



low voltage **single** & **three phase**
TRANSFORMERS



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SINGLE-PHASE TRANSFORMERS

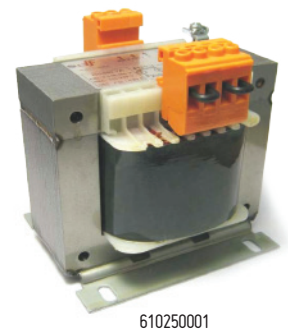
TR 21 CONTROL TRANSFORMER

Control and safety or isolating single-phase transformers. They can supply high instantaneous power necessary for the correct operation of contactors and other switch and control gear. Great flexibility due to the double primary voltage and the serial-parallel connection. TIG welding in the core and the base-plates that prevent vibrations and noise. Fast and easy connection due to the clamp type terminal blocks.

www.df-sa.es/transformers/single-phase/TR21/

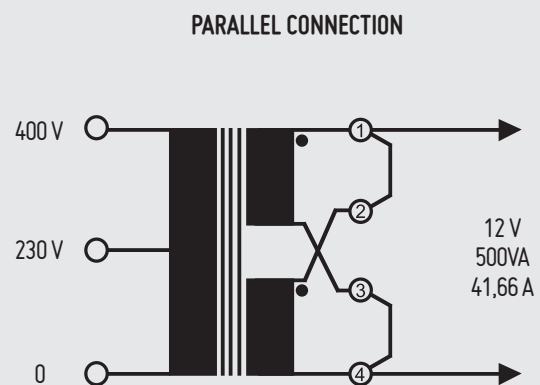
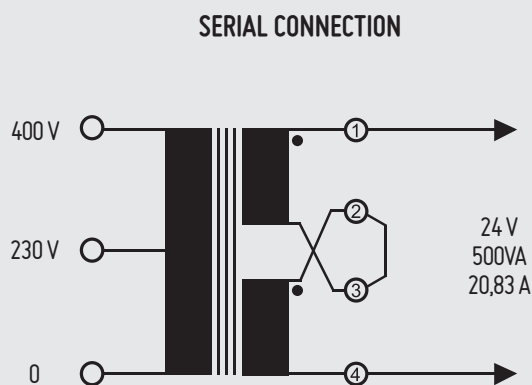
TECHNICAL	
PRI VOLTAGE	0-230-400 V
SEC VOLTAGE	12-24, 24-48 or 115-230 V
SEC CONNECTION	SERIAL or PARALLEL
THERMAL CLASS	B
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP00
DIELECTRIC STRENGTH PRI-SEC	> 4 kV

POWER (VA)	INSTANT. POWER (VA)	12 - 24V 	24 - 48V 	115 - 230V 
40	75	610040000	610040001	610040002
63	140	610063000	610063001	610063002
100	220	610100000	610100001	610100002
160	380	610160000	610160001	610160002
200	450	610200000	610200001	610200002
250	650	610250000	610250001	610250002
320	850	610320000	610320001	610320002
400	1000	610400000	610400001	610400002
500	1400	610500000	610500001	610500002
630	1600	610630000	610630001	610630002
800	2400	610800000	610800001	610800002
1000	3300	611000000	611000001	611000002



610250001

TR 21 CONTROL TRANSFORMER SECONDARY CONNECTION POSSIBILITIES*



* TRANSFORMER 230-400 // 12-24V 500VA
REF 610500000

STANDARDS	STANDARDS	SYMBOLS
IEC 61558-1 IEC 61558-2-2 IEC 61558-2-4 IEC 61558-2-6	EN 61558-1 EN 61558-2-2 EN 61558-2-4 EN 61558-2-6	 

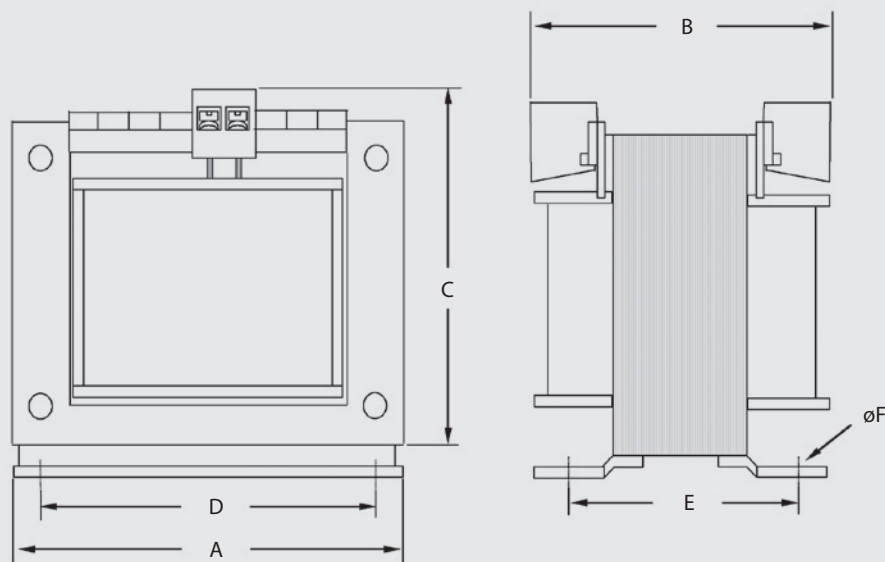
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TRANSFORMERS

SINGLE-PHASE TRANSFORMERS

TECHNICAL

TR 21 SAFETY OR ISOLATING TRANSFORMER DIMENSIONS



POWER (VA)	DIMENSIONS (mm)						WEIGHT (kg)
	A	B	C	D	E	F	
40	75	83	88	56	47	4,8	1,00
63	84	86	95	64	52	4,8	1,40
100	84	100	95	64	67	4,8	1,96
160	96	102	106	84	77	5,7	2,80
200	96	116	106	84	91	5,7	3,40
250	108	105	115	80,5	73	5,7	3,64
320	108	117	115	80,5	87	5,7	4,54
400	120	110 ⁽¹⁾	124 ⁽²⁾	90	87	5,7	5,20
500	120	126 ⁽¹⁾	124 ⁽²⁾	90	107	5,7	6,85
630	150	114 ⁽¹⁾	146 ⁽²⁾	122	92	6,8	7,50
800	150	133 ⁽³⁾	146 ⁽⁴⁾	122	108	6,8	10,2
1000	150	156 ⁽³⁾	146 ⁽⁴⁾	122	135	6,8	13,6

⁽¹⁾ SEC 12V - 24V → + 20mm

⁽²⁾ SEC 12V - 24V → + 7,5mm

⁽³⁾ SEC 12V - 24V / SEC 24V - 48V → + 20mm

⁽⁴⁾ SEC 12V - 24V / SEC 24V - 48V → + 7,5mm

TRANSFORMERS

SINGLE-PHASE TRANSFORMERS

TR 22 POWER TRANSFORMER

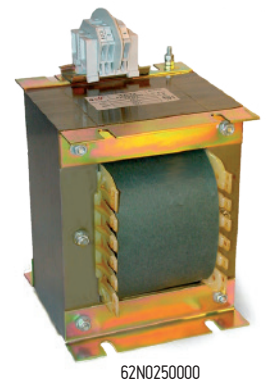
IP00

Single-phase power isolating transformers dry type. Intended for change of voltages with galvanic isolation and/or attenuation of line disturbances. Manufactured with electrical steel with low losses and copper windings. On request we can manufacture transformers with other voltages, with taps, electrostatic screen, with thermal switch, etc.

www.df-sa.es/transformers/single-phase/TR22/

TECHNICAL	
PRI VOLTAGE	230V
SEC VOLTAGE	230V
THERMAL CLASS	B
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP00 & IP23
DIELECTRIC STRENGTH PRI-SEC	> 4 kV
NATURAL AIR COOLING OTHERS CHARACTERISTICS ON REQUEST	

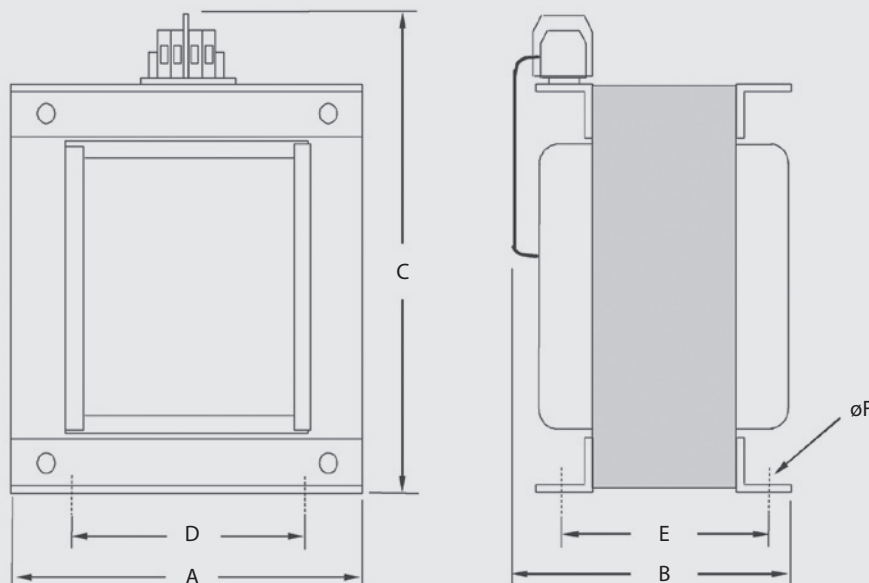
POWER (kVA)	REFERENCE	DIMENSIONS (mm)						WEIGHT (kg)
		A	B	C	D	E	F	
1,3	62N0013000	163	160	245	98	115	8	17,0
1,6	62N0016000	163	165	245	98	120	8	19,0
2,0	62N0020000	163	175	245	98	130	8	21,5
2,5	62N0025000	163	195	245	98	150	8	25,5
3,0	62N0030000	200	200	290	120	140	10	34,0
3,5	62N0035000	200	210	290	120	150	10	38,0
4,0	62N0040000	200	220	290	120	160	10	42,0
5,0	62N0050000	200	240	290	120	180	10	48,0
6,3	62N0063000	250	250	350	150	180	12	67,0
8,0	62N0080000	250	270	361	150	200	12	79,0
10	62N0100000	250	300	361	150	230	12	95,0
12,5	62N0125000	300	300	421	180	220	12	108
16	62N0160000	300	320	421	180	240	12	126
20	62N0200000	300	340	421	180	260	12	150
25	62N0250000	350	360	493	210	270	12	180
31,5	62N0315000	350	370	493	210	280	12	210



