



FP7-Fission

**LUCOE X**

Large Underground Concept EXperiments

2011 - 2014

Project Progress Meeting

14th May 2014

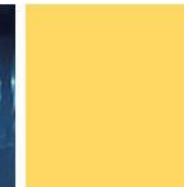
WP5

# Problem handling tools for buffer installation in KBS-3V

Keijo Haapala

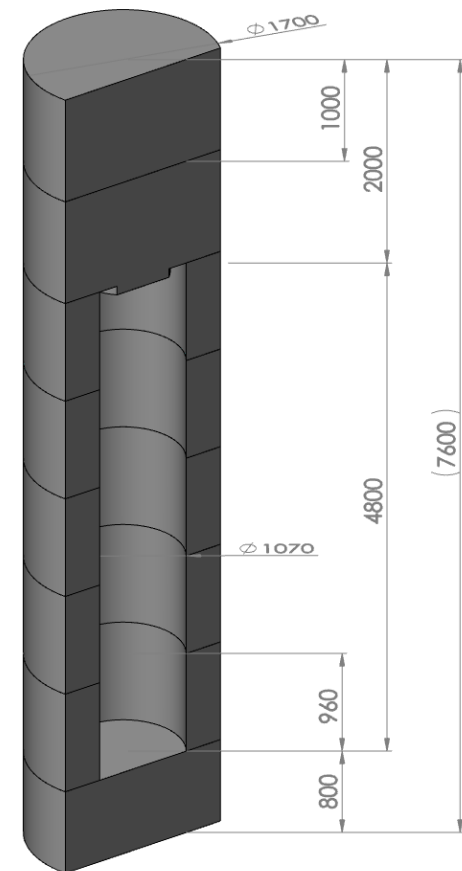


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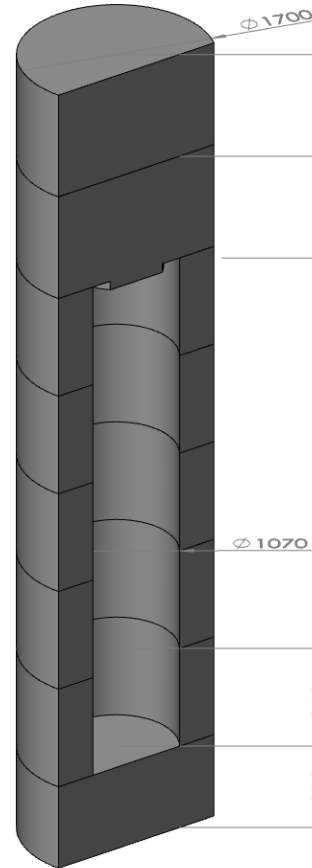
# LOT3: Problem handling tools.

- What is needed if the bentonite block falls to the deposition hole during the installation?
- The broken blocks must be taken quickly out from the hole.
- The weight of the blocks are from 1.8 to 3.5 tons.



# LOT3: Problem handling tools.

- The work can be divided in two parts.
  - Before canister installation
  - After canister
- Big parts can be lifted by vacuum griper.



# LOT3: Problem handling tools.

- Before canister
  - Repairing work by "A man in the hole".
  - Lifting and cleaning buffer parts out from the hole
  - Some fixing accessories has been tested

- Nylon Frame Plug



- Throughbolts.



# TESTING OF FIXING TOOLS



- Testing of tension and shear force of different fixing accessories in bentonite blocks has tested in Tampere university.

