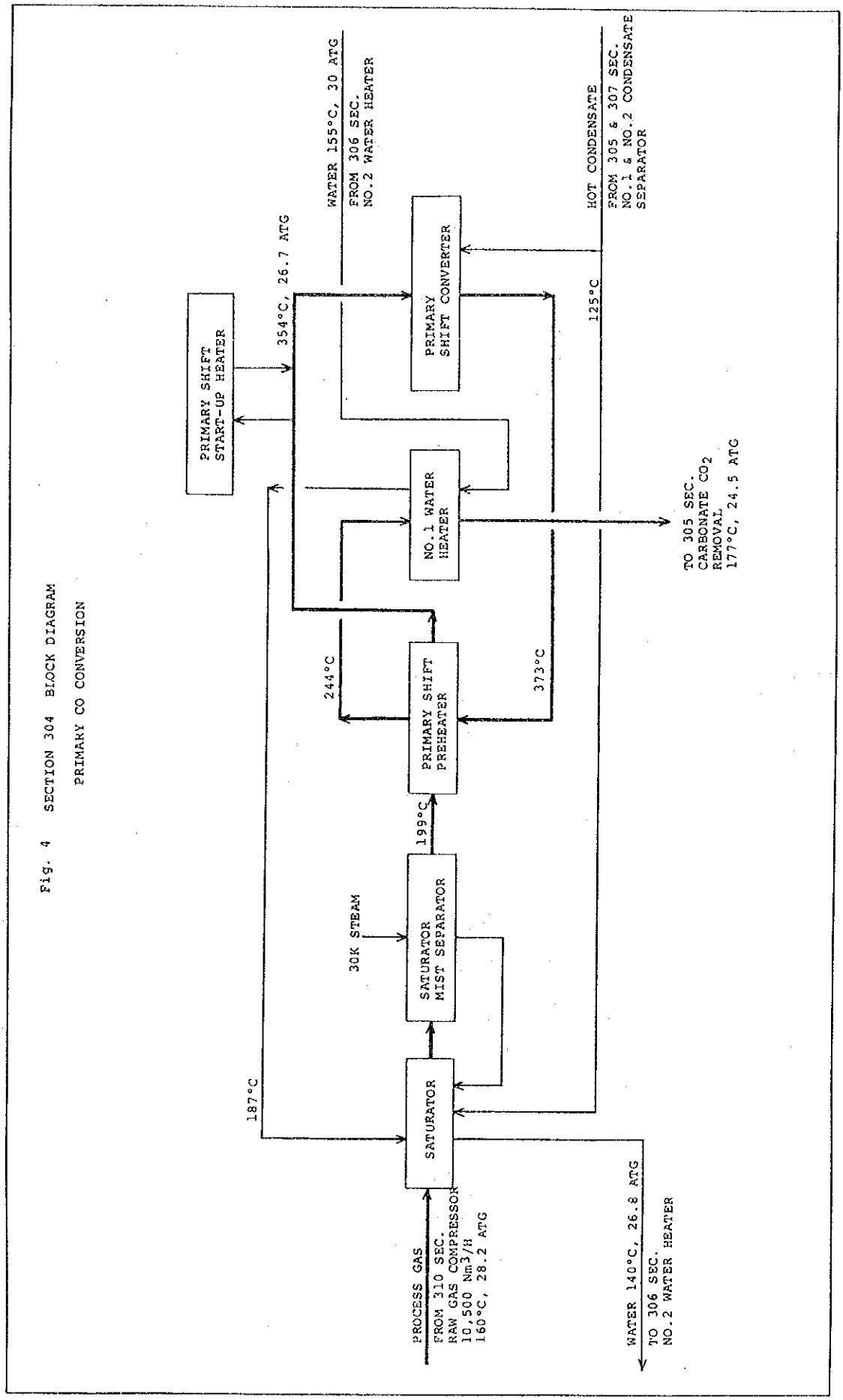


Fig. 4 SECTION 304 BLOCK DIAGRAM

PRIMARY CO CONVERSION

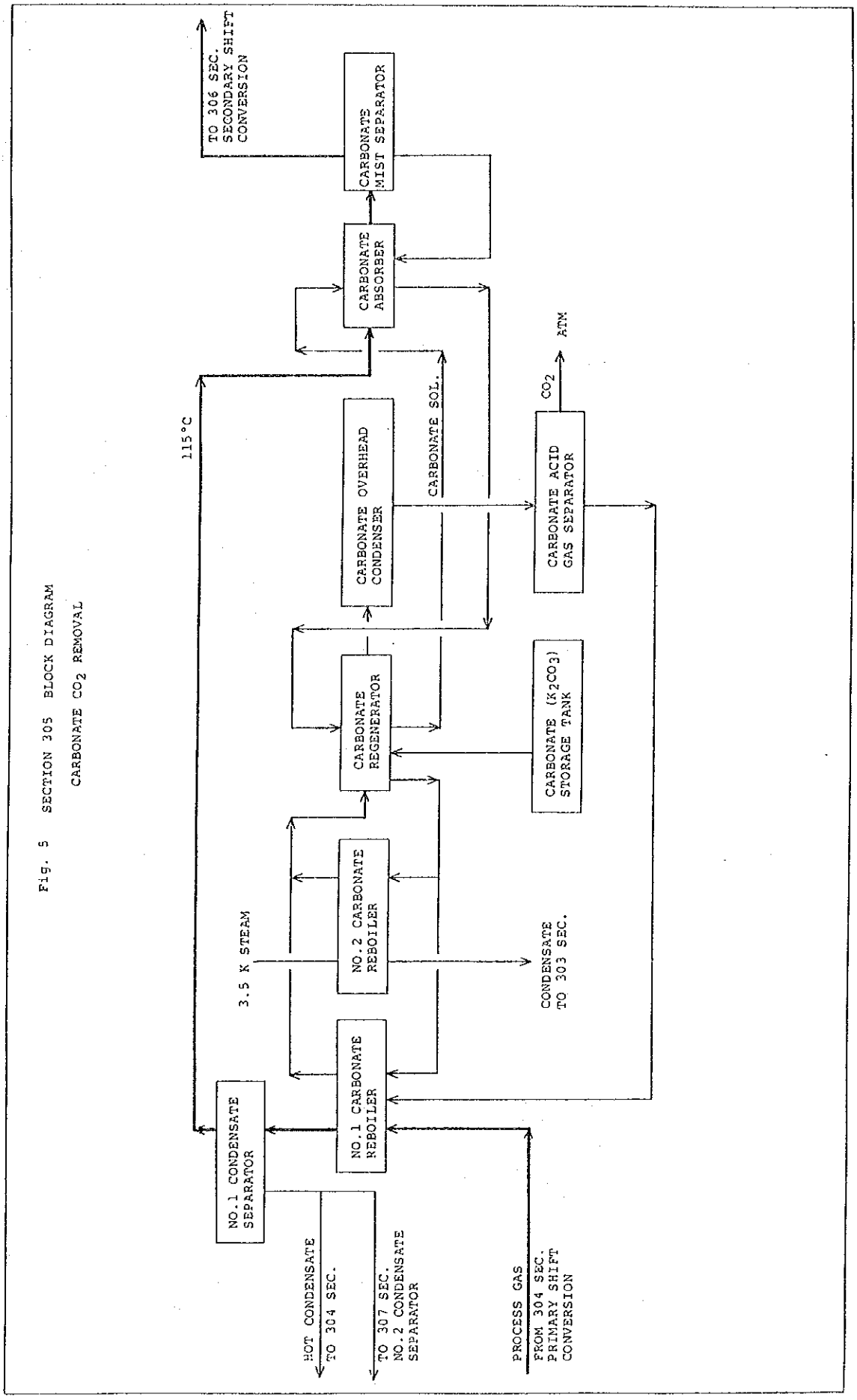
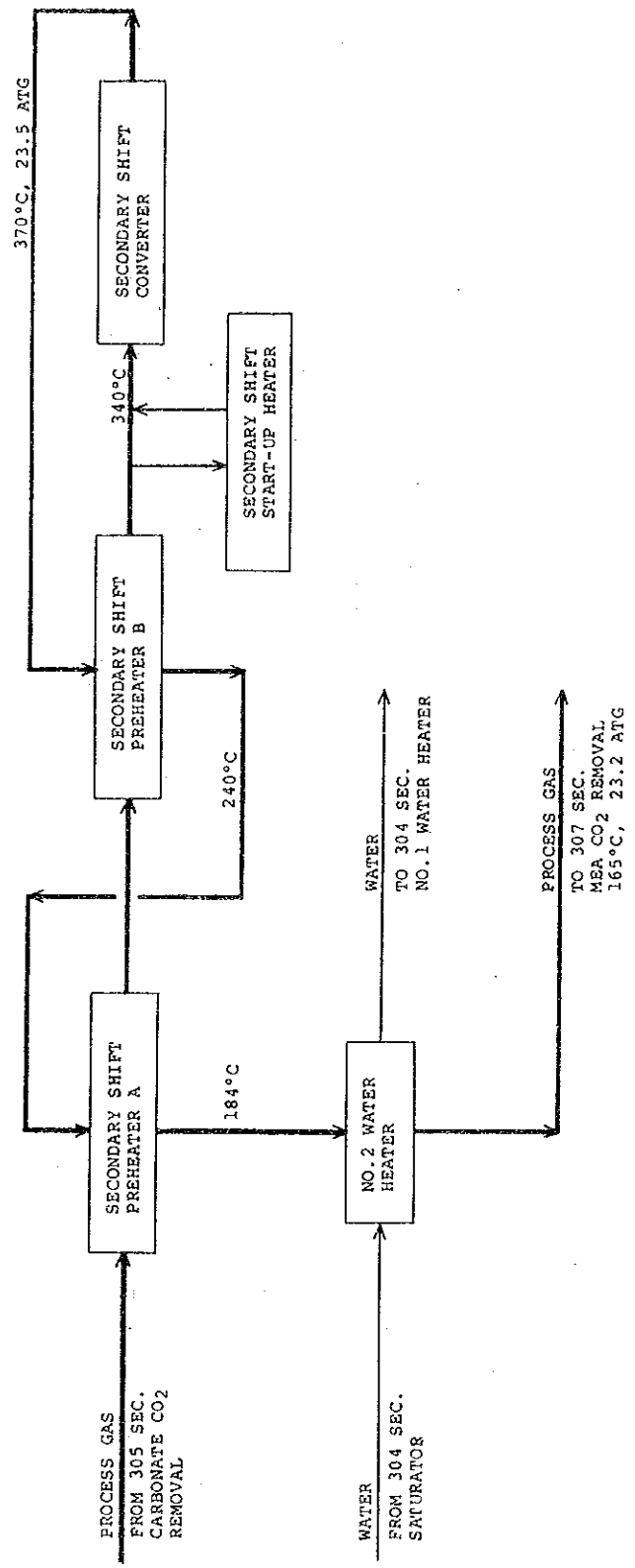


