

ENGLISH SIMPLIFIED VERSION
See Norwegian edition for complete installation guide



Installation guide

Installation of concrete pipes
and manholes

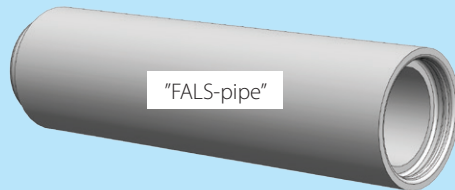
Adapted to the specification given in
NS 3420-U: 2008 and "Statens Vegvesen"
Handbook 018: 2011



Basal companies are leading in Norway in the development and production of concrete, water and wastewater, products. Basal consist of producers spread all over Norway.

Basal main products:

- Basal "FALS-pipe"
 - ig "FALS-pipe" (pipes with integrated seal)
 - "FALS-pipe" (pipes with loose seal)
- Basal "MUFFE-pipe"
 - ig "MUFFE-pipe" (pipes with integrated seal)
- Basal manholes
 - ig manholes (manholes with integrated seal)
 - manholes (manholes with loose seal)

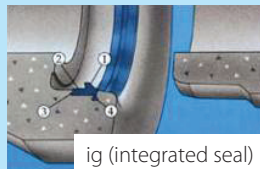


Dimensioning of pipes

The basis for dimensioning is in the internal report no.1521 and 1554 from the Public Roads Administration.

Excavation trench safety

Safety in trenches is specified in the regulation "Excavation and fortification of trenches" by the Directorate for the Norwegian Labour Inspectorate.



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Receipt of concrete products

On receipt of concrete products, the recipient will visually check that the pipes and manholes with accessories are in accordance with the order and free of damage. Receipts will be issued for goods received. Unapproved goods are marked and returned to the supplier.

Note that when items are signed for, without comments, the products have been accepted.

Storage

The surface must be level and stable and be sufficiently capable of carrying the load.

Manholes must be stored standing up, to a maximum of 3 in height. Pipes who are delivered on pallets from the factory are stored with a maximum of 2 pallets in height. If stacking pipes the lowest layer is laid on a bedding so that the pipes do not get frozen to the ground during winter time (eg. 2"x4" wooden boards). The stack must be secured properly to prevent it from collapsing.

"MUFFE-pipe": must be stacked and supported under the barrel so the socket is free of load. Every other layer is turned so that the bells protrude the opposite direction.

"FALS-pipe": Every other layer is turned in opposite direction.



Pipes

- ig-pipe is labelled: BASAL ig
- Pipe with loose seal is labelled: BASAL

NOTE! Pipes with asymmetrical reinforcement:

Concrete pipes with reinforcement that are not symmetrical are marked **"OPP" (UP) + a blue stripe** on the inside and outside of the socket.

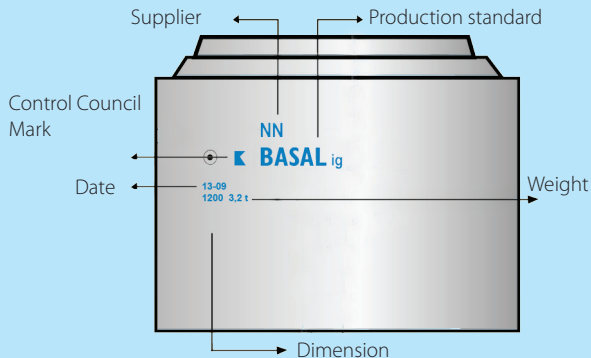
This marking must be oriented properly (up) when laying. If the pipes are laid incorrectly, the effect of the reinforcement will be reduced and strain damage can occur.



