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SIEMENS			1 (11)
SYSTEM DESCRIPTION	Respons. dept Date GPEL 040216	E DB 101	
GENERATOR SYSTEM	Prepared T.Cota	YAMAM	A CEMENT
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SYSTEM DESCRIPTION	Respons. dept	Date 040216	Reg. E DB 101
MKA GENERATOR SYSTEM	Prepared T.Cota		YAMAMA CEMENT

Purpose of the system

The purpose of the generator system is to transform mechanical shaft power into electrical 3-phase power which is adopted to voltage and frequency levels of the receiving power system.

General description of the system

The ABB AC generator is a 4-pole synchronous AC generator of salient pole type manufactured by ABB in Sweden.

The generator is of a compact welded steel design. The design concept makes very efficient use of active material employed, resulting in optimal performance with good economy and an exceptionally low total weight.

Special emphasis has been placed on designing an electrical machine with good mechanical stability. The box shaped machine base design allows the stator core with windings to rest directly on the foundations, thus ensuring that all static and dynamic forces are transmitted directly into the foundation.

A combination of short distance between the bearing centres and rigid bearing supports placed under the centre of each bearing, minimises the level of vibration. Traditional sleeve bearings of split type design are employed. The bearing liners are easily replaceable.

The rotor is of salient pole design running below the first lateral critical speed with a safe margin. A very high thermal capacity is characteristic for this rotor design. The shaft can be designed for double end drive, an often cost effective solution in combined cycles

where the gas turbine can drive the generator from one end and the steam turbine from the other.

Brushless excitation is achieved by a rotating exciter mounted on the main shaft outside the bearing at the non driven end. The excitation power is taken from a permanent magnet generator driven by the main generator shaft. The equipment is easy accessible for inspection.

The AC generator is tested according to a standard inspection plan issued by ABB. For further information concerning tests, please refer to the generator specification.

The generator terminal enclosure is a steel structure fitted to the side of the generator. It houses the generator terminals, busbars as well as neutral and line side equipment as specified.

For more information and technical data, please refer to the generator documentation "MV terminal enclosure", data sheets and brochures.

