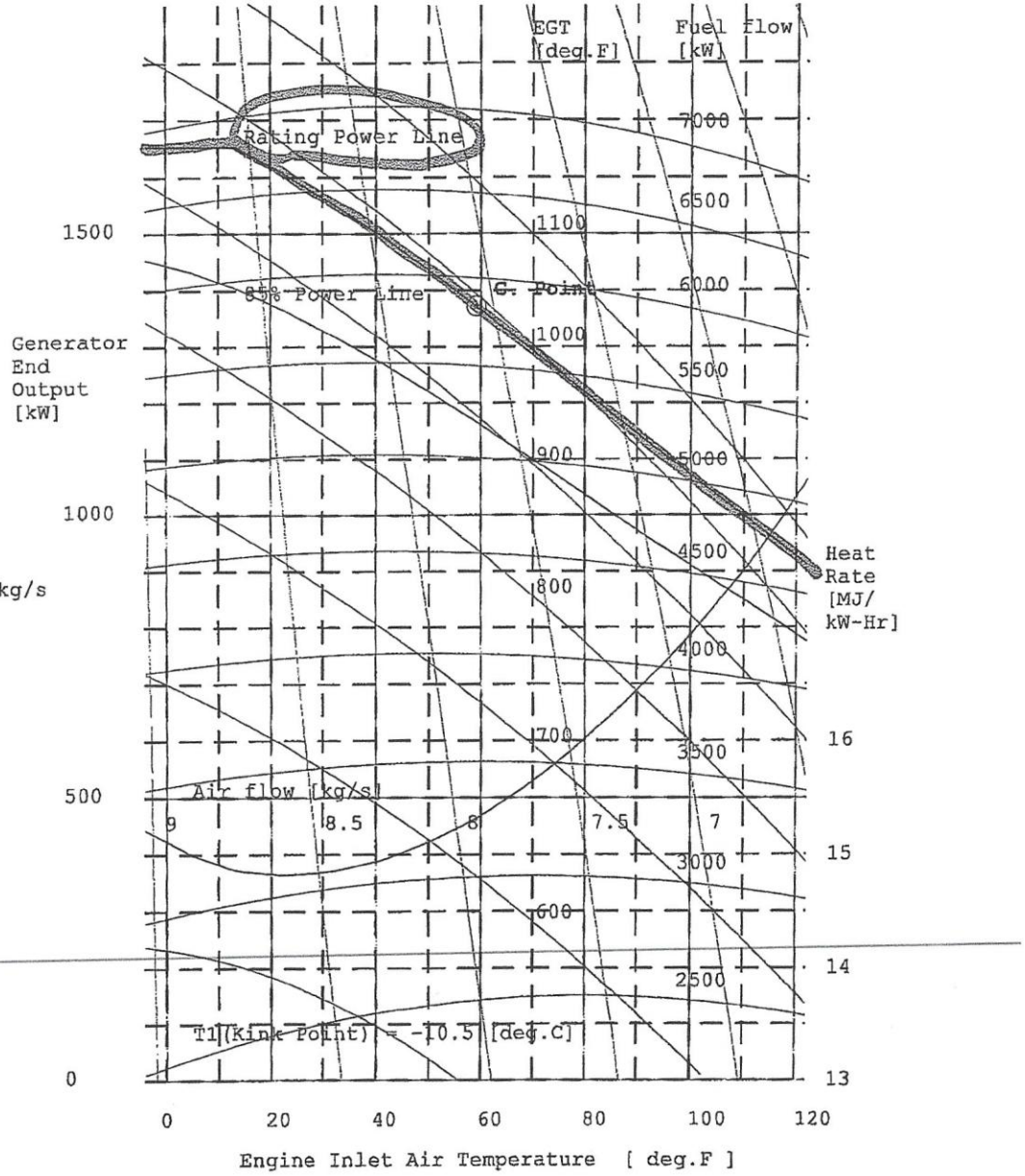
Customer : M1A-13D MODEL WITH STANDARD INTAKE & EXHAUST DUCTS
Engine Model : **Kawasaki M1A-13D Gas Turbine Engine**
No.1 & 2 bearings : Sleeve type
Modified Gearbox (M.limit: 1740 kW)
Fuel Type : Standard Gaseous Fuel (Natural Gas)
LHV 9940 kcal/Nm3 Density 0.8353 kg/Nm3
Weight Ratio of Composition [-]
C 0.7646 H 0.2354 O 0.0000 N 0.0000 S 0.0000 Ar 0.0000
Injection : No Injection
C. Point : On the Engine Shaft Rated Output

Operating Conditions	Symbol	Value	Unit
Setting Altitude	H	356	m
Ambient Pressure	P0	0.991	kg/cm2
Pressure Loss (Intake)	dPi	100	mmAq
(Exhaust)	dPe	250	mmAq
Ambient Temperature	T1	59.0	deg.F
Inj. Flow Weight Ratio	Gs/Gf	0	%
Gearbox Efficiency	Ergb	-----	
Generator Efficiency	Egen	95.0	%
Performance Data			
Engine Shaft Output	Pe	1444	kW
Ratio of Load	Pe/100L	100	%
Generator End Output	Pg	1372	kW
Heat Rate	HR	15.3	MJ/kW-Hr
Thermal Efficiency	Eff	23.5	%
Compressor			
Intake Air Flow	Ga	7.58	kg/s
Pressure Ratio	PAIc	9.54	--
Discharge Pressure	CDP	8.37	kg/cm2 gage
Combustor			
Fuel Consumption	Gf	5837	kW 505 Nm3/h 0.117 kg/s
Injection Mass Flow	Gs	0	kg/h
Turbine			
Turbine Inlet Temp.	TIT	1835	deg.F
Exhaust Gas			
Temperature	EGT	990	deg.F
Mass Flow Rate	Ge	7.62	kg/s 5.96 Nm3/s

Properties of Exhaust Gas			
Enthalpy (0 deg.C)	Ic	153	kcal/kg
(0 deg.K)	Ik	220	kcal/kg
Molecular Weight	M	28.66	kg/kmol
(Composition)		Vol.%	Wei.%
Carbon Dioxide	CO2	2.8	4.3
Oxygen	O2	15.1	16.8
Nitrogen	N2	76.0	74.3
Sulphur Dioxide	SO2	0.0	0.0
Water Vapour	H2O	5.1	3.2
Argon	Ar	1.0	1.3
Exhaust Gas Emission	(at O2=15% corrected)		
Nitrogen Oxide	NOx	< 25	[ppm]
Carbon Monoxide	CO	< 50	[ppm]

Revised on Jan. 23, 2001 (Version B)
Gas Turbine & Machinery Company
KAWASAKI HEAVY INDUSTRIES, LTD.



