

FILM STUDY GROUP
REPORT ON MICROFILM REEL NO. 12

Prepared by
BUREAU OF MINES

U. S. Government Technical Oil Mission

Summary of Items 22, 22a, 22b, 22c, and 22d of
Mission Report U. S. Technical Oil Mission

Item 22: Report for period January-July 1941 on overall efficiency of hydrogenation plant operations. 16 pages.

This report is a very brief summary of the overall efficiency of operation of a brown coal tar hydrogenation plant. Topics of discussion are: oxygen production and compression, coke consumption and quality of gas in the preparation of water-gas in a Winkler generator, sulfur removal in two stages; namely, the alkali process and catalytic organic sulfur removal, carbon monoxide content of the water-gas before and after the water-gas shift, steam and power consumption, carbon dioxide removal by washing with water under pressure; carbon monoxide removal, gas for heating purposes, tar acid recovery, gasoline and Diesel oil analyses and efficiency of production from tar and light oil, liquid (slump) phase operation efficiency, and washing and distillation of products.

Item 22a: Monthly reports for 1943 on operation of a brown coal tar hydrogenation plant (Böhlen). 210 pages.

These reports are on printed forms and of two types; namely, one giving operating and analytical data for purposes of yield and efficiency calculations, and the other presenting similar data but arranged in such fashion as to facilitate cost calculations.

The first group contains the following headings or topics:

Gas Production: Oxygen, Winkler water-gas, first and second stages of sulfur removal, water-gas shift.

Gas Compression: Compression, carbon dioxide removal, carbon monoxide removal, efficiency of hydrogen production, calculation of raw material and power consumption.

Hydrogenation: Actual and possible maximum motor fuel production; actual and possible maximum butane and propane production; by-products; quality and analyses of gasoline, Diesel oil, tar, light oil, recycle oil; quality and distribution of intermediate products; product and total yield; losses in different stages; hydrogen consumption; raw materials and power consumption.

The second (or "cost") group is divided into low- and high-pressure operations:

High-Pressure Operations: Tar stalls, recirculation gas compression, gasoline stalls, power.

Low-Pressure Operations: For centrifuging, making up of residues; tar, gasoline, and diesel oil distillations; gasoline washing; storage and shipping gasoline and diesel oil; storage and shipping of butane and isobutane; Linds (oxygen) plant; boiler house hydrogen sulfide removal; phenol recovery; total sulfur balance; sulfuric acid plant.

Items 21, 22, and 23: These items are a carefully drawn and very brief overall flow diagram of a 1.5-ton-per-day pilot plant for the Fischer-Tropsch synthesis, and some pencilled drawings of the converter. The latter consisted of a Ruhrchemie "finned-tube" type converter enclosed in a cylindrical vessel so that operation at 10-20 atmospheres was possible. A table of product distribution is included as follows:

<u>Catalyst</u>	<u>Percent of total product</u>	
	<u>Iron</u>	<u>Cobalt</u>
Hard wax	30	10
Soft wax	30	15
Oil	10	15
Gasoline	30	60

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REPORT OF THE U. S. BUREAU OF MINES
Item 26 to 41
Revised by L. L. Jones

ITEM 26.

Item 26 is a four page description of the high pressure generator installation and refers to Drawing PIG 311130 (See Item 42).

In a general way it states what the fuel consists of and how it is delivered to the bunkers, and the method of charging it to the generator.

The charging pouch, the generator and the mechanical grate, the ash removal pouch and the tar and moisture separator are described.

An analysis of the raw gas has approximately the following average analysis:

CO ₂	31.5%	H ₂ S	1.4%
O ₂	0.8%	O ₂	0.3%
CO	14.1%	H ₂	35.4%
CH ₄	15.5%	N ₂	1.0%
Density (air = 1.00)	0.77		
Upper heating value	3,100 Kcal/m ³		

Mention is made of the instruments used for the control of the generators and for the measurement of the gas.

This description is primarily intended for the plant operating personnel, and is of limited interest to designers and operators of similar equipment.

ITEM 27.

This is a laboratory report showing the monthly average analysis of the coal supplied to the Beilan gas works during the month of January 1945.

It includes a proximate analysis of the coal as received, and an ultimate analysis of the coal before and after drying and the upper and lower calorific values of the coal.

ITEM 28.

This is similar to Item 27, and shows the monthly average analysis of the broken pieces of briquettes (brikettgas) supplied to the Beilan gas works during the month of January 1945.

ITEM 29.

This is a one sheet laboratory report showing daily routine analyses and includes on one side of the sheet the composition of the raw gas, clean gas, and physical tests on tar and light oil taken at various stages of the condensing system. The tar analysis shows the specific gravity, water and dust content

and purification temperature. The oil analyses include the specific gravity, the distillation and end point. On the reverse side are shown analyses of the various grades of fuel used, the hardness of the water, and the H₂ content in the gas entering the various stages of the dry purification plant.

ITEM 10.

This is a monthly report showing the operating results for the month of January 1945. It includes data on the amount of gas, tar and light oil produced, the fuel consumed, and the amount of oxygen, steam power and water supplied. Gas and fuel analyses are also shown.

ITEM 11.

This is a report on tests made to determine the ash clinkering characteristics of the fuel used in the Bohlen plant. Four curves are included showing the sintering temperature, the motion melting temperature, and the flow point of the ash.

