Polymer material testing laboratory

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EN ISO/IEC 17025
T-198

TEST REPORT *No. 2135*

1. Test subject: ***Specimens of welded jointd of the PE casing pipes; foam insulation PUR material of district heating pipes; PE pipes, PE forms***

2. Supplier: ***SIA "IZOTERMS"***

3. Address of supplier: ***Gaujas street 24, Vangaži, Incukalna distr., LV-2136***

4. Information about the test specimens:

   - the supplier takes its own responsobility about the sampling of the test specimens
   - 6 types of the test specimens of welded joint of pipes casing; 2 types of foam PUR insulation of district heating pipes; 1 type of PE test forms of the pipe`s casing; 3 types of the PE casing pipes
   - the delivery date: ***07.02.2023.***

   Test task: ***To determine the bending resistance of the test specimens of welded joints of pipe`s casings in accordance with LVS EN 448:2020; water absorption for district heating pipe of foam insulation polyurethane (PUR) materials in accordance with LVS EN 253:2020; foam (PUR) density in accordance with LVS EN 253:2020 and LVS EN ISO 845:2009, cell size of foam PUR in accordance with LVS EN 253:2020, the compressive stress at 10% relative deformation in accordance with LVS EN 253:2020; elongation at break for the PE test forms in accordance with LVS EN 253:2020; heat reversion for the PE casing pipes in accordance with LVS EN 253:2020.***

5. Testing performed: ***23.02.2023.-28.02.2023.***

6. The translation of the test report No. 2135 is prepared in english language on ***6 pages.***

7. 3 eligible copies of the translation of the test report No.2135 are prepared.

TEST RESULTS

1. Bending resistance of the test specimens of welded joints of pipe`s casing was determined in accordance with LVS EN 448:2020 p. 4.4.3.4. The test specimens before the test were conditioned for 24 hours at standard conditions (T=23±2°C; RH=50±10%). The ram speed - 50 mm/min. Testing temperature in the laboratory T_t=21,3÷24,2°C. Relative moisture content RH=47÷52%.

Bending resistance of the test specimens of welded joints of pipes casings

Identification of the test specimen	Type of the welding seam	Bending angle α°	Thickness, mm	Width, mm	Length, mm	Diameter of ram end, mm	Distance between roller axes, mm	Pipe wall, subjected to tensile load	Outer appearance after bending
A.Leg (E)	Extrusion weld	90	6,78	19,30	212	8	90	From the inside	withstands
		90	6,80	18,71	213	8	90	From the inside	withstands
		90	6,71	19,00	212	8	90	From the inside	withstands
		90	6,69	19,46	212	8	90	From the outside	withstands
		90	6,80	19,72	213	8	90	From the outside	withstands
		90	6,71	19,52	212	8	90	From the outside	withstands
A.Liet.(E)	Extrusion weld	90	6,76	18,96	213	8	90	From the inside	withstands
		90	6,84	20,03	219	8	90	From the inside	withstands
		90	6,83	19,90	219	8	90	From the inside	withstands
		90	6,85	18,72	217	8	90	From the outside	withstands
		90	6,72	19,87	213	8	90	From the outside	withstands
		90	6,64	19,88	216	8	90	From the outside	withstands
A.Ber. (E)	Extrusion weld	90	6,65	20,57	218	8	90	From the inside	withstands
		90	6,87	20,41	217	8	90	From the inside	withstands
		90	6,86	19,30	218	8	90	From the inside S	withstands
		90	6,60	20,80	213	8	90	From the outside	withstands
		90	6,72	20,77	211	8	90	From the outside	withstands
		90	6,63	20,93	214	8	90	From the outside	withstands
A.Leg (K)	Butt weld	160	4,18	14,66	216	8	80	From the inside	withstands
		160	4,16	12,74	211	8	80	From the inside	withstands
		160	3,96	12,60	212	8	80	From the inside	withstands
		160	3,88	14,52	212	8	80	From the inside	withstands
		160	3,94	13,85	212	8	80	From the inside	withstands
A.Liet.(K)	Butt weld	160	3,65	14,72	211	8	80	From the inside	withstands
		160	3,73	15,35	211	8	80	From the inside	withstands
		160	4,13	13,81	205	8	80	From the inside	withstands
		160	4,09	13,13	211	8	80	From the inside	withstands
		160	3,63	13,34	211	8	80	From the inside	withstands
A.Ber. (K)	Butt weld	160	4,04	14,21	208	8	80	From the inside	withstands
		160	3,65	13,88	201	8	80	From the inside	withstands
		160	4,06	13,22	206	8	80	From the inside	withstands
		160	3,87	12,57	216	8	80	From the inside	withstands
		160	4,17	14,17	206	8	80	From the inside	withstands

2. The water absorption of the foam insulation materials of district heating pipes with identification *Krauss Maffei VM 40* and *Krauss Maffei Rimstar RSC 40/40* was determined in accordance with LVS EN 253:2020 p. 4.4.5 un p. 5.3.5. The test specimens before the test were conditioned for 25 hours at standard conditions (T=23±2°C; RH=50±5%). Testing temperature in the laboratory T_t=22°C. Relative moisture content RH=51%.

