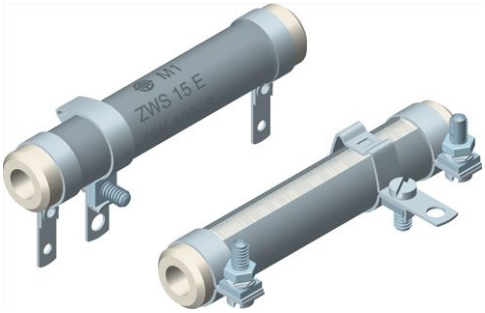
Cemented Wirewound Resistors with Lugs



FEATURES

- Lugs with various termination styles suitable for soldering or bolt connection
- Excellent pulse load capability
- Adjustable type (E) available
- Non inductive type (Ni) available
- Non-flammable coating according to UL94-V0
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE GREEN (5-2008)

The ZWS series, with a completely welded construction, is the perfect choice for high continuous power dissipation up to 250 W with the option for adjustable (ZWS E) and non-inductive (ZWS Ni) types. With their extremely high pulse power capability, they are the ideal choice as inrush current limiters. Typical applications include but are not limited to drive systems, power supplies, frequency inverters, AC and DC filters, and as snubber resistors. For a given application, requirements of ohmic value, rated power, peak voltage, pulse shape, pulse duration, termination style, and environmental conditions may be submitted to recommend the most suitable product.

APPLICATIONS

- Inrush current limiter
- Capacitor charge / discharge
- Snubber resistor
- Brake resistor
- Filter resistor

TECHNICAL SPECIFICATION

TYPE / VARIANT	RATED DISSIPATION P_{40}	RESISTANCE RANGE (1) TCR -10 ppm/K to -80 ppm/K WM50	RESISTANCE RANGE (1) TCR +100 ppm/K to +180 ppm/K WM110	RESISTANCE TOLERANCE	OPERATING VOLTAGE (2) $U_{max.}$
ZWS 6	6 W	0.82 Ω to 5.1 kΩ	1.8 Ω to 13 kΩ	± 5 %, ± 10 %	250 V
		2.7 Ω to 5.1 kΩ	-	± 2 %	150 V
ZWS 6 E	6 W	0.82 Ω to 130 Ω	1.8 Ω to 4.7 kΩ	± 5 %, ± 10 %	150 V
ZWS 6 Ni	6 W	0.15 Ω to 910 Ω	0.33 Ω to 2.4 kΩ	± 10 %	100 V
		1.0 Ω to 910 Ω	2.0 Ω to 2.4 kΩ	± 5 %	
ZWS 8	8 W	0.68 Ω to 7.5 kΩ	1.8 Ω to 20 kΩ	± 5 %, ± 10 %	400 V
		3.3 Ω to 7.5 kΩ	-	± 2 %	200 V
ZWS 8 E	8 W	0.62 Ω to 200 Ω	1.8 Ω to 6.8 kΩ	± 5 %, ± 10 %	200 V
ZWS 8 Ni	8 W	0.24 Ω to 1.3 kΩ	0.56 Ω to 3.6 kΩ	± 10 %	150 V
		1.0 Ω to 1.3 kΩ	2.0 Ω to 3.6 kΩ	± 5 %	
ZWS 12	12 W	0.62 Ω to 10 kΩ	1.8 Ω to 27 kΩ	± 5 %, ± 10 %	550 V
		3.0 Ω to 10 kΩ	-	± 2 %	300 V
ZWS 12 E	12 W	0.56 Ω to 270 Ω	1.8 Ω to 9.1 kΩ	± 5 %, ± 10 %	300 V
ZWS 12 Ni	12 W	0.33 Ω to 1.8 kΩ	0.75 Ω to 5.1 kΩ	± 10 %	200 V
		1.0 Ω to 1.8 kΩ	2.0 Ω to 5.1 kΩ	± 5 %	
ZWS 15	15 W	0.68 Ω to 12 kΩ	2.2 Ω to 33 kΩ	± 5 %, ± 10 %	700 V
		2.2 Ω to 12 kΩ	-	± 2 %	400 V
ZWS 15 E	15 W	0.68 Ω to 330 Ω	2.2 Ω to 11 kΩ	± 5 %, ± 10 %	400 V
ZWS 15 Ni	15 W	0.39 Ω to 2.2 kΩ	0.82 Ω to 6.2 kΩ	± 10 %	300 V
		1.0 Ω to 2.2 kΩ	2.0 Ω to 6.2 kΩ	± 5 %	

