

# Installation Manual **Rigofill® inspect**



Infiltration systems and watertight storage systems

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# Technology

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# NB

Please read this installation manual carefully and follow our instructions.

# This installation manual applies to

- the temperate climate zone
- infiltration systems and watertight storage systems with Rigofill inspect above the maximum groundwater level (e.g. according to ATV-A 138)

The relevant safety provisions of the building industry apply.

# 2.1 Transport and storage



Rigofill inspect modules are delivered packed in units of four (half blocks in units of eight) each. Preferably unload the packages using forklifts, cranes or other lifting tools. The excavators must have the technical equipment required for lifting gear operation.

For load handling activities, use the tunnels of the lower modules either by inserting the fork, slinging with belts, or using other suitable load handling equipment.

# 

Avoid dropping, dumping and hitting Rigofill inspect modules against each other!



Level, solid and clean ground is particularly important for temporary storage.

# ATTENTION

Do not stack packages more than two high, four modules each, height 2.7 m, to prevent accidents. In case of storm risk, the packages should be secured and preferably not stacked!



Rigofill inspect can be stored outside. The storage period outside should, however, not exceed one year. Protect the material from direct sunlight. Store in the shade or cover with bright-coloured, light-tight foil. Transport the modules by hand or using appropriate equipment at the construction site.

Check the components for defects before installation. The impact strength of the material decreases in sub-zero temperatures. Damaged modules must NOT be installed!

Weight: full block 20 kg; half block 12 kg.

# 2.2 Excavating pit and creating bearing



Excavate the pit according to design specifications. During excavation work, the walls of the pit must be sloped or constructed such that they pose no danger to the workers due to downsliding masses. Additionally, national regulations must be observed. Measures must be taken to ensure that the excavation pit is free from water during the entire execution time.



In order to install Rigofill inspect modules, a horizontal, level and stable bearing is essential. To this end, create a levelling layer of approx. 10 cm, preferably made of crushed stones or gravel (without fine fractions), on the bottom of the excavation pit. The layer must be compacted carefully and smoothed to achieve a level surface. The compression level  $D_{pr}$  should be larger than or equal to 97 % ( $E_{v2} \ge 45$  MN/m<sup>2</sup> or CBR  $\ge 12$  % top edge of the bearing). If the soil has been included in the infiltration calculation, the permeability of the compacted layer must at least correspond to the permeability (kf value) of the backfill soil (soil groups GE, GW, SE, SW, SI).



# ATTENTION

The quality of the bedding is decisive for further installation and strongly affects both bearing and setting properties of the storage/infiltration systems, particularly in case of multiple-layer designs and higher loads (soil and traffic loads).

# 2.3 Laying geotextile



Wrap the entire storage/infiltration system in RigoFlor geotextile. Before starting to lay the modules, spread out the geotextile on the planum. The geotextile must have sufficient lateral excess length in order to eventually wrap up the entire system.

# Important characteristics of geotextile (e.g. RigoFlor)

- Thickness ≥ 2 mm
- Puncture resistance: 2.0 kN
- Geotextile class 3
- Characteristic opening width 0.08 mm
- kf value (at 20 kPa): 6 x 10-<sup>2</sup> m/s
- Water permeability acc. to EN ISO 11058: 80 I/sm<sup>2</sup>
- Mass per unit area 200 g/m<sup>2</sup>
- Resistance: Anticipated resistance of up to 50 years in all natural soil types with 4 ≤ pH ≤ 9 and soil temperature of ≤ 25 °C (B.4.2.2, EN ISO 13438)

# ATTENTION

Ensure that the geotextile surface is completely closed leaving no gaps even during backfilling. Edges should overlap at least 50 cm.

# 2.4 Installing Rigofill® inspect





Rigofill inspect modules must be arranged on the planum according to design specifications. They must be placed in a row to form swale tunnels as intended. Installation at sub-zero temperatures requires greater care (impact stability, please refer to the section on transport and storage).

# 

Modules are slippery when wet or frosty!

