Product Catalogs

Sewer Manholes

For sewerage and drainage systems
as well as for municipal and industrial applications

wavin

An Orbia business.

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Introduction

Wavin is an innovative provider of solutions for construction and infrastructure across multiple continents. Supported by over 60 years of experience, the company is prepared to meet the world's greatest challenges, in terms of:

- safe and effective water supply,
- improving sanitary and hygienic conditions,
- climate-resilient cities
- and more efficient buildings.

At **Wavin** we focus on creating positive changes in the world, and our passion is building a healthy, sustainable environment. We engage and collaborate with city leaders, engineers, planners, and installers to make cities future-ready and buildings comfortable and energy-efficient.

Wavin is part of **Orbia**, a community of companies united by a common goal: to advance life around the world. Wavin employs over 11,500 people in more than 40 countries worldwide.

We provide:

Outdoor sewerage solutions
A rich offer of pipe systems for building durable and reliable sewer networks – both gravity and pressure – as well as a wide range of manholes and inspection chambers with various diameters, levels of technical advancement, and intended applications.

Stormwater management solutions
A comprehensive offer of systems for collecting rainwater, its transport to discharge points, purification, and also retention and infiltration.

Drinking Water Solutions
Wavin's offer includes a wide range of reliable systems for bringing utility water to the building and its distribution inside. They ensure the highest standards of safety and hygiene.

Indoor sewerage systems
A wide choice of systems and products with varied properties, including low-noise installations that meet even the most stringent acoustic protection parameters.

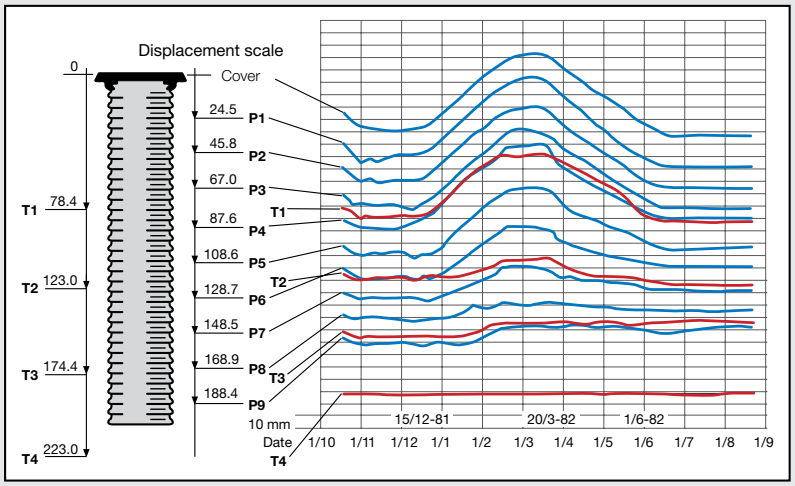
Comfort systems
Our offer of systems that enhance comfort in our homes includes mechanical ventilation with heat recovery, a rich selection of pipes and fittings made from various materials ensuring the highest standards in central heating and surface heating installations – floor, wall, and ceiling heating, and automation for controlling comfort systems.

1. Introduction

For nearly 70 years, we have closely observed the needs of our clients and sought optimal solutions for them. The problems of owners, operators, and users of sewer systems are our problems. We are well acquainted with the requirements set for modern sewer networks, and our pioneering solutions meet these demands. Nearly 30 years ago, we were the first in Poland to propose non-access manholes DN 315 and 425, followed by plastic manhole chambers with a diameter of 1000 mm. We constantly expand the possibilities for designing and constructing networks based on patented solutions, making our offer exceptional, meeting the increasing demands of investors and future operators.

To ensure its high-quality services, Wavin utilizes its own experience and conducts laboratory and field trials. Many of these real-scale studies are long-term. The oldest research sites are over 30 years old. Such includes the study of the behavior of core chamber pipes in the ground under varying temperature conditions, characteristic of the temperate climate. These studies are an invaluable source of knowledge, confirming the unique nature of the cooperation between corrugated core pipes and the ground and the effectiveness of the adopted structural solutions in protecting hardened surfaces. The Wavin Technology & Innovation central laboratory in the Netherlands and the plant laboratories in various factories, including the factory in Buk, are responsible for conducting the trials.

Behavior of the corrugated pipe in the ground



Legend

- changes in ground level due to temperature changes in the annual cycle
- corrugated pipe displacement

Purpose

Wavin manholes are an essential element of sewer network equipment. They are used for the operation of sewer networks from the surface level (inspection manholes) or allow service access to them (access manholes). Together with smooth-walled sewer pipes made from thermoplastic materials (PVC-U, PP, PE) and Wavin X-Stream structural pipes, they form coherent systems of gravity sewerage (sanitary, stormwater, and combined). They also complement Wavin drainage systems. Using transitional adapters, Wavin manholes can also be connected to sewer systems made from traditional materials.

Wavin manholes are used in sewer junctions as through manholes (straight and angled) and connection manholes. Prefabricated basin components allow for the construction of various rainwater drains equipped with inlets and designed for point drainage of hardened surfaces.

Additionally, Wavin manholes are used as expansion and cascade manholes, as well as underground enclosures for equipment (water meters, fittings, storm shutters and valves, pumping stations).

When standard solutions are insufficient or the needs of the investment are unique, Wavin offers custom-made manholes, constructed from structural pipes made of polyethylene (PE) or polypropylene (PP).

Due to their properties, Wavin manholes also find application in various sectors of the economy (industry, agriculture) – as equipment for technological networks.

2. Legal aspects – approvals for use

For most Wavin manholes, the reference standard is EN 13598-2. Catch basins comply with Technical Assessment / Technical Approval PL.

Components related to manholes are produced in accordance with the standards: EN 13598-2, EN 124, EN 1401, EN 14396, EN 681 or with national technical assessments ITB or Technical Approval PL. A detailed list of standards is available in chapter 19.

Types of documents for individual manhole components

	Components	Legal acts – reference document with specified requirements	Confirmation
Sewer manholes Tegra 1000, 600, 425 Basic 600, 425, 400, and 315	shafts	EN 13598-2	Polish National Declaration of Performance
	core pipes		
	cones 1000/600		
	from structural pipes – for custom orders	Technical Assessment / Technical Approval	Polish National Declaration of Performance
	telescopic pipes, telescopic adapters for manholes	EN 13598-2	Polish National Declaration of Performance
Catch basins	settler and non-settler manholes	EN 17670-2	Polish National Declaration of Performance
	core pipes	EN 13598-2	Polish National Declaration of Performance
	siphons	Technical Assessment / Technical Approval	
	floating debris filters	Technical Assessment / Technical Approval	
	telescopic pipes	EN 13598-2	Polish National Declaration of Performance
Crown components	iron covers	EN 124	Polish National Declaration of Performance + third-party certificate
	inlets		
	basins		
	PP covers	EN 124	Polish National Declaration of Performance
	reinforced concrete covers	Technical Assessment / Technical Approval	Polish National Declaration of Performance
	TAR plastic covers	Technical Assessment / Technical Approval	Polish National Declaration of Performance
	reinforced concrete surface elements: cones, relief rings, adapters under basins	Technical Assessment / Technical Approval	Polish National Declaration of Performance
	TAR plastic surface elements: cones, relief rings, adapters under basins	Technical Assessment / Technical Approval	Polish National Declaration of Performance
Accessories	"in-situ" inserts	EN 1401	Polish National Declaration of Performance
	"in-situ" seals	PN-EN 681-1	EC Declaration of conformity
	Tegra 1000 manhole ladders	PN-EN 14396	CE Declaration

Explanation

KDWU – Polish National Declaration of Performance with the following content:

1. trade name of the construction product
2. construction product type designation
3. intended use
4. name and address of the manufacturer's headquarters
5. product's manufacturing site
6. national system used to assess and verify performance consistency
7. national technical specification
8. declared performance

DWU – CE Declaration of Performance containing the following information:

1. trade name of the construction product
2. construction product type designation
3. intended use as specified by the manufacturer
4. name and address of the manufacturer's headquarters
5. product's manufacturing site
6. system used to assess and verify performance consistency
7. harmonized technical specification
8. declared performance

Note: For a list of tests required by standards, see Chapter 18.

Wavin Tegra manholes also have **GIG approvals** for use in mining damage areas, with usage conditions in mining areas specified as follows:

Shaft	Core	Mining site category			
		Category. I	Category. II	Category. III	Category. IV
Tegra 1000	SN > 2 kN/m^2	6 m + Hk	4.4 m + Hk	2.7 m + Hk	2.2 m + Hk
	SN > 3 kN/m^2	6 m + Hk	4.9 m + Hk	2.9 m + Hk	2.4 m + Hk
	SN ≥ 4 kN/m^2	6 m + Hk	6 m + Hk	6 m + Hk	6 m + Hk
Tegra 1000	Tegra 1000 PE	5 m + Hk	5 m + Hk	5 m + Hk	
Tegra 600 and 425	SN ≥ 4 kN/m^2	6 m	6 m	6 m	6 m

Hk – height of the shaft

Most Wavin manholes (Tegra series as well as Basic 425, 400, and 315) also have a positive opinion from the Railway Institute, allowing their use in railway infrastructure.

Other certifications

- Tegra 1000: CSTB France (NF mark), BCCA Belgium (BENOR mark), KIWA Netherlands (KOMO mark)
- Tegra 600: CSTB France (NF mark), MPA Germany (DIBT mark), DTI Denmark (Nordic Poly Mark), BCCA Belgium (BENOR mark), KIWA Netherlands (KOMO mark)
- Tegra 425: DTI Denmark (Nordic Poly Mark), KIWA Netherlands (KOMO mark)

Marking

Marking of shafts according to the EN 13598-2 standard includes permanently affixed information on the shaft:

- Wavin manufacturer code and/or trademark
- material, e.g. PP,
- name (from the internal diameter) or diameter of the manhole, e.g., Tegra 425,
- diameters of core pipes and connectors, e.g. DN 200,
- standard number, e.g. EN 13598-2
- maximum permissible groundwater level in the form of a pictogram specified in the standard,
- construction mark B
- production date and the snowflake symbol plus certification body marks.

Marking of core pipes according to the EN 13598-2 standard includes permanently affixed information on the pipe:

- manufacturer's name and/or mark: Wavin,
- material, e.g. PP,
- nominal pipe diameter, e.g. DN/ID 400,
- standard number, e.g. EN 13598-2
- construction mark B
- manufacturing date
- declaration of conformity number
- certification body marks.

Naming of Wavin manholes according to the standard is based on the internal diameter DN/ID – for such manholes, the name DN is still used. Only the DN/OD 400 series refers, following the market trend, to the external diameter. The catalog name accurately conveys this fact – DN/OD; only the product names in commercial documents use DN 400 – due to text length limitations.

Marking of iron hatch covers and basins in accordance with the standard EN 124 includes the following data:

- manufacturer's code or mark (on the cover and body),
- certification body mark,
- standard number,
- load class printed on all components,
- construction mark B.

Note: For more information on confirming compliance with standards, see Chapter 18.

3. Wavin Manholes Overview

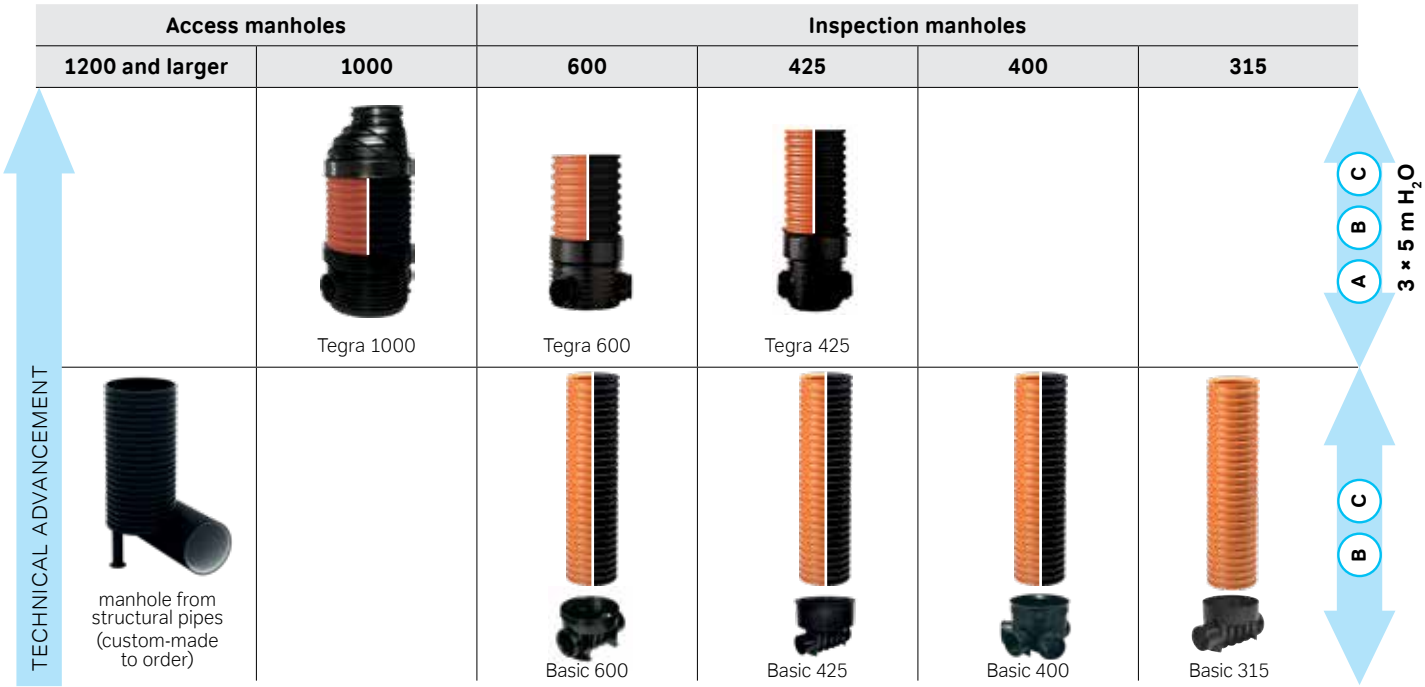
– types categorized by technical advancement

Today's demands on sewer systems are very high. The implemented solutions must ensure durability, watertightness, proper hydraulic conditions, chemical resistance, and thermal stability. They must also be adapted to operational conditions.
Synthetic manholes are characterized differently from conventional manholes. This differentiation is marked by defining their area of use and by the employed strength parameter, which is the maximum allowable groundwater level.

The maximum allowable groundwater level is a technical parameter for manholes, which the manufacturer is responsible for specifying. **It defines the manhole's durability and strength, similar to, for example, the ring stiffness in gravity pipes.**

Wavin offers a full range of solutions, ranging from highly technically advanced options to rationalized solutions that meet moderate requirements.

Wavin manhole types categorized by technical sophistication

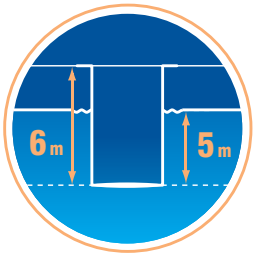


The Tegra manhole family meets the criteria of 3 × 5 m H_2O

What does 3 × 5 m H_2O mean?

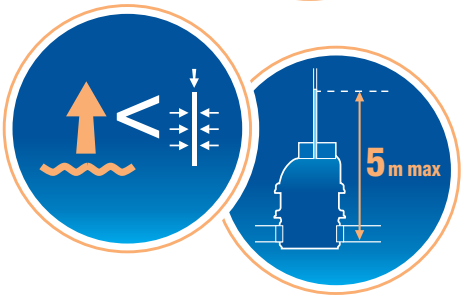
A **5 m H_2O – Verified by long-term testing according to standard EN 13598-2**, ensuring durability and structural integrity for at least 50 years.
Resistance to the pressure of a 5-meter column of water, which places a load on the synthetic manhole, means no deformation of the hydraulic profile that would disqualify further use or compromise its safety and reliability for many years.

REQUIRED STANDARD PARAMETER



B **5 m H_2O – Ability to withstand buoyant forces under standard installation conditions** (without additional installation procedures).

C **5 m H_2O – 100% manhole tightness**
– leak-tight even under D test conditions. (Test Condition D simulates the behavior of synthetic pipes in soil, making the test accurate and reflective of real conditions. During the test, the pipes are angularly displaced and bent as they might be in the ground).



4. Areas of application

According to standards, the application area confirmed by testing and declared includes the following parameters:

- Maximum groundwater level,
- Maximum installation depth,
- Maximum traffic load.

Many projects require extended information, such as approvals for areas subject to special conditions like mining areas or railway engineering zones.

Technical Parameters / Application Area*

	Basic manholes				Tegra manholes		
	315	**400**	**425**	**600**	**425**	**600**	**1000**
Maximum groundwater level* from the bottom	3 m	3 m	3 m	3 m	5 m	5 m	5 m
Maximum depth	6 m**	6 m**	6 m**	6 m**	6 m**	6 m**	6 m**
Traffic load, hatch load classes	SLW 60; D 400						
Manhole tightness	5 m	5 m	5 m	5 m	5 m ***	5 m ***	5 m ***
Resistance to groundwater buoyancy	5 m	5 m	5 m	5 m	5 m	5 m	5 m
GIG	up to Cat. IV with concrete			–	up to cat. IV		
IK	✓	✓	✓	–	✓	✓	

* Without special installation procedures (ground reinforcement, concreting, anchoring, weighting, etc.).
** Maintaining the maximum allowable groundwater level; greater depths possible.
***** Tests by European certification bodies (e.g. DiBT) confirm the watertightness of Tegra manholes at a level of 2.4 bar.**

Thanks to decades of experience, the use of thermoplastics, the implementation of advanced structural solutions, and the application of state-of-the-art manufacturing techniques, Wavin manholes meet regulatory standards, ensure safety, and also eliminate standard problems associated with sewer network equipment.

Technically advanced manholes are designed to handle the maximum static and dynamic loads anticipated by standards. They possess a high safety factor, ensuring reliability and durability under all conditions.

Wavin's range also includes manholes with rationalized technical parameters in terms of height. Reliable information allows for the safe use of these manholes, simultaneously ensuring the functionality and durability of the system.

5. Manhole-specific shaft configurations

Overview of prefabricated shafts

Tegra 1000, Tegra 600 and Tegra 425

			SW connectors							XS connectors					
			110	160	200	250	315	400	500	150	200	250	300	400	500
1	flow shafts 0° (15° L-15° P)		425	425 600 1000	425 600 1000	425 600 1000	425 600 1000	600 1000	1000	425 600	425 600	425 600	425 600 1000	600 1000	1000
2	flow shafts 30° (15-45° L and 15-45° P)			425 600	425 600 1000	600 1000	600 1000			425 600	425 600	600	600 1000		
3	flow shafts 60° (45-75° L and 45-75° P)			425 600	425 600 1000	600 1000	600 1000			425 600	425 600	600	600 1000		
4	flow shafts 90° (75-90° L and 75-90° P)			425 600 1000	425 600 1000	600 1000	600 1000			425 600	425 600	600	600 1000		
5	collector shaft 90°		425	425 600 1000	425 600 1000	600 1000	600 1000			425 600	425 600	600	600 1000		
6	type T shafts			425 600	425 600	600	600			425 600	425 600	600	600		
7	connection shaft 90° P			1000	1000	1000	1000						1000		
8	connection shaft 90° L			1000	1000	1000	1000						1000		
9	collector shaft 45°			600 1000	600 1000	1000	1000				600		600 1000	600	600
10	connection shaft 45° P			1000	1000	1000	1000						1000		
11	connection shaft 45° L			1000	1000	1000	1000						1000		
12	end shaft				600	600	600				600	600	600		
13	side inflows 160 or 200 in the form of bare connectors					425 600	425 600	600				425 600	425 600	600	
14	blank shafts/bottoms		425 600 1000												

All connectors for connecting SW sewage pipes in the range of 160–315 and XS in the range of 150–300 are equipped with adjustable sockets ± 7.5°

Broader possibilities arising from the adaptation of standard products – see: Chapter 14.

SW – connectors for smooth walled pipes
XS – connectors for double-walled pipes Wavin X-Stream
400, 500 – non-adjustable

Basic 600, 425, 400 and 315 manholes

		SW connectors					XS connectors		
		110	**160**	**200**	**250**	**315**	**500**	**600**	**800**
flow shafts 0°		315 400[1] 425	315 400[1] 425 600	315 400[1] 425 600	400[3] 425[3] 600	400[3] 425[3] 600	400 425	400 425	400 425 600
collector shaft 45°		315 400[1] 425	315 400[1] 425 600	315 400[1] 425 600	600	600			
collector shaft				315[2] 425[2]					
side inflows 160 or 200 in the form of connectors (form)					400[3] 425[3]	400[3] 425[3]			
blank shafts or bottom		315 400 425							

[1] Socketed outlet.
[2] 200/160.
[3] Bare inflow connectors.

6. Your needs, our know-how

Our know-how

- **Use of thermoplastics: PP, PE, PVC-U**
- **Leveraging developments in plastics manufacturing technology**
- **Ability to implement unique structural solutions**
- **Leveraging decades of European experience, real-scale and laboratory research**
- **Ensuring the highest quality of offered systems and compliance with standards, directives, regulations, and industry rules**

Your needs

- **Design-friendly**
- **Reliable without special execution modes – responsibility for durability lies with the product**
- **Eliminating common problems and reducing operating costs of sewer networks**
- **Occupational safety, health and ergonomics in operational activities**
- **Minimizing environmental nuisances**
- **Minimizing environmental impact and fulfilling functional requirements following sustainable development principles**

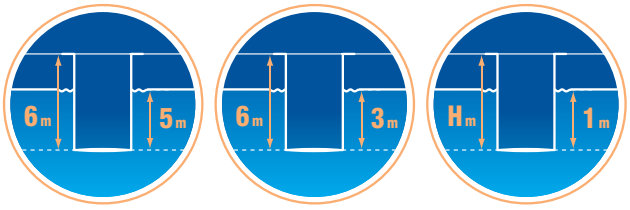
Our specialists are esteemed experts in the industry. We gladly provide technical support at every stage of the investment – from design to operation.

Investors, designers, and contractors collaborating with us receive solutions of very high quality, confirmed by decades of field research.

6.1. Design-friendly

Wavin manholes are meticulously designed to support designers' work. They take into account construction art norms and the realities of soil and climatic conditions, thereby helping to perform design work in compliance with the responsibilities arising from building law – i.e., legislative requirements, regulations, and principles of technical knowledge.

- Wavin's range of manholes is the broadest on the market–it ensures a choice based on the technical sophistication of the products: from the highest level to rationalized according to requirements. By ensuring the right quality, the solution can be tailored to the economic expectations of the investor.



6/5 6/3 H/1

- Every designer will find solutions in Wavin's offering that are tailored even to the most challenging investment conditions and special applications.
- Wavin-certified adaptations of manholes to:
  – Climatic conditions (freezing and thawing processes)
  – Various soil and water conditions and their changes over time (weak, waterlogged soils with fluctuating groundwater levels),
  – Various static loads (depths) and dynamic loads (traffic load), providing designers with professional support in problem-solving and consequently comfort and safety in designing.

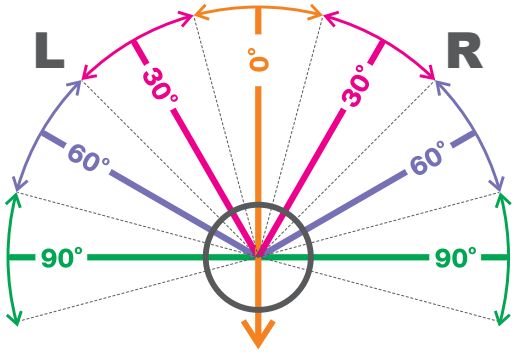
- The broadest range of configurations on the market – offering the most possibilities for correctly solving sewer network junctions using prefabrication.

Unique in the market:

45° and 90° collector shafts for 1000 access manholes,

shafts for directional changes in the Tegra series: 1000, 600, and 425,

90° collector shafts among Tegra 425 shafts.



4 shafts (0°, 30°, 60° i 90°)

Direction change possible at any angle (90° L ÷ 90° R)

0° = 15° L÷15° R
30° = 15° R ÷ 45° R or 15° L ÷ 45° L
60° = 45° R ÷ 75° R or 45° L ÷ 75° L
90° = 75° R ÷ 95° R or 75° L ÷ 90° L

Also expressed as angles up to 360°

0° = 180°, considering the adjustment range of 165°-195°

30° = 150° and 210°, considering the adjustment range of 135°-165° and 195°-225°

60° = 120° and 240°, considering the adjustment range of 105°-135° and 225°-255°

90° = 90° and 270°, considering the adjustment range of 90°-105° and 255°-270°

- In Tegra shafts, adjustable sockets ensure that angular shafts allow for any shaping of network bends – all angular changes in the sewer are possible within the scope of the manhole (without elbows).
- Many configurations may have additional applications:
  a) collector shafts can also be used with a single-side inflow,
  b) angular shafts with a single-side inflow can be applied as either a right or left solution,
  c) blind shafts can be used as bottoms for settlers, sealed tanks for underground measuring devices, or fittings.
- A wide range of adapters for connection with conventional systems.

6.2. Reliable without special execution modes

Solutions meticulously conceived from years of experience and know-how are contractor-friendly. They take into account their specific needs:

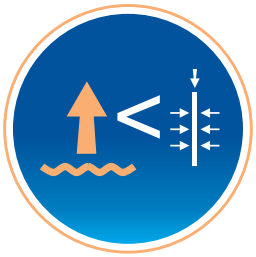
- do not transfer responsibility for durability and reliability onto various types of execution regimes and special installation procedures – maximum responsibility lies with the product,
- facilitate easy and rapid progression of construction works,
- minimize the most common construction issues affecting the acceptance of works,
- ensure reliability and eliminate the problem of complaints.

Such solutions include:

- **Manhole designs – lightweight, not burdening the surface; they do not require ground reinforcement and do not settle even under the influence of significant dynamic loads.**

- Unique, specially designed for vertical installation, corrugated core pipes – easily interact with surrounding soil classes 1–4, creating indestructible structures that flexibly respond to soil dynamics (cyclic heaving and settling due to freezing and thawing) and to settling caused by soil consolidation.

These unique behaviors of Wavin manholes significantly eliminate the most commonly occurring problems at the interface of manholes and surfaces.



- The developed surface area of the manhole walls (rich ribbing of shafts or grooving of manhole cores) protects against buoyancy even at the maximum groundwater level. This ensures a favorable distribution of forces throughout the height of the manhole, maintaining it securely in the ground. It requires no procedures such as concreting, weighting, or anchoring during construction and eliminates adverse stresses found at point protection against buoyancy.

- The flat bottom of Tegra manholes eliminates the need for laborious filling of void spaces under the manholes for contractors.

- Adjustable socket connectors in the pipes are a good solution for critical points in the sewer system – the junctions where horizontal pipelines connect with the vertical structure of manholes. They eliminate stresses in the pipes connected to the manholes, thus preventing leaks and typical damages found in rigid pipelines (cracks and chippings).

- Configurations also influence the construction organization cycle. Shafts are readily available, and their application possibilities are broad, thus reducing the need for large stocks on-site. This is also an ideal solution from a logistical standpoint – one supplier for a complete set of components for building any sewer network.

- Many attributes of manholes reveal their value in unpredictable situations. For example, adjustable sockets allow for quick problem-solving in the event of collisions with uncharted underground utilities at the work site.

- Many popular connections can be quickly executed on-site using simple tools, thanks to the reliable and watertight “in-situ” inserts provided.

6.3. Eliminating common problems during use and reducing operational costs of sewer networks

Tangible benefits are achieved by the operators of sewer networks with Wavin manholes. At the investment stage, the cost of a complete Wavin sewer system is comparable to others; it may be lower with a well-thought-out deployment of manholes. Its standard significantly affects the reduction of operational costs.

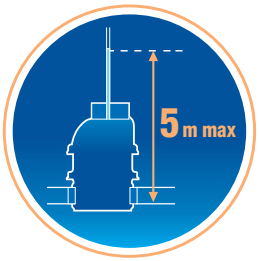
- In Wavin synthetic manholes, which are resistant to a wide pH range (2 ≤ pH ≤ 12), operators do not experience the troublesome phenomena of sulfate corrosion, characteristic of concrete manholes. The elimination of these phenomena is becoming increasingly necessary due to the increasing aggressiveness of sewage, which accompanies decreasing water usage, increasing consumption of aggressive household chemicals, or increasing amounts of aggressive discharges from local boiler houses (e.g., condensates from condensing boilers). It is especially essential in systems where sewage stagnation occurs and gases create an aggressive and corrosive environment (including H_2S), e.g., with long retention times (long networks or oversized pumping station tanks) or at expansion manholes.

- Wavin manholes, with their high strength parameters confirmed by testing, are less susceptible to damage.

- Wavin manholes have been thoughtfully designed to eliminate the most troublesome issues, including those considered inevitable in our climate, such as the effects of winter cracking of hardened surfaces around manhole crowns.

- The application of Wavin manholes:

  – reduces the frequency of sewer cleaning by providing better hydraulic conditions, reducing blockages, and root intrusions,
  – reduces the operating costs of pumping stations and sewage treatment plants thanks to the 100% watertightness of the system and minimizing the inflow of accidental waters into the sewage and the deposition of sand.



The use of Wavin manholes helps change the nature of operators' activities to more planned by reducing failures and emergency operational activities.

6.4. Occupational safety, health and ergonomics in operational activities

Wavin manholes are constructed with an uncompromising approach to OCCUPATIONAL HEALTH AND SAFETY and taking into account recommendations for modern operation.

- Wavin inspection manholes are adapted to modern operational equipment, allowing for procedures to be conducted from the surface level, eliminating the need for personnel to enter the sewer and thus removing associated dangers.

- OHS services can utilize the optional ladder equipment provided by Wavin in Tegra 1000 access manholes, thus eliminating often unnecessary entry into the manhole.

- In Wavin access manholes, care has been taken to ensure the best possible safety and ergonomic conditions in the event of necessary entry:
  - Straightness of entry is ensured for both steps and ladders,
  - Proper OSHA conditions are ensured:
    - the minimum distance from the wall at any point is 15 cm,
    - the width of the rung is 330 cm, allowing for standing on both feet,
    - the distance between the tops of successive rungs is 30 cm,
    - the cross-section of the rung measures 28.8 × 27.8 mm, ensuring a circumference of less than 14.5 cm, allowing for a hand grip;
  - The ladder is tested for tear-off and vertical load, featuring parameters higher than the requirements of the standard PE-EN 13596-2:
    - anchoring strength: 6 kN,
    - maximum vertical load: 2.6 kN.
  - The upper surfaces of the steps and ladders are non-slip, and the step mounting prevents slippage from the side,

  - The bright yellow color of the steps ensures good visibility,
  - The cone in which the manhole entry is placed has an entrance hole maximally close to the side edge, making the steps visible in the light of the entrance hole,
  - The landing is at height H = D, which prevents it from being flooded by sewage,

  - The landing has a slope towards the channel, ensuring the drainage of condensates and incidental waters,
  - In Tegra 1000 manholes, there is the possibility to rotate the cone relative to the shaft, which ensures the most convenient and safe placement of the ladder above the landing.

- The manholes are resistant to sulfate corrosion, which can be not only a cause of failure but also a hazard to the health and life of individuals performing repairs or maintenance work.

6.5. Minimizing environmental nuisances

Sewer systems are often considered a nuisance to the environment due to malodorous substances and problems at the interface of manholes and surfaces. Systems with Wavin manholes help in alleviating these inconveniences.

- The use of non-ventilated manhole covers helps to reduce the perception of unpleasant odors.

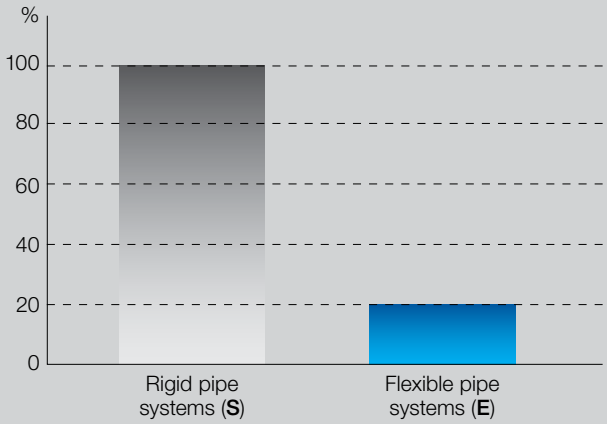
- In Wavin manholes, a series of structural solutions have been implemented to improve the quality and durability of the surface around the manholes: corrugated core pipes, floating crowns (eliminating settling), following ground movements accompanying its consolidation, and inevitable temperature changes in our climate. Users will not complain about uneven roads, repeated repairs, or puddles.

6.6. Minimizing environmental impact and fulfilling functional requirements following sustainable development principles

Wavin manholes, together with sewage pipes, form complete sewer systems. Such networks are characterized by significantly lower fault rates than conventional systems. **By eliminating the phenomena of infiltration and exfiltration, they support sustainable development.**

One hundred percent watertightness of the sewer system eliminates the phenomena of infiltration and exfiltration, along with all associated negative cost and ecological consequences.

- Infiltration:
  - significant amounts of incidental water in the sewage,
  - increased hydraulic loads on the treatment system and high electrical energy costs associated with the operation of pumping stations,
  - transportation of sand along with incidental waters equals large amounts of sand in the sewage, sand traps = high costs of storing post-treatment sludge = reduced lifespan of pumps.
- Exfiltration:
  - washing away of substrate under structures = sinking of roadways, subsidence of the substrate under existing networks = failures, unplanned maintenance work.



Comparison of Average Defect Rates per Kilometer of Network

Source: European study of the performance of various pipe systems, respectively pipe materials for municipal sewage systems under special consideration of the ecological range of effects during the service life, Bochum, August 2005.
Author: Dr. Eng. Dietrich Stein (collective work)

Total defects:
E – 8 pcs./km
S – 50 pcs./km

Total leaks:
E – 6 pcs./km
S – 41 pcs./km

7. Optimal model for equipping networks with manholes

Below are some sample recommendations from Wavin regarding the equipment of sewer systems with manholes (in terms of optimal functionality, costs, easy, safe, and hygienic operation). These can be utilized if the investor's recommendations, operator's guidelines, or detailed guidelines from water supply and sewage company are not specified otherwise.

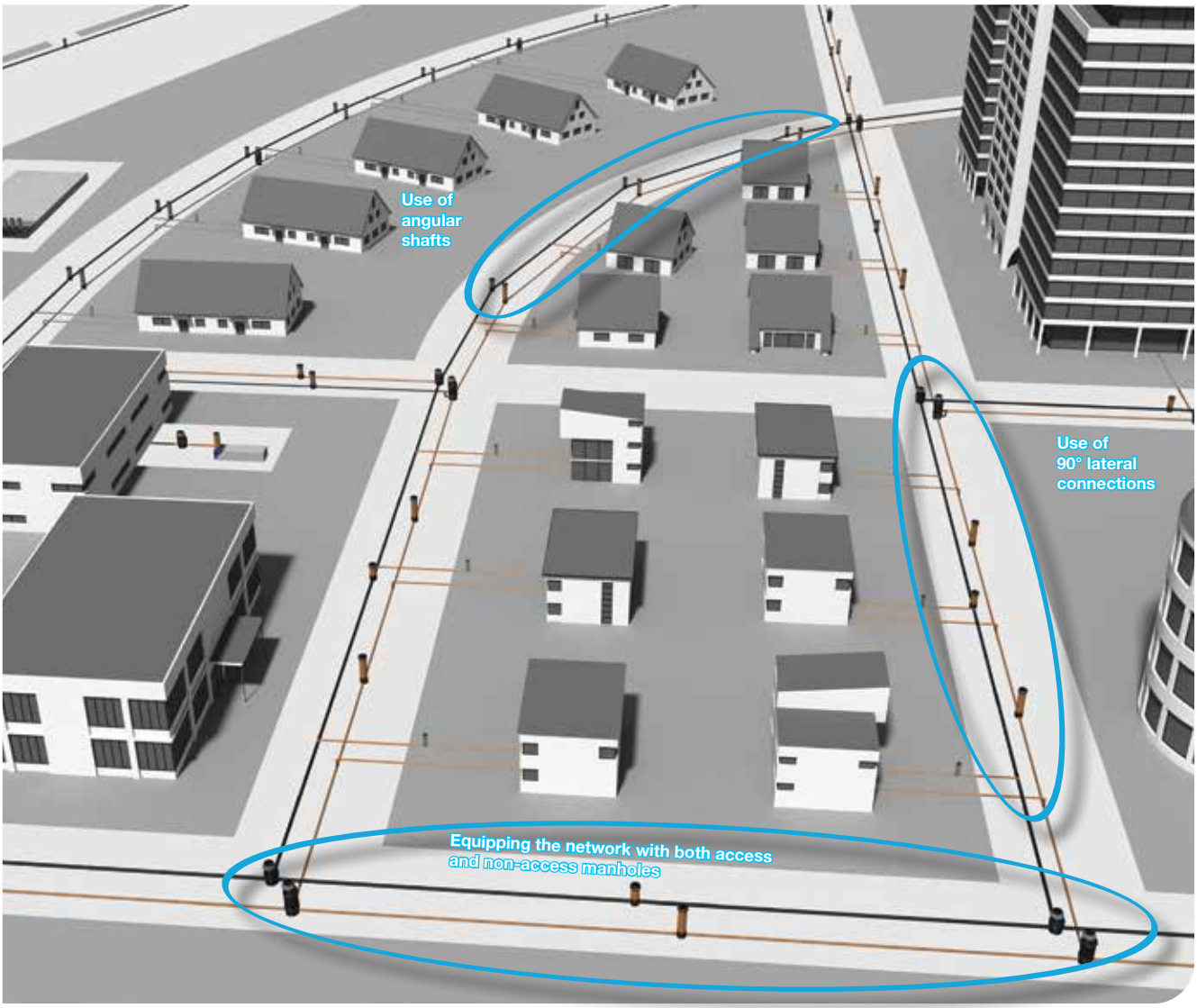
- When equipping the sewer system with manholes at sewer junctions, use both access manholes and inspection manholes (see: figure on page 21).
- Adjust the diameter of non-access manholes to accommodate operational equipment capabilities, commonly manholes with an internal diameter throughout the height > 400 mm are considered accessible for equipment. In the case of Wavin manholes, these are Tegra 600 and Basic 600, Tegra 425 and Basic 425.
- In areas where ground conditions allow, use less technically advanced manholes.
- Access manholes should primarily be used in main network nodes, but not more frequently than every 100–150 m.
- In other points, supplement the system with smaller inspection manholes (e.g., DN 315 mm), and in areas with high concentrations of sewer connections, replace some connection manholes with saddle branches.

