df Electric

TRANSFORMERS

LOW VOLTAGE TRANSFORMERS · AUTOTRANSFORMERS · REACTORS

TRT30
REVERSIBLE
three-phase autotransformers

TRT30

TRT30

TRT30 AL

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TRT30
REVERSIBLE
three-phase autotransformers

TRANSFORMERS

TRT30

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POWER
0,5kVA...200kVA

RATED VOLTAGES
230-400V

STANDARDS
IEC/EN 61558-1
IEC/EN 61558-2-13
IEC60076-11

IP00

IP23

TRT30 REVERSIBLE
Three-phase autotransformers

TRT30 autotransformers are specially intended for use as voltage adapter when a economical solution is required.

Autotransformers have a small size (and small price) that a transformer with the same rated power. The main disadvantage is that the autotransformers do not have galvanic isolation. Neither can filter disturbances and interferences produced by harmonics or high frequency.

The main applications comprise the voltage adaptation in motors, electrical pumps, machinery, or air conditioned equipment. The TRT30 autotransformers are reversible, thus can be used as step up as well as step down autotransformers.

The range comprises rated power between 0,5kVA and 200kVA.

They are sized for continuous service at 100% of power in an ambient temperature up to 40°C. For ambient temperatures above 40°C it is necessary to apply a derating.

Rated voltages 230-400V according standard values in IEC60038. On request we can manufacture autotransformers with other voltages or with regulation taps. TRT30 autotransformers can withstand an input overvoltage of up to 10%.

The windings have star connection with accessible neutral. There are versions without case (IP00) and with metallic case (IP23).

Range

POWER (kVA)	REFERENCE	
	TRT30 IP00	TRT30 IP23
0,5	70N0005000	70C0005000
1	70N0010000	70C0010000
2	70N0020000	70C0020000
3	70N0030000	70C0030000
5	70N0050000	70C0050000
8	70N0080000	70C0080000
10	70N0100000	70C0100000
12,5	70N0125000	70C0125000
16	70N0160000	70C0160000
20	70N0200000	70C0200000
25	70N0250000	70C0250000
31,5	70N0315000	70C0315000
40	70N0400000	70C0400000
50	70N0500000	70C0500000
63	70N0630000	70C0630000
80	70N0800000	70C0800000
100	70N1000000	70C1000000
125	70N1250000	70C1250000
160	70N1600000	70C1600000
200	70N2000000	70C2000000

OTHER CHARACTERISTICS ON REQUEST SUBJECT TO AVAILABILITY AND POSSIBILITY

TRT30
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three-phase autotransformers

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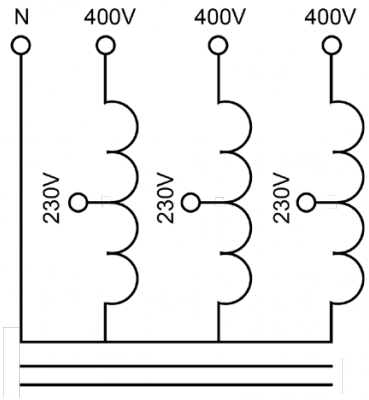
TRT30

Technical data

Use	Reversible autotransformer. Indoor use. Dry type. For stationary installation. Continuous operation (ED100%)
Rated voltages	230-400V
Rated power range	0,5kVA to 200kVA **0,5kVA to 3kVA** → IEC/EN61558-13 **5kVA to 200kVA** → IEC60076-11
Vector group	YN0 connection star with accessible neutral
Protection against electric shock	Class I
Thermal class	≤ 25kVA: B (130°C) ≥ 31,5kVA: H (180°C)
Rated ambient temperature	40ºC
Protection index	IP00 | IP23
Frequency	50/60Hz
Dielectric strength	> 3kV
Ambient temperature of service *	-20°C ... 70°C
Storage temperature	-40°C ... 85°C
Cooling	**Natural air cooling** If the transformer is placed into a cabinet, it must have adequate ventilation.

