Testing Laboratory accredited by PCA
Siemieńskiego Street 4, 02-106 Warsaw

Veolia Energia Warszawa S.A.
Batorego 2 Street, 02-591 Warsaw

AB 414

TEST REPORT No. VWAW/DE/EB/EBB/23/1024/2 1000 cycles

Date of issue: **20.10.2023** Copy No. **1**

Table 1

TEST OBJECT	*MDPW joint*
CLASSIFICATION OF CASING JOINT according to EN 489-1 Annex A	*Type 2.1 PEX shrink joint casing, single sealed*
ORDERED BY	*RADPOL S.A. ul. Batorego 14, 77-300 Człuchów*
MANUFACTURER	*RADPOL S.A. ul. Batorego 14, 77-300 Człuchów*
MARKING OF TEST OBJECT	*LB/80/2023, LB/81/2023*

Table 2

SCOPE OF THE TEST	REQUIREMENTS EN 489-1:2019	TEST METHODS EN 489-1:2019
1. Polyurethane (PUR) foam thermal insulation	4.3.3	-
• Foam density	4.3.3.2	5.6
• Compressive strength	4.3.3.3	5.6
• Cell size	4.3.3.4	5.6
• Water absorption at elevated temperature	4.3.3.5	5.6
2. Soil stress test	4.3.4	5.2
3. Water tightness	4.3.5	5.3
4. Bending test on welded plugs	4.3.7.3	5.7
5. Melt mass-flow rate (MFR) of welded plug *(subcontractor Główny Instytut Górnictwa)*	4.3.8	5.5

Table 3

INSTALLATION OF JOINT ASSEMBLY		
Marking	**LB/80/2023**	**LB/81/2023**
Date of installation	31.08.2023	
Fitter	Mateusz Ziółkowski	
Place	factory RADPOL S.A. ul. Batorego 14, 77-300 Człuchów	
Confirmation/ witness	Video documentation/ Iwona Mazurkiewicz	

Table 4

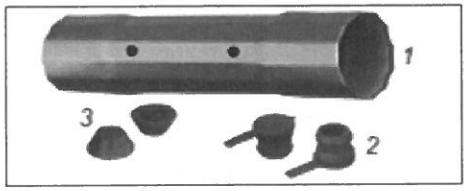
TECHNICAL INFORMATION FROM THE ORDERER	
Installation method of thermal insulation	*Foamed in the joint casing (FoamPack)*
List of components of joint (product/ manufacturer)  *FIGURE 1*	*PEX shrink joint casing (Fig. 1, No. 1) with integrated mastic made by A* and integrated adhesive hotmelt made by B** *Weld plugs (Fig 1, No. 2) made by RADPOL* *Venting plugs (Fig. 1, No. 3) made by RADPOL* *Insulation made by C** * - the full name of the sub-supplier is available at RADPOL
The largest diameter of the welding plug before welding, mm	33,0 ± 2,0
MFR value for welding plugs marked on the plugs, g/10 min.	0,3
Product data sheets	*Catalogue card:* Heat shrink joints
Installation instruction	*Catalogue card:* INSTALLATION GIUDE - RADIATION CROSSLINKED HEAT SHRINK JOINT WITH WELDING PLUGS

Table 5

DESCRIPTION OF THE TEST OBJEST	Marking	
	LB/80/2023	**LB/81/2023**
Length of the test object, mm	2500 ± 10	2500 ± 10
DN	80	150
Nominal diameter of casing, mm	160	250
Length of casing, mm	620	660
Wall thickness of casing, mm	3,2	3,3
Material of casing	PEX	PEX

Table 6

DATE	Marking	
	LB/80/2023	**LB/81/2023**
OBJECT RECEIVING	04.09.2023	
SOIL STRESS TESTS	08 ÷ 15.09.2023	20 ÷ 29.09.2023
WATER TIGHTNESS TEST	18 ÷ 19.09.2023	02 ÷ 03.09.2023
POLYURETHANE (PUR) FOAM THERMAL INSULATION TEST	11 ÷ 19.10.2023	
BENDING TESTS ON WELDED PLUGS	18.10.2023	18.10.2023

Table 7

AMBIENT CONDITION		Marking	
		LB/80/2023	**LB/81/2023**
CONDITIONING	Ambient temperature, °C	23 ± 2	
	Relative humidity, %	20,0 ÷ 50,0	
	Duration, h	600	312
SOIL STRESS TEST	Ambient temperature, °C	22,9 ÷ 24,4	21,3 ÷ 22,7
	Relative humidity, %	43,7 ÷ 59,7	51,2 ÷ 62,3
WATER TIGHTENESS TEST	Ambient temperature, °C	22,5 ÷ 22,7	22,3 ÷ 22,7
	Relative humidity, %	62,2 ÷ 71,9	67,4 ÷ 69,0
POLYURETHANE (PUR) FOAM THERMAL INSULATION TEST	Ambient temperature, °C	21,3 ÷ 23,7	
	Relative humidity, %	45,7 ÷ 61,1	
BENDING TEST ON WELDED PLUGS	Ambient temperature, °C	22,7	
	Relative humidity, %	46,5	