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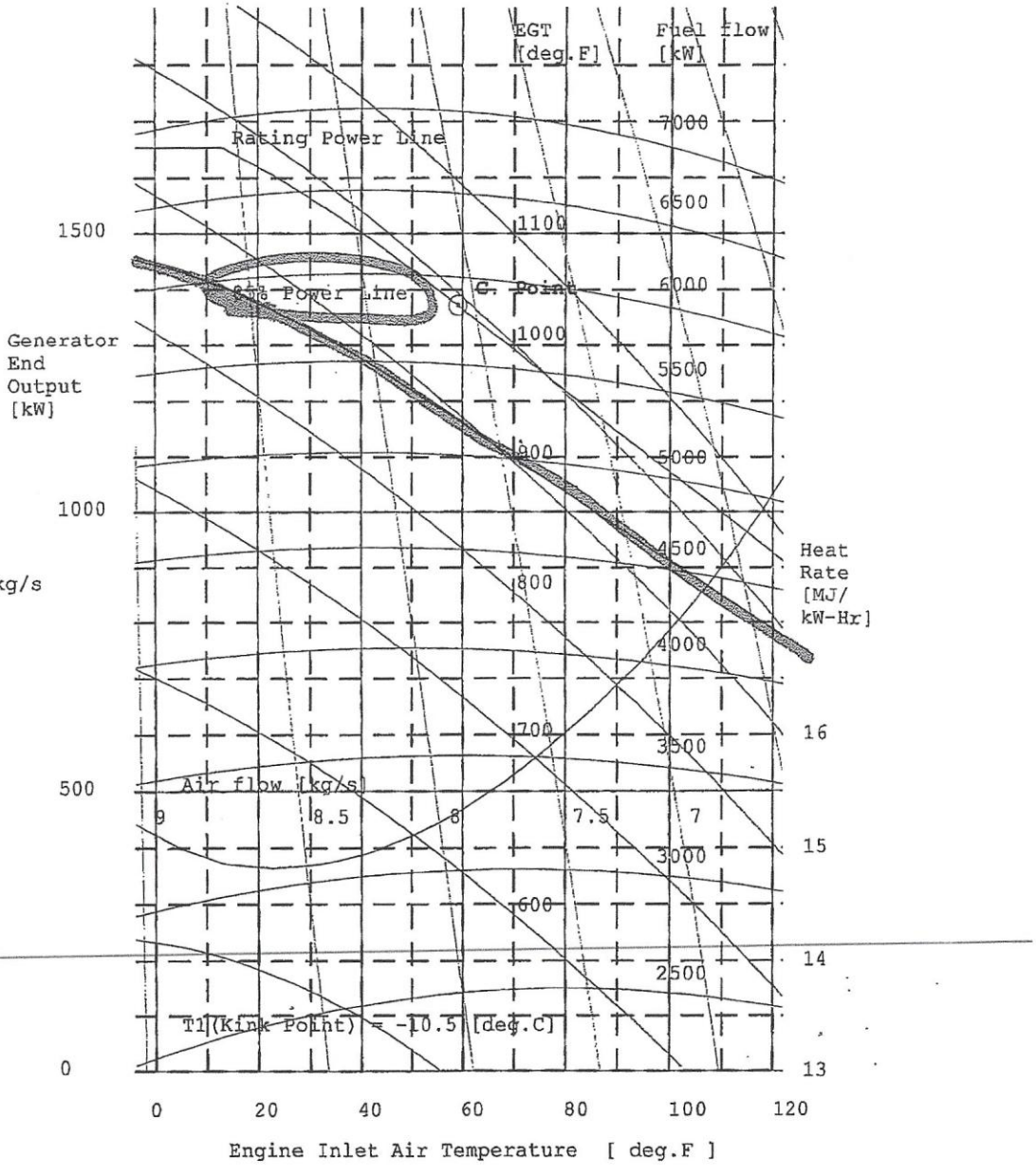

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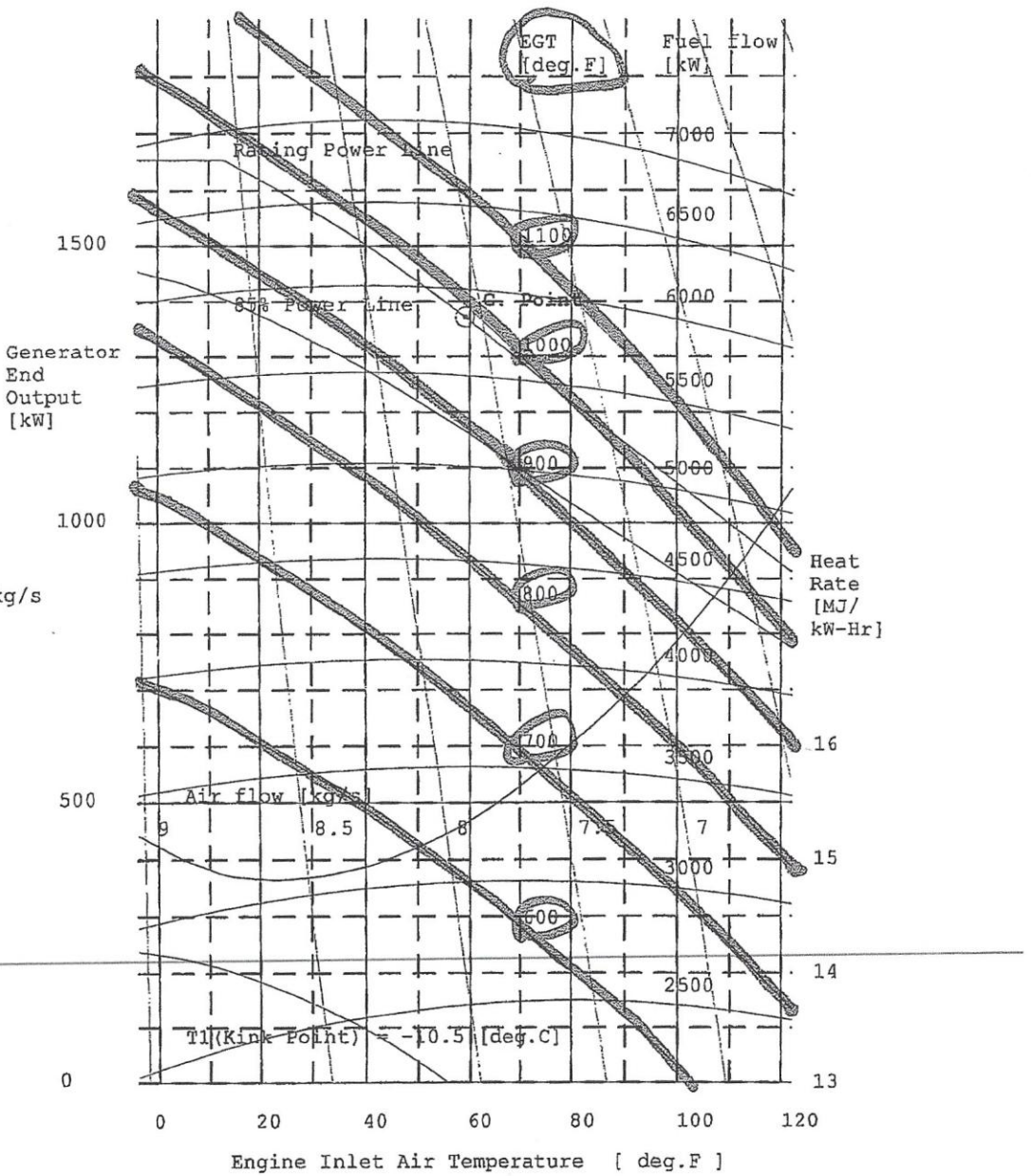

