



37<sup>TH</sup> INTERNATIONAL  
**NO - DIG**  
FLORENCE 2019

Fortezza da Basso • FLORENCE (Italy)

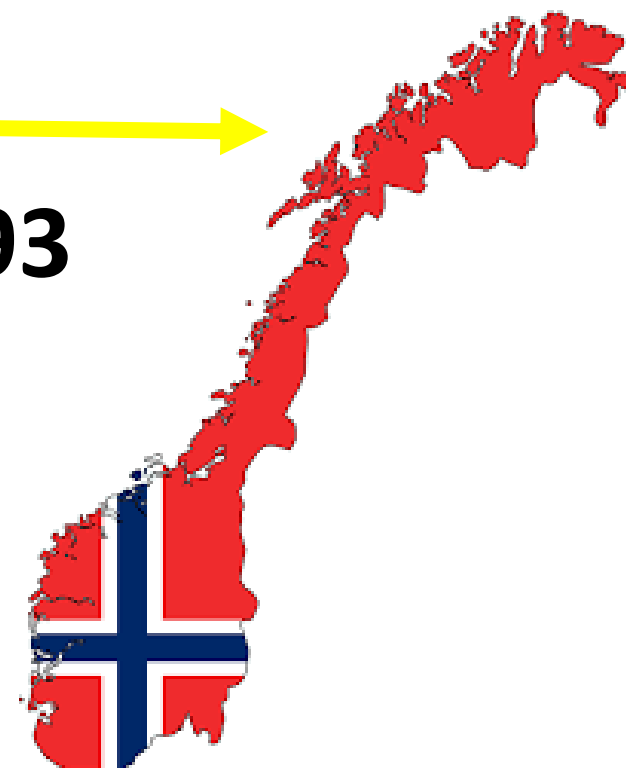
30<sup>th</sup> September • 2<sup>nd</sup> October 2019

EXPERIENCES WITH REHABILITATION OF POTABLE WATER PIPES  
IN NORWAY

HENDRIK PANMAN



**1993**



Hendrik Panman - 1967



Scandinavian Society for Trenchless Technology

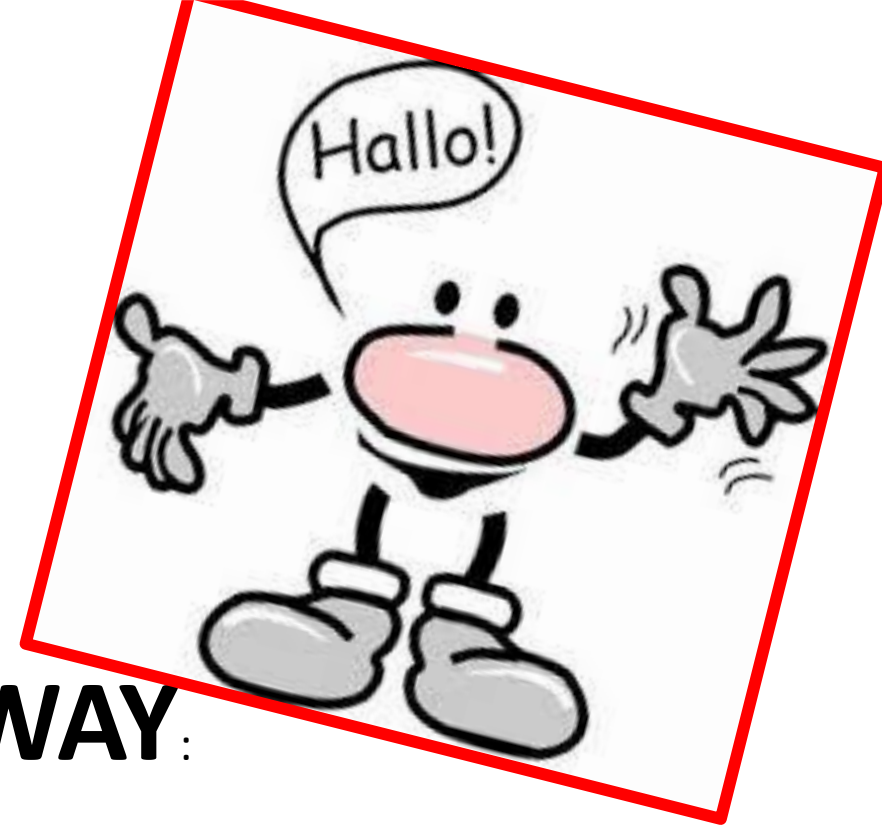
Hello!





**NORWAY:**

5 Million People



## NORWAY:

- 2 % Settlement
- 4 % Agriculture
- 82 % Nature
- 11 % Lakes - swamp
- 1% Ice







Relineurope and Kjeldaas have set up a new Alphaliner record:  
352 m Alphaliner500G with a wall thickness of 6,5 mm  
installed and cured by REE 4000 Professional  
in one installation step!

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**Kjeldaas**

**RELINEREUROPE®**



**INE**

HALLO



PRIMUS  LINE





LEDDINGSFORNYELSE  
UTEN GRAVING

Kjeldaas

Kjeldaas

MAN

KJ 37416

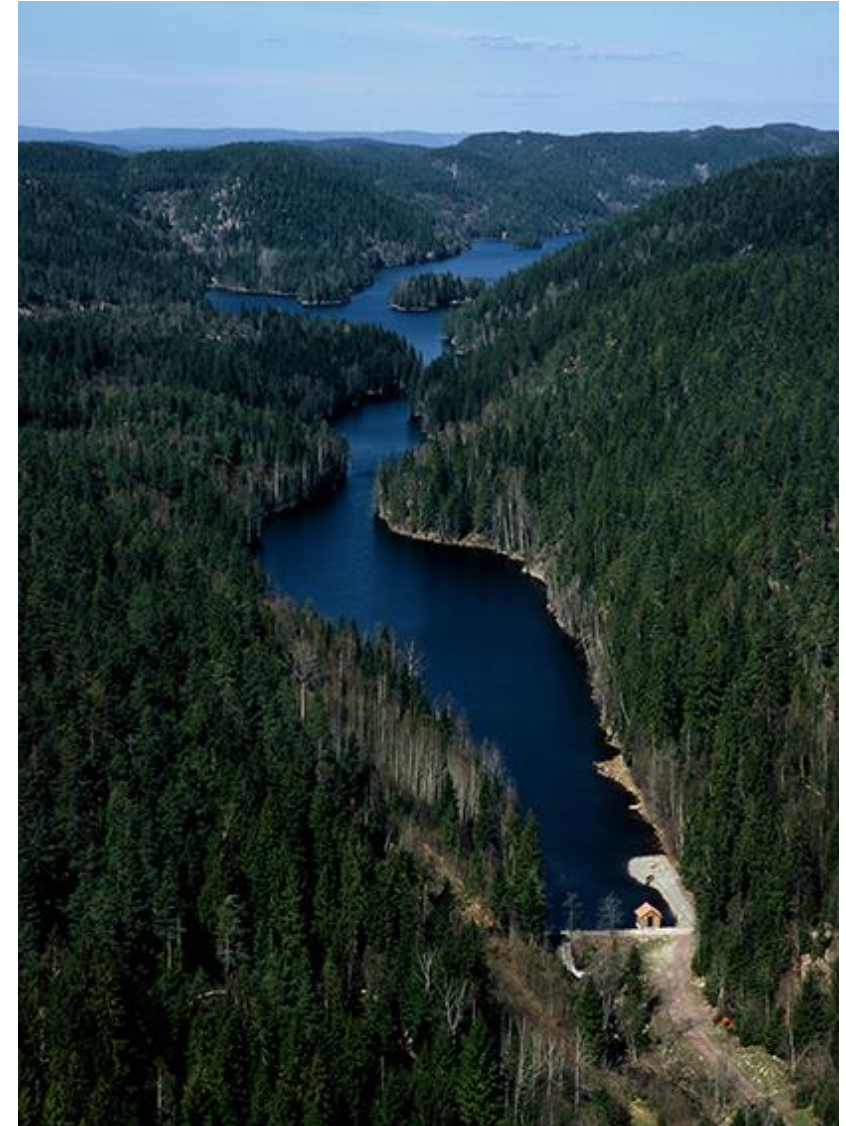




hallo!

# Where do we get the water

- Lakes 90 %
- Borehole 10%
- 96% People get from public water works (1011)
- 4% People get from private water works (570)

