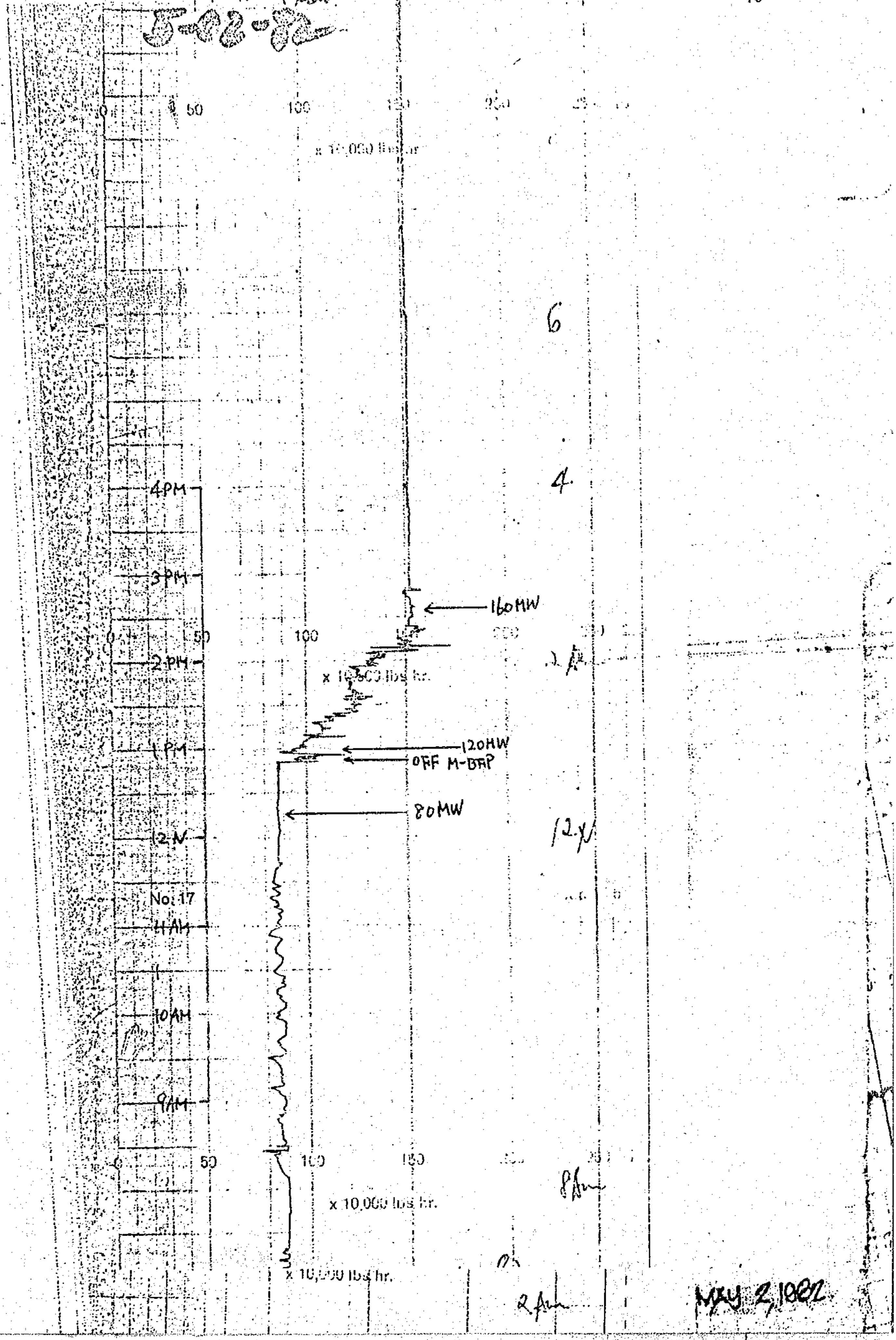
