L.W. [illegible]

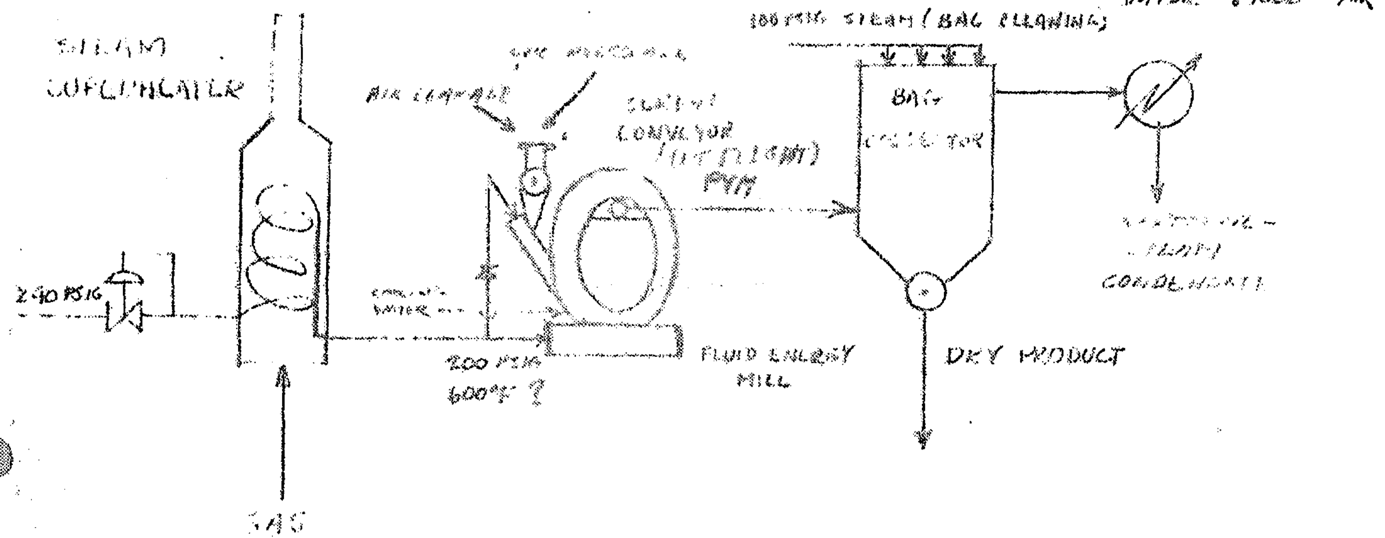
[illegible] ENERGY [illegible]

NEWPORT

D.H. [illegible] 1/25 67

Determine how much water injection is req'd to keep outlet temperature below [illegible] 310°F & 350°F

CPC 0.092 g/l
VAPOR 87000 ft³/HR




FEED QUANTITY

EXISTING [illegible] CAPACITY 280000 lb/mo

Avg rate $\frac{280000}{30 \times 24}$ = 389 lb/HR CPC [illegible]

Peak rate = $\frac{389}{0.85}$ = 457 lb/HR. Let's make it for <u>500 lb/HR</u>

[illegible] REGION [illegible] [illegible] OF PRESSCAKE

LC PRESSCAKE wt % COMPOSITION

| | CASE I | CASE II | CASE III |
|---|---|---|---|
| CPC | 42 | 50 | 46 |
| KEROSENE | 14 | 28 | 22 |
| WATER | 44 | 22 | 32 |

