Generator Typ: SGen6-100A-2P / 67-18

Nenndaten	***RATINGS***			
Leistung SN	*POWER*	28,24	MVA	
cos j	*P.F.*	0,85		
Drehzahl	*SPEED*	3600	min^{-1}	
Drehrichtung, bei Sicht von Turbine auf Gen.	*DIRECTION OF ROTATION,* *VIEW FROM TURBINE TO GEN.*	Uhrzeigersinn / clockwise		
Spannung	*VOLTAGE*	13,80 +5/-5 %	KV	
Strom	*CURRENT*	1181	A	
Frequenz	*FREQUENCY*	60	Hz	
Thermische Zeitkonstante Ständer	*THERMAL TIME CONSTANT STATOR*	7,19	Min	
Thermische Zeitkonstante Läufer	*THERMAL TIME CONSTANT ROTOR*	6,57	Min	
Kapazität Ständerwicklung pro Phase gegen Erde	*CAPACITY STATOR WINDING AGAINST EARTH PER PHASE*	0,101	µF	**b**
Kapazität Läuferwicklung gegen Erde	*CAPACITY ROTOR WINDING AGAINST EARTH*	0,063	µF	**b**
Kühlluftmenge	*RATE OF COOLING AIR*	13 459	m^3/s cu ft/s	
Kühllufttemperatur	*COOLING AIR TEMPERATURE*	33 91,4	°C °F	
Abzuführende Verluste	*HEAT LOSS*	501	kW	
Bauform	***TYPE OF CONSTRUCTION***			
Bauform (DIN IEC 34 T.7)	*TYPE OF CONSTRUCTION*	IM 7215		
Schutzart (DIN IEC 34 T.5)	*DEGREE OF PROTECTION*	IP 54		
Kühlart (DIN IEC 34 T.6)	*METHODS OF COOLING*	IC 8 A 1 W 7		
Schalldruckpegel (ISO 3744)	*SOUND PRESSURE LEVEL (ISO 3744)*	90	dB(A)	
Farbe	*COLOR*	RAL7030		
Verladebedingung	***SHIPMENT INDICATION***			
Umgebungstemperatur	*AMBIENT TEMPERATURE*	not less than -20°C - 4°F		

GENERATOR

Electrical Data, Losses and Efficiencies

Generator Type: **SGen6-100A-2P 067-18 M07** **12010763**

Load Point						N		A			
Standard						NEMA MG1		NEMA MG1			
Thermal Classification: Design / Using						F / B		F / B			
Apparent Power	Active Power			MVA	MW	28,24	24,00	26,50	22,53		
Cold Air Temp.	Cooling Water Temp.			℃	℃	33,0	28,0	40,0	35, 0		
Voltage				kV		13,80		13,80			
Voltage Deviation	+	-		%		5,0	5,0	5,0	5,0		
Armature Current				kA		1,181		1,109			
Frequency	Speed			Hz	rpm	60	3600	60	3600		
Power Factor				-		0,85		0,85			
Excitation	No load	I_{f0}	U_{f0}	A	V	434	41	434	41		
Requirements	4/4-load	I_{fN}	U_{fN}	A	V	1062	101	1015	97		
	5/4-load	$I_{f5/4}$	$U_{f5/4}$	A	V	1261	120	1198	115		
Cooling Air	Losses			kW		501		472			
	Air flow	Temp. rise		m^3/s	K	13,0	36,9	13,0	34,8		
Sudden-SCC	I_S: 3-phase (peak)			kA		18		18			
at No-Load and	I_{K3}: 3-ph. (sustained at I_{fN})			kA		1,8		1,7			
Nominal Voltage	I_{K2}: 2-ph. (sustained at I_{fN})			kA		2,7		2,6			
Short Circuit Ratio				-		**0,61**		0,65			
Reactances	x''_d	unsat.	sat.	%	%	20,5	**16,6**	19,2	15,5		
	x'_d	unsat.	sat.	%	%	29,5	26,6	27,7	24,9		
calculated values,	x_d	unsat.	sat.	%	%	172	163	161	153		
tolerance **+/-15%**	x''_q	unsat.	sat.	%	%	22,5	18,2	21,1	17,1		
acc. IEC 60034-3	x'_q	unsat.	sat.	%	%	47,5	43,0	44,8	40,5		
	x_q	unsat.	sat.	%	%	163	139	153	130		
	x_2	unsat.	sat.	%	%	21,5	17,4	20,1	16,3		
	x_0	unsat.		%		11,4		10,7			
	x_{leak}	unsat.		%		16,8		15,7			
Time constants	T''_d	T_q''		s	s	0,029	0,075	0,029	0,075		
at 95℃	T'_d	T_q'		s	s	0,586	0,621	0,586	0,624		
winding	T'_{d0}	T_{q0}'		s	s	3,680	2,500	3,680	2,500		
temperature	T''_{d0}	T_{q0}''		s	s	0,043	0,150	0,043	0,150		
	T_a			s		0,128		0,128			
Resistance	Stator winding / phase			mΩ		18,12		18,12			
at 20℃	Rotor winding			mΩ		69,71		69,71			
Voltage	PF = rated P.F.			%		37,0		35,7			
regulation	PF = 1,00			%		30,0		28,5			
Max. unbalanced	Continuous			%		10		10			
load	Short time $i_2^2 * t$			s		15		15			
Power at	Underexcited			Mvar		15,0		15,0			
PF = 0	Overexcited			Mvar		21,4		20,0			
Winding temp. rise	Stator (RTD)			K	℃	63	96	58	98		
Winding temp.	Rotor (average)			K	℃	80	113	75	115		
Losses	Bearing losses			kW		35		35			
	Windage losses			kW		132		132			
	Core losses			kW		80		80			
	Short circuit losses			kW		161		142			
	Rotor I^2R losses			kW		112		102			
	Total losses			kW		520		491			
Efficiencies with / without tol.	4/4-load			%	%	**97,88**	**97,71**	97,87			
at brushless excitation	3/4-load			%	%	97,75	97,55	97,70			
and rated P.F.	2/4-load			%	%	97,27	97,00	97,16			
(incl. bearing losses)	1/4-load			%		95,42	---	95,17			