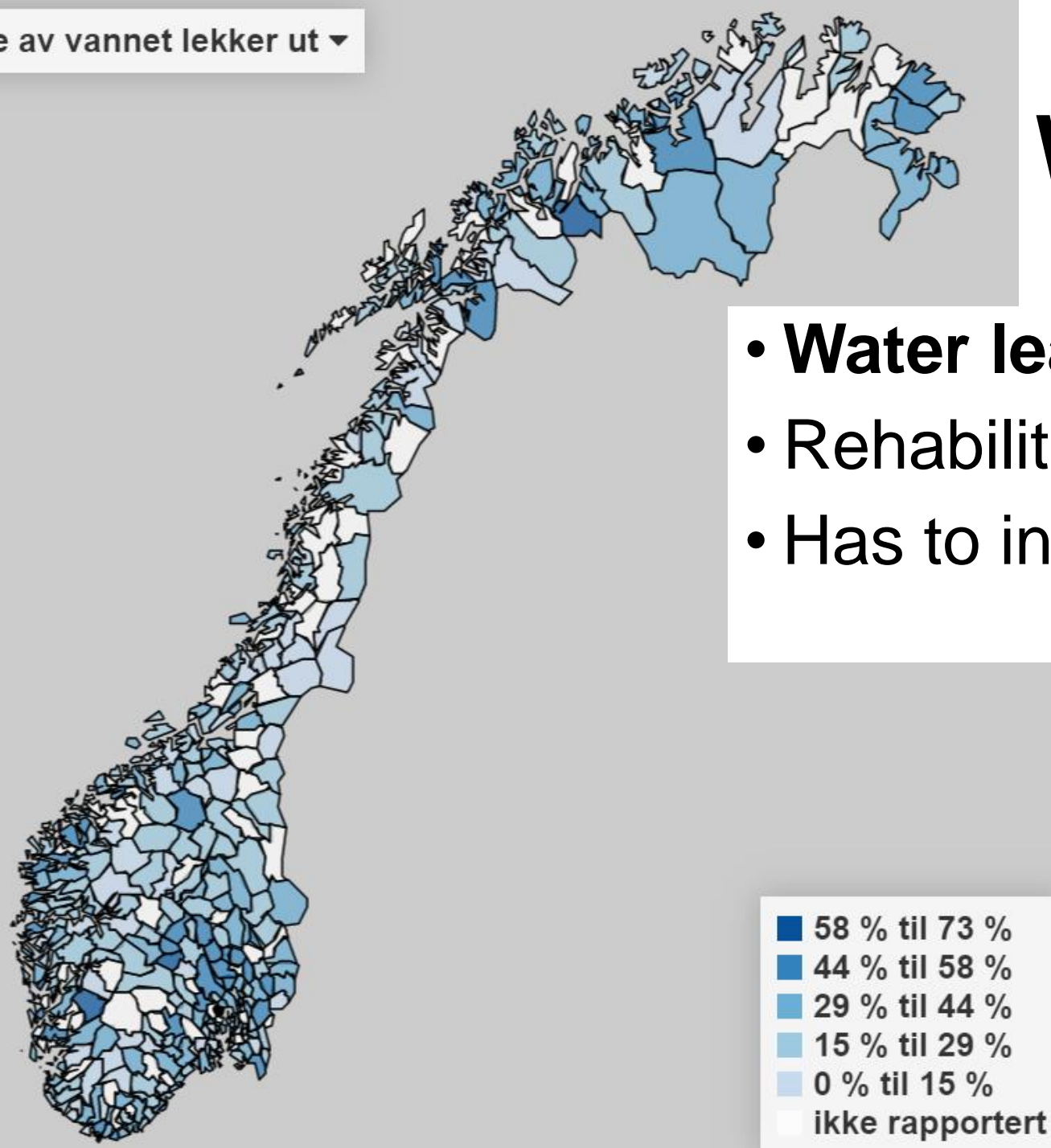


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Så mye av vannet lekker ut ▼

# Water loss Norway

- **Water leakage 35%**
- Rehabilitation 0,7%
- Has to increase 1,2 % up to 2040



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# Manholes

- Valves
- Fire hydrants
- Frostdepth 1,8 meter



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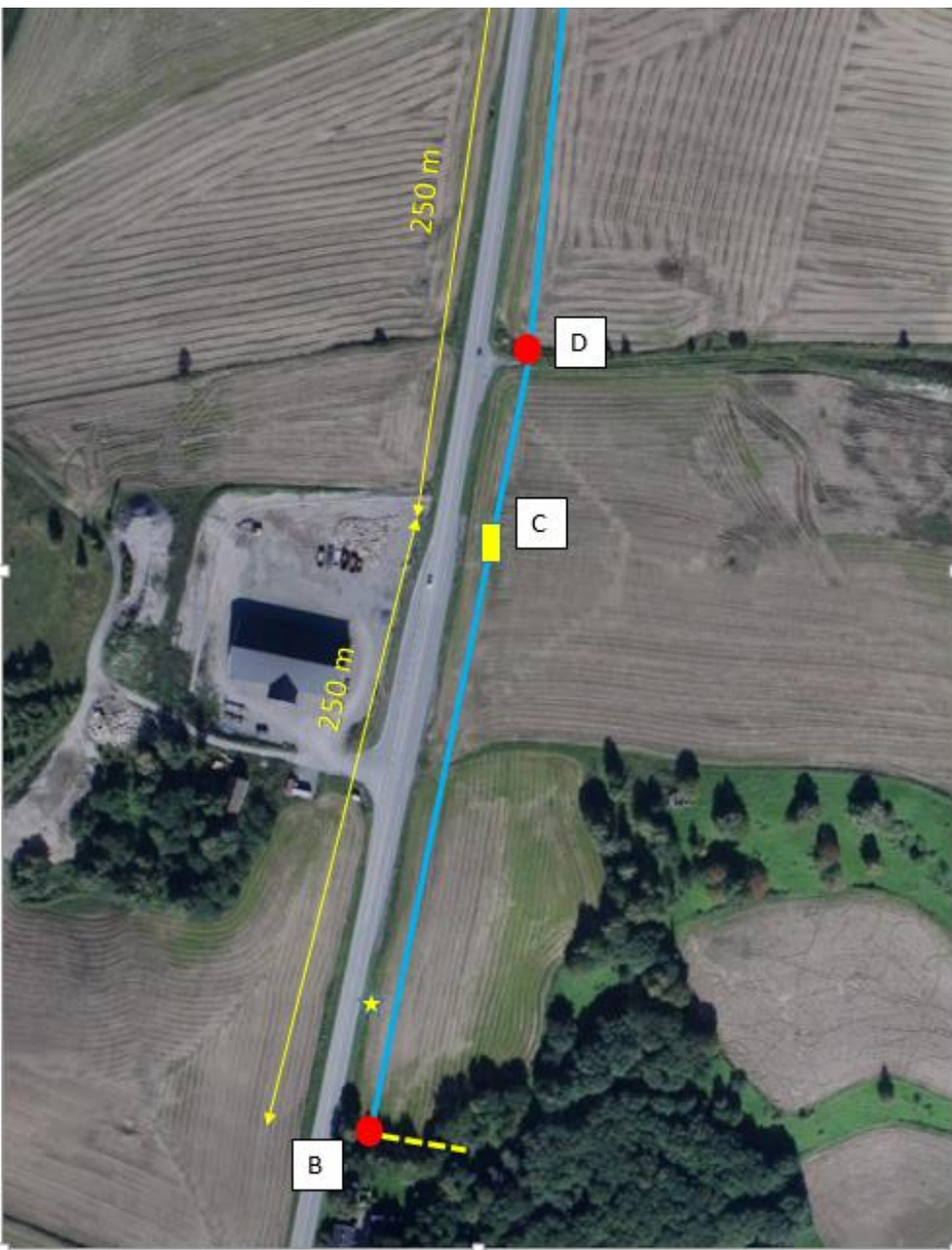
# 2012 Start CIPP - UV

- April → 2nd hand truck
- Mai → IFAT - robotics
- Mai → Training at BKP Berolina
- Juni → First installation



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# The world's first UV-light-cured GRP-liner for potable water pipes



**Sande**  
**Asbestos**  
**DN250**  
**500 meter**  
**2 sections**

May 2016



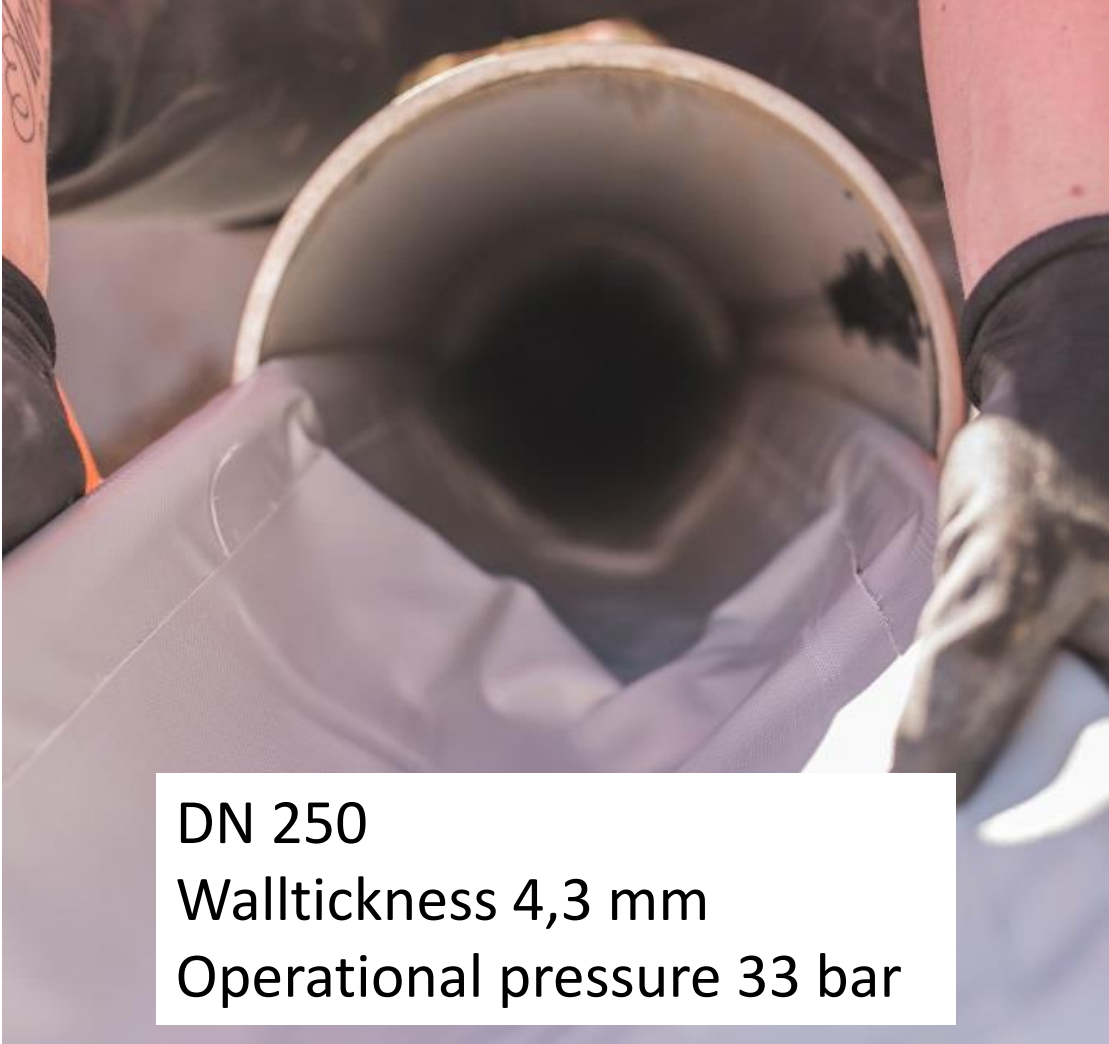
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250 meter liner in the box



UV cured



DN 250  
Wallthickness 4,3 mm  
Operational pressure 33 bar

*The Kjeldaas and SAERTEX multiCom® team presenting the product at IFAT*

# IFAT 2016



Saerbeck, September 2016

Norway is one step ahead of the rest of Europe with its trenchless rehabilitation of an asbestos cement potable water pipe with the SAERTEX-LINER® H<sub>2</sub>O



**Kjeldaas**

# Stavanger Concrete DN900 75 m

June 2017



Kjeldaas



**DN 900 – wallthickness 8,3 mm – structurall strength –  
operational pressure 7,9 bar**



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**I·V·A·R**



**SAERTEX**  
*multiCom* **H<sub>2</sub>O**

**Kjeldaas**



Saerbeck / Stavanger, 14 Juni 2017

Unique worldwide: Tab connection  
succesful installed to a  
rehabilitated potable water pipe!