* For ambient temperatures higher than 40ºC it is necessary to apply a derating.



Standards

IEC/EN 61558-1 Transformers, general specifications
IEC/EN 61558-2-13 Autotransformers for general use
IEC60076-11 Dry-type power transformers
RoHS Compliant

Constructive characteristics

Copper windings Class F (155°C) or H (180°C)
Reinforced insulation
Flexible insulating materials Class F (155°C) or H (180°C)
Impregnation Class H (180°C)
Connection with terminal blocks protected against accidental contacts up to 63 kVA and screws for terminals for powers from 80kVA up to 200kVA
With eyebolts for rated power from 20kVA
Metallic case with index protection IP23 painted with epoxy in RAL7032 colour

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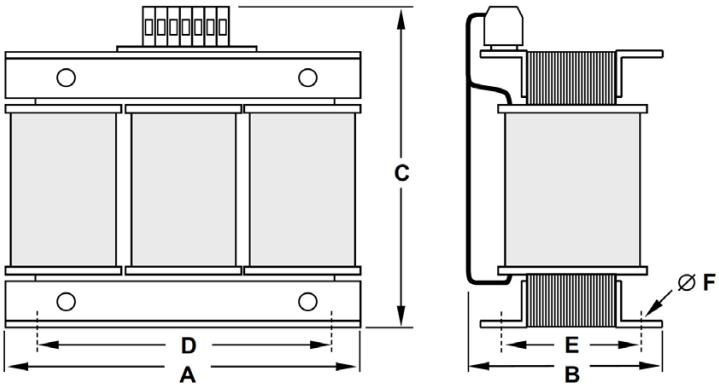
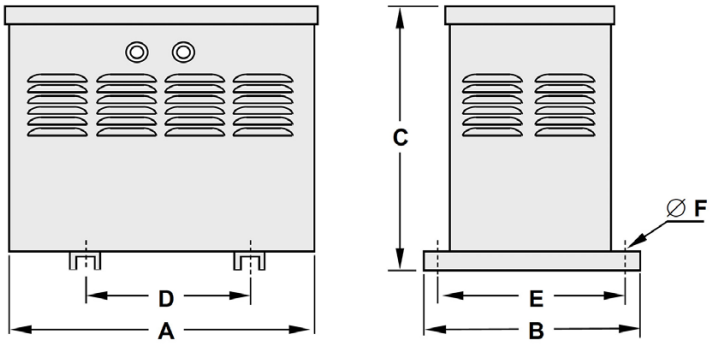
Dimensions





TRT30 IP00

POWER (kVA)	DIMENSIONS (mm)						WEIGHT (kg)
	A	B	C	D	E	F	
0,5	180	85	210	140	55	6	5,5
1	180	85	210	140	55	6	6,5
2	180	95	210	140	65	6	9,1
3	240	110	260	200	75	6	16
5	240	120	260	200	85	6	18
8	240	145	261	200	110	6	27
10	300	135	311	200	95	6	31
12,5	300	145	311	200	105	6	40
16	300	165	316	200	125	6	44
20	360	170	366	300	115	8	56
25	360	180	366	300	125	8	68
31,5	420	200	425	300	140	8	86
40	420	210	425	300	150	8	100
50	480	225	500	400	155	10	107
63	480	240	500	400	175	10	135
80	480	280	510	400	195	10	160
100	480	300	510	400	215	10	180
125	600	320	600	500	180	16	240
160	600	340	600	500	200	16	270
200	600	350	530	500	220	16	325