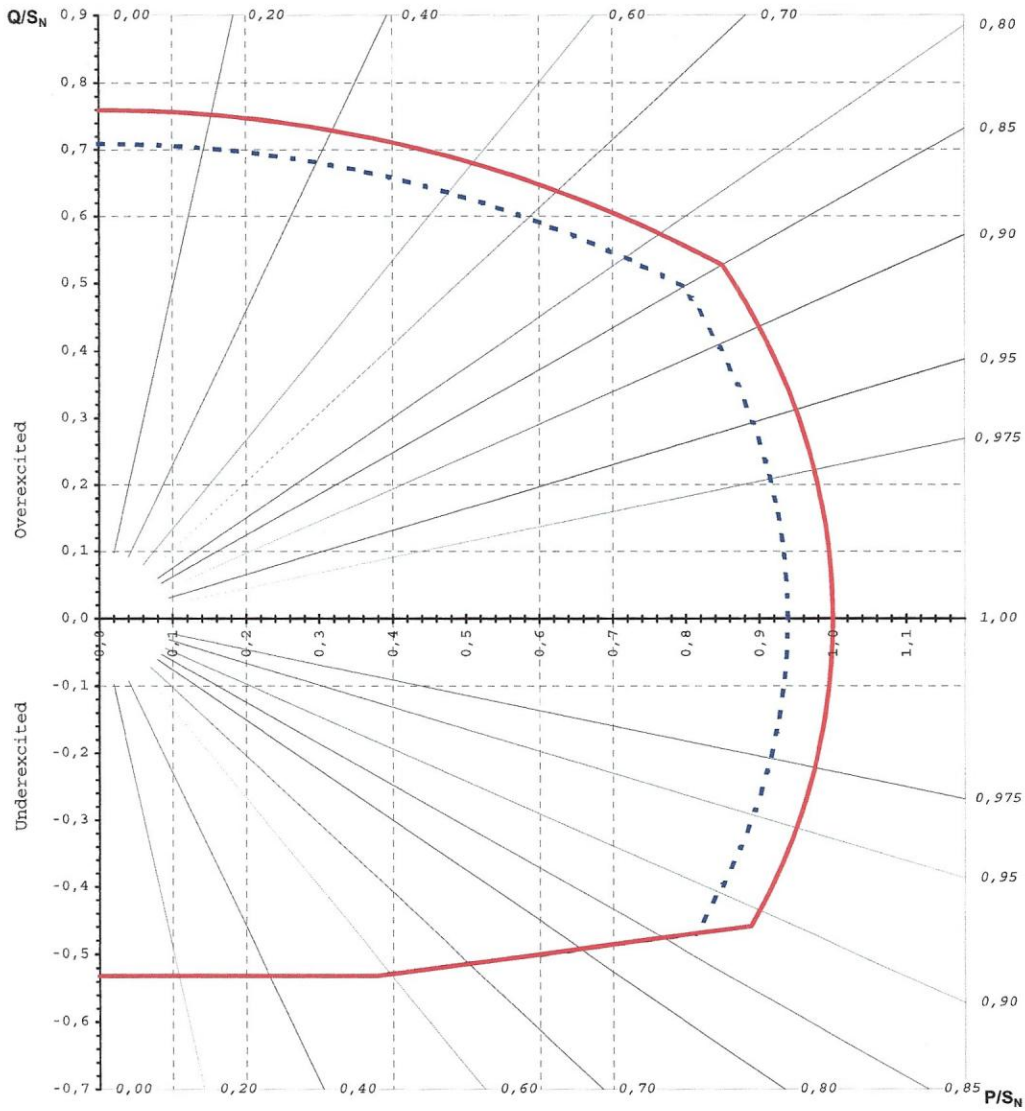
GENERATOR

Reactive Capability Curve

WE10289

Generator - Type: **SGen6-100A-2P 067-18 M07** **12010763**

Load Point	Rated	A
S_N	28,24 MVA	26,50 MVA
U_N	13,80 kV	13,80 kV
I_N	1,181 kA	1,109 kA
f_N	60 Hz	60 Hz
PF	0,85	0,85
T_{Cold}	33,0 °C	40,0 °C



