





European Technical Assessment

ETA-07/0169 of 30.11.2017

General part

Technical Assessment Body issuing the European Technical Assessment

Österreichisches Institut für Bautechnik (OIB) Austrian Institute of Construction Engineering

Trade name of the construction product

TRM-Pfahl-Duktil

Product family to which the construction product belongs

Pile pipes made of ductile iron

Manufacturer

Tiroler Rohre GmbH Innsbruckerstraße 51 6060 Hall in Tirol Austria

Manufacturing plant

Tiroler Rohre GmbH Innsbruckerstraße 51 6060 Hall in Tirol Austria

This European Technical Assessment contains

12 pages including 4 Annexes which form an integral part of this assessment.

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of

European Assessment Document (EAD) EAD 200043-01-0103 "Pile pipes made of ductile iron"



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Specific parts

1 Technical description of the product

TRM-Pfahl-Duktil is a ductile iron tubular pile pipe (spheroidal graphite cast iron) with spigot end and with or without conical pile socket, which is joined together to a flexible choice of pile length. The pile socket and the spigot end form those parts of the pile pipe which ensure a proper and easily connection of pipes for pile units. When driven they form a rigid connection with resistance to axial compressive forces.

Pile pipes are manufactured with defined length, defined external diameters and defined wall thickness.

Table 1: Types of TRM-Pfahl-Duktil

Types	External diameter [mm]	Wall thickness [mm]	Length of the pile pipe [m]
Type 98	98	6,0 7,5	5,02
Type 118	118	7,5 9,0 10,6	5,0
Type 170	170	7,5 9,0 10,6 13,0	5,0

A drawing of the pile pipes, detailed dimensions of the pile pipes and related tolerances are given in Annex 2.

2 Specification of the intended use(s) in accordance with the applicable EAD

TRM-Pfahl-Duktil is used for foundation of buildings, for foundation of civil engineering works, etc. Pile pipes are predominantly used in order to carry axial forces.

Due to resilient properties of ductile iron the product may be used at ambient temperatures of - 20 °C and above.

Pile pipes according to this ETA are used in soils with or without groundwater as defined in EN 1993-5, clause 4.4.

This ETA only covers the ductile iron pile pipe. Ductile iron pile pipes are usually used as component to form a complete pile.

The provisions made in this European Technical Assessment are based on an intended working life for the intended use of TRM-Pfahl-Duktil up to 100 years, depending on the thickness losses due to corrosion in accordance with clause 3.1.2 in this ETA, and provided that the product is subject to appropriate use.

It is the responsibility of the manufacturer to ensure that each delivery contains proper information for the use of TRM-Pfahl-Duktil including general guidance on the basis of the European Technical Assessment.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, but are to be regarded only as a means for choosing the appropriate product in relation to the expected, economically reasonable working life of the works.



3 Performance of the product and references to the methods used for its assessment

3.1 Performance of TRM-Pfahl-Duktil

Table 2: Essential characteristics and performances of TRM-Pfahl-Duktil

Basic requirements for construction works	Essential characteristics	Method of assessment	Performance
BWR 1	Internal load bearing capacity	EAD, clause 2.2.1	Clause 3.1.1
	Resistance to corrosion	EAD, clause 2.2.2	Clause 3.1.2
BWR 2	Reaction to fire	EAD, clause 2.2.3	A1 Clause 3.1.3

3.1.1 Internal load bearing capacity

The internal load bearing capacity is expressed by means of the maximum permissible axial load bearing capacity of the pile pipe.

The material properties of the pile pipes made of ductile iron are given in Annex 1.

The dimensions of the pile pipes and the dimensions tolerances are given in Annex 2.

The maximum permissible axial load bearing capacity of the pile pipes is calculated according to the EAD, clause 2.2.1 (and in equivalence to EN 1993-1-1 and EN 1993-5) and is stated in Annex 3, Table 3.1 of this ETA for each type and each wall thickness according to Table 1 in this ETA.