For technical questions, contact: ww1resistors@vishay.com

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TECHNICAL SPECIFICATION

TYPE / VARIANT	RATED DISSIPATION P_{40}	RESISTANCE RANGE (1) TCR -10 ppm/K to -80 ppm/K WM50	RESISTANCE RANGE (1) TCR +100 ppm/K to +180 ppm/K WM110	RESISTANCE TOLERANCE	OPERATING VOLTAGE (2) $U_{max.}$
ZWS 20	20 W	0.62 Ω to 16 kΩ	1.3 Ω to 43 kΩ	± 5 %, ± 10 %	900 V
		2.7 Ω to 16 kΩ	-	± 2 %	550 V
ZWS 20 E	20 W	0.62 Ω to 430 Ω	1.3 Ω to 15 kΩ	± 5 %, ± 10 %	500 V
ZWS 20 Ni	20 W	0.47 Ω to 2.7 kΩ	1.1 Ω to 8.2 kΩ	±10 %	400 V
		1.0 Ω to 2.7 kΩ	2.0 Ω to 8.2 kΩ	± 5 %	
ZWS 35	35 W	1.1 Ω to 30 kΩ	2.7 Ω to 82 kΩ	± 5 %, ± 10 %	1500 V
		1.3 Ω to 30 kΩ	-	± 2 %	1000 V
ZWS 35 E	35 W	1.1 Ω to 750 Ω	2.7 Ω to 27 kΩ	± 5 %, ± 10 %	950 V
ZWS 35 Ni	35 W	0.91 Ω to 5.1 kΩ	2.0 Ω to 15 kΩ	± 5 %, ± 10 %	700 V
ZWS 50	50 W	1.3 Ω to 33 kΩ	3.0 Ω to 91 kΩ	± 5 %, ± 10 %	2100 V
		2.2 Ω to 33 kΩ	-	± 2 %	1250 V
ZWS 50 E	50 W	1.3 Ω to 910 Ω	3.0 Ω to 33 kΩ	± 5 %, ± 10 %	1250 V
ZWS 50 Ni	50 W	1.1 Ω to 6.2 kΩ	2.4 Ω to 16 kΩ	± 5 %, ± 10 %	850 V
ZWS 100	100 W	2.7 Ω to 68 kΩ	6.2 Ω to 200 kΩ	± 5 %, ± 10 %	4450 V
			-	± 2 %	2600 V
ZWS 100 E	100 W	2.7 Ω to 1.8 kΩ	6.2 Ω to 68 kΩ	± 5 %, ± 10 %	2600 V
ZWS 100 Ni	100 W	2.2 Ω to 13 kΩ	4.7 Ω to 33 kΩ	± 5 %, ± 10 %	1800 V
ZWS 150	150 W	4.7 Ω to 130 kΩ	11.0 Ω to 360 kΩ	± 5 %, ± 10 %	7300 V
			-	± 2 %	4400 V
ZWS 150 E	150 W	4.7 Ω to 3.3 kΩ	11.0 Ω to 120 kΩ	± 5 %, ± 10 %	4200 V
ZWS 150 Ni	150 W	3.9 Ω to 22 kΩ	9.1 Ω to 62 kΩ	± 5 %, ± 10 %	3000 V
ZWS 250	250 W	8.2 Ω to 220 kΩ	20.0 Ω to 620 kΩ	± 5 %, ± 10 %	12400 V
			-	± 2 %	7400 V
ZWS 250 E	250 W	8.2 Ω to 6.2 kΩ	20.0 Ω to 220 kΩ	± 5 %, ± 10 %	7400 V
ZWS 250 Ni	250 W	6.8 Ω to 39 kΩ	15.0 Ω to 110 kΩ	± 5 %, ± 10 %	5200 V
ZWS 30/100	75 W	2.4 Ω to 62 kΩ	5.1 Ω to 180 kΩ	± 5 %, ± 10 %	3650 V
		3.0 Ω to 62 kΩ	-	± 2 %	2150 V
ZWS 30/100 E	75 W	2.4 Ω to 1.6 kΩ	5.1 Ω to 56 kΩ	± 5 %, ± 10 %	2000 V
ZWS 30/100 Ni	75 W	2.0 Ω to 11 kΩ	4.3 Ω to 30 kΩ	± 5 %, ± 10 %	1500 V
ZWS 30/133	110 W	3.3 Ω to 91 kΩ	7.5 Ω to 240 kΩ	± 5 %, ± 10 %	5100 V
			-	± 2 %	3150 V
ZWS 30/133 E	110 W	3.3 Ω to 2.4 kΩ	7.5 Ω to 82 kΩ	± 5 %, ± 10 %	3000 V
ZWS 30/133 Ni	110 W	2.7 Ω to 16 kΩ	6.2 Ω to 43 kΩ	± 5 %, ± 10 %	2150 V

Notes

- The operating temperature range for these resistors is from -55 °C up to 250 °C.

(1) Resistance values are to be selected for ± 10 % from the E12 series, and for ± 5 % and ± 2 % from the E24 series.