FLUID ENERGY DRYING

D. H. Eastham 1/25 67

HEAT REQ'T CASE I

CPC: $Q = mC_p\Delta T$

$m = 1$ lb

$C_p = 0.2$ BTU/lb °F

$\Delta T = 300 - 50 = 250$ °F

$Q = (1)(0.2)(250)$

$Q = 50$ BTU/lb CPC

$\underline{\underline{Q_{CPC} = 50 \text{ BTU/lb}}}$

WATER: $Q = \Delta H = H_2 - H_1$

$H_1 = H_2O$ @ 50°F

$H_1 = 18.07$ BTU/lb

$H_2$ $H_2O$ @ 300°F

$H_2 = 1192.0$

$Q = 1192.0 - 18.07$

$Q = 1173.93$ BTU/lb $H_2O$

$\underline{\underline{Q_{H_2O} = 1174 \text{ BTU/lb}}}$

KEROSENE: SENSIBLE HEAT

$Q = mC_p\Delta T$

$m = 1$

$C_p = 0.5$

$\Delta = 300 - 50 = 250$ °F

$Q = (1)(0.5)(250)$

$Q = 125$ BTU/lb

LATENT HEAT

$Q = m\lambda$

$m = 1$

$\lambda = 100$ BTU/lb

$Q = 100$ BTU/lb KEROSENE

TOTAL $= 100 + 125$

$= 225$ BTU/lb KEROSENE

$\underline{\underline{Q_{KERO} = 225 \text{ BTU/lb}}}$

DUP050027629

CASE I carp on p1 - CASE I had neg +

CPC : (50 BTU/lb)(0.42) = 21.0
KEROSENE : (225 BTU/lb) (0.14) = 31.5
WATER : (1174 BTU/lb) (0.44) = 517.0
total 569.5

CASE I - 570 BTU/lb PRESSCAKE

CASE II

CPC : (50)(0.50) = 25.0
KEROSENE : (225) (0.28) = 63.0
WATER : (1174) (0.22) = 258.0
346.0

CASE II - 346 BTU/lb PRESSCAKE

CASE III

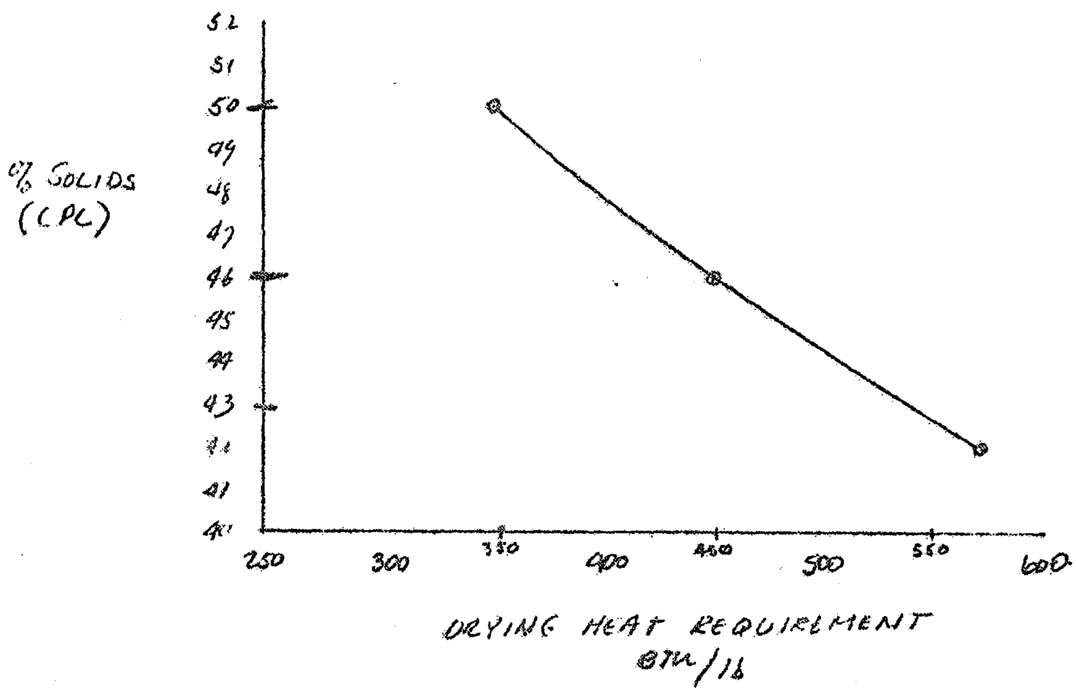
CPC : (50) (0.46) = 23.0
(225) (0.22) = 49.5
(1174) (0.32) = 376.0
448.5

CASE III - 449 BTU/lb PRESSCAKE

CALCULATED DRYING REQUIREMENT

FOR LC-CPC

PRESSCAKE



BB PRESSCAKE

39.0 % CPC
14.0 % KERO
47.0 % WATER
100.0

CPC : (50)(0.39) = 19.5
KEROSENE : (225)(0.14) = 31.5
WATER : (1174)(0.47) = 552.0
603.0

AVG PLANT BB PRESSCAKE 603 BTU/lb

LEAF TESTS IN LAB (BB)

41.0 % CPC
7.5 % KERO
51.5 % WATER

CPC : (50)(0.41) = 21.0
KEROSENE : (225)(0.075) = 16.9
WATER : (1174)(0.515) = 605.0
642.9

LEAF TESTS - 643 BTU/lb PRESSCAKE

SUMMARY

MAXIMUM HEAT LOAD (BB) 41% CPC – 643 BTU/lb

MINIMUM HEAT LOAD (CC) 50% CPC – 346 BTU/lb

Lets set outlet temp @ 265°F & determine steam requirements.