Lærling med på verdenspremiere

Vannspeilet 3-2017

Vannspeilet 3-2017



“Trainee on the world premiere”



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# Holiday 2017 – biking along the west coast of Norway

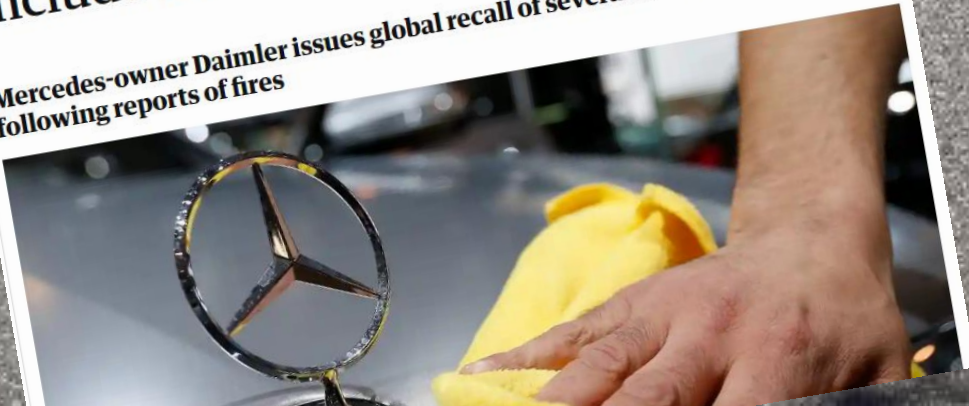


## Apple innrømmer iPhone-feil: Telefoner skruer seg plutselig av

Har du opplevd at iPhone din tar tidlig kvelden, selv om det er mye batteri igjen?  
Apple lover nå å fikse telefonene de mener er rammet.

## Global recall of 1m Mercedes cars 'could include 75,000 in UK'

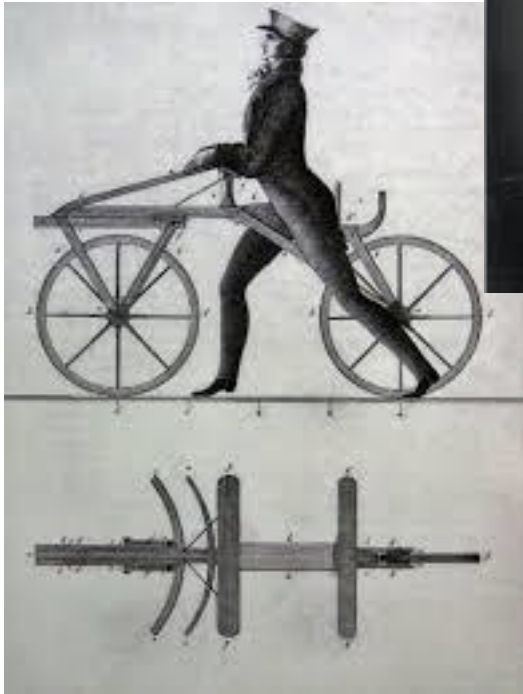
Mercedes-owner Daimler issues global recall of several models  
following reports of fires



## Tesla tilbakekaller 11.000 biler av typen Model X

Årsaken er feil med bilsetene, sier Tesla i en melding til CNBC.





Imagine a world without innovation



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# Good information – take responsibility



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March 2018



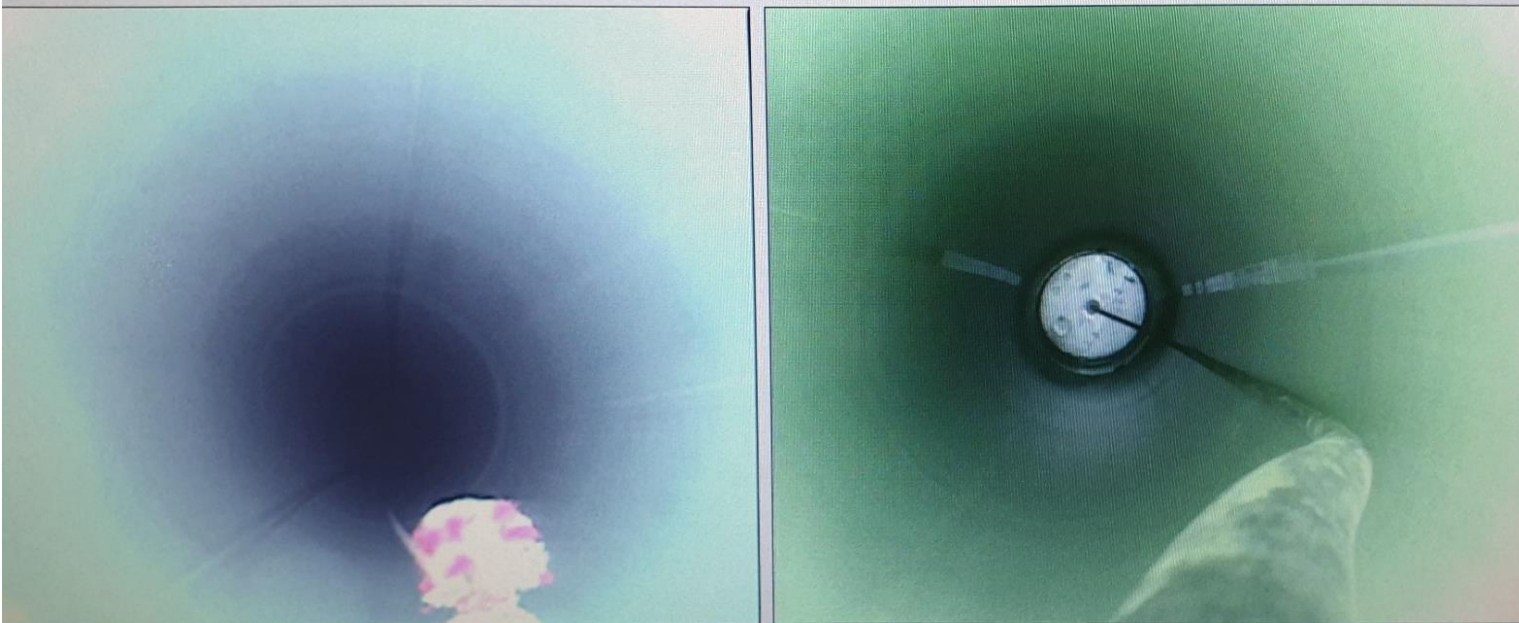
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**Curing  
DN 900  
8,3 mm  
120 meter**



**Kjeldaas**



**SAERTEX**  
multiCom<sup>H<sub>2</sub>O</sup>



**Kjeldaas**

# Drammen Iron cast DN 600 - 860 meter

## Omfattende vegarbeider i Rosenkrantzgata i sommer

Informasjon

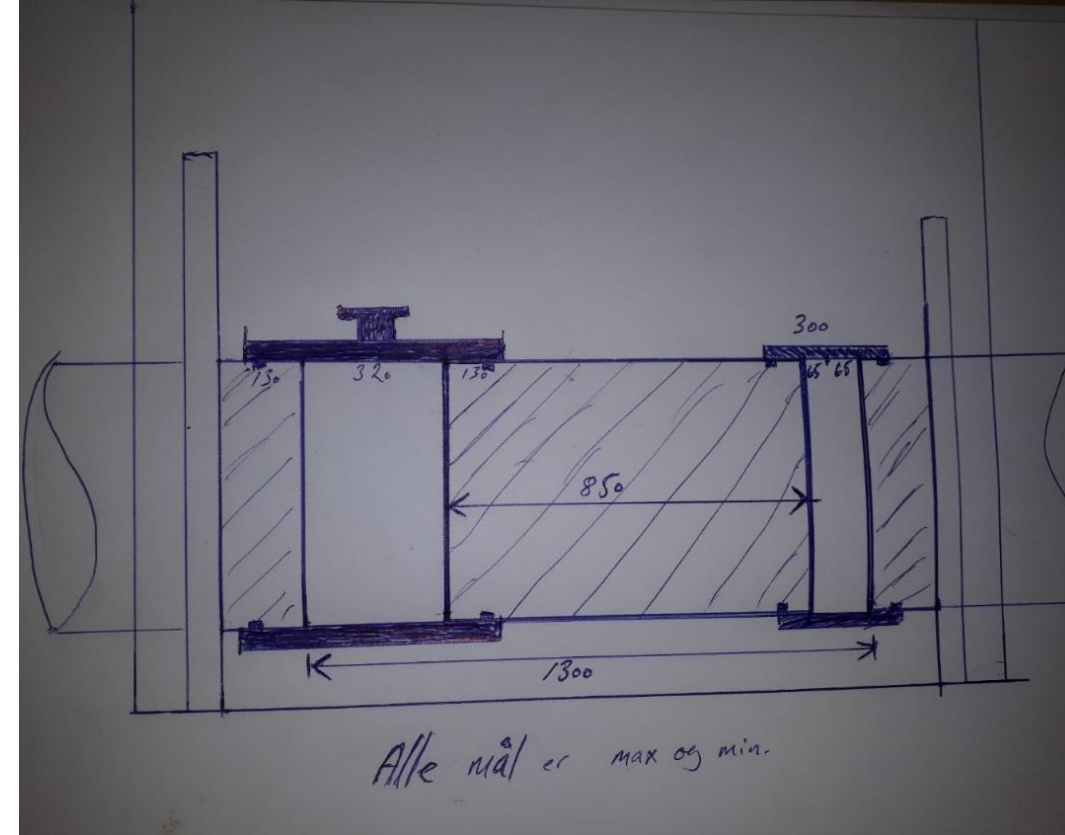
Juni 2017



August 2017



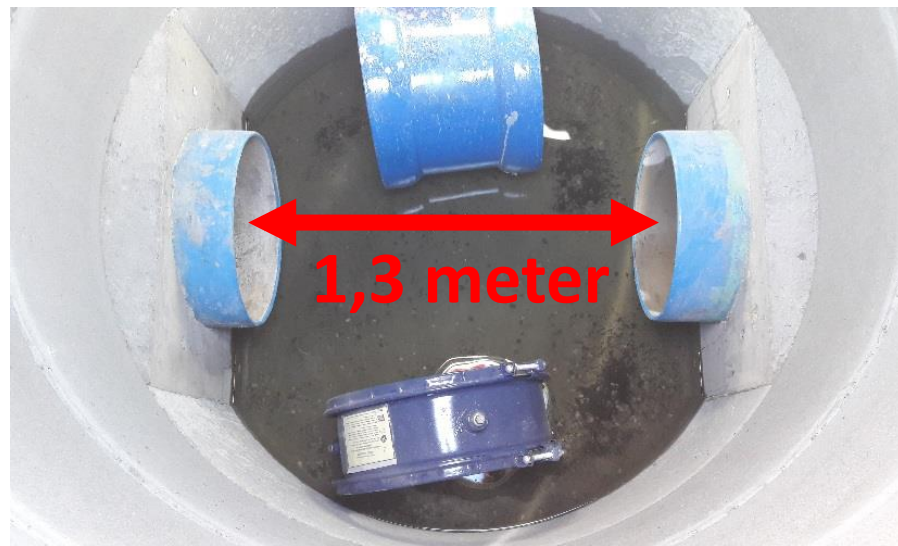
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# Manhole production «on side»