- When selecting shafts:
  - maximize the use of prefabrication – use ready-made solutions at sewer junctions,
  - perform direction changes within the light of the manhole – angular shafts are required (see: figure on page 21),

  - in the absence of ready-made shaft configurations, use system fittings (caps, reducers, tees, and elbows);
    For angular bends, elbows with gentle angles – up to 30° ensure better operation. For angles > 45°, it is advisable to make bends using two elbows (one on the inflow, the other on the outflow),
  - in stormwater and general overflow manholes, use shafts with landings positioned at height H = D,

  - Connections to the channel should occur in the upper part of the channel – protection against flooding of the connection facilitates good ventilation.
- On transit sections of the sewer network, use pass-through manholes, with small diameters, exclusively for ventilation purposes.
- For safety reasons, manholes deeper than 2 meters should be non-accessible.
- Do not equip all Tegra 1000 access manholes with ladders. For economic reasons and safety, a complete set of ladders should be provided for operational services (a recommendation resulting from OCCUPATIONAL SAFETY RULES and a European directive mandating the reduction of service personnel entry into sewers, applied among others in Scandinavian countries).
- When incorporating house connections to the sewer line into manholes, use "in-situ" inserts. DN 200 connections are possible with an "in-situ" insert for Tegra 1000, Tegra 600, and Basic 600 manholes. For smaller manholes, "in-situ" inserts are available for pipes with a maximum diameter of DN 160. Larger inlets can be factory-made, or custom-ordered (see: Chapter 14).
- For connections to active conduits, use saddle branches.

Sample model for equipping a sewer network **with manholes**



Conditions for performing transitions in both access and non-access manholes – see section 14.5.

Manholes for special tasks:

- for energy dissipation,
- expansion,
- flood prevention (with storm gates)

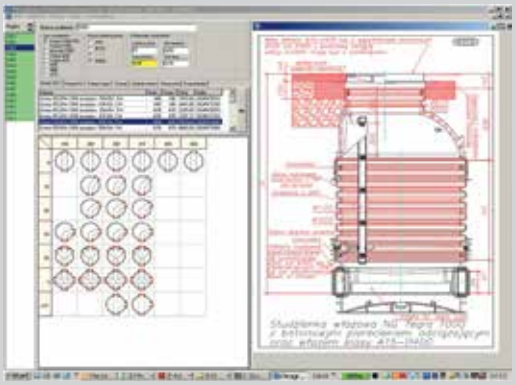
– in chapter 14.

8. Wavin Support

- Manhole Component Selection Program (PDES).
  The program has an up-to-date product database and current prices. There is an option for online price updates. Additionally, the program allows for:
  - selection and specification of manhole components,
  - price calculation for manholes,
  - preparation of material listings for investments.

  The user manual is available on the YouTube channel and directly in the program.

- Program for selecting diameters of gravity and pressure pipelines.



User manual for the PDES program

Product documentation:

- order forms available at www.wavin.com,
- technical drawings,
- manhole poster,
- catalog cards for offered covers, manholes, and cast iron inlets available in PDF format,
- installation instructions in section 17 included with CE-marked products (e.g., ladders) and available on the YouTube channel.

Videos

Comparison of installation time for sewer networks made from synthetic materials versus concrete elements

Testing of the Tegra 1000 manhole for compliance with the standard EN 13598

Installation of floating crowns

Tegra 600 in practice

Tegra 600 – a solution also for areas with heavy traffic

Multimediatraining available at www.wavin.com

Assistance in preparing technical specifications

Tegra sewer manholes have been adapted to the most challenging soil and water conditions. They can be installed in areas with heavy traffic, are easy to install, and are extremely durable. They function reliably for decades, as confirmed by various tests.

wavin

An Orbia business.

9. Tegra Family of Sewer Manholes

The most advanced sewer manholes on the market, made from synthetic materials (PP, PE), are adapted to even the most challenging soil and water conditions, and also consider climatic realities. Wavin Tegra manholes are convenient in design, ensure a high standard of network construction, and provide friendly and safe operation.

9.1. General characteristics

The Wavin Tegra family includes Tegra 1000 access manholes and Tegra 600 and Tegra 425 inspection manholes. The number in the name specifies the internal diameter of the manhole core (DN/ID).

Manholes are characterized by the following technical parameters, expressed in terms of application area:

a) permissible installation depth: 6 m,
b) permissible groundwater level: up to 5 m, measured from the bottom of the shaft,
c) permissible heavy traffic load: SLW 60 (load class of manhole covers D400).

Wavin Tegra manhole series can be used:

- for sewage at temperatures up to 60°C in continuous flow and higher temperatures during short-term sewage discharges (75°C for up to 5 minutes and 95°C for up to 2 minutes),
- for sewage with a pH of 2–12 and media specified in ISO/TR 10358 and ISO/TR 7620 standards,
- in areas affected by mining damage, in accordance with technical opinions from GIG,
- in soil classes 1-4.

In agreement with the manufacturer, the following are possible:

- greater installation depths of manholes, even up to 10 m deep,
- very shallow installations,
- installation in weak-bearing soil classes 5–6, such as peat, silt, clay, and loam.

All such special solutions are treated as individual solutions.

Compliance with standards

Product standard EN 13598-2
Applies to sewer manholes made from synthetic materials and covers all depths (up to 6 m) and areas of vehicular traffic.

System standard EN 476
Tegra 1000, with a working chamber height of at least 2 m, and if not possible, at least 1.8 m, is an access sewer manhole with an internal diameter of 1 m, accessible for cleaning and inspection performed by personnel.
Tegra 600 and 425 are non-access manholes, intended for operational, inspection, and research work from the ground level using devices designed for this purpose.

Manhole design

Shaft

- The base of the manhole features a shaped hydraulic profile with connectors for smooth-walled pipes (SW) or the Wavin X-Stream system (XS).
- Side surfaces at the hydraulic profile are positioned at a height equal to the diameter of the main channel:
  - in Tegra 1000, the landing provides proper conditions for service personnel with a 4.5° slope and an anti-slip surface,
  - in Tegra 425 and 600, the side surfaces have a 30% slope ensuring the flow of sewage and contaminants entering through the inflows integrated into the manhole core.

Corrugated PP tube

Forms the core of the manhole with a stiffness of 2 ≤ SN < 4 kN/m^2 (pipes in black color) or SN ≥ 4 kN/m^2 (orange pipes).

Cone

Reduces the diameter of the manhole from 1.0 m to 0.6 m, allowing for the use of a crown (only Tegra 1000).

Ladders

Tegra 1000 access manholes can optionally be equipped with ladders featuring two longitudinal rails, compliant with the harmonized standard PN-EN 14396 (CE mark). They are made from glass-reinforced epoxy resin (GRP), colored bright yellow throughout; they are mounted in the cone and the core of the manhole. More in section 6.4.

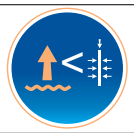
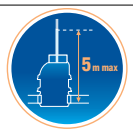
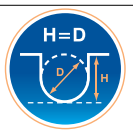
Connections of manhole components

Manhole components are connected using bell-and-spigot joints with EPDM seals. The depth of bell-and-spigot connections for shafts and cones is 20 cm.
In connectors for smooth-walled pipes (SW), seals with an EPDM/TPE reinforcing ring are used. All seals meet the requirements of the standard EN 681-1 or EN 681-2 (CE mark) and are intended for use in sewage systems. The seals ensure system tightness at a level of 0.5 bar. They are tested under conditions specified by the standard EN 13598-2 (see: chapter 18). Additionally, due to the requirements of many certification bodies, the manufacturer has seal tests under more challenging conditions. Tests by European certification units (e.g., DiBT) confirm the tightness of Tegra manholes at a level of 2.4 bar.

Tegra will never let you down

- It is friendly to all participants in the investment cycle (investor, designer, operator).
- It reduces typical, frequently occurring problems in sewer systems, which in traditional solutions are considered inevitable.
- Leads to a reduction in installation time and faster achievement of ecological effects.
- Reduces operating costs.

See chapter 6 for more information.

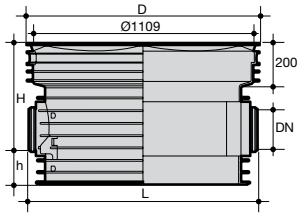
		Tegra 1000	Tegra 600	Tegra 425
type of manhole		access	inspection, non-access	
internal/external diameter of manhole core		Dw = 1000 mm Dz = 1103 mm	Dw = 600 mm Dz = 670 mm	Dw = 425 mm Dz = 476 mm
entry diameter		600 mm	not applicable	
technical parameters as permissible application area (according to EN 13598-2) (according to EN 13598-2)	**max. depth**	6 m		
	max. groundwater level measured from the bottom of the manhole as a constant load, under which durability and structural stability of the shaft are ensured[1)]	 5 m		
	traffic load	for SLW 60 – D400		
manhole components		shafts, corrugated core pipes 2 ≤ SN < 4 kN/m2, cones, double connectors for core pipes, ladders	shafts, corrugated core pipes SN ≥ 4 kN/m², 2 ≤ SN < 4 kN/m², double connectors	shafts, corrugated core pipes SN ≥ 4 kN/m², 2 ≤ SN < 4 kN/m², double connectors
resistance to groundwater buoyancy			5 m without additional measures (e.g., weighting/concreting/anchoring), only proper, durable backfill compaction required	
material	- shafts - core pipes - ladders	PE and PP PP GRP	PP PP not applicable	PP PP not applicable
diameters of connected smooth-walled X-Stream sewer pipes		**SW** – 160–500 mm **XS** – 300–500 mm	**SW** – 160–400 mm **XS** – 150–400 mm	**SW** – 110–315 mm **XS** – 150–300 mm
adjustable, articulated joint sockets ±7.5°		**SW** – 160, 200, 250, 315 **XS** – 300	**SW** – 160, 200, 250, 315 **XS** – 150, 200, 250, 300	**SW** – 110, 160, 200, 250, 315 **XS** – 150, 200, 250, 300
guaranteed tightness of the manhole component connections			≥ 0.5 bar - condition D according to EN 1277 for connectors - condition A according to EN 1277 for components Tests by European certification units (e.g., DiBT) confirm the tightness of Tegra manholes at a level of 2.4 bar.	
shaft types  4 shafts (0°, 30°, 60° and 90°)	**straight flow**	160–500	160–400	110–315
	angular flow[2)]	200–315	160–315	160–200
	collector at 90°	200–315	160–315	110–200
	collector at 45°	200–315	160, 200	–
	bottom without outflows	✓	✓	✓
diameters of connected smooth-walled X-Stream sewer pipes		**SW** – 110–200 mm **XS** – 100–200 mm with transitional fittings		**SW** – 110–160 mm **XS** – 100–150 mm with transitional fittings
landing height placement			H = D	
manhole crowning	**– class A15**	cast iron covers, PE covers, PP A15 covers		cast iron covers PP A15 covers
	– class B125	cast iron hatches or inlets, concrete-filled hatches B125		cast iron hatches or inlets B125
	– class C250	cast iron hatches or inlets, concrete-filled hatches D400		cast iron hatches or inlets D400
	– class D400			
manhole cron components		reinforced concrete rings, TAR cones telescopic adapters Ø 600 (only in compliance with OHS regulations)[3)]	telescopic adapters Ø 600, reinforced concrete rings, TAR cones	telescopic pipes Ø 425, reinforced concrete cones TAR cones
potential for using manholes for other solutions		Pump station tanks, water meter manholes, expansion manholes, stormwater sedimentation manholes with or without siphon		
domestic technical specifications		**Standards:** – PN-EN 13598-2 – PN-EN 14396 (ladders) and PN-EN 124 (covers, hatches, inlets) **Technical assessments:** – positive opinion from GIG – possibility of use in areas affected by mining damage up through category IV		

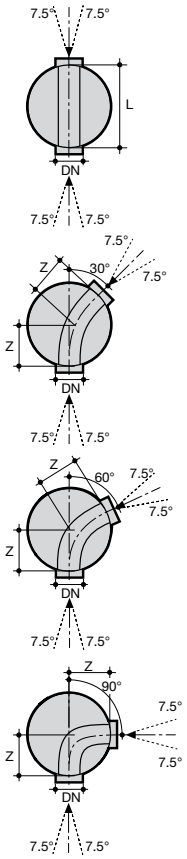
[1)] Parameters confirmed by long-term pressure testing in accordance with standard EN 13598-2.

[2)] In the range of 110–315, any angle change in the sewage system is possible.

[3)] Use of a telescopic adapter for manholes reduces the entry diameter below 600 mm. The use of telescopic adapters for manholes is possible with Tegra 1000 manholes not intended for entry (e.g., shallow – without a working chamber, minimum height of 1800 mm).

9.2. Tegra 1000 access manhole – component listing





0° = 15° L ÷ 15° R
30° = 15° R ÷ 45° R or 15° L ÷ 45° L
60° = 45° R ÷ 75° R or 45° L ÷ 75° L
90° = 75° R ÷ 90° R or 75° L ÷ 90° L

ATTENTION!
Types I and J flow shafts do not have a built-in bottom slope. Depending on the installation on the sewer line, they provide a change in direction either to the right or left. Any slope is achieved by adjusting the sockets on the inflow and outflow.

Tegra 1000 Shaft for smooth-walled pipes – SW connectos

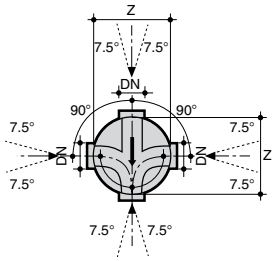
Flow Type I

DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
160	0	1187	535	185	1177	512	PP	3041540
200	0	1187	535	185	1168	512	PP	3023747
250	0	1187	647	185	1263	509	PP	3041546
315	0	1187	647	185	1260	477	PP	3023762
400*	0	1194	863	188	1282	864	PE	3023763
500*	0	1194	867	184	1207	792	PE	3023765

* Shaft without adjustable sockets.

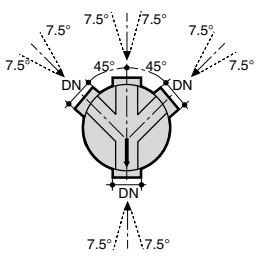
Flow Type J

DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
200	30	1187	535	185	-	484	PP	3023767
250	30	1187	647	185	-	509	PP	3041547
315	30	1187	647	185	-	477	PP	3041583
200	60	1187	535	185	-	486	PP	3041544
250	60	1187	647	185	-	509	PP	3041548
315	60	1187	647	185	-	477	PP	3041584
160	90	1187	535	185	-	486	PP	3041541
200	90	1187	535	186	-	486	PP	3041545
250	90	1187	647	187	-	509	PP	3041559
315	90	1187	647	188	-	477	PP	3041585



Collector shaft 90° (left and right inflow) – Type X

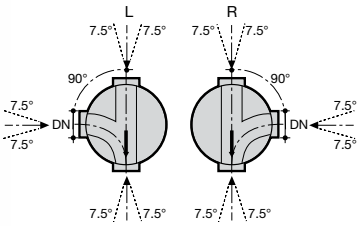
DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
160	90	1187	535	185	1177	486	PP	3041543
200	90	1187	535	185	1168	486	PP	3023797
250	90	1187	647	185	1263	509	PP	3041582
315	90	1187	647	185	1260	477	PP	3041587



Collector shaft 45° (left and right inflow) – Type Y

DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
160	45	1187	535	185	1177	486	PP	3041542
200	45	1187	535	185	1168	486	PP	3023791
250	45	1187	647	185	1263	509	PP	3041560
315	45	1187	647	185	1260	477	PP	3041586

* Shaft without adjustable sockets.



ATTENTION!
Collector and 90° connection shafts have a built-in bottom slope of 0.7%. For hydraulic reasons, lateral inflows are positioned 30 mm higher than the main flow.

90° connection shaft

DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
200 (L)	90	1187	535	185	1168	486	PP	3044089
200 (R)	90	1187	535	185	1168	486	PP	3044093
250 (L)	in preparation							
250 (R)	in preparation							
315 (L)	in preparation							
315 (R)	in preparation							

Diagrams are the same as for the Tegra 1000 shafts with SW connectors, see page 28.

ATTENTION!
Types I and J flow shafts do not have a built-in bottom slope. Depending on the installation on the sewer line, they provide a change in direction either to the right or left. Any slope is achieved by adjusting the sockets on the inflow and outflow.

ATTENTION!
Collector and 90° and 90° connection shafts have a built-in bottom slope of 0.7%. For hydraulic reasons, lateral inflows are positioned 30 mm higher than the main flow.

Tegra 1000 shaft for Wavin X-Stream pipes – XS connectors

Flow Type I

DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
300	0	1187	647	185	1250	948	PP	3023761
400*	0	1194	863	188	1220	864	PE	3023764
500*	0	1194	867	184	1207	792	PE	3023766

* Shaft without adjustable sockets.

Flow Type J

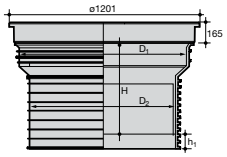
DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
300	30	1194	622	185		397	PP	3041567
300	60	1194	622	185		397	PP	3041568
300	90	1194	622	185		397	PP	3041569

Collector shaft 90° (left and right inflow) – Type X

DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
300	90	1187	647	185	1260	477	PP	3041571

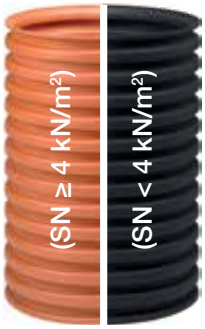
Collector shaft 45° (left and right inflow) – Type Y

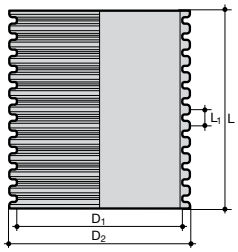
DN	α [°]	D [mm]	H [mm]	h [mm]	L [mm]	z [mm]	Mat.	SAP Index
300	45	1187	647	185	1260	477	PP	3041570



Blind shaft with a socket

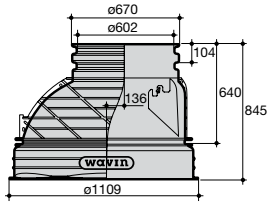
D_1 [mm]	D_2 [mm]	H [mm]	h_1 [mm]	Mat.	SAP Index
1100	935	604	97	PE	3044085





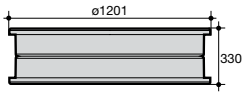
Corrugated PP 1000 core pipe

L [mm]	D_1 [mm]	D_2 [mtm]	L_1 [mm]	Mat.	SAP Index
ring stiffness 2 ≤ SN < 4 kN/m²					
1200	1004	1103	100		3023312
2400	1004	1103	100		3023311
3600	1004	1103	100		3023310
6000	1004	1103	100		3021035
ring stiffness SN ≥ 4 kN/m²					
1200	1004	1103	100		3080324
2400	1004	1103	100		3080325
3600	1004	1103	100		3080326
6000	1004	1103	100		3075692



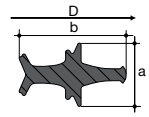
Cone 1000/600

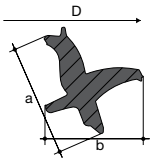
Dimension [mm]	SAP Index
1000/600	3023807



Double connector for Tegra 1000 core pipe without seals

SAP Index
3023809





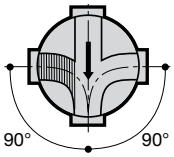
For Tegra 1000 corrugated core pipe

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
1000	36.9	61.7	1090	4066386

For the cylindrical corrugated part of Tegra 1000 cone

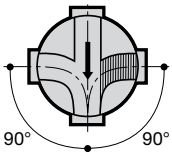
Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
600	42.7	51.1	672	4046025

ATTENTION!
To complete the assembly of a Tegra 1000 manhole, select as many seals as there are sockets in the bell-ended components (typically 2 pieces – one for the shaft and one for the cone, and possibly 2 pieces for a double connector).



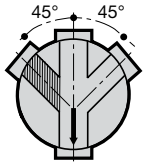
Closed end cap TEGRA 1000 X R 90

DN	Type	SAP Index
200	R 90	3029826
315	R 90	3067549



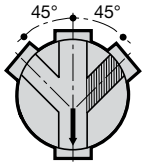
Closed end cap TEGRA 1000 X L 90

DN	Type	SAP Index
200	L 90	3029827
315	L 90	3067236



Closed end cap TEGRA 1000 Y R 45

DN	Type	SAP Index
200	R 45	3024762
315	R 45	3067238



Closed end cap TEGRA 1000 Y L 45

DN	Type	SAP Index
200	L 45	3024761
315	L 45	3067237

ATTENTION! A plug must be placed in any unused inflow.

GRP ladder complete with clamp

Number of rungs	Length [mm]	Number of clamps	SAP Index
6	1.63	1	4032050
10	2.83	1	4032049
14	4.03	2	4032048
18	5.23	2	4032047

clamp = strap + 2 supports

Ladder bracket

SAP Index
4032025

End cap for the longitudinal rail of the Tegra 1000 ladder

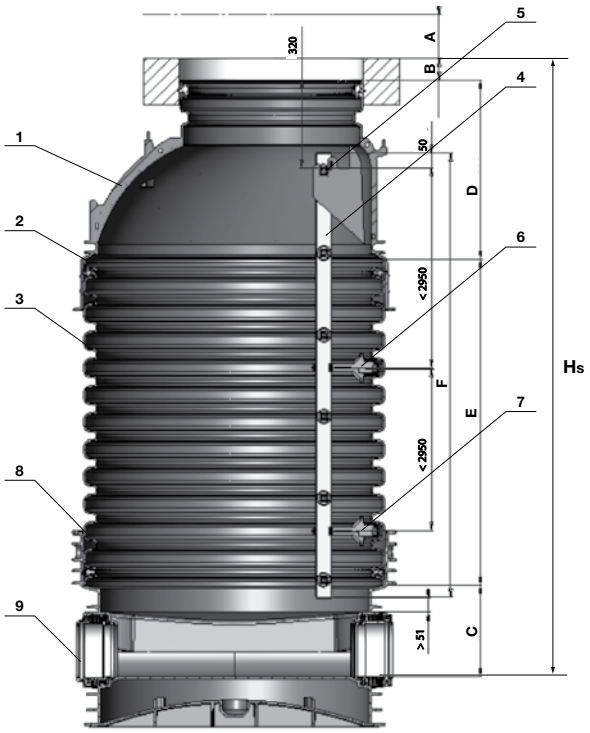
SAP Index
3040837

For cover components – see : Chapter 16.

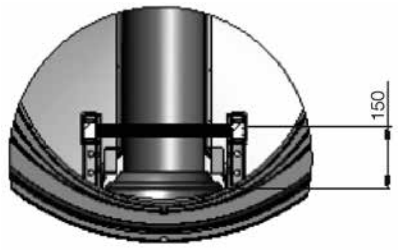
Selecting the ladder for the Tegra 1000 manhole

The length of the ladder is specified in degrees. This is directly related to the length of the core pipe used. To achieve the required number of rungs, standard-length ladders are cut. The cut longitudinal rails of the ladder must extend beyond the rungs by 50 mm.

The relationship between the length of the core pipe and the number of ladder rungs is detailed in the table at the bottom of the page.



Installation diagram of the Tegra 1000 manhole.



Positioning of ladder rungs within the light of the manhole cone access opening – top view:

1. Tegra 1000 Cone – 1000/600
2. Tegra 1000 seal – DN 1000
3. Tegra 1000 corrugated PP core pipe
4. Tegra 1000 ladder with GRP
5. Upper ladder suspension
6. Intermediate mounting (for manholes > 3.8 m)
7. Lower ladder clamp
8. Tegra 1000 seal – DN 1000
9. Tegra 1000 shaft

The length of the core pipe is determined taking into account:

1. Hatch height	**Cover height (A+B)**	A [m]	class A – C – 0.08 m; class D – 0.1 ÷ 0.12 m
2. Height of Surface Components Above the Tegra 1000 Cone: **– reinforced concrete relief ring** **– TAR relief cone** **– telescopic manhole hatch adapter**		B [m]	B = 0.03–0.1 m B = 0.03–0.08 m B = 0.03–0.3 m
3. Height of Tegra 1000 shaft without socket		C [m]	
4. Tegra 1000 cone height		D [m]	0.66 m

Connector SW – DN	Connector XS – DN	C [mm]
160	-	335
200	-	335
250	-	447
315	300	447
400	400	663
500	500	667

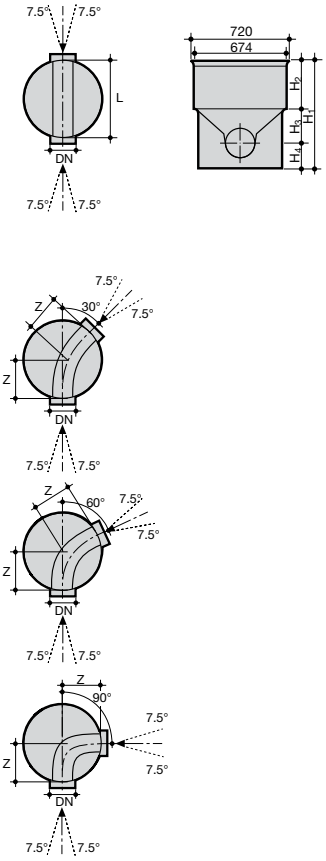
Determination of core pipe length (E) [m]

$$E = H_s - (A+B) - C - D$$

Selection of ladder (number of rungs and clamps) depending on the length of the core pipe (E) [m]

E		Manhole crown length	≥ 0.4	≥ 0.6	≥ 0.9	≥ 1.2	≥ 1.5	≥ 1.8	≥ 2.1	≥ 2.4	≥ 2.7	≥ 3.0	≥ 3.3	≥ 3.6	≥ 3.9	≥ 4.2	≥ 4.5	≥ 4.8
F	Ladder	Number of rungs	3	4	5	**6**	7	8	9	**10**	11	12	13	**14**	15	16	17	**18**
		Number of clamps	1	1	1	**1**	1	1	1	**1**	1	2	2	**2**	2	2	2	**2**

9.3. Tegra 600 manhole – component listing



0° = 15° L ÷ 15° R
30° = 15° R ÷ 45° R or 15° L ÷ 45° L
60° = 45° R ÷ 75° R or 45° L ÷ 75° L
90° = 75° R ÷ 90° R or 75° L ÷ 90° L

ATTENTION!
Types I and J flow shafts do not have a built-in bottom slope. Depending on the installation on the sewer line, they provide a change in direction either to the right or left. Any slope is achieved by adjusting the sockets on the inflow and outflow.

Tegra 600 Shaft for smooth-walled pipes – SW connectors

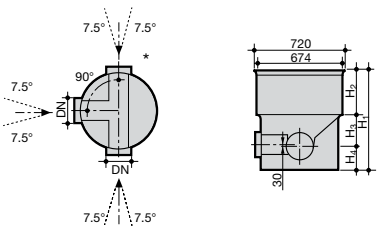
Flow Type I

DN	α [°]	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
160	0	646	207	271	168	21.0	2001525
200	0	646	207	274	165	22.0	2001526
250	0	705	207	271	227	23.7	2001527
315	0	705	207	271	227	25.8	2001528
400*	0	715	207	271	237	25.5	2001529

* Without adjustable sockets.

Flow Type J (Angular)

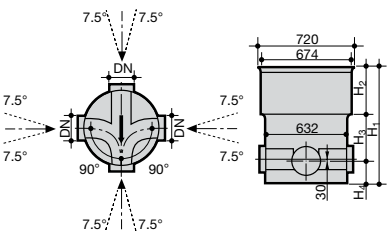
DN	α [°]	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
160	30	646	207	271	168	21.0	2001537
200	30	646	207	274	165	22.0	2001534
250	30	705	207	271	227	23.7	2001535
315	30	705	207	271	227	25.8	2001536
160	60	646	207	271	168	21.0	2001541
200	60	646	207	274	165	22.0	2001538
250	60	705	207	271	227	23.7	2001539
315	60	705	207	271	227	25.8	2001540
160	90	646	207	271	168	21.0	2001533
200	90	646	207	274	165	22.0	2001530
250	90	705	207	271	227	23.7	2001531
315	90	705	207	271	227	25.8	2001532



ATTENTION!
The bottom of the lateral inflow is situated 30 mm above the bottom of the main channel.

Connection shaft (left or right inflow) – type T

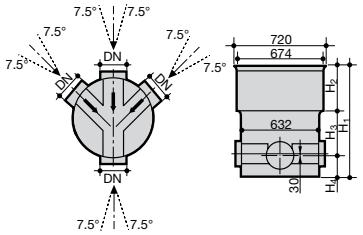
DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
160	646	207	271	168	21.0	3012391
200	646	207	271	168	23.0	3001917
250	705	207	271	227	27.5	3000243
315	705	207	271	227	28.7	3001919



ATTENTION!
Connector and 90° collector shafts have a built-in bottom slope of 0.7%. For hydraulic reasons, lateral inflows are positioned 30 mm higher than the main flow.

Collector shaft (left and right inflow) – type X

DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
160	646	207	271	168	22.0	3012392
200	646	207	271	168	24.0	3000245
250	705	207	271	227	27.5	3000246
315	705	207	271	227	31.6	3000247

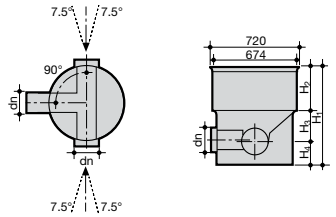


Tegra 600 shaft for smooth-walled pipes – SW connectors (continued)

Collector shaft at 45° (left and right inflow) – Type Y

DN	Angle [°]	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	SAP Index
160	45	646	207	271	168	3074052
200	45	646	207	271	168	3074051

Order form at: www.wavin.pl

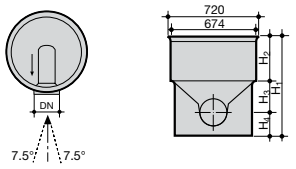


Tegra 600 shaft for smooth-walled pipes – SW connectors (continued)

Connection shaft with left, right inflow or collective shaft (inflows smaller than the main channel)

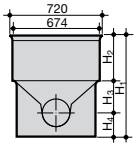
DN	Angle [°]	H_1 [mm]	H_2 [mm]	H_3 [mm]	Possible DN [mm] (*)	SAP Index
200	90	646	207	271	160	3044097
250	90	705	207	271	160, 200	3044099
315	90	705	207	271	160, 200	3044100
400	90	715	207	271	160, 200	3044101

*** ATTENTION!**
Lateral inflows are smooth-walled pipes with a beveled end. The bottom of the inflow channel is aligned with the axis of the main channel. Single or double inflows are possible.



Terminal shaft

DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
200	646	207	271	168	20	2001522
250	705	207	271	227	22	2001523
315	705	207	271	227	23.1	2001524



Tegra 600 shaft for Wavin X-Stream pipes – XS connectors

Flow Type I

DN	α [°]	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
150	0	646	207	271	168	21.0	3012393
200	0	646	207	274	165	22.0	3012399
250	0	705	207	271	227	23.7	3015182
300	0	705	207	271	227	25.8	3015183
400*	0	715	207	271	237	26.0	3044095

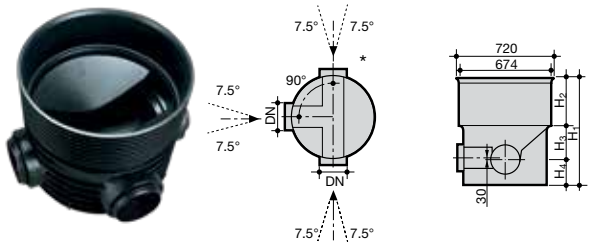
* Without adjustable sockets.

Flow Type J

DN	α [°]	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
150	30	646	207	271	168	21.0	3012396
200	30	646	207	274	165	22.0	3012402
250	30	705	207	271	227	23.7	3015188
300	30	705	207	271	227	25.8	3015189
150	60	646	207	271	168	21.0	3012395
200	60	646	207	274	165	22.0	3012401
250	60	705	207	271	227	23.7	3015186
300	60	705	207	271	227	25.8	3015187
150	90	646	207	271	168	21.0	3012394
200	90	646	207	274	165	22.0	3012400
250	90	705	207	271	227	23.7	3015184
300	90	705	207	271	227	25.8	3015185

Diagrams are the same as for the Tegra 600 shaft with SW connectors on page 33.

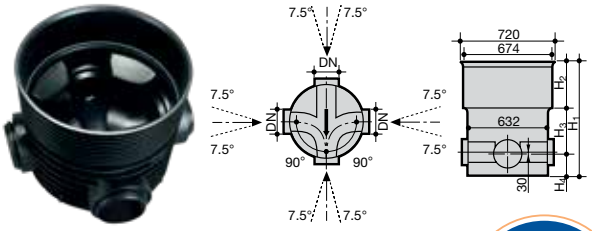
ATTENTION!
Types I and J flow shafts do not have a built-in bottom slope. Depending on the installation on the sewer line, they provide a change in direction either to the right or left. Any slope is achieved by adjusting the sockets on the inflow and outflow.



ATTENTION!
The bottom of the lateral inflow is situated 30 mm above the bottom of the main channel.

Connection shaft (left or right inflow) – type T

DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
150	646	207	271	168	21.0	3012397
200	646	207	271	168	23.0	3012403
250	705	207	271	227	27.5	3015190
300	705	207	271	227	28.7	3015191



ATTENTION!
Connector and 90° collector shafts have a built-in bottom slope of 0.7%. For hydraulic reasons, lateral inflows are positioned 30 mm higher than the main flow.

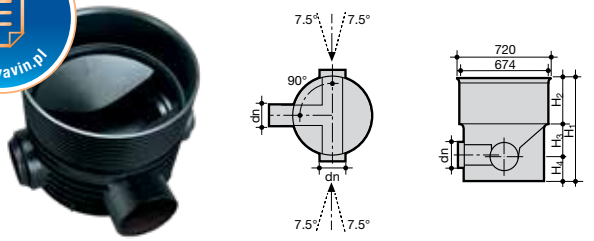
Collector shaft (left and right inflow) – type X

DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
150	646	207	271	168	22.0	3012398
200	646	207	271	168	24.0	3012404
250	705	207	271	227	27.5	3015192
300	705	207	271	227	31.6	3015193

Collector shaft 45° (left and right inflow) – type Y

DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
200	646	207	271	168	24.0	3074053

Order form at: www.wavin.pl

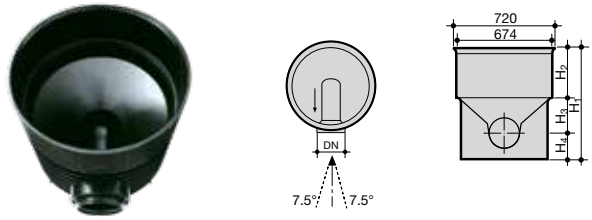


ATTENTION!
The bottom of the inflow channel is aligned with the axis of the main channel.
Single or double inflows are possible.

