

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Plastic Piping System, Thermoplastic**with type designation(s)
Polypropylene Pipes and FittingsIssued to
aquatherm GmbH
Attendorn, Nordrhein-Westfalen, Germanyis found to comply with
DNV GL rules for classification – Ships Pt.4 Ch.6 Piping systems
DNV GL class programme DNVGL-CP-0072 – Type approval – Thermoplastic piping systems**Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**Issued at **Hamburg** on **2021-02-18**This Certificate is valid until **2026-02-17**.DNV GL local station: **Essen**Approval Engineer: **Hagen Markus**for **DNV GL**Digitally Signed By: Drews, Olaf
Location: DNV GL SE Hamburg, Germany
Signing Date: 2021-02-18**Olaf Drews**
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

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Product description

Polypropylene piping system of type multi-layer and mono layer design.
 Pipe classes SDR 6, SDR 7.4, SDR 9 and SDR 11 and SDR 17.6.

Reference product catalogues "E10050 - blue pipe", "E10101 - green pipe" and "E40000 - red pipe".

Overview piping systems

Brand name	Material	SDR ¹	Size range OD mm	Design and dimensions data sheet
aquatherm green pipe	PP-R mono layer	11S ²	20 to 450	3-03_10/2012
		7.4S ²	16 to 110	3-03_11/2015
		6S ²	16 to 110	3-03_09/2013
	PP-R multi layer	7.4MF ³	20 to 355	3-04_10/2012
	PP-RCT multi layer	9MF-RP ⁴	32 to 355	3-04.2_07/2012
aquatherm blue pipe	PP-R mono layer	11S ²	20 to 160	3-03.1_09/2013
	PP-RCT multi layer	9MF-RP ⁴	32	3-03.4_05-02/2020
		11MF-RP ⁴	32 to 450	3-03.4_05-02/2020
		17.6MF-RP ⁴	125 to 450	3-03.3_05-02/2020
aquatherm red pipe	PP-R multi layer	7.4MF-HI ⁵	20 to 125	00_03/2013
		11MF ³	160	

Notes

¹ Standard dimension ratio (diameter/wall thickness)

² S: mono layer, ³ MF: multilayer (PPR), ⁴ MF- RP: multilayer raised pressure resistance (PPRCT), ⁵ MF-HI: multilayer (PPR) hardly inflammable

Overview fittings

This type approval includes joining methods and pipe fittings as specified in the product catalogue "aquatherm blue pipe catalogue".

Green pipe fitting types (use on green and blue pipes) and red pipe fittings
Sockets, Reducer, Elbow 90° and 45°, T-Piece, Cross, End Cap, Weld-In Saddle, Flange adaptor, Coupling Screw joint, Transition adaptor PP/Brass

Fitting design	
Injection moulded with fusion socket pipe connection	up to OD 125mm
Injection moulded with butt fusion pipe connection	OD 160mm up to 250mm
Butt fusion - Segment fittings	OD 250mm up to 450mm

Joining techniques pipes	
Socket fusion	up to OD125mm
Electrofusion sockets	up to OD 250mm
Butt fusion	OD 160mm up to OD 450mm
Push Fit fittings ¹	OD 90mm up to OD 450mm
Loose flange connection	OD 32mm up to 450mm

Note

¹ Application in blue pipe system only

Application/Limitation

The aquatherm PP-R piping systems are type approved for application in piping systems as listed in the table below.

Approved installation locations where "0" is specified, appropriate footnotes are to be observed.

Not approved for installation locations where "NA" or "X" is indicated and not approved for installation in gas hazardous area.