3.1.2 Resistance to corrosion

Reduced internal load bearing capacity in consideration of thickness losses due to corrosion is calculated for each type and for each wall thickness in equivalence to EN 1993-5, Clause 4.4, using the values for thickness losses given in Table 3 and safety coefficient γ_{M0} =1,0. The calculated reduced internal load bearing capacity for each type and wall thickness is given in Annex 3, Tables 3.2 to 3.6.

Table 3: Values for the loss of thickness [mm] due to corrosion in soils, with or without groundwater, according to EN 1993-5, clause 4.4, Table 4-1

Type of soil		Require	d design w	orking life	
Type of Soil	5 years	25 years	50 years	75 years	100 years
Undisturbed natural soils (sand, silt, clay, schist, etc.)	0,00	0,30	0,60	0,90	1,20
Polluted natural soils and industrial sites	0,15	0,75	1,50	2,25	3,00
Aggressive natural soils (swamp, marsh, peat, etc.)	0,20	1,00	1,75	2,50	3,25
Non-compacted and non -aggressive fills (clay, schist, sand, silt, etc.)	0,18	0,70	1,20	1,70	2,20
Non-compacted and aggressive fills (ashes, slag, etc.)	0,50	2,00	3,25	4,50	5,75



3.1.3 Reaction to fire

The pile pipes made of ductile iron are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with the EC Decision 96/603/EC (as amended) and Commission Delegated Regulation (EU) No 2016/364 without the need for testing on the basis of it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the decision 98/214/EC of the European Commission¹, the system of assessment and verification of constancy of performance (see Annex V of Regulation (EU) No 305/2011) is 2+.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the Technical Assessment Body Österreichisches Institut für Bautechnik.

The notified production control certification body shall visit the factory once a year for surveillance of the AVCP.

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The original document is signed by:

Rainer Mikulits

Managing Director

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Table 1.1: Material properties of ductile iron

Material property	Assessment method	Performance/Value
Tensile strength	EN 545, clause 6.3	≥ 450 N/mm²
Breaking elongation	EN 545, clause 6.3	≥ 10 %
Brinell hardness	EN 545, clause 6.4	≤ 230 HB
Yield strength 0,2 % ($R_{p0,2}$)	EN 545, clause 6.3, and EN ISO 6892-1	≥ 320 N/mm²
Charpy notch energy (V- notch) at a temperature of - 20 °C	EN ISO 148-1	≥ 10 J
Chemical composition Carbon (C) Silicon (Si) Manganese (Mn) Phosphorus (P) Sulphur (S) Magnesium (Mg)	Directional analysis/spectral analysis	3,3 - 3,8 % 2,1 - 2,6 % < 0,5 % < 0,1 % < 0,01 % 0,03 - 0,05 % ¹⁾
1) Content of magnesium (Mg) is	s related only to the content in soli	id state of ductile iron.

According to the verified values given in Table 1.1, the values given in Table 1.2 can be used for further calculation.

Table 1.2

Material property	Performance/Value
Compressive strength	700 N/mm²
Modulus of elasticity	164 000 – 176 000 N/mm²
Density	7050 kg/m³