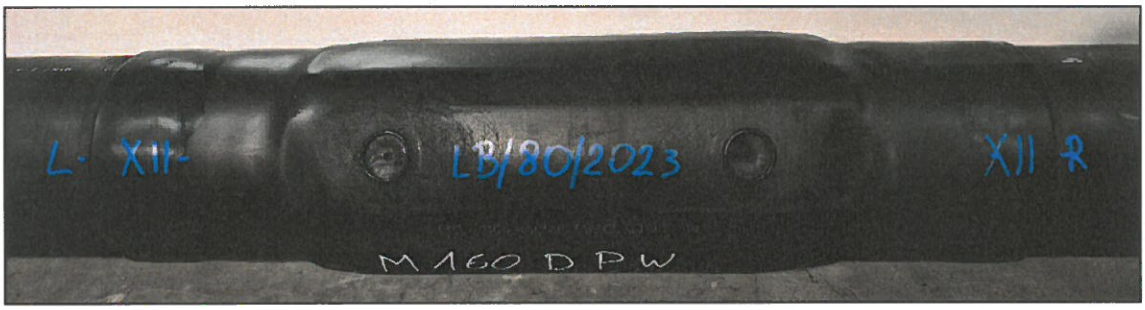
Table 8

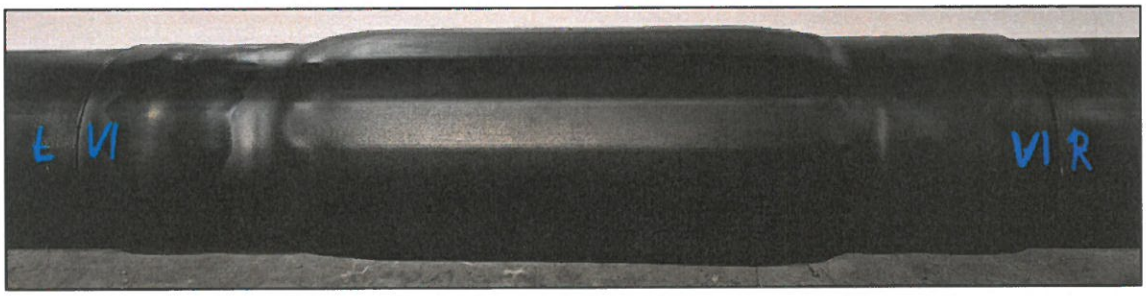
TEST CONDITIONS			Marking				Requirements EN 489-1:2019
			LB/80/2023		**LB/81/2023**		
MAINTENANCE BEFORE TESTING	Service pipe temperature	°C	120 ± 2		120 ± 2		120 ± 2
	Heating duration	h	24		24		24
SOIL STRESS TEST	Sand box outside dimensions	m	1,8 x 1,0 x 1,8				acc. to 5.2.2
	Sand	-	Natural sand in air-dried condition with a grain distribution according to EN 489-1:2019				standard grain distribution acc. to 5.2.3
	Sand temperature	°C	24,5 ÷ 26,8		22,1 ÷ 27,6		-
	Moisture content	%	0,03		0,03		max. 0,5
	Effective vertical soils stress	kPa	17,6		17,5		18 ± 1
	Sand overfill before test	mm	384		383		300 $^{+100}_{0}$
	Service pipe temperature	°C	120 ± 2		120 ± 2		120 ± 2
	Displacement	mm	75 ± 2		75 ± 2		75 ± 2
	Forward speed	mm/min	10 ± 1		10 ± 1		10 ± 1
	Backward speed	mm/min	50 ± 1		50 ± 1		50 ± 1
	Number of cycles	-	**1000**		**1000**		min. 100
WATER TIGHTNESS TEST	Temperature in water tank	°C	22,1 ÷ 23,9		20,1 ÷ 21,9		23 ± 2
	External pressure on test sample	kPa	30		30		30 ± 1
	Test duration	h	26,0		26,4		min 24
BENDING TEST ON WELDED PLUGS	Bending angle α	°	Plug No. 1	Plug No. 2	Plug No. 1	Plug No. 2	160
			160	160	160	160	

Table 9

TEST RESULTS		Marking		Requirements EN 489-1:2019
		LB/80/2023	LB/81/2023	
SOIL STRESS TEST		No change Table 10 Photo 5 ÷ 16	No change Table 10 Photo 23 ÷ 34	item 4.2.2 The joint shall be: • watertight; • able to withstand longitudinal forces initiated by longitudinal movements of the pipe in the ground; • able to withstand radial forces and bending moments; • able to withstand effects of temperature and temperature variations
WATER TIGHTNESS TEST		No water ingress Table 10 Photo 17, 18	No water ingress Table 10 Photo 35, 36	
BENDING TEST ON WELDED PLUGS		Plug No. 1 / Plug No. 2 No cracks Table 10 Photo 39, 40	Plug No. 1 / Plug No. 2 No cracks Table 10 Photo 43, 44	item 5.7 cracks detectable with visual inspection shall not arise in the weld seam before the minimum bending angle (160°) is reached
POLYURETHANE (PUR) FOAM THERMAL INSULATION TEST	Density, kg/m^3	95,4 ± 0,1	95,0 ± 0,2	item 4.3.3.2 min. 55
	Compressive strength, MPa	0,78 ± 0,09 %	0,70 ± 0,12 %	item 4.3.3.3 min. 0,3
	Cell size, mm	0,4 ± 6,2 %	0,4 ± 6,2 %	item 4.3.3.4 max. 0,5
	Water absorption, % (*m/m*)	3,7 ± 0,5 %	4,1 ± 0,5 %	item 4.3.3.5 max. 10
	Water absorption V_1/V_0	1,07	1,06	item 4.3.3.5 min. 0,75
		1,09	1,07	
		1,08	1,09	

PHOTOGRAPHIC DOCUMENTATION





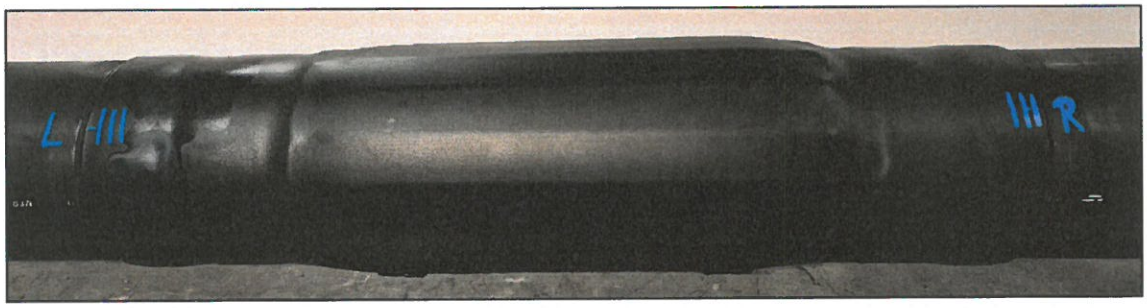
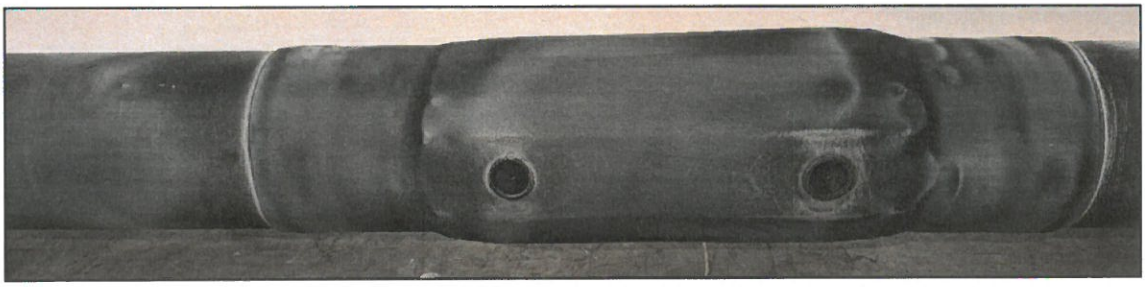
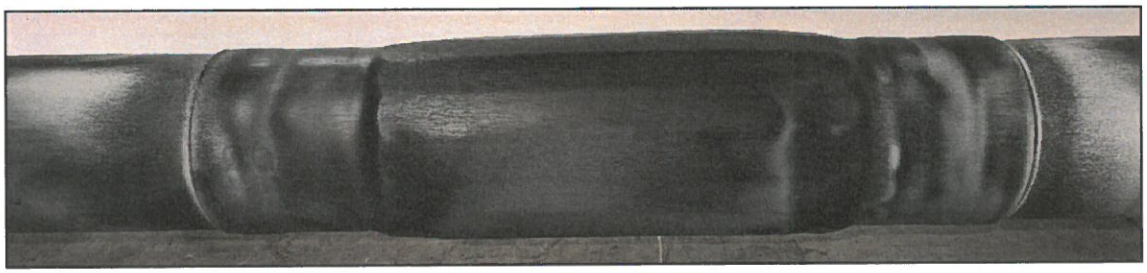