Connection shaft with left, right inflow or collective shaft (inflows smaller than the main channel)

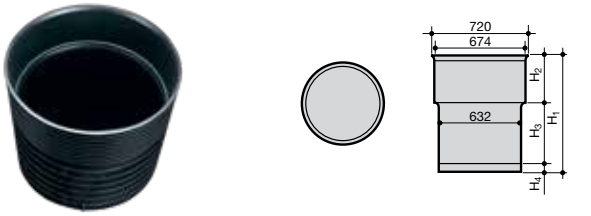
DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	Possible DN [mm] (*)	SAP Index
200	646	207	271	160	3044098
250	705	207	271	160, 200	3052829
300	705	207	271	160, 200	3052830
400*	715	207	271	160, 200	3044102

* Without adjustable sockets.



Terminal shaft

DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
200	646	207	271	168	20	3013883
250	705	207	271	227	22	3044123
300	705	207	271	227	23.1	3044131



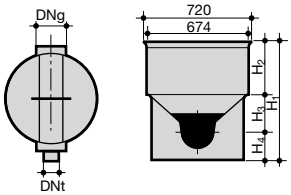
Blind shaft (without inflows and outflows)

DN	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
–	715	207	451	57	20.0	4000666

Tegra 600 monolithic shaft with a core

	SAP Index
Tegra 600 shaft with any corrugated pipe (standard 0.5 m)	3044096

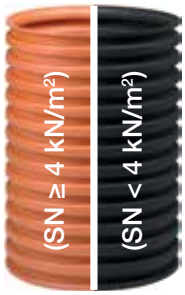
See section 14.6.3.

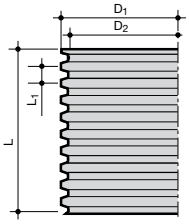


Tegra 600 Expansion Shaft, customizable

DNt	DNg	α [°]	H_1 [mm]	H_2 [mm]	H_3 [mm]	H_4 [mm]	Weight [kg]	SAP Index
40-160	160-200	0	646	207	271	168	22-23	3044104

1. All Tegra 600 expansion shafts are ordered under the universal index 3044104. When ordering, specify the diameter of the pressure inflow and the gravity outflow.
2. The partition with an overflow edge for the 200 outflow is located at the height of the widest part of the shaft.

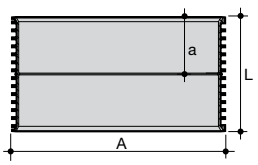




Corrugated 600 PP core pipe without socket

L [mm]	D_1 [mm]	D_2 [mm]	L_1 [mm]	Weight [kg]	SAP Index
ring stiffness SN ≥ 4 kN/m²					
1000	670	600	100	13.1	3071397
2000	670	600	100	26.2	3092339
3000	670	600	100	39.3	3092341
6000	670	600	100	78.6	3092343
3650*	670	600	100	48.4	3024789
ring stiffness 2 ≤ SN < 4 kN/m² (E)					
1000	670	600	100	7.3	3070738
2000	670	600	100	14.6	3092345
3000	670	600	100	22	3092346
6000	670	600	100	42.8	3092347

* With a socket.

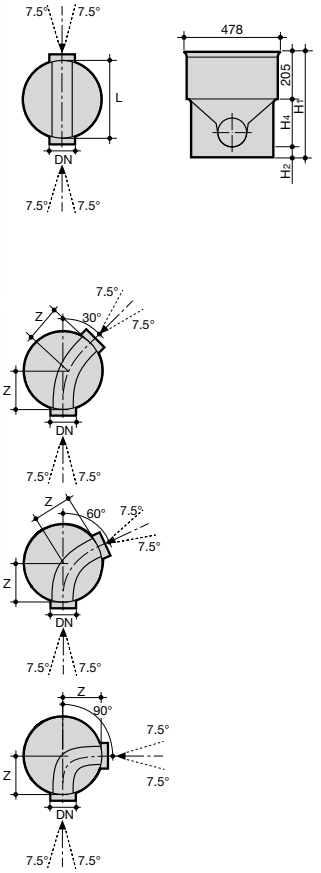


Double coupling corrugated pipe DN 600 (2 seals)

Dimension [mm]	a [mm]	L [mm]	A [mm]	SAP Index
600	165	354	674	3044171

For crown components – see Chapter 16.

9.4. Tegra 425 non-access manhole – component listing



0° = 15° L ÷ 15° R
30° = 15° R ÷ 45° R or 15° L ÷ 45° L
60° = 45° R ÷ 75° R or 45° L ÷ 75° L
90° = 75° R ÷ 90° R or 75° L ÷ 90° L

ATTENTION!
Types I and J flow shafts do not have a built-in bottom slope. Depending on the installation on the sewer line, they provide a change in direction either to the right or left. Any slope is achieved by adjusting the sockets on the inflow and outflow.

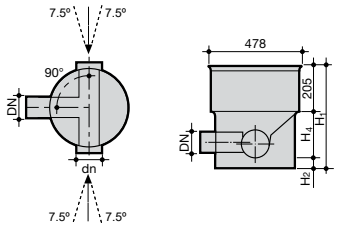
Tegra 425 shaft for smooth-walled pipes – SW connectors

Flow Type I

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	Z [mm]	SAP Index
110	0	582	81	296	538	3011327
160	0	611	85	320	570	3011328
200	0	638	93	340	619	3011330
250	0	611	80	326	909	3011333
315	0	668	79	383	1005	3011336

Flow Type J (angular)

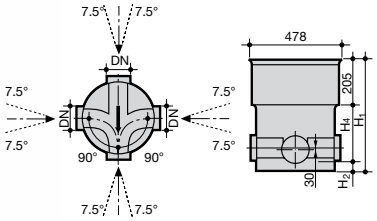
DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	Z [mm]	SAP Index
160	30	611	85	320	163	3011339
200	30	638	93	340	153	3011341
160	60	611	85	320	163	3011344
200	60	638	93	340	153	3011346
160	90	611	85	320	163	3011349
200	90	638	93	340	153	3011351



ATTENTION!
Connector shafts have a built-in bottom slope of 0.7%. For hydraulic reasons, lateral inflows are positioned 30 mm higher than the main flow.

Connection T-type (left or right inflow)

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	L [mm]	SAP Index
160	90	611	85	320	326	3011354
200	90	638	93	340	305	3011356

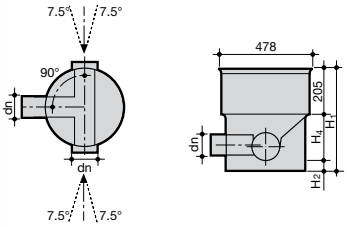


ATTENTION!
90° collector shafts have a built-in bottom slope of 0.7%. For hydraulic reasons, lateral inflows are positioned 30 mm higher than the main flow.

Collector shaft Type X (left and right inflow)

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	L [mm]	SAP Index
110	90	582	81	296	538	3011359
160	90	611	85	320	570	3011360
200	90	638	93	340	619	3011362

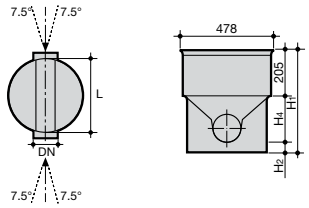
Order form at: www.wavin.pl

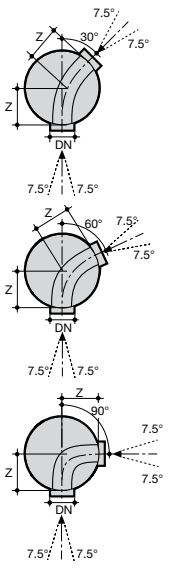


ATTENTION!
Lateral inflows are smooth-walled pipes with a beveled end. The bottom of the inflow channel is aligned with the axis of the main channel. Single or double inflows are possible.

Connection shaft with left, right inflow or collective shaft (inflows smaller than the main channel)

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	Possible DN (*) [mm]	SAP Index
200	90	638	93	340	160	3044047
250	90	611	80	326	160, 200	3044048
315	90	668	79	383	160, 200	3044049





0° = 15° L ÷ 15° R
30° = 15° R ÷ 45° R or 15° L ÷ 45° L
60° = 45° R ÷ 75° R or 45° L ÷ 75° L
90° = 75° R ÷ 90° R or 75° L ÷ 90° L

Tegra 425 shaft for Wavin X-Stream pipes – XS connectors

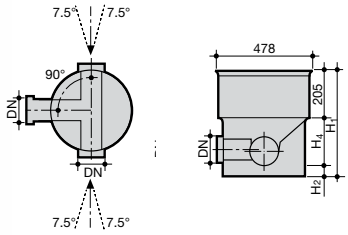
Flow Type I

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	L [mm]	SAP Index
150	0	611	80	326	627	3011329
200	0	638	80	353	651	3011331
250	0	611	65	341	925	3011334
300	0	668	68	395	991	3011337

Flow Type J (angular)

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	L [mm]	SAP Index
150	30	611	80	326	163	3011340
200	30	638	80	353	153	3011342
150	60	611	80	326	163	3011345
200	60	638	80	353	153	3011347
150	90	611	80	326	163	3011350
200	90	638	80	353	153	3011352

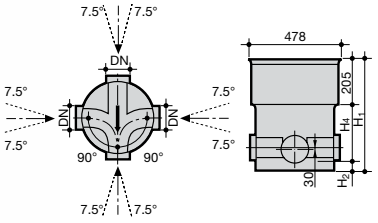
ATTENTION!
Types I and J flow shafts do not have a built-in bottom slope. Depending on the installation on the sewer line, they provide a change in direction either to the right or left. Any slope is achieved by adjusting the sockets on the inflow and outflow.



Connection T-type (left or right inflow)

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	L [mm]	SAP Index
150	90	611	80	326	326	3011355
200	90	638	80	353	305	3011357

ATTENTION!
Connector shafts have a built-in bottom slope of 0.7%. For hydraulic reasons, lateral inflows are positioned 30 mm higher than the main flow.

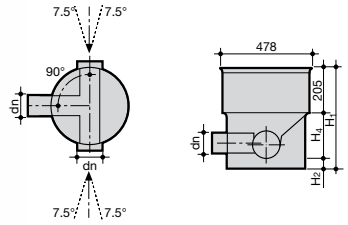


Collector shaft Type X (left and right inflow)

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	L [mm]	SAP Index
150	90	611	80	326	326	3011361
200	90	638	80	353	305	3011363

ATTENTION!
Connector and 90° collector shafts have a built-in bottom slope of 0.7%. For hydraulic reasons, lateral inflows are positioned 30 mm higher than the main flow.

Order form at: www.wavin.pl



Connection shaft with left, right inflow or collective shaft (inflows smaller than the main channel)

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	Possible dn (*) [mm]	SAP Index
200	90	638	93	340	160	3052826
250	90	611	80	326	160, 200	3052827
300	90	668	79	383	160, 200	3052828

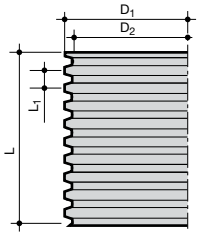
ATTENTION!
Lateral inflows are smooth-walled pipes with a beveled end. The top of the inflow pipeline is aligned with the main channel. Single or double inflows are possible.

Order form at: www.wavin.pl

Tegra 425 monolithic shaft

	SAP Index
Tegra 425 shaft, customized with core pipe (standard 0.5 m)	3044046

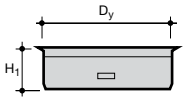
See section 14.6.3.



Corrugated PP 425 core pipe.

Diameter L [mm]	D_1 [mm]	D_2 [mm]	L_1 [mm]	SAP Index
ring stiffness SN ≥ 4 kN/m²				
2000	476	425	70	3011409
3000	476	425	70	3011408
6000	476	425	70	3011407
3000*	476	425	70	3011404
6110*	476	425	70	3011403
ring stiffness 2 ≤ SN < 4 kN/m² (E)				
750	476	425	70	3080265
2000	476	425	70	3080268
3000	476	425	70	3080267
6000	476	425	70	3045520

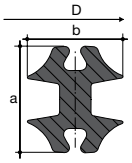
* Length including socket.



Base for the corrugated core pipe (without seal)

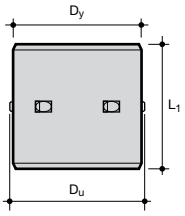
Dimension Dy [mm]	Dy [mm]	H_1 [mm]		SAP Index
425	425	140	without handles	2015215
425	425	140	with handles	3045086

The base, along with the seal, can also be used as a watertight cover.



Seal for corrugated and telescopic pipe DN 425

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
425	31.8	28.7	473.1	4052716

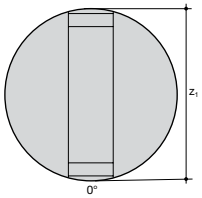


Double connector for Tegra 425 core pipe

Dimension Dy [mm]	Dy [mm]	Du [mm]	L_1 [mm]	SAP Index
425	425	488	410	3032757

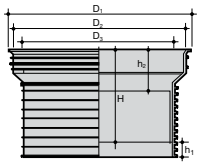
For crown components – see Chapter 16.

9.5. Tegra 1000 PE manhole – component listing



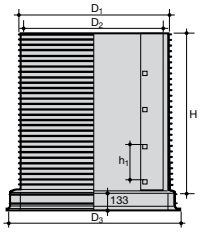
Tegra 1000 PE flow shaft

D_1 [mm]	D_2 [mm]	D_3 [mm]	H [mm]	h_1 [mm]	h_2 [mm]	Weight [kg]	z_1 [mm]	SAP Index
1100	1000	935	604	97	214	72	650	4000675



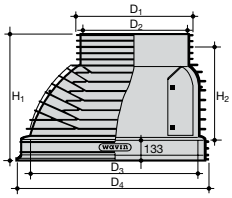
Tegra 1000 PE blind shaft

D_1 [mm]	D_2 [mm]	D_3 [mm]	H [mm]	h_1 [mm]	h_2 [mm]	Weight [kg]	SAP Index
1100	1000	935	604	97	214	56	4000671



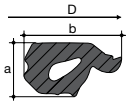
Tegra 1000 PE spacer ring

Dimension [mm]	D_1 [mm]	D_2 [mm]	D_3 [mm]	H [mm]	h_1 [mm]	Weight [kg]	SAP Index
250	1100	1000	1180	250	250	21	3022509
500	1100	1000	1180	500	250	38	3022511
750	1100	1000	1180	750	250	54	3022513
1000	1100	1000	1180	1000	250	71	4000758



Tegra 1000 PE Cone 1000/600

D_1 [mm]	D_2 [mm]	D_3 [mm]	D_4 (mm	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
695	638	1000	1180	770	560	39	4000757



Rubber seal for Tegra 1000 PE

Dimension [mm]	a	b	D	SAP Index
1000	25	45	1105	4030594

Rubber seal 640 mm

Dimension [mm]	SAP Index
640	4000699

The components of the Tegra 1000 PE manhole are compatible with the Tegra 1000 manhole – see page 100.

Basic 600, 425, 400 and 315 manholes

Inspection manholes

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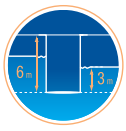
10. Inspection manholes Basic 600, 425, 400, and 315

10.1. General characteristics

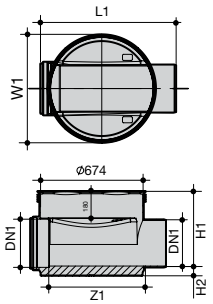
The Basic 425 (DN/ID 425) and Basic 400 (DN/OD400) and Basic 315 (DN/ID315) manholes, according to PN-EN 476, are non-access sewer manholes. They are commonly referred to as inspection maholes.

Technical parameters

		Basic 600	Basic 425	Basic 400	Basic 315
type of manhole		inspection, non-access			
internal/external diameter of manhole core		Dw = 600 mm Dz = 670 mm	Dw = 425 mm Dz = 476 mm	Dw = 364 mm Dz = 400 mm	Dw = 315 mm Dz = 353 mm
technical parameters as permissible application area (according to PN-EN 13598-2)	**maximum depth**	6 m according to EN 13598-2, 10 m after consultation with Wavin			
	maximum groundwater level measured from the bottom of the manhole as a constant load, under which durability and structural stability of the shaft are ensured[1)]				
	traffic load	for SLW 60 – D 400			
resistance to groundwater buoyancy		5 m without additional measures (e.g., weighting, concreting, anchoring), only proper, durable backfill compaction required (min. 98% SPD)			
material:	**shaft**	PP	PP (250 and 315), collector PE	PP	PP (110–200), PE (250 and 315)
	core	PP	PP	PP	PP
diameters of the connected sewer pipes		smooth-wall – 160–400 mm XS – 100–300 mm – through transition fittings	SW – 110–400 mm XS – 100–300 mm – through transition fittings	SW – 110–200 mm XS – 100–300 mm – through transition fittings	SW – 110–400 mm XS – 100–300 mm – through transition fittings
shaft types:	**flow shafts**	160–315	110–315	110–315	110–315
	collector at 45°	160–315	110–315	110–200	110–315
	collector at 90°		200 + 2 × 160		200 + 2 × 160
	bottom without outflows	✓	✓	✓	✓
"In-situ" inserts – can be integrated into the core on-site		smooth-walled – 110–200 mm XS – 100–200 mm – through transition fittings	smooth-walled – 110–160 mm XS – 100–200 mm – through transition fittings	smooth-walled – 110–160 mm XS – 100–200 mm – through transition fittings	smooth-walled – 110–160 mm XS – 100–200 mm – through transition fittings
manhole and inlet crowns:	**A15 Class**	cast iron covers, PP hatches	cast iron lids, PP covers		
	Class B125	cast iron hatches	cast iron covers, cast iron inlets		
	Class C250	cast iron inlets			
	Class D400	cast iron hatches, cast iron inlets			
manhole cron components		telescopic adapters Ø 500 reinforced concrete rings	telescopic pipes Ø 425	telescopic pipes Ø 315 TAR cones	telescopic pipes Ø 315 TAR cones
guaranteed tightness of the manhole component connections		TAR cones ≥ 0.5 bar condition D according to EN 1277 for connectors condition An according to EN 1277 for components			
potential for using manholes for other solutions			rainwater and sedimentation manholes, with or without a siphon		
domestic technical specifications		EN 13598-2	EN 13598-2 positive opinion from GIG – possibility of use in areas affected by mining damage up through category III		

[1)] Parameters confirmed by long-term pressure testing in accordance with standard EN 13598-2.

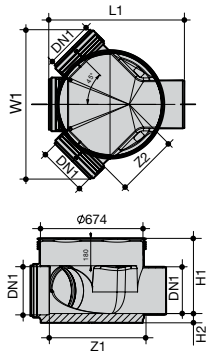
10.2. Basic 600 inspection manhole – component listing



Basic 600 shaft with seal
Flow type

DN1	L1 [mm]	Z1 [mm]	H1 [mm]	H2 [mm]	W1 [mm]	SAP Index
160	813	657	340	70	713	3065833
200	833	648	379	57	713	3065834
250	870	636	428	63	713	3065835
315	892	623	494	66	713	3065836

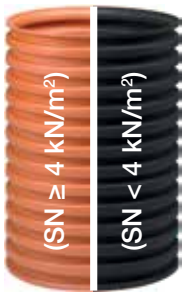
Outflow – bare connector.

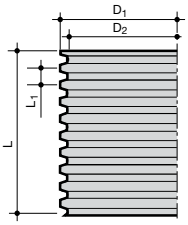


Basic 600 shaft with seal
Collector shaft at angle 45°

DN1	L1 [mm]	Z1 [mm]	Z2 [mm]	H1 [mm]	H2 [mm]	W1 [mm]	SAP Index
160	813	657	394	340	55	778	3065837
200	833	648	388	379	52	816	3065838
250	870	636	378	428	58	871	3065899
315	892	623	405	494	61	892	3065900

Outflow – bare connector.

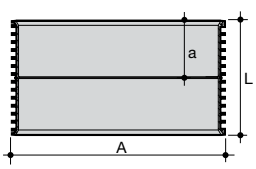




Corrugated 600 PP core pipe without socket

L [mm]	D_1 [mm]	D_2 [mm]	L_1 [mm]	weight [kg]	SAP Index
ring stiffness SN ≥ 4 kN/m²					
1000	670	600	100	13.1	3071397
2000	670	600	100	26.2	3092339
3000	670	600	100	39.3	3092341
6000	670	600	100	78.6	3092343
3650*	670	600	100	48.4	3024789
ring stiffness 2 ≤ SN < 4 kN/m² (E)					
1000	670	600	100	7.3	3070738
2000	670	600	100	14.6	3092345
3000	670	600	100	22	3092346
6000	670	600	100	42.8	3092347

* With a socket.

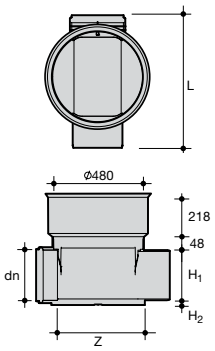


Double coupling corrugated pipe DN 600 (2 seals)

Dimension [mm]	a [mm]	L [mm]	A [mm]	SAP Index
600	165	354	674	3044171

For crown components – see Chapter 16.

10.3. Inspection chamber Basic 425 – component overview

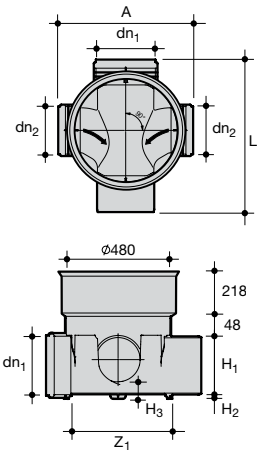


Manhole invert Basic 425 with gasket

PP Flow type

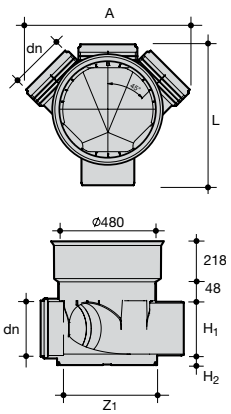
dn	L [mm]	H_1 [mm]	H_2 [mm]	Z [mm]	SAP Index
110	467	212	25	348	3045391
160	505	264	25	350	3045392
200	534	301	24	349	3045393
250*	790				3044041
315*	830				3044042

* Bk (bare ends).



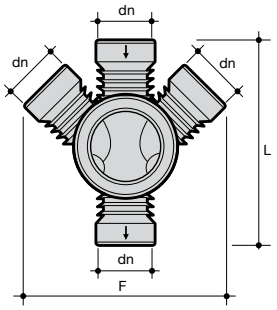
Collective at 90° angle with a gasket

Dimension dn_1/dn_2	L [mm]	A [mm]	H_1 [mm]	H_2 [mm]	H_3 [mm]	z_1 [mm]	SAP Index
200/160	534	472	301	20	59	349	3045397



Collective at 45° angle with a gasket

dn	L [mm]	A [mm]	H_1 [mm]	H_2 [mm]	z_1 [mm]	SAP Index
110	467	475	212	32	348	3045394
160	505	538	264	25	350	3045395
200	534	609	301	41	349	3045396

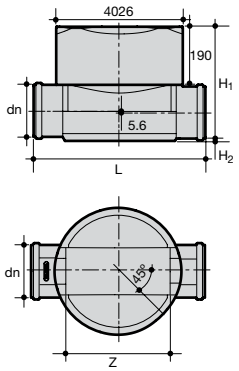


Collective at 45° with PE with a gasket

dn	F [mm]	L [mm]	SAP Index
250/250/250	1010	909	3022205
315/315/315	1195	1005	3022206

Other components as for Tegra 425.
For cover components – see : Chapter 16.

10.4. Inspection chamber Basic 400 – component overview

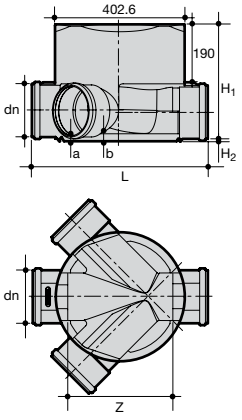


PP LC Invert, Basic 400 with a gasket

Flow-through type I 180°

Dimension dn	L [mm]	Z [mm]	H_1 [mm]	H_2 [mm]	SAP Index
110	514	388	303.9	11.9	3094115
160	562	372	355.5	17.9	3094116
200	578	338	396.7	21.9	3094117
250*	790	400	471.0	81.0	3043116
315*	830	400	529.0	80.0	3043117

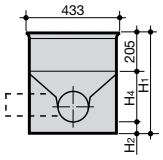
* Connectors – bare ends, socket for connecting the shaft pipe DN/OD 400, 205 mm.
Version not using post-consumer recycled materials



PP LC Invert, Basic 400 with a gasket

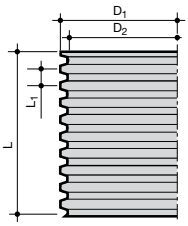
Collective type Y 45°

Dimension dn	L [mm]	Z [mm]	H_1 [mm]	H_2 [mm]	a [mm]	b [°]	SAP Index
110	514	388	303.9	11.9	11	1°	3094118
160	562	372	355.5	17.9	17.9	1°	3094119
200	578	338	396.7	21.9	21.9	1°	3094120



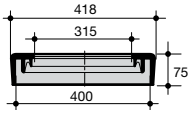
Connecting with left, right inlet or collective inlet with a gasket (inlets smaller than main duct)

DN	angle [°]	H_1 [mm]	H_2 [mm]	H_4 [mm]	Possible diameters (*) DN [mm]	SAP Index
250	90	611	80	326	160, 200	3044050
315	90	668	79	383	160, 200	3044051



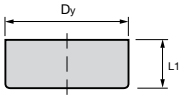
PP DN/OD 400 corrugated shaft pipe

D_1 [mm]	D_2 [mm]	L [mm]	L_1 [mm]	SAP Index
ring stiffness 2 ≤ SN < 4 kN/m² (E)				
400	364	750	50	3080266
400	364	2000	50	3044020
400	364	3000	50	3044021
400	364	6000	50	3023955
ring stiffness SN ≥ 4 kN/m²				
400	364	6000	50	3053555



Sleevedgasket

Dimension	SAP Index
400 / 315	3022161

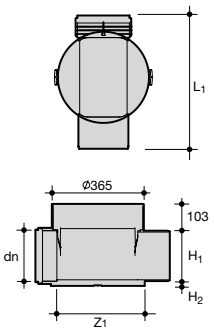


Pipe plug for corrugated pipes DN/OD 400 with a gasket

D_y [mm]	L_1 [mm]	Material	SAP Index
400	86	PVC	3044199

For cover components – see : Chapter 16.

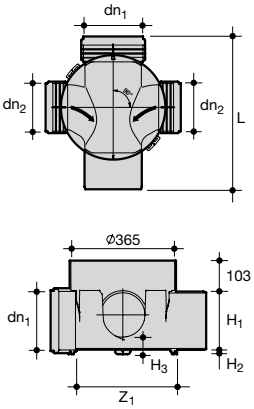
10.5. Inspection chamber Basic 315 – component overview



PP Invert, LC Basic 315 with a gasket

Flow-through type I 180°

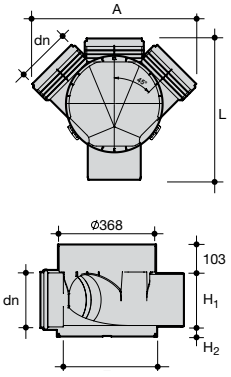
Dimension dn	L_1 [mm]	H_1 [mm]	H_2 [mm]	Z_1 [mm]	SAP Index
110	467	212	25	348	3094115
160	505	264	25	350	3094116
200	534	301	24	349	3094117



PP Invert, LC Basic 315 with a gasket

Collective type X 90°

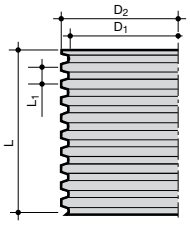
dn_1/ dn_2	L_1 [mm]	W_1 [mm]	H_1 [mm]	H_2 [mm]	H_3 [mm]	Z_1 [mm]	Z_2 [mm]	SAP Index
200/160	534	472	301	20	59	349	327	3076492



PP Invert, LC Basic 315 with a gasket

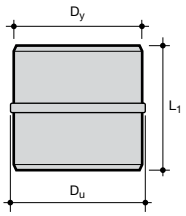
Collective type Y 45°

dn	L [mm]	A [mm]	H_1 [mm]	H_2 [mm]	z [mm]	SAP Index
110	467	475	212	32	348	3065587
160	505	538	264	25	350	3065588
200	534	609	301	41	349	3092873



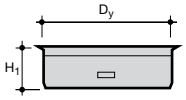
PP – SN corrugated shaft pipe 315 ≥ 4 kN/m²

D_1 [mm]	D_2 [mm]	L [mm]	L_1 [mm]	SAP Index
315	354	1250	50	3070772
315	354	2000	50	3070773
315	354	3000	50	3070774
315	354	6000	50	3070775



Double coupling for corrugated pipes Ø315 with gaskets

D_y [mm]	D_u [mm]	L_1 [mm]	SAP Index
315	317	200	3044154



PP* cover for corrugated shaft pipe with a gasket

D_y [mm]	H_1 [mm]	SAP Index
315	90	3022217

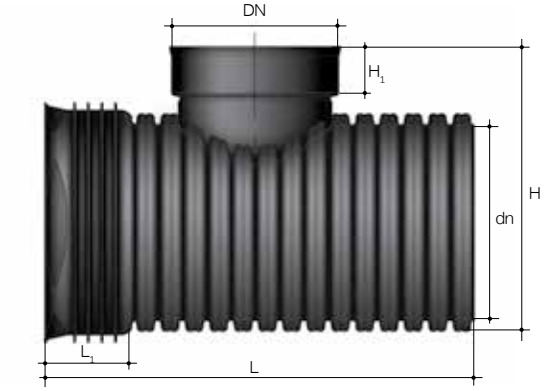
* It can be used as a bottom cap for corrugated pipes DN 315 or as a leak-proof (anti-flood or anti-odor) capping of the shaft pipe.

For cover components – see : Chapter 16.

10.6. Inspection chambers for large diameter structural pipes

Wavin X-Stream large diameter sewer pipe networks – DN 800, 600 and 500 – are equipped with inspection chambers Ø 600, 425 or 400. They are available in flow-through versions with a socket inlet connection and a bare end outlet connection. Smaller side inlets can be connected to the chamber DN 110 – 200:

- connections to the shaft of the chambers can be made with "in-situ" inserts,
- inlets can be connected to the chambers via socket branches.



Inspection inverts Ø 600*

dn	DN	L [mm]	H [mm]	L_1 [mm]	H_1 [mm]	SAP Index
800	600	1765	1119	346	200	3052502

Inspection inverts Ø425*

dn	DN	L [mm]	H [mm]	L_1 [mm]	H_1 [mm]	SAP Index
800	425	1765	1109	346	200	3044045
600	425	1358	905	294	200	3044044
500	425	1310	810	247	200	3044043

Inspection inverts Ø400*

dn	DN	L [mm]	H [mm]	L_1 [mm]	H_1 [mm]	SAP Index
800	400	1765	1074	346	170	3052825
600	400	1358	865	294	170	3052824
500	400	1310	770	247	170	3052823

* Without shaft and spigot seals.

Gaskets for corrugated shaft pipes

Dimension [mm]	SAP Index
400	4049083
425	4052716
600	4023826

Gaskets for X-Stream spigots

Dimension [mm]	SAP Index
500	4023204
600	4023205
800	4081702

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11. Tegra RG and Basic RG road inlet manhole

ROAD INLET DRAINS

Wavin Road Inlet drains are used to collect and drain rainwater and snow melt from roads, parking lots and traffic engineering areas. They are suitable for installation with street drains up to class D400 in road surfaces with SLW60 traffic. The inlet drains comply with EN 17670-2.

The drains are made of PP, are easy to install, waterproof, impact-resistant, resistant to deicing salts and leak-proof. They come with a range of innovative solutions that make installation and operation easier. They are a great alternative to traditional solutions.

11.1. Road Inlet Drain Characteristics

1. **Corrugated shaft pipes:**
   - DN/ID 425, $D_{dia.}$ 450,
   - DN/OD 400,
   - DN/ID 315.

2. **Sediment tanks:**
   - XL ≥ 100–200 dm^3,
   - L = 70 dm^3,
   - M = 45 dm^3,
   - S = 0 dm^3 – start.

3. **Possible connections: 160 and 200.**

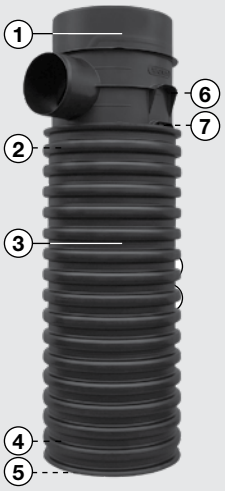
4. **Optional equipment for sediment tanks:**
   - Trap – water seal eliminates unpleasant odors,
   - 360° filter – retention of floating debris, resistant to clogging,
   - Prolongs the flow capacity of a manhole and water drainage efficiency.

5. **Easy installation:**
   - Lightweight,
   - 2 types of ergonomic handles and a stable base,
   - Easily adjustable height,
   - One-man installation without the use of heavy equipment.

6. **Easy to use:**
   - Sediment tank with rounded bottom, easy to clean,
   - 95% cleaning efficiency in a very short time,
   - Easy access to the bottom and to the sewer,
   - Leak-proof,
   - No settling.

Tegra RG sediment inlet drains

Basic RG sediment free drains



XL (100-200 dm³) with components for pipe $D_{dia.}$ 450

1. Module 425/400 with 200 or 160 outlet
2. 425 G2 gasket
3. Shaft pipe 425
4. 425 X gasket
5. 425 Bottom
6. Trap (option)
7. Filter (optional) – requires filter module and trap

XL (110 dm³) with components for pipe $D_{dia.}$ 450

1. Module 425/400 with 200 or 160 outlet
2. 425 G2 gasket
3. Sediment collector Tegra RG 425
4. Trap (option)
5. Filter (optional) – requires filter module and trap

L-70 or **M-45** for shaft $D_{dia.}$ 450 or DN/OD 400

L-70 or **M-45** for shaft DN/ID 315 pipe

S-0 for shaft DN/OD 400

S-0 for shaft DN/ID 315

	Inlet drains for corrugated shaft pipes								
Drain pipes	DN/ID425; $D_{dia.}$ 450 mm			DN/OD 400			DN/ID315		
Drain type	XL	L	M	L	M	S	L	M	S
Sediment tank size; in dm³	as per indicated requirements 100–200	70	45	70	45	0	70	45	0
Possible equipment variants	"-"; S; F+S			"-"; S; F+S		"-"	"-"; S; F+S		"-"
Drain outlet size; in mm	200 and 160			200 and 160		160	160		160 and 110
Weight of the drain (without shaft); in kg		7.7–9	7.4–8.7	7.7–9	7.4–8.7	2.6	7.1–8.4	6.1–7.2	1.9
Classes (types) of Covers	D400; C250; B125; A15			D400; B125; A15					
The range of sizes of road drains	D400 – 600x400 – F_{wl} 10 dm²; D400 – 500x500 – F_{wl} 10 dm²; B125 – F_{wl} 3.3 dm²			D400 – 420x340 mm – F_{wl} 4.5 dm²; B125 – F_{wl} 2.4 dm²					
Cover Type	floating with a telescopic tube conventional with concrete or TAR elements beneath the inlet								

Key:
"-" – without interior fittings
S – with siphon
F+S – full equipment – floating dirt filter (360°) and trap

Installing the inlet drain
– Quick installation by one person without the use of heavy equipment

Principle of the 360 filter°
– Longer retaining the flow capacity of the manhole drain due to the holding back of floating debris

Access to the manhole with 360° filter and trap and the efficiency of hydrodynamic cleaning

Principles of design of inlet manholes

- The size of the inlet depends on the size of the drainage area:
  - for 400 m^2 – street drain manholes with an inlet area of 9–10 dm^2 (typically 620 × 420, 600 × 400 or 500 × 500 mm),
  - smaller areas – inlets with a proportionally smaller area, e.g. for 100 m^2 an inlet area of 2.5 $dm^2$is sufficient.
- For manholedrains with big inlets (9–10 dm^2) use inlet manholes with a sediment tank L (70 dm^3) or XL (100 dm^3 and larger).
- For small inlet manholes (> 5 dm^2) use inlet manholes M (45 dm^3) or L (70 dm^3).
- Classes of drains A15–D400 – location according to EN 124 – see section 18.2.
- The diameter of the drain (and sewer) in accordance with the regulations for drains:
  - dn 160 – up to 12 m,
  - dn 200 – more than 12 m and the distance no more than 20 m,
  - dn 200 – for two inlets connected to a single sewer.
- The sediment tank and sewer must be positioned below the deicing zone.
- Non-sediment inlet manholes should be used:
  - When it is not possible to provide adequate manhole depth (for example, over underground garages),
  - When it is not recommended to disturb the native soil (for example, under roads).
- When using non-sediment inlet drain manholes, it is necessary to provide flow through sediment tanks, and sand separators before discharging into the sewer system.
- Trap – water seal to be used when:
  - the receiver is a public sewer system,
  - In areas at risk of explosion, e.g. filling stations.
- Floating Debris Filter 360°be used when the drainage surface has a lot of debris that can block the drainage from the manhole (e.g. leaves, debris) i.e. when draining marketplaces, wooded areas, speed reduction areas – motorway service areas and motorway exits.

