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NERC Reliability Standard MOD-032: Generator Owner Data Requirements & Reporting Procedures

Document Owner: System Planning & Asset Management

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1.0 Objective

SaskPower, in its role as a North America Reliability Corporation (NERC) registered Planning Coordinator and Transmission Planner for the province of Saskatchewan, is required to maintain and develop system models (steady state, dynamics and short circuit) for its planning studies. SaskPower collects and maintains modeling data of existing and new/future facilities from registered Generation Owners (GO) connected to the SaskPower system in accordance with NERC MOD-032 reliability standard. The purpose of this document is to provide information on modeling data requirements and reporting procedures for GOs.

This document is available through

- SaskPower public OASIS website
- Upon request from SaskPower

2.0 Responsible Generator Owners

This document is applicable to all (SaskPower and non-SaskPower) **NERC registered** generator owners connected to SaskPower transmission system.

These requirements are applicable to:

- GOs with the individual unit capacity of 20 MVA or larger (gross nameplate rating).
- GOs with aggregated generator unit capacity 75 MVA or larger (gross aggregated nameplate rating).
    - Modeling data should be submitted for each unit.
- GOs with aggregated generator unit capacity 75 MVA or larger (gross aggregated nameplate rating) and is a collector – based generating facilities. (example: wind, solar)
    - Modeling data should be submitted for aggregate generating capacity as a single unit.

Non-NERC registered GOs should contact SaskPower for applicable data requirements and reporting procedures. Typically, it would be similar to the requirements in this document.

3.0 Modelling Data Submission Requirement and Reporting Procedures

GOs are responsible for submitting/updating modeling data for their existing and/or new facilities. GOs are required to submit their existing and new[1] generating facility modeling data to SaskPower on annual basis.

GO of **existing facilities** is required to:

- Either resubmit all required modeling data annually or certify modeling data has not changed from the previous year data submission.
- Identify all changes to existing facilities and submit modified modeling data completing generator data format requirement. Refer to Appendix A for data form.
- Follow data submission schedule in section 3.2 to provide modeling data to SaskPower.

GO of **new**[1] **generating facilities** is required to:

- Submit modeling data.
    - Prior to construction, preliminary modeling data for conducting interconnection/system impact studies is acceptable.
    - Prior to commissioning, manufacture design modelling data is acceptable.
    - Post commissioning, verified modeling data is required within a year of commercial operation date.

3.1. Generator Data Format Requirement

- Refer to Appendix A for Data format for steady state, short circuit and dynamics modeling data requirements.
- Dynamic models shall be submitted to SaskPower based on standard models compatible with Siemens-PTI PSSE (Power System Simulator for Engineering).

[1] new: includes facilities that have completed construction, is under construction, has a signed or approved Interconnection Service Agreement (ISA)/Power Purchase Agreement (PPA)/Construction Service Agreement (CSA) or equivalent.

- Generator Owners are responsible for validating and maintaining all dynamics models submitted to SaskPower are compatible with the current version used by SaskPower and the latest PSSE version.

- GOs are required to provide acceptable models for their facilities as determined by SaskPower. Refer to Appendix B for the list of acceptable models. SaskPower has adopted the NERC list of acceptable models for system modeling.

  - Identified Unacceptable Models: GOs are required to contact SaskPower to discuss and identify acceptable modification plan for their existing facilities models. These models need to be modified as soon as possible.

  - Identified Not Recommended Models: GOs should consider converting their existing facilities models.

3.2. Data Submission Schedule

- SaskPower is a part of the NERC Eastern Interconnection. SaskPower participates to support creation of the interconnection-wide cases following Multiregional Modeling Working Group (MMWG) procedural manual. SaskPower submits modeling data as per the schedule described in MMWG procedural manual.

- To meet model building time lines, GOs are required to submit/certify or resubmit/recertify their generating facilities modeling data to SaskPower by **March 1st** of each calendar year.

  - If required, SaskPower will review the submitted data/information and will notify GOs to provide updated data or explanation with a technical basis for maintaining the current data.