Manholes

- ig-manhole is labelled: BASAL ig
- Manhole with loose seal is labelled: BASAL

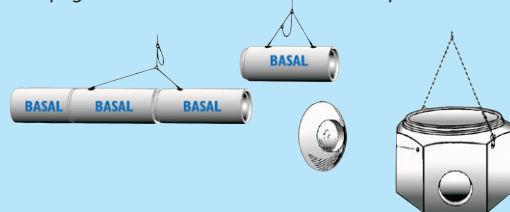
Example of labelling of Manhole



"FALS-pipe"			
DN	Length mm	Universal-anchorhead	Lifting and assembly equipment
300	1000 2000 2250	1	Congrip nr. 1 Congrip nr. 1 Congrip nr. 1C
400	1000 2000 2250	1	Congrip nr. 1 Congrip nr. 1 Congrip nr. 1C
500	1000 2000 2250	1	Congrip nr. 1 Congrip nr. 1 Congrip nr. 1C
600	1000 2000 2250	1	Congrip nr. 1 Congrip nr. 1 Congrip nr. 1C
800	1000 2000 2250	3 - 4	Congrip nr. 3 Congrip nr. 4 Congrip nr. 4C
1000	1000 2000 2250	3 - 4	Congrip nr. 3 Congrip nr. 4 Congrip nr. 4C
1200	1000 2000 2250	3 - 4	Congrip nr. 3 Congrip nr. 4 Congrip nr. 4C
1400	1000 2000 2250	3 - 4	Congrip nr. 3 Congrip nr. 4 Congrip nr. 4C
1600	1500 1750 2250	3 - 4	Congrip nr. 3 Congrip nr. 4 Congrip nr. 4C
1800	2000	3 - 4	Congrip nr. 4
2000	1500	3 - 4	Congrip nr. 3

Lifting equipment must be approved by the Norwegian Labour Inspection Authority. Equipment may be borrowed, hired or bought from Basal companies, see page 28.

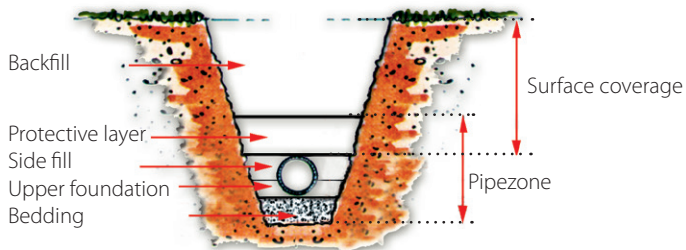
See page 12 for information about Basal Pipelifter.



Manhole			
DN	Anchour type	Universal-anchor head	Lifting equipment
1000	1	1	2-part nr. 1
1200	1	1	2-part nr. 1
1400	1	1	2-part nr. 1
1600	1	1	2-part nr. 1
2000	3	3	3-part nr. 3/4*
2400	4	4	3-part nr. 3/4*
2500	3	3	3-part nr. 3/4*
3000	4	4	3-part nr. 3/4*

* Each "leg" in the lifting chain MUST, at least have the same length as the manhole's diameter plus the distance from the top manhole to the lifting anchor.

Trench excavation

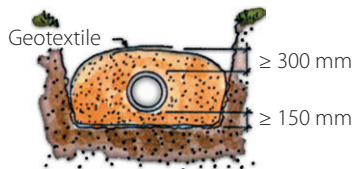


Trench width

When compaction is necessary the trench must be dug wide enough to allow compaction equipment on both sides of the pipe.

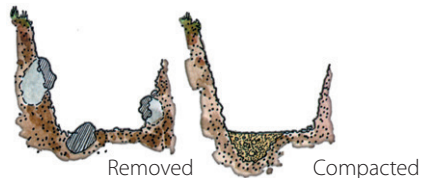
Width of trench and minimum distances between pipelines are stated in NS-EN 1610, item 6.2.2.

Geotextile



If the bottom of the trench consists of bad ground such as turf, humic material, soft clay or silt, a separation layer or geotextile must be used to avoid mixing of materials in the pipezone.

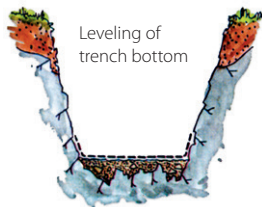
Trench bedding



The bedding must be on ground that is as undisturbed as possible. If the bottom of the trench consists of gravel or undisturbed silt or clay this is usually not a problem. Stones or other hard objects must be dug out and be replaced with gravel (crushed).

Frost protection:

In the winter trenches which are exposed to frost are at risk of freezing. When the soil thaws the material becomes soft and loses its carrying capacity. Therefore the bottom of the trench and the sides have to be covered with insulating mats if the ground will be left open over night. If frost has occurred in the ground material, the frozen mass must be removed before further work is done. Snow and ice must be removed from the trench. Frost susceptible material must not be used in the area around pipes or manholes if they are exposed to freezing temperatures.

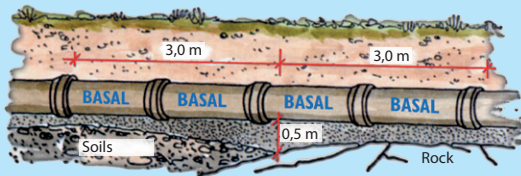


Rock trench

The bottom of the trench must be levelled with the same material as in the bedding. When there is a risk for material to washout, geotextile must be used under the bedding to prevent loose material from disappearing.