Key for the designations of inlet drain names

Colors	Raw materials	Equipment
CZ – black	PP – polypropylene	F – filter (always included with siphon)
B – white	PE – polyethylene	M – siphon for drain 160
G – Green		L – siphon for drain 200

Example:

Tegra RG Inlet Drain Manhole | **L70** | **425/400** | **x200** | **PP** | **CZ** | **L+F**

XL115; L70; M45; S0 – sediment tank capacity in dm^3

425/400; 315 – manhole shaft diameter

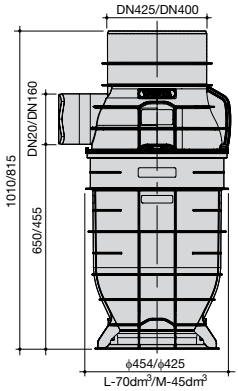
x200; x160; x110 – diameter of outlet drain connection

PP – the raw material of which the manhole is made (polypropylene)

CZ – black color

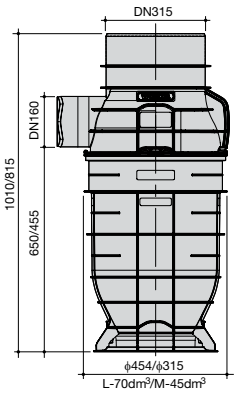
L+F; M+F – complete manhole equipment (siphon and filter 360°) trap suitable for drain diameter and filter
L; M – equipping the manhole with a siphon suitable for drain diameter

11.2. Road inlet manholes – component overview



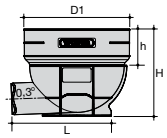
Tegra sediment manhole Tegra RG 425/400 (without gasket)

Dimension	Sediment tank	Equipment	Weight [kg]	SAP Index
425/400	L-70 dm³	outlet dn 200	–	3077251
425/400	L-70 dm³	outlet dn 200/trap L		3077252
425/400	L-70 dm³	outlet dn 200/trap L/filter		3077253
425/400	L-70 dm³	outlet dn 160		3079159
425/400	L-70 dm³	outlet dn 160/trap M		3077248
425/400	L-70 dm³	outlet dn 160/trap M/filter		3077249
425/400	M-45 dm³	outlet dn 160		3079160
425/400	M-45 dm³	outlet dn 160/trap M/filter		3079669



Tegra RG 315 sediment manhole (without gaskets)

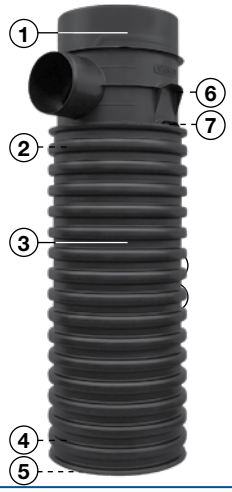
Dimension	Sediment tank	Equipment	Weight [kg]	SAP Index
315	L-70 dm³	outlet dn 160	–	3077246
315	M-45 dm³	outlet dn 160		3077243
315	M-45 dm³	outlet dn 160/trap M		3077244
315	M-45 dm³	outlet dn 160/trap M/filter		3079240



Non sediment inlet drain manhole basic RG S-0 (with a gasket)

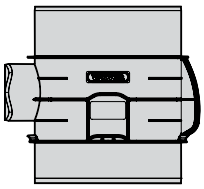
Shaft dimension × DN	D1 [mm]	H [mm]	h [mm	L [mm	Weight [kg]	SAP Index
400 × 160	417	388	150	469	2.8	3077207
315 × 160	370	304	100	445	2.0	3077206
315 × 110	370	304	100	414	2.0	3077205

Tegra RG 425 sediment manhole with XL sediment tank (with volume according to individual needs) – assembled from components



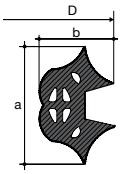
1. Module 425/400 with 200 or 160 outlet
2. 425 G2 gasket
3. Shaft pipe 425
4. 425 X gasket
5. 425 Bottom
6. Trap (option)
7. Filter (optional) – requires filter module and trap

1. Module 425/400 with 200 or 160 outlet
2. 425 G2 gasket
3. Tegra RG 425 manhole inlet sediment tank
4. Trap (option)
5. Filter (option) – requires filter module and trap



Inlet drain manhole module with an outlet (without gaskets)

Dimension	Equipment	Weight [kg]	SAP Index
425/400	outlet dn 200	3.5	3077254
425/400	outlet dn 200/filter support	3.7	3081215
425/400	outlet dn 160	3.5	3077266
425/400	outlet dn 160/filter support	3.7	3081214



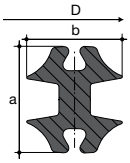
425 G2 gasket
– for connecting the outlet module to the shaft pipe 425

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
425	48.4	31.1	474.0	4067726

Tegra RG 425 XL inlet manhole sediment tank (without seal)

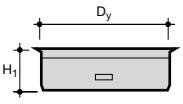
Dimension [mm]	Sediment tank	SAP Index
425	XL – 110 dm³	3088291

PP 425 corrugated shaft pipe – see manhole shafts



425 X gasket

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
425	31.8	28.7	473.1	4052716

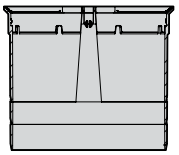


Base for the corrugated core pipe (without seal)

Dimension D_y [mm]	D_y [mm]	H_1 [mm]		SAP Index
425	425	140	without handles	2015215
425	425	140	with handles	3045086

The base, along with the seal, can also be used as a watertight cover.

Accessories for sediment inlet manholes



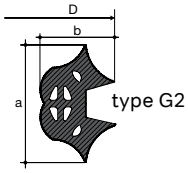
Inlet drain manhole trap + PP handle

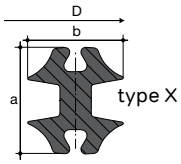
Shaft dimension x DN	Weight [kg]	SAP Index
L – for connection 200	0.7	3077258
M – for connection 160	0.7	3077257

Inlet drain manhole filter PE B

	Weight [kg]	SAP Index
	0.4	3077268

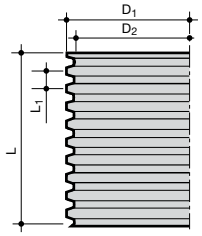
Gaskets and shafts of inlet manholes 425, 400 and 315





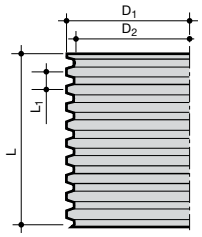
425 gasket

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
Type G2 – for connection outlet module/shaft pipe 425				
425	48.4	31.1	474.0	4067726
Type X – other connections				
425	31.8	28.7	473.1	4052716
400	24.6	20.9	402.0	4049083
315	23.2	20.0	354.0	4049033



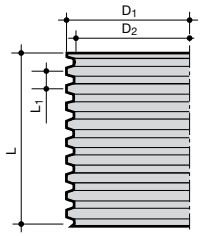
Corrugated PP 425 core pipe

D_1 [mm]	D_2 [mm]	L [mm]	L_1 [mm]	SAP Index
ring stiffness 2 ≤ SN < 4 kN/m² (E)				
476	425	750	70	3080265
476	425	2000	70	3080268
476	425	3000	70	3080267
476	425	6000	70	3045520



PP DN/OD 400 corrugated shaft pipe

D_1 [mm]	D_2 [mm]	L [mm]	L_1 [mm]	SAP Index
ring stiffness 2 ≤ SN < 4 kN/m² (E)				
400	364	750	50	3080266
400	364	2000	50	3044020
400	364	3000	50	3044021
400	364	6000	50	3023955



PP – SN corrugated shaft pipe 315 ≥ 4 kN/m²

D_1 [mm]	D_2 [mm]	L [mm]	L_1 [mm]	SAP Index
315	354	1250	50	3070772
315	354	2000	50	3070773
315	354	3000	50	3070774
315	354	6000	50	3070775

See section 16.4 covers for road inlet drain manholes with a shaft 425, 400 and 315.

12. Drain manholes made of shaft pipes

The prefabricated inlet drain manholes are sediment manholes. They are available in different variations:

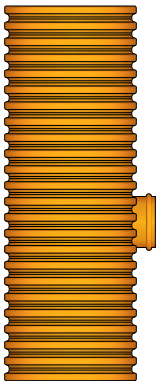
- factory-plugged bottom – the contractor makes the connection himself using in situ inserts,
- factory-plugged bottom – drain via “in-situ” insert
- blind bottom + spigot for connecting smooth- wall pipes (SW – bare end),
- plugged bottom + Wavin X-spigot for pipe connection (XS – Flange).

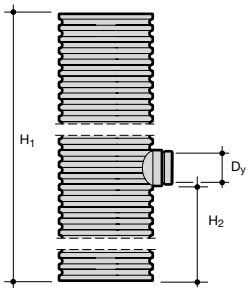
See pages 61 and 62 for more information.

	Ø600	Ø425	Ø400	Ø315
Without connection fitting	H= 2 m	H= 2 m	H= 2 m	**0**
Spigot for connecting smooth wall pipes	200 bk H= 2 m V= 200 l	200 bk H= 2 m V= 100 l	160 bk H= 2 m V= 75 l	160 sockets H= 1.75 m V= 30 l
Spigot for connecting X-Stream structural pipes	200 socket H= 2 m V= 200 l	200 socket H= 2 m V= 100 l	150 socket H= 2 m V= 75 l	
Trap	**0**	**0**	**0**	160 bk H= 2 m V= 60 l

0 – Possible with your own components
bk – Bare end of smooth wall pipes (beveled)

12.1. Sediment manholes made of corrugated pipe SN 2





Sediment manholes 600, 425 and 400

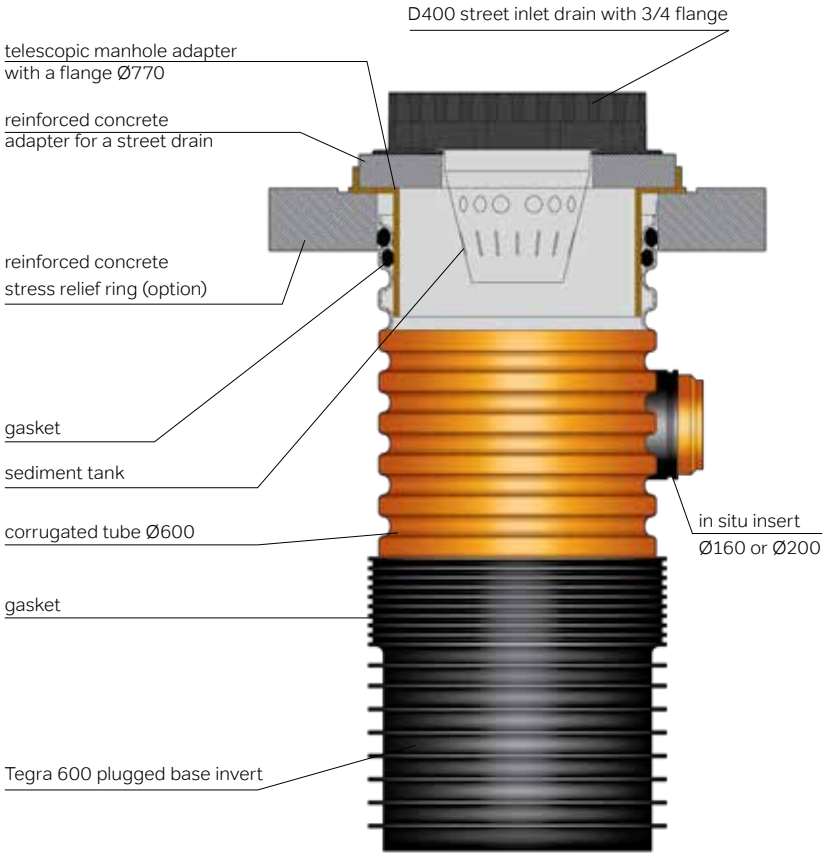
Dimension	Dimension D_1 [mm]	Type	H_1 [mm]	H_2 [mm]	Sediment tank [dm³]	SAP Index
DN/ID 600	–	–	2000		any	3044177
DN/ID 600	200	SW bk	2000	650	200	3044178
DN/ID 425	–	–	2000		any	3044180
DN/ID 425	200	SW bk	2000	650	100	3044181
DN/OD 400	–	–	2000		any	3044183

Outlet from drainless manholes is made by the contractor himself using in situ inserts.
The trap is made of 45° bends.

12.2. Inlet drains made of Tegra 600 elements

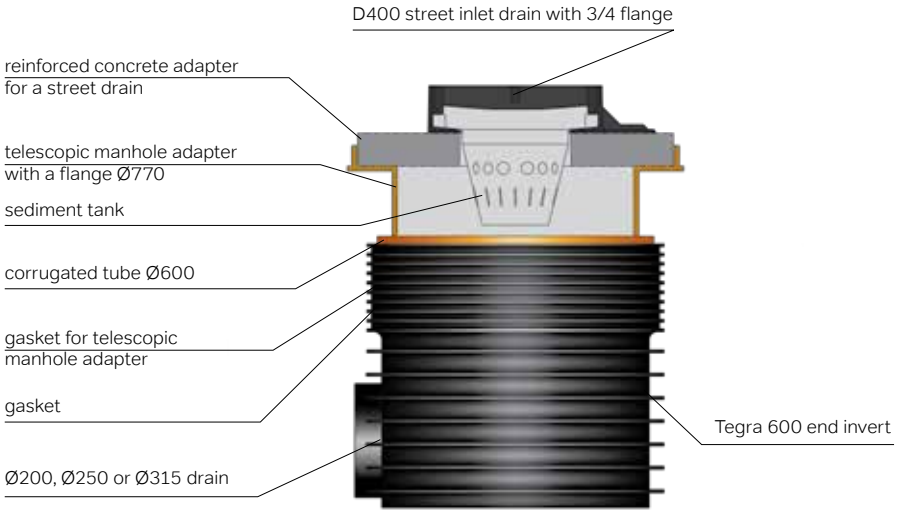
Tegra 600 sediment tank drain

made using a blind invert with a telescopic manhole/drain adapter and a reinforced concrete relief ring and D400 class street drain



Tegra 600 inlet drain without a sediment tank

made with an end invert with a telescopic adapter for manholes/inlets with class D400 street inlet with 3/4 flange



Other manholes

- Structural pipe drains
- Other functional manholes

wavin

An Orbia business.

13. Structural manhole pipe drains

13.1. Technical Specifications

If standard manholes designs are not sufficient, Wavin offers customized drains made from polyethylene (PE) structural pipes or polypropylene (PP) structural pipes.

Areas of application

Structural pipe manholes are designed for installation in unpressurized sewer systems, drainage and dewatering systems. They are designed to perform operational tasks such as cleaning, inspection, rinsing, and performing measurements taken from the level of the terrain using appropriate equipment. Drain manholes can be installed in the ground, in a lane, on the road or off the road and in green areas or other areas used for communication engineering purposes. Manholes up to a depth of 10 m are envisioned.

- Depth as required.
- For areas with heavy traffic.
- Circumferential rigidity according to rules (min. requirements):
  a) in roadways or other places exposed to dynamic loads up to and including class D400, up to a depth of 4 m – shaft tubes with nominal circumferential rigidity SN ≥ 2kN/m²,
  b) in roadways or other places exposed to dynamic loads up to and including class D400, up to a depth of 10 m – shaft tubes with nominal circumferential rigidity SN ≥ 4 kN/m²,
  c) in areas excluded from vehicular traffic (Class A15 and B125 covers) up to a depth of 2 m, using shaft pipe with a circumferential rigidity of SN ≥ 1.5 kN/m² and above 2 m, using shaft pipe with a peripheral rigidity of SN ≥ 2 kN/m² is permitted.

Manhole construction

Shaft pipes

- double-walled – in the diameter range DN/ID 300 to 1400,
- Single wall (corrugated) – in the diameter range DN/ID 425, 600 and 1000,
- spiral-welded – up to 2400 mm in diameter.

Connection spigots

The following are used as connection spigots:

- short PP or PE smooth wall pipe sections for connection to smooth wall pipe systems or X-Stream pipe sections
- X-Stream pipe sockets.

Connection spigots can also be transition fittings for pipes made of materials such as: GRP, stoneware or concrete.

Manhole steps or ladders

Wavin manholes can be equipped with steps fixed to the manhole wall, made of PP or PE-coated steel meeting the requirements of PN-EN 13101 or ladders suspended from a support and positioned with handles meeting EN 14396 requirements.

Types of manholes made of structural pipes

- Flow and collection drains,
- Sedimentation drains,
- Eccentric drains
- Underground vertical and horizontal storage tanks
- Housings for installation systems, e.g. water meters, fittings, separators, filters, flow regulators, pumping stations,
- Shafts or extensions for underground chambers and tanks.

Structural pipe sewage manholes consist of:

- Manhole base made of Wavin structural pipe with welded flat bottom or with flow gutter (invert). The flow trough may be made of plates, injection molded parts or rotationally molded parts. The base has welded connection spigots, which can be flared or plain, for connecting pipes made of various materials (PE, PP, PVC-U, GRP, stoneware, concrete and others). The spigots can be inserted above the bottom or in the bottom of the base. The base can also have an additional chamber under the bottom to be filled with concrete on site – in the event more weight is needed in areas with high groundwater levels,
- Shaft sections made of structural pipes with diameters up to DN/ID 800 for inspection chambers or manholes with diameters ≥ DN/ID 800,
- Steps or ladder (only for manholes)

- manhole chimney. A manhole chimney is found in manholes deeper than 3 m and has a diameter of at least 800 mm. The working chamber is at least 1.8 m high.

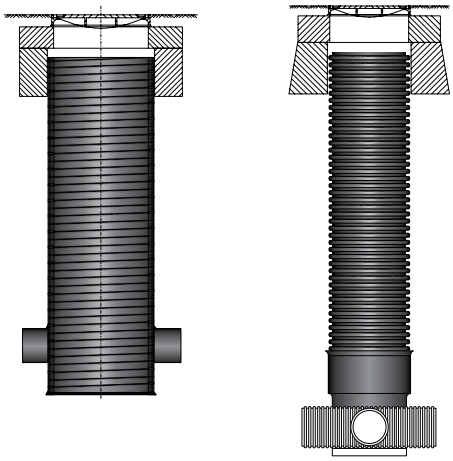


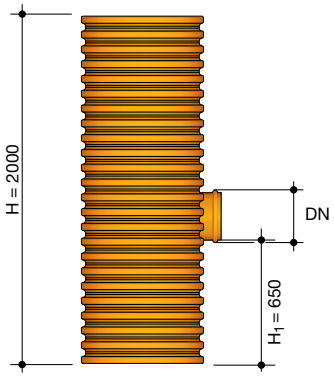
Figure 1. Examples of solutions for manholes with a flow invert made of structural pipes:
– different solutions possible: angled, connection, collective – any diameter and connection angle,
– flared or bare spigots.

Manholes with flow inverts are used as revision/inspection chambers on drains and on drain pipes.

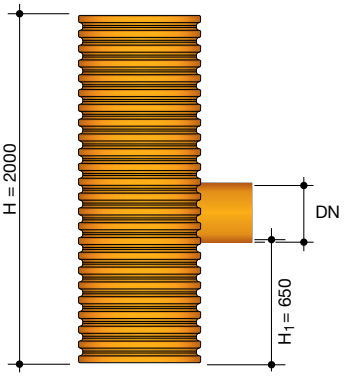
Manholes for pipes with large cross-sections can **be made as eccentric manholes (eccentric)**.

Figure 2. Example of a solution for an eccentric manhole made of structural pipes.

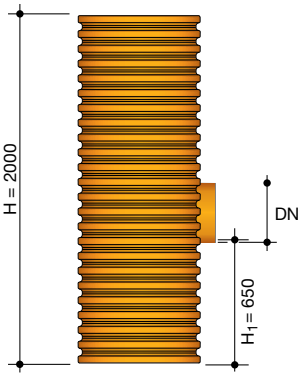
Sedimentation sumps (with or without siphon) are used in stormwater and drainage systems.



DN 600, DN 425, DN/OD 400
Manhole sealed at the factory. The volume of the sedimentation tank depends on the height of the manhole.



DN 600, DN 425, DN/OD 400
Factory sealed manhole.



DN 600, DN 425
Factory sealed manhole.

For an overview, see section 12.1.

Retention tanks, which are used for the retention of rainwater and as enclosures for various types of equipment working in flood (e.g. pumps, flow regulators, filters). They can be filled with water and run completely empty.

The range of structural pipes used and the construction technology enable the implementation of large underground retention tanks.

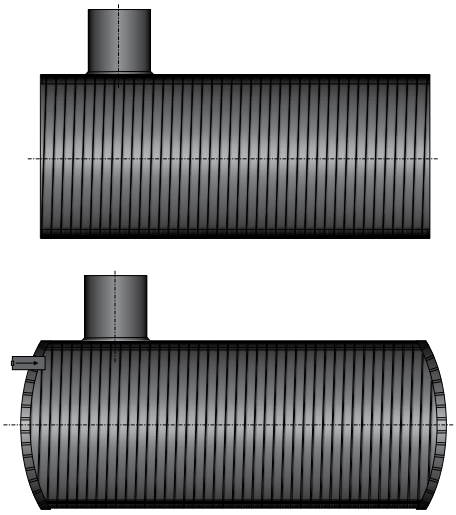


Figure 3. Example of manhole solutions – horizontal tanks made of structural pipes.

Shafts/extensions can also be used for underground chambers and tanks, which are manholes or inspection wells in the form of a manhole made of a structural pipe without a bottom, connected to the manhole opening of the underground tank or chamber. They can be made of structural pipes with diameters up to DN/ID 800 for non–manhole shafts or with diameters ≥ DN/ID 800 for manhole shafts. They are connected to the tank top by means of a passage prepared in the form of a connection sleeve, a spigot connection with a gasket or by welding or sealing.

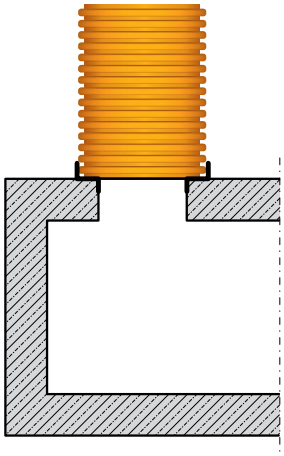
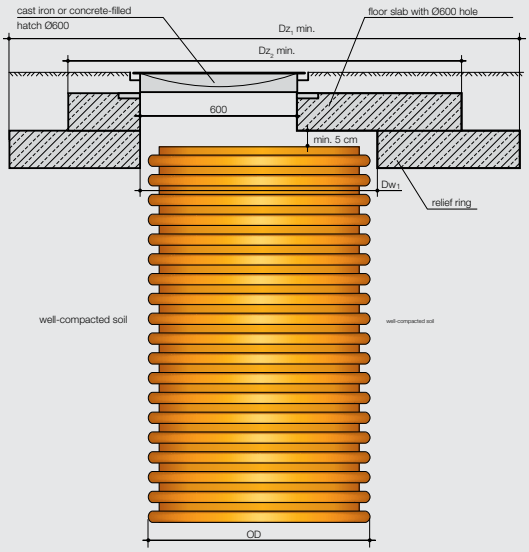


Figure 4. Example of a manhole solution – extension: manhole shaft or inspection shaft to the tank.

13.2. Manhole cover

The way of covering Wavin's manholes made of EN 124 compliant components, should ensure that road loads are safely transferred to the subsoil or structural layers of the road surface. If the permissible stresses are exceeded, a strain-relief ring or other solution with a favorable load distribution (e.g. geotextile) must be used. The top plate should be separated from the top of the shaft pipe by a construction gap of at least 5 cm. The cast iron cover must be secured against shifting during road surface formation, e.g. by making a recess in the slab.
Shaft covers with diameter DN/OD > 700.
Guidelines for making manhole covers in the form of a load-relief ring at the top plate of the manhole frame is shown in the diagram opposite.



Cover panel with hole 600
Dz_2 min. = OD + 0.4

Relief ring
Dw_1 = OD + 0.1 m
Dz_1 min. = Dw_1 + 2*0.3 m

Inquiry/order (for structural pipe manholes)*

Address details: Location, date:_____

Company:_____Contact person: _____

Address: _____

Tel./fax: _____ E-mail: _____

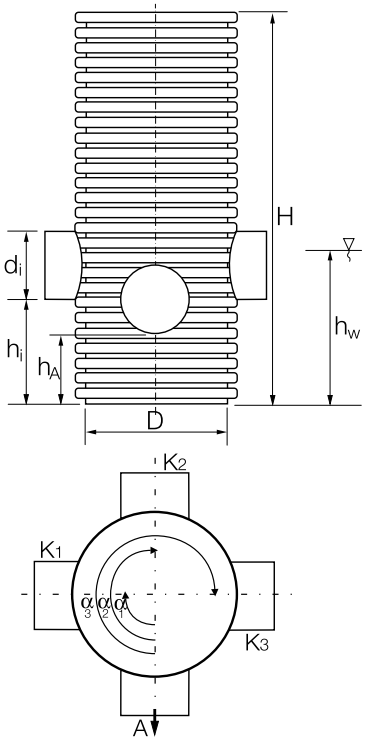
Purchase Order number

Expected delivery date

To
Wavin Polska S.A.
43 Dobieżyńska St.
64–320 Buk
tel: 61 891 10 00
fax: 61 891 10 11

Investments:

Please quote/construct* a manhole made of PE or PP structural pipes according to the dimensions specified in the drawing:



H – The height of the well from the bottom of the invert or sediment tank

A – Outlet spigot

$K_{1,2,3}$ – Inlet spigots

$h_A/h_{1,2,3}$ – Outlet spigot height $h_A/h_{1,2,3}$

$\mathbf{a}_{1,1,3}$ – Angle measured from outlet A to inlet K_1, K_2, K_3

Manhole number	Groundwater level above the bottom of the manhole [m]	Manhole diameter D [mm]	Total height	Outlet A d_A [mm]/ material	Outlet height A h_A [m]	Inlets d_i [mm]/ material			Height [m]			Angles [°]		
						K_1	K_2	K_3	h_1	h_2	h_3	$\mathbf{a}_1$	$\mathbf{a}_2$	$\mathbf{a}_3$
Scope required for quotation												Scope required for the order		

■ optional equipment

steps ☐

cascade ☐ – attach drawing

bottomless ☐

other ☐

■ floor type

profiled invert ☐

sediment bottom ☐

sediment ☐

Comments (any deviations from the standard described in the appendix)

* Delete as appropriate.

Additional information about the form can be found on the next page.

* Delete as appropriate. The order must be stamped and signed by the ordering party.

Additional information to the form for manholes made of structural pipes according to individual requirements

1. If there is no specific information in the inquiry/order form, the selection of the manhole material (PE or PP) is made by Wavin based on the analysis of the manhole connections.

2. Standard manhole diameters: 300, 400, 500, 600, 800, 1000 i 1200 mm. Larger diameters are also possible. When ordering a custom/non-standard diameter manhole, Wavin can offer an approximate standard diameter.

3. As standard, DN ≥ 1000 manholes are considered as EN 476 manholes. These manholes are equipped with steps or ladders. The steps or ladders used comply with PN-EN 13101 and PN-EN 14396 respectively. At the customer's request, manholes with a diameter of 800 ≤ DN < 1000 and a depth of up to 3 m can also be treated as manholes in accordance with EN 476.

4. Manholes with profiled inverts, designed for installation in a gravity sewer network of smooth-walled pipes, are made of PP gravity pipes or pressure pipes PE (SDR 17.6 – 21) with bare end outlets.

5. Manholes with profiled inverts for installation in a gravity sewer network of X-Stream structural pipes are made of X-Stream structural pipes ending in sockets.

6. Manholes with profiled inverts for installation in a gravity sewer network made from other structural pipes or other systems (e.g. traditional) are made of gravity pipes PP or pressure pipes PE (SDR 17.6–21) with bare end outlets, allowing connection to other systems via system adapters – transition fittings.

7. With regard to the manhole connection fittings located above the invert, the following rules apply:
   – for connection of gravity sewers made of PVC-U, PE or PP smooth-walled pipes and conventional systems (concrete or stoneware), as a spigot finishing, the bare end of the PE or PP pressure pipe is used to connect to the sewer system by means of a pipe socket or a double-socket coupling (e.g. sleeve) or adapters (transition fittings); couplings are not included in the scope of delivery of a manhole,
   – for connecting gravity sewer or drainage made from X-Stream PE/PP as finishing of the spigot, the socket made of X-Stream structural pipe without a gasket is used,
   – the bare end of the PE pressure pipe is used for connecting to the sewage system by welding or screw couplings; fittings are not included in the scope of delivery of the manhole.

8. Whenever the plain end of the pipe is left as a connection spigot, its length ensures a connection to the sewer system via a two-pipe coupling or a socket. Longer spigot lengths are available on request.

9. For an unambiguous manhole solution, the inlets and outlets must be specified by the nominal diameter and the material of the pipe to be connected to the manhole, e.g.
   – 160/PVC – gravity drainage pipe made of smooth-walled PVC pipes,
   – 300/XS – gravity sewer pipe made of X-Stream PP structural pipes,
   – 150/PE/PP – gravity sewer pipe or drainage from other PE/PP structural pipes,
   – 160 PE 100 SDR 17.26 – PE 100 SDR 17.26 pressure pipe,
   – 300/concrete.

10. If the manhole foundation site has groundwater above the top of the highest manhole inlet, it shall be protected against bottom deformation and displacement.:
    – sediment manholes are secured by welding a reinforcement and extending the manhole wall below the bottom, in order to anchor in concrete,
    – manholes with a profiled invert are equipped with a double bottom and 110 spigots for pouring concrete into the space between the bottom plates and for ventilation.

11. Any deviations from the above must be clearly marked in the "Comments" section.

12. Whenever it is necessary to deviate from the requirements set out in the inquiry/order form, Wavin will inform the recipient and provide proposals for an approved solution.

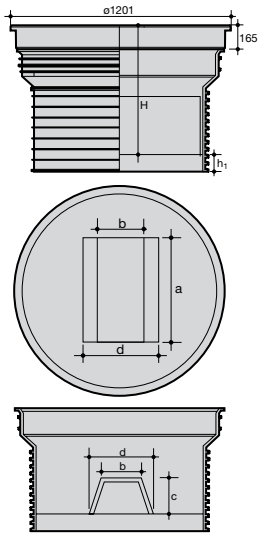
This and more forms can be found at www.wavin.com.

14. Other functional wells

14.1. Manholes as watertight underground enclosures

The Tegra 1000 and Tegra 1000 PE elements can be used to fabricate a sealed tank in which measurement or utility equipment can be installed on networks. In the Tegra 1000 wells, we offer measuring chambers with a bench on which heavier instruments can be placed.

The measuring chamber occurs:
– in a version with a socket type connection to the corrugated shaft and Tegra 1000 cone (socket version in the figure below),
– in a version without a socket for connection with ring spacers and Tegra 1000 PE cone (available under index 3044025 – dimensions as shown below, without a socket).

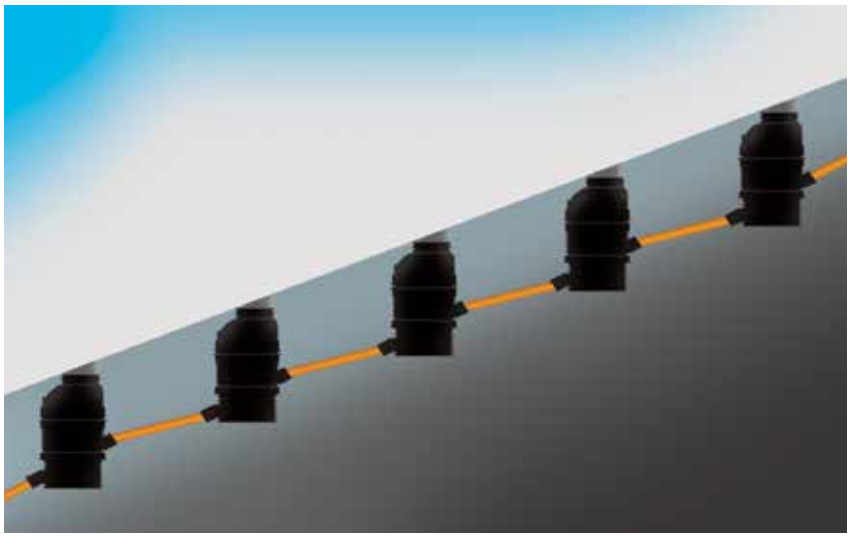


Tegra 1000 measuring chamber with a bench

DN	D_1 [mm]	D_2 [mm]	D_3 [mm]	H [mm]	h_1 [mm]	a [mm]	b [mm]	c [mm]	d [mm]	SAP Index
1000	1100	1000	935	604	97	500	250	160	200	3044026

14.2. Energy dissipation manholes (on inquiry)

In mountainous areas with steep sewer slopes, it is possible to overcome large gradient differences through inspection drop chambers.
In the case of manholes, it is recommended to use energy dissipation chambers. In these, the inflow to the manhole is connected tangentially to the wall. As it travels trough the depth, it develops a vortex motion along a funnel built into the bottom of the manhole, where it loses energy and then exits further down the system.

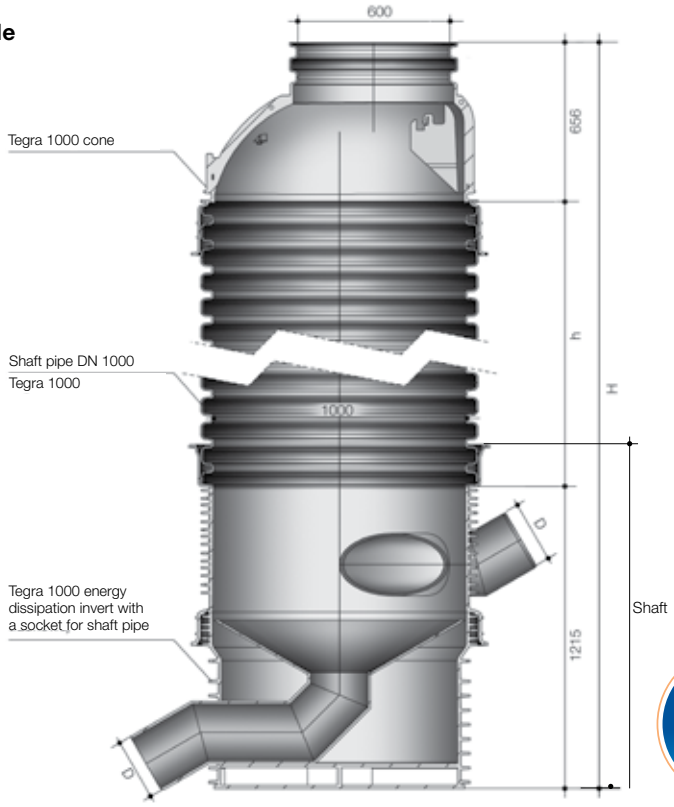


Principles of sewage system construction principle with the use of energy dissipating chambers

Lower part of the chamber invert with integrated funnel

Flow characteristics in the energy dissipation chamber

Construction of an energy dissipation manhole



Order form at:
www.wavin.pl

Component list of the Tegra 1000 energy dissipation manhole

SAP Index	Name	Quantity
3044155	Energy dissipation invert with a socket – any	1
3023312	Corrugated shaft tube PP Tegra 1000 (1.2m)	1 (optional)
4066386	Tegra 1000 gasket – DN 1000	2 (1 unit, optional)
3023807	Tegra cone 1000 1000/600	1
3032050	Tegra 1000 ladder, L = 1.63m, 6 steps	1 (option)*

* Not recommended for safety REASONS.