- Test blocks used in the tests

- Material MX-80

- L x W x H: 400 x 300 x 250 mm<sup>3</sup>

- Isostatically pressed

43 MPa, dry density 1742 kg/m<sup>3</sup>

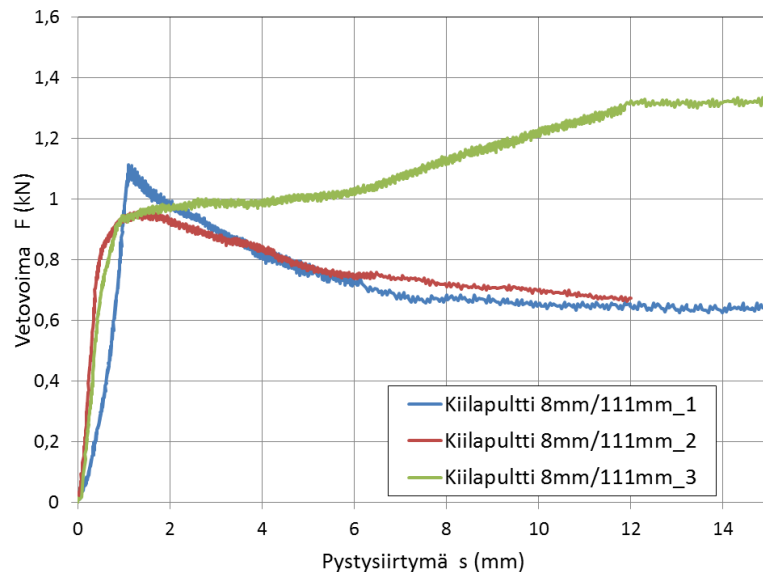


Blocks	Vaterc ratio (weight-%)
1	16,5
2	16,7
3	16,2
4	17,1

# TESTING OF TROUGH BOLT (1)



- FBN 8/50, D8 – 85/111 MM, AXIAL FORCE



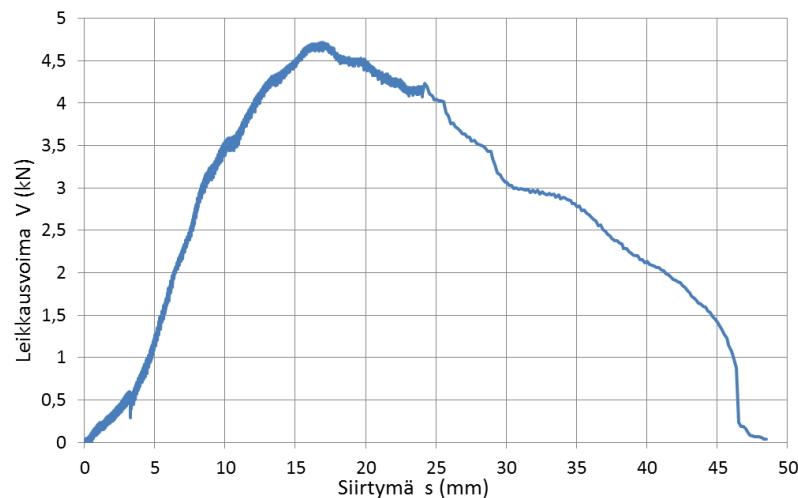
Koe	Murtovoima $F_{max}$ (kN)	Murtosiirtymä $s_{murto}$ (mm)	$F_{keskiarvo}$ (kN)	Keskihajonta $s_x$ (kN)	Koelohko
1	1,11	1,1	1,14	0,20	1
2	0,96	1,19			1
3	1,36	11,8			1