# ATTENTION

Half blocks must be installed with the "FRÄNKISCHE" inscription in the lower part of the tunnel.

# 2.4 Installing Rigofill® inspect (continued)

Connectors help secure the modules in place. Secure modules using connectors on the top surface of the module in the centre of each edge that is adjacent to another module.



Single-layer connector for installation in the roof slab of semi-/single-layer systems



Multiple-layer connector for installation in multiple-layer systems between different layers, for connecting layers with each other

-					C
-					C
			-		C

### **Determination of requirements:**

Connector		Application	Requirement	
single-layer		for single-layer installation	requirement for <b>single-row</b> installation	1 pc(s). per module
			requirement for <b>multiple-row</b> installation	2 pc(s). per module
multiple-layer		for multiple-layer installation	requirement for <b>2-layer</b> installation	1 pc(s). per module
			requirement for <b>3-layer</b> installation	1.3 pc(s). per module

# 2.5 Mounting accessories



Adapter end plate DN/OD 160

Adapter end plate DN/OD 200

Connection panel DN 250 KG



# End plate

Cover all external tunnel sides which do not connect to shafts with end plates. If necessary, a DN/OD 110, DN/OD 160 or DN/OD 200 pipe connection can be cut out.

### Adapter end plate / connection panel

DN/OD 160 and DN/OD 200 inlet pipes can be connected using adapter end plates. The DN 250 KG connection panel allows the connection of the nominal diameter DN/OD 250. For the adapter end plate, the connection opening to insert the KG pipe is already factory-provided. The connection panel is also opened and features a DN/OD 250 spigot to connect a KG coupling. Twin-wall pipes are connected using adapters (Ü-KG to be ordered separately). Adapter end plates / adapter panels are used for pipe connections without shaft only!

### The following types of shafts can be used with Rigofill systems:

- 1. QuadroControl with connections to be opened on site
- 2. QuadroControl with factory-prepared connections (project shaft)
- 3. RigoControl (shaft outside the modular block type structure)

Type and position of inspection shafts are determined according to design specifications. The shafts must be connected to the corresponding inspection tunnel.

# 3.1 Quadro<sup>®</sup>Control with connections to be opened on site



QuadroControl shafts are delivered in individual parts (shaft base, shaft top, cone and extension pipe), which can be combined and adjusted on site as required according to the following instructions. Additionally, please observe the design specifications.

# **3.1.1 Shaft components**

The individual components are colour-coded.







**Quadro cone** Connection element between Quadro top and extension pipe



**Quadro top + 1/2 Quadro top** Second or further layer of multiple-layer shafts.



**Quadro base + ½ Quadro base** Single-layer shafts or bottommost layer of multiple-layer shafts.

# 3.1.2 Combination of shaft components



QuadroControl 1/2-layer



QuadroControl 1-layer



QuadroControl 1 <sup>1</sup>/<sub>2</sub>-layer



QuadroControl 3-layer

Туре	Illustration	Height	Identification	Colour coding
Quadro cone	•	250 mm	Cone, effective height 15 cm	
½ Quadro top	0	350 mm	Top, bottom open	
Quadro top	0	660 mm	Top, bottom open	$\bigcirc$
½ Quadro base		350 mm	Base, bottom closed	
Quadro base		660 mm	Base, bottom closed	

# 3.1.3 Selecting connections to be opened

Each shaft base body has an inlet side and three tunnel sides. The inlet side is used to connect pipes DN 200 for installation alongside the system. The connection openings (220 x 220 mm) in the tunnel sides are meant to connect to the intended swale tunnels.



# Inlet side:

If necessary, open the connection use a suitable tool, e.g. a Ø 200 mm circular hole saw (suitable for plastic).

### Tunnel side:

All tunnel connections related to the DN 200 at the intended height. To do so, planned inspection tunnels must be opened in order to ensure optimum ventilation, water distribution and inspection.

# ATTENTION

The tunnel openings and unused connections DN 200 facing the soil must NOT be opened!