Photo 1÷4 Object LB/80/2023 before soil stress test





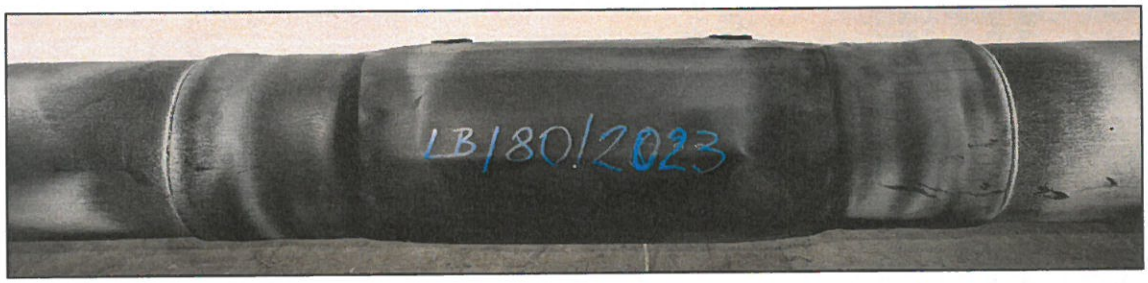


Photo 5÷8 Object LB/80/2023 after soil stress test

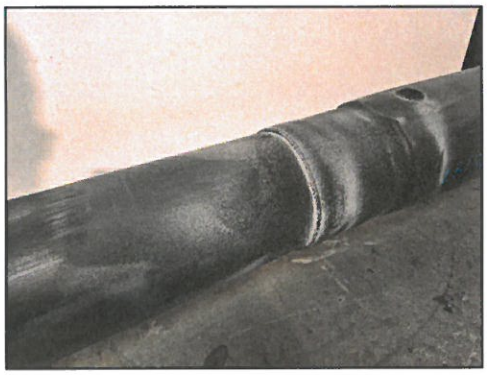
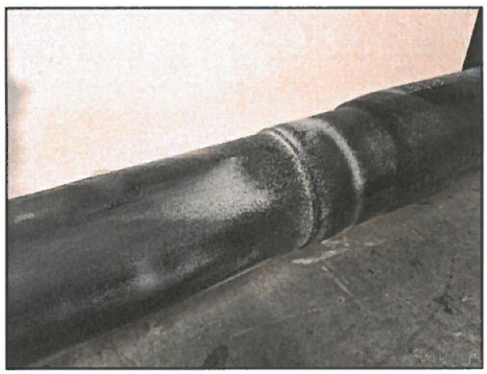
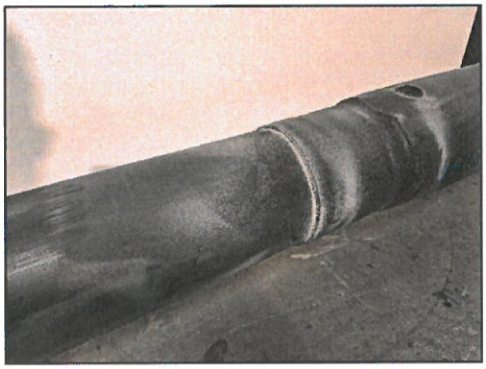
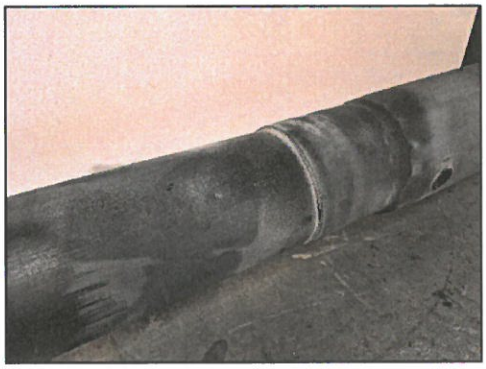
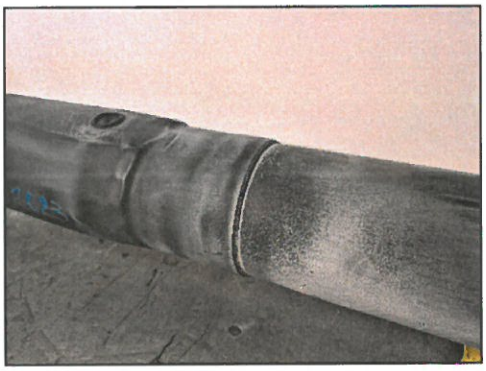
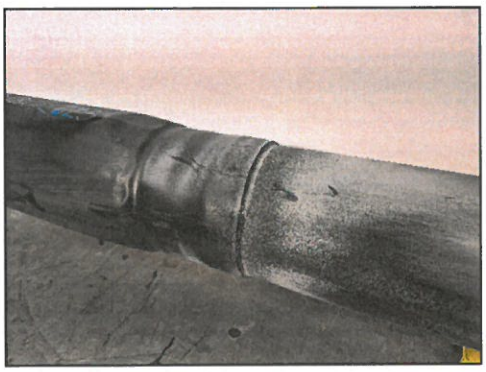
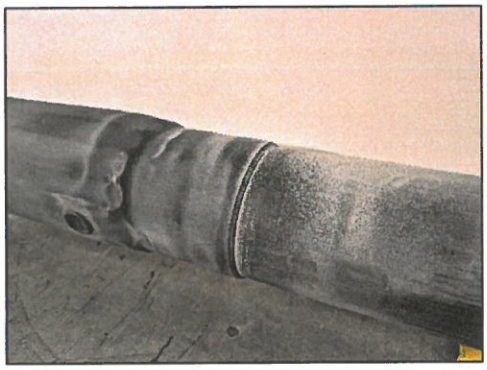
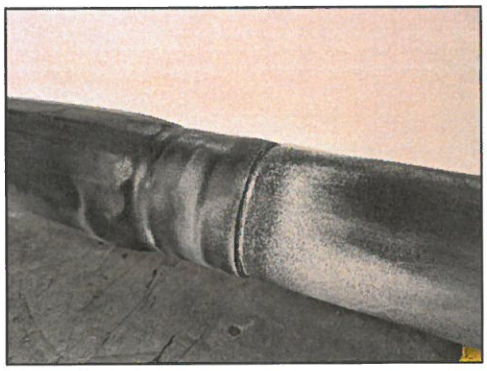
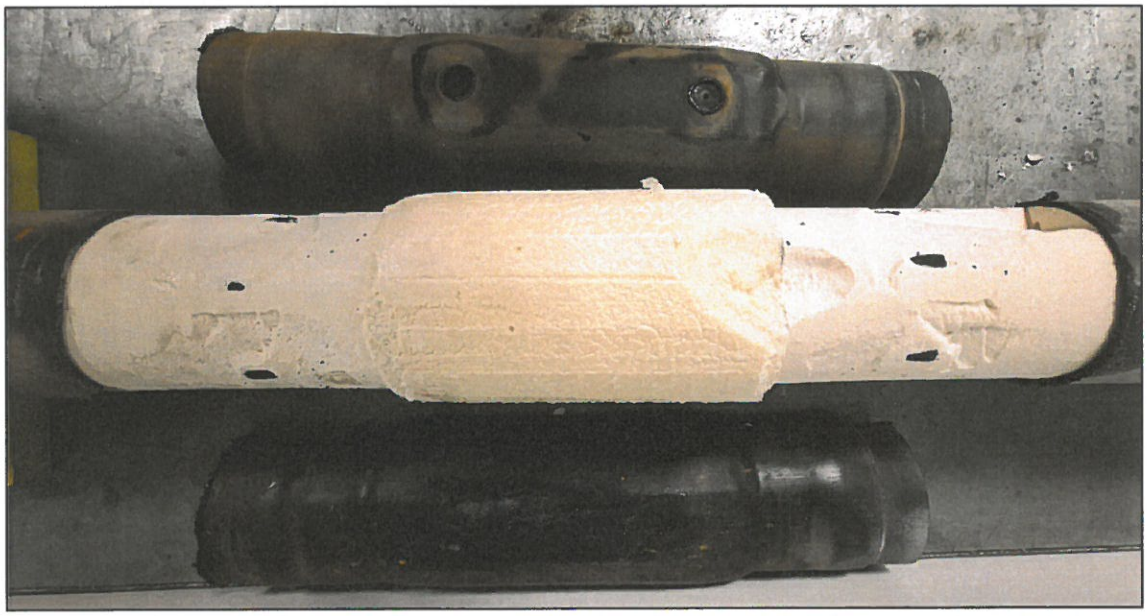









