



USER MANUAL DRAINAGE SYSTEM



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1. COMPANY PROFILE

1.1 MANUFACTURING PROGRAM

DRAINAGE SYSTEM

- Sewerage products
- Pipes
- Manholes
- Riggots

SMALL BUILDING MATERIALS AND ROADS

- Products for roads, outdoor architecture and masonry structures
- Paving
- Grassing tiles
- Kerbs and edge-line
- Sections for surface water management
- Outdoor architecture
- Fence panels
- Small building blocks
- Panels for paved areas

BUILDING STRUCTURES

- Products for the construction of building structures
- Fully framed system
- Atypical production
- Ceiling panels
- Pre-stressed wall panels
- Products for masonry structures
- Spatial prefabrication
- Additional production

ECOLOGY AND RESERVOIRS

- Circular and rectangular reservoirs
- Elements for conducting underground networks
- Noise protection walls

In all these product groups, Prefa Brno, a.s. provides customers with complex solutions from consultancy through

design support, product delivery, transport and installation.

In addition to the above mentioned product groups, the Prefa Brno offers these other products and services:

- Transport of concrete
- Sale of building materials
- Machine production

All company staff is focused on a customer satisfaction.

COMPANY PROFILE

1.2 QUALITY SYSTEM

The Prefa Brno a.s. is a holder of the certificate of quality management according to ČSN EN ISO 9001. Technical and utility properties of products manufactured and placed on the market are assessed according to Act no. 22/97

Coll. as amended, and the Government Decree no. 312/2005 Coll. The product properties are verified by authorized testing centres and documented by certificates and test reports. The company publishes for all products

a Declaration of Conformity provided to customers on demand. All company products are subject to quality control in accordance with company control and test plans within the scope of which the required properties are regularly verified.

2. CONCRETE PROPERTIES

2.1 CONCRETE PROPERTIES

Concrete used for the production of concrete and reinforced-concrete pipes, manholes and gullies corresponds with its composition and qualitative characteristics to ČSN EN 206-1/Z3 standard. Concrete used for production is abrasion-resistant, resistant to chemically aggressive environments and resistant to chemical de-icing agents.

**CONCRETE SPECIFICATIONS
ACCORDING TO ČSN EN
206-1/Z3:**

Strength class
C 40/50

Resistance to freezing
XF1–XF4 – high water saturation with de-icing agents or seawater

Resistance to chemical corrosion
XA1 – a slightly aggressive chemical environment
XA2 a XA3 – medium and highly aggressive chemical environments

Elements are mass-produced of XA1 concrete.

Chemical characteristics	XA1	XA2	XA3
Groundwater			
SO ₄ ²⁻ [mg·l ⁻¹]	≤ 600	≤ 3 000	≤ 6 000
CO ₂ [mg·l ⁻¹]	≤ 40	≤ 100	do nasycení
NH ₄ ⁺ [mg·l ⁻¹]	≤ 30	≤ 60	≤ 100
Mg ²⁺ [mg·l ⁻¹]	≤ 1 000	≤ 3 000	do nasycení
Subsoil			
SO ₄ ²⁻ [mg·l ⁻¹]	≤ 3 000	≤ 12 000	≤ 24 000

Table 1: Limit values of chemical action of groundwater and soil

3. JOINTS OF SECTIONS

3.1 TYPES OF JOINTS

GROOVE AND TONGUE

This is a solid waterproof joint made of cementing compound or cement joint mortar.

BELL-AND-SPIGOT JOINT

This is a flexible waterproof joint created by a rubber sealing profile which, after deformation in the assembled connection, acts by a permanent stress in the joint space.

JOINTS OF SECTIONS

3.2 JOINTS OF MANHOLE SECTIONS

JOINT DETAIL OF SINGLE SECTIONS

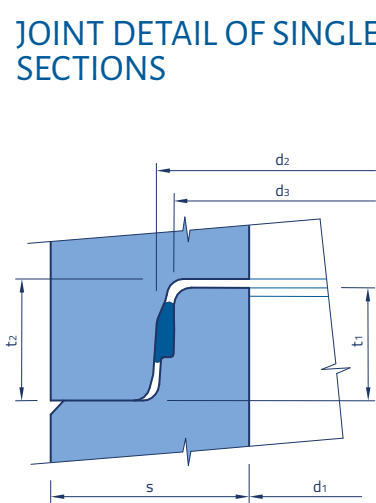


Fig. 1a. – Sections of type Q.1 – DN 800, 1000, 1200 a 1500

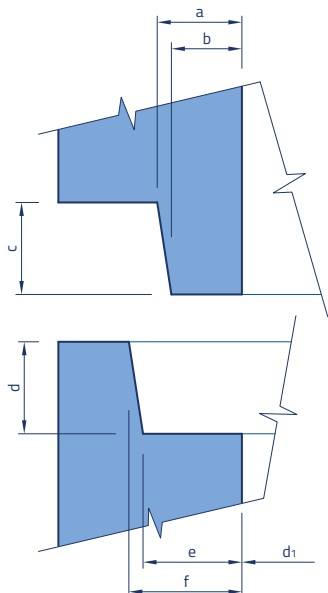


Fig. 1b. – Sections of riggots – DN 450 a 500

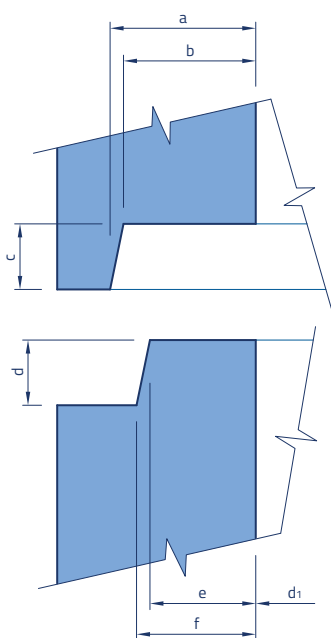


Fig. 1c. – Square cross sections – WN 1500



Fig. 2. Cross-section of sealing for Q.1 - type sections

Internal section diameter DN [mm]	Dimensions of the contact section areas [mm]							
	d ₁	d ₂	d ₃	s	t ₁	t ₂		
TYPE Q.1								
Rings								
800	800	867	890	90	65	70		
1 000	1 000	1 113	1 090	90, 100, 120	65	70		
1 200	1 200	1 327	1 300	135	75	80		
1 500	1 500	1 652	1 620	140	85	90		
Manhole beds								
1 000	1 000	–	1 090	150	65	–		
1 200	1 200	–	1 300	150	75	–		
1 500	1 500	–	1 620	150	85	–		
Internal section diameter DN [mm]	Dimensions of the contact section areas [mm]							
	d ₁	a	b	c	d	e	f	s
Square cross sections – WN 1 500								
RINGS	1 500	110	100	44	44	80	90	150
MANHOLE BEDS	1 500	–	–	–	44	80	90	150
Riggots								
450	450	26	19	27,5	27,5	23	30	50
500	500	30	25	30	30	35	40	65

Table 2: Dimensions of contact section areas

3.3 PIPE JOINTS

INTEGRATED GASKET FOR BELL-AND-SPIGOT PIPES
DN 300 TO 2 200, EGG-SHAPED PROFILE PIPES 500/750,
600/900, 700/1 050, 800/1 200 AND 900/1 350

The compression rubber gasket of full cross-section is firmly anchored in the pipe bell at the production and forms an integral section thereof.

