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4901

TURBO GENERATOR
5113

廣州電廠概況

廣州電廠概況

項目	單位	數量	備註
汽機	台	5	
水機	台	1	
發電機	台	5	
變壓器	台	10	
電線	公里	100	
電纜	公里	50	
電燈	盞	1000	
電扇	台	100	
抽水機	台	10	
起重機	台	5	
其他			

General Electric
Manufacture Single Phase
15750 K.V.A. 50 H.P.
G. E. Machinery
Siemens
14750 K.V.A. 70 H.P.
Siemens
10750 K.V.A. 40 H.P.

一九二九年七月



上海图书馆藏书



A541 212 0008 7437B

大日大學圖書館惠存

大日大學電機系電力組一九五〇級敬贈

一九五〇年十二月



商號名稱	計劃號碼	發電機每座電量	鍋爐分配法	TURBO-GENERATOR SETS 透平發電機廠家名稱	總變壓器	週波	電壓	速度	透平機蒸汽汽壓	透平機蒸汽熱度	透平機蒸汽用量				電機空氣化冷器	凝結器設備						機油冷化器 OIL COOLERS	濾油器設備 OIL FILTER	
											TURBINE WATER RATE					名稱	每座汽管	總面積	真空抽汽機	抽水機總	抽水機馬達			熱池抽水機
											100% LOAD	80% LOAD	50% LOAD	40% LOAD										
慎昌洋行	PROP. "A"	30,000 K.W. 三萬	一萬五千	每配座爐電一機座	G. E. Co. Curtiss, Horizontal Multi-stage, Single Barrel 18750 K.V.A. 80 % P.F. I. G. E. Machine Optional	無須	50 60	13,800 VOLT	3000 R.P.M. 3600 R.P.M.	390 #/ft ² ga.	720°F	9.32 #/K.W.H.	9.26 #/K.W.H.	9.28 #/K.W.H.	9.64 #/K.W.H.	二座	Worthington Simpson Surface Type	11,600 Sq. ft. (面積大小) 平方尺 Sq. ft./KW =0.77	2-STAGE STEAM-JET AIR-EJECTOR 二套	二套每個 (14,000 Imp. Gal./min (16,800 U.S. Gal./min.) Worthington Simpson)	二座每座馬力未明	二座每座 3-STAGE 6"-12 H.P. 440 V. 116 R.P.M. 2251.G.P.M.	全備	全備
西門子洋行	SCHEME I	30,000 K.W. 三萬	一萬五千	每配座爐電一機座	Siemens-Schuckertwerke 18750 K.V.A. 80 % P.F.	無須	50 60	13,200 VOLT	3000 R.P.M. 3600 R.P.M.	455 #/ft ² ga.	778°F 415°C	9.45 #/K.W.H.	9.20 #/K.W.H.	9.40 #/K.W.H.	9.90 #/K.W.H.	二座	SSW Surface Type	Sq. ft./KW =1.16 總面積 平方尺 17,500 Sq. ft.	STEAM EJECTOR 二套	17,500 U.S. Gal./min. 水量 每分鐘一萬七千五百加倫二部 (4000 cu.m. per hr.)	(150 H.P.) 馬力一百五十二座 720 R.P.M. 2300 V.	水未明 二座	全備	全備
西門子洋行	SCHEME III	30,000 K.W. 三萬	一萬五千	鍋爐三座	Siemens-Schuckertwerke 18750 K.V.A. 80 % P.F.	無須	50 60	13,200 VOLT	3000 R.P.M. 3600 R.P.M.	455 #/ft ² ga.	778°F 415°C	9.45 #/K.W.H.	9.20 #/K.W.H.	9.40 #/K.W.H.	9.90 #/K.W.H.	二座	SSW Surface Type	Sq. ft./KW =1.16 總面積 平方尺 17,500 Sq. ft.	STEAM EJECTOR 二套	17,500 U.S. Gal./min. 水量 每分鐘一萬七千五百加倫二部 (4000 cu.m. per hr.)	(150 H.P.) 馬力一百五十二座 720 R.P.M. 2300 V.	水未明 二座	全備	全備
禪臣洋行		30,000 K.W. 三萬	一萬五千	鍋爐三座	A. E. G. 95 % P.F.	無須	50	13,800 VOLT	3000 R.P.M.	455 #/ft ² ga.	800°F	2/2 9-24 #/KWH	3/4 8.98	1/2 9.13	1/3 9.64	二座	AEG	未明	二套 AIR EJECTOR	未明	二部馬力未明	二座	全備	無
安利洋行		30,000 K.W. 三萬	一萬	鍋爐五座	Metropolitan Vickers 80 % P.F.	無須	50	11,000 VOLT	3000 R.P.M.	370 #/ft ² ga.	775°F	未明	未明	未明	未明	二座	M.V.	未明	三套 AIR EJECTOR	三部水未明	三部馬力未明	三座	未明	無