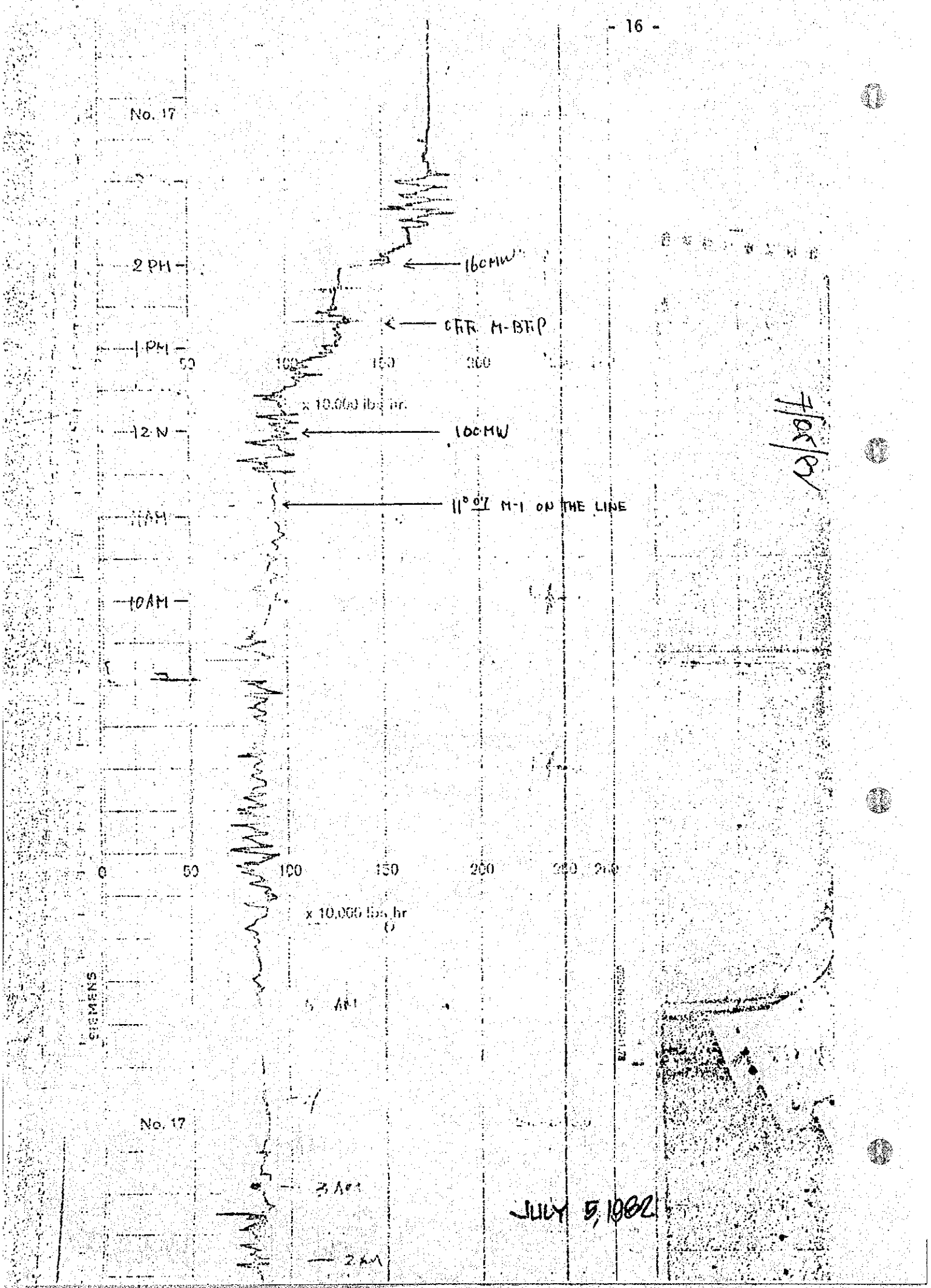