    - GOs are required to provide the response within **90 calendar days** of receipt of request from SaskPower.

  - GOs are required to submit their planned generator facilities outage schedule by **April 1st** of each calendar year. GOs are required to provide following planned outage schedule information:

    - Plant name and unit number
    - Start and end date
    - Description for outage
    - Target year

Appendix A: Generator Data Requirements

INTERCONNECTION CONTACT	
Company Name: **<u>OR</u>** SaskPower Department:	
Contact Name:	
Mailing Address:	
E-mail Address:	
Telephone Number:	

SERVICE REQUESTED	
Type of Interconnection Service: • Network Resource • Energy Resource • Load Customer Self-Supply • Modification of Facilities	

SITE LOCATION AND PROPOSED IN-SERVICE DATES:	
Proposed Location of Project: (Section-Township-Range-Meridian or provide UTM coordinates, or provide name of site if this is a capacity increase to an existing generating facility.)	
Proposed Commercial Operation Date for Generating Facility:	
Proposed In-Service Date for Transmission Interconnection	

Facilities: (Proposed date by which the transmission facilities needed to interconnect to the SaskPower transmission system are in-service.)	

GENERATING FACILITY DATA:	
Number of units:	
Type (synchronous, induction, doubly-fed induction, back-to-back convertor, etc.):	
Rated Output (MVA, MW, MVAr):	
Reactive Power capability (+/-MVAr):	
Net output to Transmission System (Cumulative production capacity range for total facility):	Maximum (MW): Minimum (MW):
Station Power Requirements: (MW, MVAr)	At Maximum Production: At Minimum Production:
Energy Source: (steam turbine, gas/combustion turbine, wind turbine, hydro turbine, etc.)	
Modes of operation: (base-load, peaking, synchronous condense, intermittent, etc.)	
GENERATOR/TURBINE DATA (to be filled out separately for each different type of generator)	
GENERATOR DATA – GENERATOR CHARACTERISTICS:	
Type of generator: (Synchronous, Induction Generator, back-to-back convertor, etc.)	
Make & Model:	
Generator rating (MVA):	

Power factor at rated output (in per unit):		
Generator rated terminal voltage:		
Voltage control range on generator terminal or back-to-back convertor terminal:		
Capability of generator/prime mover:	Nominal/ISO rating: (MW@ power factor)	
	Summer rating (40°C) (MW@ power factor)	
	Absolute maximum reduced ambient rating (MW@ power factor)	
Production capacity range of individual generators (Gross):	Maximum (MW)	
	Minimum (MW)	
Capability of facilities:	Nominal/ISO rating: (MW@ power factor)	
	Summer rating: (40°C) (MW@ power factor)	
	Absolute maximum reduced ambient rating: (MW@ power factor)	
Production capacity range of facilities (Gross):	Maximum (MW)	
	Minimum (MW)	
Power factor at rated output of facilities (in per unit):		
Voltage control range of facilities:		
Attach reactive capability curve for overall facilities (include voltage dependency)		
Provide PSS/E[2] power flow, short circuit and dynamic models representing the facilities (including generators, turbines and auxiliary equipment).		
Data Required for Synchronous Machines:	Rating of generator (MVA):	
	Power factor at rated output (%)	

[2] Request current version format from System Planning & Asset Management

• Impedances expressed in per unit on machine base. • Unsaturated values are required. Saturated values should also be provided if available.	Speed (RPM)	
	Inertia constant (H) (Generator and prime mover)	
	Direct axis synchronous reactance (x_d)	
	Direct axis transient reactance (x'_d)	
	Direct axis sub-transient reactance (x''_d)	
	Quadrature axis synchronous reactance (x_q)	
	Quadrature axis transient reactance (x'_q)	
	Quadrature axis subtransient reactance (x''_q)	
	Open circuit direct axis transient time constant (T'_{do})	
	Short circuit direct axis transient time constant (T'_d)	
	Open circuit direct axis sub-transient time constant (T''_{do})	
	Short circuit direct axis sub-transient time constant (T''_d):	
	Quadrature axis transient time constant (T'_{qo})	
	Quadrature axis sub-transient time constant (T''_{qo})	
	Armature Resistance (R_a)	
	Stator leakage reactance (X_l)	
	Armature short circuit time constant (T_a)	
	Saturation factor at 1.0 per-unit flux	
	Saturation factor at 1.2 per-unit flux	
	Negative sequence resistance (R_2)	
	Negative sequence reactance (X_2)	
	Zero sequence resistance (R_0)	
	Zero sequence reactance (X_0)	

