

**33306-04**

D-R DOCUMENT #: \_\_\_\_\_  
DOCUMENT TITLE: Generator Data Sheets & Curves  
CLIENT DOCUMENT #: A4AN-4-0302-01-00034

**REVISION HISTORY:**

Rev.	Date Issued	Description	Issued By
0	11.18.2008	Initial Issue	JMM
1	1/7/09	Re-issued with docs attached.	JMM

**Index of Attached Documents:**

Document #	Description
410167	10.15.08 Data sheets
SPE70390.WGN/8	CAPABILITY CURVE
SPE70390.WGN/8	EFFICIENCY CURVE
SPE70390.WGN/8	NO LOAD & SHORT CIRCUIT
SPE70390.WGN/8	OUTPUT CURVE @ B-RISE
SPE70390.WGN/8	OUTPUT CURVE @ F-RISE
SPE70390.WGN/8	V-CURVE
SPE70390.WGN/8	COMPUTER REP OF BRUSHLESS EXCITATION SYSTEM
SPE70390.WGN/8	SHORT CIRCUIT DECREMENT CURVE
SPE70390.WGN/8	VOLTAGE & FREQUENCY DIAGRAM

**Dresser-Rand Reference Information:**

D-R Contract Number: C-33306  
D-R Unit Serial Number: D6397

**Client Title Block:**

Project Name: Tesoro LAR COGEN & Boiler Replacement  
Client Name: Fluor  
Client PO #: A4AN-4-0302-01/A4AN100196  
Item #: ~~1ST-TRB-0100~~ T-0522 / G-0041  
End User: Tesoro - Los Angeles Refinery  
End User Location: Wilmington, CA

**AW - PROCEED WITH COMMENTS** **FLUOR.**  
Notification to proceed does not constitute acceptance nor relieve Contractor/Seller of any liability. Acceptance is accomplished under the terms of the Contractor/Purchase Order.

Number of Pages (Including Cover Page): 11

A4AN-4-0302-01-00034-2  
Tag No. T-0522



DATA SHEET SYNCHRONOUS MACHINES



BASIC DATA			
Date :	2008-10-15		
Order no.	410167		
Ordered by	Dresser Rand		
Destination	Tesoro		
Type	DG165ZI-04	Design no:5115160Z11	
Rated voltage	13800	V, 60 Hz	
Rated output	18598	kVA, at p.f. 0,85	
Speed	1800	rpm	
Rated current	778	A	
Rated temperature	120	F, water	
Method of cooling	IC8A1W7		
Degree of protection	IP54		
Mounting arrangement	IM1005		
Insulation class Stator	F, temp rise to B		
Insulation class Rotor	F, temp rise to B		
Insulation class Exciter	F, temp rise to B		
Type of excitation	Brushless		
Exciter type	DGBP60/15		
P.M.G.	ND 540/40		
Exciter response	2,33	1/sec	
	Stator	Rotor	
No load voltage	13	22	V
No load current	2,1	235	A
Exc. rated voltage	29	49	V
Rated current	4,8	539	A
Ceiling voltage	57	96	V
Ceiling current	9,3	1054	A
Doc. no.	SPE70390.WGN	Version 8	

ELECTRICAL DATA			
Standards	NEMA MG1		
Gen. stator resistance	0,0199	Ohm at 20 °C	
Gen. rotor resistance	0,0707	Ohm at 20 °C	
Exc. stator resistance	4,7	Ohm at 20 °C	
REACTANCES	Unsaturated	saturated	
d-axis synchronous	1,57	p.u.	1,41 p.u.
transient	0,20	p.u.	0,16 p.u.
sub transient	0,14	p.u.	0,12 p.u.
q-axis synchronous	0,80	p.u.	0,72 p.u.
sub transient	0,21	p.u.	0,18 p.u.
Negative sequence	0,17	p.u.	0,15 p.u.
Zero sequence	0,08	p.u.	
Potier reactance	0,16	p.u.	
Short Circuit Ratio	0,67		
TIME CONSTANTS			
d-axis transient short circuit			0,96 sec.
d-axis transient open circuit			7,4 sec.
d-axis subtransient short circuit			0,03 sec.
d-axis subtransient open circuit			0,04 sec.
q-axis subtransient short circuit			0,03 sec.
q-axis subtransient open circuit			0,11 sec.
Armature			0,15 sec.
Short Circuit Conditions			
3 phase Peak	17225 A	22,1 p.u.	
3 phase RMS	6053 A	7,8 p.u.	
2 phase Peak	12561 A	16,1 p.u.	
Steady state	1194 A	1,5 p.u.	

