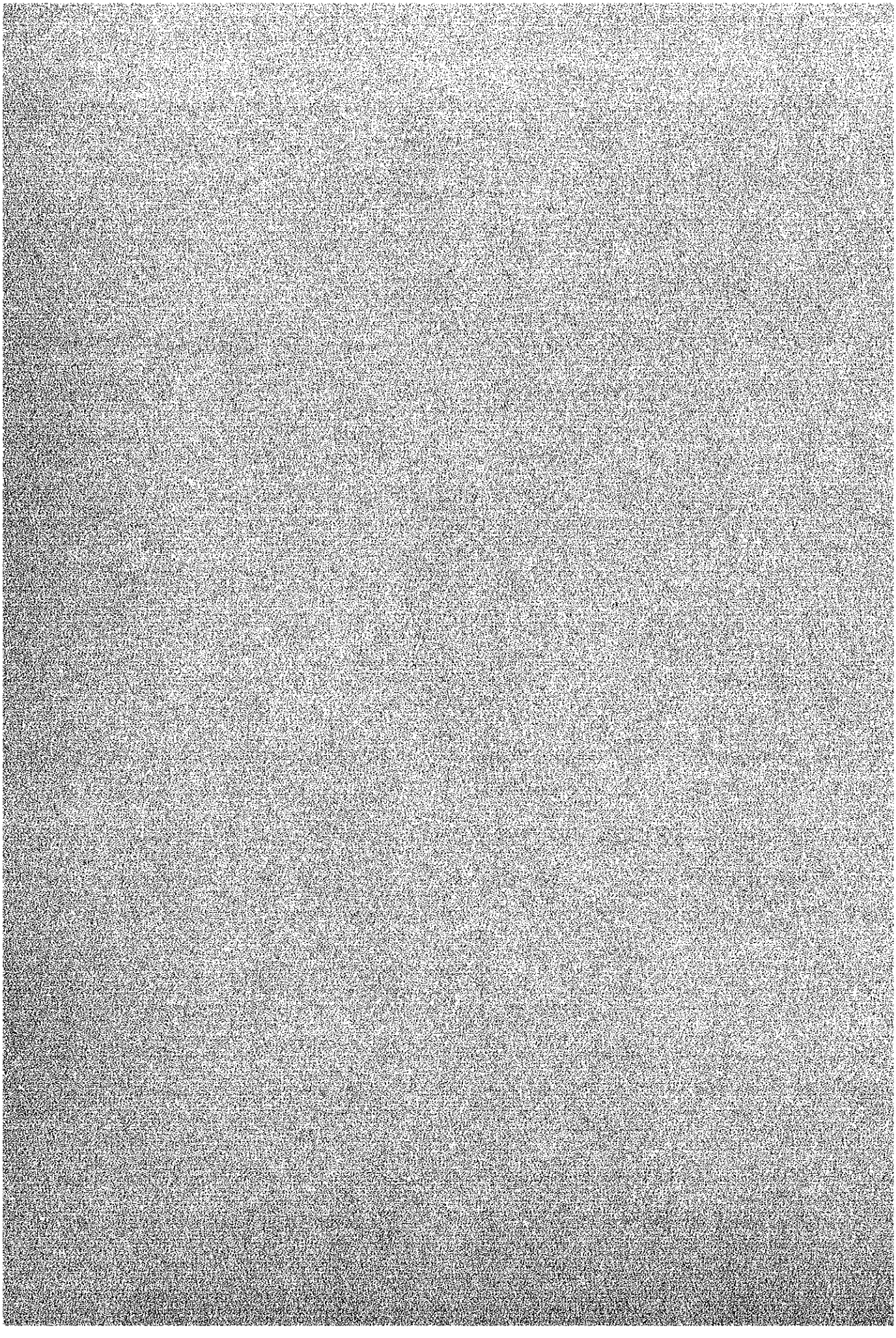
APPENDIX-14 S-1 ANNUAL OVERHAULING ACTIVITIES



S-1 ANNUAL OVERHAULING ACTIVITIES

QAG-82-0174
August 27, 1982

Mr. J. C. Villanueva
Manager
Sucat Thermal Plant

SUBJECT: JICA Mission Recommendation/Comments on Forthcoming S - 1 Overhauling

As agreed during our meeting with Mr. T. H. Calasanz last August 10, 1982, the JICA Group member assigned at your station were requested to conduct an independent review/study on the activities to be performed during the annual overhauling of the above subject unit.

Supplemental to the above, they also conducted actual survey on the present operating conditions and consequently came up with some comments/recommendations, a copy of which is herewith attached for your information and possible consideration/inclusion in your work program.

L. F. OSILLA
Manager
Quality Assurance Group
Office of the President

Encl.: a/s

cc.:
Gen. M. S. Escandeqra
Mr. J. U. Jovellanos
Mr. T. H. Calasanz
Mr. T. Oga
Mr. A. P. Estandian
Mr. R. Pedron
Mr. A. Tatlonghari
QA File

August 23, 1982

MEMORANDUM -

FOR : Mr. L. F. Osilla
Manager
Quality Assurance Group

FROM : JICA Mission Group Member
Gardner/Snyder Thermal Plant

SUBJECT : S - 1 Annual Overhauling Activities

We were notified that the above subject unit will be overhauled as soon as G-2 is synchronized and stabilized in the grid. In this connection and upon NPC's request, the JICA Mission Group members assigned at Gardner/Snyder station gave priority to the immediate ocular inspection of the units' systems and components afterwhich reviewed the overhauling activities prepared and provided us by plant personnel.

As a result thereof, we are submitting herewith our recommendation/comments for possible adoption by NPC plant management. The duration of the overhauling schedule, however, will have to be decided/resolved by NPC considering system power demand and various resources needed in the forthcoming overhauling of the unit.

We hope that you will find the attached report in order, but should you need further clarification on the matter, please feel free to contact us.

K. Ariyoshi

K. ARIYOSHI
Mechanical Engineer
JICA Mission

Attached: a/s

cc.: Mr. T. Oga
NPC Counterpart
JICA File

JICA MISSION RECOMMENDATION/COMMENTS
ON S-1 OVERHAULING ACTIVITIES

I GENERAL

1) Re-check of all spare parts required for replacement of defective equipment. Purchase spare parts if not available.

2) Installation of additional temporary lifting equipment for smooth and quick transfer/movement of materials and tools during overhauling.

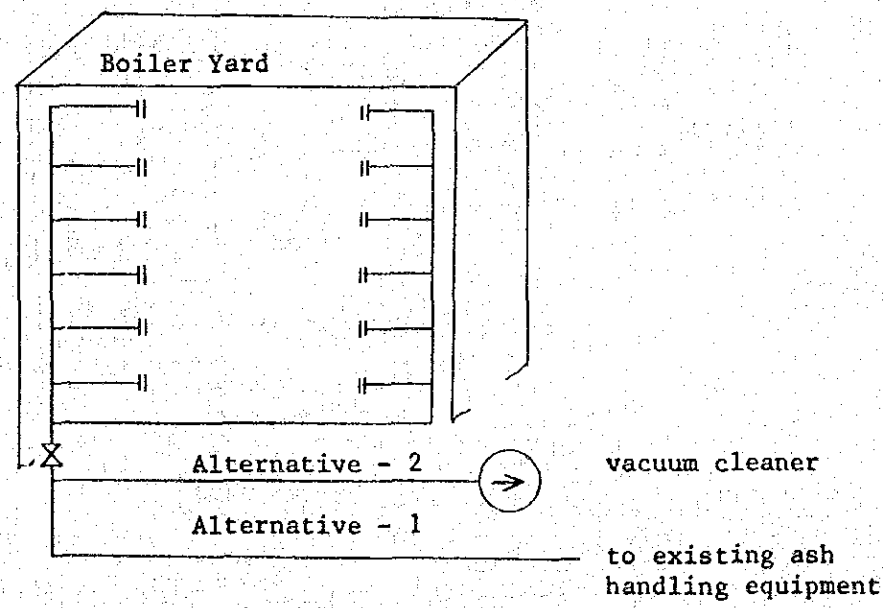
3) Permanent installation of vacuum cleaner connection on each floor of boiler (yard) area to clean all equipment.

ALTERNATIVE - 1

Utilization of existing ash handling vacuum line.
Repair the existing ash handling equipment and connect the cleaning line to be additionally installed with the existing vacuum piping as shown in Figure I.

ALTERNATIVE - 2

New, additional installation of vacuum cleaner.



F I G I

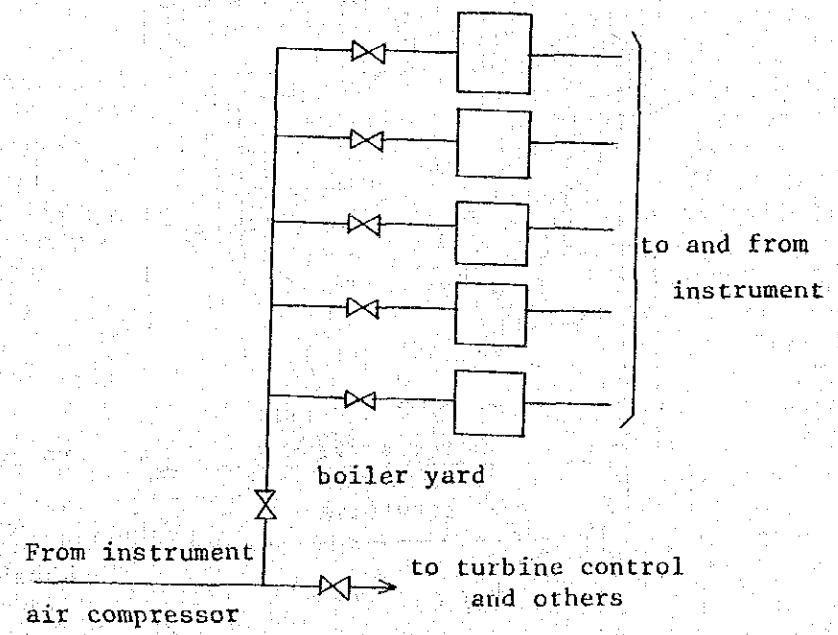
4) A large volume of gas leak from the boiler casing particularly on the 10th and 11th floor.
The ambient temperature is very high (about 50°C)and nobody can withstand the heat for a minimum period of 10 minutes. One factor causing this condition is the insufficient ventilation in this area. Boiler casing should be perfectly repaired for the health of plant personnel and effectiveness in performing operation, preventive maintenance, inspection and overhauling activities.

