

# Isolating transformer ES710/...-1

with primary voltage 400 V

Single-phase isolating transformers for power supplies in medical locations

**Also available as energy-efficient Green Line (GL) edition**



# Isolating transformer ES710 / ...-1

Single-phase isolating transformers  
for power supplies in medical locations



ES710/...-1

## Device features

- Built-in temperature sensors acc. to DIN 44081 (120 °C)
- Screen winding with brought-out insulated connection terminal
- Insulated mounting angles
- Degree of protection, IP00 (open design)
- Degree of protection, IP23 (with enclosure)
- Protection class I
- Protection class II (option: encapsulated version)
- Reinforced insulation
- Classification of insulation:  $t_a40/B$
- Connections: screw terminals
- Noise level < 35 dB (A) (no-load and nominal load)
- Vector group: liO
- Primary voltage 400 V

## Application and description

The transformers of the ES710 series have reinforced insulation and comply with the requirements of IEC 61558-1/DIN EN 61558-1 (VDE 0570-1): 1998-07 and IEC 61558-2-15/DIN EN 61558-2-15 (VDE 0570-2-15): 2001-11.

In addition, the transformers comply with the requirements of IEC 60364-7-710/DIN VDE 0100-710 (VDE 0100-710): 202-11 for IT systems in medical locations. The windings are galvanically isolated. In order to minimize electrical interferences, an electrostatic screen is installed between the primary and secondary winding the lead out of which is connected to an insulated terminal for connection to the equipotential bonding.

The fixing angles are isolated from the transformer core in order to guarantee an isolated installation to comply with the requirements of DIN VDE 0100-710 (VDE 0100-710), para. 710.512.1.6.2).

The transformers are available for horizontal and vertical installation. Protection against corrosion is guaranteed by a complete resin impregnation.

The transformers are designed for use in dry locations. Transformers of the SK2 series are completely encapsulated and fulfil the requirements of protection class II.

## Frequency/ratings

The transformers are designed for rated frequencies of 50...60 Hz. The values specified in the chapter "Technical data" refer to a maximum ambient temperature of 40 °C and a rated frequency of 50 Hz.

## Temperature rise

Free air circulation must be ensured. An ambient temperature exceeding 40 °C will reduce the rated power. For temperature monitoring, a PTC thermistor is placed on each transformer leg and the leads are connected to the terminals.

## Enclosure

Appropriate steel sheet enclosures, degree of protection IP 23, are available for all standard types of isolating transformers.

## Rated power

According to DIN VDE 0100-710 (VDE 0100-710): 2002-11, the rated power of the transformer shall not be less than 3.15 kVA and shall not exceed 8 kVA.

## Overload protection

When isolating transformers are used to form a medical IT system in accordance with para. 710.512.1.6.2 of DIN VDE 0100-710 (VDE 0100-710): 2002-11, **overload protection is not permitted**. In this case, short-circuit protection is required. That means, emphasis is focused on the availability of the power supply; it is therefore essential to avoid disconnection on the occurrence of transient overload. The protection of isolating transformers against overload and overtemperature can be realized by using monitoring devices in accordance with para. 710.531.3.1. The appropriate fuses for short-circuit protection can be selected from the table "Technical data".

## Standards

ES710 isolating transformers comply with the device standards and the regulations for installation: DIN EN 61558-1 (VDE 570-1), IEC 61558-1, DIN VDE 0100-710 (VDE 0100-710), DIN EN 61558-2-15 (VDE 0570-2-15), IEC 61558-2-15, IEC 60364-7-710.

