



# **Automated Tie-In New Tie-In Technology for Pipeline Construction**

**Peter Schwengler, *E.ON Ruhrgas AG***

**23rd World Gas Conference,  
Amsterdam, NL  
7th June 2006**

# Automated Tie-In



**e-on**

**ruhrgas**

2

- **Project Scope**
- **Project Description & Findings**
- **Current Status**
- **Further Actions**



# Project Scope



**e-on**

**ruhrgas**

3

- **Improve Productivity and Reduce Costs**
- **Improve Safety Performance**
- **Reduce Environmental Impact**



# Project Description



1. The Work Process
2. Technology Matching
3. Outline Performance Specification
4. Identify Options
5. Market Research
6. Option Selection
7. Develop Conceptual Designs
8. Cost Estimates
9. Risk Analysis



# Project Description



e-on

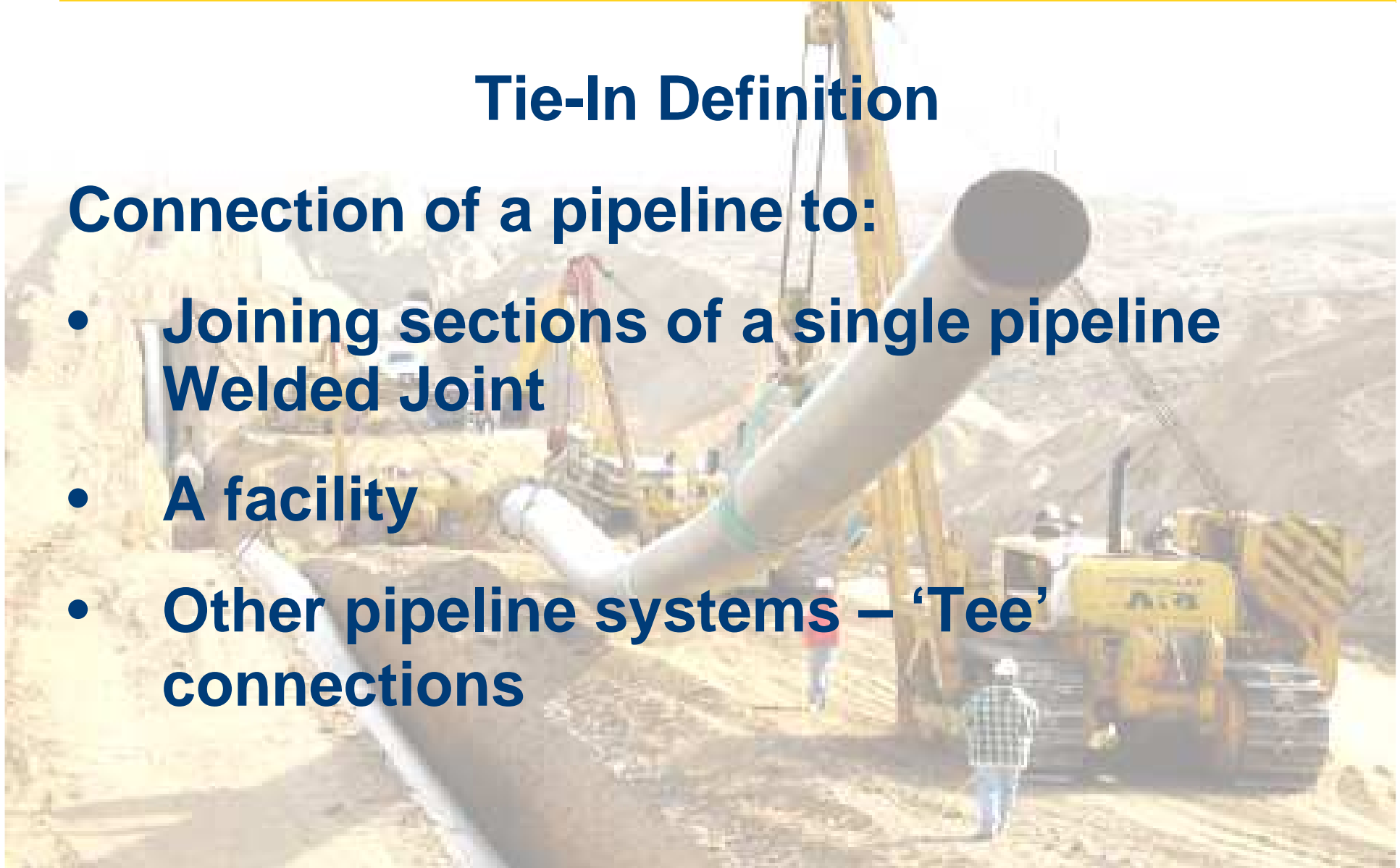
ruhrgas

5

## Tie-In Definition

Connection of a pipeline to:

- **Joining sections of a single pipeline  
Welded Joint**
- **A facility**
- **Other pipeline systems – ‘Tee’  
connections**

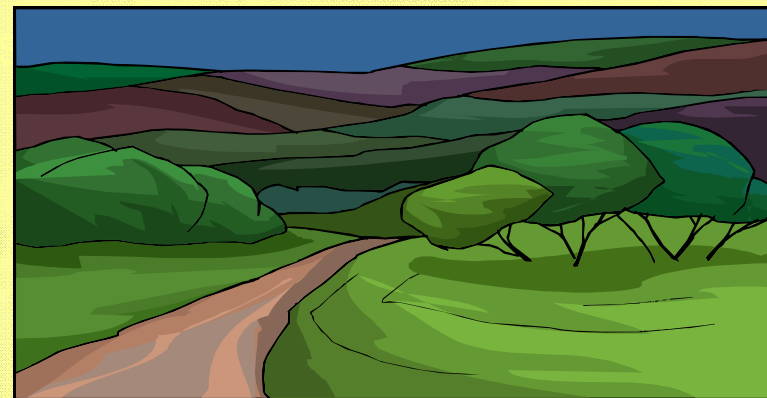


# Project Description



## Physical Obstructions

Road & river crossings, ditches, etc.





# Project Description



Physical Obstructions

Road & river crossings, ditches, etc.

Sharp Direction Changes

Horizontal/vertical : 'hot'/factory bends



Welds

Cut out pipe & insert Tee - 2



# Project Description



**Physical Obstructions**

Road & river crossings, ditches, etc.

**Sharp Direction Changes**

Horizontal/vertical : 'hot'/factory bends

**Hydrotest Requirements**

Test heads welded to pipe ends





# Project Description



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Horizontal/vertical : 'hot'/factory bends

**Hydrotest Requirements**

Test heads welded to pipe ends

**Special Features**

Instrumentation, valve stations



Use Connectio  
Weld

2 welds  
2 welds



# Project Description



**Physical Obstructions**

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Horizontal/vertical : 'hot'/factory bends

**Hydrotest Requirements**

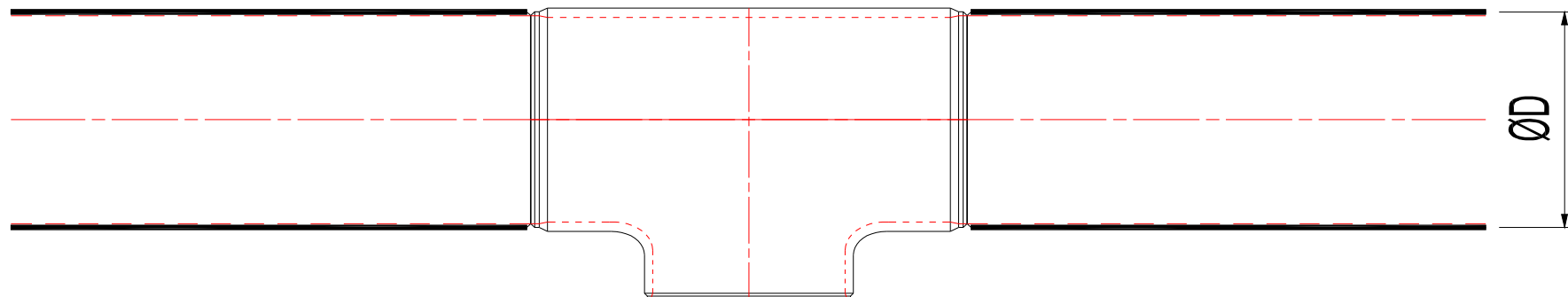
Test heads welded to pipe ends

**Special Features**

Instrumentation, valve stations etc.

**Tee Connections**

Cut out pipe & insert Tee – 2 welds



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Road & river crossings, ditches, etc.