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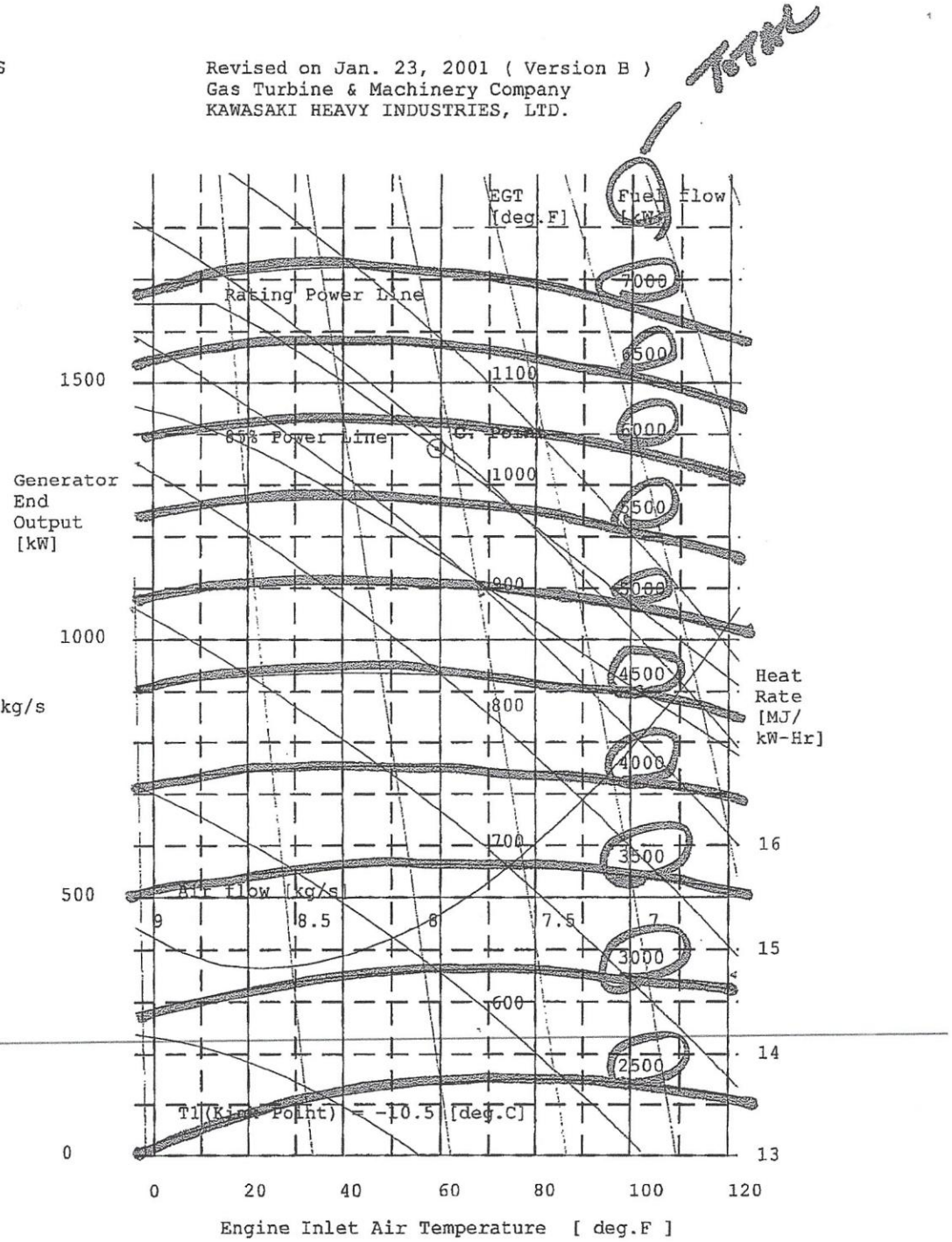

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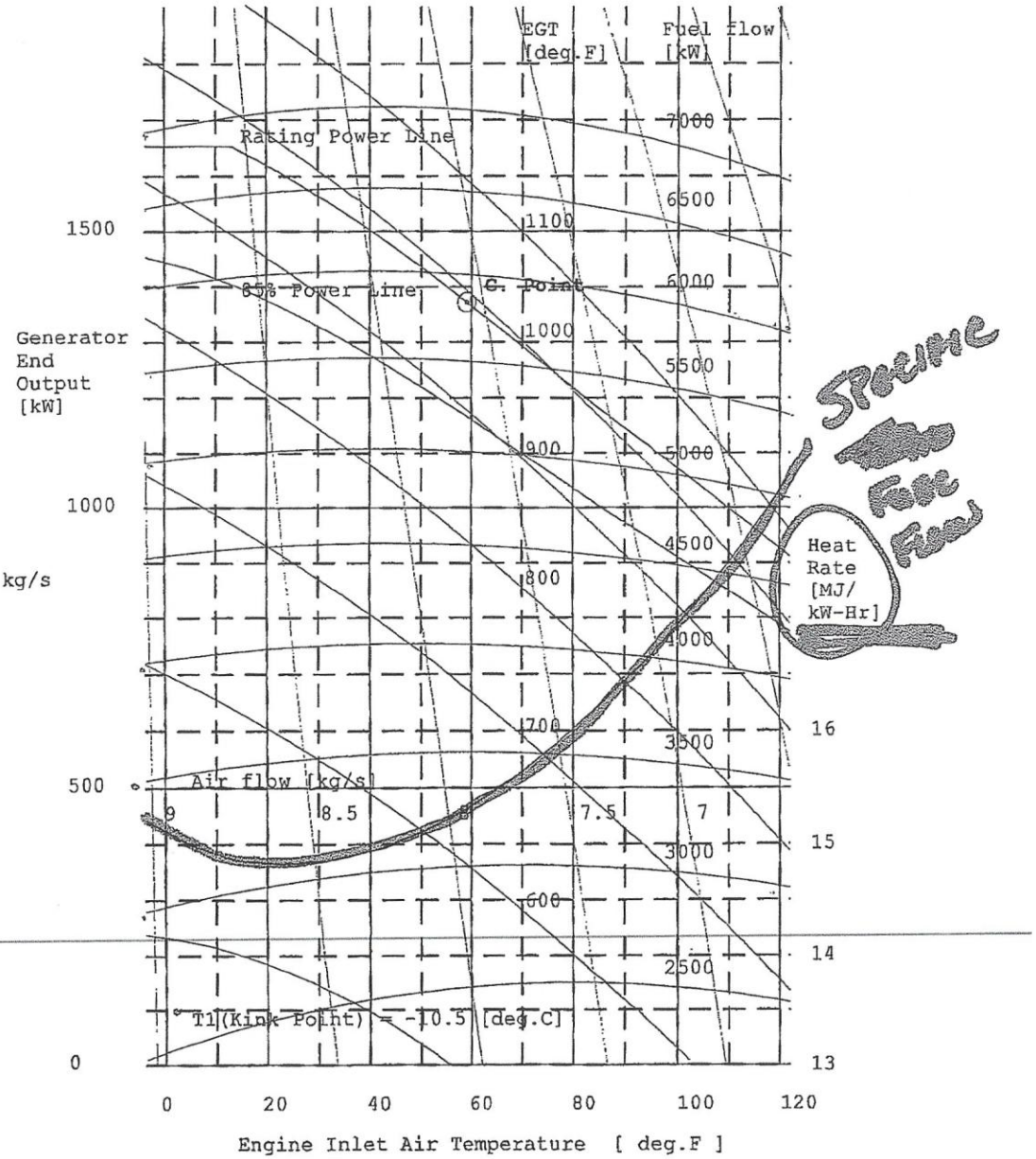