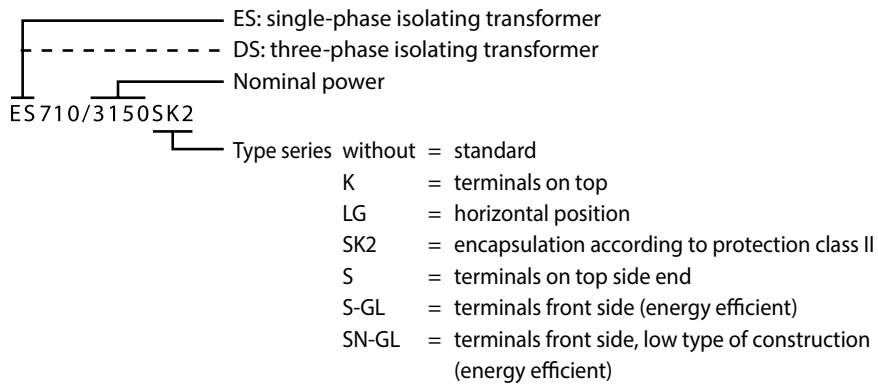


### Hazard warning:

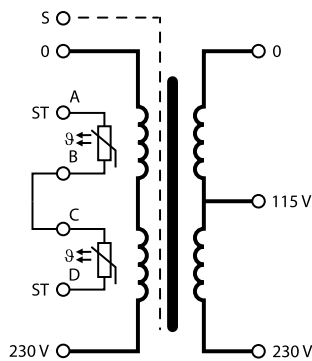
*When performing installation work in the environment of the transformer, it has to be ensured that the insulation coordination of the transformer is not influenced in a negative way.*

*For example, no ferromagnetic and conductive metal swarf may fall down close to the transformer. This can interfere with the function and the dielectric properties, especially after being turned on. The environment of the transformer must be kept free from such particles during the entire operating time and controls must be carried out at regular intervals.*

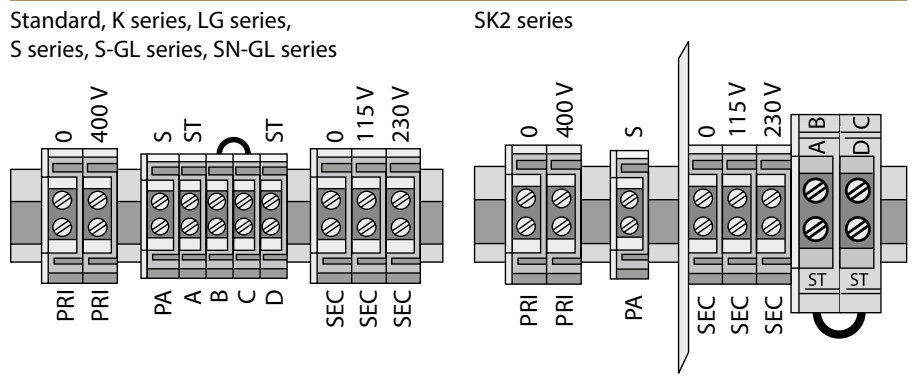
**Nameplate**



**Wiring diagram**



**Terminal diagram**



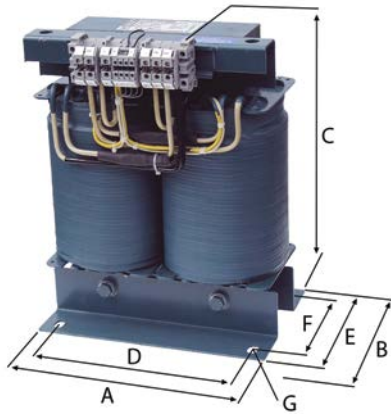
**Connection properties**

Type	Input terminals flexible/rigid	Screen winding flexible/rigid	Control terminals flexible/rigid	Control terminals for protection class II flexible/rigid	Output terminals flexible/rigid
ES710/3150	16/25 mm <sup>2</sup>	16/25 mm <sup>2</sup>	4/6 mm <sup>2</sup>	2.5/4 mm <sup>2</sup>	16/25 mm <sup>2</sup>
ES710/4000	16/25 mm <sup>2</sup>	16/25 mm <sup>2</sup>	4/6 mm <sup>2</sup>	2.5/4 mm <sup>2</sup>	16/25 mm <sup>2</sup>
ES710/5000	16/25 mm <sup>2</sup>	16/25 mm <sup>2</sup>	4/6 mm <sup>2</sup>	2.5/4 mm <sup>2</sup>	16/25 mm <sup>2</sup>
ES710/6300	16/25 mm <sup>2</sup>	16/25 mm <sup>2</sup>	4/6 mm <sup>2</sup>	2.5/4 mm <sup>2</sup>	16/25 mm <sup>2</sup>
ES710/8000	16/25 mm <sup>2</sup>	16/25 mm <sup>2</sup>	4/6 mm <sup>2</sup>	2.5/4 mm <sup>2</sup>	16/25 mm <sup>2</sup>
ES710/10000	35/35 mm <sup>2</sup>	35/35 mm <sup>2</sup>	4/6 mm <sup>2</sup>	2.5/4 mm <sup>2</sup>	35/35 mm <sup>2</sup>