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Horizontal/vertical : 'hot'/factory bends

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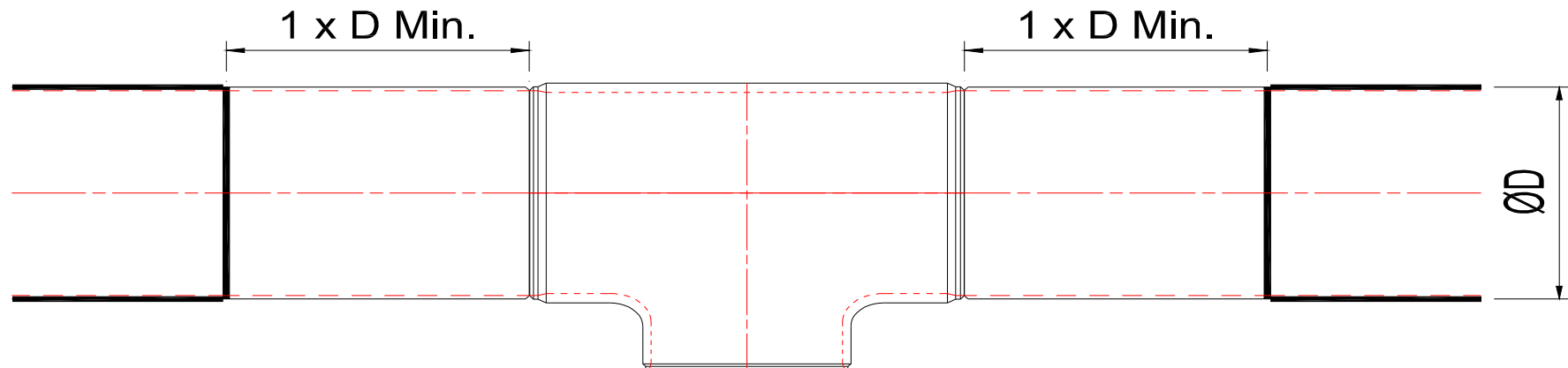
Test heads welded to pipe ends

**Special Features**

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**Tee Connections**

Cut out pipe & insert Tee – 2 welds





# Project Description



**Physical Obstructions** Road & river crossings, ditches, etc.

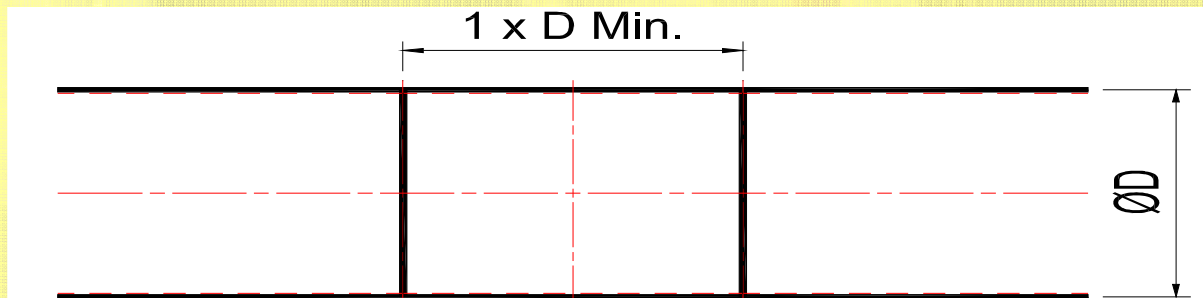
**Sharp Direction Changes** Horizontal/vertical : 'hot'/factory bends

**Hydrotest Requirements** Test heads welded to pipe ends

**Special Features** Instrumentation, valve stations etc.

**Tee Connections** Cut out pipe & insert Tee – 2 welds

**Defective Welds** Cut out pipe & insert spool – 2 welds



problems,  
multiple



# Project Description



13

## Physical Obstructions

Road & river crossings, ditches, etc.

## Sharp Direction Changes

Horizontal/vertical : 'hot'/factory bends

## Hydrotest Requirements

Test heads welded to pipe ends

## Special Features

Instrumentation, valve stations etc.

## Tee Connections

Cut out pipe & insert Tee – 2 welds

## Defective Welds

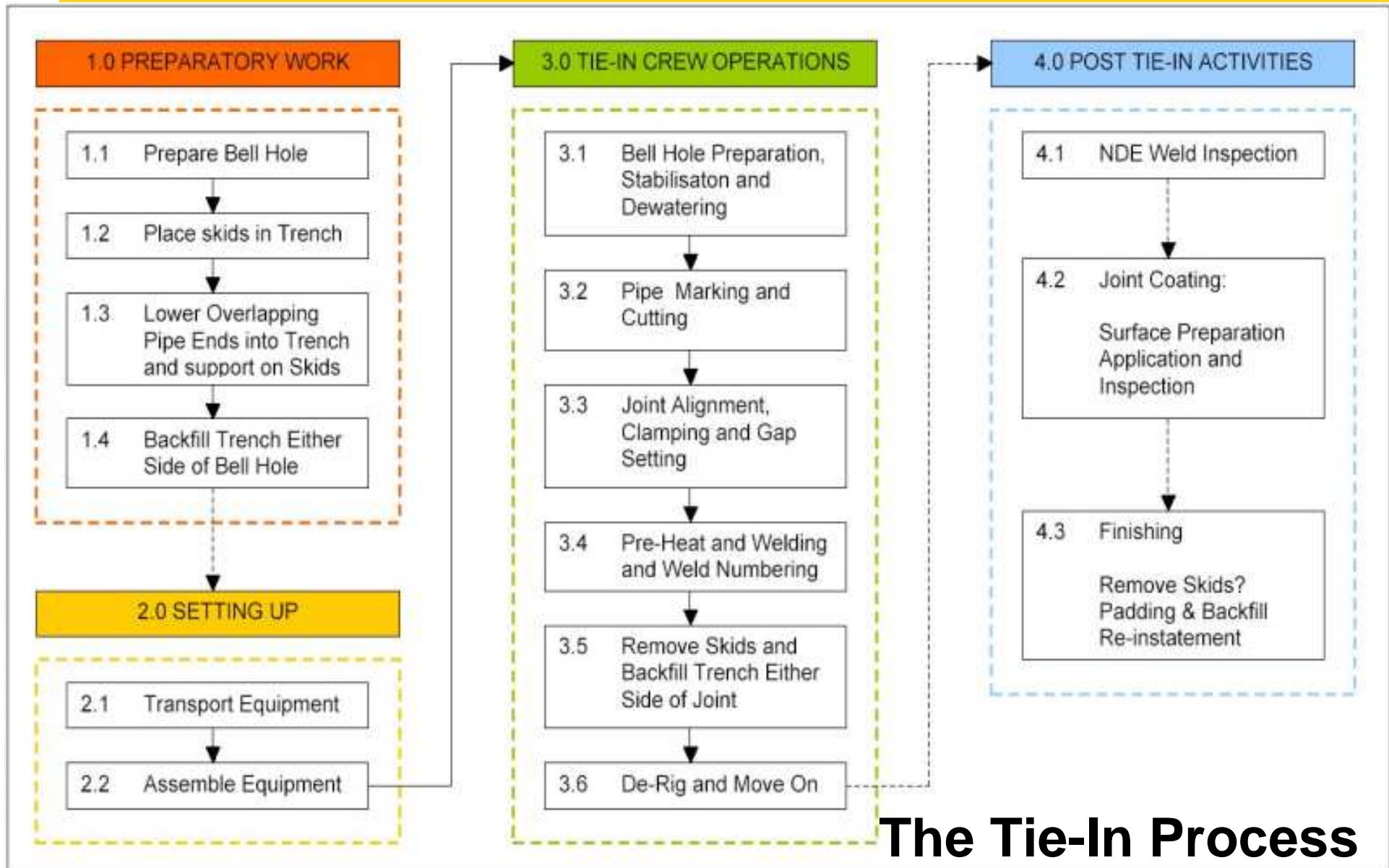
Cut out pipe & insert spool – 2 welds

## Others

Unforeseen problems,

Connecting multiple spreads

# Project Description



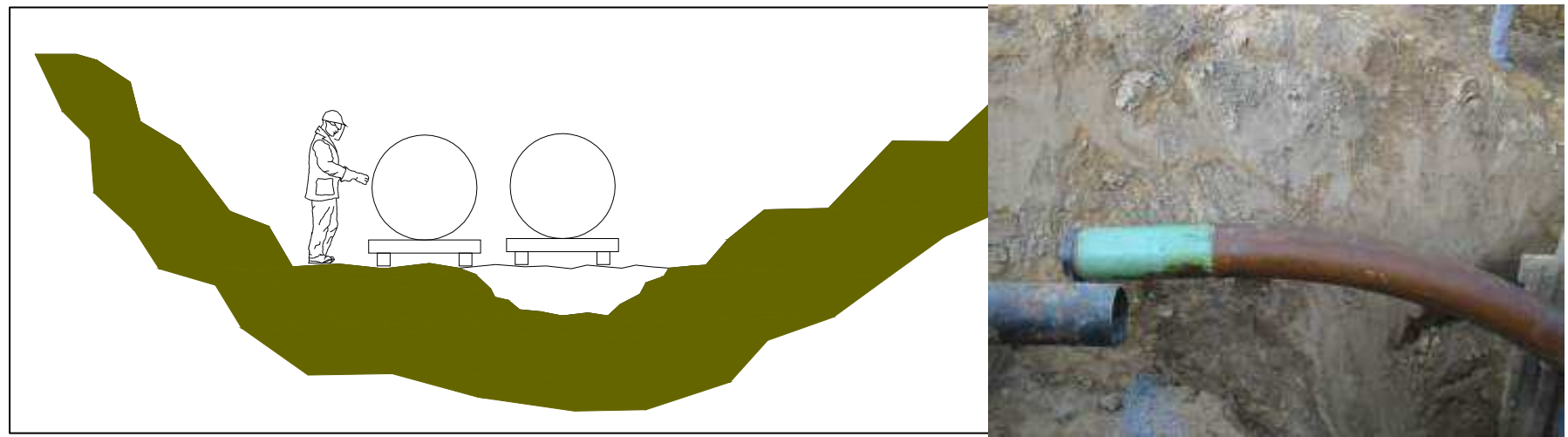
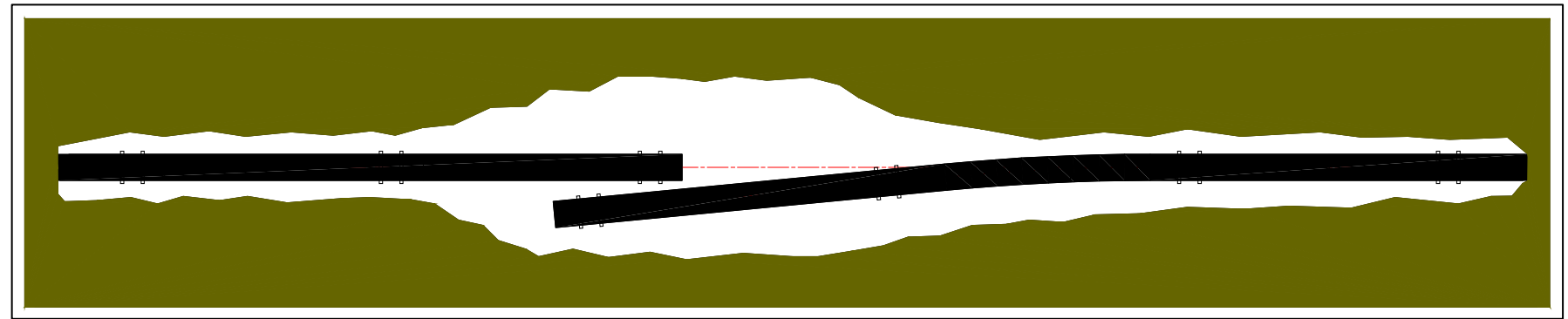
**The Tie-In Process**