CURVES	
Capability	8WGN 022601
Efficiency	8WGN022602
No-Load & Short-Circuit	8WGN022603
Output at B-rise	8WGN022604
V-Curves	8WGN022605
Excitation system diagram	8WGN022606
MECHANICAL PROPERTIES	
Acceleration time Tj	3,5 sec
Inertia constant H	1,49 kWsec/kVA
Damping factor kd	19,0 MW/Hz
Direction of rotation	CW
Rotortype	salient poles
Poles are	massive without damperwinding
Shaft extension	flange
LOSSES AT NOMINAL RATING	
Friction and windage losses	131 kW
Core losses	115 kW
Stray load losses	38 kW
Armature I²R losses @ 95°C	51 kW
Field I²R losses:	29 kW
EFFICIENCIES, Guaranteed	
	4/4    3/4    1/2    1/4
p.f. 1,00	98,24    97,96    97,28    95,06
p.f. 0,85	97,87    97,54    96,75    94,18





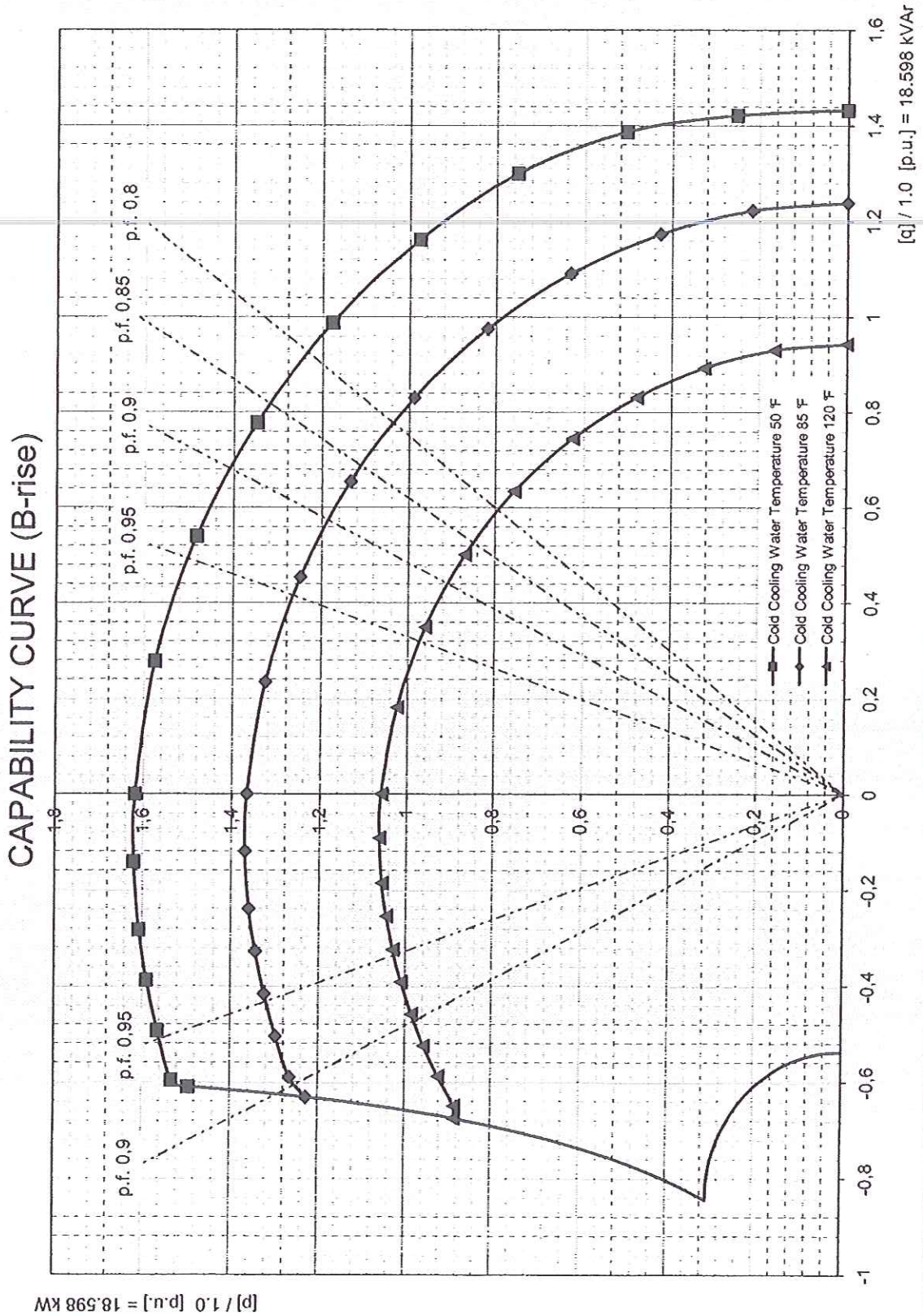
# SYNCHRONOUS GENERATOR CAPABILITY CURVE