References, Rules Pt.4 Ch.6, Section 2 – 1.7 Plastic pipes "Table 1- Fire endurance requirements matrix" and para. 1.7.6 (non-essential systems)

Reference to Table 1	Item	Example of piping systems
Freshwater		
Non-essential systems	22	Potable hot and cold water ¹ and bunkerlines. Grey and black water, hot water heating, Potable water treatment systems (Osmosis and Evaporation) Chilled water and cooling water of air condition systems
Sanitary drains and scuppers		
Sanitary drains internal	24	Black and grey water including wastewater treatment and discharge lines to shore
Scuppers and discharges (overboard)	25	
Sounding and air		
Water tanks or dry spaces	26	Sounding and air pipes of water tanks and dry spaces, cofferdams
Sea water		
Non-essential systems	19	Piping systems of Ballast Water Management Systems (BWMS) ²
Essential system	12, 13, 14, 15, 16, 17, 18	Bilge main and branches, Fire main and water spray, Foam Systems, Sprinkler system, Ballast water systems, Cooling water, Tank cleaning services fixed machines
Miscellaneous		
Service air (non-essential)	29	
Brine	30	
Central vacuum cleaners	32	

Notes

¹ aquatherm green pipe only

² For installation location where "L3 and higher fire endurance levels" is required, metallic isolation valves are to be fitted at the boundary to the ballast piping system of the ship. The isolation valves shall be remotely controlled valves from outside the space, e.g. fire control station and the valve shall be a fail-safe-closing type valve.

Permissible working pressures

For freshwater, sanitary drains and scupper, sounding and air, miscellaneous systems and further non-essential systems the approved working pressure are according to the tables in catalogues E10050 (blue pipe), E10101 (green pipe and red pipe)
 For application in essential systems the nominal pressures in below table applies

Brand name	Material	SDR	PN ¹	Size range OD mm
aquatherm green pipe ²	PP-R mono layer	11S	10	20 to 450
		7.4S	16	16 to 110
		6S	20	16 to 110
	PP-R multi layer	7.4MF	16	20 to 355
	PP-RCT multi layer	9MF-RP	16	32 to 355
aquatherm blue pipe ²	PP-R mono layer	11S	10	20 to 160
	PP-RCT multi layer	9MF-RP	16	32
		11MF-RP	10	32 to 450
		17.6MF-RP	6	125 to 450
aquatherm red pipe	PP-R multi layer	7.4MF-HI	16	20 to 125
		11MF	10	160

Note

¹ Service pressure for media temperatures >25° according to aquatherm permissible working pressure tables with reduction factor of 0.5
² For piping system with Butt fusion - Segment fittings the service pressure is to be reduced by 25%.

External pressure resistance

Brand name	Material	SDR	Size range OD mm	External pressure rating
aquatherm green pipe	PP-R mono layer	11S	20 to 450	7.2bar
		7.4S	16 to 110	
		6S	16 to 110	
	PP-R multi layer	7.4MF	20 to 355	
	PP-RCT multi layer	9MF-RP	32 to 355	
aquatherm red pipe	PP-R multi layer	7.4MF HI	20 to 125	7.2bar
		11MF	160	
aquatherm blue pipe	PP-R mono layer	11S	20 to 160	7.2bar
	PP-RCT multi layer	9MF-RP	32	
		11MF-RP	40 to 450	
		17.6MF-RP	125 to 450	

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Extent of Type Tests applicable to piping system dependent on application

Fire endurance level

The aquatherm PP-R piping system as specified in this certificate is not tested with respect to Fire Endurance characteristics.

Flame spread

Surface flame spread characteristics is confirmed by ADTMD635-18 , Classification HB.

Smoke and toxicity

The aquatherm PP-R piping system is not tested with respect to capability of producing excessive quantities of smoke and toxic products as defined in IMO FTP Code, Annex 1: Part 2.

Electrical conductivity

Not applicable.

Passenger vessels

For application on passenger vessels additional requirements specified in the Rules and Regulations of the appropriate flag state authority may have to be observed.

Installation

For designing and installation of the piping system the instructions specified in the aquatherm installation instruction specified in "aquatherm blue pipe catalogue" are to be observed.

In addition, the installation requirements specific to the ship as specified by the shipyard as well as DNV GL Rules Pt.4, Ch6, Section 10 are to be observed.