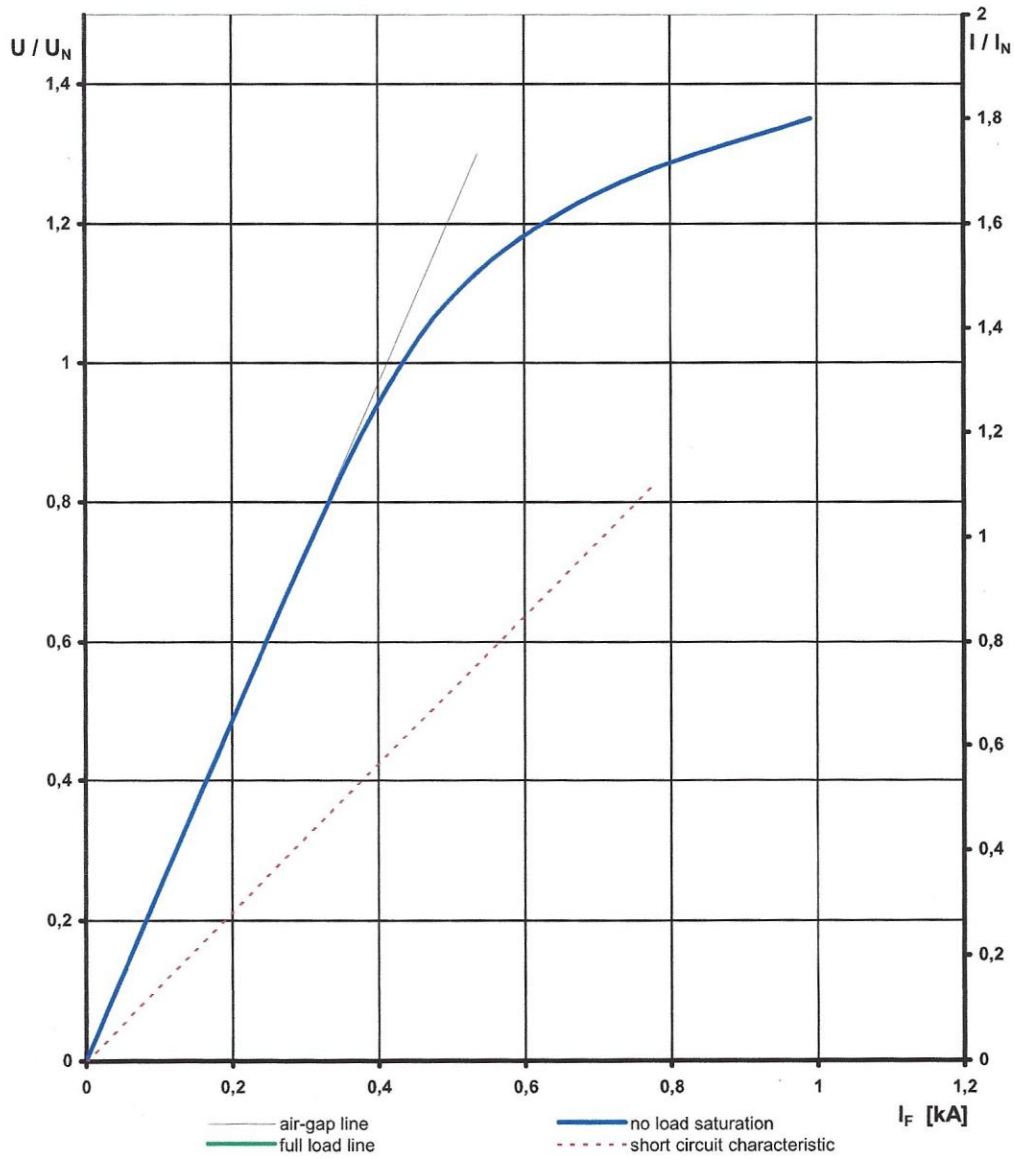
GENERATOR

No Load Saturation and Short-Circuit Characteristic

WE10289

Generator - Type: **SGen6-100A-2P 067-18 M07** **12010763**

S_N =	28,24 MVA	PF =	0,85	S(1,0) =	5,2 %
U_N =	13,80 kV	SCR =	0,61	S(1,2) =	26,4 %
I_N =	1,181 kA	I_{f0} =	434 A		
f_N =	60 Hz	I_{fN} =	1062 A		