(2) Depending on the resistance value, limited by $\sqrt{P \times R}$

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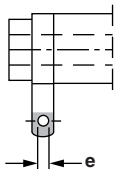
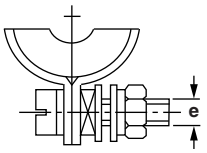
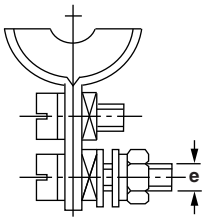
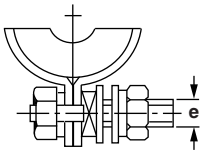
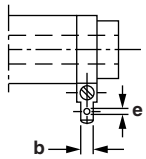
TERMINALS

	SL	SS	SB	SSB	FST
					
TYPE / VARIANT	Lug for soldering	Screw terminal	Terminal with 2 screws, one for electrical, and one for mechanical connection	Terminal with bolt and 2 hexnuts	Fast on terminal with 6.3 mm x 0.8 mm DIN 46244
ZWS 6 **ZWS 6 E** **ZWS 6 Ni**	e = 1.5 mm	-	-	-	-
ZWS 8 **ZWS 8 E** **ZWS 8 Ni**	e = 2.0 mm	e = M3 x 16			
ZWS 12 **ZWS 12 E** **ZWS 12 Ni**					
ZWS 15 **ZWS 15 E** **ZWS 15 Ni**					
ZWS 20 **ZWS 20 E** **ZWS 20 Ni**			e = M3 x 16		e = 1.65 mm b = 6.3 mm
ZWS 35 **ZWS 35 E** **ZWS 35 Ni**					
ZWS 50 **ZWS 50 E** **ZWS 50 Ni**	-	e = M4 x 20	e = M4 x 20	e = M4 x 20	
ZWS 100 **ZWS 100 E** **ZWS 100 Ni**					
ZWS 150 **ZWS 150 E** **ZWS 150 Ni**					
ZWS 250 **ZWS 250 E** **ZWS 250 Ni**					
ZWS 30/100 **ZWS 30/100 E** **ZWS 30/100 Ni**					
ZWS 30/133 **ZWS 30/133 E** **ZWS 30/133 Ni**					

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PACKAGING

TYPE	PACKAGING CODE	QUANTITY	FORMAT	DIMENSION OF PACKAGE
All	LX	Variable	Bulk, separately packed with paper	Box size selection according to quantity and product size

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: ZWS006331001KLX000

Z	W	S	0	0	6	3	3	1	0	0	1	K	L	X	0	0	0

TYPE	VARIANT / TERMINAL	TCR / MATERIAL	RESISTANCE	TOLERANCE	PACKAGING	SPECIAL
ZWS006 = ZWS 6 **ZWS008** = ZWS 8 **ZWS012** = ZWS 12 **ZWS015** = ZWS 15 **ZWS020** = ZWS 20 **ZWS035** = ZWS 35 **ZWS050** = ZWS 50 **ZWS100** = ZWS 100 **ZWS150** = ZWS 150 **ZWS250** = ZWS 250 **ZWSN84** = ZWS 30/100 **ZWSN91** = ZWS 30/133	**3** = SL **4** = SS **5** = SB **6** = SSB **7** = FST **8** = E SL **9** = E SS **A** = E SB **B** = E SSB **C** = E FST	**1** = WM50 -10 ppm/K to -80 ppm/K **3** = WM110 +100 ppm/K to +180 ppm/K	**3 digit value** **1 digit multiplier** MULTIPLIER **7** = $*10^{-3}$ **8** = $*10^{-2}$ **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$ **3** = $*10^{3}$	**G** = ± 2 % **J** = ± 5 % **K** = ± 10 %	**LX** = loose pack without quantity	**000** = standard **3 digit code** = customized version Ni version (1)

Product Description: ZWS 6 SL 3 1K0 10 %

ZWS6	SL	3	1K0	10 %
TYPE	VARIANT / TERMINAL	TCR / MATERIAL	RESISTANCE	TOLERANCE
ZWS6 **ZWS8** **ZWS12** **ZWS15** **ZWS20** **ZWS35** **ZWS50** **ZWS100** **ZWS150** **ZWS250** **ZWS30/100** **ZWS30/133**	**SL** **SS** **SB** **SSB** **FST** **E SL** **E SS** **E SB** **E SSB** **E FST**	**1** = WM50 **3** = WM110	**R15** = 0.15 Ω **620K** = 620 kΩ	± **2 %** ± **5 %** ± **10 %**

Notes

- The products can be ordered using either the PRODUCT DESCRIPTION or the PART NUMBER.

(1) For special windings or the non-inductive (ZWS Ni) versions, please contact: ww1resistors@vishay.com.