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# Longest installation 265 meter DN 600



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# PVC DN 280

## 350 meter



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**New record???**  
**350 meter**  
**one section**

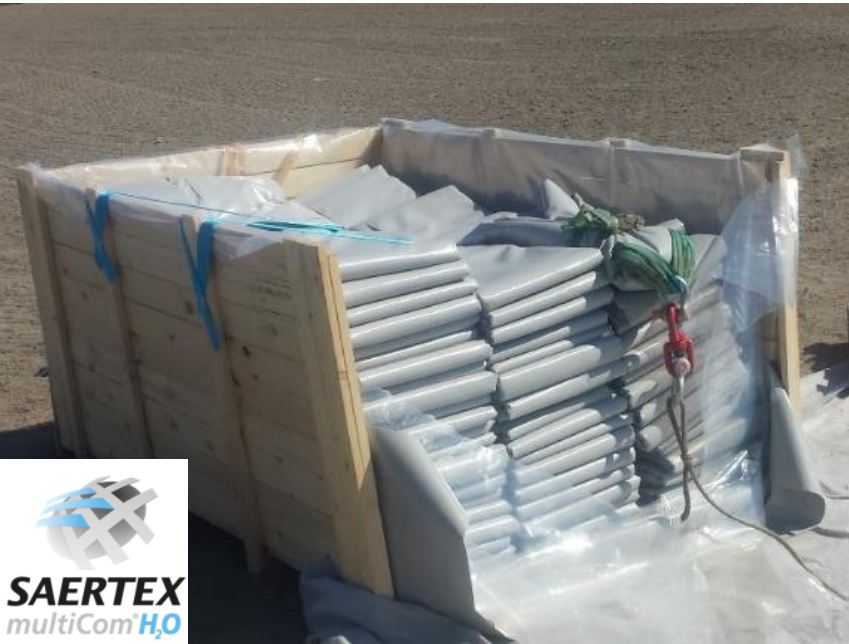


December 2018



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# Shooting a mouse with a canon



**Seartex H2O liner**  
**DN 250 – 4,3 mm**  
**8 kg pr meter**



**Swivel**



**Pulling force 10 tonn**



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# Asker Iron cast DN 200 GRP flange 50 + 75 meter

**RELIN**APTEC  
Advanced Liner for Pressure Pipes



Certified to  
NSF/ANSI 61

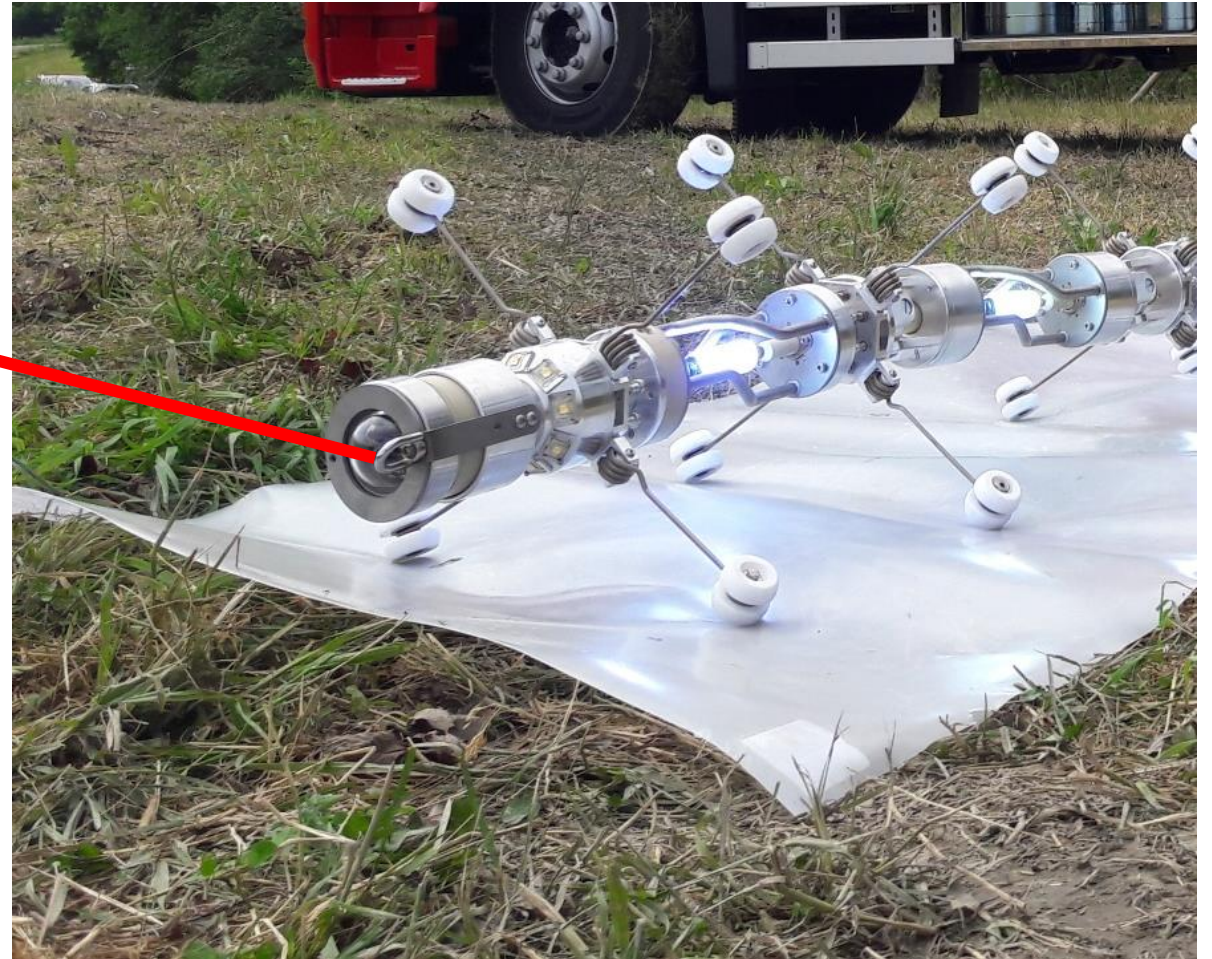
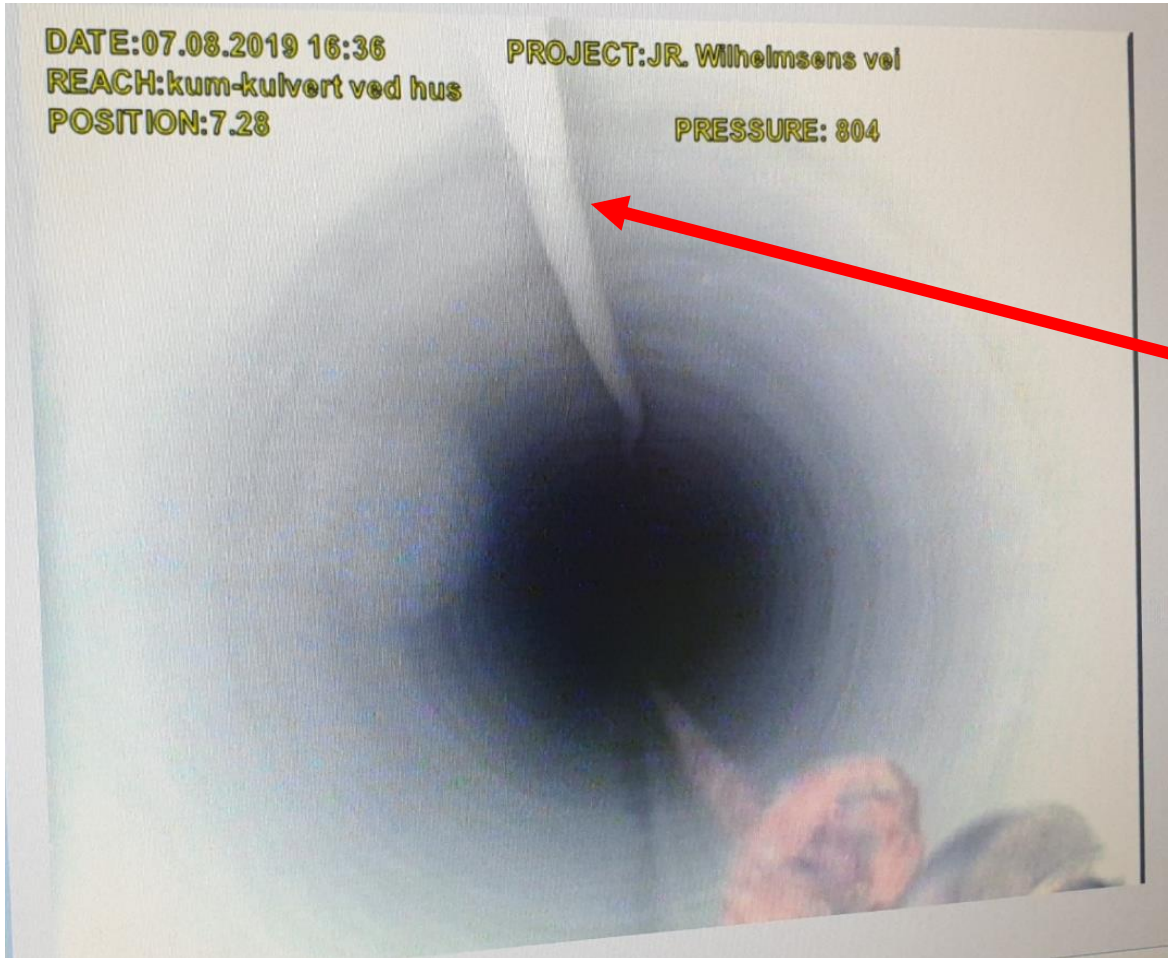