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SYSTEM DESCRIPTION		GPEL	040216	E DB 101			
MKA		Prepared					
GENERATOR SYSTEM		T.Cota		YAMAMA CEMENT			
Main components							
• Generator							
MKA10 The comparison for	MKA10						
Stator	lowing main co	Simponents:					
- Rotor							
• Exciter							
MKC10							
The exciter comprise follow	wing main com	ponents:					
- Exciter with rotating diod	les						
- Pilot exciter							
For more detailed informat	ion see system	description MK([~] MKV draw	no 1CS28920			
T of more detailed informat	ion see system	description wite	, with unaw	. 10 10520720.			
Generator terminal box							
+MKA10GA001							
The following equipment is	The following equipment is installed in the terminal box:						
- Current transformers for I	ine respective	neutral side, see l	below.				
- Voltage transformers, see	below.						
- Stand still heater element,	, see below.						
- Heater element, see below	V.						
• Voltage transformer							
+MKA10GA001.T1							
+MKA10GA001.T2							
+MKA10GA001.T3							
The transformer measures	generator volta	ge for AVR, met	ering, synchro	onisation and protection.			
• Current transformer, genera	ator line side						
+MKA10GA001.T4							
+MKA10GA001.T5							
+MKA10GA001.16			. Each tuanaf				
phase and has three cores	all cores are us	ed for protection	e. Each transf	ormer measures in one			
phase and has three cores, an cores are used for protection.							
• Current transformer, genera	ator neutral sid	e					
+MKA10GA001.T7							
+MKA10GA001.T8							
+MKA10GA001.19	annont on the	rananatan namen-1	aida Each to-	noformor magazza in an			
nhase and has three cores	one core is used	d for the ΔVR to	side. Each tra	ion			
phase and has three cores, (io ioi pioteet	.011.			
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MKA	GPEL 040216	E DB 101	
GENERATOR SYSTEM	T.Cota	YAMAMA	A CEMENT
 Surge arrester +MKA10GA001.F1 +MKA10GA001.F2 +MKA10GA001.F3 			
• Heater element +MKA10GA001.R04			
• Grounding resistor +MKA10GA001.R21			
• MCB terminal box +MKA10GA002			
The following equipment is installed in th - MCB:s for AVR, protection/measuring, - Terminals for current transformers, line	ne terminal box: see below. respective neutral side.		
• MCB, AVR +MKA10GA002 F1			
The Miniature Circuit Breaker protects th	e AVR measuring circuit fro	om overload/over	current.
Tripped MCB gives an alarm and transfer For more information see system descript	rs the voltage regulation to F tion for MKC, MKY draw no	CR (Field Currer 0 1CS28920.	nt Regulator).
• MCB's, protection/measuring			
+MKA10GA002.F2	MCB, generat	tor protection sub	0.1
+MKA10GA002.F3 +MKA10GA002 F4	MCB, generat MCB measur	tor protection sub	0.2 Conising
+MKA10GA002.F5	MCB, measur MCB, spare	ement for synem	omsnig
+MKA10GA002.F6	MCB, open de	elta/earth fault	
The Miniature Circuit Breakers protects t overload/overcurrent. An alarm is given i	he generator protection respection f any of the MCB's is tripped	ective measuring d (excluding spar	circuits from e MCB).
• Exciter terminal box +MKA10GA003			
The following equipment is installed in the	ne terminal box:		
- Excitation field breaker.			
- Excitation trypistor convertor. - Rotating diode protection			
For more detailed information see system	description MKC, MKY dra	aw. no 1CS28920).
- Measuring converters for voltage, current	nt, active and reactive power	, see below.	
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JIL I			Respons. dept	Date	Reg.	5 (11)	
SYST	EM DESCRIPTIO	DN	GPEL	040216	E DB 101	l	
MKA GENE	ERATOR SYSTEM	Ν	Prepared T.Cota		YAMAM	IA CEMENT	
• Me +M +N +N +N	easuring converters IKA10GA003.E1. IKA10GA003.E1. IKA10GA003.E1. IKA10GA003.E1.	S A03 U04 U05 U06					
• Fie +M The - T	eld instruments terr IKA10GA004 e following equipn erminals for field i	ninal box nent is installed in t instruments on gene	he terminal box: erator, see below.				
• Hea +M Tha - T	ater elements term IKA10GA006 e following equipn erminals for stator	inal box nent is installed in t heater elements, se	he terminal box:				
• PM +M The - N	 PMG terminal box +MKA10GA007 The following equipment is installed in the terminal box: - MCB:s for the excitation system PMG, see below. 						
• MC +M The giv for	CB, PMG IKA10GA007.F01 e Miniature Circuit res an alarm and tri MKC, MKY draw	t Breaker protects t ips the generator cir 7 no 1CS28920.	he PMG circuit fron cuit breaker. For mo	n overload/ove ore informatio	ercurrent. T in see syster	ripped MCB n description	
• AC +M	injection unit roto IKA10GA008	or earth fault					
Ger MF The MF Hea Tha	nerator heater XA10AH005 e generator is equip XA10AH005.R01 ater element, gener XA10AH005.R02 ater element, gener XA10AH005.R03 ater element, gener XC10AH005.R01 ater element, excit e heater elements a	pped with following rator stator rator stator rator stator er are connected so tha	g anti-condensation at they form one 3-p	stand still hea hase power co	ter element: onsumer.	S,	
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	SIEMENS				6 (11)	
	SYSTEM DESCRIPTION	Respons. dept	Date 040216	Reg. E DB 101		
	MKA GENERATOR SYSTEM	Prepared T.Cota		YAMAMA	CEMENT	
This document is issued in Pulse.	 Temperature transmitter, bearing m MKA10CT005 The Pt100 sensor measures the driv High metal temperature (H1) gives shutdown is required. Temperature transmitter, bearing m MKA10CT010 The Pt100 sensor measures the non High metal temperature (H1) gives 	netal DE we end bearing metal tem an alarm and if the secon netal NDE n drive end bearing metal an alarm and if the secon	perature. nd alarm level (temperature. nd alarm level (H2) is reach H2) is reach	ed manual ed manual	
lery AB	 Temperature transmitter, incoming MKA10CT015 The Pt100 sensor measures temper Cooling air temperature above (H1 	air DE rature of the cooling air co) gives an alarm and unlo	oming to the ge bads the turbine	nerator in the	e drive end.	
val Industrial Turbomachin	 Temperature transmitter, outgoing air MKA10CT020 The Pt100 sensor measures temperature of the cooling air leaving the generator. High outgoing cooling air temperature (H1) gives an alarm. 					
© Demag Dela	 Temperature transmitter, incoming MKA10CT025 The Pt100 sensor measures temper end. The signal is used for indication ar 	air NDE cature of the cooling air co ad also in the AVR for bia	oming to the ge asing of the Fiel	nerator in the	e non drive niter.	
	 Temperature transmitter, stator win MKA10CT030 The Pt100 sensor measures the ten Winding temperature above (H1) g high temperature (H3) initiates alar 	nding phase L1 operature at the phase L1 gives event, high winding rm and after 5 min. unloa	stator winding. temperature (H ds the turbine.	[2) gives an a	ılarm and	
	• Temperature transmitter, stator win MKA10CT035 The Pt100 sensor measures the ten Winding temperature above (H1) g high temperature (H3) initiates ala	nding phase L2 operature at the phase L2 gives event, high winding rm and after 5 min. also u	stator winding. temperature (H inloads the turb	I2) gives an a ine.	ılarm and	
JU-U3 MS Word 97	• Temperature transmitter, stator win MKA10CT040 The Pt100 sensor measures the ten Winding temperature above (H1) g high temperature (H3) initiates alar	nding phase L3 nperature at the phase L3 gives event, high winding rm and after 5 min. also u	stator winding. temperature (H inloads the turb	I2) gives an a ine.	ılarm and	
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GENERATOR SYSTEM	Prepared T.Cota		YAMAMA CEMENT