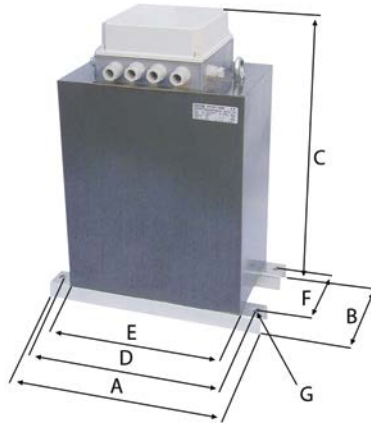
**Dimension diagram/type of construction**

Standard

Dimension B is the depth incl. terminals

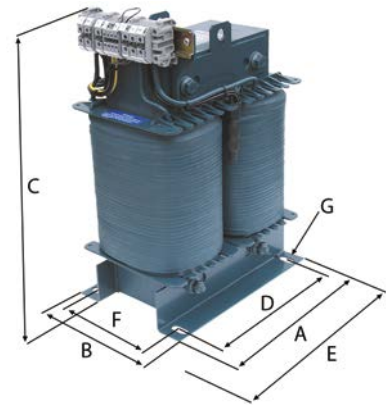


SK2 series

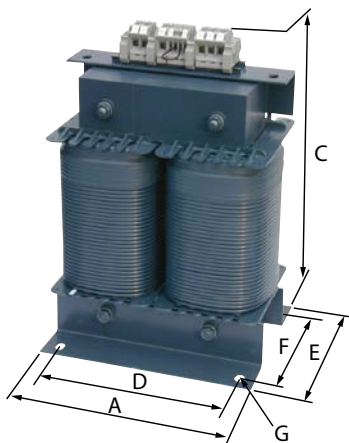


S series

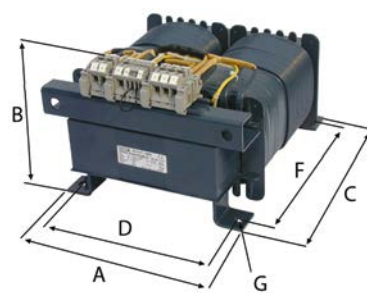
Dimension E is the depth incl. terminals



