DOCKETED

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Project Title:	Alamitos Energy Center
TN #:	201620-39
Document Title:	AEC AFC Appendix 3A CAISO Study, Correspondence and Proof of Payment
Description:	Previously TN# 201493-12
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Appendix 3A
CAISO Interconnection Study

the power of being global

AES NORTH AMERICA DEVELOPMENT, LLC

March 09, 2012

Dear Ms. Debi Le Vine,

Please find enclosed the required information for the interconnection process associated with redevelopment at the AES Alamitos facility. To the extent that the CAISO or Participating TO find that the total capability or electrical characteristics of the Generating Unit have substantially changed then it is AES' intention to proceed to Cluster 5 and potentially the independent study path.

Specifically the information provided includes the Affidavit stating AES believes the redevelopment does not represent a substantial change and the technical data supplied in Appendix A and its Attachment 1 describing the redevelopment.

Should you require additional information, please do not hesitate to contact me. We appreciate your consideration to this request and further your cooperation to do so in a very timely fashion.

Kind Regards,

Jennifer Didlo
Vice President
AES North America Development, LLC

AFFIDAVIT

This affidavit is being submitted in satisfaction of the requirements in Section 25.1.2 of the CAISO Tariff of the California Independent System Operator Corporation ("CAISO").

1. I, Jennifer Didlo, the undersigned, as a representative of AES North America Development, LLC located at 4300 Wilson Blvd, Arlington, VA, 22203, am authorized to execute this affidavit on behalf of AES North America Development, LLC.

2. AES North America Development, LLC is an affiliate of AES Alamitos, LLC, the legal owner of the AES Alamitos generating facility located at 690 N. Studebaker Road, Long Beach, CA 90803 and connected to the CAISO Controlled Grid.

3. AES North America Development, LLC further represents that it is proceeding with repowering activities at the AES Alamitos generating facility.

4. AES North America Development, LLC further represents that the total generating capacity of any Generating Unit(s) at the AES Alamitos generating facility will not be increased and the electrical characteristics of any Generating Unit(s) will remain substantially unchanged as part of the contemplated repowering activities.

I, Jennifer Didlo, declare under penalty of perjury that the foregoing statements are true to the best of my knowledge.

Signed: ______________________

Print Name: Jennifer Didlo

Title: Vice President

Date: March 9, 2012

AES North America Development, LLC

4300 Wilson Blvd

Arlington, VA 22203

Appendix 1 Interconnection Request
INTERCONNECTION REQUEST

Provide **three copies** of this completed form pursuant to Section 7 of this GIP Appendix 1 below.

1. The undersigned Interconnection Customer submits this request to interconnect its Generating Facility with the CAISO Controlled Grid pursuant to the CAISO Tariff (check one):
   - ☐ Fast Track Process.
   - ☐ Independent Study Process.
   - ☒ Queue Cluster Process.
   - ☐ One-Time Deliverability Assessment pursuant to GIP Section 8.1.
   - ☐ Annual Deliverability Assessment pursuant to GIP Section 8.

2. This Interconnection Request is for (check one):
   - ☐ A proposed new Generating Facility.
   - ☒ An increase in the generating capacity or a Material Modification to an existing Generating Facility.

3. Requested Deliverability Status is for (check one):
   - ☒ Full Capacity (For Independent Study Process and Queue Cluster Process only)
     (Note – Deliverability analysis for Independent Study Process is conducted with the next annual Cluster Study – See GIP Section 4.6)
   - ☐ Energy Only

4. The Interconnection Customer provides the following information:

   a. Address or location, including the county, of the proposed new Generating Facility site or, in the case of an existing Generating Facility, the name and specific location, including the county, of the existing Generating Facility;

   Project Name: **Alamitos Energy Center**

   Project Location:
   Street Address: **690 N Studebaker Rd**
   City, State: **Long Beach, California**
   County: **Los Angeles**
   Zip Code: **90803**
   GPS Coordinates (decimal format):
   Latitude: **33.76926944** Longitude: **-118.1003139**

   b. Maximum net megawatt electrical output (as defined by section 2.c of Attachment A to this appendix) of the proposed new Generating Facility or the amount of net megawatt increase in the generating capacity of an existing Generating Facility;

   Maximum net megawatt electrical output (MW): **1902.867 MW at 85 °F** ***OR***
   Net Megawatt increase (MW):

c. Type of project (i.e., gas turbine, hydro, wind, etc.) and general description of the equipment configuration (if more than one type is chosen include net MW for each);

☐ Cogeneration	(MW)
☐ Reciprocating Engine	(MW)
☐ Biomass	(MW)
☐ Steam Turbine	(MW)
☐ Gas Turbine	(MW)
☐ Wind	(MW)
☐ Hydro	(MW)
☐ Photovoltaic	(MW)
☒ Combined Cycle	**1902.867** (MW)
☐ Other (please describe):	(MW)

General description of the equipment configuration (e.g. number, size, type, etc):
The project is comprised of four CCGT blocks (Block 1, Block 2, Block 3 and Block 4) having a maximun net output of 1902.867 MW @ 85F. Each block is comprised of 3 gas turbines rated at 115.962 MW, 122.065 MVA each and 1 steam turbine rated at 145.148 MW, 152.787 MVA.

d. Proposed In-Service Date (first date transmission is needed to the facility), Trial Operation date and Commercial Operation Date by day, month, and year and term of service (**dates must be sequential**):

Proposed In-Service Date:	**Block 1: 01/01/2017, Block 2: 01/01/2017, Block 3: 01/01/2020, Block 4: 01/01/2023**
Proposed Trial Operation Date:	**Block 1: 06/01/2018, Block 2: 06/01/2018, Block 3: 06/01/2021, Block 4: 06/01/2024**
Proposed Commercial Operation Date:	**Block 1: 01/01/2019, Block 2: 01/01/2019, Block 3: 11/01/2022, Block 4: 11/01/2025**
Proposed Term of Service (years):	**30 years (All blocks)**

e. Name, address, telephone number, and e-mail address of the Interconnection Customer's contact person (primary person who will be contacted);

Name:	**John Kistle**
Title:	**Vice President**
Company Name:	**AES North America Development, LLC**
Street Address:	**690 N. Studebaker Road**
City, State:	**Long Beach, California**
Zip Code:	**90803**
Phone Number:	**(562) 493-7894**
Fax Number:	**(562) 493-7320**
Email Address:	**John.Kistle@AES.com**
DUNS Number:	

f. Approximate location of the proposed Point of Interconnection (i.e., specify transmission facility interconnection point name, voltage level, and the location of interconnection);

230 kV Alamitos Switching Station.

g. Interconnection Customer data (set forth in Attachment A)

The Interconnection Customer shall provide to the CAISO the technical data called for in GIP Appendix 1, Attachment A. Three (3) copies are required.

5. Applicable deposit amount as specified in the GIP made payable to California ISO. Send check to CAISO (see section 7 for details) along with the:
   a. Appendix 1 to GIP (Interconnection Request) for processing.
   b. Attachment A to Appendix 1 (Interconnection Request Generating Facility Data).

6. Evidence of Site Exclusivity as specified in the GIP and name(s), address(es) and contact information of site owner(s) (check one): **Current Title Report is available upon request.**

   Site is an existing generating facility, wholly owned by AES.
   Plant Manager: Weikko Wirta
   690 N. Studebaker Rd.
   Long Beach, CA 90803
   562-493-7831

   ☒ Is attached to this Interconnection Request
   ☐ Deposit in lieu of Site Exclusivity attached, Site Exclusivity will be provided at a later date in accordance with this GIP

7. This Interconnection Request shall be submitted to the CAISO representative indicated below:

   New Resource Interconnection
   California ISO
   P.O. Box 639014
   Folsom, CA 95763-9014

   Overnight address: California ISO, Attn: Grid Assets, 250 Outcropping Way, Folsom, CA 95630

8. Representative of the Interconnection Customer to contact:

Name:	**Hala Ballouz, PE**
Title:	**President**
Company Name:	**Electric Power Engineers, Inc. (EPE)**
Street Address:	**9433 Bee Caves Road, Building 3, Suite 210**
City, State:	**Austin, Texas**
Zip Code:	**78733**
Phone Number:	**(512) 382-6700**
Fax Number:	**(866) 379-3635**
Email Address:	**hballouz@epeconsulting.com**

9. This Interconnection Request is submitted by: **AES North America Development, LLC**

   Legal name of the Interconnection Customer: **AES North America Development, LLC**

   By (signature): ____________________

   Name (type or print): **John Kistle**

   Title: **Vice President**

   Date: **9 March, 2012**

Attachment A Generating Facility Data
To GIP Appendix 1
Interconnection Request

GENERATING FACILITY DATA

Provide three copies of this completed form pursuant to Section 7 of GIP Appendix 1.

All drawings provided herein as PDFs are also available electronically upon request.

1. **Provide two original prints and one reproducible copy (no larger than 36" x 24") of the following:**

   A. Site drawing to scale, showing generator location and Point of Interconnection with the CAISO Controlled Grid.
   B. Single-line diagram showing applicable equipment such as generating units, step-up transformers, auxiliary transformers, switches/disconnects of the proposed interconnection, including the required protection devices and circuit breakers. For wind and photovoltaic generator plants, the one line diagram should include the distribution lines connecting the various groups of generating units, the generator capacitor banks, the step up transformers, the distribution lines, and the substation transformers and capacitor banks at the Point of Interconnection with the CAISO Controlled Grid.

2. **Generating Facility Information**
   A. Total Generating Facility rated output (MW): **Gross: 1972.135 MW at 85 °F and 95% PF**
   B. Generating Facility auxiliary Load (MW): **69.268 MW at 85 °F**
   C. Project net capacity (A-B)(MW): **1902.867 MW at 85 °F and 95% PF**
   D. Standby Load when Generating Facility is off-line (MW): **1.1**
   E. Number of Generating Units: **4 blocks (each composed of 3 gas turbines and 1 steam turbine)**
   (Please repeat the following items for each generator)
   F. Individual generator rated output (MW for each unit):
   Gas: 115.962 MW at 38.8°C rated coolant inlet temperature.
   Steam: 145.148 MW at 38.8°C rated coolant inlet temperature.
   G. Manufacturer: **BRUSH (for all generators)**
   H. Year Manufactured: _____
   I. Nominal Terminal Voltage (kV): **13.8 (for all generators)**
   J. Rated Power Factor (%):**0.95 (for all generators)**
   K. Type (Induction, Synchronous, D.C. with Inverter): **Synchronous (for all generators)**
   L. Phase (three phase or single phase): **Three Phase (for all generators)**
   M. Connection (Delta, Grounded WYE, Ungrounded WYE, impedance grounded):
   Impedance grounded
   N. Generator Voltage Regulation Range (+/- %):
   Gas: +/- 10%,
   Steam: Selectable from +/- 10% to +/- 25%.
   O. Generator Power Factor Regulation Range:
   Gas: -0.7 to +0.7,
   Steam: -0.95 to +0.85
   P. For combined cycle plants, specify the plant net output capacity (MW) for an outage of the steam turbine or an outage of a single combustion turbine **1439.019 MW at 85 °F and 95% PF for an outage of a single combustion turbine from each block**

3. Synchronous Generator – General Information:
(Please repeat the following for each generator model)

A. Rated Generator speed (rpm): **3600 (for all generators)**

B. Rated MVA:
Gas: 122.065 MVA each,
Steam: 152.787 MVA each

C. Rated Generator Power Factor: **0.95 (for all generators)**

D. Generator Efficiency at Rated Load (%):
Gas: 98.62% each
Steam: 98.67% each

E. Moment of Inertia (including prime mover):
42,707 kgm2 for each Gas Turbine + Generator.
6102 kgm2 for each Steam Turbine + Generator.

F. Inertia Time Constant (on machine base) H:
1.28 kW sec/kVA for each gas turbine generator,
1.09 kW sec/kVA for each steam turbine generator sec or MJ/MVA

G. SCR (Short-Circuit Ratio - the ratio of the field current required for rated open-circuit voltage to the field current required for rated short-circuit current): **Gas: 0.53 each, Steam: 0.49 each**

H. Please attach generator reactive capability curves.

I. Rated Hydrogen Cooling Pressure in psig (Steam Units only): _____

J. Please attach a plot of generator terminal voltage versus field current that shows the air gap line, the open-circuit saturation curve, and the saturation curve at full load and rated power factor.

4. Excitation System Information
(Please repeat the following for each generator model)

A. Indicate the Manufacturer **Gas: ABB inc., Steam: Brush** and Type **Gas: UNITROL 6000, Steam: Brushless** of excitation system used for the generator. For exciter type, please choose from 1 to 9 below or describe the specific excitation system.

☐ (1) Rotating DC commutator exciter with continuously acting regulator. The regulator power source is independent of the generator terminal voltage and current.

☐ (2) Rotating DC commentator exciter with continuously acting regulator. The regulator power source is bus fed from the generator terminal voltage.

☐ (3) Rotating DC commutator exciter with non-continuously acting regulator (i.e., regulator adjustments are made in discrete increments).

☐ (4) Rotating AC Alternator Exciter with non-controlled (diode) rectifiers. The regulator power source is independent of the generator terminal voltage and current (not bus-fed).

☐ (5) Rotating AC Alternator Exciter with controlled (thyristor) rectifiers. The regulator power source is fed from the exciter output voltage.

☐ (6) Rotating AC Alternator Exciter with controlled (thyristor) rectifiers.

☐ (7) Static Exciter with controlled (thyristor) rectifiers. The regulator power source is bus-fed from the generator terminal voltage.

☐ (8) Static Exciter with controlled (thyristor) rectifiers. The regulator power source is bus-fed from a combination of generator terminal voltage and current (compound-source controlled rectifiers system.

☒ (9) Other (specify):
Steam: as in #1 above.
Gas: Static Exciter with controlled (thyristors) rectifiers. The main power source for the Exciter is fed from an AC auxilliary source through a step down transformer

B. Attach a copy of the block diagram of the excitation system from its instruction manual. The diagram should show the input, output, and all feedback loops of the excitation system.

C. Excitation system response ratio (ASA):
Gas: 180% Ceiling Voltage; Steam: 2.4

D. Full load rated exciter output voltage: **Gas: 145 VDC (Based on Generator Field Data provided); Steam: 174 VDC**

E. Maximum exciter output voltage (ceiling voltage): **Gas: 263 VDC (Based on 180% Ceiling voltage requirement); Steam: 365 VDC**

F. Other comments regarding the excitation system?

5. Power System Stabilizer Information

(Please repeat the following for each generator model. All new generators are required to install PSS unless an exemption has been obtained from WECC. Such an exemption can be obtained for units that do not have suitable excitation systems.)