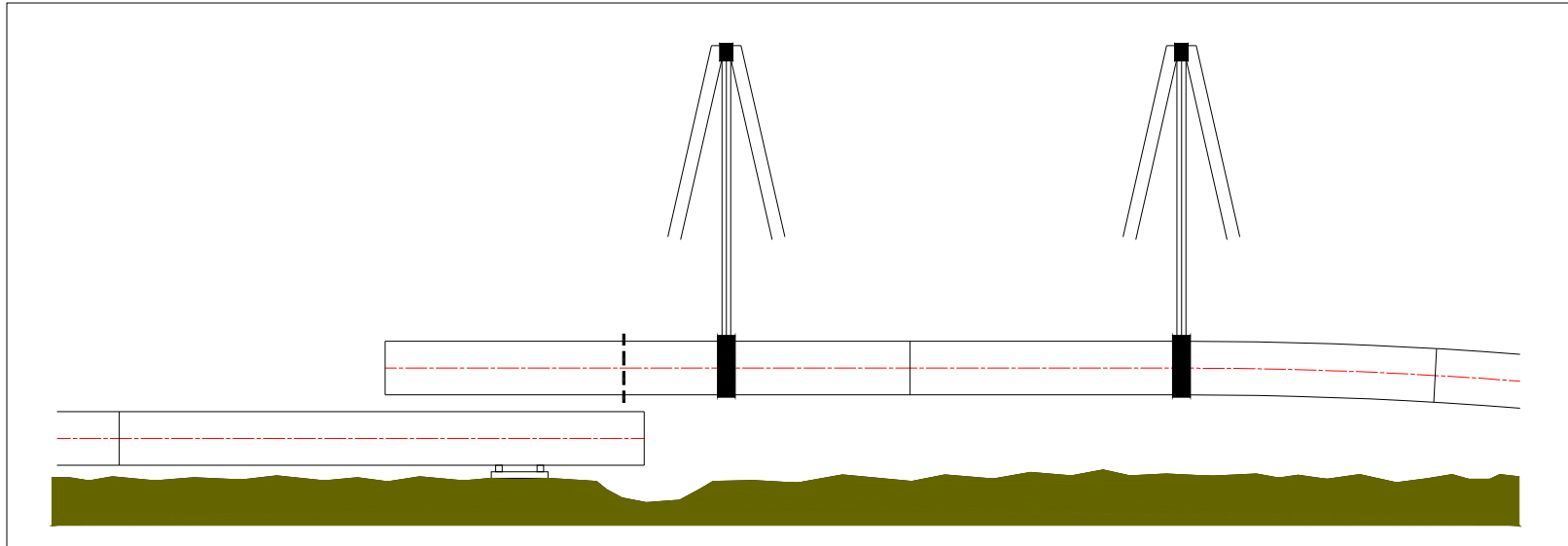
# Project Description & Findings



## Typical Arrangements



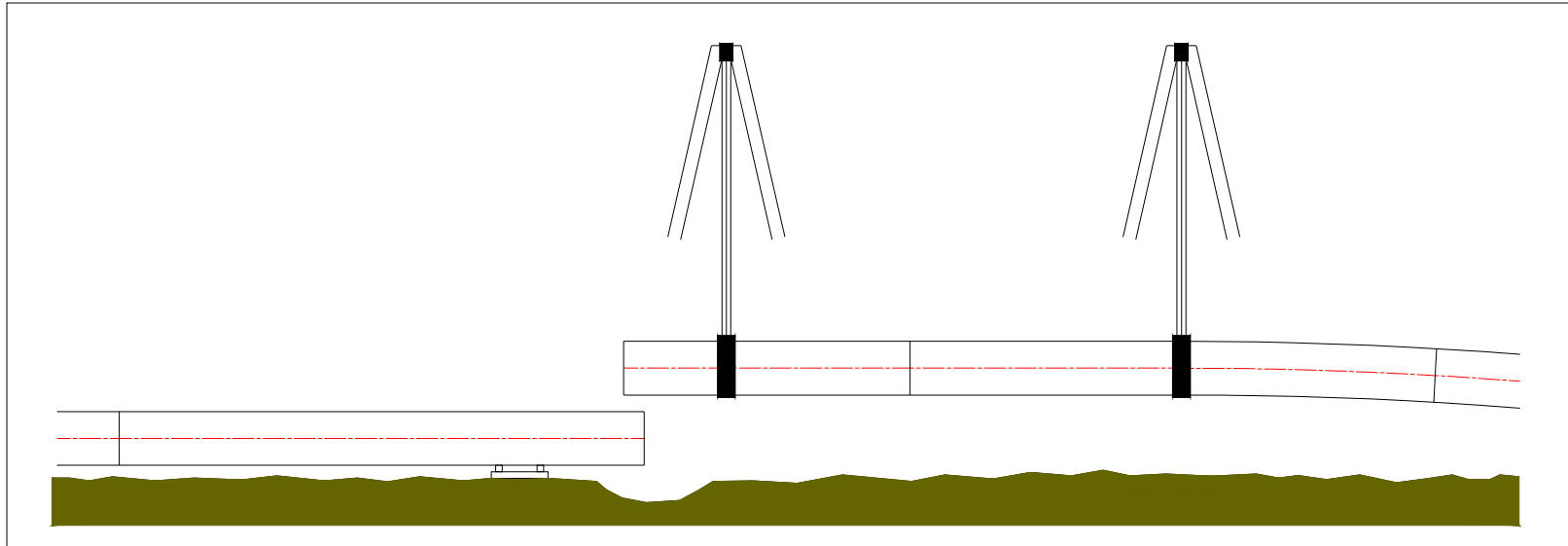
# Project Description & Findings



pipe marking  
and cutting



# Project Description & Findings

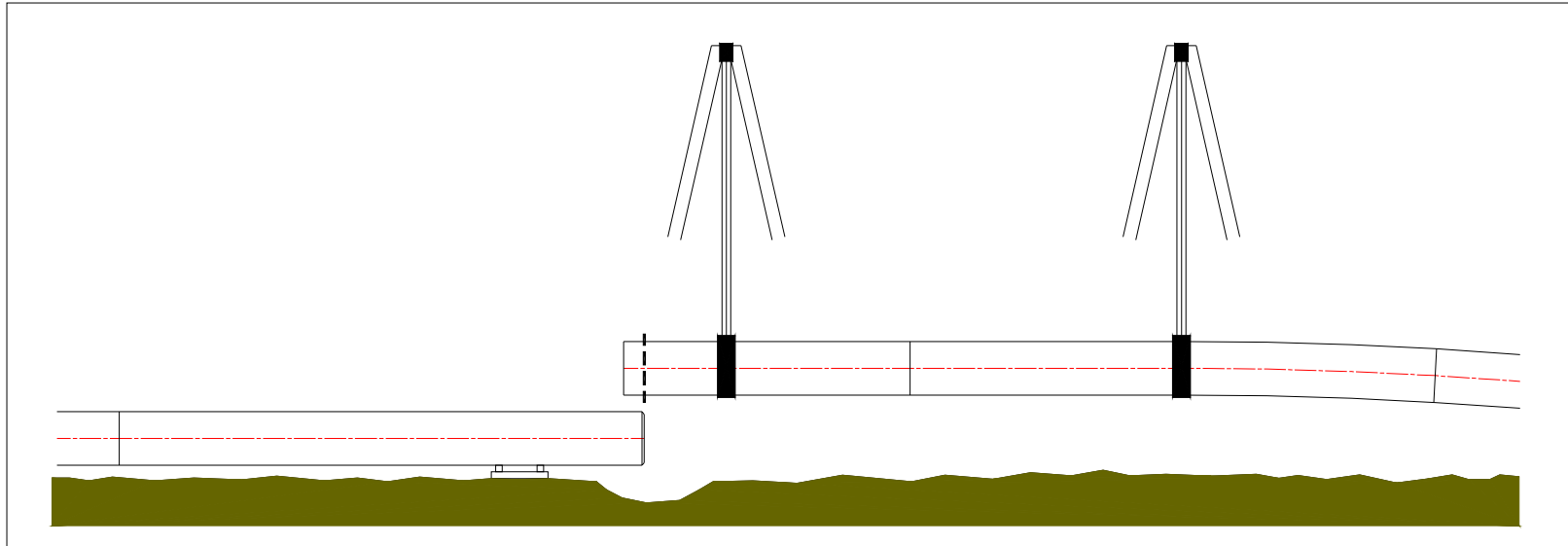


first alignment





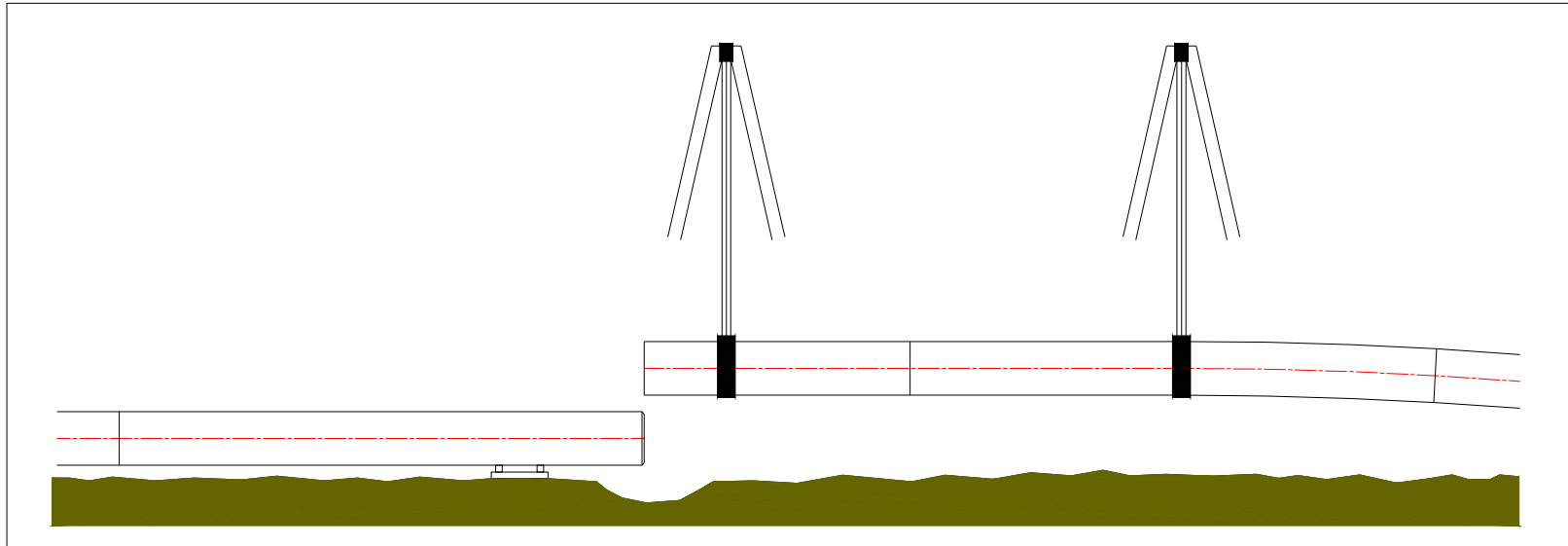
# Project Description & Findings



**second marking  
and cutting**



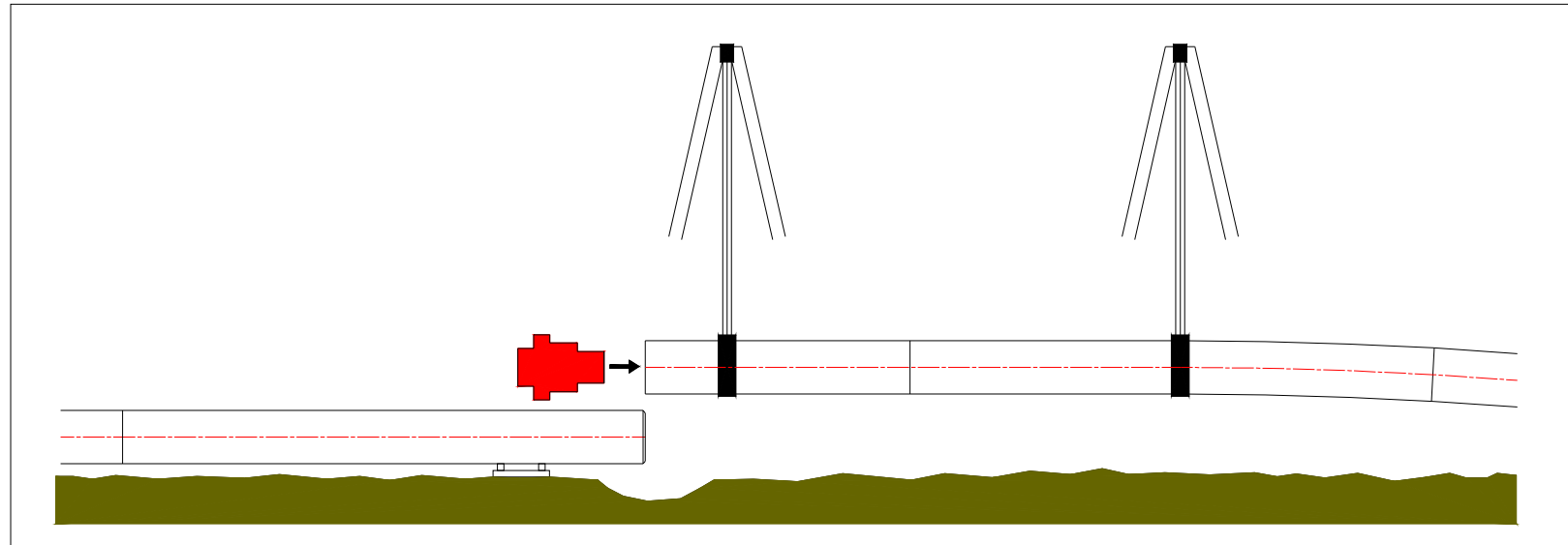