Depth of installation depth without shaft pipe and without cover: 1.87 m.
The expansion manhole is complemented by the typical Tegra 1000 manhole covers (see chapter 16).

14.3. Expansion manholes

It is recommended to use expansion manholes before connecting pressure pipelines to gravity sewers. In expansion manholes, the flow characteristics change, accompanied by the release of gases. Wavin expansion manholes are based on Tegra 600 or Tegra 1000 plastic manholes and Tegra 1000 PE manholes, which are resistant to the environments of both wastewater and aggressive wastewater vapors from sewage. Commercially available odor filters may be installed under the hatches. This solution is many times more durable than those commonly used, – but not sulfate corrosion resistant – and wearable concrete expansion manholes. The expansion manhole invert is equipped with an inlet spigot for connection to the PE discharge pipeline and a spigot connection for gravity pipelines made of smooth-walled pipes, e.g. PVC-U. A permanently flooded inlet chamber is separated in the lower invert space. The discharge pipe enters this chamber below its fill level. The gravity drain is located behind the overflow edge.

Through the expansion manhole constructed in this way, wastewater from the pressurized sewer system is fed into the gravity sewer system without disturbing the flow. Cooperation of the sewage pumping plant with such a receiver:

- protects the discharge pipeline from air aeration,
- protects the pump-discharge system from falling out of its effective operating range during each pumping cycle.

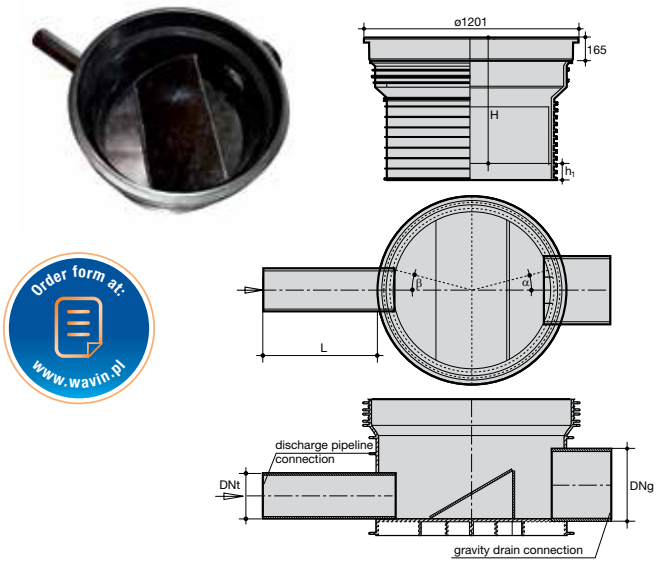
In the Tegra 1000 manholes, we offer expansion inverts:

- a version with a socket for connection to the Tegra 1000 corrugated shaft and cone (socket version in the figure below),
- a version without a socket for connection with spacer rings and the Tegra 1000 PE cone (available under index 3044146 – dimensions as shown, without a socket).

In the Tegra 1000 invert, the spigots can be positioned straight or ahead or in a direction that allows the wastewater flow to be reversed.

Standards:
– the gravity drain is positioned opposite the overflow edge (□ = 0°),
– the pressure inlet is connected at an angle (ß = 0°).
On request, the pressure inlet can be connected at an angle of ß = +/- 45°.
Larger direction changes can be made with fittings mounted on the discharge line.

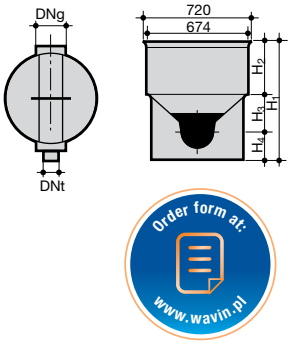
Non-standard changes of direction are made as a folding angle – use of fittings – elbows +/- angle ß (on individual orders – within existing limitations).



Order form at: www.wavin.pl

Tegra 1000 Expansion Manhole Invert

Name	SAP Index
An expansion invert with a spigot for Tegra 1000 Shaft	3052503
An expansion invert for Tegra 1000 PE shaft	3044146



Tegra 600 Expansion Shaft, customizable

DNt	DNg	α [°]	H1 [mm]	H2 [mm]	H3 [mm]	H4 [mm]	Weight [kg]	SAP Index
40-160	160-200	0	646	207	271	168	22-23	3044104

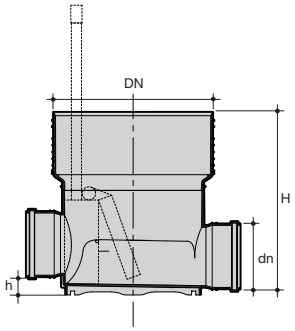
1. All Tegra 600 expansion shafts are ordered under the universal index 3044104. When ordering, specify the diameter of the pressure inflow and the gravity outflow.
2. The divider with an overflow edge for drain 200 is located at the height of the widest part of the invert.

14.4. Manholes with stormwater gate valves

It is recommended that low-lying areas connected to the sewer system be protected against backflow flooding, which can occur due to sewage backing up in the sewer system (e.g. heavy precipitation in general sewer systems, blockages in the outflow or inactive pumping stations with sewage backed up).
Available storm gate valves as devices that require operation are built in:
– Tegra 1000 manholes,
– Tegra 600 shallow manholes, where the gate valves are within hands reach from the pavement level.
It is advisable to use these manholes for valves with manual locking – in case of periodic closing.

Alternatively, the 425, 400 and 315 inspection chamber inverts with a built-in storm flap are another solution. They have a simple locking mechanism without a manual lock to remove pavement level. The device does not require specialized operation for maintenance. It works in such a way during standard operation that the wastewater flows freely, lifting the loosely hanging flapper. If there is a build-up of wastewater on the drain side, the flapper is pressed against a specially designed socket. The process is completely self-contained and requires no handling. The trough and flap are made of PP and the flap itself is clad in high-quality chrome-nickel steel– protecting the gasket against rodents. The device flap is permanently connected to an aluminum rod ending in a handle. This allows the element to be easily removed from the manhole for inspection and maintenance. The rod can be extended up to several meters (so-called extensions – SAP index 4059468 – are 0.7 m long). Once the inspection is complete, the flapper assembly is easily put back into place in the manhole using the rod.

Note!
As a rule of thumb, the storm flap only protects premises at risk of backflow and does not cut off the outflow of wastewater from the entire facility. A common error is that the storm gate valve is installed in such a way that the sewage from the upper floors has its outflow cut off and floods the rooms below. Storm gates are also an effective rodent protection.
Operators use manual levers to temporarily shut off the drain – e.g. when away – to cut off bad odors. It is imperative to remember to open the hand lever before use.

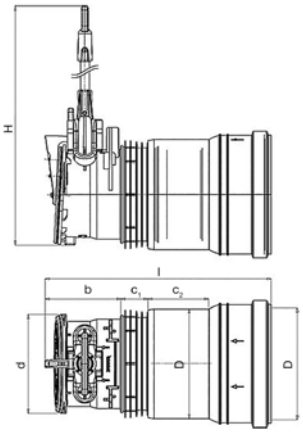


Type 0 storm gates in the gully (without gasket)

	DN	dn	H [mm]	h [mm]	SAP Index
Storm gate valve T0 + invert 425 DN160 without remarks	425	160	470	32	3067550
Storm gate valve T0 + 425 DN200 invert without remarks	425	200	470	32	3067551
Storm gate valve T0 + invert 400 DN160 without remarks	400	160	455	32	3067554
Storm gate valve T0 + invert 400 DN200 b/u	400	200	455	32	3067555
Storm gate valve T0 + invert 315 DN160 b/u	315	160	410	32	3067552
Storm gate valve T0 + invert 315 DN200 b/u	315	200	410	32	3067553

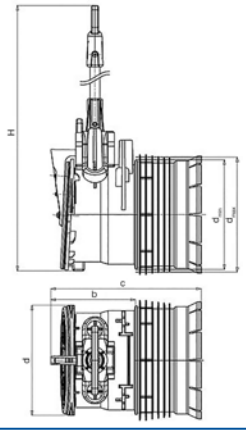
Complemented by gaskets and stem pipes, respectively: 425, 400 and 315.

Extension 0.7 m	-	-	-	-	4059468



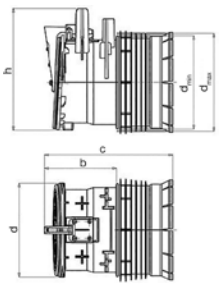
Storm gate valve T0 for a spigot with a handle

DN	d [mm]	b [mm]	c_1 [mm]	c_2 [mm]	l [mm]	H [mm]	SAP Index
110	94	123	47	66	305	1700	4065256
160	136	147	57	88	382	1750	4067406
200	180	138	49	110	410	1750	4067409



Storm gate valve T0 for opening with a handle

DN	d [mm]	d_{min} [mm]	d_{max} [mm]	b [mm]	c [mm]	H [mm]	SAP Index
110	94	123	47	66	305	1700	4065257
160	136	147	57	88	382	1750	4067407
200	180	138	49	110	410	1750	4067410



Storm gate valve T0 for opening without a handle

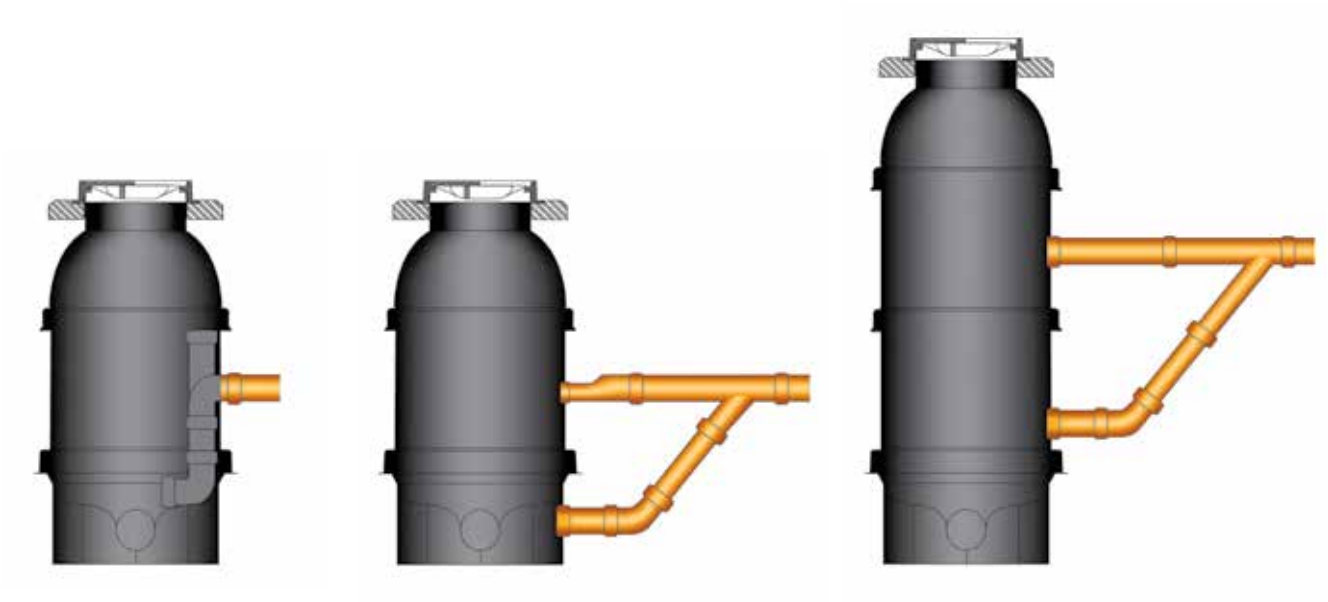
DN	d [mm]	d_{min} [mm]	d_{max} [mm]	b [mm]	c [mm]	h [mm]	SAP Index
110	94	123	47	66	305	142	4065258
160	136	147	57	88	382	205	4067408
200	180	138	49	110	410	234	4067411

14.5. Cascades in manholes

Cascade in Tegra 1000 manholes

If a sewer with a diameter of up to 0.4 m has to overcome large height differences (from 0.5 m to 4.0 m), the need arises to use a cascade at the manhole, which can be installed with a drop pipe located outside or inside the manhole.

In the case of the Tegra 1000 manhole, it is recommended to make the outlet with a vertical drop pipe or at an angle of 45° – with the same diameter as the inlet pipe. OSH REGULATIONSrequire that the drop pipe be connected at max. of 0.5 m above the manhole invert.



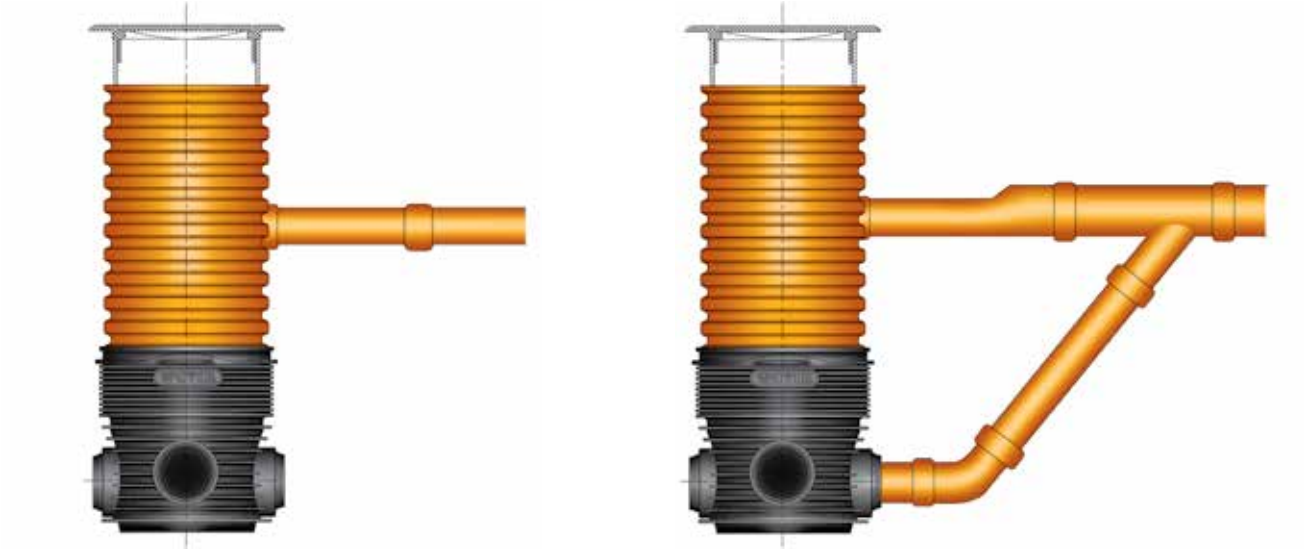
Example of a cascade solution fat manholes

In Tegra 1000 manholes, the drop pipe can be connected above the restraint (up to DN 200) or directly to the inlet spigot (up to DN 315). As a general rule, it is also necessary to provide access to the combined sewer from inside of the manhole, i.e. to make a cleanout. This part of the sewer may have a reduced diameter. The incorporation of the inlet pipe and the cleanout into the shaft of the manhole is done with an in situ insert (with a diameter of 200, 160 or 110 mm).

Cascade in inspection chambers

If level differences are to be overcome through a sewer on which inspection manholes are installed, it is not necessary to install the inlet 0.5 m above the bench – as in manholes. In Wavin inspection chambers, due to physical and chemical properties of the material and mechanical manholes, instead of a cascade, a drop is used, which means that the difference in height between the inflow and outflow can be up to 4 m and it does not require running a special drop pipe. The difference in level is overcome on a manhole.

The sewer channel is inserted into the shaft of the manhole using an in situ insert with a diameter of 200, 160 or 110mm for DN/ID 600 shafts and with a diameter of 160 or 110 mm for the shafts of smaller manholes. However, in the case of a sewer supply channel with a diameter larger than the possible in situ inserts, only the sump fittings are used. In this case, the drop pipe can be run as a vertical pipe or at an angle of 45°, and access to the sewer channel from inside the manhole is carried out to manholes shafts, i.e. by means of a cleanout, which can have a reduced diameter.



Examples of cascade solutions for non-manhole shafts

14.6. Modifications to standard manholes

14.6.1 Inverts with additional spigots

Side connections can be made in the standard Wavin inverts. The most common custom connections (Tegra 600 and 425 with 90° side inlets) are included in the section **Product overview.**
If other solutions are required, please contact the manufacturer.

14.6.2. Connections in manhole shafts

In shafts of Wavin manholes, connections can be made with "in-situ" inserts. For larger diameters than the available "in-situ" inserts, it is possible to manufacture spigots factory-made to order. The spigots used are available in the following forms:
– bare (socketless) ends of smooth-walled pipes to be connected by sockets or double couplings to smooth-walled sewer pipes,
– X-Stream sockets for connection to X-Stream or Twin Wall sewer or drainage pipes.
If other solutions are required, please contact the manufacturer.

14.6.3. Monolithic solutions (shaft invert)

Wavin also offers Tegra 600 and Tegra 425 manholes, made as a monolith together with a 0.5 m long shaft pipe. Such a manhole does not have a socket connection to the shaft.

This solution is used in the following cases:

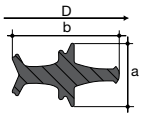
- when the connection socket to the shaft pipe is an obstacle to the "in-situ" connection – collision of the "in-situ" insert with the socket,
- when the manhole is used very shallow and the relief ring under the manhole falls at the height of the invert socket – collision of the relief ring with the socket.

When ordering inverts connected to a shaft tube, specify which standard invert is to be used as the base. It is possible to order monolithic manholes with longer shafts.
In the case of using a monolithic manhole as a solution to the collision of "in-situ" connections with the manhole socket, the required height of the manhole can also be achieved by extending the shaft with a double coupling to a suitable corrugated pipe.

15. Manhole Accessories and Tools

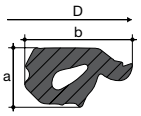
15.1. Gaskets

Most of the manhole components come complete with a gasket. These gaskets do not have elements: Tegra 1000, Tegra 1000 PE and base for core shaft 425. All gaskets can be ordered separately.



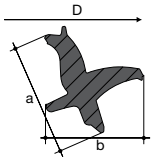
Rubber gasket for Tegra 1000 for corrugated pipes

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
1000	36.9	61.7	1090	4066386



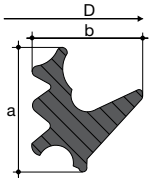
Tegra 1000 PE gasket for spacer ring and ribbed invert

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
1000	25	45	1105	4030594



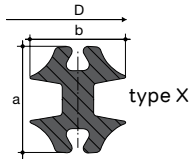
Gasket for DN 600 corrugated pipe and cylindrical corrugated part of Tegra 1000 cone

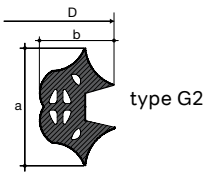
Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
600	42.7	51.1	672	4046025



Self-lubricating gasket for a telescopic adapter

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
600	48	42.5	676.5	4046042



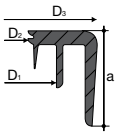


Gasket for corrugated and telescopic shaft– type X

Dimension [mm]	a [mm]	b [mm]	D [mm]	SAP Index
425	31.8	28.7	473.1	4052716
400	24.6	20.9	402.0	4049083
315	23.2	20.0	354.0	4049033

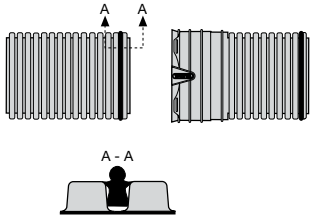
Gasket for drainage module of 425 – type G2 an inlet manhole

425	48.4	31.1	474.0	4067726



Sleevedgasket

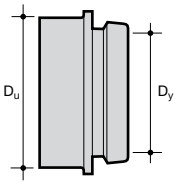
Dimension [mm]	a [mm]	D_1 [mm]	D_2 [mm]	D_3 [mm]	SAP Index
400/315	75	400	309.5	421	3022161



Wavin X-Stream Gasket

DN/ID	Mat.	SAP Index
800	EPDM	4081702
600	EPDM	4023205
500	EPDM	4023204

15.2. “In-situ” Inserts



For Tegra 1000

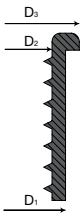
D_y [mm]	D_u [mm]	SAP Index
110	127	3024090
160	177	3024091
200	228	3018504

For Tegra 600 and Basic 600

D_y [mm]	D_u [mm]	SAP Index
110	127	4000645
160	177	4000646
200	228	4000647

For Tegra 425 and Basic 425, 400 and 315 manholes

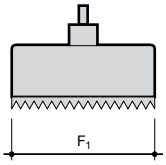
D_y [mm]	D_u [mm]	SAP Index
110	127	3022226
160	177	3022228



In situ gasket

Dimension [mm]	a [mm]	D_1 [mm]	D_2 [mm]	D_3 [mm]	SAP Index
40/51	40	52.6	42	63	3030369
50/60	50	61.8	52	74	3030370
63/70	63	72.8	64	84	3030371

15.3. Tools



Jigsaw for in situ inserts, universal for PP, PE and PVC shaft pipes

Dimension [mm]	F1 [mm]	SAP Index
110	127	4005549
160	177	4005551
200	228	4024645

Covers

- Used covers
- Sewage manhole covers
- Covers for drains

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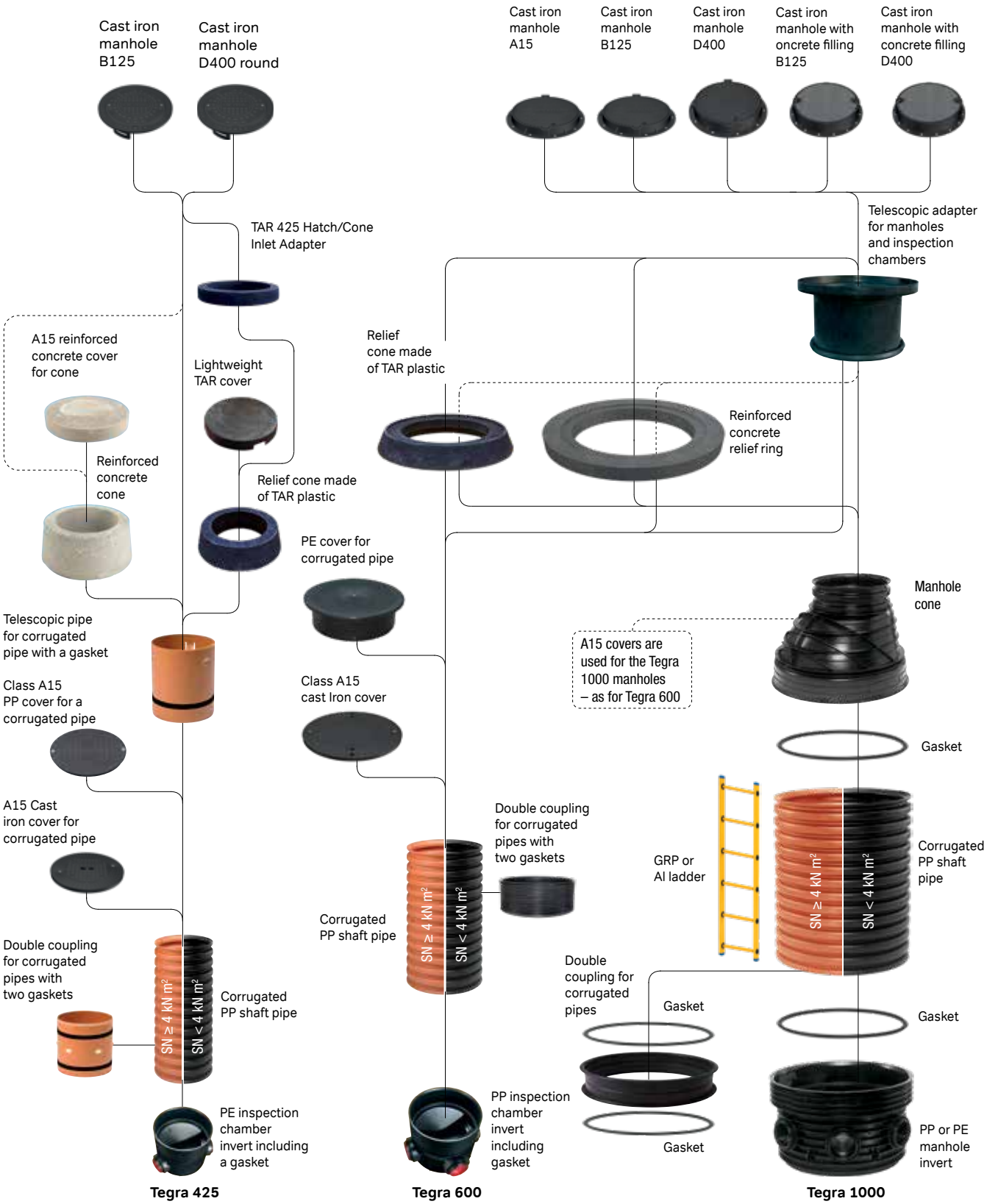
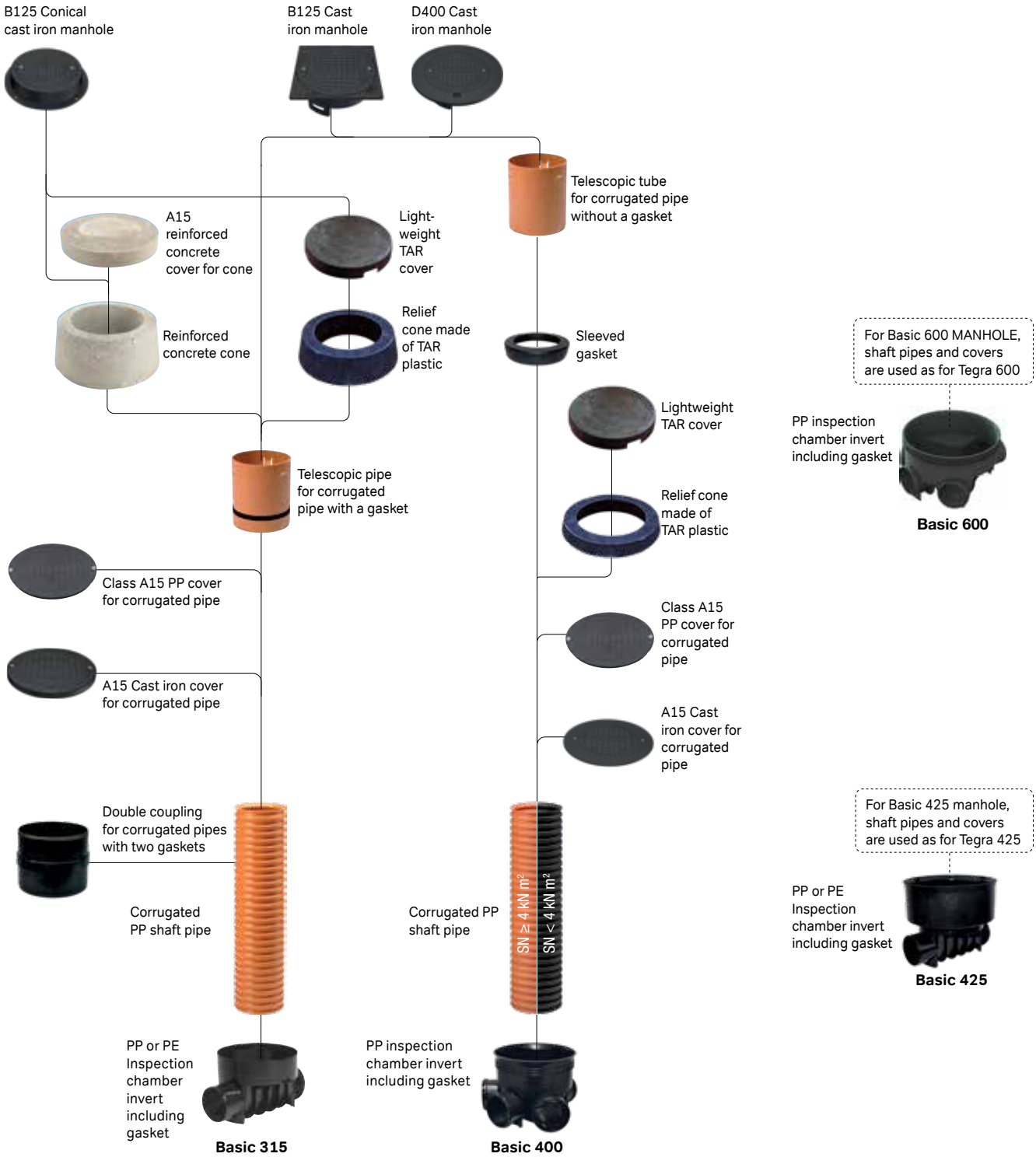
WAVIN TEGRA 1000, TEGRA 600 AND TEGRA 425 SEWAGE MANHOLES



WAVIN SEWAGE MANHOLES: INSPECTION CHAMBERS BASIC 600, 425, 400, 315



16. Covers

16.1. Used covers

Wavin manholes– depending on their purpose and location – have covers in the form of:

- Covers
- Manholes,
- inlets.

Depending on the expected traffic load, they correspond to the following load classes: A15, B125, C250 or D400 according to EN124:

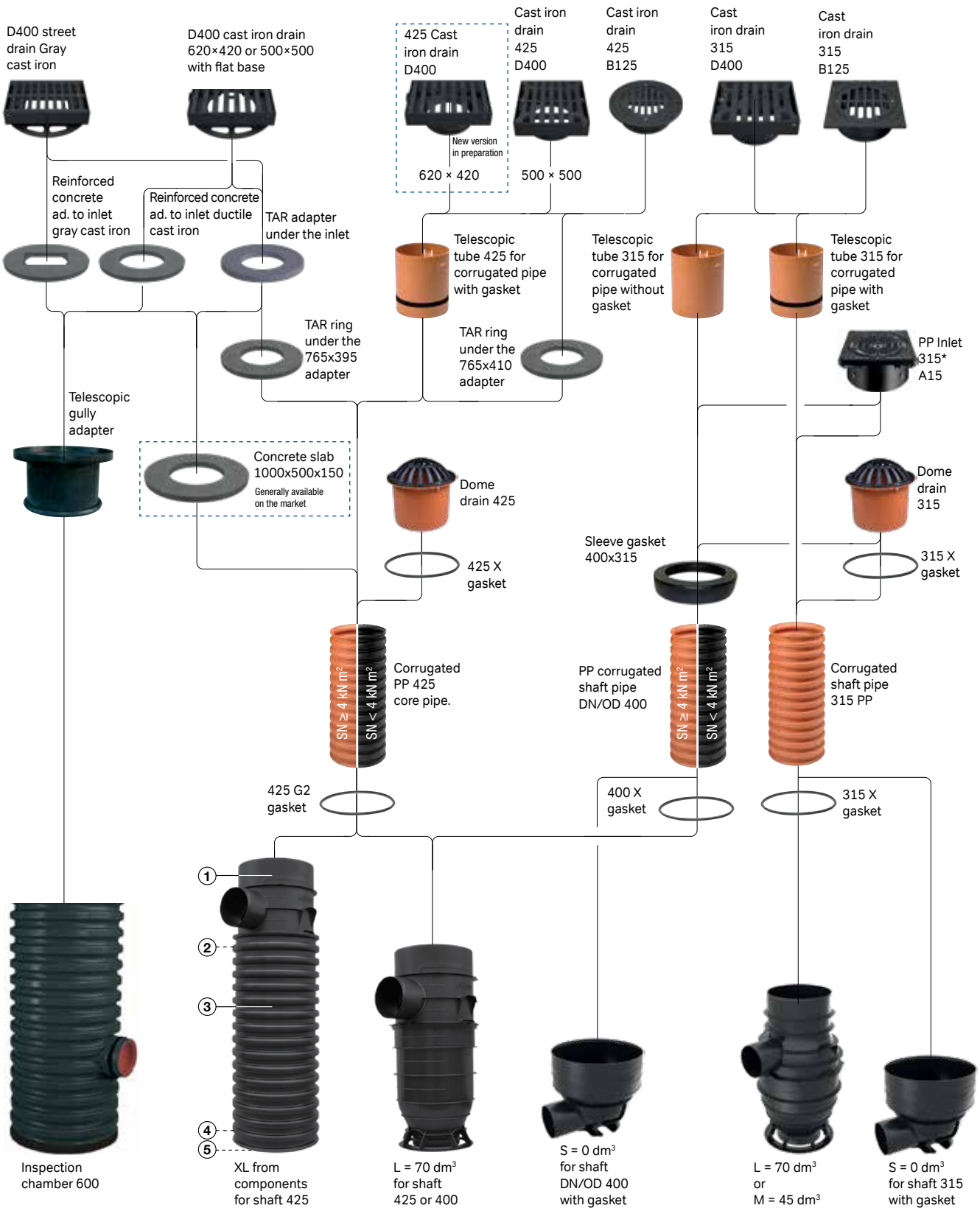
- **Class A15** – areas dedicated exclusively to pedestrians and cyclists,
- **Class B125** – roads and pedestrian areas, equivalent areas, parking lots or areas for parking car,
- **Class C250** – inlets at the curbs within a max. area of 0.5 m in the traffic path and 0.2 m in the pedestrian path,
- **Class D400** – roadways (including pedestrian paths), paved shoulders and parking areas for all types of road vehicles.

Covers, manholes and inlets are made of various materials: gray cast iron, ductile iron, thermoplastics (PE, PP), a mixture of TAR plastics or reinforced concrete.
An overview of the covers, manholes and inlets for all manholes can be found in the following tables.

Cast iron covers and manholes

Class / Inlet manholes with corrugated pipe shaft	A15	B125	C250, D400
600			
425			
400			
315			

WAVIN INLET MANHOLES: 600, 425, 400, 315



Components for the construction of the 425 XL sediment manhole

1. Module 425/400 with an 200 or 160 outlet
2. 425 G2 gasket
3. Shaft pipe 425
4. 425 X gasket
5. 425 Bottom

* 315 SN2 pipe sections and 315 X gaskets supplied by the customer

Inlets

Class / Manholes	A15, B125	C250		D400
Inspection chambers with corrugated pipe shaft 600		 F = 3.5 dm²		
Road inlet manholes with 425 corrugated pipe shaft	 F = 3.3 dm²		 F = 9 dm²	 street inlet, ductile cast iron F = 9.8 dm²
Road inlet manholes with DN/OD 400 corrugated pipe shaft	 F = 2.4 dm²		 F = 4.5 dm²	
Road inlet shafts with 315 corrugated pipe shaft				

In terms of design, Wavin's manhole cover solutions are divided into:

- covers laid directly on the shaft of the manhole
- covers to protect the end of the manhole in unconsolidated soils, laid on cones,
- "floating" covers, i.e. transferring loads to the upper or lower layers of the pavement structure, rather than to the manhole shaft:
  a) manholes/inspection chambers with the body positioned on a ring or cone type surface element,
  b) telescopic solutions classified as self-leveling, i.e. manholes/telescopic chambers, integrated into a monolith with the upper layers of the paved surface during its pouring.

"Floating" covers, tied to structural pavement layers, have a beneficial effect on water collection from drained surfaces and on the durability of the pavement. These solutions are appreciated by road builders, as they minimize the occurrence of typical defects (cracking and collapsing of the pavement) and the formation of puddles at inlets.

Note: For a detailed description of the manholes and inlets offered, see "Manhole and Inlet Data Sheets", available as a PDF file at www.wavin.pl.

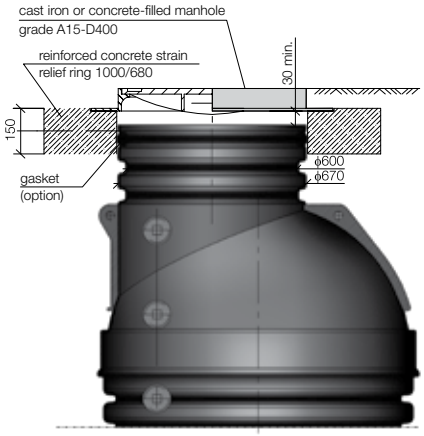
16.2. Sewage manhole covers

Tegra 1000, as well as Tegra and Basic 600 manhole covers
All of these manholes have the same finishing result – Tegra 600 corrugated pipe is dimensionally the same as the cylindrical part of the DN 1000/600 cone.
Both covers, inlets, and drains can be installed on all manholes.