Fig. 5 SECTION 305 BLOCK DIAGRAM

CARBONATE CO_2 REMOVAL

Fig. 6 SECTION 306 BLOCK DIAGRAM

SECONDARY CO CONVERSION



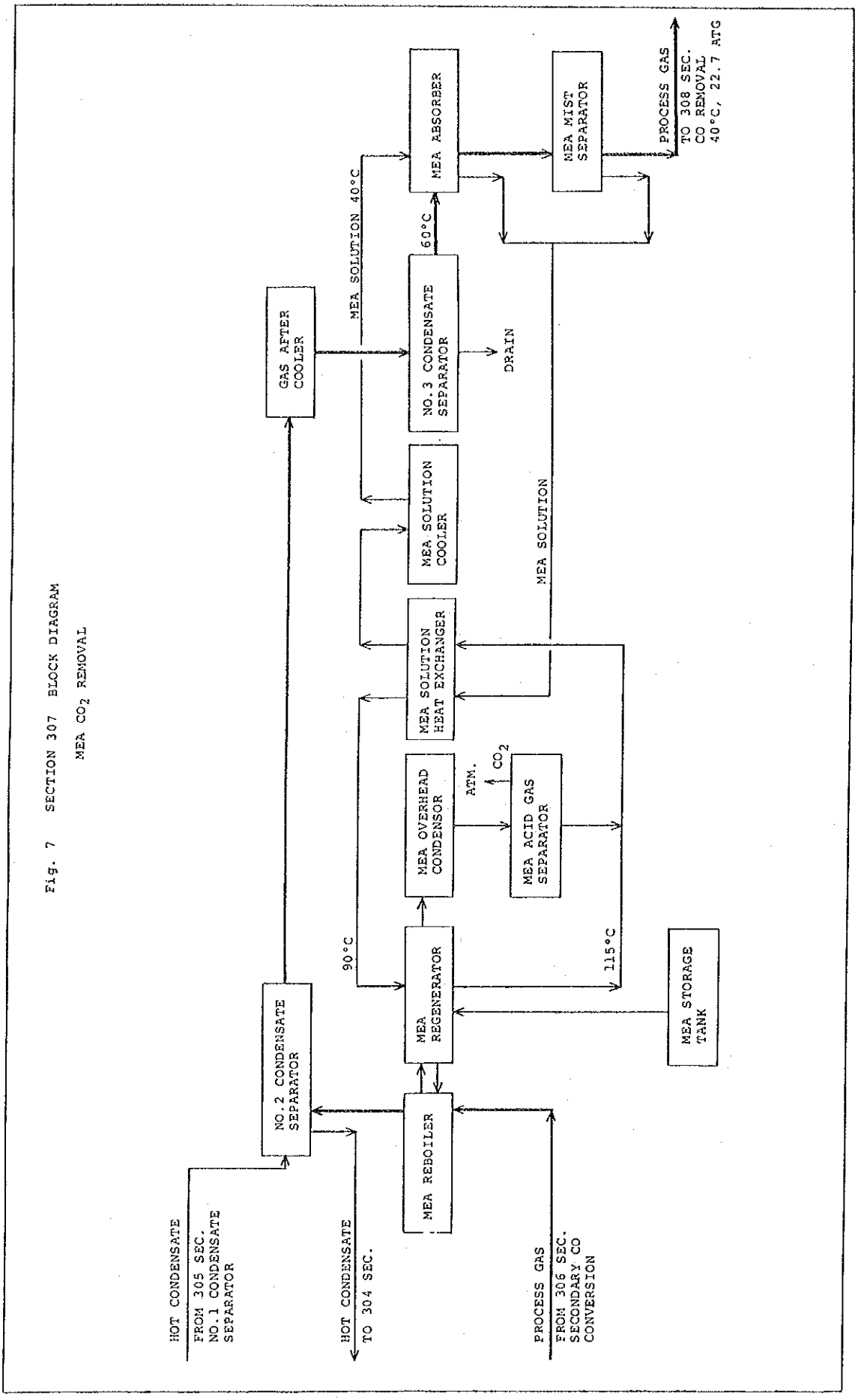


Fig. 7 SECTION 307 BLOCK DIAGRAM

MEA CO_2 REMOVAL

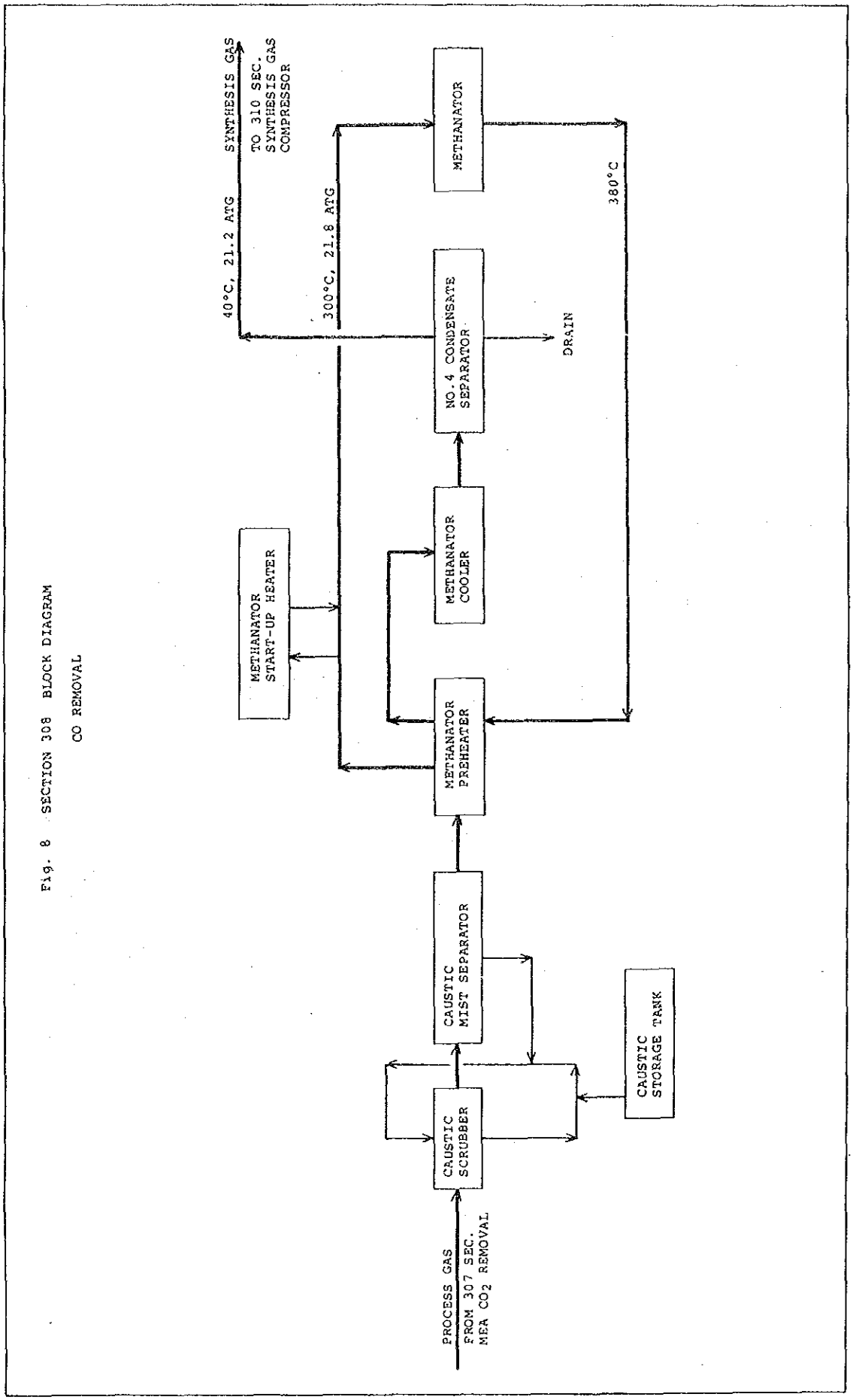


Fig. 8 SECTION 308 BLOCK DIAGRAM
CO REMOVAL

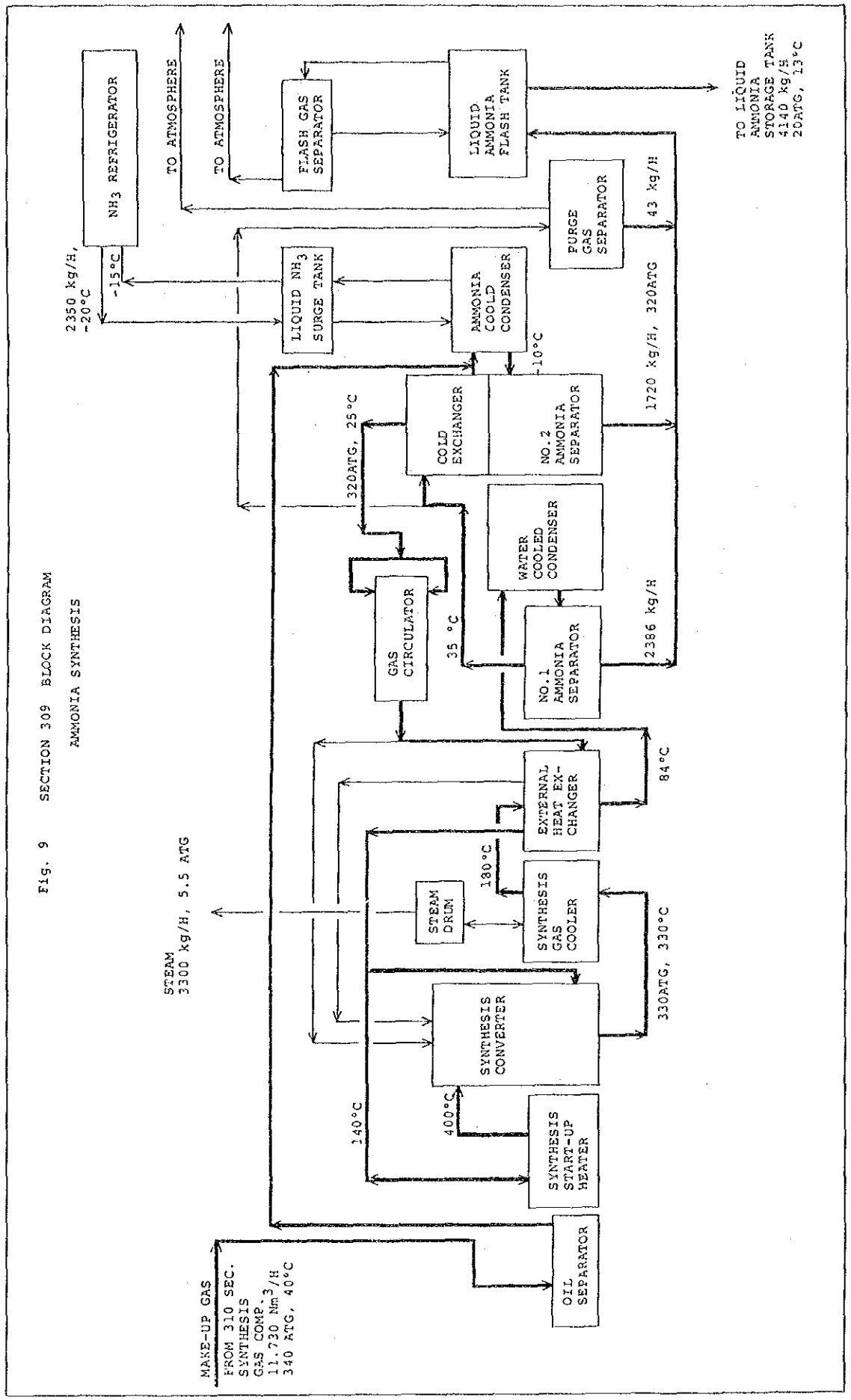


Fig. 9 SECTION 309 BLOCK DIAGRAM

AMMONIA SYNTHESIS

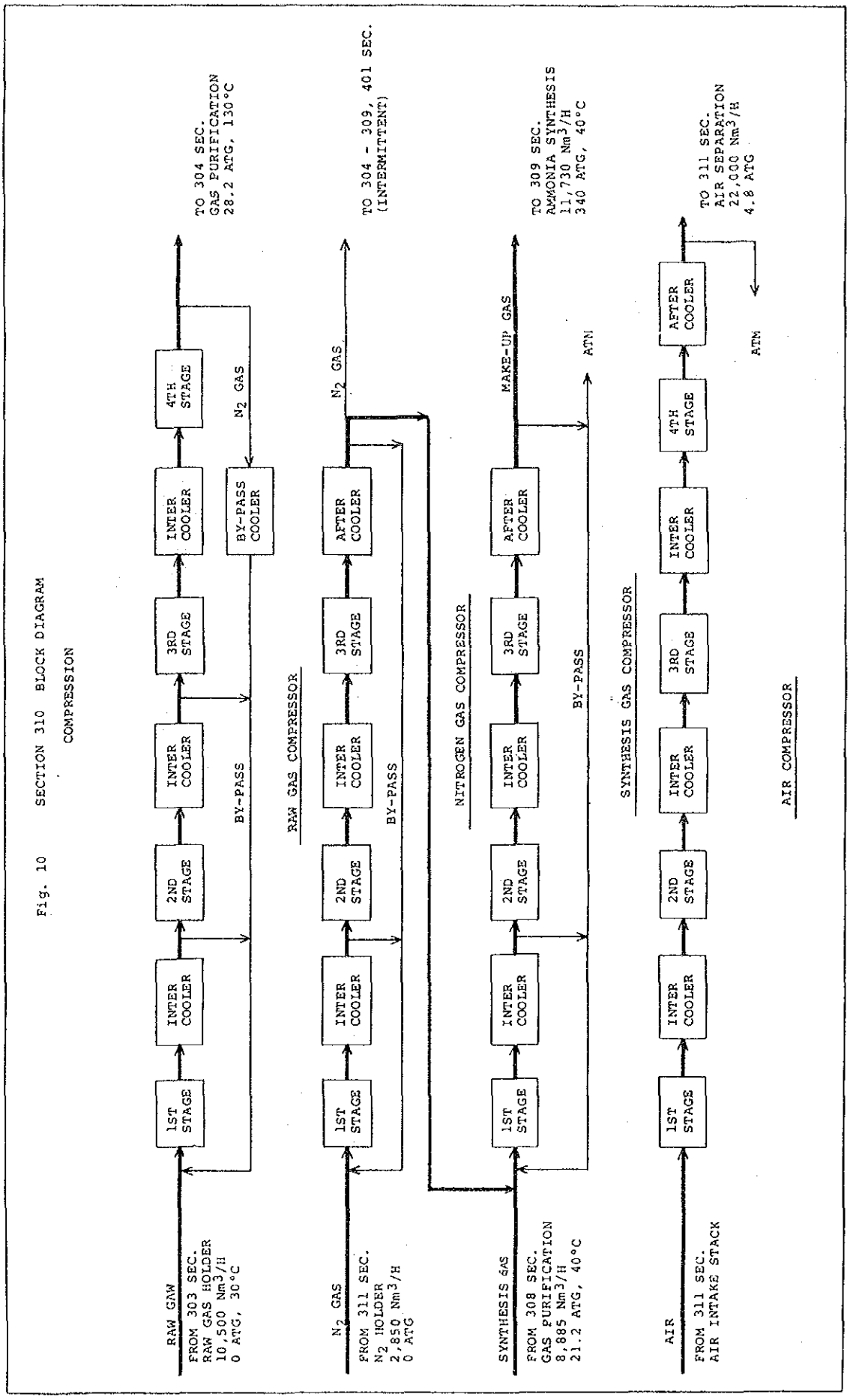


Fig. 10 SECTION 310 BLOCK DIAGRAM
COMPRESSION
RAW GAS COMPRESSOR
NITROGEN GAS COMPRESSOR
SYNTHESIS GAS COMPRESSOR
AIR COMPRESSOR
RAW GAW
FROM 303 SEC.
RAW GAS HOLDER
10,500 Nm3/H
0 ATG, 30°C
N2 GAS
FROM 311 SEC.
N2 HOLDER
2,850 Nm3/H
0 ATG
SYNTHESIS GAS
FROM 308 SEC.
GAS PURIFICATION
8,885 Nm3/H
21.2 ATG, 40°C
AIR
FROM 311 SEC.
AIR INTAKE STACK
1ST STAGE
INTER COOLER
2ND STAGE
INTER COOLER
3RD STAGE
INTER COOLER
4TH STAGE
AFTER COOLER
BY-PASS
BY-PASS COOLER
N2 GAS
MAKE-UP GAS
ATM
TO 304 SEC.
GAS PURIFICATION
28.2 ATG, 130°C
TO 304 - 309, 401 SEC.
(INTERMITTENT)
TO 309 SEC.
AMMONIA SYNTHESIS
11,730 Nm3/H
340 ATG, 40°C
TO 311 SEC.
AIR SEPARATION
22,000 Nm3/H
4.8 ATG

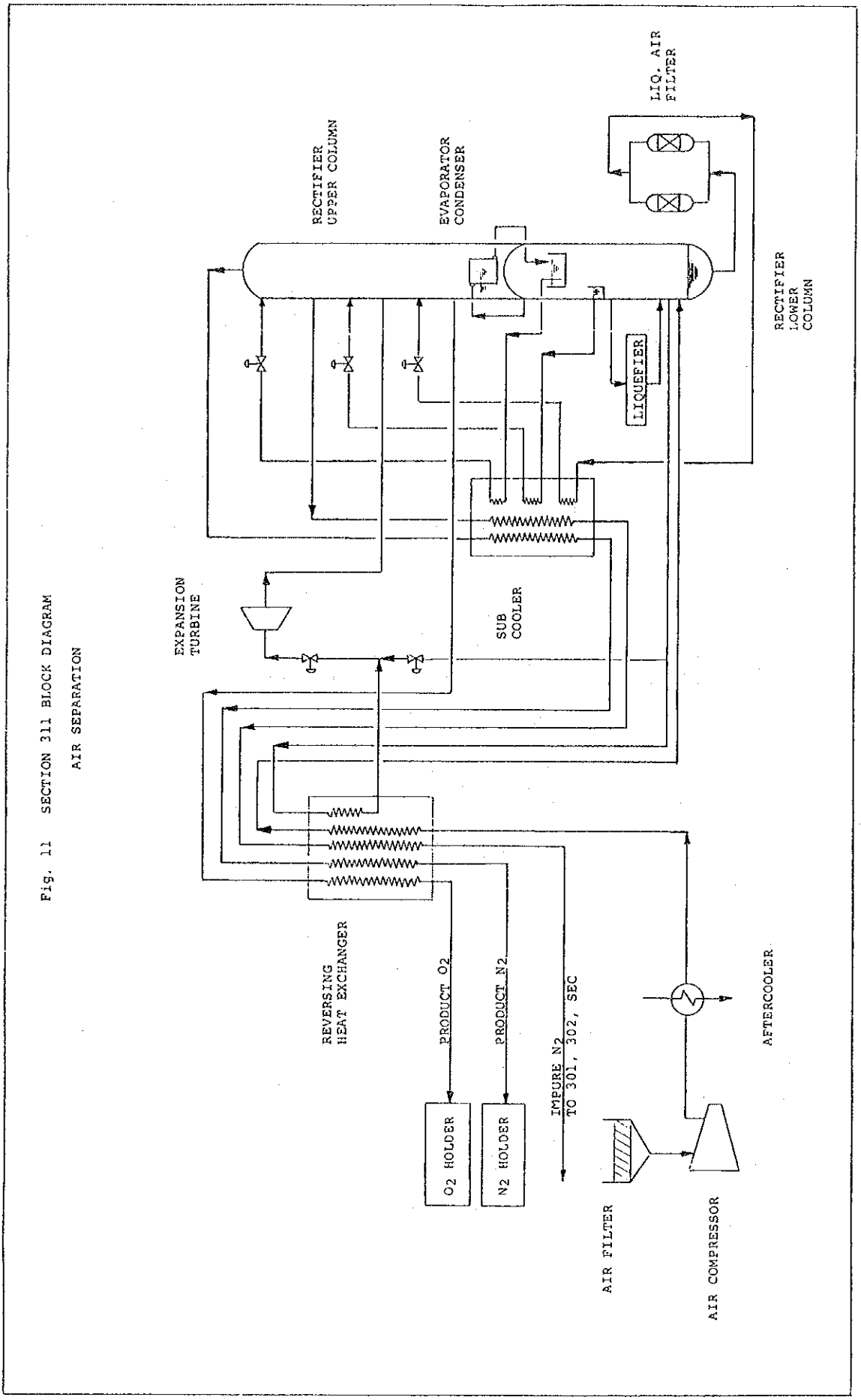


Fig. 11 SECTION 311 BLOCK DIAGRAM

AIR SEPARATION

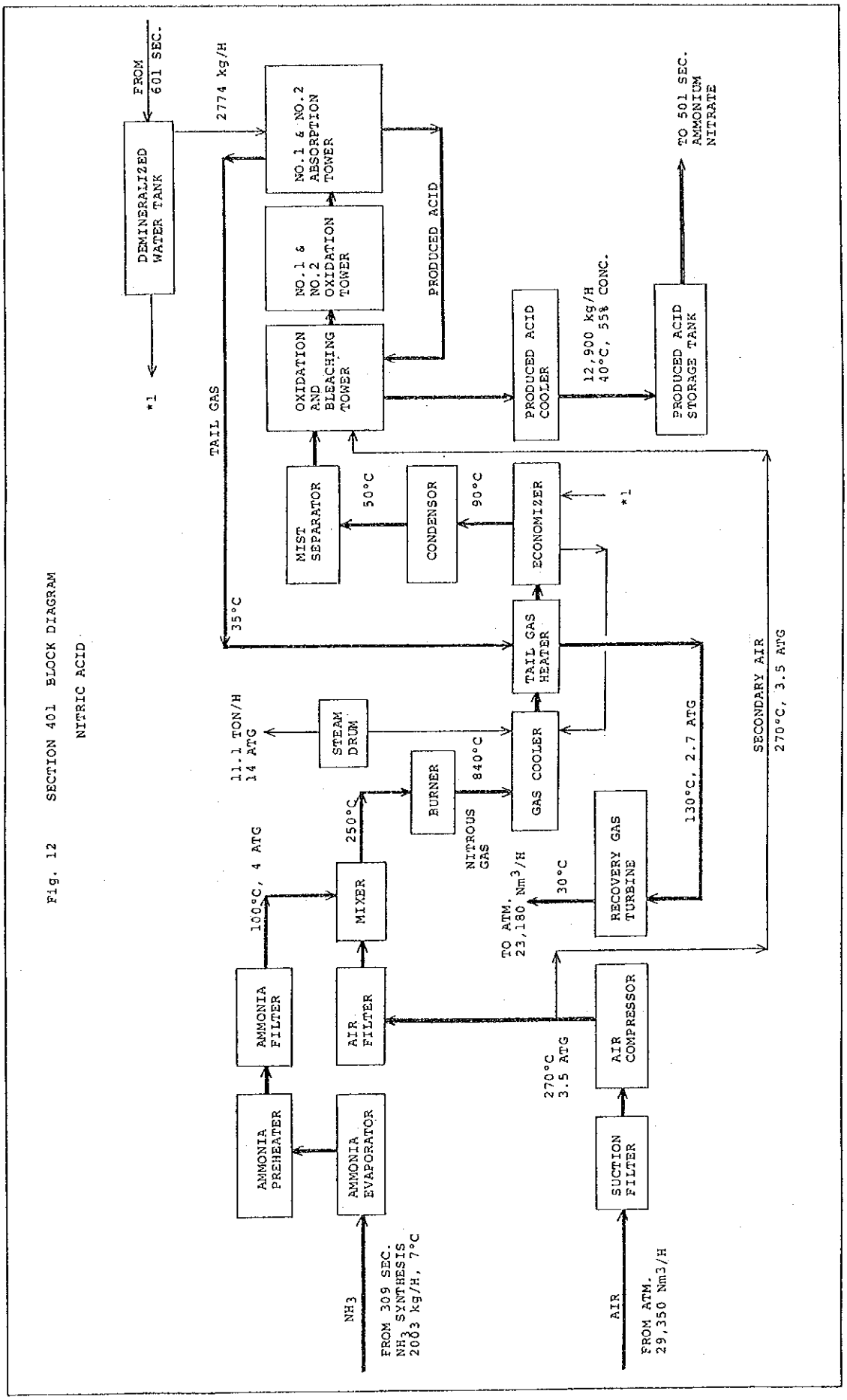


Fig. 12 SECTION 401 BLOCK DIAGRAM

NITRIC ACID

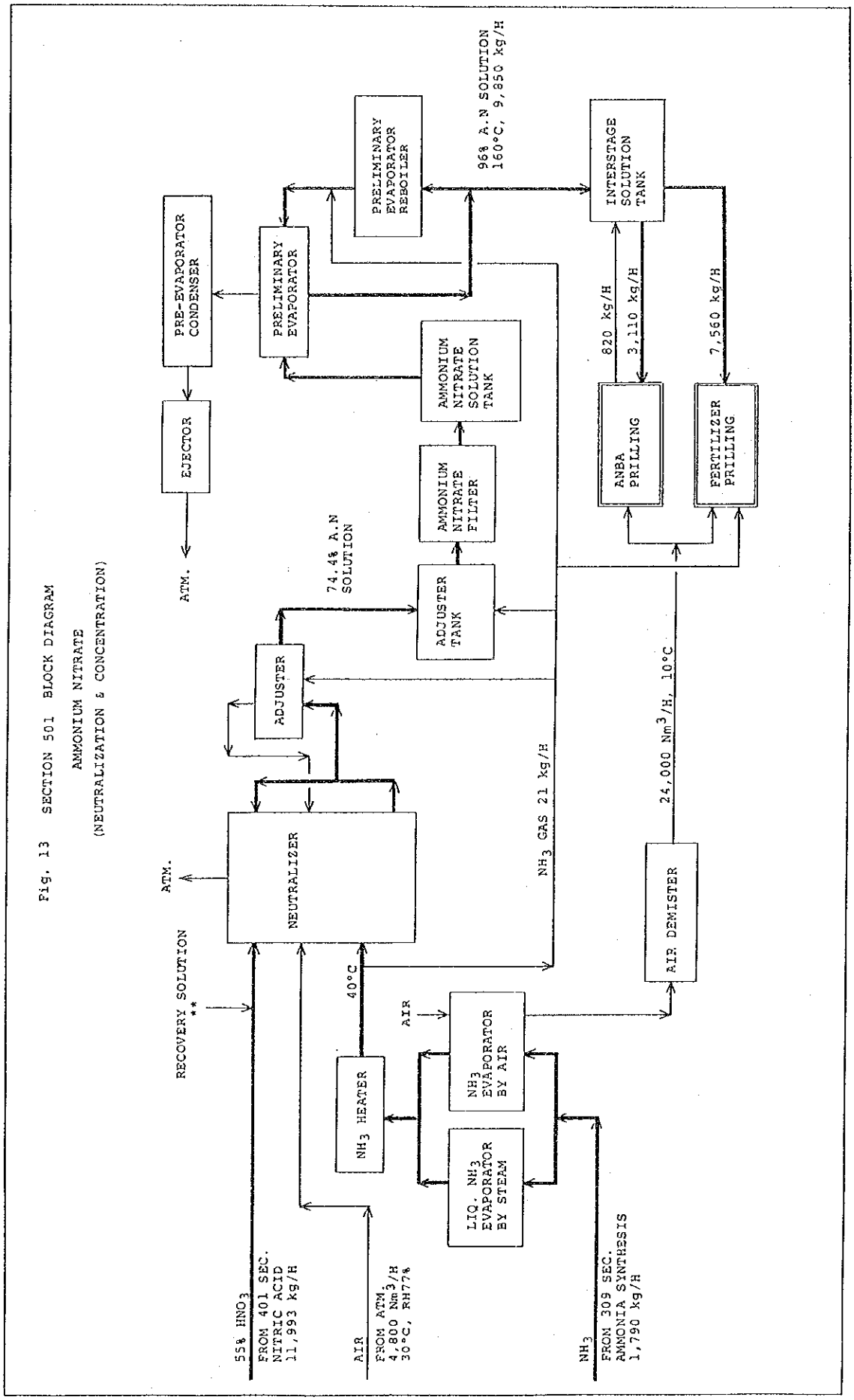


Fig. 13 SECTION 501 BLOCK DIAGRAM
AMMONIUM NITRATE
(NEUTRALIZATION & CONCENTRATION)

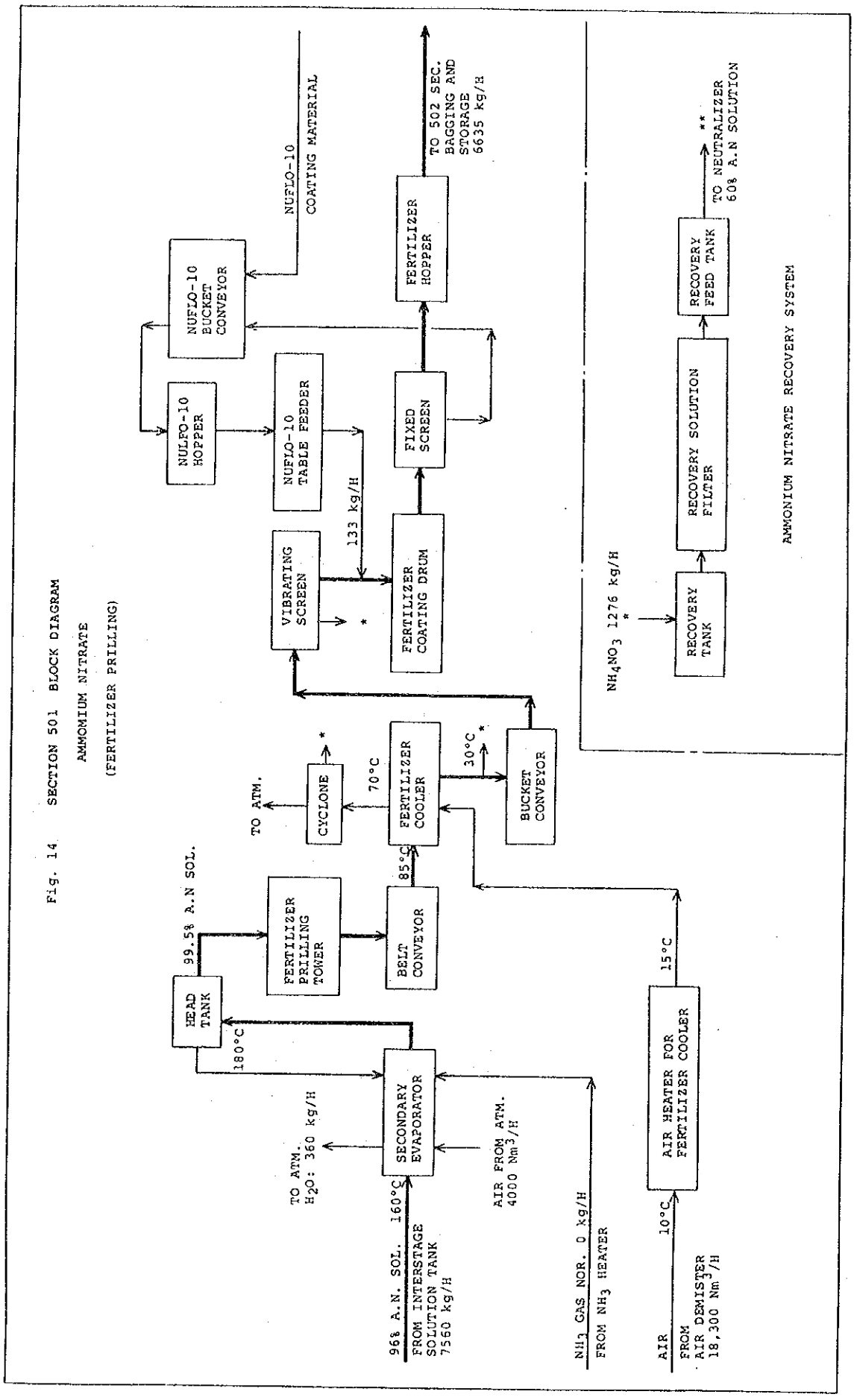
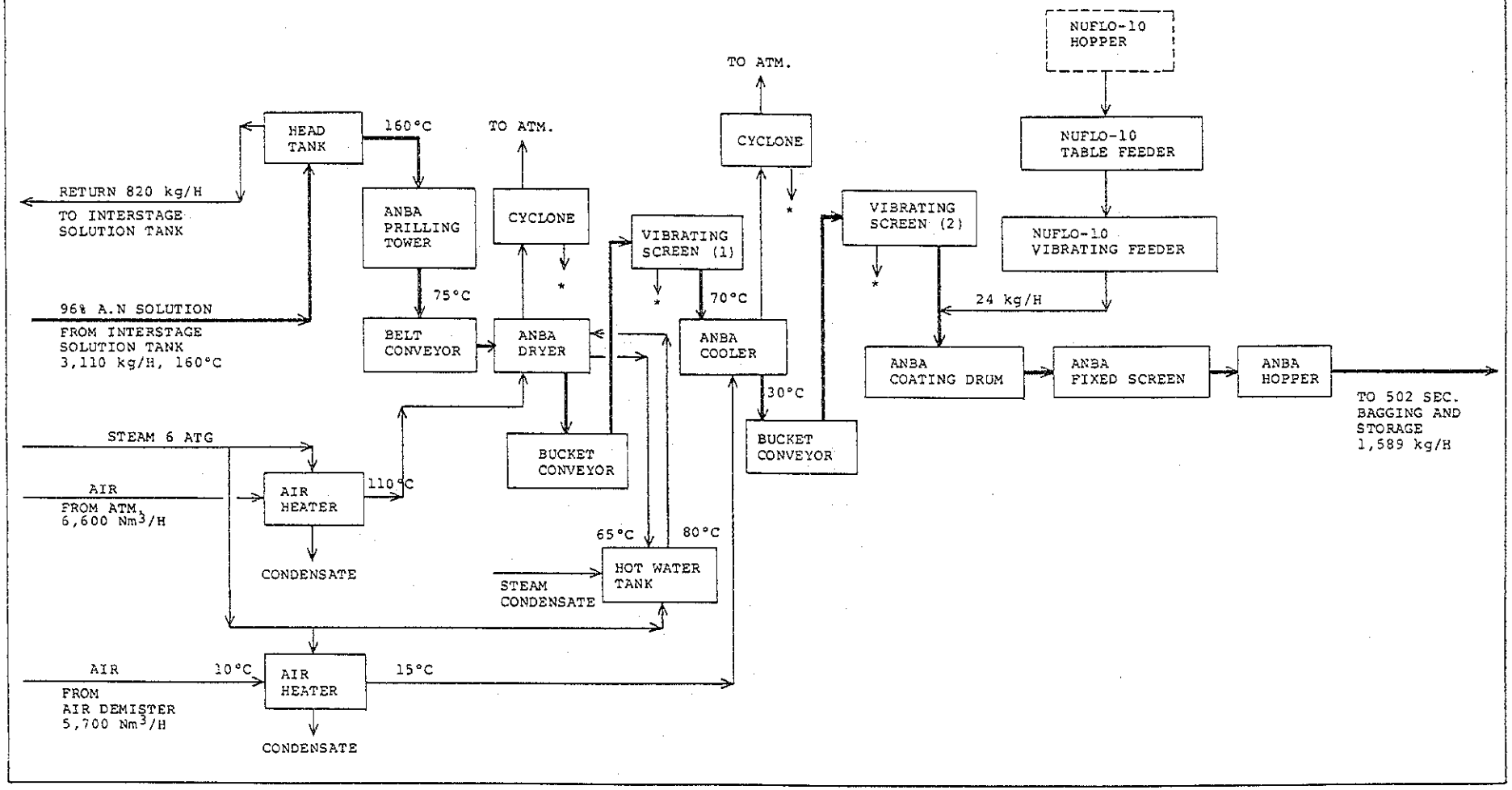

