

Comparison of ICON acc. to EN 50288-7 and BS 5308

1. Legal situation

2. Technical comparison

1. Legal situation

EN 50288-7 A European standard for instrument cables replacing BS 5308

“The international market for instrumentation cables is largely characterised by an immense number of different products – with a further rising tendency.....”

“In this way the ‘instrumentation cables’ are invented again and again with all corresponding consequences of loss of economic viability, clearness, rapidity, in summary of loss of efficiency in handling. The few existing national standards for instrumentation cables (eg, UK, France) are not suited as specification basis for the international scene. Tailor-made to its national market demands, they cover only a small fraction of the constructional and performance requirements of the international market.

The new European Standard EN 50288-7 for instrumentation cables, erected by the European Standardisation Organisation CENELEC and published in September 2005, is suited to solve this problem. It describes: "Single and multi-element cables with copper conductors ... They may be individually and/or overall screened and optionally may incorporate armouring and/or moisture or environmental protection layers."

The constructional design options cover more or less the complete range of products worldwide completed by well-coordinated material and test standards.

Thus, a conclusive, quality-assured standardised work, closed unit is now available.

The structure of this standard is comparable to IEC 60502-1, the standard for low voltage power cables. It does not contain finished products, but it specifies the single cable elements with its permitted constructional variants as well as the respective characteristic demands."

The application of this standard offers many chances to users, engineers and consultants such as manufacturers. Key improvements are:

- cost reduction
- clarity
- conclusiveness....

The standard will become national standard in all CENELEC member countries. Further, all present national standards conflicting with it (like BS 5308, etc) will have to be withdrawn by 31.03.2008 at the latest.

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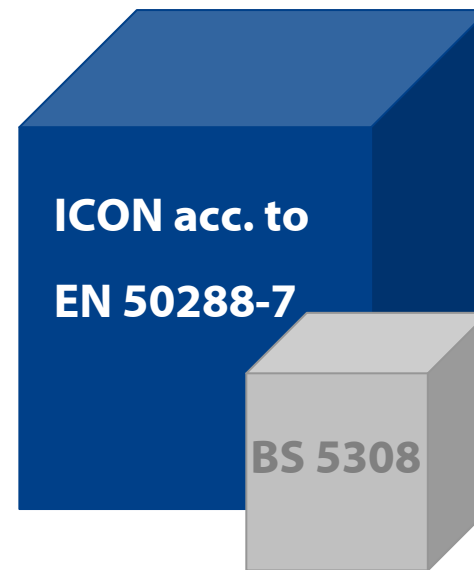
BS EN 50288-7:2005
Sectional specification for
instrumentation and control cables
no current standard is superseded
ISBN 0 580 47283 3

Will on 1st of April 2008 change to:

BS EN 50288-7:2005
Sectional specification for
instrumentation and control cables
supersedes BS 5308 : Part 1 : 1986
supersedes BS 5308 : Part 2 : 1986
ISBN 0 580 47283 3

2. Technical comparison

The ICON construction is very close to BS but offers more possibilities.