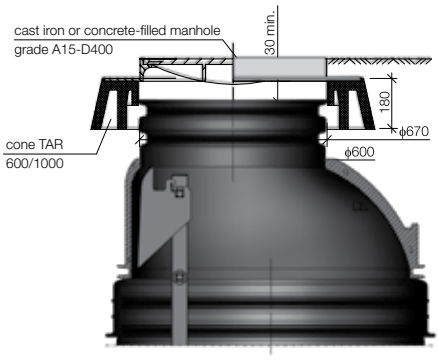
The following types of manhole covers are envisioned for Tegra 1000 and Tegra and Basic 600 :

- A15 cover laid directly on the corrugated part of the manhole; covers fit the largest diameter – pipes should be cut at the top of the notch,
- A15, B125 or D400 manhole positioned on telescopic manhole adapter, TAR cone or reinforced concrete relief ring.

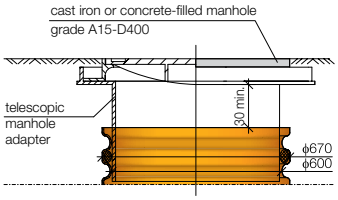
For Tegra 1000 and Tegra and Basic 600



A15, B125 or D400 manhole
on reinforced concrete ring



A15, B125 or D400 manhole
on a TAR cone



A15, B125 or D400 manhole
on telescopic chamber adapter

Manholes with a body height of no less than 115mm are recommended for areas with high intensity heavy traffic. Spheroidal ductile iron manhole covers with H < 115 mm frame are not suitable for high traffic conditions. Then cracking of the pavement at the edges of the elements supporting the manholes then occurs.

For manholes, it is recommended to lay a TAR cone and reinforced concrete ring for the manhole on a ground reinforced with a sheet of geotextile of min. dimension of 1200 × 1200 mm or diameter 1200 mm, with an opening hole of Ø 700.
In the offer, there is an O-ring, sealing the connection between the corrugated part and the reinforced concrete ring for the manhole.

Examples of cover solutions for Tegra 425 and Basic 425 manholes
The following types of covers are provided for sewage manholes with 425 shaft pipe :

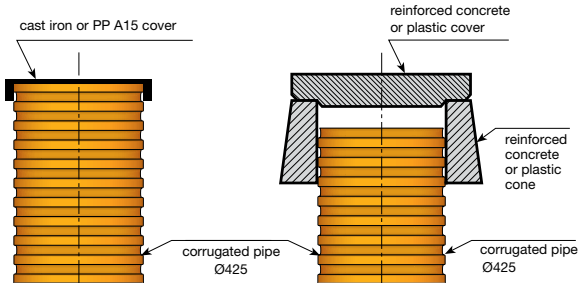
- A15 cover made of cast iron or PP laid directly on the corrugated part of a manhole,
- A15 cover made of TAR plastic or reinforced concrete laid on a cone,
- B125 or D400 manhole with a telescopic pipe.

Covers laid on cones should be installed above the pavement.

The 425 manhole shaft can be equipped with a street drain. The following 425 inlet types are provided:

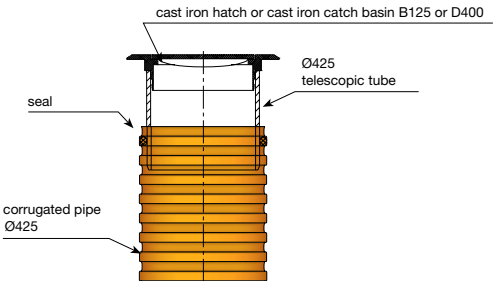
- B125 inlet with 425 telescopic pipe,
- D400 street drain with dimensions of about 0.4 × 0.6 m or 0.5 × 0.5 m, with an inlet area of about 10 dm^2, with a telescopic pipe.

For Tegra and Basic 425



A15 cover on corrugated pipe

TAR plastic or reinforced concrete cover laid on a cone



B125 or D400 manhole with telescopic pipe

Example solutions for Basic 400 and Basic 315 manholes

The following types of covers are provided for the Basic 400 and Basic 315 inspection chambers:

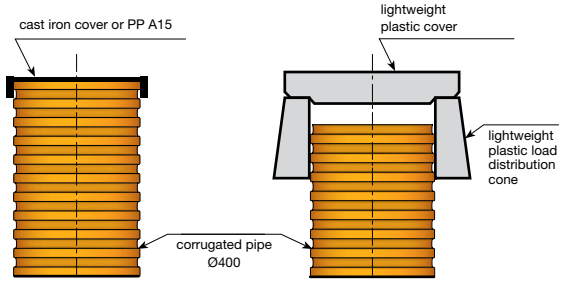
- A15 cast iron or PP cover laid directly on the corrugated part of the manhole,
- A15 cover made of TAR plastic or reinforced concrete laid on a cone,
- B125 manhole on a 315 TAR or reinforced concrete cone (only for DN 315 manhole),
- B125 or D400 manhole with a 315 telescopic pipe.

Covers laid on cones should be installed above the pavement. Both manholes can be equipped with a street drain with 315 telescopic pipes.

The following 315 inlet types are provided:

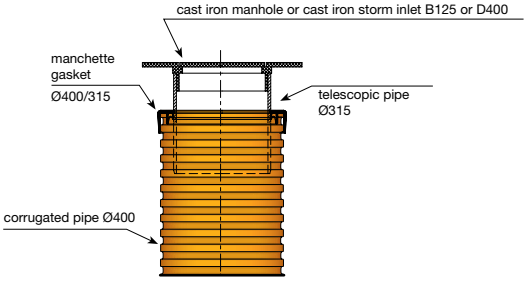
- B125 inlet with a 315 telescopic pipe,
- D400 street drain with a 315 telescopic pipe.

For Basic 400



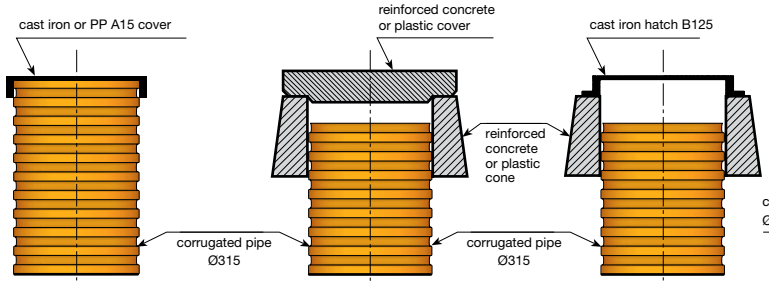
A15 cover on corrugated pipe

TAR plastic cover laid on cone



Use of a cone according to the rules described in section 17.2.2.

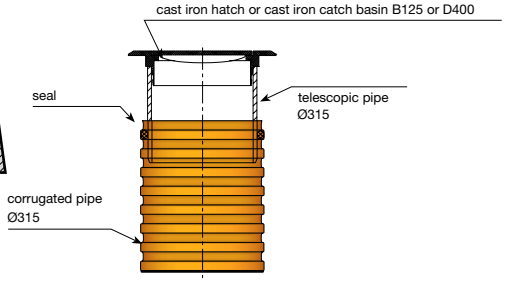
For Basic 315



A15 cover on corrugated pipe

TAR plastic cover laid on cone

B125 cover on a 315 cone



Use of a cone according to the rules described in section 17.2.2.

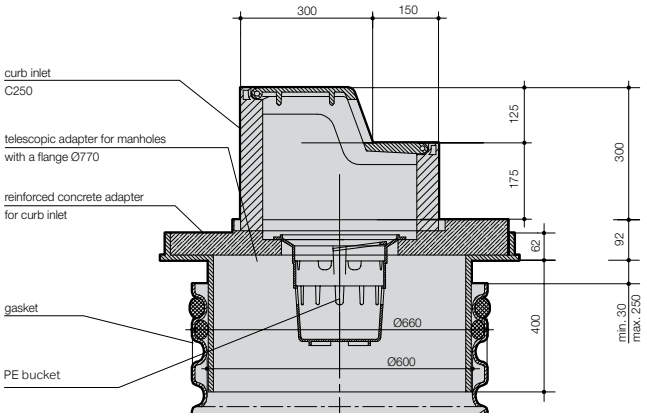
16.3. Inspection chambers covers 600

Types of inlet covers

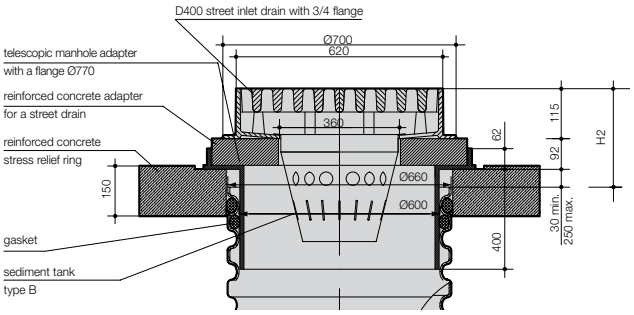
Street or curb inlets can be installed on manholes:

- C250 curb inlet used with a telescopic adapter with a DM770 flange and special reinforced concrete adapter,
- D400 street inlet approximately 0.4 × 0.6 m with an inlet area approximately 10 dm^2 – available in two versions; used with a telescopic adapter with a DN 770 flange and a special reinforced concrete adapter for each type of drain.

It is also possible to install standard round drains with a corpus cover – but these are not available from Wavin. Surface elements (similar to manholes) are used for them.



C250 curb drain on telescopic adapter with a DN 770 flange



Street drain or gray cast iron {sic} on telescopic adapter with a DN770 flange

16.4. Road inlet inspection chamber covers

Covers with inlets for 425 and 315 telescopic pipes

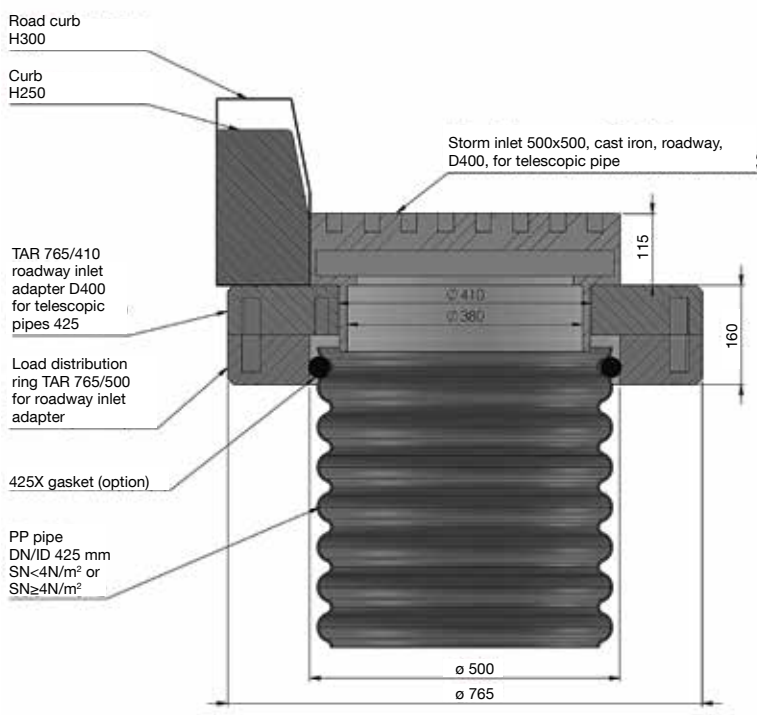
Inlets mounted in the same way as the manholes.

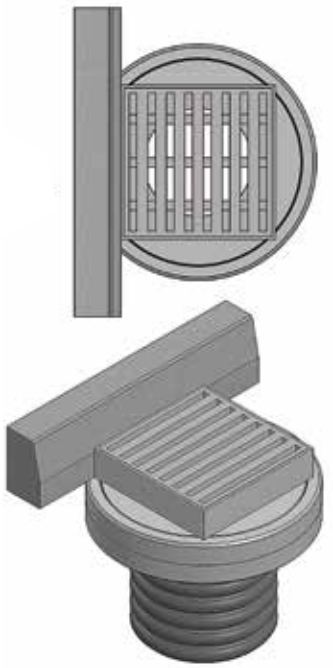
Drains for 425 telescopic pipe supported by an adapter under the drain

The same 425 drains (but without a telescopic pipe)

- 500 × 500
- 620 × 420 – in preparation

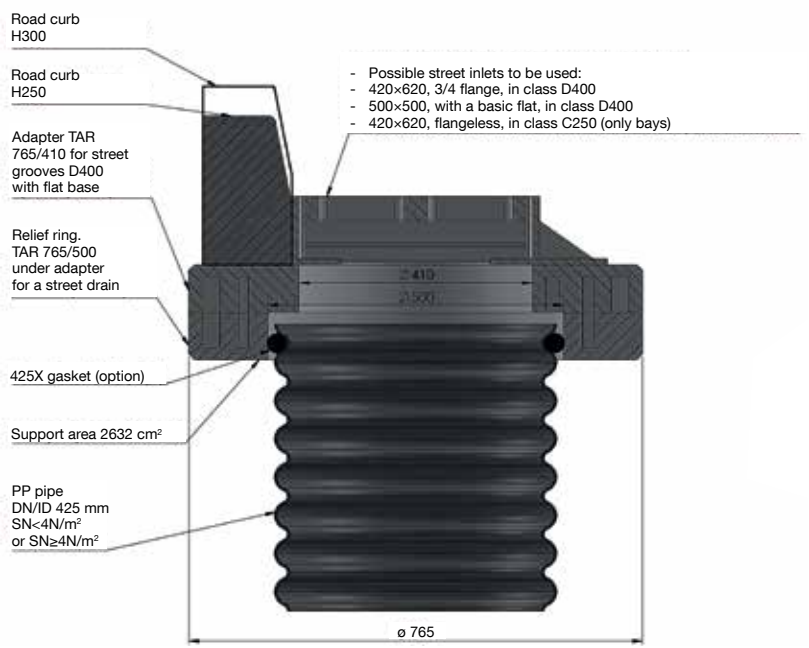
can be used on TAR ring size 765 × 410 × 80, i.e. SAP 4065919 Adapt. TAR765/410 under reinforced iron reference inlet pipe tel. 425





Inlet covers with flat base 620 × 420, 600 × 400 or 500 × 500

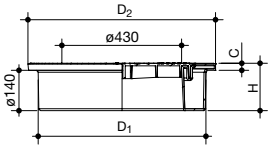
- Traditional – concrete (use of existing inspection chamber adapters)
  - suitable reinforced concrete drain adapter diameter of 765 mm/80 mm slab thickness
  - generally available concrete plate with the diameter of about 960–1000 mm / hole 500 mm /plate thickness 150 mm
- With TAR plastic elements
  - TAR inlet adapter
  - TAR relief/support plate under the adapter



- Mixed – reinforced concrete and TAR plastic elements can be combined in sets (e.g. SAP 4065919 Adap.TAR765/410 for inlet reinforced pipes tel.425 + SAP 4045079 Reinforced concrete D400 street inlet drain adapter for DI grating 420×620

16.5. Sewage manhole covers – component overview

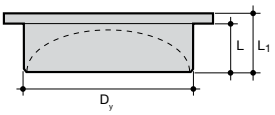
16.5.1. Plastic manhole inlets and covers – for mounting directly on the shaft of the manholes



PP A15 manhole with gasket

Type	D_1 [mm]	D_2 [mm]	H [mm]	C [mm]	SAP Index
A15	600	670	170	30	3031705
A15 leakproof	600	670	170	30	3040045

* For Tegra 1000 and Tegra and Basic 600.



600 PE cover for corrugated part of manhole* with an opening 600

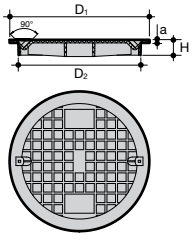
Type	L [mm]	L_1 [mm]	D_y [mm]	SAP Index
without a lock	180	210	600	3013167
with a lock	235	270	600	3045093

The cover without a lock is fastened by pressing.
Locking cover equipped with patented locking mechanism.
* For Tegra 1000 and Tegra and Basic 600.


Open


locked

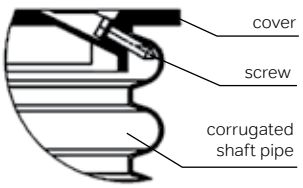
Note:
The PE cover SAP 3013167 together with the gasket SAP 3041832 form a tight seal for the shaft tubes 600.



Class A15 PP cover for corrugated pipe

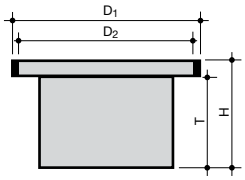
Dimension	D_1 [mm]	D_2 [mm]	H [mm]	a [mm]	SAP Index
425	434	423	39	9.8	4049104
400	410	358	36	9.0	4049103
315	362	293	30	9.4	4049102

Method of cutting the corrugated shaft pipe when installing the PP A15 cover



16.5.2. Surface elements

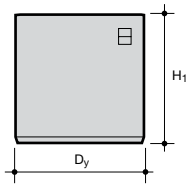
Telescopic elements



Telescopic adapter with a gasket

Type	D_1 [mm]	D_2 [mm]	H [mm]	T [mm]	Weight [kg]	SAP Index
770*	798	774	462	400	11.0	3013544
805**	850	805	548	488	12.0	4000649

* For manholes with bases up to Ø765mm and reinforced concrete adapters for inlets.
** For manholes with a base larger than Ø765mm.



Telescopic pipe:

with a gasket for a corrugated DN 425 pipe

Dimension D_y/H_1 [mm]	D_y [mm]	H_1 [mm]	SAP Index
*425/375	425	375	3032299
*425/750	425	750	3044054

without a gasket

Dimension D_y/H_1 [mm]	D_y [mm]	H_1 [mm]	SAP Index
315/375	315	375	3044052
315/750	315	750	3044053

DN 315 with a gasket for a corrugated pipe

Dimension D_y/H_1 [mm]	D_y [mm]	H_1 [mm]	SAP Index
315/375	315	375	3022179
315/750	315	750	3022180

TAR plastic components

Material

The cover elements – cones and covers – are made of a mixture of polymeric plastics, containing plasticized polyvinyl chloride PVC and other polymeric plastics as the base material.

These elements are lightweight and have a high mechanical resistance to static pressure and dynamic loads.

In road applications, these components achieve particularly useful damping and energy dissipation properties under dynamic loads. The plastic mixture owes its name (TAR) to these characteristics.

T – vibration damping

A – dynamic energy absorption

R – energy dissipation

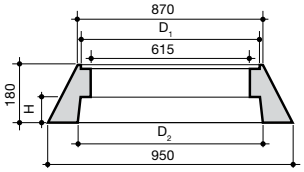
Material characteristics:

- specific gravity: 1.4 g/cm^3,
- hardness: 65 (according to Shore),
- elastic modulus: 2500–3200 N/mm^2,
- water absorption < 0.5%,
- max. permissible deformation: 5%,
- thermal resistance: from -30 to +60°C in continuous operation and up to 180°C during installation
- chemical resistance: high resistance to acids, alkalis, oils, solvents, fats in concentrations found in sewage and surface rainwater.

Benefits of using TAR relief cones:

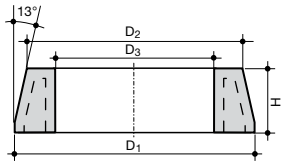
- perfect complement to plastic floating manhole covers, supporting the cover/manhole/inlet and transferring loads to the surroundings of the manhole (beyond the shaft structural elements),
- perfect fit with cast iron manholes/inlets,
- damping and shock-absorbing effect in transferring loads – protection of the paved surface and manhole,
- significant reduction in the number of pavement defects caused by traffic and water exposed to freezing and thawing, including cracking,
- chemical resistance, including deicing salts,
- Increased traffic safety and comfort,
- light weight– eliminates the need for heavy equipment during transport, loading, unloading and assembly operations.

TAR elements are approved for marketing and use in road construction – based on Technical Assessment / Technical Approval PL IBDiM-KOT-2017/0047 issue 1.
Load relieving cones are surface elements of covers that are tested for resistance to surface and traffic loads in accordance with the standard EN 14802; according to EN 13598-2, they are required for plastic manholes intended for use in areas subject to traffic loads.



TAR plastic cone
for standard manhole with a round base

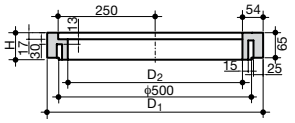
Dimension [mm]	D_1 [mm]	D_2 [mm]	H [mm]	Weight [kg]	SAP Index
600	810	700	85	50	4037286



TAR plastic cone

Dimension	D_1 [mm]	D_2 [mm]	D_3 [mm]	H [mm]	Weight [kg]	SAP Index
425	770	680	509	200	41	4044978
400*	610	550	440	150	15	4044980
315	570	500	370	200	19	4044982

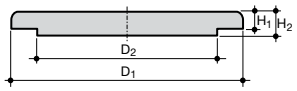
* Lightweight, up to class B125, not used in D400 class covers.



TAR plastic 425 cone adapter

Dimension	D_1 [mm]	D_2 [mm]	H [mm]	Weight [kg]	SAP Index
425	560	453	70	7.5	4044977

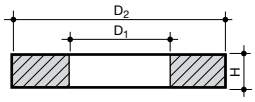
Adapter under the manhole to put on the 425 cone.



Lightweight TAR cover

Dimension	D_1 [mm]	D_2 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
425	500	640	50	60	17	4044979
400	440	610	40	55	12	4044981

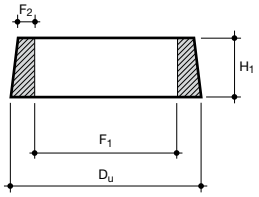
Reinforced concrete elements



Reinforced concrete relief ring

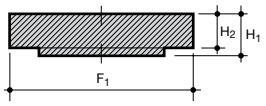
Type	D_1 [mm]	D_2 [mm]	H [mm]	Weight [kg]	SAP Index
For Tegra 1000 PP and Tegra 600 1000/680	680	1000	150	152	3022236
On the main surface there is a 10 mm recess with a diameter of 770 mm.					
For Tegra 1000 PE 1100/700	700	1100	150	202	3022235
On the main surface there is a 10 mm recess with a diameter of 805 mm.					

CAUTION! with Tegra 1000, lay on a sheet of geotextile Ø or ☐ 1200 mm.



Reinforced concrete cones

Dimension	D_u [mm]	F_1 [mm]	F_2 [mm]	H_1 [mm]	Weight [kg]	SAP Index
425	730	490	80	240	112	3022233
315	565	365	70	240	65	3022232

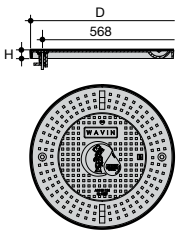


Class A15 reinforced concrete cover

Dimension	F_1 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
425	680	105	90	79	3022234
315	565	365	70	43	4045080

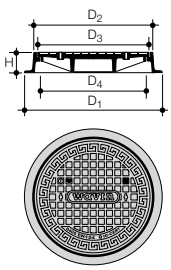
16.5.3. Cast iron covers and manholes for sewage manholes Overview of products according to manhole diameter

For Tegra 1000 and Tegra and Basic 600 manholes



A15 Cover with latches

Dimension	D [mm]	H [mm]	Weight [kg]	SAP Index
600	690	40	25.4	4044951

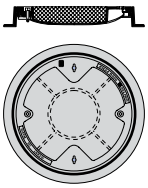


Cast iron manhole with a round base

Type	D_1 [mm]	D_2 [mm]	D_3 [mm]	D_4 [mm]	H [mm]	Weight [kg]	SAP Index
A15/600	755	663	638	604	80	32	3022219
B125/600	755	663	638	604	80	36	3024035
D400/600	760	666	638	604	115	86	3022222
D400/600*	785	666	638	604	120	55	4045065

* Manhole with PUR damping insert.

Tight cast iron manhole on request. 4059529

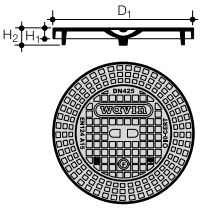


Concrete-filled manhole cover

Type	D_1 [mm]	D_2 [mm]	D_3 [mm]	D_4 [mm]	H [mm]	Weight [kg]	SAP Index
B125	760	662	638	600	80	57	4045063
D400*	785	664	638	–	100	102	4045064

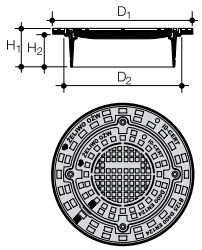
*Manhole cover with PUR damping insert.

For Tegra and Basic 425 chambers



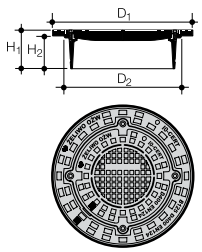
A15 cast iron cover with two latches for corrugated pipe 425

Dimension	D_1 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
425	493	36	59	13.4	3022170



B125 cast iron hatch for telescopic pipe 425 – with two screws

Dimension	D_1 [mm]	D_2 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
425	441	533	145	117	20.5	3042104

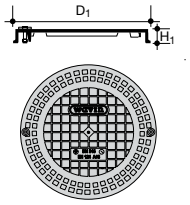


D400 cast iron hatch for telescopic pipe 425 – with two screws

Dimension	D_1 [mm]	D_2 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
425	441	532	145	117	24.6	3041048

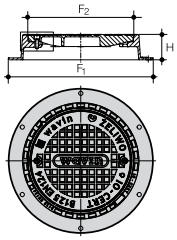
Hatch with PUR damping insert.

For Basic 400 and 315 chambers



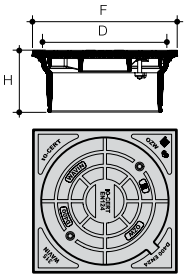
A15 cast iron cover for corrugated pipe with two screws

Dimension	D_1 [mm]	H_1 [mm]	Weight [kg]	SAP Index
400	440	40	10.9	3029925
315	373	38	7.3	3022171



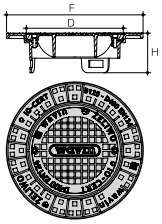
B125 cast iron hatchfor reinforced concrete cone 315 – with two screws

Dimension	F_1 [mm]	F_2 [mm]	H [mm]	Weight [kg]	SAP Index
315	450	329	79	16.7	3022173



B125 cast iron hatch for telescopic pipe 315 – with two screws

Dimension	F [mm]	D [mm]	H [mm]	Weight [kg]	SAP Index
315	346	329	129	12.8	3042045



D400 cast iron hatch for telescopic pipe 315 – with two screws

Dimension	F_1 [mm]	D_y [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
315	402	315	135	118	20.1	4044948

Hatch with PUR damping insert.

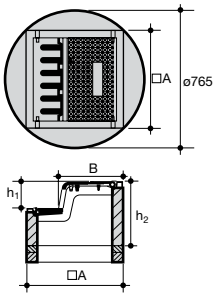
Polyurethane PUR damping pads vulcanized with cast iron manhole part. High chemical and mechanical resistance. They dampen noise from vibrations caused by wheels hitting the chamber tops.

16.6. Inlet chamber tops – breakdown of products by chamber diameter

The following surface elements are used for inlets:

- telescopic adapters with flange DN 770 mm,
- telescopic pipes DN 425 and 315 (see section 16.5.).

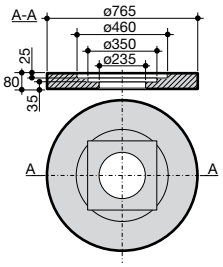
16.6.1. For Tegra 1000 and Tegra and Basic 600 chambers



Curb inlet – cast iron/concrete C250

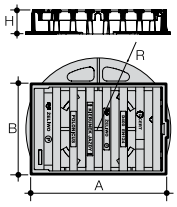
Dimension	□ A [mm]	B [mm]	h_1 [mm]	h_2 [mm]	Weight [kg]	SAP Index
C250/600	450	348	125	290	75	4044954

F_{WL} = 3.5 dm²
Option to suspend PE buckets under inlet.



Reinforced concrete curb inlet adapter

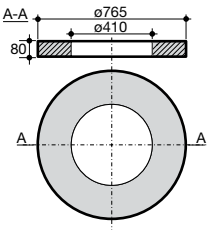
Type	Weight [kg]	SAP Index
C250	70.2	3022238



Roadway inlet, ductile cast iron, 420x620, D400, 3/4 flange/hinge/clasp

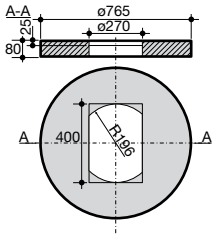
Type	A × B [mm]	R [mm]	H [mm]	Weight [kg]	SAP Index
D400	620 × 420	340	115	48.0	4044953

F_{WL} = 9.8 dm²
Gap width: 38 mm.
Option to suspend type B buckets under inlet.



Reinforced concrete roadway inlet adapter, 420 × 620, ductile cast iron

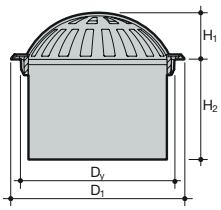
Type	Weight [kg]	SAP Index
D400	71.9	4045079



Reinforced concrete roadway inlet adapter, 400 × 600, gray cast iron

Type	Weight [kg]	SAP Index
D400	71.9	3022237

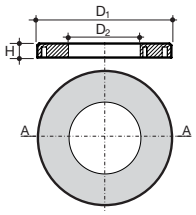
16.6.2. For road inlet chambers DN 425



Cast iron dome inlet + telescopic pipe 425 – without gasket

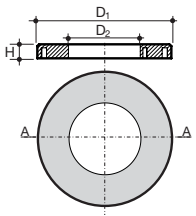
Dimension	D_y [mm]	D_1 [mm]	H_1 [mm]	H_2 [mm]	F_{wl} [cm²]	Weight [kg]	SAP Index
425	425	470	155	300	640	20.2	3016896

Also required – gasket for corrugated pipe DN 425 × index: 4052716



TAR Ring for adapter for cast iron inlet

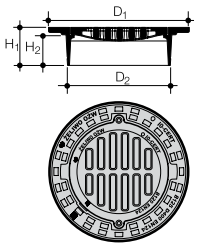
Dimension	D_1 [mm]	D_2 [mm]	H [mm]	Description	Weight [kg]	SAP Index
425	765	500	80	for TAR or reinforced concrete adapter	24.0	4065921



TAR adapter for cast iron inlet 425

Dimension	D_1 [mm]	D_2 [mm]	H [mm]	Description	Weight [kg]	SAP Index
425	765	410	80	for inlet to telescopic pipe*	28.0	4065919
425	765	395	80	for inlet with flat base	30.0	4065920

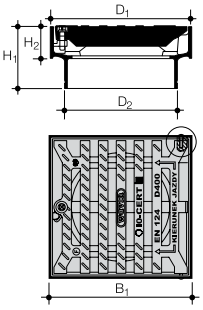
* Use of an adapter for inlet 4044942 or 4030593 eliminates the need for telescopic pipe 425



Round cast iron inlet B125/425 for telescopic pipe 425 – with two screws

Dimension	D_1 [mm]	D_2 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
425	532	404	145	117	22.4	4044942

F_{WL} = 3.3 dm²
Gap width: 25 mm.
Option to suspend type B bucket under inlet.

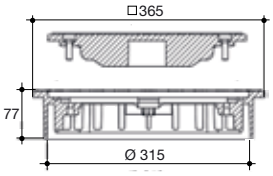


Cast iron roadway storm inlet D400 for telescopic pipe 425 with hinge and bolt

Dimension	D_1 x B_1 [mm]	D_2 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
425	500 × 500	404	222	115	42.7	4030593

F_{WL} = 9 dm²
Gap width: 31 mm.
Option to attach type B bucket to the inlet.

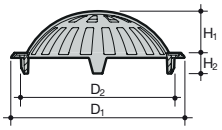
16.6.3. For roadway inlet chambers DN/OD 400 and DN 315



Square PP inlet A15 (3T)
4 screws/UV resistant

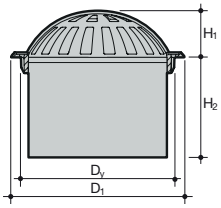
Dimension	SAP Index
315	4057722

315 SN2 pipe sections and 315 X gaskets not included



Cast iron dome inlet
for mounting directly on corrugated pipe 315

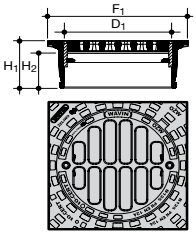
Dimension	D_y [mm]	D_1 [mm]	D_2 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
315	315	370	324	99.8	33.7	4.67	4081154



Cast iron dome inlet
+ telescopic pipe 315 – without gasket

Dimension	D_y [mm]	D_1 [mm]	H_1 [mm]	H_2 [mm]	F_{wl} [cm²]	Weight [kg]	SAP Index
315	315	369	95	375	402	11.9	4045573

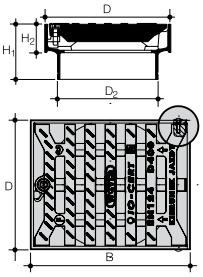
Also required – gasket for corrugated pipe DN 315 × index: 4049033



Cast iron roadway storm inlet B125
for telescopic pipe 315 – with two screws

Dimension	F_1 [mm]	D_1 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
315	355	314	130	100	15.2	3022174

F_{WL} = 2.37 dm²
Gap width: 25 mm.
Option to suspend type K bucket or PE bucket.

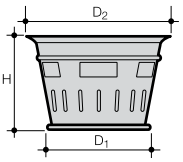


Cast iron roadway storm inlet D400
for telescopic pipe 315 – with hinge/bolt

Dimension	W × D [mm]	D_2 [mm]	H_1 [mm]	H_2 [mm]	Weight [kg]	SAP Index
315	420 × 340	299	222	115	27.2	3022240

F_{WL} = 4.5 dm²
Gap width: 26 mm.
Option to suspend type K bucket or PE bucket.

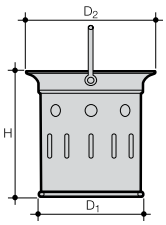
16.6.4. Inlet buckets



Type B-inlet bucket, galvanizedsteel

Material	D_2 [mm]	D_1 [mm]	H [mm]	Weight [kg]	SAP Index
galvanized steel.	385	270	250	2.5	4045028

Cast iron, round inlet bucket, B125/425.
Roadway inlet bucket, ductile cast iron,
420 × 620, D400 and 500 × 500, D400.



PE bucket

Material	D_2 [mm]	H [mm]	SAP Index
PE	260	245	4025576

Bucket for cast iron, square inlet B125/315.
Bucket for cast iron inlet D400/315, hinge/latch.
Bucket for curb inlet, cast iron/concrete, C250.

Assembly

instructions

- General rules for assembly
- Occupational health and safety instructions
- Installation instructions for Tegra 1000 manholes
- Assembly instructions for inspection chambers
- Manhole height adjustment
- Assembly instructions for in situ inserts
- Assembly instructions for manhole covers
- Assembly instructions for class A15 manhole cover
- Assembly instructions for class B125-D400 manhole covers

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17. Assembly instructions

17.1. Assembly instructions for chambers

17.1.1. General rules for assembly

Wavin plastic manholes should be installed in accordance with the technical design and recommendations of standards PN-C-89224 and PN-EN 1610.

Preparatory works

Before starting assembly works, all provided products must be checked to ensure that they meet the requirements of the investment and are free of contamination and damage, in particular:

- check for compliance with the design:
  – chamber diameter,
  – hydraulic profile configuration,
  – type and diameter of stub pipes,
- check the completeness of the provided elements,
- check the condition and cleanliness of gaskets.

Earthworks recommendations

For earthworks, follow the recommendations for the type of excavation, drainage, formwork and the soil used. It is particularly important to ensure that the soil is properly compacted over the entire height of the chamber and maintained. Unless otherwise specified in the design, adhere to standards PN-C-89224 and PN-EN 1610.

Excavation

Excavations should not be too wide (to be adapted to the depth of the excavation, the formwork and the mechanical equipment used). The bottom of the excavation for the chamber is usually deeper than under the sewer pipe system.

Excavation drainage

Drainage of the excavation must be carried out prior to installation works.

Substrate

The substrate under the chambers should be stable. This can be unbroken soil or well-compacted loose soil. If the substrate is comprised of soil with low load-bearing capacity, it should be reinforce with geo-fiber. Large and sharp rocks should be removed from the bottom of the excavation. Any local depressions can be filled with compacted soil.

Ballast

A layer of ballast comprising sand or gravel with a thickness of 5–15 cm is laid on such substrate, depending on the structure of the bed and the location of chamber stub pipes. The ballast layer must be leveled before the chamber is installed. It must not be compacted so that the lower structural elements of the chamber bottom (usually reinforcement ribbing) can sink freely into the ballast layer during installation. During assembly in the ballast, make local depressions to allow the socket stub pipes to be easily installed.