Bedding variation

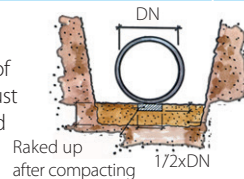
Where the bottom of the trench changes from rock to soil, or from very hard soil material to less compact material, the difference in material density is compensated by increasing the thickness of the bedding in the transition between rock and soil. This will prevent setting of the trench bottom.



Bedding

The bedding is the most important part of the trench cross section. The bedding must distribute the support under the pipe and ensure that large rocks, etc. are not pressing against the pipe. The bedding must consist of gravel (crushed).

The thickness after compaction must be at least as listed in table (I), see below. The maximum allowed grain size in the bedding materials depends in the diameter of the pipe and is listed in table (II).



Bedding material must be free of frost and ice, and compacted to 95 % Standard Proctor. Usually 1 pass with a vibroplate or vibrostamper provides optimal compaction of the bedding of uniform sized aggregate. After compaction, 1/3 of the bedding thickness must be loosened by raking to a width of at least half the pipe diameter. Loosely distributed uniform sized aggregate gives the same effect as the raking procedure.

Minimum bedding thickness (I)		
DN	Normal ground conditions	Hard ground conditions*
DN < 400	150	150
400 ≤ DN ≤ 1200	200	300
1200 < DN ≤ 2000	250	400
Maximum nominal grain size for bedding material (II)		
DN	Well sorted material	Uniform sized material
DN < 400	32	22
DN ≥ 400	53	32

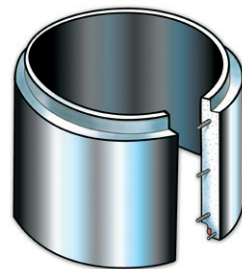
*eg. rock or concrete

Preparation before installing pipes and manholes with integrated seals:

1. Clean the spigot and socket
2. Check that the pipes/manholes are not damaged.
3. Check the product quality and laying depth
4. Remove any styrofoam remaining on the ig-seal
5. Lubricate the spigot with Forsheda lubricant

Fitting of seals on pipes and manholes with loose seals:

See page 19, Installation of manholes and manhole seals.



Installation of "MUFFE-pipe"

Dig a space for the socket so that the pipe barrel and the socket have even contact with the bedding. The spigot is centred in the socket before pulling them together, and they are joined with a special installation tool. Check that the pipes are properly installed.

The supplier of pipes and manholes also provides lifting and installation equipment.

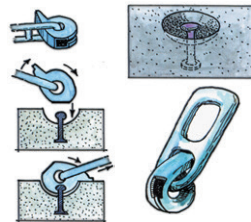
Laying usually begins from the downstream end of the trench and the socket will point upstream. Any change of angle in the joint is made after the pipes are assembled.



Correct use of lifting equipment

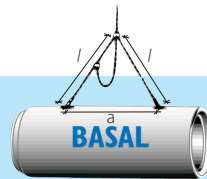
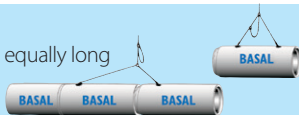
"FALS-pipe" and manholes have lifting anchors. The lifting link is attached to the lifting anchor as shown in figure. Ensure that the lifting link is locked before lifting.

Any ice or concrete remainings around the lifting anchor must be removed before installation of lifting equipment.



Installation of "FALS-pipe"

Three part lifting and installation tools have two equally long chains that are used for lifting and transport. The third and longest chain is used to pull the pipes together. The pipe is lowered down and is laid next to the previously installed pipe. The chain nearest the socket is disconnected and hung onto the lifting hook. The installation chain is connected to the lifting anchor at the opposite end of the already installed pipe. When applying an upwards force the new pipe is pulled into place without pushing the previous pipe out of place.



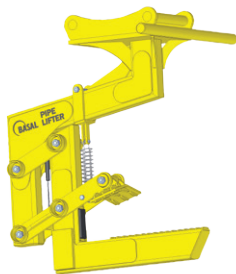
The chain sling top angle must not exceed 60° . This is achieved when the length of the chain sling (l) is longer than the distance between the lifting anchors (a). Giving $l > a$.

- Basal Pipelifter type 1: DN 200 - DN 400 Basal ig-pipe
- Basal Pipelifter type 2: DN 300 - DN 1200 Basal ig-pipe
- Basal Pipelifter type 3: DN 1400 - DN 2000 Basal ig-pipe
- May be equipped with all known types of quick hitch attachments.
- May be combined with rotary tilt and machine-fitted GPS
- May be tilted to a 25° angle
- Pipe up to 6 tons

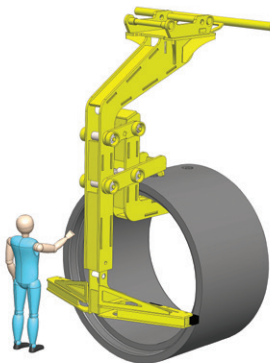
Basal Pipelifter provides optimal and flexible pipe positioning, both in terms of direction and angle. The work goes faster at the same time as important HSE considerations are taken care of. All installation and fitting may be carried out from the cabin of the digger.



