

**GENERAL DESCRIPTION**

1. Standard capacitor values are .15  $\mu$ F, .22  $\mu$ F and .30  $\mu$ F / 1500V.
2. Standard resistor value is 35  $\Omega$  / 20 watt.
3. Specify 240, 520 or 630 Vac MOV's.
4. Mating plug is AMP P.N. 1-480700-0.
5. Material is .093 in. thick G10 epoxy-glass.
6. Creepage distances exceed .40 in. for operation to 600 Vac as specified in UL-508.

**CIRCUIT BOARD DIMENSIONS**

MODEL	L x W x H	MTG CTRS
TSB-1T-01	2.50x5.00x1.20	1.90x4.53
TSB-2T-01	4.40x5.00x1.20	3.80x4.53
TSB-3/6T-02	7.50x5.00x1.20	6.75x4.53
TSB-6/12T-1-2	7.50x6.00x1.20	6.75x5.00

# ENERPRO

**SINGLE BOARD CONNECTORIZED  
SNUBBER CIRCUITS**

Approvals	Date	REV. 2-10-88: ADD TSB-6/12T-2-1	Drawing No. <b>E251</b>
drawn: jpb	4-21-87		
rev. web	2-10-88		

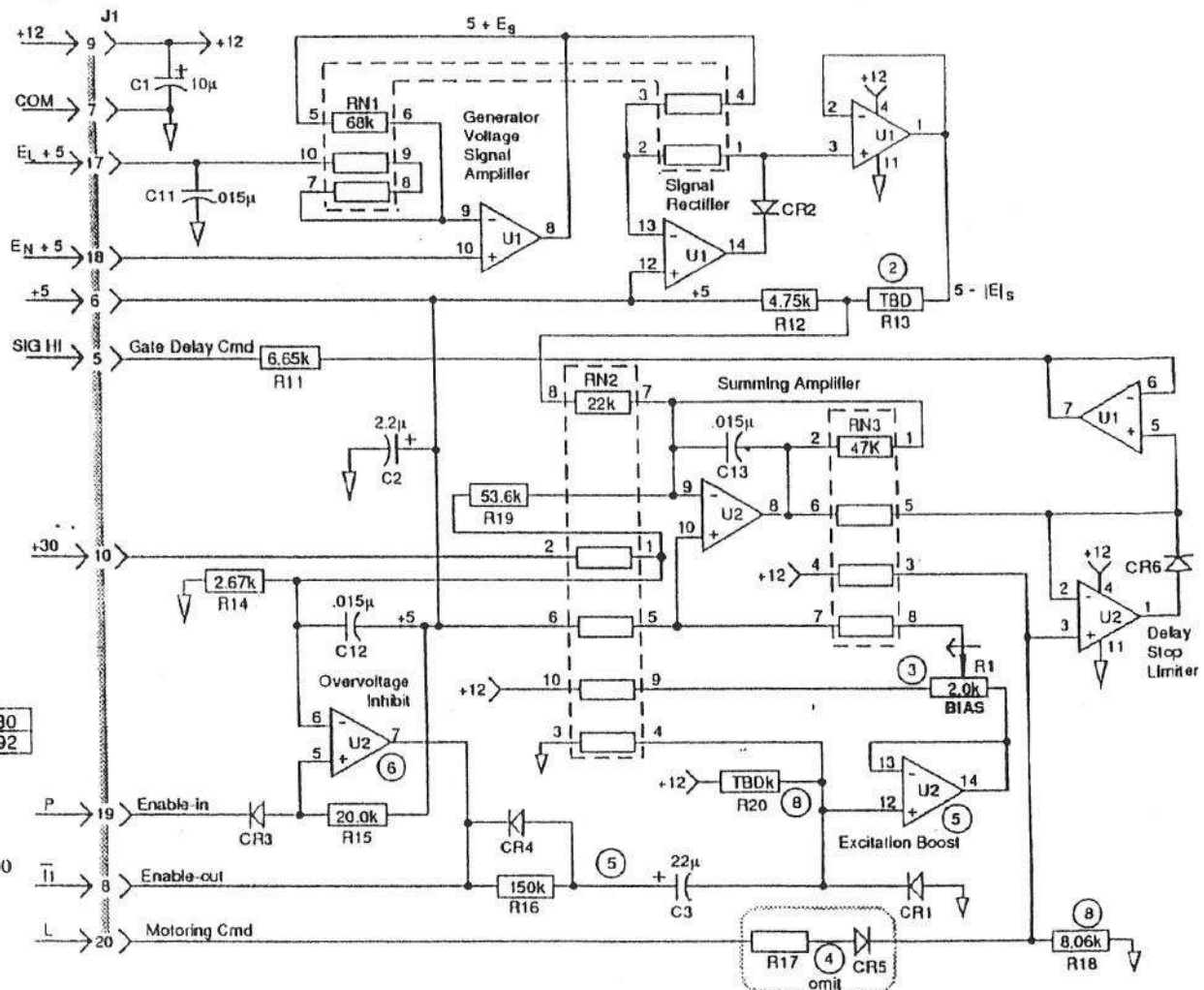
-109-



PART	DESCRIPTION
U1	LM224N
U2	MC34074P
CR1	1N270
CR2-CR4	1N914B
CR5	1N914B (4)
CR6	1N914B
RN1	750-103-R68K
RN2	750-103-R22K
RN3	750-83-R47K
R1	93P-R2K
R11	RN60-8.65K
R12	RN60-4.75K
R13	RN60-TBDk (2)
R14	RN60-2.67K
R15	RN60-20.0K
R16	RN60-150K (5)
R17	RN60-TBDk (4)