Excavation filling (gravel pack and backfill)

Plastic chambers require good and durable soil support. As regards the conditions for the construction of road surfaces, it must also be ensured that the excavations located under paved surfaces are filled with one of the soils approved for use in road construction, specified in PN-S-02205. When filling excavations, the soil down to the full depth of the chamber must be compacted accordingly for the loads and groundwater conditions.

The following soil compaction levels are recommended:

- min. 92% SCL in areas not subject to road traffic load,
- min. 95% SCL in areas subject to road traffic load.

In hydrated soils, however, the degree of soil compaction must be increased:

- min. 95% SCL in areas not subject to road traffic load,
- min. 98% SCL in areas subject to road traffic load.

Soil compaction must be carried out in layers as specified in PN-C-89224 (maximum 30 cm) – in such a way as to avoid excessive ovalization of the chamber and to prevent any displacement or bending of the sewer connections.

Particular care should be taken **when filling around chamber bases without a flat bottom** – add sand or gravel with a shovel under the bottom of the chamber to fill any empty spaces and ensure good, even support over the entire surface. Ensure even support over the entire surface of the chamber base together with benching. It is important to apply the first layers of gravel pack particularly carefully, as this leads to compaction of the soil in the area of the chamber base (including below it). The compaction should not cause any deformation or displacement of the manhole, so it is advisable to make more layers with less compaction and compact the bottom layers with the top layers.

Compaction maintenance

Remember to compact the soil around the chamber when removing formwork. It is also important to protect the gravel pack and backfill from removal of fine fractions as a result of groundwater flow, i.e. rainwater run-off and groundwater flow in damaged soil along the sewage system route, especially during the soil consolidation period. In order to maintain good compaction of the soil in the excavation, it is recommended to block the removal of fine fractions in the form of:

- impermeable loam or clay barriers (if clay soil from the excavation is available),
- sheets of geofiber or cement-stabilized soil, used across the excavation behind the chambers.

Barriers should be positioned max. every 50 m, preferably 0.5-1 m behind the manhole outlet, have a width corresponding to the width of the excavation and reach up to 0.3 m above the highest expected groundwater level. Barriers should extend to the bottom of the excavation, i.e. also block flow in the ballast layer, provided that the clay layer is about 0.3 m thick.

Installation Recommendations – connection of sewer pipes

It is advisable to use prefabricated chamber bottoms in sewer junctions.

They are equipped with stub pipes for connection to Wavin X-Stream smooth-walled (SW) and double-walled drainage systems with a socket or plain-end design.

SW socket stub pipes have a groove with a factory-installed gasket and allow the connection of SW stub pipes with smooth-wall pipes made of PVC-U and other materials (PP, PE), as well as with pipes from other systems, e.g. pressure pipes made of PE, cast iron, stoneware, concrete (using adapters). The plain ends of pipes with socket connections should be beveled.

XS socket stub pipes allow for connection with Wavin X-Stream structural pipes. In this case, a gasket is placed on the pipe between the last two ridges.

Connection with other structural pipe systems has not been tested.

Some chambers have connections in the form of plain-end, smooth-walled stub pipes. The prefabricated plain ends are pre-beveled and prepared for connection to a socket stub pipe or fitting.

When connecting plain stubs with a Wavin X-stream dual wall pipe system, use (double) adapters.

Regardless of the type of connection made, the components must be clean and free of gravel and sand.

Lubricants

If dirty, clean thoroughly. During assembly, it is advisable to use professional lubricants recommended for plastic materials and rubber gaskets.

Do not use any abrasive HEAVY-DUTY HAND CLEANING PASTES or petroleum-based lubricants that would damage rubber seals.

Plain stub pipes inserted into sockets must be protected during transport, storage and installation. Scratched stub pipes must not be used as leak tightness is no longer guaranteed.

Due to the nature of the loads in the soil and the risk of leaks and destruction of pipes (especially rigid pipes) at the points of connection to the chambers, it is recommended to maintain flexible connections. All Wavin socket/plain-end connections maintain functionality at deviations of+/- 2° for diameters up to DN 315 and +/ - 1.5° for diameters > DN 315.

Wavin offers a wide range of flexible connections for both chamber stub pipes and “in-situ” inserts.

Tegra chamber base stub pipes are equipped with integrated, adjustable connection sockets with an adjustment range of +/-7.5° as standard.

When making non-standard angles using the adjustment range of the adjustable sockets, the following is recommended:

- distribute the used adjustment range as evenly as possible,
- do not exceed the maximum angle range (+/- 7.5°) in any joint.

Note!

For operational reasons, many operators require the direction of sewer piping to be changed in view of the chamber – so-called “angle chamber bases”. In special cases, bends with an angle of up to 45° are permitted. However, articulated fittings for pipe branches mounted on the inlet and outlet of the chamber are not permitted.

If Wavin chambers are used as equipment of systems made of other materials (e.g. concrete, stoneware), special fittings must be used, i.e.:

- adapters for concrete systems DN 110 – DN 500,
- adapters for stoneware systems DN 110 – DN 315.

Adapters for concrete systems DN 110 – DN 560 (smooth-wall / concrete pipe socket adapter)

Adapters for stoneware systems DN 110– DN 200 (smooth-wall / stoneware pipe socket adapter)

Adapters for stoneware systems DN 250 – DN 315 (smooth-wall / stoneware pipe socket adapter)

17.1.2. Occupational health and safety instructions

1. Health and safety regulations must be observed.
2. Observe all safety precautions during transport operations, handling of tools and equipment.
3. Ensure safe conditions for future operating personnel in the installed chambers:

- when installing the Tegra 1000 PE spacer rings, maintain the linearity of the steps in the following components;
- when cutting the distance rings by 12.5 cm, move the steps so that the distances between the steps are equal;
- ladders should not be installed in Tegra 1000 manhole chambers with a shallow structure. Arrange with the investor or future operator for their handover to operation service personnel;
- according to the directive, a ladder is available as an option in Tegra 1000 manhole chambers – to prevent accidents.

17.1.3. Installation instructions for Tegra 1000 chambers

Step 1 – Preparatory work

The Tegra 1000 chamber, due to the double bottom of the chamber, should be situated lower than the excavation for the sewer pipe by approx. 15 cm.

Many items can be transported by 1–2 people. For deep excavations and the transport of components heavier than 50 kg, mechanical equipment must be used to assist the work. The chamber elements should be transported suspended using ropes or straps.

Step 2 – First connection

There are two ways to make connections:

a) connection of the manhole chamber base to the installed pipe by mounting and or setting of the chamber on the pipe,

b) connection of the pipe to the chamber by pressing the pipe into the chamber base socket.

Step 3 – Level the chamber base

Level the chamber base using standard tools (e.g. laser spirit level).

Step 4 – Other connections

Install the remaining connections with the correct angle and slope. Lubricant can be used to facilitate installation. Adjustable sockets allow spherical adjustment by 7.5° – in any direction. The direction of the adjustable sockets can be changed using a pipe with a suitable diameter and length > 1 m.

Step 5 – Stabilization of the chamber base

To immobilize the chamber base during installation, it is recommended to fill the excavation to a height of at least 20 cm above the top of the pipes or pipe. The gravel pack must be applied in layers of max. 30 cm thick all around the circumference of the chamber and compacted thoroughly.

Step 6 – Trimming the riser pipe

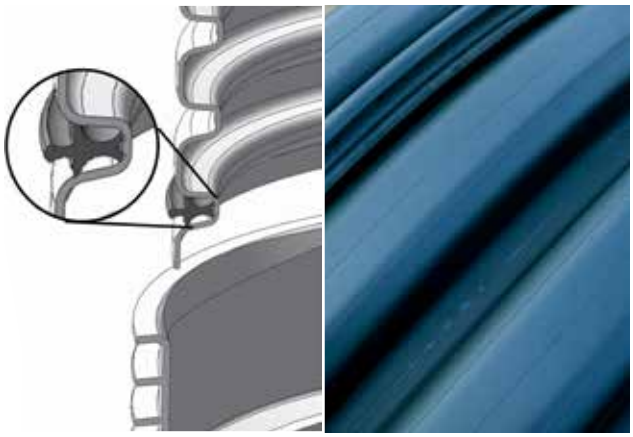
A DN 1000 corrugated riser pipe is used as the chamber's shaft. Cut it to the required height with an electric or hand saw – it should be cut at the widest point (top of the ridge). After the riser pipe has been properly trimmed, the ends of the pipe must be deburred and the debris removed.

Step 7 – Gasket installation

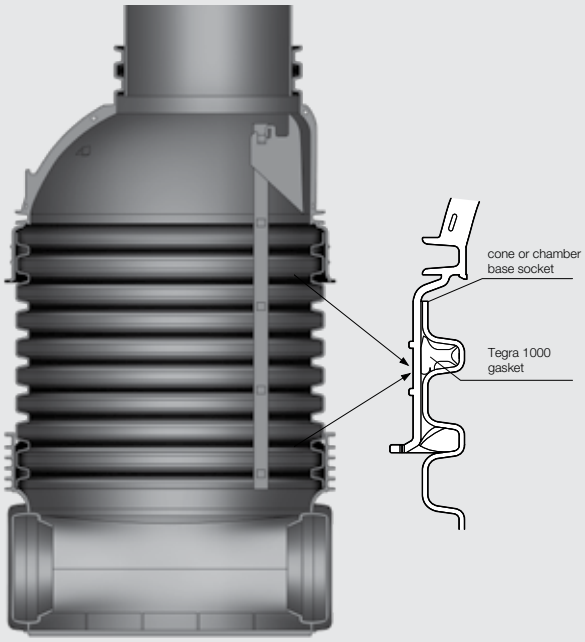
The gasket for the DN 1000 socket connection must be placed on the external side of the riser pipe in the lowest groove.

CAUTION! Make sure that the gasket is installed correctly (see figure below).

The position of gaskets and cut locations of the riser pipe – in different connection variants.



Tegra 1000 component connection

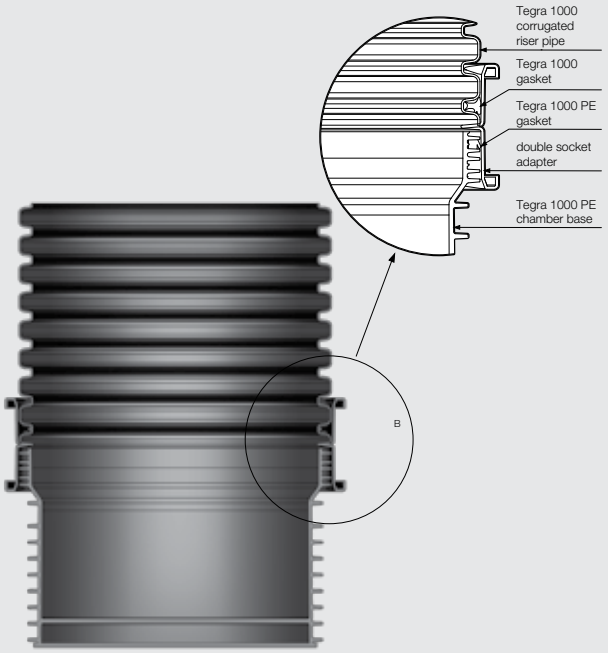


Step 8 – Assembling the shaft pipe

Apply a suitable lubricant to the chamber base socket and connect the riser pipe to the chamber base. Hold the riser pipe perpendicular to the socket during assembly.

It is also recommended to lubricate the gasket to facilitate installation.

Connection of Tegra 1000 PE chamber base with Tegra 1000 riser pipe



Note!

The Tegra 1000 chamber base can also be combined with Tegra 1000 PE spacer rings. For the connection, the ring socket is cut and a Tegra 1000 PE gasket is used.

Step 9 A – Cone installation

To assemble the cone with the riser pipe, the gasket must be positioned in the first full groove on the outside of the corrugated pipe. Apply lubricant to the cone socket and a gasket, and then install the cone while holding the riser pipe perpendicular to the socket.

Step 9 B – Shallow installation

For shallow installations without the use of a riser pipe, the chamber base can be connected to a cone. In this case, find the designated cutting point on the outside of the cone and use an electric or hand saw to cut off the socket. A gasket is placed in the resulting groove at the bottom of the cone, and the cone is assembled with the chamber base using the chamber base socket.

Step 10 – Filling the excavation around the chamber

See: General rules for assembly, point 17.1.1.

Step 11 – Chamber tops

For a description of the types of chamber top, see chapter 16.
For further chamber top assembly instructions, see section 17.2.

Step 12 – Ladder assembly

There are many instances where it is unreasonable or against OSHA rules to place a ladder in a chamber with manhole chamber dimensions. These include, but are not limited to:

- low-structure chambers (e.g. no working chamber with a minimum height of 1.8 m),
- integrated chambers under rain inlets,
- chambers with a narrowed entry way of less than 600 mm (with telescopic adapter)
- speed-reducing chambers.

In addition, in line with the increasingly prevalent tendency to restrict personnel entering sewers, Tegra 1000 chambers are designed in such a way that the use of ladders is only possible at the request of the investor or future operator. Wavin recommends that a set of ladders be handed over to the operating services instead of placing them in all installed manhole chambers. **Installation of the ladder in Tegra 1000 manholes is therefore optional.**

Ladder length

Ladders are supplied in four standard lengths: 6, 10, 14 and 18 rungs. The packaging, in addition to the ladder, includes one clamp (for 6 and 10-step ladders) or two clamps (for 14 and 18-step ladders). The assembly instructions for the ladders are also included in the packaging. Standard lengths can be cut with a hand saw or a power saw to match chamber depth.

The person responsible for installation must select the ladder length (in terms of the number of steps), the number of support points in the chamber and the support points depending on chamber height, according to the enclosed assembly diagram.

The assembly diagram outlines **two ways to fix the ladder in the chamber:**

- the first rung of the ladder is mounted in the cone (basic option),
- the first rung is closer to the road surface and the second rung is fixed in the cone. Since the ladder, in this mounting option, narrows entry way to the chamber and does not comply with standard PN-EN 476, this is not recommended. However, some countries use this solution based on national safety rules, which are indicated as overriding in the standard EN 476.

The catalog describes the recommended installation method in Poland.

Installation variant selection

For Tegra 1000 chambers, there are two ways of installing the ladder:

- installation of a ladder in a Tegra 1000 chamber placed in soil (step 12 A, points 1–4);

- step ladder assembly – initial phase carried out before assembly of the riser pipe (step 12 B, points 1–5).

If it is necessary to cut the ladder, the following rules must be observed:

- the ladder stiles at the top and bottom should always extend 65 mm beyond the steps, measuring from the middle of the step, or 50 mm from the edge of the step (see assembly diagram),
- the ladder supports should not rest on the benching,
- a distance of 0.3-0.5 m is recommended between the last step and the benching, i.e. close to the distance between the steps.

Remember ! Installation according to the instructions and adherence to the above rules ensures the safety of persons entering the chamber.

Prior to assembly, check the ladder and the supplied fastenings for completeness and suitability for assembly, and refer to the enclosed instructions and assembly diagram.

Step 12 A – Installation of a ladder in a Tegra 1000 chamber placed in the ground

1. Mounting of supports on ladder

Place the supports on the ladder stiles between the lowest and second step of the ladder and then fix them in place by installing the end caps in the ladder supports.
If necessary (see assembly diagram), a second pair of supports should also be attached – halfway up the ladder. Refer to Figures 1 and 2 during this operation for the intended end result.

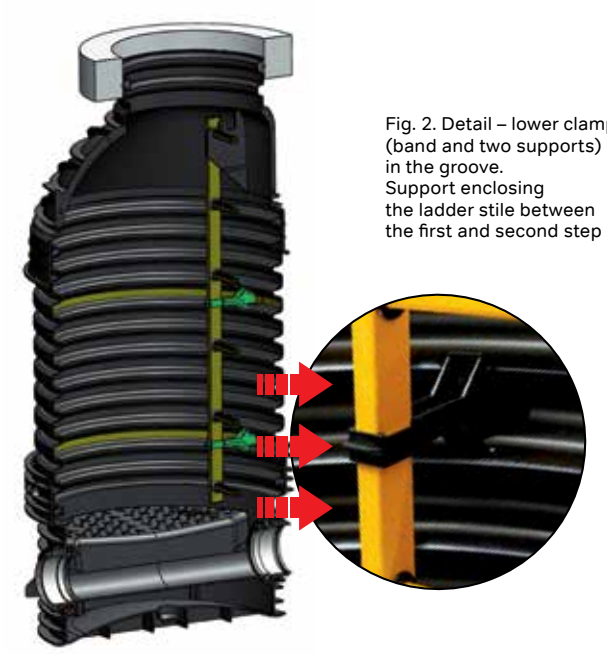


Fig. 1. GRP ladder in Tegra 1000 chamber

Fig. 2. Detail – lower clamp (band and two supports) in the groove. Support enclosing the ladder stile between the first and second step

2. Hanging the ladder in the chamber

Insert the ladder with the attached supports into the chamber and hang it by pushing the top step into the upper ladder bracket in the cone. See: Figure 3.

Fig. 3. Detail – upper ladder support – ladder bracket positioned in cone

3. Installation and fastening of ladder clamp

Entering the chamber is necessary to attach the bottom ladder clamp. Caution must be taken when descending the ladder before the bottom clamp is finally attached. It is recommended to use a harness and a fall arrest system during this operation. Turn the band so that the smooth side faces the inside of the chamber and pull it through the opening of the supports so that the band joint is on the opposite side (180°) of where the ladder will be placed.

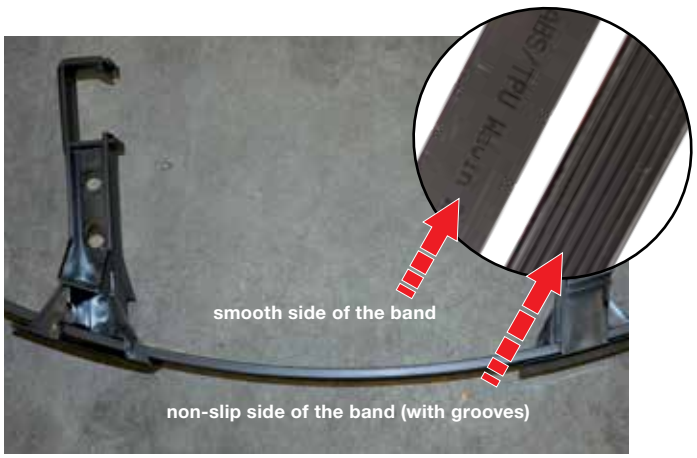


Fig. 4. Detail – Position of ladder supports on band.
Non-slip side of the band (facing the corrugated pipe),
smooth side of the band (facing the inside of the chamber)

4. Positioning of the band in the groove of the riser pipe

Stand inside the chamber with your back to the ladder, grasp the ends of the band with both hands and bend them towards the inside of the pipe, fit the ends (tongue/groove), push the band back to a circular shape and let it “click” into the appropriate groove of the riser pipe. Due to the elasticity of the belt, be careful not to trap your fingers.

Step 12 B – Stepwise installation of the ladder in the chamber

Tegra 1000 – initial phase, carried out before installation of the riser pipe.
For deep excavations, it is recommended to pre-install the ladder clamp in the riser pipe before assembling the riser pipe with the chamber base.

CAUTION! Deep chambers (> 3.8 m) must also be equipped with a second clamp (band and two supports), which must be positioned halfway up the ladder, keeping in mind that the maximum distance between the ladder attachment points is 2.95 m. If required, an additional clamp can be purchased: 3064823901 – ladder clamp (band and two supports).

1. Preparing the ladder clamp (band and two supports)
First, mount the supports on the ladder band in the correct orientation (see figure 4) and be sure to mount them on the smooth side of the band. Its non-slip side, with rubber grooves, will be placed in the groove of the riser pipe.

2. Initial phase – Pre-assembly of ladder clamp in riser pipe
Position the ladder band with the supports at the lower end of the riser pipe (see assembly diagram) so that the connection is opposite (180°) the point where the ladder is to be placed. The distancing and position of the supports on the band are then adjusted to the width of the ladder.

CAUTION! Be careful not to get your fingers caught during this operation due to the elasticity of the belt.

3. Aligning the upper and lower ladder brackets
When installing the chamber cone (step 8), adjust the position of the chamber cone so that the ladder bracket in the cone fits the pre-installed ladder supports.

Fig. 5. Pre-assembly of the ladder clamp in the riser pipe

4. Hanging the ladder in the chamber
When the manhole chamber assembly is complete, the ladder must be hung in the chamber by pressing the upper step into the upper ladder bracket in the cone (see figure 2), and the stiles into the support clamps (see figure 2). When pressing the step into the bracket in the cone, the spring element should retract when pressed, and when the step is placed in the prepared location, the spring element of the clamp should partially enclose the circumference around the ladder and secure it against accidental ejection.

5. Completion of assembly

Completion of the ladder assembly requires entering the chamber. Caution must be taken when climbing down the ladder before the stiles are finally secured. The use of a harness and a fall arrest system is recommended for this operation. Fix the ladder in place by closing the support clamp with the end caps in the special grooves (see figure 6).

Fig. 6. Installation of end caps by supports

In both assembly variants, check that all parts of the ladder are securely positioned at the designated points and that the personnel safety regulations are observed.

17.1.4. Assembly instructions for inspection chambers with flat bottoms (Tegra 600 and 425)

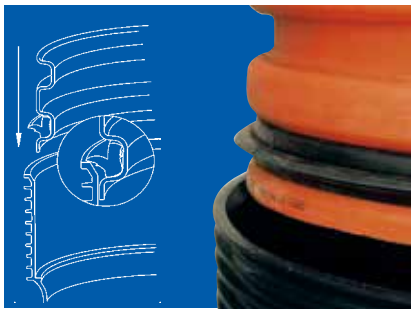
1. Due to their size, inspection chambers can be installed in an excavation with a width adapted to the diameter of the pipe – without local expansion. The light weight of the individual components enables installation by one person.

2. Chamber bases should be mounted on a stable, level substrate and uncompacted sand ballast of 5–10 cm. Tegra double-bottomed chamber bases require a 10-centimeter depression in relation to the excavation for the sewer pipe. The invert base is set up in the prepared substrate. The top of the chamber base must be level.

3. Connect the sewer pipes to the chamber base by pushing them into the socket – in the case of stubs with adjustable sockets (spherical adjustment range: +/-7.5° on each socket). The adjustment range used must be, to the extent possible, distributed evenly at the inlet and outlet stub. To immobilize the connected sewer junction, it is recommended to fill the excavation to a height of at least 10 cm above the top of the pipe. The connection socket to the riser pipe remains above the gravel pack.

4. Cut the riser pipe to the required height using a hand saw or power saw. Remember that the pipe should be cut along the middle of the ridge. The cut pipe is positioned correctly with the gasket in the riser pipe socket.

5. The corrugated pipe gasket is then placed on the outside of the riser pipe in the groove between the first and second ridges of the pipe.



6. The gasket for the corrugated tube is a molded gasket and must be positioned according to the figure included on the label.

7. Clean the chamber base socket. Coat the inside with lubricant.

8. The riser pipe with an installed gasket should be placed in the chamber base socket.

9. Sand pack is compacted evenly in layers (max. 30 cm) all around the chamber.

17.1.5. Assembly instructions for Basic 600, 425, 400 and 315 chambers

When installing inspection chambers, there is no need to widen the excavations in relation to the width required for the pipelines to be laid. The individual components are lightweight and can be carried and attached by one person.
Always use clean cloths to clean the components during installation, as well as lubricants suitable for rubber and plastic seals for lubrication.

1. Before installation, check the chamber components and make sure that the gaskets are positioned correctly in the grooves.

2. Prepare the bottom of the excavation – make a leveling bed measuring approx. 10 cm thick on a stable substrate.

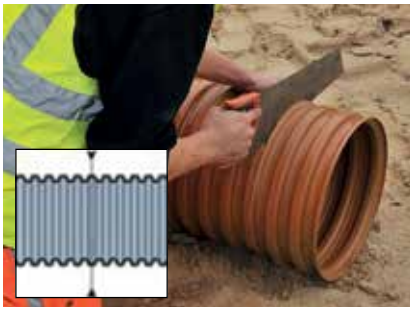
3. When installing socket connections, measure the socket depth and mark the required insertion depth at the plain end of the part to be joined.

4. Clean and lubricate the seals in the socket.

5. Press the beveled and cleaned plain end into the socket in the indicated location.

6. Stabilize the chamber base by filling the excavation to a height of approx. 3/4 of the pipe diameter. Then check that the chamber base is correctly leveled.

   Caution: Pay attention to the soil compaction between the reinforcement ribs.



7. Cut the riser pipe to the required length. Cutting should be done on along the top of a ridge.

   Caution: The riser pipe can also be cut to the required height after filling the excavation.

8. Deburr the end of the riser pipe after cutting. A clean gasket is then inserted into the first groove of the corrugated pipe.

   Caution: Make sure that the gasket is not twisted when applied.

9. Clean and lubricate the chamber base socket.

10. Lubricate the gasket on the riser pipe and press the riser pipe into the chamber base socket.

11. Secure the chamber to prevent the entry of sand while filling the excavation.

12. The excavation must be filled with layers of max. 30 cm thickness, burying the chamber evenly from each side up to the height where the chamber top will be placed.

Caution: The soil compaction must be suitable for the ground/water conditions and future external loads (min. 92% SCL in green areas without groundwater, 95% in irrigated soils and min. 98% for paved surfaces).

13. Install one of the recommended chamber tops.

Class A15 – load distribution cone with cover

Class A15 – cast iron or PP cover placed directly on corrugated pipe

Class B125 or D400 – top with telescopic pipe





17.1.6. Chamber height adjustment

There are two ways to adjust the height of chambers:

- adjustment of the riser pipe height, and/or in the case of the Tegra 1000 – adjustment of the height of the cylindrical part of the cone,
- adjustment of the position of the top (see chapter 16).

Correct trimming of the chamber riser

For Tegra 1000 chambers and inspection chambers, it is recommended to cut the riser pipes at the top of the ridge. Cutting the riser pipe in this way ensures best positioning in the socket on the one hand, while on the other hand it enables A15 covers to be mounted directly on the riser pipe.

Keep the connected parts clean when assembling socket connections with a gasket.
When placing the cone on the manhole riser, the linearity of the steps in the well should be maintained.
When using heavy equipment (e.g. excavator bucket), it is advisable to protect the edge of the cone from damage, e.g. by using a wooden spacer.
The load must be distributed symmetrically (lateral load can cause the cone on the riser to tilt).
Connecting the cone to the shaft can be done before the chamber is installed in the ground, as well as after installation in the excavation and when the chamber is partially buried.

If necessary, the height of a standard chamber can be adjusted by cutting the riser or cone.

Cutting the cylindrical part DN 600 of the Tegra 1000 manhole cone

The chamber height can be reduced by trimming the cylindrical part of the cone. With a PE cover, it can be reduced by a maximum of 20 cm. For other tops, it is necessary to leave the last ridge of the cylindrical part of the cone – maximum reduction of 15 cm.

17.1.7. Assembly instructions for in situ inserts

Wavin sewer manholes also allow for pipe connections above the invert base – at the height of the riser pipe. This is prepared so that the connection can be made at the construction site. Connections can be made both during the construction of new networks with chambers and when adding new connections to an existing network. This is achieved by using specially designed, prefabricated, two-piece molded parts consisting of a rubber seal and a pipe connection socket – known as "in-situ" inserts. Simple, commercially available tools are required for the assembly work, e.g. a jigsaw for round holes and a drill – at least 850 W. For a large number of holes in a short time, especially in manholes with PE or PP walls, stronger drills are better. For installer safety, it is recommended that the drill be equipped with a clutch. Wavin chamber risers provide good, wide support for inserts and connecting pipes due to the structural design of the walls.

In order to maintain the tightness and durability of the connection, it is recommended to provide a good soil support for the pipes connected above the bottom of the chamber – good compaction of the soil to the in situ connection height and careful compaction of the soil above (without excessive bending and ovalization).

1. A hole is made in the corrugated pipe with a special jigsaw.

2. The edges of the opening are then deburred.

3. The in situ insert seal is mounted in the opening made.

4. If installation is difficult, the edges of the hole can be coated with lubricant.

5. Lubricant is applied to the inside of the installed seal, allowing the socket fitting to fit into it.

6. The “in-situ” insert is now ready for a sewer pipe to be inserted.

1. A hole is made in the corrugated tube with a special jigsaw.

2. The edges of the opening are then deburred.

3. The in situ insert seal is mounted in the hole made.

4. If installation is difficult, the edges of the hole can be coated with lubricant.

5. Lubricant is applied to the inside of the installed seal, allowing the socket fitting to fit into it.

6. The “in-situ” insert is now ready for a sewer pipe to be inserted.

In DN 1000 and 600 manhole chambers, connection with sewer pipes with diameters of 110, 160 and 200 mm is possible. For smaller chambers, sewer pipes with diameters of 110 and 160 mm can be connected. Pressurized pipes with diameters of 40, 50, 63 and 90 mm can also be connected to a chamber riser. When connecting small pressurized pipes, specially designed hole saws and in situ seals are used (see chapter 15).

Notes

Note 1

It is important that the connection does not interfere with the gasket in the socket connection. It is best to avoid the entire socket connection. The Tegra 600 and 425 invert bases have a version that solves the problem of the collision of "in-situ" inserts with the invert base socket – monolithic solutions (see section 14.6.3.).

Note 2

When making several connections to the same chamber, it is recommended that the edges of the holes for "in-situ" inserts not be less than 10 cm apart.

Note 3

Universal jigsaws are suitable for making holes in all chambers (PVC, PE and PP).

Note 4

A jigsaw is a steel tool, and therefore its size changes due to temperature. In summer, if left in the sun for a long time, it can make too large holes, and in winter it can make too small holes. It is advisable to make holes with a jigsaw stored at a temperature of 10–25°C.

17.1.8. Assembly instructions for road inlet chambers

For the assembly of inlet chambers, the general rules from section 17.1.1. apply.

1. Collect the components and check that they are complete and in good condition.

2. Measure the chamber location at the location indicated by the design. In case of positioning by a curb, mark the manhole axis according to the dimensions of the inlet used and its surface-level components. Determine the sedimentation depth according to the design, taking into account that the sedimentation part of the inlet manhole and the connection should be at a depth below the ground freezing level.

3. Place the base of the chamber on the bottom of the prepared excavation on a sand bed, with the drain pointing towards the connection.

4. Compact the area around the base to ensure that it is immobilized.
5. In the case of an XL chamber:
   - make a sedimentation part from the bottom, a 425X gasket and a corrugated riser pipe section 425,
   - connect a drainage module with a suitable outlet diameter (according to documentation) to the sedimentation part of the XL chamber.

6. Prepare a suitable section of the corrugated riser pipe.

7. Make the connection and connect it to the receiver (usually a rain gutter). Follow the assembly instructions for the piping systems.

8. Connect the base to the riser pipe 425, 400 or 315 using a suitable gasket, i.e. 425 G2 gasket, 400 × or 315 × respectively, remembering that the 425 G2 gasket is placed in the internal groove of the ridge.

The gasket overlaps the plain end of the catch chamber, and the remaining riser and base connections have a gasket applied to the outer groove of the ridge and riser pipe, and with the gasket applied they enter into the base connection element.

9. Fill the excavation around the chamber in layers. Same rules as for sewer chambers.
10. Top assembly instructions – see: point 17.2.

17.2. Assembly instructions for Wavin chamber tops

17.2.1. Assembly instructions for Wavcin chamber tops for class A15

For class A15 top assembly, two solutions are used:

- cover placed directly on the chamber riser

or

- on unpaved terrain – as a cover on the cone.

When covers are placed directly on the chamber riser, it is important to cut the chamber edge at a suitable point. This ensures that the cover fits the chambers. When fitting PP or cast iron covers, screws or bolts fix the covers to the chamber by fastening them from the inside to the first inner ridge.

With the second solution, it is recommended that the upper edge of the cone be placed at least 2 cm above surface level. This prevents soil from entering the chamber when the cover is removed.

17.2.2. Assembly instructions for class B125–D400 Wavin chamber tops

General Guidelines

The rules for properly installing a floating top are as follows:

- coherent connection between the surface, manhole cover and the telescopic pipe,
- elimination of gaps between the surface and cast iron and plastic components,
- ensuring support of the body of the manhole cover over the entire surface (filling of voids in the bottom layer of the body).

The following instructions and recommendations are to be regarded as guidance.

The contractor responsible for installing the manhole cover must adapt the installation method to the specific pavement solution in each case. The contractor may also reserve the right to make changes and improvements to the manner of assembly of chamber tops. At the same time, however, he or she should observe the above-mentioned rules and technical recommendations.

Before assembly, check that no component is damaged. Damaged components must not be installed under any circumstances.

The bonding layer between the cast iron components and the surface should be continuous and have a thickness of min. 4–5 cm. Rigid top components (e.g. load distribution cone) should be positioned at least 10 cm below the road surface. In the case of bituminous pavements, it is recommended to replace rigid load distribution components with plastic components (e.g. TAR load distribution cones) that can be placed at a shallower depth below the surface (min. 5–6 cm).

Ensure that compaction lasts – the gravel pack and backfill layers must be protected from being washed away.

Additional recommendations

Properly compact the soil in the excavation before constructing the road surface. Compact the soil around chambers in layers over the entire height of the chamber, evenly around the circumference. Achieve soil compaction in accordance with paved surface construction design requirements. Ensure that compaction lasts – the gravel pack and backfill layers must be protected from being washed away.

Refer to standard PN-C-89224 for recommendations on soil compaction according to soil class and equipment.

In order to guarantee the durability of the compaction around the chambers, use the measures and methods of protection provided for in standards PN-EN 1610 and PN-C-89224.

Need for the use of cones in telescopic tops

Inspection chambers do not require load distribution components when constructing paved surfaces. The manhole cover/inlet assembled with the telescopic pipe is supported by the top structural layers of the paved surface.

If a load distribution cone is used to protect manhole covers from falling due to dynamic loads, and as vaulting over fill layers that self-compact due to dynamic loads and consolidation due to weather and climatic changes, the top must be constructed in accordance with the principles indicated in the introduction to the instructions.

Interim solution

The use of a load distribution cone to support the manhole cover is recommended for a temporary period of use of the manhole cover/inlet in an unpaved surface. The connecting component between the manhole cover and the load distribution cone is a “cap” made of concrete cast on site, measuring min. 4 cm thick and with a diameter of min. 15 cm larger than the manhole cover’s diameter. The “cap” protects the manhole cover from destruction (usually brittle fracture) due to dynamic loads and makes it easier for wheels to drive onto the manhole cover without large, sudden steps. In such cases, a cone as a highly durable prefab provides:

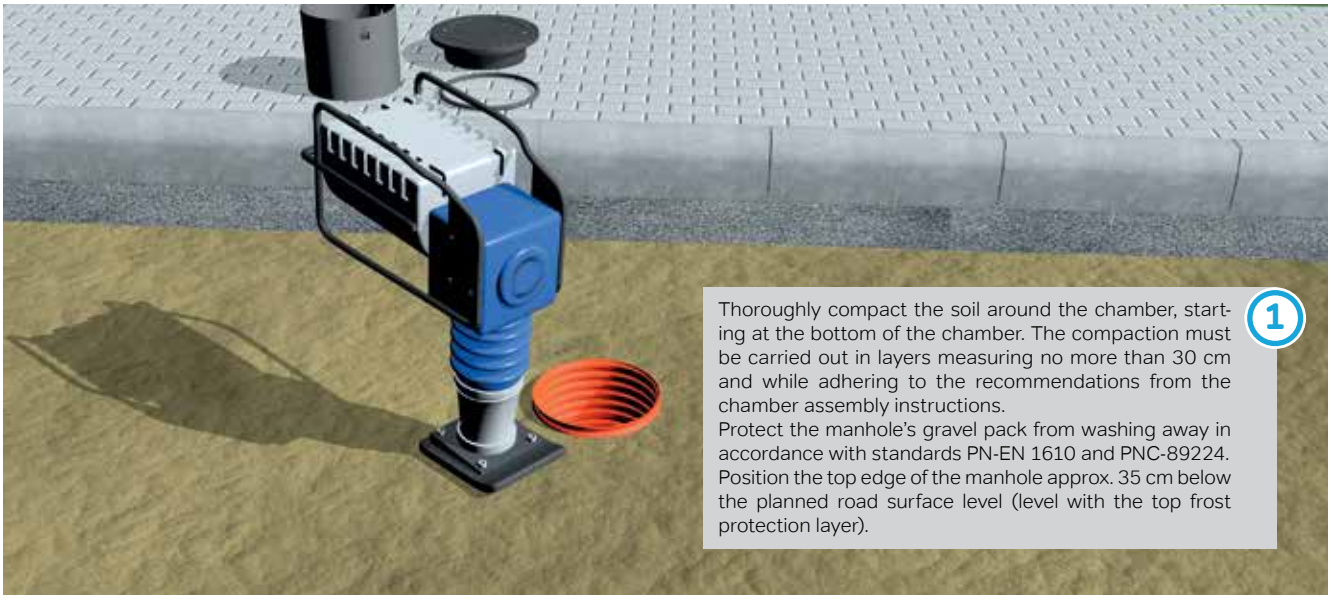
- reinforcement of temporary concreting;
- stabilization of the top, which is not easily tilted in conditions of poor soil compaction;
- vaulting over fill layers that undergo self-compacting due to dynamic loads and consolidation due to weather and climatic changes.