A. Manufacturer: **Gas: ABB; Steam: Brush**

B. Is the PSS digital or analog? **Gas: Digital; Steam: Digital**

C. Note the input signal source for the PSS:
☐ Bus frequency ☐ Shaft speed ☐ Bus Voltage
☒ Other (specify source):
Gas: Three phase generator CT's (Current Measurement);
Steam: Active Electrical Power Frequency & Generator Internal Voltage. Both inputs derived from sensing transformer signals.

D. Please attach a copy of a block diagram of the PSS from the PSS Instruction Manual and the correspondence between dial settings and the time constants or PSS gain.

E: Other comments regarding the PSS?

6. Turbine-Governor Information

(Please repeat the following for each generator model)

Please complete Part A for steam, gas or combined-cycle turbines, Part B for hydro turbines, and Part C for both.

A. Steam, gas or combined-cycle turbines:

(1) List type of unit (Steam, Gas, or Combined-cycle): **4 x Combined-cycle blocks (3 x Gas and 1 x Steam per block)**

(2) If steam or combined-cycle, does the turbine system have a reheat process (i.e., both high and low pressure turbines)? **Non- Reheat**

(3) If steam with reheat process, or if combined-cycle, indicate in the space provided, the percent of full load power produced by each turbine:
Low pressure turbine or gas turbine: _____%
High pressure turbine or steam turbine: _____%

B. Hydro turbines:

(1) Turbine efficiency at rated load: _____%
(2) Length of penstock: _____ft
(3) Average cross-sectional area of the penstock: _____ft2
(4) Typical maximum head (vertical distance from the bottom of the penstock, at the gate, to the water level): _____ft
(5) Is the water supply run-of-the-river or reservoir: _____

(6) Water flow rate at the typical maximum head: _____ft3/sec
(7) Average energy rate: _____kW-hrs/acre-ft
(8) Estimated yearly energy production: _____kW-hrs

C. Complete this section for each machine, independent of the turbine type.

(1) Turbine manufacturer: **MHI for both Gas and Steam**
(2) Maximum turbine power output: _____MW
(3) Minimum turbine power output (while on line): _____MW
(4) Governor information:
   (a) Droop setting (speed regulation): **Gas: 4%, Steam: >4%**
   (b) Is the governor mechanical-hydraulic or electro-hydraulic (Electro-hydraulic governors have an electronic speed sensor and transducer.)? **Electro-Hydraulic for both Gas and Steam**
   (c) Other comments regarding the turbine governor system? _____

7. Induction Generator Data:

A. Rated Generator Power Factor at rated load: _____
B. Moment of Inertia (including prime mover): _____
C. Do you wish reclose blocking? ☐Yes ☐No
Note: Sufficient capacitance may be on the line now, or in the future, and the generator may self-excite unexpectedly.

8. Generator Short Circuit Data
For each generator model, provide the following reactances expressed in p.u. on the generator base:

- X"1 – positive sequence subtransient reactance: **Gas: 0.121, Steam: 0.14** p.u**
- X2 – negative sequence reactance: **Gas: 0.15, Steam: 0.182** p.u**
- X0 – zero sequence reactance: **Gas: 0.082, Steam: 0.091** p.u**

Generator Grounding (select 1 for each model):

A. ☐ Solidly grounded
B. ☒ Grounded through an impedance
Impedance value in p.u on generator base
R: **614.66 on 100 MVA base (for all generators)** p.u.
X: **249.95 on 100 MVA base (for all generators)** p.u.
C. ☐ Ungrounded

9. Step-Up Transformer Data

For each step-up transformer, fill out the data form provided in Table 1.

10. Interconnection Facilities Line Data
There is no need to provide data for new lines that are to be planned by the Participating TO. However, for transmission lines that are to be planned by the generation developer, please provide the following information:

Nominal Voltage: **230**kV
Line Length: **Block 1: Two 3-phase lines, 0.26 miles each**
Block 2: Two 3-phase lines, 0.05 miles each
Block 3: Two 3-phase lines, 0.46 miles each

Line termination Points: _____
Conductor Type: **ACSR** Size: **1033.5 kcmil**
If bundled. Number per phase: _____, Bundle spacing: _____in.
Phase Configuration. Vertical: **X**, Horizontal: _____
Phase Spacing: A-B: **15**ft., B-C: **15**ft., C-A: **30**ft.
Distance of lowest conductor to Ground at full load and 40°C: **44.8** ft
Ground Wire Type: **AW** Size: **313.7** Distance to Ground: **49** ft
Attach Tower Configuration Diagram
Summer line ratings in amperes (normal and emergency) **Normal: 1001.5 Amps (x 2; two 3-phase lines); Emergency: 1057.5 Amps (x 2; two 3-phase lines)**
Positive Sequence Resistance (R): **Block 1: 0.000045; Block 2: 0.000009, Block 3: 0.00079, Block 4: 0.000034** p.u.** (for entire line length)
Positive Sequence Reactance: (X): **Block 1: 0.000364; Block 2: 0.000070, Block 3: 0.000645, Block 4: 0.000280** p.u**(for entire line length)
Zero Sequence Resistance (R0): **Block 1: 0.000186; Block 2: 0.000036, Block 3: 0.000328, Block 4: 0.000143** p.u.** (for entire line length)
Zero Sequence Reactance: (X0): **Block 1: 0.001258; Block 2: 0.000242, Block 3: 0.002225, Block 4: 0.000968** p.u** (for entire line length)
Line Charging (B/2): **Block 1: 0.00039331; Block 2: 0.000075636, Block 3: 0.00069585, Block 4: 0.00030254** p.u**
** On 100-MVA and nominal line voltage (kV) Base

10a. For Wind/photovoltaic plants, provide collector System Equivalence Impedance Data Provide values for each equivalence collector circuit at all voltage levels.

Nominal Voltage: _____
Summer line ratings in amperes (normal and emergency) _____
Positive Sequence Resistance (R1): _____ p.u. ** (for entire line length of each collector circuit)
Positive Sequence Reactance: (X1): _____ p.u** (for entire line length of each collector circuit)
Zero Sequence Resistance (R0): _____ p.u. ** (for entire line length of each collector circuit)
Zero Sequence Reactance: (X0): _____ p.u** (for entire line length of each collector circuit)
Line Charging (B/2): _____ p.u** (for entire line length of each collector circuit)
** On 100-MVA and nominal line voltage (kV) Base

11. Wind Generators

Number of generators to be interconnected pursuant to this Interconnection Request: _____

Average Site Elevation: _____ ☐Single Phase ☐Three Phase

Inverter manufacturer, model name, number, and version:

_____

List of adjustable set points for the protective equipment or software:

_____
Field Volts: _____
Field Amperes: _____
Motoring Power (MW): _______
Neutral Grounding Resistor (If Applicable): _____
I22t or K (Heating Time Constant): _____
Rotor Resistance: _____
Stator Resistance: _____
Stator Reactance: _____
Rotor Reactance: _____

Magnetizing Reactance: _____
Short Circuit Reactance: _____
Exciting Current: _____
Temperature Rise: _____
Frame Size: _____
Design Letter: _____
Reactive Power Required In Vars (No Load): _____
Reactive Power Required In Vars (Full Load): _____
Total Rotating Inertia, H: _____ Per Unit on 100 MVA Base

Note: A completed General Electric Company Power Systems Load Flow (PSLF) data sheet must be supplied with the Interconnection Request. If other data sheets are more appropriate to the proposed device then they shall be provided and discussed at Scoping Meeting.

12. Load Flow and Dynamic Models:

Provide load flow model for the generating plant and its interconnection facilities in GE PSLF *.epc format, including new buses, generators, transformers, interconnection facilities. An equivalent model is required for the plant with generation collector systems. This data should reflect the technical data provided in this Attachment A.

For each generator, governor, exciter and power system stabilizer, select the appropriate dynamic model from the General Electric PSLF Program Manual and provide the required input data. The manual is available on the GE website at www.gepower.com. Select the following links within the website: 1) Our Businesses, 2) GE Power Systems, 3) Energy Consulting, 4) GE PSLF Software, 5) GE PSLF User's Manual. **Include any user written *.p EPCL files to simulate inverter based plants' dynamic responses (typically needed for inverter based PV/wind plants). Provide a completed *.dyd file that contains the information specified in this section.**

There are links within the GE PSLF User's Manual to detailed descriptions of specific models, a definition of each parameter, a list of the output channels, explanatory notes, and a control system block diagram. The block diagrams are also available on the CAISO Website.

If you require assistance in developing the models, we suggest you contact General Electric. Accurate models are important to obtain accurate study results. Costs associated with any changes in facility requirements that are due to differences between model data provided by the generation developer and the actual generator test data, may be the responsibility of the generation developer.

TABLE 1

TRANSFORMER DATA
(Provide for each level of transformation)

UNIT **Gas Generators (12 Identical Generators, 3 per Block)**

NUMBER OF TRANSFORMERS **1 per Gas Generator** PHASE **Three**

RATING	H Winding	X Winding	Y Winding
Rated MVA	**75/99/123**	**75/99/123**	_____
Connection (Delta, Wye, Gnd.)	**Wye Grounded**	**Delta**	_____
Cooling Type (OA,OA/FA, etc) :	**ONAN/ONAF/ONAF**	**ONAN/ONAF/ONAF**	_____
Temperature Rise Rating	**65 °C**	**65 °C**	_____
Rated Voltage	**230**	**13.8**	_____
BIL	**900**	**95**	_____
Available Taps (% of rating)	**+/- 10%**	**N/A**	_____
Load Tap Changer? (Y or N)	**Y**	**N**	_____
Tap Settings		**N/A**	_____
IMPEDANCE	**H-X**	**H-Y**	**X-Y**
Percent	**10%**	_____	_____
MVA Base	**73**	_____	_____
Tested Taps	_____	_____	_____
WINDING RESISTANCE	**H**	**X**	**Y**
Ohms	_____	_____	_____

CURRENT TRANSFORMER RATIOS

H_____ X_____ Y_____ N_____

Percent exciting current at 100% Voltage _____ 110% Voltage _____

Supply copy of nameplate and manufacture's test report when available

TABLE 1

TRANSFORMER DATA
(Provide for each level of transformation)

UNIT **Steam Generators (4 Identical Generators, 1 per Block)**

NUMBER OF TRANSFORMERS **1 per Steam Generator** PHASE **Three**

RATING	H Winding	X Winding	Y Winding
Rated MVA	**93/123/153**	**93/123/153**	_____
Connection (Delta, Wye, Gnd.)	**Wye Grounded**	**Delta**	_____
Cooling Type (OA,OA/FA, etc) :	**ONAN/ONAF/ONAF**	**ONAN/ONAF/ONAF**	_____
Temperature Rise Rating	**65 °C**	**65 °C**	_____
Rated Voltage	**230**	**13.8**	_____
BIL	**900**	**95**	_____
Available Taps (% of rating)	**+/- 10%**	**N/A**	_____
Load Tap Changer? (Y or N)	**Y**	**N**	_____
Tap Settings		**N/A**	_____
IMPEDANCE	**H-X**	**H-Y**	**X-Y**
Percent	**10%**	_____	_____
MVA Base	**93**	_____	_____
Tested Taps	_____	_____	_____
WINDING RESISTANCE	**H**	**X**	**Y**
Ohms	_____	_____	_____

CURRENT TRANSFORMER RATIOS

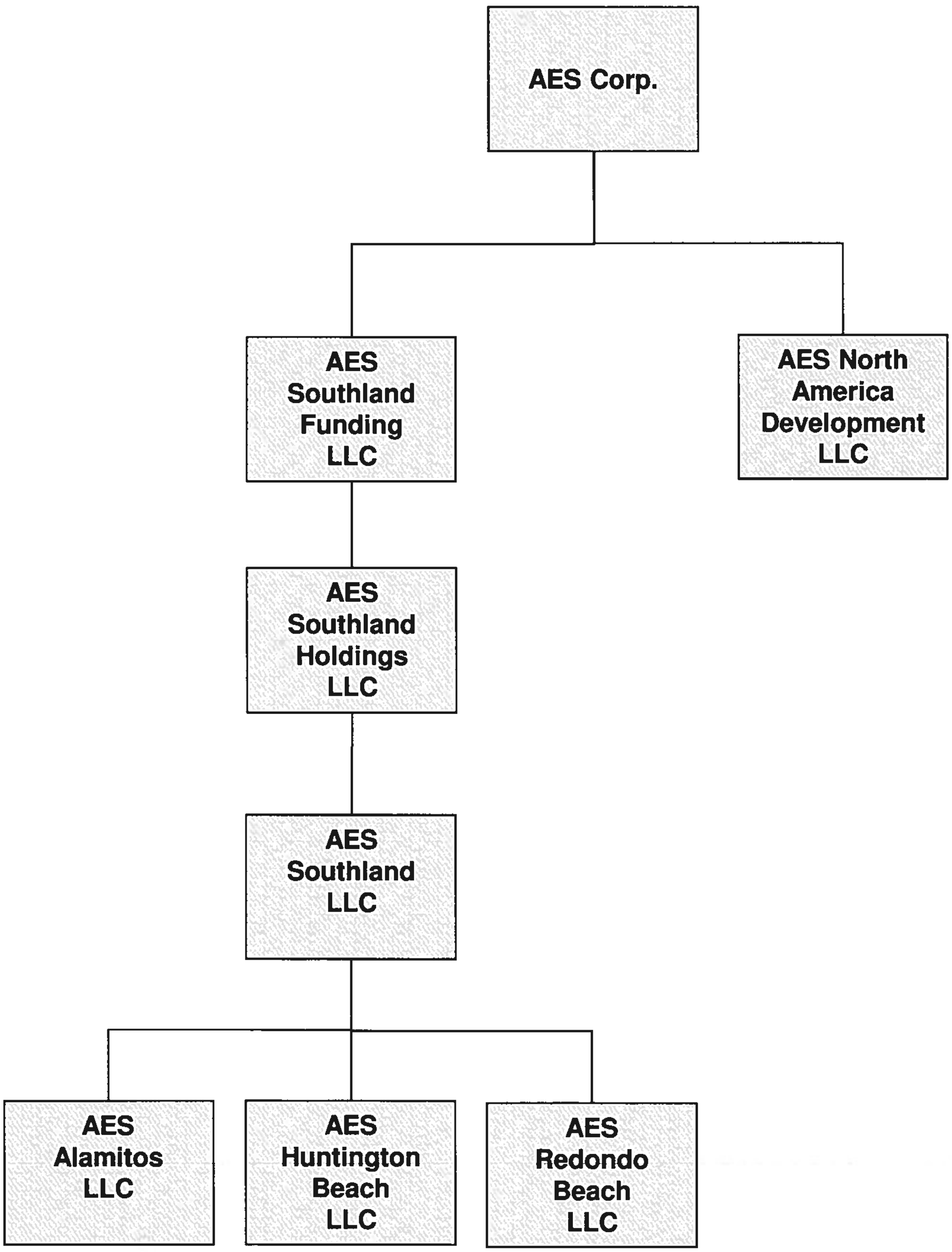
H_____ X_____ Y_____ N_____

Percent exciting current at 100% Voltage _____ 110% Voltage _____

Supply copy of nameplate and manufacture's test report when available

AES Legal Structure

March 9, 2012



BRUSH

ELECTRICAL DATA SHEET

Falcon Works, Nottingham Road, Loughborough, Leics. LE11 1EX, England
Telephone: +44 (0) 1509 611511 Fax: +44 (0) 1509 610440 E-mail: salesuk@brush.eu

1. RATING DETAILS

1.1	Frame size	YDAX 8-400ER
1.2	Terminal voltage	13.80 kV
1.3	Frequency	60 Hz
1.4	Speed	3600 rev/min
1.5	Power factor	0.850
1.6	Applicable national standard	IEEE C50.13
1.7	Rated air inlet temperature	15.0 °C
1.8	Rated output	120.700MW, 142.000 MVA

2. PERFORMANCE CURVES

2.1	Output vs air inlet temperature	H.E.P. 31216
2.2	Generator capability diagram	H.E.P. 31217
2.3	Efficiency vs output	H.E.P. 31218
2.4	Open and short circuit curves	H.E.P. 31219
2.5	Permitted duration of negative sequence current	H.E.P. 1216

3. REACTANCES

3.1	Direct axis synchronous reactance, Xd(i)	251 %
3.2	Direct axis saturated transient reactance, X'd(v)	20.1 % ± 15 %
3.3	Direct axis saturated sub transient reactance, X"d(v)	14.4 % ± 15 %
3.4	Unsaturated negative sequence reactance, X2(i)	17.7 %
3.5	Unsaturated zero sequence reactance, X0(i)	9.7 %
3.6	Quadrature axis synchronous reactance Xq(i)	229 %
3.7	Quadrature axis saturated transient reactance X'q(v)	24 %
3.8	Quadrature axis saturated sub transient reactance X"q(v)	17 %
3.9	Short circuit ratio	0.45

Notes:

Date: 24-Aug-2011

1. The electrical details provided are calculated values. Unless otherwise stated, all values are subject to tolerances as given in the relevant national standards.