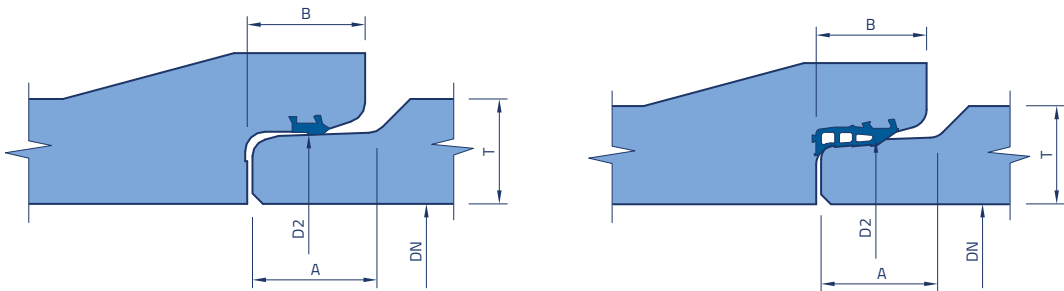


Fig. 4 – Detail of joint – single-point seal
– egg-shaped pipes

Fig. 4a – Detail of joint – cellular seal
– circular pipes

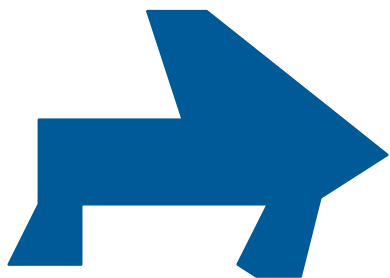


Fig. 5 – Single-point seal

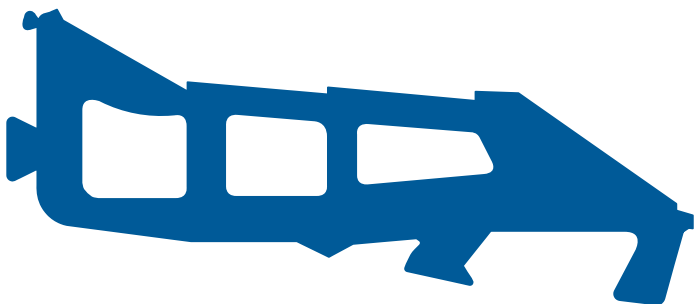


Fig. 6 – Cellular seal

Pipe marking	Dimensions of the contact section areas [mm]				
	DN	B	A	D2	T
TZH–Q 30/250	300	80	85	404	70
TZH–Q 30/* PR	300	–	85	– –	70
TBH–Q 40/250, TZh–Q 40/250	400	90	95	505	80
TBH–Q 40/200 PR, TZh–Q 40/* PR	400	–	95	– –	80
TBH–Q 50/250, TZh–Q 50/250	500	90	95	610	85
TBH–Q 50/200 PR, TZh–Q 50/* PR	500	–	95	– –	85
TBH–Q 60/250, TZh–Q 60/250	600	90	95	726	105
TBH–Q 60/200 PR, TZh–Q 60/* PR	600	–	95	– –	105
TBH–Q 80/250, TZh–Q 80/250	800	100	105	962	130 a 150
TBH–Q 80/200 PR, TZh–Q 80/* PR	800	–	105	– –	130 a 150
TBH–Q 80/250 RIM, TZh–Q 80/250 RIM	800	100	105	– –	122
TBH–Q 100/250, TZh–Q 100/250	1 000	100	105	1 198	160
TBH–Q 100/200 PR, TZh–Q 100/* PR	1 000	–	105	– –	160
TBH–Q 100/250 RIM, TZh–Q 100/250 RIM	1 000	100	105	– –	145
TBH–Q 120/250, TZh–Q 120/250	1 200	100	105	1 434	165
TBH–Q 120/200 PR, TZh–Q 120/* PR	1 200	–	105	– –	165
TBP–Q 140/250, TZP–Q 140/250	1 400	125	135	1 634	210
TBP–Q 140/200 PR, TZP–Q 140/* PR	1 400	–	135	– –	210
TBP–Q 160/100, TZP–Q 160/100	1 600	145	150	1 800	220
TBP–Q 160/200, TZP–Q 160/200	1 600	145	150	– –	220
TBP–Q 160/100 PR, TZP–Q 160/100 PR	1 600	–	150	– –	220
TBP–Q 180/200, TZP–Q 180/200	1 800	145	150	2 002	220
TBP–Q 200/200, TZP–Q 200/200	2 000	145	150	2 232	250
TBP–Q 220/200, TZP–Q 220/200	2 200	145	150	2 402	220

* Branch pipes in lengths of 1 100, 1 400 and 1 700 are supplied as reinforced-concrete ones only.

Table 4: Dimensions of the contact section areas

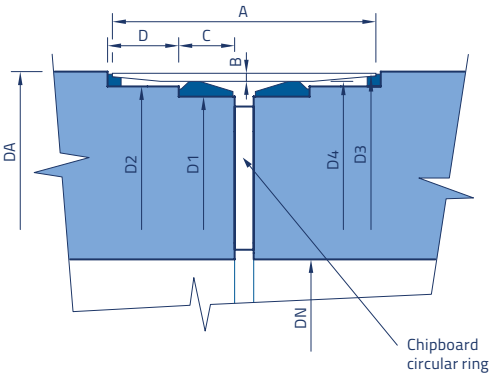


Fig. 7 – Joint detail – DN 800 to 1 200

PIPE JOINTS FOR PUSHING

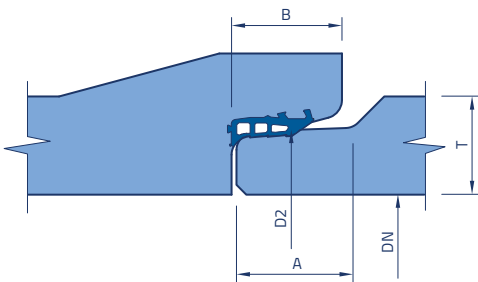


Fig. 7a – Joint detail – DN 1 400 to 2 200

Pipe marking	Dimensions of the contact section areas [mm]									
	DN	DA	D1	D2	D3	D4	D	C	A	B
TZT-Q 80-108/199	800	1 060	1 010	1 045	1 052	1 032	58	42	200	10
TZT-Q 100-128/199	1 000	1 280	1 226	1 246	1 272	1 252	58	42	200	10
TZT-Q 120-150/199	1 200	1 500	1 438	1 458	1 492	1 472	58	42	200	10

Pipe marking	Dimensions of the contact section areas [mm]					
	DN	DA	B	A	D2	T
TZT-Q 140-182/250	1 400	1 820	125	125	1 634	210
TZT-Q 160-204/200	1 600	2 040	145	145	1 800	220
TZT-Q 180-224/200	1 800	2 240	145	145	2 002	220
TZT-Q 200-250/200	2 000	2 500	145	145	2 232	250
TZT-Q 220-264/200	2 200	2 640	145	145	2 402	220

Table 5: Basic dimensions of pipe joints for pushing

JOINTS OF SECTIONS

3.4 RUBBER SEALING PROFILES – REQUIREMENTS

The sealing profiles mentioned in the previous points are always **compression rubber (styrol-butadiene rubber) seals**.

The sealing of pipe joint is effected by pushing the conical end of the pipe into the socket with built-in seal (for pipes)

or the socket into the sealed drum (for manholes). The stresses required to seal the joint are the result of compression of the seals in conically decreasing space.

The properties of the sealant material are determined by **ČSN EN 681 – 1**,

which, among other things, establishes qualitative requirements for sealing gaskets of sections for drainage sewers, drainage connections and rainwater outlets with continuous flow rate up to + 45°C and intermittent flow rate up to 95°C.

4. EQUIPMENT OF SECTIONS

4.1 FOOT IRONS

The rules for positioning of the foot irons in the manhole sections are set out in ČSN EN 1917 at these basic points:

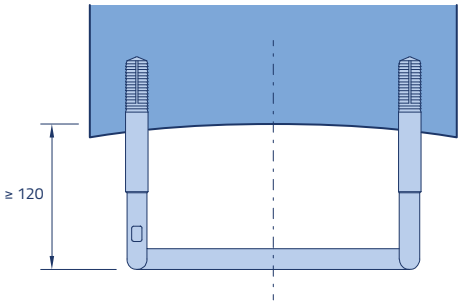


Fig. 8 – The length of built-in foot iron must not be less than 120 mm.