Order no. : 410167  
Ordered by : Dresser Rand

Type : DG165ZI-04  
Destination : Tesoro

Doc. no. : SPE70390.WGN/8  
Curve no. : 8WGN022601/1  
Cooling : IC8A1W7



Appendix 2.10

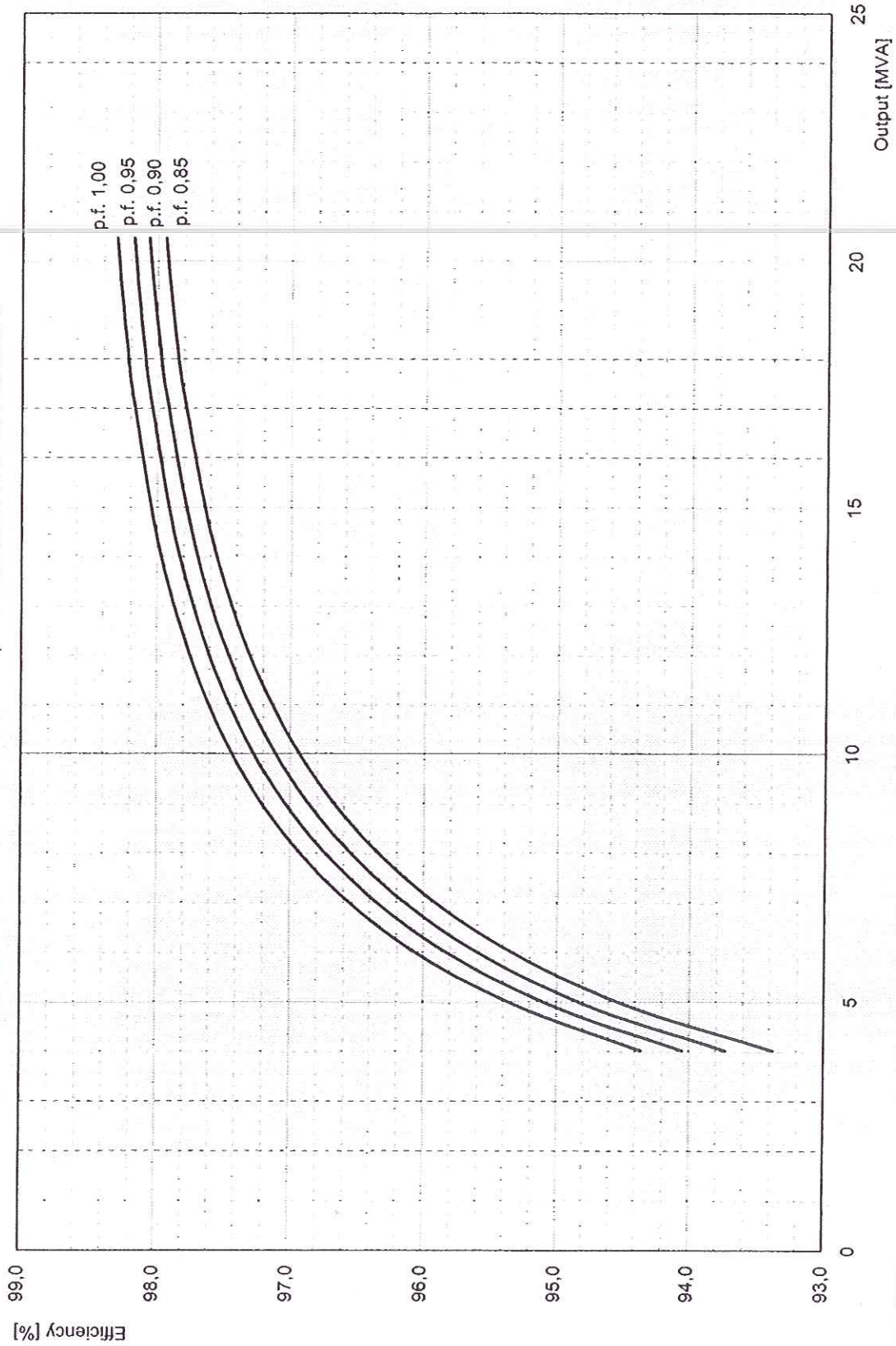


# SYNCHRONOUS GENERATOR EFFICIENCY CURVE



Order no. : 410167	Type : DG165ZI-04	Doc. no. : SPE70390.WGN/8
Ordered by : Dresser Rand	Destination : Tesoro	Curve no. : 8WGN022602/1
		Cooling : IC8A1W7

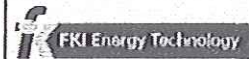
EFFICIENCY CURVE, no tolerance on losses