I.D.: OPP01562C1

BRUSH

ELECTRICAL DATA SHEET - CONTINUATION

YDAX 8-400ER, 120.700 MW, 0.850 pf, 13.80 kV, 60 Hz

4. RESISTANCES AT 20°C

4.1	Rotor resistance	0.070 ohms
4.2	Stator resistance per phase	0.0012 ohms

5. TIME CONSTANTS AT 20°C

5.1	Transient O.C. time constant, T'_{do}	13.1 seconds
5.2	Transient S.C. time constant, T'_{d}	0.84 seconds
5.3	Sub transient O.C. time constant T''_{do}	0.05 seconds
5.4	Sub transient S.C. time constant, T''_{d}	0.04 seconds

6. INERTIA

6.1	Moment of inertia, WR^2 (See note 2)	2157 $Kg.m^2$
6.2	Inertia constant, H	1.08 kW.secs/kVA

7. CAPACITANCE

7.1	Capacitance per phase of stator winding to earth	0.40 microfarad

8. EXCITATION

8.1	Excitation current at no load, rated voltage	540 amps
8.2	Excitation voltage at no load, rated voltage	38 volts
8.3	Excitation current at rated load and P.F.	1664 amps
8.4	Excitation voltage at rated load and P.F.	145 volts
8.5	Inherent voltage regulation, F.L. to N.L.	35 %

Notes:

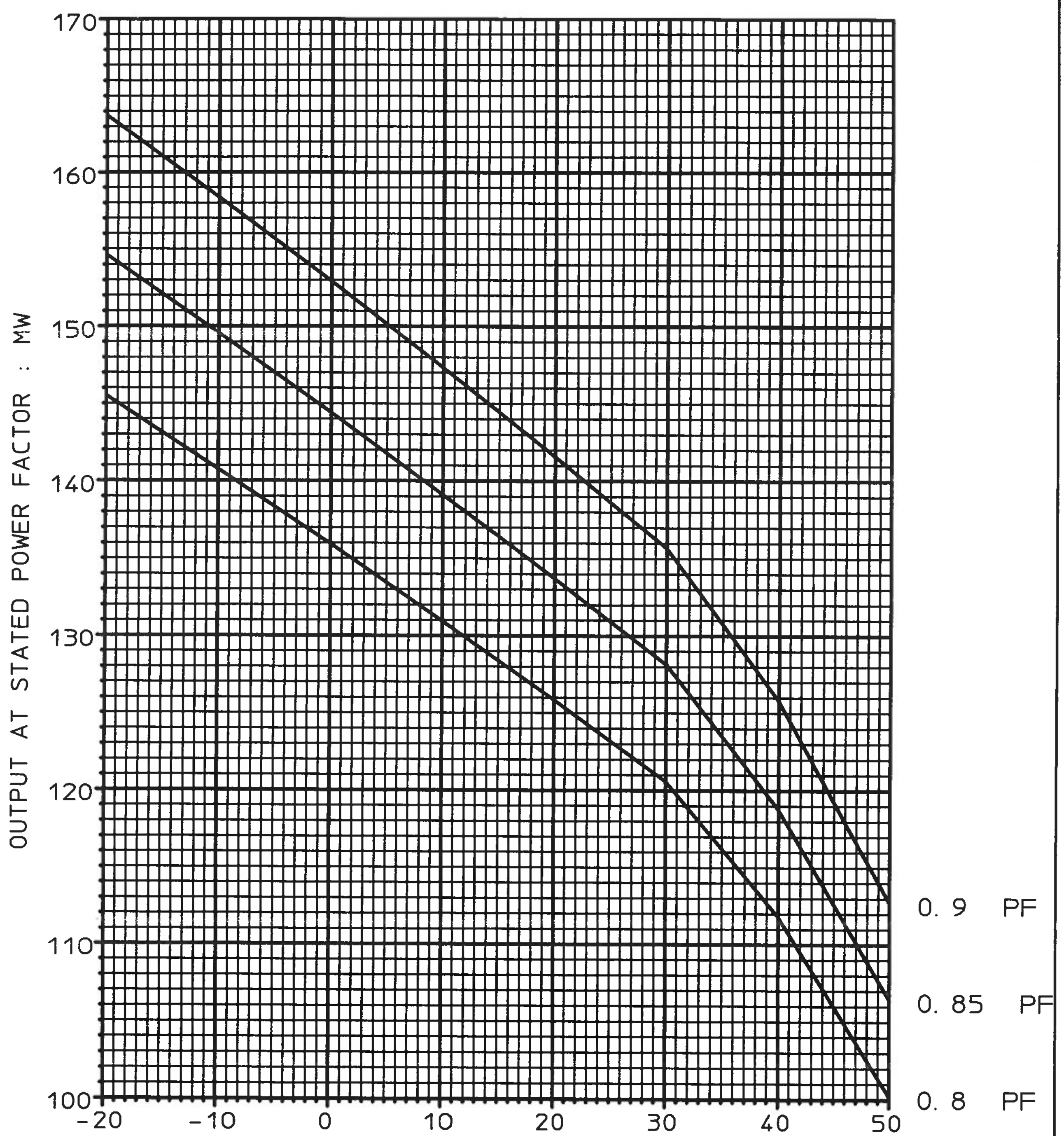
1. The electrical details provided are calculated values. Unless otherwise stated, all values are subject to tolerances as given in the relevant national standards.

2. The rotor inertia value may vary slightly with generator / turbine interface. In the event of conflict, the figure quoted on the rotor geometry drawing takes precedence.

Date: 24-Aug-2011

I.D.: OPP01562C1

VARIATION OF GENERATOR OUTPUT WITH AIR INLET TEMP



YDAX 8-400ER
13. 80KV, 3 Ph, 60Hz.

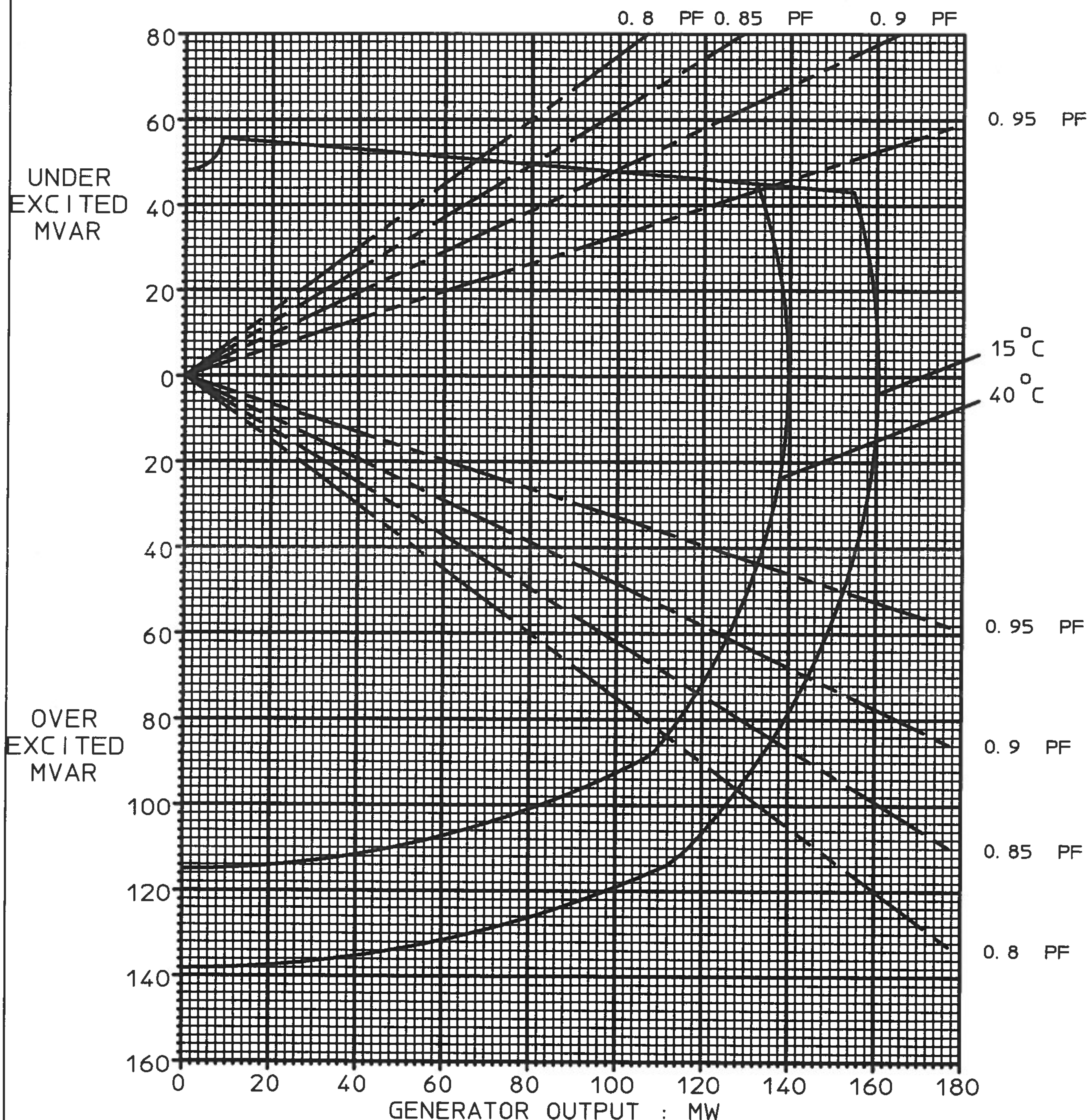
Up to 1000 meters ASL

IN ACCORDANCE WITH
IEEE C50. 13
Class B temperatures.
Total temperatures Stator 123 Deg C
Rotor 125 Deg C

Issue No. 1 : 24-Aug-2011

BRUSH ELECTRICAL MACHINES LTD. H. E. P 31217

GENERATOR CAPABILITY DIAGRAM



YDAX 8-400ER
13. 80KV, 3 Ph, 60Hz.

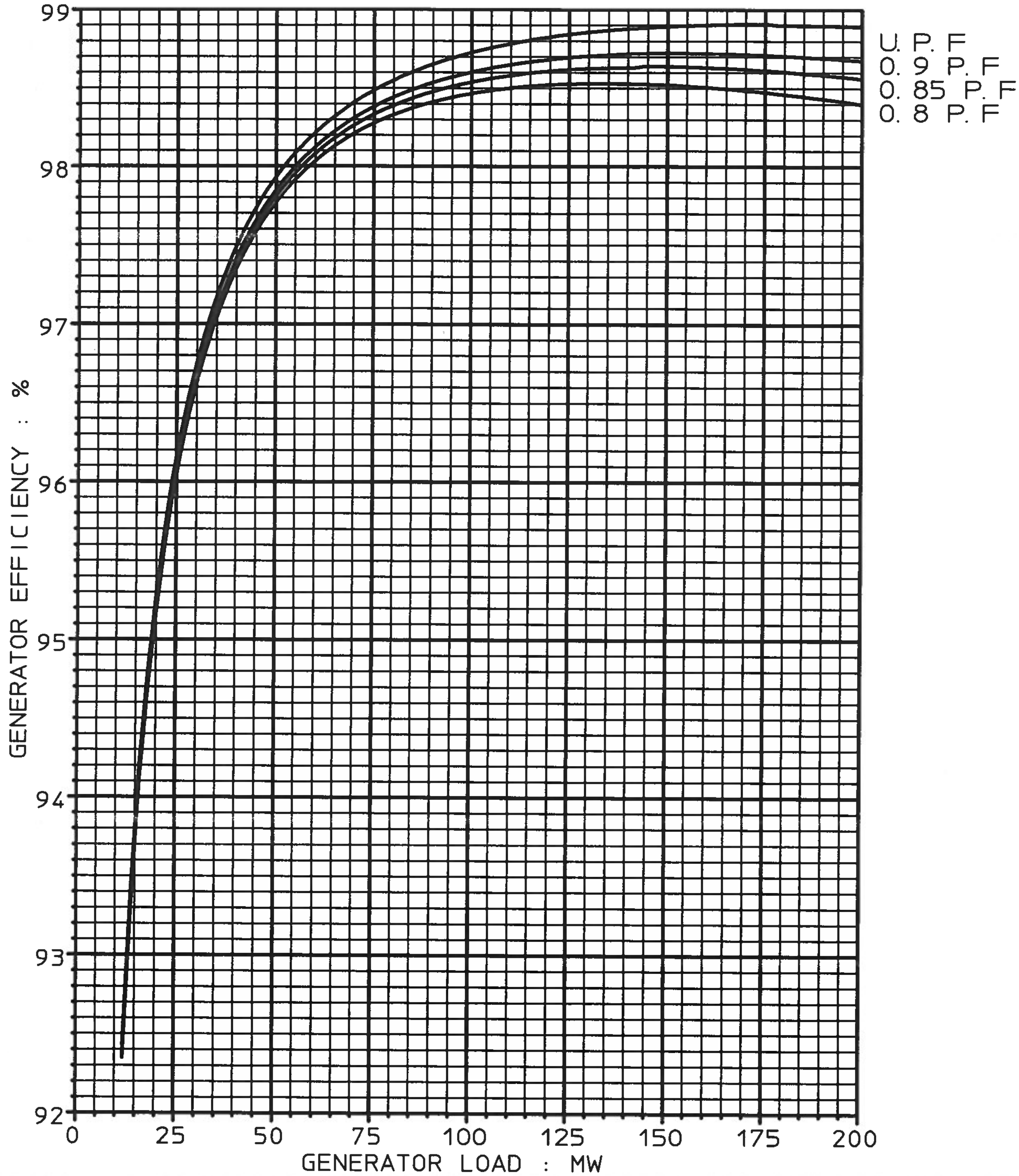
Up to 1000 meters ASL

IN ACCORDANCE WITH
IEEE C50. 13
Class B temperatures.
Total temperatures Stator 123 Deg C
Rotor 125 Deg C