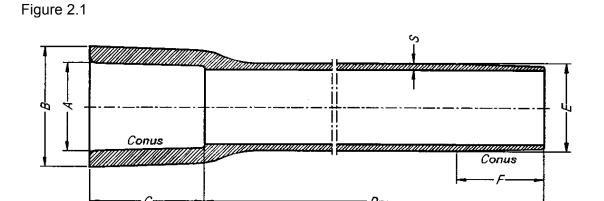


Table 2.1: Dimensions of pile pipe and dimension tolerances

	Type 98 ¹⁾	Type 118 ¹⁾	Type 170 ¹⁾
SOCKET			
Internal diameter A [mm]	104 + 2,0/-1,0	118,5 + 2,0/-1,0	171,5 + 2,0/-1,0
External diameter B [mm]	132 ± 1,6	≥ 162	≥ 220
Conus (optional)	-	1:10 – 1:18	1:12 – 1:18
Conus length C [mm]	-	155 ± 1,0	215 ± 1,0
PILE PIPE SHAFT			
External diameter E [mm]	98 +1,5/-1,0	118 +1,5/-1,0	170 +2,5/-1,0
Wall thickness S [mm]	6 - 0,8	7,5 - 0,8	7,5 - 0,8
	7,5 - 0,8	9,0 - 0,8	9,0 - 0,8
	-	10,6 - 0,8	10,6 - 0,8
	-	-	13,0 - 0,8
Pile pipe length D [mm]	5020 ± 100	5000 ± 100	5000 ± 100
Straightness	according to EN 545, 4.2.4: ≤ 0,125 % of the pile pipe length	according to EN 545, 4,2,4: ≤ 0,125 % of the pile pipe length	according to EN 545, 4,2,4: ≤ 0,125 % of the pile pipe length
SPIGOT END			
Conus (optional)		1:10 – 1:18	1:12 – 1:18
External diameter E [mm]	98 +1,5/-1,0	118 + 1,5/-1,0	170 + 2,5/-1,0
Conus length F [mm]	-	110 – 20,0	150 – 20,0



Table 3.1: Internal load bearing capacity

Туре	Nominal wall thick-	Assessment method	Safety coefficient	Internal load bearing capacity design value $N_{\rm Sd}$
-	ness			[kN]
98	6,0		1,0	555
	7,5		1,0	682
118	7,5		1,0	833
	9,0	Calculation	1,0	986
	10,6	according to EAD,	1,0	1144
170	7,5	clause 2.2.1	1,0	1225
	9,0]	1,0	1457
	10,6]	1,0	1699
	13,0	1	1,0	2052

Note: The load bearing capacity is calculated for the cross section. Buckling is not taken into account.

Internal load bearing capacity



Table 3.2: Reduced internal load bearing capacity [kN] for TRM-pile-pipes in undisturbed natural soils (sand, silt, clay, schist, etc.)

Туре	Nominal wall	5)	5 years	25	25 years	50	50 years	75	75 years	100	100 years
:	thickness	Loss of	Reduced	Loss of	Reduced	Loss of	Reduced	Loss of	Reduced	Loss of	Reduced
		thickness	internal load	thickness	internal load	thickness	internal load	thickness	internal load	thickness	internal load
			bearing		bearing		bearing		bearing		bearing
			capacity		capacity		capacity		capacity		capacity
Q	6,0		555		525	•	496		467		438
90	7,5		682		653		624		594		566
	7,5		833		798		762		727		692
118	9,0		986		951		915		880		845
	10,6	0,00 mm	1144	0,30 mm	1109	0,60 mm	1074	0,90 mm	1039	1,20 mm	1004
	7,5		1225		1174		1123		1072		1022
170	9,0		1457		1406		1355		1304		1253
2	10,6		1699		1647		1596		1546		1495
	13,0		2052		2001		1950		1899		1848
Table	3.3: Reduc	æd internal	load bearing c	apacity [kN	Table 3.3: Reduced internal load bearing capacity [kN] for TRM-pile-pipes in polluted natural	-pipes in po		oils and inc	soils and industrial sites		
Type	Nominal	5	5 years	25	25 years	50	50 years	75	75 years	100	100 years
	±	Loss of thickness	Reduced internal load	Loss of thickness	Reduced internal load	Loss of thickness	Reduced internal load	Loss of thickness	Reduced internal load	Loss of thickness	Reduced internal load
			bearing		bearing capacity		bearing capacity		bearing capacity		bearing capacity
20	6,0		540		482		409		338		268
90	7,5		668		609		537		466		396
	7,5		815		745		657		571		486
118	9,0		968		898		811		724		639
	10,6	0,15 mm	1127	0,75 mm	1056	1,50 mm	969	2,25 mm	883	3,00 mm	798
	7,5		1200		1098		971		846		722
170	9,0		1431		1329	•	1203		1077	•	953
-	10,6		1673		1571		1445		1319		1195
	13,0		2026		1924		1798		1672		1548



Table 3.4: Reduced internal load bearing capacity [kN] for TRM-pile-pipes in aggressive natural soils (swamp, marsh, peat,...)