5-02-82
0
50
100
150
200
x 10,000 lbs hr.
6
4
4PM
3PM
160MW
2PM
120MW
1PM
OFF M-BFP
80MW
12 N
No. 17
11AM
10AM
9AM
8Am
2Am
MAY 2, 1982


No. 17
2 PM
1 PM
12 N
11 AM
10 AM
160MW
CFR M-BTP
100MW
11° 07 M-1 ON THE LINE
x 10,000 lbs/hr
0
50
100
150
200
SIEMENS
No. 17
JULY 5, 1982

Idea II

2. Result of Study for 50% Capacity of M-BFP

(1) Location

New M-BFP can be installed between existing M-BFP and boiler on the basement floor.

Required floor area is assumbed to be same as 50% M-BFP of M-2 (4000 mm x 13,000 mm)

Available height of around 4 m seemed enough.

There are two (2) drainage pit, which should be relocated for new pump but it could not be difficult.

As mentioned above, since there is enough space for new pump foundation and installation works could be carried out even when the plant is in service.

Connection works to the deaerator storage tank and existing pipe line and electrical equipment can be carried out during conventional annual shutdown. There will be no necessary special shutdown for this pump installation.

(2) Regarding the Pipe Size

Existing pipe size is 8 inches. Assumed capacity of new pump will be 590 t/h (half of existing T-BFP capacity).

As indicated below, existing pipe size will not be enough in view of the velocity inside the pipe.

	Suction pipe (schedule 80)			Discharge pipe (scedule 120)		
	8 inch	10 inch	12 inch	8 inch	10 inch	12 inch
Outer dia (mm)	216.3	267.4	318.5	216.3	267.4	318.5
Thickness (mm)	12.7	15.1	17.4	18.2	21.4	25.4
Inner dia. (mm)	190.9	237.2	283.7	179.9	224.6	267.4
Inside Section Area (m^2)	0.0286	0.0442	0.0632	0.0254	0.0396	-.-562
Computed velocities(m/s)	5.73	3.71	2.59	6.48	4.14	2.92
Standard Velocity	3.2	3.4	3.6	3.T5	3.3	3.6
Use			0			0

(3) Minimum Flow Line

Existing minimum flow line is commonly provided for T-BFP and M-BFP. In case that new 1/2 MCR M-BFP will be installed the existing minimum flow line should be used for T-BFP only and new minimum flow line should be provided for the new 50% M-BFP.

(4) Feedwater Regulating Valve

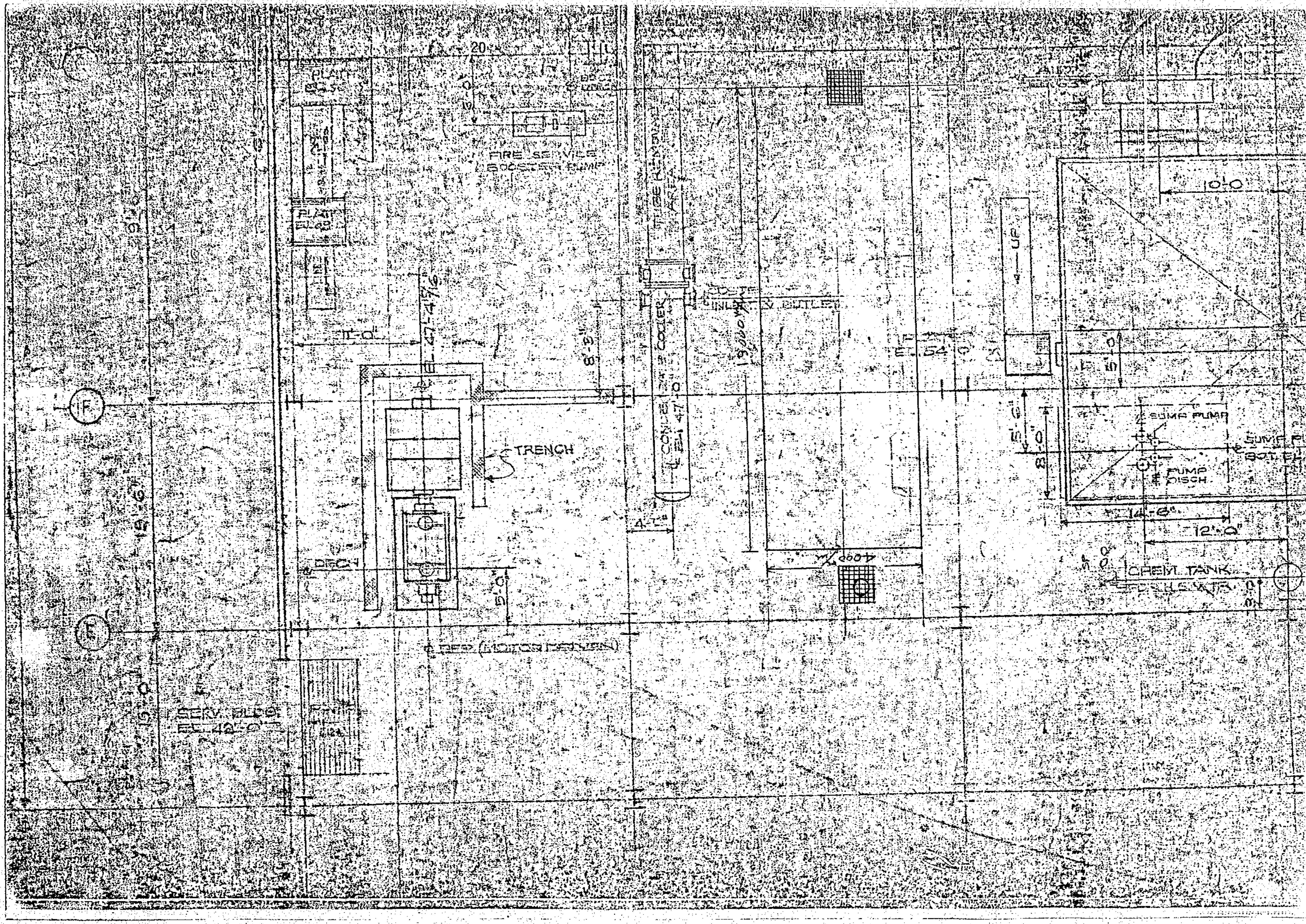
Capacity of feedwater control valve should be studied for the 50% M-BFP.