When pouring out the final surface, the concrete “cap” is removed, releasing the manhole cover with the telescopic pipe. The cone remains in its previous position (if necessary, its position is corrected – placed parallel to the road surface) if, after construction of the new surface, it is at least 10 cm below the surface’s upper level. If the new surface does not cover the cone with a layer of at least 10 cm, it is recommended to remove the cone, as shallower coverage of the rigid element is unfavorable for the paved surface. The rigid structure among the top structural layers of the pavement under the influence of dynamic loads will form an edge on which micro-cracks will follow – deepening over time due to constant dynamic loads and the influence of water migration and freezing processes.

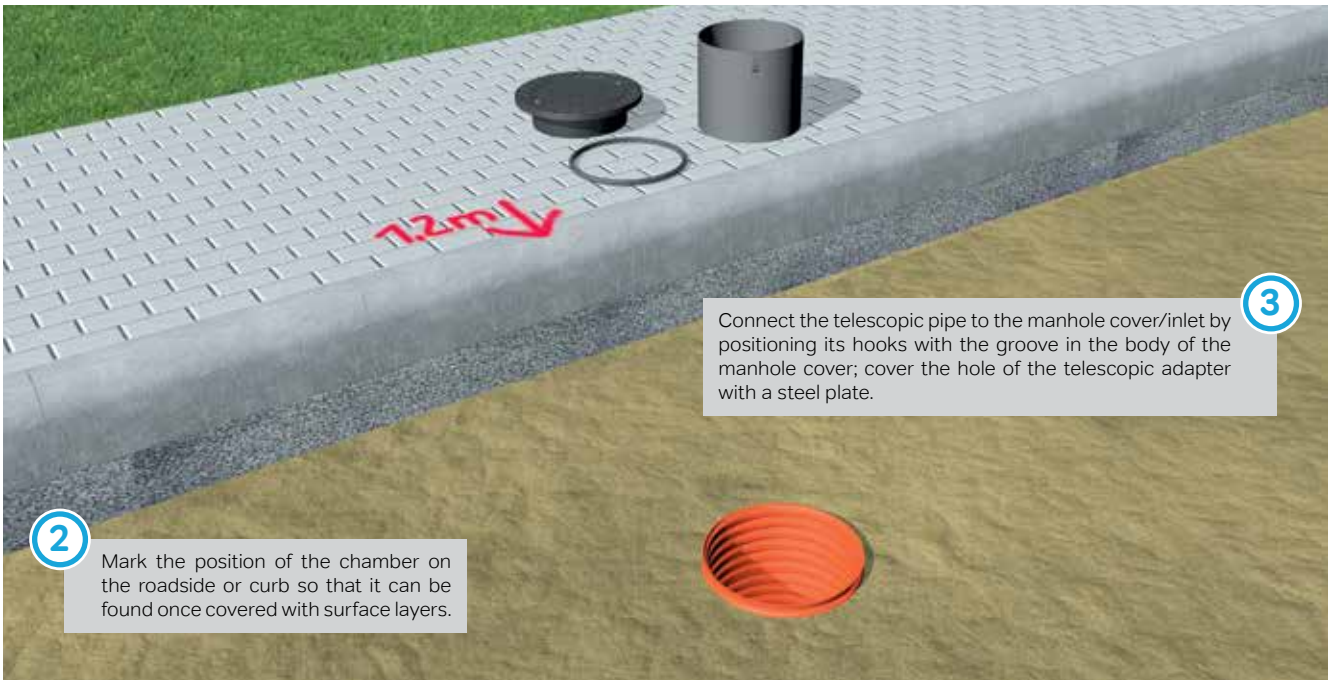
Example instruction for construction of a new three-layered paved surface with the following structure:

- 4 cm wearing layer,
- 10 cm load-bearing bitumen layer (binding),
- 25 cm of gravel support layer/crushed aggregate base.

Refer to the assembly instructions.



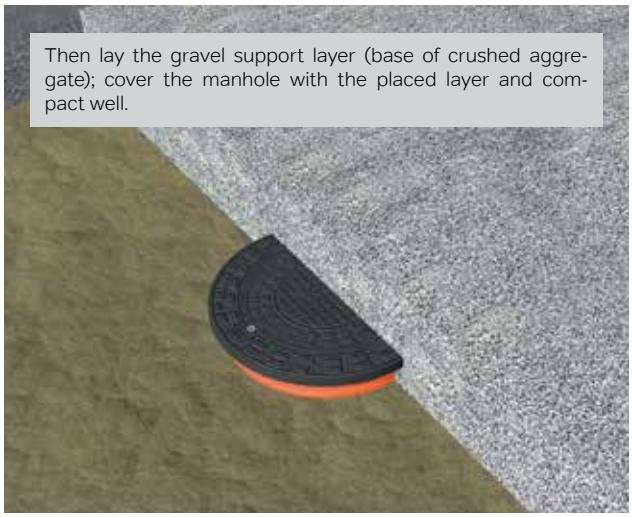
1 Thoroughly compact the soil around the chamber, starting at the bottom of the chamber. The compaction must be carried out in layers measuring no more than 30 cm and while adhering to the recommendations from the chamber assembly instructions.
Protect the manhole's gravel pack from washing away in accordance with standards PN-EN 1610 and PNC-89224.
Position the top edge of the manhole approx. 35 cm below the planned road surface level (level with the top frost protection layer).



2 Mark the position of the chamber on the roadside or curb so that it can be found once covered with surface layers.

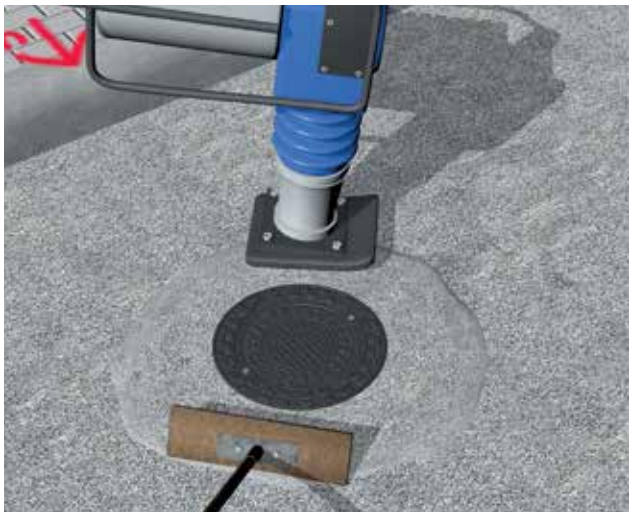
3 Connect the telescopic pipe to the manhole cover/inlet by positioning its hooks with the groove in the body of the manhole cover; cover the hole of the telescopic adapter with a steel plate.

4 Insert the telescopic part of the chamber top (telescopic adapter or telescopic pipe) into the chamber riser. Within the connection, use a seal for the telescopic pipe, which must be placed inside the riser pipe in the highest groove.



Then lay the gravel support layer (base of crushed aggregate); cover the manhole with the placed layer and compact well.

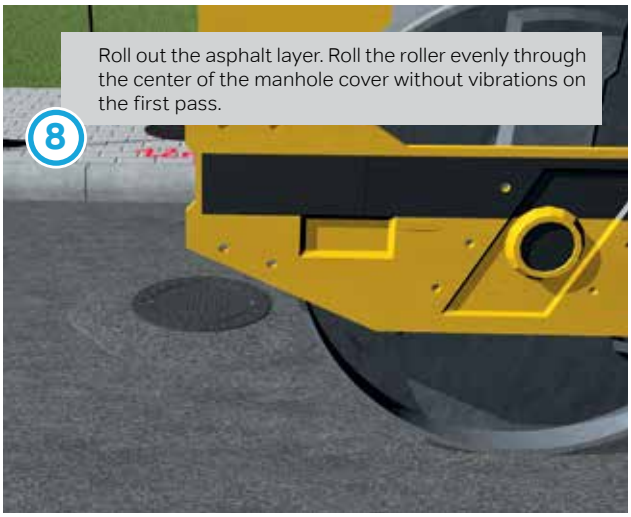
5 Expose the chamber, extend the telescopic part upwards. Fill in the resulting depression.



Carefully fill the space under the telescopic adapter or the manhole cover mounted on the telescopic pipe.

6 Then protect the manhole cover from becoming dirt from the bitumen layer by covering it with sand or a thin metal sheet. Spread a load-bearing bitumen layer that is 20% thicker than the target load-bearing asphalt layer.

7 Open the manhole cover, remove the sheet and use suitable tools, such as a pick or spade, to move the manhole cover upwards. Fill the excavated depression by completely filling the space under the manhole cover mounted on the telescopic pipe.



8 Roll out the asphalt layer. Roll the roller evenly through the center of the manhole cover without vibrations on the first pass.

9 Then lay the wearing layer with a laying machine.

Repeat all previous steps (open manhole cover, remove sheet, move manhole cover up, fill depression, clean manhole cover thoroughly, roll).

10 When the work is finished, the remaining asphalt residues must be removed from the manhole cover.

11 Position the telescopic adapter at the target elevation, taking into account the height of the other elements (manhole cover or inlet and reinforced concrete inlet adapter). Remove the cover sheet. Install the top components.

12 Spread the bitumen load-bearing layer and wear layer. Use scrapers on thee bitumen layers to fill all the spaces around the manhole cover/inlet and remove any gaps. Use compaction with smaller mechanical equipment, e.g. a jumping jack, around the manhole covers/inlets themselves. When rolling, avoid top components protruding above the road surface. Only on the final layer – when the level of the road surface and the asphalt being compacted is equal – can the roller be rolled over the manhole cover/inlet. The first pass of the roller should be even for the manhole cover, preferably through the middle and without vibration.

18. Regulatory requirements

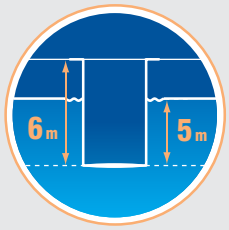
18.1. Regulatory requirements for drains

Standards for drains

The provisions of the system standard PN-EN 476 apply to drains. The exact requirements for underground chambers and non-manhole chambers made of thermoplastics (PVC-U, PP and polyethylene PE) are defined by the following standards:

- PN-EN 13598-1, which applies to chambers with a depth of 1.25 m, located in an area without traffic.

- PN-EN 13598-2, which applies to chambers installed at a depth of max. 6 m in areas subject to traffic load. It specifies: mechanical properties, performance requirements and minimum required marking and how they are tested. Due to the responsible, wide area of use of the chambers covered by the standard and the associated static and dynamic loads as well as groundwater pressure, the standard introduces a new performance parameter relating to durability, i.e. the permissible groundwater level, which the manufacturer is obliged to declare.



The standard also requires new, demanding tests to verify the durability and structural consistency of the chamber bases with the groundwater hydrostatic pressure level declared by the manufacturer. According to the standard, it is necessary to carry out tests on the durability and structural integrity of the chamber base in long-term vacuum tests at the height associated with the declared groundwater level. These tests should take a 2 m water column into account as the minimum level.

In addition, the standard requires testing of the permissible traffic load and the tightness of manhole socket connections with sewer pipes in tests according to condition D, i.e. with a simultaneous pipe deflection of 5% and an axial deflection of 2°.

Wavin's Tegra family of chambers meet the requirements under standard PN-EN 13598-2 with groundwater pressure even up to a 5 m water column. Basic inspection chambers, on the other hand, are designed for a groundwater level equating to a 3 m water column.

There are also chambers on the market with limited testing. A comparison of the scope of testing and the level of requirements fulfilled provides the basis for comparing the durability and performance properties of chambers.

Types of drains

Chambers are facilities on the sewer network that allow periodic maintenance work to be carried out.

Based on their diameter and accessibility to service personnel, drains are divided into manhole and inspection chambers. The latter are commonly referred to as inspection chambers, where:

- manhole chambers have a diameter of at least 1000 mm, suitable for entering and exiting the sewer for the purpose of service activities,
- inspection chambers have a diameter of less than 800 mm and are suitable for carrying out service activities in the sewer from ground level.

Inspection chambers are recommended as part of a plastic pipe sewer system.

Wavin offers 1000 mm diameter manhole chambers and inspection (non-manhole) chambers with the following diameters: 315, 400, 425 and 600 mm.

Due to their function, chambers can be divided into the following categories:

- review (control) – allowing service work to be carried out, used in wastewater, sanitary and rainwater channels,
- rainwater – mounted on a service pipe (with or without a sediment tank) or a network, with a rainwater inlet, used on general wastewater channels (with water trap) or rainwater channels,
- cascade chambers – to connect a channel at an elevation above the bottom of the chamber base. For diameters of connected channels > 0.4 m, they should have an incline, whereas for diameters of not more than 0.4 m and drop heights from 0.5 m to 4.0 m, they can be made with a downpipe inside or outside the chamber. A downpipe can be omitted for non-manholes (inspection chambers) and plugged manholes.

More and more advanced functional solutions are also being used: chambers for energy loss (used in sewers with large drops – 25% and more), expansion chambers for feeding discharge lines into unpressurized sewers, rinsing chambers, soaking chambers and others.

Wavin chamber components can be adapted to many other functions and applications.

Based on the construction method of the chambers, we can divide them into the following categories:

- prefabricated, where at least the main part of the work chamber and the manhole chimney are made of prefabricated parts,
- monolithic, where at least the working chamber is designed as a monolithic structure.

The Wavin chambers shown in this catalog are prefabricated.

Dimensional requirements for chambers

The general requirements for the geometrical dimensions of sewer chambers are also specified in PN-EN 476. According to this standard:

- DN 1000 diameter chambers are manhole chambers, with access for personnel to carry out cleaning and inspection,
- a manhole chamber with a diameter of 800 ≤ DN < 1000 and a depth of up to 3 m should be treated as a manhole chamber, with access to carry out cleaning and inspection, with the occasional possibility of a person wearing a harness to enter.

The standards do not specify the dimensions of non-manhole chambers. The smallest inspection chamber size suitable for the equipment held should be determined by the network operator.

Wavin's range of chambers includes:

- manhole chambers with a diameter of 1000 mm, which are chambers for entering and carrying out service activities in the channel,
- Tegra 600 and Tegra 425 and Basic 600, 425, 400 and 315 inspection chambers, which are adapted to carry out service operations in the channel from ground level (with specialized equipment).

Requirements for manhole steps or ladders

Manhole chambers shall be equipped with steps in accordance with PN-EN 13101 or with a fixed ladder in accordance with PN-EN 14396.

According to PN-EN 13101, the steps can be single (for standing on one foot) or double (for standing on two feet). The front of the steps should be positioned at least 120 mm from the inner wall of the chamber. The vertical distance between the steps should be 250–350 mm. Standard PN-EN 13101 requires that double steps be at least 250 mm wide and that the depth of the step be more than 120 mm. In order to provide effective support for a shoe and to allow an ergonomic grip with the hand, the minimum step profile width should be 20 mm and the step circumference should not exceed 14.5 cm.

Custom-made chamber steps meet all these requirements, comply with the standard and carry a CE mark.

Standard PN-EN 13898-2 also contains requirements for ladders installed in chambers. They should meet the requirements of PN-EN 14396 and be tested for tensile strength and vertical load with the above parameters:

- vertical pulling force: 1 kN,
- vertical load: 2 kN.

According to standard PN-EN 14396:2006, a ladder for fixed attachment with two stiles must meet the following requirements:

- the distance between the top of the next rungs should be between 250 and 300 mm,
- the rung width should be greater than 300 mm,
- the minimum distance to the wall at any point should be greater than 150 mm,
- the maximum distance between the two supports over the height of the ladder should not exceed 3000 mm,
- the distance between the ground and the top of the first rung and the distance of the bottom rung from the bottom of the chamber should be less than the distance between the next rungs.

The Tegra 1000 chamber ladder meets all these requirements, complies with the standard and is CE-marked.

Performance requirements

Durability of manhole chamber and non-manhole chamber risers

According to PN-EN 13598-2 and PN-EN 476 for deep chambers installed in areas subject to heavy traffic loads, the required peripheral rigidity of the chamber riser should be at least 2 kN/m^2.
Wavin chamber risers are designed for large installation depths and heavy traffic loads.

Watertightness

Manhole chambers must be able to withstand internal hydrostatic pressures of up to 50 kPa without leaks. Non-manhole chambers intended for use at depths less than 2 m should withstand a hydrostatic pressure equal to the pressure present when they are fully filled, and chambers intended for depths > 2 m should, like manhole chambers, withstand an internal hydrostatic pressure of up to 50 kPa without leakage.
Wavin manhole and non-manhole chambers are designed for a broad range of depths and meet water tightness requirements at a pressure of 50 kPa.

Requirements for pipe bottom conformity

Standard PN-EN 476 standard also specifies a parameter that affects hydraulics – pipe bottom conformity.
It states that the bottom of pipes in connections must comply with the maximum tolerances calculated as follows:

- nominal size less than or equal to DN/OD 315 or DN/ID 300 – step up to 6 mm,
- nominal dimension larger than DN/OD 315 or DN/ID 300 – step 0.02 × DN, but not larger than 30 mm.

Sealing requirements

Seals used in chambers should meet the requirements of PN-EN 681, whereby those used in sewer systems must be tested for this specific application.
All of Wavin's chambers comply with these standards.
Basic chambers are supplied with WC-labeled SBR rubber lip seals in accordance with EN 681-1.
WH-marked seals with EPDM are installed as standard in Tegra chambers, in accordance with PN-EN 681-2.

In the sockets for smooth-walled pipes, there are three-lipped gaskets with a polypropylene (PP) Dinlock™ support element made of EPDM/TPE.
Tests confirm that these seals provide an increased standard of sealing. Dinlock™ seals ensure a perfect seal in all circumstances and over a wide range of pipe joint tolerances while requiring less force during installation. The PP stiffener ensures that the seal sits better in the groove and prevents seals from slipping or folding during installation.

Compliance of plastic chambers **with occupational health and safety RULES**

Safety Rules

When operating sewer systems and other systems equipped with Wavin chambers, occupational health and safety regulations must be adhered TO.
It is currently recommended (recommendations under European standards) that all operations carried out on the network should be carried out from the ground level for operational safety reasons, even if manhole chambers are available.
Where there are no national recommendations, then the recommendations of the standard PN-EN 476 should be used as safety recommendations for the dimensions of manhole chambers – i.e. manhole chambers with access for personnel to carry out cleaning and inspection should have the following dimensions:

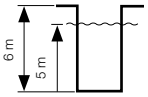
– diameter ≥ 1000 mm,
– the chamber entrance should have a diameter of 600 mm the entrance part (tapered to 600 mm) should be a maximum of 450 mm high,
– the depth of the working chamber, i.e. the part of the chamber intended for operating activities, should be min. 1800 mm,
– in the case of chambers with a diameter of DN > 1000, the manhole chimney, i.e. the shaft connecting the working chamber with the surface, intended for service personnel to enter and exit the work area, must be ≥ 700 mm (may be 1000 mm).

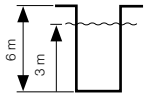
PN-EN 13598-2 requirements

Standard point	Performance and technical properties	Test Methodology	Requirements	Tegra chambers	
				Tegra 1000	Tegra 600
Chamber base material					
4.1.	chamber base material according to standards for sewer pipes: PN-EN 1401-1, PN-EN 13476-2, PN-EN 13476-3 (PVC-U) PN-EN 1852-1, PN-EN 13476-2 and PN-EN 13476-3 (PP) PN-EN 12666-1, PN-EN 13476-2 and PN-EN 13476-3 (PE) PN-EN 14758-1 (PP-MD)		- material that is compliant with standards for sewer pipes – invert base durability test: 1000 hours - material not compliant with the above standards – invert base durability test: 3000 hours	compliant materials – test: 1000 hours	
Chamber base requirements					
4.2.3.	durability at maximum groundwater level H test parameters: p = -0.1 × H/R T depending on material (e.g. 80°C for PVC, PP, PP 80°C for rotary casting, PE 60°C for rotary casting) t ≥ 1000 h/3000 h	PN-EN 13598-2 Annex A; PN-EN 14830	no cracks or micro-cracks	5 m	
Requirement for seals					
4.4.	compliance with seal standards PN-EN 681-1 PN-EN 681-2			gaskets in SW sockets according to PN-EN 681-2 manhole invert base/riser pipe gaskets and adju socket gaskets – according to standard PN-EN 6 (special designs for Wavin)	
Geometric Dimensions					
6.1.1.	the inner diameter of the riser should be used for classification of the nominal dimension of manhole and non-manhole chambers	PN-EN 476	the inner diameter of the riser should be used for dimension classification	for DN/ID 1000 riser; Dw = 1000 mm; for cone Dw 600	DN/ID 600; Dw = 600 mm; Dz 670, internal diameter of telescopic adapter Dw > 590
Chamber tops					
6.2.1.	tops in accordance with PN-EN 124		certificate from an external certifying body, marking according to standard: load class (A15-D400), manufacturer's mark, certification body's mark, construction mark B		
6.2.1.	tops made of other materials (plastic, concrete) - in accordance with national technical assessments of IBDiM			reinforced concrete covers and reinforced concr TAR covers and TAR surface components have IB	

	Basic inspection chambers				
Tegra 425	**600**	**425**	**DN/OD 400**	**315**	**NOTES**
	compliant materials – test: 1000 hours				Basic Low Carbon chamber bases are made from post-consumer recycled PP. They undergo 3000 hours of tests and show unchanged performance properties in relation to chamber bases made from primary PP. They are produced with a lower carbon footprint.
	3 m				**Mandatory parameter under PN-EN 13598-2, which must be provided by the manufacturer. It is verified via durability and structural integrity tests. Min. requirement under standard: H = 2 m.** This is a durability parameter (such as standard pressure for pressurized pipes and peripheral rigidity for gravity pipes).
2 stable 81-1	seals on stubs and chamber base/riser pipe seals - according to standard PN-EN 681-1 (special designs for Wavin)				Gaskets in XS sockets are not included – they are purchased with X-Stream pipes. All gaskets are suitable for sewer conditions – WC (PN-EN 681-1) a nd WT/WH (PN-EN 681-2) marking. Gaskets are subject to a **CE declaration**.
DN/ID 425; Dw = 425 mm; Dz 477, telescopic pipe diameter Dw > 400	DN/ID 600; Dw = 600 mm; Dz 670, internal diameter of tele-scopic adapter Dw > 590	DN/ID 425; Dw = 425 mm; Dz 477, telescopic pipe diameter Dw > 400	DN/OD 400; Dw = 364 mm; Dz 400, telescopic pipe diameter Dw > 300	DN/ID 315; Dw = 315 mm; Dz 356, telescopic pipe diameter Dw > 300	There are DN/ID and DN/OD series on the market. Wavin uses DN/ID, except for DN/OD 400 manholes.
					All covers, hatches, inlets are certified by a third party. Marking in accordance with the standard: class, standard no., manufacturer's mark, certification body's mark.
ete surface elements have KOT IBDiM (tested in IBDiM) BDiM KOT (based on IBDiM tests)					

PN-EN 13598-2 requirements (continued)

Standard point	Performance and technical properties	Test Methodology	Requirements	Tegra chambers	
				Tegra 1000	Tegra 600
Steps and ladders					
6.2.2.	steps in accordance with PN-EN 13101 or ladders in accordance with PN-EN 14396		required ergonomic tread spacing: Required ergonomic tread spacing: 0.25-0.35 m, tread width:min. 30 cm, minimum distance from the front of the step to the wall: 12 cm	GRP ladder – yellow	N/A
Chamber base mechanical properties					
7.	structural consistency – extrapolated (over a period of 50 years) deformation of the main pipe of the chamber	PN-EN 13598-2 Annex C; PN-EN 14830	no collapses or cracks	5 m 	
	test parameters: p = -0.5 bar T = 22 to 25°C t ≥ 1000 h		deformation of the main pipe of the chamber in the horizontal direction (W) ≤ 10% of the outer diameter of the outlet		
			deformation of the main pipe of the chamber in the vertical direction (H) ≤ 5% of the outer diameter of the outlet		
7.	impact resistance; test parameters: load: 1 kg, r = 50 mm, T = (23 +/- 2)°C	PN-EN 13598-2 Annex D	no cracks or other damage	test – positive result	
7.	impact resistance (drop on hard surface method); test parameters: 500 mm, weakest point, T = (-10 +/- 2)°C	PN-EN 12061	no cracks or other damage	test – positive result	
Corrugated riser pipe					
7.	peripheral rigidity	PN-EN 14982	peripheral rigidity ≥ SN 2 in kN/m²	2 ≤ SN < 4 kN/m²	2 ≤ SN < 4 kN/m² 4 ≤ SN < 6 kN/m² asrequir
Ladder in manhole chambers					
7.	resistance of the ladder's attachment to detachment by a horizontal force of 1 kN	PN-EN 13101 (steps) PN-EN 14396 (ladders)	no damage	test – positive result	N/A
7.	rung resistance to a vertical load of 2 kN		deflection under load ≤ 10 mm and permanent deformation after unloading ≤ 5 mm		
Physical properties of PVC-U components					
8.	changes due to heating – oven test of injection molded PVC-U products T = 150 ± 2°C, test duration: 15 min. for wall thickness e ≤ 3 mm; 30 min. for wall thickness 3 mm < e ≤ 10 mm; 60 min. for wall thickness 10 mm < e ≤ 20 mm	PN-EN ISO 580 Method A	depth of cracks and delaminations not greater than 20% of wall thickness	only applies to PVC injection molded parts	
Chambers – performance requirements					
9.	tightness of the connections with elastomer gaskets of the chamber base with inlet/outlet pipes - test temp.: (23 ± 5)°C; - water pressure: 0.05 bar; - water pressure: 0.5 bar; - air vacuum: -0.27 bar to -0.3 bar	PN-EN 1277 variant D	no leaks or damage during and after high and low pressure testing	positive results	
9.	watertightness of connections with elastomer gaskets of the chamber base and the riser pipe - test temperature: (23 ± 5)°C; - water pressure: 0.05 bar; - water pressure: 0.5 bar; - air vacuum: -0.27 bar to -0.3 bar	PN-EN 1277 variant A	no leaks or damage during and after high and low pressure testing	positive results	
9.	watertightness of the riser pipe connections with the accompanying parts and components - test pressure: 0.1 bar; - test duration: 15 min	Chamber filled with water up to the maximum water depth recommended by the manufacturer	no leaks	positive results	

	Basic inspection chambers				
Tegra 425	**600**	**425**	**DN/OD 400**	**315**	**NOTES**
	N/A				CE declarations are required for ladders.
	3 m 				Mandatory parameter from PN-EN 13598-2; min. H = 2 m.
	test – positive result				
	test – positive result				
ed by the standard	2 ≤ SN < 4 kN/m^2 4 ≤ SN < 6 kN/m^2 requirement under standard				
	N/A				
					No Wavin chamber parts are subject to this test.
	positive results				Very strict requirement according to PN-EN 13598-2. Obligatory. Verifies tightness under real conditions (deflection and deformation).
	positive results				
	positive results				

PN-EN 13598-2 requirements (continued)

				Tegra chambers	
Standard point	**Performance and technical properties**	**Test Methodology**	**Requirements**	**Tegra 1000**	**Tegra 600**
Marking					
10.1.	chamber base marking: – durable during use (a) – at least legible for installation (b)		(a): – name of manufacturer – material – max. permissible groundwater depth above the straight-through bottom of the chamber (b): – standard no. – area of application (U) – nominal dimension of riser pipe – date and place of manufacture – permissible depth – optionalcold climate performance properties	according to standard + according to Polish law r	
10.2.	marking of other parts		material, manufacturer's mark, date of manufacture	+ BENOR, Poly Mark, KOMO certificates	

18.2. Regulatory requirements for chamber tops

The classification of chamber tops and their location are described in detail in standard PN-EN 124. Below you will find selected sections of the above-mentioned standards for:

- chamber top classification:

"Wastewater inlet covers and manholes are divided into the following classes: A15, B125, C250, D400, E600, F900",

- chamber top locations:

"Appropriate inlet and manhole cover classes are used depending on the installation location. The various installation locations are divided into groups 1 to 6 listed below." The adjacent figure shows (...) the location of some of them in the vicinity of an express road. For each group, guidance is provided in parenthesis on which grades of inlet and manhole covers should be used. The designer is responsible for selecting the appropriate class. In cases of doubt, a higher class should be selected.

Group 1 (min. class A15)
Surfaces intended for pedestrians and cyclists only.

Group 2 (min. class B125)
Roads and pedestrian areas, similar surfaces, car parks or areas intended for parking passenger cars.

Group 3 (min. Class C250)
Applies only to curbside inlet tops in an area that, measured from the curb wall, can extend up to a maximum of 0.5 m into the traffic lane and 0.2 m nto the pedestrian way.

Group 4 (min. Class D400)
Road lanes (including areas intended for both vehicle and pedestrian traffic), paved roadsides and parking areas for all types of road vehicles.

Group 5 (min. Class E600)
Surfaces subjected to high wheel loads, e.g. ramps, runways.

Group 6 (Class F900)
Surfaces subjected to particularly high wheel loads, e.g. runways.

Wavin's offer includes covers from classes A15–D400. All of these have the certifications from independent bodies required under standard PN-EN 124. Reinforced concrete elements– load distribution rings and cones – also have the appropriate IBDiM approvals.

	Basic inspection chambers				
Tegra 425	**600**	**425**	**DN/OD 400**	**315**	**NOTES**
mark B					**See how we test Tegra 1000 manholes.**

With regard to the planned loads at the site of the chamber, Wavin tops are designed differently for class A15 and higher classes:

- **for class A15**, two solutions are used – a cover placed directly on the chamber riser or on unpaved terrain as a cover on a cone,
- **for higher classes** on paved surfaces, telescopic or supported solutions are used on manhole cones or rings and do not rest on the upper edges of the chambers. They are called **floating tops**, due to the way they bear loads, and they are also called **self-leveling tops** due to the way the manhole cover is connected to the ground.

It is expected that manhole tops with rings/cones are supported by a load-bearing soil substrate or a lower layer of the roadway substructure, and the top with a telescopic element (pipe or adapter) is supported by the upper layer of the roadway substructure.

The top elements should be connected to the road surface, and at the same time an expansion joint must be provided between the chamber riser and the surface connected to the manhole cover.

Floating tops ensure that loads from road traffic are safely transferred to the ground or structural layers of the road surface. There should be a gap of 3–5 cm (filled with frost-free soil or installation foam) between the top edge of the chamber and the manhole cover/inlet support.

19. List of cited standards

System and Implementation Standards

1. **PN-EN 476**
   General requirements for components used in gravity drainage systems.

2. **PN-EN 752**
   Outdoor sewer systems.

3. **PN-C-89224**
   Piping systems made of thermoplastics – External unpressurized and pressurized systems for water transfer, drainage and sewerage made of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Technical conditions for execution and acceptance.

4. **PN-EN 1610**
   Construction and testing of sewer pipes.

5. **PN-B-10736**
   Earthworks. Open excavations for water and sewer pipes. Technical conditions.

6. **PN-EN 14654-1**
   Roads – Earth works – Requirements and tests.

7. **PN-EN 14654-1**
   Management and control of drainage and sewerage system cleaning operations outside buildings – Part 1: Cleaning.

8. **ISO/TR 10358**
   Plastic pipes and fittings
   Combined chemical-resistance classification table/Plastic pipes and fittings. Chemical-resistance classification.

9. **ISO/TR 7620**
   Rubber materials
   Chemical resistance/Elastomers. Chemical resistance.

Product standards

1. **PN-EN 13598-2**
   Plastic pipe systems for underground unpressurized drainage and sewerage – Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Part 2: Specifications for manhole and inspection chambers.

2. **PN-EN 13598-1**
   Plastic pipe systems for underground unpressurized drainage and sewerage – Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Part 1: Specifications of auxiliary fittings and shallow non-manhole chambers.

3. **PN-EN 14396**
   Ladders for permanent attachment in manhole chambers.

4. **PN-EN 13101**
   Steps for manhole chambers. Requirements, marking, testing and conformity assessment.

5. **PN-EN 17670-2:2024-01**
   Plastic pipe systems for underground unpressurized transfer of surface water – Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Part 2: Roadway inlet specifications.

6. **PN-EN 124-1**
   Inlet and manhole chamber tops for road surfaces for pedestrian and vehicle traffic – Part 1: Classification, general design principles, functional and test requirements, test methods and conformity assessment.

7. **PN-EN 124-2**
   Inlet and manhole chamber tops for road surfaces for pedestrian and vehicle traffic – Part 2: Inlet and manhole chamber tops made of cast iron.

8. **PN-EN 124-3**
   Inlet and manhole chamber tops for road surfaces for pedestrian and vehicle traffic – Part 3: Inlet and manhole chamber tops made of steel and aluminum alloys.

9. **PN-EN 124-4**
   Inlet and manhole chamber tops for road surfaces for pedestrian and vehicle traffic – Part 4: Inlet and manhole chamber tops made of steel-reinforced concrete.

10. **PN-EN 124-5**
    Inlet and manhole chamber tops for road surfaces for pedestrian and vehicle traffic – Part 5: Inlet and manhole chamber tops made of composite materials.

11. **PN-EN 124-6**
Inlet and manhole chamber tops for road surfaces for pedestrian and vehicle traffic – Part 6: Inlet and manhole chamber tops made of polypropylene (PP), polyethylene (PE) or unplasticized poly(vinyl chloride) (PVC-U).

12. **PN-EN 681-1**
Elastomer seals. Material requirements for water and drainage pipe joint seals – Part 1: Rubber.

13. **PN-EN 681-2**
Elastomer seals. Material requirements for water and drainage pipe joint seals – Part 2: Thermoplastic elastomers.

14. **PN-EN 1401-1**
Plastic pipe systems for underground unpressurized drainage and sewerage – Unplasticized poly(vinyl chloride) (PVC-U) – Part 1: Pipe, fitting and system specifications.

15. **PN-EN 12666-1**
Plastic pipe systems for underground unpressurized drainage and sewerage. Polyethylene (PE) – Part 1: Pipe, fitting and system specifications.

16. **PN-EN 1852-1**
Plastic pipe systems for underground unpressurized drainage and sewerage. Polypropylene (PP) – Part 1: Pipe, fitting and system specifications.

17. **PN-EN 14758-1**
Plastic pipe systems for underground unpressurized drainage and sewerage. Polypropylene with mineral modifiers (PP–MD) – Part 1: Pipe, fitting and system specifications.

18. **PN-EN 13476-2**
Plastic pipe systems for underground unpressurized drainage and sewerage. Structural-walled piping systems made of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Part 2: Specifications for pipes and fittings with smooth internal and external surfaces, and system specifications, type A.

19. **PN-EN 13476-3**
Plastic pipe systems for underground unpressurized drainage and sewerage. Structural-walled piping systems made of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) – Part 3: Specifications for pipes and fittings with smooth internal surface and a profiled external surface, and system specifications, type B.

Testing standards

1. **PN-EN ISO 580**
Plastic pipe and casing pipe systems. Thermoplastic injection molded fittings. Methods for visual assessment of changes due to heating.

2. **PN-EN 1277**
Plastic piping systems. Thermoplastic piping systems for unpressurised underground networks. Leak test method for connections with elastomer sealing ring.

3. **PN-EN 12061**
Plastic piping systems. Thermoplastic pipe fittings. Impact resistance test method.

4. **PN-EN 14802**
Plastic piping systems. Riser pipes made of thermoplastics for manhole or non-manhole chambers. Indication of resistance to surface and vehicle wheel loads.

5. **PN-EN 14830**
Manhole and non-manhole chamber bases made from thermoplastics. Deformation resistance test.

6. **PN-EN 14982**
Plastic pipe and casing pipe systems. Riser pipes made of thermoplastics for manhole and non-manhole chambers. Indication of peripheral rigidity.

Notes

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