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DESCRIPTION

The rugged design of cemented wirewound resistors enable them to withstand extreme high pulses and makes them well suited for use in high power / high current applications. Production is strictly controlled and follows an extensive set of instructions established for reproducibility. The winding is done with specific materials on a specially developed fine ceramic body (Al_2O_3). With different diameters and turn spacings, a large ohmic value range can be offered. The ceramic used meets the highest requirements against mechanical resistance, thermal shock shocks, dielectric strength, and insulation resistance at high temperatures. The cement coating is fired layer by layer several times at high temperatures. The resulting cement coating is resistant to the cleaning solvents specified in IEC 60115-1 (1).

The resistors are marked with type, resistance, and tolerance.

Product quality is verified by testing procedures, performed on all individual resistors.

The ZWS series meet single lot / date code packaging requirements.

MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein (2)
- The Global Automotive Declarable Substance List (GADSL) (3)
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) (4) for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see www.vishay.com/how/leadfree.

Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at www.vishay.com/doc?49037.

ASSEMBLY

The resistors are available with lug style terminals (SL style) for soldering, multiple screw terminal options (SS style, SB style, or SSB style) for mechanical and electrical fixing, or fast plug terminals (FST style) for assembly / disassembly processes. The terminals of the resistors are completely lead (Pb)-free. The special tin plating used provides compatibility with lead (Pb)-free and lead-containing soldering processes.

3D-Models are available on request, please inquire at ww1resistors@vishay.com.

Different mounting accessories are available, see the datasheet: www.vishay.com/doc?21015.

The slider of the adjustable type should be only moved after removal of voltage and sufficient loosening of the screw.

APPLICATION INFORMATION

The power dissipation of the resistor generates a temperature rise with respect to the ambient. The permissible dissipation is derated for temperatures above 40°C, as shown in the derating diagram, in order to avoid overheating of the resistor. The heat dissipated from the resistor may affect adjacent components, hence proper clearance will be required in order to avoid overheating.

All materials used are non-flammable and inorganic according to UL 94-V0.

These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

RELATED PRODUCTS

In higher continuous power applications and more demanding environmental conditions the vitreous coated alternative, like the GWS series might be suitable, see the datasheet:

“Vitreous Wirewound Resistors with Lugs”
www.vishay.com/doc?21003

For low ohmic values and rated dissipation up to 500 W, there is the cemented coated ZBS series, see the datasheet:

“Cemented Wirewound Resistors with Corrugated Ribbon”
www.vishay.com/doc?21011

Notes

(1) Other cleaning solvents with aggressive chemicals should be evaluated in actual cleaning process for their suitability.
(2) The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at http://std.iec.ch/iec62474.
(3) The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council, and available at www.gadsl.org.
(4) The SVHC list is maintained by the European Chemical Agency (ECHA) and available at http://echa.europa.eu/candidate-list-table.

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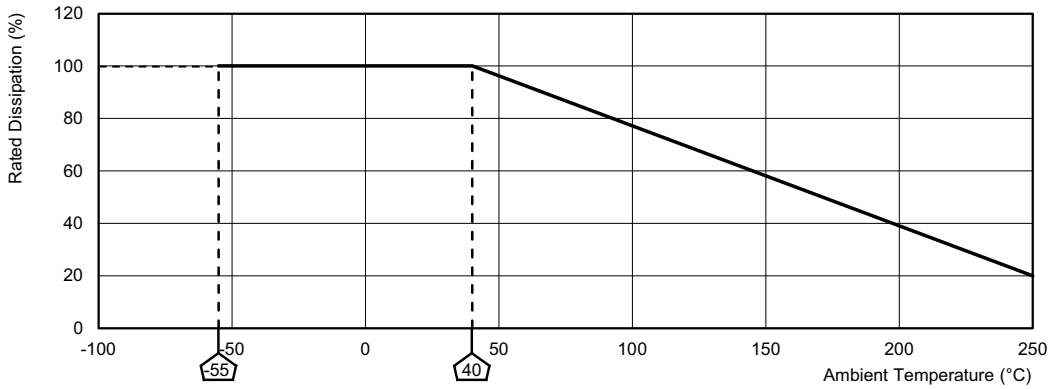
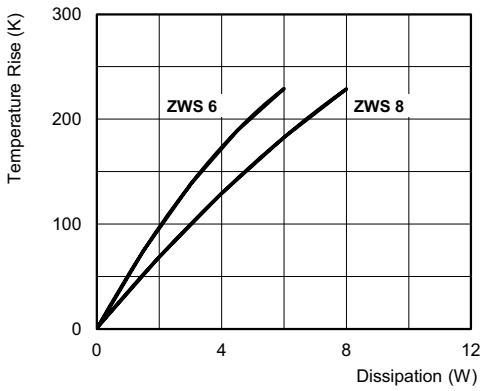
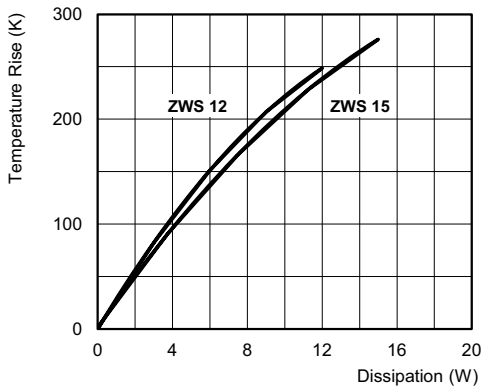
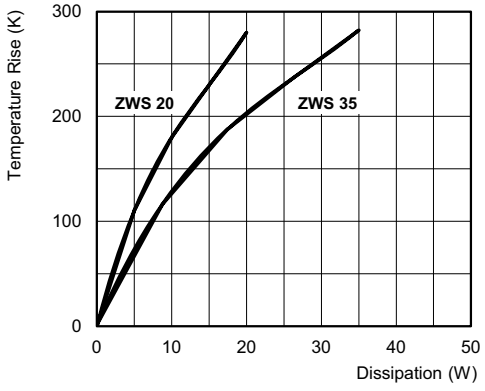
DERATING