Data Required for Non Synchronous Machines:	The Interconnection Customer must provide a model suitable for use in dynamics studies using the PSS/E[3] engineering simulation program. The proponent must provide evidence that any non-standard models have been validated through testing.	
Data Required for Induction Machines: • Impedances expressed in per unit on machine base.	Rating of generator (MVA):	
	Power factor at rated output (%)	
	Speed (RPM)	
	Inertia constant (H) (Generator and prime mover)	
	Synchronous reactance (x)	
	Transient reactance (x')	
	Sub-transient reactance (x'')	
	Leakage reactance (x_l)	
	Open circuit transient time constant (T')	
	Open circuit sub-transient time constant (T")	
	per-unit flux (E_1)	
	Open Circuit Saturation Factor (E_1)	
	per-unit flux (E_2)	
	Open Circuit Saturation Factor (E_2)	

GENERATOR DATA: VOLTAGE/POWER FACTOR CONTROL:			
Power factor or voltage regulator control range:		To	
Power factor or voltage regulator setting tolerance (%):			
For synchronous generators provide:	1. A description of the excitation system (rotating brushless, static, etc.)		

[3] Request current version format from System Planning & Asset Management

	2. An AVR/Exciter Laplace-domain control block diagram showing all control blocks with all time constants greater than 0.02s, completely specifying the transfer function from the generator terminal voltage, and field current, to the generator field voltage[4]

GENERATOR DATA: GOVERNOR CONTROLS:	
For synchronous generators provide:	1. A description of the proposed governor system
	2. A Laplace-domain control block diagram showing all control blocks with all-time constants greater than 0.02s, completely specifying the transfer function for the prime mover/governor system
For sites with fluctuations in prime mover output provide:	1. A description of expected, and maximum frequency and magnitude variations in power output
	2. Rate at which unit output can increase or decrease

GENERATOR STEP-UP TRANSFORMER DATA:		
Rating ONAN/ONAF (MVA):		
Winding voltage and connections:	HV winding	
	LV winding	
Positive sequence impedance: (% on ONAN base):		
Zero sequence impedance: (% on ONAN base):		
On-load tap range (if equipped):		
On-load tap step size (%):		
Off-load tap range:		
Off load tap step size (%):		

STATION INTERRUPTING DEVICE:	
Type of primary interrupting device (circuit breaker, fuses, etc.):	
Interrupting rating (Amperes):	

[4] Specify excitation system, power system stabilizer, and governor data in accordance with IEEE Standards or PSS/E format. If they cannot be modeled as an IEEE or PSS/E standard model, the Interconnection service requestor will have a model suitable for dynamics studies created for the PSS/E engineering simulation program.

Rated Interrupting Time (cycles):	

DRAWINGS:
General site location map showing land location of the generation plant facilities.
Site plan showing the station location, layout, and the point of interconnection to the SaskPower transmission system.
Station layout drawing for generation plant facilities.
Electrical single-line diagram of the generation plant electrical equipment and other associated facilities.
Protection and metering single-line drawing for generation plant facilities.
Plot of generator reactive capability curves (MVAR output vs. MW output) and V curves for all synchronous generators.
Plot of generator air-gap and open-circuit saturation curves and short circuit characteristic for all synchronous generators.
Plot of off-nominal frequency capability and V/Hz characteristic for all generator/turbines.
Plot of over-voltage capability for all generators.