# TESTING OF TROUGH BOLT (1)

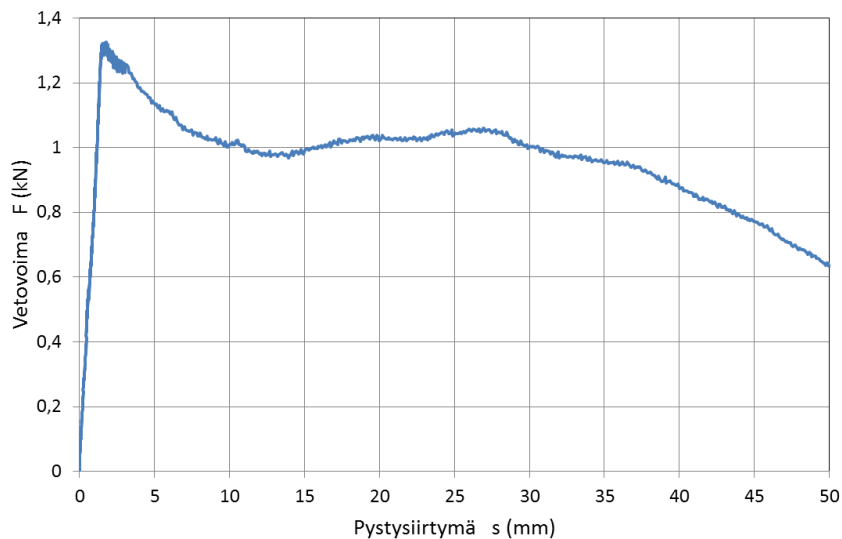


- FBN 8/50, D8 – 85/111 MM, SHEAR FORCE



# TESTING OF TROUGH BOLT (2)

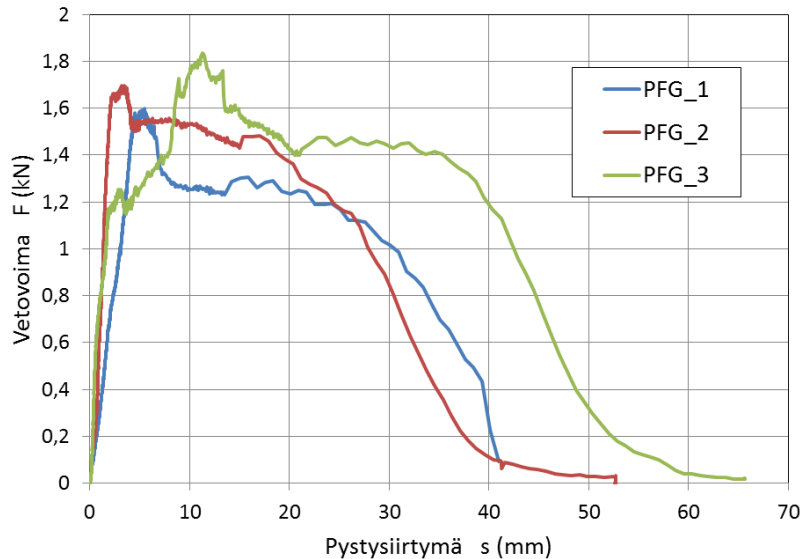
- D10 – 75/92 MM, AXIAL FORCE





# TESTING OF TROUGH BOLT (3)

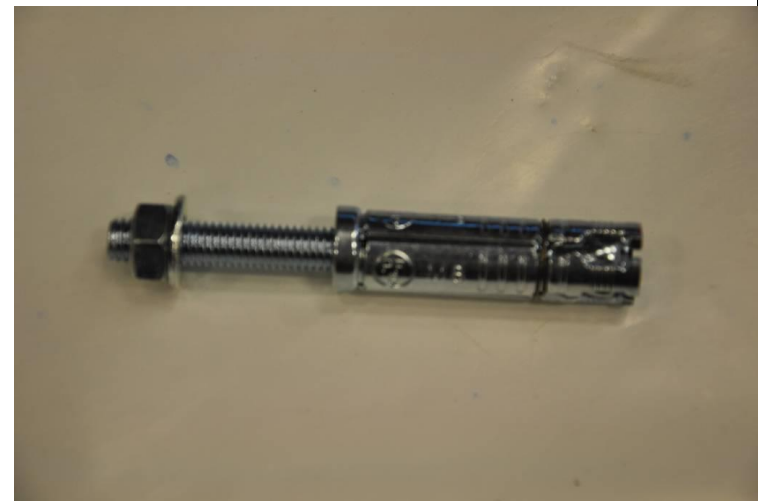
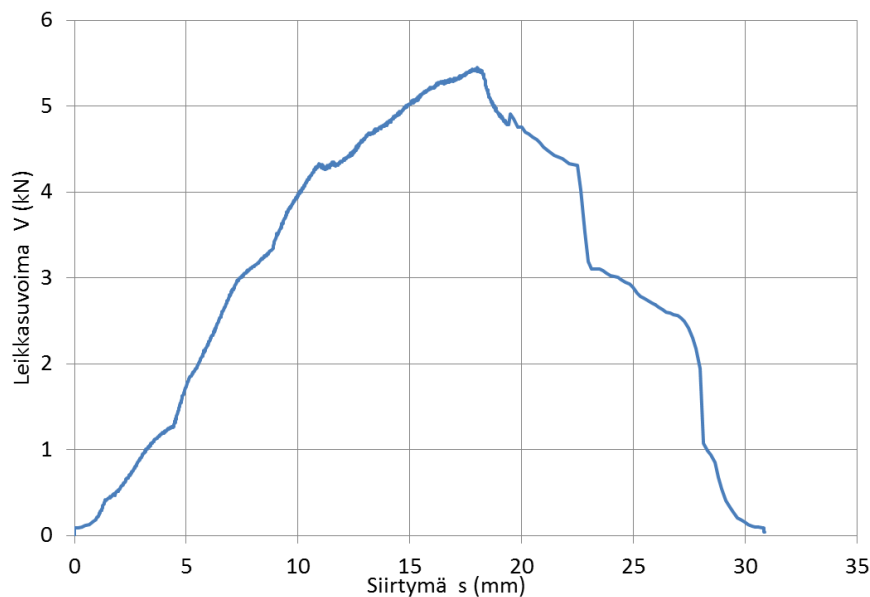
- PFG 8/85 (12.5 - 65 MM) AXIAL FORCE