Photo 9 ÷ 16 Object LB/80/2023 after soil stress test



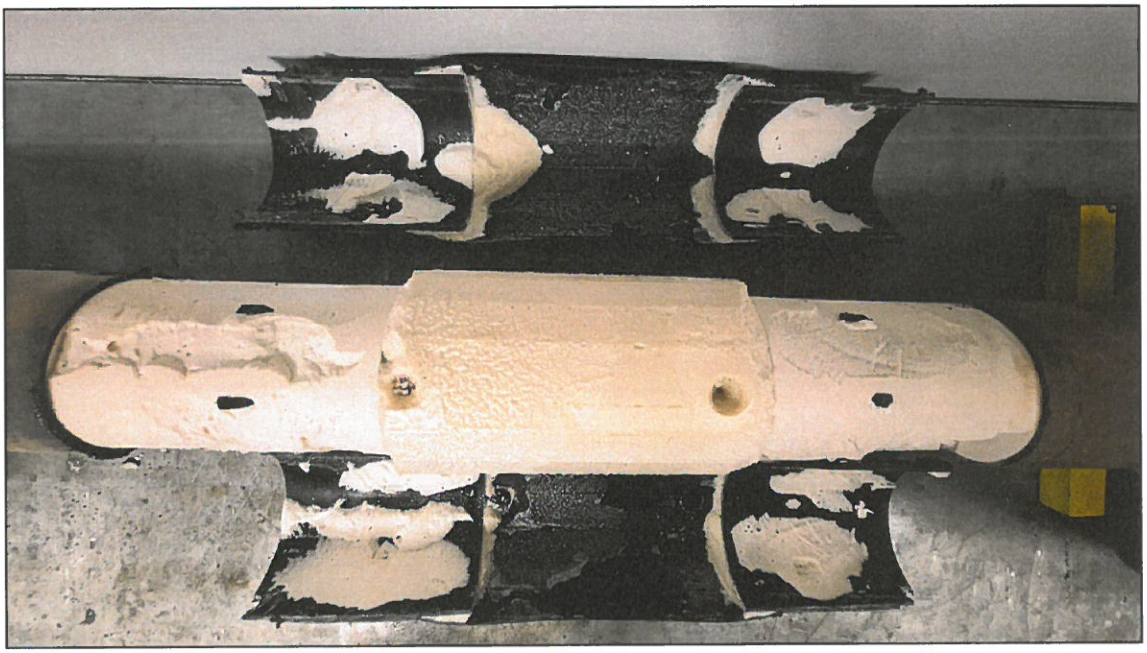
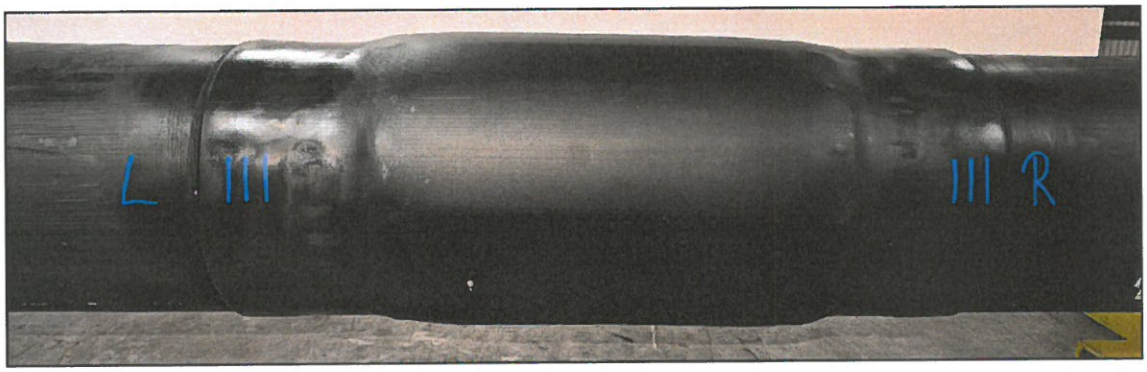
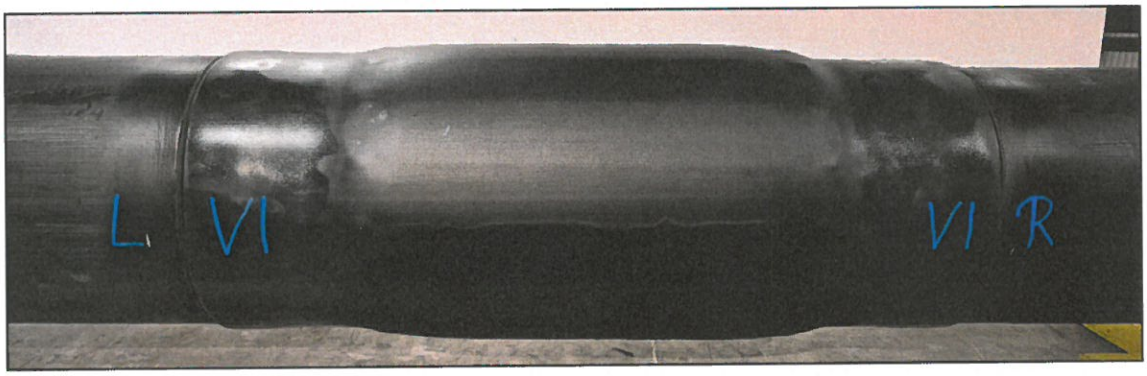