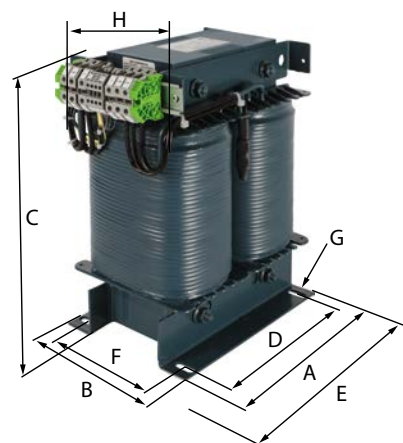
K series



LG series



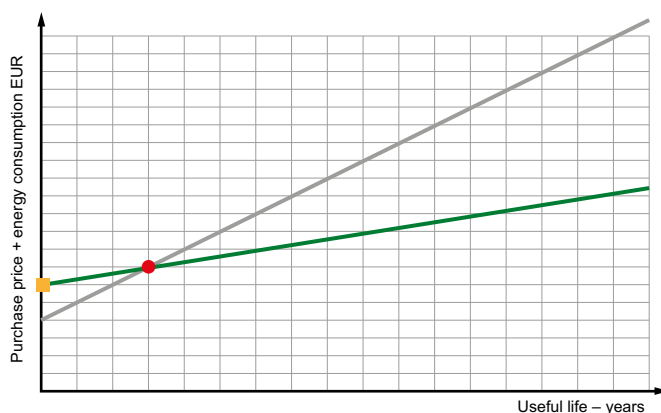
SN-GL series



**Ordering information**

	Dimensions (mm)								Cu weight (kg)	Weight (kg)	Core U/I	Type	Art. No.
	A	B	C	D	E	F	G	H					
GL series	240	230	325	200	180	145	11 x 28		15	49	180/93	ES710/3150-1-GL	B92090141
	280	200	370	240	150	115	11 x 28		24	59	210/63	ES710/4000-1-GL	B92090142
	280	210	370	240	160	125	11 x 28		25	61	210/73	ES710/5000-1-GL	B92090143
	280	225	370	240	175	140	11 x 28		26	65	210/88	ES710/6300-1-GL	B92090144
	280	240	370	240	190	155	11 x 28		27	74	210/103	ES710/8000-1-GL	B92090145
	280	255	370	240	205	170	11 x 28		33	85	210/120	ES710/10000-1-GL	B92090146
S-GL series	280	180	370	240	290	145	11 x 28		15	49	180/93	ES710/3150-1S-GL	B92090071
	280	150	420	240	290	115	11 x 28		24	59	210/63	ES710/4000-1S-GL	B92090072
	280	160	420	240	290	125	11 x 28		25	61	210/73	ES710/5000-1S-GL	B92090073
	280	175	420	240	290	140	11 x 28		26	65	210/88	ES710/6300-1S-GL	B92090074
	280	190	420	240	290	155	11 x 28		27	74	210/103	ES710/8000-1S-GL	B92090085
	280	205	420	240	290	170	11 x 28		33	85	210/120	ES710/10000-1S-GL	B92090086
SN-GL series	280	180	370	240	290	145	11 x 28		15	49	180/93	ES710/3150-1SN-GL	B92090131
	280	150	370	240	320	115	11 x 28		24	59	210/63	ES710/4000-1SN-GL	B92090132
	280	160	370	240	320	125	11 x 28		25	61	210/73	ES710/5000-1SN-GL	B92090133
	280	175	370	240	320	140	11 x 28		26	65	210/88	ES710/6300-1SN-GL	B92090134
	280	190	370	240	320	155	11 x 28		27	74	210/103	ES710/8000-1SN-GL	B92090135
	280	210	370	240	320	175	11 x 28		33	85	210/120	ES710/10000-1SN-GL	B92090136
LG-GL series	260	220	365	234	–	280	9 x 14		25	61	210/73	ES710/5000-1LG-GL	B92090079
	260	235	365	234	–	280	9 x 14		26	65	210/88	ES710/6300-1LG-GL	B92090080
	260	250	365	234	–	280	9 x 14		27	74	210/103	ES710/8000-1LG-GL	B92090078
Standard	240	230	325	200	180	145	11 x 28		15	49	180/93	ES710/3150-1	B924253
	280	200	370	240	150	115	11 x 28		24	59	210/63	ES710/4000-1	B924206
	280	210	370	240	160	125	11 x 28		25	61	210/73	ES710/5000-1	B924199
	280	225	370	240	175	140	11 x 28		26	65	210/88	ES710/6300-1	B924207
	280	240	370	240	190	155	11 x 28		27	74	210/103	ES710/8000-1	B924200
	320	260	420	270	200	160	13 x 35		39	85	240/83	ES710/10000-1	B924254

**Green Line transformer (energy efficient version) – High degree of energy saving over the life time (16 years AfA)  
(German AfA table for depreciation of wear and tear)**



This general illustration is based on calculations of the transformer’s energy consumption while energy costs remained constant at 13.4 ct/kWh (source: first energy) for 16 years. The wide variety of bandwidths result from the different transformer capacities.

- Afa = Depreciation of wear and tear
- = Standard version
- = GL version (Green Line)
- = A higher purchase price of approx. 15-20%
- = ROI (Return on Investment) after about 1-3 years