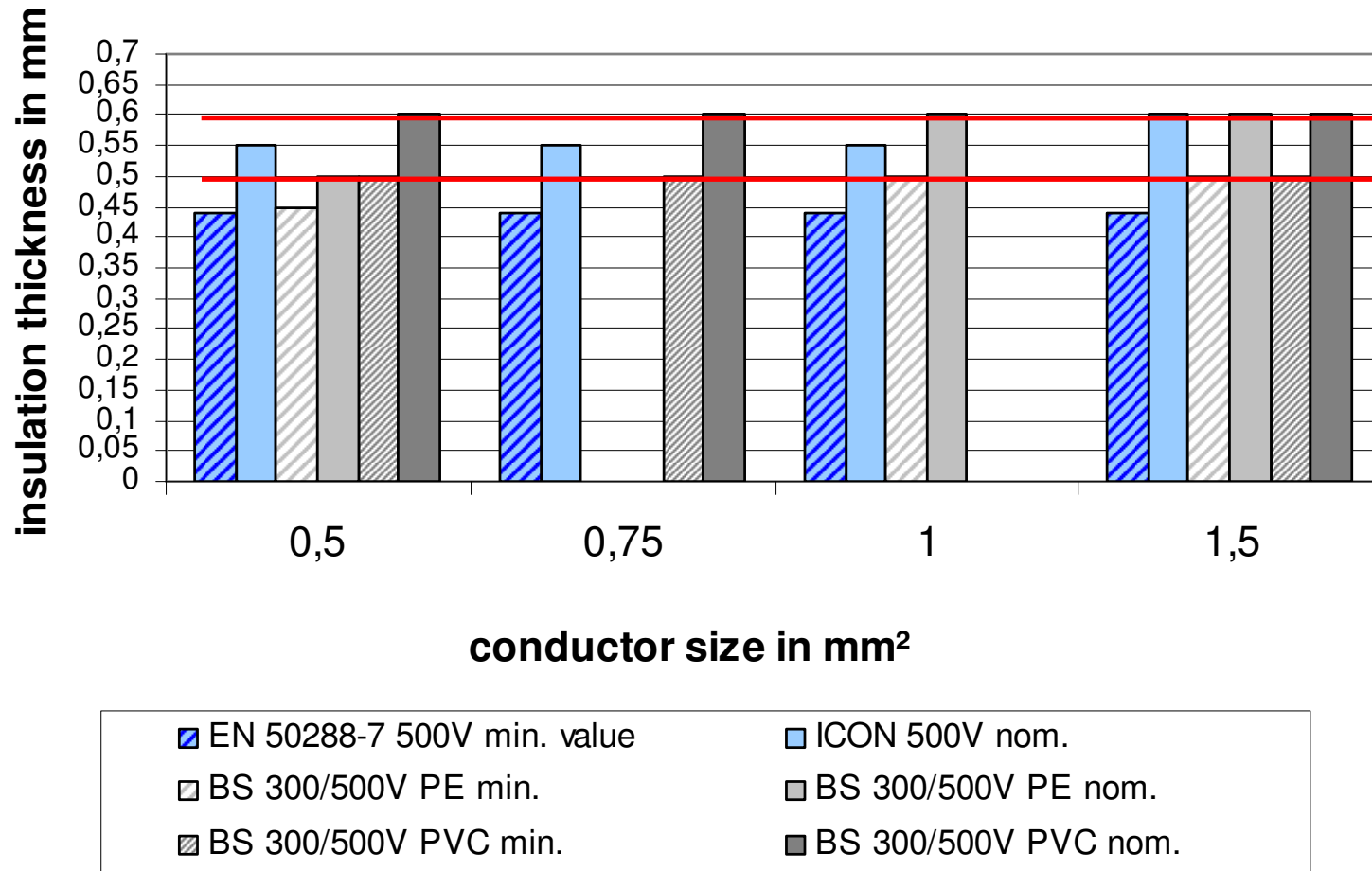


conductor:

	ICON acc. to EN 50288-7	BS 5308
kind of conductor	solid stranded multistranded (HD383=IEC 60288 (cl. 1, 2, 5))	solid stranded multistranded (BS 6360)
copper	plain annealed or metal coated	plain annealed
dimension	0.5; 0.75; 1.0; 1.3; 2.0; 2.5; (4.0) mm ²	0.5; 0.75; 1.0; 1.5 mm ²
resistance	comparable with each other	

Insulation:

	ICON acc. to EN 50288-7	BS 5308
materials	PVC PE XLPE acc. to EN 50290-2 (21-29) temp. range from 70°C up to 105°C	Part 1 PE acc. to BS 6234 Part 2 PVC acc. to BS 7655 Temp. range max. 65°C
range	300V 500V	300/500 V
thickness	see next page	see next page



* For 0.5mm² PE insulation values taken for solid conductor (BS)

With the ICON range we offer much more than BS 5308




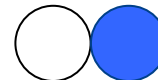
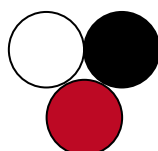
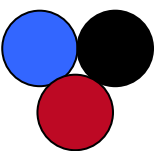
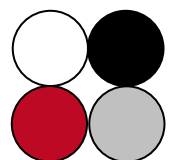
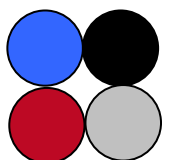
Advantage ICON

	conductor size	conductor			insulation material			sheath material		
		solid wire	stranded	multistranded	PE	PVC	XLPE	PVC	LSZH	HDPE 80°C
	0,5	✓		✓	✓	✓		✓		
	0,75			✓		✓		✓		
	1	✓			✓			✓		
	1,3									
	1,5		✓		✓	✓		✓		
	2,5									
temp. range	70°C				✓	✓		✓		
	90°C									
	105°C									
✓ marked areas show the range defined in the BS 5308 standard offered as part of ICON range (acc. to EN 50288-7)										

