

ENGLISH
SIMPLIFIED VERSION
See Norwegian edition
for complete installation guide



BASAL **installation guide**

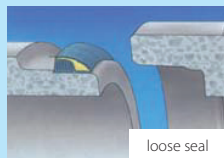
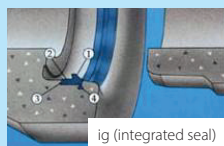
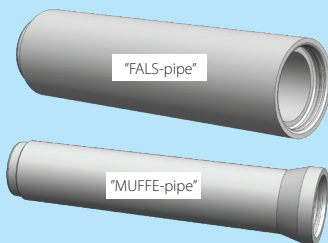
Installation of concrete pipes
and manholes

Adapted to the specification given in NS 3420-U
and "Vegnormalene" Handbook N200

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.

See more information in Norwegian version

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Receipt of product – Storage

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.



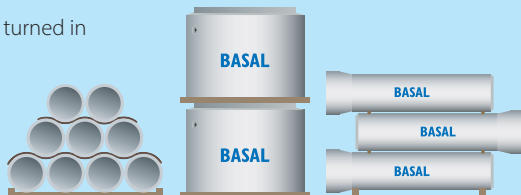
Storage

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.



Labelling of pipes and manholes

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.

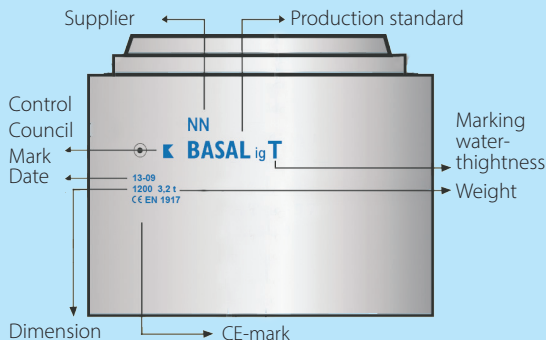


Pipes DN ≥ 1200 will normally always have asymmetrical reinforcement.
Smaller dimensions can also have this type of reinforcement.

Manholes

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

Example of labelling of Manhole



NOTE:

Pipes that are not T-marked as well as pipes with larger surface coverage than 5-6 m and DN > 1600 has not CE mark.

Manholes that are not T-marked and manholes DN > 1200 are not CE marked.

Lifting and assembly equipment

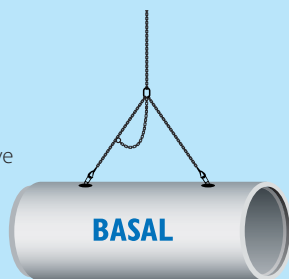
"FALS-pipe"			
DN	Length mm	Universal-anchorhead	Lifting and assembly equipment
300	1000 - 2000 2250	1 - 1,3	1 1C
400	1000 - 2000 2250	"	1 1C
500	1000 - 2000 2250	"	1 1C
600	1000 - 2000 2250	"	1 1C
800	1000 2000 2250	3 - 5	3 4 4C
1000	1000 2000 2250	"	3 4 4C
1200	1000 2000 2250	"	3 4 4C
1400	1000 2000 2250	"	3 4 4C
1600	1500 1750 2250	"	3 4 4C
1800	2000	"	4
2000	1500 2000	"	3 4
2400	1500	6 - 10	contact the supplier
3000	1750	15	"

Manholes normally have 3-part lifting system, and can have deviating lifting anchor.

Lifting equipment must be approved by the Norwegian Labour Inspection Authority.

Equipment may be borrowed, hired or bought from Basal companies.

See page 13 for information about Basal Pipelifter.