Basal Pipelifter type 1:
DN 200 - DN 400



Basal Pipelifter type 2:
DN 300 - DN 1200



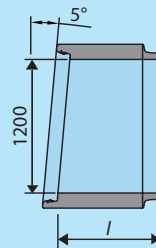
Basal Pipelifter type 3: DN 1400 - DN 2000

See page 5 for information about orientation of pipes when using the Pipelifter.

Angular deflection are to be carried out after the pipes are installed

DN	Pipe length in metres	Max angular deflection in joint
100	1,0	2,9°
125	1,0	2,9°
150	1,25	2,9°
200	1,5	2,9°
250	1,5	2,9°
250	2,0	2,9°
300	2,0	1,7°
400	2,25	1,7°
500	2,25	1,7°
600	2,25	1,7°
800	2,25	1,2°
1000	2,25	1,2°
1200	2,25	1°
1400	2,25	0,9°
1600	2,0	0,7°
1800	1,75	0,6°
2000	1,5	0,6°

BASAL ig-langbend
"FALS-pipes"



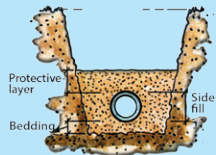
Mål (mm)			Radius (m)	Additional angular deflection in joint (°)
α	DN	l		
5°	500	900	10,1	1,7
5°	600	900	10,1	1,7
5°	800	900	10,0	1,2
5°	1000	900	9,9	1,2
5°	1200	900	9,8	1
5°	1400	1850	20,6	0,9
5°	1600	1850	20,5	0,7
5°	1800	1850	20,4	0,6
5°	2000	1350	24,6	0,6

Max allowed angle change in mm/m is given in the tables for pipes pages 21 and 22.

Sidefill, protective layer

Sidefill must be placed in layers on each side of the pipe before compressing.

DN	DN < 400	DN ≥ 400
Largest nominal grain size	64 mm	120 mm



Areas that require an even ground level (roads and squares) the sidefill and protective layer are usually compacted to 95% Standard Proctor.

1-2 passes of vibration stamper (maximum 300 mm thickness per layer) normally provide adequate compaction when aggregate or gravel are used.

If vibrator plate is used: 2-4 passes per layer is necessary (maximum 200 mm thickness per layer)

When pipelines are laid on several levels, fill up the entire width of the trench layer by layer, to the underside of the next pipe. Compaction is carried out in layers, but the zone right over the pipe must not be compacted.

Permitted weight of compaction equipment in sidefill and protective layer:

DN ≤ 1000: Up to 100 kg

DN > 1000: Up to 200 kg



Protective layer (300 mm) directly over the pipeline will normally be laid out loosely.

In areas where there is no requirement of an even ground level (for example outside of roads and squares) compressing is normally not necessary as long as the pipeline is not laid down with thicker top cover than 2/3 of the indicated top cover on the pipe.



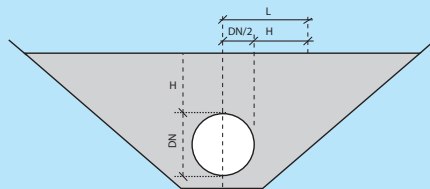
Backfill

The backfill material must not contain stones with a larger diameter than 0.5 m. If the fill material is to be compacted, the largest diameter for stones must not exceed 2/3 of layer thickness.

Compaction with heavy equipment right over the pipe must not be carried out before the thickness of the layer is:

Min. thickness over top of pipe before compaction with heavy equipment (m)	Compaction equipment
0,20	Vibrating plate 50-200 kg
0,30	Machine stamper < 70 kg Vibrating plate 201-500 kg
0,40 ¹⁾	Vibrating roller 10-15 kN/m
0,60 ¹⁾	Vibrating roller 16-25 kN/m
1,20 ¹⁾	Vibrating roller 26-40 kN/m
1,80 ¹⁾	Vibrating roller 41-55 kN/m
2,40 ¹⁾	Vibrating roller > 55 kN/m

¹⁾For concrete pipes marked with a top cover of minimum 4 metres the thickness of the layer before compaction with heavy equipment must be as given in the table. For pipes marked with a top cover less than 4 metres, the layer thickness must be increased by one level in the table.