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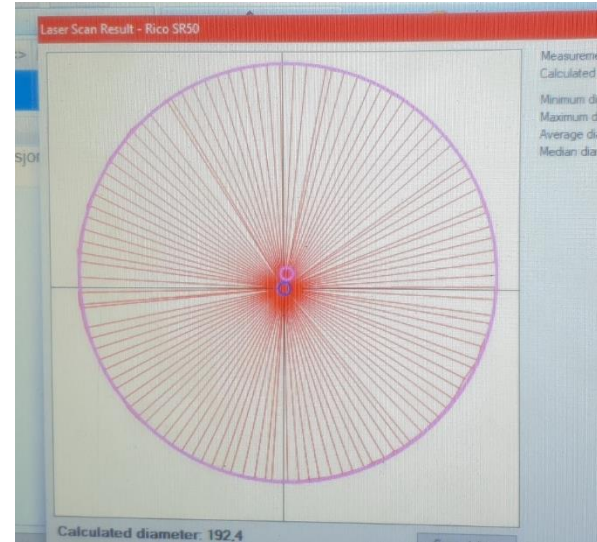
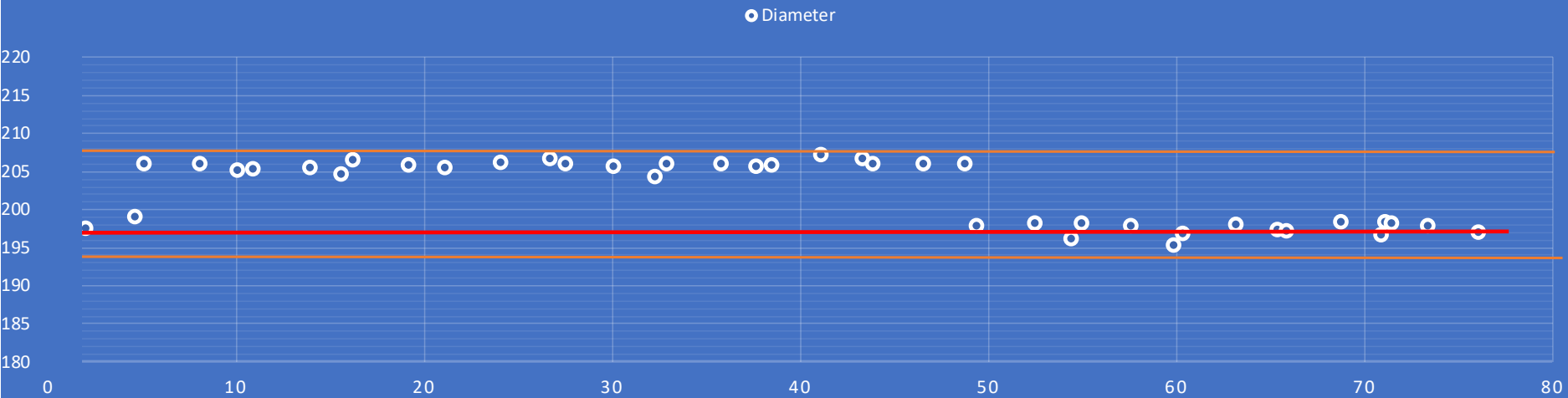
# You see what you get



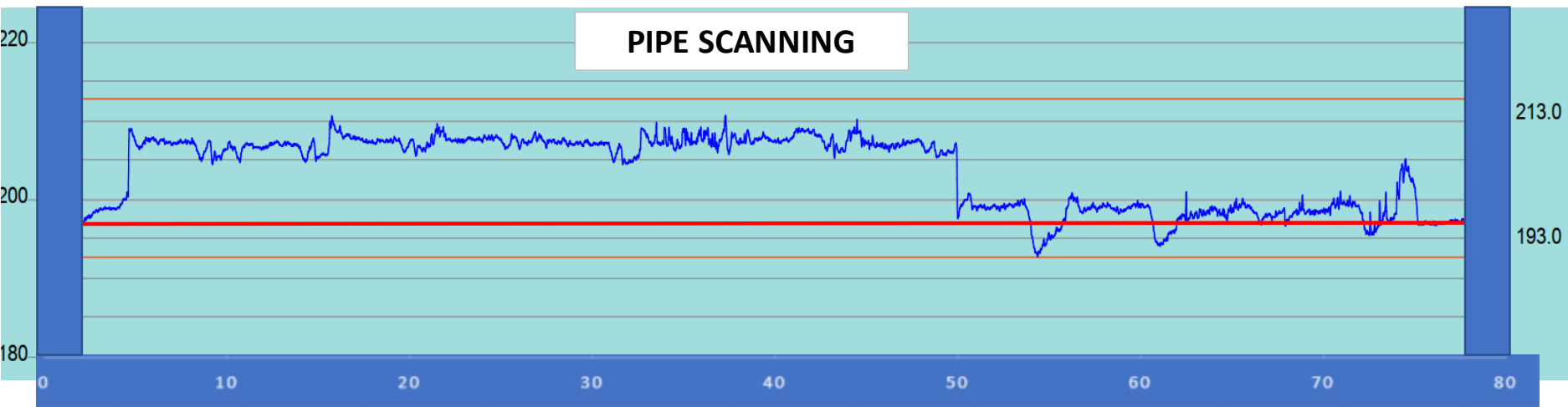
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## POINT MEASUREMENT EVERY 3 METER



## PIPE SCANNING



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# Advantage with the GRP flange

“One small step for man, one giant leap for mankind”



**RELINE**APTEC  
Advanced Liner for Pressure Pipes



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# GRP liners do not like bends





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Sørum  
PVC  
DN 150  
165 meter  
1 section  
2 bends



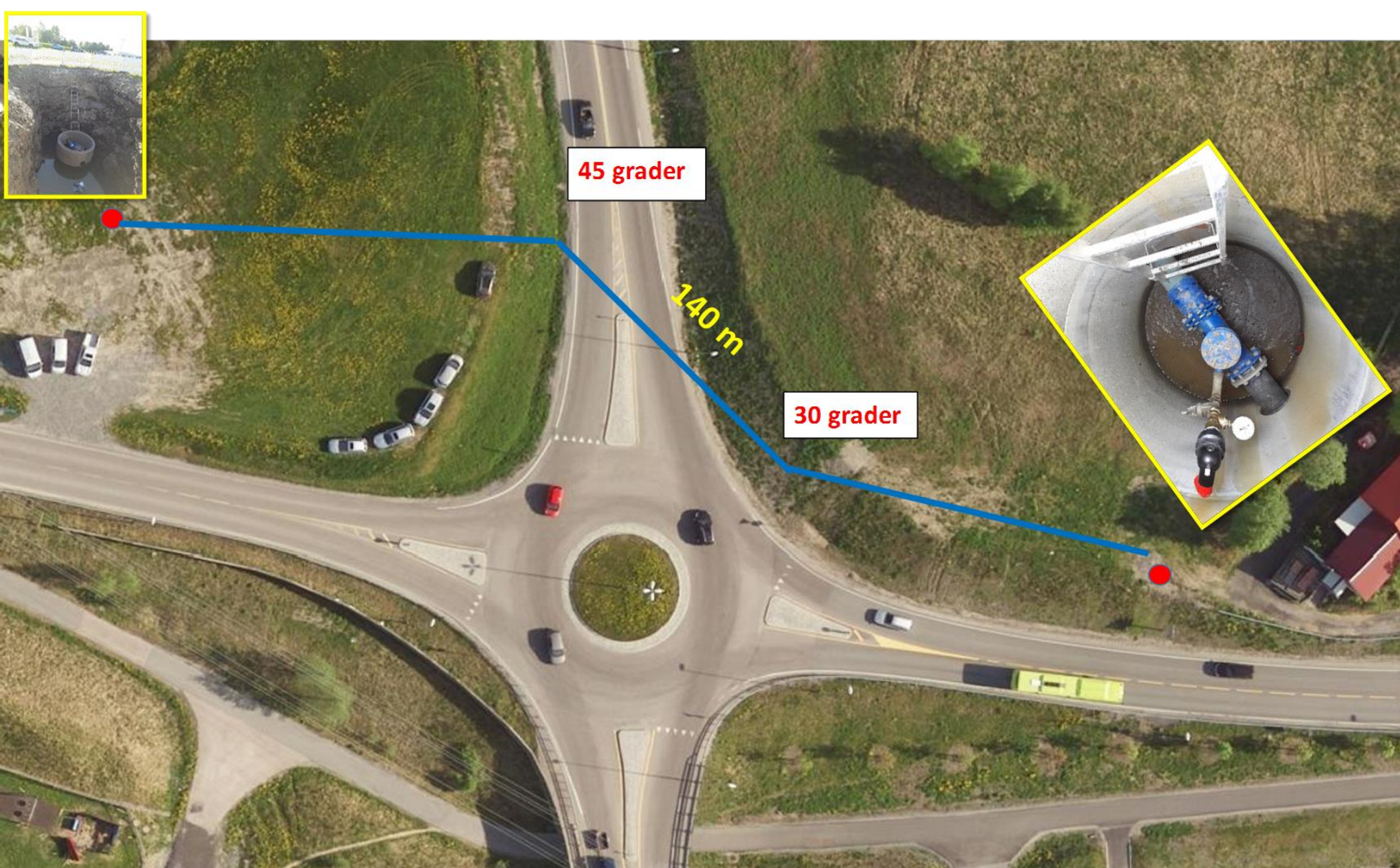
April 2014

PRIMUS  LINE

The prime solution for pipes.