62N0250000

TR 22 POWER TRANSFORMER DIMENSIONS

IP00



DIMENSIONS MAY SLIGHTLY VARY ACCORDING THE VOLTAGES

STANDARDS	SYMBOLS
IEC 60726	

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TRANSFORMERS

SINGLE-PHASE TRANSFORMERS



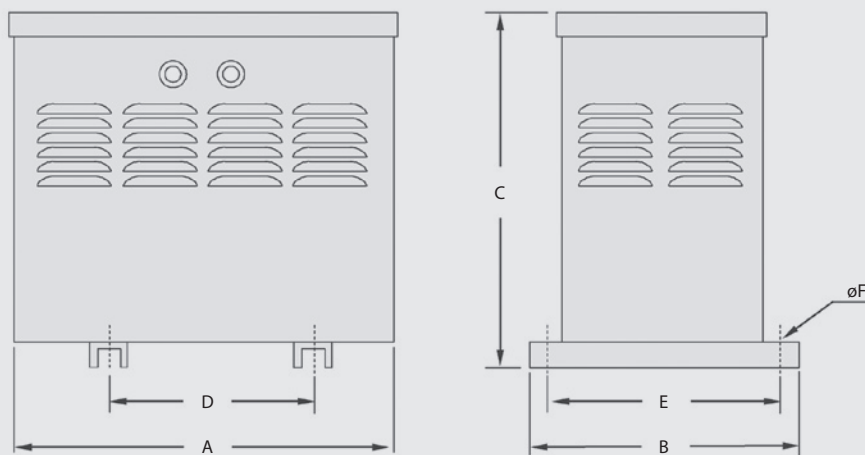
TR 22 IP23 POWER TRANSFORMER

POWER (kVA)	REFERENCE	DIMENSIONS (mm)						WEIGHT (kg)
		A	B	C	D	E	F	
1,3	62C0013000	285	290	335	200	265	12	21,0
1,6	62C0016000	285	290	335	200	265	12	23,0
2,0	62C0020000	285	290	335	200	265	12	25,5
2,5	62C0025000	285	290	335	200	265	12	29,5
3,0	62C0030000	375	300	435	200	270	12	41,5
3,5	62C0035000	375	300	435	200	270	12	45,5
4,0	62C0040000	375	300	435	200	270	12	49,5
5,0	62C0050000	375	300	435	200	270	12	55,5
6,3	62C0063000	450	400	480	300	370	12	75,0
8,0	62C0080000	450	400	480	300	370	12	87,0
10	62C0100000	450	400	480	300	370	12	103
12,5	62C0125000	540	500	610	400	470	12	116
16	62C0160000	540	500	610	400	470	12	134
20	62C0200000	540	500	610	400	470	12	158
25	62C0250000	540	500	610	400	470	12	190
31,5	62C0315000	540	500	610	400	470	12	220



62C0250000

TECHNICAL TR 22 IP23 POWER TRANSFORMER DIMENSIONS



TR 22 IP23 POWER TRANSFORMER WHEELS KIT

REFERENCE	DESCRIPTION
690000005	WHEELS KIT (max 200 kg/wheel)



TRANSFORMERS

SINGLE-PHASE TRANSFORMERS

TR 23 CUSTOMER DESIGN TRANSFORMER

Single-phase special transformers manufactured on request (customer design). These transformers can be manufactured with fuse holders, thermal protectors, electrostatic screen. TIG welding in the core and the base-plates that prevent vibrations and noise. Fast and easy connection due to the clamp type terminal blocks that are delivered open.

www.df-sa.es/transformers/single-phase/TR23/

TECHNICAL	
PRI VOLTAGE	ON REQUEST
SEC VOLTAGE	ON REQUEST
THERMAL CLASS	B
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP00
DIELECTRIC STRENGTH PRI-SEC	> 4 kV

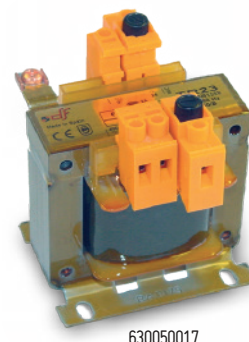
POWER (VA)	DIMENSIONS (mm)						WEIGHT (kg)
	A	B ²	C ²	D	E	F	
10-12-16-20	60	71	77	44	39	3,5	0,51
25-30	60	80	77	44	49	3,5	0,74
40	75	77	88	56	47	4,8	1,00
50	75	82	88	56	52	4,8	1,10
63	84	80	95	64	52	4,8	1,35
100	84	94	95	64	67	4,8	1,96
160	96	96	106	84	81	5,7	2,78
200	96	110	106	84	91	5,7	3,35
250	108	99	115	80,5	73	5,7	3,64
320	108	111	115	80,5	87	5,7	4,40
400	120	106	124	90	87	5,7	4,90
500	120	126	124	90	107	5,7	6,70
630	150	114	146	122	92	6,8	7,50
800	150	133	146	122	108	6,8	9,80
1000	150	156	146	122	135	6,8	13,2

- Dimensions may slightly vary according the voltages.
- In transformers with the following characteristics:

- Rated power up to 250VA.
- Without electrostatic screen.
- One primary voltage up to 400V.
- One SEC voltage between 12V and 230V.

- Terminal block → +9 mm.
- Terminal block with current >32 A → +15 mm.
- Currents >80 A (flat terminals or busbar) → +50 mm.
- Terminal block with fuse → +10 mm.
- Terminal block with current >32 A → +7,5 mm.

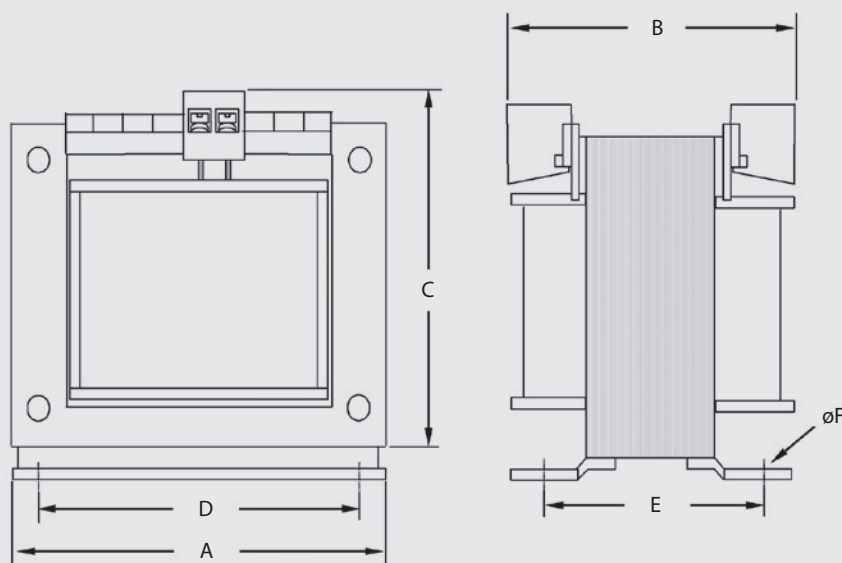
The dimensions and weight are those corresponding to the immediate smaller rated power.