MAXIMUM HEAT REQUIREMENT

$\frac{500 \text{ lb/hr CPC}}{0.41}$ = 1222 lb/hr PRESSCAKE

1222 (643) = 785000 BTU/HR

Neglect heat loss

INLET 650°F 200 PSIG ; H = 1345 BTU/lb

OUTLET 265°F 0.3 PSIG ; H = 1176 BTU/lb

AVAILABLE ΔH 169 BTU/lb STEAM

MAX. $\frac{785000 \text{ BTU/HR}}{169 \text{ BTU/lb Stm}}$ = 4650 lb Stm/hr @ 650°F

MINIMUM HEAT REQUIREMENT

$\frac{500 \text{ lb/hr CPC}}{0.50}$ = 1000 lb/hr CPC PRESSCAKE

MIN. $\frac{(1000)(346)}{169}$ = 2050 lb/hr Stm @ 650°F

Try 800°F Steam

Steam 800°F - 200 PSIG $H_1$ = 1423 BTU/lb

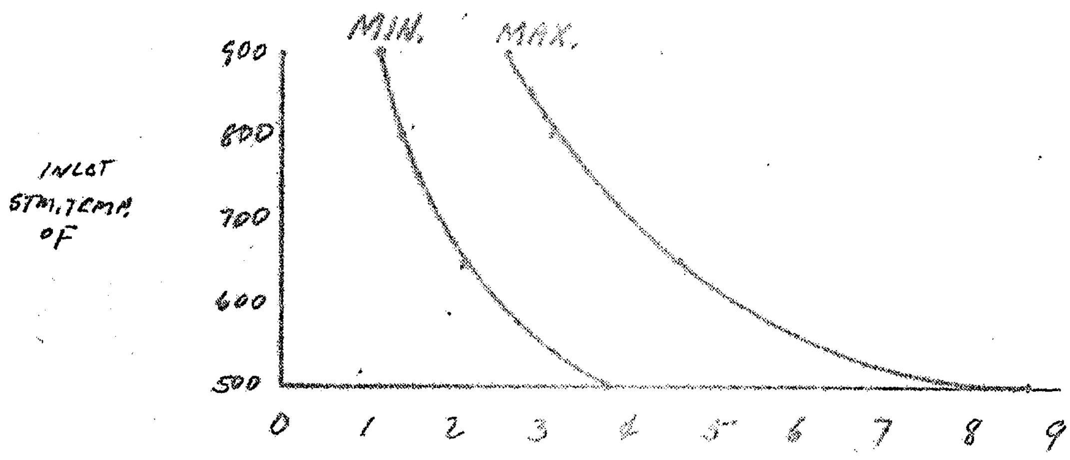
263°F - 0.3 PSIG $H_2$ = 1176 BTU/lb

$\Delta H$ 247 BTU/lb

MAX $\frac{785000}{247}$ = 3180 lb/HR.

MIN $\frac{346000}{247}$ = 1400 lb/HR

EFFECT OF STEAM TEMPERATURE ON STEAM QUANITY



Title of Project or Study ........ Project or Study No. ........
Subject ........ Work ........
........ Computer ........ Date ........ 19 ........