Kjeldaas





Ås  
**Asbestos**  
**DN 150**  
**140 meter**  
**1 section**  
**2 bends**

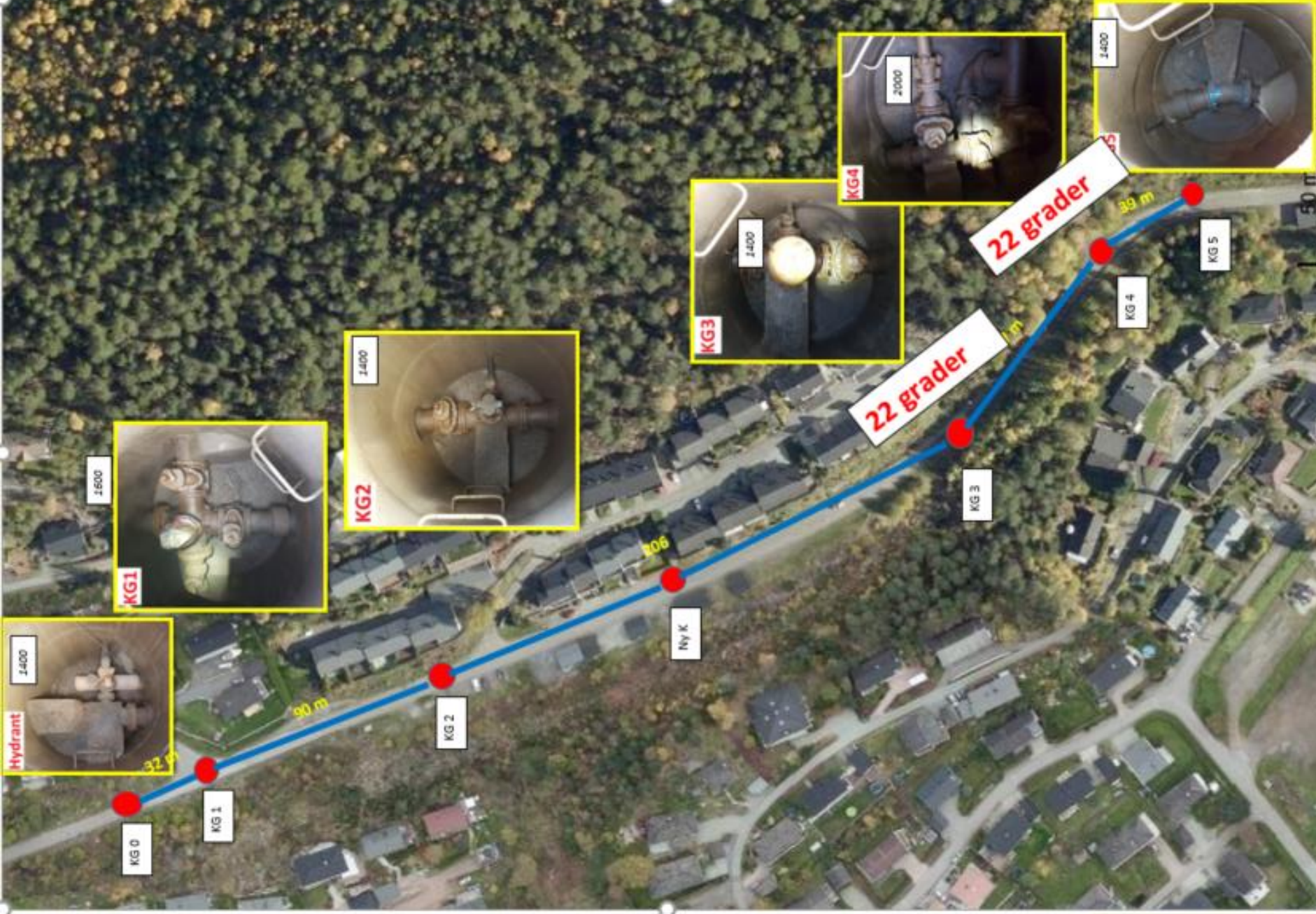
**PRIMUS**  **LINE**  
The prime solution for pipes.

May 2018



**Kjeldaas**

**Sande  
Asbestos  
DN 200  
430 meter  
1 section  
2 bends**

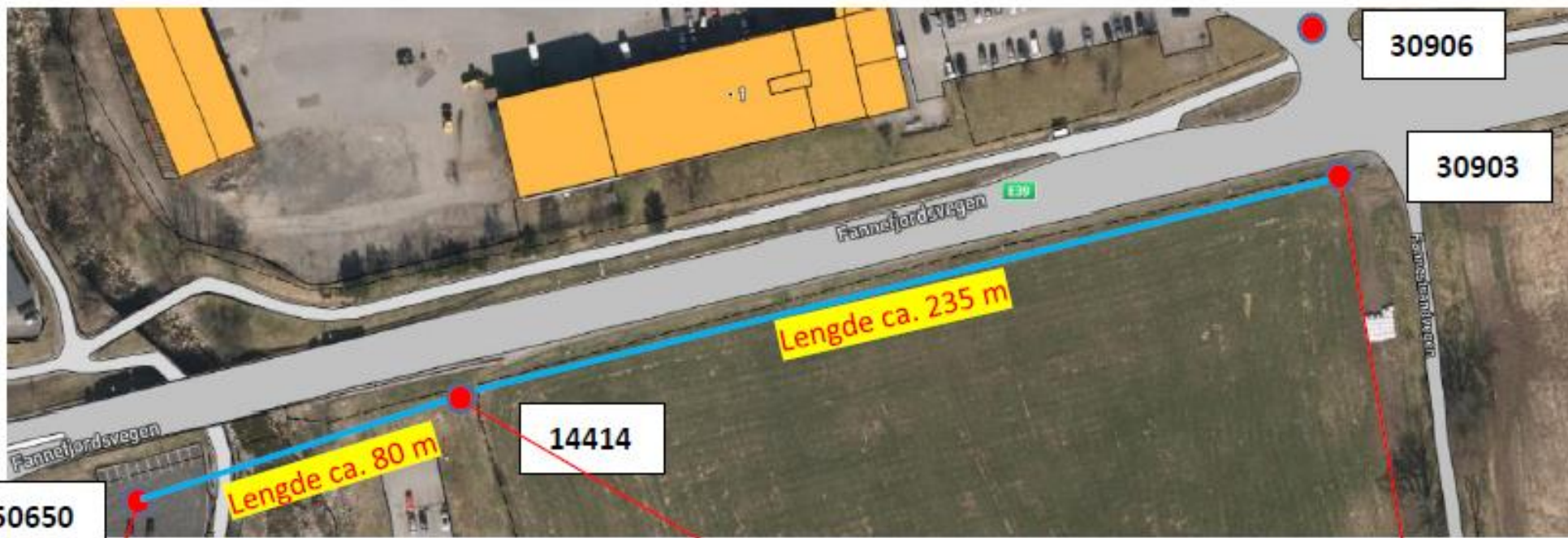


**PRIMUS LINE**  
The prime solution for pipes.

August 2018



**Kjeldaas**



**Molde**  
**Asbestos**  
**DN 150**  
**315 meter**  
**1 section**  
**2 bends**



Sarpsborg  
Iron cast  
DN 500  
630 meter  
1 section  
4 bends



PRIMUS  LINE  
The prime solution for pipes.



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Avavi as  
16.01.19 11:13 F 0.00 P -1.2° R -1.0°  
Sarpsborg Baterød Vannverk  
E < G  
Stål sirkulært 500



29.2m 2.0bar 10.80± 12:00↑ Y -135°↙

# DN 500

## Before scraping



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«Potable» water?



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27.02.19 12:39 F 0.00 P -4.1° R 12.3°  
Batterød  
E -> A  
Støpejern, grått 500

# DN 500

## After scraping

19.8m 2.0bar 11.39<sub>min</sub> 12:00↑ Y -135°↙



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**Length transport reel – 6 m**



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# Calibrating



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# Assembling connector



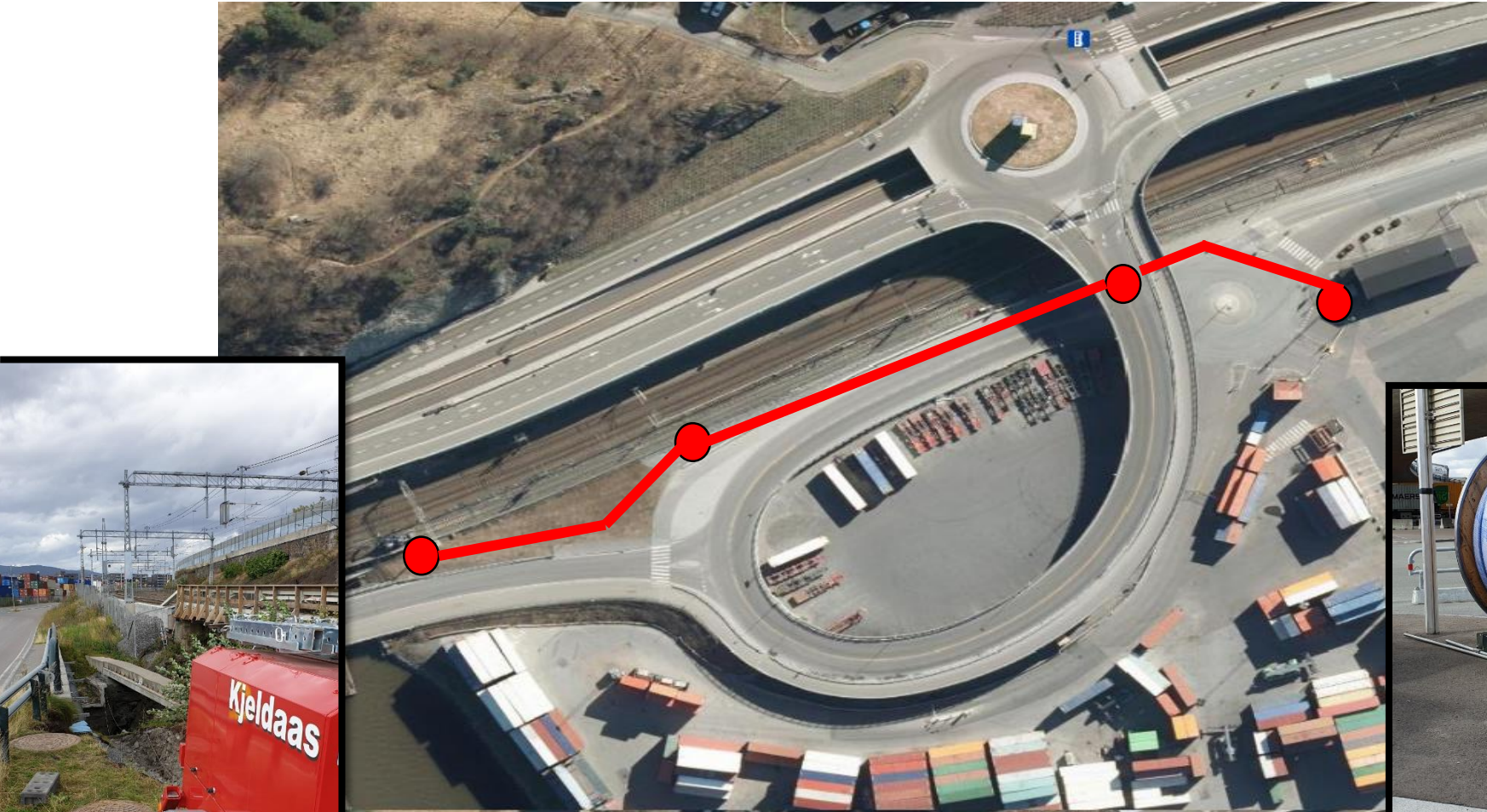
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# Primus Line connector DN 500