SECTION 501 BLOCK DIAGRAM
AMMONIUM NITRATE
(FERTILIZER PRILLING)
AMMONIUM NITRATE RECOVERY SYSTEM
96% A.N. SOL. 160°C
FROM INTERSTAGE SOLUTION TANK 7560 kg/H
SECONDARY EVAPORATOR
TO ATM. H2O: 360 kg/H
AIR FROM ATM. 4000 Nm3/H
HEAD TANK
180°C
99.5% A.N SOL.
FERTILIZER PRILLING TOWER
BELT CONVEYOR
85°C
CYCLONE
TO ATM.
70°C
FERTILIZER COOLER
30°C
BUCKET CONVEYOR
VIBRATING SCREEN
133 kg/H
FERTILIZER COATING DRUM
NULFO-10 HOPPER
NULFO-10 TABLE FEEDER
NULFO-10 BUCKET CONVEYOR
NULFO-10 COATING MATERIAL
FIXED SCREEN
FERTILIZER HOPPER
TO 502 SEC. BAGGING AND STORAGE 6635 kg/H
NH3 GAS NOR. 0 kg/H
FROM NH3 HEATER
AIR HEATER FOR FERTILIZER COOLER
15°C
AIR 10°C
FROM AIR DEMISTER 18,300 Nm3/H
NH4NO3 1276 kg/H
RECOVERY TANK
RECOVERY SOLUTION FILTER
RECOVERY FEED TANK
TO NEUTRALIZER 60% A.N SOLUTION

Fig. 14

Fig. 15 SECTION 501 BLOCK DIAGRAM

AMMONIUM NITRATE

(ANBA PRILLING)



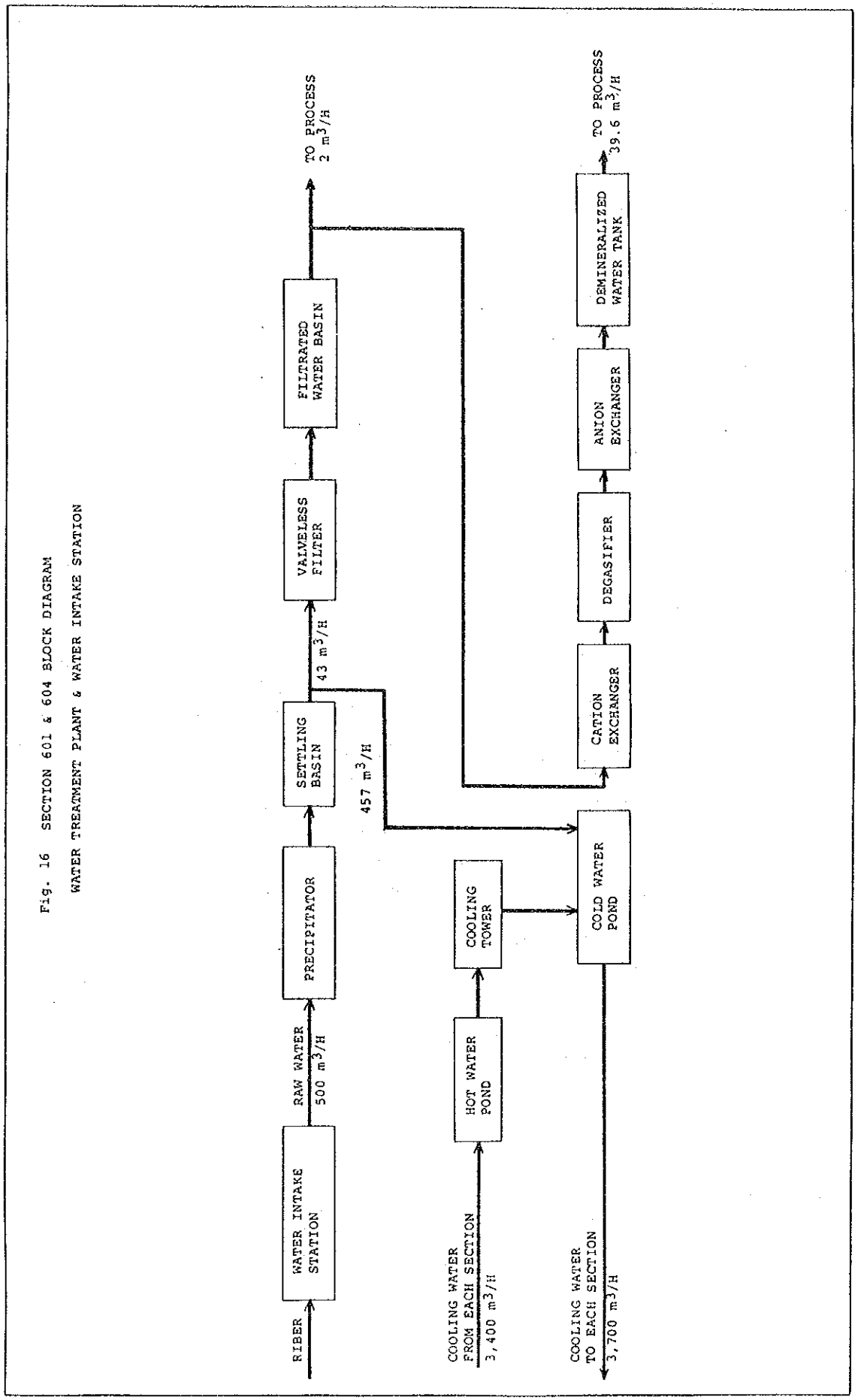


Fig. 16 SECTION 601 & 604 BLOCK DIAGRAM

WATER TREATMENT PLANT & WATER INTAKE STATION

Fig. 17 SECTION 602 BLOCK DIAGRAM

BOILER PLANT

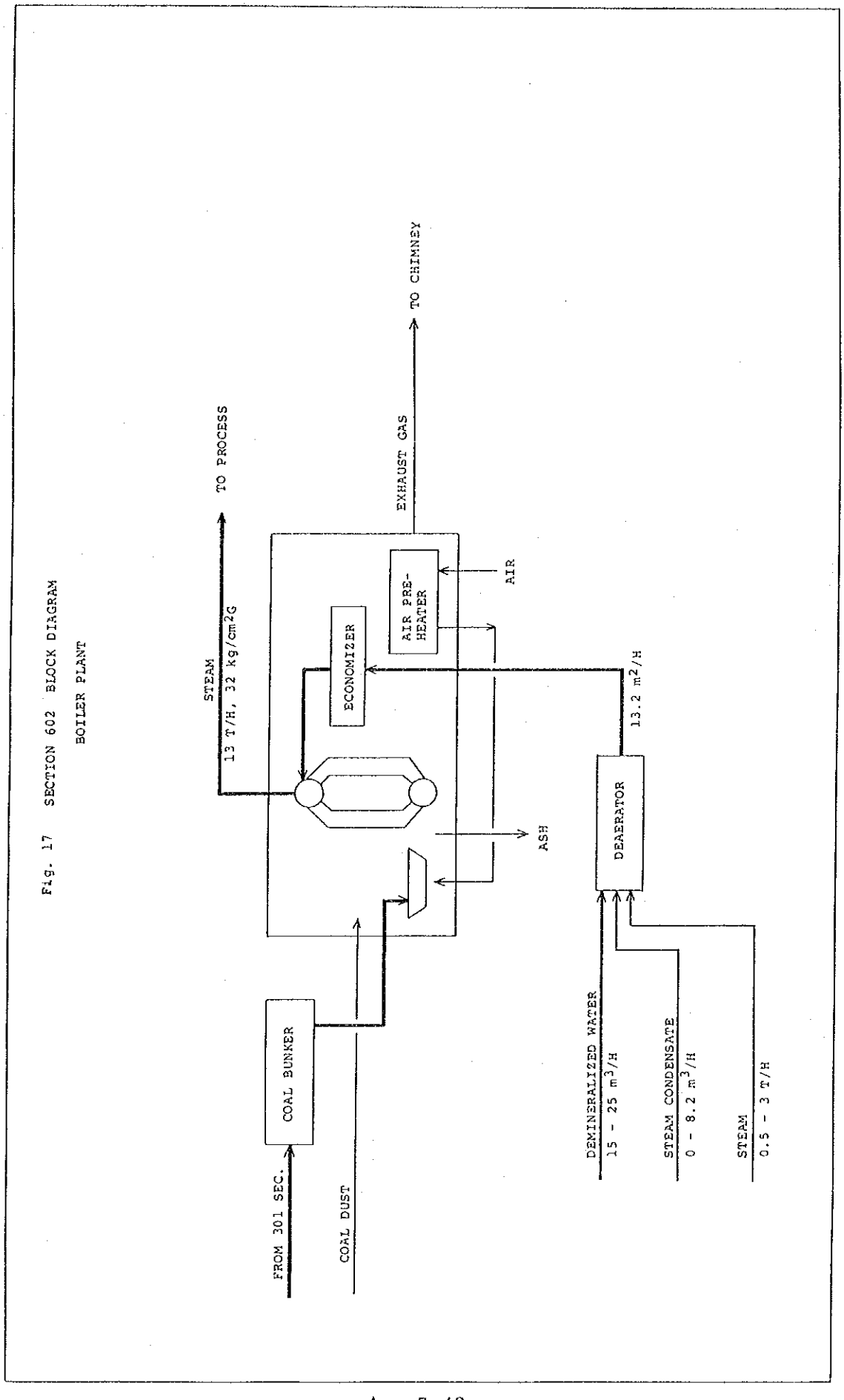
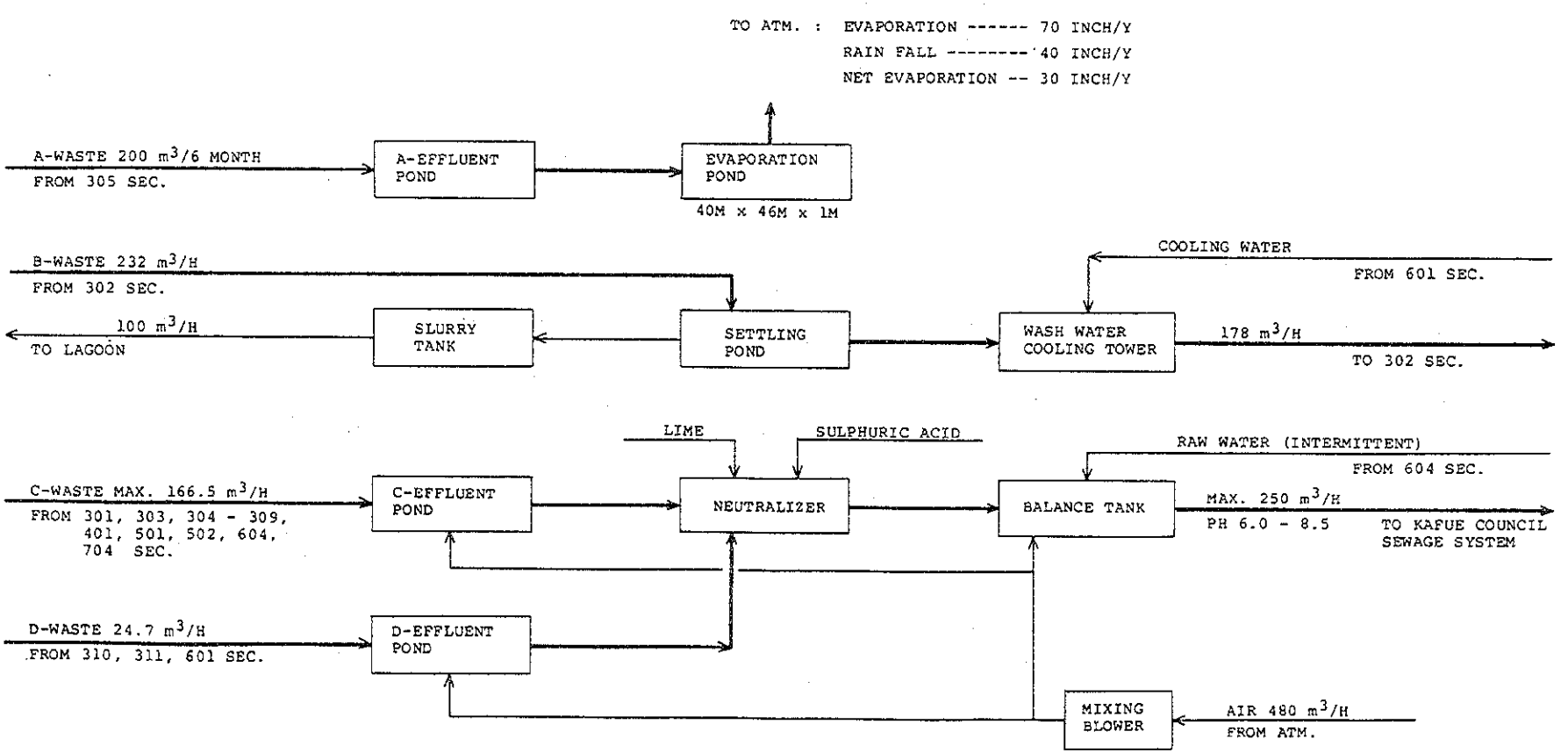


Fig. 18 SECTION 605 BLOCK DIAGRAM

EFFLUENT TREATMENT



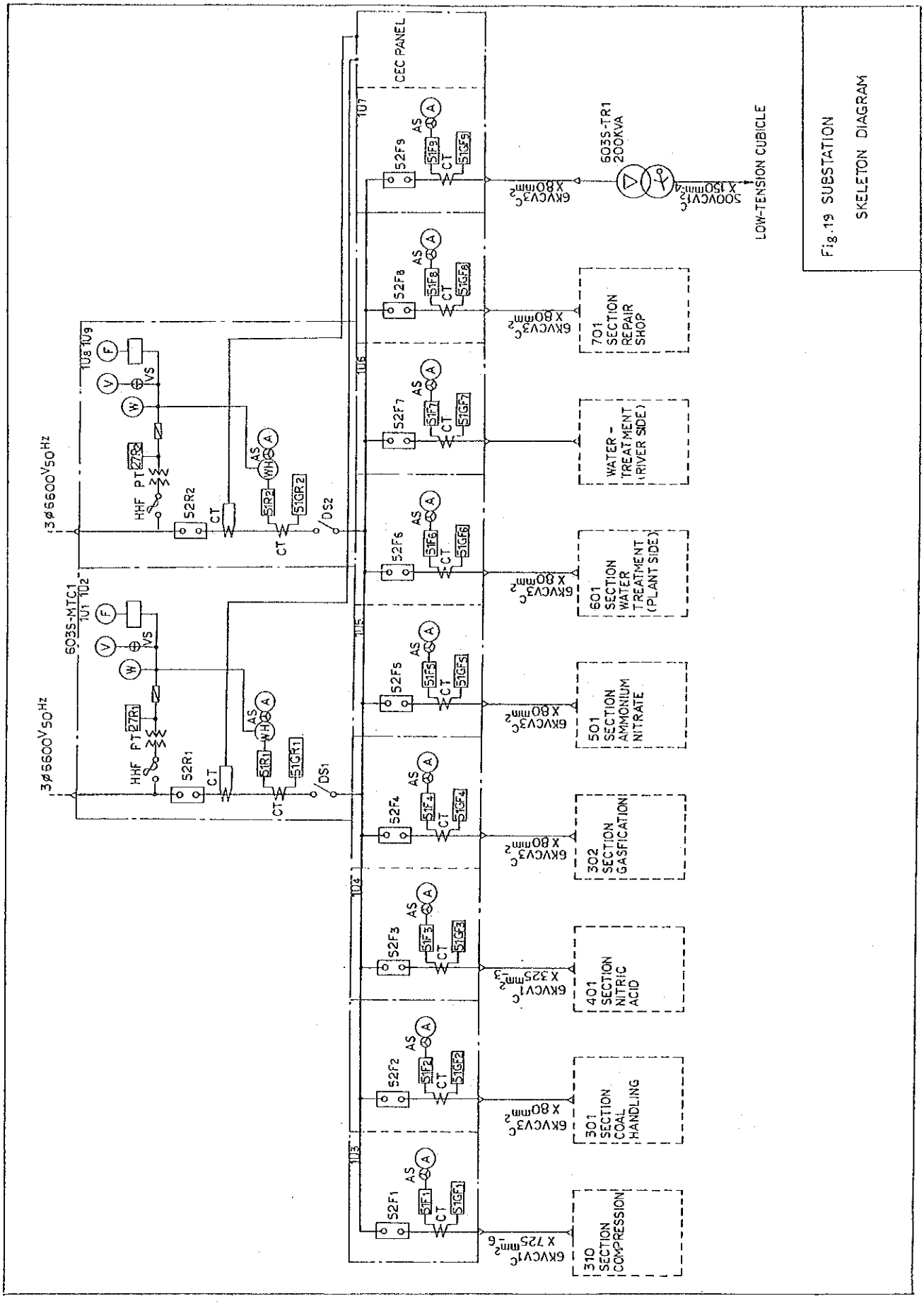


Fig.19 SUBSTATION SKELETON DIAGRAM

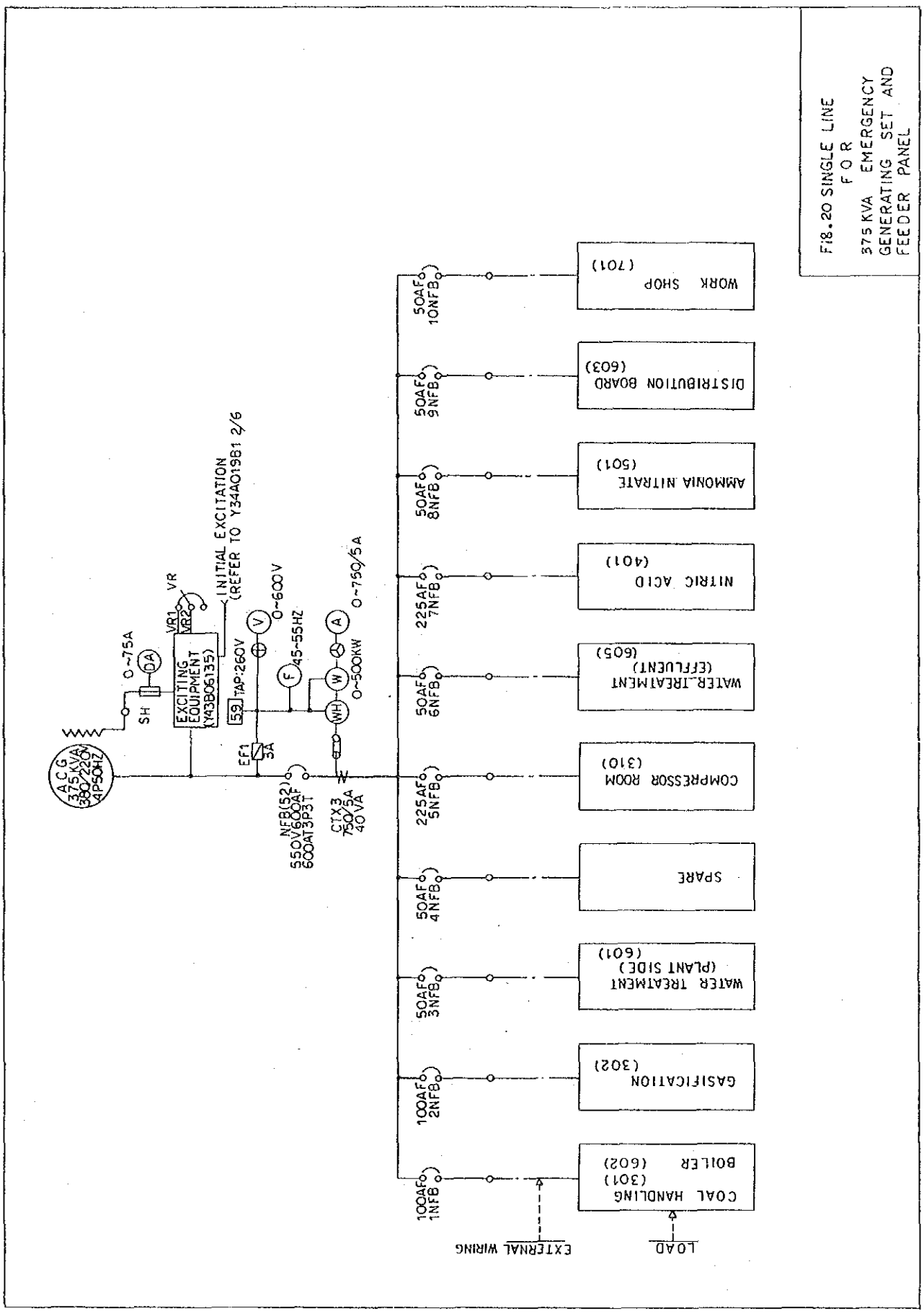


Fig. 20 SINGLE LINE FOR 375 KVA EMERGENCY GENERATING SET AND FEEDER PANEL

Table 1 PARTS LIST OF ELECTRIC APPARATUS FOR EMERGENCY POWER PLANT

TAG NO.	DUTY	Q'ty	TYPE	NET WEIGHT	DRAWING NO.	NOTE
603 S-EE1 & DG1	Diesel-Generator set	1	Engine: 460PS/1500 rpm, 4-cycle, Vertical Water cooled Generator: 375KVA, 4-pole, 380V, 50 cycle 3-phase (4 wire), Open type Attachment for set: refer to PE-8240	(total) 8,750 kg	PE-8240	Foundation & Arrangement: PE-8241A Piping Diagram: PE-8242
————	Accessories for Diesel Engine:			150 kg		
————	Exhaust Silencer	1		150 kg	8004-1200120A	
————	Exhaust Flexible Pipe	1		30	8002-1150360	
603 S-T1	Fuel Oil Tank	1		600 (Dry 150)	8005-1110482A	
————	Fuel Oil Tank Stand	1		40	8006-1100500A	
————	Fuel Oil Transfer Hand Pump	1		6	8016-9100000A	
————	Fuel Oil Flexible Pipe	1		0.4	8001-1200400A	
————	Gauge Board	1		15	PE-832A	
603 S-BTT2	Battery	1 set	(4× H200 type)	(total) 300	8011-0002000A	
603 S-CHA2	Battery Charger	1		50	PE-1027L	
————	Nozzle Tester	1		7.7	BE-1205A	
————	Spare Parts for Year	1 set	(1 box)	20		
————	Special Tools	1 set	(2 boxes)	50		
————	Piping Materials	1 set		400		

Table 2 GENERAL VIEW OF MOTORS

SECTION	HIGH-TENSION MOTOR		LOW-TENSION MOTOR	
301	G05-M1 (Compeb Mill 280kW)	B	A, B	
302	——		C	
303	——		A	
304	——		A	
305	P01A/B-M1 (Carbonate Pump 340kW×2)	A		
306	——		A	
307	——		A	
308	——		A	
309	K02-M1 (NH_3 Refrigerator 370kW)	C	A K01-M1 (Gas Circulator 180kW)	
310	K01-M1 (Raw Gas Comp. 2400kW) K02-M1 (N_2 Comp. 530kW) K03-M1 (Syn. Gas Comp. 1750kW) K04-M1 (Air Comp. 2300kW)	C D D B	B, A	
311	——		A	
401	K01-M1 (Air Comp. 2200kW)	E	A, B	
501	——		A	
601	P09A/B-M1 (Cooling Water Pump 200kW×2)	B	P08A-C-M1 (Hot Water Pump 100kW×3)	B
602	——		A	
603	——		A 603S-EG1 (Diesel Generator) 375kVA	D
604	——		A	
605	——		A	

Remark: A: Totally enclosed fan cooled, outdoor type
B: Totally enclosed fan cooled, indoor type
C: Flame proof
D: Open type drip proof
E: Totally enclosed water cooled

APPENDIX 8

RESULT OF CHECK/INSPECTION AND REHABILITATION WORK

CONTENTS

EQUIPMENT & MACHINERY

GENERAL NOTES:

1. The column "Rehabilitation Work" describes the final action as the result of the first field survey and the check/inspection in the second field survey.