Photo 17, 18 Object LB/80/2023 after water tightness test





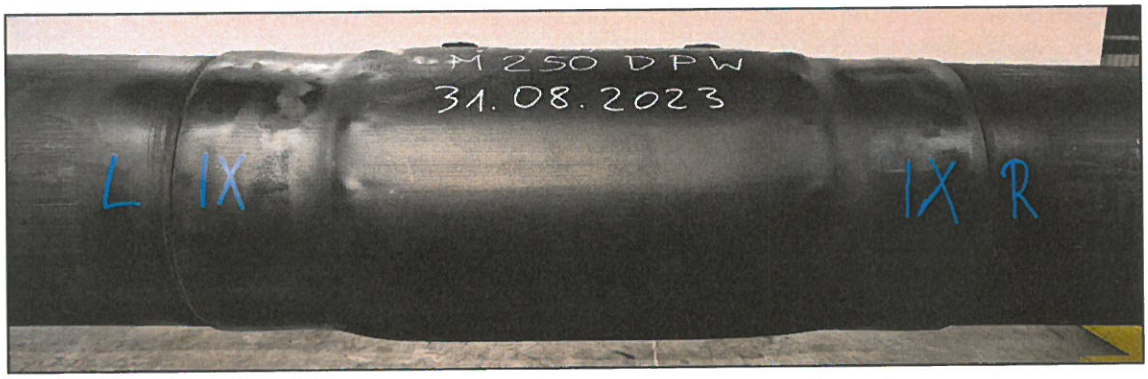
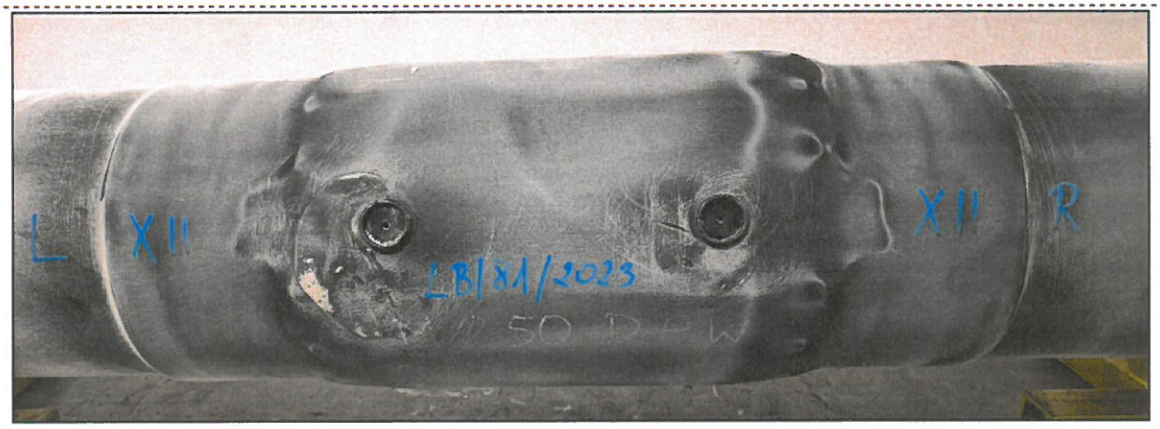
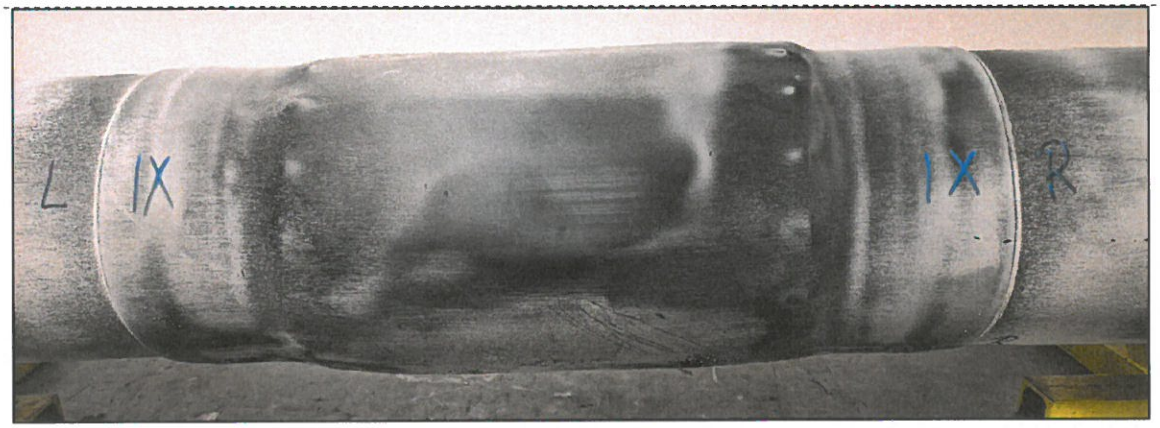
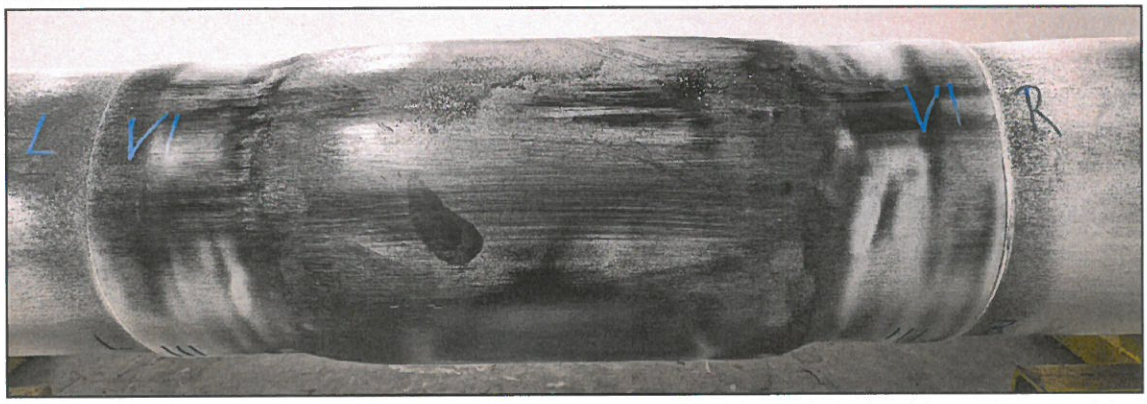