OTHER DATA:	
Provide any other relevant information for the purpose of facilitating interconnection to the SaskPower transmission system. For example operating and maintenance scenarios, backup generation/load requirements, load/generation interdependencies, processes etc.	
Provide information regarding any temporary interconnections to the SaskPower transmission system.	

Appendix B: NERC List of Acceptable Models for Interconnection-wide Modeling (Siemens PTI v. 33)

Use of this model is not recommended. Other models are more suitable.
Use of this model is considered unacceptable. Future use of this model should be prohibited.
Modeling limitations or discrepancies known.

Model Type	Model Description	Unacceptable Models	Siemens PTI (v. 33)
Machine Model	Round Rotor Generator Model (IEEE Std 1110 §5.3.2 Model 2.2)		GENROU
	Salient Pole Generator Model (IEEE Std 1110 §5.3.1 Model 2.1)	✓	GENSAL
	Round Rotor Generator Model (IEEE Std 1110 §5.3.2 Model 2.2)		GENROE
	Salient Pole Generator Model (IEEE Std 1110 §5.3.1 Model 2.1)		GENSAE
	Round Rotor Generator with DC Offset Torque Component		GENDCO
	Cross Compound WECC Type F		--
	Generator Type F		--
	Generator Type J		GENTPJU1
	Classical Generator Model (IEEE Std 1110 §5.4.2)	✓	GENCLS
	Third Order Generator Model		CGEN1
	Transient Level Generator Model	✓	GENTRA
	Salient Pole Frequency Changer Model		FRECHG
	"Two-cage" or "One-Cage" Induction Generator		CIMTR1, CIMTR3
Signal Playback Models	Play-In of Voltage and/or Frequency Signal		PLBVFU1
	Frequency Playback Model		TSTGOV1
	Play-In of Generator Field Voltage		--
	Delivers Played-In Signal to Dynamic Simulation Models		--
	Play-In of Voltage Regulator and Governor Reference Settings		--
	Play-In Turbine Power		--
	Thevenin Source of Defined Voltage Amplitude and Frequency		--
Renewable Energy Resource Models	Generic Type 1 WTG Generator Model (Fixed-speed induction generator)		WT1G1
	Generic Type 2 WTG Generator Model (Variable slip induction generator with variable rotor resistance)		WT2G1
	Generic Type 3 WTG Generator/Converter Model -	✓	WT3G1

	PSSE (Doubly-fed induction generator)		
	Generic Type 3 WTG Generator/Converter Model - PSLF (Doubly-fed induction generator)	✓	WT3G2
	Generic Type 4 WTG Generator/Converter Model - PSSE (Variable speed generator with full converter)	✓	WT4G1
	Generic Type 4 WTG Generator/Converter Model - PSLF (Variable speed generator with full converter)	✓	WT4G2
	Generic Type 2 WTG Rotor Resistance Control Model		WT2E1
	Generic Type 3 WTG Electrical Control Model	✓	WT3E1
	Generic Type 4 WTG Electrical Control Model - PSSE	✓	WT4E1
	Generic Type 4 WTG Electrical Control Model - PSLF	✓	WT4E2
	Generic Type 1 Two Mass Turbine Model		WT12T1
	Generic Type 2 Two Mass Turbine Model		WT12T1
	Generic Type 3 WTG Turbine Model	✓	WT3T1
	Generic Type 3 and 4 WTG Drive Train Model		WTDTAU1
	Generic Type 3 WTG Pitch Control Model	✓	WT3P1
	Generic Type 3 and 4 WTG Pitch Control Model		WTPTAU1
	Generic Type 1 and 2 WTG Pitch Control Model	✓	WT12A1
	Generic Type 2 and 2 WTG Pitch Control Model		--
	Generic Type 3 and 4 WTG Aerodynamics Model		WTARAU1
	Generic Type 3 and 4 WTG Torque Control Model		WTTQAU1
	Generic Type 4 WTG Power Converter Model	✓	--
	Generic Type 4 Pitch Control Model	✓	--
	Linearized Model of PV Panel Output Curve		PANELU1
	Linearized Model of PV Panel Solar Irradiance Profile		IRRADU1
	Generic Phase 2 Renewable Energy Generator/Converter Model		REGCAU1
	Generic Phase 2 Renewable Energy Electrical Controls Model		REECAU1
	Generic Phase 2 Renewable Energy Plant Controller		REPCAU1
	Generic Phase 2 PV Electrical Controls Model		REECBU1
	Generic Phase 2 Energy Storage Electrical Controls		--
	Generic Phase 2 Renewable Energy Auxiliary Control Model		REAX4BU1
	Vestas Model of Wound-Rotor Induction Generator (with Variable External Rotor Resistance)		--
	Vestas Model of Rotor Resistance Control for Wound-Rotor Induction WTG		--
	GE Wind Turbine Control Model - Doubly Fed Induction Generator (DFIG) and Full Converter (FC) Models		--
	GE Wind Turbine Generator/Converter - DFAG and		--