2. Expected life (Estimated as the equipment/machinery are now)
   A : 7 ····· 9 Years
   B : 4 ····· 6 Years
   C : 2 ····· 3 Years
   Z : Immediate Replacement

3. Supervisor

"Yes" means that presence of supervisors is recommended for the rehabilitation work.

SECTIONWISE NUMBERS OF EQUIPMENT/ MACHINERY TO BE REHABILITATED

Section	Complete Replacement	Replacement of Parts	Repair by NCZ	N/R
301	8	14	(1)	8
302	12	12	(2)	10
303	7	12	(2)	6
304－8	10	18	(6)	19
309	3	3	—	4
310	9	11	(3)	10
311	1	15	—	4
401	5	11	(6)	18
501	6	10	(13)	34
601	8	7	(4)	13
602	2	2	—	4
604	2	1	—	1
605	8	1	—	7
Total	81 (24%)	117 (35%)	(37) (Included in) N/R	138 (41%)

N/R : Not to be included in the rehabilitation programme.

GRAND TOTAL 336 ITEMS

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
301−C01 MULTICLONE DUST COLLECTOR	No problem on casing. Internal parts such as Guide Blade are corroded heavily. Rotary valve clearance too big. (To be replaced)	C	Replacement of Parts : 1 set	−
301−C02 WET SCRUBBER WITH EXHAUST FAN	Scrubber shell corroded heavily and repaired by welding patches of stainless sheets. Baffle Plate damaged. Exhaust Fan eroded heavily. Casing partly damaged Motor good.	C	Replacement of Exhaust Fan : 1 set	−
301−C03 MULTICLONE DUST COLLECTOR	Same as 301-C01	C	Replacement of Parts : 1 set	−
301−C04 WET SCRUBBER WITH EXHAUST FAN	Same as 301-C02	C	Replacement of Exhaust Fan : 1 set	−
301−D01 EBRO TYPE ROTARY DRYER	Plain riding ring and support Rollers are not aligned properly and worn unevenly. Thrust Riding Ring and Thrust Rollers the same. No Problem on the Dryer Shell.	C	Replacement of Parts	YES
301−C02 WET COAL BUNKER	NCZ observed blocking and bridging at the bottom in the rain season. Pneumatic knocker recommended.	−	Nil	−
301−G03 HOT AIR FURNACE	Fire bricks worn. Partly fallen. Heavy erosion around Fired Room.	B	Re-lining of Fire Brick : 1 set	YES

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
301−G05 COMPEB MILL	No problem on the mill shell. Rotating parts worn heavily. (To be replaced) . Shell liners to be replaced.	C	Replacement of Parts : 1 set	YES
301−G06 GRINDING MEDIA FOR COMPEB MILL	Almost worn out. Size distribution not satisfactory. All to be checked for size and replaced as required by NCZ.	−	NIL	−
301−G09 CHUTES, DUCTS AND PIPING	No Problem. (Repaired by NCZ) .	A	NIL	−
301−G10 INSULATING MATER-IAL	No Problem. (Repaired by NCZ) .	A	NIL	−
301−K01 ROOTS BLOWER	No Problem.	A	NIL	−
301−K02 A/B COMPRESSOR	Unloaders, Cylinder Valves and oil scraper rings to be replaced.	C	Replacement of Parts : 2 sets	−
301−K03 AIR PURGE BLOWER	Not in Service	−	NIL	−
301−W01 A, B WEIGHING FEEDER	Weighing Mechanism worn out, to be replaced.	C	Complete Replacement	−

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
301－W02 WEIGHING FEEDER	Weighing Mechanism worn out, to be replaced.	C	Complete Replacement	－
301－W03 WEIGHING FEEDER	-do- (This feeder should be for high temperature service of dried coal) .	C	Complete Replacement	－
301－W04 － do －	Weighing Mechanism worn out, to be replaced.	C	Complete Replacement	－
301－Y01 BELT FEEDER	No problem	A	NIL	－
301－Y02 BUCKET ELEVATOR	Casing and Gered Motor : O. K. Chain, Buckets and Driving Wheel are eroded heavily and be replaced.	B	Replacement of Parts : 1 set	－
301－Y03 BELT CONVEYOR	Structure, Frame and Motor : O. K. Conveyor belt, carrying idlers, impact idlers, self aligning unit, sprocket driver etc. to be replaced.	C	Replacement of Parts : 1 set	－
301－Y06 BELT CONVEYOR	-do-	C	Replacement of Parts : 1 set	－
301－Y08 FLOW CONVEYOR	No Problem	A	NIL	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
301－Y09 SCREW CONVEYOR	Casing, Screw, bearing etc. heavily eroded.	C	Complete Replacement : 1 set	－
301－Y10 BUCKET ELEVATOR	Main chain, buckets, driving and driven wheels etc. heavily worn. Casing repaired by patching in 1981. Geared Motor can be used.	C	Complete Replacement : 1 set	－
301－Y11 SCREW FEEDER	Casing, screw, bearing, roller chain, reducer etc. heavily worn. Especailly, the screw is broken and cannot be repaied.	C	Complete Replacement : 1 set	－
301－Y12 SCREW CONVEYOR	Casing, screw, bearing, roller chain, reducer, rotary valve etc. heavily worn. Especially, the screw is broken and can not be repaired.	C	Complete Replacement : 1 set	－
301－Y13 FLOW CONVEYOR	Casing : repaired by NCZ. Driving and driven wheels to be replaced (Both heavily worn) .	B	Replacement of Parts : 1 set	－
301－Y14 PNEUMATIC CONVEYOR	Cone valve and Feeding valve heavily correded (To be replaced) . 2-way-valve, Piston valve and Diaphragm valve are damaged heavily. (To be replaced. ShellThickness 11.4㎜ (New 12㎜)) .		Replacement of Parts : 1 set	－
301－Z02 AERATION UNIT FOR PULVERIZED COAL BUNKER	Repaired by NCZ frequently. Flexible hoses and canvas clothes to be replaced.	C	Replacement of Parts : 11 sets	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
302－G01 GASIFIER WITH IMMERSION SHAFT	Water leakage noticed because of erosion and deformation by high temperature. Frequent repairs by NCZ. Water cooling jacket material changed to stainless steel by NCZ.	C	Replacement of Parts : 1 set	－
302－G02 GASIFIER OUTLET	Inner shell heavily corroded resulting in water leakage. Repaired by welding many times. Outer shell to be fitted with an expansion joint	C	Complete Replacement : 1 set	－
302－G03 INTERMEDIATE PIECE BETWEEN IMMERSION SHAFT & EXTRACTOR	Inner shell heavily eroded	C	Replacement of Parts : 1 set	－
302－T01 COOLING WASHER	Baffle plates and spray pipes heavily corroded. Brick lining eroded and fallen partly. (Especially at the bottom) . Thickness 6.6／9.7 (new 7／10) . Good.	Vessel : A Others : C	1. Replacement of Baffle plate : 1 set 2. Brick-lining of inlet nozzle : 1 set 3. Replacement of spray pipe : 1 set	－
302－T02 WATER SEPARATOR	Shell and bottom plate corroded heavely (4㎜ for 8㎜ when new) . Wooden grids broken. Wooden grid supports corroded and deformed : B-Unit has no spray nozzles.	C	Complete Replacement : 2 sets	－
302－E02 TUBULAR BOILER	Channel, Tube Sheet and Tubes eroded heavily. Design to be studied.	C	Replacement of Tube Bundle : 1 set and inner shell	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
302−E04 A, B O_2−C00LER	No Problem	A	NIL	−
302−E05 A, B NO. 1 N_2 COOLER	Two Tubes plugged. Tube Bundles corroded heavily	B	Replacement of Tube Bundle : 2 sets	−
302−E06 NO. 2 N_2 COOLER	No Problem.	A	NIL	−
302−G06 ASH EXTRACTOR	Original one damaged 1971. One made by NCZ not satisfactory. Replacement with genuine one recommended.	C	Complete Replacement : 1 set	−
302−K01 A, B O_2−BLOWER	Discharge check values to be replaced (2 sets) . Metal sleeve and Labyrinth of A-Unit to be replaced. Rotor of B-Unit changed in 1980.	B A	A : Replacement of Parts : 1 set B : NIL	−
302−K02 A, B NO. 1 N_2 BLOWER	Labyrinth and bearing worn. (To be replaced) . By-pass cooler (cooling water side) heavily corroded. (To be replaced) .	B	A : Replacement of Parts : 1 set B : Complete Replacement : 1 set	−
302−K03 NO. 2 N_2 BLOWER	No problem	A	Replacement of Parts : 1 set	−
302−K05 AIR PURGE BLOWER	Not in Service	−	NIL	−

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
302－NO1－1 A, B THEISEN WASHER	Rotors, casings, shafts, shaft-sleeves etc. are corroded/eroded heavily. Materials applied should be further studied.	C	Complete Replacement : 2 sets	—
302－NO1－2 A, B THEISEN WASHER	-do-	C	Complete Replacement : 2 sets	—
302－P01 A, B WASH WATER PUMP	Impeller is cracked at the inlet. Repaired by welding by NCZ.	B	Replacement of Impellers : 2 sets	—
302－P02 A, B FEED WATER PUMP	Impeller, shaft, bearing and wearing ring are to be replaced.	B	Replacement of Parts : 2 sets	—
302－P03 A, B QUENCH WATER PUMP	Same as 302-P02	B	Replacement of Parts : 2 sets	—
302－P04 A, B LIGHT OIL PUMP	No Problem now. But spare parts required.	A	Complete Replacement : 2 sets	—
302－P05 FUEL OIL PUMP	The motor is replaced with South African make. No Problem	A	-do-	—
302－G07 CONNECTING E02 & T01	No Problem	A	NIL	—
302－G07－Z1 REFRACTORY BRICKS FOR CONNECT PIPE	Heavy erosion. Partly fallen off.	C	Complete Replacement : 1 set	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
302-G08 EXPANSION JOINT	To be replaced by NCZ. Many cracks on the Expansion bellows.	B	NIL	–
302-G08-Z1 REFRACTORY BRICKS FOR EXPANSION JOINT	Same as 302-G07-Z1	C	Complete Replacement : 1 set	–
302-G09-1-4 BURNERS	No Problem All made by NCZ	A	NIL	–
302-Z02 EXPANSION JOINT BETWEEN GASIFIER AND RAD. BOILER	Heavy erosion. Cracks on the weld repair lines.	C	Complete Replacement : 1 set	–
302-G01-Z1 GASIFIER LINING	Heavy erosion. Partly damaged.	C	-do-	–
302-E02-Z3 CLEANING DEVICE FOR TUB. BOILER	No Problem All made by NCZ.	–	NIL	–
302-E02-Z4 CASTABLE & BRICKS FOR BRANCHES	Castable to be repaired, (Partly) NCZ has in stock. To be reparied by NCZ.	A	NIL	–
302-E02-Z5 CONNECTION PARTS BETWEEN E01 & E02	Heavy erosion	C	Replacement of Connection : 1 set Parts	–

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
302−T02−Z1 STONE WARE RING	No Problem	A	NIL	−
303−E01 SOLUTION HEATER	Five tubes out of 15 plugged. Corrosion heavy. Thickness 5.7 ㎜ (new 6 ㎜) GOOD. Tubes are blocked with sulfur. Type of heater to be studied.	C	Complete Replacement : 1 set	−
303−E02 EVAPORATOR	Frame heavily corroded. Filling material damaged. Sulfur is blocking filling material. Type of Evaporator to be stuided.	C	Complete Replacement : 1 set	−
303−F01 FILTER PRESS	Fixed and movable heads and Oil pressure unit : No prblem. Other Parts to be replaced. Driving unit of filter plate removed and automatic filtration system out of service.	B	Replacement of Parts : 1 set	−
303−J01 A−H JET EJECTOR	No Problem	A	NIL	−
303−K01 A, B AIR BLOWER	12-16 cogs of timing gear of B-unit repaired by welding. (To be replaced) NO check valve on discharge line. 1 set of check valve to be installed.	B	Replacement of Rotating Parts : 2 sets	−
303−K02 A, B AIR COMPRESSOR	Removed in 1978. Instrument air is available and this compressor is not required.	−	NIL	−

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
303－P01 NO. 1 ABSORBER FEED PUMP	Impeller corroded and eroded heavily, check valve leaks because of corrosion	B	Replacement of Parts : 1 set	－
303－P02 A, B NO. 2 ABSORBER FEED PUMP	Impeller corroded and eroded heavily, check valve leaks because of corrosion.	B	Replacement of Parts : 2 sets	－
303－P03 REACTION TANK FEED PUMP	Impeller corroded and eroded heavily. Check valve leaks because of corrosion.	B	Replacement of Parts : 1 set	－
303－P04 A, B OXID-IZER FEED PUMP	-do-	B	-do- : 2 sets	－
303－P05 A, B FILTER FEED PUMP	Casing and imppeller eroded heavily. common bed corroded.	C	Complete Replacement : 2 sets	－
303－P06 CHEMICAL SOLUTION FEED PUMP	Motor now under repair by NCZ No Problem	A	NIL	－
303－T01 NO. 1 ABSORBER	Repaired by patching. Tower inside corroded for lower 10 meters, where stainless lining was made by NCZ. Wooden Grids damaged (To be replaced) .	C	Complete Replacement : 1 set	YES