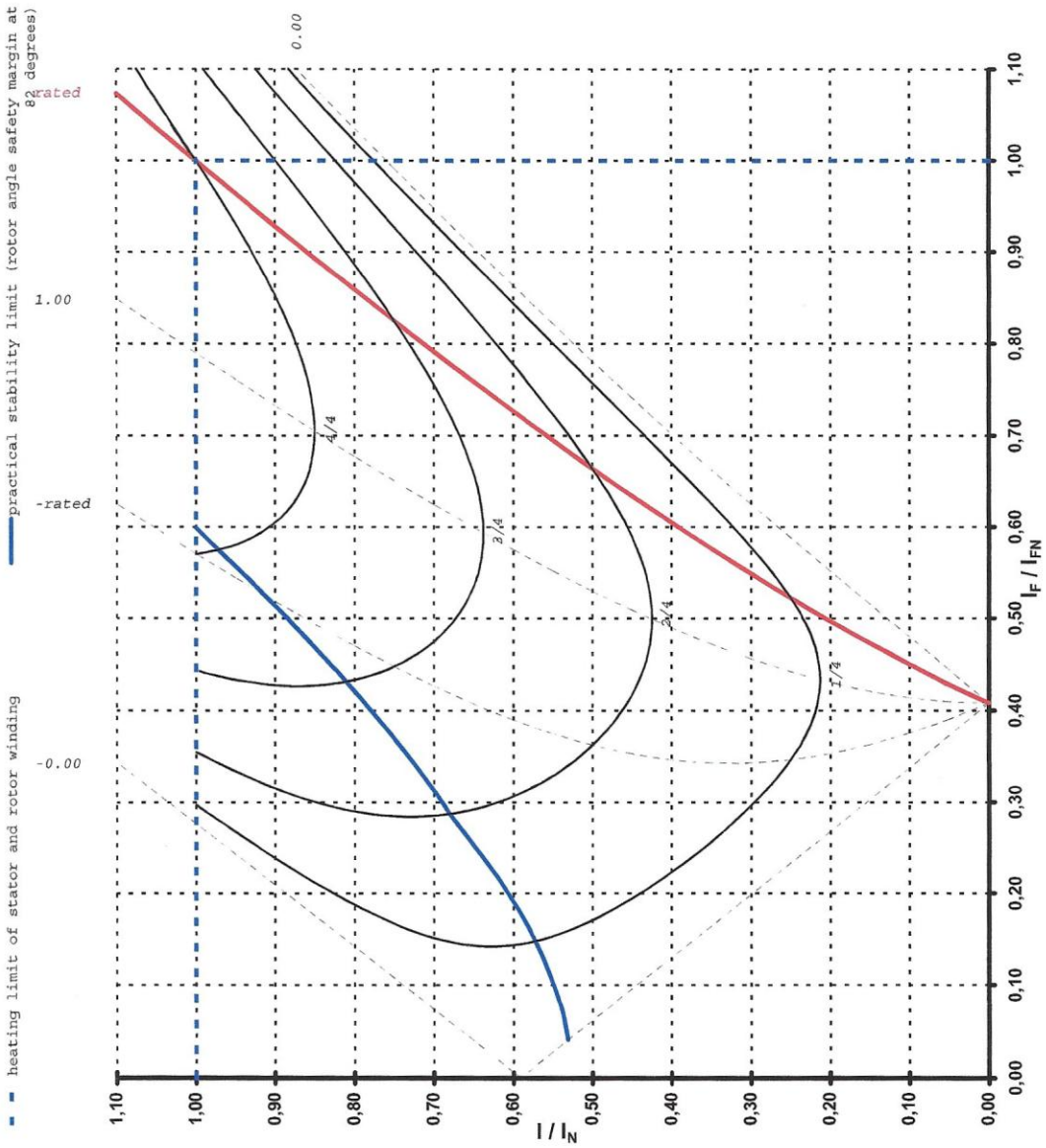
GENERATOR

V-Curves at Rated Voltage

WE10289

Generator - Type: **SGen6-100A-2P 067-18 M07** **12010763**

S_N =	28,24 MVA	PF =	0,85	I_{f0} =	434 A
U_N =	13,80 kV	f_N =	60 Hz	I_{fN} =	1062 A
I_N =	1,181 kA	$T_{Cold\ Air}$ =	33,0 °C		