630050017

TR 23 CUSTOMER DESIGN TRANSFORMER

DIMENSIONS



STANDARDS
IEC 61558
EN 61558

SYMBOLS



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PROTECTION

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IP PROTECTION INDEX

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TRANSFORMERS

SINGLE-PHASE TRANSFORMERS



TR 26 IP20 SAFETY FOR SWIMMING-POOL TRANSFORMER

Single-phase safety transformers intended to supply spotlights in swimming-pools, garden ponds, ornamental fountains and moist locations, where for safety reasons it is necessary to supply with safety extra low voltage (SELV). It has several taps in the primary winding in order to compensate for the voltage drop in the transformer-spotlight line conductors and thus gets an adequate brightness in every spotlight. On request we can manufacture transformers with other rated power or voltages, or with other line lengths between transformers and spotlights.

www.df-sa.es/transformers/single-phase/TR26/

TECHNICAL

PRI VOLTAGE	230V
SEC VOLTAGE	12V
THERMAL CLASS	B(130°C) & F(155°C)
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP20
DIELECTRIC STRENGTH PRI-SEC	≥ 4,5 kV
DIELECTRIC STRENGTH BETWEEN WINDINGS & METALLIC PARTS	≥ 2,5 kV

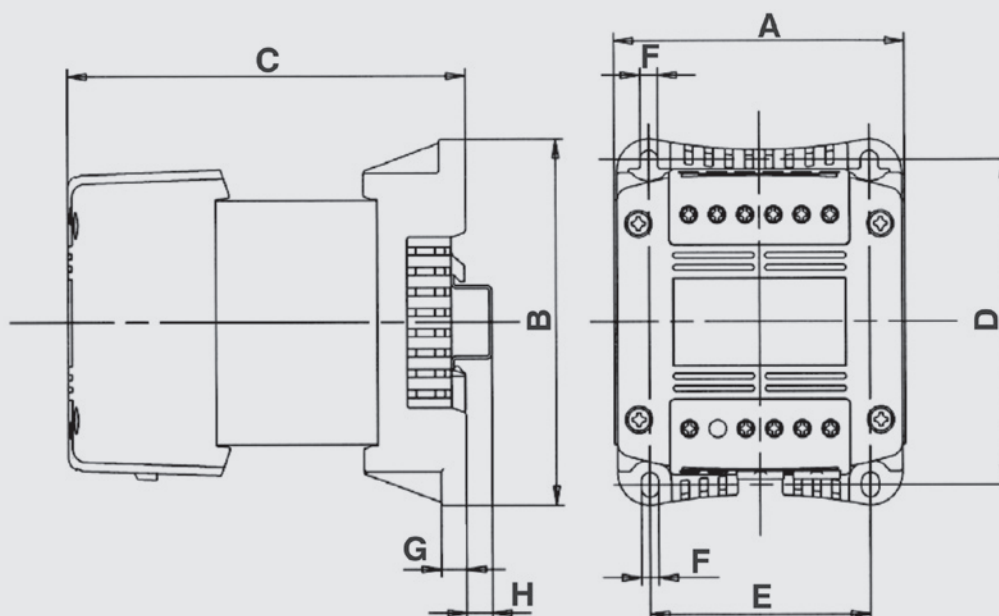
POWER (VA)	REFERENCE	DIMENSIONS (mm)								FOR SPOTLIGHT	DISTANCES transformer - spotlight	WEIGHT (kg)
		A	B	C	D	E	F	G	H			
130	660130000	84	113	116	101	66	5	7,5	2	1x12V 100W	10-18-25 m	2,00
350	660350000	108	135	138	120	82	6,5	9,5	9,5	1x12V 300W	10-25-40 m	4,45
700	660700000	120	152	166	135	94	7	9,5	-	2x12V 300W	10-25-40 m	7,89



660350000

TR 26 IP20 SAFETY FOR SWIMMING-POOL TRANSFORMER

DIMENSIONS



STANDARDS
IEC 61558-1 IEC 61558-2-6 EN 61558-1 EN 61558-2-6

SYMBOLS

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TRANSFORMERS

SINGLE-PHASE TRANSFORMERS

TR 26 SAFETY FOR SWIMMING-POOL TRANSFORMER

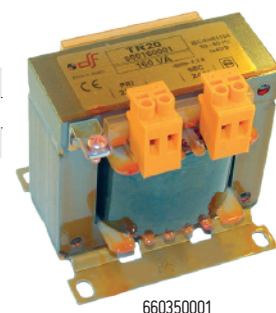
IP00

Single-phase safety transformers intended to supply spotlights in swimming-pools, garden ponds, ornamental fountains and moist locations, where for safety reasons it is necessary to supply with safety extra low voltage (SELV). It has several taps in the primary winding in order to compensate for the voltage drop in the transformer-spotlight line conductors and thus gets an adequate brightness in every spotlight. On request we can manufacture transformers with other rated power or voltages, or with other line lengths between transformers and spotlights.

www.df-sa.es/transformers/single-phase/TR26/

TECHNICAL	
PRI VOLTAGE	230V
SEC VOLTAGE	12V
THERMAL CLASS	B(130°C) & F(155°C)
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP00
DIELECTRIC STRENGTH PRI-SEC	≥ 4,5 kV
DIELECTRIC STRENGTH BETWEEN WINDINGS & METALLIC PARTS	≥ 2,5 kV

POWER (VA)	REFERENCE	DIMENSIONS (mm)						FOR SPOLIGHT	DISTANCES transformer - spotlight	WEIGHT (kg)
		A	B	C	D	E	F			
130	660130001	84	90	90	64	67	4,8	1x12V 100W	10-18-25 m	1,96
350	660350001	108	110	93	90	80	5,0	1x12V 300W	10-25-40 m	3,90
700	660700001	120	135	108	90	117	5,7	2x12V 300W	10-25-40 m	7,80

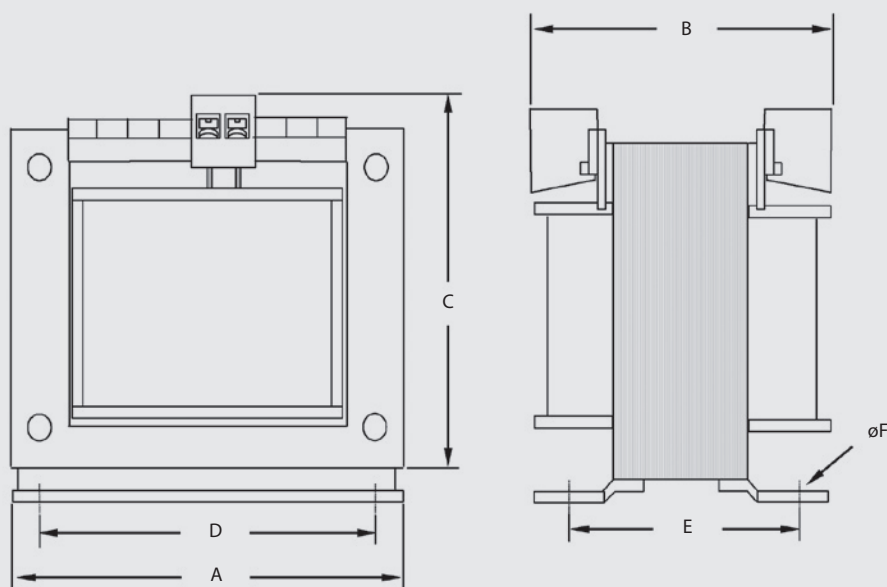


660350001

TR 26 SAFETY FOR SWIMMING-POOL TRANSFORMER

DIMENSIONS

IP00



STANDARDS
IEC 61558-1
IEC 61558-2-6
EN 61558-1
EN 61558-2-6



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TRANSFORMERS

SINGLE-PHASE TRANSFORMERS

TR 26 H SAFETY FOR SWIMMING-POOL TRANSFORMER **NEW**

Single-phase safety transformers intended to supply spotlights in swimming-pools, garden ponds, ornamental fountains and moist locations, where for safety reasons it is necessary to supply with safety extra low voltage (SELV). It has several taps in the primary winding in order to compensate for the voltage drop in the transformer-spotlight line conductors and thus gets an adequate brightness in every spotlight. On request we can manufacture transformers with other rated power or voltages, or with other line lengths between transformers and spotlights. The main characteristic of this model is the reduced height that allows the installation in a low profile box.

www.df-sa.es/transformers/single-phase/TR26/

TECHNICAL	
PRI VOLTAGE	230V
SEC VOLTAGE	12V
SEC CONNECTION	SERIAL or PARALLEL
THERMAL CLASS	F(155°C)
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP20
DIELECTRIC STRENGTH PRI-SEC	> 4 kV
ELECTROSTATIC SCREEN BETWEEN WINDINGS	

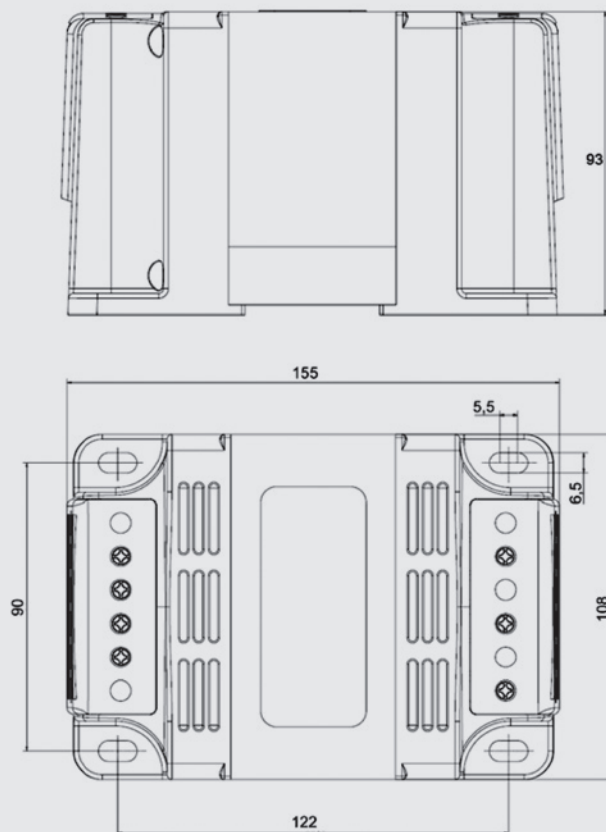
POWER (VA)	REFERENCE	FOR SPOLIGHT	DISTANCES transformer - spotlight	WEIGHT (kg)
350	660350010	1x12V 300W	8-18-25 m (WIRE SIZE 6 mm ²) 10-25-40 m (WIRE SIZE 10 mm ²)	4,2