# Project Description & Findings



**second alignment**



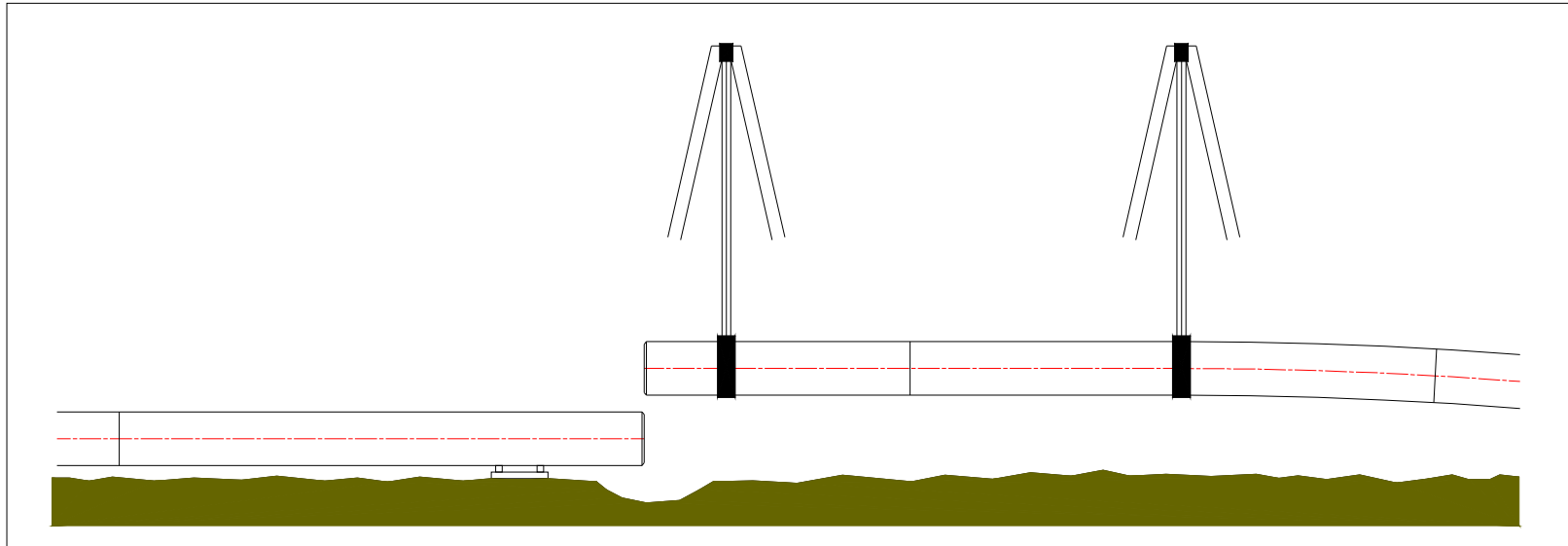
# Project Description & Findings



**end preparation  
beveling**



# Project Description & Findings

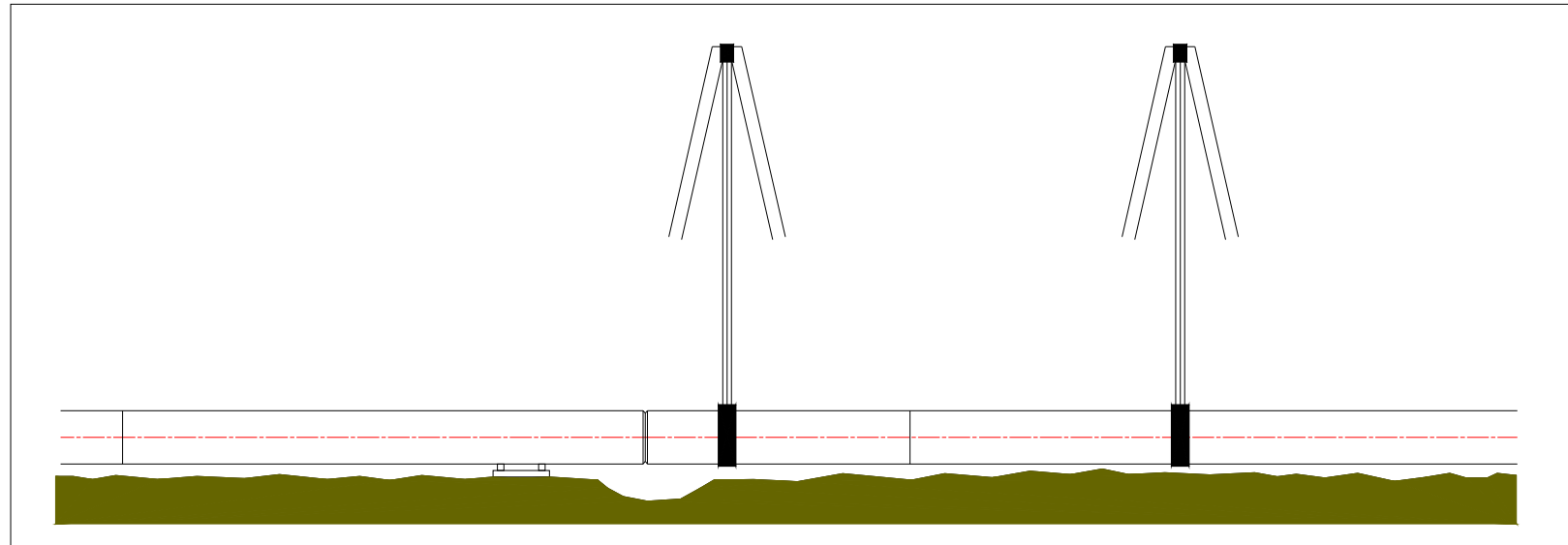


final alignment





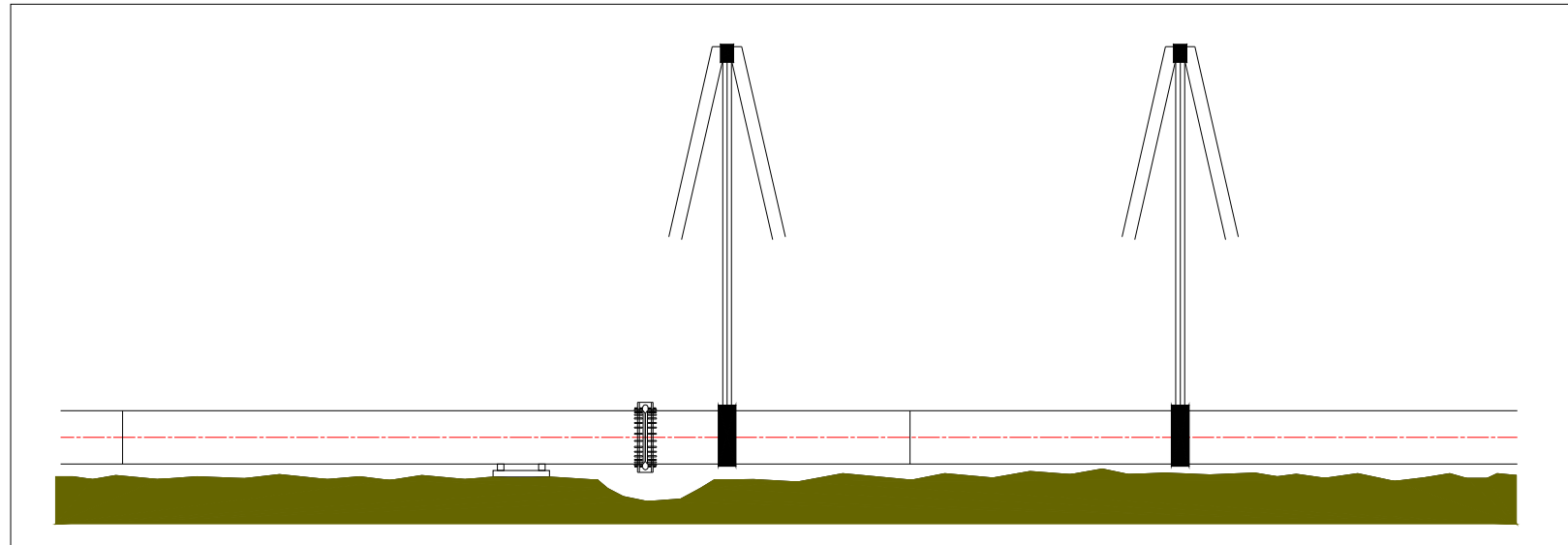
# Project Description & Findings



**centering**



# Project Description & Findings



climbing



and welding



# Project Description & Findings



## Typical Tie-In



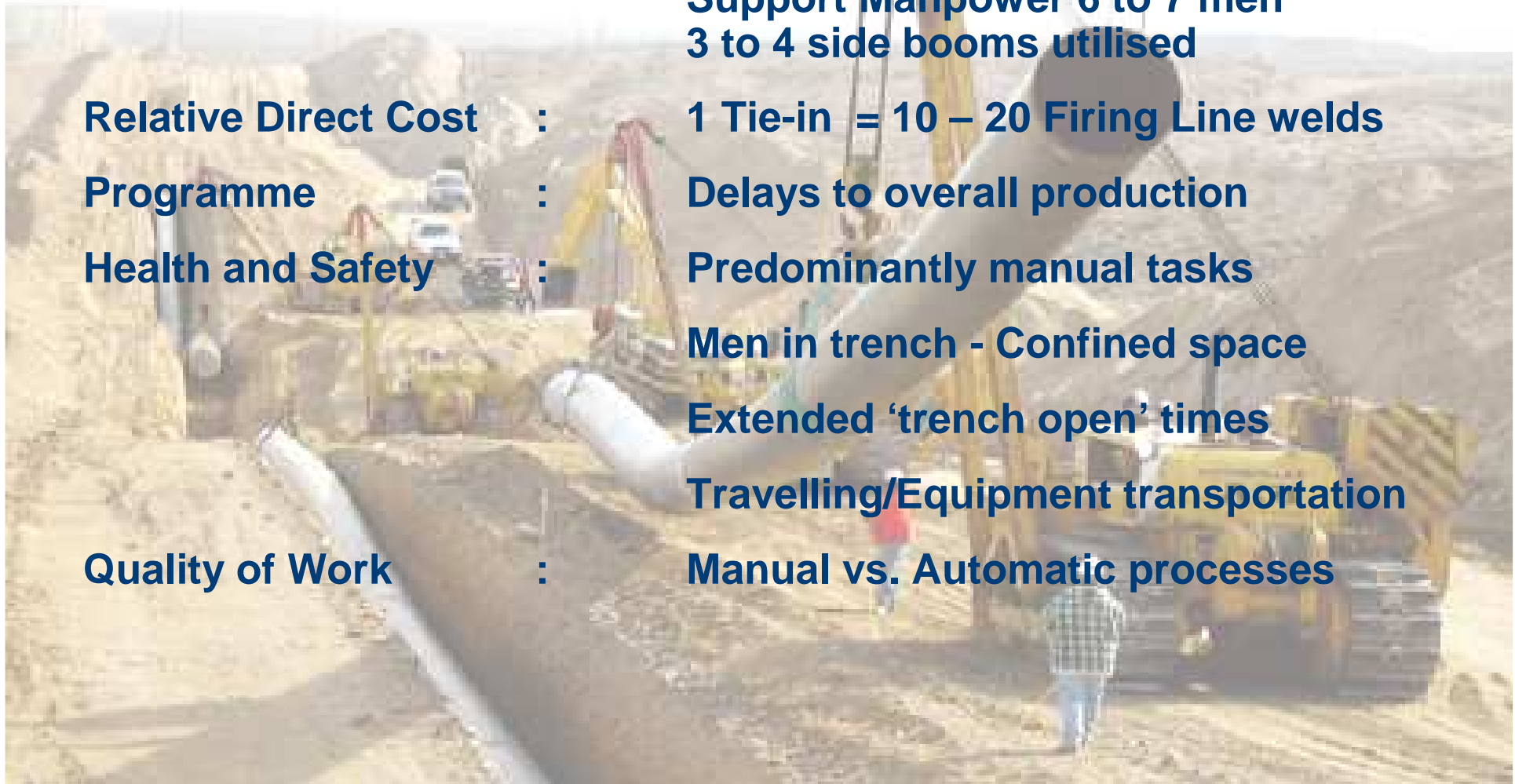
1 – 2 Joints/Day



# Project Description & Findings



- Resources** : One Tie-In crew = 1.5 Tie-in/day  
Direct Manpower 22 to 27 men  
Support Manpower 6 to 7 men  
3 to 4 side booms utilised
- Relative Direct Cost** : 1 Tie-in = 10 – 20 Firing Line welds
- Programme** : Delays to overall production
- Health and Safety** : Predominantly manual tasks  
Men in trench - Confined space  
Extended 'trench open' times  
Travelling/Equipment transportation
- Quality of Work** : Manual vs. Automatic processes