Bulkhead penetration

Pipe penetration through watertight bulkheads or decks as well as through fire divisions shall be type approved unless the penetration pipe is welded into the bulkhead/deck.

When plastic pipes pass through watertight bulkheads or decks which are also a fire division and a fire may cause flooding of watertight compartments, the watertight integrity of the bulkhead or deck is to be maintained by a metallic shut-off valve fitted at the bulkhead or deck. The operation of this valve shall be provided from above the freeboard deck.

Refer to DNV GL Rules Pt.4, Ch.6 Section 3 – 1.4 Fittings on watertight bulkheads.

On passenger vessels, where the watertight bulkhead is also a fire division, the requirements of the SOLAS Chapter II - 1, Regulation 13.2.3. are to be observed.

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Type Approval documentation

Actual TAP00001WZ

Test reports

NSF International, USA

Report	Test Standard	Type	Test scope
FI20200226091141, 2020-02-26	ISO 15874-7, NSF/ANSI 14	Aquatherm blue, SDR.4MF 25x3,5mm PP-RP/PP- GF/PP-RP	Hydrostatic Strength Reference curve Verification Test

SKZ type test reports

Report	SKZ test standard	Type	Class	Dimensions mm
201371-I/19 ¹ 2020-06-22	HR 3.28:2019-06, Table B (type test)	aquatherm blue pipe PP-RCT/ PP-RCT-GF/ PP-RCT	SDR11	32x2.9, 75x6.8, 250x22.7
201371/19 2020-01-28			SDR17.6	125x7.1, 315x17.9
100513/12-II 2014-05-14	HR 3.28:2019-06, Table B (type test)	aquatherm green pipe PP-RP/ PP-RP-GF/ PP- RP	SDR9, 7.4 4bar, 6bar, 8bar,10bar	dn<63, 75<dn<225
201371/19-II ² 2019-11-04 to 2020-08-25	HR 3.28:2019-06	aquatherm blue pipe PP-RCT/PP-RCT- GF/PP-RCT	SDR9	32x3.6
			SDR11	32x2.9, 75x6.8, 250x22.7
			SDR17.6	125x7.1, 315x17.9

Notes

¹ 32mm: outer diameter of inner layer, falling ball test, long-term hydrostatic test @ 110°C /8760h, dimensions of single layers,
see SKZ test report 201371/19II.

² Type tests due to change of colour (blue instead of green) and glass fibre manufacturer.

TGM, Austria – Test report TGM – VA KU 20951/2 (E)

Test standard	Type	Class	Dimensions
EN ISO 15874-1, 2, 3, 5 Class 1 / 10bar, Class 2 / 8bar	PP-R, aquatherm fusiotherm (green pipe)	S 2.5, SDR6	16 to 110mm

Flame spread test according to ASTM D 635-18

RINA – Italy Fire & Calibration Testing

Report	Test specimens	Average burning rate (mm/min)	Date
2020CS011405/1	Aquatherm Green Pipe ¹ SDR 11 S – 8.6mm	13.5	17/07/2020
2020CS011405/2	Aquatherm Green Pipe ¹ SDR 7.4 MF – 8.9mm	11.8	17/07/2020
	Aquatherm Green Pipe ¹ SDR 9 MF RP – 8.6mm	11.8	
2020CS011405/3	Aquatherm Blue Pipe ¹ SDR11 MF RP – 8.5mm	11.6	17/07/2020
2020CS011405/4	Aquatherm Red Pipe ² SDR 7.4 MF HI – 9.2mm	0	17/07/2020

Notes

¹ Three samples, ² Ten samples

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Test reports - Pipe spools and pipes

Internal pressure short term pressure acc. to ISO 15874-2 (holding time 5 minutes),
 Burst pressure (Short term test acc. to DNVGL CP-072), Impact resistance
 Testing facilities – aquatherm GmbH, 57439 Attendorn – Labor/Qs