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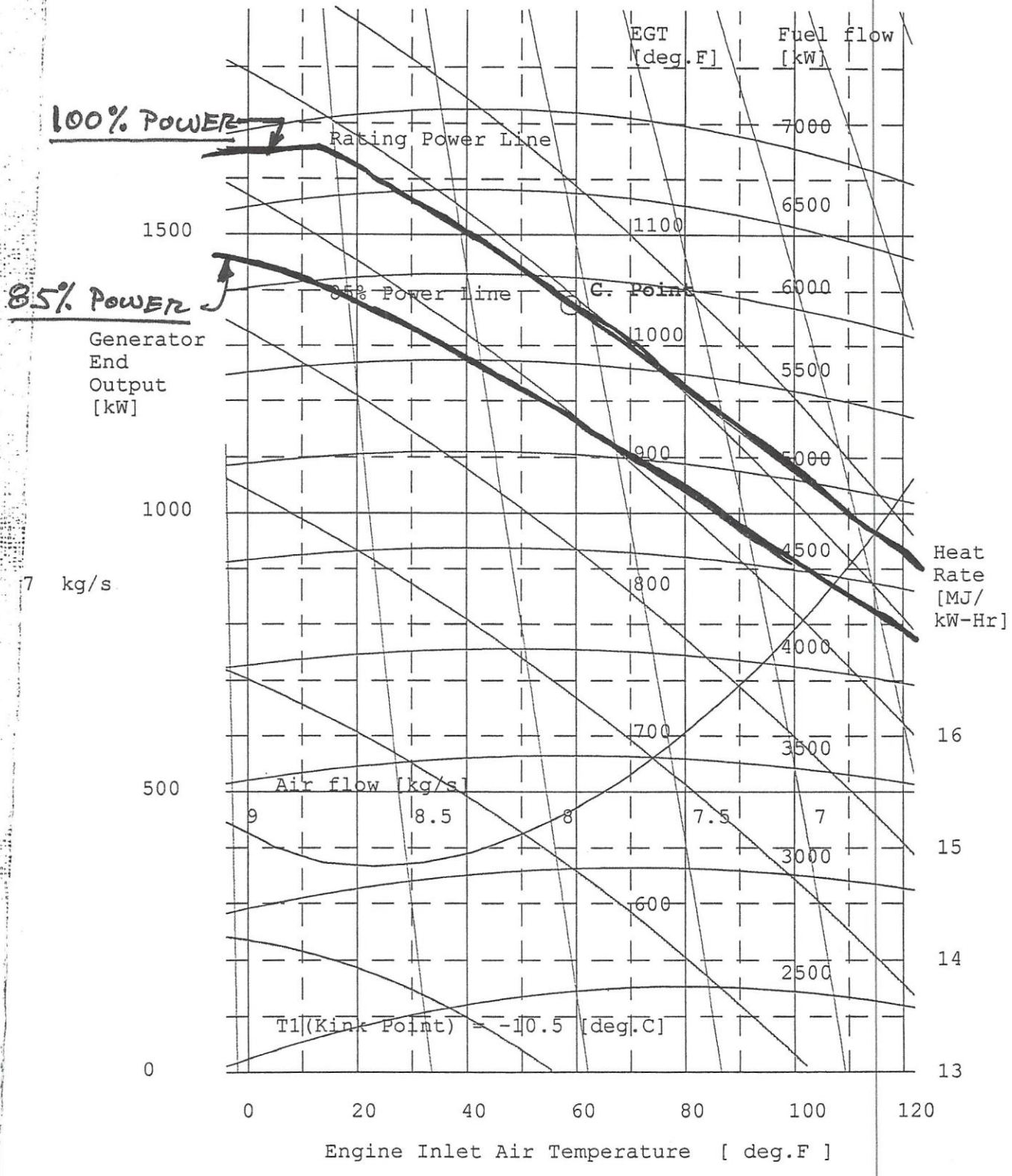


TABLE 1-1
SUMMARY OF TEST RSULTS
KAWASAKI MOTORS GAS TURBINE
NOVEMBER 4-6, 2002

Parameter	Units	Turbine Load Conditio		
		100%	95%	90%
NO_x	% by Vol.	0.0017	0.0016	0.0013
	ppm	17.0	16.4	13.1
	iso corrected ppm @ 15% O_2	19.1	19.0	15.6
	lb/hr	1.61	1.54	1.22
	lb/MM Btu	0.072	0.069	0.056
	lb/MM scf fuel	72.9	69.2	56.9
CO	ppm	5.5	6.8	18
	ppm @ 15% O_2	6.1	7.5	20
	lb/hr	0.32	0.39	1.01
	lb/MM Btu	0.014	0.017	0.046
	lb/MM scf fuel	14.3	17.5	46.9
O_2	%	15.8	15.7	15.9

This table presents the average test results of three test runs per load condition.

SPECIFICATIONS

1. Model No.	HVSI 824C2
2. Generator Type:	HVSI
3. Frame:	8
4. Excitation:	Brushless, self excited, PMG AVR Type: MA327(supplied loose) Isolation transformer : Fitted Voltage Sensing: 3 phase Voltage Regulation: +/−0.5%
5. Poles:	4 Pole, 1800rpm, 60Hz
6. Core Length:	C
7. No. of Bearings:	2 (ball type, regreasable)
8. Coupling:	Coupling Disc: Not applicable Flange Adaptor: Not applicable
9. Insulation:	Class F
10. Ratings:	Continuous, 3 phase 60 Hz/1800 rpm
3 Ph	12,470V
Temp. Rise	F
KVA KW Eff% KW Input @40°C and 1000m altitude	1,875 1,500 95.21 1,575
11. Output Winding	6 end. (HV bushing type)
12. Terminal Box	Fitted
13. Space Heaters	Fitted, 2 x 300 W, 220–260 V, 1 phase
14. Paint	Grey primer
15. Protection	IP22
16. Winding RTD's	6 x RTD's (2 x RTD/phase–PT100)
17. Bearing RTD's	2 x RTD's (1 RTD/bearing–PT100)
18. Power Factor Controller	Supplied loose
19. Excitation loss of module	Supplied loose
20. Direction of rotation	Clockwise

Design and Build Specification.