# SYNCHRONOUS GENERATOR NO-LOAD AND SHORT CIRCUIT

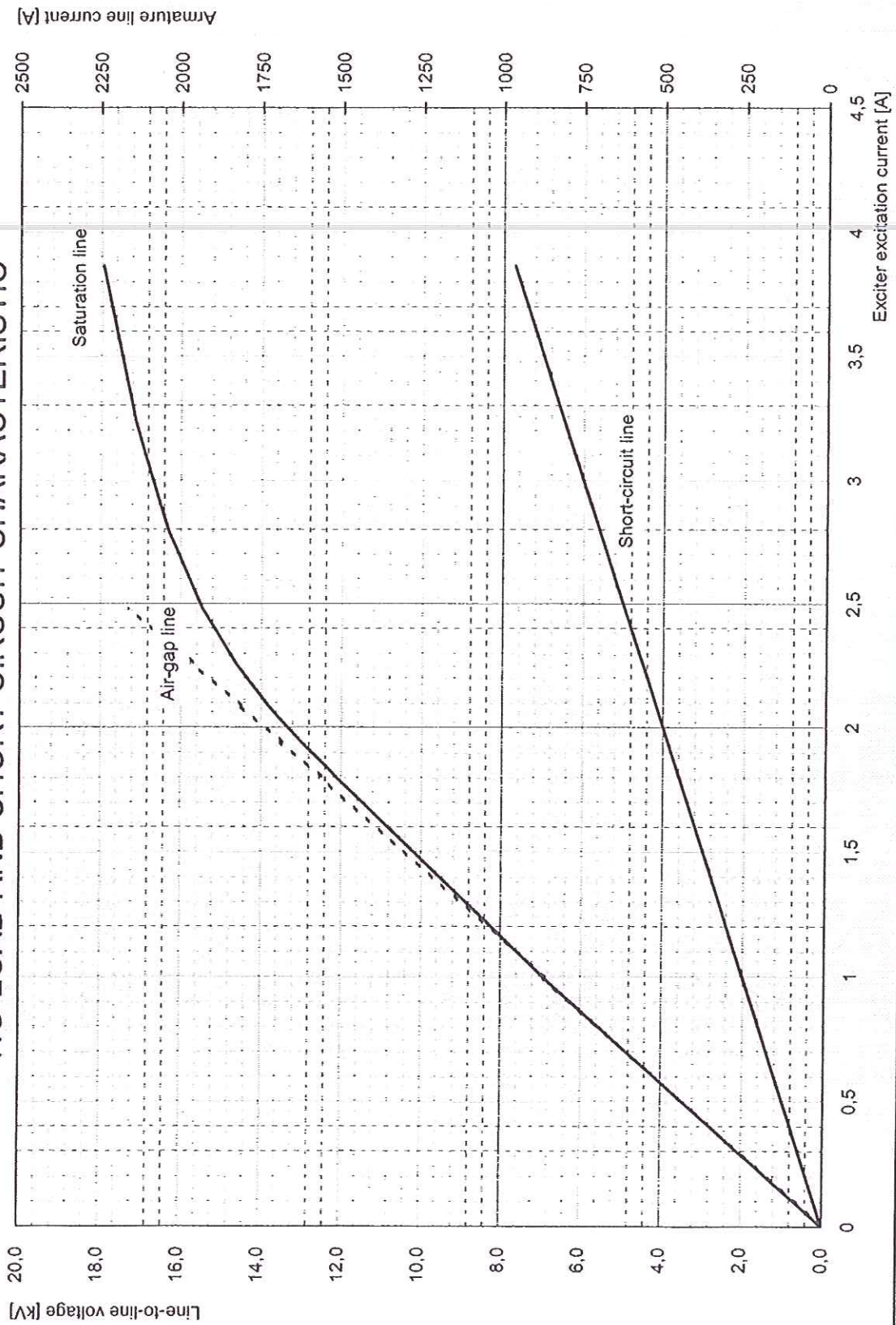


Order no. : 410167  
Ordered by : Dresser Rand

Type : DG165ZI-04  
Destination : Tesoro

Doc. no. : SPE70390.WGN/8  
Curve no. : 8WGN022603/1  
Cooling : IC8A1W7

## NO-LOAD AND SHORT CIRCUIT CHARACTERISTIC