660350010

TR 26 H SAFETY FOR SWIMMING-POOL TRANSFORMER DIMENSIONS

NEW



TRANSFORMERS

SINGLE-PHASE TRANSFORMERS

TR 28 2.2 CONTROL & SAFETY OR ISOLATING TRANSFORMER

NEW

Control and safety or isolating single-phase transformers. They can supply high instantaneous power necessary for the correct operation of contactors and other switch and control gear. IP20 protection index (finger safe). For mounting on DIN/EN rail up to 320 VA. Fast and easy connection due to the high capacity clamp type terminal blocks.

www.df-sa.es/transformers/single-phase/TR28/

TECHNICAL	
PRI VOLTAGE	0-230-400V
SEC VOLTAGE	12-24, 24-48 or 115-230 V
THERMAL CLASS	B/F
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP20
DIELECTRIC STRENGTH PRI-SEC	≥ 4,5 kV
DIELECTRIC STRENGTH BETWEEN WINDINGS & METALLIC PARTS	≥ 2,5 kV

POWER (VA)		INSTANT. POWER (VA)	REFERENCE		
t _a 40°C	t _a 25°C		12 - 24V	24 - 48V	115 - 230V
25	40	75	680025043	680025044	680025045
40	63	120	680040043	680040044	680040045
63	100	150	680063043	680063044	680063045
100	130	230	680100043	680100044	680100045
160	200	350	680160043	680160044	680160045
200	250	450	680200043	680200044	680200045
250	320	600	680250043	680250044	680250045
320	400	800	680320043	680320044	680320045
400	500	950	680400043	680400044	680400045
500	630	1275	680500043	680500044	680500045
630	800	1700	680630043	680630044	680630045
800	1000	2100	680800043	680800044	680800045
1000	1250	3300	681000043	681000044	681000045
1300	1600	4300	-	681300044	681300045
1600	2000	5200	-	681600044	681600045
2000	2500	6800	-	682000044	682000045
2500	3000	8250	-	682500044	682500045
3000	3500	9800	-	683000044	683000045



680320044

TR 28 5.2 CONTROL & SAFETY OR ISOLATING TRANSFORMER

Control and safety or isolating single-phase transformers. They can supply high instantaneous power necessary for the correct operation of contactors and other switch and control gear. IP20 protection index (finger safe). For mounting on DIN/EN rail up to 320 VA. Great flexibility due to the several primary rated voltages with regulation taps ±15V and the serial-parallel secondary connection. Fast and easy connection due to the high capacity clamp type terminal blocks.

www.df-sa.es/transformers/single-phase/TR28/

TECHNICAL	
PRI VOLTAGE	0-230-400-460±15V
SEC VOLTAGE	12-24, 24-48 or 115-230 V
THERMAL CLASS	B
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP20
DIELECTRIC STRENGTH PRI-SEC	≥ 4,5 kV
DIELECTRIC STRENGTH BETWEEN WINDINGS & METALLIC PARTS	≥ 2,5 kV

POWER (VA)		INSTANT. POWER (VA)	REFERENCE		
t _a 40°C	t _a 25°C		12 - 24V	24 - 48V	115 - 230V
25	40	75	680025010	680025011	680025012
40	63	120	680040010	680040011	680040012
63	100	150	680063010	680063011	680063012
100	130	230	680100010	680100011	680100012
160	200	350	680160010	680160011	680160012
200	250	450	680200010	680200011	680200012
250	320	600	680250010	680250011	680250012
320	400	800	680320010	680320011	680320012
400	500	950	680400010	680400011	680400012
500	630	1275	680500010	680500011	680500012
630	800	1700	680630010	680630011	680630012
800	1000	2100	680800010	680800011	680800012
1000	1250	3300	681000010	681000011	681000012

t_a maximum ambient temperature



680320011

STANDARDS	STANDARDS	SYMBOLS
IEC 61558-1 IEC 61558-2-2 IEC 61558-2-4 IEC 61558-2-6	EN 61558-1 EN 61558-2-2 EN 61558-2-4 EN 61558-2-6	

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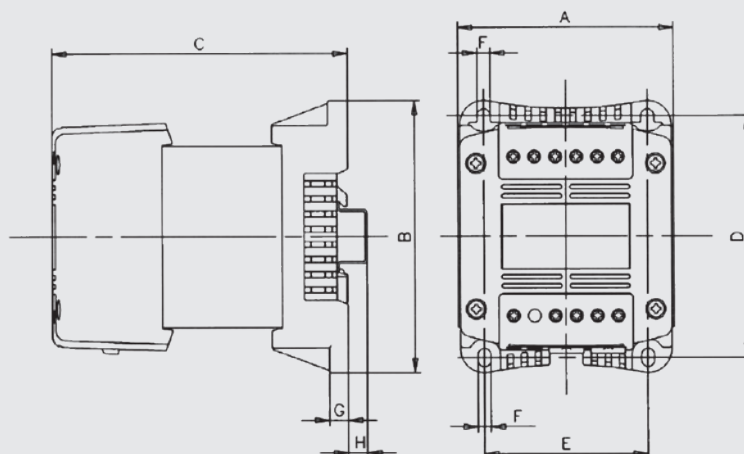
SINGLE-PHASE TRANSFORMERS

TECHNICAL

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2.2

CONTROL & SAFETY OR ISOLATING TRANSFORMER DIMENSIONS

NEW



POWER (VA)	DIMENSIONS (mm)								WEIGHT (kg)
	A	B	C	D	E	F	G	H	
25	84	113	96	101	66	5	7,5	2	1,15
40	84	113	105	101	66	5	7,5	2	1,45
63	84	113	112	101	66	5	7,5	2	1,80
100	84	113	116	101	66	5	7,5	2	1,95
160	84	113	131	101	66	5	7,5	2	2,55
200	108	135	133	120	82	6,5	9,5	9,5	4,15
250	108	135	138	120	82	6,5	9,5	9,5	4,40
320	108	135	148	120	82	6,5	9,5	9,5	4,95
400	120	152	141	135	94	7	9,5	–	5,80
500	120	152	156	135	94	7	9,5	–	7,00
630	150	177	140	160	115	7	2	–	8,60
800	150	177	160	160	115	7	2	–	11,4
1000	150	177	182,60	160	115	7	2	–	14,3
1300	192	210	170	193	150	7	2	–	14,6
1600	192	210	185	193	150	7	2	–	17,8
2000	192	210	200	193	150	7	2	–	20,8
2500	192	210	220	193	150	7	2	–	25,7
3000	192	210	250	193	150	7	2	–	31,5

