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GENERAL ELECTRIC MODEL PG6461 GAS TURBINE B

ESTIMATED PERFORMANCE - CONFIGURATION: HEAVY FUEL

COMPRESSION INLET TEMPERATURE 53.1° F 11.5° C

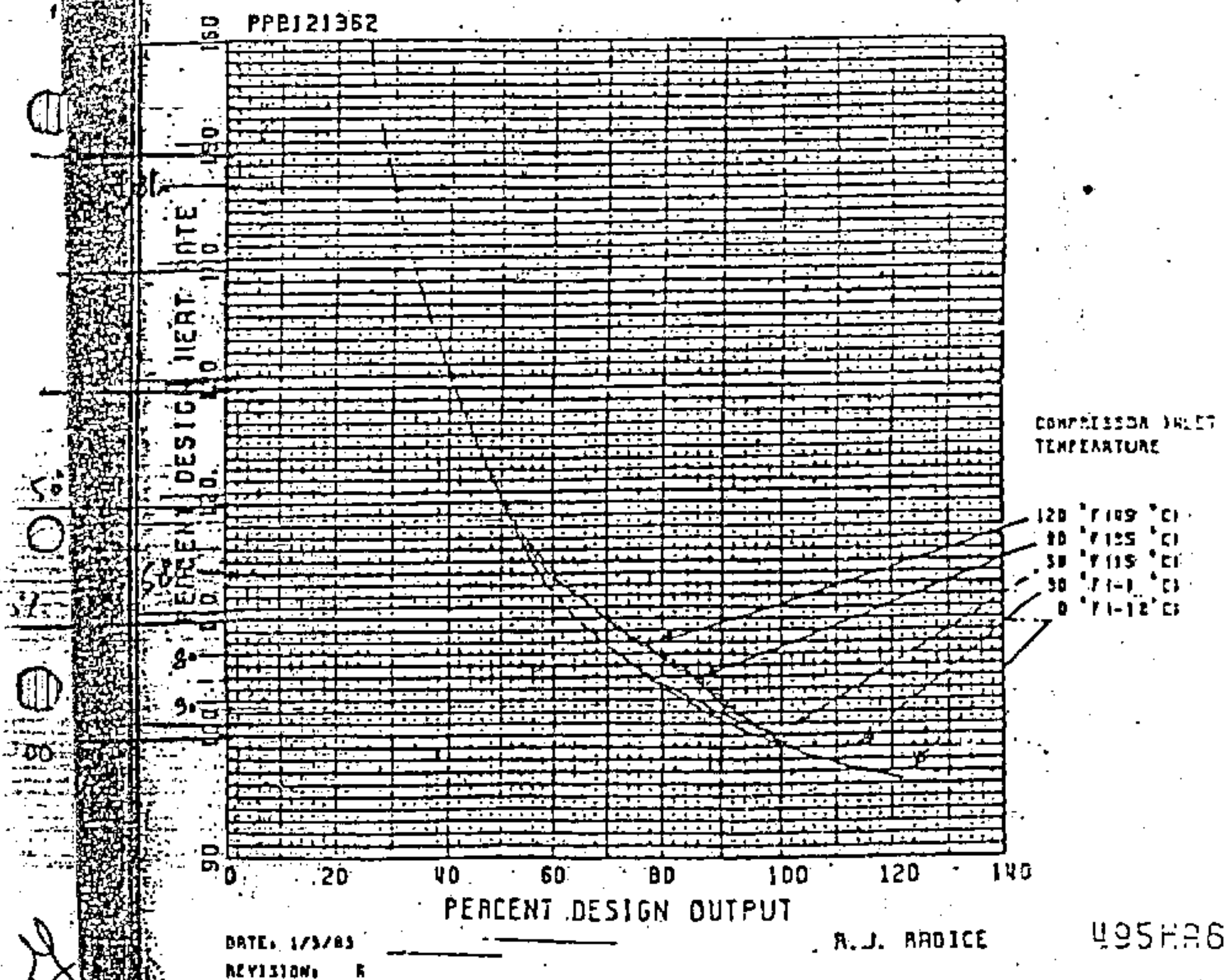
ATMOSPHERIC PRESSURE 14.70 PSIA (1.013 BAR)