	FC Models		
	GE Wind Turbine Excitation (converter) Control Model for DFAG Generators		--
	GE Wind Turbine Plant-Level Supervisory Voltage/VAR Control		--
	Solar Photovoltaic Generator/Converter Model		PVGU1
	Solar Photovoltaic Electrical Control Model		PVEU1
	Distributed photovoltaic system		--
Excitation System Models	IEEE Std 421.5 Type AC1A		ESAC1A
	Modified IEEE Std 421.5 Type AC1A		ESURRY
	IEEE Std 421.5 Type AC2A		ESAC2A
	IEEE Std 421.5 Type AC3A		ESAC3A
	IEEE Std 421.5 Type AC4A		ESAC4A
	IEEE Std 421.5 Type AC5A		ESAC5A
	IEEE Std 421.5 Type AC6A		ESAC6A
	Modified IEEE Std 421.5 Type AC6A (added speed multiplier)		USAC6AU
	IEEE Std 421.5 Type AC7B*		AC7B
	IEEE AC7B Excitation System Model w/ OEL for Brushless Exciters and GE EX2100 Controls		--
	IEEE Std 421.5 Type AC8B		AC8B
	Modified IEEE Std 421.5 Type AC8B		ESAC8B
	IEEE Std 421.5 Type DC1A		ESDC1A
	IEEE Std 421.5 Type DC2A		ESDC2A
	IEEE Std 421.5 Type DC3A		DC3A
	IEEE Std 421.5 Type DC4B		DC4B
	IEEE Std 421.5 Type ST1A		ESST1A
	IEEE Std 421.5 Type ST2A		ESST2A
	IEEE Std 421.5 Type ST3A		ESST3A
	IEEE Std 421.5 Type ST4B		ESST4B
	Modified IEEE Std 421.5 Type ST4B (without OEL & UEL inputs and Vgmax)		--
	IEEE Std 421.5 Type ST5B**		ST5B
	IEEE Proposed Type ST5B Excitation System		URST5T
	IEEE Std 421.5 Type ST6B		ST6B
	IEEE Std 421.5 Type ST7B		ST7B
	1968 IEEE Type 1+B127		IEEET1
	Modified 1968 IEEE Type 1		IEET1A
	Modified 1968 IEEE Type 1		IEET1B
	1968 IEEE Type 2		IEEET2
	1968 IEEE Type 3		IEEET3
	1968 IEEE Type 4		IEEET4
	Modified 1968 IEEE Type 4		IEEET5