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
303－T02 NO. 2 ABSORBER	Patched around the middle of the tower. Lower shell and bottom plate were lined with stainless steel. Wooden Grids to be replaced.	TOWER : B OTHERS : C	1. Inside epoxy coating : 1 set 2. Replacement of Wooden Grids : 1 set	YES
303－T03 NO. 3 ABSORBER	Inside corroded Wooden grids to be replaced	B	1. Epoxy Coating of inside : 1 set 2. Replacement of Wooden Grids : 1 set	YES
303－V01 REACTION TANK	NCZ changed the Tank 3 times except the cone, because it was heavily corroded. The one now in service was replaced in 1980 but some leakage noticed at the bottom outlet tube.	B	1. Complete Replacement with Epoxy coating of inside : 1 set	YES
303－V02 OXIDIZER	Shell 6.0㎜ (New 6㎜) GOOD. Epoxy coating recommended. Air Blast pipes are clogged sometimes, inspection of which is difficult without the sight glass.	B	1. Epoxy coating of inside : 1 set 2. Supply of Sight Glasses : 8 sets	YES
303－V03 SLURRY TANK	Top plate and roof plate heavily corroded. (To be replaced by NCZ) . Sulfur accumulated inside the Tank.	B	NIL	－
303－V04 BALANCE TANK	Painting peeled off. To be painted. Thickness 6.1㎜ (New 6㎜) . GOOD. Piping from V02 to be replaced by NCZ.	B	NIL	－
303－V05 MIXING TANK	Not in service now	B	NIL	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
303－V06 MIST SEPARATOR	The demister is removed because of clogging of carbon dusts. Shell corroded heavily. Carbon dusts piled inside.	C	Complete Replacement : 1 set	—
303－V07 WASH WATER TANK	Not in service since 1974, but to be back in service by replacing the automatic valve.	B	Replacement of Automatic Valve : 1 set	—
303－V09 A, B AUTOCLAVE REMELTER	Vessel : No Problem. Bottom steam trace and the piping from Remelter to Flaker to be replaced. (Heavy Corrosion)	VESSEL : A OTHERS : C	Replacement of Parts : 2 sets	— —
303－D01 FLAKER	Almost all the parts are heavily corroded. To be replaced.	C	Replacement of Parts : 1 set	—
303 SECTION pH CONTROL	Now operated without pH meter. To be installed.	—	Supply pH Analyser : 1 set	—
304－E01 PRIMARY SHIFT PREHEATER A, B	Shell : Thickness 16.1㎜ (New 15㎜) GOOD. Tube bundle heavily corroded. Tube bundle replaced by NCZ in 1974. No Problem.	B B	A : Replacement of Tube Bundle : 1 set B : NIL	—
304－E02 NO. 1 WATER HEATER	Shell repaired by patching, baffle plates are corroded (material to be changed to S/S). Pitting noticed on the expansion bellows.	C	Complete Replacement : 1 set	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
304－H01 PRIMARY SHIFT CONVERTER	No problem, though some pitting is noticed inside the Vessel. Shell : 36.4㎜ (new 36㎜) GOOD. Castable on the 2nd layer repaired by GOOD. Castable on the 2nd layer repaired by NCZ in 1979. Alundum balls damaged.	VESSEL : A OTHERS : C	1. Replacement of Castable : 1 set 2. Replacement of Catalyst : 1 set 3. Replacement of Alundum Balls : 1 set	－
304－P01 A, B WATER PUMP	A-Unit has some wear on the shaft and the wearing ring, but no problem.	B	NIL	－
304－T01 SATURATOR	Vessel 24.9㎜ (New 25㎜) GOOD. Crack and swell noticed on the lower part. S/S lining made by NCZ) . Grating heavily corroded. (To be replaced) .	VESSEL : A OTHERS : C	1. Replacement of Grating : 2 sets 2. Replacement of Rashig Ring : 1 set 3. Repair of lining : 1 set	YES
304－V02 NO. 1 DESUPERHEATER	Shell 21.4㎜ (New 21㎜) GOOD.	A	NIL	－
304－V03 NO. 2 DESUPERHEATER	Shell 21.5㎜ (New 21㎜) GOOD.	A	NIL	－
PIPING (1) CIRCULATING WATER LINE	Changed partly to S／S in 1970 No Problem	A	NIL	－
PIPING (2) PROCESS LINE	Almost half the piping changed to S／S in 1970. Other half is corroded heavily. (Especially elbows.) NCZ is changing to S／S. (Partly)	B	Replacement of Piping : 1 set Materials	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
305－E01 NO. 1 CARBONATE REBOILER	Five Tubes plugged. Corrosion not heavy. Shell fouled heavily. (To be cleaned periodically.) (Shell 8㎜) GOOD. Channel 20.1㎜ (New 20㎜) GOOD.	A	NIL	－
305－E02 NO. 2 CARBONATE REBOILER	15 Tubes plugged. Tube bundle heavily corroed. Shell 6.1㎜ (New 6㎜) GOOD. Shell cracked (150㎜ long) .	C	Complete Replacement : 1 set	－
305－E03 CARBONATE OVER HEAD CONDENSER	Shell 11.0㎜ (New 12㎜) GOOD. Seven tubes plugged. Heavy carbon accumulation on the tube sheet.	B	NIL	－
305－F01 CARBONATE SIDE STREAM FILTER	Not in service since 1974. Filter Plate driving unit and piping corroded. (To be replaced) .	C	Complete Replacement : 1 set	－
305－P01 A, B CARBONATE SOLUTION PUMP	First Stage casing corroded, wear ring worn. Shaft, shaft sleeve and wear ring are to be replaced.	C B	A : Complete Repalcement : 1 set B : Replacement of Parts : 2 sets	－ －
305－P02 A, B PEFLUX PUMP	Motor cover is corroded because of the leakage on the carbonate line overhead.	B	A : Complete Replacement : 1 set B : NIL	－
305－P04 A, B WATER INJECTION PUMP	B-Unit changed to British make No Problem A-Unit, Driving unit to be changed by NCZ.	A B	NIL	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
305－T01 CARBONATE REGENERATOR	Distribution pipe, Distributor, Grating etc. heavily corroded (To be replaced) Rashig rings dirty, many are damaged. (To be replaced) .	VESSEL : A OTHERS : B	Replacement of Parts : 1 set and Raschig Ring	YES
305－T02 CARBONATE ABSORBER	-do- Vessel Thickness 28.2㎜ (New 31㎜) GOOD.	VESSEL : A OTHERS : B	Replacement of Parts : 1 set and Raschig Ring	YES
PIPING (1) CARBONATE SOLUTION LINE	Corrosion heavy, Repaired by patching materials to be studied. Stainless steel lines : No Problem.	A, C	Replacement of piping	－
PIPING (2) CO_2 GAS LINE	-do- Thickness of the pipe where there is no patching repair was 5㎜ (New 6㎜) GOOD.	C	Replacement of Piping	－
PIPING (3) REBOILER VAPOR LINE	All pipe pieces are changed to rolled weld lines of which have many pinholes and deformed expansion joint to connect 305-E02 removed (To be installed) .	C	Replacement of Piping.	－
PIPING (4) REBOILER LIQUID LINE	Pipe Thickness : 250 A Line 3.4㎜ (New 3.0㎜) 200 A Line 3.0㎜ (New 3.0㎜)	A	NIL	－
HOT POTASSIUM CARBONATE SYSTEM		－	Supply of corrosion inhibitor	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
305－P03 CARBONATE SOLUTION SUMP PUMP	No Problem on motor, frame and column Other Parts, such as pump, shaft, intermediate bearing etc. are to be replaced.	A&C	Complete replacement : 1 set	－
306－E01 SECONDARY SHIFT PREHEATER A	Heavy corrosion. The Tubes were replaced with stainless tubes made in Germany in 1973 but used only for three months.	C	Complete Replacement : 1 set	－
306－E02 SECONDARY SHIFT PREHEATER B	Heavy corrosion, especially on tubes many pitting spots noticed. Nine tubes in the lower unit plugged.	C	Complete Replacement : 1 set	－
306－E03 NO. 2 WATER HEATER	The shell is repaired by welding patches. Tubes are corroed heavily. Materials to be studied.	C	Complete Replacement : 1 set	－
306－H01 SECONDARY SHIFT CONVERTER	Vessel thickness 26.4㎜ (New 27㎜) Grating and wire meshes are corroded heavily. The catalyst and Alundum Balls are to be replaced.	VESSEL : A OTHERS : C	1. Replacement of Catalyst : 1 set 2. Replacement of Alundum Balls : 1 set 3. Replacement of grating and wire mesh : 1 set	－
PIPING (1) PROCESS GAS LINE	A part of piping was replaced with stainless pipes in 1970. But other parts are carbon steel, which is repaired by welding.	A, C	Replacement of Piping Materials	－
PIPING (2) HOT WATER LINE	No Problem	A	NIL	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
307－E01 MEA REBOILER	Shell fouled heavily. (To be cleaned periodically) Shell 6.0㎜ (New 6㎜) GOOD.	A	NIL	－
307－E03 MEA OVERHEAD CONDENSER	Two tubes plugged. Some pitting noticed. Carbon steel parts (Baffle plates. Tie rods, spacers etc.) Corroded heavily. Shell 9.3㎜ (New 9㎜) GOOD.	B	Replacement of Tube Bundle : 1 set	－
307－E04 A, B MEA SOLUTION HEAT EXCHANGER	No Problem. Shell dirty, to be cleaned periodically. Shell 9.2㎜ (New 9㎜) GOOD.	A	NIL	－
307－E05 A, B MEA SOLUTION COOLER	Tube sheet and Tubes corroded heavily, shell 8.8㎜ (New 9㎜) GOOD.	C	Replacement of Tube Bundle : 2 sets	－
307－P01 A, B MEA SOLUTION PUMP	Corrosion and erosion noticed on all parts (shaft, shaft sleeve, impeller etc.) except casing.	B	Replacement of Parts : 2 sets	－
307－T01 MEA REGENERATOR	Inside was clean with no heavy corrosion Raschig Rings also were clean. Shell 7.8／12.4／10 (New 8／12／10) GOOD.	A	NIL	－
307－T02 MEA ABSORBER	Thickness : 18.4㎜ (New 18㎜) GOOD. Top and bottom gratings are corroded and to be replaced. (Also Rachig Rings) .	A	1. Replacement of Grating : 2 sets 2. Replacement of Raschig Ring : 1 set	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
307－V01 NO. 2 CONDENSATE SEPARATOR	NCZ changed material (C/S to S/S) in 1970. No Problem.	B	NIL	－
PIPING (1) MEA SOLUTION LINE	Material partly changed to stainless steel by NCZ. A part of insulation peeled off (To be repaired) .	A	NIL	－
PIPING (2) CO_2 GAS LINE	NCZ Changed material from carbon steel to stainless steel. No Problem.	A	NIL	－
308－E02 METHANATOR COOLER	Shell replaced once and Tube bundle 4 times. The present one corroded on shell and tube heavily. Materials to be studied.	C	Complete Replacement : 1 set	－
308－P01 A, B CAUSTIC SOLUTION PUMP	Leakage noticed through Mechanical Seal for both units. (More for B-Unit) . The spare Mechanical Seals available in NCZ Store now.	A	NIL	－
308－P02 A, B CAUSTIC MAKE-UP PUMP	Slight sound noticed on the worm gear. No Problem.	A	NIL	－
308－P03 CAUSTIC SUMP PUMP	No Problem on motor, frame and column.Other parts, such as pump, shaft, intermediate shaft etc. , to be replaced.	A&C	Replacement of Parts : 1 set	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
309－E03 WATER COOLED CONDENSER	Tubes corroded heavily. (Pitting all over the tubes) . Shell 6.2㎜ (New 6㎜) GOOD.	C	Replacement of Tube Bundle : 1 set	－
309－E09 AMMONIA CONDENSER	Tubes corroded heavily. Capacity may not be sufficient for the service. (To be studied) .	C	Complete Replacement : 1 set	－
309－E10 LIQUEFIER CONDENSER	Tubes and tube sheet heavily corroded. Capacity may not be sufficient for the service (To be studied) .	C	Complete Replacement : 1 set	－
309－E11 GAS PUPGER	No Problem	B	NIL	－
309－K02－E1 OIL COOLER	Tubes replaced by NCZ in 1974. Slight corrosion noticed on the channel cover but no problem.	B	NIL	－
309－P01 A, B WATER PUMP	A-Unit replaced with Swedish make.	A	Complete Replacement of B-Unit : 1 set	－
309－V04 STEAM DRUM	Corrosion noticed on Demister when opened by NCZ in 1979. (To be replaced) . Thickness 11.5㎜ (New 12㎜) GOOD.	VESSEL : A	Replacement of Demister : 1 set	－
309－H01 SYNTHESIS CONVERTER	NCZ had placed order already.	－	NIL	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
309-K01 GAS CIRCULATOR	All parts except the casing to be replaced.	—	Replacement of Parts : 1 set Overhauling : 1 set	YES
310-D01 INSTRUMENT AIR DEHYDRATOR		C	NIL	—
310-K01 RAW GAS COMPRESSOR		A	1. Replacement of lst stage Casing : 1 set 2. Complete Overhauling	YES
310-K01-E1 IST STAGE INTERCOOLER	No problem. NCZ changed material of shell and tubes to stainless steel. Periodical cleaning of carbon dusts required.	A	NIL	
310-K01-E2 2ND STAGE INTERCOOLER	-do- Shell 6.6㎜ (New 6㎜) GOOD	A	NIL	
310-K01-E3 3RD STAGE INTERCOOLER	NCZ replaced tube bundle in 1971. No problem. Small pieces of wood found on the tube inlets (about one third of all tubes) .	B	NIL	
310-K01-E4 BY-PASS COOLER	Heavy corrosion all over shell and tube bundle. Small pieces of wood found on all the tube inlets. Shell 15.5㎜ (New 19㎜) NO GOOD.	C	Complete Replacement : 1 set	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
310-K01-E5 OIL COOLER	Tubes corroded heavily. Visual inspection of the shell : NO PROBLEM	B	Replacement of tube bundle : 1 set	–
310-K01-F1 SUCTION FILTER	Now in service without filter element (To be installed) Mixture of oil and carbon dusts accumulated at the bottom. Modification to be studied.	B	Replacement of parts : 1 set	–
310-K01-P2 A, B NO. 1 SEAL PUMP	Clearance between casing and rotor is too big. To be replaced.	C	Complete Replacement : 2 sets	–
310-K01-P3 A, B NO. 2 SEAL PUMP	Clearance between casing and rotor is too big. To be replaced.	C	Complete Replacement : 2 sets	–
310-K01-V1 1ST STAGE DRAIN SEPARATOR	Mixture of oil and carbon accumulated inside. The design to be studied.	B	Complete Replacement : 1 set	–
310-K01-V2 2ND STAGE DRAIN SEPARATOR	NCZ repaired by patching in jume 1979. Shell 3.4㎜ (New 6㎜) . To be replaced or repaired immediately.	C	Complete Replacement : 1 set	–
310-K01-V3 3RD STAGE DRAIN SEPARATOR	Shell patched by NCZ in June 1979. Shell thickness (without the patch) . 8.0㎜ (New 12㎜) .	C	Complete Replacement : 1 set	–

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
310-K01-V4 BY-PASS DRAIN SEPARATOR	Heavily corroded. Shell 7.2㎜ (New 17.4㎜) (Min. thickness required is 6.2㎜) . To be replaced at once.	C	Complete Replacement : 1 set	—
310-K01-V20 1ST DISCHARGE SILENCER	Mixture of carbon and oil accumulated. Type to be changed to maintain silencing effect and to clean easily.	B	Complete Replacement : 1 set	—
310-K01-V25 2ND DISCHARGE SILENCER	-do-	B	Complete Replacement : 1 set	—
310-K02 NITROGEN GAS COMPRESSOR		A	Complete Overhauling : 1 set	YES
310-K03 SYNTHESIS GAS COMPRESSOR		A	Complete Overhauling : 1 set	YES
310-K03-E1 1ST STAGE COOLER	Thickness 6.4㎜ (NEW 7㎜) GOOD A few pittings (≒ 4㎜ deep) were noticed on the inlet short pipe (to be replaced immediately by NCZ) .	A	NIL	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
310−K03−E2 2ND STAGE COOLER	Thickness 8.3㎜ (New 8.7㎜) GOOD A few pittings (≒ 2.5㎜ deep) were noticed on the inlet short pipe (to be replaced by NCZ immediately) .	A	NIL	−
310−K03−E3 3RD STAGE COOLER	Thickness 13.2㎜ (New 11㎜) GOOD. -do-	A	NIL	−
310−K03−E4 OIL COOLER	No problem Spare made by NCZ in 1980	A	NIL	−
310−K04 AIR COMPRESSOR		A	1. Complete Overhauling : 1 set 2. Replacement of Drain Traps : 4 pcs	YES
310−K04−E1 A−C INTER COOLER	Same as 310-K04-E2 Shell 9.0㎜ (New 9㎜) GOOD	VESSEL : A OTHERS : C	1. Replacement of Tube Bundle : 3 sets 2. Replacement of Drain Trap and Demister : 3 sets	−
310−K04−E2 AFTER COOLER	Tube sheet corroded heavily. Shell 9.4㎜ (9㎜ New) GOOD. Demister damaged. (To be replaced) . Drain Trap corroded. (To be replaced) .	VESSEL : A OTHERS : C	1. Replacement of Tube Bundle : 1 set 2. Replacement of Drain Trap and Demister : 1 set	−
310−K04−E3 OIL COOLER	Tube bundle made by NCZ. No Problem.	B	NIL	−
310−K02−E1 1ST STAGE COOLER	Tube bundle corroded heavely. Shell 6.4㎜ (New 6㎜) GOOD.	SHELL : A BUNDLE : B	Replacement of tube bundle : 1 set	−

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
310-K02-E2 2ND STAGE COOLER	Tube bundle corroded heavily. 20 tubes plugged. Shell 6.2㎜ (New 6㎜) GOOD	SHELL : A BUNDLE : C	Replacement of tube buudle : 1 set	—
310-K02-E3 3RD STAGE COOLER	Tube bundle corroded heavily Three tubes plugged Shell 10.8㎜ (New 11.1㎜) GOOD	SHELL : A BUNDLE : B	-do-	—
310-K02-E4 OIL COOLER	Tube sheet and inner corroded. No problem. Shell 8.0㎜ (New 8.0㎜) GOOD Bonnet cover 5.8㎜ (New 5.6㎜) GOOD	A	NIL	—
311-E09 DEFROSTING AIR HEATER	No problem	A	NIL	—
311-E10 DEFROSTING AIR HEATER & COOLER	No problem	A	NIL	—
311-F01 AIR FILTER	Elements (Curtain chain, curtain, sealing material etc.) are to be replaced. Curtain broken down.	VESSEL : A ELEMENT : C	Replacement of Element : 1 set	—
311-F01-B AIR FILTER		—	Installation of Suction : 1 set Air Filter	

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
311－F02 A, B FILTER BEFORE TUR-BINE	Not opened this time.	－	Overhauling	YES
311－F03 A, B LIQUID AIR FILTER	-do-	－	Overhauling	YES
311－K01 A, B EXPANSION TURBINE		A	Complete Overhauling : 2 sets	YES
311－K01－E, A, B OIL COOLER	Not opened this time.		Overhauling : 2 sets	－
311－K01－F1 A, B PRIMARY FILTER	Filter Element to be replaced.	VESSEL : A ELEMENT : C	Overhauling : 2 sets Replacement of Element : 2 sets	－
311－K01－F2 A, B SECONDARY FILTER	Filter Element to be replaced.	VESSEL : A ELEMENT : C	Overhauling : 2 sets Replacement of Element : 2 sets	－
311－K01－P A, B LUBRICATION OIL PUMP	Not opened this time.	－	Overhauling : 2 sets	－
311－K01－V1 A, B PRESSURIZED OIL RECEIVER	-do-	－	Overhauling : 2 sets	－
311－K01－V2 A, B OIL TANK	Not opened this time.		Overhauling : 2 sets	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
311－K01－V4 SILENCER	No problem	A	NIL	
311－V02 CHECK VALVE BOX (O_2 SIDE)	Not opened this time.	－	Overhauling : 1 set	YES
311－V03 CHECK VALVE BOX (O_2 SIDE)	-do-	－	Overhauling : 1 set	YES
311－V04 CHECK VALVE BOX (N_2 SIDE)	Not opened this time.	－	Overhauling : 1 set	YES
311－V05 CHECK VALVE BOX (N_2 SIDE)	Not opened this time.	－	Overhauling : 1 set	YES
311－V07 SILENCER	No problem	A	NIL	－
401－B01 MIXER	Visual check : GOOD Thickness 3.8㎜ (New 4㎜) GOOD	A	NIL	
401－E01 AMMONIA EVAPOR-ATOR	22 tubes plugged. Thickness 16.8㎜ (New 16㎜) : GOOD Crack on the channel separator to be welded.	C	Complete Replacement : 1 set	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
401－E03 GAS COOLER	57 lower tubes are plugged with cement. Bottom of the channel corroded. Reinforcement plate on the iniet nozzle repaired by welding.	C	Replacement of Channel : 1 set and channel cover	YES
401－E04 TAIL GAS HEATER	Shell flange bottom corroded heavily (For about 300㎜). Immediately repair or replacement strongly recommended.	C	Complete Repalcement : 1 set	YES
401－E05 ECONOMIZER	NCZ had already placed an order for a replacement unit.	C	NIL	－
401－E06 CONDENSER	Thickness : Shell 5.9㎜ (New 6㎜) : GOOD Bottom channel 6.4㎜ (New 6㎜) : GOOD Corrosion to be repaired on the legs and the top cover.	B	NIL	－
401－E07 PRODUCED ACID COOLER	Skirt can be replaced by NCZ. Drain piping and concrete foundation can also be repaired by NCZ. Thickness 4.8㎜ (New 5㎜) GOOD	B	NIL	－
401－E08 WEAK ACID COOLER	As above Thickness 4.2㎜ (New 4㎜) GOOD	B	NIL	－
401－F02 AMMONIA FILTER	Filter element to be installed by NCZ. Thickness : 9.8㎜ (New 9㎜) : GOOD	A	NIL	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
401－H01 BURNER	Lower Part corroded heavily. Gauze support deformed and quartz tubes broken. Upper shell flange deformed. Only 32 out of 60 tightening bolts are tightly fitted.	C	1. Replacement of Lower Part : 1 set 2. Replacement of Gauze Support : 1 set 3. Replacement of Quartz Tubes : 1 set 4. Replacement of Upper Shell Flange : 1 set	－
401－K01 AIR COMPRESSOR		A	Complete Overhauling : 1 set	YES
401－K01－F1 AIR FILTER	Filter Element to be cleaned by NCZ.	A	NIL	－
401－K01－P1 LUBRICATION OIL PUMP			Complete Overhauling : 1 set	－
401－K01－R1 SPEED UP GEAR UNIT			Complete Overhauling : 1 set	YES
401－K02 RECOVERY GAS TURBINE			Complete Overhauling : 1 set	YES
401－P01 A, B FEED WATER PUMP	Both casing and impeller are corroded and eroded. One store spare (not installed but stored) is recommended.	C	Complete Replacement : 1 set	－
401－P02 A, B WEAK ACID PUMP	Replaced with the units of English make by NCZ. No problem	A	NIL	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
401-P03 A, B DEMINERALIZED WATER PUMP	No problem	A	NIL	—
401-P04 A, B RECYCLE ACID PUMP	Replaced by NCZ with the units of English make. No problem.	A	NIL	—
401-P05 A, B ACID PUMP	Replaced by NCZ with the units of English make. No problem.	A	NIL	—
401-P06 A, B PRODUCT FEED PUMP	-do-	A	NIL	—
401-P07 A, B COOLING WATER PUMP	No problem	A	NIL	—
401-P08 A, B LIQUID AMMONIA PUMP	No problem One additional pump was installed by NCZ	A	NIL	—
401-P09 A, B COOLING WATER RECYCLE PUMP	No problem	A	NIL	—
401-T01 OXIDATION AND BLEACHING TOWER	Lower part corroded heavily and repaired by NCZ. (Patches welded) . The first stage of the trays fallen and all trays corroded Concrete Foundation to be repaired by NCZ (Acid resistant mortar recommended.)	C	Replacement of lower part of Tower with trays : 1 set	YES

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
401－T02 A, B NO. 1 OXIDATION TOWER	Lower part (specially on the skirt) corroded heavily. A trough provided by NCZ for leakage. Shell thickness : 8.4／5.4 (NEW 8／5) GOOD	B	Replacement of lower parts of Towers : 2 sets	YES
401－T03 A, B NO. 2 OXIDATION TOWER	-do- Shell thickness 8.4／- (New 8／5) GOOD	B	Replacement of lower parts of Towers : 2 sets	YES
401－T04 NO. 1 ABSORPTION TOWER	An umbrella-shaped-guard-plate to be provided on the skirt by NCZ. Pneumatic pressure test on all the cooling coils recommended Thickness : 7.2／8.6／11.3 (New 7／9／11) GOOD	Tower : A Cooling Coils : C	Replacement of Cooling Coils : 6 sets	YES
401－T05 NO. 2 ABSORPTION TOWER	Bottom Head plate slightly corroded, to be repaired by NCZ. Thickness : 7.1／9.0／11.0 (New 7／9／11) GOOD	A	NIL	－
401－V03 SEPARATOR	Repaired by welding (1 point longitudinally 3 points radially) Colour penetration check : GOOD Thickness : 3.8㎜ (New 4.0㎜) GOOD	B	NIL	－
401－V06 MIST SEPARATOR	Thickness : 4.0㎜ (New 4.0㎜) GOOD	A	NIL	－
401－EXJ－01 EXPANSION JOINT	Heavily corroded. The companion flange shall be SUS-304 (stainless steel)	C	Complete Replacement : 1 set	－

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
401−EXJ−03 EXPANSION JOINT	One repaired by NCZ on the top head weld line. Weld line on the flange lining pitted and the gasket surface not flat.	B	Complete Replacement : 1 set	
PIPING (1) BETWEEN E06 AND T05	Many patches welded to repair.	B	Replacement of piping : 1 set	−
401−CV53F, CV53H CHECK VALVE	No (Nitrogen monoxide) gas returns to compressor sometimes in an emergency shutdown.	C	Complete Replacement : 2 sets	−
501-A02 ANBA VIBRATING SCREEN NO. 1	Damaged and deformed all over. To be replaced by NCZ (order placed already)	C	NIL	−
501-A03 ANBA VIBRATING SCREEN NO. 2	-do-	C	NIL	−
501-A06 AIR WASHER FOR ANBA DRYER	Upper Head Plate corroded ; to be repaired by NCZ. Concrete Foundation also is to be repaired by NCZ.	B	NIL	−
501-A08 AIR WASHER FOR ANBA COOLER	Bolts and Nuts of the shell flange are all corroded. (To be repalced by NCZ) . Cracks and corrosion on the concrete foundation. (To be repaired by NCZ) .	B	NIL	−