The dimensions may sligthtly vary according the different rated voltages

TRT30 IP23

POWER (kVA)	DIMENSIONS (mm)						WEIGHT (kg)
	A	B	C[1]	D	E	F	
0,5	235	240	285	140	215	12	9,0
1	235	240	285	140	215	12	9,5
2	235	240	285	140	215	12	12
3	285	290	335	200	265	12	20
5	285	290	335	200	265	12	22,5
8	285	290	335	200	265	12	31
10	375	300	435	200	270	12	38
12,5	375	300	435	200	270	12	47
16	375	300	435	200	270	12	51
20	450	400	480	300	370	12	66
25	450	400	480	300	370	12	78
31,5	510	400	540	300	370	12	97
40	510	400	540	300	370	12	111
50	540	500	610	400	470	12	126
63	540	500	610	400	470	12	156
80	540	500	610	400	470	12	180
100	540	500	610	400	470	12	197
160	880	530	830	500	500	12	300
200	880	730	830	500	500	12	365

The dimensions may sligthtly vary according the different rated voltages

[1] Eyebolts ≥ 6,3kVA +45mm

Typical values

RATED POWER t_a 40°C (kVA)	RATED CURRENT 230V (A)	RATED CURRENT 400V (A)	NO-LOAD CURRENT I_o (% In)	NO-LOAD LOSSES P_{FE} (W)	CC LOSSES P_{CU} (W)	Ucc (%)	EFFICIENCY (%)
0,5	1,26	0,72	15	10	8	1,5	96
1	2,51	1,44	10	13	25	2,2	95,9
2	5,02	2,89	5,5	16	50	2,2	96,2
3	7,53	4,33	4,5	24	58	1,7	97
5	12,6	7,22	3,5	27	128	2,2	96,5
8	20,1	11,5	3	52	230	2,3	96,9
10	25,1	14,4	2,5	56	185	1,9	97,3
12,5	31,4	18	2,4	70	221	1,8	97,4
16	40,2	23,1	2,4	78	255	1,8	97,7
20	50,2	28,9	2,4	71	275	1,7	98
25	62,8	36,1	2,9	92	390	1,8	97,8
31,5	79,1	35,5	1,5	130	407	1,9	98,3
40	100	57,7	1,3	165	508	1,7	98,3
50	126	72,2	1,3	200	620	2,4	98,4
63	158	90,9	1,45	240	716	2,2	98,5
80	201	115	1,45	280	818	1,9	98,6
100	251	144	1,35	300	1033	1,9	98,7
125	314	180	1,3	320	1217	1,7	98,7
160	402	231	1,2	396	1550	1,8	98,8
200	502	289	1,15	450	1720	1,6	98,9

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Autotransformer protection

The autotransformers (and their lines) must be protected against overloads and/or shortcircuits that they can be submitted in use, and could causes dangerous situations for persons, animals or installations.

These protections are also a requirement of the standards and the national regulations about electrical installations.

The most adequate way to protect these autotransformers (and their lines) is to include on the output side a device protection capable to interrupt overloads as well as short circuits.

For the other hand the input line must be protected against short circuit.

As a general rule the criteria to select the ratings of protection devices are the following:

Protection on the **output side** (load)

In this part can appear overloads (if the user try to obtain a power higher than the rated power) as well as short circuits.

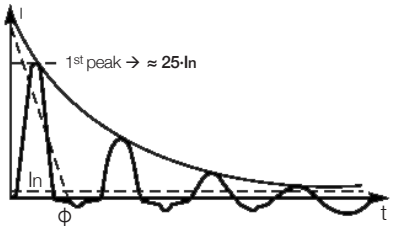
In order to achieve a good protection, the device (fuse link, circuit breaker or similar) must be capable to interrupt all range of currents (overloads and short circuits) and must has a rated current of the autotransformer (see the nameplate of the autotransformer).

Protection on the **input side** (supply line)

In this part there is no risk of overload because if the output protection has been correctly selected, it will operate if appear an overload at the output side and the load will be disconnected of the autotransformer.

For this reason we only must protect the input line of autotransformer against short circuits in the line, in the autotransformer connections or inside the windings in a hypothetical failure of the insulations.

When the autotransformer is energized, it can demand a high momentary current (can be about 25 times the rated current) with a duration of a few milliseconds, that decrease very quickly until reach the rated value



The amplitude of this peak it depends of several factors (autotransformer design, instantaneous value of the voltage when the transformer is energized, ...)