5) Power supply and lighting for overhauling works

Adequate electric outlets should be provided at each floor of boiler (yard) area for temporary lighting and welding.

6) Control instrument air piping

Blowing out/purging of instrument air pipings for control units including locally mounted control units is required for satisfactory operation of automatic controls. For long-term rehabilitation, instrument air piping should be modified as follows:



7) The constant differential fuel oil pump is not placed into service (out of order). Main fuel oil burners are designed as return flow atomizers not as straight mechanical atomizers. Using this type of burner without constant differential fuel oil pump will possibly cause a long flame and incomplete combustion in the furnace, resulting in AH burning out in the worst case due to unburnt carbon adhesion on the AH elements, and also clogging of the element. Place constant fuel oil pump into operation immediately.

8) Complete heat insulation of pipings and equipment requiring insulation

9) Clean up of condenser internals to remove all rust and deposits on throat expansion parts before condensate line clean up.

10) <u>TESTS AND TRIAL OPERATION TO BE CARRIED OUT DURING AND AFTER OVERHAULING</u>

I BOILER AND AUXILIARIES

1) Hydraulic Test
2) Boiler air leak test
3) Boiler tripping interlock test
   a) Both forced draft fans trip including air dampers interlock
   b) Reheater Protection test
   c) Furnace draft high trip test including FDF tripping interlock
   d) Fuel oil pressure low trip including fuel oil shut-off valve interlock
   e) Feed water flow low trip test including BFP trip interlock
   f) Furnace purge and MFT reset
4) Burner light-off and pressurization for safety valve test

5) Other valves test including motor-driven, air actuated, etc.

6) Boiler feed water pump test
   a) Minimum flow control valve test
   b) Auxiliary oil pump auto-start test

7) Fuel oil pump test including diesel oil pump test

8) Air preheater test including air motor back-up start test

9) Soot blower test

II TURBINE AND AUXILIARIES

1) Major valve test
   a) Main stop valve test
   b) Governing valve test
   c) Reheat stop valve
   d) Intercept valve

2) Turbine tripping interlock test
   a) Manual trip lever test
   b) Solenoid trip test
   c) Thrust movement
   d) Bearing oil pressure low trip test
   e) Vacuum low trip test
   f) Both MSV closed
   g) No load trip

3) Leak test
   a) MSV
   b) Turbine control valves test

4) Vacuum up test including ejector and gland steam regulator

5) Turbine speed up test

6) Condenser test

7) Major valve test including extraction steam non-return valves.

8) Turning device test

9) Oil pump auto-start test
   a) Auxiliary oil pump
   b) Emergency oil pump
   c) Turning oil pump

10) HP/LP heater leak test

11) Gland steam exhauster test

12) Major pump test
   a) Condensate pump
   b) Circulating water pump

13) Re-consideration of plant efficiency (for reference)

Checks of over-all plant performance on the basis of daily operating summary records indicated that there is a considerable decrease on plant efficiency. For purposes of restoring decreased power plant output, taking into consideration the present operating condition, we suggest that the following items be taken cared of immediately.

According to operating summary dated July 31 to August 2, 1982, gross heat rates of S-1 and S-2 at generator end are very high and are as follows:

	S-1	S-2
Daily average heat rate (BTU/KWH)	12,228	12,762

These values are equivalent to plant efficiency of 27% and 29%, respectively. Plant efficiency of similar power plant in Japan is about 34 to 35% at present.

Low plant efficiency may be caused by the following causes:

a) Excessive spray water flow due to SH/RH spray control valves leakage.

Spray flow rates on August 23, 1982

	S - 1	S - 2
Out put	140 MW	200 MW
SH Spray	14,000 lb/h (6.35 t/h)	80,000 lb/h (36.3 t/h)
RH Spray	38,000 lb/h (17.2 t/h)	40,000 lb/h (18.1 t/h)

b) Inadequate combustion air temperature

Combustion air temperature is not controlled automatically due to defective control valves. It is controlled manually with the aid of by-pass valves of SAH temperature control valves.

c) Main steam leak to turbine by-pass line

Flash tank pressure on August 23, 1982

S - 1	S - 2
250 lb/in^2	300 lb/in^2
(17.5 kg/cm^2)	(21.0 kg/cm^2)

d) Increase in radiation loss due to poor heat insulation

e) High auxiliary power ratio

Gas leak will require more power of FDF, and increase auxiliary power ratio. Operation of feedwater pump keeping minimum flow valve opened at a load condition when it is suppose to be close causes also high auxiliary power rate.

f) In adequate vacuum operation

Recorded turbine back pressure ranges from 2.7" Hg - 3.3" Hg (guaranteed value 2.0" Hg)

II BOILER AND AUXILIARIES

1) Inspection and repair of relief valves on all high pressure pipings.
2) Inspection of condition of high pressure pipings and boiler hangers including vibration eleminator.
3) Replacement of Gas O_2 analyzer at Economizer outlet.
4) Repair of ash handling equipment
5) Check and repair of the safety valve on secondary superheater inlet.
6) Check of pressure reducing valve inlet stop valve (MV-3)
7) Repacking of major valves including air vent valves, sampling root valves, instrument root valves, etc.

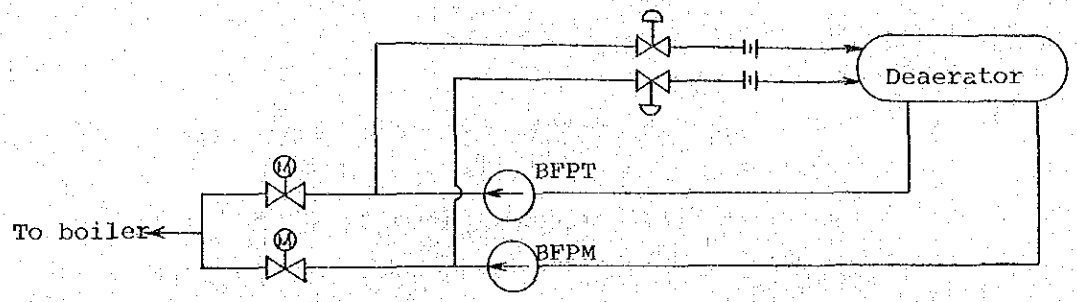
8) Retightening of gland packings after start-up.

9) Provide identification on piping, and/or name plate of valves including instrument to avoid misoperation.

III TURBINE AND AUXILIARIES

1) Check and repair of feed water control valve and the by-pass valve, minimum flow control valve and BFP-T/M discharge motor-driven valves.

2) Minimum flow pipings of BFP-M and BFP-T should be separately arranged, and the orifice should be added to the line respectively.



3) Carry out eddy current test on condenser tube after clean-up of respective tubes with the aid of brush designed for cleaning tube internals.

4) Thickness measurement and possible patch weld repair of circulating water pipe portion found to be below required allowable thickness.

5) Inspection and repair of reversing valve.

6) Installation of feed water heater by-pass line.

7) Install the pressure gauges at the inlet and outlet of the condensate pump suction strainer so that the differential pressure can be checked.

8) Provide high pressure pipings and heater drains and vent valves with series valves.

9) Repacking of major valves including air vent valves, sampling root valves, instrument root valves, vacuum valves, etc.

10) Retightening of gland packings after start-up.

11) Provide identification on piping and/or name plate of valves including instruments to avoid misoperation.

12) All valves on vacuum line should be sealed.

IV ELECTRICAL/CONTROL AND INSTRUMENT

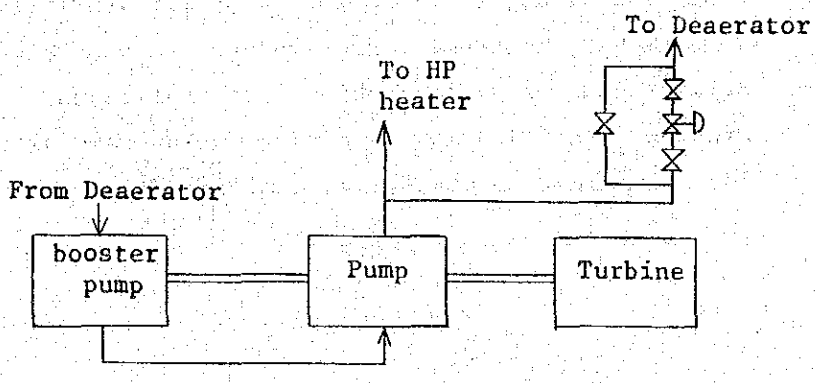
1) Overall check of automatic boiler control system including turbine by-pass control.

   a) List down all defective parts
   b) Re-check of spare parts storage
   c) Study on why the control system can not be operated automatically.
   d) Take measures against defective parts.
   e) Signal matching and loop check of each control system.

2) Pressure switch, PS-134 for BFP-M interlock should be replaced with micro switch type one.

3) Valves handles for root valves of instrument including transmitter, pressure gauge, etc. are not mounted, and some of them defective. Re-check the spare parts for replacement of defective vlave handles, if no spare parts, purchase all kinds of valve handles prior to overhauling.

4) Wire for solenoid valve of turbine-driven BFP minimum flow control valve is not connected, and BFP-T is operated keeping fully opened. This valve should be replaced with hydraulic-actuated valves, and by-pass valve and isolating should be at least installed as follows:



5) Auxiliary steam leaks considerable from auxiliary steam pressure control valve gland, and so the valve gland should be replaced with new one.

6) Auxiliary steam for soot blowing leaks from head valve of 23 L soot blower.
Overall checking of soot blower system should be made.

7) All control valves on turbine by-pass line should be rechecked, repaired and replaced for smooth boiler acid cleaning and unit start-up.

a) High pressure superheater stop valve (MV-1)
b) Resistor tube by-pass valve pressure reducing valve (MV-2)
c) Pressure reducing valve inlet stop valve (MV-3)
d) Low pressure superheater stop valve (MV-4)
e) Flash tank outlet motor operated stop valve (MV-5)
f) Superheater attemperator spray control and shut-off valves (CV-1A/1B)
g) Reheater attemperator spray shut-off valve (CV-2A)
h) Reheater attemperator spray control valve (CV-2B)
i) Superheater by-pass control valves (CV-10VA/B)
j) Turbine by-pass control valve (CV-102)
k) Superheater pressure reducing valve (CV-103)
l) Pressure control valve for dump steam control (CV-104)
m) Pressure control valve for deaerator heating steam control (CV-105)
n) Pressure control valve for HP heater heating steam control (CV-106)
o) Flash tank level control valve (CV-107)
p) Turbine by-pass steam spray water control valve (CV-108)
q) Feed water control valve

Check Item

- Valve stroke, positioner
- Diaphragm for control
- Instrument air piping

- Controller and transmitter
- Valve seat, gland

8) Replacement of all existing mercury-type pressure switches with micro switch type ones.