Issue No. 1 : 24-Aug-2011

BRUSH ELECTRICAL MACHINES LTD. H. E. P 31218

VARIATION OF GENERATOR EFFICIENCY WITH LOAD



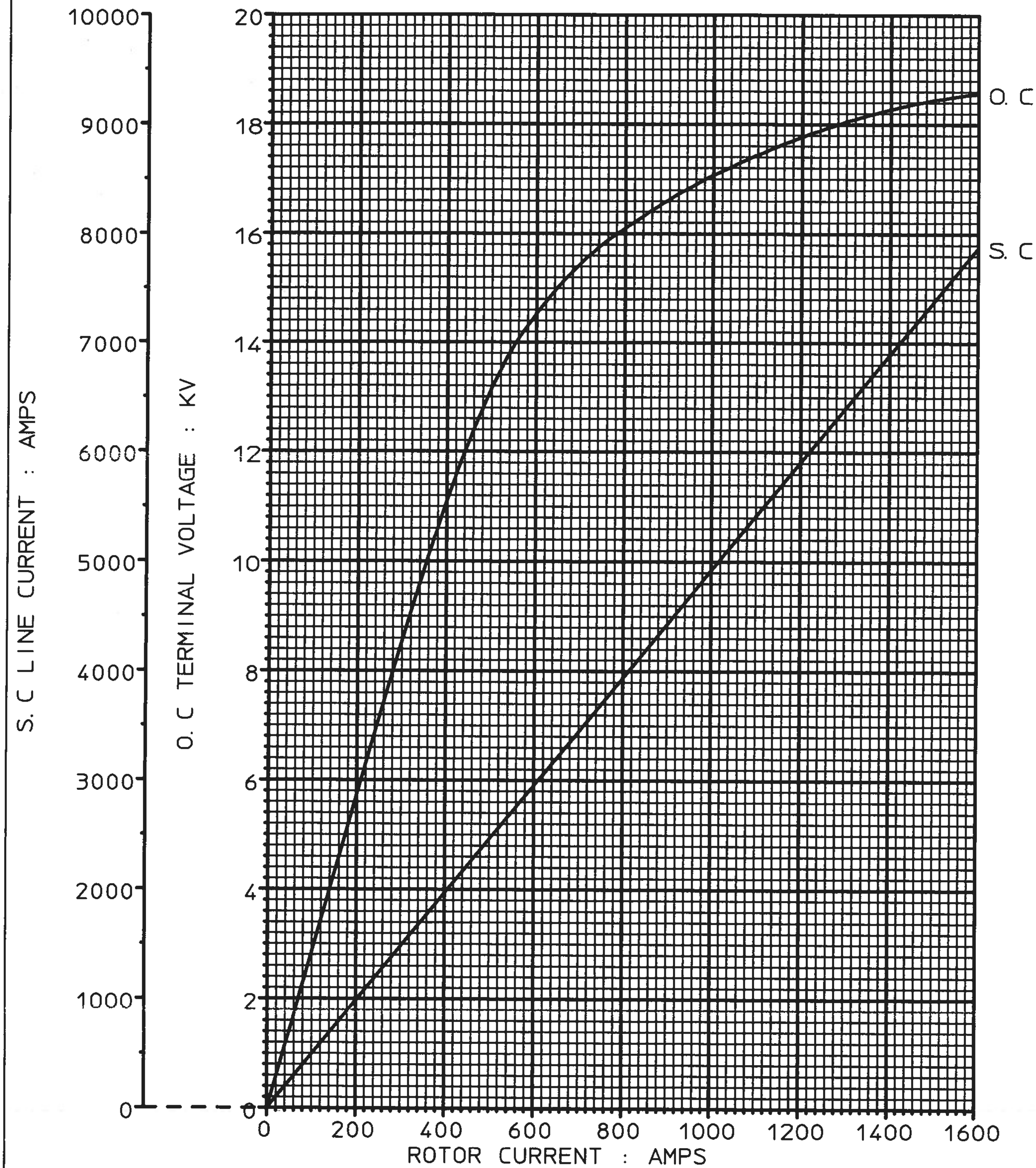
YDAX 8-400ER
13. 8 KV, 3 Ph, 60 Hz.

Efficiencies shown are guaranteed subject to the tolerance specified in IEC 60034-1.

Issue No. 1:24-Aug-2011

BRUSH ELECTRICAL MACHINES LTD. H. E. P 31219

OPEN CIRCUIT AND SHORT CIRCUIT CHARACTERISTIC

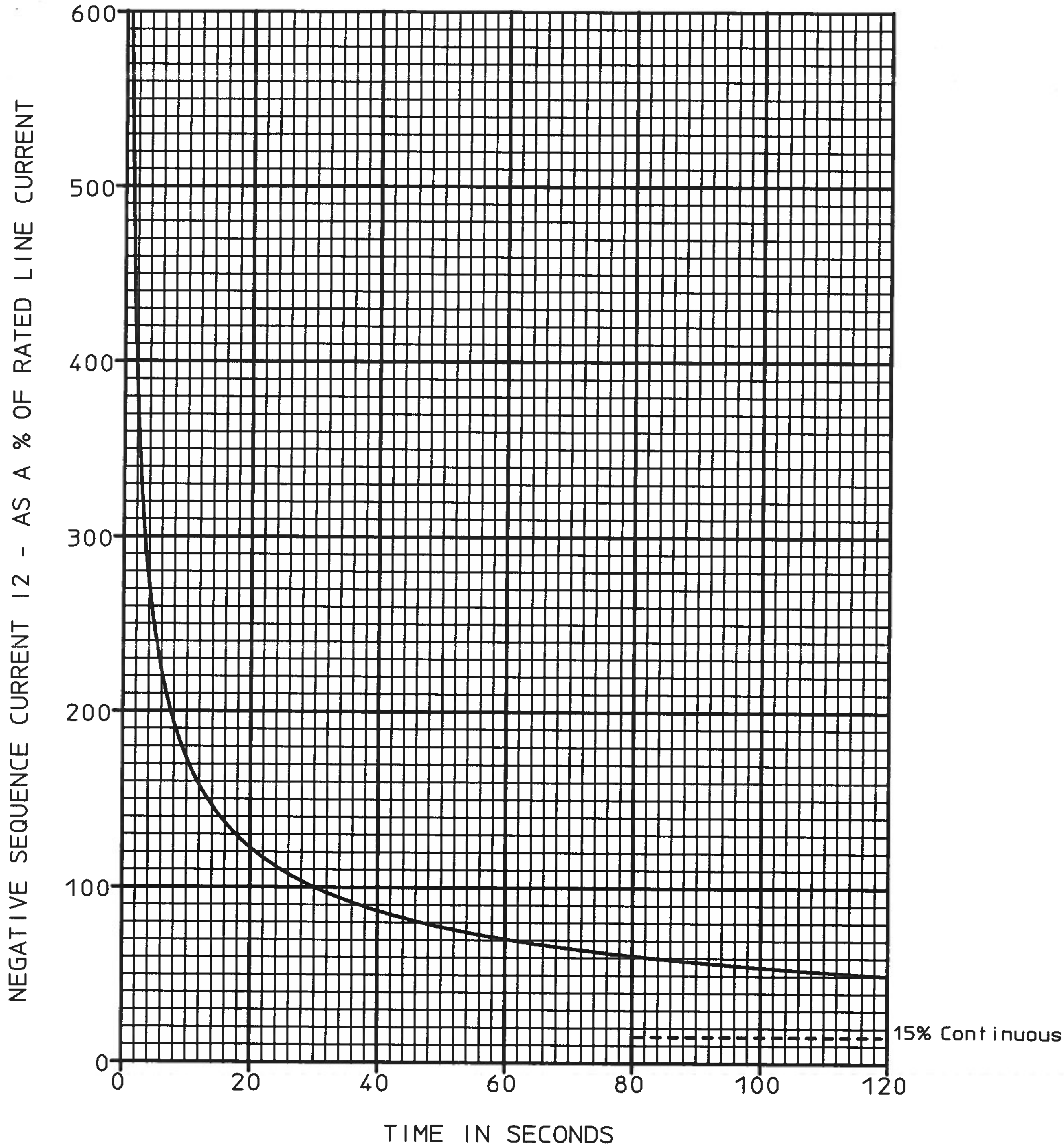


YDAX 8-400ER
3Ph, 60Hz, 3600 RPM.

Issue No. 1 : 24-Aug-2011

PERMISSIBLE DURATION OF NEGATIVE SEQUENCE CURRENT

$$I_2^2 t = 30$$



NOTE: For continuous operation rated current must not be exceeded in any one phase.

BRUSH

ELECTRICAL DATA SHEET

Falcon Works, Nottingham Road, Loughborough, Leics. LE11 1EX, England
Telephone: +44 (0) 1509 611511 Fax: +44 (0) 1509 610440 E-mail: salesuk@brush.eu

1. RATING DETAILS

1.1	Frame size	BDAX 82-445ERH
1.2	Terminal voltage	13.80 kV
1.3	Frequency	60 Hz
1.4	Speed	3600 rev/min
1.5	Power factor	0.950
1.6	Applicable national standard	IEEE C50.13
1.7	Rated coolant inlet temperature	38.8 °C
1.8	Rated output	145.148MW, 152.787 MVA

2. PERFORMANCE CURVES

2.1	Output vs coolant inlet temperature	H.E.P. 31605
2.2	Generator capability diagram	H.E.P. 31606
2.3	Efficiency vs output	H.E.P. 31607
2.4	Open and short circuit curves	H.E.P. 31608
2.5	Permitted duration of negative sequence current	H.E.P. 1216

3. REACTANCES

3.1	Direct axis synchronous reactance, Xd(i)	227 %
3.2	Direct axis saturated transient reactance, X'd(v)	19.3 % ± 15 %
3.3	Direct axis saturated sub transient reactance, X"d(v)	14.0 % ± 15 %
3.4	Unsaturated negative sequence reactance, X2(i)	18.2 %
3.5	Unsaturated zero sequence reactance, X0(i)	9.1 %
3.6	Quadrature axis synchronous reactance Xq(i)	207 %
3.7	Quadrature axis saturated transient reactance X'q(v)	23 %
3.8	Quadrature axis saturated sub transient reactance X"q(v)	17 %
3.9	Short circuit ratio	0.49

Notes:

1. The electrical details provided are calculated values. Unless otherwise stated, all values are subject to tolerances as given in the relevant national standards.

Date: 05-Mar-2012

I.D.: OPP01562G2

BRUSH

ELECTRICAL DATA SHEET - CONTINUATION

BDAX 82-445ERH, 145.148 MW, 0.950 pf, 13.80 kV, 60 Hz

4. RESISTANCES AT 20°C

4.1	Rotor resistance	0.077 ohms
4.2	Stator resistance per phase	0.0009 ohms

5. TIME CONSTANTS AT 20°C

5.1	Transient O.C. time constant, T'_{do}	12.4 seconds
5.2	Transient S.C. time constant, T'_{d}	0.85 seconds
5.3	Sub transient O.C. time constant T''_{do}	0.05 seconds
5.4	Sub transient S.C. time constant, T''_{d}	0.04 seconds

6. INERTIA

6.1	Moment of inertia, WR^2 (See note 2)	2352 $Kg.m^2$
6.2	Inertia constant, H	1.09 kW.secs/kVA

7. CAPACITANCE

7.1	Capacitance per phase of stator winding to earth	0.45 microfarad

8. EXCITATION

8.1	Excitation current at no load, rated voltage	579 amps
8.2	Excitation voltage at no load, rated voltage	44 volts
8.3	Excitation current at rated load and P.F.	1521 amps
8.4	Excitation voltage at rated load and P.F.	155 volts
8.5	Inherent voltage regulation, F.L. to N.L.	33 %

Notes:

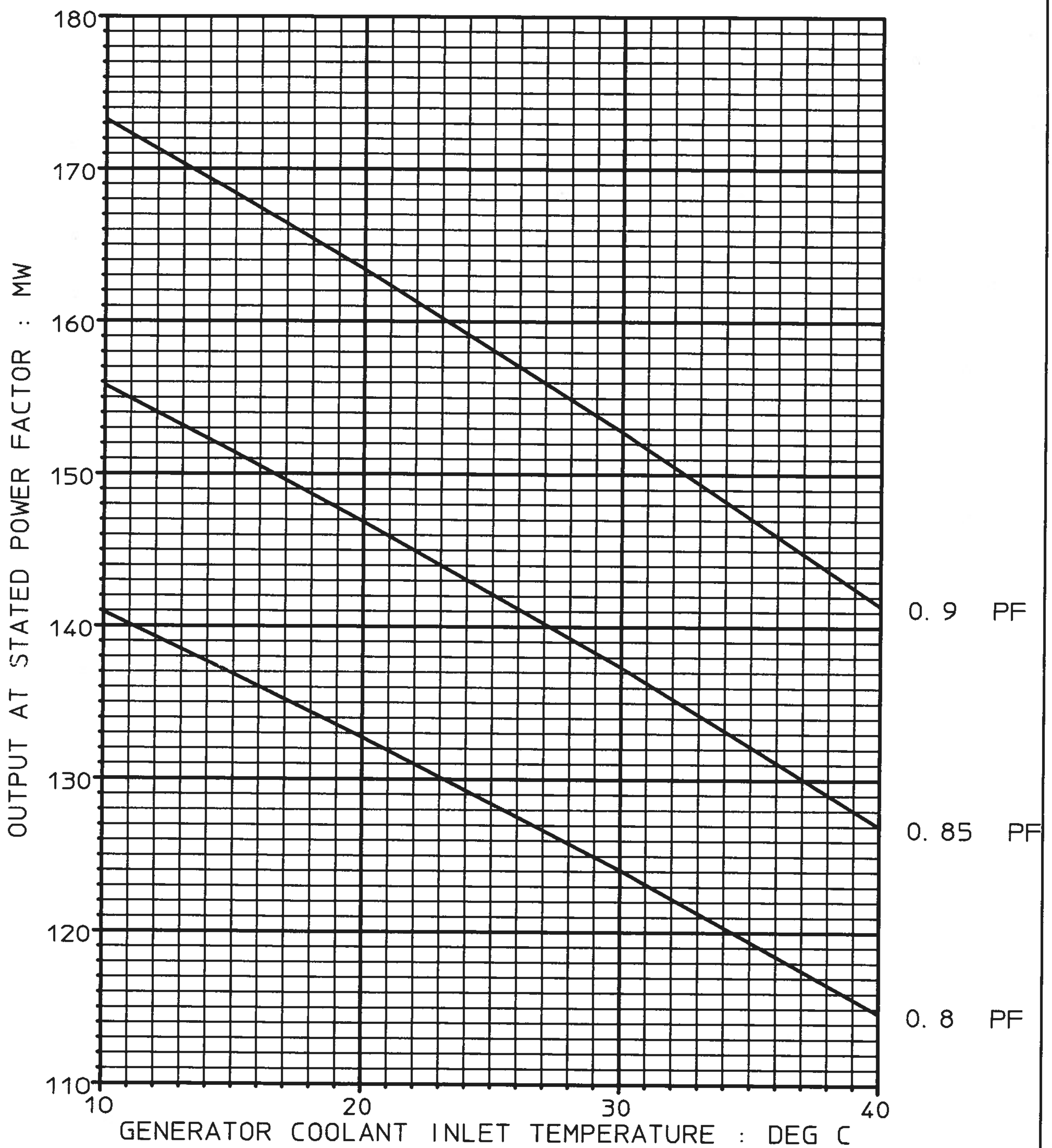
1. The electrical details provided are calculated values. Unless otherwise stated, all values are subject to tolerances as given in the relevant national standards.