Photo 19÷ 22 Object LB/81/2023 before soil stress test







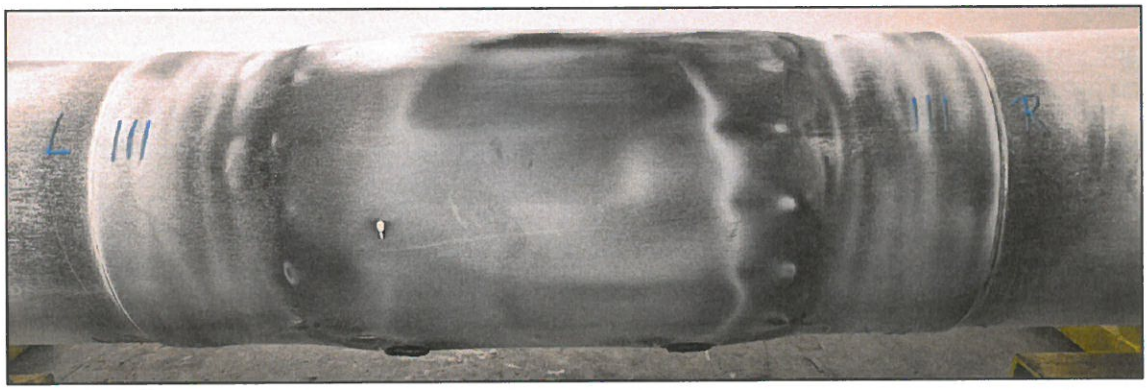
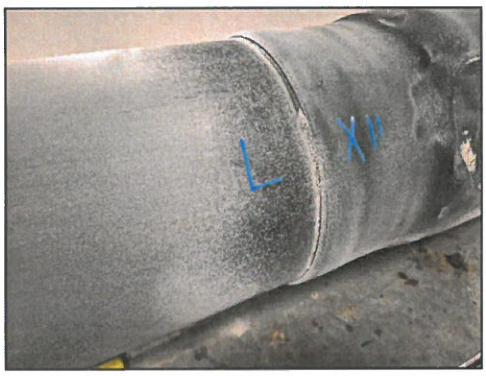
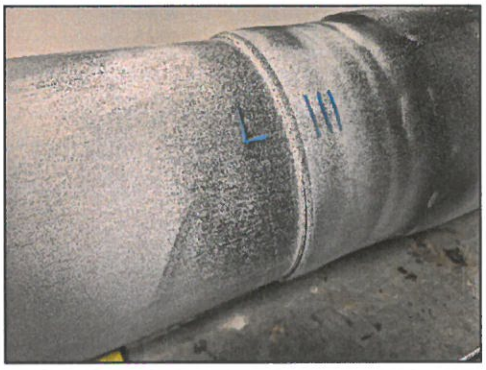