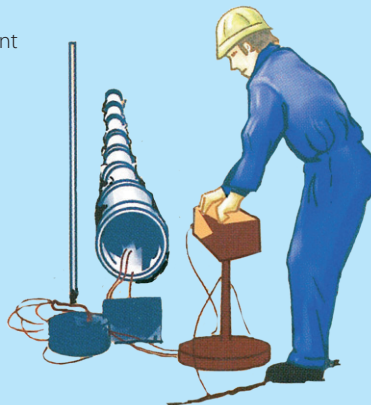
Requirement for top cover before compaction also applies to a distance L from the centre of the pipe, where L = thickness above the top of the pipe (H) plus half the pipe diameter.

Generally

Before testing, the plugs and connections on the equipment must be checked for any leaks. When testing pipes between manholes, plugs are to be fitted inside the pipe.

Air is supplied so that the pressure becomes 10 % higher than the testing pressure. The air supply is then closed. After 5 minutes, the pressure must be reduced to the indicated test pressure (P_0).

If the pressure drop after the test period is less than given in table (Δp), the pipeline is approved.



For testing of
DN > 1000 refer
to NS 3420.

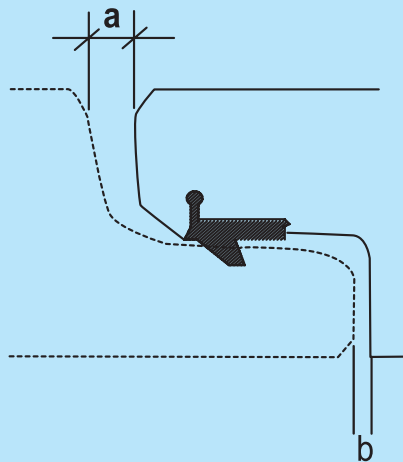
Test method	Pressure mVS / Bar		Test time with air (minutes)					
	P_0	Δp	DN200	DN300	DN400	DN600	DN800	DN1000
LC	1 / 0,1	0,15 / 0,015	3	4	5	8	11	14
LD	2 / 0,2	0,15 / 0,015	1,5	2	2,5	4	5	7

The difference in test method LC and LD are test pressure and test time.

Pipes with integrated seals

If the exterior gap dimension (a) measured in mm is outside the values given in the table, the interior gap dimension (b) should be checked.

Clarification directly with the supplier is recommended if there is uncertainty about the installation and the control of the gap size.



DN	Min a	Max a	Min b	Max b
150			2	13
200			2	14
250			2	19
300	(16)	(33)	2	19
400	18	36	2	20
500	14	32	2	20
600	15	33	2	20
800	18	43	2	27
1000	18	43	2	27
1200	22	48	2	28
1400	24	50	2	28
1600	28	57	2	31
1800	28	61	2	35
2000	30	63	2	35

Pipes with loose seal

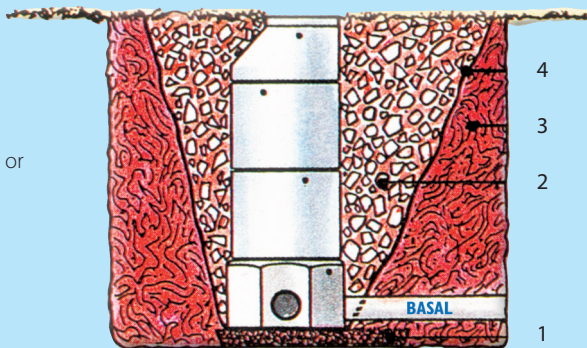
DN	Max b
1200 - 2000	20

Bedding

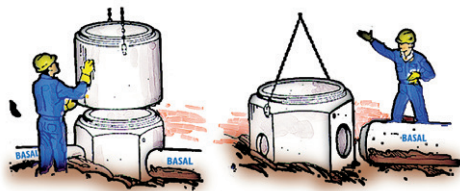
Bedding is levelled to the correct height. Support bars or concrete foundation should normally not be used.

Use gravel (crushed) $d_{\max} = 53 \text{ mm}$, compacted to 95 % Standard Proctor, similar to pipes.

It should not be used frost susceptible soil for bedding or backfill around manholes.



1. **Bedding.** Same material, types and grain size, as for pipes.
2. **Backfill.** Same material, types and grain size, as for sidefill of pipes.
3. **Native material**
4. **Use Geotextile** where the native material is clay, silt or similar.



Place the seal on the spigot in to the recess. Stretch out the seal by pulling it out at some points. Centre the manhole and assemble. The seal's glued joint will slip the first time when assembled (applies only to certain seals). If refitting is necessary, place the skin as shown.