V-Curves Refer to Apparent Power

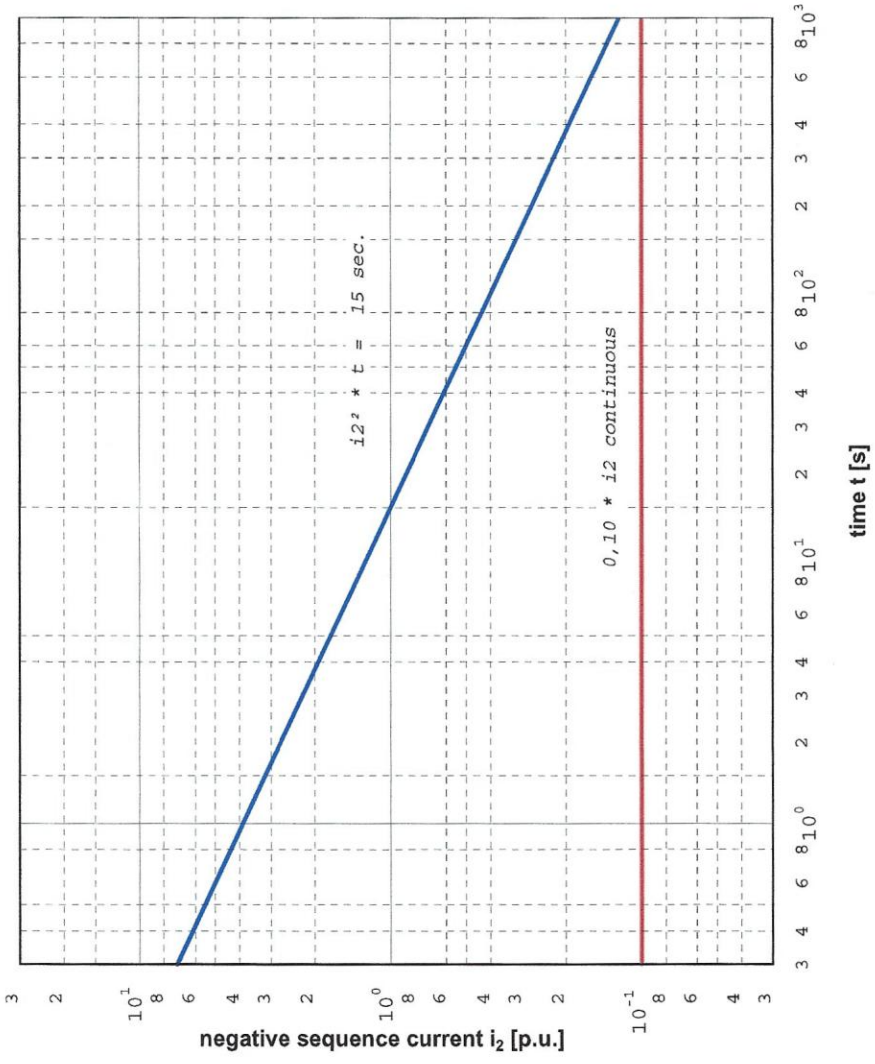
GENERATOR

Unbalanced Load-Time-Curve

WE10289

Generator - Type: **SGen6-100A-2P 067-18 M07** **12010763**

S_N =	28,24 MVA	PF =	0,85	$T_{Cold\ Air}$ =	33,0 °C
U_N =	13,80 kV	f_N =	60 Hz		
I_N =	1,181 kA	n_N =	3600 rpm		



Max. permitted values of negative sequence current incl. percentage caused by harmonic load.

None of the phase currents may exceed the nominal current.