# SYNCHRONOUS GENERATOR OUTPUT CURVE @ B-RISE

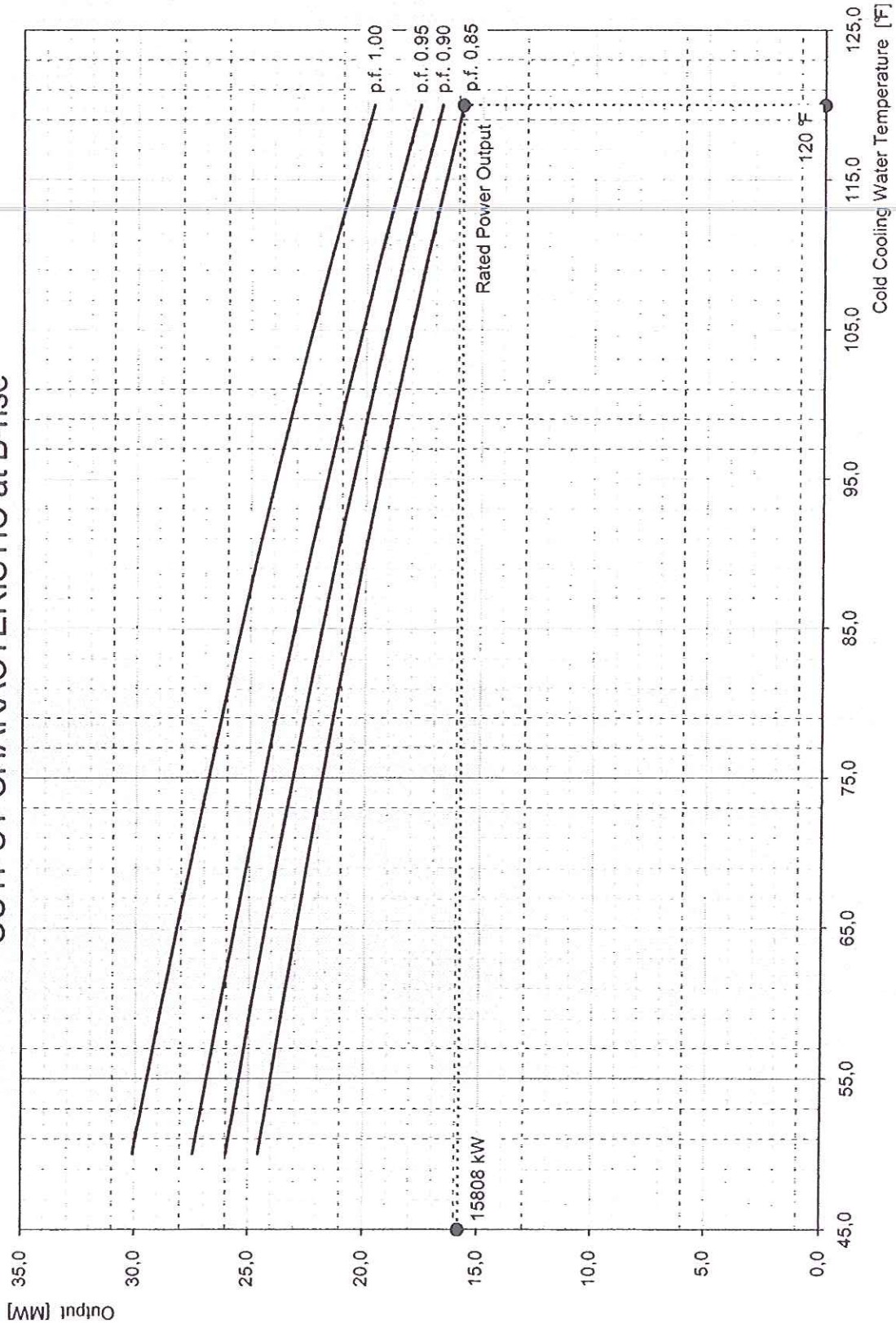


Order no. : 410167  
Ordered by : Dresser Rand

Type : DG165ZI-04  
Destination : Tesoro

Doc. no. : SPE70390.WGN/8  
Curve no. : 8WGN022604/1  
Cooling : IC8A1W7

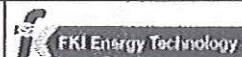