Photo 23÷26 Object LB/81/2023 after soil stress test





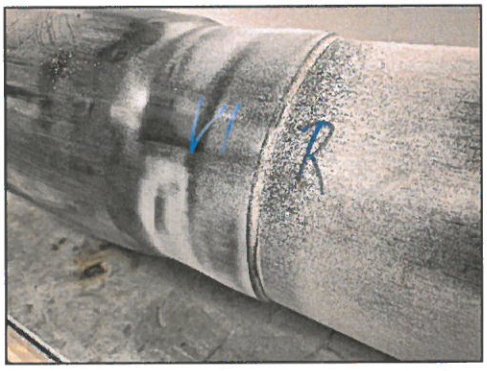
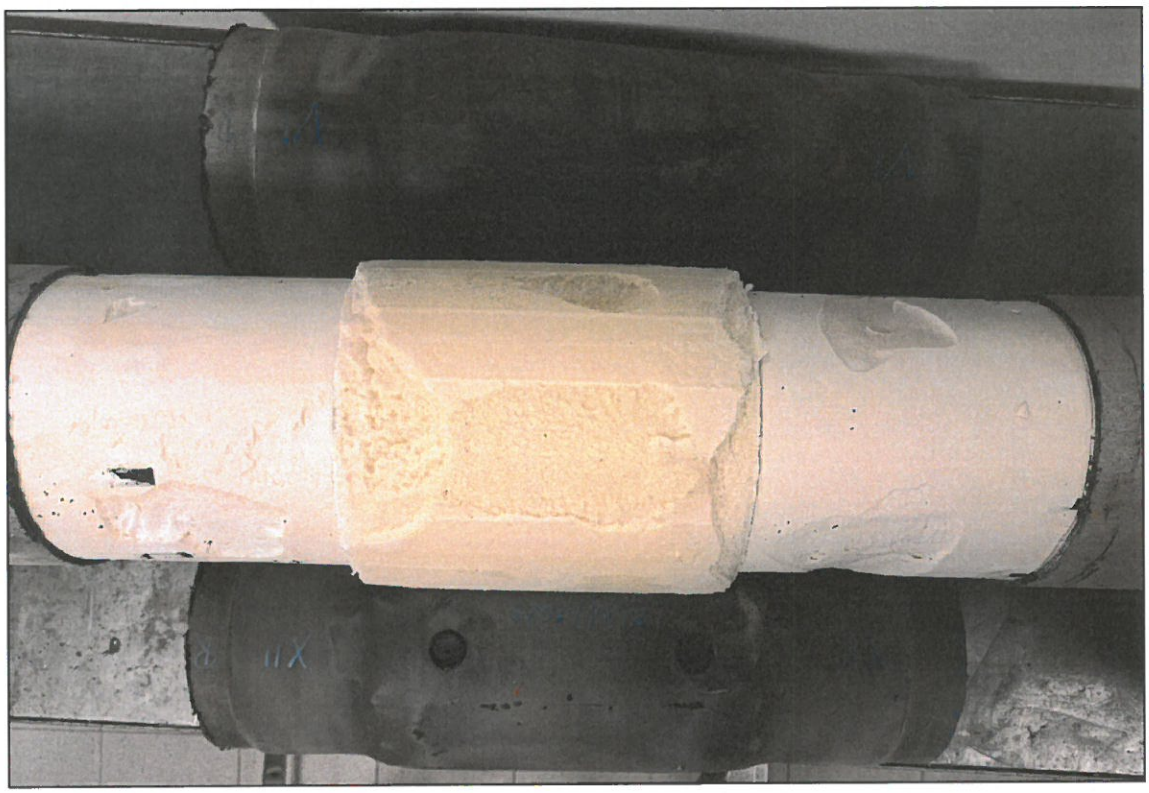


Photo 27 ÷ 34 Object LB/81/2023 after soil stress test



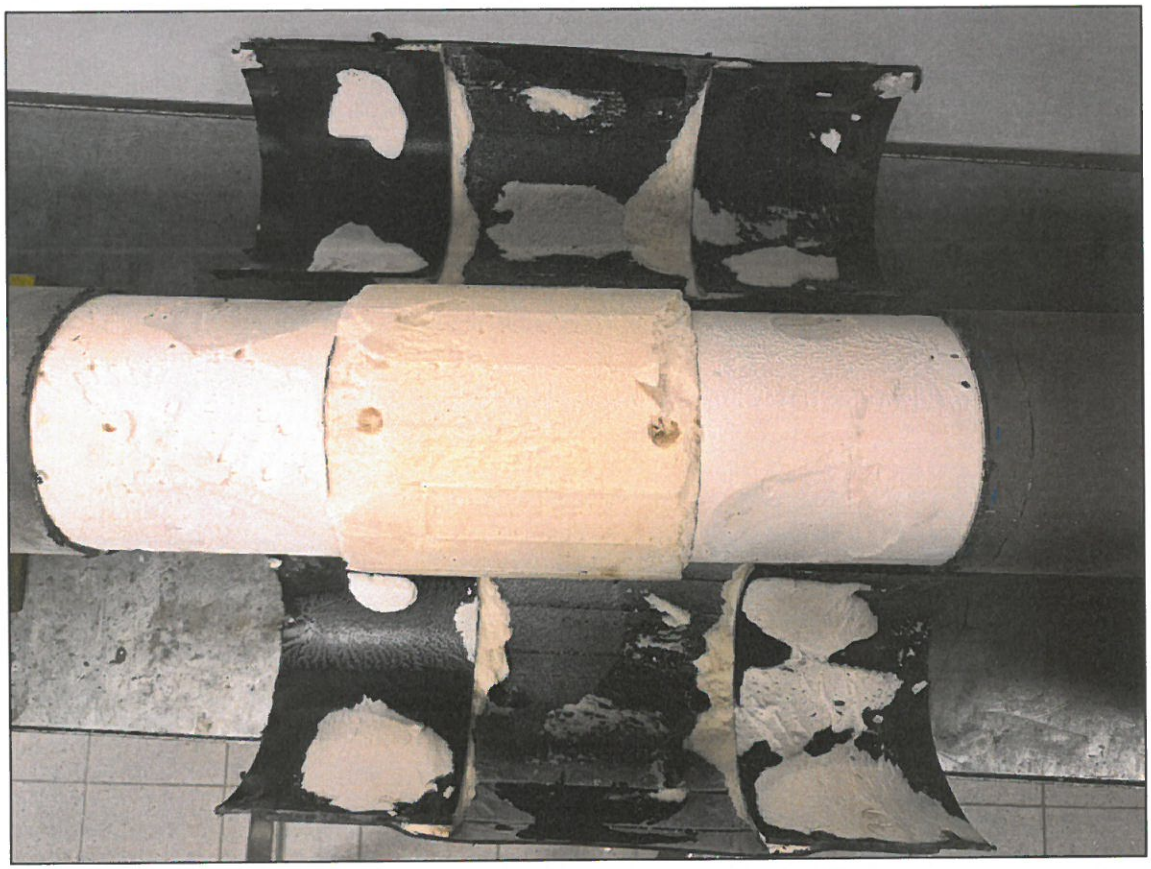
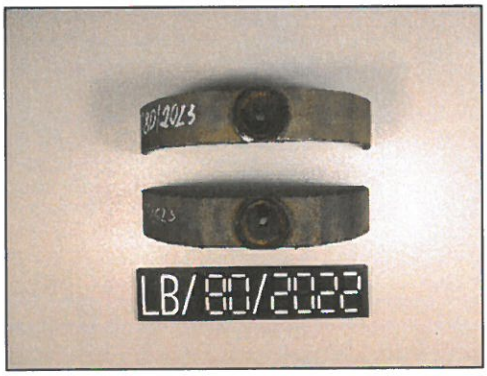