Koe	Murtovoima $F_{max}$ (kN)	Murtosiirtymä $s_{murto}$ (mm)	$F_{keskiarvo}$ (kN)	Keskihajonta $s_x$ (kN)	Koelohko
1	1,59	4,5	1,71	0,119	2
2	1,69	2,6			2
3	1,83	10,8			2

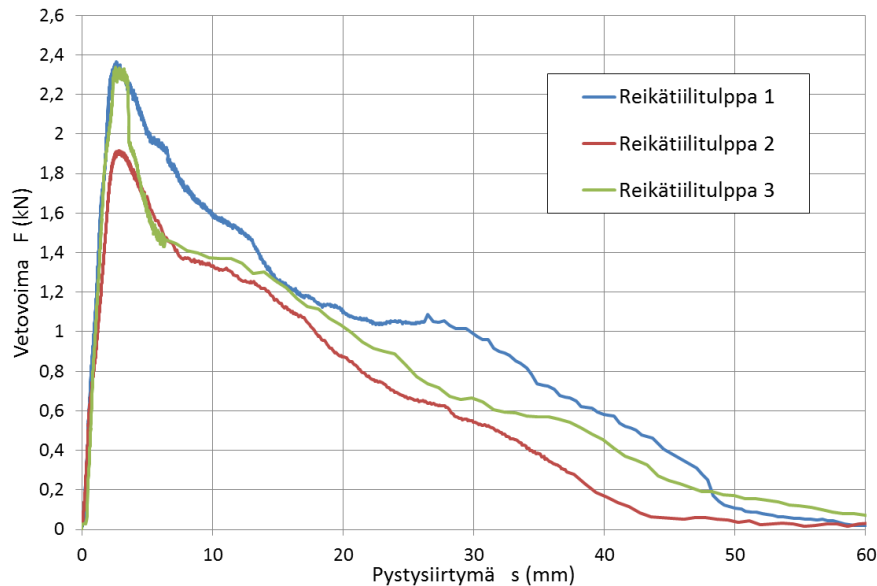
# TESTING OF TROUGH BOLT (3)