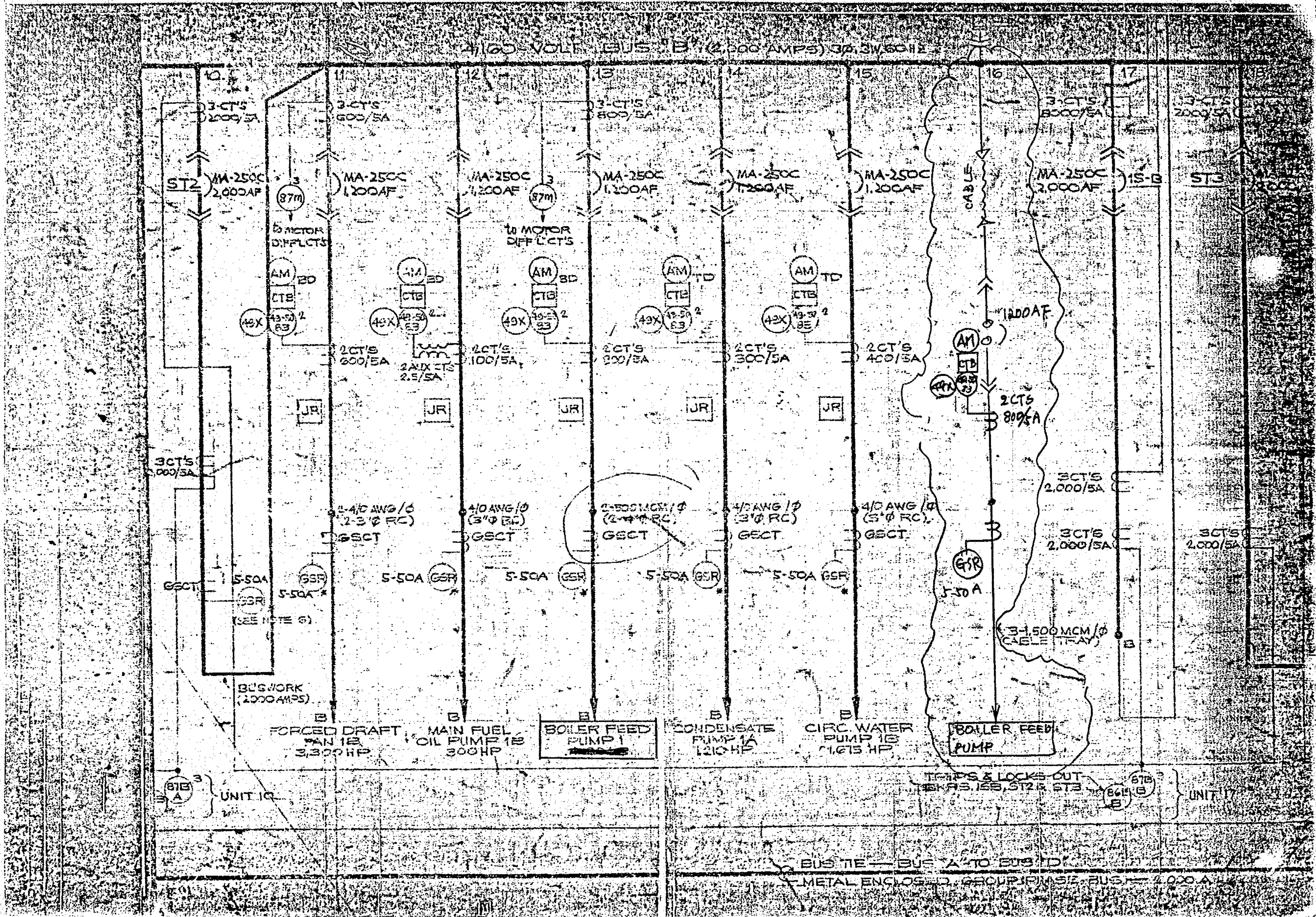
Capacity of control valve can be decided after determination of discharge pressure of M-BFP.