9) Provide adequate support for instrument air piping especially around boiler yard as a safeguard against vibration and to protect the unit from tripping.

10) Local control valves

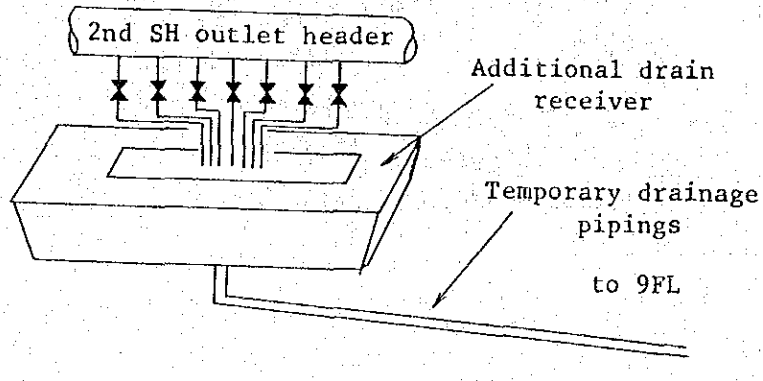
All local control valves should be repaired especially the following valves:

a) Auxiliary steam pressure control valves
b) Control valves around deaerator
c) HP/LP heater drain level control valves
d) SAH temperature control valves
e) Soot blowing steam pressure control valves.
f) Turbine extraction steam line drain control valves
g) Fuel oil pressure control valve
h) Fuel oil temperature control valve

11) Stop immediately steam and drain leakage from secondary superheater outlet header drain and vent valves.

The drain drips on the soot blower motor and terminal block for thermocouple connection on 8th floor.

Temporary drainage should be considered to dispose the drain to outside of boiler yard as shown in sketch below:



12) Fuel oil leak drips on HP heaters, the drain level controllers and pressure gauges should be wiped out clearly. The ambient temperature is very high, fire may occur due to vaporization of this oil leaks in the worst case.

13) Differential pressure switch for strainer pre-alarm

Differential pressure between inlet and outlet of the fuel oil strainer should be separately provided from fuel oil shut-off valve interlock, and additional pre-alarm "Fuel oil strainer Diff. Press. High" should be provided in the central control room.

14) Central Control Room

The following recorders are not placed into service.

a) Economizer outlet O_2 percent recorder
b) Boiler metal temperature recorder

15) Improvement of central control room air conditioning system

Additional air conditioners should be installed in S-1 and S-2 central control room and relay room, furthermore, openings in the central control boards and relay panels should be filled up with iron steel plate so as not to allow the hot air from outside enter into the room.

16) Prevention of excessive vibration of fuel oil integration meter

V. CHEMICAL/WATER TREATMENT

1) Inspection and clean-up

Condenser hotwell, Deaerator, flash tank and steam headers

a) Quantity of sludge, and analysis of sludge contents.

b) Measures against entering foreign matters into the system during overhauling

c) Flushing before starting

d) Recording and keeping of result of inspection

2) Water purifier, condensate demineralizer

a) Check of quantity of resin and performance of the system

b) Inspection of resin tower inside

c) Inspection of resin trap

d) Inspection and clean up of pure water tank and condensate tank, if possible.

3) Sampling rack and chemical inspection

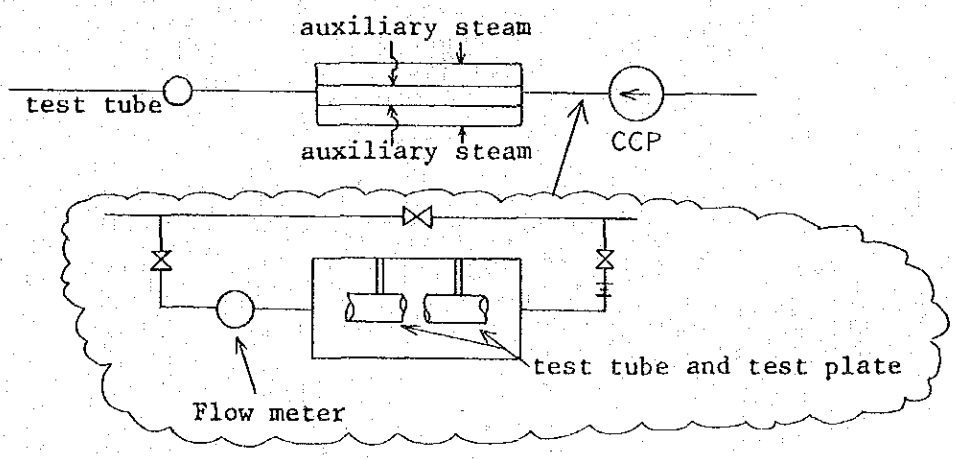
a) Inspection and repair of the root valves

b) Repair of piping steam leak

4) Boiler acid cleaning

a) Review of schedule for acid cleaning taking the unit start-up into consideration

b) Review of location of test tube and test plate



c) Secure all valves leading to Main Condenser that may possibly be affected during acid cleaning to preclude damaging condenser tube in case of acid solution leak, thru valve seat installed along the line.

R E C O M M E N D E D B Y :

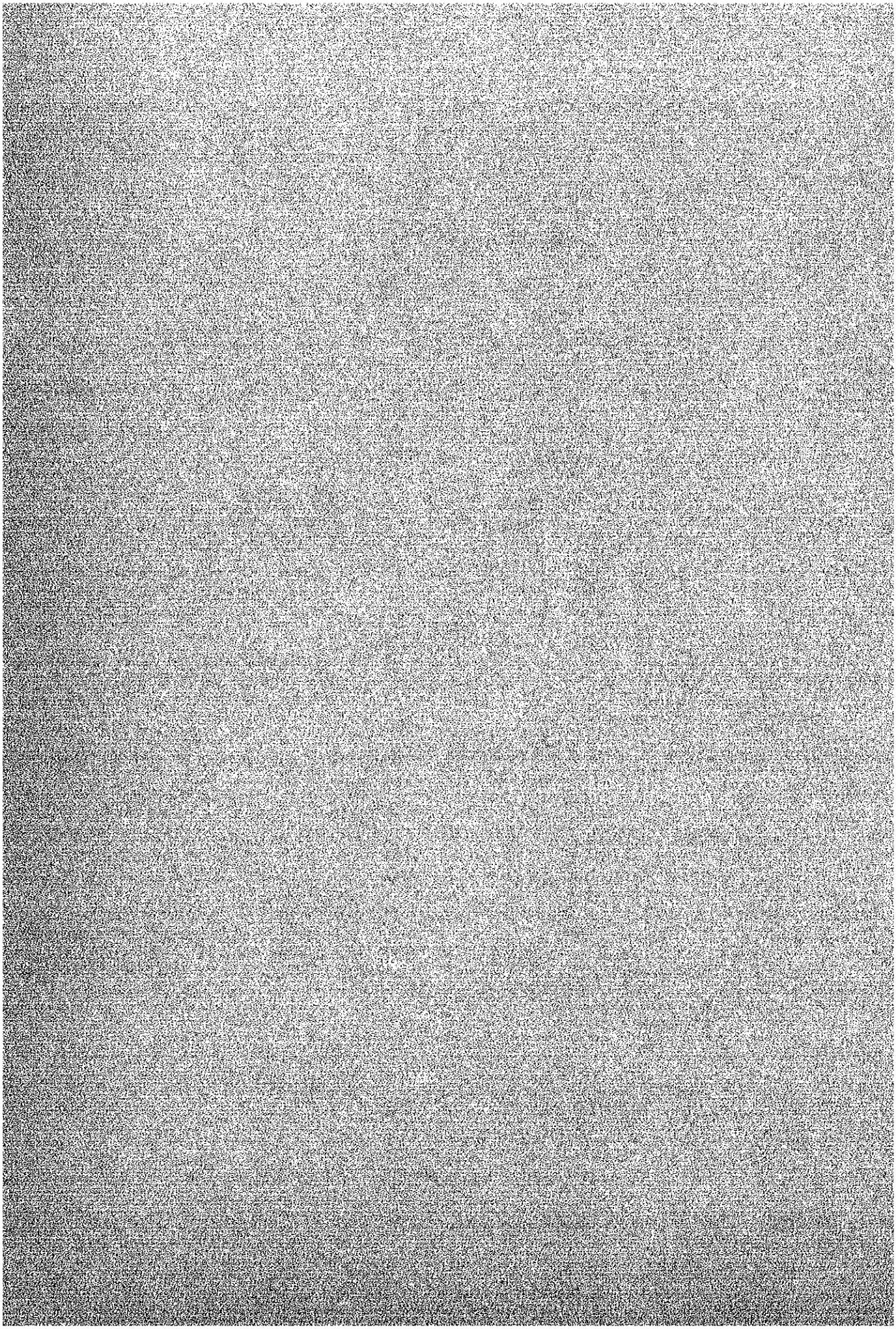
K. ARIYOSHI
Mechanical Engineer

H. MAEDA
Mechanical Engineer

J. FJIMOTO
Electrical Engineer

M. KOTANI
Electrical Engineer

APPENDIX-15 STUDY ON THE CAPACITY INCREASE OF M-BFP OF M-1



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STUDY ON THE CAPACITY INCREASE OF M-BFP OF M-1

The following study on the improvement of existing M-BFP system was given in response to the NPC request to JICA Team to increase the said pump capacity up to 1/2 from 1/3 of the boiler capacity.

Idea I - Improvement of the BFP operation procedure at boiler start-up if possible.

Idea II - Replacement of boiler feed pump and its motor rated 50% of boiler capacity instead of 1/3 capacity including study on station service power and space for the installation, piping, valves, etc.

Idea III - Relocation of 1/3 capacity BFPM from S-2 to M-1 including study on station service power and space for the installation.

Conclusion of the Study

It is concluded that no capacity increase of the pump will be required since the existing system provides sufficient performance during start-up of the plant when the operation is proceeded in proper order.

Nevertheless, if the capacity increase is required, the need of pipigg replacement and new installation of electrical equipment will take place.

However, the existing space will allow these new installations and and modifications of the system in M-1.

It is also possible to relocate the existing M-BFP rated 1/3 boiler capacity from S-2 to M-1 but since the temperature and pressure design conditions are based on 1/3 boiler capacity, this idea only provides a stand-by unit for existing M-BFP.