		170			118		90	80				Туре	Table (7	170			118		90	90) ybc	Type
13,0	10,6	9,0	7,5	10,6	9,0	7,5	7,5	6,0			thickness	Nominal wall	3.5: Reduc	13,0	10,6	9,0	7,5	10,6	9,0	7,5	7,5	6,0				thickness	Nominal
				0,18 mm							Loss of thickness	5	ed internal					0,20 mm							thickness	l oss of	5
2021	1668	1426	1194	1123	965	812	665	537	capacity	bearing	Reduced internal load	5 years	load bearing c	2018	1664	1423	1191	1121	963	809	663	535	capacity	bearing	internal load	Reduced	5 years
				0,70 mm							Loss of thickness	25	apacity [kN					1,00 mm							thickness	l nee of	25
1933	1579	1338	1106	1062	904	751	614	486	capacity	bearing	Reduced internal load	25 years	ا] for TRM-pile	1882	1529	1287	1055	1027	869	716	585	457	capacity	bearing	internal load	Reduced	25 years
				1,20 mm							Loss of thickness	50	e-pipes in no					1,75 mm							thickness	l oss of	50
1848	1495	1253	1022	1004	845	692	566	438	capacity	bearing	Reduced internal load	50 years	Table 3.5: Reduced internal load bearing capacity [kN] for TRM-pile-pipes in non-compacted a	1756	1403	1161	929	940	782	629	513	386	capacity	bearing	internal load	Reduced	50 years
				1,70 mm							Loss of thickness	75	and non-ag					2,50 mm							thickness	l nee of	75
1764	1411	1169	938	946	787	634	518	390	capacity	bearing	Reduced internal load	75 years	nd non-aggressive fills (clay, schist, sand, silt,	1631	1278	1036	804	854	696	543	442	315	capacity	bearing	internal load	Reduced	75 years
				2,20 mm							Loss of thickness	100	lay, schist, s					3,25 mm							thickness	l oss of	100
1681	1327	1086	854	888	730	577	470	343	capacity	bearing	Reduced internal load	100 years	sand, silt,)	1507	1154	912	680	770	611	458	373	_ 1)	capacity	bearing	internal load	Reduced	100 years

1) According to the manufacturer residual wall thickness of the pile pipes of < 3 mm are not used for design. Note: The load bearing capacity is calculated for the cross section. Buckling is not taken into account.



Туре	Nominal wall thickness	5 Loss of thickness	5 years Loss of Reduced thickness internal load bearing	25 Loss of thickness	25 years Loss of Reduced thickness internal load bearing	Loss of thickness	50 years of Reduced internal load bearing	Loss of thickness	<u> </u>	Reduced internal load bearing	
Ď	6,0		506		362			_ 1)	_ 1)	_1) _1)	
90	7,5		633		489			373	373	373 259	
	7,5		774		600			458	458	458 320	
118	0,6		927		753)	611	611	611 473	
	10,6	0,50 mm	1085	2,00 mm	911	3,25 mm		770	770 4 ,50 mm		4 ,50 mm
	7,5		1140		887		9	680	80	80 477	
170	9,0		1371		1119		.6	912	12	12 708	
2	10,6		1613		1361		11	1154	54	54 950	
	13,0		1967		1714		31	1507	507	1303	

Table 3.6: Reduced internal load bearing capacity [kN] for TRM-pile-pipes in non-compacted and aggressive fills (ashes, slag,...)

1) According to the manufacturer residual wall thickness of the pile pipes of < 3 mm are not used for design. Note: The load bearing capacity is calculated for the cross section. Buckling is not taken into account.

Internal load bearing capacity

Annex 3 of European Technical Assessment ETA-07/0169



REFERENCE DOCUMENTS

European Assessment Document - EAD 200043-01-0103 "Pile pipes made of ductile iron"

- EN 545:2010 "Ductile iron pipes, fittings, accessories and their joints for water pipelines Requirements and test methods"
- EN 1993-1-1:2010 "Eurocode 3: Design of steel structures Part 1-1: General rules and rules for buildings"
- EN 1993-5:2007+AC 2009 "Eurocode 3 Design of steel structures Part 5: Piling"
- EN ISO 148-1:2016 "Metallic materials Charpy pendulum impact test Part 1: Test method"
- EN ISO 6892-1:2016 "Metallic materials Tensile testing Part 1: Method of test at room temperature"