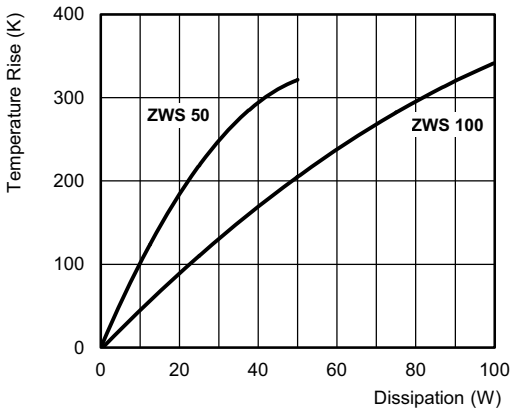


TEMPERATURE RISE









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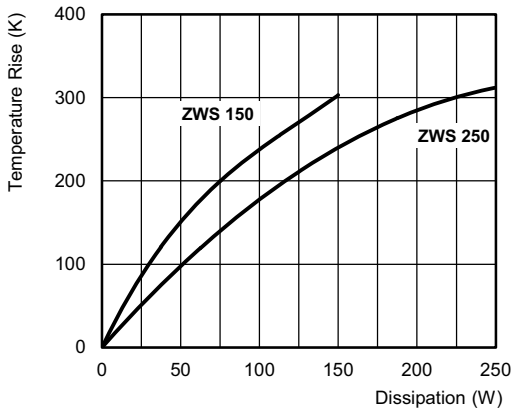
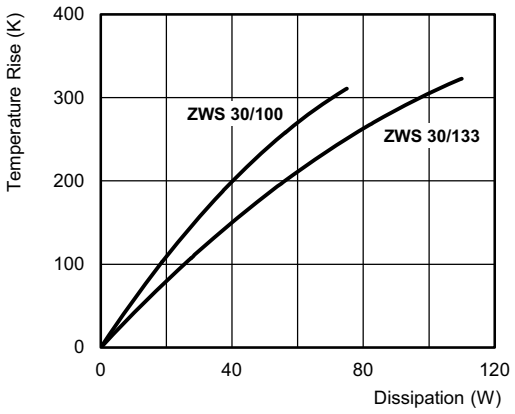
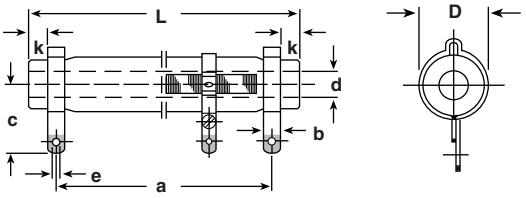
TEMPERATURE RISE





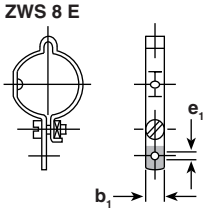
DIMENSIONS AND MASS for ZWS 6, ZWS 8, ZWS 12, and ZWS 15