Valve size should be determined to have 120% - 140% CV

(Valve coefficient) valve to computed CV valve.

If CV valve is too big, there will be difficulty at low load operation.


FIRE SERVICE
BOOSTER PUMP
PLAT
PLAT
EL 49
TRENCH
DRCH
SERV. BLDG.
EL 42'-0"
LUBE REMOVAL AREA
COOLER
INLET & OUTLET
EL 54'-0"
UP
10'-0"
SUMP PUMP
PUMP DISCH
14'-6"
12'-0"
CHEM. TANK
5'-0"
4'-1"
8'-3"
11'-0"
EL 47'-4 5/16
CONDENSATE COOLER
EL 47'-0
19060 W
4000 W


4160 VOLT BUS "B" (2,000 AMPS) 3Φ, 3W, 60 Hz
3-CT'S 2000/5A
MA-250C 2,000AF
ST2
3-CT'S 600/5A
MA-250C 1,200AF
87m
to MOTOR DIFF. CT'S
AM
CTB
49X
2CT'S 600/5A
2 AUX CTS 2.5/5A
2CT'S 100/5A
2CT'S 200/5A
2CT'S 300/5A
2CT'S 400/5A
JR
3CT'S 2,000/5A
2-4/0 AWG/Φ (2-3"Φ RC)
4/0 AWG/Φ (3"Φ RC)
GSCT
GSR
5-50A
(SEE NOTE 6)
BUSWORK (2000 AMPS)
FORCED DRAFT FAN 1B 3,300 HP
MAIN FUEL OIL PUMP 1B 300 HP
BOILER FEED PUMP 1
CONDENSATE PUMP 1A 1210 HP
CIRC. WATER PUMP 1B 1,675 HP
CABLE
1200AF
2CTS 800/5A
3-1,500 MCM/Φ CABLE TRAY
BOILER FEED PUMP
1S-B
ST3
87B A
UNIT 10
UNIT 17
TRIPS & LOCKS OUT BKRS. 1SB, ST2 & ST3
86L B
87B
BUS TIE — BUS "A" TO BUS "D"
METAL ENCLOSED GROUP PHASE BUS — 2,000 A

STUDY FOR 50% M-BFP FOR ELECTRICAL EQUIPMENT

1. Transformer and 4.160 KV bus capacity

   There is enough capacity for 50% M-BFP

2. Voltage drop at motor starting

   50% M-BFP should be provided with 2 motors in order not to exceed 15% votage drops reaches about 17% however, the bus voltage is maintained 5% above the rated voltage so that motor can be started within 15% voltage drop at 4.160 V bus from the rated voltage.