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汽用量 RATE		電機空氣化冷器	凝結器設備					機油化冷器 OIL COOLERS	濾油器設備 OIL FILTER	總機房起重機 MAIN CRANE	飼水加熱組織 FEED WATER HEATING SYSTEM			電制台設備					鍋										
60% LOAD	40% LOAD		名稱	每座面積	真空抽汽機	抽水機	抽水機馬達				熱池抽水機	透平機泄汽位置	水箱	電氣開關板 PANELS	本廠壓用器	本廠各量電表	鍋爐數目	鍋爐式樣	蒸汽壓	蒸汽溫度	加熱總面積	鍋爐馬力							
75% 9.28 #/K.W.H.	50% 9.64 #/K.W.H.	二座	Worthington Simpson Surface Type	11,600 Sq. ft. (面積大小) 平方尺 Sq. ft./KW = 0.77	2-STAGE STEAM-JET AIR-EJECTOR 二套	二套 每個 (14,000 Imp. Gal./min. 16,800 U.S. Gal./min.) Worthington Simpson.	二座 每座 3-STAGE 6"-12 H.P. 440 V. 1165 R.P.M. 2251 G.P.M.	全備	全備	四十噸部 Morris	位置未明	三個	全備	附屬開關二副	總銅板全	附屬銅板全	發外本電 電機線廠附開 板板板一 二副三副副	附變本機 屬壓附屬 機件及電 器三座	燈變壓器 機件及電 三座	電波調節器 無	電波標準表 無	二座	水管放式斜 四個水鼓	每四百磅 平方寸	華氏 七百二十五度	二十七方尺 二萬七千八百	二千七百八十二		
50% 9.40 #/K.W.H.	25% 9.90 #/K.W.H.	二座	SSW Surface Type	Sq. ft./KW = 1.16 總面積 平方尺 17,500 Sq. ft.	STEAM EJECTOR 二套	17,500 U.S. Gal./min. 水 量 每分鐘一萬七 千五百加倫 部 (4000 cu.m. per hr.)	(150 H.P.) 馬力 一百五十二 座 720 R.P.M. 2300 V.	全備	全備	五十噸部	Bleeding Point at 4.5 Atmos. (65 #/sq. ga.)	一個	有	附屬開關副	總銅板全	附屬銅板全	發外本電 電機線廠附開 板板板二 二副三副副	附變本機 屬壓附屬 機件及電 器一座	池 機件及電 一	電波標準表 無	電波標準表 無	二座	水管式 W. & B. TYPE 三個水鼓	每四百七十七磅 平方寸	華氏 七百九十七度	一萬七千尺	一千七百九十		
50% 9.40 #/K.W.H.	25% 9.90 #/K.W.H.	二座	SSW Surface Type	Sq. ft./KW = 1.16 總面積 平方尺 17,500 Sq. ft.	STEAM EJECTOR 二套	17,500 U.S. Gal./min. 水 量 每分鐘一萬七 千五百加倫 部 (4000 cu.m. per hr.)	(150 H.P.) 馬力 一百五十二 座 720 R.P.M. 2300 V.	全備	全備	五十噸部	同上	一個	有	同上	同上	同上	同上	同上	同上	同上	同上	同上	三座	水管斜放式 二個水鼓	同上	同上	同上	一萬零六百尺	一千零六十五
1/2 9.13	1/3 9.64	二座	AEG	未明	二套 AIR EJECTOR	未明	二部 馬力未明	全備	無	全三十五噸部	未明	未明	有	二副	全	全	全	全	全	全	全	三座	水管式 三個水鼓	每四百八十五磅 平方寸	華氏 八百一十度	未明	未明		
未明	未明	二座	M.V.	未明	三套 AIR EJECTOR	三部 水量未明	三部 馬力未明	未明	無	全五十五噸部	未明	二個	有	三副	全	全	全	全	全	全	全	五座	水管斜放式 B. & W. TYPE	每三百七十磅 平方寸	華氏 七百七十五度	八千九百尺	八百九十一		

SPECIFICATION OF 30,000 KILOWATT STEAM POWER PLANT.

A. Boiler Plant.

1) Two *Steinmueller Vertical Boilers*, each of 1100 square-meters heating surface, including cooling elements at the lateral walls of the furnaces, for 36 effective atmospheres, including fine and rough fittings as specified below.

One *Gallery* for watching the water gauges and for the inspection of the upper drums, arranged between the boilers, with stairs to an intermediate platform and from there to the gallery, furthermore two stairs from the gallery to connecting bars between the boilers for inspecting the boiler-tops.

