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## Type Testing for PE Pressure Pipe Compounds

5/11/2004

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Some institutes split the number of test and use others as subcontractors or leave time consuming tests to the compound producer but monitor the running tests in his laboratory.

Usually an evaluation takes around 2 years until being finalized. This is due to the time consuming hydraulic pressure tests for the evaluation of the regression lines and the MRS.

The costs for an Initial Type Test amount to approximately 70.000 €

### 8. Approvals of different countries

If once a material has been type tested, the complete set of results must be submitted to the national approval bodies. Depending on the country the application is more or less formal. The national approval body again compares compliance of the results with the requirements of the valid standards and national regulations.

There are some countries, e.g. Spain, which repeat some tests for witnessing or conduct a 2 days audit on the manufacturers premises.

Eventually the certain compound gets the approval for the use it has been applied for. Often the compound is kept in a so called "materials list" frequently accompanied by a selected code for the material.

The time span from application to the permission may take from 1 month to 6 months always depending on the regulations the certain country applies.

Once the approval has been done the converter can start to produce pipe in order to conduct pipe tests. It must be emphasized that in the majority of the European countries the converter has to conduct a particular approval with pipes of a certain material.

The extension of the tests to be conducted depends on the regulations valid in the particular country.

### 9. List of tables

Table 1:	Requirements ISO and EN standards
Table 2:	Requirements Hygienic Germany
Table 3:	Requirements Hygienic UK

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**Table 1**  
**Requirements of ISO and EN standards**

Property	Relevant Standard	Unit	Compound						
			PE 80	PE 100	ISO 4437	ISO 4427	EN 1555	EN 12201	EN 13244
MRS	ISO 12162	Mpa	8,0	10,0	X	X	X	X	X
			2 stress levels at 20 °C						
MFR 190/5	ISO 1133	%	max. range 0,2 - 1,4				X	X	X
			± 20% of nominal		X	X	X	X	X
Density (Base polymer)	ISO 1183	kg/m <sup>3</sup>	≥ 930		X	X	X	X	X
OIT 200 °C	EN 728	min	≥ 20		X	X	X	X	X
Carbon Black Content	ISO 6964	%	2,0 - 2,5		X	X	X	X	X
Carbon Black distribution	ISO 18553	note	≤ 3		X	X	X	X	X
Pigment dispersion	ISO 18553	note	≤ 3		X	X	X	X	X
Volatile content	EN 12099	mg/kg	≤ 350		X		X	X	X
Water content	EN 12118/ISO 15512	mg/kg	≤ 300		X		X	X	X
<b>Compound in the form of pipes</b>									
Organoleptic									
Oddour						no influence		national reg	
Flavour						no influence		national reg	
Ppositive list						WHO		national reg	
Full Scale Test 0 °C	ISO 13478	bar	(P <sub>c</sub> ≥ 1,5 x MOP)		(X)	X	X		
S4 Test 0 °C e ≥ 15 mm	ISO 13477	bar	P <sub>c</sub> ≥ MOP/2,4-0,72		X	X	X		
Full Scale Test 0 °C	ISO 13478	bar	(≥ 20)	(≥ 24)				(X)	(X)
S4 Test 0 °C e ≥ 15 mm	ISO 13477	bar	≥ 8	≥ 10				X	X
Notch Test - 110/125 mm SDR 11	ISO 13479								
80 °C - 8,0 bar on SDR 11	ISO 13479	h	≥ 165	----	X	X	X	X	X
80 °C - 9,2 bar on SDR 11	ISO 13479	h	----	≥ 165	X	X	X	X	X

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Requirements of ISO and EN standards  
(continue)

Property	Relevant Standard	Unit							
			PE 80	PE 100	ISO 4437	ISO 4427	EN 1555	EN 12201	EN 13244
<b>Compound in the form of pipes</b>									
Weathering 3,5 GJ/m <sup>2</sup>	EN 1056				X	X	X	X	
Elongation at break	EN 638	%	≥ 350	X	X	X	X		
OIT 200 °C	EN 728	min	≥ 20	X		X	X		
80 °C - 5,4 Mpa	EN 921	h	----	≥ 165		X	X	X	
80 °C - 5,0 Mpa	EN 921		----	----					
80 °C - 4,5 Mpa	EN 921	h	≥ 165	----	X	X	X	X	
80 °C - 4,0 Mpa	EN 921		----	----					
Resistance to Gas Condensates	EN 1555-1				X		X		
80 °C - 2 Mpa	EN 921	h		≥ 20	X		X		
<b>Compound in the form of pipes</b>									
Fusion compatibility							X		
Fusion	ISO 11414								
80 °C - 5,4 Mpa	EN 921	h	----	----					
80 °C - 4,5 Mpa	EN 921	h	----	----					
Elongation at break	EN 638	%		ductile failure			X	X	X
				ductility of joints			X	X	X
<b>Pipes</b>									
Hydrostatic Strength									
20 °C -12,4 Mpa	EN 921	h	----	≥ 100	X		X	X	X
20 °C -10,0 Mpa	EN 921	h	≥ 100	----			X	X	X
20 °C - 9,0 Mpa	EN 921	h	≥ 100	----	X				
80 °C - 5,4 Mpa	EN 921	h	----	≥ 165	X		X	X	
80 °C - 5,0 Mpa	EN 921	h	----	≥ 1000	X		X	X	X
80 °C - 4,5 Mpa	EN 921	h	≥ 165	----	X		X	X	
80 °C - 4,0 Mpa	EN 921	h	≥ 1000	----	X		X	X	X
Full Scale Test 0 °C - 500 SDR 11	ISO 13478	bar		(P <sub>c</sub> ≥ 1,5 x MOP)	(X)		(X)		
S4 Test 0 °C e ≥ 15 mm	ISO 13479	bar		P <sub>c</sub> ≥ MOP/2,4-0,72	X		X		
if e is g.t. e of compound test									