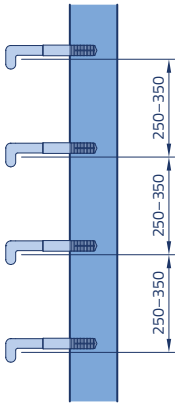


Fig. 9 – The foot irons shall be situated at uniform vertical distances of two heights of the section 250-350 mm with a tolerance of ± 10 mm.

Strength requirements for built-in foot irons:

When applying a vertical load of 2.0 kN, the deflection caused by single-row foot irons shall not exceed 10 mm with a permanent bend of not more than 2 mm.

The foot irons must withstand a horizontal pulling force of 5.0 kN.

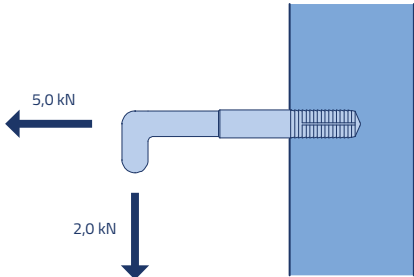


Fig. 10 – Strength requirements for built-in foot irons

To equip the manholes the following foot irons are used:

1. TACKED FOOT IRON:

Steel coil with PE coating according to ČSN EN 13101

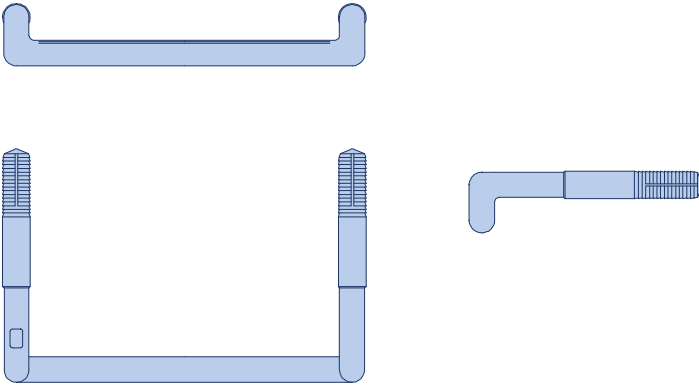


Fig. 11

2. POCKED FOOT IRON:

It is placed only in the transition rings (cones) as the top foot iron.

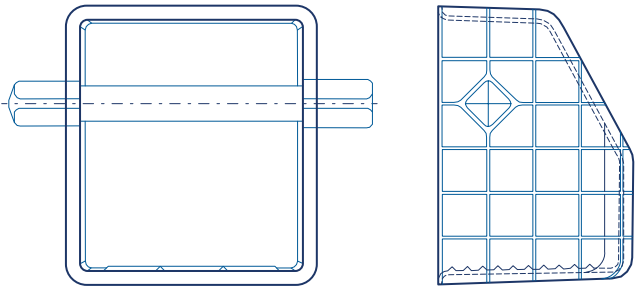


Fig. 12

The foot irons are firmly built into the manhole wall in two ways:

- Embedding in concrete directly within part manufacturing
- Striking into dowels embedded during section manufacture (tacked foot iron)

EQUIPMENT OF SECTIONS

4.2 HANDLING AND INSTALLATION MEANS

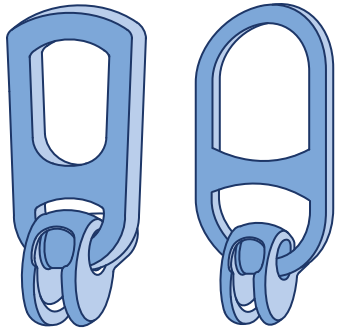
For easy handling of sections and safe assembly there are ball-head anchors installed in the pipes and manhole sections.

TRANSPORT FIXTURES

The transport fixture systems are building elements permanently integrated into the precast stones on which the attachment of the lifting device is temporarily attached.

LIFTING JACKS FOR BALL-HEAD ANCHORS (UNIVERSAL CONNECTING PIECE)

Weight category [t]
1,3
2,5
5,0
10,0
20,0
32,0



These lifting jacks are made of alloy steel. There are characterized by compact, lightweight construction and fast assembly.

Before using the lifting jacks for ball-head anchors for the first time, we recommend user to mark permanently these lifting jacks with inventory number.

The lifting jack must rotate before the lifting force is activated so that its tongue faces the lifting direction as shown in the following figures! Any modifications (grinding) or repairs of jacks for ball-head anchors, in particular, welding are not permitted!

The inspections of lifting jacks must be carried out by a trained professional, at least once a year according to the following regulations:

VBG 9, 9a, § 39 and § 401 and in accordance with ČSN ISO 1480-1.

The lifting jacks for ball-head anchors are intended for repeated loads, but they cannot be applied for permanent loads!

Before each use the lifting jack must be inspected by appointed and trained person.

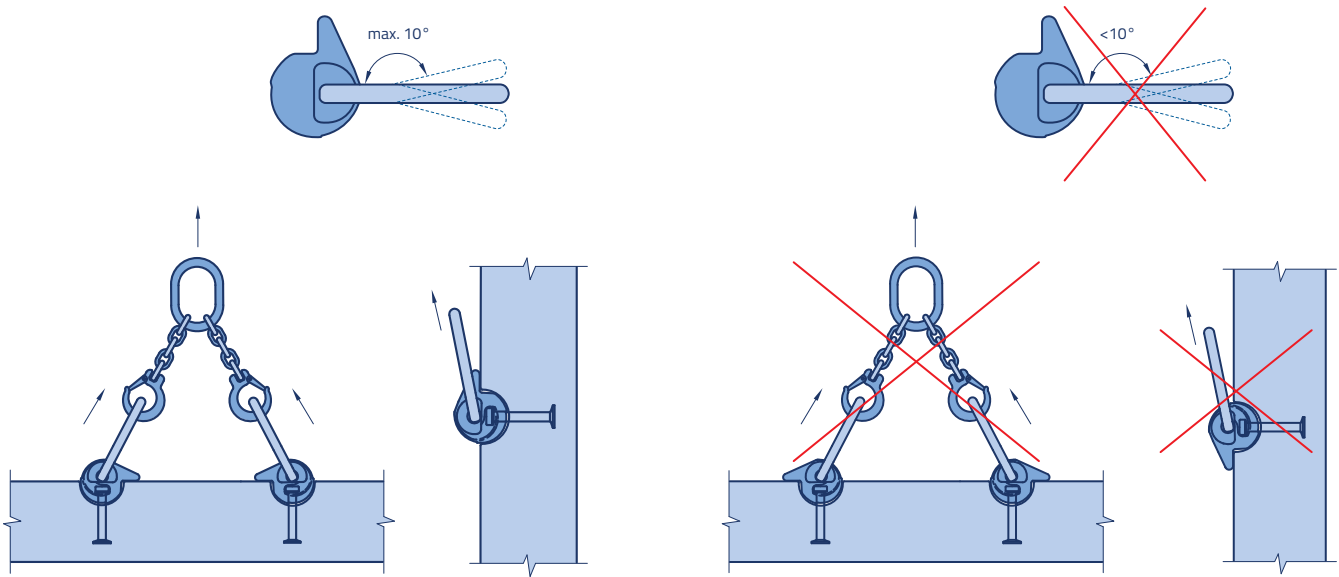
Damage to the lifting jack is considered when it is obvious that it has occurred:

- corrosion damage
- deformation of any part of the lifting attachment
- cracks in any part of the lifting attachment

- frequent use causing the wear of its parts so that it no longer meets the limit dimensions

If the suspension eye of the lifting jack is bent due to misuse, it must not be bent back but discarded.

Using of damaged lifting jack is forbidden!