Test report date	Pipe spool made of pipes and fittings	ODxs (mm)	Remarks
03.02.2020	Green pipe SDR6S (PN20)	20x3.4	Pipe spool figure 1 Burst pressure: 100bar Short term: $82\text{bar}/4=20.5 >20\text{bar}$
	Blue pipe SDR11MF-RP (PN10)	90x8.2	Pipe spool figure 1 Burst pressure: 60,5bar Short term: $42\text{bar}/4=10.5 >10\text{bar}$
	Blue pipe SDR11MF-RP (PN10)	250x22.7	Pipe Burst: 53.6bar
	Blue pipe SDR17.6MF-RP (PN6)	315x17.9	Pipe Burst: 30bar Short term: $26.5\text{bar}/4=6.6\text{bar} >6$

Internal pressure short term pressure acc. to DNVGL CP-072

Testing facilities – aquatherm GmbH, 57439 Attendorn

Test report date /ID	Pipe spools made of pipes and fittings	Pipe OD / PN	Burst pressure bar
aquatherm			
2020-12-17 2020110113/000 2020110115/000 2020110118/000 2020120030/000	Red SDR7,4MF-HI	40/16	89.28 > 4xPN
		75/16	80.84 > 4xPN
		160/10	52.24 > 4xPN

Internal pressure short term pressure acc. to DNVGL CP-072

Testing facilities SKZ Würzburg

SKZ			
2020110222	Blue SDR17.6 MF-RP push-fit socket	250x14.2 /6	39,22 > 4xPN
2020110226	Blue SDR11 MF-RP electrofusion socket	250x22.7/10	57.36 > 4xPN
2020-11-17 213653/20-1	90° segmental bends PP-RCT/PP-RCT-GF/ PP-RCT	450x40.9(SDR11), PN10	50.3 > 4xPN
		450x25.5 (SDR 17.6), PN6	30.2 > 4xPN
2020-11-10 20200110088		450 (SDR17.6), PN6	30.21 > 4xPN
2020-11-11 2020110089/002		450 (SDR11), PN10	50.29 > 4xPN

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Internal pressure short term pressure acc. to DNVGL CP-072

Pipe spools made of straight pipe, tee, elbow and caps.

Joining techniques pipes	
Socket fusion	up to OD125mm
Electrofusion sockets	up to OD 250mm
Butt fusion	OD 160mm up to OD 450mm
Push Fit fittings	OD 90mm up to OD 450mm

Test reports

SKZ No. 213653/20-III 2021-02-04	blue pipe 17.6 MF-RP with butt fusion joints	Pipe spool made of pipes and fittings (90° elbow, T-piece, End cap), material PPRCT/PPRCT-GF/PPRCT, dimension 450x25,5mm (SDR 17.6, PN6) Tp: 18 bar, Sf=3, PN6
SKZ No. 213653/20-II 2021-02-04	blue pipe 11 MF-RP with butt fusion joints	Pipe spool made of pipes and fittings (90° elbow, T-piece, End cap), material PPRCT/PPRCT-GF/PPRCT, dimension 450x40.9mm (SDR 11, PN10) Tp> 30bar, Burst pressure: 42bar, Sf>3, PN10
aquatherm, 2021020028/004, 2021-02-16	Blue 17.6 MF-RP, flange adapter	Two pipes connected by flange adapter 450x25,5mm, PN6
aquatherm, 2020-12-17	red pipe, PP-R multi-layer, SDR11MF-HI (PN10)	Pipe spool made of pipes and fittings of size 40, 75, 160mm
aquatherm, 2021020005/00, 2021-02-04	blue pipe , SDR11 MF-RP	Pipe spool made of pipes connected by push fit coupling size 250mm, Tp >40bar
aquatherm, 2021020002/00, 2021-02-03	blue pipe , SDR9 MF-RP	Pipe spool made of pipes connected by push fit coupling size 450mm, Tp >64bar