R18	RN60-8.06K (8)
R19	RN60-53.6K (8)
R20	RN60-TBD (8)
C1	ECSF16E10
C2	ECSF16E2R2
C3	ECSF16E22 (5)
C11-C13	MKS02-.015μ
J1	103183-8

REVISIONS			
REV	DESCRIPTION	DATE	APPD.
A	Add R19 and R20, change R1 to 1.0k	8-9-91	ljb

J1 connects to J8 on FCOG6100 SCR firing board



**NOTES**

- Generator control connections to FCOG6100 firing board Jack J3: To inhibit generator excitation, connect pin 5(P) to pin 8(com). To enable generator excitation, disconnect pin 5 from pin 8.
- Select R13 as shown in the table below:  

E mains (Vrms)	240	380	420	480	600	680
R13(kohm)	0.0	.442	.536	1.30	2.80	3.92
- Adjust BIAS pot for 95 Vrms zero speed generator excitation with 480 V mains. Increase or decrease excitation in proportion to mains voltage.
- Install R17 and CR5 for optional motoring current control. To motor the generator connect FCOG6100 Jack J3-9 to +12V. Omit FCOG6100 resistor R2
- Excitation Boost circuit increases generator excitation for about 3.0 second when thyristors are enabled. R16 determines the excitation boost level. C3 determines the excitation boost duration.