Manhole (loose seal)		
DN	Universal-anchor head	Lifting equipment
1000	1 - 1,3	2-part
1200	"	2-part
1400	"	2-part
1600	1 - 1,3 / 3 - 5	2-part / 3-part
2000	3 - 5	3-part
2400	3 - 5 / 6 - 10	3-part
2500	"	3-part
3000	"	3-part

Manhole ig		
DN	Universal-anchor head	Lifting equipment
1000	1 - 1,3	2-part
1200	3 - 5	2-part
1400	"	2-part
1600	"	3-part
2000	"	3-part

Some products weighing more than 7 - 10 ton have been based on safety factor 3 for the capacity of the lifting anchors. Such products are marked "SF3" and should not be transported/ belted in the lifting equipment.

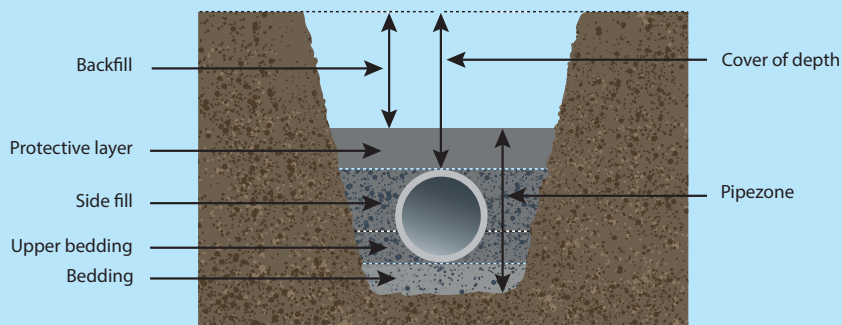


Each "leg" in the lifting chain **MUST**, at least have the same length as the manhole's diameter plus the distance from the top manhole to the lifting anchor.



Trench excavation – pipes

Trench excavation



Trench width

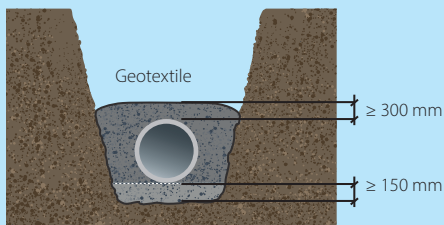
When compaction is necessary the trench must be dug wide enough to allow compaction equipment on both sides of the pipe.

Width of trench and minimum distances between pipelines are stated in NS-EN 1610, item 6.2.2. /VA-Miljøblad nr. 6

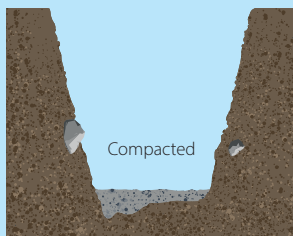
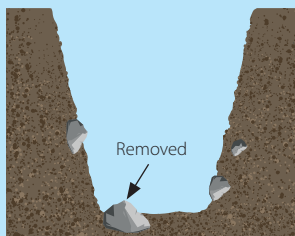
Geotextile – Trench bedding – Frost protection

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). It is also important that the bedding thickness varies as little as possible.

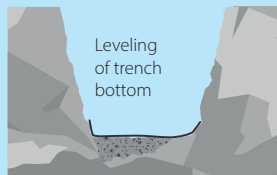
Frost protection:

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 – Bedding variation – Bedding

Rock trench

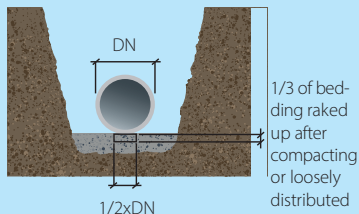
The bottom of the trench must be levelled with the same material as in the bedding. When there is a risk for material to washout, geotextile must be used under the bedding to prevent loose material from disappearing.



Bedding

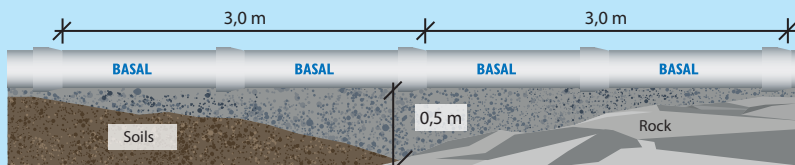
The bedding is the most important part of the trench cross section. The bedding must distribute the support under the pipe and ensure that large rocks, etc. are not pressing against the pipe. The bedding must consist of gravel (crushed).