2. The rotor inertia value may vary slightly with generator / turbine interface. In the event of conflict, the figure quoted on the rotor geometry drawing takes precedence.

Date: 05-Mar-2012

I.D.: OPP01562G2

VARIATION OF GENERATOR OUTPUT WITH COOLANT TEMP



BDAX 82-445ERH
13. 80KV, 3 Ph, 60Hz.

Up to 1000 meters ASL

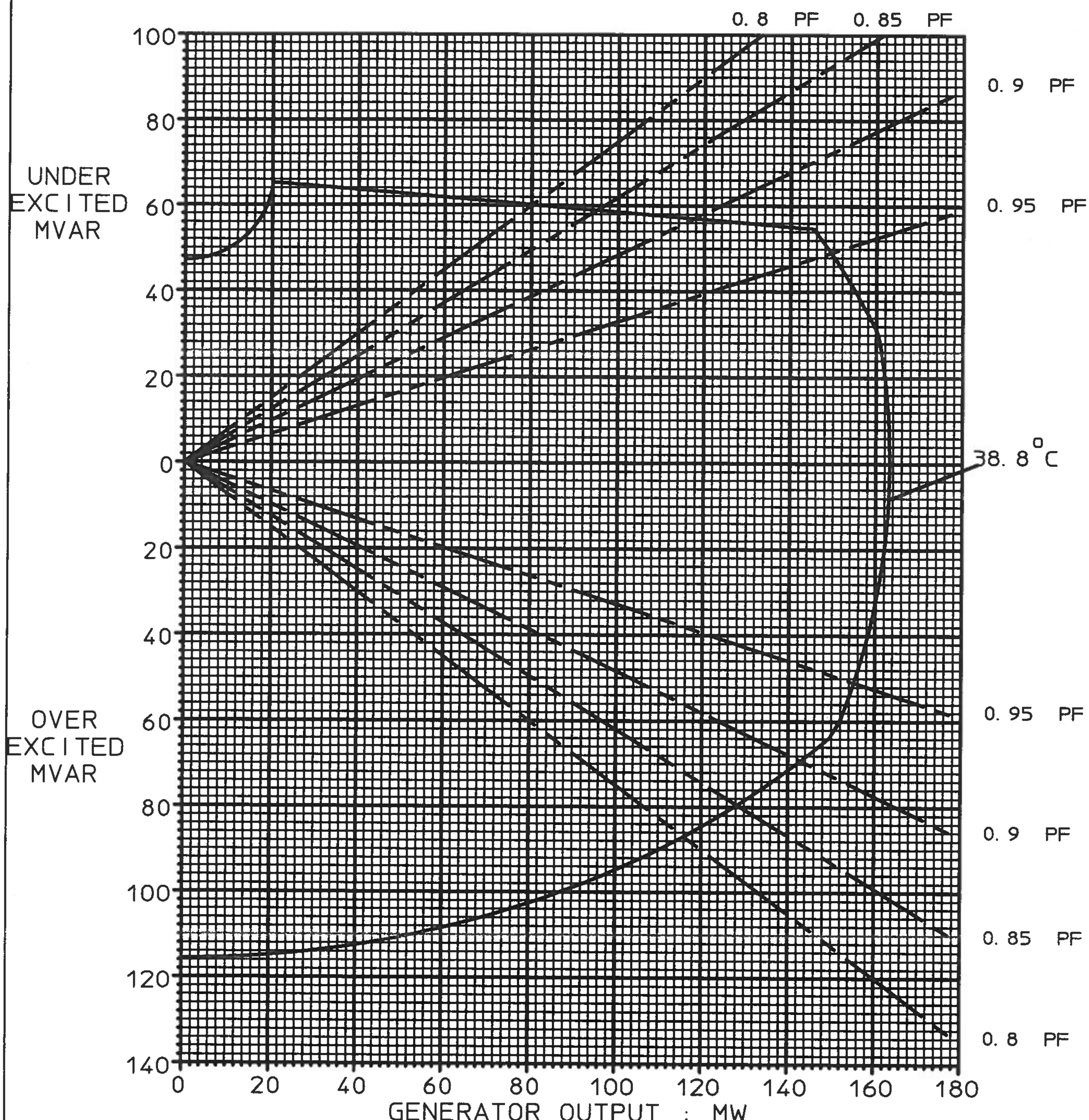
Coolant: Fresh Water

IN ACCORDANCE WITH
IEEE C50. 13
Class B temperatures.
Total temperatures Stator 123 Deg C
Rotor 125 Deg C

Issue No. 1 : 16-Nov-2011

BRUSH ELECTRICAL MACHINES LTD. H. E. P 31606

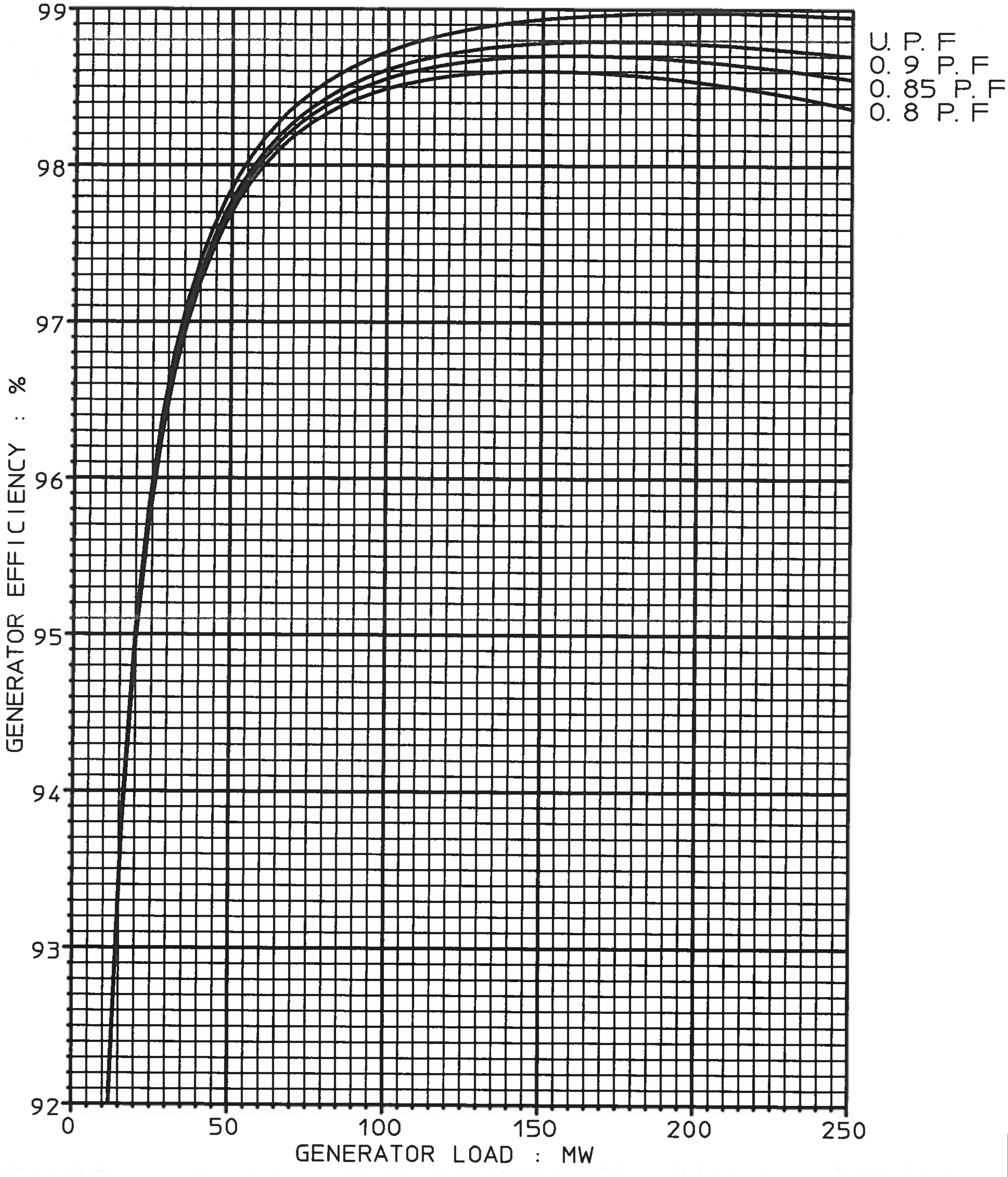
GENERATOR CAPABILITY DIAGRAM



BDAX 82-445ERH 13. 80KV, 3 Ph, 60Hz.	IN ACCORDANCE WITH IEEE C50. 13 Class B temperatures.
Up to 1000 meters ASL	Total temperatures Stator 123 Deg C Rotor 125 Deg C
Coolant:	Fresh Water

Issue No. 1 : 16-Nov-2011

VARIATION OF GENERATOR EFFICIENCY WITH LOAD

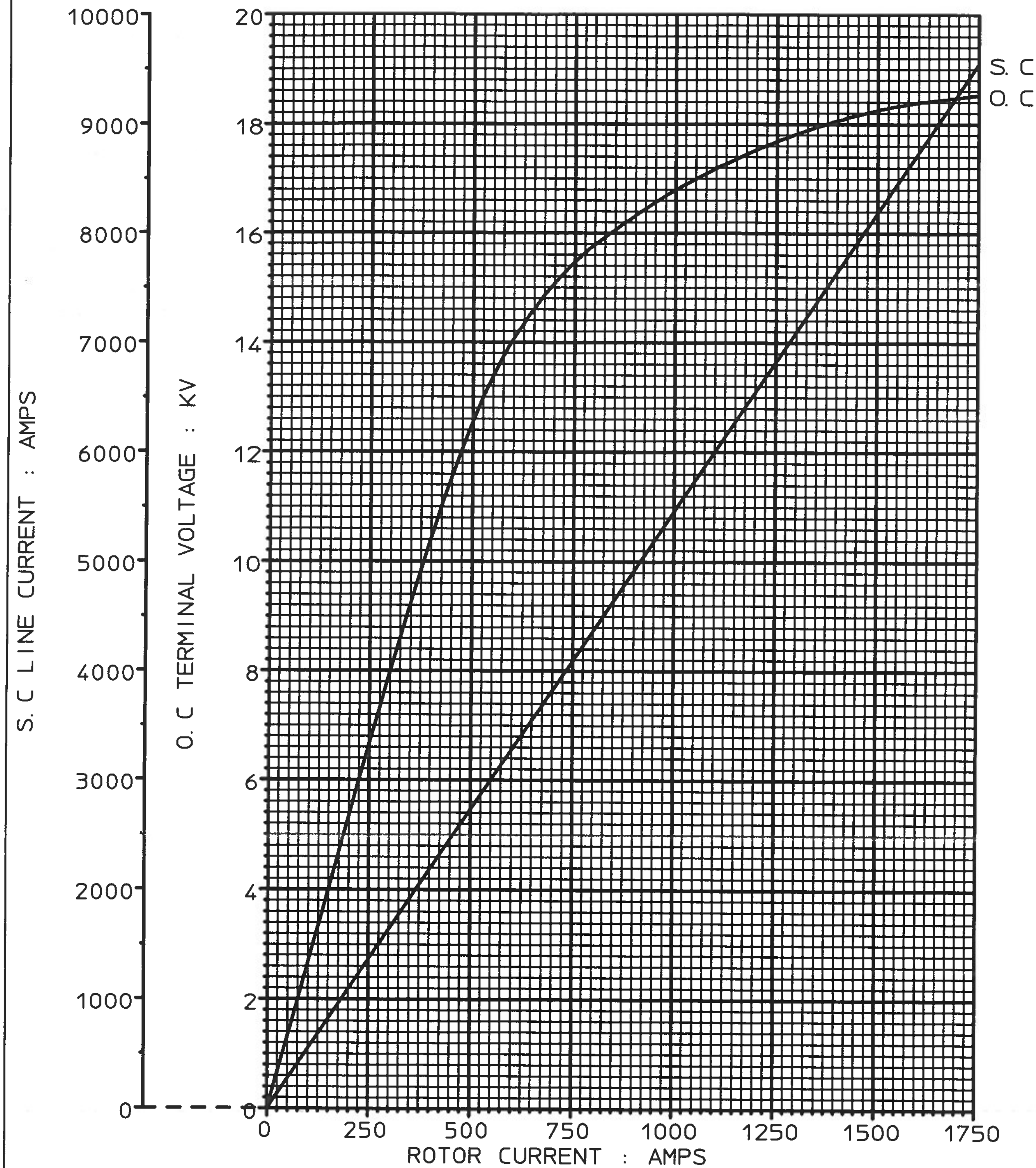


BDAX 82-445ERH
13. 8 KV, 3 Ph, 60 Hz.