	Modified 1968 IEEE Type 4		IEET5A
	1981 IEEE Type AC1		EXAC1
	Modified 1981 IEEE Type AC1 (modified rate feedback source and with added speed multiplier)		EXAC1A
	Modified 1981 IEEE Type AC1		--
	1981 IEEE Type AC2		EXAC2
	1981 IEEE Type AC3		EXAC3
	Modified 1981 IEEE Type AC3		ESAC3A
	1981 IEEE Type AC4		EXAC4
	1981 IEEE Type DC1		IEEEX1
	Modified 1981 IEEE Type DC1		IEEEX2
	Modified 1981 IEEE Type DC1		IEEX2A
	1981 IEEE Type DC2		EXDC2
	Modified 1981 IEEE Type DC2		IEEEX2
	1981 IEEE Type DC3		IEEEX4
	1981 IEEE Type ST1		EXST1
	1981 IEEE Type ST2		EXST2
	Modified 1981 IEEE Type ST2		EXST2A
	Modified 1981 IEEE Type ST2		IEEEX3
	1981 IEEE Type ST3		EXST3
	Modified 1981 IEEE Type ST3		ESST3A
	General Purpose Rotating Excitation System Model		REXSYS
	General Purpose Rotating Excitation System Model		REXSY1
	Proportional/Integral Excitation System Model		EXPIC1
	Manual Excitation Control with Field Circuit Resistance		--
	General Purpose Transformer Fed Excitation System	✓	--
	Bus or Solid Fed SCR Bridge Excitation System Model		SCRX
	Bus or Solid Fed SCR Bridge Excitation System Model Type NEBB (NVE)		EXNEBB
	Bus or Solid Fed SCR Bridge Excitation System Model Type NI (NVE)		EXNI
	Simplified Excitation System	✓	SEXS
	IVO Excitation System Model		IVOEX
	ELIN Excitation System		CELIN
	Basler Static Voltage Regulator Feeding DC or AC Rotating Exciter		EXBAS
	Brown-Boveri Transformer-Fed Static Excitation System Model		BBSEX1
	Static PI Transformer Fed Excitation System		EXELI
	VATECH (ELIN) Static Excitation System with PSS		--
	GE EX2000 Excitation System	✓	EX2000

	AEP Rockport excitation system		EMAC1T
	Czech Proportional/Integral Excitation System Model		BUDCZT
	High Dam Excitation System Model		URHIDT
Power System Stabilizer	Transient Excitation Boosting Stabilizer Model		BEPSST
	Dual-Input Signal Power System Stabilizer Model		IEE2ST
	1981 IEEE Power System Stabilizer		IEEEST
	IVO Stabilizer Model		IVOST
	Ontario Hydro Delta-Omega Power System Stabilizer		OSTB2T
	Ontario Hydro Delta-Omega Power System Stabilizer		OSTB5T
	IEEE Std 421.5-2005 Single-Input Stabilizer Model		PSS1A
	1992 IEEE Type Dual-Input Signal Stabilizer Model		PSS2A
	IEEE Std 421.5-2005 PSS2B Dual-Input Stabilizer Model		PSS2B
	IEEE Std 421.5-2005 PSS3B Dual-Input Stabilizer Model		PSS3B
	IEEE Std 421.5-2005 PSS4B Dual-Input Stabilizer Model		PSS4B
	PTI Microprocess-Based Stabilizer Model		PTIST1
	PTI Microprocess-Based Stabilizer Model		PTIST3
	Speed Sensitive Stabilizer Model		STAB1
	ASEA Power Sensitive Stabilizer Model		STAB2A
	Power Sensitive Stabilizer Model		STAB3
	Power Sensitive Stabilizer Model		STAB4
	Dual-Input Signal Power System Stabilizer Model		ST2CUT
	Dual Input Stabilizer (IEEE Type PSS2A) + Voltage Boost Signal Transient Stabilizer and Vcutoff		--
	WECC Supplementary Signal for Static Var System		STBSVC
	Synchronous Condenser Auxiliary Control Model		SYNAXBU1
	Single Input PSS for SVSMO1, SVSMO2, and SVSMO3		--
Current Compensation Models	Cross-Current Compensation Model with Reactive Current Feedback		CCOMP4U1
	Voltage Regulator Compensating Model		COMP
	Cross and Joint Current Compensation Model		COMPCC
	IEEE Std 421.5 Current Compensator		IEEEVC
	Remote Bus Voltage Signal Model		REMCMP
Turbine-Governor Models	Steam Plant Boiler Turbine-Governor Model		--
	Combined Cycle Plant Steam Turbine Model		UCBGT
	GE Frame 6, 7, and 9 Gas Turbine Model		--
	General Purpose (Gas Turbine & Single Shaft CC) Turbine-Governor Model		GGOV1