1.	Air Pressure.	No pressure curves available. Cooling medium requirements as per data sheet supplied.
2.	Weights. (Kgs)	
	Complete Alternator.	5,740
	Stator.	3,884
	Rotor.	1,856
3.	Reactance values. (p.u.)	Based on 1875kVA, 12,470V, 60Hz.
	Synchronous. Xd.	1.610
	Subtransient. X''d.	0.102
	Transient. X'd.	0.138
4.	Various.	
	WR^2 Value.	75.4Kgm^2
	Alternator time constants.	
	T''d.	0.015 sec.
	T'd.	0.201 sec.
	T'do.	4.14 sec.
	Short Circuit Ratio.	0.62
5.	Drawings.	
	General Arrangement.	C998-10132
	Terminal Box layout.	
	Wiring Diagram.	
	Shaft Inertia.	DI18-10266
6.	Voltage Overload Curve.	
7.	Thermal Damage Curve.	See attached.
8.	No load Excitation.	
	Voltage.	17V.
	Current.	0.8A
9.	Over current curve.	See decrement curve
10.	Parts List.	See manual
11.	Spare Parts List.	See manual.
12.	Others.	None.
13.	Shop Test Procedure.	DD15590 and DD15621

Efficiency for HVSI 824C2.
12,470V, 60Hz. Based on 1875kVA.

Load %.	Efficiency %.
25	88.98
50	93.45
75	94.77
100	95.21
110	95.28

Special Winding

RATINGS	REFER TO SALES AND SERVICE BRIEFING
ALTITUDE	UPTO 1000 METRES ABOVE SEA LEVEL
AMBIENT TEMP.	40 ^{0} C

CONTROL SYSTEM SER. 3	SEPARATELY EXCITED BY P.M.G.	
A.V.R.	MA327	
VOLTAGE REGULATION	± 0.5%	With 4% ENGINE GOVERNING
SUSTAINED SHORT CIRCUIT	REFER TO SHORT CIRCUIT DECREMENT CURVES OF THIS SECTION	

INSULATION SYSTEM	CLASS F
RATED POWER FACTOR	0.8
WINDING PITCH	FIVE SIXTH
WINDING LEADS	6
WAVEFORM DISTORTION	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%
MAXIMUM OVERSPEED	2250 Rev/Min
EFFICIENCY	REFER TO EFFICIENCY CURVES OF THIS SECTION

	50 Hz	60 Hz
TELEPHONE INTERFERENCE	THF<2%	TIF<50
COOLING AIR	4.7 m^3/sec	5.5 m^3/sec
TAGE STAR (Y)		12,470
kVA BASE RATING FOR REACTANCE VALUES		1875
Xd DIR. AXIS SYNCHRONOUS		1.610
X'd DIR. AXIS TRANSIENT		0.138
X"d DIR. AXIS SUBTRANSIENT		0.102
Xq QUAD. AXIS REACTANCE		1.045
X"q QUAD. AXIS SUBTRANSIENT		0.173
X_L LEAKAGE REACTANCE		0.066
X_2 NEGATIVE SEQUENCE		0.133
X_o ZERO SEQUENCE		0.116
REACTANCES ARE SATURATED	VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED	
T'd TRANSIENT TIME CONST.	0.201 sec	
T"d SUB-TRANSTIME CONST.	0.015 sec	
T'do O.C. FIELD TIME CONST.	4.140 sec	
Ta ARMATURE TIME CONST.	0.054 sec	

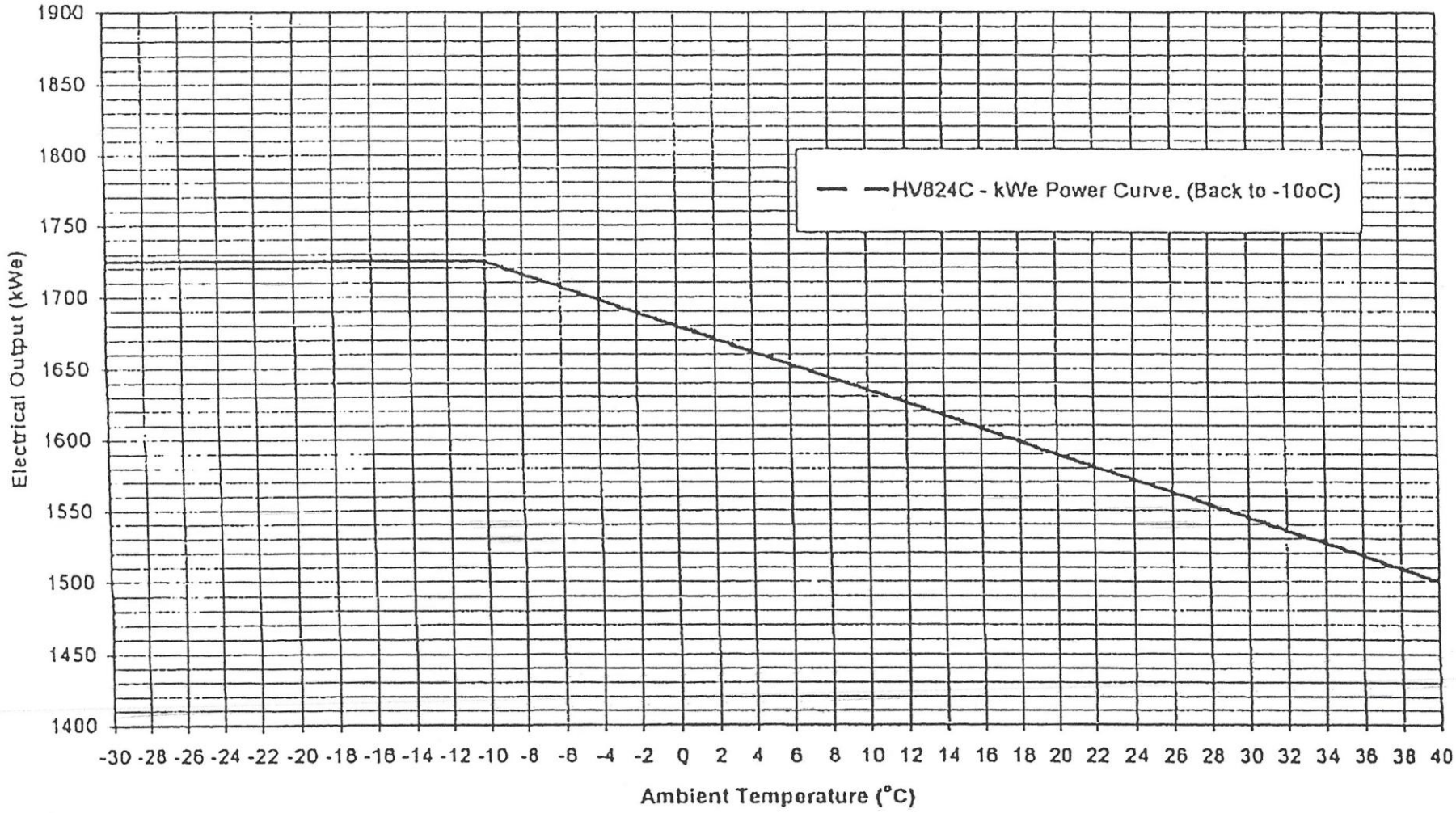
STATOR WDG. RESISTANCE AT 20°C (L-N)	0.5171
ROTOR WDG. RESISTANCE	1.080
EXCITER STATOR RESISTANCE	18.00
EXCITER ROTOR RESISTANCE (L-L)	0.094
PMG STATOR RESISTANCE (L-L)	2.800
RESISTANCE VALUES ARE IN OHMS AT A 20^0 C AMBIENT	