FUEL		NATURAL GAS	DISTILLATE
DESIGN OUTPUT	KW	37300.	38500.
DESIGN HEAT RATE (Btu/kWh)	BTU/KWH	10810. (11510.)	11030. (11640.)
DESIGN HEAT CONSUMPTION (lb/kWh)	LB/KWH	406.9 (429.3)	402.6 (424.8)
DESIGN AIR FLOW	10 ³ LB/KWH	1083. (1091.)	1083. (1091.)
MODE: BASE LOAD			

NOTES:

1. ALTITUDE CORRECTION ON CURVE 016H662
2. AMBIENT TEMPERATURE CORRECTION ON CURVE 016H662
3. PLANT PERFORMANCE IS MEASURED AT THE GENERATION TERMINALS AND INCLUDES ALLOWANCES FOR EXCITATION POWER AND 0.0° K20 (10.0M BAR) INLET AND 2.5° K20 (16.2 M.BAR) EXHAUST PRESSURE DROPS.
4. ADDITIONAL PRESSURE DROP EFFECTS

	Δ EFFECT ON OUTPUT (KW)	Δ EFFECT ON EXHAUST TEMP (°F)
0.0° K20 (10.0M BAR) INLET	-1.55	0.55
0.0° K20 (10.0M BAR) EXHAUST	0.55	0.55
		2.2° F (1.2° C)



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ATMOSPHERIC PRESSURE IN INCHES H₂O

Altitude (ft)	Atmospheric Pressure (in. H ₂ O)	Barometric Pressure (in. Hg)
0	40.7	29.92
1000	39.1	29.54
2000	37.5	29.16
3000	35.9	28.78
4000	34.3	28.40
5000	32.7	28.02
6000	31.1	27.64
7000	29.5	27.26
8000	27.9	26.88
9000	26.3	26.50
10000	24.7	26.12

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NOTES:

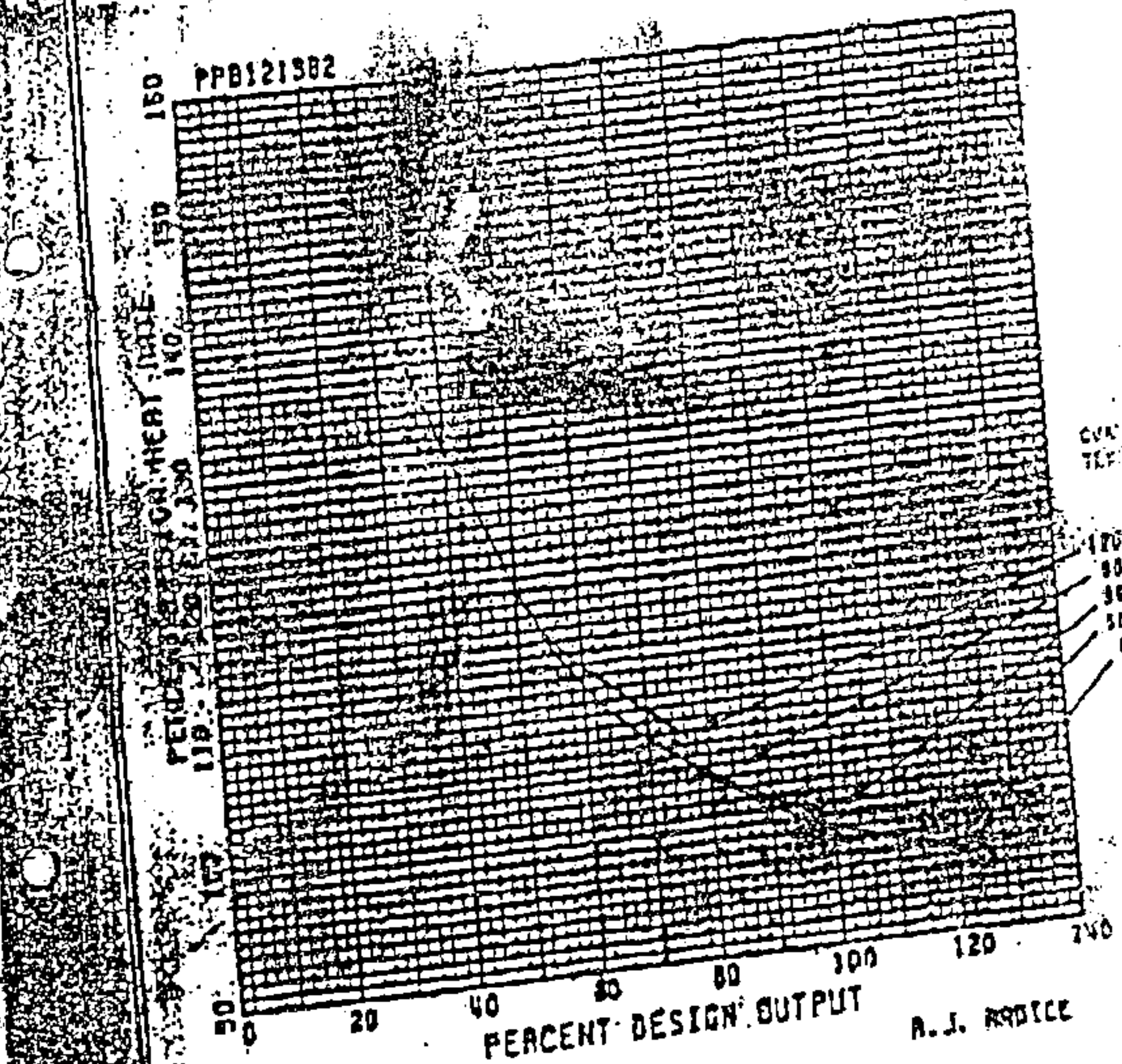
1. ALTITUDE CORRECTION ON CURVE
2. AMBIENT TEMPERATURE CORRECTION ON CURVE
3. PLANT PERFORMANCE IS MEASURED AT THE GENERATOR TERMINALS AND INCLUDES ALLOWANCES FOR EXCITATION POWER AND 3.0° N2O INLET AND 2.5° N2O EXHAUST PRESSURE DROPS.
4. ADDITIONAL PRESSURE DROP EFFECTS