- PFG D8 – 85 (12.5 - 65 MM) SHEAR FORCE



# TESTING OF PLASTIC PLUG (4)

- Plastic plug HD82 – 7/105 (9 – 85 MM) AXIAL FORCE

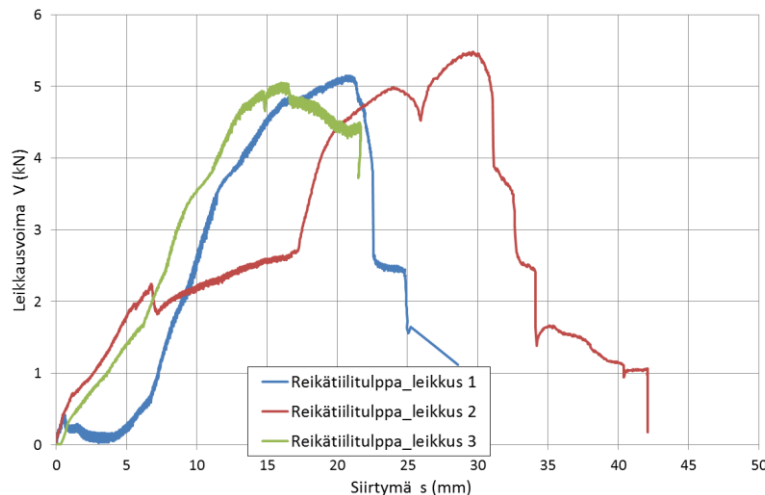


Koe	Murtovoima $F_{max}$ (kN)	Murtosiirtymä $s_{murto}$ (mm)	$F_{keskiarvo}$ (kN)	Keskihajonta $s_x$ (kN)	Koelohko
1	2,36	2,0	2,20	0,25	2
2	1,91	2,4			2
3	2,33	2,5			2



# TESTING OF PLASTIC PLUG (4)

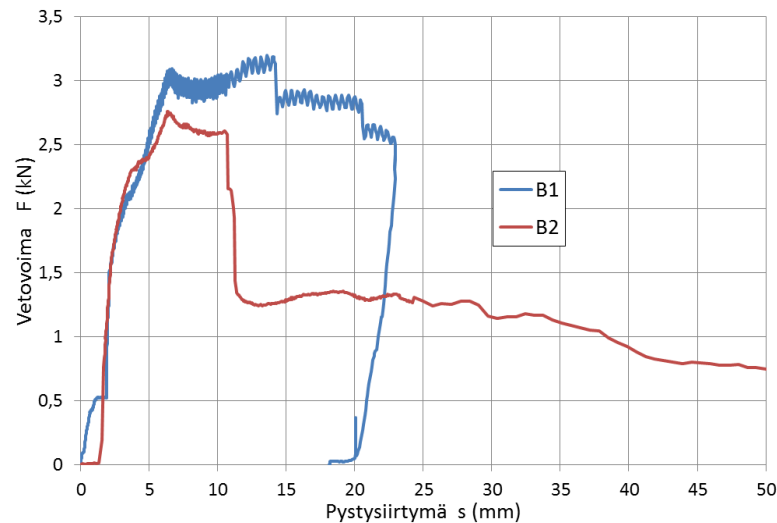
- Plastic plug HD82 – 7/105 (9 – 85 MM) SHEAR FORCE



Koe	Murtovoima $V_{max}$ (kN)	Murtosiirtymä $s_{murto}$ (mm)	$V_{keskiarvo}$ (kN)	Keskihajonta $s_x$ (kN)	Koelohko
1	5,14	20,8	5,22	0,225	1
2	5,48	29,3			1
3	5,05	15,9			2

# TESTING OF HEAVY TROUGH BOLT (5)

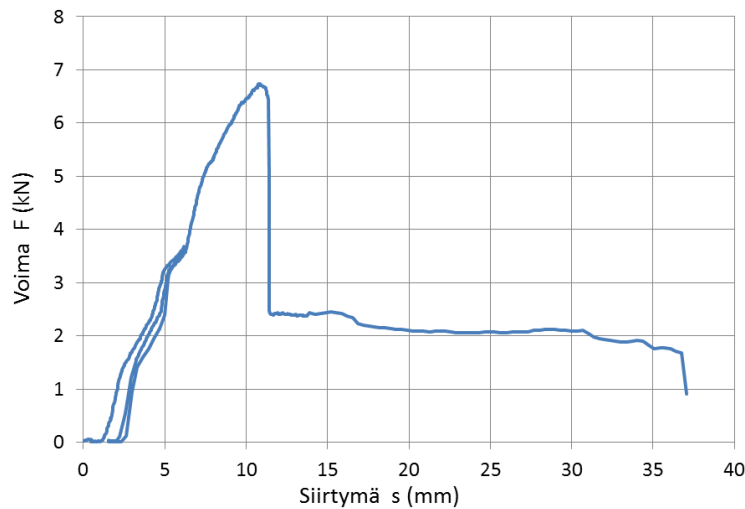
- PGF D12 – 112 MM (11 - 98 MM) AXIAL FORCE



Koe	Murtovoima $F_{max}$ (kN)	Murtosiirtymä $s_{murto}$ (mm)	$F_{keskiarvo}$ (kN)	Keskihajonta $s_x$ (kN)	Koelohko
1	3,19	13,5	2,97	0,096	3
2	2,76	6,1			4