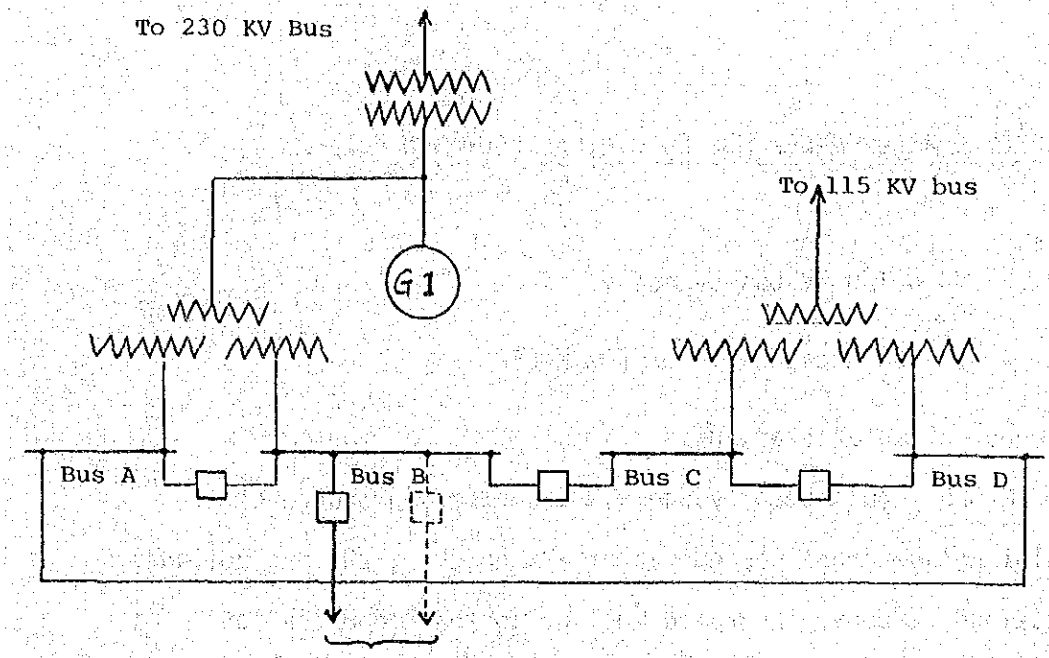
3. Reconstruction to be carried out for 50% M-BFP

   (1) Installation of New 4.160 V SWGR unit (to be connected "B" bus by cable)

   (2) Cable works for new motors.

Table I - M-1 Transformer and 4.160 V Bus

	Station Service	Emergency Station	Result
Transformer cap (FA)	25,000KVA/12.500 KVA 12500	26600/13,300 KVA 13,300	O. K.
Present load condition at 150 MW without M-BFP running	Bus A 5.0 MVA (150 MW) Bus B 3.7 MVA Jul. 3'82	Bus C (3.6 MVA) (160 MW) Bus D (5.0 MVA) Jul. 5'82	-
Estimated load with M-BFP running	Bus A 5.0 MVA Bus B 10.7 MVA	Bus C (10.6 MVA) Bus D (5.0 MVA)	O. K.
Bus current with M-BFP running	Bus A 720 A Bus B 1,544A (2000 A rating)	Bus C (1500 A) Bus D (720 A) (2000 A rating)	O. K.



Motor Capacity

4190^{HP} (3124 KW) - - - - > 530 A - - - - - - - 1/3 capacity
(Existing motor)

8000^{HP} (5965 KW) - - - - > 1013 A - - - - - - - 1/2 capacity
(Estimated capacity)

Case I - 1 Pump - 1 Motor (Not applicable)

Voltage Fluctuation at bus B

Load before motor start

3.700 x (0.85 - j 0.526) 0.85 = power factor

Motor Starting

$$\frac{5965\ KW}{0.85} \times 6\ (0.2 + j\ 0.98) \fallingdotseq 42100 \times (0.2 - j0.98)$$