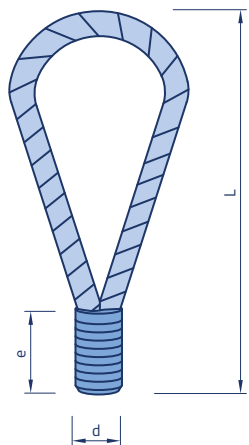


Precise rotation of lifting jack for proper lifting

Forbidden lifting method

ROPE CLAMPING WITH THREAD

Rd thread	M thread	Lifting capacity [t] 0°–30°	L [mm]	ø rope [mm]	Max. lifting capacity 30°–45°
d x e	d x e				
Rd 12 x 22	M 12 x 22	0,5	155	6	0.35 t
Rd 14 x 24	M 14 x 24	0,8	155	7	0.55 t
Rd 16 x 27	M 16 x 27	1,2	155	8	0.85 t
Rd 18 x 34	M 18 x 34	1,6	190	9	1.10 t
Rd 20 x 35	M 20 x 35	2,0	215	10	1.40 t
Rd 24 x 37	M 24 x 37	2,5	255	12	1.75 t
Rd 30 x 50	M 30 x 50	4,0	300	16	2.80 t
Rd 36 x 65	M 36 x 65	6,3	340	18	4.40 t
Rd 42 x 70	M 42 x 70	8,0	425	21	5.60 t
Rd 52 x 80	M 52 x 80	12,5	480	26	8.75 t



Rope clamps are fitted with a plastic label showing the lifting capacity and allowing an axial, but also pitched pulls up to maximum of 45° from the anchor axis. These clamps can also be used when the cap has not been used to fix the transport anchor and the anchor is the same with the precast unit. It is emphasized that the radius of the suspension hook must

always be at least twice greater than the diameter of the clamp rope and at least 5 times greater if bearing capacity is over 10 tons. This reduces the wear of clamp and increases its service life.

The ropes must not come in contact with aggressive materials and liquids, such as acids, which could cause considerable cor-

rosion. The rope clamp must be easily and loosely screwed into the anchor thread.

The inspections of threaded rope clamps must be carried out by skilled and trained worker at least once a year. For more frequent use of these clamps, it is necessary to perform wear inspections more frequently!

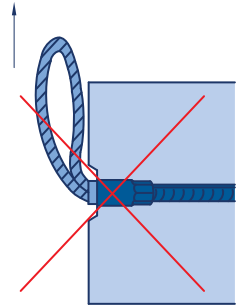
! Before screwing the clamp is always required to check the thread cleanness in anchor and remove eventual impurities, if needed. Any modifications (grinding) or repairs of jacks for threaded anchors, in particular, welding are not permitted!

Before each use the clamp must be inspected by appointed and trained person:

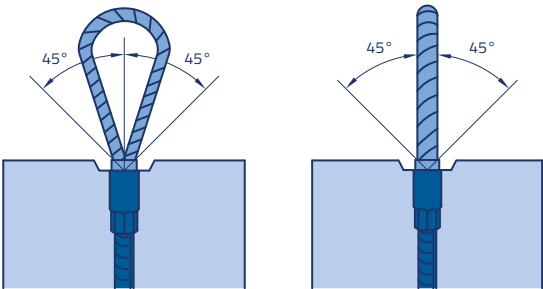
- excessive damage, breakage and deformation of rope
- observing the maximum lifting capacity stated on a label
- corrosion damage
- thread damage or its excessive wear (limit values)
- deformation of the rope clamp, e.g. by excessive bending
- releasing the outer wires from rope
- breaking of 4 wires per rope length, corresponding to 3x rope diameters*
- breaking of 6 wires per rope length, corresponding to 6x rope diameters
- breaking of 16 wires per rope length, corresponding to 10x rope diameters
- breaking of 1 wire bundle
- breaking of more than 4 wires in the suspension area

* Example
For a 10 mm (Rd20) rope diameter we will multiply 3 x 10 mm = 30 mm. It means that a maximum of 4 wires can be torn in a length of 30 mm.

! Using of damaged clamp is forbidden!



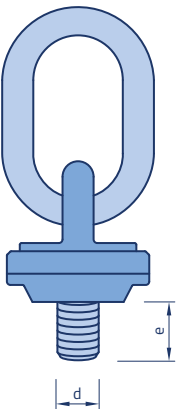
Forbidden lifting method!



Precise rotation of lifting jack for proper lifting and permitted angles

EYE SCREW (COMBI HEAD)

Rd thread	M thread	Lifting capacity [t]	e [mm]	Max. lifting capacity 45°–90°
thread	thread			
Rd 12	M 12	0,5	21	0.25 t
Rd 14	M 14	0,8	23	0.40 t
Rd 16	M 16	1,2	26	0.60 t
Rd 18	M 18	1,6	30	0.80 t
Rd 20	M 20	2,0	32	1.00 t
Rd 24	M 24	2,5	36	1.25 t
Rd 30	M 30	4,0	45	2.00 t
Rd 36	M 36	6,3	55	3.15 t
Rd 42	M 42	8,0	62	4.00 t
Rd 52	M 52	12,5	75	6.25 t



The eye screws (hereinafter referred to as „clamp“) allow axial, but also pitched and transverse pulls, up to maximum angle of 90° from the anchor axis. The attachment with pivot head must be easily and loosely screwed into the anchor thread.

Any modifications (grinding) or repairs of eye screws for threaded anchors, in particular, welding are not permitted! These clamps are intended for repeated loads, but they cannot be applied for permanent loads!

! Before screwing the clamp is always required to check the thread cleanness in anchor and remove eventual impurities, if needed. The eye screw must be screwed as far as possible into the cap recess.

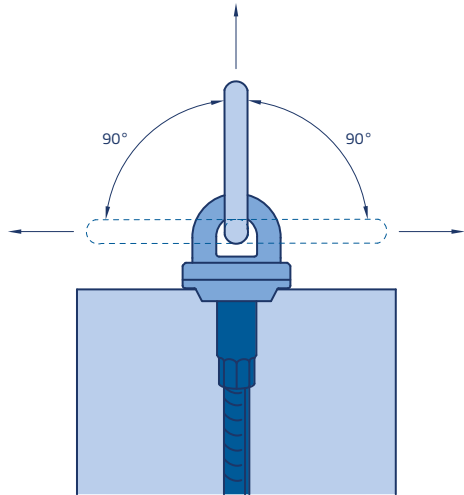
Before each use the clamp must be inspected by appointed and trained person.

The inspections of eye screws must be carried out by skilled and trained worker at least once a year according to the following regulations: VBG9, 9a, § 39 and § 401 and in accordance with ČSN ISO 12480-1.

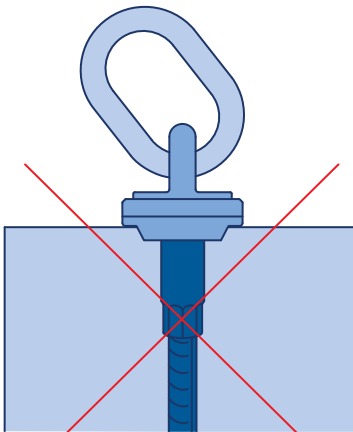
Damage to the clamp is considered when it is obvious that it has occurred:

- corrosion damage
- thread damage or its excessive wear (limit values)
- deformation of any part of the clamp
- cracks in any part of the clamp

Using of damaged clamp is forbidden!