Cable elements:

	ICON acc. to EN 50288-7	BS 5308
kind of elements	core pair (twisted) triple (twisted) quad (twisted)	core pair (twisted) quad (around a single dummy; only for 2 pair)
twisting of elements	lay length clearly defined; depending on conductor size and element; between 100 and 150 mm	reverse layer or reciprocating lay technique $\leq 100\text{mm}$
Individual pair screens	laminated tape aluminium/PET total thickness 24 μm (metallic side down, in contact with drain wire + wrapping consisting of one layer of plastic tape under and above screen)	laminated tape aluminium/PET aluminium thickness $\geq 8 \mu\text{m}$ PET thickness $\geq 10 \mu\text{m}$ (metallic side down, in contact with drain wire + wrapping consisting of one layer tape (50% overlap) or two layers of tape ($\geq 23\mu\text{m}$) (each 25% overlap).)
drain wire	solid tinned copper drain wire 0.6mm \varnothing , under individual screen	solid or stranded, tinned annealed copper cross section $\geq 0.5\text{mm}^2$

Colour code:

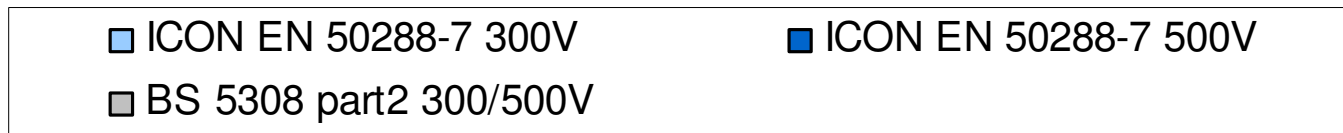
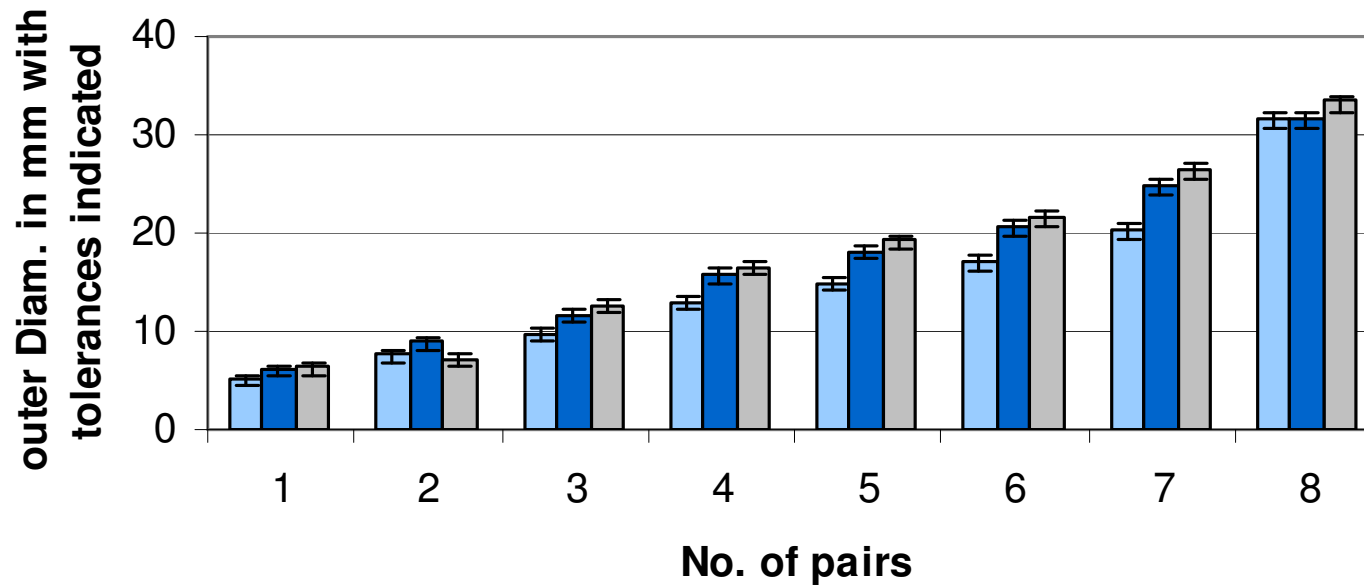
	ICON acc. to EN 50288-7		BS 5308	
	300 V	500 V	PE insulated	PVC insulated
Pairs	 (code is identical for all pairs)		 (code is different for no. pair >1)	
Triples			Not defined	
Quads			Not defined (exception: 2 pair is a 1 quad construction)	
Remark:	300 V cables are continuously numbered on white core; 500 V on blue core		differentiation of the pairs is defined through different colour codes for each pair; alternatively numbered PET foil around pairs	