Impact test reports

Testing facilities – aquatherm GmbH, 57439 Attendorn – Labor/Qs

Test report date	Pipe type	ODxs/PN	Remarks
03.02.2020 2020070033 2020070034	Green pipe SDR6	20x3.4mm	H50: 1.19
		50x8.3mm	H50: 1.69

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External pressure tests

IMA Test report V391/20, 2020-12-17

Buckling pressure determination by testing and calculation for sizes DN250 up to DN 450

Brand name	Material	Size range OD (mm)	SDR, (PN)	Tested Dimensions	Buckling pressure bar	Pext bar
aquatherm blue pipe	PP-RCT multi-layer	40 to 450	11MF-RP (10)	d160 SDR11, 160x14.6	20,22,22 Average: 21.3	7.2
				d200 SDR11, 200x18.2	23,22,22 Average: 22.3	
				d250 up to d450	Calculated Average: 21	
		125 to 450	17.6MF-RP (6)	d160 SDR17.6, 160x9.1	6, 6,5, 5,5 Average: 6bar	1.8
				d200 SDR17.6, 200x11.4	5,1,5,1,5,1 Average 5.1bar	
				d250 up to d450	Calculated Average 5.4bar	
aquatherm red pipe	PP-R multi-layer	20 to 125	7.4MF HI (16)	Not tested due to bigger/same wall thickness as tested pipe types		
		160	11MF (10)			
aquatherm green pipe	PP-R mono layer	20 to 250	11S (10)			
		16 to 110	7.4S (16)			
		16 to 110	6S (20)			
		PP-R multi-layer	20 to 250		7.4MF (16)	
aquatherm green pipe	PP-RCT multi-layer	32 to 250	9MF-RP (16)			
		aquatherm blue pipe	PP-R mono layer		20 to 160	11S (10)
aquatherm blue pipe	PP-RCT multi-layer	32	9MF-RP (16)			

Miscellaneous documents

- aquatherm product catalogues:
 - “aquatherm blue pipe” – E10050, 2019-02
 - “aquatherm green pipe” – E10101, 2020-08
 - “aquatherm red pipe” – E40000, 2017-02
- DNVGL Application for Type Approval, 2019-10-15
- Quality management
- ISO 9001:2015 certificate 01 100 5348, TÜV Rheinland Cert GmbH, 2018-01-23
- Quality control sheets “Regelüberwachung” EX-
- Quality plan “SKZ HR 3.28 – Specification for tests and inspection”.
- Process descriptions
- DNVGL Assessment report – Production place aquatherm Attendorn, 2020-07-15

Previous type approval certificate 86 069-96HH

Reference DNV GL Ref.No.: 15-057206


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Tests carried out

- Internal Pressure Short-term on pipe spools
- Internal Pressure Long-term test acc. to piping system design standard
- External Pressure, External load and Impact resistance
- Flame spread test acc. to ASTM D635-18
- Type tests according to industrial standards:
 - SKZ type test programme HR 3.28:2019-06, Table B (type test)
 - NSF ISO 15874-7, NSF/ANSI 14
 - TGM, Austria EN ISO 15874-1, 2, 3, 5

Marking of product

Each component of the piping system is to be marked to ensure traceability to this certificate.

Product	Scope	Example
Pipes	Brand logo	a
	Brand name	aquatherm blue pipe SDR 17.6 MF-RP
	Material grade	PP-RP/PP-RP-GF/PP-RP
	Standard	ASTM F2389
	Dimension ODxs	75x6.8mm
	Colour	blue
	Traceability code Production date, time, Machine code	LA-27.06.19-4 11.07.19Time,M-08GPXC3116K72
Fittings	Dimension	
	Brand logo	
	Material	

Periodical assessment

For retention of the Type Approval, a DNV GL Surveyor shall perform periodical assessment to verify that the conditions for the Type Approval are complied with.
Refer to the Class Programme DNVGL-CP-0338, Sec.4.

To check the validity of this certificate, please look it up in <https://approvalfinder.dnvgl.com>

End of certificate