**NOTES(cont.)**

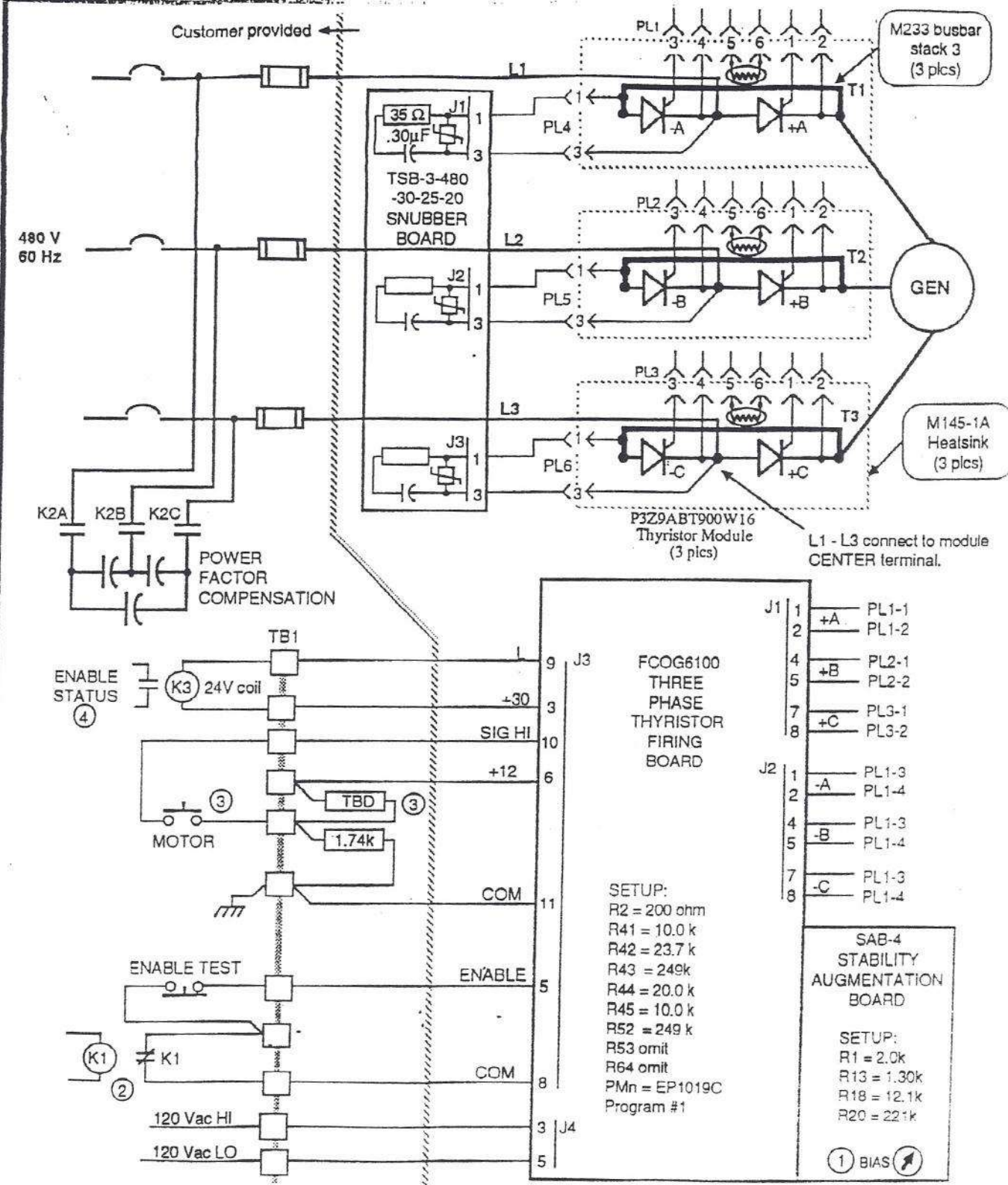
- FCOG6100 firing board parameters:  
 a. R2 = 100Ω, R4-R6 = 200Ω, R41 = 10.0k, R42 = 23.7k, R43 = 130k, R44 = 20.0 k, R52 = 249k, R53 omit, R64 omit.  
 b. Cut +12V trace to J6-19 and J3-5.  
 c. Jumper pads 11 and 14 of U9.
- For use with Torque Limit Board TLB-1: R18 = 12.1k, R20 = 249k, also make R43 = 249k on FCOG6100.