Idea I

1. Problems on the Existing M-BFP

(1) Contents of study in MALAYA THERMAL POWER PLANT

a. There will be no operating problems in case the plant facilities/and auxiliaries are maintained in good and efficient operating conditions.

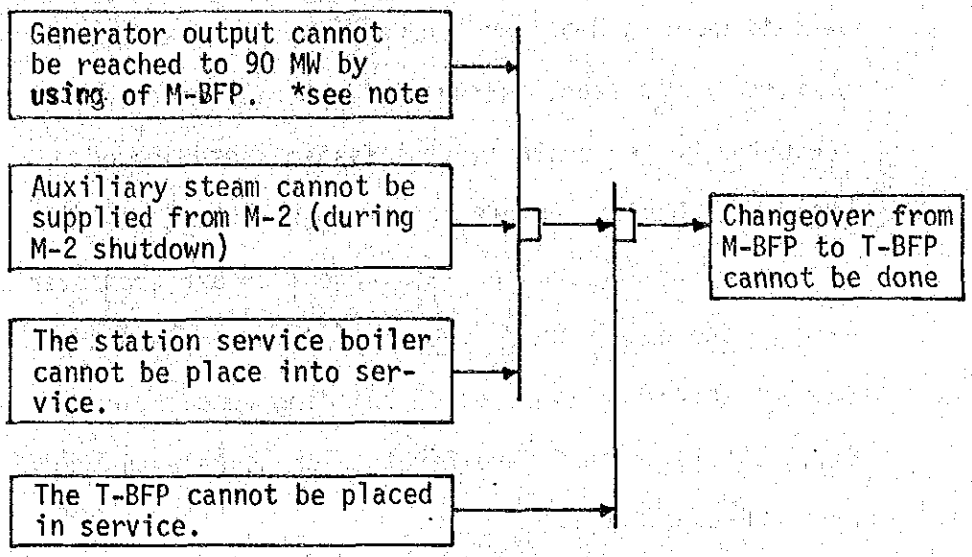
Usually, T-BFP is driven by CRH steam and is changed over from M-BFP at 80 - 100 MW.

In case that the motor driven BFP cannot be placed in service, the plant can be started by T-BFP driven by auxiliary steam from M-2 or the auxiliary boiler steam.

b. There are some cases wherein the T-BFP cannot be placed in service due to abnormal condition of the plant auxiliary. However, these cases are rare.

One such case is when the M-BFP cannot be changed over to T-BFP

For example:



* The case when the generator output cannot reach 90 MW by the use of the M-BFP means abnormal conditions of power plant auxiliaries such as feedwater system or steam system deficiencies. In this case, it is not desirable to continue plant operation.

c. If the capacity of the M-BFP is changed from 1/3 to 1/2 of MCR, steam conditions for T-BFP will be increased and in the case of T-BFP failure, 50% (150 MW) output of generator could be obtained.

d. According to the result of the survey of M-1 unit, there are many things to be done prior to changing the M-BFP capacity to 50%.

Installation of chlorination equipment, purchase spare condenser tubes, installation of chloride detecting equipment, perfection of monitoring equipment for con-

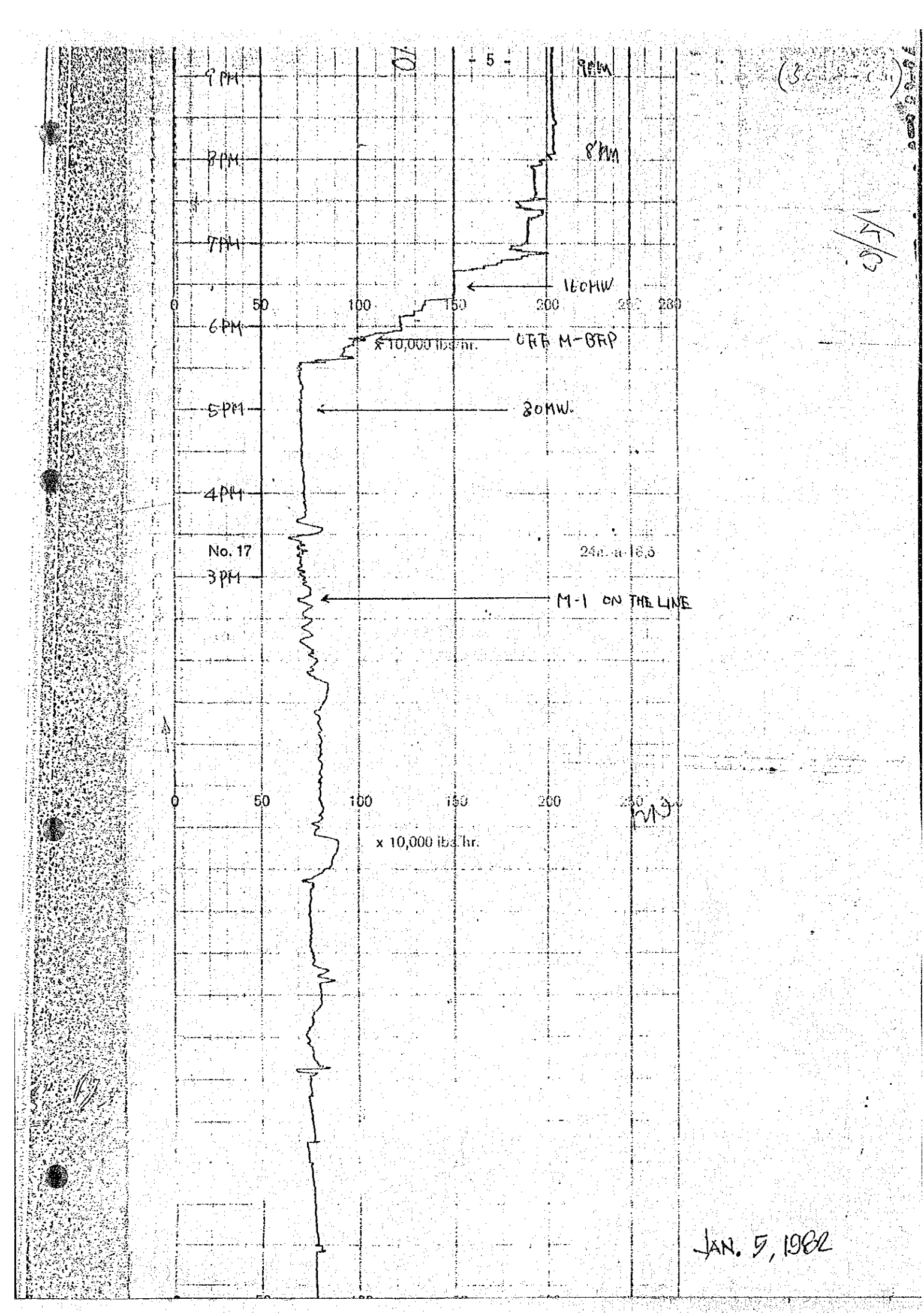
densate water and boiler feedwater system, replacement of feedwater heater, improvement/rehabilitation of feedwater heater drain control system, retubing of boiler and having another set of spare tubes, repairing of boiler casing, repalcement of air preheater element and obtaining another spt of spare element. Improvement/rehabilitation of building ventilation etc., should be perfonmed first in preference to chagge of M-BFP capacity.

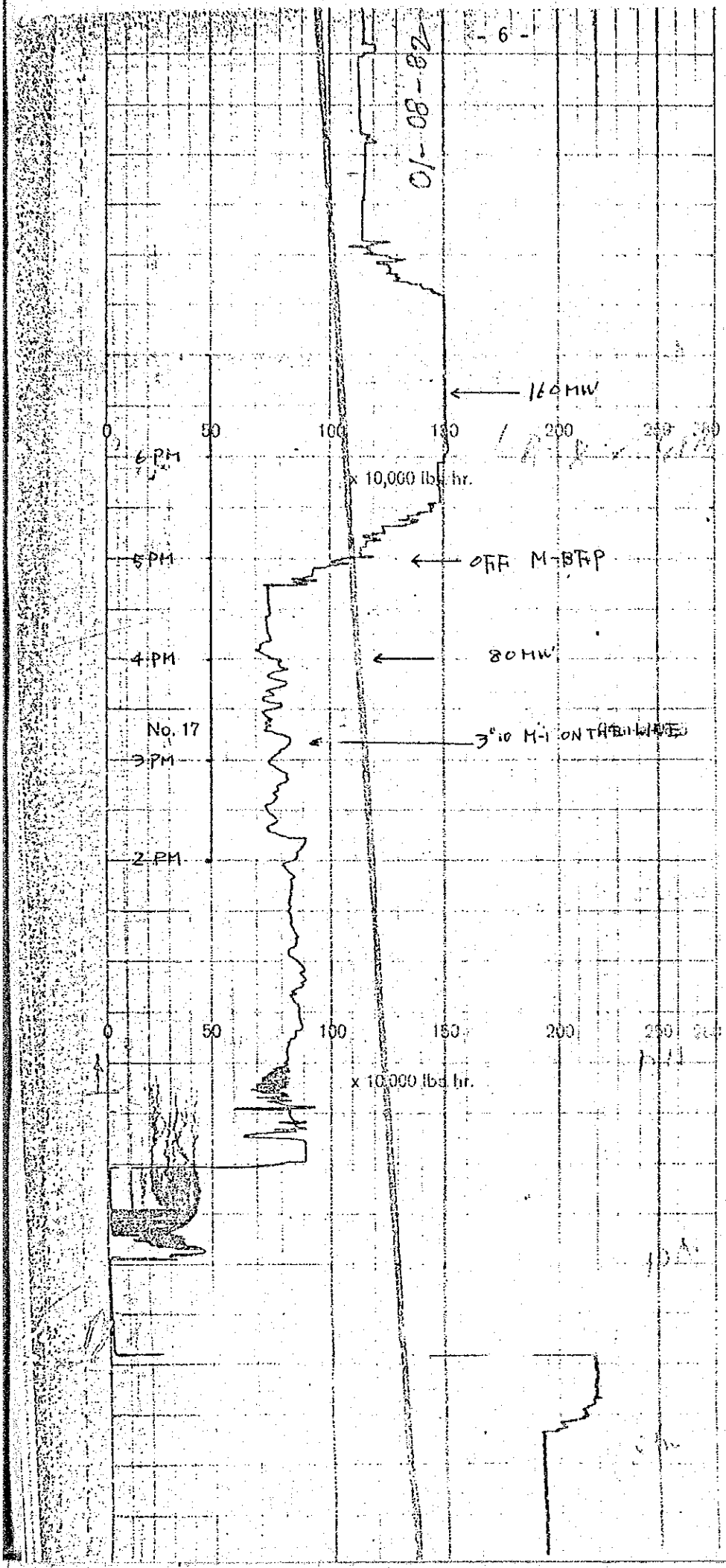
Ranking of preference should be determined to include the inprovement/rehabilitation of M-2

e. Operating conditions were analyzed in accordance with the data gathered on feedwater flow, since Jan. 1982 until now, as follows:

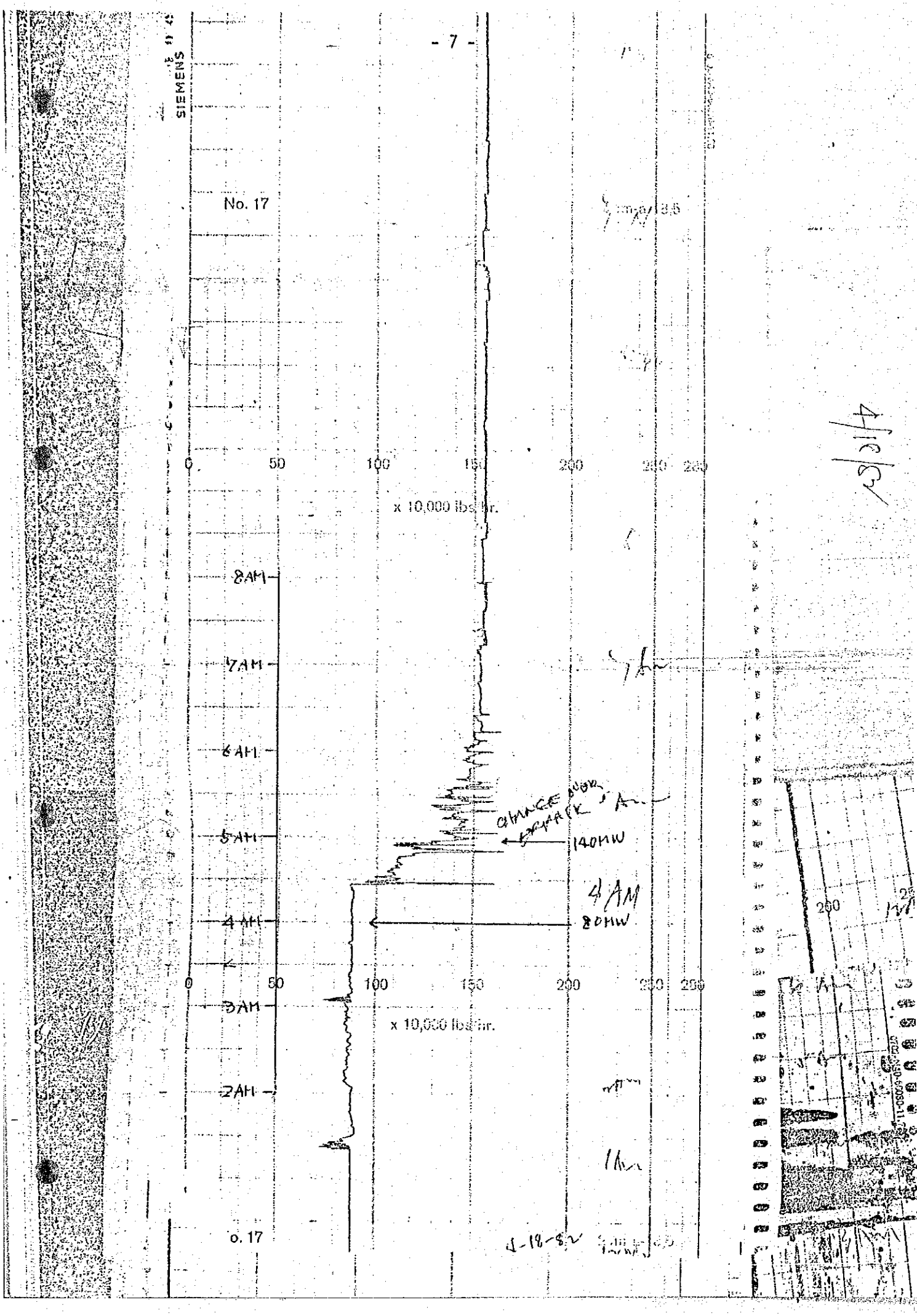
° T-BFP is started at 80 MW - 100 MW
° Generator output is increased with the service of T-BFP
° M-BFP is stopped at around 120 MW
° Target output for stable operation is set at 160 MW
° Time for load up from 80 MW to 160 MW, including changeover of BFP, is one hour earlier, two hour average.

According to the above study, there is no problem on changeover of existing M-BFP. (Refer to attached sheets)


9PM
8PM
7PM
6PM
5PM
4PM
3PM
160MW
OFF M-BRP
80MW.
M-1 ON THE LINE
0
50
100
150
200
x 10,000 lbs/hr.
No. 17
JAN. 5, 1982


01-08-82
160 MW
0
50
100
150
200
250
6 PM
x 10,000 lbs hr.
5 PM
OFF M-BFP
4 PM
80 MW
No. 17
3 PM
3°10 MINUTES
2 PM
0
50
100
150
200
250
x 10,000 lbs hr.

JAN 0 1982.