These factors should be take into account to choose the protection in order to avoid the fusing of the fuses or the not desired operation of the circuit breakers.

For the protection of the line side of the TRT30 autotransformers we can use the following devices:

- aM fuses
  I fuse ≥ 1,1 · I autotransformer
- gG fuses
  I fuse ≥ 2,2 · I autotransformer
- Circuit breaker D type
  I MCB ≥ 1,6 · I autotransformer
- Circuit breaker C type
  I MCB ≥ 3,3 · I autotransformer

Obviously, there are several ways to ensure the correct protection of the TRT30 autotransformers because in the market we can find a wide range of protection devices.

We must take into account the main characteristics of this devices:

- Rated current.
- Rated voltage.
- Breaking range.
- Breaking capacity.

Autotransformer protection (cont.)

The following table defines the more common protection devices as gG or aM fuses according IEC/EN60269 or circuit breakers according IEC/EN60947.

Autotransfomer working as **STEP-UP (230V → 400V)**

POWER	MINIMUM RATED CURRENT OF PROTECTION					
	INPUT SIDE (230V)				OUTPUT SIDE (400V)	
(kVA)	gG FUSE (A)	aM FUSE (A)	MCB charact. D (A)	MCB charact. C (A)	gG FUSE (A)	MCB ① (A)
0,5	4	2	3	6	-	1
1	6	4	6	10	-	2
2	12	6	10	16	-	3
3	16	10	16	25	4	4
5	32	16	25	40	8	10
8	50	25	40	80	10	10
10	63	32	50	80	12	16
12,5	80	40	63	100	16	16
16	100	50	80	125	20	20
20	125	63	100		25	25
25	160	80	125		32	32
31,5	200	100			40	40
40	224	125			50	50
50	315	160			63	63
63	355	200		③	80	80
80	400	250	③		100	100
100	500	315			125	125
125	630	400			160	
160	800	500			224	②
200	1000	630			250	

① The characteristic will be selected according to the kind of the load

② Moulded case circuit breaker with the thermal trip adjusted at the rated current of the autotransformer

③ Moulded case circuit breaker with thermal trip adjusted at 1,05·In of the autotransformer

Autotransformer protection (cont.)

The following table defines the more common protection devices as gG or aM fuses according IEC/EN60269 or circuit breakers according IEC/EN60947.

Autotransfomer working as **STEP-DOWN (400V → 230V)**

POWER	MINIMUM RATED CURRENT OF PROTECTION					
	INPUT SIDE (400V)				OUTPUT SIDE (230V)	
(kVA)	gG FUSE (A)	aM FUSE (A)	MCB charact. D (A)	MCB charact. C (A)	gG FUSE (A)	MCB ① (A)
0,5	2	1	2	3	1,25 AT ④	2
1	4	2	3	6	2,5 AT ④	3
2	8	4	6	10	5 AT ④	6
3	10	6	10	16	8 AT ④	10
5	16	10	16	25	12	16
8	25	16	20	40	20	20
10	32	20	25	50	25	25
12,5	40	25	32	63	32	32
16	50	32	40	80	40	40
20	63	40	50	100	50	50
25	80	50	63	125	63	63
31,5	100	63	80		80	80
40	125	80	100		100	100
50	160	100	125		125	125
63	200	125			160	
80	250	160		③	200	
100	315	200			250	②
125	400	224	③		315	
160	500	315			400	
200	630	355			500	

① The characteristic will be selected according to the kind of the load

② Moulded case circuit breaker with the thermal trip adjusted at the rated current of the autotransformer

③ Moulded case circuit breaker with thermal trip adjusted at 1,05·In of the autotransformer

④ 5x20 or 6x32 fuse links according IEC/EN60127

Selection guide

Determination of rated power of the autotransformer for the supply motors

When it is necessary to select an autotransformer for supply a electric motor or an equipment where the main charge is a motor, it is important to take into account the type of mechanic charge of the motor as well as the type of start, in order to consider the time and the peak currents that the autotransformer must withstand.