## Technical data

Type	ES710/3150-1	ES710/4000-1	ES710/5000-1	ES710/6300-1	ES710/8000-1	ES710/10000-1
<b>Power/voltages/currents</b>						
Rated power	3150 VA	4000 VA	5000 VA	6300 VA	8000 VA	10000 VA
Rated frequency	50...60 Hz	50...60 Hz	50...60 Hz	50...60 Hz	50...60 Hz	50...60 Hz
Rated input voltage	AC 400 V	AC 400 V	AC 400 V	AC 400 V	AC 400 V	AC 400 V
Rated input current	8,2 A	10,4 A	13 A	16,3 A	20,7 A	26 A
Rated output voltage	AC 230/115 V	AC 230/115 V	AC 230/115 V	AC 230/115 V	AC 230/115 V	AC 230/115 V
Rated output current	13,7 A	17,4 A	21,7 A	27,4 A	34,7 A	43,5 A
Inrush current $I_E$	$< 12 \times \hat{I}_n$	$< 12 \times \hat{I}_n$	$< 12 \times \hat{I}_n$	$< 12 \times \hat{I}_n$	$< 12 \times \hat{I}_n$	$< 12 \times \hat{I}_n$
Inrush current $I_E$ GL version	$< 8 \times \hat{I}_n$	$< 8 \times \hat{I}_n$	$< 8 \times \hat{I}_n$	$< 8 \times \hat{I}_n$	$< 8 \times \hat{I}_n$	$< 8 \times \hat{I}_n$
Leakage current	$\leq 0,5$ mA	$\leq 0,5$ mA	$\leq 0,5$ mA	$\leq 0,5$ mA	$\leq 0,5$ mA	$\leq 0,5$ mA
No-load input current $i_0$	$\leq 3$ %	$\leq 3$ %	$\leq 3$ %	$\leq 3$ %	$\leq 3$ %	$\leq 3$ %
No-load input current $i_0$ GL version	$\leq 2$ %	$\leq 2$ %	$\leq 2$ %	$\leq 2$ %	$\leq 2$ %	$\leq 2$ %
No-load output voltage $U_0$	$\leq 235$ V	$\leq 235$ V	$\leq 234$ V	$\leq 234$ V	$\leq 233$ V	$\leq 233$ V
Short-circuit voltage $U_k$	$\leq 3$ %	$\leq 3$ %	$\leq 3$ %	$\leq 3$ %	$\leq 3$ %	$\leq 3$ %
<b>Environmental conditions</b>						
Ambient temperature	$\leq 40$ °C	$\leq 40$ °C	$\leq 40$ °C	$\leq 40$ °C	$\leq 40$ °C	$\leq 40$ °C
No-load temperature rise	$\leq 20$ °C	$\leq 23$ °C	$\leq 26$ °C	$\leq 32$ °C	$\leq 35$ °C	$\leq 40$ °C
Full-load temperature rise	$\leq 60$ °C	$\leq 48$ °C	$\leq 65$ °C	$\leq 65$ °C	$\leq 70$ °C	$\leq 75$ °C
Noise level (under no-load conditions and nominal load)	$\leq 35$ dB(A)	$\leq 35$ dB(A)	$\leq 35$ dB(A)	$\leq 35$ dB(A)	$\leq 35$ dB(A)	$\leq 35$ dB(A)
<b>Other</b>						
Insulation classification	$t_a40/B$	$t_a40/B$	$t_a40/B$	$t_a40/B$	$t_a40/B$	$t_a40/B$
Degree of protection	IP00	IP00	IP00	IP00	IP00	IP00
Protection class	I/II*	I/II*	I/II*	I/II*	I/II*	I/II*
Core U/I	180/93	210/63	210/73	210/88	210/103	240/83
Core U/I GL version	180/93	210/63	210/73	210/88	210/103	210/120
Recommended use when used in accordance with DIN VDE 0100-710	16 A gL/gG	20 A gL/gG	25 A gL/gG	35 A gL/gG	35 A gL/gG	50 A gL/gG
Recommended use when used in accordance with DIN VDE 0100-710 GL version	16 A gL/gG	16 A gL/gG	20 A gL/gG	25 A gL/gG	25 A gL/gG	35 A gL/gG
Induction	0,86 T	0,94 T	1 T	1,05 T	1 T	1,05 T
$R_{primary}$	0,540 $\Omega$	0,450 $\Omega$	0,375 $\Omega$	0,205 $\Omega$	0,175 $\Omega$	0,210 $\Omega$ (-GL 0,15 $\Omega$ )
$R_{secondary}$	0,230 $\Omega$	0,110 $\Omega$	0,095 $\Omega$	0,070 $\Omega$	0,056 $\Omega$	0,036 $\Omega$ (-GL 0,045 $\Omega$ )
Efficiency	95 %	96 %	96 %	96 %	96 %	96 % (-GL 97 %)
<b>Loss at 20...22 °C ambient temperature</b>						
Fe loss (iron loss)	$< 55$ W	$< 65$ W	$< 80$ W	$< 105$ W	$< 110$ W	$< 150$ W
Fe loss (iron loss) GL version	$< 18$ W	$< 20$ W	$< 26$ W	$< 35$ W	$< 38$ W	$< 42$ W
Cu loss (copper loss)	$< 90$ W	$< 85$ W	$< 105$ W	$< 130$ W	$< 165$ W	$< 250$ W
Cu loss (copper loss) GL version	$< 90$ W	$< 85$ W	$< 105$ W	$< 130$ W	$< 165$ W	$< 210$ W
<b>Heat dissipation loss at 40 °C ambient temperature and 100 % continuous load</b>						
Heat dissipation loss	$< 165$ W	$< 165$ W	$< 210$ W	$< 270$ W	$< 320$ W	$< 440$ W
Heat dissipation loss GL version	$< 125$ W	$< 115$ W	$< 145$ W	$< 185$ W	$< 230$ W	$< 275$ W

