

Three-phase phase-shifter non simmetrical autotransformer

Installed units at REN FALAGUEIRA Substation and REN PEDRALVA Substation

This equipment is a three-phase phase-shifter non simmetrical autotransformer, with a rated power of 450MVA and connecting the system voltages of 400kV and 150kV. This machine is a set of two three-phase units (one auto-transformer and a series transformer) built in a dissociated-phases configuration.

At the 150kV, it performs an amplitude regulation of 21 positions (-10% to +7.5%) and an angle regulation (-25° to +25°) with a maximum of 25 positions.

This machine has the ability to operate under two modes:

- as a phase-shifter, in which the series unit is in use and a regulation in amplitude and in angle is performed
- as an auto-transformer, in which the series unit is not being used and only amplitude regulation is possible



Autotransformer Characteristics

	Unit	HV	LV	Neutral	Excitation (max ph shift.)	Tertiary
Rated power						
ONAN	MVA	230	230	-	103	31
ONAF	MVA	330	330	-	147	44
ODAF	MVA	450	450	-	201	60
Rated voltage, at no load						
Nominal tap	kV		150	-	45	20,5
Lower tap	kV	400	135	-	39	21,7
Higher tap	kV		161,25	-	46,9	16,6
Tap changers						
Type	-	-	OLTC	-	OLTC	-
Tapping range	-	-	+7,5% -10% (21 pos.)	-	+25° -25° (25 pos.)	-
Vector group	-	YN, a0, yn, d1				
Insulation level						
Highest voltages for the equipment	kV rms	420	170	-	-	36
Alternating voltage test (1 min)	kV rms	570	275	185	185	70
Lightning impulse withstand voltage (1.2/50 µs)	kV peak	1300	650	450	450	170
Switching impulse withstand voltage (250/1000 µs)	kV peak	1050	-	-	-	-
Rated frequency	Hz	50				
Aplicable standards	-	IEC 60076				

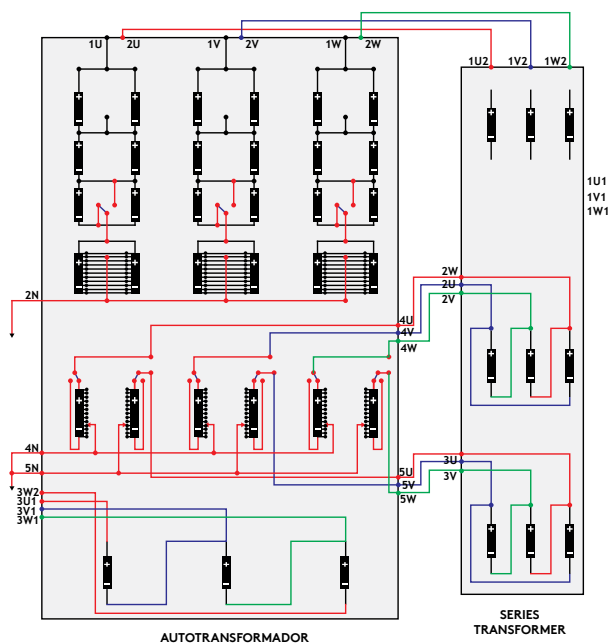
Autotransformer Characteristics

Rated power	Unit	HV	LV
ONAN	MVA	103	103
ONAF	MVA	147	147
ODAF	MVA	201	201
Rated voltage, at no load			
Phase shifting $\pm 25^\circ$, LV voltage of 161.25 kV	kV	78	47
Phase shifting $\pm 25^\circ$, LV voltage of 150 kV	kV	75	45
Phase shifting $\pm 25^\circ$, LV voltage of 135 kV	kV	65	39
Insulation level			
Highest voltages for the equipment	kV rms	170	-
Alternating voltage test (1min)	kV rms	325	140
Lightning impulse withstand voltage (1.2/50 μ s)	kV rms	750	325
Rated frequency	Hz	50	
Aplicable standards	-	IEC 60076	

Complete Unit Characteristics (autotransformer + series transformer)

Rated power	Unit	HV	LV	Tertiary
ONAN	MVA	230	230	31
ONAF	MVA	330	330	44
ODAF	MVA	450	450	60
Rated voltage, at no load				
Nominal tap	kV		150	20,5
Lower tap	kV	400	135	21,7
Higher tap	kV		161,25	16,6
Tap changers				
Type	-	-	OLTC	-
Tapping range	-	-	+7,5% -10% (21 pos.) +/- 25° (25 pos.)	-
Insulation level				
Highest voltages for the equipment	kV rms	420	170	36
Alternating voltage test (1 min)	kV rms	570	275	70
Lightning impulse withstand voltage (1.2/50 μ s)	kV peak	1300	650	170
Switching impulse withstand voltage (250/1000 μ s)	kV peak	1050	-	-
Rated frequency	Hz	50		
Aplicable standards	-	IEC 60076		

Connections Diagram



Efacec Energia, Máquinas e Equipamentos Eléctricos, S.A.
Transformers Business Unit

Parque empresarial Arroiteia (Poente), Apartado 1018, • 4466-952 S. Mamede de Infesta • Portugal
T. +351 229 562 300 • F. +351 229 562 880 • M. sales_trf@efacec.com

www.efacec.com