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 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.



Minimum bedding thickness (I)		
DN	Normal ground conditions	Hard ground conditions*
DN < 400	150	150
400 ≤ DN ≤ 1200	200	300
1200 < DN ≤ 2400	250	400

*e.g. rock or concrete

Maximum nominal grain size for bedding material (II)		
DN	Well sorted material	Uniform sized material
DN < 400	32	22
DN ≥ 400	53	32

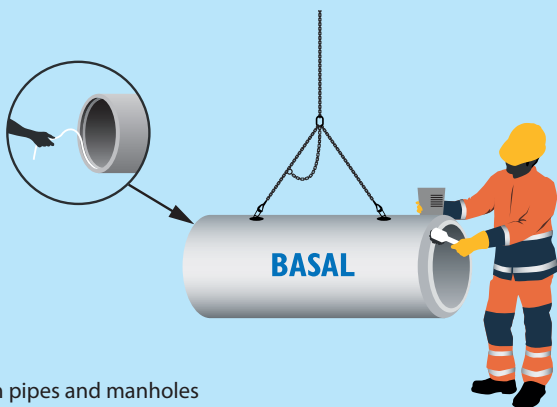
Bedding material must be free of frost and ice, and compacted to 95% Standard Proctor. Usually 1 pass with a vibroplate or vibrostamper provides optimal compaction of the bedding of uniform sized aggregate. After compaction, 1/3 of the bedding thickness must be loosened by raking to a width of at least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

Preparation before installing pipes and manholes

For drilling in concrete pipes for connection of new branch pipes, see Norwegian version

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 20, Installation of manholes and manhole seals.

Installation of pipes

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

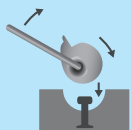
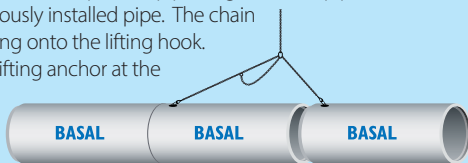


Figure 1



Figure 2

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 1.

Ensure that the lifting link is locked before lifting, figure 2. Any ice or concrete remainings around the lifting anchor must be removed before installation of lifting equipment.

The lifting eye of the bell must be movable in all directions, figure 3.

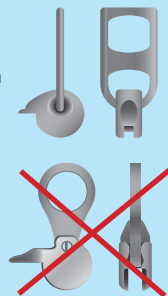
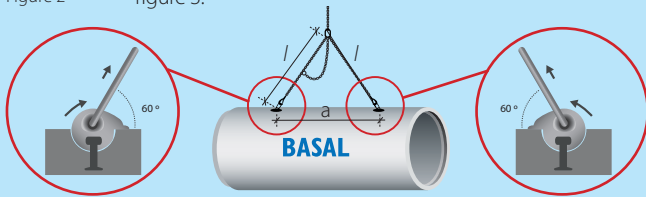


Figure 3



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 $l > a$.

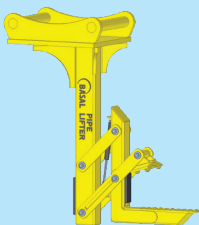
- Basal Pipelifter type 1: DN 200 - DN 400 Basal ig-pipe
- Basal Pipelifter type 2: DN 300 - DN 1200 Basal ig-pipe
- Basal Pipelifter type 3: DN 1400 - DN 2000 Basal ig-pipe
- May be equipped with all known types of quick hitch attachments.
- May be combined with rotary tilt and machine-fitted GPS
- 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.