# 3.1.4 Arrangement variants



Corner of the storage/infiltration system: one tunnel connection



Side of the storage/infiltration system: one tunnel connection



Inlet side (if necessary)



Front-end of a single-row storage/infiltration system: one tunnel connection



Side of the storage/infiltration system: two tunnel connections





Within the storage/infiltration system: two tunnel connections



Side of the storage/infiltration system on a single-row system: two tunnel connections



# 3.1.5 Cutting pipe connections DN 200



A drill with a circular hole saw Ø 200 mm suitable for plastic including a pilot drill is required to establish pipe connections DN 200 on site.

# ATTENTION

Make sure that the drilling is carried out vertically and axially in relation to the pipe connection.



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After cutting the shaft wall has been completed, the drill must first be switched off and brought to a complete halt. Then remove the hole saw from the opening.

# 3.1.6 Cutting tunnel openings

Use appropriate tools to create tunnel openings.



Place the shaft base body onto a level surface. Please ensure that the side to be opened faces upwards.



The corners of the set-back surface must be provided with one drill hole each,  $\emptyset$  at least 12 mm (drill diameter must be larger than the width of the saw blade to be used).

# 

# Wear protective equipment when creating tunnel openings.



Open the sides of the tunnel opening using appropriate cutting tools.



Remove resulting edges and irregularities on the cutting surfaces with a grater, file or another suitable tool.



Remove chips from the shaft body afterwards. Dispose of cuttings appropriately.

# 3.1.7 Installation



# Installation of shaft elements

The prepared shaft base bodies must be installed at the intended position in the layout.

The connections of the tunnel sides must be aligned with the respective Rigofill inspection tunnel, see sub-section 3.1.4 Arrangement variants (page 11) and/or design specifications.

In case of multiple layer systems, the correct order must be ensured. Type Quadro base and/or ½ Quadro base is intended for the bottommost layer, and type Quadro top and/or ½ Quadro top for any additional layer. Before installing the shaft cone, wrap the shaft in geotextile. After the cone has been installed, cut an opening into the geotextile.

# **3.1.7 Installation (continued)**

# Installing extension pipes

After wrapping in geotextile and lateral backfilling have been completed (see following sections), extension pipes must be installed. Mount the extension pipe onto the shaft cone. Make sure that the shafts and extension pipes are installed upright and do not shift during compaction.



### Temporary construction site cover

The extension pipe bodies are delivered ex works with temporary construction site covers. Make sure that no dirt, e.g. backfill material, enters the shafts during the construction period. Do NOT remove the respective temporary construction site covers before installing shaft covers. Additionally protect shaft openings against earth slides until final installation of shaft covers.

# 

Shafts must NOT be accessed before installing the cover. If necessary, the required load transfer to the native soil must be ensured using a wide steel plate.



Shaft cover

\* to be supplied on site



Optionally: gully gutter

\* to be supplied on site

### Installing shaft covers

Cut the  $D_0$  600 extension pipe such that it reaches the support ring. The gap between the support ring and the shaft cover must be sealed using a DOM sealing ring. Mount the sealing ring onto the last corrugation of the extension pipe.



DOM sealing ring

Place a  $D_0$  600 sediment trap on the extension pipe. If the start shaft must feature a gully gutter according to design specifications, a bucket handle (or feed hopper) and a bucket according to DIN 4052-A4 must be installed.

Shaft covers, concrete support rings, gully gutter, bucket handle and bucket are not included in the scope of delivery of FRÄNKISCHE Rohrwerke and must be supplied on site. Install shaft covers according to DIN EN 124, CW 610, installation according to design specifications.

Place a support ring h = 100 mm according to DIN 4034 under the shaft cover/gully gutter on an appropriate bearing. Create the bearing from compacted bearing layer material ( $E_{v_2}$  module larger than or equal to 100 MN/m<sup>2</sup>) or in-situ concrete C 16/20. Avoid interlocking of the bearing with the corrugations of the extension pipe (use casing aid!). Vertical loads may only be transferred to the load-bearing underground.