### Benefits of Automated Tie-In Processes

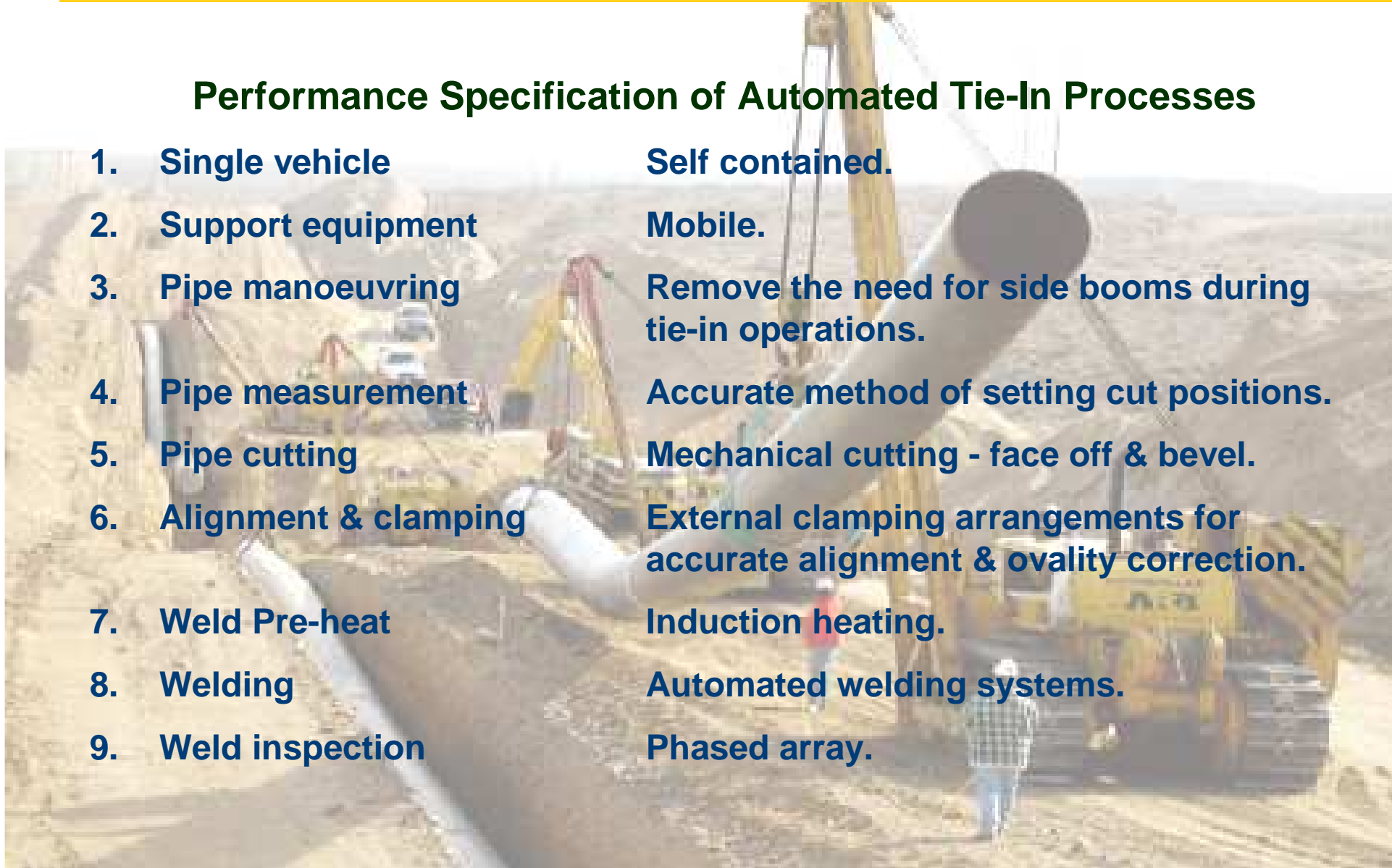
- Increased Speed and/or
- Reduced Equipment Requirements and/or
- Reduced Manpower Requirements and/or
- Joint Quality and/or
- Improved Health and Safety





## Performance Specification of Automated Tie-In Processes

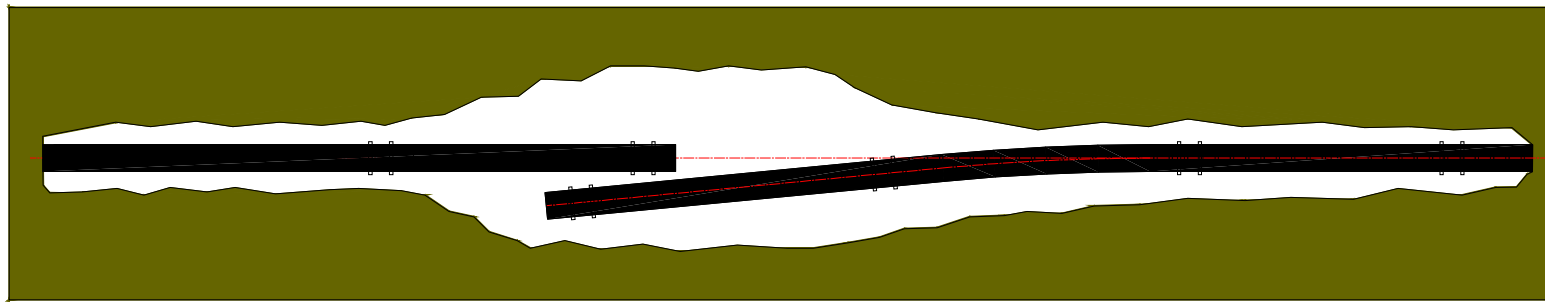
- |                         |   |
|-------------------------|---|
| 1. Single vehicle       | Self contained.   |
| 2. Support equipment    | Mobile.   |
| 3. Pipe manoeuvring     | Remove the need for side booms during tie-in operations.                    |
| 4. Pipe measurement     | Accurate method of setting cut positions.                                   |
| 5. Pipe cutting         | Mechanical cutting - face off & bevel.                                      |
| 6. Alignment & clamping | External clamping arrangements for accurate alignment & ovality correction. |
| 7. Weld Pre-heat        | Induction heating.  |
| 8. Welding              | Automated welding systems.  |
| 9. Weld inspection      | Phased array.   |