NO LOAD EXCITATION VOLTAGE	17.000
FULL LOAD EXCITAION VOLTAGE	60.000

SHORT CIRCUIT RATIO	1/Xd

ISSUE 1

HVS1824C. Power Curve.



Prepared by Trevor French
Applications Engineer - Frame 8.

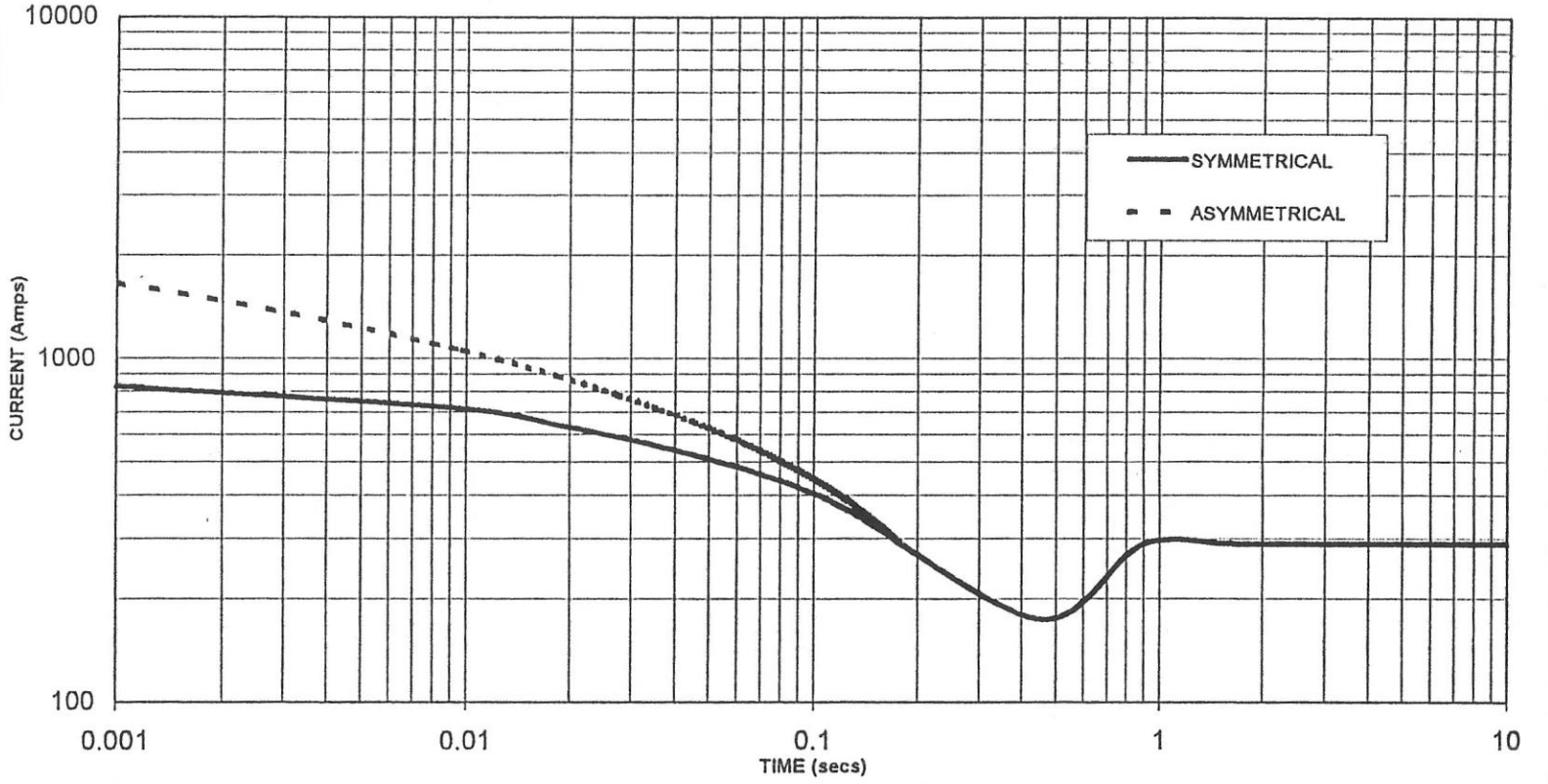
05/(

NEWAGE INTERNATIONAL	A.C. GENERATOR FRAME	HV824C

THREE PHASE SHORT CIRCUIT DECREMENT CURVE

A.V.R TYPE	MA	WINDING	91	4 POLE	FREQ	60 Hz	1800	Rev/Min

SERIES STAR (WYE) CONNECTION — NO LOAD EXCITATION AT RATED SPEED



SUSTAINED SHORT CIRCUIT = 290 AMPS

NOTE 1
THE FOLLOWING MULTIPLICATION FACTORS SHOULD BE USED TO ADJUST THE VALUES FROM CURVES BETWEEN THE 0.001 SECONDS AND THE MINIMUM CURRENT POINT IN RESPECT OF NOMINAL OPERATING VOLTAGE

VOLTAGE	FACTOR
12470v	X 1.00
0	0
0	0
0	0

THE SUSTAINED CURRENT VALUE IS CONSTANT IRRESPECTIVE OF VOLTAGE LEVEL

NOTE 2
THE FOLLOWING MULTIPLICATION FACTORS SHOULD BE USED TO CONVERT THE VALUES CALCULATED IN ACCORDANCE WITH NOTE 1 TO THOSE APPLICABLE TO THE VARIOUS TYPES OF SHORT CIRCUIT

	3 PHASE	2 PHASE L-L	1 PHASE L-N
INSTANTANEOUS	X 1.0	X 0.87	X 1.3
MINIMUM	X 1.0	X 1.80	X 3.20
SUSTAINED	X 1.0	X 1.50	X 2.50
MAX SUSTAINED DURATION	10 SEC	5 SEC	2 SEC