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**Oslo  
DN 300  
230 meter  
1 section  
2 bends**



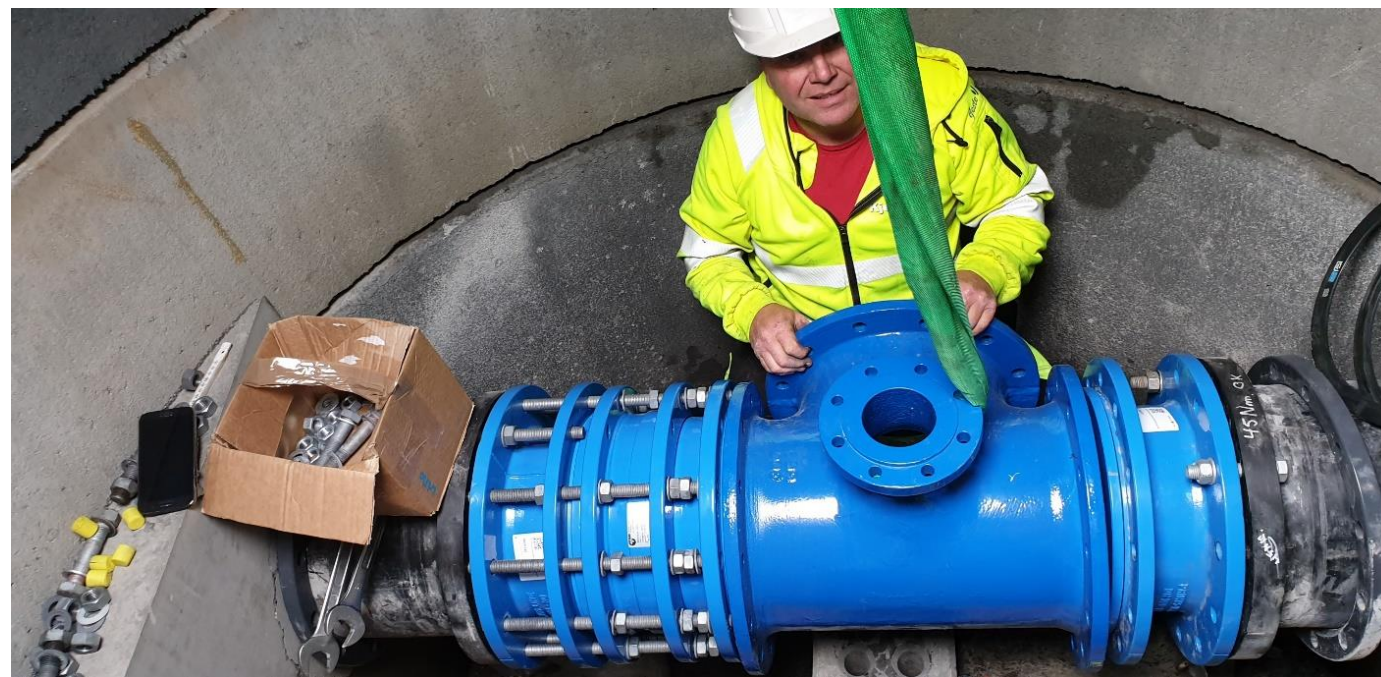
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# Manhole C

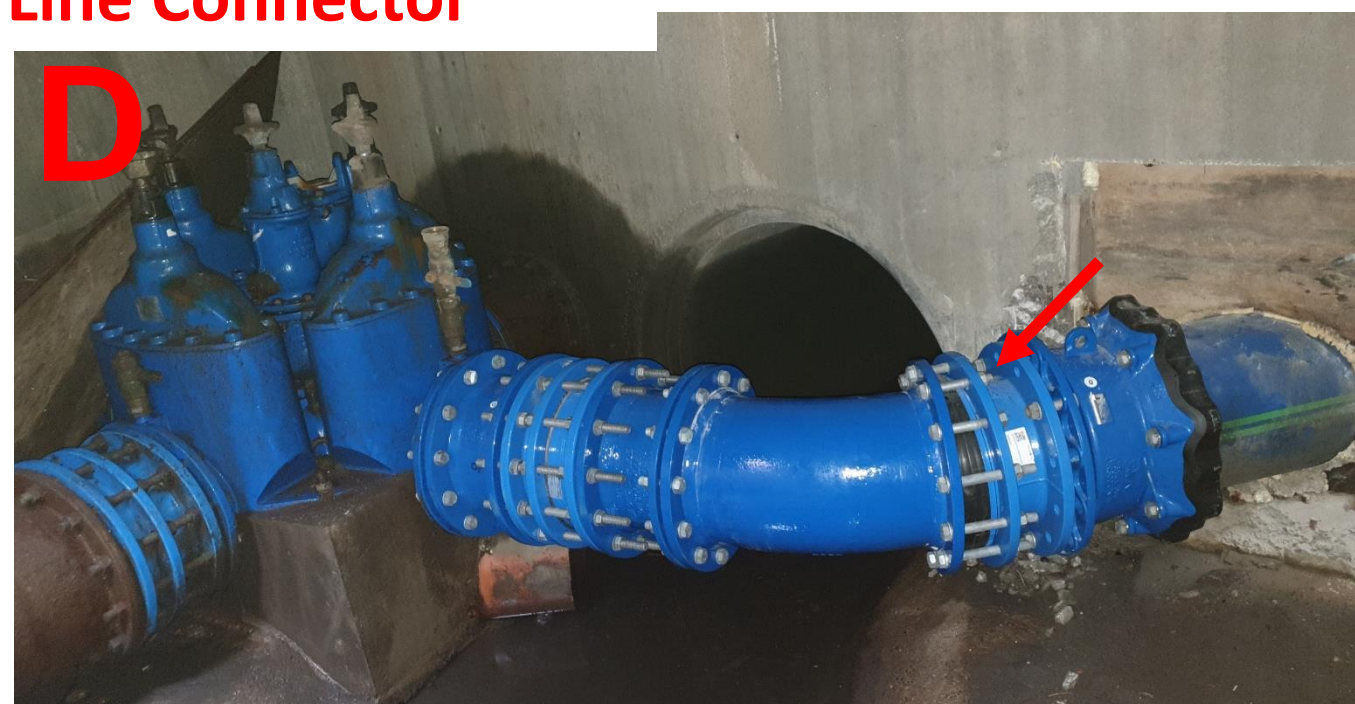
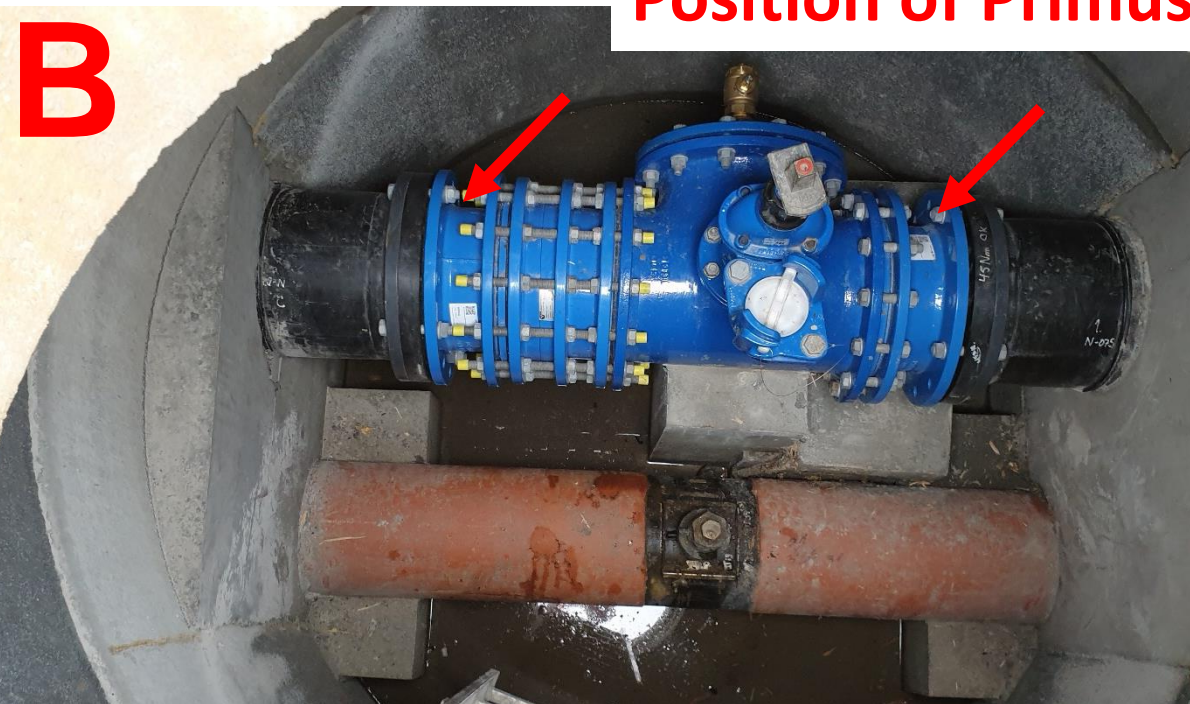
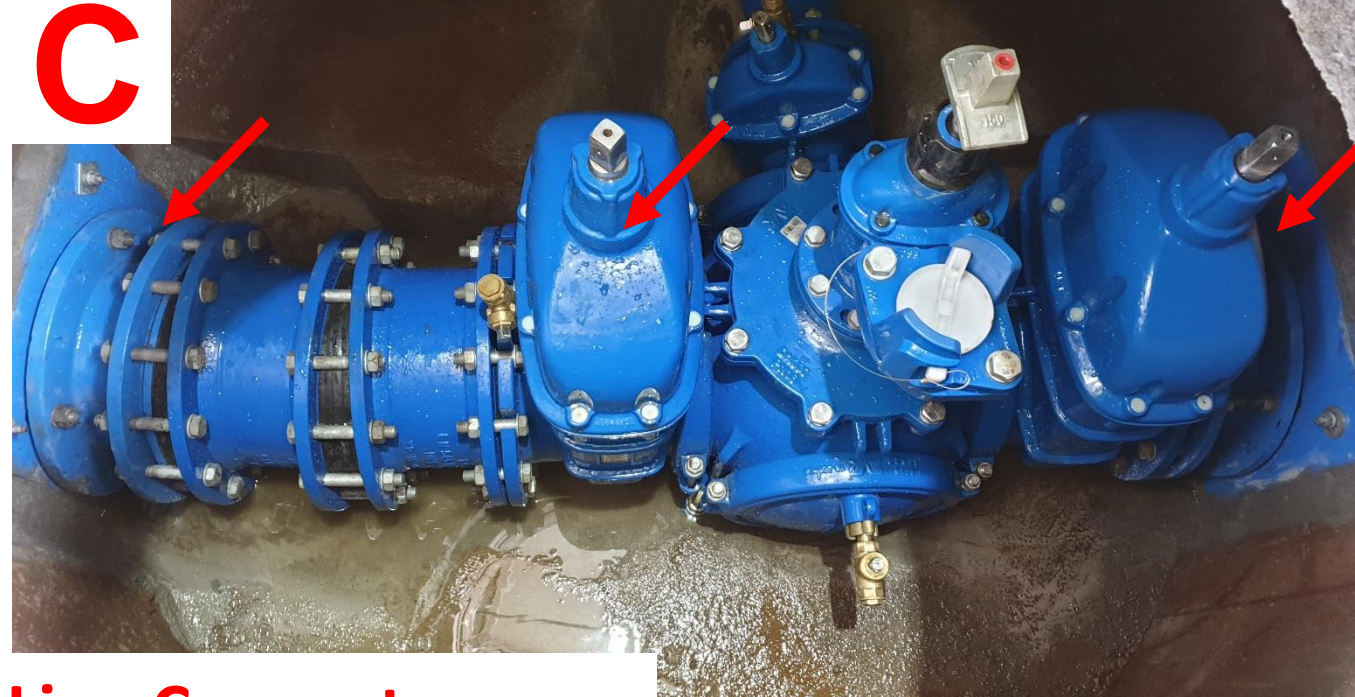