# 3.2 Quadro<sup>®</sup>Control with factory-prepared connections (project shaft)



QuadroControl project shafts are delivered unassembled in individual parts (shaft base body, cone and extension pipe), which are labelled according to the installation position in the storage/infiltration system.

Place the shaft on the planum of the Rigofill storage/infiltration system. The connections on the tunnel sides must be aligned with the respective Rigofill inspection tunnel. In case of multiple-layer systems, the designated order of individual shaft bodies must be ensured.

Before installing the shaft cone, wrap the shaft in geotextile. After the cone has been installed, cut an opening into the geotextile.

### Assembly and installation

For the installation of extension pipes and shaft covers see sub-section 3.1.7 Installation (pages 12–13).

# **3.3 Rigo®Control** – shafts



RigoControl

RigoControl shafts are placed outside the Rigofill layout. A separate bearing must be created in the hand pit for the shafts. In doing so, a 25 cm deep sedimentation chamber must be taken into account. Compact the bearing and level it to reach the required height.

The connection to the Rigofill inspect modules is established using short connecting pipes, adapters and adapter end plates (included in the scope of delivery). Adapter end plates (and end plates, if applicable) must be installed in the block first. Prior to installing the connecting pipes, create the geotextile wrapping. Cut a cross-sectional opening into the geotextile in the area of the pipe connection. Secure the resulting geotextile triangles with an adapter.



# ATTENTION

Ensure that the geotextile surface is completely closed leaving no gaps even during backfilling!

Cross section for pipe connection

# 3.3.1 Installing extension pipes



After wrapping in geotextile and lateral backfilling have been completed (see following sections), extension pipes must be installed. Install the coupling onto the RigoControl shaft. Afterwards, insert the extension pipe into the coupling. Make sure that the shafts and extension pipes are installed upright and do not shift during compaction.

The extension pipe bodies are delivered ex works with temporary construction site covers. Make sure that no dirt, e.g. backfill material, enters the shafts during the construction period. Do NOT remove the respective temporary construction site covers before installing shaft covers. Additionally protect shaft openings against earth slides until final installation of shaft covers.

After the covering has been created (see following section), install the shaft covers. Cut the  $D_0$  400 extension pipe such that it reaches the

support ring. According to the design specifications, a sediment trap

 $D_0$  400, a dirt trap  $D_0$  400 or a filter set  $D_0$  400 must be placed onto

Install shaft covers and/or gully gutters according to the design

specifications. Place a support ring h = 100 mm on an appropriate

bearing under the shaft cover/gully gutter. Create the bearing from

compacted bearing layer material or in-situ concrete C 16/20. Avoid interlocking of the bearing with the corrugations of the extension

pipe (use casing aid!). Vertical loads may only be transferred to the

# 3.3.2 Installing shaft covers







Cast iron shaft covers

the extension pipe.

load-bearing underground.



Square shaft cover for on-site application

to be supplied on site

# Class B 125 shaft cover, square

Manually cut the extension pipe considering the installation depth of the cover. Create the height of the backfill at the extension pipe considering a bedding for the cover to be created, if applicable.

Do not remove the trough from the frame before later installing the cover, since this might lead to subsequent problems with opening and closing. Make sure that there are no foreign objects (dirt, etc.) between trough and frame during installation. The seal glued into the frame limits the space between frame and trough. Protect the screw heads and edges of the trough and frame from concrete splashes if the trough shall be filled with concrete. An installation manual is included with the product.

# **4** Final installation steps

# 4.1 Creating geotextile wrapping



Rigofill inspect systems must completely be wrapped in geotextile (e.g. RigoFlor). QuadroControl shafts are part of the cubage of the storage/ infiltration system and must be wrapped as well. At the edges, sufficient overlapping shall be provided (at least 50 cm) to make sure no backfill material enters the system. Produce sand-tight pipe inlets by cross-shaped cutting of the geotextile.

# ATTENTION

Ensure that the geotextile surface is completely closed leaving no gaps even during backfilling!