Precise rotation of eye for proper lifting



Forbidden lifting method

Section	Handling means					
	Ball-head fixture	Rope length l (universal connecting piece) [m]	Threaded rod fixture	Rope length l (Combi head) [m]	Rope length l (rope clamp) [m]	Rope length l (rope pivot clamp) [m]
Pipes DN < 800	–	–	–	–	–	–
Pipes DN ≥ 800	x	min. 1,4	–	–	–	–
Pipes with lining DN < 600	–	–	–	–	–	–
Pipes with lining DN ≥ 600	x	min. 1,4	–	–	–	–
Pipes with pushing DN ≥ 800	x	min. 1,4	–	–	–	–
Egg-shaped pipes	x	min. 1,4	–	–	–	–
Manhole rings and cones						
DN ≤ 1 000	x	min. 1,9	–	–	–	–
DN 1 200	–	–	x	min. 1,5	min. 1,5	min. 1,5
DN 1 500	x	min. 2,3	–	–	–	–
WN 1 500	–	–	x	min. 1,8	min. 1,8	min. 1,8
Manhole beds						
DN 1 000	x	min. 1,4	–	–	–	–
DN 1 200	–	–	x	min. 1,5	min. 1,5	min. 1,5
DN 1 500	–	–	x	min. 1,8	min. 1,8	min. 1,8
WN 1 500	–	–	x	min. 1,8	min. 1,8	min. 1,8
Cover slabs						
DN 100–63	x	min. 1,4	–	–	–	–
DN 120–63	x	min. 1,7	–	–	–	–
DN 150–63	x	min. 2,0	–	–	–	–
WN 150–63	–	–	x	min. 2,0	–	min. 2,0
Angle slabs						
DN 120–100	x	min. 1,8	–	–	–	–
DN 150–100	x	min. 2,1	–	–	–	–
WN 150–100	–	–	x	min. 2,1	–	min. 2,1

Table 6: Used handling equipment and rope lengths at the sections

Fixture lifting capacity [t]	Sections
Ball-head fixture	
2.5	Rings DN 800 and 1 000, cone DN 1 000, manhole beds DN 1 000, cover and angle slabs DN 1 000, 1 200 a 1 500
5.0	Pipes DN 800 to 1 200, egg-shaped pipes 50/75 to 90/135, rings DN 1 500
7.5	Pipes DN 1 400 to 1 800
10.0	Pipes DN 2 000 to 2 200
Threaded rod fixture	
2.5 RD 24	Rings and manhole beds DN 1 200; rings, manhole beds
	Cover and angle slabs WN 1 500
4.0 RD 30	Manhole beds DN 1 500

Table 7: Lifting fixture capacity

EQUIPMENT OF SECTIONS

4.3 EQUIPMENT OF MANHOLE BEDS

The wastewater is transferred through the manhole bottom in a channel (cunette) corresponding to the width of the sewer, in general, h = 1/2 DN. In the event of a change of direction, the channel forms an arc and, in case of a change in profile, the channel forms a transition between the inlet and outlet sewer profiles.

The equipment of manhole bed is determined by the **customer’s require-**

ment. This is solved via **order sheet of manhole beds in the Prefa a.s. catalogue** or separate program for designing **Winplan** manholes. Everything is also on www.prefa.cz.

The following rules apply to the above mentioned requirements of manhole bed making:

- the gradient of the flow channel (i.e. the gradient determined by placing the lowest points of the inlet and

outlet profiles) usually corresponds to the gradient of the connected pipe

- the horizontal tolerance for the placing of inlet and outlet profiles (angular tolerance) of +/- 3° is permitted according to ČSN EN 1917
- the vertical tolerance for the placing of inlet and outlet profiles of +/- **15 mm is permitted** according to ČSN EN 19177

EQUIPMENT OF SECTIONS

4.4 LINING OF INTERIOR PIPE SURFACES

The interior surfaces of pipes may be provided with linings of abrasion-resistant and chemically resistant materials embedded in concrete or suitably fastened to the concrete, unless there is decrease in the useful properties of the pipes.

The following materials are used to lining manufacture:

Basalt segment (CV)

- a) Circular pipes:
- 120°, 180° and 360° of flow cross-section

- b) Egg-shaped pipes:
- The lining is fitted in the lower third of the pipe

The basalt lining multiplies the lifetime of concrete and reinforced-concrete pipes.

PARAMETERS		LINING MATERIAL
Physical properties	Unit	Basalt segments
Bulk density	[MPa]	2 900–3 000
Compressive strength	[MPa]	min. 300–450
Bending strength	[MPa]	min. 45
Grinding hardness	[cm³/cm²]	max. 5/50
Wear resistance	[mm³]	110
Hardness	–	min. 8
Absorption rate	[%]	0
Solubility in sulphuric acid	[%hm]	max. 9

Table 7: Qualitative properties of the materials used for the production of pipe linings

4.5 CLOSER MATERIAL BETWEEN LINING SEGMENTS

Only the following materials can be used to fill joints between individual segments:

- Ergelit SBM
- PCI Kanafug
- Eufix
- Permapatch Rapid

Pipe marking	BASALT LINING (CV) POSITION ANGLE
DN 300	360°
DN 400	360°
DN 500	360°
DN 600	180°
DN 800	120°, 180°, 360°
DN 1000	120°, 180°, 360°
DN 1200	120°, 180°, 360°
DN 1400	120°, 180°, 360°
DN 1600	120°, 180°, 360°
DN 1800	120°, 180°, 360°
DN 2000	120°, 180°, 360°
DN 2200	120°, 180°, 360°

Table 8: Possible options of linings of concrete and reinforced-concrete bell-and-spigot pipes

5. WATER-TIGHTNESS OF SECTIONS – REQUIREMENTS AND TESTING

5.1 WATER-TIGHTNESS OF PIPES

Pipes shall be considered waterproof if they comply with a hydrostatic pressure of 50 kPa (0.5 bar or ca. 5m water column) for 15 minutes according to annex E of ČSN EN 1916.

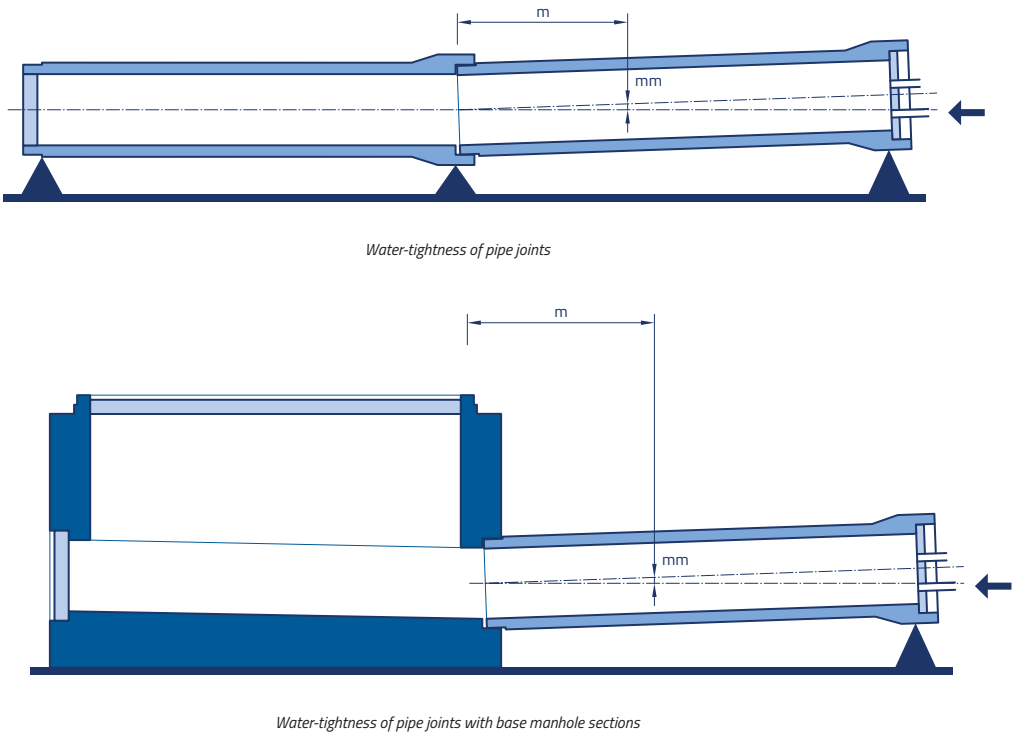
During the test period, the individual building section or pipe joint must not show leakage or other visible defects. Humidity that sticks to the surface is not considered leakage. Building sections with a design wall thickness of

more than 125 mm need not undergo a hydrostatic test.

It is necessary to moisten the building sections before the test for a maximum of 28 hours. The conventional operating tests of waterproofing - vacuum testing - are carried out according to Strážnice. The principle is the vacuum test of all manufactured pipes. The testing process of each pipe produced and tested is recorded.