# Assembling



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**Position of Primus Line Connector**

# PU coating



**PU rigg**

**Activator and Base**



**Airmotor**

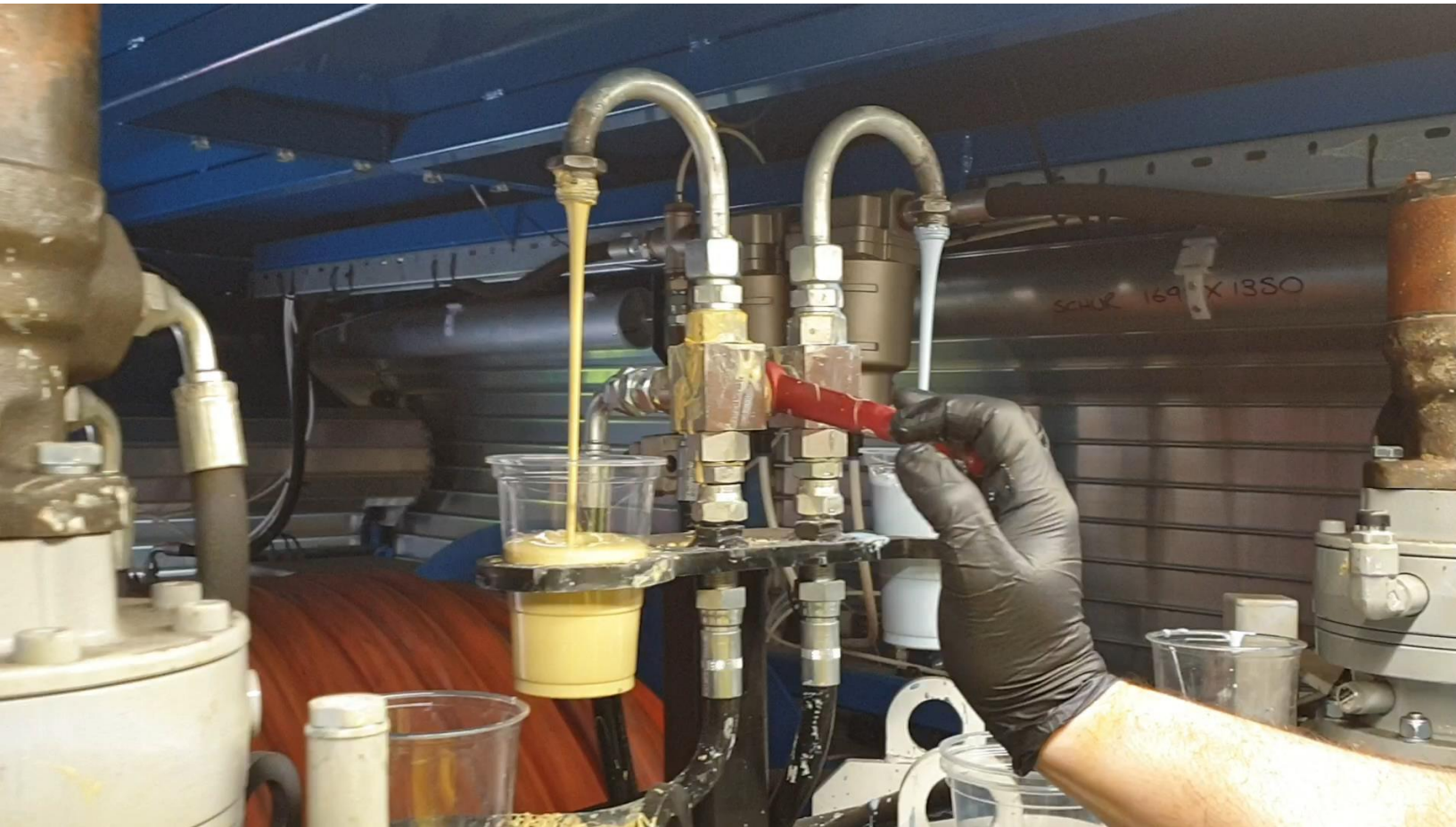


# Bitumen in the pipe



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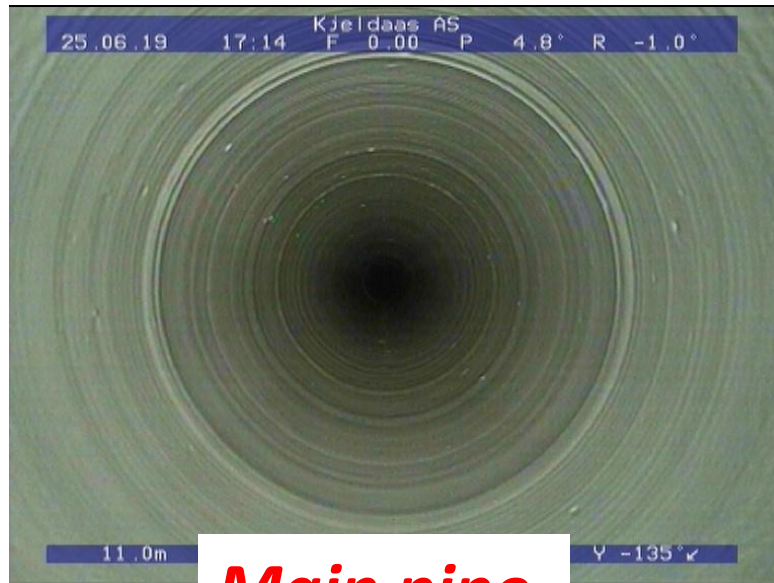
# Weight check of base and activator



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## House connection



**Main pipe**





# Such a feeling's comin' over me



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# There is wonder in most every thing I see



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**Not a cloud in the sky, got the sun in my eyes**

**And I won't be surprised if it's a dream**



# Everything I want the world to be



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Is now comin' true especially for me

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Advanced Liner for Pressure Pipes



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# And the reason is clear, it's because you are here



You're the nærest thing to heaven that I've seen



**SAERTEX**  
multiCom **H<sub>2</sub>O**

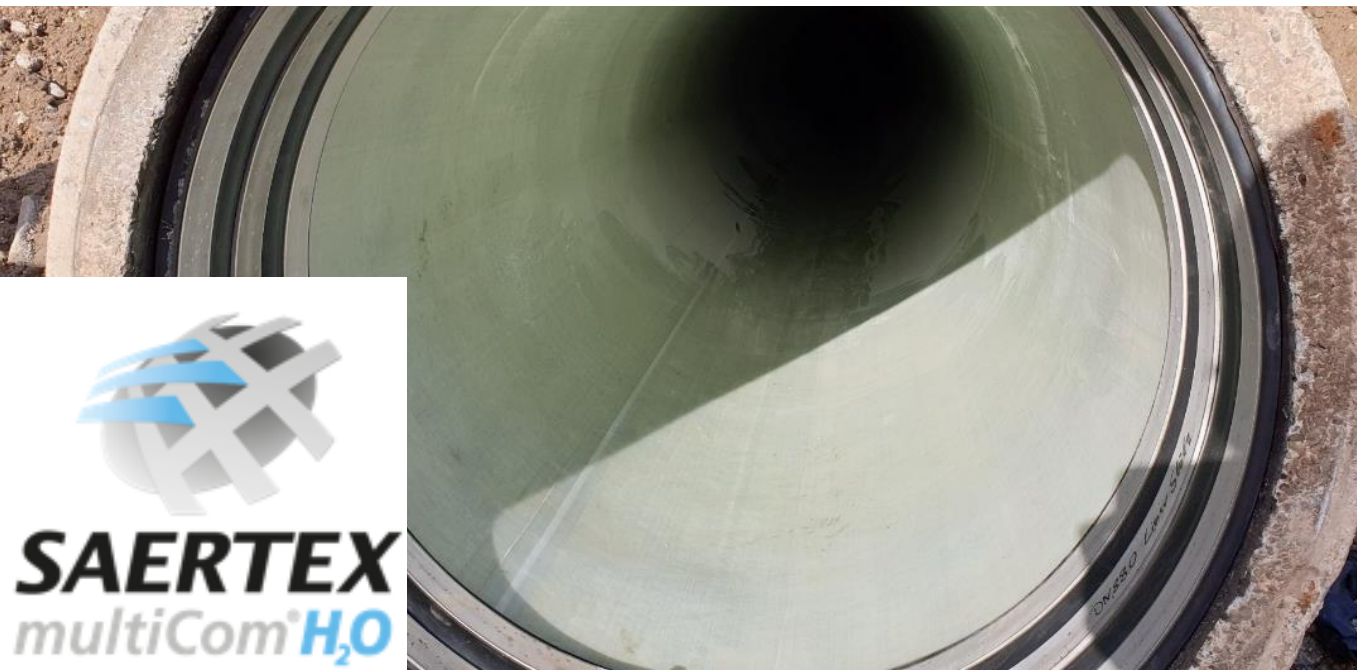
I'm on the top of the world lookin' down on creation



# And the only explanation I can find



# Is the love that I've found ever since you've been around



**Kjeldaas**



**Your love's put med at the top of the world**

Thank you



**Kjeldaaas**