When using Basal ig-manhole (manhole with integrated seal) the manhole spigots are lubricated, see page 10.

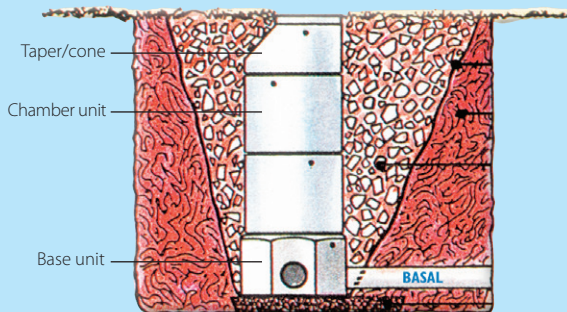
The surface is compacted and levelled. Installation of manholes is normally assisted by the manhole own weight. Manholes with a low height may require an extra load when assembling.



Basal manhole system is handled using a chain sling.

A "spissvender" is installed in the last pipe's bell, and the base section is centred on this. The base section is hoisted free from the surface and installed at the spigot with the use of an iron bar. For larger pipe dimensions the base section is jacked on to the spigot using a special installation tool.

Testing with air



For manholes $DN \leq 1000$ the specifications in NS-EN 1610, point 13.2 apply. These are the same requirements as for pipes, but half the testing time stated for pipes will be used.

See page 16, Watertightness by air testing - pipes

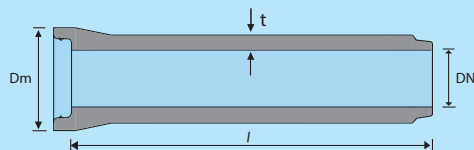
For manholes $DN > 1000$ it is recommended to use simplified testing with water. For testing with air $DN > 1000$ the test specification is described in NS 3420.

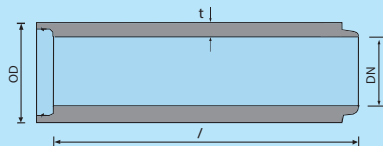
Simplified test with water

1. The manhole is filled with water to the top cone or cover slab
2. Conditioning
3. Refill to the top cone or cover slab
4. After 30 minutes new amounts of water are fed to the top cone or cover slab
5. The new amounts of water must be $< 0.2 \text{ l/m}^2$ interior wetted manhole surface.

NOTE: When choosing another method for testing of the manholes apart from simplified testing with water, it is necessary to check that the cover slab and cones will withstand the forces that will arise during leak testing.

Basal "MUFFE-pipes" ig (pipes with integrated seal)						
Measurement (mm)				Top cover min/max (m)	Max angular deflection (mm/m)	Weight per pipe approx. (kg)
DN	l	t	Dm			
150	500	33	284	0,5-10,0	50	35
	1000	33				55
200	500	37	353	0,5-8,0	50	50
	1000	37				90
	1500	41				140
250	500	42	425	0,5-7,0	50	70
	1000	42				130
	1500	45				190
	2000	48				250
300	500	45	481	0,5-6,0	30	80
	2000	53				340
400	1000	50	590	0,5-5,0	30	240
	2000	63				500





Basal "FALS-pipes" (loose seal)

Measurement (mm)				Top cover min./max (m)	Seal F140 (or F146) (mm)	Max. angular deflection (mm/m)	Weight approx. (kg)
DN	l	t	OD				
1200	2000	136	1472	0,5-3,0 **	20,0	17	2880
1400	2000	156	1712	0,5-3,0 **	24,5	15	3980
1600	2000 2250	176	1952	0,5-3,0 **	24,5	13	5000 5640
2000	1500	215	2430	0,5-3,0 **	24,5	10	5700
2400	1000 1500	180	2760	0,5-3,0	27,0	-	3700 5550

* Unreinforced. Pipe with large top cover must be ordered specially.

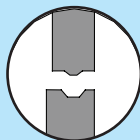
** Pipes are reinforced. Maximum desired top cover must be stated when ordering.

Pipe with top cover as given in the table are normal stocked goods.

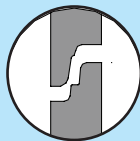
¹⁾ At road exits the minimum top cover can be reduced to 0.2 m.

Backfill must be done with aggregate 8-12, then compacted.