SIEMENS
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150
200
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x 10,000 lbs/hr.
8AM
7AM
6AM
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2AM
CHANGE BOOM
140HW
4 AM
80HW
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250
x 10,000 lbs/hr.
o. 17
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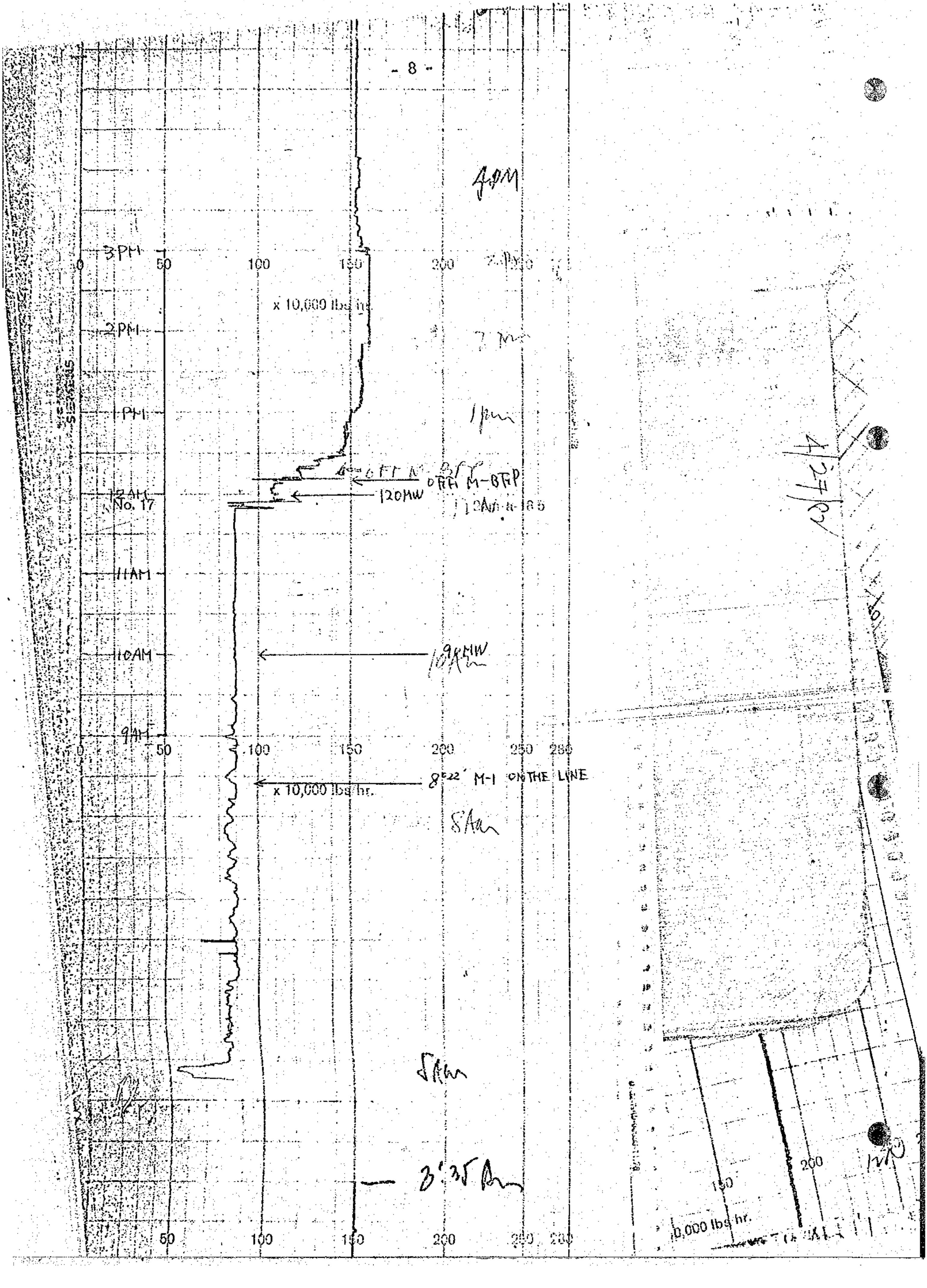
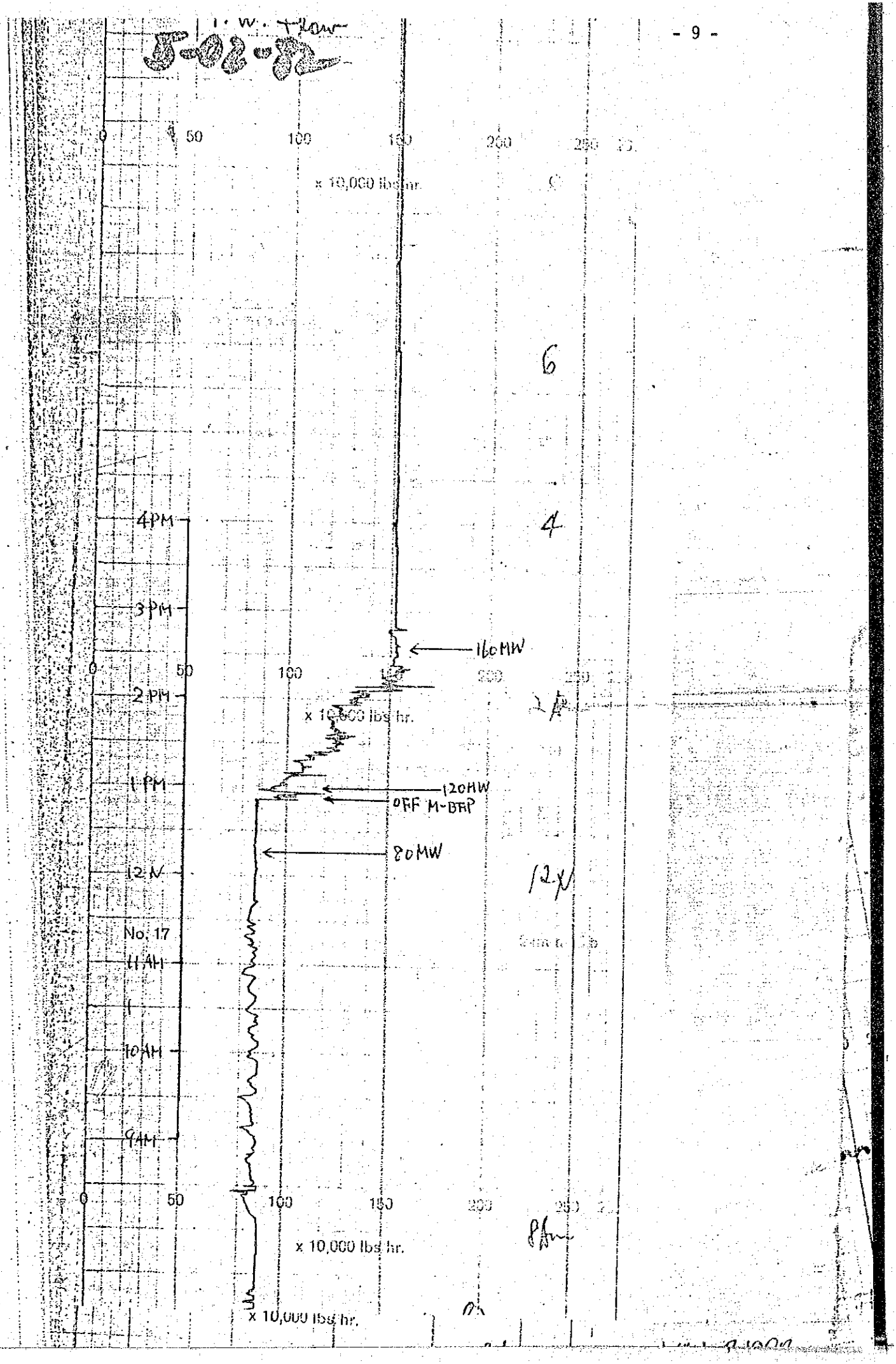
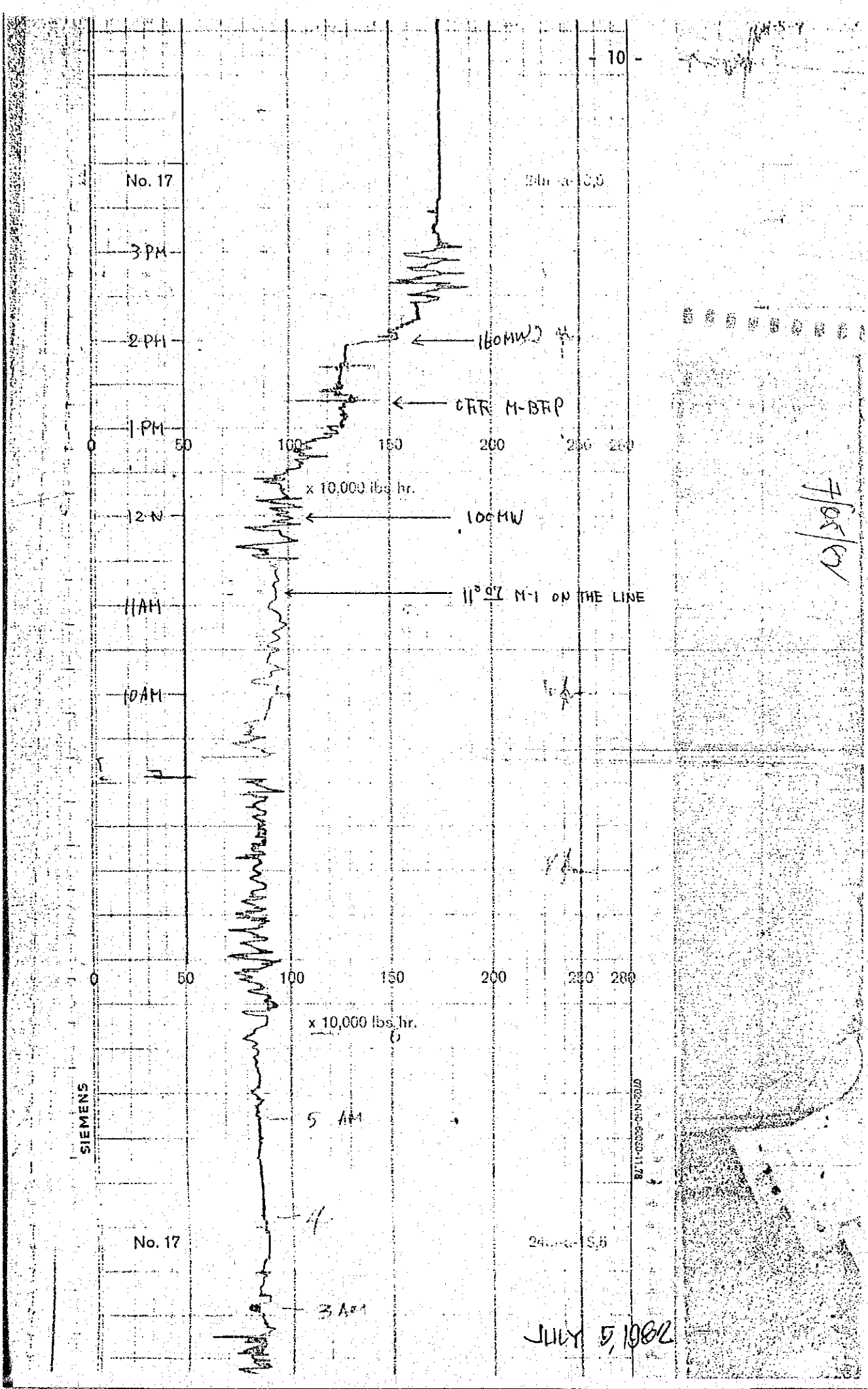
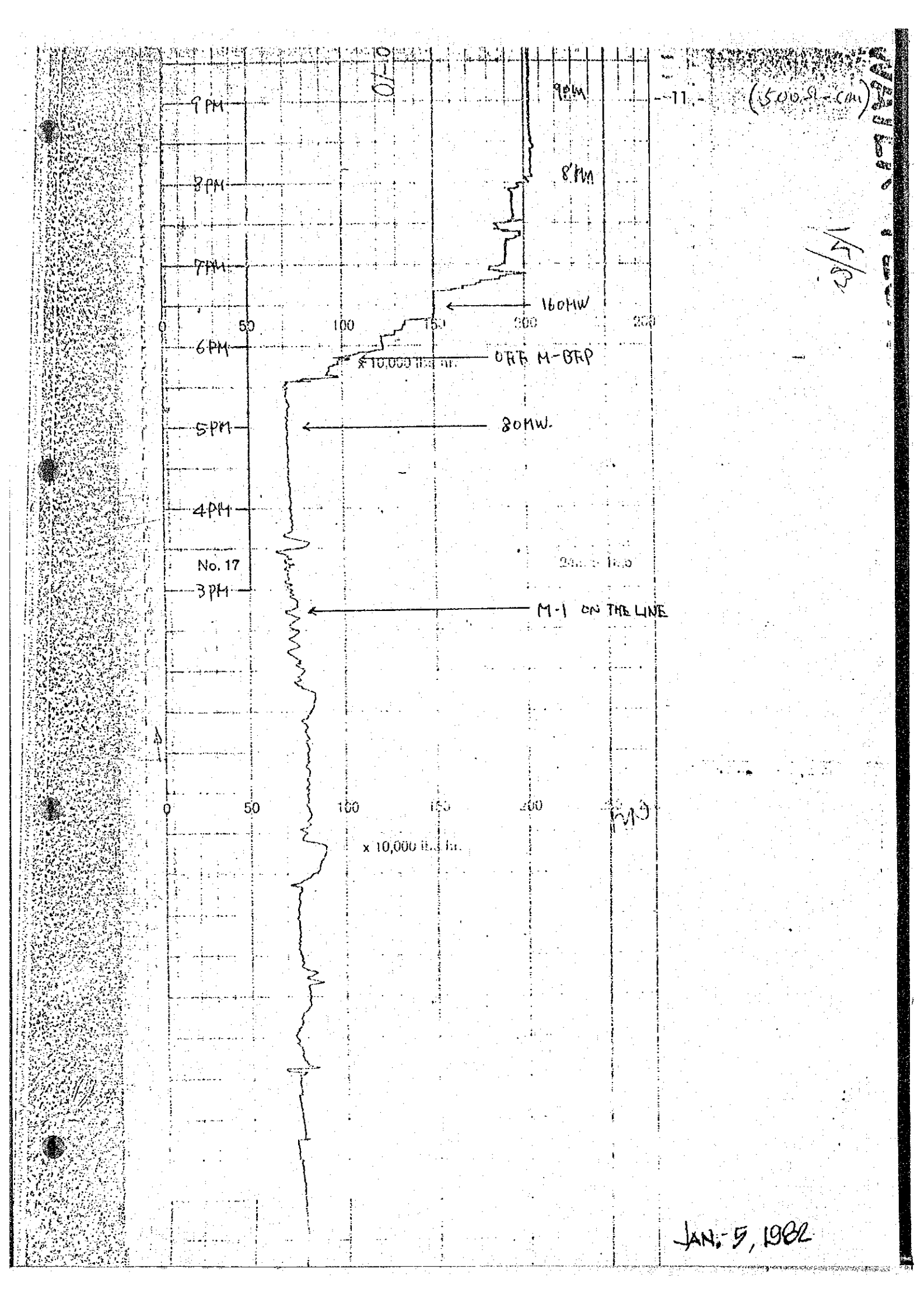
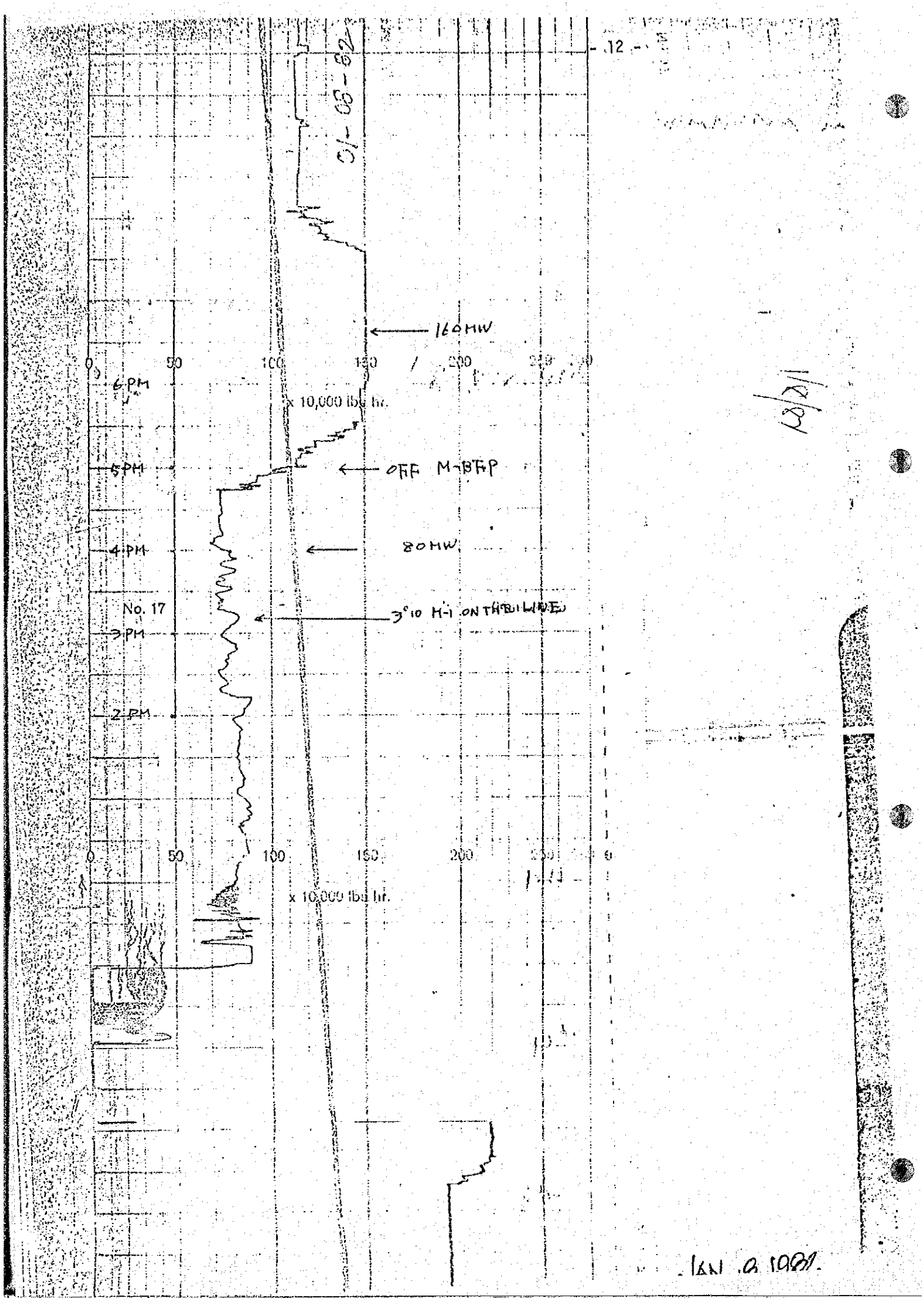
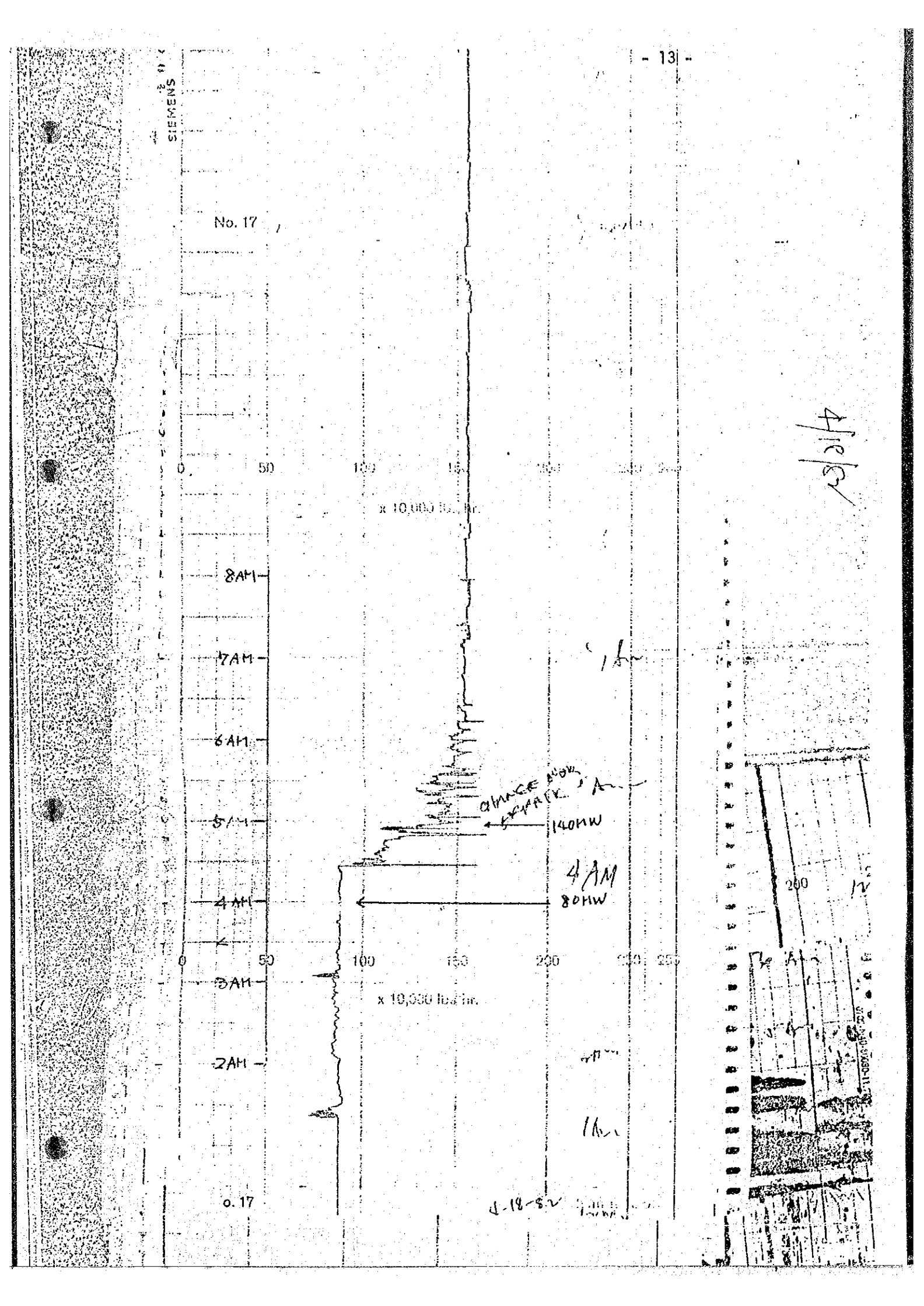