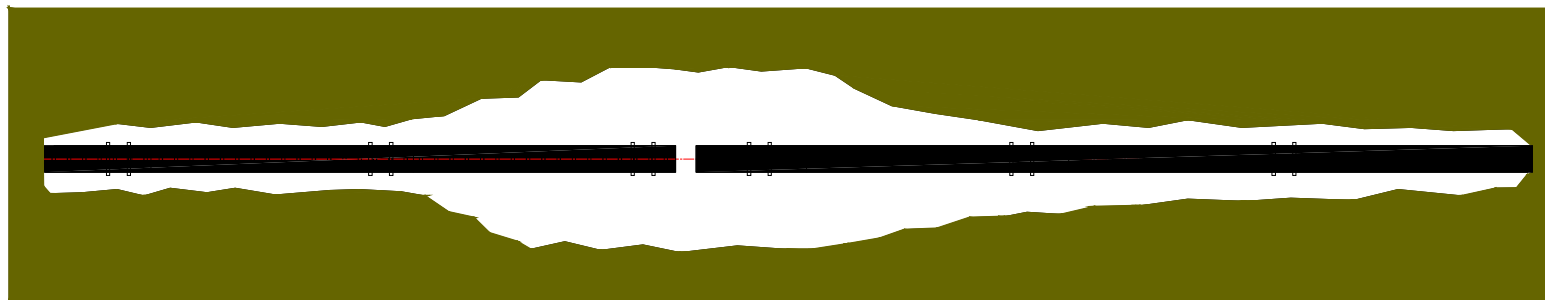
# Project Description & Findings



## Typical Existing Arrangement



## Option for Consideration



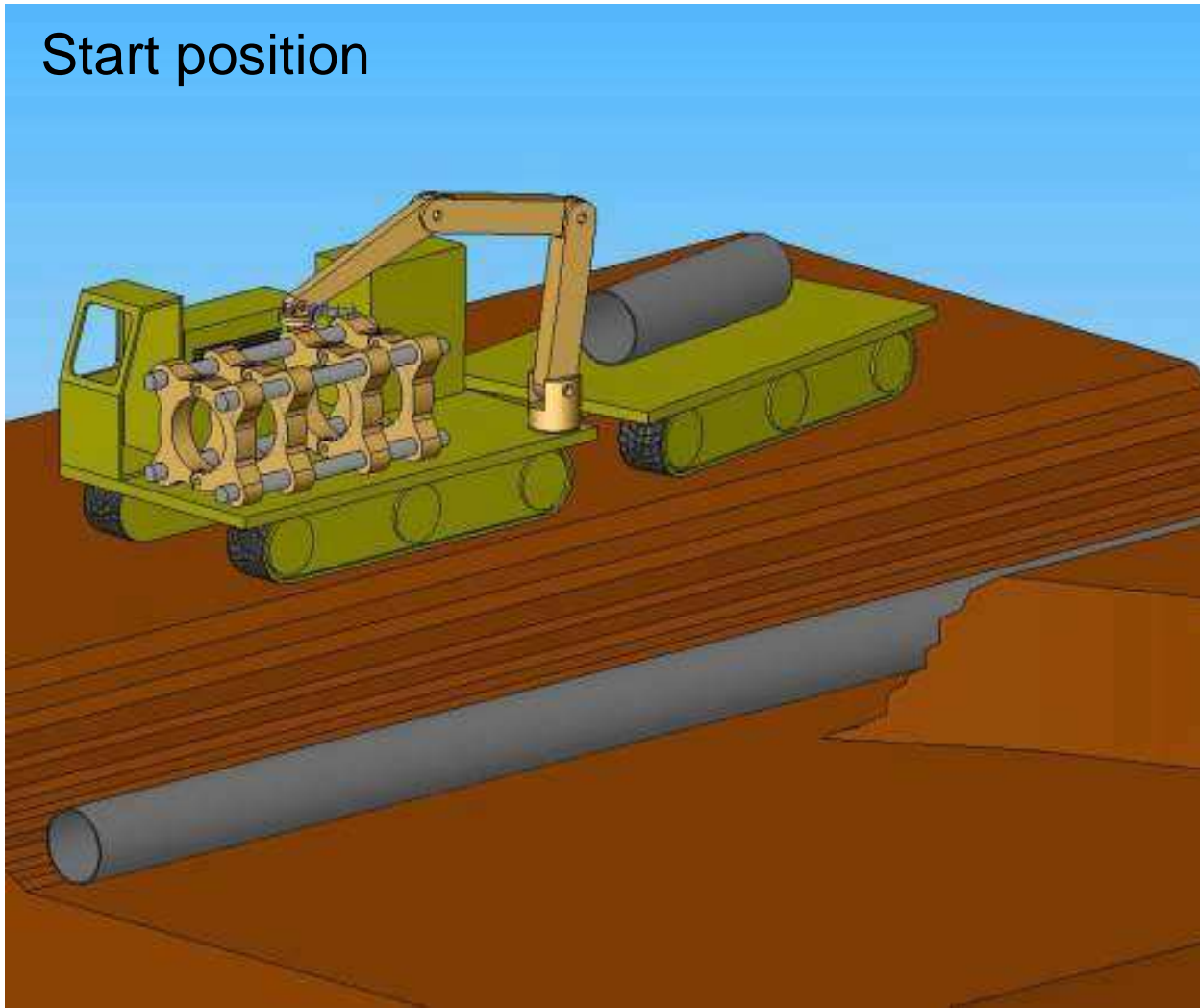
But 2 Welds Required



# Project Description & Findings



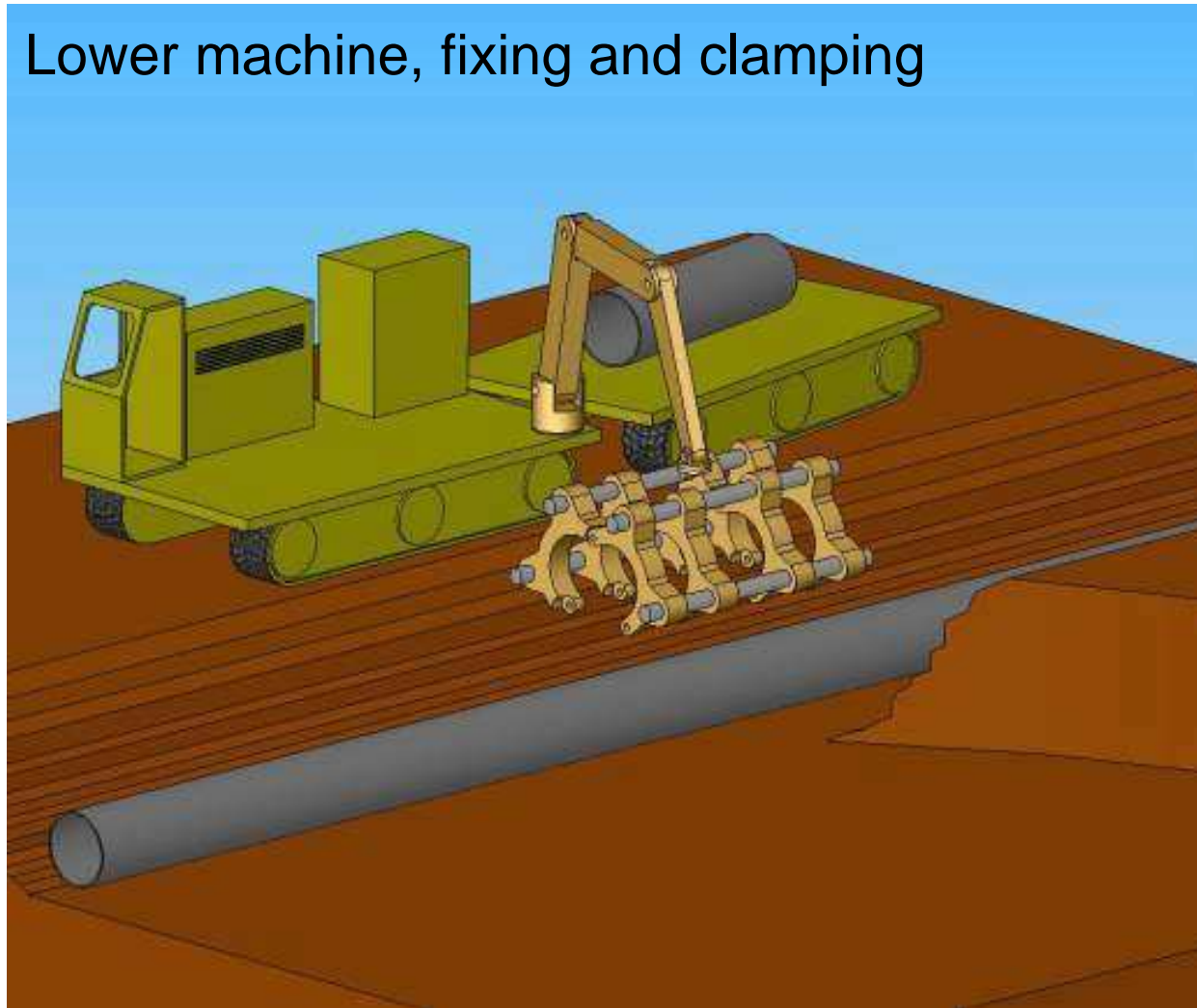
Start position



# Project Description & Findings



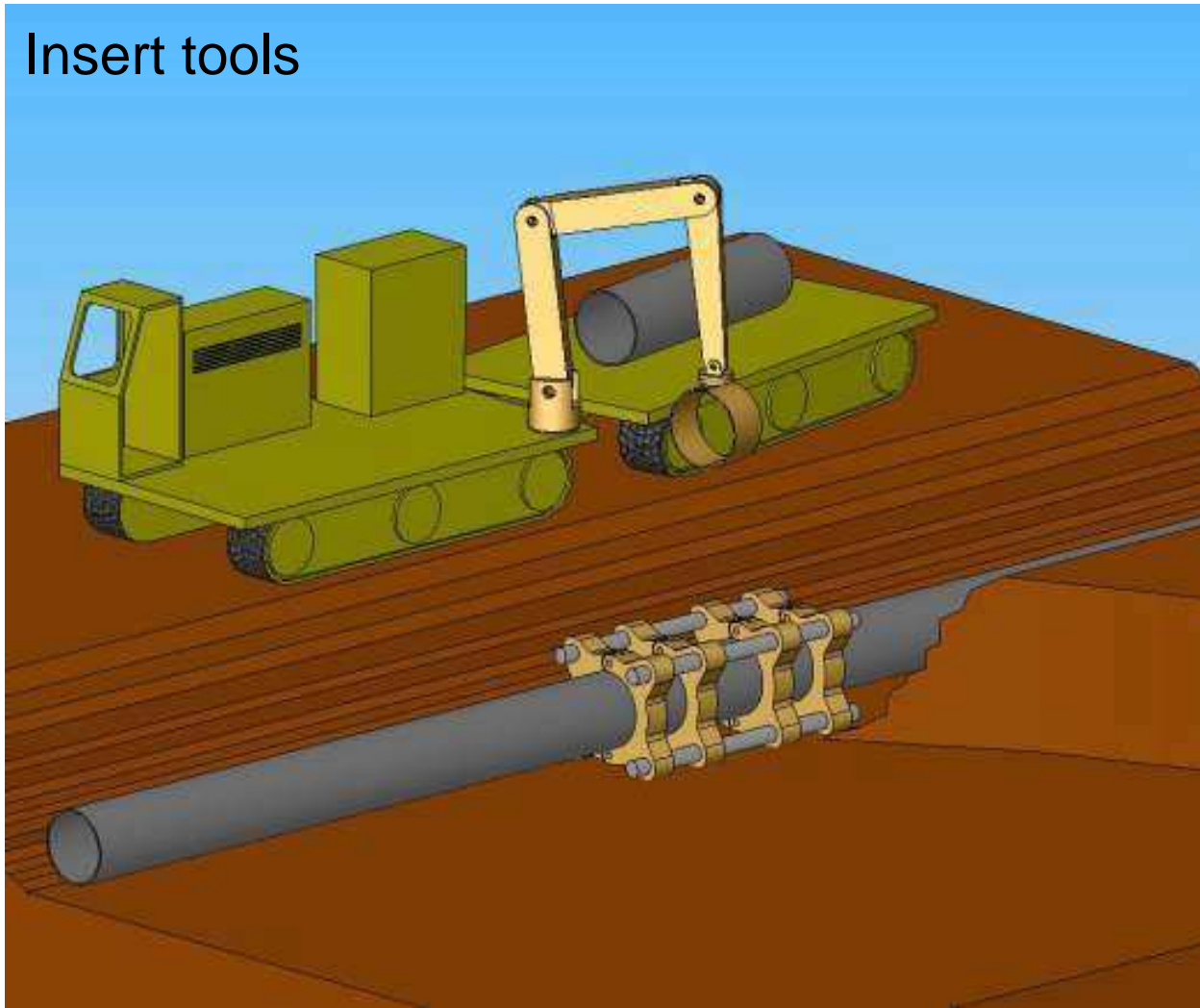
Lower machine, fixing and clamping