The railing for the gallery, stairs and around the boiler tops is composed of polished drawn steel tubes with wrought iron railing posts. The gallery will be provided with grating floor and will be supported by brackets.

2) Two *Steinmueller — Superheaters*, including connecting piping between boiler and superheater, constructed for superheating the boiler-steam up to about 425° Celsius, measured at superheater's outlet at normal boiler output.

3) Two *Steinmueller soot blowers*, in Steinmueller's special construction for boiler and superheater, each being composed of:

Five head wall blowers for keeping clean the cooling tubes in the furnace, the boiler tubes before the superheater as well as the superheater tubes, with withdrawable nozzle tubes.

Four nozzle tubes for cleaning the other boiler tubes, each with an automatic rapid closing valve, main stop valve, wrought iron connection nozzle for the steam piping, the necessary supply line, including flanges, packings and boltings, as well as a reducing valve.

4) Two *water level indicators with reading from stoke-hole, system Igema.*

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5) Two *water level regulators*, system "Hannemann".

6) Two *Steinmueller-Forced draught travelling grates*, of suitable grate area to generate the below stated steam quantity, using the coal quality specified, being composed of: the grate carriage, coal supply funnel with stop slide, coal layer adjuster with refractory bricks, interchangeable during service, the chain links made of best suitable cast iron. The air-and dust tight casing of the front part of the grate, the closing doors of the shaft of coal layer adjusting slide. The electric lamps for the rear part of the grate, the continuous drive with 5 different speeds, arranged for direct coupling with four electric motors, each of 3.5 horse powers at 1450 revolutions per minute, 380 volts, 50 cycles. The sight-holes for watching the fire, fire-doors and access-doors with sight glasses.

7) Two *Steinmueller-fire bridges*, each being composed of: the water-cooled cross-beam with stop-cock and muddrain, the lodging in the brick-work, pendulums with adjustable weights and a gear for lifting and lowering the pendulums from stoke-hole.

8) Two *secondary air fans*, for an output of about 300 cubic-meters per minute each, at a static pressure of about 120 millimeters water column, with drive by electric motors, each of 12 horse powers, 1450 revolutions per minute, 220/380 volts, 50 cycles.

9) Two *secondary air lines* for hot air in the front wall, with regulating devices, brackets for fans and motors.

10) Two *Steinmueller suspended roofs*, each being composed of: the refractory bricks including 10% of spare bricks, the cast and wrought iron suspensions, including profile-irons as well as the insulating and packing materials.

11) Two *Steinmueller-gilled-tube economisers*, each of 1656 square-meters heating surface, each being composed of: 288 gilled tubes of 84 millimeters inside diameter, 2500 millimeters length, with the necessary connection bends between the individual gilled tubes, water inlet and outlet nozzles, screws, packings, asbestos-cord, safety valves, thermometer, pressure gauge, delivery valve, man-hole, staying of the brick work and the set of tubes.

NOTE. The Supplier reserves the right of increasing the heating surface of the economiser by about 280 square meters to 1936 square meters, in case the burning tests of the coal in the Manufacturers' Laboratory show the advisability of doing so. In this case the air preheater (item 14) will have to be decreased in size or omitted and the sizes and numbers of the fans will have to be adjusted accordingly

12) Two *soot blowers* for the economisers.

13) Two *slide valves* as shut off the by-pass.

14) Two Steinmueller — Pocket Air Preheaters, each of 1300 square meters heating surface, with hot air return device, each being composed of: the welded pocket elements, made of best annealed and machine straightened thin plates of Siemens-Martin steel, with enclosing and connecting frames, cold—and hot air branches, ground frame and foundation bolts.

Four *Fans*, two pieces for each of the preheaters, Output: about 900 cubic meters per minute, Static pressure: about 150 millimeters water column, consisting of: the fan-casing, balanced rotor with steel shaft, oil-ring bearings, foundation plate, elastic coupling, electric motor of about 78 horse powers, 585 revolutions per minute and 380 or 2200 volts.

15) The *staying* of the brickwork and of the support beams, for the preheater.

16) Four *wrought iron hot air ducts* with insulating materials.

17) Four *wrought iron cold air ducts*.

18) The *refractory brickwork* of the furnace and the boiler flues, consisting of high grade refractory material of best suitable quality: material with a Seger cone 34 containing more than 44% alumina for the inside covering of the furnace, material with a Seger cone 32 containing 36 — 39% alumina for the inside covering of the first flue, a refractory material with a Seger cone 28 — 29 containing less than 30% alumina for the rest of the inside covering.

19) The *Insulating Material* for the faces of the drums, for the tube connection between boiler and superheater and between boiler and economiser, for the outside pipings of the cooling elements, for the drum-jacket and the steam collector.