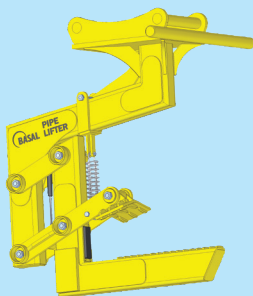
The work goes faster at the same time as important HSE considerations are taken care of. All installation and fitting may be carried out from the cabin of the digger.

NB!

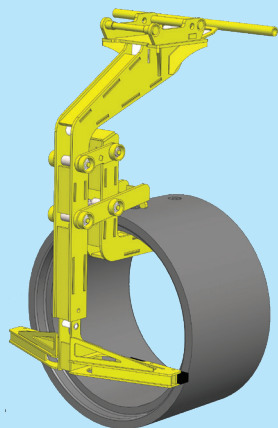
See page 5 for information about orientation of pipes when using the Pipelifter.



Basal Pipelifter type 1:
DN 200 - DN 400



Basal Pipelifter type 2:
DN 300 - DN 1200

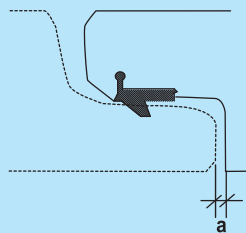


Basal Pipelifter type 3:
DN 1400 - DN 2000

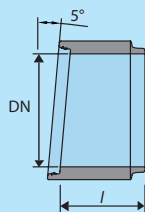
Angular deflection and permitted gap in joint

Max gap ig pipes					
DN	a (mm)			Recommended max angular deflection	
	Min	Recommended max	Max	(mm/m)	(°)
150		10	14	63	3,6
200		10	14	49	2,8
250		14	20	54	3,1
300	3	14	20	45	2,6
400	4	15	21	36	2,1
500	4	15	21	29	1,7
600	4	15	21	24	1,4
800	5	19	28	23	1,3
1000	5	19	28	18	1,1
1200	5	20	29	16	0,9
1400	5	20	29	14	0,8
1600	7	24	36	15	0,9
1800	7	24	36	13	0,8
2000	7	24	36	12	0,7
2400	8	42	63	17	1,0
3000	8	42	63	14	0,8

Internal gap (a) applies as an acceptance criterion.



Pipes laid in curves



BASAL ig-langbend "FALS-pipes"				
Measure mm			Radius m	Additional angular deflection in joint (°)
α	DN	l		
5°	500	900	10,1	1,7
5°	600	900	10,1	1,4
5°	800	900	10,0	1,3
5°	1000	900	9,9	1,1
5°	1200	900	9,8	0,9
5°	1400	1850	20,6	0,8
5°	1600	1850	20,5	0,9
5°	1800	1850	20,4	0,8
5°	2000	1350	14,6	0,7
2,5°	2400	1350	29,8	1,0
5°	2400	1350	14,4	1,0

Sidefill, protective layer and backfill

Sidefill, protective layer

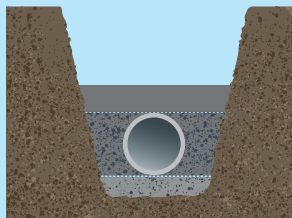
Sidefill must be placed in layers on each side of the pipe before compressing.

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 above the pipeline (top of pipe) shall normally be loosely distributed.

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 with a cover of depth bigger than 2/3 of the indication on the pipe.

Sidefill, protective layer and backfill

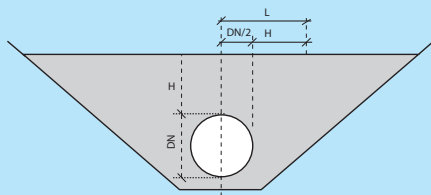
Backfill

The backfill material must not contain stones with a larger diameter than 0.3 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 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 cover of depth 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 cover of depth 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.

Watertightness by air testing - pipes

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 (P0).

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

For testing of DN > 1000, please refer to NS 3420-U.

DN 500 - 1000 can also be tested for vacuum, see NS 3420-U.