For another hand we must bear in mind the frequency of the starts of the motor (number of starts per hour).

Basically we can consider **three load types on the motor**:

NORMAL LOAD

Direct start on line, star-delta or start with resistors/reactances with fast start and low inertia load on the motor.

Examples

- **Air conditioned**
- **Colds chambers or freezers**
- **Compressors**
- **Machine tools**

HEAVY LOAD

Applications where the motor has a load with high inertia what causes a very slow start.

Examples

- **Belt conveyor**
- **Fans**
- **Shaping machine**
- **Grinding machine**
- **Pump**
- **Rolling-mill train**

SOFT STARTER
VARIABLE SPEED DRIVE

The use of soft starters or variable speed drives can avoid the high starting current, however, the harmonics increase the losses in the autotransformers which cause elevation of temperature.

This point must be taken into account for the correct choosing of the rated power because an excessive temperature rise can reduce drastically the duration of the autotransformer.

RATED POWER OF AUTOTRANSFORMER

MOTOR*					NON FREQUENT START (UP TO 4 STARTS / HOUR)			FREQUENT START (UP TO 15 STARTS / HOUR)		
					NORMAL LOAD	HEAVY LOAD	VARIABLE SPEED DRIVE	NORMAL LOAD	HEAVY LOAD	VARIABLE SPEED DRIVE
(CV)	(kW)	FP	η (%)	(kVA)	(kVA)	(kVA)	(kVA)	(kVA)	(kVA)	(kVA)
0,25	0,18	0,72	72	0,35	0,5	0,5	0,5	0,5	1	0,5
0,5	0,37	0,72	72	0,71	1	1	1	1	2	1
0,75	0,55	0,75	73	1,01	1	2	2	2	2	2
1	0,74	0,76	75	1,29	2	2	2	2	3	2
1,5	1,10	0,78	76	1,86	2	2	3	3	5	3
2	1,47	0,80	77	2,39	3	3	3	3	5	3
2,5	1,84	0,82	79	2,84	3	5	5	5	8	5
3	2,21	0,83	80	3,33	5	5	5	5	8	5
4	2,94	0,84	80	4,38	5	8	8	8	8	8
5	3,68	0,84	83	5,28	8	8	8	8	10	8
5,5	4,05	0,84	83	5,81	8	8	10	8	12,5	10
7,5	5,52	0,84	85	7,73	10	12,5	12,5	10	16	12,5
10	7,36	0,84	86	10,2	12,5	16	16	16	20	16
15	11	0,85	87	14,9	16	20	20	20	31,5	20
20	14,7	0,85	88	19,7	25	31,5	31,5	31,5	40	31,5
25	18,4	0,85	89	24,3	31,5	40	40	31,5	50	40
30	22,1	0,86	90	28,5	31,5	40	40	40	63	40
40	29,4	0,86	94	36,4	40	50	50	50	80	50
50	36,8	0,87	96	44,1	50	63	63	63	100	63
60	44,2	0,87	97	52,3	63	80	80	80	100	80
75	55,2	0,88	98	64	80	100	100	100	125	100
100	73,6	0,88	98	85,3	100	125	125	125	160	125
125	92	0,88	98	106,7	125	160	160	160	200	160
150	110,4	0,88	98	128	160	200	200	200	-	200
180	132,5	0,88	98	153,6	200	200	200	200	-	200
200	147,2	0,88	98	170,7	200	-	-	-	-	-

***** Approximate values for three-phase squirrel cage motors, 4 poles, 50/60 Hz
(Could be different according the manufacturer)