4PM
3PM
0 50 100 150 200
x 10,000 lbs hr.
2PM
SIEMENS
1PM
1pm
OFF M-BTP
120MW
12AM
No. 17
11AM
10AM
109MW
9AM
0 50 100 150 200 250 250
8:22 M-1 ON THE LINE
x 10,000 lbs hr.
8Am
5Am
3:35 Am
50 100 150 200
150 200
0,000 lbs hr.

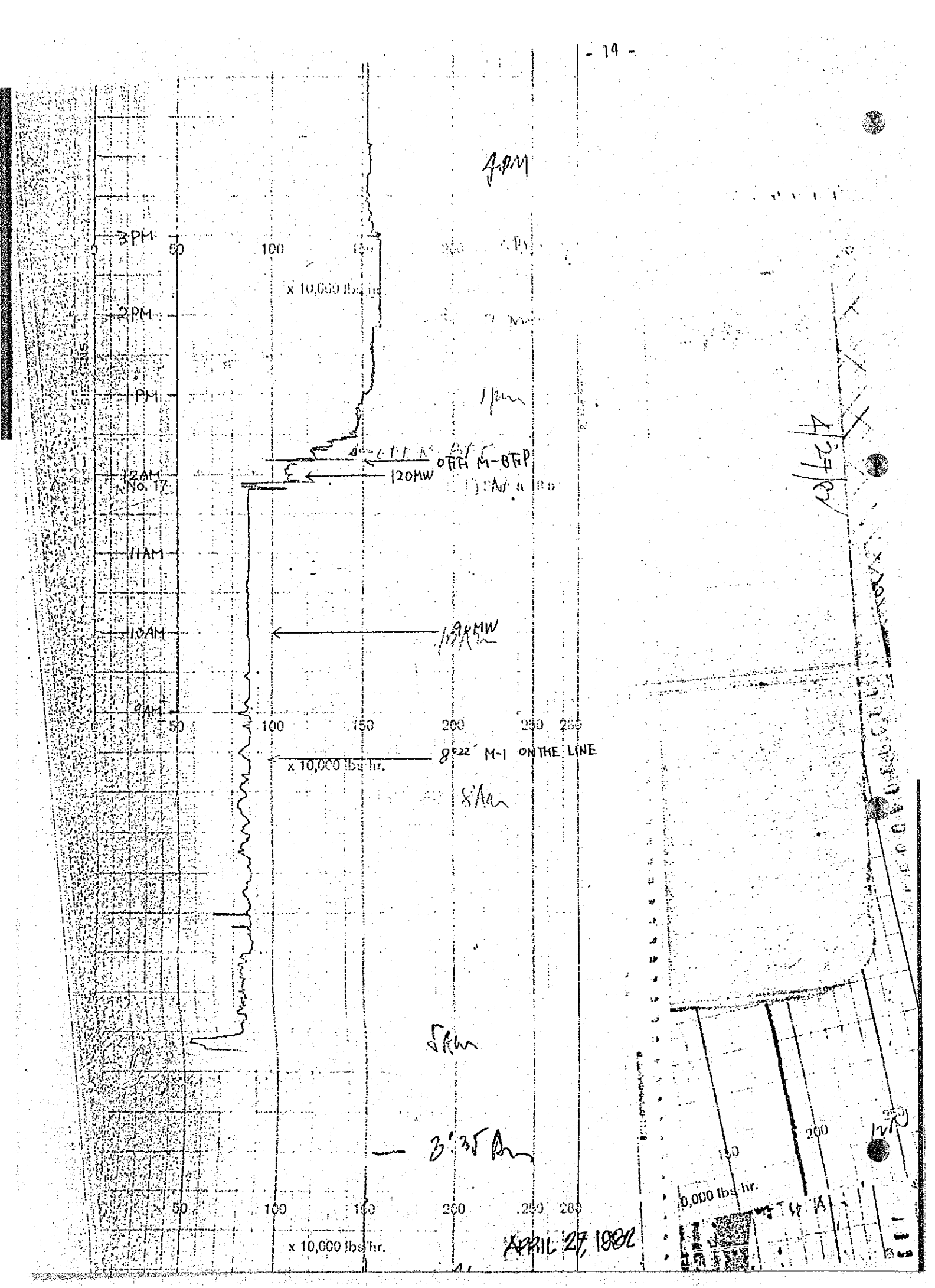

5-02-82
F.W. Flow
0
50
100
150
200
250
x 10,000 lbs/hr.
4PM
3PM
2PM
1PM
12N
No. 17
11AM
10AM
9AM
160MW
120MW
OFF M-BFP
80MW
x 10,000 lbs/hr.
x 10,000 lbs/hr.
x 10,000 lbs/hr.