WATER-TIGHTNESS OF THE PIPE JOINT AT ANGULAR DEFLECTION

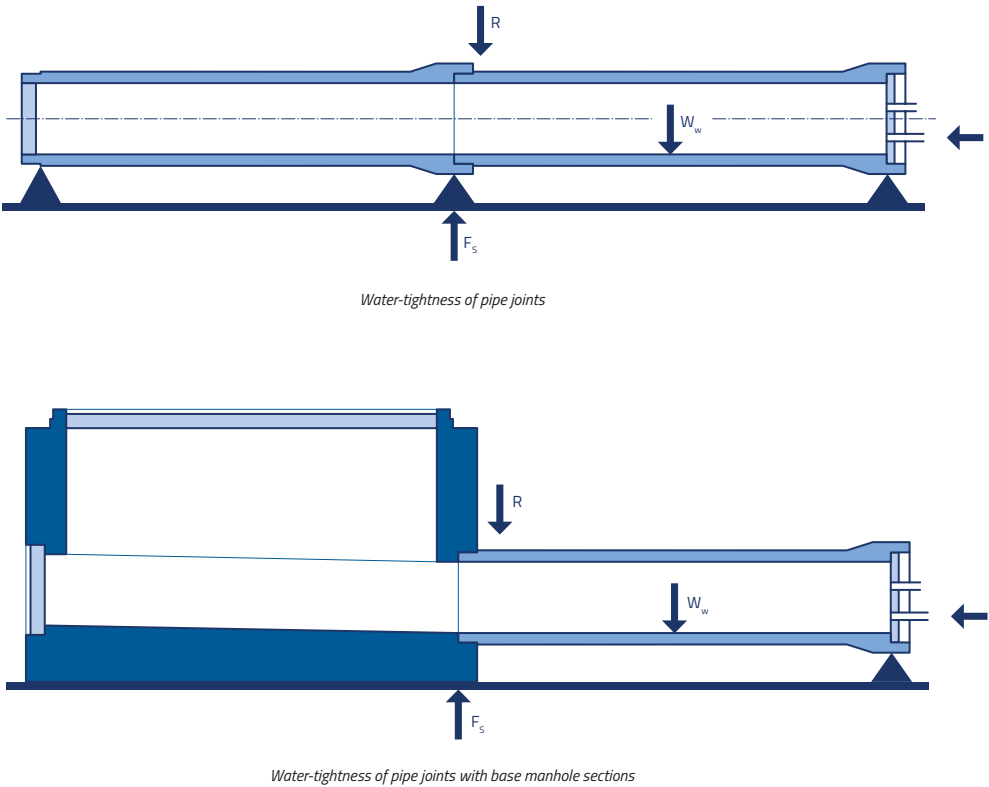
Two connected pipes must remain waterproof at the deflection one of them by less than 12,500/DN in mm/m or by 50 mm/m according to annex E of ČSN EN 1916. The deflection is defined as the distance of the longitudinal axis of the pipe at its free end from the extended longitudinal axis of the second pipe.



THE WATER-TIGHTNESS OF THE PIPE JOINT UNDER SHEAR STRESS LOAD

Two connected pipes must be waterproof at the shear pressure F_s [kN] = $DN \times 0.03$ according to annex E of ČSN EN 1916.

R – additional load (weight of backfill, weight of pipe)
 W_w – weight of pipe filling



5.2 WATER-TIGHTNESS OF MANHOLES AND RIGGOTS

The sewer manhole sections shall be considered waterproof if, in the water-tightness test according to annex C of ČSN EN 1917 they comply with the hydrostatic pressure for 15 minutes:

- 30 kPa (0.3 bar or ca. 3 m water column) for manhole, drum and cover building sections of the control manhole.
- 40 kPa (0.4 bar or ca. 4 m water column) for manhole bed of the control manhole

- 50 kPa (0.5 bar or ca. 5 m water column) for manhole beds, rings, circular drums and cover building sections

During the test period, the individual vertical section or pipe joint must not show leakage or other visible defects, regardless of whether foot irons are fitted. Humidity that sticks to the surface is not considered leakage. The vertical building sections with a design

wall thickness of more than 125 mm need not undergo a hydrostatic test.

It is necessary to moisten the building sections before the test for a maximum of 28 hours.

5.3 WATER-TIGHTNESS OF SEWERS

The sewer waterproof test is carried out according to ČSN EN 1610 "Implementation of sewers and sewage connections and their testing" by air ("L" method) or by water ("W" method). In the case of a single or repeated failing air test, the water test is passed with a decisive result.

Prefa Brno a.s. performs these tests on request.

6. INSTALLATION OF CONCRETE AND REINFORCED-CONCRETE PIPES

6.1 INSTALLATION OF CONCRETE AND REINFORCED-CONCRETE PIPES

1. STORAGE

- Pipes are stored on wooden base beams on a level, reinforced and drained subsoil and must be secured by wedges to prevent them from being moved or pulled. The pipes are stacked on top of each other so that the next stored layer of pipes turns the socket end in reverse.
- The pipes should be protected from adverse climatic conditions (high temperatures, direct).

2. HANDLING

- The pipes in situ are handled using the self-clamping pliers or rope clamps by hanging the pipe into loops around the pipe circumference and the pipes equipped with ball-head fixtures using the chain layer with a universal connecting bulbs.
- **It is impermissible to handle the pipes in the areas of sockets and drums or lift and handle pipes with the rope clamp run through the pipe.**
- The pipes must be handled in such a way so that to prevent their impact load, dropping, splintering or hutching on the ground.

3. INSTALLATION

- Before each installation any pipe must be thoroughly cleaned and inspected, particularly the drum and socket including the seal. **All damaged pipes must be unconditionally removed.**
- The trench bottom and the substrate for pipe laying must be designed according to the design and the trench must be kept dry when laying.
- **The trench width must not be less than the minimum dimensions according to ČSN EN 1610** (see table).

DN	Minimum trench width (OD + x) [m]		
	cased trench	uncased trench	
		$\beta > 60^\circ$	$\beta \leq 60^\circ$
≤ 225	OD + 0,40	OD + 0,40	
$> 225 \text{ až } \leq 350$	OD + 0,50	OD + 0,50	OD + 0,40
$> 350 \text{ až } \leq 700$	OD + 0,70	OD + 0,70	OD + 0,40
$> 700 \text{ až } \leq 1\,200$	OD + 0,85	OD + 0,85	OD + 0,40
$> 1\,200$	OD + 1,00	OD + 1,00	OD + 0,40

As regards the **OD + x** indication the x/2 corresponds to the smallest space between the pipe and the trench wall, event. sheeting, where: OD is the outside diameter of the pipe [m], β is the angle of inclination of the wall of the uncased trench measured towards the horizontal axis

- The pipe shall be suspended through the lifting device into the self-clamping pliers, rope fasteners or chain layer.
- A continuous layer of approved DS GLEITMITTEL B05 or CONCRETEC GLEITMITTEL UK170 is applied uniformly to the drum and pipe seal.

Protect the lubricated parts from adhering the impurities to grease. **Not applying or using the insufficient amount of sliding agent, the seal could be ripped off during pipe shifting and thus creating a leaky joint and increasing the assembly consumed work** (see figure).

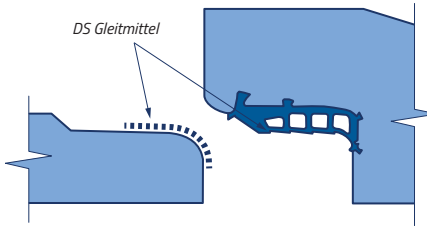


Fig. 1

DN	approx. joints from 5 kg of sliding agent
300	12
400	11
500	10
600	8
800	5
1 000	5
1 200	4
1 400	4
1 600	3
1 800	3
2 000	2
2 200	2

- The pipes are embedded on 2 pieces of concrete sleepers (fig. no. 3, 5, 6 and 9).
- The pipes are installed in the following ways:

INSTALLATION OF CONCRETE AND REINFORCED-CONCRETE PIPES

6.1.1 CHAIN LAYER

When installing, the pipe sockets must be directed against the flow of the medium to be transported. To join the first two pipes, a chain layer with equally long (symmetrical) clamps (fig.