	General Governor Model with Frequency-Dependent Fuel Flow Limit		--
	General Governor Model with GE Gas Turbine Control Features		--
	LM 2500 Aero-Derivative Gas Turbine Governor Model	✓	--
	LM 6000 Aero-Derivative Gas Turbine Governor Model	✓	--
	Single Shaft Combined Cycle Plant Model		--
	Woodward 2301 Governor and Basic Turbine Model		--
	Brown-Boveri Turbine-Governor Model		BBGOV1
	Cross Compound Turbine-Governor Model		CRCMGV
	Woodward Diesel Governor Model		DEGOV
	Woodward Diesel Governor Model		DEGOV1
	WECC Gas Turbine Governor Model	✓	URGS3T
	Gas Turbine-Governor Model	✓	GAST
	Gas Turbine-Governor Model	✓	GAST2A
	Gas turbine-governor	✓	GASTWD
	Hydro Turbine-Governor Model		HYGOV
	Hydro Turbine-Governor Model		HYGOV2
	Hydro Turbine-Governor Lumped Parameter Model		HYGOVM
	Fourth Order Lead-Lag Hydro-Turbine Model		HYGOVR1
	Hydro Turbine-Governor Traveling Wave Model		HYGOVT
	Hydro Turbine-Governor Model		--
	Model to Manage Parameter Data for h6b Hydro Turbine-Governor Model		--
	Hydro Governor Model for up to 4 Units on Common Penstock		--
	Hydro Turbine-Governor (plants w/ straightforward penstock config + PID governor, blade angle for Kaplan)		--
	Hydro Turbine w/ Woodward Electro-Hydraulic PID Governor, Penstock, Surge Tank, and Inlet Tunnel		--
	1981 IEEE Type 1 General Steam Turbine-Governor Model		IEEEG1
	1981 IEEE Type 2 General Approx. Linear Ideal Hydro Model	✓	IEEEG2
	1981 IEEE Type 3 General Mechanical-Hydraulic Model		IEEEG3

	Hydro Turbine-Governor (plants with straightforward penstock config + hydraulic govs of 'dashpot' type)		IEEEG3
	1973 IEEE General Steam Non-Reheat		IEESGO
	IVO Turbine-Governor Model		IVOGO
	Hydro Turbine-Governor Model		PIDGOV
	Pratt & Whitney Turboden Turbine-Governor Model		PWTBDU1
	Torsional-Elastic Shaft Model for 25 Masses		SHAF25
	Steam Turbine-Governor Model		TGOV1
	Steam Turbine-Governor Model w/ Fast Valving		TGOV2
	1973 Modified IEEE Type 1 General Steam Turbine-Governor Model w/ Fast Valving		TGOV3
	Modified IEEE Type 1 General Steam Turbine-Governor Model w/ PLU and EVA		TGOV4
	Modified IEEE Type 1 General Steam Turbine-Governor Model w/ Boiler Controls		TGOV5
	Czech Hydro or Steam Turbine-Governor Model		TURCZT
	Tail Water Depression Hydro Governor Model 1		TWDM1T
	Tail Water Depression Hydro Governor Model 2		TWDM2T
	Combined Cycle - Single Shaft Turbine-Governor Model		URCSCT
	Woodward Electronic Hydro Governor Model		WEHGOV
	Westinghouse Digital Governor Model for Gas Turbines	✓	WESGOV
	Woodward PID Hydro Governor Model		WPIDHY
	WECC Double Derivative Hydro Governor Model		WSHYDD
	WECC GP Hydro Turbine-Governor Model		--
	PID Governor, Double-Derivative Governor, and Turbine (WECC GP governor, WECC G2 turbine-governor)		WSHYGP
	Modified IEEE Type 1 General Steam Turbine-Governor Model w/ Speed Deadband		WSIEG1
Load Controller Models	Turbine Load Controller Model		LCFB1
Load Models	Induction Generator Model with Rotor Flux Transients		CIMTR1
	Induction Motor Model with Rotor Flux Transients		CIMTR2
	Induction Generator Model with Rotor Flux Transients		CIMTR3
	Induction Motor Model with Rotor Flux Transients		CIMTR4
	Induction Motor Model		CIM5BL