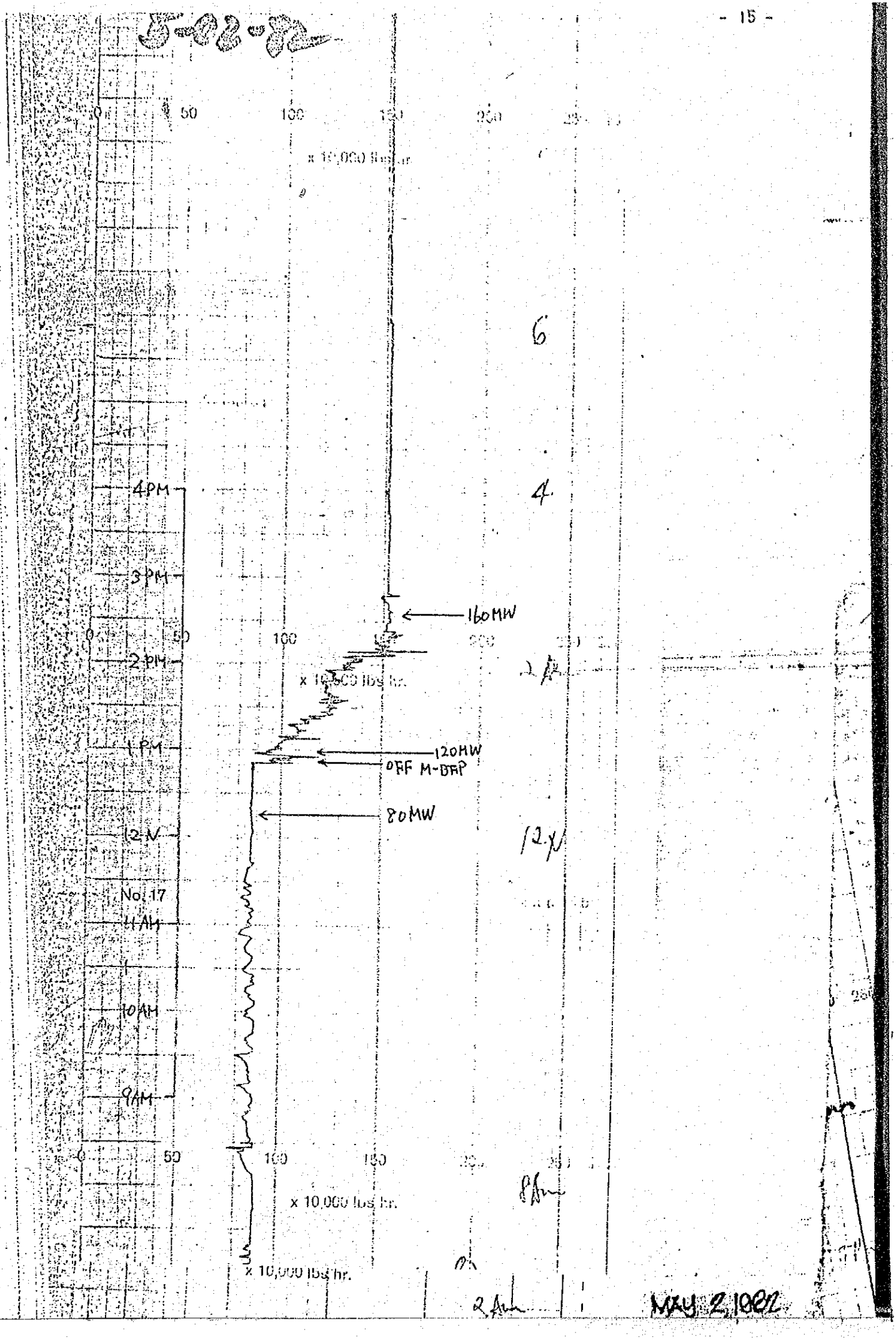

No. 17
3 PM
2 PM
1 PM
12 N
11 AM
10 AM
5 AM
0
50
100
150
200
250
280
x 10,000 lbs hr.
160MW
CRF M-BFP
100MW
11° ∠ M-1 ON THE LINE
SIEMENS
JULY 5, 1982

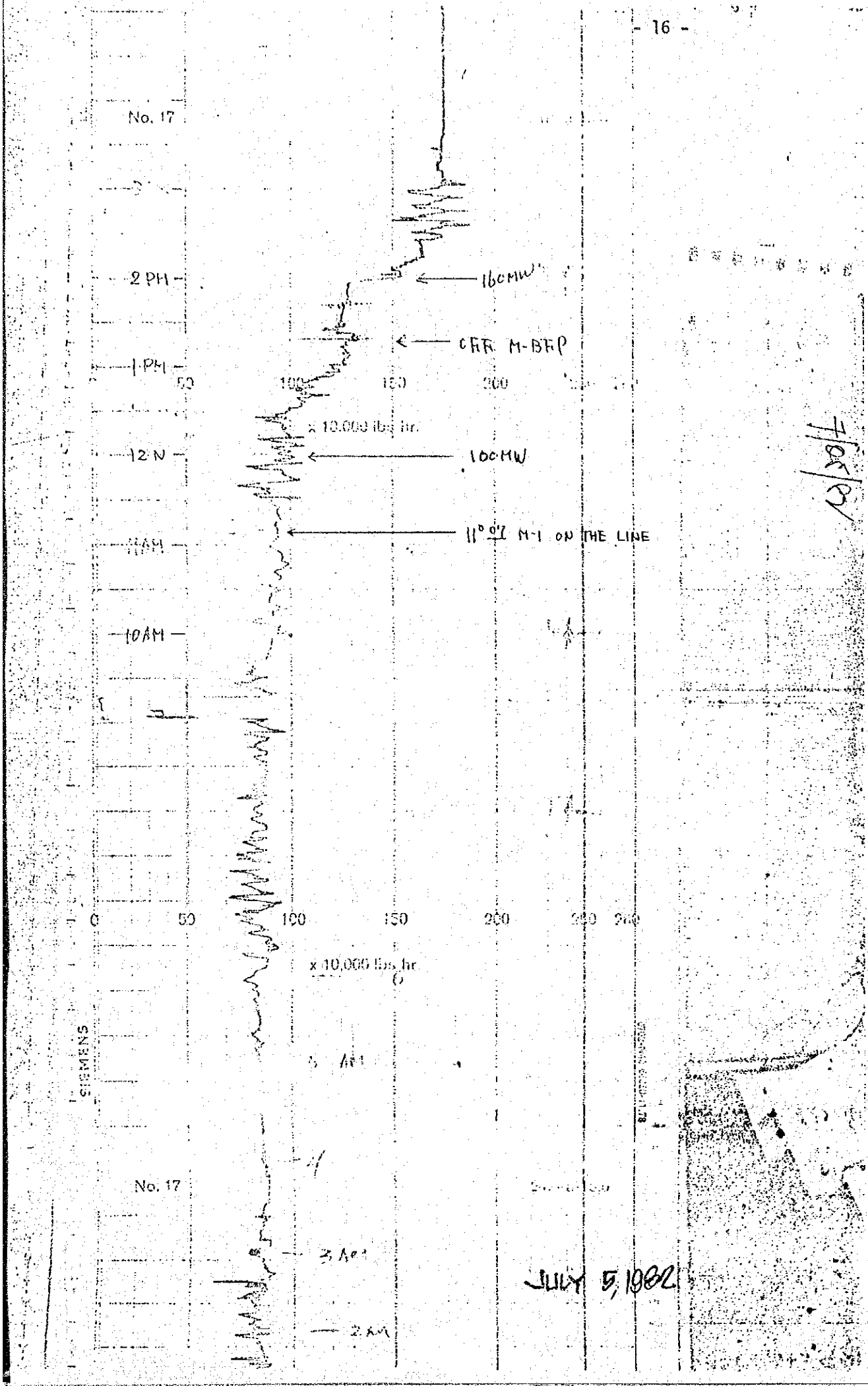

9PM
8PM
7PM
6PM
5PM
4PM
3PM
160MW
OFF M-BFP
80MW.
M-1 ON THE LINE
No. 17
0
50
100
150
200
x 10,000 lb./hr.
JAN. 5, 1982


01-05-82
12
160MW
0
50
100
150
200
6 PM
x 10,000 lbs hr.
5PM
OFF MBFP
4 PM
80MW
No. 17
3 PM
3°10 H-1 ON THE LINE
2 PM
0
50
100
150
200
x 10,000 lbs hr.
JAN 0 1981.


SIEMENS
No. 17
0
50
100
150
200
250
x 10,000 lb./hr.
8AM
7AM
6AM
5AM
4AM
3AM
2AM
CHANGE NOW
EXPECT
140MW
4AM
80MW
0
50
100
150
200
250
x 10,000 lb./hr.
o. 17
4/18/82
1-18-82
200


4PM
3PM
2PM
1PM
12AM
11AM
10AM
9AM
50
100
150
200
250
x 10,000 lbs/hr.
OFF M-BTP
120MW
8:22 M-1 ON THE LINE
APRIL 27, 1982


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


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