# TESTING OF HEAVY TROUGH BOLT (5)

- PGF D12 – 112 MM (11 - 98 MM) SHEAR FORCE



# LOT3: Problem handling tools.

- **After canister**
  - **Repairing work by "No one in the hole" because of radiation.**
  - **Possible to use remotely the same tools as "Before Canister" situation**
  - **Demonstrations will be done manually.**



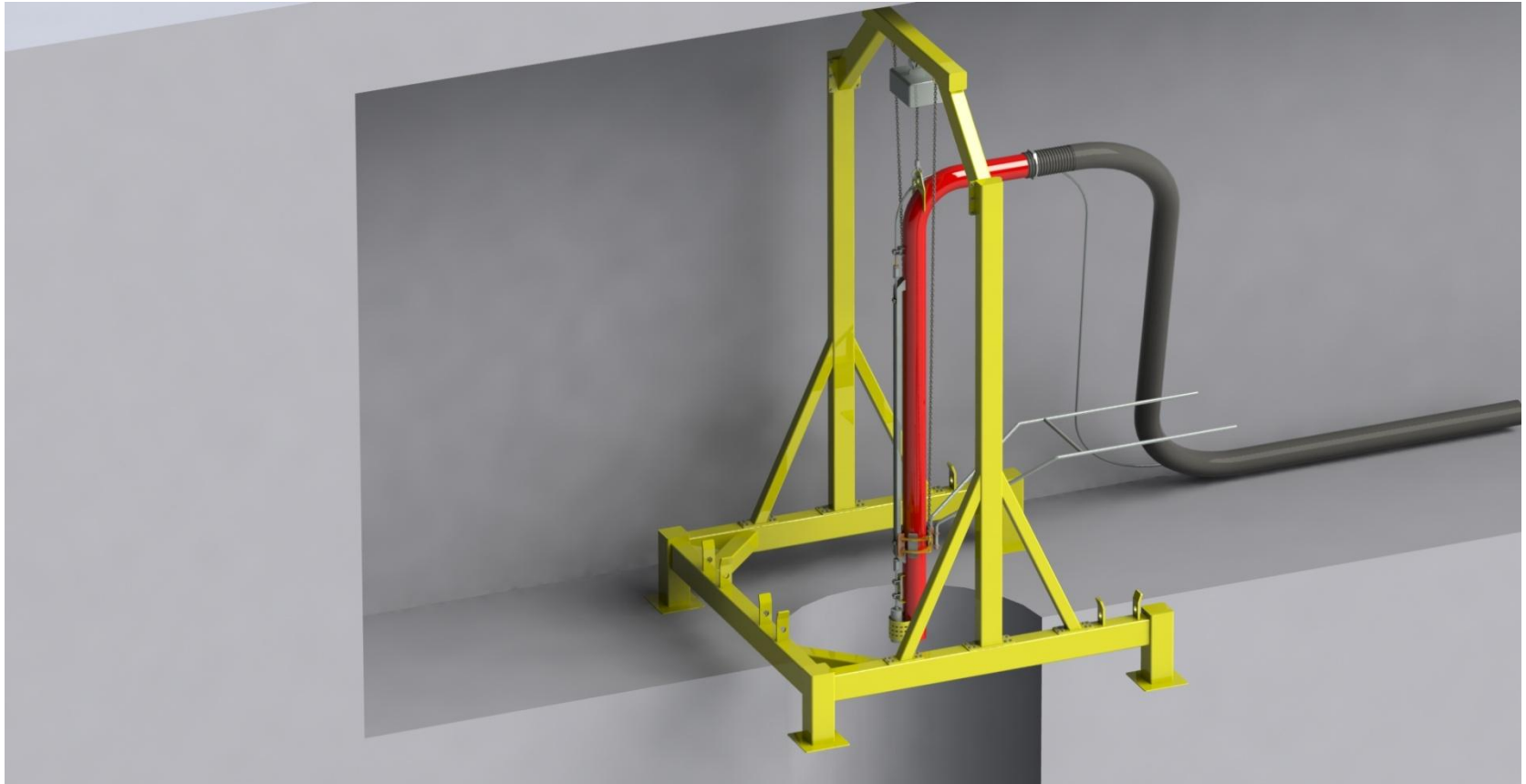
# LOT3: Problem handling tools.