0.2 = power factor at motor starting

Total Load at Motor Starting

3,700 x (0.85 - j0.526) + 42,100 x (0.2 - j0.98)

= 11,565 - j43.204.

$$\sqrt{11{,}565^2 + 43.204^2} = 44{,}724 \text{ KVA } \cos\phi = 0.259$$

Voltage regulation at motor starting

% impedance = 8.6% at 12500 KVA

Votage regulation at motor starting

$$V = \frac{44.724}{12.500} (R \times 0{,}259 + XX0.966)$$

$$R = 0$$

$$X = 8.6\%$$

$$= \frac{44.724}{12.500} (0 + 8.6 \times 0.966) = 29.7\%$$

Voltage drop must be less than 15% so that case I cannot be applied.

Case 2 - I pump - 2 Motors applicable

Load before 2nd motor start

$$\left(3700 + \frac{5965 \times 1/2}{0.85}\right) \times (0.85 - jo.526) \quad 0.85 = \text{power factor}$$

$$= 7{,}209 \times (0.85 - j0.526)$$

Motor starting current

$$\frac{5965 \times 1/2}{0.85} \times 6 \times (0.2 - jo.98) = 21050 \times (0.2 - j0.98)$$

(0.2 = power factor)

Total load at motor starting

$$7209 \times (0.85 - j0.526) + 21050 \times (0.2 - j0.98)$$

$$= 10{,}338 - j\ 24.421$$

$$10.338^2 + 24.421^2 = 26{,}519 \qquad \cos\phi = 0.39$$

Voltage regulation at motor starting

% impedance = 8.6% at 12,500 KVA

$$V = \frac{26519}{12,500} \left(R \times 0.39 + Xx\ 0.92 \right)$$

$$= \frac{26.519}{12.500} \times (0 + 8.6 \times 0.92)$$

$$= 16.8\%$$

Votage regulation will exceed 15% but bus voltage is maintained by 5% above the rated voltage so that this 2nd motor can be started within 15% voltage drop from the rated voltage.

Idea 3

Relocation of 1/3 M-BFP from S-1

1. Available Capacity of the Unit

Since the existing M-BFP is designed on the condition of 1/3 boiler capacity with pressure of 2950 psi and temperature of 283°F, unit operation at more than 1/3 rating by operating two (2) M-BFP will cause some difficulty in view of temperature and pressure conditions.