EFFECT ON
ORIGINAL CURVE

3.0° N2O INLET AND 2.5° N2O EXHAUST -0.35

4. EFFECT ON
ORIGINAL CURVE

3.0° N2O INLET AND 2.5° N2O EXHAUST -0.35



GENERAL ELECTRIC MODEL PG6461 GAS TURBINE

EFFECT OF COMPRESSION RATIO TEMPERATURE ON
MAXIMUM OUTPUT, HEAT RATE, HEAT CONSUMPTION,
AIR FLOW AND EXHAUST TEMPERATURE AT 100% SPEED

Radice

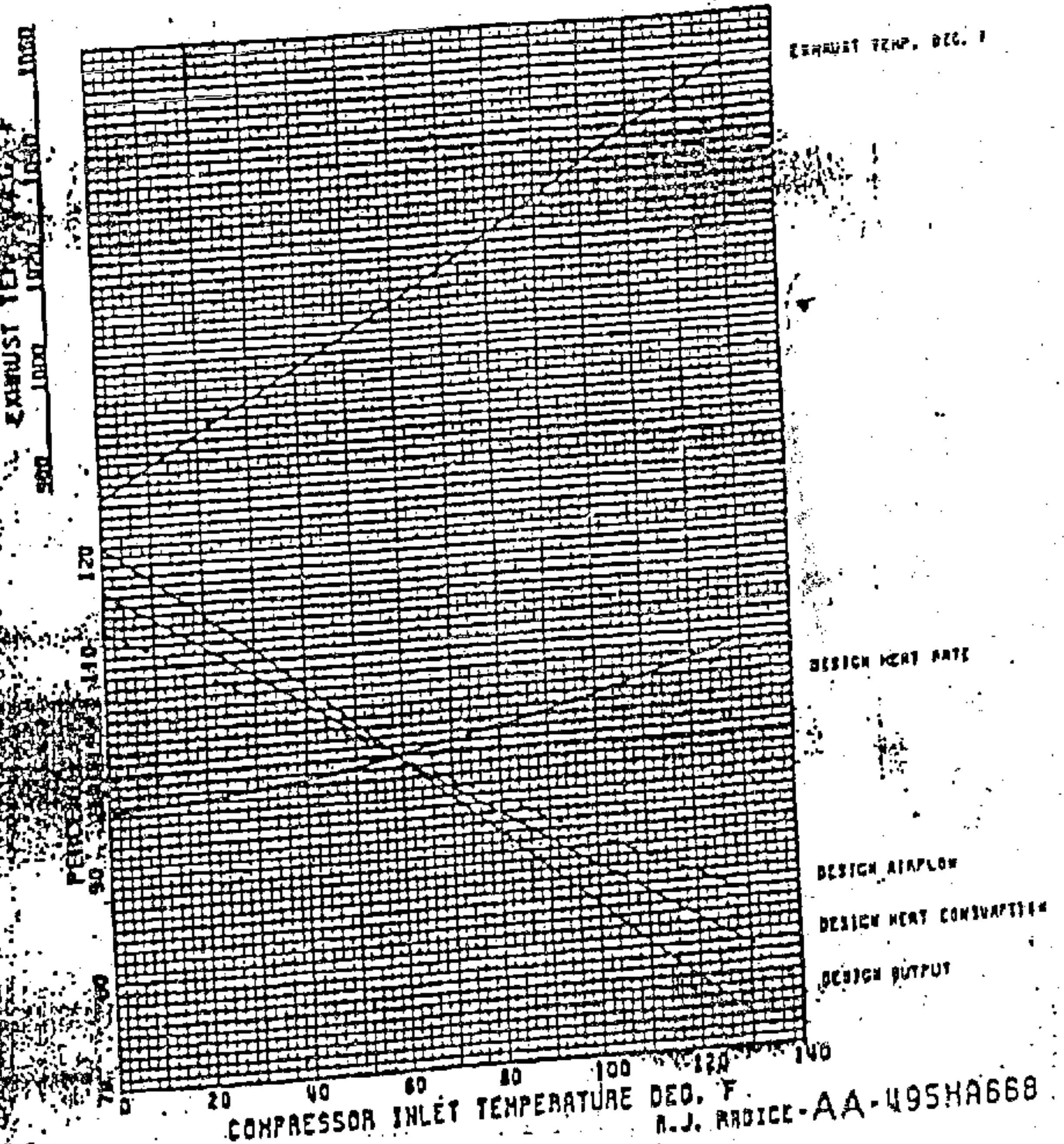
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GENERAL ELECTRIC MODEL PG6461 GAS TURBINE E

EFFECT OF COMPRESSOR INLET TEMPERATURE ON
MAXIMUM OUTPUT, HEAT RATE, HEAT CONSUMPTION,
AIRFLOW AND EXHAUST TEMPERATURE AT 100% SPEED
FUELS: NATURAL GAS AND DISTILLATE OIL
MODE: BASE LOAD



COMPRESSOR INLET TEMPERATURE DEG. F.
DATE: 1/3/53
REVISION: 0
R.J. RADICE-AA-495HA668

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FRAME 6

Performance characteristics for Frame 6 Gas Turbine at base load

Inlet temp (C)	Ex. Temp(C)	HR (%)	HC (%)	Output (MW) %	Flow (%)
49	567	108	83	77	87
38	561	105	88	84	91
27	556	102	94	92	95
15	549	100	100	100	100
4.5	543	98	105	107	104