	Induction Motor Model		CIM6BL
	Induction Motor Model		CIMWBL
	IEEE Load Model		IEEL__
	Load Frequency Model		LDFR__
	Extended-Term Load Reset Model		EXTLBL
	Complex Load Model		CLOD__
	Composite Load Model		CMLDBLU1
	Composite Load Model w/ DER Component		--
	Composite Load Model w/ Modular Capability		--
	Performance-Based Model of Single Phase Air Conditioner Motor Model		ACMTBLU1
	Phasor Model of Single-Phase Air-Conditioner Compressor Motor	✓	--
Static Var Systems and FACTS	WECC Generic Continuous Control SVC Model		SVSMO1U2
	WECC Generic Discrete Control SVC Model		SVSMO2U2
	WECC Generic STATCOM-Based SVC Model		SVSMO3U2
	SCR Controlled Static VAR Source Model		CSVGN1
	SCR Controlled Static VAR Source Model		CSVGN3
	SCR Controlled Static VAR Source Model		CSVGN4
	WECC Controlled Static VAR Source Model		CSVGN5
	WECC Controlled Static VAR Source Model		CSVGN6
	Switched Shunt Model		SWSHNT
	American Superconductor DSMES Device		CDSMS1
	Static Condenser FACTS Model		CSTATT
	Static Condenser (modeled as FACTS in power flow)		CSTCNT
	ABB SVC Model		ABBSVC1
	SVC for Switched Shunt		CHSVCT
	SVC for Switched Shunt		CSSCST
	EPRI Superconducting Electromagnetic Energy Storage FACTS Model		CSMEST
	EPRI Battery Energy Storage FACTS Model		CBEST
Protection and Other Models	Generic Generator Protection System		--
	Generic Generator Protection System		--
	Under-/Over-Frequency Generator Bus Disconnection Relay		FRQTPAT
	Under-/Over-Frequency Generator Trip Relay		FRQDCAT
	Under-/Over-Voltage Generator Bus Disconnection Relay		VTGTPAT
	Under-/Over-Voltage Generator Trip Relay		VTGDCAT
	Time-Inverse Overcurrent Relay		TIOCR1
	Definite Time Underfrequency Load Shedding Relay		LDS3BL
	Definite Time Undervoltage Load Shedding Relay		LDS3BL
	Definite Time Undervoltage Load Shedding Relay		LDS3BL

	Out-of-Step Relay with 3 Zones (Lens, Tomato, or Circle)		--
	Out-of-Step Relay with 3 Zones (Lens, Tomato, Circle, or Rectangle)		--
	Out-of-Step Mho Relay with Blinders		--
	Metal Oxide Varistor and Bypass Protection for Series Capacitor		--
	Switched Capacitor Bank Model		SWCAPT
	Mechanically Switched Capacitor		--
	Mechanically Switched Reactor		--
	Mechanically Switched Line Reactor		--
	Mechanically Switched Shunt		--
	Mechanically Switched Shunt		--
	Over-Excitation Limiter for Synchronous Machine Excitation System		--
	Load Tap Changer Model		OLTC1T
	Variable Frequency Transformer or Rotary Phase Shift Regulator		OLPS1T

Reference:

http://www.nerc.com/comm/PC/System%20Analysis%20and%20Modeling%20Subcommittee%20SAMS%20201/Acceptable_Models_List_2017-08-19.xlsx