• Vibration transducer, DE

MKA10CY005

The accelerometer sensor measures vibration on the generator drive end bearing casing. High vibration (H1) gives an alarm and high vibration (H2) gives turbine trip.

Vibration transducer, NDE MKA10CY010 The accelerometer sensor measures vibration on the generator non drive end bearing casing. High vibration (H1) gives an alarm and high vibration (H2) gives turbine trip.

Function

Start up

The generator voltage is controlled by the voltage regulator and the generator speed is determined by the turbine during start up.

Continuos operation

The reactive power produced by the generator is determined by the voltage regulator and the active power is determined by the turbine.

During continuous turbine operation the anti-condensation heaters in the stator, exciter and the MV terminal box is switched off.

Turbine stop

The generator coasts down with the gear and power turbine.

Stand still

The generator, gear and power turbine is at stand still, also during the gas turbine cooling down period.

During standstill the anti-condensation heaters shall be switched on.

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SYSTEM DESCRIPTION MKA GENERATOR SYSTEM	Respons. dept Date GPEL 040216	Reg. E DB 101
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Disturbances

Gas turbine trip

After a gas turbine trip the generator coasts down with the power turbine and gear. The lube oil supply to the generator is ensured by the gas turbine lube oil system.

Generator breaker trip

The load throw off from the generator will give an overspeed. The turbine controller will control the turbine and return it to synchronous speed. The turbine controller will then keep the generator at synchronous speed. The voltage regulator will control the generator voltage at nominal voltage. Decision has then to be taken whether the unit should be shut down or synchronised and loaded again.

Loss of power supply

Loss of power supply does not directly affect the system. The lube oil supply to the generator is ensured by the gas turbine lube oil system. The generator can be without lube oil when the rotor is at standstill.

System faults

If there are any damages on the generator the gas turbine unit may not be started or has to be shut down.

- Electrical faults

The generator protection system protects the generator at internal electrical faults by tripping the generator circuit breaker and if necessary also the turbine and the excitation circuit breaker.

The measuring/protection circuits are protected by an MCB on respective circuit, which will trip on overcurrent/overloading.

The PMG circuit is protected by an MCB which will trip on overcurrent/overloading.

The stator winding temperature in each phase is monitored and alarm is given if any of them goes high. Should the temperature continue to increase then an unloading turbine trip is initiated.

- Bearings

Wear or damage to the bearings gives high vibration or/and high bearing metal temperature. Generator vibration respective bearing metal temperature is monitored and alarm is given if any of them goes high.

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Other faults

Fault in connecting systems:

- Electrical faults

The relay protection system protects the generator at external electrical faults by tripping the generator circuit breaker and if necessary also the turbine and excitation circuit breaker.