SERIAL NOS.	Cust	R13 value	(kΩ)
	Rating	R17 value	(kΩ)
	Voltage	R18 value	(kΩ)
	Freq.	R20 value	(kΩ)

Ver. 7-24-92

<p><b>ENERPRO</b></p> <p>ASC STABILITY AUGMENTATION BOARD</p>		Part no.	SAB-4
		Dwg. no.	E576

6.11.3 Auto Synchronous Controller



**CONTROLLER SETUP AND OPERATION**

1. Adjust BIAS potentiometer to give 100 Vrms L-L generator voltage at zero speed.
2. Energize relay K1 to open K1A contact and enable thyristors at 1750 rpm. The generator will self-excite and increase its voltage when speed exceeds 1800 rpm.
3. Select resistor value to give desired motoring current with MOTOR switch closed.
4. Enable status contacts close when thyristors are enabled.

CUSTOMER: International Wind Systems  
 Assy. P.N.: PCA-ASC-3x305-64-P3Z9-480-0-E602

<b>ENERPRO</b>	
CONNECTION DIAGRAM: AUTO SYNCHRONOUS CONTROLLER	
12-10-91 cog	E602







6.11.5 General Purpose 3-Phase Firing Circuit

PART	DESCRIPTION
U1	W02M
U2	LM340LAH-12
U3	ULN2004A
U4	EP1011A
U5	LM239N
U6	LM224N
U7	MC34074P
U8	MC14053BCP
U9	MC14077BCP (16)
DN1	MAD1109P
RN1	MDP1403153G
RN2	MSP08A03124G
RN3	MSP08A03473G
RN4	MSP08A01104G
RN5	MSP08A03152G
RN6	MSP08A03154G (16)
CR1-CR2	1N4746A(18V)/1N5241B(11V)
CP1-CP2	PCB-2
PP1	435704-8
J1-J2/P1-P2	640584-1/640582-1
J3/P3	350433-1/1-480708-0
J4/P4	1-350945/350809-1
J5/P5	1-350949-0/1-480763-0
P1-P5 SOCKETS	350689-3 (24-18AWG)
J6/P6	103311-5/499568-4
J7A/P7A	640454-3/640440-3
J7B/P7B	350789-1/350766-1(optional)
J8/P8	640456-8/640440-8
J9/P9	640456-8/640440-8
J10/P10	640454-3/65474-001
C1-C2	470µF 50V ECEA1HV471S
C3	22µF 16V ECSF16E22
C4-C5	2.2µF 16V ECSF16E2R2
C11-C13	MKC4 10% 63V
C21-C28	MKS3 5% 63V/100V
C31-C33	FKC3 5% 160V
C34	MKS02 20% 50V
C35	MKS3 5% 63V
R1	CW2C 300Ω 5%
R2	CW2C (8) 5%
R3	CW2C 10Ω 5%
R4-R6	CW5 200Ω 5%
R31-R39	1/2 W 2.00MΩ 1% RN65D2004F
R41-R67	1/4 W 1% RN60
PD1-PD2/PD3	550-2404 (RED)/550-2204(GRN)
T1	EP1030(120), EP1031(120/240)
T1	EP1032A(240/480) EP1031-1(240)
T1	EP1033B(350)
PM1-PM6	EP1019C