Efficiencies shown are guaranteed subject to the tolerance specified in IEC 60034-1.

BRUSH ELECTRICAL MACHINES LTD. H. E. P 31608

OPEN CIRCUIT AND SHORT CIRCUIT CHARACTERISTIC

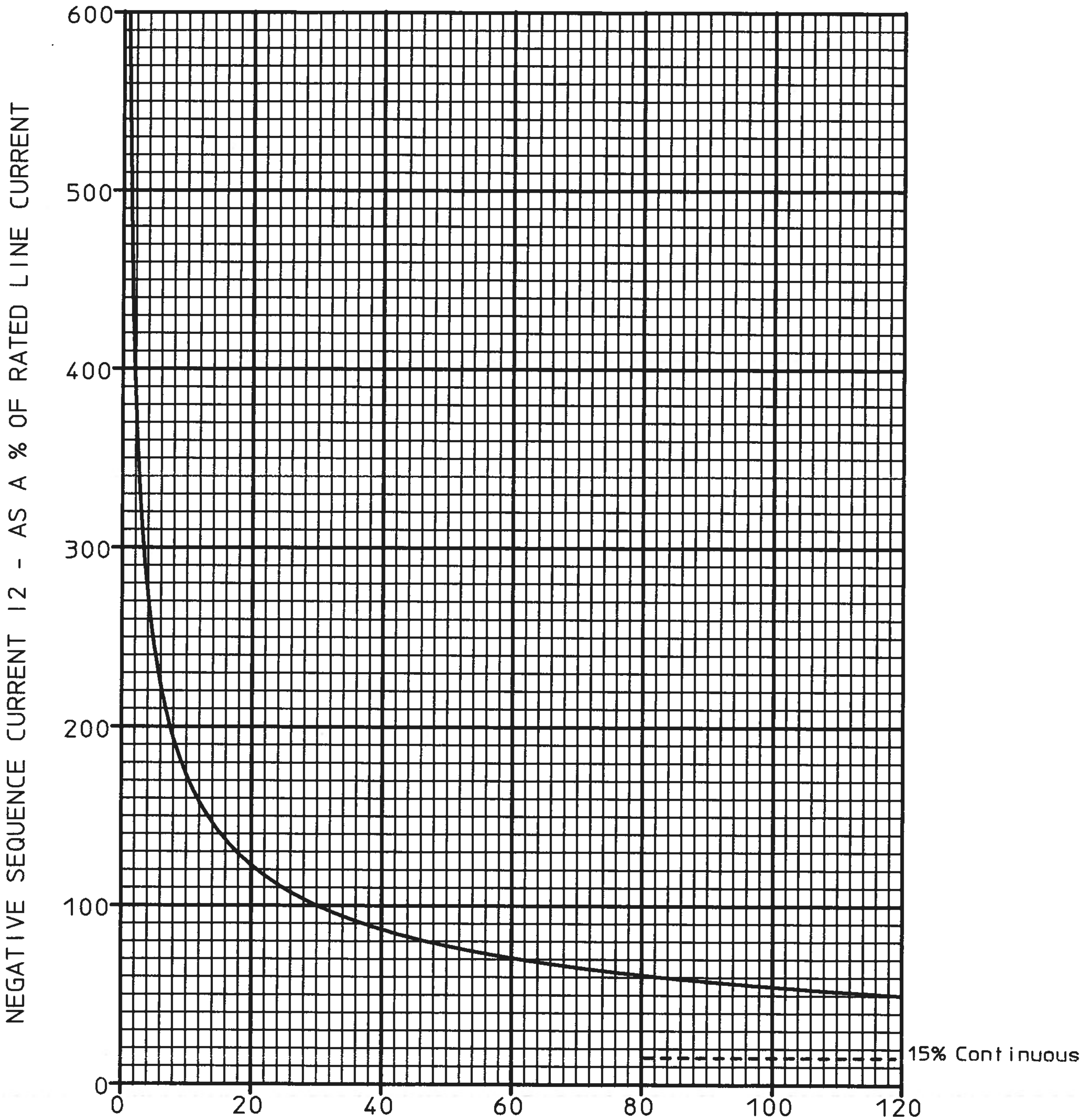


BDAX 82-445ERH
3Ph, 60Hz, 3600 RPM.

Issue No. 1 : 16-Nov-2011

PERMISSIBLE DURATION OF NEGATIVE SEQUENCE CURRENT

$$I_2^2 t = 30$$



NOTE: For continuous operation rated current must not be exceeded in any one phase.

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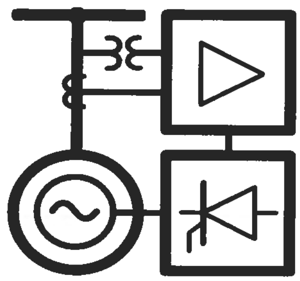
Unitrol® 6000



Static Excitation System
Model Conversion to IEEE Type ST1A

Type des.	Unitrol 6000		Part no.				
Prep.	A.Tristan	2010-11-15	Doc.kind	Technical description			No. of p.
Appr.	P.Smulders	2010-11-22	Title	Static Excitation System Model Conversion to IEEE Type ST1A			4
Resp.dept.	DMPE						
ABB	ABB Inc.		Doc. no.	-	Lang. en	Rev. ind. -	Page 1

FILE: Unitrol 6000 Static Excitation Model Conversion to IEEE Type ST1A.doc; TEMPLATE: Techn_Doc_Stand_P.dot R0; SKELETON: ; SAVEDATE: 11/22/2010 10:15:00 AM

1. Unitrol 6000 AVR Parameters and IEEE Model

The Unitrol 6000 Model for Static Excitation Systems is directly represented by the ST5B model as defined in IEEE Standard 421.5-2005. The introduction of this model into the IEEE standard is relatively recent and as a consequence, power system simulator software for modeling and analisys of excitation systems performace may not have the ST5B model included. Since the ST5B is a variation of the ST1A model (figure 1) the later can be used as an alternate model to represent the Unitrol 6000 static excitation system.

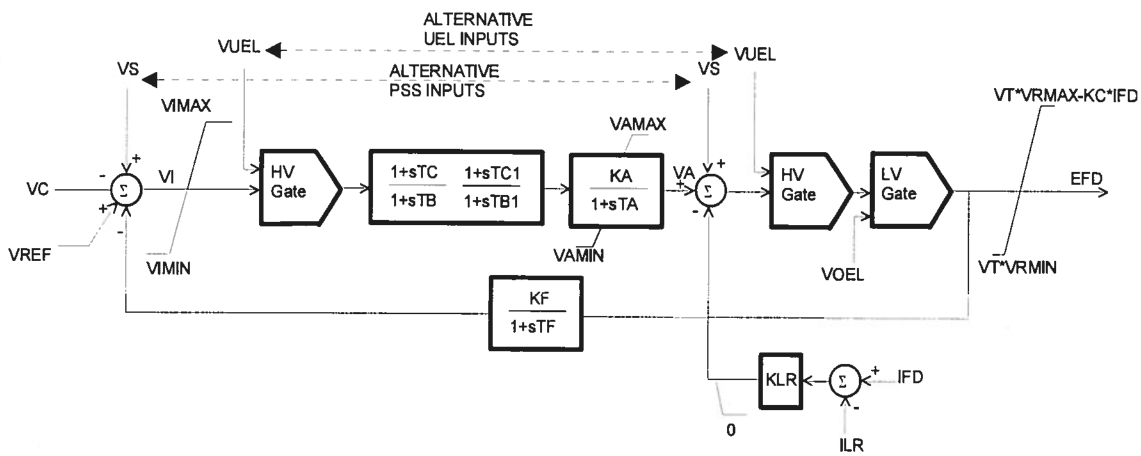


Figure 1 IEEE Model Type ST1A for Static Excitation

The following illustrates the conversion from Unitrol 6000 parameters to ST1A format

V_{RMax} = V_{Amax} = Upper Ceiling Factor Limit = $1.35*U_{ac}*\cos(\alpha_{min})/(I_{fAGL}*U_{fn}/I_{fn})$ [pu]

V_{RMin} = V_{Amin} = Lower Ceiling Factor Limit = $1.35*U_{ac}*\cos(\alpha_{max})/(I_{fAGL}*U_{fn}/I_{fn})$ [pu]

V_{IMax} $\cong V_{RMax} / V_p$ [pu]

V_{IMin} $\cong V_{RMin} / V_p$ [pu]

T_C = T_a [s]

T_B = $T_a(V_o/V_p)$ [s]

T_{B1} = $T_b(V_p/V_\infty)$ [s]

T_{C1} = T_b [s]

K_A = V_o [pu]

T_A = T_s = 0.003s

K_F = 0.0 (not applicable to Unitrol)

T_F = 0.001 (not applicable to Unitrol, but some programs do not accept 0.0)

I_{LR} = $1.6*(I_{fn}/I_{fAGL})$ [pu]

KLR $\cong$ Vp (oel) [pu] (proportional gain of the Over-Excitation Limiter)

K_C can be set to 0 since the excitation transformer calculation already considers the voltage drop caused by commutation overlap

V_T variable representing the generator terminal voltage (excitation is fed from generator terminals).

Abbreviations:

α_{min} : Minimum thyristor firing angle (typically 10deg)

α_{max} : Maximum thyristor firing angle (typically 150deg)

I_{fAGL} : Field current on air gap line to give rated terminal voltage (@ no-load)

I_{fn} : Nominal (rated) excitation current

U_{ac} : Excitation transformer rated secondary voltage

U_{fn} : Nominal (rated) excitation voltage

V_o : PID AVR low frequency gain

V_p : PID AVR proportional gain

V_∞ : PID AVR high frequency gain

T_a : PID AVR time constant

T_b : PID AVR time constant

$V_{p\,(oel)}$: PID Maximum Field Current Limiter proportional gain

T_s : Converter time delay (power stage)

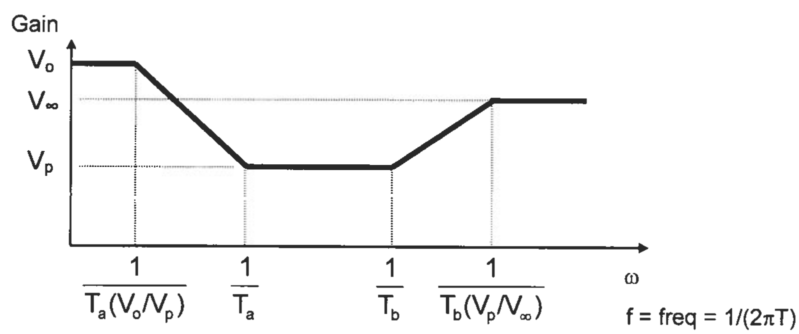


Figure 2 Unitrol 6000 PID-Filter characteristic

Unitrol 6000 parameter ranges		
Name	**Description**	**Value range**
UpperCeilingFactorLimit	Calculated automatically by software	-100..100
LowerCeilingFactorLimit	Calculated automatically by software	-100..100
vo	PID AVR low frequency gain	0.01..10000
vp	PID AVR proportional gain	0.01..10000
voo	PID AVR high frequency gain	0.01..10000
ta	PID AVR time constant	0..100 s
tb	PID AVR time constant	0..10 s
vp (oel)	PID Maximum Field Current Limiter proportional gain	0.01..10000

3 Power system stabilizer

3.1 Computer representation of IEEE PSS 2B

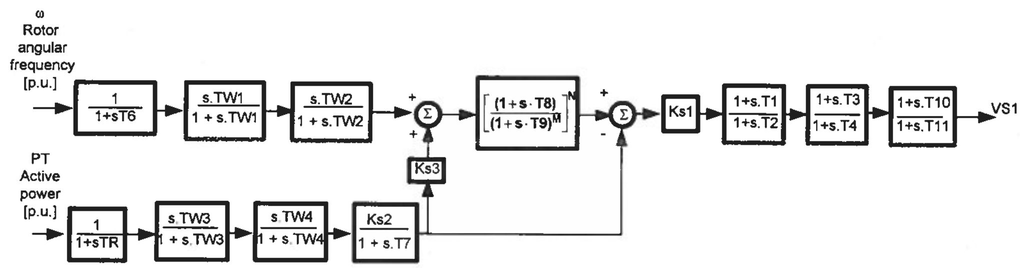


Figure 3-1: Computer representation of PSS2B according to IEEE 421.5 2005

<u>Short model description of PSS2B (ref. to Figure 3-1)</u>

The model consists of the following sub models:

- Calculation of driving power
- Filtering of torsional oscillations and noise components
- Calculation of acceleration power
- Phase and gain conditioning for stabilizing signal

The required signals for the generations of stabilizing signals are the active power PT and the rotor angular frequency deviation.
Both signals are submitted to two wash-out stages which are provided for the elimination of steady state signal component.
An approach for the integral of electric power is obtained by applying the output of the second washout filter of power channel to a first order transfer function. The value T7 shall correspond washout time constants TW1, TW2, TW3 that are selected to allow the operation of the PSS in the frequency range of interest (e.g. >0.1 Hz). The constant Ks2 shall be equal to T7/(2H) in order to obtain a proper signal relationship for the calculation of the acceleration power.
Ks3 is provided for the fine scaling between signals coming from power and frequency channels. Normally Ks3 is equal to 1.
The integral of driving power is obtained from the summation of conditioned frequency signal and the calculated integral of electric power variation.
A selective low pass filter so called "ramp tracking filter" is provided for the suppression of high frequency components (e.g. shaft torsional oscillations).
The integral of acceleration power is calculated from the difference between integral of driving power and integral of electric power.
The conditioning network consisting of the gain Ks1 and three lead-lag stages are provided in order to achieve the required phase and gain compensation for the stabilizing signal. Finally the maximum and minimum amplitudes of stabilizing signal can be limited as well by individual and adjustable maximum and minimum adjustable limitation parameters (ref. PSS control logic).