- Lube oil system

Fault in the lube oil system may result in incorrect incoming lube oil temperature and/or pressure to the generator. These parameters are monitored in the lube oil system and the turbine is tripped at too low pressure respective at too high temperature.

Technical specification

Design criteria and standards

EN, IEC, NEMA, IEEE

Dimensioning data

The generator is designed to match the turbine output curve. The turbine output at base load operation (TBO 40000h) shall be generated with a PF of 0.8 with temperature rise as per class B at nominal voltage and frequency.

Peak load (TBO 4000h) shall be handled with temperature rise acc. to class F.

The generator shaft/flange is designed for 5 x nominal torque in order to withstand a 2 phase short circuit.

Emergency power supply

The generator requires lube oil during operation and coast down, but can be without lube oil when the rotor is at standstill.

Installation

A protective cover for the shaft/coupling shall be installed.

Materials

-

Component data

-

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Testing and service

A grounding ball is available at each phase on generator line side, for safety grounding during maintenance on generator.

Testing during normal operation

No testing during normal operation is required.

Accessibility during normal operation

Terminal boxes and protection MCB's may be accessed during normal operation.

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SYSTEM DESCRIPTION MKA GENERATOR SYSTEM

+	
+MKA10GA001	
Generator terminal box	3
+MKA10GA001.F1	
Surge arrester, phase L1	4
+MKA10GA001.F2	
Surge arrester, phase L2	4
+MKA10GA001.F3	4
Surge arrester, phase L3	4
+MIKA10GA001.K04 Heater element	4
$\pm MK \Delta 10 G \Delta 001 R 21$	4
Grounding resistor	4
+MKA10GA001.T1	•
Voltage transformer, phase L1	3
+MKA10GA001.T2	
Voltage transformer, phase L2	3
+MKA10GA001.T3	
Voltage transformer, phase L3	3
+MKA10GA001.T4	
Current transformer, line side, phase L1	3
+MKA10GA001.15	2
Current transformer, line side, phase L2	3
+MINA100A001.10 Current transformer, line side, phase I.3	3
±MK Δ10G Δ001 T7	3
Current transformer, neutral side, phase L1	3
+MKA10GA001.T8	U
Current transformer, neutral side, phase L2	3
+MKA10GA001.T9	
Current transformer, neutral side, phase L3	3
+MKA10GA002	
MCB terminal box	4
+MKA10GA002.F1	
MCB, AVR	4
+MIKA10GA002.F2 MCP generator protection sub 1	4
\pm MKA10GA002 F3	4
MCB generator protection sub 2	4
+MKA10GA002.F4	-
MCB, measurement for synchronising	4
+MKA10GA002.F5	
MCB, spare	4
+MKA10GA002.F6	
MCB, generator protection sub.1 (open delta/earth fault)	4
+MKA10GA003	,
Exciter terminal box	4
+WIKA100A003. E1.A03	5
$+MK \Delta 10G \Delta 003 F1 U04$	3
$\pm WIXA100A003, E1.004$	

	_
Reactive load	5
+MKA10GA003. E1.U05	
Active load	5
+MKA10GA003. E1.U06	
Generator current L1-L3	5
+MKA10GA004	
Field instruments terminal box	5
+MKA10GA006	
Heater elements terminal box	5
+MKA10GA007	
PMG terminal box	5
+MKA10GA007.F01	
MCB, PMG	5
+MKA10GA008	
AC injection unit rotor earth fault	5

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Date

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MBK10CY010	
Vibration Transducer	7
MKA10	
Generator	3
MKA10AH005	
Generator heater	5
MKA10AH005.R01	
Heater element, stator	5
MKA10AH005.R02	
Heater element, stator	5
MKA10AH005.R03	
Heater element, stator	5
MKA10CT005	
Temperature Transmitter	6
MKA10CT010	
Temperature Transmitter	6
MKA10CT015	
Temperature Transmitter	6
MKA10CT020	_
Temperature Transmitter	6
MKA10CT025	
Temperature Transmitter	6
MKA10CT030	-
Temperature Transmitter	6
MKAI0C1035	
Temperature Transmitter	6
MKA10C1040	(
MKA10CX005	0
WIKATUC Y 005	7
VIDIATION TRANSDUCET	/
Fueiter	2
	5
Heater element exciter	5
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