ITEM 12.

This consists of seven pages of figures comparing the estimated and actual costs of construction of the large pressure gasification plant at Bohlen.

ITEM 13.

This is composed of a miscellany of material and includes the following:

Four pages furnishing detailed instructions for bringing up a cold generator to full operating capacity in Section I, and for bringing up a hot generator in standby condition to full operating capacity in Section II.

Curves showing the proportions of steam to air and oxygen (repeated below).

Three pages of descriptive matter relating to the Linde-Frankl oxygen apparatus.

Twelve pages of detailed instructions for the operation of the oxygen plant.

Two pages identifying the individual items of equipment shown on a one page diagram of the Linde-Frankl plant.

A production plan for the Bohlen plant for 1943/1944 showing the quotas for the various materials to be produced each month.

Four typical monthly operating reports for the Bohlen gas works.

One report showing the daily gas production for the month of November 1944

Nine pages of instructions for the operation of the pressure gas generators.

Curves showing the proportions of steam to air and oxygen (duplicate of above).

Four pages of detailed instructions for taking a Lurgi pressure generator out of service.

Six pages showing monthly operating figures for the year 1943. These include data on production of gas, tar and light oil; consumption of fuel, oxygen, steam, power and water; ratios of gas to fuel and many other important relationships, analyses of gas and fuel; and number of persons employed.

One sheet showing the brown coal operating figures for 1943.

One sheet showing graphically the monthly gas output for the years 1941, 1942, 1943, and 1944.

Five pages describing the pressure water scrubbing system at Böhlen and including detailed operating instructions. A flow sheet of the pressure water scrubbing system is included.

One sheet showing the operating results of the Böhlen gas works for 1943.

One sheet showing the monthly aqueous liquor and tar production at the Böhlen gas works in 1941 and part of 1942.

Several sheets showing monthly production and consumption data for the years 1940-1944 and graphic representation of the data.

One sheet showing the average monthly analyses of the clean gas produced during 1943.

ITEM 24.

This consists of Brabag plant operations relating to the Winkler gas production and includes the following:

Four page test report on HCN removal prior to the Alkanid purification plant (three pages of text and one flowsheet).

One sheet showing a daily report of operations in the Alkanid plant, clean plant, final purification plant, and blower house (for 11 July 1940).

One sheet showing a daily report of gas production (for 11 August 1936).

Six pages of operating instructions for the oxide plant for the removal of hydrogen sulphide.

Three pages on Winkler generator operating difficulties at high rates of operation.

Six page report on the sulphur removal from the water gas - includes one flowsheet.

Eight pages of material which it is difficult to analyze because of poor legibility.

ITEM 14.

This is a diagram showing the products resulting from the treatment of raw brown coal at Böhlen.

ITEMS 16 and 17.

This is a Plan view of the Sachsischerwerke at Böhlen drawn to a scale of 1:1000 (two sheets).

ITEM 18.

This is a ground plan of the Böhlen gas works. Scale 1:250.

ITEMS 19 to 70.

Various detailed drawings as listed in the index of Reel No. 12A.

These drawings should be of considerable value to any engineering organization planning the design and construction of a similar plant. They include many details of the individual components entering into the generator assembly. They are not, however, complete and additional details appear on another microfilm. See T.O.M. Reel No. 137 (Original Designation, Navy Reel No. 5815) See T.O.M. Reel No. 62 (Original Designation, Reel 33A)

The list of drawings by title follows:

Document

No.

39. Drg. Gas connections in Gas Plant. 1939
40. Drg. Flow diagram of oxygen plant. 1940.
41. Drg. Flow diagram of oxygen plant. 1939.
42. Drg. Diagram of h.p. Generator. 12/4/41.
43. Drg. Diagram of coal supply to generator. 1941.
44. Drg. Studs on generator.
45. Drg. Pressure Vessel.
46. Drg. Brickwork of Generator. 1940.
47. Drg. Coal distributor for generator. 1939.
48. Drg. Coal distributor for a different plant. 1941.
49. Drg. Charging pouch of h.p. generator. 1941.
50. Drg. Automatic Valve for Charging Pouch.
51. Drg. Valve of charging pouch. 1943.
52. Drg. Valve of charging pouch. details.
53. Drg. Discharging Pouch. 1940.
54. Drg. Ash discharge device. 1940.
55. Drg. Steam and water pipes on generator. 1941.
56. Drg. Rig for re-grinding faces. 1941.
57. Drg. Hoods for dumping off gases from charging pouch.
58. Drg. Temperature-measuring Points.
59. Drg. Scrapers in generator. 1941.
60. Drg. off-take elbow and valve. 1937.
61. Drg. Scoiler (Principal). 1940.
62. Drg. Scoiler (final). 1940.

Document

No.

(Cont'd.)

63. Eng. Tar separator.
64. Eng. Air separator - Arrangement of Mouth Rings.
65. Eng. Bussell Scrubber. 1977.
66. Eng. Pressure Water Washing - General Plan. 1968.
67. Eng. Pressure Water Washing - General Arrangement. 1976.
68. Eng. Pressure Water Washing - Pipe Lines.
69. Eng. Pressure Water Washing - Pipe Lines. 1979.
70. Eng. Attention Tower. 1978.