3.2 Parameter list of PSS2B

Parameter	Description	Unit	Standard settings	Proposed setting
TW1,TW2	Wash out time constants	s	2.0	
TW3,TW4	Wash out time constants	s	2.0	
Ks1	PSS gain factor	p.u.	5.0	
Ks2	Compensation factor for calculation of integral of electric power	p.u.	0.2	
Ks3	Signal matching factor	p.u.	1.0	
T1,T3,T10	Lead time constants of conditioning network	s	0.20 0.36 0.01	
T2,T4,T11	Lag time constants of conditioning network	s	0.04 0.12 0.01	
TR	Active power transducer time constant	s	0.02	0.02
T6	Rotor angular frequency deviation transducer time constant	s	0.02	0.02
T7	Time constant for integral of electric power calculation	s	2.0	
T8	Ramp tracking filter time constant	s	0.0	
T9	Ramp tracking filter time constant	s	1.0	
M	Ramp tracking filter degree	-	5	
N	Ramp tracking filter degree	-	1	

3.3 Correspondence between model parameters and equipmet settings

Parameter	Equipment settings correspondece for PSS2B
TR and T6	No correspondence, constant values
TW1	Reg_PSS_IEEE_2B.TW1
TW2	Reg_PSS_IEEE_2B.TW2
TW3	Reg_PSS_IEEE_2B.TW3
TW4	Reg_PSS_IEEE_2B.TW4
Ks1	Reg_PSS_IEEE_2B.Ks1
Ks2	Reg_PSS_IEEE_2B.Ks2
Ks3	Reg_PSS_IEEE_2B.Ks3
T1	Reg_PSS_IEEE_2B.T1
T2	Reg_PSS_IEEE_2B.T2
T3	Reg_PSS_IEEE_2B.T3
T4	Reg_PSS_IEEE_2B.T4
T7	Reg_PSS_IEEE_2B.T7
T8	Reg_PSS_IEEE_2B.T8
T9	Reg_PSS_IEEE_2B.T9
T10	Reg_PSS_IEEE_2B.T10
T11	Reg_PSS_IEEE_2B.T11
M	Reg_PSS_IEEE_2B.m
N	Reg_PSS_IEEE_2B.n

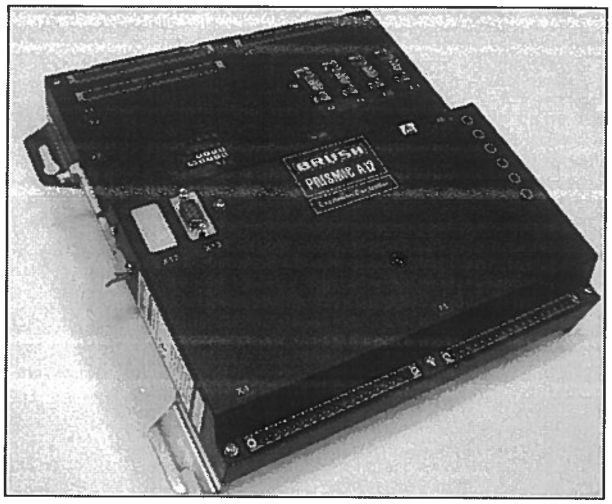
PRISMIC® A12

Excitation System

PRODUCT SPECIFICATION

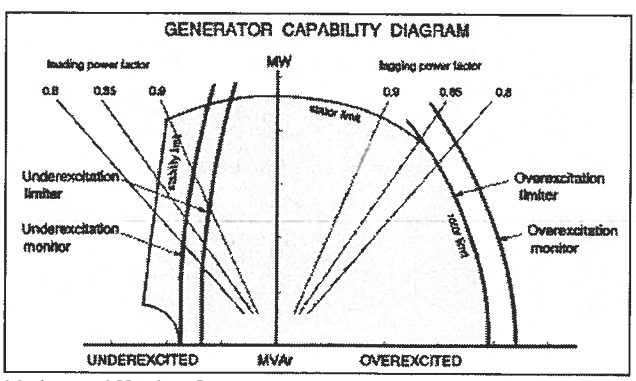
Introduction

The PRISMIC® A12 excitation system has been designed to control the excitation of a brushless generator. It incorporates the latest digital micro controller technology to make it the most comprehensive and compact controller available.



The PRISMIC® A12 is based upon proven technology and combines the experience and hardware of the BRUSH PRISMIC® A50 excitation controller. It includes, additional features such as intergrated speed detection, power system stabiliser and sychronisation.

The PRISMIC® A12 is produced on a plate mounted system either as a single channel or twin channel arrangement. As a twin system each controller acts as a hot standby for the other and is independently controlled with auto tracking, and smooth transfer. An optional colour display screen is also available.



Limiter and Monitor Settings

Features

- Complete excitation system mounted on a plate
- Available either as a single unit or as a high integrity twin configuration
- Integrated Power System Stabiliser (optional)
- Integrated auto synchroniser (optional)
- Integrated speed detection eliminating need for seperate speed switch
- Rotor earth fault detector input included eliminating the need for separate unit
- Negative forcing of exciter field voltage
- Modes of operation include generator terminal voltage control, power factor control, VAr control and offload VArs
- Digital Outputs
- Analogue Input Signal for special application
- Auxiliary power supply input allows easy setting of unit without PMG supply present
- Manual Reference
- Soft start for controlled application of excitation
- Diode Failure Detection and Indication
- HMI (Human Machine Interface) software for advanced maintenance diagnostics and downloading of data
- Oscilloscope style trending and analogue data logging (5ms resolution) via HMI
- Event Logging
- Externally mounted display interface computer (Optional)
- Automatic and manual excitation limiters

The following limiters are included:

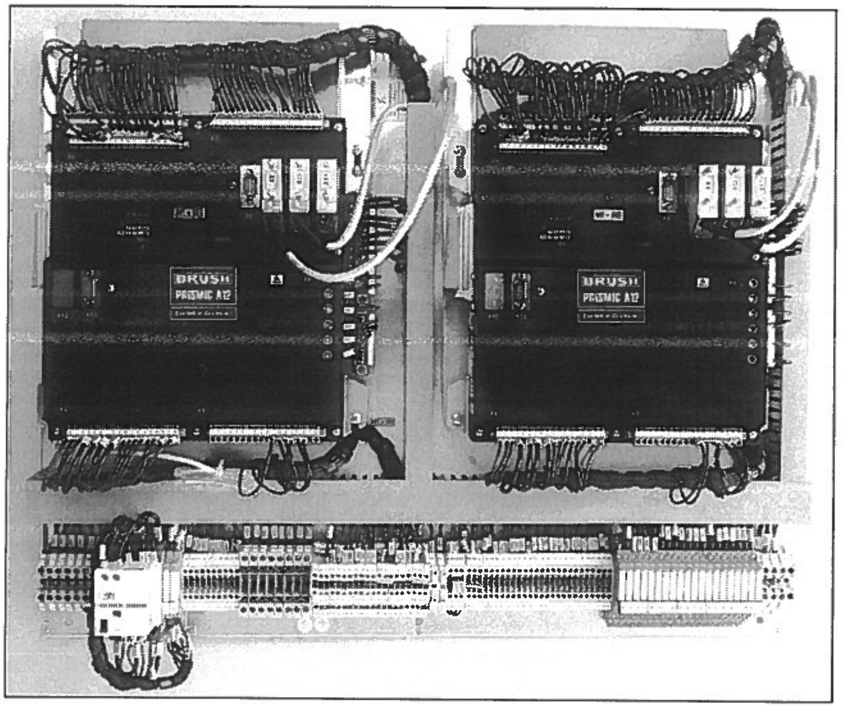
- Under Excitation Limiter
- Over Excitation Limiter
- Over Flux (V/Hz) Limiter
- Stator Current Limiter
- Fast Acting Field Current Limiter
- Terminal Voltage Limiter

Automatic transfer of control to hot standby channel initiated by:

- Over Voltage Monitor Triggered
- Under Voltage Monitor Triggered
- Over Excitation Monitor Triggered
- Under Excitation Monitor Triggered
- Over Flux Monitor Triggered
- Voltage Sensing Error

The PRISMIC® A12 includes the following communication port

- 1 x RS232 service port
- 1 x CANbus port for communication with hot standby unit in twin configurations
- 1 x CANbus port available for connection of display interface computer
- 1 x RS485 / RS232 Modbus RTU port for SCADA/ DCS communications
- 1 x PROFIBUS port (optional)



Ratings

Max continuous output current:	20A
Max 10 second output current:	30A
Excitation supply voltage:	Single phase 85 to 264V
Excitation supply frequency:	48Hz to 480Hz
Nominal sensing voltage:	100V to 120V
Auxiliary power supply:	24V d.c.
Voltage sensing phases:	Either 3 phase or 1 phase
Nominal generator frequency:	50Hz or 60Hz
Current transformer input nominal:	Either 5A or 1A
Current transformer input burden:	Less than 0.5VA
Maximum field voltage for forcing:	75% of available PMG voltage*
Minimum field voltage:	-75% of available PMG voltage*
Voltage adjustment range	Selectable from +/-10% to +/-25%
Accuracy of control:	+/-0.25%
Operating temperature range:	-20DegC to +50 DegC
Storage temperature range:	-20DegC to +80 DegC
Dimensions	570x699x185mm (HxWxD)
Weight:	31kg

Standards Applicable

The excitation controller is designed according to IEC61010. The controller functions according to the AC8B model defined in the IEEE Std 421.5 2005 for Excitation Systems Modelling.

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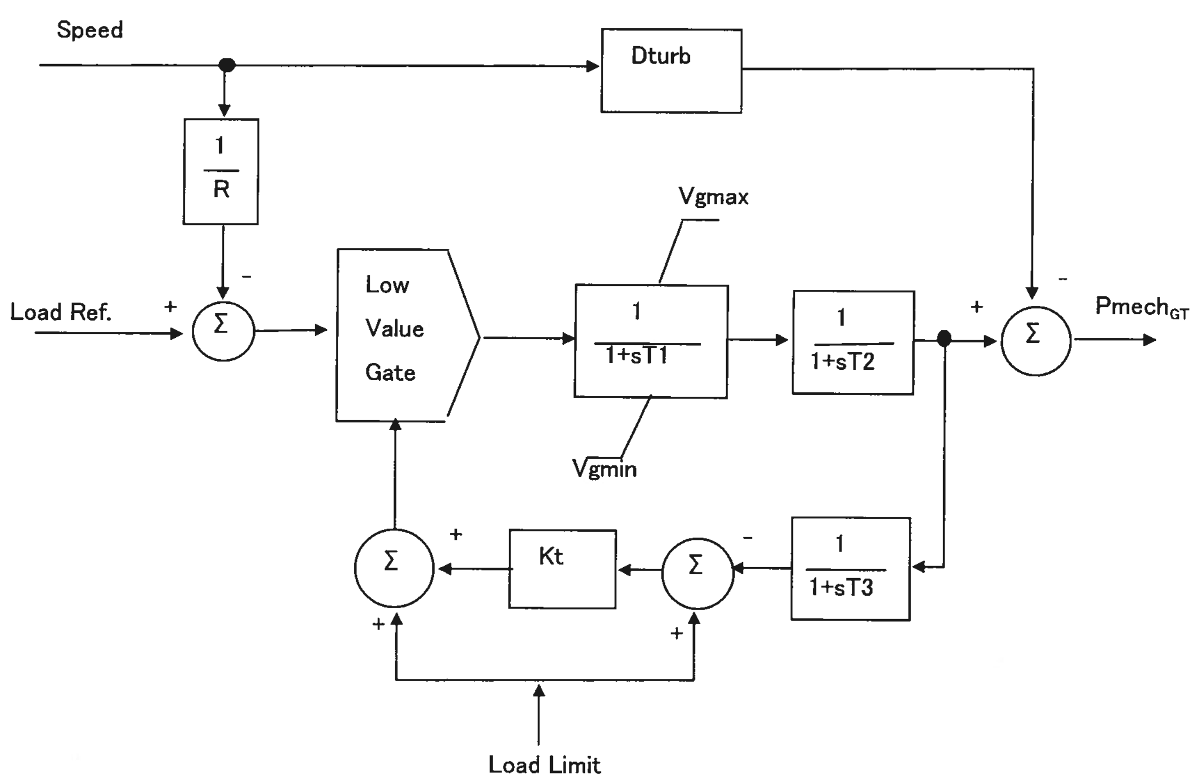
Email: prismiccz@brush.eu
Web: www.brush.eu

Gas Turbine Governor Model

1.	Speed Droop	R=	0.04	
2.	Controller Lag Time Constant	T1=	0.1	second
3.	Turbine Power Time Constant	T2=	1.0	second
4.	Turbine Exhaust Temperature Time Constant	T3=	5.0	second
5.	Temperature Limitter Gain	Kt=	3 (1 + 1/24s)	
6.	Maximum Valve Position	Vgmax=	1.0	
7.	Minimum Valve Position	Vgmin=	0.05	
8.	Turbine Damping Coefficient	Dturb=	0.10	

Block Diagram

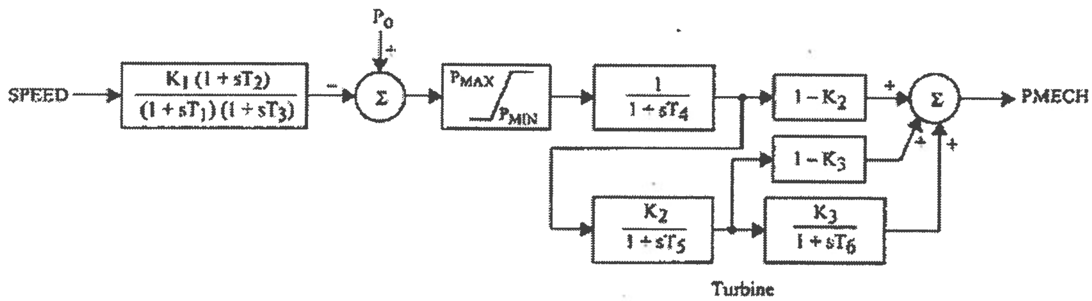


(based on GAST)

Drawing No. F30-791

Turbine Dynamic Model Block Diagram

IEESGO : IEEE standard turbine-governor model



0.004	T_1, Controller Lag (Seconds)
0.02	T_2, Controller Lead (Seconds)
0.35	T_3, Governor Lag (>0) (Seconds)
0.06	T_4, Delay Due To Steam Inlet Volumes Associated With Steam Chest And Inlet Piping (Seconds)
0	T_5, Reheater Delay Including Hot And Cold Leads (Seconds)
0	T_6, Delay Due To IP-LP Turbine, Cross-Over Pipes, And LP End Hoods (Seconds)
20	K_1, 1/Per Unit Regulation
0	K_2, Fraction
0	K_3, Fraction
Max output [MW]	P_{MAX}, Upper Power Limit
0	P_{MIN}, Lower Power Limit

Only for Reference

AES

the power of being global

1450 Lake Robbins Drive, Suite 600,The Woodlands,TX 77380

Bank of America, National Association
901 Main St, Lower Level
MCKINNEY TX US 75069

001107

Date
March 26, 2012
VOID AFTER 180 DAYS

Amount
********500,000.00

*** Five hundred thousand dollars and zero cents ***

Authorized Signature

Pay to the Order of:
California ISO
Attn: Grid Assets
250 Outcropping Way
Folsom CA US 95630

Authorized Signature

⑈001107⑈ ⑆111000012⑆ 4427110595⑈

AES North America Dev.LLC

Remittance Advice Voucher

Vendor ID	Vendor Name	Check Date	Check No
50000858	California ISO	March 26,2012	001107

Invoice No	Invoice Date	PO#	Text	Gross Amount	Withholding Tax	Cash Discount	Net Amount
CR031912A	03/19/2012			250000.00	0.00	0.00	250,000.00
CR031912B	03/19/2012			250000.00	0.00	0.00	250,000.00
TOTAL:				500,000.00	0.00	0.00	500,000.00

California ISO
Shaping a Renewed Future

California Independent System Operator Corporation

May 24, 2012

Jennifer Didlo
Vice President
AES North America Development, LLC
4300 Wilson Boulevard
Arlington, Virginia 22203

RE: AES Alamitos and Redondo Beach

Dear Ms.Didlo:

The California Independent System Operator Corporation ("ISO") and Southern California Edison Company ("SCE") have completed their assessment of AES North America Development, LLC request dated March 9, 2012 to review the AES Alamitos Energy Center ("Alamitos") and Redondo Beach Generating Facility ("Redondo") repowering to determine if the total capability and electrical characteristics are substantially unchanged in accordance with Section 25.1 of the ISO tariff. As discussed further below, due to the short-circuit duty impact of the Alamitos repowering and the change to total capability of Redondo repowering, neither repowering meets the criteria to forgo the interconnection queue process.