# 4.2 Lateral backfilling



Connectors secure the individual Rigofill inspect modules and prevent the storage/infiltration module from shifting during backfilling.

Use non-cohesive, non-frozen earthwork material with a maximum grain size of 32 mm for backfilling.

Distribute the backfill material evenly and compact it in layers of max. 30 cm using a light or medium compacting machine (area vibrator or vibratory rammer). In doing so, a compaction level  $D_{Pr}$  of larger than or equal to 97 % should be achieved. The modules must NOT be damaged. National guidelines for earthworks (such as ZTV E-StB) must be adhered to.

Make sure that the overlapping geotextile is not pulled apart during backfilling and compacting, and that the Rigofill inspect modules are not damaged!

The permeability of the backfill must at least correspond to the permeability of the backfill soil.

# **4** Final installation steps

# 4.3 Creating the cover

The storage/infiltration system must be covered according to design specifications. Non-cohesive, compactable graded earthwork material with a maximum grain size of 32 mm should be used for the cover, which is a mandatory requirement under traffic areas! Frozen soil is not permissible!

Additionally, national guidelines for earthworks (such as ZTV E-StB) apply here as well.

# Stability analysis

Storage/infiltration systems are subsoil structures and must have sufficient loadcarrying capacity against impacting soil and traffic loads. The stability must be proven according to Eurocode, taking into account partial safety factors and/or limiting factors. With conventional installation parameters\*, depths of cover of  $D_c$  max. 4 m and soil depths of  $D_s$  max. 6 m are possible for infiltration systems. A project-specific stability analysis can be prepared by FRÄNKISCHE. Under traffic areas, a minimum cover  $D_c$  of 80 cm must be observed.

\*HGV 60; specific weight of soil 18 kN/m<sup>3</sup>; friction angle 28°;  $\kappa$  = 0.3; mean soil temperature 23 °C

# Standard installation under a traffic area

	SLW 60 / HGV 60	
Traffic area		
Superstructure according to relevant guidelines, e.g. RStO 12	Planum E <sub>ivi</sub> ≥ 45 MN/m <sup>2</sup> CBR≥12 %	
Upper levelling layer		
Rigofill inspect		D <sub>S</sub> ≤ 6 m "
	Bearing $E_{y_2} \ge 45$ MN/m <sup>2</sup> CBR $\ge 12$ %	
Subsoil	(highest groundwater level)	

SLW 60 / HGV 60

# ATTENTION

Note for HGW over structure soil: Rigofill inspect systems, which are used as watertight storage systems with impermeable membranes, have been designed for application above the highest groundwater level (HGW). Use in groundwater is possible under corresponding technical conditions after consultation with FRÄNKISCHE. Please contact us!

National guidelines, e.g. RStO 12, must always be observed for installation under traffic areas. To build the planum for the subsequent road construction, a cover must be provided, preferably a gravel sub-base with a thickness of at least 35 cm. Other construction materials normally lead to greater depths of cover.

Generally, at the surface of the cover (= planum), a uniform modulus of deformation  $E_{v_2}$  larger than or equal to 45 MN/m<sup>2</sup> or CBR larger than or equal to 12 % must be achieved.

Soil layers must always be provided and compacted in layers of no more that 30 cm. The compaction level D<sub>pr</sub> should be larger than or equal to 97 %.

Compacting must be carried out by means of light or medium area vibrators only!

# 

Compacting by means of vibratory rollers and explosion rammers is not permissible!

<sup>1)</sup> Lower cover upon request!

<sup>2)</sup> At least the same permeability (k,) as the subsoil

# **4** Final installation steps

# 4.4 Use of construction vehicles during installation



### Use of vehicles when applying the first cover layer

The first cover layer can be applied, for example, using a wheel loader or a front-type mobile excavator. For a wheel loader or mobile excavator with a maximum total weight of 15 tons (chain, 4 wheels, twin-tyres), a compacted cover of at least 30 cm must be placed over the storage/infiltration system. Possible formation of ruts must be taken into account! Avoid steering manoeuvres at this construction stage.