Basal “FALS-pipes” ig (integrated seal)					Max. angular deflection (mm/m)	Weight approx. (kg)
Dimensions (mm)				Top cover min/max (m)		
DN	l	t	OD			
300	1000 2000	90	480	0,5-12 * ¹⁾	30	275 550
400	1000 2000	85	570	0,5-7,0 * ¹⁾	30	330 650
500	1000 2000	90	680	0,5-6,0 *	30	420 840
600	1000 2000	94	788	0,5-4,0 */**	30	520 1030
800	1000 2000	110	1020	0,5-4,0 **	20	790 1580
1000	1000 2000	125	1250	0,5-4,0 **	20	1110 2210
1200	1000 2000	136	1472	0,5-3,0 **	17	1430 2860
1400	1000 2000	156	1712	0,5-4,0 **	15	1910 3820
1600	1500 1750	176	1952	0,5-3,0 **	13	3690 4120
1800	2000	200	2200	0,5-3,0 **	11	6290
2000	1500	215	2430	0,5-3,0 **	10	5610



TONGUE AND GROOVE
JOINT

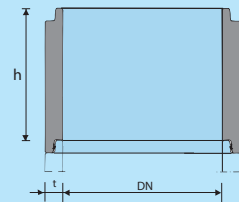


"FALS" JOINT

Basal chamber units			
Dimensions (mm)			Weight approx. (kg)
DN	h	t	
650 (tongue and groove)	400	70	150
	500		190
	1000		380
650 ("FALS" joint)	500	90	270
	1000		530
1000	300	90	230
	500		370
	1000		740
	1500		1095

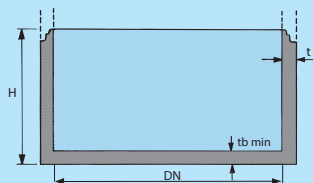
Basal chamber units			
Dimensions (mm)			Weight approx. (kg)
DN	h	t	
1400	300	90	310
	500		520
	1000		1020
1600	300	90	360
	500		600
	1000		1200
	2250		2700
2000	300	110	600
	500		920
	800		1450
	1000		1830
	1500		2750
2400	2250	180	4150
	500		1850
	800		3000
	1000		3700
2500	1500	130	5550
	500		1360
	800		2200
	1000		2760
3000	2000	200	5500
	500		2500
	800		4000
	1000		5000

Basal ig-chamber units			
Dimensions (mm)			Weight approx. (kg)
DN	h	t	
1000	300	125	350
	500		575
	1000		1150
	1500		1700
1200	300	135	450
	500		700
	1000		1400
1400	300	150	550
	500		910
	1000		1800
1600	300	160	650
	500		1100
	1000		2200
2000	300	165	850
	500		1400
	1000		2800



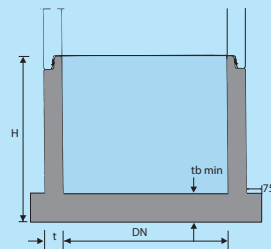
Basal base units				
Dimensions (mm)				Weight approx. (kg)
DN	H	t	tb	
650 (tongue and groove)	500 1000	70	100	270 460
650 ("FALS" joint)	540 1040	90	120	350 610
1000	580 1080 1580	90	120	570 940 1300
1200	580 1080 1580	90	120*	730 1170 1800
1400	580 1080	90	120*	890 1390

* "Water manhole" must have tb ≥ 150 mm



Basal base units				
Dimensions (mm)				Weight approx. (kg)
DN	H	t	tb	
1600	560 1060 2310	90	150	1240 1840 3340
2000	560 860 1060 1560 2060	110	150	1950 2860 2950 3900 5200
2400	630 930 1130 1630	180	180	3900 5000 5700 7550
2500	580 880 1080 2080	130	180	3500 4300 4900
3000	630 930 1130	200	200	6000 7400 8400

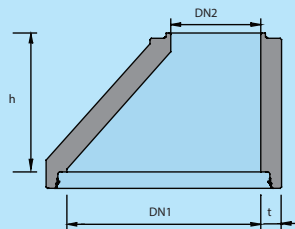
Basal-ig base units				
Dimensions (mm)				Weight approx. (kg)
DN	H	t	tb	
1000	658 1158	125	180	1200 1700
1200	650 1150	135	180	1600 2300
1400	675 1175	150	200	2100 3000
1600	695 1195	160	220	2700 3800
2000	695 1195	165	220	3800 5200



Basal ig-cones				
Dimensions (mm)				Weight approx. (kg)
DN1	DN2	h	t	
1000	650 *	500	125	570
1200	650 **	600	135	900
1400	650 *	1000	150	1850
	800**	850		1600
1600	650 *	1000	160	2000
	800 **	850		2100