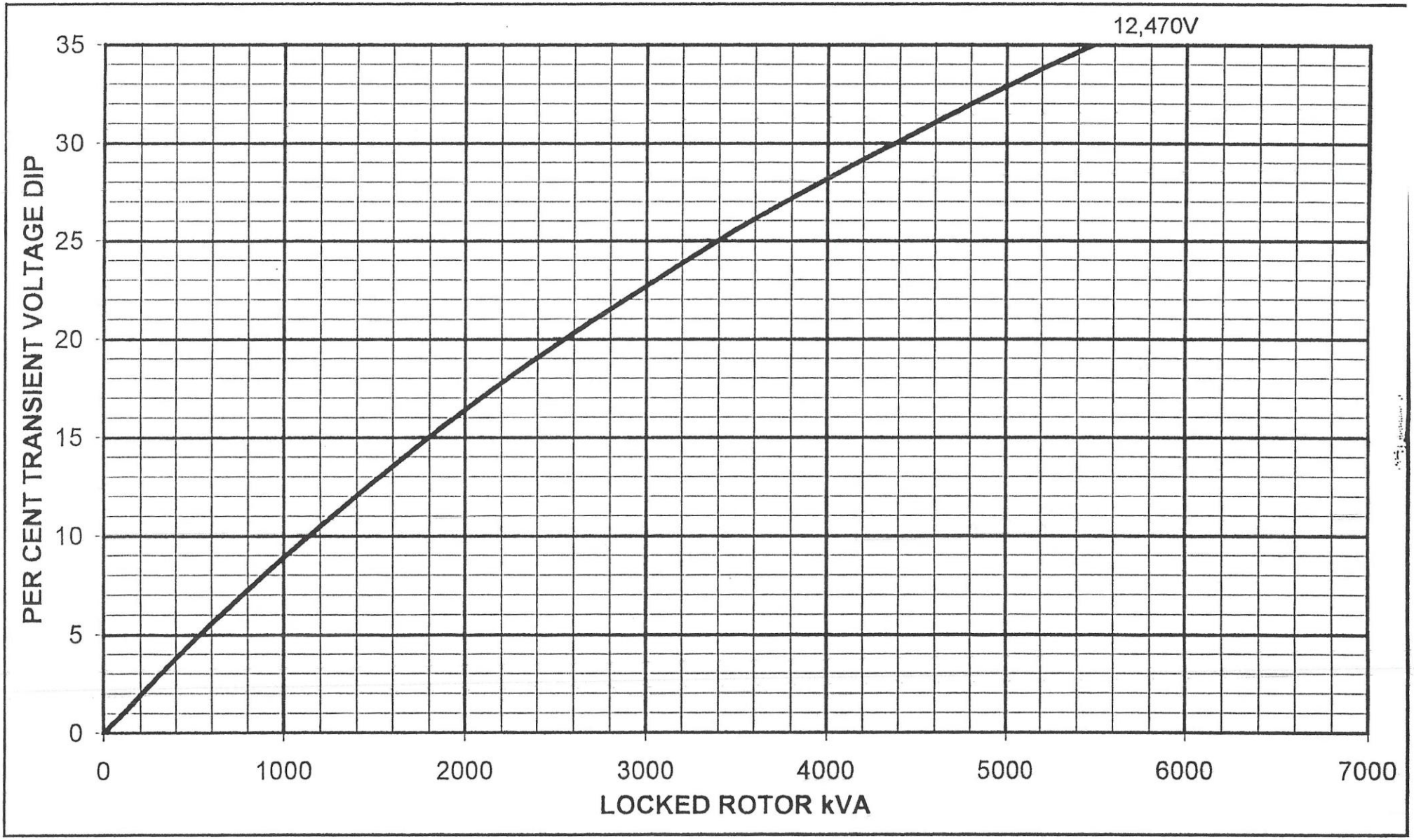
ALL OTHER TIMES ARE UNCHANGED

APPLICATION DATA SHEET NUMBER PPQ0265 ISSUE A DATE 17/09/99

NEWAGE INTERNATIONAL
LOCKED ROTOR MOTOR STARTING CURVE

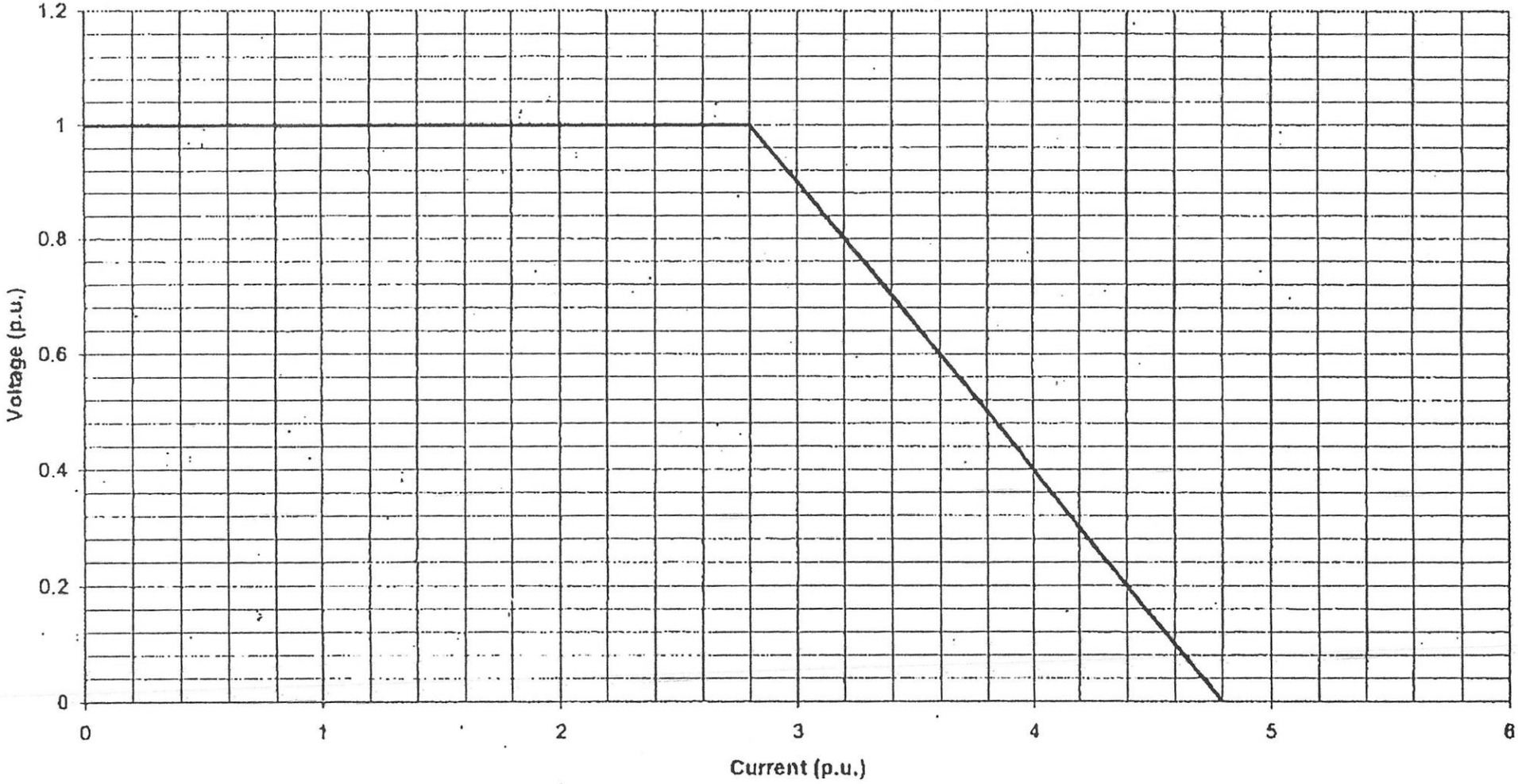
A.C. GENERATOR FRAME
60 Hz AVR MA

HVSI824C2
WINDING Spl



APPLICATION DATA SHEET NUMBER HVSI824C2/Spl/60/MA/3 ISSUE 0 DATE

Voltage Overload Curve - HVSI 824C2. KHI/KMM - Lincoln Project.

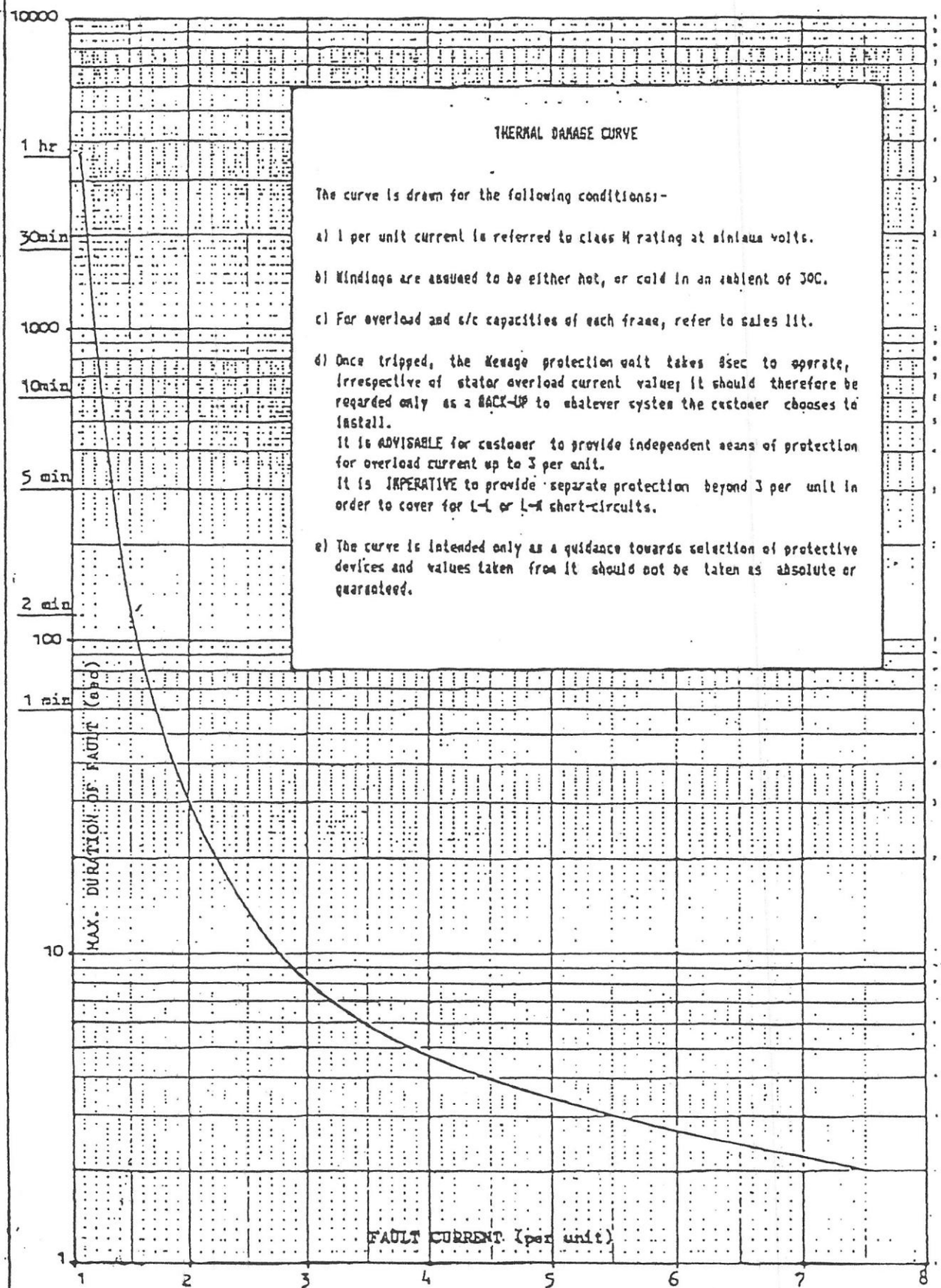


PPQ0285

Rating: 1875kVA, 12,470V, 60Hz
1p.u. current equals 87A

THERMAL DAMAGE CURVE

APPLICATION DATA SHEET | ISSUE | DATE



THERMAL DAMAGE CURVE

The curve is drawn for the following conditions:-

a) 1 per unit current is referred to class H rating at minimum volts.

b) Windings are assumed to be either hot, or cold in an ambient of 30C.

c) For overload and s/c capacities of each frame, refer to sales lit.