### Use of construction vehicles

Driving over the cover with heavy construction vehicles with a wheel load of up to 50 kN (e.g. HGV 30) is possible if the thickness of the compacted cover is no less than 60 cm. Possible formation of ruts must be taken into account! When dumping the earthwork material, the wheel load of 50 kN must not be exceeded; if necessary, load distribution plates must be used.

### 

It is not allowed to use construction vehicles directly on the modules!

# **5** Note for waterproof systems



When using Rigofill inspect for stormwater storage, the system can be wrapped in impermeable plastic foil (KDB). Besides this installation manual, also observe the manufacturer's specifications when installing the impermeable plastic foil (KDB).

In addition to the static verification, uplift verification is required in case of groundwater. Dewatering measures are to be checked and, if necessary, provided during construction in order to prevent upwards floating of watertight systems if these are not yet sufficiently covered.

Follow the steps described in this manual to install the modules. Install and weld the impermeable membrane and execute the impermeability test of individual weld seams according to the instructions of the manufacturer/installer.

### Applications

- Stormwater retention
- Stormwater harvesting (tank)
- Fire water storage
- Combined applications

# 6 Safety instructions

### ATTENTION

Staff responsible for installation, assembly, operation, maintenance and repair must have appropriate qualifications required for this kind of work. The builder is responsible for organising in detail authority, responsibility and supervision of staff.

The operational safety of the system components supplied is only guaranteed in case of proper installation and correct use. Technical threshold values must not be exceeded.

Observe the accident prevention regulations and relevant standards and directives for installation, fitting, operation, maintenance and repair!

### This includes (in extracts):

- Accident prevention regulations
  - Construction work BGV C22 (Bauarbeiten BGV C22)
  - Technical wastewater systems GUV-V C5 (Abwassertechnische Anlagen GUV-V C5)
- Safety regulations for working in enclosed spaces of technical wastewater systems GUV-R 126 (Sicherheitsregeln für Arbeiten in umschlossenen Räumen von abwassertechnischen Anlagen GUV-R 126)
- Handling biological working materials in technical wastewater systems GUV-R 145 (Umgang mit biologischen Arbeitsstoffen in abwassertechnischen Anlagen GUV-R 145)
- Directives for working in tanks and narrow spaces BGR 117 (*Richtlinien für Arbeiten in Behältern und engen Räumen BGR 117*)
- Standards
  Excavations and trenches Slopes, planking and strutting, breadths of working spaces DIN 4124
  Construction and testing of drains and sewers DIN EN 1610
- Tool for safety and health protection in technical wastewater systems

Hazards from gases and vapours such as risk of suffocation, risk of poisoning and risk of explosion

- Risk of falling
- Risk of drowning
- Germ pollution and wastewater with sewage
- High physical and psychological stress during work in deep, narrow and dark spaces
- And others

### **A DANGER**

Non-compliance with the operating manual may result in considerable property damage, injury or death.

# 

The system is part of an entire network. During installation, maintenance, service and repair work on one component, always consider the entire system. Avoid work during rain.

Changes or modifications to the system may only be carried out in agreement with the manufacturer. For safety reasons, use original spare parts and accessories approved by the manufacturer. The use of other parts voids the liability for any consequences arising therefrom.

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Information about or assessments of the use and installation of our products and systems are exclusively provided on the basis of the information submitted. We do not assume any liability for damage caused by incomplete information. If the actual situation deviates from the planned situation or if a new situation occurs or if different or new installation techniques are applied, these must be agreed upon with FRÄNKISCHE, since these situations or techniques may lead to different conclusions. Notwithstanding the above, the customer is solely responsible for verifying the suitability of our products and systems for the intended purpose. In addition, we do not assume any liability or responsibility for system characteristics and system functionalities when third-party products or accessories are used in combination with FRÄNKISCHE systems. We only assume liability if original FRÄNKISCHE products are used. For use in other countries than Germany, country-specific standards and regulations must also be observed.

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