Test method	Pressure mVS		Test time with air (minutes)					
	P0	Δp	DN200	DN300	DN400	DN600	DN800	DN1000
LC	1	0,15	3	4	5	8	11	14
LD	2	0,15	1,5	2	2,5	4	5	7

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

Trenching manholes

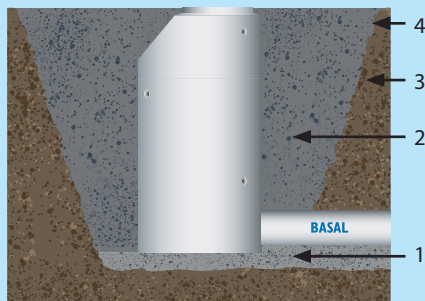
Bedding

Bedding is levelled to the correct height.

Support bars or concrete foundation should normally not be used.

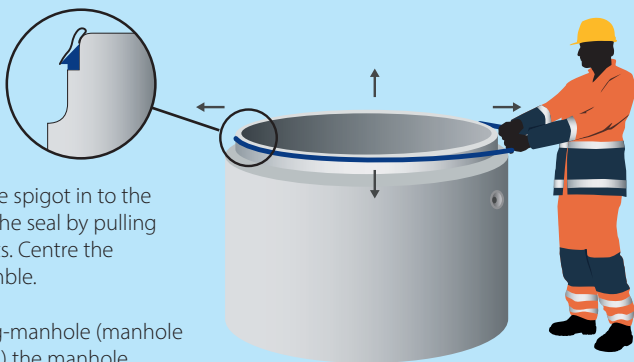
Use gravel (crushed) $d_{\max} = 53 \text{ mm}$, compacted to 95 % Standard Proctor, similar to pipes.

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



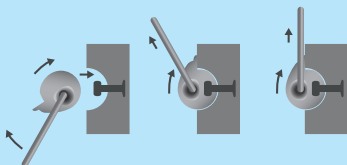
1. **Bedding.** Same material, types and grain size, as for pipes.
2. **Backfill.** Same material, types and grain size, as for sidefill of pipes.
3. **Native material**
4. **Use Geotextile** where the native material is clay, silt or similar.

Installation of manhole and seal



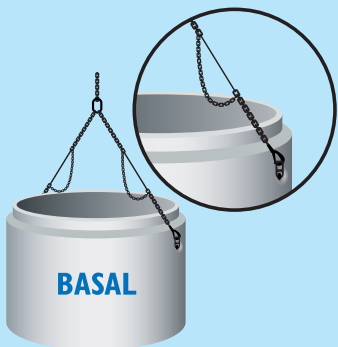
Place the seal on the spigot in to the recess. Stretch out the seal by pulling it out at some points. Centre the manhole and assemble.

When using Basal ig-manhole (manhole with integrated seal) the manhole spigots shall be lubricated, see page 11



Basal manhole system is handled using a chain sling and lifting bell.

To ensure that the "nail" on the lifting bell points towards the lift, a chain sling should be used.



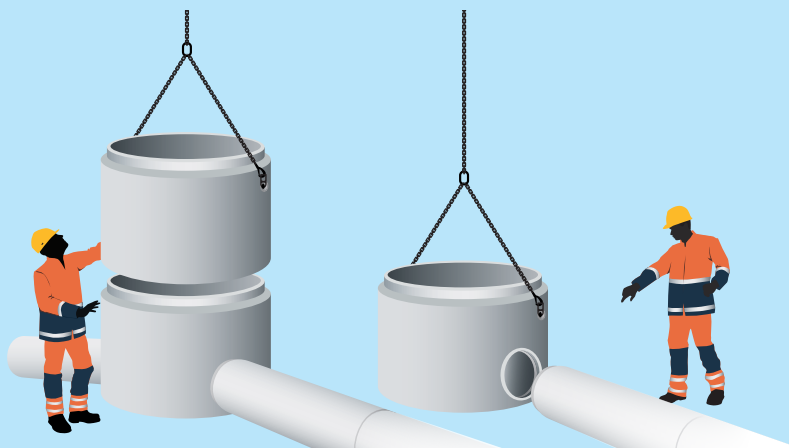
To prevent the lifting bell from coming out of position, lifting equipment to manholes should have a chain sling fitted. Chain sling also eliminates the risk of crushing damage.