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
501-A09 FERTILIZER VIBRATING SCREEN	Same as A02 and A03	C	NIL	—
501-D01 ANBA DRYER	Inlet and Outlet Hoods deformed. (To be repaired by NCZ) . Heating coils to be pneumatically pressure tested. Crack on the inlet distributor already repaired by NCZ.	A	NIL	—
501-D02 ANBA COOLER	Inlet and Outlet Hoods are deformed Inlet Hood cracked. (To be repaired by NCZ).	A	NIL	—
501-D03 ANBA COATING DRUM	Ring gear, Pinion Gear, thrust and plane Riding Ring, and Trunnion Roller heavily worn.	C	Replacement of parts : 1 set	YES
501-D04 FERTILIZER COOLER	Inlet and Outlet Hoods deformed and cracked at many points. (To be repaired by NCZ.)	B	NIL	—
501-D05 FERTILIZER COATING DRUM	Same as 501-D03	C	Replacement of parts : 1 set	YES
501-E01 AMMONIUM EVAPOR-ATOR BY STEAM	One U-tube plugged. Internal surface of all the lower side tubes looks like sponge because of heavy corrosion. Bonnet the same. Shell thickness : 12.8㎜ (New 12㎜) GOOD	C	Replacement of Tube Bundle : 1 set	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
501-E02 AMMONIUM EVAPOR-ATOR BY AIR	Inlet casing slightly corroded (to be repaired by NCZ.)	A	NIL	—
501-E03 AMMONIUM HEATER	Shell internal to be cleaned. Many tubes are repaired by welding. Thickness : : Shell : 5.6㎜ (New 4.5㎜) GOOD Channel : 7.5㎜ (New 6㎜) GOOD	C	Replacement of Tube Bundle : 1 set	—
501-E05 AIR HEATER FOR ANBA DRYER	Heavily corroded. Just going to be out of service. Cracks on the inlet casing. NCZ had placed an order for new unit already.	Z	NIL	—
501-E06 AIR HEATER FOR ANBA COOLER	Heavily corroded. Just going to be out of service. NCZ had placed an order for new unit already.	Z	NIL	—
501-E07 AIR HEATER FOR FERTILIZER COOLER	Out of service now. NCZ had placed an order for new unit already.	—	NIL	—
501-F01 AMMONIUM NITRATE SOLUTION FILTER	Out of service now. Design to be studied for reliable service	—	Complete Replacement : 1 set	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
501-F02 A, B 96% AMMONIUM NITRATE STRAINER	Out of service now. Design to be studied for reliable service.	—	Complete Replacement : 2 sets	—
501-F03 A, B 99% AMMONIUM NITRATE STRAINER	Removed now. Design to be studied for reliable service.	—	Complete Replacement : 2 sets	—
501-F04 RECOVERY SOLUTION FILTER	-do-	—	Complete Replacement : 1 set	—
501-J01-1, 2 EJECTOR	Rust on the body, but no problem	A	NIL	—
501-P02, A, B NEUTRALIZER CIRCULATION PUMP	No problem	A	NIL	—
501-P03 A, B AMMONIUM NITRATE SOLUTION PUMP	A-unit : replaced with an English make unit. B-unit : original one No problem	A	NIL	—
501-P04 A, B PR. EVAPORATOR FEED PUMP	-do-	A	NIL	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
501-P05 A, B PR. EVAPORATOR CIRCULATION PUMP	One unit is storage spare now.	A	NIL	—
501-P06 A, B ANBA PRILING TOWER FEED PUMP	Both units were replaced with English make units. No problem	A	NIL	—
501-P09 A, B FERTILIZER PRILLING TOWER PUMP	A-unit : replaced with English make B-unit : original one No problem.	A	NIL	—
501-P11 RECOVERY PUMP	The removed unit of 501 P06 is installed as spare (501-P11B) , because the unit 501 P11 was too small. No problem.	A	NIL	—
501-P13 A, B RECOVERY FEED PUMP	A-unit : replaced with English make unit B-unit : original one No problem	A	NIL	—
501-T01 NEUTRALIZER	Air inlet nozzle deformed because of hammering. (To be replaced by NCZ) Stack corroded heavily with some cracks. Concrete Foundation corroded. (To be repaired by NCZ) . Thickness : 5.9/4.6/3.6 (New 6/5/4mm)	B	Replacement of Demister : 1 set	—
501-T02 ANBA PRILLING TOWER	Heavily deformed by hammering. Cracks on the fillet welding of the prilling nozzles.	B	Replacement of Top Piping : 1 set and Prilling Nozzles.	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
501-T03 FERTILIZER PRILLING TOWER	Heavily deformed by hammering. Cracks on the fillet welding of the prilling nozzles.	B	Replacement of Top Piping : 1 set and Prilling Nozzles.	–
501-V03-B1 ADJUSTER TANK	Thickness : Tank 7.4㎜ (New 6㎜) GOOD Heating Pipes : 3.0㎜ (New 2.8㎜) GOOD	A	NIL	–
501-V04 AMMONIUM NITRATE SOLUTION TANK	Thickness : Tank 7.1㎜ (New 6㎜) GOOD Heating Pipes : 3.1㎜ (New 2.8㎜) GOOD	A	NIL	–
501-V05 PR. EVAPORATOR WITH DEMISTER	Demister to be cleaned. Thickness : 8.1㎜ (New 8㎜) GOOD	A	NIL	–
501-V09 ANBA HOPPER	Deformed heavily by hammering.	B	Replacement of Bottom Cone : 1 set Install Vibrator : 1 set	YES
501-V13 FERTILIZER HOPPER	Deformed heavily by hammering.	B	Replacement of Bottom Cone : 1 set Install Vibrator : 1 set	YES
501-V25 RECOVERY TANK	Installed in a deep pit and floats when the pit is filled with water, which bends and twists the connecting pipes. This tank firmly to be fixed.	A	NIL	–
501-V29 AIR DEMISTER	Demister to be cleaned. Thickness 6.1㎜ (New 6㎜) GOOD	A	NIL	–

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
501-Y03 ANBA BUCKET ELEVATOR NO. 1	Lower casing deformed. (To be replaced by NCZ.)	B	NIL	–
501-Y04 ANBA BUCKET ELEVATOR NO. 2	-do-	B	NIL	–
501-Y06 FERTILIZER BUCKET ELEVATOR	-do-	B	NIL	–
501-Y07 NUFLO-10 TABLE FEEDER FOR ANBA	No problem	A	NIL	–
501-Y09 NUFLO-10 TABLE FEEDER FOR FERTILIZER	-do-	A	NIL	–
501-Y11 BUCKET ELEVATOR FOR NUFLO-10	No problem	A	NIL	–
501-E09 SURFACE CONDENSER	Circumferential welding on the bottom channel has some pin holes. (To be repaired by NCZ) . Shell thickness : 5.4㎜ (New 5㎜) GOOD.	A	NIL	–

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
501-E10 FALLING FILM EVAPORATOR	No problem	A	NIL	—
501-SECTION PRILLING TOWER CONCRETE SURFACE	Repaired lining has cracks and swells. (To be repaired by NCZ.)	B	Epoxy Resin coating to : 1 set concrete surface.	—
601-C01 PRECIPITATOR	Back-wash line : already replaced	A	NIL	—
601-C01-B1 MIXER FOR PRECIPITATOR	Bottom bearing seal modified already and running satisfactorily.	B	NIL	—
601-C01-R1 REDUCER FOR PRECIPITATOR	No problem	B	NIL	—
601-F01 AUTOMATIC VALE LESS FILTER	Repair under way by NCZ	B	Replacement of Strainer : 1 set	—
601-K01 BLOWER FOR DEGASIFIER		B	Complete Replacement : 1 set	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
601-K02 A, B FAN FOR COOLING TOWER	No problem	A	NIL	–
601-P01 A, B COAGULANT AND ALKALI FEED PUMP	Plunger and V-Packing to be replaced	B C	A : Replacement of Parts : 2 sets B : Complete Replacement : 1 set	–
601-P04 A, B FILTRATED WATER PUMP.	Wearing Ring and Bearing to be replaced by NCZ.	A	NIL	–
601-P05 A, B PROCESS WATER PUMP	P05B is out of service	–	Complete Replacement of P05B : 1 set	–
601-P06 A, B TRANSFER PUMP	Impeller to be replaced No problem.	C B	A : Replacement of Parts : 1 set B : Nil	–
601-P07 A, B DEMINERALIZED WATER PUMP	No problem	A	NIL	–
601-P09 A, B, C COLD WATER PUMP	No problem, but expansion joints to be replaced.	A	Replacement of suction side Expansion Joint : 3 sets	–
601-T01 CATION EXCHANGER	Outer surface : corroded heavily. Internal rubber lining : Repaired by NCZ by patching. (1980)	C	Complete Replacement : 1 set	–

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
601-T03 ANION EXCHANGER	No problem.	A	NIL	–
601-T04 COOLING TOWER	Small pieces of wood found in cooling water are fallen off cooling tower filling material.	B	Replacement of Drift : 1 set Eliminator and Filling Matrerials	YES
601-V01 A, B COAGULANT FEEDER	To be repaired by NCZ	B	NIL	–
601-V01 A, B-B1 AGITATOR FOR COAGULANT FEEDER	To be replaced by NCZ (not included in the rehabilitation items) .	Z	NIL	–
601-V04 DEGASIFIED WATER TANK	No problem	A	NIL	–
601-V05 ACID STORAGE TANK	NCZ replaced	C	NIL	–
601-SECTION COOLING WATER- (1)	Newly installed as a rehabilitation item	–	Installation of Algacide : 1 set Agent Unit Installation of Strainer : 1 set	–
601-SECTION COOING WATER- (2)	-do-	–	Installation of Oil Fence : 1 set in the Hot Water Pond	–
601-SECTION PIPING- (1)	-do-	–	Installation of Overhead : 1 set Piping System from 601 Sec. to 605 Sec.	–

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
601-SECTION PIPING- (2)	To be changed to a dilution tank and a water ejector.		Replacement of Piping for : 1 set Regenerant	—
601-SECTION DRAIN TRENCH		—	Resin coating to surface of : 1 set Drain Trench	—
602-K01 PRIMARY FORCED DRAFT FAN	No problem	A	NIL	—
602-K02 SECONDARY FORCED DRAFT FAN	Not in service, because secondary air is supplied by the coal pulverizer together with pulyerized coal.	—	NIL	—
602-K03 INDUCED DRAFT FAN	NCZ is using the casing and the impeller of their own make. Materials to be studied.	—	Complete Replacement : 1 set	—
602-P01 A, B FEED WATER PUMP	B unit was replaced with the German make, and thus one set of replacement is required (NCZ has spares for German make) .	B	Replacement of Impeller : 1 set	—
602-P02 A, B FEED WATER PUMP		B	Replacement of Impeller : 2 sets	—
602-P03 CONDENSATE PUMP	Not in service, because the flow line was changed.	—	NIL	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
602 SECTION ASH HANDLING	Coal ash is removed from the bottom of the boiler combustion chamber by water circulation. Ash handling facility is to be installed on the settling pond. (Now it is done manually by labourers) .		Installation of Ash Handling : 1 set facility	—
603 SECTION 110V BATTERY SET		C	Complete Replacement : 2 sets	—
604-P01 A-C WATER INTAKE PUMP		B	Replacement of Impeller and Wearing Rings : 3 sets	—
604-P02 VACUUM PUMP		C	Complete Replacement : 1 set	—
604-P03 DRAIN PUMP	Out of order now.	C	Complete Replacement with larger capacity : 1 set	—
605-B09 NEUTRALIZER MIXER	The agitator for B-effluent pond is used now, but the shaft is too short to have satisfactory mixing.	—	Complete Replacement : 1 set	—
605-C08 BALANCE TANK	No problem	A	NIL	—
605-C09 C-EFFLUENT POND	Heavy corrosion, especially at the inlet. To be re-lined by NCZ.	B	NIL	—

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
605-C10 A, B D-EFFLUENT POND	-do-	B	NIL	—
605-C11 NEUTRALIZER	The long lime feed line is clogged frequently because of its length. 605-V04 (No. 1 milk tank) and 605-Y01 (No. 1 Lime Feeder) are to be shifted next to this Neutralizer.	B	Complete Replacement of : 1 set Automatic Lime Feeding System	—
605-K01 MIXING BLOWER	Now out of order and removed.	—	Complete Repalcement : 1 set	
605-K02 MIXING BLOWER	-do-	—	Complete Replacement : 1 set	—
605-K03 MIXING BLOWER	-do-	—	Complete Replacement : 1 set	—
605-P04 ACID PUMP	-do-	—	Complete Replacement : 1 set	—
605-P05 NO. 1 MILK PUMP	Not required, if the system is changed as suggested in the 605-C11 column.	—	NIL	—
605-P09 A, B C-EFFLUENT PUMP	A part of rubber lining peeled off. The suction noozzle on the casing is fixed by welding.	C	Complete Replacement : 2 sets	

EQUIPMENT	RESULT OF CHECK / INSPECTION	EXPECTED LIFE	REHABILITATION WORK	SUPER-VISOR
605-P10 A, B D-EFFLUENT PUMP	Pump casing, common beds and concrete foundations are corroded heavily. The discharge check valves are not operable.	C	Complete Replacement : 2 sets	
605-P12 A, B A-EFFLUENT PUMP	No prorblem	B	NIL	—
605-V04 NO. 1 MILK TANK	To be shifted next to 605-C11 To be done by NCZ.	A	NIL	—
605-Y01 NO. 1 LIME FEEDER	-do-	A	NIL	—
605-SECTION PIPING	Heavy corrosion. All to be replaced.	—	Complete Replacement of : 1 set 605-P10 Suction and Discharge Piping.	—

INSTRUMENTS

I. PANEL INSTRUMENTS
CONTROL VALVES

ABBREVIATION :

A. Check Up Point Column :

MODEL NO.	ITEM	CHECK UP POINT
54	1	Record system
	2	Vessel
	3	Inside mechanism
	4	Control relay
	5	Outside mechanism
	6	Controller
	7	Transmitter
52	8	Element
	9	Control relay
	10	Under mechanism
	11	Inside mechanism
ERB ERE EIE EIH	12	Balance resister
	13	Balance motor
	14	Selector switch
	15	Amplifier
	16	Inside mechanism
	17	Alarm contact
	18	Record system
	19	Others
Control Valve	I	Inner valve
	S	Seat ring
	Ga	Gasket packing
	Pr	Packing ring
	Gl	Gland packing
	D	Diaphragm
	V	Teflon V packing
	Re	Reducing valve

x : Bad, to be exchanged or repaired

o : Fair

— : Not equipped or not checked

B. Rehabilitation Work (R/W) Column :

x : Complete replacement

* : Overhaul

o : Fair, but necessary to be exchanged with New Model

R : Replacement of parts

MODEL 54 (YEW)

SEC. NO.	TAG NO.	SPECIFICATION	TYPE	CHECK UP POINT										RE-HABILI. WORK
				1	2	3	4	5	6	7				
302	FR-01	2pen 0−10sqx500Nm³/H	5420F-E	x	x	x	—	o	—	x	—	—	—	x
	PRA1-01	300mmAq	5420F-E	x										
	FRA-09	0−10sqx200Nm³/H	5410F-E	x	o	x	—	x	—	o				x
	FRA-10	0−10 x200Nm³/H	5410F-E	x	x	x	—	o	—	x				x
	FRA-11	200Nm³/H	5410F-E	x	o	x	—	o	—	o				x
	FRA-12	200Nm³/H	5410F-E	x	o	x	—	x	—	o				x
	FRA-14	2pen 1500Nm³/H	5420F-E	o	x	x	—	x	—	x				x
	PRS31	0−10kg/cm²	5420F-E	o			—			x				
	FRA-1T	3pen 400kg/H	5430F-E	x			—			x				
	FR1-13	0−10x300kg/H	5430F-E	x	x	x	—	o	—	x				x
	FR1-30	0−10x1000kg/H	5430F-E	x			—			x				
	PRA-42	−250～+1.000mm H_2O	5420F-E	x	o	x	—	x	—	x				x
	PPC-48	−350～+250mmH_2O	5412SF-E	o	o	o	o	o	o	x				o
303	FR-1	0−10x1500Nm³/H	5410F-E	x	x	x	—	o	—	x				x
	FRC-2	2pen 0−10x40m³/H	5422TS-F-E	x	o	o	x	o	o	x				x
	FR-4	0−10x200m³/H	5422TS-F-E	x						x				
	FR-3	0−10x4m³/H	5410F-E	x	o	x	—	x	—	x				x
	PdR-2	0−100mmH_2O	5410F-E	x	o	x	—	x	—	o				x
304	FRCSA-2	0−10x800kg/H	5412TSF	x	o	o	o	o	o	x				x
	FRCSA-8	0−10x1200Nm³/H	5412TSF	x	o	o	o	o	o	x				x
305	PRC-1	0−10kg/cm²	5412TSF	x	o	o	o	x	o	x				x
306	FRCSA-1	0−10x700kg/H	5412TSF	x	o	o	x	o	x	o				x
307	PRC-1	0−1.0kg/cm²	5412TSF	x	o	o	o	o	o	o				x
308	FRS-1	0−10x1200m³/H	5410F-E	x	o	o	—	o	—	o				x
	PRC-1	0−50kg/cm²	5412TSF	x	o	o	x	o	o	o				x
309	FRCS-10	2pen 0−10x100Nm³/H	5422TSF-E	x	o	o	o	o	o	x				x
	FR-15	0−10x20Nm³/H	5422TSF-E							x				
	FR-11	0−10x500kg/H	5410F-E	o	o	x	—	o	—	x				o

MODEL 54 (YEW)

SEC. NO.	TAG NO.	SPECIFICATION	TYPE	CHECK UP POINT										RE-HABILI. WORK
				1	2	3	4	5	6	7				
309	LICA-1	0−100%	5403TS	−	o	o	o	o	o	x				o
	LICA-2	0−100%	5403TS	−	o	o	o	o	o	x				o
310	FRCS-1	0−10x400Nm³/H	5412TS-E	x	o	o	o	o	o	o				x
	PICA-1	0−51kg/cm²	5403TS	−	o	o	o	o	o	o				o
	PIC-2	0−50kg/cm²	5403TS	−	o	o	o	o	o	o				o
311	FR-1	0−10x2500Nm³/H	5410F-E	x	x	x	−	x	−	x				x
	FR-2	2pen 0−10x450Nm³/H	5420F-E	x	x	x	−	x	−	o				x
	FR-3	0−10x450Nm³/H	5420F-E	x						o				x
	LIC-1	0−100%	5403TS	−	o	o	o	o	o	o				o
	LIC-2	0−100%	5403TS	−	o	o	o	o	o	o				o
401	FrRC-4	2pen 0−10x3000Nm³/H	5422PSF-E	x	o	o	o	o	o	x				x
	FR-5	0−10x3000Nm³/H	5422PSF-E	x						x				
	FR-9	0−10x1500kg/H	5410F-e	x	x	o	−	o	−	x				x
	PRC-9	0−30kg/cm²	5412TSF-E	x	x	o	x	o	o	x				x
501	FrRCAS-2	0−17x1000kg/H	5412PSF-E	x	o	o	o	o	o	x				x
	FRCA-3	0−100x30Nm³/H	5412TSF-E	x	x	o	o	o	o	x				x
	FRC-7	0−10x600kg/H	5412TSF-E	x	o	o	o	x	o	x				x
	FR-14	2pen 1500kg/H	5420F-E	x	x	o	−	o	−	x				x
	FR-15	15T/H	5420F-E	x						x				
601	FR-1	0−10x5Nm³/H	5410F-E	x	x	x	−	o	−	x				x
602	FR-1	2pen 0−10x	5420F-E	x	o	x	−	o	−	x				x
	FR-2													

MODEL 52 (YEW)

SEC. NO.	TAG NO.	SPECIFICATION	TYPE	CHECK UP POINT										RE-HABILL WORK
				8	9	10	11	7						
304	FICA-1	0～10x8m³/H	52A-SM4F	o	o	o	x	o						x
	FIC-7	0～10x0.7m³/H	52A-SM4F	o	o	o	o	o						o
305	FICA-1	0～10x35m³/H	52A-SM4F	o	o	o	x	o						x
	FICA-2	0～10x500kg/H	52A-SM4F	o	o	o	x	o						x
307	FICA-1	0～10x4m³/H	52A-SM4F	o	o	o	o	o						o
309	PICA-4	0～20kg/cm²	52A-SM4F	o	o	o	o	x						x
	PICA-5	0～40kg/cm²	52A-SM4	o	o	o	o	x						x
	LICA-4	0～100%	52A-SM4	o	o	o	o	o						o
	LICA-6	0～100%	52A-SM4	o	o	o	o	o						o
	LICA-7	0～100%	52A-SM4	o	o	o	o	o						o
	LICA-8	0～100%	52A-SM4	o	o	o	o	o						o
401	LICA-1	0～100%	52A-SM4	o	o	o	x	x						x
	LICA-2	0～100%	52A-SM4	o	o	o	x	x						x
	LICA-3	0～100%	52A-SM4	o	o	o	o	x						x
	LICA-4	0～100%	52A-SM4	o	o	o	o	x						x
	LICA-5	0～100%	52A-SM4	o	o	o	x	x						x
	LICA-6	0～100%	52A-SM4	o	o	o	o	x						x
	LICA-7	0～100%	52A-SM4	o	o	o	x	x						x
501	FIC-5	0～250kg/cm²	52A-SM4	o	o	o	x	x						x
	PIC-1	0～6kg/cm²	52A-SM4	o	o	o	x	x						x
	PIC-4	−1～0kg/cm²	52A-SM4	o	x	o	x	x						x
	PIC-10	0～100kg/cm²	52A-SM4	o	o	o	o	x						x
	PIC-14	0～6kg/cm²	52A-SM4	o	x	o	o	x						x
	TICA-1	−10～40°C	52A-SM5	o	o	o	o	x						x
	TIC-14	0～250°C	52A-SM5	o	o	o	o	x						x
	LIC-2	0～100%	52A-SM4	o	x	o	x	x						x
	LIC-7	600～1300mm	52A-SM4	o	x	o	o	x						x
	LIC-9	0～100%	52A-SM4	o	o	o	o	x						x
602	LIC-1	0～100%	52A-SM4	o	x	o	o	x						x

SEC. NO.	TAG NO.	SPECIFICATION	TYPE	CHECK UP POINT										RE-HABILI. WORK
				8	9	10	11	7						
602	LIC-2	1－100%	52A-SM4	o	o	o	o	x						o

SEC. NO.	TAG NO.	SPECIFICATION	TYPE	CHECK UP POINT										RE-HABIL. WORK
				12	13	14	15	16	17	18				
302	TR-1	0−150°C 6point	ERB6-30-34	x	o	x	o	x	−	o				x
	TR-2	0−1600°C 3point	ERB3-30-23	x	o	x	o	x	−	o				o
303	TR-1	0−100°C 6point	ERB6-30-34	o	o	o	o		−	o				o
304	TRA-3	0−600°C 12point	ERB12-30K12B −23MU	x	x	x	x	x	o	x				x
305	TR-1	0−200°C 6point	ERB-30-34 3W	x	x	x	x	x	o	x				x
306	TRA-1	0−600°C 12point	ERB12-90K22BZ −23MU											o
309	TRA-1	0−600°C 12point	ERB12-90K22BZ -23MU	x	x	o	x	x	o	o				x
	TRA-2	0−600°C 12point	ERB12-90K22BZ -23MU	x	x	o	x	x	o	o				x
310	WR-1	0−250KW	ERB1-30K22 -123	x	x	−	x	x	x	x				x
311	TR-1	−200°C−+50°C 6 point	ERB6-30K22B-34	x	x	x	o	x	−	x				x
	TR-2	−200−+50°C 6 point	ERB6-30K22B-34	x	x	o	x	x	−	x				x
	TR-3	−200−+50°C 6 point	ERB6-30-34	x	x	x	x	x	−	x				
401	TRA-33	2pen 500−1200°C	ERB2P-30K12 −23/30K22−23	x	x	−	x	x	o	x	−			x
	TRA-34													
601	XRA-1	0−50/0−500ppm	ERB2-90ZML6 -194	x	x	−	x	x	o	x				x
602	TR-1	0−400°C	ERB6-30-23	x	x	x	x	x	−	x				x
605	PHR-1	0−14 PH	ERB-30ML6-154	x	o	o	x	x	o	o				x

SEC. NO.	TAG NO.	SPECIFICATION	TYPE	CHECK UP POINT										RE-HABILI. WORK
				12	13	14	15	16	17	18				
301	WR-01A	0－10.000kg/H	ERE-10	x	x	--	o	x	—	x				x
	WR-01B	0－10.000kg/H	ERE-10	o	x	—	o	o	—	x				x
	WR-02	0－10.000kg/H	ERE-10	x	x	—	x	x	—	x				x
	WR-03	0－10.000kg/H	ERE-10	o	o	—	o	o	--	x				x
	WR-04	0－360kg/H	ERE-10	o	o	—	o	o	—	x				x
302	ARCO$_2$-07	0--25% CO_2	ERE-10	o	x	—	o	o	o	o				x
	ARAO$_2$-08	0－1% O_2	ERE-10K	o	x	--	o	o	o	x				x
304	TRCA-1	0--600°C	EREA-30K-23MU	o	o	—	o	o	o	o				o
	TRCA-2	0－600°C	EREA-30K-23MU	o	o	—	o	o	o	o				o
311	ARA-1	99.995--100.000% 0--10mV	ERE-10K	x	x	—	x	o	x	x				x
	RIA-401	0--35000ppm	EIE-90KZ-123	x	x	—	x	o	o	—				x
	RIA-402	0--35000ppm	EIE-90KZ-123	x	x	—	x	o	o	—				x
401	TRCA-32	2pcn 0－150°C	ERE5-30WK-34	x	o	--	x	x	o	x				x
	NH_3RA-1	0--15% NH_3	ERE-30K22-123	o	o	--	o	o	o	o				
501	PHRCA-1	0--14PH	EREA5-10K	x	x	—	x	o	o	x				x
601	CRA-1	0--20μ/cm	ERE30K-172	x	x	—	x	x	o	x				x