The water absorption

Indetification of the test specimen	Initial dimensions of the test specimen			Initial volume of the specimen	Initial weight of the test soecimen	Final weight of the test specimen	Water absorption	Mean value of the water absorption	Dimensions of the test specimen after holding in water			Volume of the specimen after holding in water	Volume ratio of the test specimen before and after moisture absorption
	a_o, mm	b_0, mm	c_o mm	V_o, ml	m_o, g	m_1, g	%	%	a_1, mm	b_1, mm	C_1, mm	v_1, ml	%
Krauss Maffei VM 40	24,90	25,43	25,00	15,83	0,97922	1,45248	3.0	3,0	27,22	26,63	25,92	18,79	119
	24,86	24,73	25,43	15,64	0,99160	1,37664	2.5		25,58	26,00	25,53	16,98	109
	24,83	24,79	24,55	15,11	1,04912	1,50773	3,0		26,11	25,94	26,31	17,81	120
	24,44	24,60	25,10	15,09	0,92339	1,44805	3.5		25,17	27,03	26,56	18,07	118
	24,60	24,63	24,66	14,94	0,91148	1,35202	2,9		25,27	26,10	27,04	17,83	121
	24,75	24,55	24,45	14,86	0,90818	1,38995	3,2		27,12	26,05	25,15	17,77	120
Krauss Maffei Rimstar RSC 40/40	24,46	24,82	24,92	15,13	0,92709	1,34100	2.7	2,9	25,09	26,22	27,42	18,05	119
	25,07	24,79	25,02	15,54	0,93173	1,39271	3,0		27,04	25,63	26,68	18,49	119
	25,27	24,74	25,01	15,64	1,00678	1,57186	3.6		27,19	26,05	25,84	18.30	117
	25,38	25,22	24,68	15,80	0,95510	1,36198	2.6		27,83	26,71	25,33	18,83	119
	24,48	24,46	24.56	14,71	0,90373	1,33701	2,9		25,22	26,44	26,52	17,68	119
	25,00	25,18	25.56	16,09	0,97912	1,42748	2.8		25,61	26,83	28,10	19.31	120

3. The apparent density of the foam insulation PUR material of district heating pipes with identification *Krauss Maffei VM 40* and *Krauss Maffei Rimstar RSC 40/40* was determinated in accordance with LVS EN 253:2020 p. 4.4.4. and p. 5.3.4., and LVS EN ISO 845:2009. The test specimens before the test were conditioned for 30 hours at standard conditions (T=23±2°C; RH=50±5%). Testing temperature in the laboratory T_t=22,6÷23,2°C. Relative moisture content RH=49,3÷51,5%.

The apparent density

ID of the test specimen	Dimension of specimen		Volume Mm^3	Weight, g	Apparent density ρ_a, kg/m^3	Mean value of the apparent density ρ_a, kg/m^3	Standard deviation
	d, mm	h, mm					
Krauss Maffei VM 40	30,3	30,8	22190	1,79348	80,8	77,9	3,3
	30,2	30,7	21936	1,70167	77,6		
	30,3	30,2	21686	1,72799	79,7		
	30,2	30,3	21748	1,57011	72,2		
	30,3	30,6	21983	1,68191	76,5		
	30,1	30,5	2170	1,75155	80,7		
Krauss Maffei Rimstar RSC 40/40	30,1	30,1	21469	2,00713	93,5	90,8	5,2
	30,1	30,3	21583	1,86019	86,2		
	30.2	30,2	21576	2,01788	93,5		
	30.2	29,7	21269	1,92291	90,4		
	30,1	30,5	21660	1,81231	83,7		
	30,2	31,1	22244	2,17567	97,8		

4. Siltumapgādes cauruļu putu poliuretāna (PUR) materiālu ar šifriem *Krauss Maffei VM 40* un *Krauss Maffei Rimstar RSC 40/40* šūnu izmēri noteikti saskaņā ar LVS EN 253:2020 p. 4.4.2.2. un p. 5.3.2.1. Paraugi pirms testēšanas kondicionēti 25 st. pie standartapstākļiem (T=23±2°C; RH=50±10%). Testēšanas temperatūra laboratorijā T_t=22,2+23,6°C. Relatīvais mitruma saturs RH=50,2-^51,5%.