OUTPUT CHARACTERISTIC at B-rise





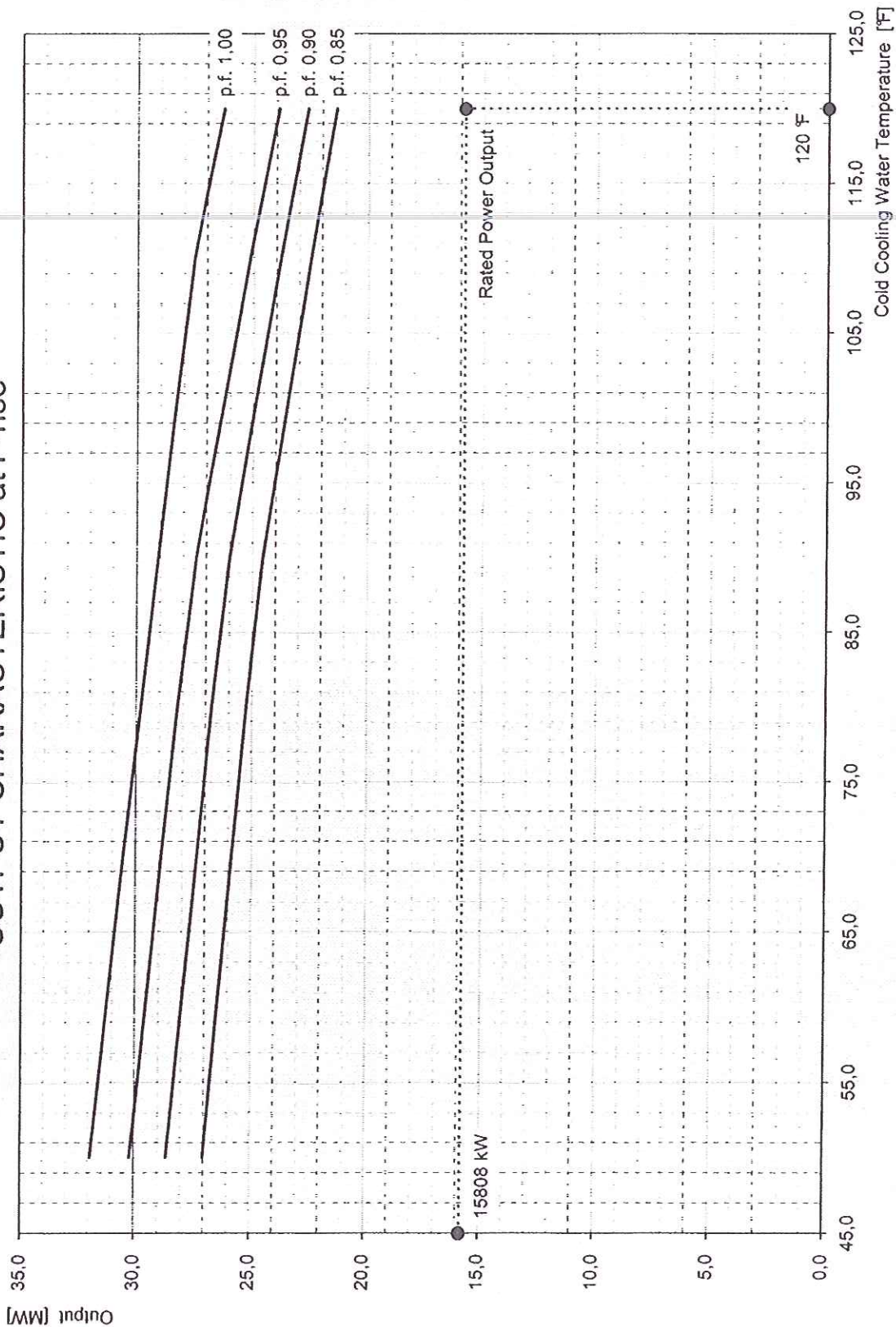


# SYNCHRONOUS GENERATOR OUTPUT CURVE @ F-RISE



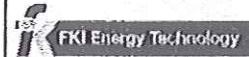
Order no. : 410167	Type : DG165ZI-04	Doc. no. : SPE70390.WGN/8
Ordered by : Dresser Rand	Destination : Tesoro	Curve no. : 8WGN022614/1
		Cooling : IC8A1W7

