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European Technical Assessment

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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
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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 $\gamma_{M0} = 1,0$. 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	Required design working life				
	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

Figure 2.1

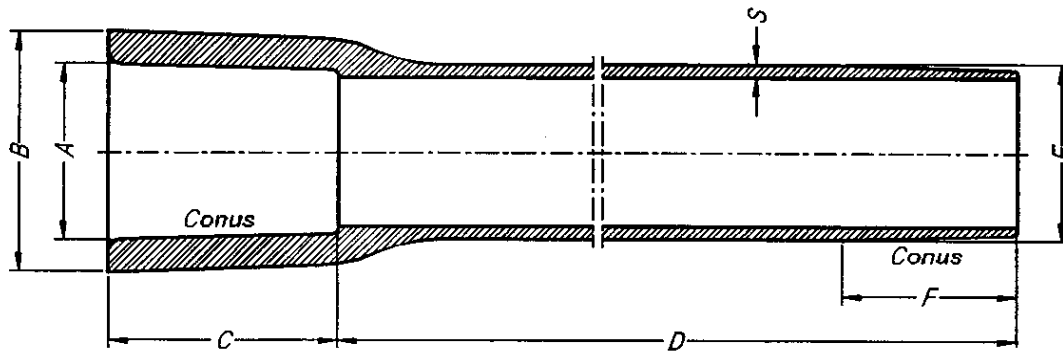


Table 2.1: Dimensions of pile pipe and dimension tolerances

	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
1) Type 98, Type 118, Type 170 – see Clause 1			

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

Type	Nominal wall thickness	5 years		25 years		50 years		75 years		100 years	
		Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity
98	6,0	0,00 mm	555	0,30 mm	525	0,60 mm	496	0,90 mm	467	1,20 mm	438
	7,5		682		653		624		594		566
	7,5		833		798		762		727		692
118	9,0	0,00 mm	986	0,30 mm	951	0,60 mm	915	0,90 mm	880	1,20 mm	845
	10,6		1144		1109		1074		1039		1004
	7,5		1225		1174		1123		1072		1022
170	9,0	0,00 mm	1457	0,30 mm	1406	0,60 mm	1355	0,90 mm	1304	1,20 mm	1253
	10,6		1699		1647		1596		1546		1495
	13,0		2052		2001		1950		1899		1848

Table 3.3: Reduced internal load bearing capacity [kN] for TRM-pile-pipes in polluted natural soils and industrial sites

Type	Nominal wall thickness	5 years		25 years		50 years		75 years		100 years	
		Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity
98	6,0	0,15 mm	540	0,75 mm	482	1,50 mm	409	2,25 mm	338	3,00 mm	268
	7,5		668		609		537		466		396
	7,5		815		745		657		571		486
118	9,0	0,15 mm	968	0,75 mm	898	1,50 mm	811	2,25 mm	724	3,00 mm	639
	10,6		1127		1056		969		883		798
	7,5		1200		1098		971		846		722
170	9,0	0,15 mm	1431	0,75 mm	1329	1,50 mm	1203	2,25 mm	1077	3,00 mm	953
	10,6		1673		1571		1445		1319		1195
	13,0		2026		1924		1798		1672		1548

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

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

Type	Nominal wall thickness	5 years		25 years		50 years		75 years		100 years	
		Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity
98	6,0	0,20 mm	535	1,00 mm	457	1,75 mm	386	2,50 mm	315	3,25 mm	- ¹⁾
	7,5		663		585		513		442		373
118	7,5	0,20 mm	809	1,00 mm	716	1,75 mm	629	2,50 mm	543	3,25 mm	458
	9,0		963		869		782		696		611
	10,6		1121		1027		940		854		770
170	7,5	0,20 mm	1191	1,00 mm	1055	1,75 mm	929	2,50 mm	804	3,25 mm	680
	9,0		1423		1287		1161		1036		912
	10,6		1664		1529		1403		1278		1154
170	13,0	0,20 mm	2018	1,00 mm	1882	1,75 mm	1756	2,50 mm	1631	3,25 mm	1507

Table 3.5: Reduced internal load bearing capacity [kN] for TRM-pile-pipes in non-compacted and non-aggressive fills (clay, schist, sand, silt,...)

Type	Nominal wall thickness	5 years		25 years		50 years		75 years		100 years	
		Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity	Loss of thickness	Reduced internal load bearing capacity
98	6,0	0,18 mm	537	0,70 mm	486	1,20 mm	438	1,70 mm	390	2,20 mm	343
	7,5		665		614		566		518		470
118	7,5	0,18 mm	812	0,70 mm	751	1,20 mm	692	1,70 mm	634	2,20 mm	577
	9,0		965		904		845		787		730
	10,6		1123		1062		1004		946		888
170	7,5	0,18 mm	1194	0,70 mm	1106	1,20 mm	1022	1,70 mm	938	2,20 mm	854
	9,0		1426		1338		1253		1169		1086
	10,6		1668		1579		1495		1411		1327
170	13,0	0,18 mm	2021	0,70 mm	1933	1,20 mm	1848	1,70 mm	1764	2,20 mm	1681

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.

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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“