The ISO and SCE performed a number of studies to evaluate if the total capability and electrical characteristics are substantially unchanged including:

- Dynamic stability assessments under both no-disturbance and critical contingency conditions;
- Post transient governor power flow studies under critical contingencies; and
- Short circuit duty studies

Because Redondo Beach's proposed total capacity is less than one half of its existing plant capacity, the analyses for determination of equivalent electrical characteristics and total capability were performed mutually exclusive (i.e., plant-by-plant basis) of the proposed repowering of Alamitos, which has total capability that is not "substantially unchanged" from its existing capacity (per Section 25.1.2). Otherwise, if both of these proposals were studied on an aggregated basis, they would not satisfy the "total capability" requirements. The evaluation was performed using the WECC-approved 2012 heavy summer power flow case (12hs4a.sav) and its corresponding dynamic data. To further evaluate the performance of the proposed Alamitos repowering project with respect to the status of Redondo Beach power plant, the ISO also performed additional sensitivity assessments for the two scenarios where (a) Redondo Units 5, 6, and 7 were retired and Unit 8 was replaced with the new proposed project, and (b) Redondo 5, 6, and 7 were kept in service and Unit 8 was replaced with the new proposed project.

Alamitos Repowering

Total Capability
Total capability of the Alamitos repowered project is "substantially unchanged", with the new capacity representing 98% of the existing plant's capacity.

Dynamic Stability Assessment
Two dynamic stability studies were performed, the first is a no-disturbance and the second is a major disturbance evaluation (i.e., G-2 Palo Verde where two units at Palo Verde trip off-line). The no-disturbance test is to evaluate whether the dynamic models of the new units provide a straight line response (i.e., good data) under no disturbance conditions. The second test was performed with the worst contingency in the WECC system (i.e., G-2 Palo Verde) to see if the new units have the same or better dynamic stability response as the existing facilities. Alamitos met WECC reliability criteria for both of these evaluations.

Post-transient Governor Power Flow Study
The post-transient governor power flow study was performed with the same contingency as above (G-2 Palo Verde) to test whether a solution was obtained and whether the post-transient voltage results are the same as in the existing system. A solution was obtained for the Alamitos case, under the contingency, and the results were similar to the existing system study case. The proposed Alamitos project met the above requirements.

Short-Circuit Duty Test
Based on the short circuit duty assessment, AES' proposed plan for Alamitos could cause negative short-circuit duty impacts at five substations (Center, Barre, Lewis, Villa Park and Ellis). The short-circuit duty decreases on one side of the Alamitos Bus (the 230 kV bus is operated in split arrangement) which also decreases duty at Lighthipe, Hinson, Redondo Beach, and Long Beach Substations, which is a good outcome. However, short-circuit duty increases on the other side of the Alamitos Bus (+2090 amps) which also increases short-circuit duty at Center (+460 amps), Barre (+190 amps), Lewis (+120 amps), Villa Park (+70 amps), Ellis (+60 amps). This increase in short-circuit duty could result in creating a need for new breaker upgrades that have not yet been defined at these substations. The specific results are as follows:

		3PH (kA)		
Bus	kV	Existing	Repower	Delta (kA)
Alamitos A	230	35.63	33.24	-2.39
Lighthipe	230	44.59	44.11	-0.48
Hinson	230	42.20	42.05	-0.15
Mesa	230	54.69	54.7	0.01
Redondo	230	45.95	45.87	-0.08
Alamitos B	230	31.60	33.69	2.09
Barre	230	59.35	59.54	0.19
Longbeach	230	28.34	28.25	-0.09
Ellis	230	44.10	44.16	0.06
Lewis	230	58.17	58.29	0.12
Villa park	230	50.10	50.17	0.07
Center	230	42.50	42.96	0.46

With this impact to the other buses, the electrical characteristics of the Alamitos repowering are not substantially unchanged from the existing facilities. Thus Section 25.1.2.1 of the ISO tariff cannot be cited as a path to forgo the interconnection queue process. Alamitos has already applied to cluster 5 and will need to continue through the interconnection queue process.

If AES decides to revise the technical specifications used for each generator at Alamitos to mitigate the short circuit duty, then the ISO and SCE are willing to evaluate the new proposal.

Redondo Beach Repowering

Total Capability

The new total plant capacity is 37% of its existing total plant's capacity, and that is a significant change from the existing capability. Since the total capability of the repowered project does not meet the criteria of "substantially unchanged" as required in Section 25.1.2, no further reliability assessments were performed.

With this change in total capability the Redondo repowering is substantially changed from the existing facilities. Thus Section 25.1.2.1 of the ISO tariff cannot be cited as a path to forgo the interconnection queue process. AES has already applied to cluster 5 for the Redondo repowering project and will need to continue through the interconnection queue process.

The ISO and SCE look forward to working with AES to repower these units. Please feel free to contact Judy Brown at 916-608-7062 or jbrown@caiso.com with any questions.

Kindest regards,

Deborah A. Le Vine
Director of Interconnection Implementation

Cc: Jill Horswell (SCE)
David Berndt (SCE)
Jorge Chacon (SCE)

June 6, 2012

John Kistle
Vice President
AES North America Development, LLC
690 N. Studebaker Road
Long Beach, California 90803

Dear Mr. Kistle:

This letter is to confirm the CAISO has received your application and fee for the Cluster 5 interconnection studies for the new generators to be constructed and installed as part of the Alamitos Energy Center project. Your application has been accepted and I confirm receipt of the application fee. The CAISO will evaluate the information provided to determine the system impact issues that might arise as a result of this project. The CAISO will contact AES with further information requests as required and to establish a schedule for the completion of the study.

Sincerely,

Judy Brown

Judy Brown
Lead Interconnection Specialist

August 1, 2012

Jennifer Didlo
Vice President
AES Alamitos, LLC
690 N. Studebaker Road
Long Beach, California 90803

RE: AES Alamitos

Dear Ms. Didlo:

As discussed in the May 24, 2012 letter from the California Independent System Operator Corporation ("ISO") and Southern California Edison Company ("SCE") completed their assessment of AES North America Development, LLC request dated March 9, 2012 to review the AES Alamitos Energy Center ("Alamitos") and Redondo Beach Generating Facility ("Redondo") repowering to determine if the total capability and electrical characteristics are substantially unchanged in accordance with Section 25.1 of the ISO tariff. In that initial review, due to the short-circuit duty impact of the Alamitos repowering project; the repowering did not meet the criteria to forgo the interconnection queue process.

Since that point in time, Alamitos has worked with SCE and subsequently the ISO to change the generation step up transformer impedance to resolve the concern on the short circuit duty studies. Based on the revised generation step up transformer and generation data (which was sent to SCE on June 13, 2012 and to the ISO on July 3, 2012), as well as the new interconnection configuration for Alamitos West and Alamitos East 230 kV buses, the ISO agrees that Alamitos can forgo the interconnection queue process as the total capability and electrical characteristics are substantially unchanged from the existing facility. The following table lists the changes in short circuit duties at various locations in the Los Angeles basin near the Alamitos switchyard based on the updated short circuit duty assessment completed by SCE. The updated short circuit duty lowered the three-phase short circuit duties at various locations noted below. Based on the updated study results as presented to the ISO on July 2, 2012, the previously identified short circuit duty concerns are mitigated with the changes in the generator step up transformers submitted by the Interconnection Customer.

		3PH (kA)		
Bus	kV	Existing	Repower	Delta (kA)
Alamitos A	230	35.63	34.50	-1.13
Lighthipe	230	44.59	44.30	-0.29
Hinson	230	42.20	42.06	-0.14
Mesa	230	54.69	54.53	-0.16
Redondo	230	45.95	45.87	-0.08
Alamitos B	230	31.60	30.63	-0.97
Barre	230	59.35	58.85	-0.50
Longbeach	230	28.34	28.27	-0.07
Ellis	230	44.10	43.99	-0.11
Lewis	230	58.17	57.87	-0.30
Villa park	230	50.10	49.93	-0.17
Center	230	42.50	42.19	-0.31

Total Capability
Total capability of the Alamitos repowered project is "substantially unchanged". The previous analysis resulted in 1,893.6 MW output representing 98% of the existing plant's capacity and the new analysis resulted in 1,893 MW output.

Dynamic Stability Assessment
Two dynamic stability studies were performed, the first is a no-disturbance and the second is a major disturbance evaluation (i.e., G-2 Palo Verde where two units at Palo Verde trip off-line). Alamitos still meets the WECC reliability criteria for both of these evaluations.

Post-transient Governor Power Flow Study
The post-transient governor power flow study was performed with the same contingency as above (G-2 Palo Verde) to test whether a solution was obtained and whether the post-transient voltage results are the same as in the existing system. The proposed Alamitos project still meets the above requirements.

Short-Circuit Duty Test
Based on the short circuit duty assessment, AES' revised proposal for the generation step-up transformer and splitting of the Alamitos bus into an East bus and West bus, resolved the negative short-circuit duty impacts that could have been caused at five substations (Center, Barre, Lewis, Villa Park and Ellis). With this new configuration, the electrical characteristics of the Alamitos repowering are substantially unchanged from the existing facilities.

Therefore, Section 25.1.2.1 of the ISO tariff can be cited as a path to forgo the interconnection queue process. Alamitos has already applied to cluster 5 and will need to withdraw from that interconnection queue process as soon as possible. With respect to the deposit Alamitos made in the cluster 5 process, Alamitos will receive a refund of the $250,000 study deposit less costs incurred to date for application review and the scoping meeting. The ISO notified SCE to stop charging to Alamitos on July 27, 2012 and we anticipate an invoice from them shortly so that we can close out this project and send you a refund.

The ISO and SCE look forward to working with AES to repower these units. Please feel free to contact Judy Brown at 916-608-7062 or jbrown@caiso.com with any additional questions.

Kindest regards,

Deborah A. Le Vine
Director of Infrastructure Contracts & Management

Cc: Julie Gill (AES)
Jill Horswell (SCE)
David Berndt (SCE)
Jorge Chacon (SCE)

Madams, Sarah/SAC

From: Hala Ballouz [HBallouz@epeconsulting.com]
Sent: Tuesday, July 03, 2012 10:14 AM
To: Brown, Judy
Cc: Zhang, Yi; Le, David; John Kistle; Jennifer Didlo; Carlos Matar; Hugo Mena; Billy Yancey
Subject: RE: Alamitos Additional Data Request
Attachments: Alamitos V17_2012-7-3.epc; Alamitos Project_One Line Diagram_2012-07-03.pdf

Judy,

Please find attached the EPC file for power flow case that reflects the latest changes to the Alamitos project interconnection design that SCE evaluated for SCD. Note that for technical reasons while converting from our software to .epc, we could not include zero sequence data; therefore, and in the interest of time, we are listing below all the zero sequence data that your Team need to supplement in the model. Please refer to the attached One-line diagram for the table header labeling.

Please let me know if your engineers will enter the zero sequence data, else we will revert to working on addressing the conversion issues in the next day or two.

GSUs

	Generators Connected to Alamitos A		Generators Connected to Alamitc	
	T4 and T8	T1, T2, T3, T5, T6 and T7	T12 and T16	T9, T10, T11, T13, T
GSU MVA Ratings	94/124/154 ONAN/ONAF/ONAF	75/99/123 ONAN/ONAF/ONAF	94/124/154 ONAN/ONAF/ONAF	75/99/12 ONAN/ONAF/(
MVA Base for Z%	94	75	94	75
Z %	6.25	6.25	16	16
X/R	34.1	34.1	34.1	34.1
R (pu) on 100 MVA base (Z+)	0.0019	0.0024	0.0049	0.0062
X (pu) on 100 MVA base (Z+)	0.0664	0.0832	0.1701	0.2132
R_0 (pu) on 100 MVA base (Z_0)	0.0017	0.0021	0.0044	0.0056
X_0 (pu) on 100 MVA base (Z_0)	0.0598	0.0749	0.1531	0.1919

Tie Lines:

	Block 1 to Switchyard	Block 2 to Switchyard	Block 3 to Switchyard	Block 4 to Switchyard
R (pu) on 100 MVA base (Z+)	0.000057	0.000051	0.000092	0.000018
X (pu) on 100 MVA base (Z+)	0.000461	0.000414	0.000751	0.000149
B (pu) on 100 MVA base (B+)	0.00050933	0.00045777	0.00082988	0.00016457
R_0 (pu) on 100 MVA base (Z_0)	0.000308	0.000277	0.000501	0.000099
X_0 (pu) on 100 MVA base (Z_0)	0.001264	0.001136	0.002060	0.000408

Generators:

	Gas	Steam
MVA base	122.065	153.229
X''1 – Positive sequence subtransient reactance	0.123	0.14
X''2 – Negative sequence	0.153	0.183

subtransient reactance		
X''0 – Zero sequence subtransient reactance	0.084	0.091

Generator Grounding (for all generators):

R : 614.66 on 100 MVA base
X : 249.95 on 100 MVA base

Best,

Hala N. Ballouz, P.E. , President

Electric Power Engineers, Inc.
Office: (512) 382 6700 ext 301

From: Brown, Judy [mailto:jbrown@caiso.com]
Sent: Monday, July 02, 2012 3:00 PM
To: Hala Ballouz
Cc: Zhang, Yi; Le, David
Subject: Alamitos Additional Data Request

Hala:
Would you please send us the updated epc files for power flow case modeling that reflect these changes for the generator step up (GSU) transformers? Thank you!

Judy Brown
Lead Interconnection Specialist
California ISO
(916) 608-7062

NOTE: Failure to include the correct Project Name, Cluster Number, and Queue Number in the SUBJECT LINE will significantly delay the processing of and response to your communications.

****
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