OUTPUT CHARACTERISTIC at F-rise





# SYNCHRONOUS GENERATOR V-CURVE

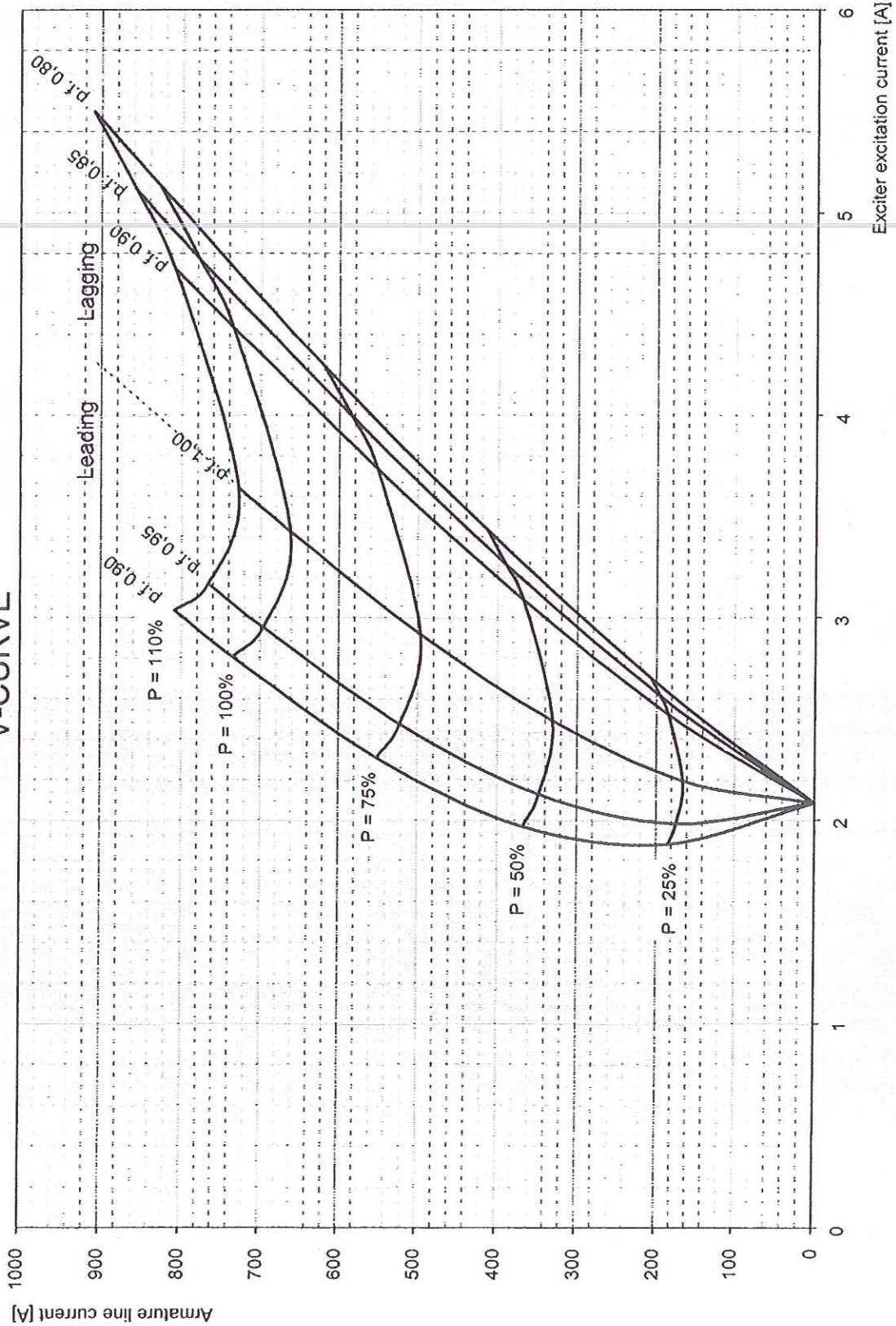


Order no. : 410167  
Ordered by : Dresser Rand

Type : DG165ZI-04  
Destination : Tesoro

Doc. no. : SPE70390.WGN/8  
Curve no. : 8WGN022605/1  
Cooling : IC8A1W7

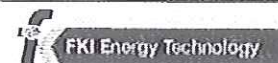
## V-CURVE







**COMPUTER REPRESENTATION  
OF BRUSHLESS  
EXCITATION SYSTEM**



Order no. : 410167

Type : DG165ZI-04

Doc. no. : SPE70390.WGN/8

Ordered by : Dresser Rand

Destination : Tesoro

Sheet no. : 8WGN022606/1

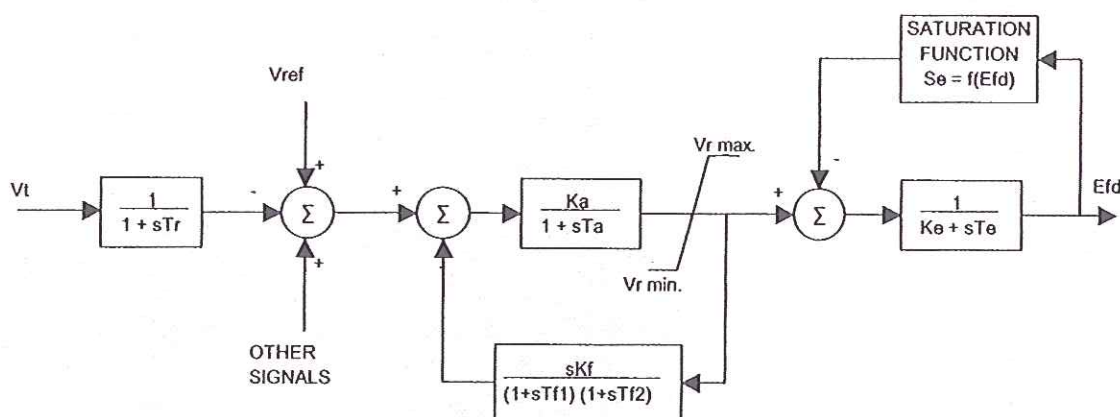
Cooling : IC8A1W7

DGBP60/15

S 18598 kVA  
U 13800 V  
f 60 Hz  
p.f. 0,85

cooling IC8A1W7

Model AC5A to IEEE 421.5-2005



**Exciter Parameters**

VR	1 pu exciter field voltage (no-load)	12 Vdc
Vp <sub>pmg</sub>	PMG output voltage at rated speed at full load	209 Vac
KE	Exciter constant	0,56
TE	Exciter field time constant	0,30 sec
SE75	Exciter saturation parameter	0,77
SE100	Exciter saturation parameter	0,78

**AVR Parameters**

TR	Input smoothing time constant	- single phase PMG - three phase PMG	0,04 sec 0,024 sec
TA	Amplifier time constant		0,02 sec
TF1	Feedback time constant (set to equal TE)		0,30 sec
TF2	Feedback time constant (set to generator on load time constant)		3,3 sec
KA	Amplifier gain (VRMAX / 0.01 VR)		1178
KF	Feedback gain (adjustable)		
VRMIN	Minimum AVR output		0 V
VRMAX	Maximum AVR output (0,64 * Vp <sub>pmg</sub> )		144 V