Overall screen:

	ICON acc. to EN 50288-7	BS 5308
Collective screen (St)	<p>collective screen (24 µm aluminium/PET) tape + 7 stranded tinned copper drain wire (0.5mm²); overlap of foil min 20%; drain wire in direct contact with metallic side of the foil</p> <p>Wrapping layer of tape under collective screen</p>	<p>laminated tape aluminium/PET aluminium thickness ≥ 8 µm PET thickness ≥10 µm + drain wire (optional) consisting of solid or stranded, tinned annealed copper cross section ≥ 0.5mm²</p> <p>Wrapping layer of tape under collective screen</p>
Metal braid C	<p>tinned copper wires (C) wire diameter ≥ 0.3 mm filling factor ≥ 0.57 mm</p>	not defined

Dimensional comparison of outer cable diameter BS and EN

RE-Y(St)Y-fl 0,5 mm² (multistranded)



Conclusion of comparison on previous page:

- BS 5308 cables are slightly thicker (thus heavier)
- for some dimensions differences can hardly be recognized

Result:

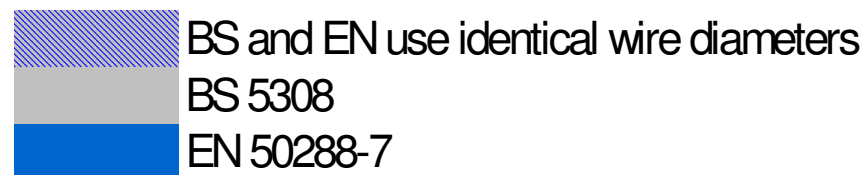
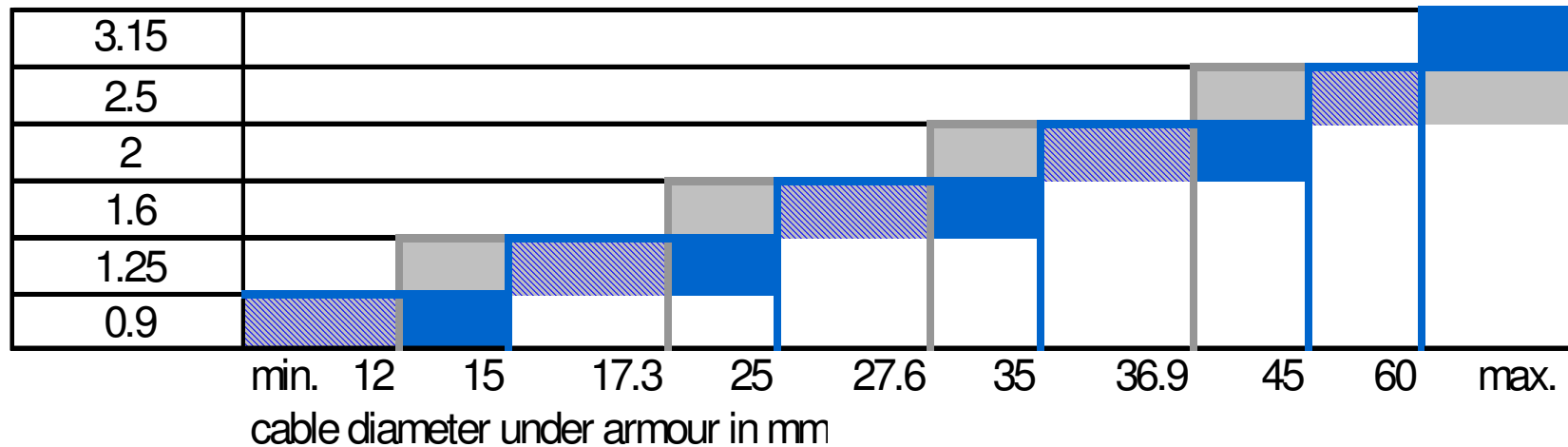
Changing from BS to EN is very easy – ask for our datasheets to check the dimensions for your specific cable

Metallic protection/armouring:

	ICON acc. to EN 50288-7	BS 5308
round steel wire SWA	SWA Min. thickness of wires 0.9 mm (see next page for details)	SWA Min. thickness of wires 0.9 mm (see next page for details)
flat steel wires with counter helix FG	F (flat galvanised steel wire); G (counter helix) Only defined for overall diameter under armour ≥ 15 mm	not defined
steel or brass tape B	min. thickness of tape; brass: 0.075 mm steel: 0.20 mm offered as double layer steel tape B	not defined
Metal braid Q	galvanised steel wires (Q) wire diameter ≥ 0.3 mm filling factor ≥ 0.57 mm	not defined

SWA steel wire dimension comparison:

steel wire diameter in mm



Bedding/inner sheath:

Consequences
for flame
propagation

	ICON acc. to EN 50288-7	BS 5308															
materials	PVC (EN 50290-2-22) Polyethylene (EN 50290-2-24) Halogen free flame retardant compound LSZH (EN 50290-2-27)	<table border="1"> <thead> <tr> <th></th> <th>Part I</th> <th>Part II</th> </tr> </thead> <tbody> <tr> <td>Insulation</td> <td>PE</td> <td>PVC</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>cables</th> <th colspan="2">Bedding material</th> </tr> </thead> <tbody> <tr> <td>Type 2</td> <td>PE</td> <td>PVC</td> </tr> <tr> <td>Type 3</td> <td>PVC</td> <td></td> </tr> </tbody> </table> Explanation: Type 2 (armoured) Type 3 (with lead sheath and armour) PE bedding (acc. to BS 6234) PVC bedding (acc. to BS 6746)		Part I	Part II	Insulation	PE	PVC	cables	Bedding material		Type 2	PE	PVC	Type 3	PVC	
	Part I	Part II															
Insulation	PE	PVC															
cables	Bedding material																
Type 2	PE	PVC															
Type 3	PVC																
used under	a metallic sheath or armour and between a lead sheath and a metallic armour	a metallic sheath or armour and between a lead sheath and a metallic armour															

Fact: inner sheath of part I cable constructions is defined **as PE only**

Cable with steel wire armour and polyethylen insulation

acc. to BS

RE-2Y (St) **2Y** SWA Yfl

No alternativ inner sheath
is allowed

acc. to EN

RE-2Y (St) Y SWA Y-fl

Material for inner sheath
can be chosen from list

Consequence:

cables with the construction **RE-2Y (St)2YSWAYfl** do not fulfill the flame propagation test on bunched cables!

Test on single cable

BS 4066-1 ✓

equals (IEC 60332-1)

Test on bunches cables

~~BS 4066-3~~

equals (IEC 60332-3)

Outer sheath:

	ICON acc. to EN 50288-7	BS 5308																		
material	<p>PVC (EN 50290-2-22)</p> <p>Polyethylene (EN 50290-2-24)</p> <p>Halogen free flame retardant compound LSZH (EN 50290-2-27)</p>	<table border="1"> <thead> <tr> <th></th> <th>Part I</th> <th>Part II</th> </tr> </thead> <tbody> <tr> <td>Insulation</td> <td>PE</td> <td>PVC</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>cables</th> <th colspan="2">sheath material</th> </tr> </thead> <tbody> <tr> <td>Type 1</td> <td>PVC</td> <td>PVC</td> </tr> <tr> <td>Type 2</td> <td>PVC</td> <td>PVC</td> </tr> <tr> <td>Type 3</td> <td>PVC</td> <td>-</td> </tr> </tbody> </table>		Part I	Part II	Insulation	PE	PVC	cables	sheath material		Type 1	PVC	PVC	Type 2	PVC	PVC	Type 3	PVC	-
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thickness	<p>Calculated acc. to formular:</p> <p>without metallic protection $S_{RT} = 0.04 \times D + 0.7$ (min. 0.8 mm)</p> <p>with metallic protection $S_{RT} = 0.028 \times D + 1.1$ (min 1.3 mm)</p> <p>D = Diameter under outer sheath</p>	<p>Defined in a table, values between 0.8 mm and 2.9 mm as well depending on Type of cable (1-3)</p>																		