NOTES

- For current signal input select R41 to give SIG III = +5.0 Vdc with maximum signal current.
- Select R42 for desired gate delay span. } consult factory for recommended delay angle limits for a specific application
- Select R43 for desired gate delay bias. }
- Select R44 for desired soft-start time.
- Select R45 for desired soft-stop time.
- Factory selected R46.
- For 50 Hz, install P10 in positions 2 and 3 and change RN2 to 150k
- Select R2 resistance for +24V control voltage.
  - U3-16 = +30 when gating is inhibited
  - U3-16 = +5 when gating is enabled (typical voltages)
- Select PP1 shunts as shown in dwg. E128, sheet 1.
- For off-board phase references:
  - install R37-R39 and J5.
  - omit R31-R33 and T1.
- J7 provided for test reference inputs (J7A) or mains voltage output signals (J7B).
- For gating paralleled SCRs connect FCOAUX60 auxiliary board via cable to J8
- Make +12V connections to J3-4 or to J6-8 to instantly enable SCR gating. The inhibit signal is gated by CK1 to prevent randomly narrow gate pulses
- For four-quadrant six-pulse gating:
  - cut +12V trace to J6-19 and J3-5 labelled "Cut Trace for Bipolar Operation."
  - connect P to +12V to enable "A" bridge.
  - connect P to COM to enable "B" bridge.
  - connect FCOAUX60 board via cable to J8.
- For four-quadrant three-pulse gating:
  - cut +12V trace to J3-5 and J6-19 labelled "Cut Trace for Bipolar Operation."
  - connect jumper JU1 from U4-28 to COM.
  - connect P to +12V to enable +A, +B, +C SCRs.
  - connect P to COM to enable -A, -B, -C SCRs.
- For four quadrant polarity transition inhibit:
  - install U9, RN6, C29, C30 and R65.
  - cut trace from U9-3 to +12V labelled "Cut Trace for Polarity Transition Inhibit."
- For two-quadrant 12-pulse gating:
  - cut +12V trace to J3-5 and J6-19 labelled "Cut Trace for Bipolar Operation."
  - connect jumper from J6-4 to J6-19.
  - change RN5 to 6-pin SIP network.
  - make C27 = .047µF, replace R64 with jumper.
  - connect FCOAUX60 board via cable to J9.
  - open PP1 position 7, close position 3.
- R52 = 150k for 0V < SIG III < 5.0V  
R52 = 249k for .9V < SIG III < 5.9V
- Optional capacitor C35 to reduce the bandwidth of the firing circuit
- Optional 1.50k pullup resistor R66, connect T1 to COM for instant inhibit.
- Install jumper JU4 to -12 when using the 2-60 degree spaced gate pulse profile.

20 Optional speed-up values: C26 = .068µ, C27 = .0022µ, R51 = 28.0k  
R42 = R42' + 14.0k where R42' = standard value of R42

RN60 RESISTORS (kΩ) (22)				MK/FK CAPACITORS(µF) (22)			
R41	NOTE 1	R55	3.01	C11	.33	C31	.0033
R42	NOTE 2	R56	3.01	C12	.33	C32	.00068
R43	NOTE 3	R57	1.00	C13	.33	C33	.0033
R44	NOTE 4	R58	115	C21	.033	C34	.10
R45	NOTE 5	R59	100	C22	.033	C35	(19)
R46	NOTE 6	R60	100	C23	.033		
R47	115	R61	47.5	C24	.033		
R48	100	R62	14.0	C25	.15		
R49	47.5	R63	10.0	C26	.15		
R50	100	R64	20.0	C27	.022		
R51	14.0	R65	.100 (16)	C28	.22		
R52	NOTE 18	R66	NOTE 20	C29	.10 (16)		
R53	32.4	R67	2.00	C30	.68 (16)		
R54	20.0						

Rev. K

<b>ENERPRO</b>			
<b>GENERAL PURPOSE 3Ø FIRING CIRCUIT</b>			
dwg:	lib:	6-6-89	PCB PN FCOG6100
chkd:	web:	6-14-89	
rev:	lib:	6-30-89	
VERSION	1-9-92	Dwg. No.	E128
			Sheet 2 of 2