# SYNCHRONOUS GENERATOR SHORT CIRCUIT DECREMENT CURVE

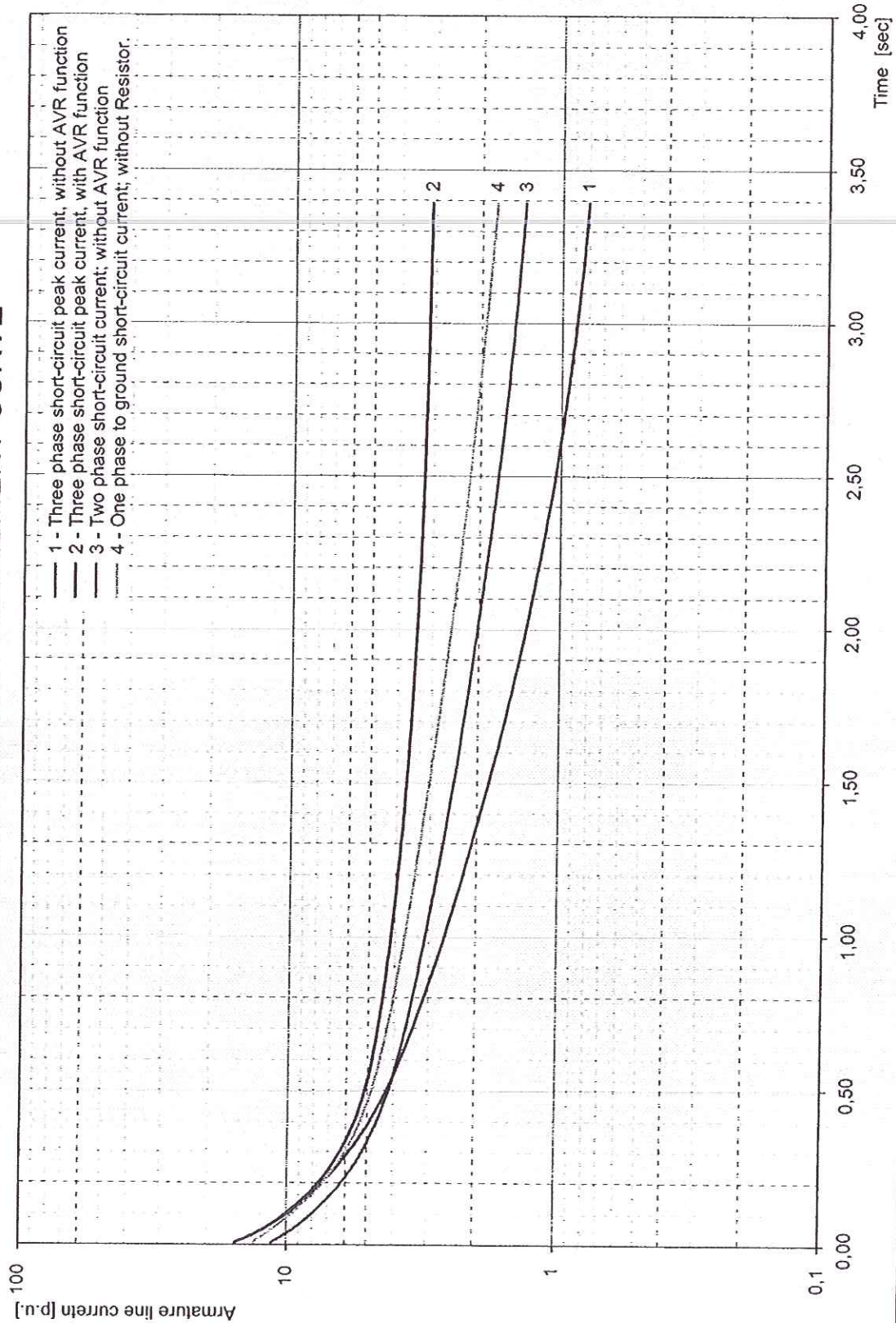


Order no. : 410167  
Ordered by : Dresser Rand

Type : DG165ZI-04  
Destination : Tesoro

Doc. no. : SPE70390.WGN/8  
Curve no. : 8WGN022607/1  
Cooling : IC8A1W7

## SHORT CIRCUIT DECREMENT CURVE







# SYNCHRONOUS GENERATOR VOLTAGE & FREQUENCY DIAGRAM



Order no. : 410167  
Ordered by : Dresser Rand

Type : DG165ZI-04  
Destination : Tesoro

Doc. no. : SPE70390.WGN/8  
Curve no. : 8WGN022609/1  
Cooling : IC8A1W7

## VOLTAGE & FREQUENCY DIAGRAM