500°F - 200 PSIG

$H_1 = 1268$
$H_2 = \underline{1176}$
92 BTU/lb

MAX $\frac{785000}{92} = 8525$

MIN $\frac{346000}{92} = 3760$

900°F - 200 PSIG

$H_1 = 1474$
$H_2 = \underline{1176}$
298 BTU/lb

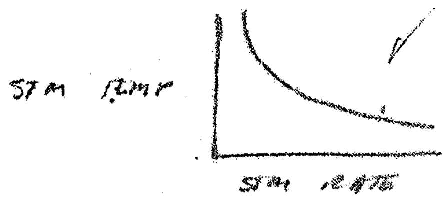
MAX $\frac{785000}{298} = 2640$ lb/HR

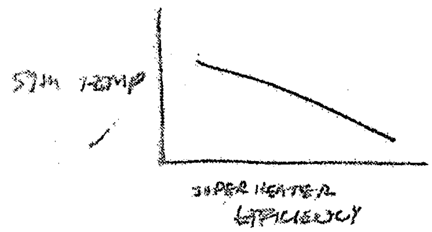
MIN $\frac{346000}{298} = 1161$ lb/HR

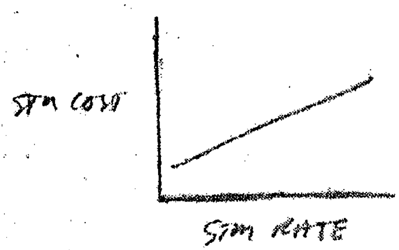
TITLE OF PROJ OR STUDY ______ PROJ OR STUDY NO ______
SUBJECT ______ WORKS ______
______ COMPUTER ______ DATE ______ 19 ______

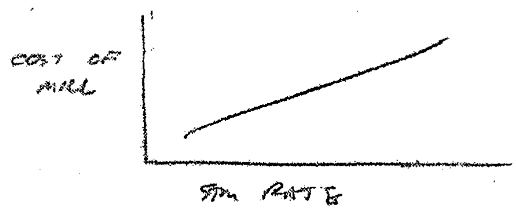
Lets try to optimize steam temperature!

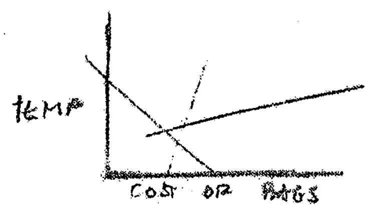
The following effects hold in relation to steam temp.




(Neglect this one. assume bags can be protected by water injection)

"Guesstimated" EFFICIENCY

| Outlet Stm Temp | $\eta$, % |
|---|---|
| 650 | 71.0 |
| 825 | 61.5 * |
| 900 | 58.0 |

* As per quote from vendor (Petrochem Development)

6-46 REV. 11-59

ENGINEERING DU PONT COMPUTATION SHEET

SHEET No. 10

TITLE OF PROJ. OR STUDY ______ PROJ. OR STUDY No. ______

SUBJECT ______ WORK ______

______ COMPUTED ______ DATE 1/26 19 67

Assume 0.6 factor holds for both superheater cost and cost of Fluid Energy mill.

| STEAM TEMP. °F | Thermal Eff % | STEAM RATE (#/HR) | FLUID ENERGY MILL COST | SUPER HEATER COST | STEAM COST #/1000 | GAS AS COST $/YR |
|---|---|---|---|---|---|---|
| 650 | 71.0 | 4650 | 15000 | 10500 | 34200 | 3660 |
| 825 | 61.5 | 3100 | 12000 | 9000 | 22800 | 4230 |
| 900 | 58.0 | 2640 | 10000 | 8000 | 19400 | 4500 |

$0.85 \times 360 \times 24 = 7350$ HR/YR

GAS RATE = $\text{COST} \times \frac{\text{HEAT LOAD}}{\eta \times 1000} \times \text{TIME}$ {Say 1000 BTU/FT³, 0.45 $/MM BTU}

$$\text{GAS COST} = \frac{785000}{\eta \times 1000} \times 7350 \times \frac{0.45}{1000}$$

$$= \frac{2600}{\eta}$$

| | 650 °F | 825 °F | 900 °F |
|---|---|---|---|
| MILL | 15000 | 12000 | 10000 |
| SUPERHEATER | 10500 | 9000 | 8000 |
| STM | 34200 | 22800 | 19400 |
| GAS | 3660 | 4230 | 4500 |
| TOTAL | 63360 | 48030 | 41900 |