-6.6	537	97	112	115	109

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SIEMENS (Correction due to)						
Age(Yrs.)	Ageing	Compressor Fouling	Inlet air filter Losses	Part Load Operation	Total Correction	Total Correction (rounded)
0-5	0.754	0.5	0.5	2.9	4.654	4.65
5-10	0.891	0.5	0.7	2.9	4.991	5.00
10-15	1.056	0.5	0.7	2.9	5.156	5.16
ABB						
Age(Yrs.)	Ageing	Compressor Fouling	Inlet air filter Losses	Part Load Operation	Total Correction	Total Correction (rounded)
0-5	1.471	0.607	0.5	2	4.573	4.53
5-10	1.892	0.723	0.7	2	5.305	5.31
10-15	1.967	0.732	0.7	2	5.395	5.40
GE						
Age(Yrs.)	Ageing	Compressor Fouling	Inlet air filter Losses	Part Load Operation	Total Correction	Total Correction (rounded)
0-5	1.529	0.607	0.5	2.43	5.065	5.07
5-10	1.764	0.723	0.7	2.43	5.617	5.62
10-15	1.842	0.732	0.7	2.43	5.704	5.70
MHI						
Age(Yrs.)	Ageing	Compressor Fouling	Inlet air filter Losses	Part Load Operation	Total Correction	Total Correction (rounded)
0-5	0.836	0.607	0.5	2.35	4.293	4.3
5-10	1.032	0.723	0.7	2.35	4.805	4.8
10-15	1.15	0.732	0.7	2.35	4.932	4.93