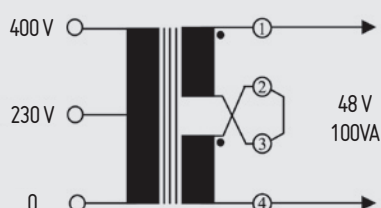
TECHNICAL

TR 28
2.2

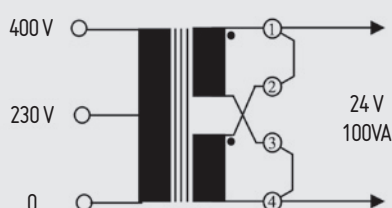
CONTROL & SAFETY OR ISOLATING TRANSFORMER CONNECTION POSSIBILITIES

NEW

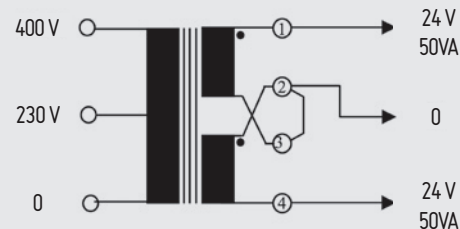
SERIAL CONNECTION



PARALLEL CONNECTION



WITH MIDDLE TAP



* TRANSFORMER 0-230-400 // 24-48V 100VA
REF 680100044

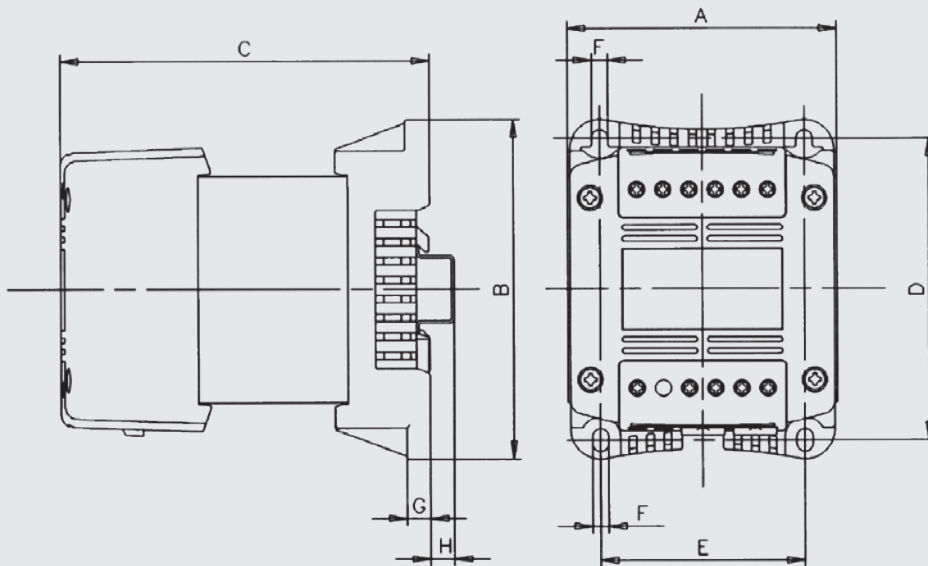
TRANSFORMERS

SINGLE-PHASE TRANSFORMERS

TECHNICAL

TR 28
5.2

CONTROL & SAFETY OR ISOLATING TRANSFORMER DIMENSIONS



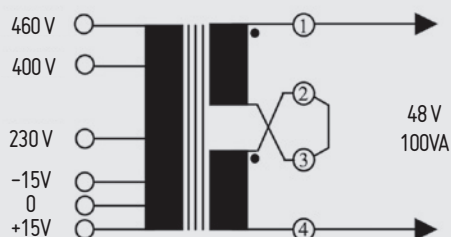
POWER (VA)	DIMENSIONS (mm)								WEIGHT (kg)
	A	B	C	D	E	F	G	H	
25	84	113	96	101	66	5	7,5	2	1,17
40	84	113	105	101	66	5	7,5	2	1,48
63	84	113	112	101	66	5	7,5	2	1,83
100	84	113	116	101	66	5	7,5	2	2,00
160	84	113	131	101	66	5	7,5	2	2,65
200	108	135	133	120	82	6,5	9,5	9,5	4,20
250	108	135	138	120	82	6,5	9,5	9,5	4,45
320	108	135	148	120	82	6,5	9,5	9,5	5,00
400	120	152	136	135	94	7	9,5	—	5,30
500	120	152	156	135	94	7	9,5	—	7,08
630	150	177	140	160	115	7	2	—	8,68
800	150	177	160	160	115	7	2	—	11,5
1000	150	177	182,60	160	115	7	2	—	14,4

TECHNICAL

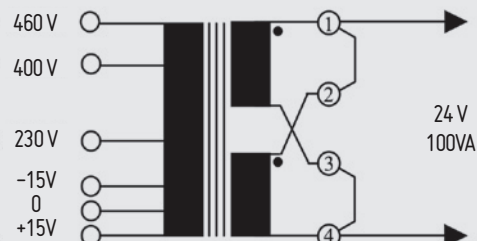
TR 28
5.2

CONTROL & SAFETY OR ISOLATING TRANSFORMER CONNECTION POSSIBILITIES

SERIAL CONNECTION



PARALLEL CONNECTION



* TRANSFORMER 0-230-400 // 24-48V 100VA
REF 680100001

TRANSFORMERS

THREE-PHASE TRANSFORMERS

TRT 33 IP00 POWER ISOLATING TRANSFORMER

Three-phase power isolating transformers dry type. Intended for change of voltages with galvanic isolation, attenuation of line disturbances and/or when it is necessary to change the neutral system. Connection with terminal blocks or with screws for flats terminals. Manufactured with electrical steel with low losses and copper windings. On request we can manufacture transformers with other voltages, with taps, electrostatic screen, with thermal switch, etc.

www.df-sa.es/transformers/three-phase/TRT33/

TECHNICAL

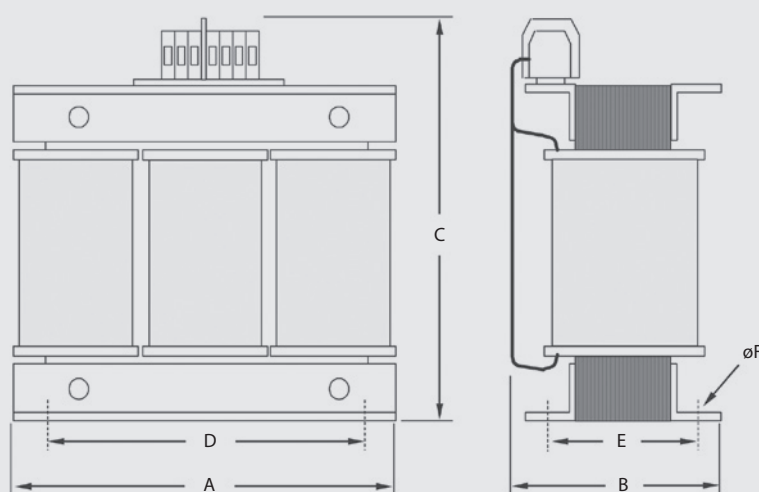
PRI VOLTAGE	400V
SEC VOLTAGE	230V
THERMAL CLASS	B/H
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP00 & IP23
DIELECTRIC STRENGTH PRI-SEC	> 4 kV
VECTOR GROUP	Dyn5
NATURAL AIR COOLING OTHER CHARACTERISTICS ON REQUEST	

POWER (kVA)	REFERENCE	DIMENSIONS (mm)			FIXING (mm)			WEIGHT (kg)
		A	B	C	D	E	F	
0,5	73N0005000	180	85	200	140	55	6	6,5
1	73N0010000	240	110	250	200	75	6	16,0
1,6	73N0016000	240	120	250	200	85	6	18,5
2	73N0020000	240	130	250	200	95	6	23,0
3,5	73N0035000	300	135	340	200	105	6	33,5
4	73N0040000	300	145	340	200	115	6	40,0
5	73N0050000	300	175	340	200	135	6	50,0
6,3	73N0063000	360	170	361	300	115	8	56,0
8	73N0080000	360	180	361	300	125	8	58,0
10	73N0100000	360	190	361	300	135	8	66,7
12,5	73N0125000	420	200	425	300	140	8	86
16	73N0160000	420	210	425	300	150	8	100
20	73N0200000	480	225	500	400	155	10	107
25	73N0250000	480	240	500	400	175	10	135
31,5	73N0315000	480	280	510	400	195	10	160
40	73N0400000	480	300	510	400	215	10	178
50	73N0500000	600	320	600	500	180	16	238
63	73N0630000	600	340	600	500	200	16	269
80	73N0800000	600	350	530	500	220	16	323
100	73N1000000	720	300	620	500	200	16	420



73N0035000

TRT 33 IP00 POWER ISOLATING TRANSFORMER DIMENSIONS



DIMENSIONS MAY SLIGHTLY VARY ACCORDING THE VOLTAGES



TRANSFORMERS

THREE-PHASE TRANSFORMERS



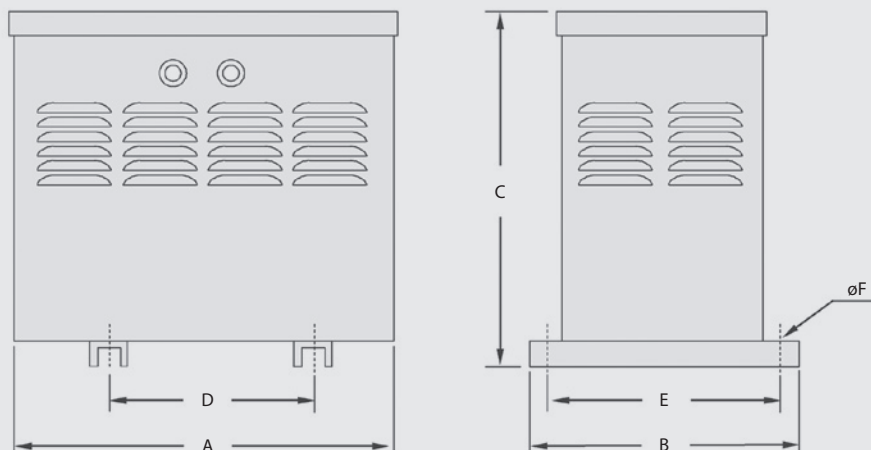
TRT 33 IP23 POWER ISOLATING TRANSFORMER

POWER (kVA)	REFERENCE	DIMENSIONS (mm)			FIXING (mm)			WEIGHT (kg)
		A	B	C	D	E	F	
0,5	73C0005000	235	240	285	140	215	12	9,5
1	73C0010000	285	290	335	200	265	12	20,0
1,6	73C0016000	285	290	335	200	265	12	22,5
2	73C0020000	285	290	335	200	265	12	27,0
3,5	73C0035000	375	300	435	200	270	12	40,5
4	73C0040000	375	300	435	200	270	12	47,0
5	73C0050000	375	300	435	200	270	12	57,0
6,3	73C0063000	450	400	480	300	370	12	66,0
8	73C0080000	450	400	480	300	370	12	68,0
10	73C0100000	450	400	480	300	370	12	76,5
12,5	73C0125000	510	400	540	300	370	12	97
16	73C0160000	510	400	540	300	370	12	111
20	73C0200000	540	500	610	400	470	12	126
25	73C0250000	540	500	610	400	470	12	156
31,5	73C0315000	540	500	610	400	470	12	179
40	73C0400000	540	500	610	400	470	12	197
50	73C0500000	880	530	830	500	500	12	268
63	73C0630000	880	530	830	500	500	12	299
80	73C0800000	880	730	830	500	700	12	363
100	73C1000000	880	730	830	500	700	12	470



73C0035000

TECHNICAL TRT 33 IP23 POWER ISOLATING TRANSFORMER DIMENSIONS



TRT 33 IP23 POWER ISOLATING TRANSFORMER WHEELS KIT

REFERENCE	DESCRIPTION
690000005	WHEELS KIT (max 200 kg/wheel)



TRANSFORMERS

SINGLE-PHASE AUTOTRANSFORMERS



TR 24 REVERSIBLE AUTOTRANSFORMER

Single-phase reversible autotransformers, especially intended for use as a voltage adapter when an economical solution is required in applications where the galvanic isolation or attenuation of disturbances are not required. On request we can manufacture autotransformers with other voltages, with taps, with thermal switch, etc.