GENERATOR

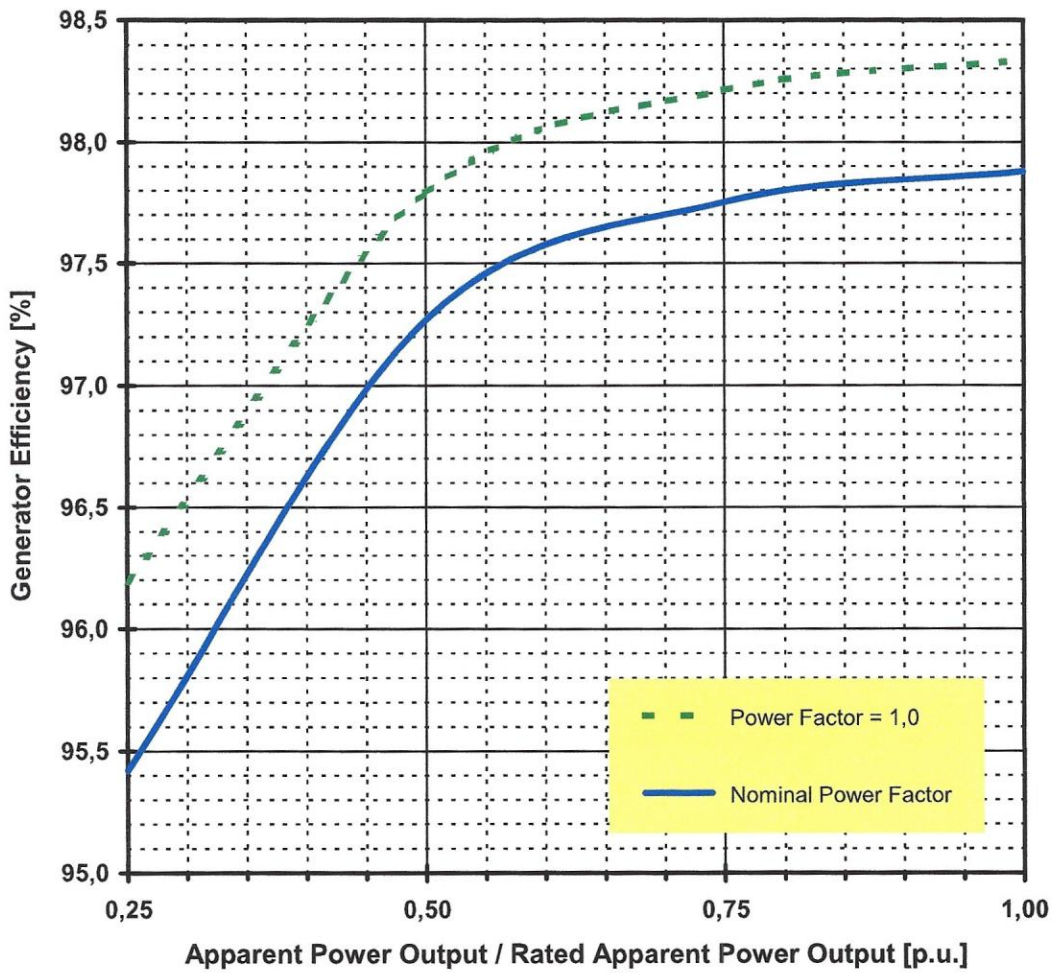
Efficiency vs. Apparent Power and Power Factor

WE10289

Generator - Type: **SGen6-100A-2P 067-18 M07** **12010763**

S_N =	28,24 MVA	PF =	0,85	$T_{Cold\ Air}$ =	33,0 °C
U_N =	13,80 kV	f_N =	60 Hz	Efficiency acc. to:	
I_N =	1,181 kA	n_N =	3600 rpm		

Apparent Power Output		MVA	7,1	14,1	21,2	28,2
		p.u.	0,25	0,50	0,75	1,00
Efficiency at	P.F. = 1,00	%	96,19	97,79	98,21	98,33
Efficiency at	nominal P.F. = 0,85	%	95,42	97,27	97,75	97,88