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**Table 1**  
**Requirements of ISO and EN standards**

Property	Relevant Standard	Unit	PE 80	PE 100	ISO 4437	ISO 4427	EN 1555	EN 12201	EN 13244
			<b>Pipes</b>						
<b>Pipes</b>									
Notch Test e $\geq$ 5 mm									
80 °C - 8,0 bar on SDR 11	ISO 13477	h	$\geq$ 165		----	X		X	
80 °C - 9,2 bar on SDR 11	ISO 13477	h		----	$\geq$ 165	X		X	
Cone Test e < 5 mm	ISO 13780	h	no failure within agreed time					X	
Weathering 3,5 GJ/m <sup>2</sup>	EN 1056								
Elongation at break	EN 638	%	$\geq$ 350		X	X			
OIT 200 °C	EN 728	min	$\geq$ 20		X	X			
80 °C - 5,4 Mpa	EN 921	h	----	$\geq$ 165	X	X			
80 °C - 5,0 Mpa	EN 921		----	----					
80 °C - 4,5 Mpa	EN 921	h	$\geq$ 165	----	X	X			
80 °C - 4,0 Mpa	EN 921		----	----					
<b>Pipes</b>									
Appearance	prEN 1555-2		smooth without defects				X	X	X
Colour	prEN 1555-2		no specific requirement					X	X
Shape/geometry	prEN 1555-2		within tolerance				X	X	X
Reversion circumferencial	prEN 1555-2		$\leq$ tolerance value				X	X	
Reversion longitudinal	prEN 1555-2	%	$\leq$ 3			X	X	X	
Elongation at break	EN 638	%	$\geq$ 350		X		X	X	X
OIT 200 °C	EN 728	min	$>$ 20 min			X		X	X
MFR	ISO 1133		g/10 min $\pm$ 20% of batch value			X	X	X	X
Density	ISO 1183	kg/m <sup>3</sup>	$\geq$ 930			X	X		
Marking	prEN 1555-2		details see 1555-2						
Fusion compatibility									
Normal Conditions	prEN 1555-5								
Elongation at break	EN 638	%	ductile failure					X	X
Exteme conditions	prEN 1555-5								
80 °C - 5,5 Mpa	EN 921	h	----	$\geq$ 165			X	X	X
80 °C - 4,6 Mpa	EN 921	h	$\geq$ 165	----			X	X	X
Elongation at break	EN 638	%	ductile failure					X	X

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**Table 2**  
**Requirements for Evaluation according to KTW recommendations**

Characteristic		Requirement		Extraction time
Granulate				
Odour		< 2	at 30 °C	1 x 4 h
Flavour		< 2	at 30 °C	
Material in form of pipes				
Odour		< 2	at 23 °C	3 x 72 h
Flavour		< 2	at 23 °C	3 x 72 h
TOC		< 2,5 mg/m <sup>2</sup> d	at 23 °C	3 x 72 h
Appearance			at 23 °C	3 x 72 h
Turbidity		no significant change	at 23 °C	3 x 72 h
Colouring		no significant change	at 23 °C	3 x 72 h
Foam formation		no significant change	at 23 °C	3 x 72 h

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**Table 3**  
**Requirements for Evaluation according to BS 6920**

Characteristic		Requirement	Unit	Number of extracts
Taste	Chlorine free	no odour		7
Taste	chlorinated	no odour		7
Appearance				
Colour	Chlorine free	< 5	FNU	7
Haze	Chlorine free	< 0,5	FNU	7
Growth of microorganisms				
Coliform organisms		< 10 x of population on glass		
<i>Pseudomonas aeruginosa</i>		< 10 x of population on glass		
MDOD		< 2,4	mg/L	
The extraction of substances that may be of concern for public health		no cytotoxic response		
The extraction of metals				1
Aluminium		200	µg/L	
Antimony		10	µg/L	
Arsenic		50	µg/L	
Barium		1000	µg/L	
Cadmium		5	µg/L	
Chromium		50	µg/L	
Iron		200	µg/L	
Lead		50	µg/L	
Manganese		50	µg/L	
Mercury		1	µg/L	
Nickel		50	µg/L	
Selenium		10	µg/L	
Silver		10	µg/L	

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