

# Jetting resistance of drain and sewer pipes

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## Standards and test protocols : Moving jet test method

Reference	Date	Pressure	Flow rate	Jet power density	Number of jets	Jet spread angle	Nozzle orifice diameter	Vertical distance between the test surface and the nozzle orifice	Velocity of travel
DIN 19523 "Material test"	août-08	unspecified	35.7 L/min	450 W/mm <sup>2</sup>	1	30°	2.5 mm	10 mm	0.2 m/min (3 cycles)
DIN 19523 "Practical test"	août-08	unspecified	280 L/min	330 W/mm <sup>2</sup>	8	30°	2.6 mm	unspecified	1 m/s (60 m/min) forth and 0.1 m/s (6 m/min) back (60 cycles)
CEN/TR 14920	mars-05	12 Mpa	46 L/min	480 W/mm <sup>2</sup>	1	30°	2.8 mm	10 mm	1 m/min (50 cycles)
"Hamburger Modell"	août-02	12 Mpa	320 L/min	798 W/mm <sup>2</sup>	8	30°	2.4 mm	unspecified	1 m/s (60 m/min) forth and 0.1 m/s (6 m/min) back (30 cycles)
PR DIN 19517 Moving jet test	janv-02	12 Mpa	46 L/min	481 W/mm <sup>2</sup>	1	30°	2.8 mm	8.5 mm	1 m/min (50 cycles)
PR DIN 4264	oct-99	12 Mpa	320 L/min	798 W/mm <sup>2</sup>	8	30°	2.4 mm	unspecified	1 m/s (60 m/min) forth and 0.1 m/s (6 m/min) back (60 cycles)

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## Standards and test protocols : Stationary jet test method

Reference	Date	Pressure	Flow rate	Jet power density	Number of jets	Jet Spread angle	Nozzle orifice diameter	Vertical distance between the test surface and the nozzle orifice	Number of tests on a sample	Test period
PR DIN 19517 - Stationary jet test	janv-02	12 to 34 Mpa	3.65 to 8.25 L/min	116 to 1337 W/mm <sup>2</sup>	1	30°	1 mm	5 mm	10	unspecified
Draft CEN/TR 14920 Stationary jet test	avr-01	12 to 34 MPa	3.65 to 8.25 L/min	116 to 1337 W/mm <sup>2</sup>	1	30°	1 mm	5 mm	10	3 min
WIS 4-35-01 - "Specification for thermoplastics structured wall pipes - Supplementary test requirements"	oct-08	the pipe shall withstand a jetting pressure of 180 bar without damage	No flow rate specified (The pump shall be capable of delivering 40L/min of water pressure)	/	1	30°	1.5 mm	5 mm	5	2 min
High-Pressure Water Jetting : Avoiding Damage to Sewers	août-98	34 MPa : pressure limit for concrete pipes	unspecified	/	1	30° or 45°	1.4 mm	5 mm	5	2 min

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## Pressure/Flow rate/Type of nozzle : Laboratory test (1 jet per nozzle)

Parameters	CEN/TR 14920	DIN 19523							
<b>Nozzle :</b>									
Number of jets	1								
Nozzle orifice diameter	2.8 mm	2.5 mm							
Jet spread angle	30°								
Flow rate	46 l/min	35.7 l/min							
Pressure	2 MPa	7.3 MPa	8.3 MPa	9 MPa	11.5 MPa	15 MPa	20.5 MPa	29.3 MPa	
Jet power density	480 W/mm <sup>2</sup>	450 W/mm <sup>2</sup>							
Coefficient of discharge C <sub>d</sub>	0.805	1	0.94	0.9	0.8	0.7	0.6	0.5	
Velocity of travel	1 m/min	0.2 m/min							
Test period	50 cycles (back and forth)	3 cycles (back and forth) ; these 3 cycles are laterally spaced (10cm)							
<b>Test sample :</b>									
Sample length	13 m (1m used)								
Vertical distance between the test sample and the nozzle orifice	10 mm	10 mm							

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## Pressure/Flow rate/Type of nozzle: Simulation of field conditions

Paramètres	DIN 19523							DWA-M 143-20
Nozzle :								
Number of jets	8							8
Nozzle orifice diameter	2,6 mm							2,4 mm
Coefficient of discharge Cd	1	0.94	0.9	0.8	0.7	0.6	0.5	0.95
Jet spread angle	30°							30°
Flow rate	280 l/min to 285 l/min → 35 l/min for one orifice							320 l/min → 40 l/min for one orifice
Pressure	6 MPa	6.8 MPa	7.4 MPa	9.4 MPa	12.3 MPa	16.7 MPa	24.1 MPa	12 MPa
Jet power density	330 W/mm <sup>2</sup>							800 W/mm <sup>2</sup>
Velocity of travel	Forth : 1 m/s Back : 0,1 m/s							Forth : 1 m/s Back : 0,1 m/s
Number of cycles	60 cycles							30 cycles
Test sample :								
Sample length	15 m							20 m
Additional test parameters	3 pipe joints on the sample							- Addition of gravel for each cycle (5l of gravel 3/6mm) - Additional stationary test (3 x 3 min)

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## Testing parameters vs field practices

### FRENCH TRENDS:

> 250 l/min, 120 MPa

But

> Which jet power density (330 W/mm<sup>2</sup>, 450 W/mm<sup>2</sup>, 800 W/mm<sup>2</sup>) ?

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## Testing parameters vs field practices

RESULTS BASED ON 8 NOZZLES/HEAD:

		Nozzle orifice diameter				
		2.1 mm	2.4 mm	2.6 mm	2.8 mm	
Pressure : 12 MPa	Coefficient of discharge : 0.9 (Round jet)	Flow rate	232 L/min	303.2 L/min	356 L/min	412.8 L/min
		Jet power density	678 W/mm <sup>2</sup>	678 W/mm <sup>2</sup>	678 W/mm <sup>2</sup>	678 W/mm <sup>2</sup>
	Coefficient of discharge : 0.7 (Flat jet)	Flow rate	180.8 L/min	236 L/min	276.8 L/min	320.8 L/min
		Jet power density	319 W/mm <sup>2</sup>	319 W/mm <sup>2</sup>	319 W/mm <sup>2</sup>	319 W/mm <sup>2</sup>

		Nozzle orifice diameter				
		2.1 mm	2.4 mm	2.6 mm	2.8 mm	
Flow rate : 250 L/min	Coefficient of discharge : 0.9 (Round jet)	Pressure	13.9 MPa	8.2 MPa	5.9 MPa	4.4 MPa
		Jet power density	847 W/mm <sup>2</sup>	380 W/mm <sup>2</sup>	235 W/mm <sup>2</sup>	151 W/mm <sup>2</sup>
	Coefficient of discharge : 0.7 (Flat jet)	Pressure	23 MPa	13.5 MPa	9.8 MPa	7.3 MPa
		Jet power density	847 W/mm <sup>2</sup>	380 W/mm <sup>2</sup>	235 W/mm <sup>2</sup>	151 W/mm <sup>2</sup>

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