d) Once tripped, the Newage protection unit takes 8sec to operate, irrespective of stator overload current value; it should therefore be regarded only as a BACK-UP to whatever system the customer chooses to install.
It is ADVISABLE for customer to provide independent means of protection for overload current up to 3 per unit.
It is IMPERATIVE to provide separate protection beyond 3 per unit in order to cover for L-L or L-N short-circuits.

e) The curve is intended only as a guidance towards selection of protective devices and values taken from it should not be taken as absolute or guaranteed.

CONTRACT DATA

BOILER

BOILER TYPE & NO.: S1-1414	
CONVECTION HEATING SURFACE:	**8,956 SQ. FT.**
RADIANT FURNACE HEATING SURFACE:	**N/A**
TOTAL HEATING SURFACE:	**8,956 SQ. FT.**
DESIGN PRESSURE:	**300 PSIG**
OPERATING PRESSURE:	**250 PSIG**
TEMPERATURE OF FEEDWATER TO BE FURNISHED TO UNIT:	**156° F.**
CONTINUOUS STEAM CAPACITY:	**10,500 PPH**
WATER CAPACITY WHEN FLOODED:	**37,975 LB. 4,563 GAL.**
WATER CAPACITY AT OPERATING LEVEL:	**36,500 LB. 4,398 GAL.**