www.df-sa.es/transformers/autotransformers/single-phase/TR24/

TECHNICAL

VOLTAGES	0-230-400V
THERMAL CLASS	B
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP00
DIELECTRIC STRENGTH	> 3 kV

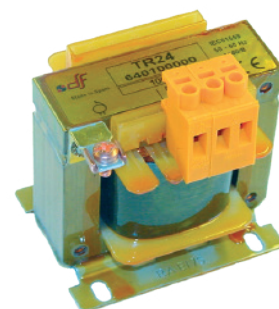
REVERSIBLE
OTHER CHARACTERISTICS ON REQUEST

100VA
3000VA

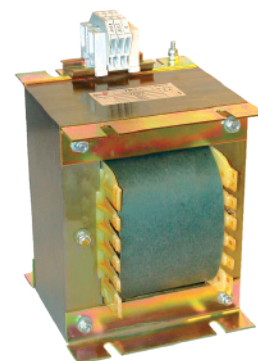
POWER (kVA)	REFERENCE	DIMENSIONS (mm)			FIXING (mm)			WEIGHT (kg)
		A	B	C	D	E	F	
100	640100000	75	71	84	56	47	4,8	1,00
200	640200000	84	84	90	64	67	4,8	1,90
320	640320000	96	82	100	84	67	5,7	2,23
400	640400000	96	92	100	84	77	5,7	2,68
500	640500000	96	107	100	84	91	5,7	3,35
630	640630000	108	91	111	80,5	73	5,7	3,60
800	640800000	108	104	111	80,5	87	5,7	4,40
1000	641000000	120	106	118	90	87	5,7	4,90
1600	641600000	150	114	142	122	92	6,8	7,50
2000	642000000	150	130	142	122	108	6,8	9,80
2500	642500000	150	157	142	122	135	6,8	12,9
3000	643000000	150	157	142	122	135	6,8	13,2

4000VA
6300VA

4000	644000000	163	165	256	98	120	8	19,0
5000	645000000	163	175	256	98	130	8	21,5
6300	646300000	163	195	256	98	150	8	23,5



64010000

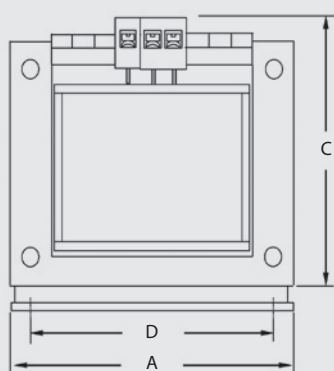


644000000

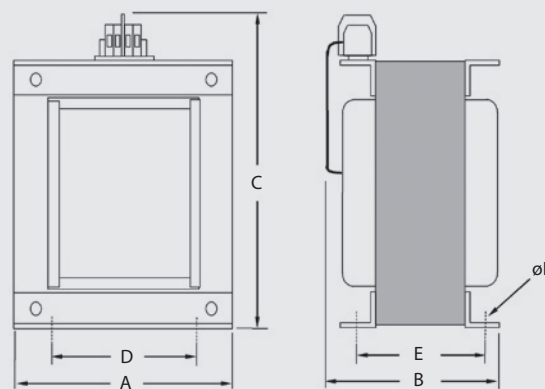
TECHNICAL

TR 24 REVERSIBLE AUTOTRANSFORMER DIMENSIONS

100VA
3000VA



4000VA
6300VA



DIMENSIONS MAY SLIGHTLY VARY ACCORDING THE VOLTAGES

STANDARDS
IEC 61558
EN 61558
IEC 60076-11



TECHNICAL
PROTECTION

PAG 26

TECHNICAL
IP PROTECTION INDEX

PAG 28

TRANSFORMERS

THREE-PHASE AUTOTRANSFORMERS

TRT 30 IP00 REVERSIBLE DRY TYPE AUTOTRANSFORMER

Three-phase reversible autotransformers, dry type, intended for use as voltage adapter when an economical solution is required in applications where the galvanic isolation or attenuation of disturbances are not required. The main applications include the voltage adaptation in motors, pumps, machines, air conditioning equipment. Connection with terminal blocks or with screws for flat terminals. Manufactured with electrical steel with low losses and copper windings. On request we can manufacture autotransformers with other voltages, with taps, with thermal switch, etc.

www.df-sa.es/transformers/autotransformers/three-phase/TRT30/

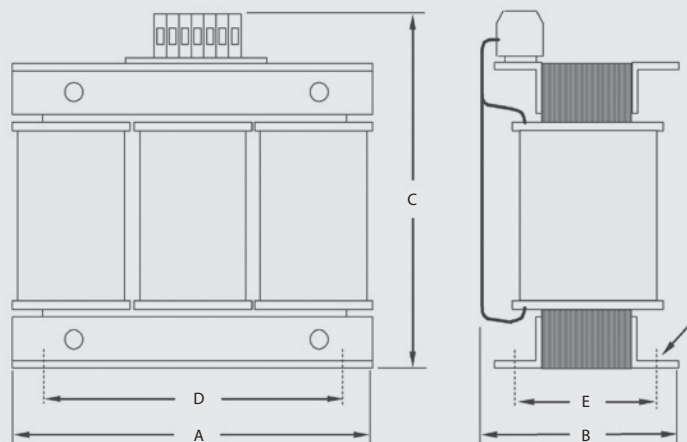
TECHNICAL	
VOLTAGES	230-400V
THERMAL CLASS	B/H
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50/60 Hz
CLASS	I
PROTECTION INDEX	IP00
DIELECTRIC STRENGTH	> 3 kV
VECTOR GROUP	Yn0 (with neutral)
REVERSIBLE COPPER WINDINGS NATURAL AIR COOLING OTHER CHARACTERISTICS ON REQUEST	

POWER (kVA)	REFERENCE	DIMENSIONS (mm)			FIXING (mm)		WEIGHT (kg)
		A	B	C	D	E	
0,5	70N0005000	180	85	185	140	55	5,5
1	70N0010000	180	85	200	140	55	6,5
2	70N0020000	180	95	200	140	65	9,1
3	70N0030000	240	110	250	200	75	16
5	70N0050000	240	120	250	200	85	18,5
8	70N0080000	240	145	261	200	110	27
10	70N0100000	300	135	311	200	95	31
12,5	70N0125000	300	155	311	200	115	40
16	70N0160000	300	165	311	200	125	44
20	70N0200000	360	170	361	300	115	56
25	70N0250000	360	180	361	300	125	58
31,5	70N0315000	420	200	425	300	140	86
40	70N0400000	420	210	425	300	150	100
50	70N0500000	480	225	500	400	155	107
63	70N0630000	480	240	500	400	175	135
80	70N0800000	480	280	510	400	195	160
100	70N1000000	480	300	510	400	215	180
125	70N1250000	600	320	600	500	180	240
160	70N1600000	600	340	600	500	200	270
200	70N2000000	600	350	530	500	220	325



70N0630000

TRT 30 IP00 REVERSIBLE DRY TYPE AUTOTRANSFORMER DIMENSIONS



DIMENSIONS MAY SLIGHTLY VARY ACCORDING THE VOLTAGES

STANDARDS	SYMBOLS
IEC 61558 EN 61558 IEC 60076-11	

TECHNICAL SELECTION GUIDE	TECHNICAL PROTECTION	TECHNICAL IP PROTECTION INDEX
PAG 24	PAG 26	PAG 28



TRANSFORMERS

THREE-PHASE AUTOTRANSFORMERS



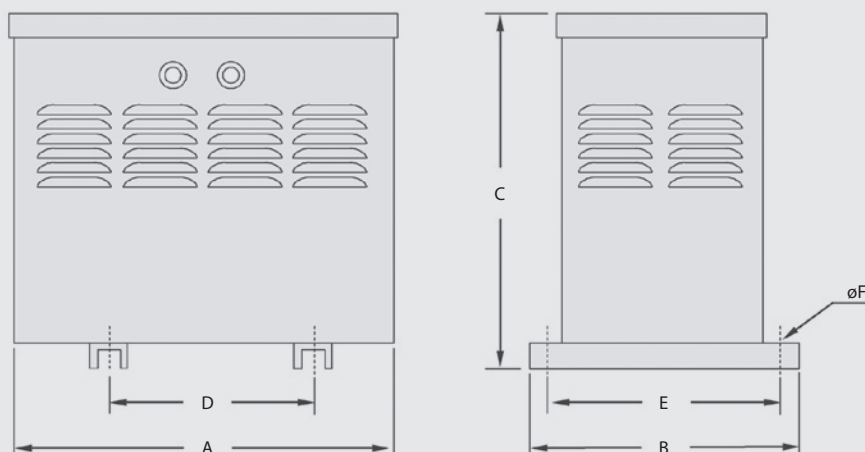
TRT 30 IP23 REVERSIBLE DRY TYPE AUTOTRANSFORMER

POWER (kVA)	REFERENCE	DIMENSIONS (mm)			FIXING (mm)		WEIGHT (kg)
		A	B	C	D	E	
0,5	70C0005000	235	240	285	140	215	9,0
1	70C0010000	235	240	285	140	215	9,5
2	70C0020000	235	240	285	140	215	12,0
3	70C0030000	285	290	335	200	265	20,0
5	70C0050000	285	290	335	200	265	22,5
8	70C0080000	285	290	335	200	265	31,0
10	70C0100000	375	300	435	200	270	38,0
12,5	70C0125000	375	300	435	200	270	47,0
16	70C0160000	375	300	435	200	270	51,0
20	70C0200000	450	400	480	300	370	66,0
25	70C0250000	450	400	480	300	370	68,0
31,5	70C0315000	510	400	540	300	370	97
40	70C0400000	510	400	540	300	370	111
50	70C0500000	540	500	610	400	470	126
63	70C0630000	540	500	610	400	470	156
80	70C0800000	540	500	610	400	470	180
100	70C1000000	540	500	610	400	470	197
125	70C1250000	880	530	830	500	500	268
160	70C1600000	880	530	830	500	500	300
200	70C2000000	880	730	830	500	700	365