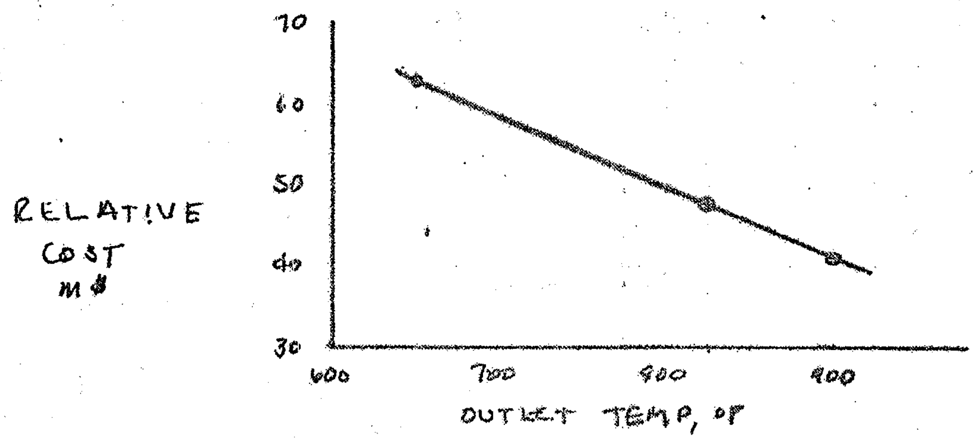
ENGINEERING COMPUTATION SHEET

Sheet No. 11

Title of Project or Study ____ Proj. or Study No. ____

Subject ____ Work ____

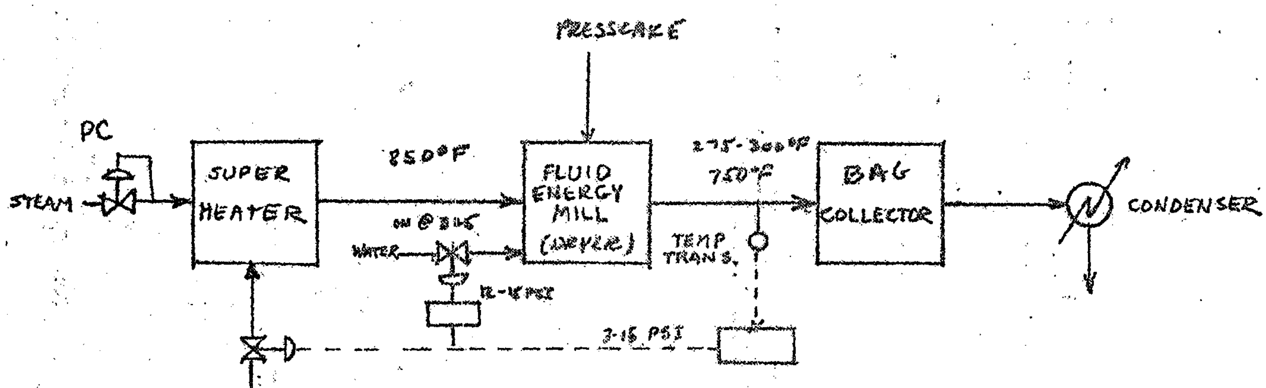
Computer D. G. Eastham Date 1/26 1967




Conclusions: Steam cost is major factor-

LETS SET INLET STEAM TEMP AT 850°F (455°C) ARRANGE WATER ADDITION TO PREVENT TEMP FROM EXCEEDING 325°F. SET TEMPERATURE CONTROLLER TO CONTROL SUPERHEATER OUTLET TEMP. TO SET DRYER OUTLET TEMPERATURE AT 275-300.

## INSTRUMENTATION




GAS RATE SET TO CONTROL TEMP. AT DRYER OUTLET 275-300°F.

TITLE OF PROJ. OR STUDY ____ PROJ. OR STUDY NO. ____

SUBJECT ____ WORK ____

COMPUTER DRE DATE 1/26 19 67

Required amount of cooling water:

850 - 100 = 750 °F

Cool 750 to 335.   H @ 750 = 1406
H @ 335 = 1203
ΔH   203 BTU/lb

Amt $H_2O$ req'd
H of Btu @ 335 °F = 1203
H. of water @ 90 °F = 58
1145 BTU/lb $H_2O$

STEAM RATE @ 850 = 2900 lb/hr

$$\frac{(2900 \text{ lb/hr})(203 \text{ BTU/lb})}{(1145 \text{ BTU/lb})(500 \frac{\text{GPM}}{\text{lb/hr}})} = 1.03 \quad \text{GPM } H_2O @ \eta = 100\%$$

Spray water need 0 - 1.5 gpm