GENERATOR

Stator Current and Field Voltage versus Time

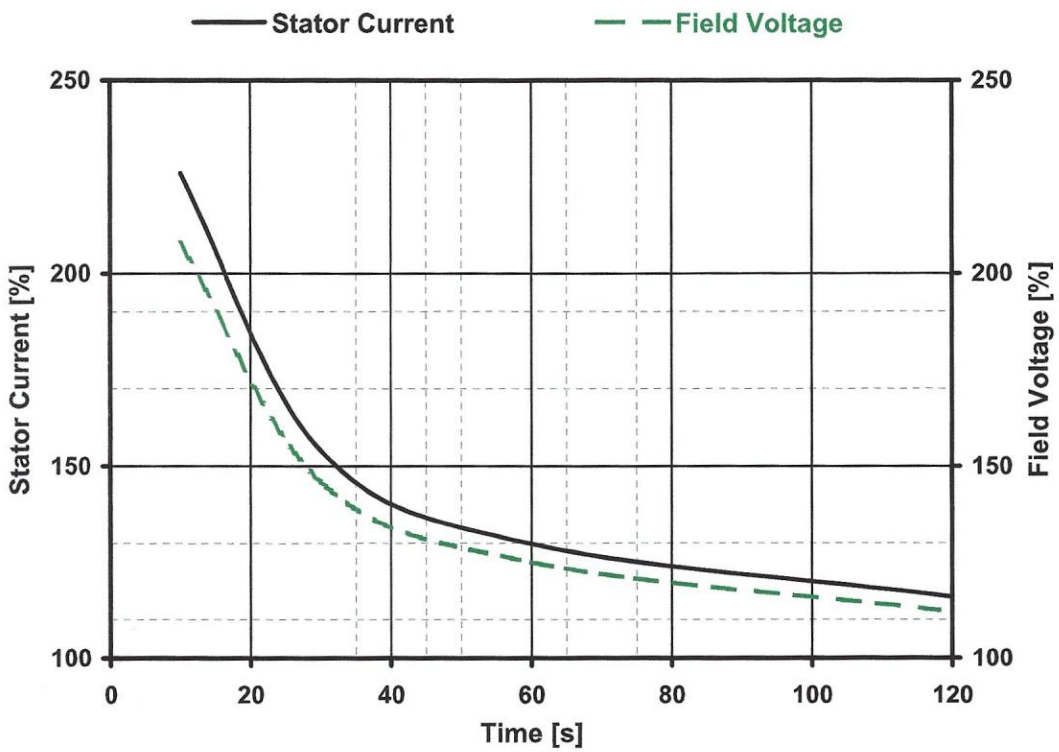
WE10289

Generator - Type: **SGen6-100A-2P 067-18 M07** **12010763**

S_N =	28,24 MVA	PF =	0,85	$T_{Cold\ Air}$ =	33,0 °C
U_N =	13,80 kV	f_N =	60 Hz	I_{fN}=	1062 A
I_N =	1,181 kA	n_N =	3600 rpm		

Time [s]	10	30	60	120
Stator Current I/I_N [%]	226	154	130	116
Field Voltage U_f/U_{fN} [%]	208	146	125	112

Fullfills IEC and ANSI requirements



The generator is capable of operating at 130 percent of rated stator current for 1 min.

The generator field winding is capable of operating at 125 percent of rated load field voltage for 1 min.

Both requirements are fullfilled starting from stabilized temperatures at rated conditions.

It is recognized that winding temperatures under these conditiones will exceed rated-load values.

Number of such operations should be limited to two times a year (corresponds to ANSI and IEC).

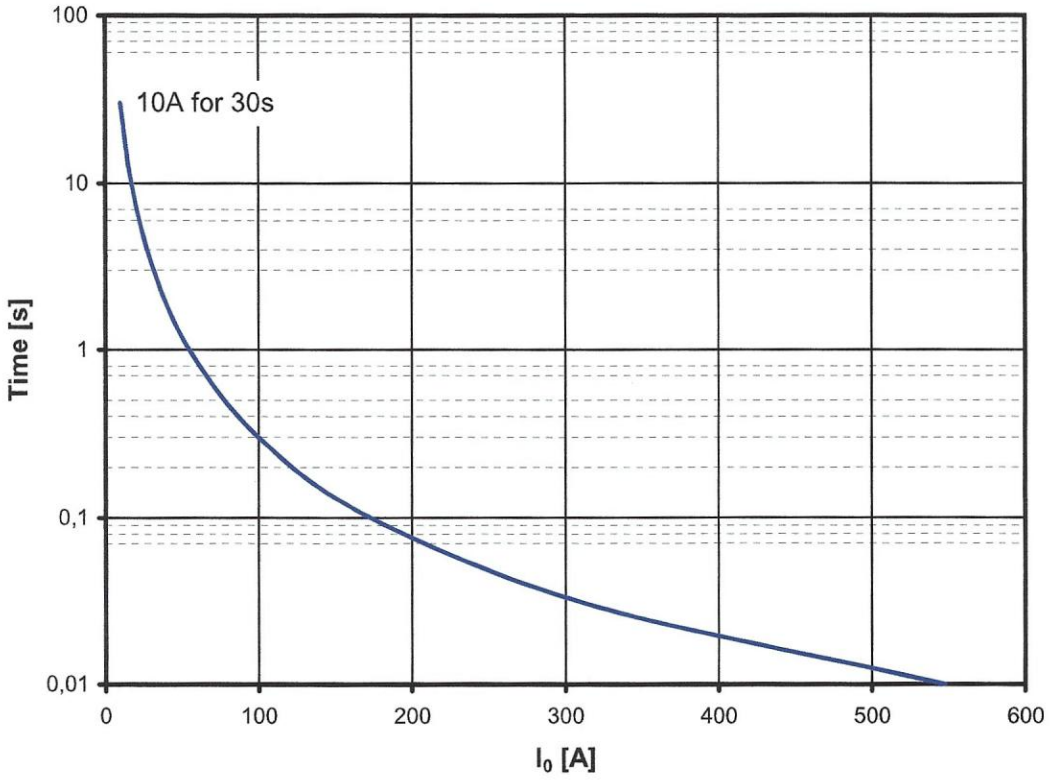
GENERATOR

Limitation of Earth Fault Current versus Time

WE10289

Generator - Type: **SGen6-100A-2P 067-18 M07** **12010763**

S_N =	28,24 MVA	PF =	0,85	$T_{Cold\ Air}$ =	33,0 °C
U_N =	13,80 kV	f_N =	60 Hz		
I_N =	1,181 kA	n_N =	3600 rpm		



I_0 [A] Ground fault current over neutral point to earth

Time [s] Limitation time for I_0 to prevent damage from stator iron core

Diagram basis is $I^2 * t$ = const.; 10 A for 30 s is Siemens standard for dimensioning earthing.

When exceeding limitation curve, stator iron is endangered melting in the fault region.

Worst case is earth fault on phase side (opposite to neutral point side) of winding.