Note:

Chain sling is a "rubber band" that is attached on the chain link, and holds the lifting bell in position before tightening the chain.

The chain sling can be purchased from the Basal companies.

Installation of manhole and seal



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.

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.

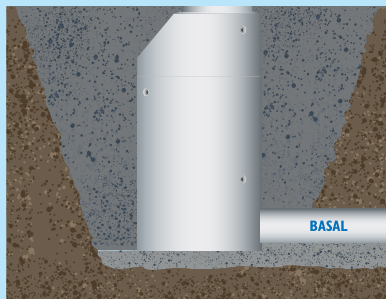
For larger pipe dimensions the base section is jacked on to the spigot using a special installation tool.



Testing with air

For manholes DN ≤ 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 18, 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.



Testing with water

- The manhole is filled with water to the top cone or cover slab
- Conditioning
- Refill to the top cone or cover slab
- After 30 minutes new amounts of water are fed to the top cone or cover slab
- 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. .

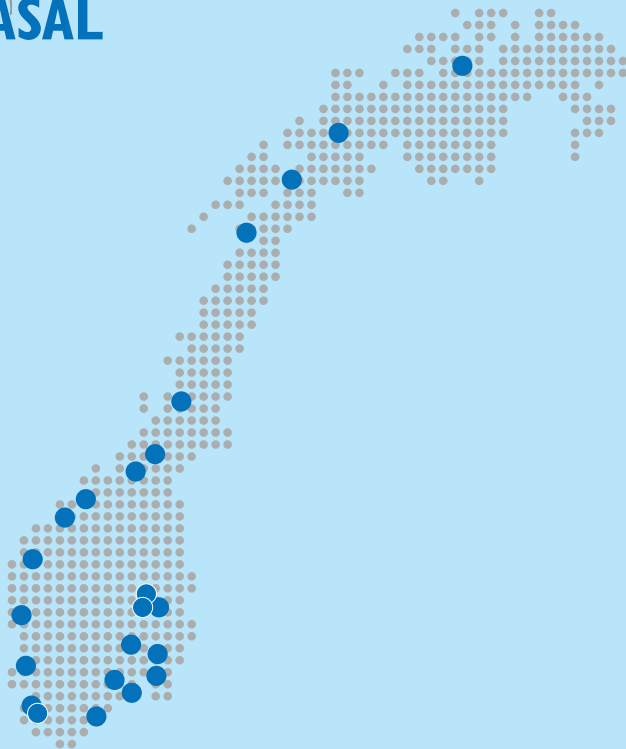
Use of lubricant

Indicative use of lubricant

DN	Grams per. joint	Quantity joint per. bucket	
		1,4 kg	4 kg
300	62	23	64
400	74	19	54
500	91	15	44
600	109	13	37
800	149	9	27
1000	184	8	22
1200	231	6	17
1400	284	5	14
1600	328	4	12
1800	389	4	10
2000	411	3	10
2400	495	3	8
3000	690	2	6



See the Norwegian version for assembly of cover.



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Ulvestad Sementvarefabrikk AS · Førde Sementvare AS · Hedrum
Cementstøperi AS · Holmen Betong AS · Jaro AS · Loe Rørpro-
dukter AS · Loe Rørprodukter Nord AS · Loe Sylteosen Betong AS
· Loe Midt-Norsk Betong Mosjøen AS · Midt-Norsk Betong AS ·
Nobi AS · Skjæveland Gruppen AS · Ølen Betong AS ·
Østfold Betongprodukter AS · Østraadt Rør AS