70C0630000

TECHNICAL TRT 30 IP23 REVERSIBLE DRY TYPE TRANSFORMER DIMENSIONS



TRT 30 IP23 REVERSIBLE DRY TYPE TRANSFORMER WHEELS KIT

REFERENCE	DESCRIPTION
690000005	WHEELS KIT (max 200 kg/wheel)



TRANSFORMERS

SINGLE-PHASE REACTORS

RE 8 SINGLE-PHASE REACTORS

Single-phase line reactors (intended for the attenuation of notches and spikes, reduction of harmonics and limitation of inrush currents in power converters and motor drives), as well as DC link chokes for DC side of converters. Manufactured with magnetic steel with low losses and copper windings. On request we can manufacture reactors with other characteristics, for other applications or with thermal switch.

www.df-sa.es/transformers/reactors/single-phase/

RE 8 LINE REACTOR

Single-phase reactors intended for the attenuation of notches and spikes, reduction of harmonics and limitation of inrush currents. Drop voltage of 4% of the rated voltage (230V). On request we can manufacture reactors with other characteristics, for other applications or with thermal switch.

www.df-sa.es/transformers/reactors/single-phase/RE8/

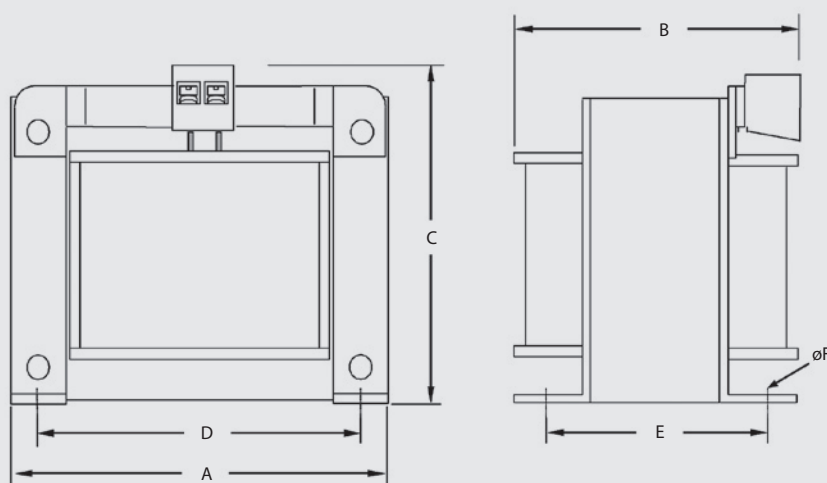
TECHNICAL	
VOLTAGE DROP	4% at I_n (230V)
THERMAL CLASS	B
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50 Hz
CLASS	I
PROTECTION INDEX	IP00
DIELECTRIC STRENGTH	> 3 kV
OTHER CHARACTERISTICS ON REQUEST	

CURRENT		REFERENCE	DIMENSIONS			FIXING			WEIGHT
(A)	(mH)		(mm)			(mm)			(kg)
			A	B	C	D	E	F	
6	4,881	8006100480	60	70	68	50	48	4	0,73
10	2,928	8010100290	75	66	81	62,5	45	4	0,98
16	1,830	8016100180	84	85	86	70	66	4	1,98
25	1,171	8025100110	96	90	96	80	70	5	2,65
32	0,915	8032291500	108	112	106	90	75	5	3,56
40	0,732	8040273200	108	126	116	90	89	5	4,37
50	0,586	8050258600	120	123	128	100	84	6	5,00
63	0,465	8063246500	120	143	128	100	104	6	6,75



8025100110

RE 8 LINE REACTOR DIMENSIONS



STANDARDS
IEC 60076
IEC 61558
EN 61558



TECHNICAL
IP PROTECTION INDEX

TRANSFORMERS

THREE-PHASE REACTORS

RET 9 THREE-PHASE REACTORS

Three-phase line or motor reactors for power converters (intended for the attenuation of notches and spikes as well as reduction of harmonics and limitation of inrush currents in power converters and motor drives). There are also types for the protection of capacitor banks in power factor correction equipment with presence of harmonics (to avoid resonance effects, to minimize harmonic currents through the capacitors and to reduce losses, increasing capacitor life. Manufactured with electrical steel with low losses and copper windings. On request we can manufacture reactors with other characteristics, with built-in thermal switch, etc.

www.df-sa.es/transformers/reactors/three-phase/

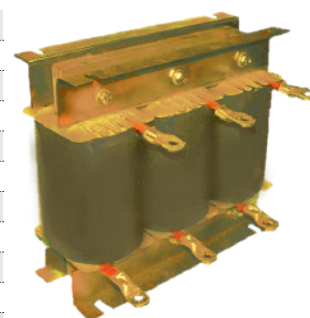
RET 9 LINE REACTOR

Three-phase reactors intended for the attenuation of notches and spikes, reduction of harmonics and limitation of inrush currents in converters and variable speed drives. Drop voltage of 4% of the rated voltage (400V). Manufactured with electrical steel with low losses and copper windings. On request we can manufacture reactors with other characteristics or with thermal switch.

www.df-sa.es/transformers/reactors/three-phase/RET9/

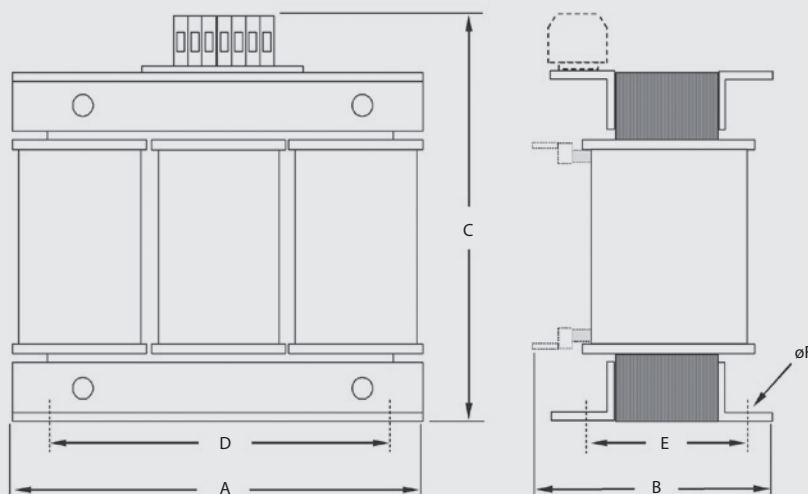
TECHNICAL	
VOLTAGE DROP	4% at In (400V)
THERMAL CLASS	B
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50 Hz
CLASS	I
PROTECTION INDEX	IP00
DIELECTRIC STRENGTH	> 4 kV
NATURAL AIR COOLING OTHER CHARACTERISTICS ON REQUEST	

CURRENT (A)	(mH)	REFERENCE	DIMENSIONS (mm)			FIXING (mm)			WEIGHT (kg)
			A	B	C	D	E	F	
10	2,928	9010100290	180	90	205	140	55	6	4,5
16	1,830	9016100180	180	90	205	140	55	6	4,8
20	1,464	9020100140	180	90	205	140	55	6	5,2
25	1,171	9025100110	180	90	205	140	55	6	5,5
32	0,915	90322291500	180	90	220	140	55	6	6,5
40	0,732	9040273200	180	100	235	140	65	6	8,5
50	0,586	9050258600	180	100	235	140	65	6	9,0
63	0,465	9063246500	180	140	185	140	75	6	10,0
80	0,366	9080236600	240	140	235	200	75	6	14,0
100	0,293	9100229300	240	140	235	200	75	6	15,0
125	0,234	9125223400	240	140	235	200	75	6	16,0
160	0,183	9160218300	240	150	235	200	85	6	18,5
200	0,146	9200214600	300	190	290	200	95	6	30,0



9063246500

RET 9 LINE REACTOR DIMENSIONS



TRANSFORMERS

THREE-PHASE REACTORS

RET9 HARMONIC CIRCUIT FILTER REACTOR

Three-phase reactors for the protection of capacitor banks in power factor correction equipment with presence of harmonics. Avoids resonance effects, minimizes harmonic currents through the capacitors and reduces the losses, increasing capacitor life. Manufactured with electrical steel with low losses and copper windings. Built-in thermal switch. On request we can manufacture reactors with other characteristics.

www.df-sa.es/transformers/reactors/three-phase/RET9/

TECHNICAL	
VOLTAGE DROP	400V
FILTERING FACTOR	$p=0,07$ (7%)
f_r	189 Hz
TOLERANCE L	3%
LINEARITY (95% L_N)	1,8In
MAX PERMANENT OVERLOAD	1,17In
THERMAL CLASS	B
MAX AMBIENT TEMPERATURE	40°C
FREQUENCY	50 Hz
CLASS	I
PROTECTION INDEX	IP00
DIELECTRIC STRENGTH	> 4 kV
THERMAL MICRO SWITCH OTHER CHARACTERISTICS ON REQUEST	