- After canister
  - If it is needed to clear out the hole buffer, and be carefull with copper canister?  
-> Water jet cutting.

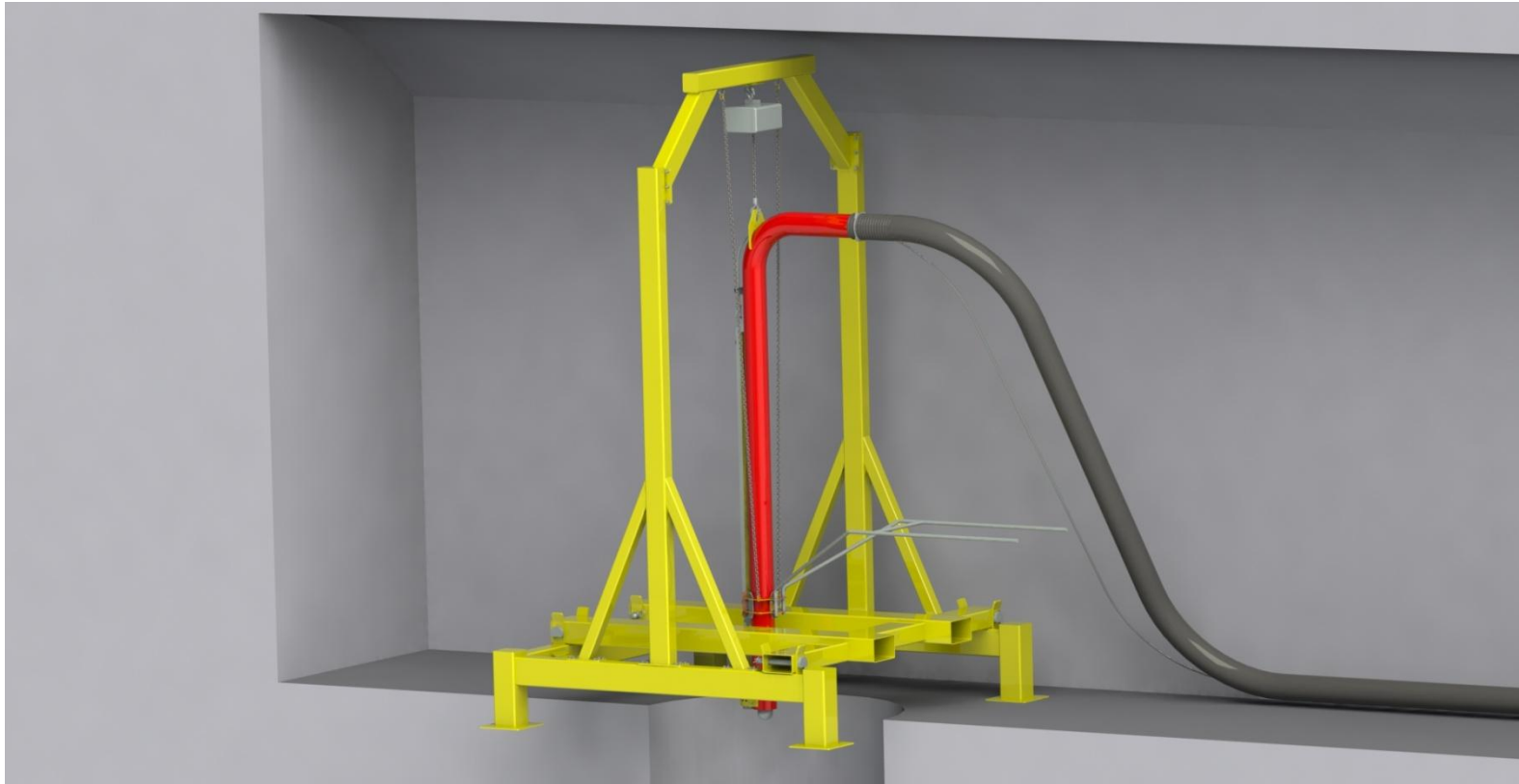




# WATER JET CUTTING TOOL



# WATER JET CUTTING TOOL





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