Cell sizes of district heating pipe foam polyurethane (PUR) materials with identification *Krauss Maffei VM 40* and *Krauss Maffei Rimstar RSC 40/40* were determined in accordance with LVS EN 253:2020 p. 4.4.2.2. and p. 5.3.2.1. The samples were conditioned for 25 hours before testing at standard conditions (T=23±2°C; RH=50±10%). Testing temperature in the laboratory Tt=22.2÷23.6°C. Relative moisture content RH=50.2÷51.5%.

Cell sizes

Identification of the specimen	Pores per 10 mm	Cell size, mm	The mean value of cell size., mm
Krauss Maffei VM 40	23 22 23	0,43 0,45 0,43	0,44
Krauss Maffei Rimstar RSC 40/40	21 22 21	0,48 0,45 0,48	0,47

5. The compressive stress at 10% relative deformation of foam insulation materials (PUR) of district heating pipes with identification *Krauss Maffei VM 40* un *Krauss Maffei Rimstar RSC 40/40* is determined in accordance LVS EN 253:2020 p.4.4.3. and p.5.3.3., and LVS EN ISO 844:2021 ***(accredited method)***, by using the Procedure A. The test specimens were loaded in the direction of their thickness. The test specimens before the test were conditioned for 47 hours at standard conditions (T=23±2°C; RH=50±10%). Testing temperature in the laboratory T_t=22,1÷23,4°C. Relative moisture content RH=50,7÷52,1%. Sensitivity of the dynamometer in the given diapason ±1N.

The compressive stress at 10% relative deformation

ID of the test specimen	Thickness mm	Diameter, mm	Loading speed, mm/min	The compressive stress at 10% relative deformation σ_{10},	The mean value of the compressive stress at 10% relative σ_{10}, MPa
Krauss Maffei VM 40	20,1	30,1	2,0	0,524	0,532
	20,0	30,4	2,0	0,588	
	20,0	30.3	2,0	0,504	
	20,6	30.3	2,1	0,583	
	20,4	30,3	2,0	0,538	
	21,0	30.5	2,1	0,454	
Krauss Maffei Rimstar RSC 40/40	20,6	30,0	2,1	0,707	0,862
	20,0	30,3	2,0	0,776	
	20,4	30.2	2,0	1,128	
	19,9	30.3	2,0	0,922	
	20,8	30.3	2,1	0,786	
	20,0	30,2	2,0	0,850	

6. For the supplied PE blade-shaped samples with the ID PE "Borealis", the relative breaking elongation in tension is determined in accordance with LVS EN 253:2020 p.5.2.2. ***(accredited method)***. Samples before testing were conditioned 24 hours at standard conditions (T = 23±2°C; RH = 50±5%). Sample type "A". Deformation speed - 100 mm/min. Base length (Lo) - 25 mm. Testing temperature in the laboratory Tt=22.1÷24.5°C. Relative moisture content RH=50.2÷53.4%. The sensitivity of the dynamometer in the given range is ±1N.

Casing PE pipes elongation at break

ID of the specimen	Thickness, mm	Width, mm	Sample elongation in tension, mm	Sample elongation in tension, %	The mean value of sample elongation in tension, %
Borealis PE	3,08	5,73	190	660	544
	3,06	5,67	165	560	
	3,16	5,83	165	560	
	3,05	5,89	170	580	
	3,03	5,93	115	360	

7. The heat reversion of PE pipe samples with identification D120; D160 and D280 is determined in accordance with LVS EN 253:2020 p. 4.3.2.5 and LVS EN ISO 2505:2005.

Samples before testing were conditioned 24 hours at standard conditions (T = 23±2°C; RH = 50+5%). Testing temperature in the laboratory Tt=22.2÷24.3°C.

Samples 1 hour were matured in a thermal chamber at T=110°C.

Garenvirziena sarukums

ID of the test specimen	The distance between the marks before the test Lo, mm	The distance between marks after test L mm	Longitudinal shrinkage s $R_{L.i}$, %	The mean value of the longitudinal shrinkage. $R_L.i$,	The mean value of the longitudinal shrinkage $R_{L.i}$.,
D120	100 100	98,29 99,06	-1,71 -0,94	1,74	1,75
	100 100	98,32 98,86	-1,68 -1,14	1,68	
	100 100	98,16 98,66	-1,84 -1,34	1,84	
D160	100 100	98,83 99,08	-1,17 -0,92	1,17	1,21
	100 100	98,59 98,88	-1,41 -1,12	1,12	
	100 100	98,65 98,87	-1,35 -1,13	1,35	
D280	100 100	98,63 98,93	-1,37 -1,07	1,37	1,33
	100 100	98,77 99,03	-1,23 -0,97	1,23	
	100 100	98,62 98,87	-1,38 -1,13	1,38	

REMARKS:
Test results correspond to the product, mentioned in the test report.
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Testing was performed by the Researcher of the RTU Polymer Material Testing Laboratory

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