SEC. NO.	TAG NO.	SPECIFICATION	TYPE	CHECK UP POINT									RE-HABILI. WORK
				12	13	14	15	16	17	18			
301	TIA-1	0－500°C	EIH-30K22-23	x	x	—	x	o	o	—			x
	TI-2	0－500°C	EIH-30-23	x	o	—	o	x	—	—			x
	TI-3	0－500°C	EIH-30-23	x	o	—	o	o	—	—			x
304	TI-4	0－600°C	EIH-30-23	x	o	—	o	o	—	—			x
		Select switch 20point	STH-11-20	—	—	—	—	—	—	—			x
306	AIA-1	0－1% CO	EIH-30K12-123	o	o	—	o	o	o	—			o
307	AIA-1	0－0.1% CO_2	EIH-30K12-123	o	o	—	o	o	o	—			o
308	AIA-1	0－100ppm CO_2	EIH-30K12-123	o	o	—	o	o	o	—			o
309	TI-3	0－200°C	EIHM-30-34	x	x	—	x	x	—	—			x
		Select switch 60point	STB31-60	—	—	—	—	—	—	—			x
311	TI-4	－200－＋50°C	EIHM-30-34	o	o	—	o	o	o	—			o
		Select switch 40point	STB-31-40	—	—	—	—	—	—	—			x
	TI-5	0－200°C	EIHM-30-34	x	x	—	x	x	—	—			
		Select switch 10point	STH-31-10	—	—	—	—	—	—	—			x
401	TI-1	0－100°C	EIHM-30-34	x	x	—	x	o	—	—			x
		Select switch 24point	STC-31-34	—	—	—	—	—	—	—			x
	TI-2	0－300°C	EIHM-30-34	x	x	—	x	o	o	—			
		Select switch 10point	STH-31-10	—	—	—	—	—	—	—			x
501	TI-4	0－200°C	EIHM-30-34	x	x	—	x	x	—	—			x
		Select switch 32point	STC-31-32	—	—	—	—	—	—	—			x
309	AR-3	0－25% NH_3 0－20% CH_4	ERI-90-G1110	x	x	—	x	x	o	—			x
		0－20% Ar											
		Programmer	RGH-1139	—	—	—	—	—	x	—			x

CONTROL VALVE (301Y14 HITACHI FLUXO)

SEC. NO.	TAG NO.	SER. NO.	SIZE	CHECK UP POINT									RE-HABILI. WORK
				I	S	Ga	Pr	Gl	D	V	Re		
301	301-D1		3B	x	x	x		x	x				x
	301-D2		3B	x	x	x		x	x				x
	301-E1		3B	x	x	x		x	—			PISTON x	x
	301-E2		3B	x	x	x		x	—			PISTON x	x

CONTROL VALVE (MOTOYAMA)

SEC. NO.	TAG NO.	SER. NO.	SIZE	CHECK UP POINT									RE-HABILI. WORK
				I	S	Ga	Pr	Gl	D	V	Re		
302	HICV-18	91329	10B			x					–		*
	HICV-19	91330	10B			x					–		*
	HICV-20	91331	6B			x					–		*
	HICV-21	91332	6B			x					–		*
	HICV-22	91333	4B	x	x							TEFLON MEMBRANE x	x
	HICV-09	91334	4B								o	BODY CORRODED x	x
	PICV-05	91335	2B			x		x			–		R
	PICV-06	91336	5B			x					o		R
	PICV-07	91337	5B			x		x			o		R
	PICV-12	91338	10B			x		x	x		o		R
	PICV-13	91339	10B			x					o		R
	XSAV-04	91328	2B					x					*
	LICVA−01	N28386	2 x $1\frac{1}{2}$B			x		x			o		*
	XIV-2008	N29397	2B	x	x	x		x					x
	PCV-2023	N29401	250A			x		x					R
	PCV-01	N10476	$1\frac{1}{2}$ x $1\frac{1}{4}$	x	x	x		x					x
	PCV-11	N10477	$1\frac{1}{2}$ x $1\frac{1}{4}$	x	x	x		x					x
	LCV-1	91341	$2\frac{1}{2}$B			x		x			x	POSITIONER x	x
303	TCV-2	85444	10B			x	x	x			x		R
	TCV-7	85441	4B			x		x			x		R
	TCV-8	85442	4B			x		x			x		R
	TCV-9	85443	2B			x		x			o		R
304	TCV-1	81964	3B					x			o		R
	TCV-2	81965	$2\frac{1}{2}$B					x			o		R
	TCV-7	81966	$1\frac{1}{2}$ x $\frac{3}{4}$			x		x			x		R
	TCV-8	91984	4B	x	x						o	BODY x	x
	TCV-1	81967	$\frac{3}{4}$ x $\frac{3}{8}$	x	x						x	BODY x	x
	TCV-2	81968	$\frac{3}{4}$ x $\frac{1}{4}$B								x		R
305	TCV-1	81969	6B	x	x						o	BODY x	x
	TCV-2	81970	5B	x	x						o	BODY x	x
	PCV-1	81971	250A					x			o		*
	LCV-1	81972	$1\frac{1}{2}$B	x	x						o	BODY x	x
	LCV-2	81973	3B			x		x		x	o		R
	LCV-4	81974	$1\frac{1}{2}$B			x		x			o		R
306	FCV-1	81975	3 x 2B		x	x		o			o	BODY x	x

CONTROL VALVE (MOTOYAMA)

SEC. NO.	TAG NO.	SER. NO.	SIZE	CHECK UP POINT									RE-HABILI WORK
				I	S	Ga	Pr	G1	D	V	Re		
307	FCV-1	81976	$2\frac{1}{2}$ x 2B			x					o		*
	PCV-1	81977	3B			x					o		*
	PCV-2	81978	2B										x
	LCV-1	81979	$1\frac{1}{2}$B			x		x			o		R
	LCV-2	81980	1B			x					o		*
	LCV-6	81981	1 x $\frac{1}{2}$B			x					o		*
309	PCV-4	85446	3B	x	x	x	x	x			x		x
	PCV-5	85447	$1\frac{1}{2}$B			x		x			o		R
	LCV-7	85452	2B			x		x			o		R
	LCV-8	85453	$\frac{1}{2}$B			x		x			o		R
	LCV-9	85454	$\frac{1}{2}$B					x			o		*
310	PCV-1	85458	2B			x		x					R
	FCV-1	86768	4 x 3B			x		x	x				R
	PCV-2	85459	$1\frac{1}{2}$B			x		x					R
401	FrCV-4	85426	6B			x		x			o		x
	PCV-9	85431	8B			x		x			o		R
	LCV-1	85423	1B			x		x			o		R
	LCV-2	85430	2B			x		x	x				R
	LCV-3	85433	$1\frac{1}{2}$B			x		x					R
	LCV-4	85435	1B						x			YOKE x	x
	LCV-5	85437	2B									YOKE x	x
	LCV-6	85438	$1\frac{1}{2}$B						x			YOKE x	x
	LCV-7	85439	2B						x			YOKE x	x
	TCV-32	85425	1B								o	YOKE x	x
	HCV-1	85429	300A			x		x			o		R
	HCV-2	85428	3B	x	x	x	x	x					x
	HCV-4	85432	3B			x		x					R
	HCV-48	90087	8B			x		x					R
501	FCV-2	84225	$1\frac{1}{2}$ x $1\frac{1}{2}$										x
	FCV-3	84226	2B	x	x	x	x	x	x		x		x
	FCV-5	84227	$\frac{3}{4}$B			x		x					R
	FCV-7	84228	4B			x		x			x		R
	PCV-1	84229	$2\frac{1}{2}$B			x		x	x				R
	PCV-4	84230	$\frac{3}{4}$ x $\frac{3}{8}$	x	x	x	x	x					x
	PCV-10	84231	2B	x	x	x	x	x	x				x

CONTROL VALVE (MOTOYAMA)

SEC. NO.	TAG NO.	SER. NO.	SIZE	CHECK UP POINT									RE-HABILL WORK
				I	S	Ga	Pr	G1	D	V	Re		
501	PCV-12	84232	$2\frac{1}{2}$B										x
	TICV-1	84234	$\frac{1}{2} \times \frac{1}{4}$								o		x
	TCV-3	84235	1B										x
	TCV-9	84236	$1\frac{1}{2}$B										x
	TCV-10	84237	$1\frac{1}{2}$B			x	x	x					R
	TCV-11	84238	$\frac{1}{2} \times \frac{3}{8}$										x
	TCV-14	84230	1B										x
	TCV-16	84240	$\frac{3}{4} \times \frac{1}{2}$										x
	LCV-2	84241	1B			x		x					R
	LCV-3	84242	$2\frac{1}{2}$B			x		x					R
	LCV-7	84243	2B			x		x					R
	PHCV-1	84245	$\frac{3}{4} \times \frac{1}{2}$	x	x	x	x	x	x				x
	HCV	J81921	$1\frac{1}{2}$B			x							*
602	LCV-1	85460	2B			x		x					R
	LCV-2	85461	$1\frac{1}{2} \times$ 1B			x		x	x		x		R
	PCV-1	N10476	$1\frac{1}{2} \times 1\frac{1}{4}$	x	x	x	x	x	x				x
	PCV-3	85462	$3 \times 1\frac{1}{2}$	x	x							BONNET x BODY x	x
	PCV-11	N10477	$1\frac{1}{2} \times 1\frac{1}{4}$			x		x					R
201	PCV-1	87097	$2\frac{1}{2}$B	x	x	x	x	x	x			BONNET x BODY x	x
	PCV-2	87098	$2\frac{1}{2}$B	x	x	x	x	x	x		o	BONNET x BODY x	x
	PCV-3	87099	$2\frac{1}{2} \times 1\frac{1}{4}$			x		x					R
	PCV-4	87100	$1\frac{1}{2} \times \frac{1}{4}$B			x		x					R

CONTROL VALVE (NAKAKITA)

SEC. NO.	TAG NO.	SER. NO.	SIZE	CHECK UP POINT									RE-HABILL WORK
				I	S	Ga	Pr	Gl	D	V	Re		
311	HCV-1	3A1121	150B			o		o			o		*
	HCV-2	3A1122	150			o		o			o		*
	HCV-3	3A1123	40			o		o			o		*
	HCV-4	3A1124	80			o		o			o	POSITIONER x	*
	HCV-5	3A1125	BUTTERFLY 200			o		o			o		*
	HCV-6	3A1126	〃			o		o			o		*
	LCV-1	3A1127	80			o		o			o	POSITIONER x	*
	LCV-2	3A1128	50			o		o			o		*
	RCV-1	BJ317	BUTTERFLY 250			o		o			-		*
302	HIC-01	7K192	200A			x		x			—		R
	HIC-02	7K192	200A			x		x			—		R
	HIC-03	7K192	200A			x		x			—		R
	HIC-04	7K192	200A			x		x			—		R
	HIC-05	7K193	100A			x		x			—		R
	HIC-06	7K193	100A			x		x			—		R
	HIC-07	7K193	100A			x		x			—		R
	HIC-08	7K193	100A			x		x			—		R
	HIC-10	7K194	65A			x		x			—		R
	HIC-13	7K197	600A			x		x			—		R
	HIC-24	7K198	500A								—		*

CONTROL VALVE (KITAMURA)

SEC. NO.	TAG NO.	SER. NO.	SIZE	CHECK UP POINT									RE-HABILI. WORK
				I	S	Ga	Pr	Gl	D	V	Re	O-RING	
601	3"-DVPS-13C	U57222-1	80A	x	x				x			x	x
	3"-DVPS-13C	U57222-2	80A	x	x				x			x	x
	2½"-DVPS-13C	U57223-1	65A	x	x				x			x	x
	2½"-DVPS-13C	U57223-2	65A	x	x				x			x	x
	1"-DVPS-13C		25A	x	x				x			x	x
	3"-DVPL-13A		80A	x	x				x			x	x
	3"-DVP-13A	U57226-1	80A	x	x				x			x	x
	3"-DVP-13A	U57226-2	80A	x	x				x			x	x
	2½"-DVPSL-13A	U57227-1	65A	x	x				x			x	x
	2½"-DVPSL-13A	U57227-2	65A	x	x				x			x	x
	2½"-DVPSL-13A	U57227-3	65A	x	x				x			x	x
	2½"-DVPS-13A	U57228	65A	x	x				x			x	x
	2"-DVPSL-13A	U06745-1	50A	x	x				x			x	x
	2"-DVPS-13A	U57230	50A	x	x				x			x	x
	1½"-DVPSL-13A		40A	x	x				x			x	x
	1"-DVPS-13A	U57232-1	25A	x	x				x			x	x
	1"-DVPS-13A	U57232-2	25A	x	x				x			x	x
	1"-DVPS-13A	U57232-3	25A	x	x				x			x	x
	¾"-DVPS-13A		20A	x	x				x			x	x
	¾"-TVP-13A		20A	x	x				x			x	x
	1½"-TVPR-13A	T02056	40A	x	x				x			x	x
			—										
	4"-DVPS-13A	U11032	100A	x	x				x			x	x
	4"-DVPSL-13A	U11033-2	100A	x	x				x			x	x

II. PANELS (DIMENSION)

LOCAL INSTRUMENTS

OTHER INSTRUMENTS &
EQUIPMENT

ANALYZERS

TEST INSTRUMENTS &
TOOL SETS

PANELS : Complete Replacement

CONTROL ROOM	PANEL SIZE (㎜) Height × Width × No. × Depth
301 SECTION	2300 × 1200 × 4 × 800 (with SEMI GRAPHIC)
302	2800 × 1200 × 3 × 800 (with SEMI GRAPHIC)
303—309	2300 × 1200 × 6 × 800
311 (310)	2300 × 1200 × 4 × 800 (with SEMI GRAPHIC)
401	2300 × 1200 × 2 × 800
501	2300 × 1200 × 2 × 800
601	2300 × 1900 × 1 × approx. 1700 (DESK TYPE)
602	2350 × 1100 × 1 × 800
605	2300 × 600 × 1 × 800

LOCAL INSTRUMENTS : Quantity of Replacement

SECTION	LOCAL CONTROL-LER	TRANS-MITTER	POSI-TIONER	AIRSET	THERMO-WELL	THERMO-COUPLE	RESIST-ANCE BULB
						(CA)	
302	5	35		19	3	3	
303	3	17	4	7			
304		11	6	2			
305		6	5				
306		5	1				
307	1	5	3	1			
308		7	2				
309		25	13	20	3	21 (309TE-1) (309TE-2)	
310		3	3	3			
311		9	9	9			
401	3	19	12	20	2	2	
501	5	24	21	31			28 (501TI-4)
601		3					
602	1	5	2	4			
201	4	1	4	8			
TOTAL	22	175	85	124	8	26	28

OTHER INSTRUMENTS & EQUIPMENT

SECTION	TAG NO.	DESCRIPTION		REHABILITATION WORK
310		Instrument Air Dryer	1	Complete Replacement
301		Local Panel for		do.
		Hot Air Furnace (YEW)	1	
		Pneumatic Conveyor (HITACHI)	1	
311	RE401/402	Expansion Turbine Pick Up	2	do.
305	LICT-4	Displacer Level Meter	1	do.
		MOTOYAMA SSF-14-5700-20		
309	LIT-8	Displacer Level Meter	1	do.
		TOKYO KEISO FSM-13F		
		Propeller Type Level Meter	6	do.
		BABCOCK-HITACHI SG-6		
311	311RS-1	RHE Reversal System	1	do.
		(Micro Switch, Relay, ··· TATEISHI		
		Timer, Magnetic Valve)		
310	KO-4	By-Pass Valve	1	To be opened and checked
		NAKAKITA		
311		Resistance Bulbs	30	do.
311	RCV-1	Motor Damper	1	do.
302-309 311, 401,501		Orifice for Flow Meter	A11	do.

ANALYZERS : Complete Replacement

SECTION	TAG NO.	SPECIFICATION	TYPE	MAKER
302	ARCO₂-07	0—25% CO_2 Analyzer	6140-2070-CO_2 Rauter	MITAKA
306	AIA-1	0—1% CO Analyzer	EIA-1A Infrared Gas Analyzer	HORIBA
307	AIA-1	0—0.1% CO_2 Analyzer	do.	HORIBA
308	AIA-1	0—100 ppm CO_2 Analyzer	do.	HORIBA
309	AI-3	0—25% NH_3, 0—20% CH_4 0—20% Ar Gaschromatograph	8111	YEW
	AI-1	60—90% H_2 Analyzer	Rauter	MITAKA
	AI-2	40—90% H_2 Analyzer	Rauter	MITAKA
401	NH₃RA-1	0—15% NH_3 Analyzer	Infrared Gas Analyzer	HORIBA
501	PHRCA-1	0—14PH	PH Meter	YEW
605	PHRA-1	0—14PH	PH Meter	YEW
	PHIC-2	0—14PH	PH Meter	YEW
601	XE-1-2	0—50 ppm Turbidity Transmitter	8562	YEW
	XE-1-1	0—500 ppm Turbidity Transmitter	8562	YEW
	CRA-1	0—20 μV/cm Salinometer	8531	YEW

TEST INSTRUMENTS & TOOL SETS

(Recommended to be owned)

1)	Mechanical Tool Set (Model 6925-1000)	30	sets
2)	Electrical Tool Set (Model 6925-2000)	30	sets
3)	Maintenance Tool Set for Foxboro Instruments (MODEL 6925-6000)	30	sets
4)	Air Connection Set (Model 6922-3000)	10	sets
5)	Transistorized Insulation Testers (Model 3213)	4	sets
6)	Circuit Tester (Type 3201)	2	sets
7)	Portable DC Voltage/Current Standard (Type 2554)	2	sets
8)	Test Connector for 100−Line Instruments (Model 6928)	5	sets
9)	Control Relay Calibration Tool	2	sets
10)	PH Cell Checker (Model 8491)	1	set
11)	Digital Manometers (Type 2654-23)	2	sets
	Digital Manometers (Type 2654-24)	1	set
	Digiral Manometers (Type 2654-25)	1	set
12)	Decade Resistance Box (Type 2793-01)	1	set
13)	Digital Multimeter (Type 2502)	1	set

ELECTRICALS

I. HIGH-TENSION PANEL

LOW-TENSION PANEL

TRANSFORMER

LOCAL SWITCH

MOTOR

BATTERY CHARGER & BATTERY

EMERGENCY GENERATOR & DIESEL ENGINE

MOTOR VALVE

ABBREVIATION :

"Rehabilitation Work" Column :

R : Replacement of Parts (Contactor etc.)

* : Overhaul

x : Complete Replacement

o : Fair, no rehabilitation work

- : Not equipped

301 SECTION (SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
301S-MTC1	Receiving	o	-	-	
	Compeb mill	*	*	o	STARTER *
	Transformer primary	*	-	-	TRANS *
301S-CC1	Control circuit	o	-	-	
	Receiving	R	-	-	
301Y01-M1	Belt feeder	o	o	o	
301Y03-M1	Belt conveyor	o	o	o	
301Y04-M1	Belt conveyor	o	x	x	
301Y05-M1	Belt conveyor	o	x	x	
301W01A-M1	Weighing feeder	o	x	x	
301W01B-M1	Weighing feeder	o	x	*	
301Y06-M1	Belt conveyor	R	x	x	
301Y07-M1	Belt conveyor	R	x	x	
301D01-M1	Rotary dryer	o	x	*	
301G03-M1	Stoker for furnace	o	o	o	
301G03-M2	Blower for furnace	o	o	o	
301C01-M1	Rotary valve	o	o	x	
301C02-M1	Exhaust fan	o	o	x	
301C02-M2	Fuel oil pump	o	x	x	
301Y08-M1	Flow conveyor	o	o	o	
301Y09-M1	Screw conveyor	o	o	o	
301Y10-M1	Bucket elevator	o	x	x	
301W03-M1	Weighing feeder	o	x	x	
301Y02-M1	Bucket elevator	o	o	o	
301W04-M1	Weighing feeder	o	o	o	
301Y11-M1	Screw feeder	R	x	x	
301G05-M2A	Lub-compeb mill	C	o	o	
301G05-M2B	Lub-compeb mill	o	o	o	
301C03-M1	Rotary valve	o	o	o	
301C04-M1	Exhaust fan	o	o	o	
301C04-M2	Sludge ejector	x	x	x	
301Y12-M1	Screw conveyor	o	x	x	
301Y13-M1	Flow conveyor	o	o	o	
301K01-M1	Roots blower	o	o	x	

301 SECTION (SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
301Y14	Pneumatic conveyor	o	x	*	
301W02-M1	Weighing feeder	o	o	o	
301Y15-M1	Belt conveyor	o	x	x	
301Y16-M1	Bucket elevator	o	x	x	
	Lighting	o	-	-	
	Spare	x	-	-	
	Instrument	o	-	-	
	Spare	o	-	-	
	Auto starter	o	-	-	
	Emergency lighting	o	-	-	
	Emergency receiving	o	-	-	
302P05-M1	Fuel oil pump	o	x	x	

302 SECTION (FUJI)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
302S-MTC1	Coal gasification high tension	o	-	-	TRANS *
302S-LC1	Load center	o	-	-	
302K01A-M1	O_2-Blower	o	x	x	
302K02A-M1	No. 1 N_2-Blower	o	x	o	
302K01B-M1	O_2-Blower	o	x	o	
302K02B-M1	No. 1 N_2-Blower	o	o	o	
302K03-M1	No. 2 N_2-Blower	o	o	o	
302Y02-M1	Cleaning winch	o	x	x	
302G06-M1	Ash extractor	o	o	o	
302R01-M1	Double screwing	o	x	x	
302R01-2-M1	Double screwing	o	o	o	
302R01-3-M1	Double screwing	o	x	x	
302K04A-M1	Raw gas blower	o	x	x	
302K04B-M1	Raw gas blower	o	o	o	
302R01-4-M1	Double screwing	o	o	x	
302V05-1-R1-M1	Bunker emergency gauge	o	o	o	
302N01-1A-M1	Theisen washer	o	o	o	
302V05-2-R1-M1	Bunker emergency gauge	o	o	o	
302G04-1-M1	Baily feeder	o	o	x	
302G05-2-M1	Bailey feeder	o	o	x	
302N01-2A-M1	Theisen washer	o	x	o	
302R01-4-R1-M1	D. S. abjusting device	o	o	o	
302F01-1-R1-M1	C. D. F beating mechanism	o	o	o	
302F01-1-K1-M1	Coal dust filter fan	o	o	o	
302N01-1B-M1	Theisen washer	o	x	x	
302F01-1-K2-M1	C. D. F flushing gas fan	o	o	o	
302P01B-M1	Wash water pump	o	x	x	
302N01-2B-M1	Theisen washer	o	o	o	
302F01-1-Y1-M1	C. D. F air lock	o	o	o	
302P01A-M1	Wash water pump	o	x	x	
302R01-1-R1-M1	D. S adjusting device	o	o	o	
302R01-2-R1-M1	D. S adjusting device	o	o	o	
	Slurry pumps main supply	x	-	-	
	Slurry pumps main supply	x	-	-	

