

INSPECTION OF THE FÖLITZ HYDROGENATION PLANTCoal Cycle Systems

The coal hydrogenation units are connected with three independent cycle systems. The lines have a diameter of 4.74 in. The suction lines are heated and insulated and the pressure lines are insulated. The suction side contains 3 recycle gas coolers, bypasses ahead of the coolers and wash towers, 5 wash towers and 2 small separators ahead of the gas pumps. Each cycle system has automatic pressure and temperature recorders.

Coal hydrogenation units

6 coal stalls are in operation of which one is run on Rumanian oil, one on tar and the rest on coal. All stalls are equipped with one gas heat exchanger and 2 paste heat exchangers. One stall contains 3, four contain 4 and one contains 5 converters; each stall has one hot separator. The operating pressure is 10,300 psi.

The preheater exit temperature must be kept at 21.6 mV (probably iron-constantan, about 780°F.), the inlet temperature of reactor #1 is kept at 23.9-24.0 mV (about 850°F.). The reactor temperature must not exceed 25.2 mV (890°F.).

The following schedule is followed for charging, starting, heating, injection, cooling and shutting down:

Filling with hydrogen:	4 hours,	
lighting of gas:	after 3 hours,	
gas flow:	within 1 hour.	
Temperature increase:	by 1.5 mV to	a temperature of 12mV(480°F)
"	" : " 1.2 mV " "	" " 18mV(660°F)
"	" : " 1.0 mV " "	" " 21mV(760°F)
At 8 mV(350°F.)	flushing oil injected at converter	#1
at 14 mV(540°F.)	pasteing oil	" #4
at 21 mV(760°F.)	kept for 2 hours.	

For warming up for the purpose of subsequently tightening the connections the temperature is lowered from 21 mV to 12 mV in the same way.

Gas flow is stopped within 1 hour and the pressure is released over a period of 4 hours. A total of 26 hours is required for warming up the unit.

Heating to the initial operating temperature of 21 mV after the connections have been tightened is carried out in the same way.

Change-over to coal paste is carried out by passing 793 gals. pasteing oil and 793 gallons thin paste through the heat exchanger and passing 1321 gals. pasteing oil and 1321 gals. thick paste through the preheater. Temperatures and through-put are raised to the regular operating values over a period of 6 hours.

After 250 days the coal hydrogenation units are shut down because by that time the hairpin tubes of the preheater have become so fouled that tube wall temperatures reach 968°F. The hot part of the heat exchanger also shows large deposits at that time. The formation of deposits in the preheater amounts to about 0.04 in. per month.

The temperature in the hot separator is kept at 22.5 mV (about 810°F.) at the separator exit by means of cold gas.

In converter #1 caviar formation is obtained and a "desanding" line has been installed through which sludge is removed every 3 minutes.

For emergency depressuring of the reactors and hot separators there are 2 lines of 4.74 in. diameter which make connection with the 2 emerging depressuring towers.

#### Recycle gas absorbers.

5 absorbers are in operation using about 4.5-7.5 gals. of oil/1000 cu.ft. of gas. The total quantity of gas processed amounts to 9,180,000 cu.ft.

The gas temperature at the inlet is 99-109°F. and at the outlet 99-100°F; the density of the gas at the inlet is 0.343 and at the outlet 0.311. The sp. gravity of the absorption oil is 0.810 and its temperature at the inlet is 100°F. and at the outlet 102°F.

The oil is depressured in one stage from 10,300 psi. to 485 psi. and in a second stage to atmospheric pressure.

#### Centrifuge plant.

The plant has 44 centrifuges with a capacity of 4.4 tons each. The centrifuging temperature is 392°F. The centrifuges are flushed about 30 times within 24 hours and 1-3 centrifuges have to be taken up within 24 hours. In general, it has been found that not much difficulty is experienced with the centrifuge plant when the quantity of sludge is large but that operations become more difficult when the hydrogenation units work satisfactorily.

#### Vapor phase hydrogenation.

8 units are in operation of which 5 are pre-hydrogenation units and 3 gasoline units. Three of the prehydrogenation units have electric preheaters and the others gas preheaters.

The converters using catalyst 5058 are placed third in the system since the catalyst was spent after 1/4 year when the converters were placed in position-1. It appears that catalyst 7846 W250 is more rugged and very satisfactory.

The units are operated according to temperature indications rather than the spec. gravity of the separator product.

Tightening of the prehydrogenation and gasoline units after warming up is found unnecessary.

The following schedule is followed for charging, starting, heating, cooling and shutting down the units:

Charging: 4 hours  
Gas flow: within 1 hour  
Heating: 1.0 mV/hour up to 10 mV (410°F.)  
          0.5 mV/hour " " 15 mV (570°F.)  
          0.5 mV/hour " " 18 mV (660°F.)

Injection in prehydrogenation units is started with 528 gals. and raised 264 gals/hour; injection in gasoline units is started with 1056 gals. and raised 264 gals/hour.

On cooling down the temperature is held at 18 mV (660°F.) until the catalyst is dry and the temperature is subsequently lowered at the same rate as during the heating up period until 2 mV (about 170°F) has been reached; the pressure is released over a period of 4 hours.