\* Option: completely encapsulated version  
Energy efficient version GL = Green Line

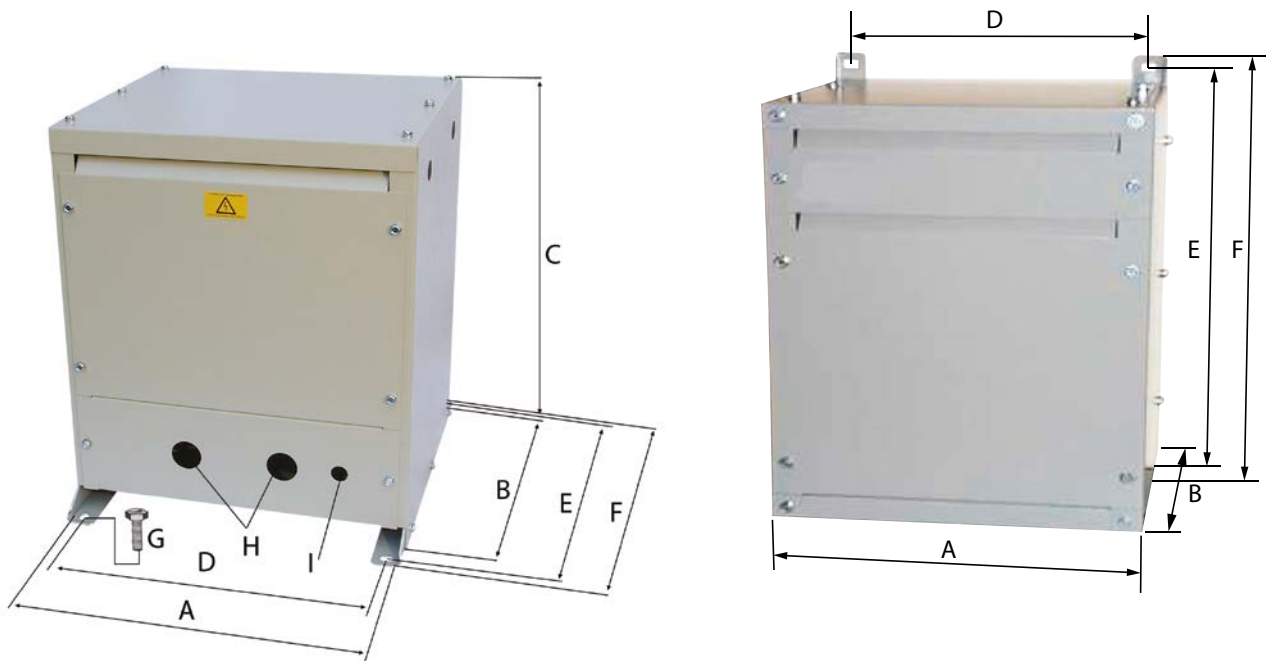
**Isolating transformer enclosure**

**ESDS0107**

Sheet steel enclosure in vertical position for single-phase transformers of the series ES710/3150 to ES710/10000.

**Enclosure**

- Sheet steel, varnished in RAL 7032
- Degree of protection IP 23
- Bore holes for cable entry
- The enclosures of the transformers (standard(GL) version), transformer sizes of 3.15 to 10 kVA, are provided with fixing holes intended for easy retrofitting at any time.
- The sheet steel enclosure ESDS701 is only suitable for the -LG series for hanging mounting.



**Ordering information enclosure**

Dimensions (mm)									Weight (kg)	Ausführung	Type	Art. No.
A	B	C	D	E	F	G	H	I				
430	380	500	385	420	450	M10	ø 37,5	ø 20,5	16	floor mounting	ESDS0107-1	B924673
350	300		315	550	580				18	hanging mounting	ESDS710	B924741



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