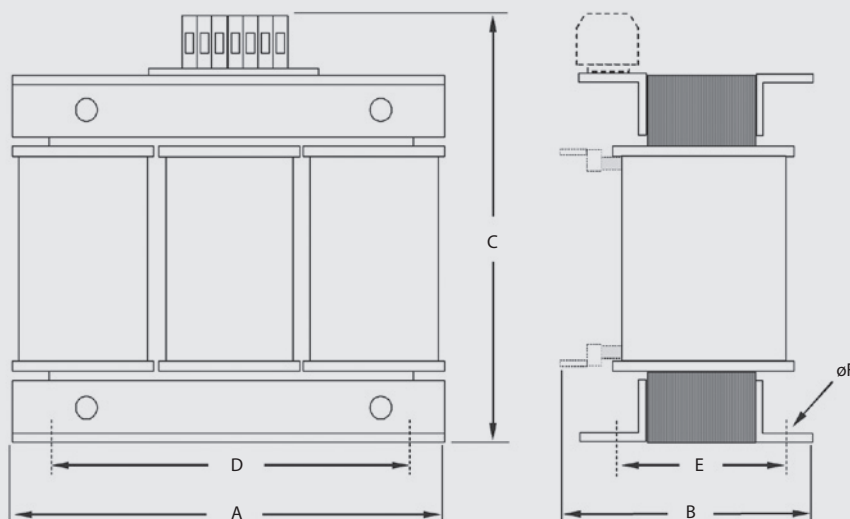
POWER (kvar)*	L (mH)	CURRENT (A)		REFERENCE	DIMENSIONS (mm)			FIXING (mm)		WEIGHT (kg)
		I_N 50 Hz	I_N rms		A	B	C	D	E	
5	7,67	7,65	8,44	9008100760	180	85	220	140	55	6,5
10	3,83	15,3	16,9	9015100380	180	95	220	140	65	9,0
12,5	3,07	19,1	21,1	9019100310	180	105	170	140	75	11,5
15	2,56	22,9	25,3	9023100260	240	135	230	200	75	15,0
20	1,92	30,6	33,7	9031100190	240	135	230	200	75	15,4
25	1,53	38,2	42,2	9038100150	240	135	230	200	75	15,9
30	1,28	45,9	50,6	9046100120	240	145	230	200	85	18,0
40	0,958	61,2	67,5	9061295800	240	145	230	200	85	20,0
50	0,767	76,5	84,4	9076276700	300	170	285	200	95	30,0
60	0,639	91,8	101,3	9092263900	300	180	285	200	105	36,0
70	0,548	107,1	118,2	9107254800	300	190	285	200	115	40,0
80	0,479	122,4	135,1	9122247900	300	200	285	200	125	42,0

* EFFECTIVE FILTERED COMPENSATING REACTIVE POWER



9038100150

RET9 LINE REACTOR DIMENSIONS



STANDARDS
IEC 61558
IEC 60289
EN 61558
EN 60289



TECHNICAL
IP PROTECTION INDEX

PAG 28

DETERMINATION OF RATED POWER OF THE TRANSFORMER IN CONTROL APPLICATIONS

For the correct sizing of a control transformer we must consider the continuous power as well as the inrush power due to the high momentary inrush current caused when electromechanical devices such as contactors or relays are energized. During the normal operation of control circuit the transformer must supply a high instantaneous power for a short time. From the thermal point of view this is not a problem due to the very short time, however, this situation could be problematic due to the reduction of output voltage in the transformer. If the secondary voltage decreases in excess, some devices might not operate and the control circuit won't work properly.

Thus, in every control circuit we will take into account several facts:

- The maximum power in a given moment (inrush power).
- Continuous power requirement.
- Power factor.
- Minimum admissible voltage.

An exhaustive study in each situation could be very complex due to the particularities on every application, however there are simple rules to determine the correct size of a transformer. We can suppose that the power factor is $\cos\varphi=0,5$ during the operation of contactors.

The instantaneous power will be:

$$P_{inst} = \Sigma P_m + \Sigma P_s + P_a$$

ΣP_m sum of the sealed power of the contactors.

ΣP_s sum of the power of the signalling lamps.

P_a Inrush power of the biggest contactor.

DETERMINATION OF AUTOTRANSFORMERS FOR 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.
- Heavy load.
- Soft starter or variable speed drive.

1. 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.

2. 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.

3. SOFT STARTER OR 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 take into account for the correct choosing of the rated power because an excessive temperature rise can reduce drastically the duration of the autotransformer.

TRANSFORMERS

THREE-PHASE TRANSFORMERS

TECHNICAL

TRT 30 THREE-PHASE TRANSFORMERS REVERSIBLES SELECTION GUIDE

RATED POWER OF AUTOTRANSFORMER

				NON FREQUENT START (UP TO 4 STARTS / HOUR)				FREQUENT START (UP TO 15 STARTS / HOUR)		
MOTOR*				NORMAL LOAD			VARIABLE SPEED DRIVE	NORMAL LOAD		
(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	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	64,0	80	100	100	100	125	100
100	73,6	0,88	98	85,3	100	125	125	125	160	125
125	92,0	0,88	98	106,7	125	160	160	160	200	160
150	110,4	0,88	98	128,0	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)

TECHNICAL

TRANSFORMERS & AUTOTRANSFORMERS PROTECTION

The transformers and autotransformers (and their lines) must be protected against overloads and/or short-circuits that they can be submitted in use, and could causes dangerous situations for persons, animals or installations. This protection are also a requirement of the standards and the national regulations about electrical installations. Due to the high inrush current (about $25 \cdot I_n$) it is very difficult to get an optimal protection in the primary side. If we select the rated current of fuses according to the primary rated current, the inrush current will melt the fuses. On the other hand, if the fuses are overrating for withstand the inrush, the transformer won't have a good protection against overloads.

For this reason **we recommend to protect transformers and autotransformers on the secondary side (output)**. The most adequate way to protect this devices (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 have a rated current equal or lower than the output rated current 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 transformer 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.

This 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:

- Miniature fuses 5x20 ó 6x32 time-lag (slow) according to IEC/EN60127:

In fuse link $\geq 3 \cdot I_n$ transformer

- Fuse links aM type according to IEC/EN60269:

In fuse link $\geq 1,8 \cdot I_n$ transformer

- Fuse links gG type according to IEC/EN60269:

In fuse link $\geq 3 \cdot I_n$ transformer

TRANSFORMERS

THREE-PHASE TRANSFORMERS

TECHNICAL

TRT 33 TRT34 THREE-PHASE TRANSFORMERS VECTOR GROUPS

VECTOR GROUP	PHASE ANGLE	GREATER VOLTAGE	SMALLER VOLTAGE	VECTOR GROUP	PHASE ANGLE	GREATER VOLTAGE	SMALLER VOLTAGE
Dd0	0 (0°)			Dd6	6 (180°)		
Yy0	0 (0°)			Yy6	6 (180°)		
Dy5	5 (150°)			Dy11	11 (330°)		
Yd5	5 (150°)			Yd11	11 (330°)		

D → DELTA CONNECTION
Y → STAR (WYE) CONNECTION

- Capital letters (D, Y, N) are associated to the winding with the greater voltage and small letters (d, and, n) with the smaller voltage.
- If the neutral point of star connection winding is accessible (can be connected) is indicated by the letter N: YN or yn.

TRANSFORMERS, AUTOTRANSFORMERS & REACTORS IP PROTECTION INDEX

FIRST NUMBER PROTECTION AGAINST CONTACTS AND SOLID OBJECTS

0

NO SPECIAL PROTECTION

1



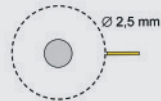
PROTECTED AGAINST SOLID
OBJECTS GREATER THAN 50 mm
(SUCH AS A HAND)

2



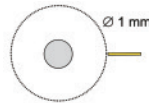
PROTECTED AGAINST SOLID
OBJECTS GREATER THAN 12,5 mm
(SUCH AS A FINGER)

3



PROTECTED AGAINST SOLID
OBJECTS GREATER THAN 2,5 mm
(SUCH AS A TOOLS)

4



PROTECTED AGAINST SOLID
OBJECTS GREATER THAN 1 mm
(SUCH AS A SMALL TOOLS AND WIRES)

5



PROTECTED AGAINST DUST
(LOW INGRESS OF DUST)
(SATISFACTORY OPERATION OF THE EQUIPMENT)

6



DUST-TIGHT
(NO INGRESS OF DUST)

SECOND NUMBER PROTECTION AGAINST HARMFUL INGRESS OF WATER

0

NO SPECIAL PROTECTION

1



PROTECTION AGAINST DRIPPING WATER
(VERTICALLY FALLING DROPS)

2



PROTECTION AGAINST DRIPPING WATER
AT AN ANGLE UP TO 15°

3



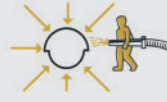
PROTECTION AGAINST DRIPPING WATER
AT AN ANGLE UP TO 60°

4



PROTECTION AGAINST SPLASHING
WATER FROM ANY DIRECTION

5



PROTECTION AGAINST WATER JETS

6



PROTECTION AGAINST
POWERFUL WATER JET

7



PROTECTION AGAINST THE EFFECTS OF
TEMPORARY IMMERSION IN WATER

8



PROTECTION AGAINST THE EFFECTS OF
CONTINUOUS IMMERSION IN WATER



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