302 SECTION (FUJI)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
302T01-Y1-M1	Scraper chain	o	x	x	
302P03A-M1	Quench water pump	o	x	x	
302P03B-M1	Quench water pump	o	o	o	
302P04A-M1	Light oil pump	o	o	x	
302P04B-M1	Light oil pump	o	o	o	
302Y03-M1	Two-way valve	o	o	o	
	Lighting for general	o	o	-	
	302 turbo fan	x	-	x	
	Spare	x	-	-	
	Spare	x	-	-	
	PP settling	x	-	-	
302F01-2-R1-M1	C. D. F beating mechanism	o	x	x	
302F01-2-K1-M1	Coal dust filter fan	o	x	x	
302F01-2-K2-M1	C. D. F flushing gas fan	o	x	x	
302F01-2-Y1-M1	C. D. F air lock	o	o	o	
	Spare	o	-	-	
	Spare	o	-	-	
	Emergency commercial change	o	-	-	
	over switch				
302Z00-M4	HIC-12 Motor valve	R	-	o	
302Z00-M5	HIC-24 Motor valve	R	-	o	
302Z00-M1	HIC-13 Motor valve	R	-	o	
302Z00-M2-1	HIC-01 Motor valve	R	-	o	
302Z00-M2-2	HIC-02 Motor valve	R	-	o	
302Z00-M2-3	HIC-03 Motor valve	R	-	o	
302Z00-M2-4	HIC-04 Motor valve	R	-	o	
302Z00-M3-1	HIC-05 Motor valve	R	-	o	
302Z00-M3-2	HIC-06 Motor valve	R	-	o	
302Z00-M3-3	HIC-07 Motor valve	R	-	o	
302Z00-M3-4	HIC-08 Motor valve	R	-	o	
302-Z00M6	HIC-10 Motor valve	R	-	o	
302Z00-M7	HIC-25 Motor valve	o	-	o	
	Spare	o	-	-	
	Welding outlets	o	-	-	
	Spare	o	-	-	

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
	Analyser supply	o	-	-	
302P02B-M1	Feed water pump	o	x	x	
302P02A-M1	Feed water pump	o	x	x	
	Spare	-	-	-	
	Spare	o	-	-	
	Measuring voltage 380／220V , 20A	o	-	-	
	〃	o	-	-	
	Measuring voltage 3 KVATr	o	-	-	

303-311 SECTION (FUJI, SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
	Receiving (H. T)				
309K02-M1	Ammonia refrigerator	*	O	*	
309S-TR1	Transformer	*	-	-	TRANS *
309K01-M1	Gas circulator	*	o	x	
305P01A-M1	NO. 1 carbonate pump	*	o	x	
305P01B-M1	NO. 2 carbonate pump	*	o	x	
310K01-M1	Raw gas comp.	*	o	*	
310K01-M1	Relay panel	*	o	x	
310K02-M1	Nitrogen gas comp.	*	o	*	
310K04-M1	Air comp.	*	o	*	
310K03-M1	Synthesis gas comp.	*	o	*	
310S-TR1	Trnsformer	*	-	-	TRANS *
310K03-M1	Exciter for synchronous motor	*	o	*	
	Load center				
310S-CC1	Load center (CT unit)	o	-	-	
309Y0-M1	Over head crane for 309 sec.	o	x	x	
309Y0-M1	Over head crane for 310 sec.	o	x	*	
	Lighting for gas purification	o	-	-	
	Lighting for synthesis	o	-	-	
	Change over switch	o	-	-	
	Emergency lighting for gas	o	-	-	
	purification & motor temp. meter				
	Lighting for comp. sec.	o	-	-	
310K0-5C-M1	Instrument air comp.	o	-	-	
310K0-5A-M1	Instrument air comp.	o	-	-	
310K0-5B-M1	Instrument air comp.	o	-	-	
310	Battery charger	o	-	-	
	Instrument	o	-	-	
311K03-M1	Impure N_2blower	o	o	o	
302P05-M1	Fuel oil pump	o	x	x	
605P12A-M1	A - Effluent pump	o	x	x	
605P12B-M1	A - Effluent pump	o	x	x	
	Instrument air dryer	o	o	o	
309K02-M2	Refrigerator oil pump	o	o	o	

303-311 SECTION (FUJI, SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
309K03-M3	Refrigerator feed pump	o	x	x	
309K02-M4	Refrigerator capacity control	o	x	x	
309P01A-M1	Boiler feed water pump	o	x	x	
309P01B-M1	Boiler feed water pump	o	o	o	
309P02-M1	Light fuel oil pump	o	o	o	
309P03-M1	SYN gas comp. exciter	R	o	*	
308P01A-M1	Caustic solution pump	o	x	x	
308P01B-M1	Caustic solution pump	o	x	x	
308P02B-M1	Caustic make-up pump	o	x	o	
308P03-M1	Caustic sump pump	o	x	o	
	310 Turbo fan	o	o	o	
308P02A-M1	Caustic make-up pump	o	x	x	
307P01A-M1	MEA solution pump	x	x	x	
307P01B-M1	MEA solution pump	R	x	x	
307P02-M1	MEA sump pump	o	x	x	
305P01A-M2	Lub. oil pump for 305P01A-M1	o	x	x	
305P01B-M2	Lub. oil pump for 305P01B-M1	o	x	x	
305P02A-M1	Carbonate reflux pump	o	x	x	
305P02B-M1	Carbonate reflux pump	o	x	o	
305P03-M1	Carbonate sump pump	o	x	x	
305P04A-M1	Water injection pump	o	x	x	
305P04B-M1	Water injection pump	o	x	x	
304P01A-M1	Water pump	R	x	x	
304P01B-M1	Water pump	R	x	x	
304P02A-M1	Hot condensate pump	R	x	x	
304P02B-M1	Hot condensate pump	o	x	x	
310K03-M2	SYN gas comp. oil pump	o	-	o	
310K03-M3	SYN gas comp. oil pump	o	-	o	
310K04-M2A	Air comp. oil pump (A)	o	-	o	
310K04-M2B	Air comp. oil pump (B)	o	-	o	
310K04-M4	Air comp. cool fan filter	o	-	o	
310K04-M5	Air comp. filter	o	*	o	
310P01-M1	Oil recovery unit	R	-	o	
310K01-M3A	RG comp. seal oil pump (A)	o	-	o	
310K01-M3B	RG comp. seal oil pump (B)	o	-	o	

303-311 SECTION (FUJI, SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
310K01-M6	RG comp. injection oil pump	o	-	o	
310K01-M4	RG comp. cooling fan	o	o	o	
310K02-M2	N_2 gas comp. oil pump	o	-	o	
310K04-M3	Air comp. cooling fan	o	o	o	
311K02A-M1	Defrosting air blower (A)	o	o	o	
311K02B-M1	Defrosting air blowre (B)	o	o	o	
310K01-M2A	RG comp. oil pump (A)	o	-	o	
310K01-M2B	RG comp. oil pump (B)	o	-	o	
310K01-M5	RG comp. cool fan filter	o	*	o	
303P06-M1	Chemical solution feed pump	o	x	x	
303D01-M1	Flaker	o	x	x	
303V05-M1	Agitator	o	x	x	
303Z01-M1	Draft fan	o	x	x	
311K01A-M1	EXP turb. pump (A)	o	-	o	
311K01B-M1	EXP turb. pump (B)	o	-	o	
311RCV-1-M1	Motor valve	R	-	o	
303K01A-M1	Air blower	o	x	x	
303K01B-M1	Air blower	o	x	x	
303Y01-M1	NO. 1 belt conveyor	o	x	x	
303Y02-M1	NO. 2 belt conveyor	o	x	x	
303P04A-M1	Oxidizer feed pump	x	x	x	
303P04B-M1	Oxidizer feed pump	x	x	x	
303P08-M1	Condensate pump	x	x	x	
303P02A-M1	NO. 2 absorber feed pump	x	x	x	
303P03-M1	Reaction tank feed pump	x	x	x	
303F01-M1	Filter press	x	x	x	
303P01-M1	NO. 1 absorber feed pump	x	x	x	
303P02B-M1	NO. 2 absorber feed pump	x	x	x	
303E02-M1	Evaporator	o	x	x	
309	Battery charger	x	-	-	
309S-PP-1	Gas circulator	R	-	-	

401 SECTION (SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
401S-MTC1	Receiving	o	-	-	
	Air comp. (401K01)	*	o	x	
	Transformer primary	o	-	-	TRANS *
401S-CC1	Control circuit	o	-	-	
	Receiving	R	-	-	
401P01A-M1	Feed water pump	o	o	x	
401P01B-M2	Air comp. oil pump	o	o	o	
309K03A-M1	Ammonia liquefier	o	x	*	
309K03B-M1	Ammonia liquefier	o	x	*	
401K01-M3	Air filter	o	-	o	
501P01A-M1	Liquid ammonia pump	o	x	*	
501P01B-M1	Liquid ammonia pump	o	x	*	
401P08A-M1	Liquid ammonia pump	o	x	x	
401P08B-M1	Liquid ammonia pump	o	x	x	
401P07A-M1	Cooling water pump	o	-	x	
401P07B-M1	Cooling water pump	o	-	x	
401P05A-M1	Acid pump	o	x	x	
401P05B-M1	Acid pump	o	x	x	
401P06A-M1	Product acid pump	o	x	x	
401P06B-M1	Product acid pump	o	x	x	
401P09A-M1	Water recycle pump	o	x	x	
401P09B-M1	Water recycle pump	o	x	x	
401P02A-M1	Weak acid pump	o	x	x	
401P02B-M1	Weak acid pump	o	x	x	
401P03A-M1	Demineralized water pump	o	x	x	
401P03B-M1	Demineralized water pump	o	x	x	
401P04A-M1	Recycle acid pump	o	x	x	
401P04B-M1	Recycle acid pump	o	x	x	
401P10-M1	Chemical feeder	o	-	x	

501 SECTION (FUJI, SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
501S-MTC1	Receiving	o	-	-	
	Transformer primary	o	-	-	
501S-LC1	Load center	o	-	-	
501P02A-M1	No. 1 Neutralizer circulation pump	R	x	x	
501P02B-M1	No. 2 Neutralizer circulation pump	R	x	x	
501P03A-M1	No. 1 Ammonium nitrate solution pump	R	x	x	
501P03B-M1	No.2 Ammonium nitrate solution pump	x	x	x	
501P04A-M1	No. 1 Pre. evaporator feed pump	R	x	x	
501P04B-M1	No. 2 Pre. evaporator feed pump	R	x	x	
501P05-M1	Pre. evaporator circulation pump	R	x	x	
501P11AB-M1	Recovery pump	R	x	x	
501P12A-M1	No. 1 Condensate pump	R	x	x	
501P13A-M1	No. 1 Recovery feed pump	R	x	x	
501P13B-M1	No. 2 Recovery feed pump	R	x	x	
501K01-M1	Cooling air fan	R	x	x	
501K02-M1	Neutralizer air fan	R	x	x	
501V03B1-M1	Adjustor tank agitator	R	x	x	
501P06A-M1	No. 1 ANBA prilling tower feed pump	R	x	x	
501P06B-M1	No. 2 ANBA prilling tower feed pump	R	x	x	
501P10-M1	Washing water pump	R	x	x	
501P07A-M1	No. 1 Hot water	x	x	x	
501P07B-M1	No. 2 Hot water	R	x	x	
501Y01-M1	ANBA belt conveyor	R	x	o	
501Y01-M1	ANBA belt conveyor	R	x	x	
501Y03-M1	No. 1 ANBA bucket elevator	o	x	x	
501Y04-M1	No. 2 ANBA bucket elevator	o	x	x	
501Y07-M1	Diatomaceous earth table feeder	o	x	x	
	for ANBA				
501Y11-M1	Bucket elevator for diatomaceous	o	x	x	
	earth				
501A02-M1	No. 1 ANBA vibrating screen	R	x	x	
501A03-M1	No. 2 ANBA vibrating screen	o	x	x	
501A04-M1	ANBA fixed screen	o	x	x	
501D01-M1	ANBA dryer	o	x	x	
501D02-M1	ANBA cooler	o	x	x	

501 SECTION (FUJI, SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
501D03-M1	ANBA coating drum	o	x	x	
501P09A-M1	No. 1 Fertilizer prilling tower	o	x	x	
	feed pump				
501P09B-M1	No. 2 Fertilizer prilling tower	R	x	x	
	feed pump				
501K03-M1	Exhaust fan ANBA DRYER	R	x	o	
501K04-M1	Exhaust fan ANBA cooler	o	x	o	
501K05-M1	Forced fan ANBA dryer	o	x	o	
501K06-M1	Sec. evaporator fan	o	x	o	
501K07-M1	Exhaust fan for fertilizer cooler	o	x	o	
501Y05-M1	Fertilzer belt conveyor	o	x	x	
501Y06-M1	Fertilizer bucket elevator	R	x	x	
501Y09-M1	Diatomaceous earth table feeder	o	x	x	
	for fertilizer				
501A09-M1	Fertilizer vibrating screen	o	x	x	
501A10-M1	Fertilizer fixed screen	o	x	x	
501D04-M1	Fertilizer cooler	o	x	o	
501D05-M1	Fertilizer coating drum	o	x	x	

601 SECTION (SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
601S-MTC-1	Receiving	o	-	-	
	No. 1 Cold water pump	*	o	o	
	No. 2 Cold water pump	*	o	o	
	No. 3 Cold water pump	*	o	o	
	Transformer primary	*	-	-	TRANS *
601S-CC1	Receiving	o	-	-	
601P10A-M1	Vacuum pump No. 1	o	-	x	
601P10B-M1	Vacuum pump No. 2	o		x	
601P09A-MV-M1	Motor valve No. 1 (Cold water)	o	-	o	
601P09B-MV-M1	Motor valve No. 2 (Cold water)	o	-	o	
601P09C-MV-M1	Motor valve No. 3 (Cold water)	o	-	o	
601P08A-M1	Hot water pump (No. 1)	o	-	o	
601P08A-MV-M1	Motor valve No. 1 (Hot water)	o	-	o	
601P08B-MV-M1	Motor valve No. 2 (Hot water)	o	-	o	
601P08C-MV-M1	Motor valve No. 3 (Hot water)	o	-	o	
601P08B-M1	Hot water pump No. 2	o	-	o	
601P11-M1	Drainage pump	o	x	x	
601V01A-M1	Coagulant feeder No. 1	o	x	x	
601V01B-M1	Coagulant feeder No. 2	o	x	o	
601P08C-M1	Hot water pump No. 3	o	-	o	
601V03A-M1	Aid feeder No. 1	x	-	x	
601V03B-M1	Aid feeder No. 2	x	-	x	
601P01A-M1	Coagulant & alkali feed pump No. 1	o	x	x	
601P01B-M1	Coagulant & alkali feed pump No. 2	o	x	x	
601P02A-M1	Aid feed pump No. 1	o	x	x	
601P02B-M1	Aid feed pump No. 2	o	x	x	
601K02A-M1	Fan No. 1	o	x	x	
601K02B-M1	Fan No. 2	o	x	x	
601P03A-M1	Clear water feed pump No. 1	o	x	x	
601P03B-M1	Clear water feed pump No. 2	o	x	x	
601P05A-M1	Process water pump No. 1	o	x	x	
601P05B-M1	Process water pump No. 2	o	x	x	
601P04A-M1	Filtrated water pump No. 1	o	x	x	
601P04B-M1	Filtrated water pump No. 2	o	x	x	

601 SECTION (SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
601P06A-M1	Transfer pump No. 1	o	x	x	
601P06B-M1	Transfer pump No. 2	o	x	x	
601K01-M1	Degasifier blower	o	x	x	
601V06-M1	Caustic soda agitator	o	x	*	
	Acid pump	o	-	x	
	Lighting	o	-	-	
	Emergency	o	-	-	
601V02A-M1	Alkali feeder No. 1	o	-	x	
601V02B-M1	Alkali feeder No. 2	o	x	x	
601C01-M1	Coagulating precipitator	o	x	x	
601P07A-M1	Demineralized water pump No. 1	o	x	x	
601P07B-M1	Demineralized water pump No. 2	o	x	x	
	Lighting & process water pump	o	-	-	
	Instrumentation	o	-	-	
	Caustic soda transfer pump	o	-	x	

602 SECTION (TOSHIBA, SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
602Z01	Stoker	o	-	x	
602K01	Primary F. D fan	o	-	o	
	W. H meter	o	-	-	
	NFB	o	-	-	
602K02	Secondary F. D fan	o	-	o	
602K03	I. D fan	o	-	o	
602Y02	Chemical pump	o	-	o	
602Z05	Chemical pump	o	-	o	
602Y04	Secondary ash conveyor	o	o	x	
602Y01	Coal conveyor	o	o	x	
602Y03	Primary ash conveyor	o	o	x	
602P02A	FW pump (No. 1)	o	-	o	
602P02B	FW pump (No. 2)	o	-	x	
602P03	Condensate pump	o	-	x	
	Lighting	o	-	-	
	Instrument	o	-	-	
	Trans	o	-	-	
	Emergency	o	-	-	
602P01A	BFW pump (No. 1)	o	-	o	
602P01B	BFW pump (No. 2)	o	-	o	
	Emergency	o	-	-	

603 SECTION (FUJI, SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
603S-MTC1	Receiving 1	R	-	-	
	Receiving 2	R	-	-	
	Feeder 1 (310 sec.)	R	-	-	
	Feeder 2 (301 sec.)	R	-	-	
	Feeder 3 (401 sec.)	R	-	-	
	Feeder 4 (302 sec.)	R	-	-	
	Feeder 5 (501 sec.)	R	-	-	
	Feeder 6 (Water treatment 1)	R	-	-	
	Feeder 7 (Water treatment 2)	R	-	-	
	Feeder 8 (701 sec.)	R	-	-	
	Feeder 9 (Lighting)	R	-	-	
603S-TR1	Transformer	-	-	-	TRANS *
603S-DP1	Distribution board No. 1	*	-	-	
603S-CHA1 BTT1	Battery chager & battery	*	-	-	CHARGER x
603S-DP2	Generator panel	*	-	-	
603S-PP1	Control panel	*	-	-	
603S-DPM	Feeder panel	*	-	-	
603S-EE1 EG1	Diesel engine & generator	*	-	-	ENGINE & GE-
					NERATOR *
603S-CHA2 BTT2	Battery charger & battery	*	-	-	CHARGER x

604, 605 SECTION (SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
605S-CC2	Control circuit	o	-	-	
	Receiving	o	-	-	
605G02-M1	Hammer crusher	o	o	o	
605k04-m1	Exhaust blower	o	o	o	
605G01-M1	Pulverizer	o	o	o	
605C01-M1	Rotary valve	o	o	o	
604S-	Control circuit	x	-	-	
	Receiving	x	-	-	
604P01A-M1	Water intake pump	x	o	*	
604P01B-M1	Water intake pump	x	o	*	
604P01C-M1	Water intake pump	x	o	*	
604P02-M1	Vacuum pump	x	o	*	
604P03-M1	Drain pump	x	o	*	

605 SECTION (SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
605S-MCT1	Transformer primary	*	-	-	TRANS *
605-CC1	Control circuit	o	-	-	
	Receiving	o	-	-	
605P01A-M1	Spray pump	x	-	x	
605P01B-M1	Spray pump	o	x	o	
605P02A-M1	Recovery water pump	o	x	x	
605P02B-M1	Recovery water pump	o	x	o	
605P03A-M1	Sulphate pump	o	x	x	
605P03B-M1	Sulphate pump	o	x	x	
605P04-M1	Acid pump	o	x	o	
605P05-M1	No. 1 Milk pump	o	x	x	
605P06-M1	No. 2 Milk pump	o	x	x	
605P07-M1	No. 3 Milk pump	o	x	x	
605P08A-M1	Sludge pump	o	x	x	
605P08B-M1	Sludge pump	o	x	x	
605P09A-M1	C-Effluent pump	o	x	x	
605P09B-M1	C-Effluent pump	o	x	x	
605P10A-M1	D-Effluent pump	o	x	x	
605P10B-M1	D-Effluent pump	o	x	x	
605P11-M1	Water pump	o	x	x	
	Spare	-	-	-	
605P13-M1	Floc. aid pump	o	x	x	
605P14-M1	Drain pump	o	x	x	
605P15A-M1	B-Effluent pump	o	x	x	
605P15B-M1	Air compressor	o	x	x	
605B01-M1	Reaction tank agitator	o	x	x	
605B02A-M1	Sulphate mixer	o	x	x	
605B02B-M1	Sulphate mixer	o	x	x	
605B03-M1	No. 1 Milk mixer	o	x	x	
605B04-M1	No. 2 Milk mixer	o	x	x	
605B05-M1	No. 3 Milk mixer	o	x	x	
605R02-M1	Lake arm	o	x	x	
605B07-M1	No. 1 Decomposition tank	o	x	x	

605 SECTION (SHINKO)

TAG NO.	DUTY	REHABILITATION WORK			
		PANEL	LOCAL SW	MOTOR	
605B08-M1	No. 2 Decomposition tank	o	x	x	
605B09-M1	Neutralizer mixer	o	o	o	
605B10-M1	Floc. acid tank mixer	o	x	x	
605B11-M1	Floc. acid dissolving tank mixer	o	x	x	
605K01-M1	Mixing blower	o	x	x	
605K02-M1	Mixing blower	o	o	o	
605Y01-M1	No. 1 Lime feeder	o	o	o	
605Y02-M1	No. 2 Lime feeder	o	x	x	
605Y03-M1	No. 3 Lime feeder	o	x	x	
605Y05-M1	Vibrator	o	x	x	
605Y06-M1	Vibrator	o	x	x	
605Y07-M1	Vibrator	o	x	x	
	Spare	-	-	-	
	Spare	-	-	-	
	New acid pump	x	-	x	
605P16-M1	Acid intake pump				
605K03-M1	Mixing blower	o	x	x	
	Lighting	o	-	-	
	Spare	-	-	-	
	Emergency power receiving	o	-	-	
	Lighting	o	-	-	
	Instrument	o	-	-	

II. OTHERS