2) is used. The suspended pipe is led through the drum into the socket of the previous pipe, centred on the laying axis and embedded. Subsequently, the clamp with ball-head connecting bulb

is loosened at the socket, changed over to the previous pipe again to the fixture at the socket and the whole jack with suspended pipes is lifted using the lifting device (fig. no. 3).



Fig. 2



Fig. 3

The chain layer with asymmetric clamps (fig. no. 4) is used to connect other pipes. First, using the symmetrical clamps, the next pipe is led through the drum into the socket of the previous pipe, centred on the laying axis and

embedded. Subsequently, the chain layer with asymmetrical clamps is used, when the shorter clamp is attached to the fixture at the drum of the last assembled pipe. Finally, the whole chain layer with suspended pipes is lifted by means of

lifting device (fig. no.5). **It is necessary to ensure an axial symmetrical pulling-down!**

The average mounting force required for pipe connection is approx. as follows:



Fig. 4



Fig. 5

INSTALLATION OF CONCRETE AND REINFORCED-CONCRETE PIPES

6.1.2 CHAIN RATCHET JACK – HUPCUK

This method is especially recommended for pipes \geq DN 1 400, which are provided with mounting fixtures on the side surfaces of the pipes.



DN	Recommended mounting force [kN]
300	15
400	20
500	25
600	30
800	70
1 000	90
1 200	110
1 400	130
1 600	150
1 800	170
2 000	190
2 200	210

The so-called “hupcuk” (lifting device) is used to connect the manhole bed (fig. no. 6 to 9).



Fig. 6



Fig. 7



Fig. 8



Fig. 9

After installing the pipes with handling fixtures it is necessary to seal these fixtures with a suitable cement-based binding material (Ergelit, Remmers Schnellzement, Sika Schnellmörtel, etc).

The drum not pushed as far as possible into the socket inside the pipe up to 20 mm has no negative effect to the water-tightness of the joint.

7. INSTALLATION OF MANHOLE SECTION

7.1 INSTALLATION OF MANHOLE SECTION

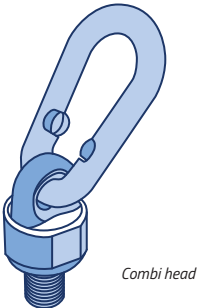
1. STORAGE

- The manhole sections are stored on the base beams on a level, reinforced and drained subsoil so that the joint profiles of sections cannot be damaged. The sections are stored in the installation position up to max. height of 2 m.

2. HANDLING

- The manhole sections can be handled only with handling fixtures, which are fitted to these sections when manufacturing.

Section	Handling device		Length of ropes
Bed DN 1 000	Universal connecting piece	2.5 t	1.4
Bed DN 1 200	Combi head (max. lifting angle 90°) / rope pivot clamp (max. lifting angle 90°) / rope clamp (max. lifting angle 45°)	2.5 t	1.5
Bed DN 1 500	Combi head (max. lifting angle 90°) / rope pivot clamp (max. lifting angle 90°) / rope clamp (max. lifting angle 45°)	4.0 t	1.8
Square-shaped bed DN 1 500	Combi head (max. lifting angle 90°) / rope pivot clamp (max. lifting angle 90°) / rope clamp (max. lifting angle 45°)	2.5 t	1.8
Ring DN 1 000	Universal connecting piece	2.5 t	1.9
Ring DN 1 200	Combi head (max. lifting angle 90°) / rope pivot clamp (max. lifting angle 90°) / rope clamp (max. lifting angle 45°)	2.5 t	1.5
Ring DN 1 500	Universal connecting piece	5.0 t	2.3
Square-shaped ring DN 1 500	Combi head (max. lifting angle 90°) / rope pivot clamp (max. lifting angle 90°) / rope clamp (max. lifting angle 45°)	2.5 t	1.8
Cover slab DN 1 000	Universal connecting piece	2.5 t	1.4
Cover slab DN 1 200	Universal connecting piece	2.5 t	1.7
Cover slab DN 1 500	Universal connecting piece	2.5 t	2.0
Square-shaped cover slab DN 1 500	Combi head (max. lifting angle 90°) / rope pivot clamp (max. lifting angle 90°)	2.5 t	2.0
Angle slab DN 1 200	Universal connecting piece	2.5 t	1.8
Angle slab DN 1 500	Universal connecting piece	2.5 t	2.1
Square-shaped angle slab DN 1 500	Combi head (max. lifting angle 90°) / rope pivot clamp (max. lifting angle 90°)	2.5 t	2.1



Combi head



Rope clamp



Rope pivot clamp

- It is impermissible to handle the manhole sections in the areas of sockets and drums or and handle the pipes with the rope clamp run through the product or foot iron.

- The manhole sections must be handled in such a way so that to prevent their impact load, dropping, splintering or hutching on the ground.

3. INSTALLATION OF MANHOLE BEDS

- Before each installation any bed must be thoroughly cleaned and inspected, particularly the joint profiles. **All damaged sections must be unconditionally removed.**
- The trench bottom and the substrate for pipe laying must be designed according to the design and the trench must be kept dry when laying.

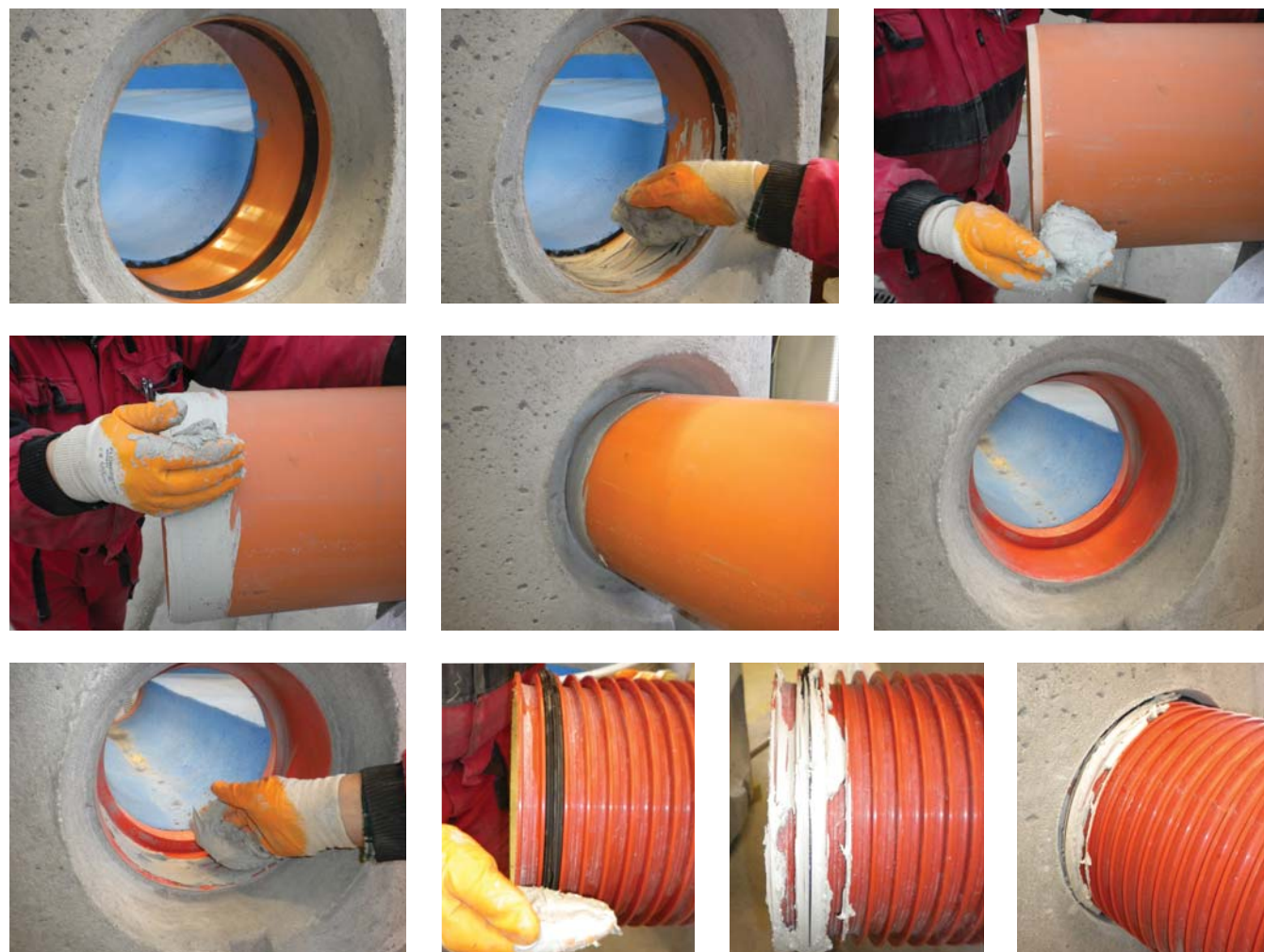
4. INSTALLATION OF PIPES ON MANHOLE BEDS