20) Two *direct acting induced draught plants*, each being composed of: a special flue gas fan with water-cooled oil ring bearings and elastic coupling, a sheet iron stack of 20 meters height with socket and emergency steam blower, flue gas damper and by-pass flue for natural draught, direct coupled to electric motors, each of 70 horse-powers, 585 revolutions per minute, 380 or 2200 volts, 50 cycles.

21) One *coal supply plant* for an hourly output of 40 tons of coal, consisting of:

One vertical paternoster elevator for a lift of about 24 meters with completely closed pit made of plate iron of 2×3 millimeters thickness with reinforcement by structural iron, the upper and lower chain wheels with shafts and bearings, common drive for elevator and transport belt, double traced chain with suspended throughs and reinforced rim, filling and discharging shoot, the necessary supports and fastening material.

One transport belt, running over the concrete coal bunkers for a distance between the axles of about 26 meters, with supporting frames of sectional iron, supported by the bunker, two belt pulleys with shafts and bearings, belt tightener operated by spindle, with supporting rollers for the upper belt, running in ball-bearings, supply guide, a rubber belt with plies, endless vulcanised rubber-coverings on both carrying and running sides, adjustable scrapers with discharge shoots on both sides.

Four supply shoots from the bunkers to the grates with lagging of structural iron, each with flat slide valve closing with rack, pinion, chain, chain-wheel, and hand-chain, including fastening materials, chamelered plate, covering the feeding end of the pit.

One electric motor of about 10 horse powers, 950 revolutions per minute, 380 Volts, 50 cycles.

22) One *ash and clinker removing plant* consisting of special dust proof ash cars with accessories.

23) One *Turbo-feed pump* for an hourly output of 140 tons water, having a temperature of 135° Celsius, for a head of 400 meters, with all accessories for installation ready for working, with measuring and control instruments, fine fittings, differential pressure regulator. The turbine to be connected to the 36 atmospheres live steam pipes and to work at 4,5 atmospheres back-pressure.

24) One *Electro-Pump*, for the same conditions as before, with all accessories, including coupling and electric motor of about 400 horse powers, 2200 volts, 2950 revolutions per minute, 50 cycles.

25) One *complete Feed Water Make-up Plant*, comprising:

One single stage evaporator for 5 tons feed water per hour, with removable feed pipe system made of seamless steelpipes, for a steam pressure of 4,5 atmospheres and a back pressure of 1,5 atmospheres including one automatic regulating valve.

One evaporator feed pump directly coupled with three phase motor on common bedplate, for 5 cubic-meters per hour capacity and 2900 revolutions per minute.

One condensate discharging vessel with accessories, all armatures and insulating materials, where necessary.

One mixing preheater with de-aerating device for 60 tons condensate per hour and heating up from 35° to 102° Celsius, built up on feed water tank of 50 cubicmeters capacity, with 3 meters diameter and 7 meters length, to be equipped with all necessary fittings instruments and water gauge besides equipped with an automatic steam pressure valve for using live steam, including the necessary insulating material for the mixing preheater.

26) The *pipings inside the boiler house*, consisting of:

Main steam line of seamless steel tubes, flanges, packings and screw as well as cast steel pieces and the necessary supports.

Steam line to the blowers of the induced draught plants, consisting of seamless steel tubes with all accessories as before, including stop valves and reducing valve 36 × 16 atmospheres.

Superheated steam pipings to the turbine pump, connected with the main steam line, consisting of seamless steel tubes with all accessories as before, including stop valves with chain-wheel drive.

Exhaust steam main from the turbine pump to the feed-water tank and into the open air, consisting of seamless steel tubes with all accessories as before, including stop valve and safety valve.

Suction pipings of the pumps, consisting of seamless steel tubes, with all accessories as before, including stop valves with fittings made of phosphor bronze free of zinc.

Feed pressure piping, consisting of seamless steel tubes with bends, welded flanges, supports, suspensions, packings with bolts, cast iron stop valves with fittings made of bronze free of zinc, supports and suspensions.

Exhaust piping of the economiser safety-valves, consisting of seamless steel tubes with accessories as before, including check valves and control glasses.

Cooling Water piping to the bearings of the induced draught fans with fittings, stop valves, over-run funnel and supports.

Connecting piping between boilers, superheaters and economisers, consisting of seamless steel-tubes, with all accessories as before, including branches welded-on.

Delivery—over-run—and drain piping of the feed water tank, consisting of seamless steel tubes, with all accessories as before, including stop valve with bronze-fittings, siphon-tube and safety valve, weight operated.

Cooling Water piping for the fire-bridges consisting of seamless steel tubes, with all accessories, including branches welded-on, control-glasses and supports.

Blow-off piping of the boiler safety valves, consisting of welded tubes of sheet iron, with flanges and fastenings, packings and bolts and connections to the roof.