PRODUCTS WITH SL TERMINALS

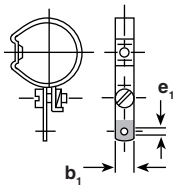


ADJUSTABLE LUGS

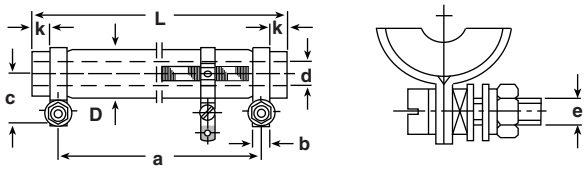
ZWS 6 E
ZWS 8 E



ZWS 12 E
ZWS 15 E

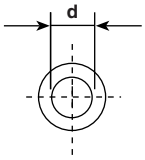


PRODUCTS WITH SS TERMINALS



CORE SECTION

ZWS 6 ... ZWS15



TYPE / VARIANT	TERMINAL	D (mm)	L (mm)	a (mm)	b (mm)	b_1 (mm)	c (mm)	d (mm)	e (mm)	e_1 (mm)	k (mm)	MASS (g)
ZWS 6 ZWS 6 E ZWS 6 Ni	SL	7.5 ± 0.5	45.0 ± 1.5	36.0 ± 2.0	4.0	4.0	15.5	2.6	1.5	2.8	2.5	5.0
ZWS 8 ZWS 8 E ZWS 8 Ni	SL	9.5 ± 0.5	50.0 ± 1.5	39.0 ± 2.0	4.0	4.0	18.0	3.5	2.0	2.8	3.5	6.5
	SS			40.0 ± 2.0	5.0	4.0	10.5	3.5	M3 x 12	2.8	2.5	
ZWS 12 ZWS 12 E ZWS 12 Ni	SL	11.8 ± 0.8	55.0 ± 1.5	43.0 ± 2.0	4.0	5.0	19.0	5.5	2.0	2.8	4.0	11.5
	SS			44.0 ± 2.0	5.0	5.0	11.5	5.5	M3 x 12	2.8	3.0	
ZWS 15 ZWS 15 E ZWS 15 Ni	SL	11.8 ± 0.8	62.0 ± 2.0	50.0 ± 2.0	4.0	5.0	19.0	5.5	2.0	2.8	4.0	12.5
	SS			51.0 ± 2.0	5.0	5.0	11.5	5.5	M3 x 12	2.8	3.0	

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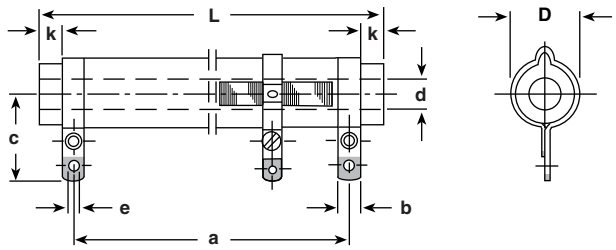
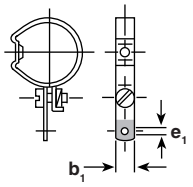
DIMENSIONS AND MASS for ZWS 20, ZWS 35, and ZWS 50