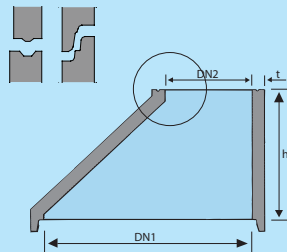
* Only with tongue and groove

** Only with "FALS" joint

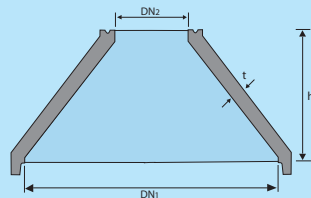


Basal cones (eccentric manhole)				
Dimensions (mm)				Weight approx. (kg)
DN1	DN2*	h	t	
1000	650	500	90	330
1200	650	500	90	400
		1000		730
1400	650	1000	90	800
1600	650	1000	90	1070
2000	650	1000	110	1700

* DN2 can be delivered with tongue/groove or "FALS" joint

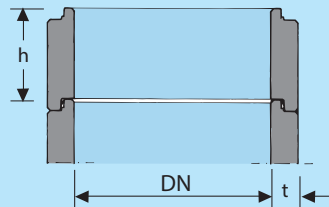
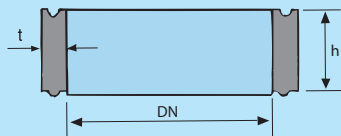


Basal cones (centric manhole)				
Dimensions (mm)				Weight approx. (kg)
DN1	DN2	h	t	
1200	650	250	90	400
		750		750
1400	650	1000	90	900
1600	650	700	90	700
		1000		1000
2000	650	800	110	1350

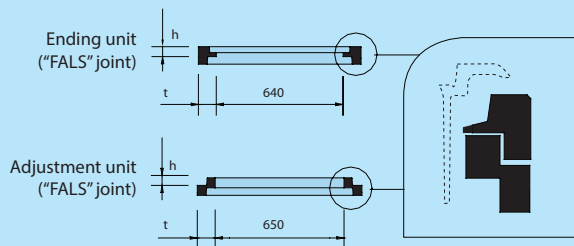
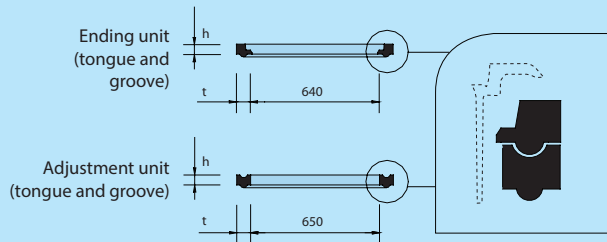


Basal adjustment units with tongue and groove			
Dimensions (mm)			Weight approx. (kg)
DN	h	t	
650	100	70	40
	150		60
	200		80
	250		100
	300		120
800	100	90	70
	150		100
	200		130
	300		190
	400		250
	500		340

Basal adjustment units with "FALS"			
Dimensions (mm)			Weight approx. (kg)
DN	h	t	
650	100	90	55
	200		110
	300		160
800	100	90	65
	200		130
	300		200
	500		320

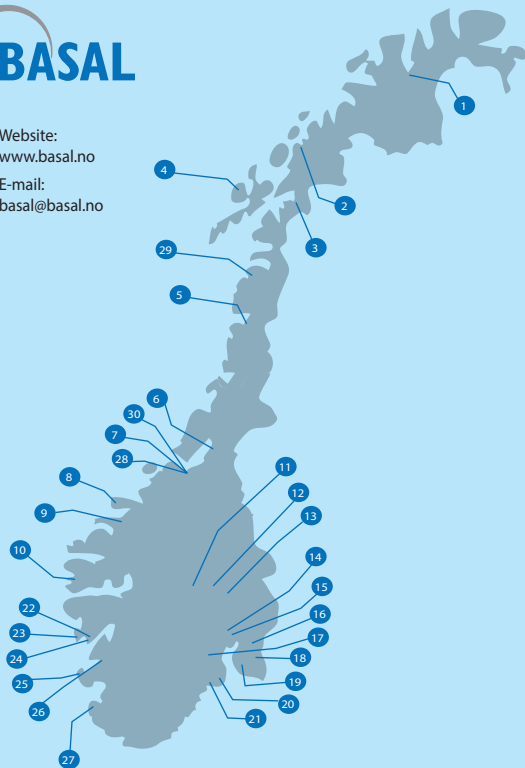


Basal ending and adjustment units in recycled materials				
DN	Dimensions (mm)			Weight approx. (kg)
	Type of ring	h	t	
650 (tongue and groove)	Adjustment	50		10
	Adjustment	100	70	20
	Ending	50		10
650 ("FALS" joint)	Adjustment	50		10
	Adjustment	100	90	20
	Ending	50		15





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