In that case the potential of neutral point changes from zero to phase-to-phase-voltage / $\sqrt{3}$

Fault current and recommended trip time depend on earthing resistance.

GENERATOR

Short Time Voltage/Frequency Capability

WE10289

Generator - Type: **SGen6-100A-2P 067-18 M07** **12010763**

S_N =	28,24 MVA	PF =	0,85	$T_{Cold\ Air}$ =	33,0 °C
U_N =	13,80 kV	f_N =	60 Hz		
I_N =	1,181 kA	n_N =	3600 rpm		

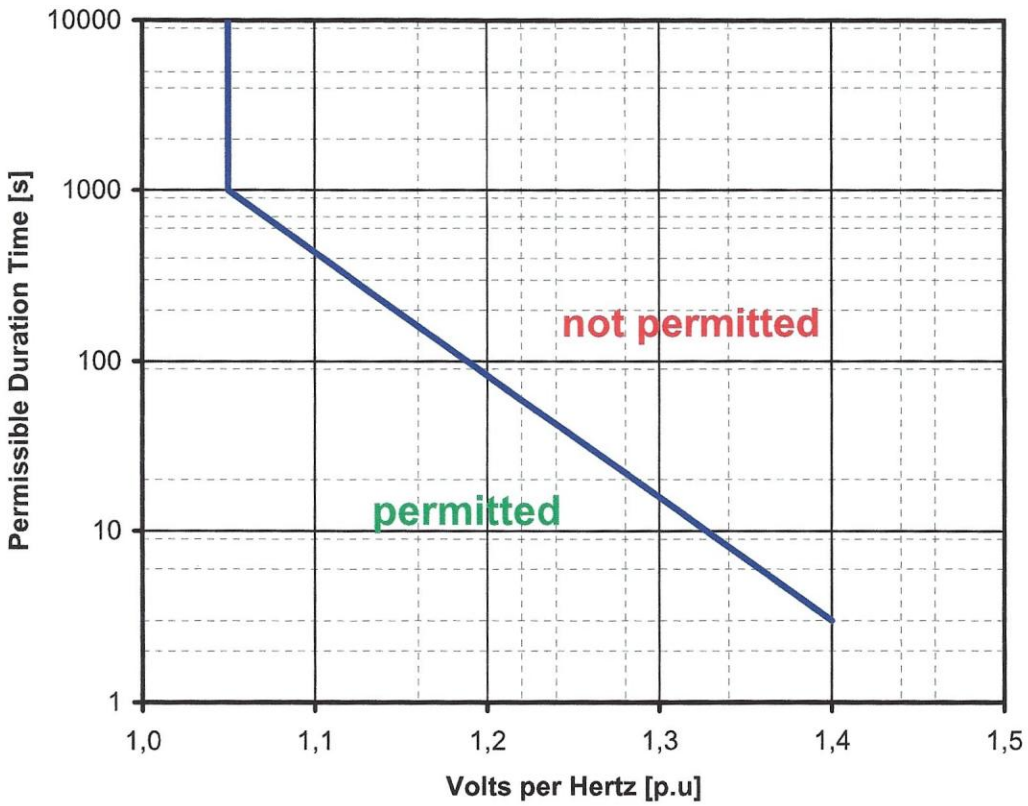
Continuous operation limits (S1)

Voltage max.:	+5,0 % 1)	**Frequency max.:**	+5,0 %
Voltage min.:	-5,0 %	**Frequency min.:**	-5,0 % 1)

1) In case of overvoltage and underfrequency at the same time the sum of both deviations for continuous operation is limited to: 5,0 %

Minimum requirements IEC 34-3 Item 5

Voltage:	+/- 5 %	**Frequency:**	+/- 2 %



Moments and Critical Speeds	Moments and Speeds	Unit
Maximal short-circuit torque of stator in single-phase two-winding short-circuit	615	kNm
Polar mass moment of inertia for generator rotor	465,2	kgm²
Critical speeds of rotor (calculated)	n_{k1} = 1791 n_{k2} = 4642	min^{-1}

Flow of Cooling Air Volume	Volume	Unit
Flow of cooling air	13,0	m³/s

Weights	Weight	Unit
Rotor complete	9 400	kg
Stator Active Part complete	22 000	kg
Base Frame	16 000	kg
Stator Exciter / Brush assembly	1 000	kg
Bearing / Intermediate Frame	2 400	kg
Shrouding Cover	3 500	kg
Cooling Elements, Cover	3 700	kg
Accessories	1 000	kg
Anchoring	1 000	kg
Total Weight	60 000	kg
Weight dispatch complete	55 500	kg

Brushes, Brush Holders and Limits of Wear		Shaft Earthing for Generator Rotor
Brush holders	type	06.00.0468.00
	quantity	2
Carbon brush	type	EMT 513-005 20 x 8 x 32 mm
	quantity	4
	new size	32 mm
	smallest size	12 mm

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