PRODUCTS WITH SL TERMINALS

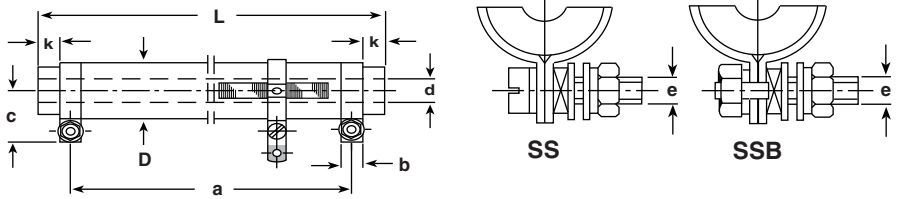


ADJUSTABLE LUGS

ZWS 20 E ... ZWS 50 E

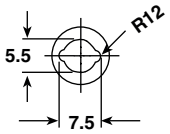


PRODUCTS WITH SS AND SSB TERMINALS

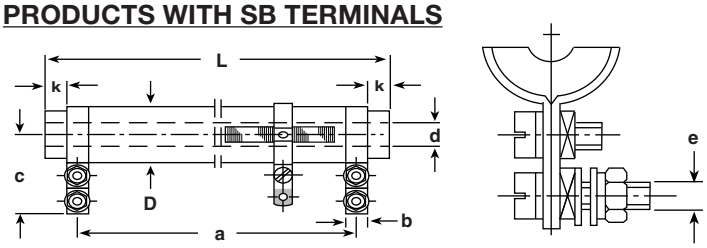


CORE SECTION

ZWS 20 ... ZWS 35

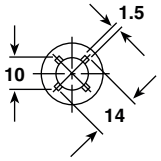


PRODUCTS WITH SB TERMINALS

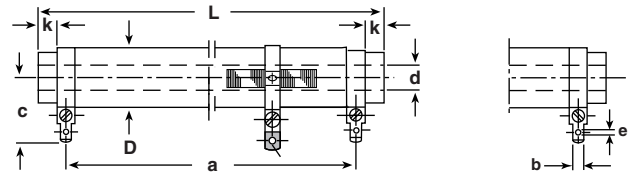


CORE SECTION

ZWS 50



PRODUCTS WITH FST TERMINALS



TYPE / VARIANT	TERMINAL	D (mm)	L (mm)	a (mm)	b (mm)	b_1 (mm)	c (mm)	d (mm)	e (mm)	e_1 (mm)	k (mm)	MASS (g)
ZWS 20 ZWS 20 E ZWS 20 Ni	SL	14.8 ± 0.8	62.0 ± 2.0	50.0 ± 2.0	4.0	5.0	20.5	5.5	2.0	3.2	4.0	25.0
	SS			51.0 ± 2.0	5.0	5.0	13.0	5.5	M3 x 12	3.2	3.0	
	SB			51.0 ± 2.0	5.0	5.0	23.0	5.5	M3 x 12	3.2	3.0	
	FST			48.0 ± 2.0	6.3	5.0	23.5	5.5	1.65	3.2	3.0	
ZWS 35 ZWS 35 E ZWS 35 Ni	SL	14.8 ± 0.8	100.0 ± 2.0	86.0 ± 2.0	4.0	5.0	20.5	5.5	2.0	3.2	5.0	33.0
	SS			87.0 ± 2.0	5.0	5.0	13.0	5.5	M3 x 12	3.2	4.0	
	SB			87.0 ± 2.0	5.0	5.0	23.0	5.5	M3 x 12	3.2	4.0	
	FST			84.0 ± 2.0	6.3	5.0	23.5	5.5	1.65	3.2	4.0	
ZWS 50 ZWS 50 E ZWS 50 Ni	SS	22.3 ± 1.3	100.0 ± 2.0	72.0 ± 2.0	8.0	5.0	18.5	10.0	M4 x 16	3.2	10.0	80.0
	SSB			72.0 ± 2.0	8.0	5.0	18.5	10.0	M4 x 16	3.2	10.0	
	SB			72.0 ± 2.0	8.0	5.0	29.5	10.0	M4 x 16	3.2	10.0	
	FST			72.0 ± 2.0	6.3	5.0	27.0	10.0	1.65	3.2	10.0	

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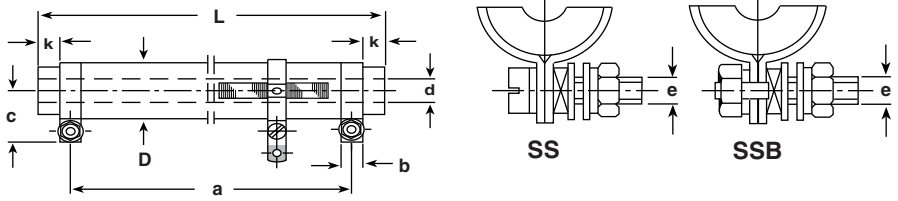
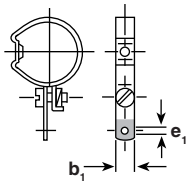
DIMENSIONS AND MASS for ZWS 100, ZWS 150, and ZWS 250