B) Gas Turbines on Simple Cycle mode

The overall degradation factor for the gas turbine plants also depend upon the ageing, compressor, fouling, inlet Air filter losses, and losses due to part load operation of the gas turbine. The degradation factors calculated for the combined cycle plants are assumed for calculating the degradation of gas turbines operating in simple cycle mode also.

C) Heat Rate Considering Degradation Factors

The guaranteed heat rate after considering the degradation factors are worked out as follows:

Ram

Ram

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10-15	1.967	0.732	0.7	2	5.395	5.40
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C) Heat Rate Considering Degradation Factors

The guaranteed heat rate after considering the degradation factors are worked out as follows:

RECOMMENDATIONS

HEAT RATE (kCal/kWh)

For existing stations

Based on the heat rate values arrived at in table Nos. 8 and 9 for various categories gas turbine models the recommended heat rate figures are as indicated in table No. 12 for CCGT and Simple Cycle gas turbines.

The recommendations are tabulated below :

Table No. 12

Gas Turbine Capacity (ISO Rating)	Combined Cycle Heat Rate(kCal/kWh)		Simple Cycle Heat Rate(kCal/kWh)	
	Age Less than 10 years	Age More than 10 years	Age Less than 10 years	Age More than 10 years
Gas Turbines with Capacity less than 30MW	2500	2550	3500	3550
Gas Turbines with Capacity 30MW or more but less than 100MW	2150	2200	3200	3250
*Gas turbine 100MW & above	2000	2050	2900	3000
Advance Class gas turbines (e.g. 6FA)	1875	—	2800	—

*Does not include advance class.

Notes:

- 1: Simple Cycle operation is generally not recommended.
- 2: In Case of CCGT Generating Stations with liquid firing capability only, the above specified Gross Heat Rate Figures shall be multiplied by a factor of 1.02.
- 3: In case of CCGT Generating Stations using conventional combustor (other than dry low NOx) and steam/water injection for NOx control, Gross Heat Rate shall be increased by 25 kCal/kWh for combined cycle plants and 40 kCal/kWh for Simple Cycle plants.
- 4: Stations using air cooled condensers shall be allowed 50 kCal/kWh in addition to the above mentioned values of heat rate.

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- 5: It is also seen that number of stations are operating at heat rates significantly higher than the proposed normative heat rates. These stations may be asked to submit the reasons for such abnormally high heat rates to the respective regulatory commissions and if need be an Energy Audit may be carried out to identify the causes of losses. Based on the above, a target for reduction of heat rate over a period of 2-3 years could be assigned to the stations.

1.2 For New Plants

Gas turbine plants commissioned on or after 1st April 2004 shall be considered as new plants. Station Heat Rate for these plants shall be the guaranteed heat rate multiplied by the degradation factor (1.04).

The design heat rate to be considered for new units shall be the guaranteed heat rate at 100% nameplate rating of the unit, 0% makeup, design ambient conditions

2 RECOMMENDATIONS ON AUXILIARY POWER CONSUMPTION

2.1 For existing stations

Based on the data received from various power utilities the average auxiliary power consumption is of the order of 2.6% irrespective of the size and capacity of the power plant. However, in the case of 100% liquid fired power plants the auxiliary consumption is about 3% or slightly more than 3% (see table no.11 below). In case electric driven gas booster compressors are part of the auxiliary plant, the auxiliary power consumption is found to be 2.5% more than the auxiliary power consumption without electric driven gas booster compressors.

From the above, it is recommended that the auxiliary power consumption for a combined cycle plant may be taken as 3% and in case electric driven gas booster compressor is part of the plant then the auxiliary power consumption may be 5.5%. Similarly, when the gas turbine are operating on simple cycle mode the auxiliary power consumption may be taken as 1% and 4% respectively for stations without and with electric driven gas compressors.

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