Advantage ICON

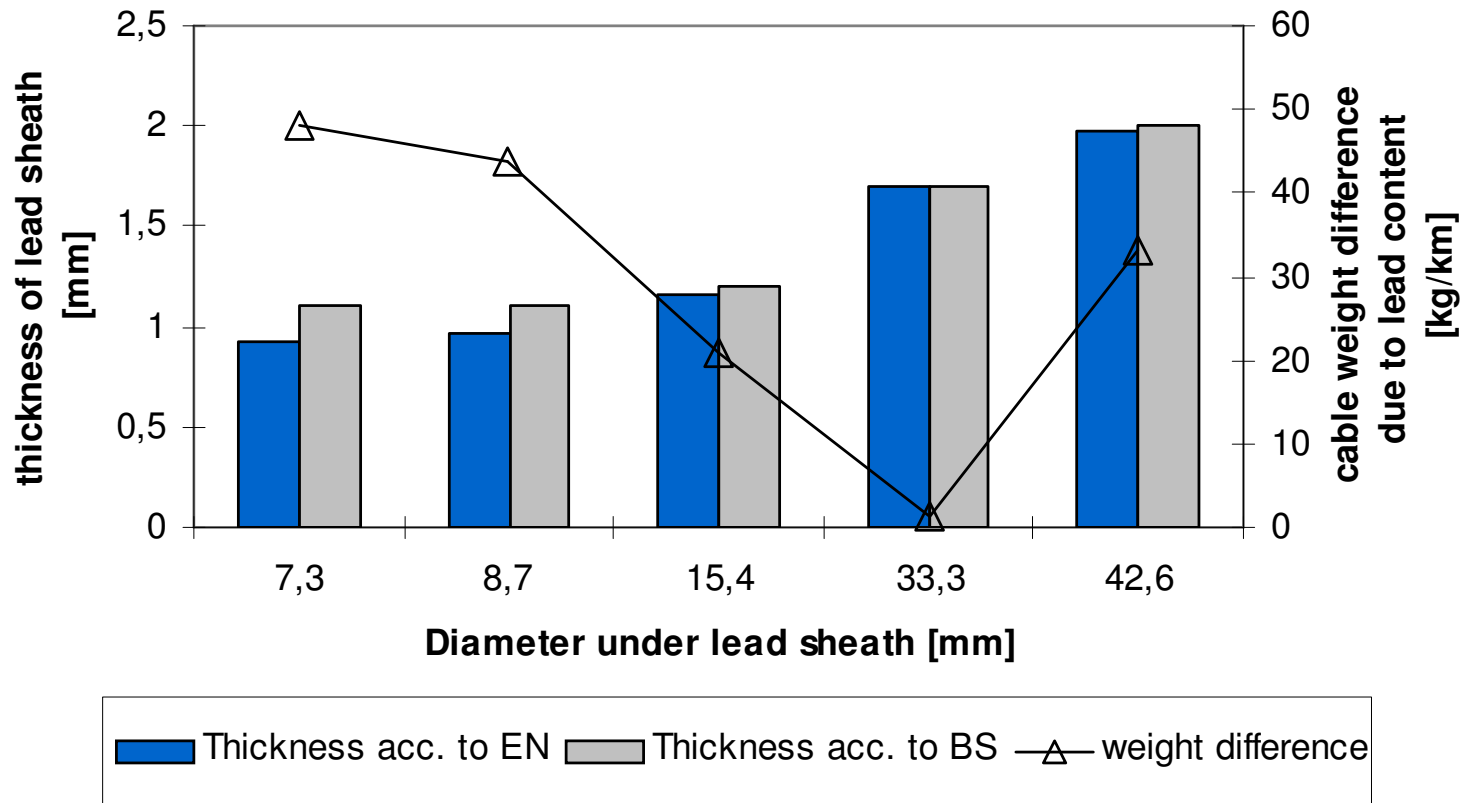
Environmental and other protection:

	EN 50288-7	BS 5308
Moisture barriers	1) Water swellable tape 2) Water swellable non – toxic powder 3) Filling compound 4) Laminated sheath of a longitudinally overlapped metallic foil (150µm) 5) Combination of 1) – 4)	not defined
Chemical protection Multilayer sheath (L)2Y4Y (ALNYC)	Multilayer sheath Laminated aluminium (Al) foil with an extruded layer of HDPE + layer of Polyamide (PA) Thickness of Al $\geq 15 \mu\text{m}$ Thickness of PA $\geq 0.3 \text{ mm}$ (thickness at any point)	not defined

Lead sheath:

	ICON acc. to EN 50288-7	BS 5308
<p>Chemical protection</p> <p>Lead sheath M</p>	<p>M (Lead sheath) complying with EN 50307 can be applied The thickness is calculated in acc. to the diameter (D) underneath; Formular: $L_{RT} = 0.03 \times D + 0.7\text{mm}$</p> <p>with a thickness at any point min. $\geq 0.66 \text{ mm}$</p>	<p>Part 1 cables (PE insulation) may include a lead sheath; (Thickness of the sheath is given in a table)</p>

Advantage in weight



The lead sheath calculated by the method of EN standard is rather thinner than the lead sheath acc. to BS (thicknesses given are nom. values)

Electrical requirements for cable with PE insulation:

	ICON acc. to EN 50288-7	BS 5308 Part 1
Insulation resistance	<p>acc. to EN 50288-7 1 G Ohm is required; ICON products are better than the standard</p> <p>Insulation resistance: ≥ 5 G Ohm conditions: 1 km length; 20°C</p>	<p>500 V d.c. applied for 1 min <u>measured:</u> insulation resistance measured against remaining conductors/ screens/ lead/armour</p> <p>result: ≥ 5 G Ohm conditions: 1 km cable length; 20°C</p>

valid for 500V as well as 300V

Electrical requirements for cable with PVC insulation :

	ICON acc. to EN 50288-7	BS 5308 Part 2
Insulation resistance	<p>acc. to EN 50288-7 10 M Ohm are required; ICON products are better than the standard</p> <p>Insulation resistance: ≥ 100 MOhm conditions: 1 km length; 20°C</p>	<p>500 V d.c. applied for 1 min <u>measured:</u> insulation resistance measured against remaining conductors/ screens/armour</p> <p>result: ≥ 25 MOhm conditions: 1 km cable length; 20°C</p>

valid for 500V as well as 300V

Electrical requirements for cables:

	ICON acc. to EN 50288-7	BS 5308																														
L/R ratio	<table border="1"> <thead> <tr> <th>conductor</th> <th>300V and 500V</th> </tr> </thead> <tbody> <tr> <td>0.5 mm²</td> <td>25 μH/OHM</td> </tr> <tr> <td>0.75 mm²</td> <td>25 μH/OHM</td> </tr> <tr> <td>1.0 mm²</td> <td>25 μH/OHM</td> </tr> <tr> <td>1.3 mm²</td> <td>40 μH/OHM</td> </tr> <tr> <td>1.5 mm²</td> <td>40 μH/OHM</td> </tr> </tbody> </table>	conductor	300V and 500V	0.5 mm ²	25 μH/OHM	0.75 mm ²	25 μH/OHM	1.0 mm ²	25 μH/OHM	1.3 mm ²	40 μH/OHM	1.5 mm ²	40 μH/OHM	<table border="1"> <thead> <tr> <th>conductor</th> <th>Part 1; Part 2</th> </tr> </thead> <tbody> <tr> <td>0.5 mm²</td> <td>25 μH/OHM</td> </tr> <tr> <td>0.75 mm²</td> <td>25 μH/OHM</td> </tr> <tr> <td>1.0 mm²</td> <td></td> </tr> <tr> <td>1.3 mm²</td> <td></td> </tr> <tr> <td>1.5 mm²</td> <td>40 μH/OHM</td> </tr> </tbody> </table>	conductor	Part 1; Part 2	0.5 mm ²	25 μH/OHM	0.75 mm ²	25 μH/OHM	1.0 mm ²		1.3 mm ²		1.5 mm ²	40 μH/OHM						
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Mutual capacitance	<p>Values for Leoni Kerpen cables of the ICON family are below – and thus better – than the ones according to BS standard</p> <p>The differences are compared to</p> <p>Part 1: Δ 10-15 pF/m</p> <p>Part 2: Δ 50-130 pF/m</p>	<table border="1"> <thead> <tr> <th rowspan="2">Part 1 conductor</th> <th colspan="2">screens</th> <th rowspan="2"></th> </tr> <tr> <th>without or with collective</th> <th>as ind. pair</th> </tr> </thead> <tbody> <tr> <td>0.5 mm²</td> <td>75</td> <td>115</td> <td>pF/m</td> </tr> <tr> <td>1.0 mm²</td> <td>75</td> <td>115</td> <td>pF/m</td> </tr> <tr> <td>1.5 mm²</td> <td>85</td> <td>115</td> <td>pF/m</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Part 2 conductor</th> <th>independant of constr.</th> <th></th> </tr> </thead> <tbody> <tr> <td>0.5 mm²</td> <td>250</td> <td>pF/m</td> </tr> <tr> <td>1.0 mm²</td> <td>250</td> <td>pF/m</td> </tr> <tr> <td>1.5 mm²</td> <td>250</td> <td>pF/m</td> </tr> </tbody> </table>	Part 1 conductor	screens			without or with collective	as ind. pair	0.5 mm ²	75	115	pF/m	1.0 mm ²	75	115	pF/m	1.5 mm ²	85	115	pF/m	Part 2 conductor	independant of constr.		0.5 mm ²	250	pF/m	1.0 mm ²	250	pF/m	1.5 mm ²	250	pF/m
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Electrical requirements for cables:

	ICON acc. to EN 50288-7	BS 5308																		
Test voltage	<table border="1"> <thead> <tr> <th>cable rating</th> <th>EN</th> <th>ICON</th> <th></th> </tr> </thead> <tbody> <tr> <td>300V</td> <td>≥ 1.0 kV</td> <td>1.5 kV</td> <td>Testvoltage AC</td> </tr> <tr> <td>500V</td> <td>≥ 2.0 kV</td> <td>2.0 kV</td> <td>Testvoltage AC</td> </tr> </tbody> </table> <p>Test duration 1 minute</p> <p><i>Advantage ICON</i></p>	cable rating	EN	ICON		300V	≥ 1.0 kV	1.5 kV	Testvoltage AC	500V	≥ 2.0 kV	2.0 kV	Testvoltage AC	<table border="1"> <thead> <tr> <th>cable rating</th> <th>BS</th> <th></th> </tr> </thead> <tbody> <tr> <td>300/500V</td> <td>≥ 1.0 kV</td> <td>Testvoltage AC</td> </tr> </tbody> </table> <p>Test duration 1 minute</p>	cable rating	BS		300/500V	≥ 1.0 kV	Testvoltage AC
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500V	≥ 2.0 kV	2.0 kV	Testvoltage AC																	
cable rating	BS																			
300/500V	≥ 1.0 kV	Testvoltage AC																		

- ICON test conditions are again higher than the EN 50288-7 demands
- for the 500V rated cables test are carried out at a test voltage twice as high as the demands in the BS 5308

⇒ **more security offered by ICON**

Summary:

- EN 50288-7 offers a wide range of insulation/inner sheath/sheath materials
- there are no fixed dimensional links with respect to the materials
- cables are offered for 300V and 500V as different ranges (300V is lighter and smaller)
- cables are available as core, pair, triple or quad regardless the dimension or insulation material

⇒ **cable constructions exactly to customers needs – no overengineering**

- EN 50288-7 offers alternative screens and armours
- a multilayer sheath ALNYC (free of lead) is offered as an alternative chem. protection

⇒ **environmental and cost effective aspects**

Summary:

- ICON instrumentation cables are in many points very close to the BS 5308 (electrical properties, dimensional factors)

- for some aspects ICON cables fulfill stronger test conditions

⇒ **better properties by changing over to ICON**

- ICON standard range covers the market demands with respect to temperature requirements and additional protection (impact forces, environmental, chemical, rodent, fire performance behaviour)

- we offer a growing range of stock items ICON instrumentation cable

⇒ **opportunity to use standard products and save time and money**

- product alterations are possible (e.g. colour code for cores or sheath, cable marking)

- documentation of routine tests or equivalent reports are available

⇒ **flexibility to fulfill your individual demands**

Summary:

- the decision for ICON instrumentation cable is a decision for the future
 - planning with EN standard products today will guarantee the availability for maintenance and expansion for this century
 - as Leoni Kerpen is part of the Leoni Group (with over 34 000 employees worldwide) we are a strong and steady partner for your international business
 - with ICON instrumentation cable produced by Leoni Kerpen you have a profound partner for your measurement, control and steering equipment
- ⇒ **ICON instrumentation cable are your partner today and in the future**

Abbreviations

Y = PVC

Yw = PVC with high temperature resistance

Yö = PVC sheath with improved oil resistance

2Y = Polyethylen

2X = cross linked polyethylen insulation (XLPE)

H = low smoke zero halogen (LSZH) sheathing material

2G = insulation offering circuit integrity

(St) = overall screen

C = copper wire braid

Q = steel wire braid

SWA = steel wire armour

B = flat steel tape armour

FG = flat steel wire, counter helix

M = lead sheath

(L)2Y = multilayer sheath

(L)2Y4Y = ALNYC sheath

IMF = in metal foil e.g. PIMF = pair in metal foil (individual pair screen)