PRODUCTS WITH SS AND SSB TERMINALS

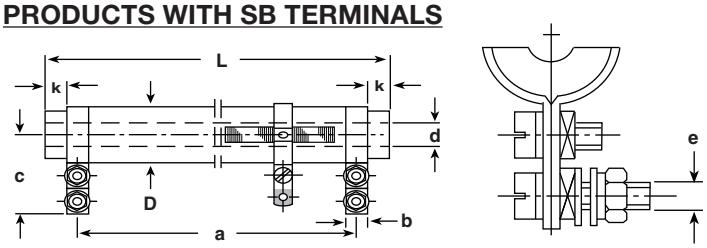


ADJUSTABLE LUGS

ZWS 100 E...ZWS 250 E

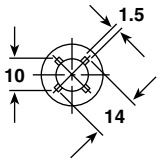


PRODUCTS WITH SB TERMINALS

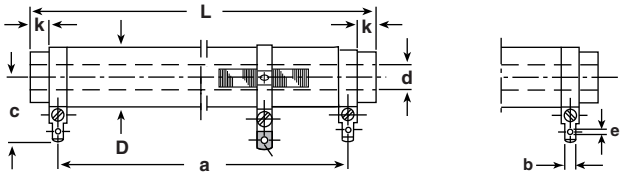


CORE SECTION

ZWS 100 ... ZWS 150

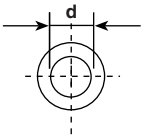


PRODUCTS WITH FST TERMINALS



CORE SECTION

ZWS 250



TYPE / VARIANT	TERMINAL	D (mm)	L (mm)	a (mm)	b (mm)	b_1 (mm)	c (mm)	d (mm)	e (mm)	e_1 (mm)	k (mm)	MASS (g)
ZWS 100 ZWS 100 E ZWS 100 Ni	SS	22.3 ± 1.3	165.0 ± 2.0	136.0 ± 2.0	8.0	5.0	18.5	10.0	M4 x 16	3.2	10.5	113.0
	SSB				8.0	5.0	18.5	10.0	M4 x 18	3.2	10.5	
	SB				8.0	5.0	29.5	10.0	M4 x 16	3.2	10.5	
	FST				6.3	5.0	27.0	10.0	1.65	3.2	10.5	
ZWS 150 ZWS 150 E ZWS 150 Ni	SS	22.3 ± 1.3	265.0 ± 4.0	235.0 ± 2.0	8.0	5.0	18.5	10.0	M4 x 16	3.2	10.5	194.0
	SSB				8.0	5.0	18.5	10.0	M4 x 18	3.2	10.5	
	SB				8.0	5.0	29.5	10.0	M4 x 16	3.2	10.5	
	FST				6.3	5.0	27.0	10.0	1.65	3.2	10.5	
ZWS 250 ZWS 250 E ZWS 250 Ni	SS	32.5 ± 1.5	330.0 ± 5.0	280.0 ± 2.0	8.0	8.0	23.5	20.0	M4 x 16	4.2	21.0	375.0
	SSB				8.0	8.0	23.5	20.0	M4 x 18	4.2	21.0	
	SB				8.0	8.0	35.0	20.0	M4 x 16	4.2	21.0	
	FST				6.3	8.0	31.5	20.0	1.65	4.2	21.0	

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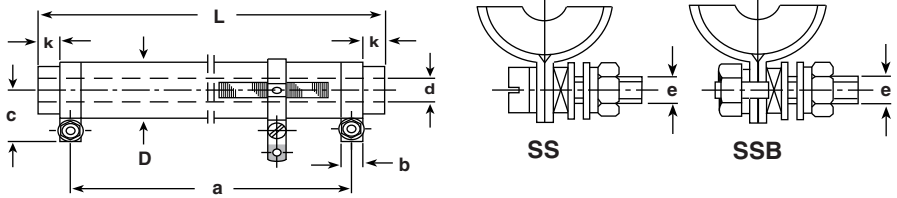
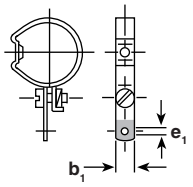
DIMENSIONS AND MASS for ZWS 30/100, and ZWS 30/133

PRODUCTS WITH SS AND SSB TERMINALS

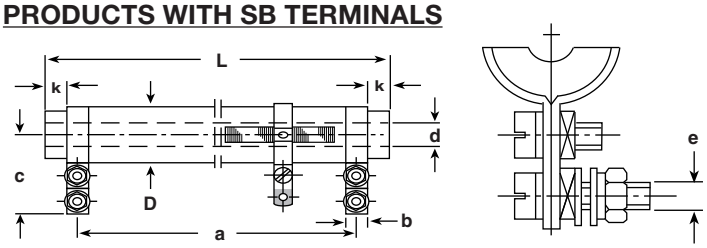


ADJUSTABLE LUGS

ZWS 30/100 E; ZWS 30/133 E

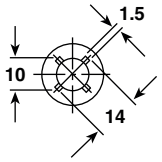


PRODUCTS WITH SB TERMINALS

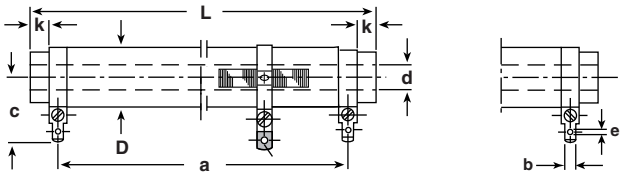


CORE SECTION

ZWS 30/100 E; ZWS 30/133 E



PRODUCTS WITH FST TERMINALS



TYPE / VARIANT	TERMINAL	D (mm)	L (mm)	a (mm)	b (mm)	b_1 (mm)	c (mm)	d (mm)	e (mm)	e_1 (mm)	k (mm)	MASS (g)
ZWS 30/100 ZWS 30/100 E ZWS 30/100 Ni	SS	32.5 ± 1.5	100.0 ± 2.5	85.0 ± 2.0	8.0	8.0	23.5	14.0	M4 x 16	4.2	3.5	167.0
	SSB				8.0	8.0	23.5		M4 x 18	4.2	3.5	
	SB				8.0	8.0	35.0		M4 x 16	4.2	3.5	
	FST				6.3	8.0	31.5		1.65	4.2	3.5	
ZWS 30/133 ZWS 30/133 E ZWS 30/133 Ni	SS	32.5 ± 1.5	133.0 ± 3.0	118.0 ± 2.0	8.0	8.0	23.5	14.0	M4 x 16	4.2	3.5	212.0
	SSB				8.0	8.0	23.5		M4 x 18	4.2	3.5	
	SB				8.0	8.0	35.0		M4 x 16	4.2	3.5	
	FST				6.3	8.0	31.5		1.65	4.2	3.5	

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