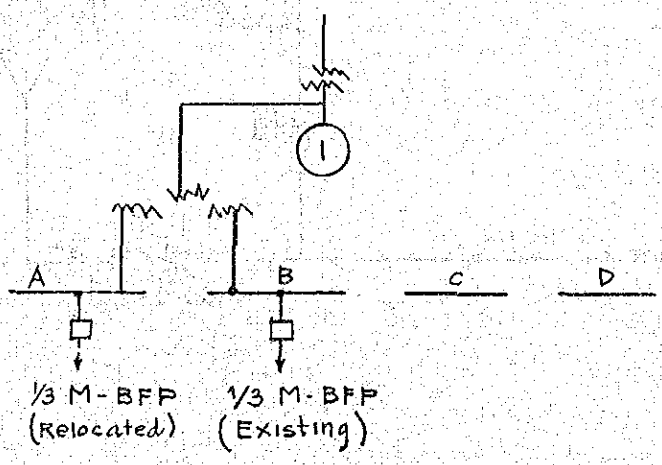
2.1 Power Source

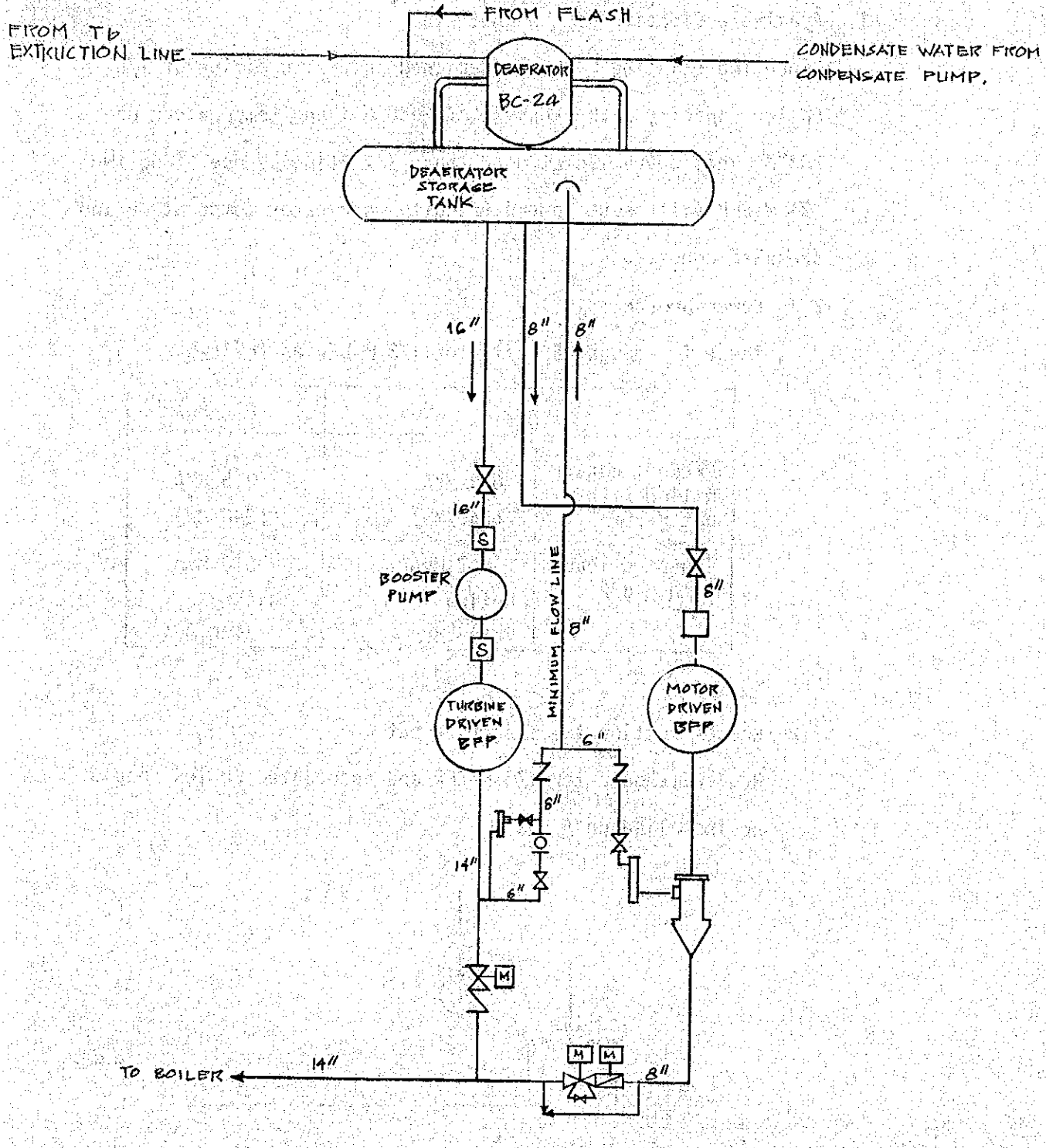
There is enough capacity for 1/3 M-BFP as follows:

	A Bus	B Bus
Present condition without M-BFP	6.3 MVA (240 MW)	3.5 MVA (240 MW)
Expected load with M-BFP	9.7 MVA Rating 125 MVA	6.0 MVA Rating 125 MVA

2.2 Reconstruction to be carried out

New switchgear for 1/3 M-BFP and associated cables should be installed on A bus




FROM FLASH
FROM T6
EXTRUCTION LINE
CONDENSATE WATER FROM
CONDENSATE PUMP.
DEAERATOR
BC-24
DEAERATOR
STORAGE
TANK
16"
8"
8"
16"
S
BOOSTER
PUMP
S
MINIMUM FLOW LINE
8"
8"
TURBINE
DRIVEN
BFP
MOTOR
DRIVEN
BFP
6"
8"
14"
6"
M
TO BOILER
14"
M
M
8"