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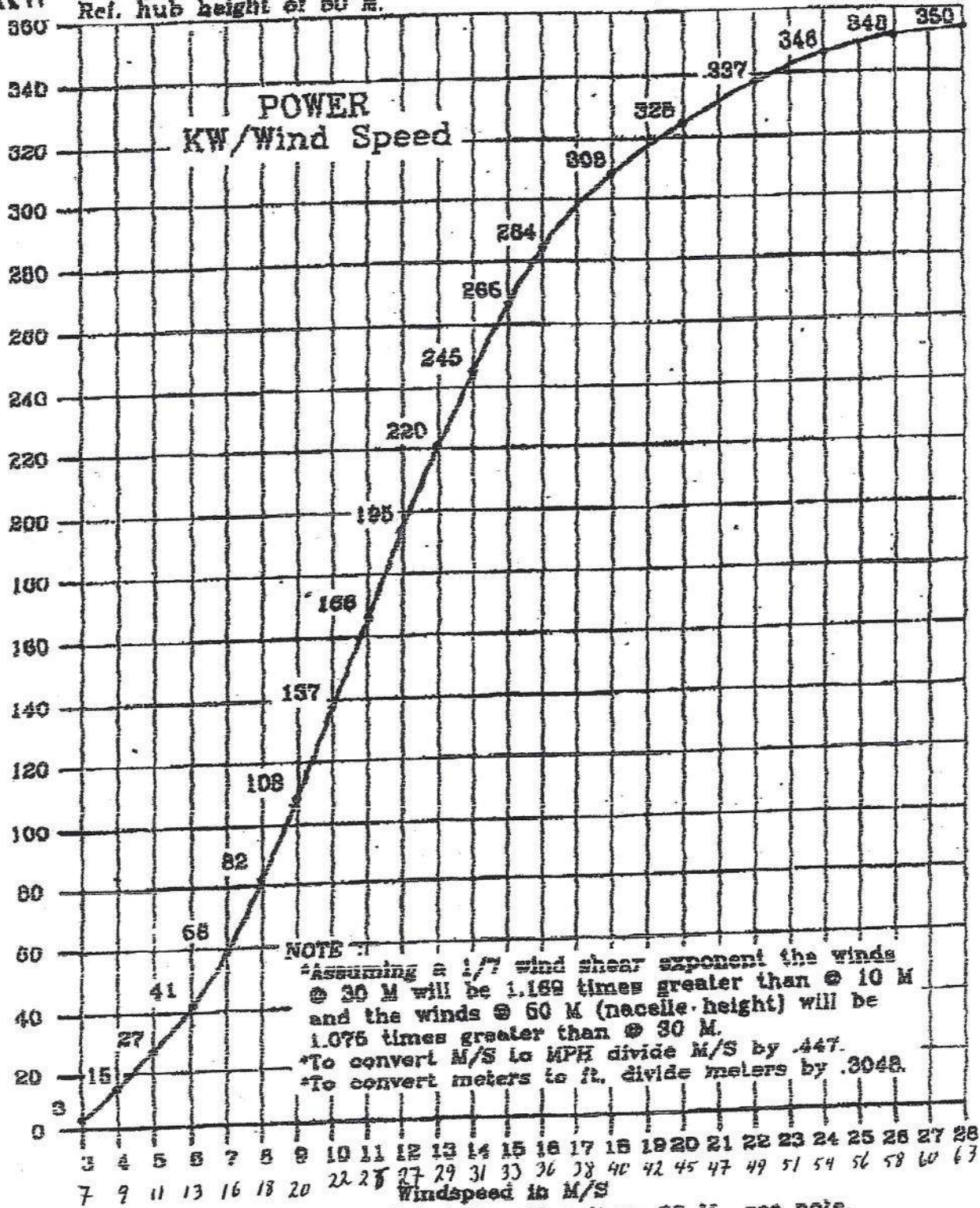
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78' diameter blade

# POWER CURVE CARTER WIND TURBINE MODEL 300

Conditions: Sea level, std. day, smooth level terrain, clean blades  
Windspeed measured at the tower at 30 M above the ground.  
Ref. hub height of 50 M.

KW



**NOTE:**

\*Assuming a 1/7 wind shear exponent the winds @ 30 M will be 1.169 times greater than @ 10 M and the winds @ 50 M (nacelle height) will be 1.076 times greater than @ 30 M.  
\*To convert M/S to MPH divide M/S by .447.  
\*To convert meters to ft. divide meters by .3048.

For windspeeds at heights other than 30 M., see note.