Photo 35, 36 Object LB/81/2023 after water tightness test



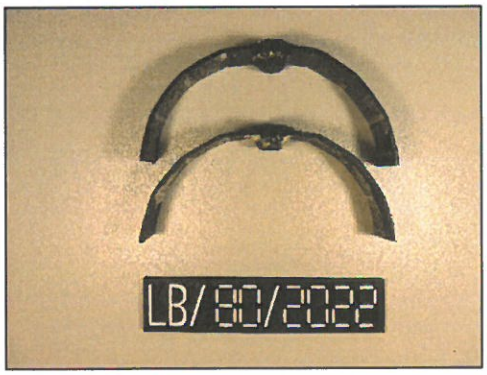
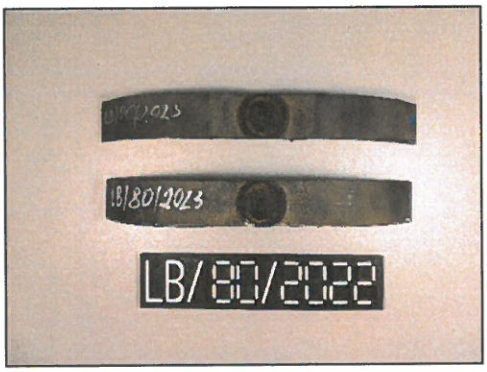


Photo 37, 38 Samples LB/80/2023 before bending test on welded plugs



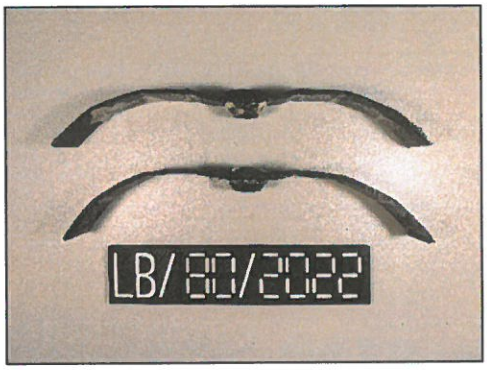


Photo 39, 40 Samples LB/80/2023 after bending test on welded plugs

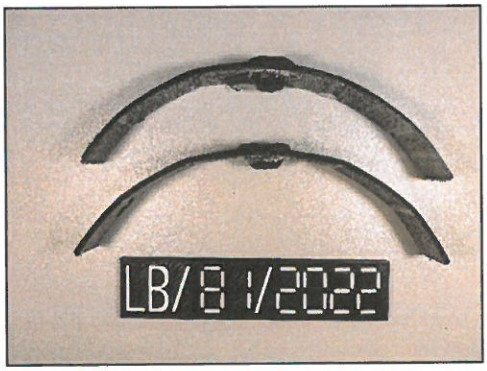
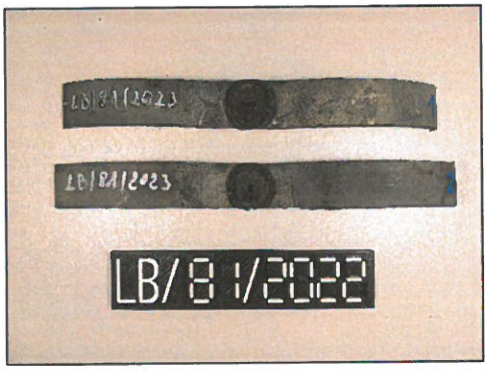


Photo 41, 42 Samples LB/81/2023 before bending test on welded plugs



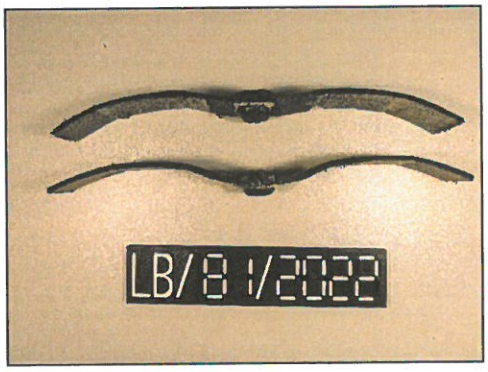


Photo 43, 44 Samples LB/81/2023 after bending test on welded plugs

STATEMENT OF THE TYPE TEST RESULTS

MDPW joint

with radiation cross-linked shrink sleeve
classified according to Annex A, Table A.1 as Type 2.1 *"PEX shrink joint casing, single sealed"*

after soil load test - **1000 cycles**
meets the requirement of EN 489-1:2019 in the field of type test.

Notice:

1) *The result refers only to the tested objects.*
2) *The objects were delivered to Lab by the Customer.*
3) *Without a written permission from Testing Laboratory this report cannot be copied otherwise than in full version.*
4) *In the tables there are the expanded measurement uncertainties for a 95% level of confidence and k=2.*
5) *When assessing compliance with the specified requirements, the Laboratory applies the evaluation principle based on the method of simple acceptance of the test result, taking into account the expanded uncertainty of measurement at the 95% confidence level.*
6) *The results of the MFR test of welding plugs are available in Test report BL-5/23-9, date of issue 10.02.2023 issued by Główny Instytut Górnictwa - Zakład Inżynierii Materiałowej Centralne - Laboratorium Badań Rur z Tworzyw Sztucznych – Laboratorium Badań Właściwości Fizyko-Chemicznych Materiałów Niemetalowych, Plac Gwarków 1, 40-166 Katowice*

==========THE END OF THE REPORT==========

The research was conducted by (according to Table 2):

Katarzyna Omen	item 1.1, 1.2
Krzysztof Strzeżek	item 1.3, 2, 3
Piotr Sałek	item 1.4, 4

The Test Report prepared by:	**The Test Report verified by:**	**The Test Report authorized by:**
Specjalista ds. badań i pomiarów	Kierownik Działu Badań Materiałowych	Kierownik Laboratorium Badawczego
Katarzyna Omen	Iwona Mazurkiewicz	Ewa Kręcielewska