- A continuous layer of approved DS GLEITMITTEL B05 or CONCRETEC GLEITMITTEL UK170 is applied uniformly to the manhole liner, socket (compact system), pipe drum and seal. Protect the lubricated parts from

adhering the impurities to grease. **Not applying or using the insufficient amount of sliding agent, the seal could be ripped off during pipe shifting and thus creating a leaky joint and increasing the assembly con-**

sumed work. Slide the pipe end into the insert (socket) as far as possible, taking care not to push the seal out of the working surface. The mounting by means of high blows through heavy thing is not permitted.

INSTALLATION OF PIPING TO THE GFK AND PP MANHOLE LINERS



INSTALLATION OF PIPING TO THE "COMPACT SYSTEM"



5. INSTALLATION OF RINGS; ANGLE AND COVER SLABS

- Before each installation any bed must be thoroughly cleaned and inspected, particularly the joint profiles. **All damaged sections must be unconditionally removed.**
- The seal is evenly put on the drum.
- A continuous layer of approved DS GLEITMITTEL B05 or CONCRETEC GLEITMITTEL UK170 is applied uniformly to the seal. **Not applying or using the insufficient amount of sliding agent, the seal could be**

ripped off during pipe shifting and thus creating a leaky joint.



DN	approx. joints from 5 kg of sliding agent
1 000	7
1 200	5
1 500	3

- For the installed section, the socket is also coated with a sliding agent
- The assembled ring is centrally and vertically lowered and allowed to sit (the correct rotation of foot irons is fundamental).
- If the handling fixture is released or the integrity of the concrete surface is damaged at its placement, it must be sealed with a cement-based waterproofing cement (Ergelit, etc.).
- Backfilling of manholes – the backfill material must comply with the design requirements and static calculation



8. INSTALLATION OF RIGGOTS

8.1 INSTALLATION OF RIGGOTS

1. GENERALLY

- We produce and supply concrete sections of riggots DN 450 and 500 (hereinafter referred to as "riggots"), which are used to capture rain and surface water from roads or other public areas and to discharge them into the sewer network.

2. TRANSPORT

- The riggots shall be deposited on the transport means either individually on stickers in the installation position or on the pallets, and must be secured against displacement.
- Before unloading, the consignee examines each delivery on its completeness and compliance with the order. The quality of products is checked, i.e. they are not damaged by transport, especially in the area

of joint (sockets and drums). The proper quality will be confirmed by the authorized representative of the buyer on the delivery note by his signature and stating the surname in capital letters.

3. STORAGE

- The riggots are stored in the built-in position individually or on pallets on level, reinforced and drained subsoil.

4. HANDLING

- It is not permissible to hang, lift and handle the rope clamp pulled through element or discharge hole.
- The riggot sections must be handled in such a way so that to prevent their impact load, dropping, splintering or hutching on the ground.

5. INSTALLATION

- Before each installation any section must be thoroughly inspected and all damaged sections unconditionally removed.
 - The riggot bed is embedded on the trench bottom, adjusted according to the relevant project.
 - The jointed bed parts and the individual sections must be adjusted according to the type of used jointing material (for cement-based cements, it is necessary to thoroughly soak the concrete in joints with water or to apply a penetration primer, etc.).
- A jointing material of such consistency is uniformly applied to the joint of the lower section so that it can be pushed out of each joint after sitting down the top section.
 - The top section must be centred with the lower section and the sections are joined by gravity.
 - The extruded jointing material is removed from the joint and then smoothed.

6. OCCUPATIONAL SAFETY

- During transport, storage, handling and installation of pipes, all precautions arising from the law and the relevant regulations, in particular, when working with suspended load according to ČSN ISO 12.480-1 and earthworks according to ČSN EN 1610.

7. RESPONSIBILITY FOR DEFECTS

- Prefa Brno a.s. is not responsible for defects in goods caused by unprofessional handling of the goods after its acceptance by the buyer, by unskilled installation activities that would be inconsistent with these technological principles.

Freight quantity for truck with a load capacity of 24 tons		
Section	KS/truck	Structure
PIPES (pyramid 4 bottom, 3 middle, 2 top etc.)		
DN 300	40	lengthwise in sequence 4x4 + 4x3 + 4x2 + 4x1
DN 400	24	lengthwise in sequence 4x3 + 4x2 + 4
DN 500	23	lengthwise in sequence 4x3 + 4x2 + 4
DN 600	12	lengthwise in sequence 4x2 + 4x1
DN 800 ČD	9	lengthwise in sequence 4x2 + 4x1
DN 800 RIM	10	lengthwise in sequence 4x2 + 4x1
DN 1 000	4	lengthwise in sequence 4x1
DN 1 000 RIM	4	lengthwise in sequence 4x1
DN 1 200	4	lengthwise in sequence 4x1
DN 1 200 RIM	4	lengthwise in sequence 4x1
DN 1 400	3	lengthwise in sequence 3x1
DN 1 600	3	lengthwise in sequence 3x1
TBO 50/75	12	lengthwise in sequence 4x3
TBO 60/90	8	lengthwise in sequence 4x2
TBO 70/105	8	lengthwise in sequence 4x2
TBO 80/120	6	lengthwise in sequence 3x2
TBO 92/135	4	lengthwise in sequence 2x2
TZT 80/106/199	11	crosswise
TZT 100/128/199	9	crosswise
TZT 120/150/199	7	crosswise
TZT 140/182/250	3	lengthwise in sequence 3x1
TZT 160/204/200	3	lengthwise in sequence 3x1
MANHOLE BEDS		
DN 100/60	12	bed + cone (cover slab)
DN 100/80	12	bed + cone (cover slab)
DN 100/100	11	bed + cone (cover slab)
DN 120	6	bed + cover (angle) slab
DN 150	3	bed + cover (angle) slab

Section	KS/truck	Structure
RINGS		PIECES / TRUCK
DN 1 000	TBR 100-63/58/9 (10)	22
	TBS 100/25/9 (10)	110
	TBS 100/50/9 (10)	64
	TBS 100/100/9 (10)	22
	TBR 100-63/58/12	38
	TBS 100/25/12	76
	TBS 100/50/12	46
	TBS 100/100/12	19
	+ possible combinations up to 24 tons	
Balance ring 4, 6, 8, 10, 12	17 (4), 18 (6), 14 (8), 11 (10), 9 (12)/pallet	24 pallets
Cover plate 3.5 t	16/pallet	24 pallets
Cover plate 12.5 t	12/pallet	24 pallets
Cover plate 40.0 t	8/pallet	24 pallets
Pipe padstones	25/pack	12 packs

Table 10: Freight quantity for truck with a load capacity of 24 tons



9. REFERENCE CONSTRUCTIONS

9.1 REFERENCE CONSTRUCTIONS



LEGO KLADNO – Construction of retences in Kladno industrial zone - TZh DN 1200



Brno – Pionýrská Street – Reconstruction of sewer network - TZh DN 1200 CV 180



D3 Votice Construction of D3 culvert – side installation DEHA Pipes TZh DN 1600



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