Drain pipe lines with all accessories, including steam separators, stop valves, siphons and pipe hangers.

All steam and water piping for the feed water make-up plant consisting of seamless steel tubes with accessories as before.

The insulating material for all steam and hot water pipings, in thickness from 30 to 70 millimeters impasted, with jute-bandage, lacquer painting, removable flange-caps with double wall and iron shells for the lagging-ends.

27) *Spare parts and tools for the boilers:*

- 4 headers for boiler tubes,
- 2 headers for superheater tubes,
- 2 tube cleaners,
- 2 inside tube cutters,
- 3 sets of wrenches,
- 3 scrapers for cleaning the fire,
- 3 pokers,
- 3 tube brushes,
- 3 surface cutters,
- 3 breast braces,
- 30 boiler tubes,
- 20 superheater tubes,
- 15 economiser tubes,
- 3 sets of joints,
- 30 water gauge glasses,
- 20 round closings,
- 15 oval closings,
- Spare rollers and spindles,

28) One set of *spare parts for the evaporator plant*, consisting of:

One spare heating pipe system, 25 square meters heating surface, made of seamless steel pipes, with connecting flanges ready made for the evaporator.

One complete evaporator feed pump with motor and accessories.

Guarantee Figures:

The forced draught travelling grate is suitable for combustion of Chinese coal (mixture of hard and soft coal at the rate of 1:1) with a lower heating value of 6400 kilogram-calories, and of the following analysis:

ash:	18 %
water:	3,5 %
volatile matters:	17 %
granulation:	0 — 30 millimeters, whereof 35% less than 5 millimeters and 20 % less than 1 millimeter.

Capacity. Using the above coal and under ordinary working conditions, especially in respect to feed water temperature, economiser and preheater, each boiler is capable to evaporate:

normally:	56,000 kilograms per hour
maximum continuously:	70,000 " " "

Efficiency. In case of above mentioned forced draught travelling grate being used and if coal, containing a heating value of 6400 kilogram-calories, is burned, which neither cakes nor forms fluid clinker, which contains not more than 8% of ashes and clinker and which does not stick to the boiler tubes, the boiler, superheater, economiser—and air preheating-plant, develope and efficiency of 80% measured in accordance with the technical book "Huette" and at normal output.

Procedure of tests: The guarantee is based on the lower heating value of the fuel. The proof regarding the accomplishment of the guaranteed output, if such proof is requested, will be furnished by Sellers at Buyers expenses, by corresponding evaporation tests in accordance with the rules for acceptance tests of boiler plants formulated by the "Verein Deutscher Ingenieure", latest within 2 months after starting.

Buyers decision, whether such proof is required or not, must reach Sellers at least 6 weeks before the expiration of the above mentioned 2 months' period.

Penalty: Buyers are entitled to deduct from the price of the boilers: $\frac{1}{2}\%$ for each full per cent of steam, which at the acceptance tests would remain below the guaranteed figure of steam production, as well as for each full per cent, which would be obtained less than the guaranteed figure of the entire efficiency, in the event of these failures exceeding the allowed margin of 5% as stipulated by the "Verein Deutscher Ingenieure", without however the sellers entering into further obligations.

B. Turbo Plant.

29) Two live steam condensing *Turbines*, design Siemens-Schuckert Werke, single cylinder Type with bleeder Tapping for feed water make-up plant, for the following Technical data:

Steam Pressure at stop valve: 32 kilograms per square centimeter

Steam Temperature at stop valve: 415° Celsius

Bleeder Steam from 0 to 15,000 kilograms per hour at 3.5 Kilogram per square centimeter (4,5 atmospheres absolute)

Speed: 3000 revolutions per minute, with the following accessories:

1 complete *Casing* containing the guide wheels,

1 *Shaft* complete with runner wheels,

1 *Coupling* between turbine and alternator,

2 *Stuffing Boxes* with labyrinth metal packings,

1 *Bed-plate* for the turbine including foundation bolts, where necessary,

1 *Steam Separator* for live steam with accessories,

1 Steam Inlet Main Valve for the turbine, including connecting pipe between turbine and inlet valve.

One automatic quick-acting *Safety Stop Valve* shutting off the steam in case the speed of the turbine exceeds 10—15% of the normal speed.

1 *Regulating Device* consisting of centrifugal governor, worm wheel drive, regulating valves with oil servomotor and interconnecting gear.

1 *Speed Regulating Device* for varying the speed of the turbine within 5% above or below the normal speed, by hand or by remote control from the switchboard.

1 *Oil tank* of ample size with drain cock and gauge.

1 *Oil Cooler* including connecting oil pipes to the turbo set.

1 *Toothed Wheel Oil Pump* driven from the turbine shaft.