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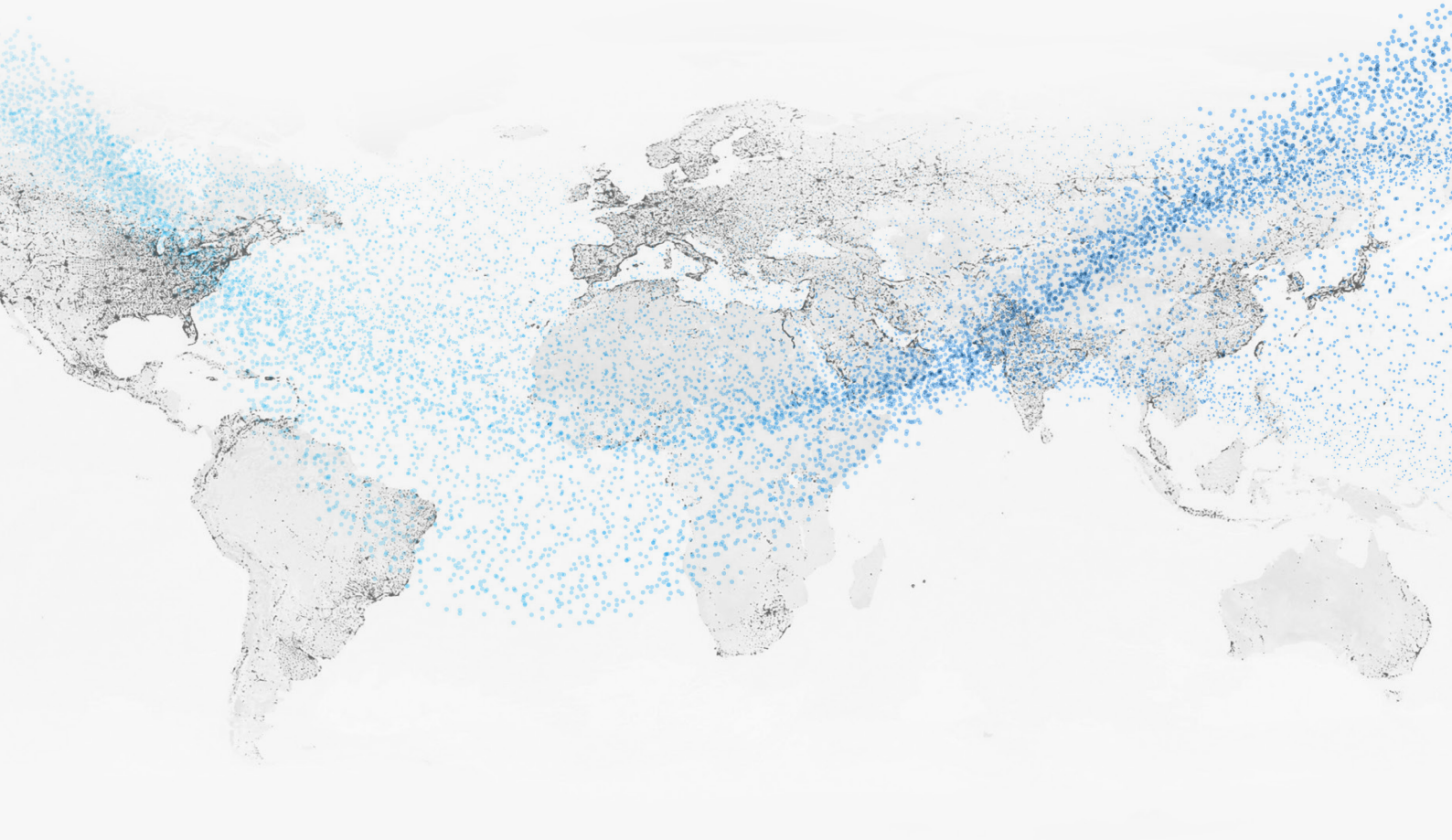

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MADE IN SPAIN

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The "electro technical expert" logo marked on the products included in this data sheet indicates that the installation of these products must be carried out by expert personnel with specialized knowledge.

To prevent electrical hazards, carry out the installation without voltage.

Safety notice
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