1 *Auxiliary Oil Pump*, steam driven, for lubrication during starting and stopping the set.

All necessary Piping within the turbo set foundation.

All necessary *Gauges, Thermometers, etc.* for steam, water and oil, required for checking the different temperatures and pressures, including cocks and connecting piping.

1 *Tachometer with drive.*

1 rack with *Spanners and Special Tools.*

All *Lagging* of the turbine and piping where necessary.

First *Painting* before Shipment.

Not included in the delivery are:

All chequered plates for covering pipe channels,

Concrete foundation,

First oil charge,

Cooling water pump for oil cooler, if necessary.

30) Two Condensing Plants, design Siemens-Schuckert Werke, each consisting of:

Contra Flow Surface Condenser of horizontal type, constructed for river water (free from acid or salt), having an average temperature of 25° Celsius, capable to condense 63,800 kilogram of steam per hour.

The drum of the condenser to be welded, cooling tubes made of brass and expanded into the tube plates.

1 *Centrifugal Pump* for the cooling water, of ample size and sufficient manometric head.

1 *Centrifugal Pump* for the condensate of the turbine.

1 *Electric motor* for 2200 volts, 50 cycles, for the above two pumps.

1 *Air Pump* Steam—ejector type, of ample size.

1 Set of *Instruments and Fittings* for the condensing plant.

First Painting before Shipment.

Special Equipment: The condenser is constructed in such a way, that half of the condenser can be opened and cleaned during operation of the turbo set.

31) Two *Three-phase Synchronous Alternators* for the following data:

Output:	15,000 kilowatts
Power factor:	0,8
Voltage:	13,200 volts
(—5% at constant, current, plus 5% at constant output)	
Speed:	3,000 revolutions per minute
Frequency:	50 cycles
Exciter Voltage:	220 volts direct current

Each alternator set consisting of:

1 Three phase Synchronous *Turbo-Alternator*, design Siemens-Schuckert Werke, direct coupled to the turbine, including coupled exciter dynamo.

Efficiency of the alternator in accordance with the German Electrical Rules (REM 1930) to be:

Load:	4/4 3/4 2/4 1/4
Power Factor—1,0:	96,1 95,8 94,6 91,6 %
Power Factor—0,8:	94,9 94,7 93,4 81,0 %
Cooling air required:	6 cubicmeters per second

1 *Air Cooler*, closed circuit system, including control instruments, danger indicator, interconnecting piping for the following technical data:

Quantity of air:	6 cubicmeters per second
Temperature of air:	35° Celsius
Temperature of cooling water:	25° Celsius

1 *Shunt Regulator* with fine regulation for the exciter^{CS}.

1 *Bed-plate* with foundation bolts for the alternator and exciter.

First Painting before shipment.

Special Equipment: Three Thermo Couples to measure the temperature of the windings of each phase of the alternator.

Guarantees:

Steam Consumption: the following consumption figures are guaranteed assuming that steam of 32 atmospheres and 415 degrees Celsius is available:

Load:	15,000	12,000	9,000	6,000
Steam Consumption:	4,30	4,18	4,28	4,5 kilogram
Power factor:	0,8	0,8	0,8	0,8 per kilowatt hour

The figures are understood with a margin of 3% and less condensate in the steam mains. The figures include excitation losses, but are excluding the consumption of auxiliaries. It is further understood that cooling water of 3800 cubicmeters per hour at 25° Celsius temperature is available.

Governing: The momentary speed variation will not exceed 1.5% of the normal speed at sudden changes of load by 25%.

At sudden change from full to no-load the speed increase will not exceed about 5% of the no-load speed.

Under normal conditions the difference of speed between full and no-load will be about 4%.

On constant loads the speed does not vary more than 0.5%.

Tests.

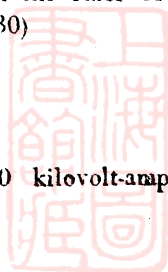
All tests will be made in accordance with the rules of the International Electrotechnical Commission (IEC) Part I (Specifications) and Part II (Rules for Acceptance Tests).

The electrical equipment is in accordance with the rules of the German Electrical Engineers' Association (REM 1930)

C. Switchplant

I. 13.2 kilovolt Circuits

32) Two Alternator Branches, each of 18,000 kilovolt-amperes capacity and each comprising:



1 Instrument Panel for the alternator each to be equipped with the following instruments:

- 1 **Ammeter, 0-800 amperes,**
- 1 **Kilowatt-meter. 0-18,000 kilowatt,**
- 1 **Power Factor Meter,**
- 1 **Ammeter for the exciter circuit,**
- 1 **Voltmeter for the exciter circuit,**
- 1 **Synchronising Socket,**
- 1 **Speed Control Switch,**
- 1 **Remote Control Switch for the Oilswitch,**
- 4 **Signal Lamps,**
- 1 **Kilowatt-hour meter, behind the panel,**
- 1 **Overload and time limit relay combination, behind the panel.**

For Installation in high tension cells, 13.2 kilovolt.

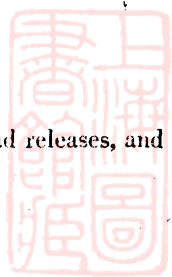
- 6 **single pole disconnecting switches with auxiliary switch,**
- 1 **High Efficiency Oilswitch, with motor drive for remote control and no-voltage relay for 24 volts direct-current.**
- 4 **Current Transformers, ATO 800/5 Amperes.**
- 3 **Potential Transformers, VTO, 13,2/0,11 kilovolt.**
- 3 **High Tension Fuses.**

33) *One Panel for the quick-acting regulating outfit, with all accessories and with change over switch to either one of the two alternators.*

34) *Three Feeder Branches, 13.2 kilovolts, capacity 8,000 kilovolt amperes and each comprising:*

One Panel to be equipped with:

- 3 **Ammeters,**
- 1 **Kilowatt meter,**
- 1 **Power Factor Meter,**
- 4 **Signal lamps,**
- 1 **Kilowatt-hour meter,**
- 1 **Automatic oil switch with three overload releases, and hand drive, for mounting in cells.**
- 9 **Single pole Disconnecting Switches,**
- 2 **Current Transformers, 400/5 Amperes.**



35) One Feeder Branch to the station transformer, 1,000 kilovolt-amperes, 13.2/2.3 kilovolt, comprising:

One Panel to be equipped in front with:

- 1 Ammeter,
- 1 Kilowatt-hour Meter,
- 4 Signal Lamps,

Behind the Panel:

- 6 Disconnecting Switches,
- 1 High Efficiency Oilswitch, with 2 overload releases, and hand drive,
- 2 Current Transformers.

36) One Feeder Branch to station transformer, 1,000 kilovolt-amperes, 13.2/380 / 220 volts, comprising:

One Panel equipped with:

- 3 Ammeters,
- 1 Kilowatt-hour Meter,
- 4 Signal Lamps,

Behind the Panel:

- 6 Disconnecting Switches,
- 1 Oilswitch with 2 overload releases and hand drive,
- 2 Current Transformers.

37) One Double Busbar System for the 13.2 kilovolt high tension cells. consisting of the necessary busbars of ample size, supporting insulators, inter-connections, etc. besides, two potential transformers with high tension fuses for all kilowatthour meters of the feeders.

1 Turnable Box with double voltmeter, double frequency meter and zero-voltmeter for synchronising purpose.

II. 2.3 kilovolt Circuits

38 One Feeder Branch to the secondary side of the transformer, 1,000 kilovoltamperes, 13.2/2.3 kilovolt, comprising:

- 1 Oilswitch with 2 overload releases, 350 amperes and hand drive,
- 6 single pole disconnecting switches,

- 1 Ammeter,
- 1 Voltmeter,
- 1 Current transformer,
- 4 Signal lamps.

39) Three *Feeder Branches* to the high tension motors in the power plant, each comprising:

- 1 Oilswitch with 2 overload releases, 200 amperes, hand driven,
- 6 single pole disconnecting switches,
- 1 Current Transformer,
- 1 Ammeter,
- 4 Signal Lamps,

40) One *Double Busbar System* for 2.3 kilovolt cells, comprising all copper busbars, insulators, inter-connections, etc. besides, 1 potential transformer for the voltmeter.

III. 380/220 Volts Distribution

- 41) One *Cast Iron Totally Enclosed Distribution System* consisting of:
- 7 Busbar Boxes with busbars of ample size,
 - 7 Cable End-Boxes with disconnecting switches,
 - 1 Ammeter and Voltmeter Box for the incoming cable,
 - 4 Ammeter Boxes for the outgoing cables,
 - 2 Distribution Boxes with switches for light circuits.

IV. Emergency Circuits.

42) One *Storage Battery* of 90 ampere-hours, 24 volts, in ready burnt glasses, with stand, acid, insulators, etc. for emergency light circuits and relay circuits.

One *Dry Transformer*. 1 kilovolt-ampere, 220/24 volts.

One *Emergency Switch automatically working* if the light circuit fails and switching-on the battery to the emergency light circuits of 24 volts.

All necessary *Fuses*, etc.

One *Dry Rectifier* including panel, for charging the battery.

V. Transformers

43) *One Oil Immersed Self Cooling Three phase Transformer.*

Capacity: 1,000 kilovoltamperes,

Ratio: 13.2/2.3 kilovolt at full load and power factor 0.8,

Efficiency: 98.3% at power factor 1.0

with plus minus 5% tappings, including oil filling, on rollers.

44) *One Transformer, as above, but*

Ratio: 13,200/380/220 volts.

VI. Connecting Cables within the Power Plant.

45) *All high tension connecting cables between the switchplant, alternators and motors.*

46) *All low tension connecting Cable between the switch plant and motors.*

47) *All auxiliary cables and connections within the switchplant.*

D. Crane and Engine House Piping.

48) *One Travelling Crane for the engine room, 50 tons capacity, for a span of 14 meters, with rails for a length of 32 meters and electric drive including switchgear.*

All Piping within the engine room for steam, water and oil, including all fittings and insulating material where necessary.

E. Steel Structure.

50) *Steel Construction Materials for the building of the boiler and engine-house (excluding switch house and auxiliaries) consisting of purlins for the roof, roof trusses, girders, frame work for the front and rear walls of the engine - and boiler - house, between roof and engine - and boiler - house floor respectively, for lining with 5 inches bricks thickness, further of the bunker columns with cross beams, the bunker fixing parts including ventilation, the bridge beams over the bunkers. Furthermore, there were included the supporting beams for a raw water tank, the ceiling construction for the platforms of the boiler-house, the crane columns and support of rails for the crane, the*

engine room floor for a load of 500 kilograms per square meter, with the necessary ceiling columns and the engine-room ventilation on the roof. Besides, the complete accessories, as foundation bolts, screws, nuts and rivets are included. All parts are painted before shipment for rust protection.

Galvanised TZ-Gratings of about 30 millimeters thickness for the engine house floor, ready out, including frames.

Steps for the stairs within the building, each consisting of side frames made of sheet iron with corrugated sheet iron steps of 0.75 to 1 meter width, including angle iron supports.

Steps of the ladder type, of 0,5 meters width.

Railing for the stairs and platforms made of polished steel pipe of 30 millimeters outer diameter.

Adjustable Wrought Iron Shutters, for the ventilation, with bronze shaft and bearings, gear for adjusting from the boiler platform or condensate room.

Wrought Iron Windows complete with all accessories partly to be opened from the platform, including gear but excluding glass.

Wrought Iron Windows for the bunker-house.

Rhineland Window Glasses, 6/4 II. type, for above windows, ready cut.

Glass Putty.

Outer Double Win Iron Pressed Doors with all accessories and frame.

Single Wing Doors within the building complete with all accessories.

The iron structure will be made of special construction steel ST-1 and or ST-52 conforming to German Standard.

Canton, February 22nd, 1934.

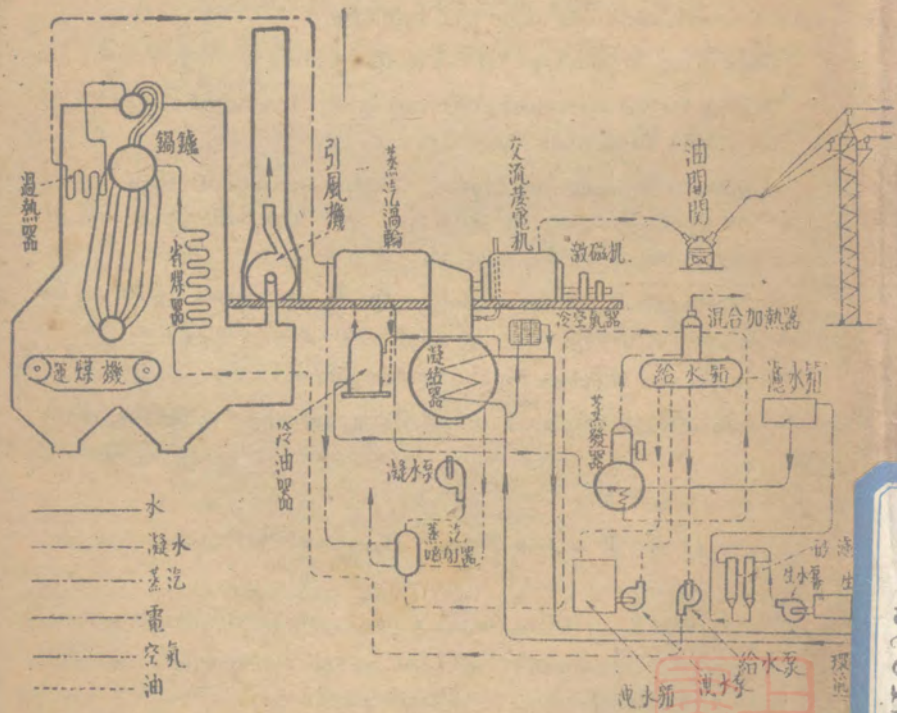
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(signed)



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