# Project Description & Findings



## Insert tools

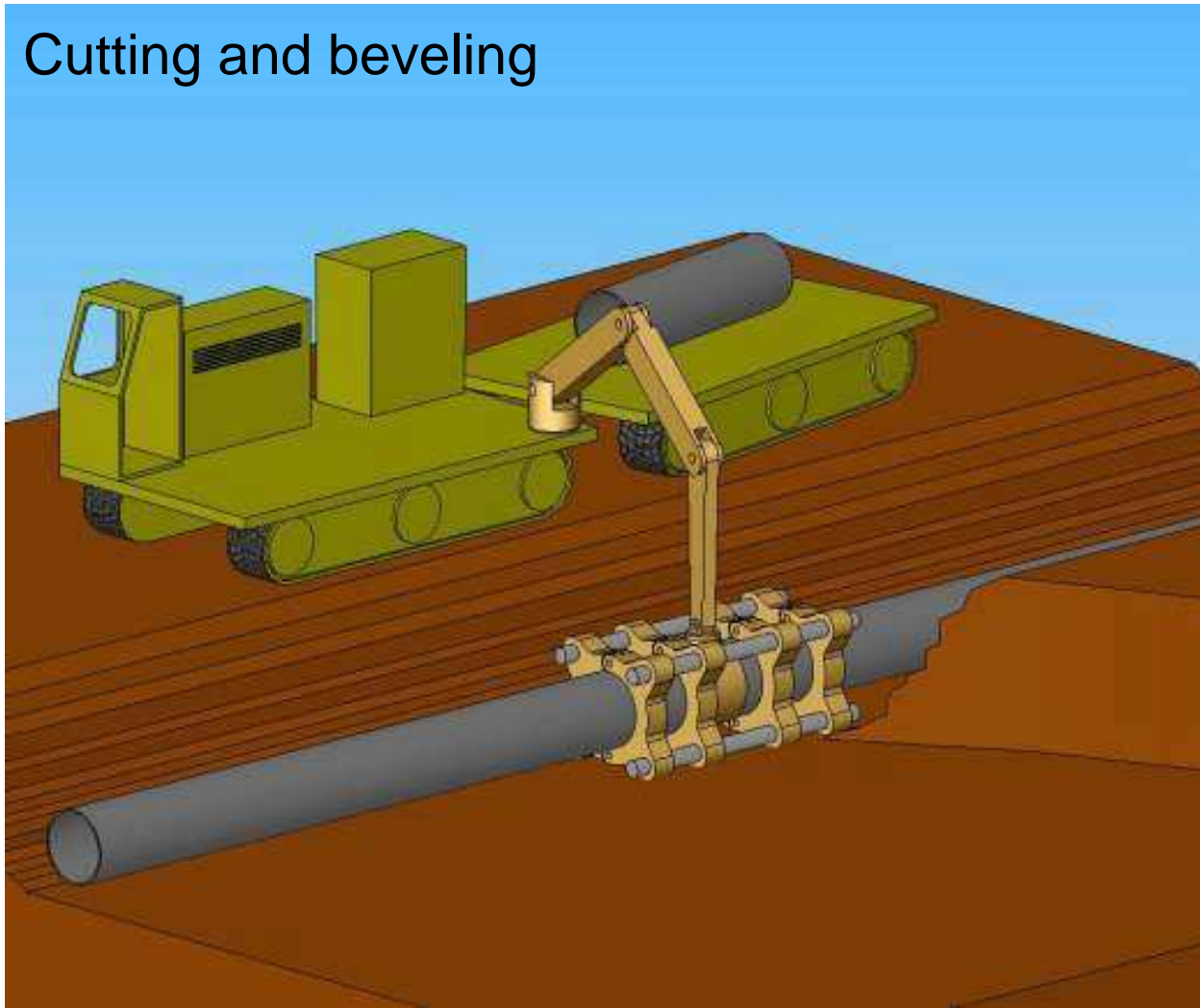




# Project Description & Findings



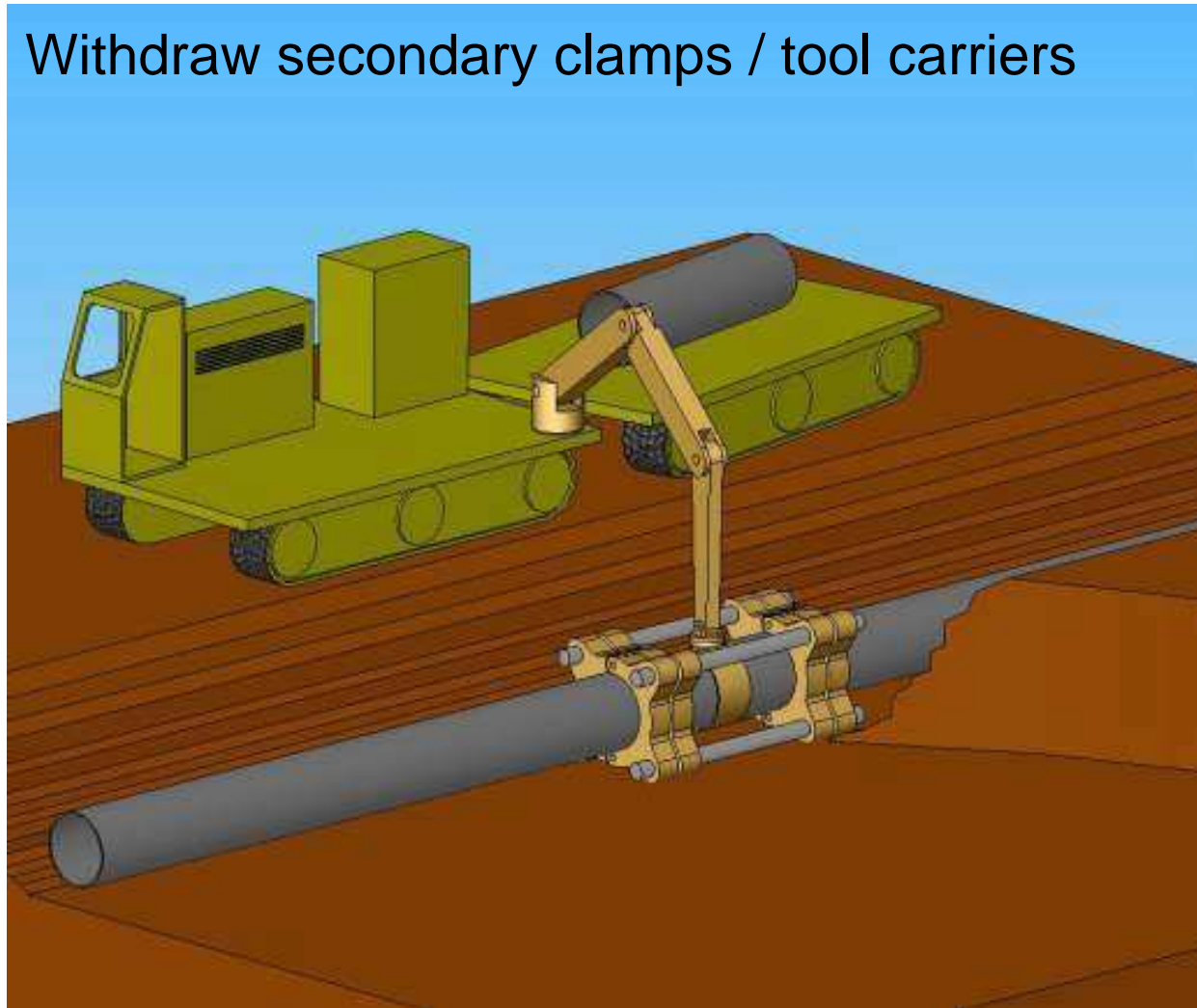
## Cutting and beveling



# Project Description & Findings



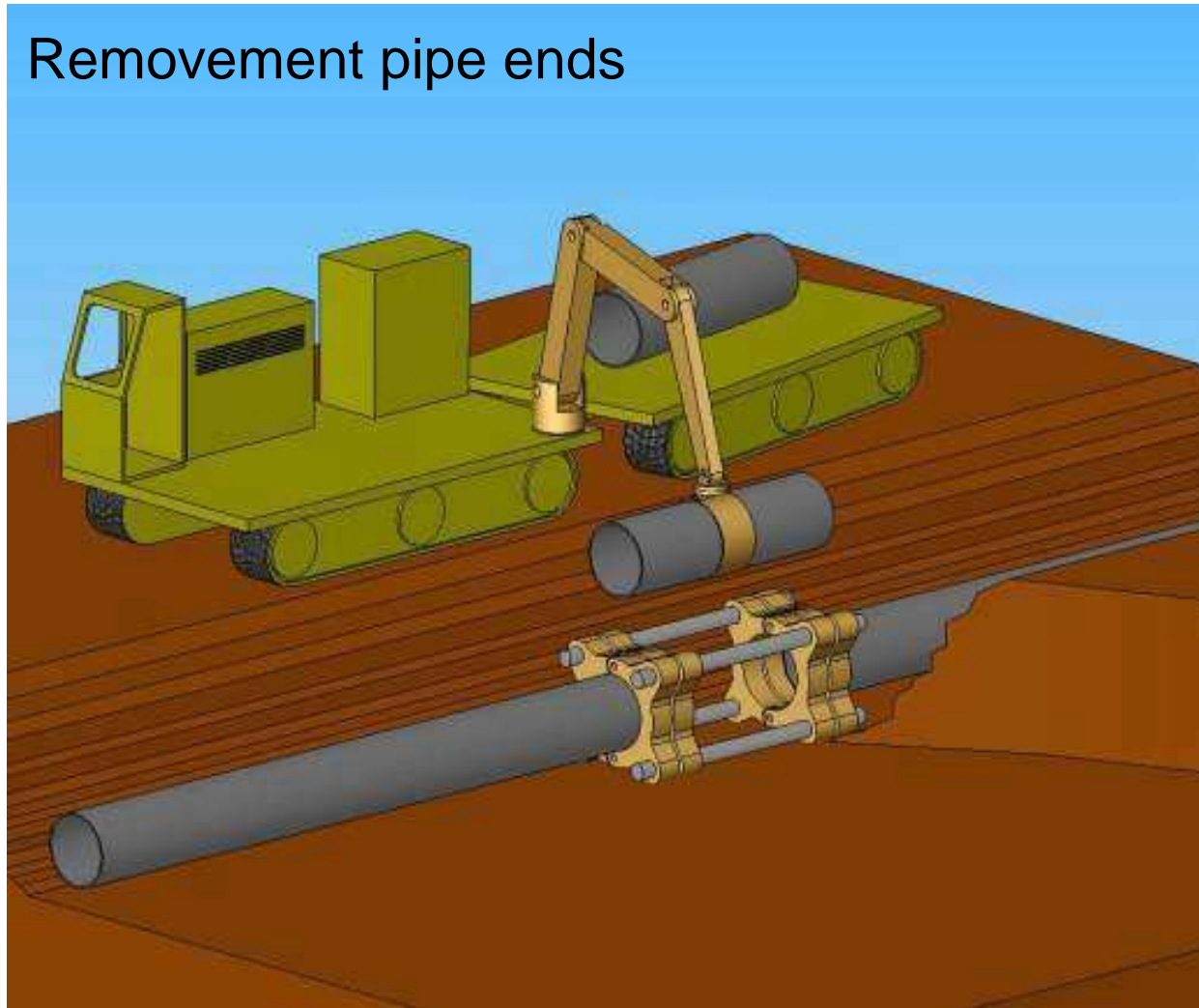
Withdraw secondary clamps / tool carriers



# Project Description & Findings



## Removement pipe ends

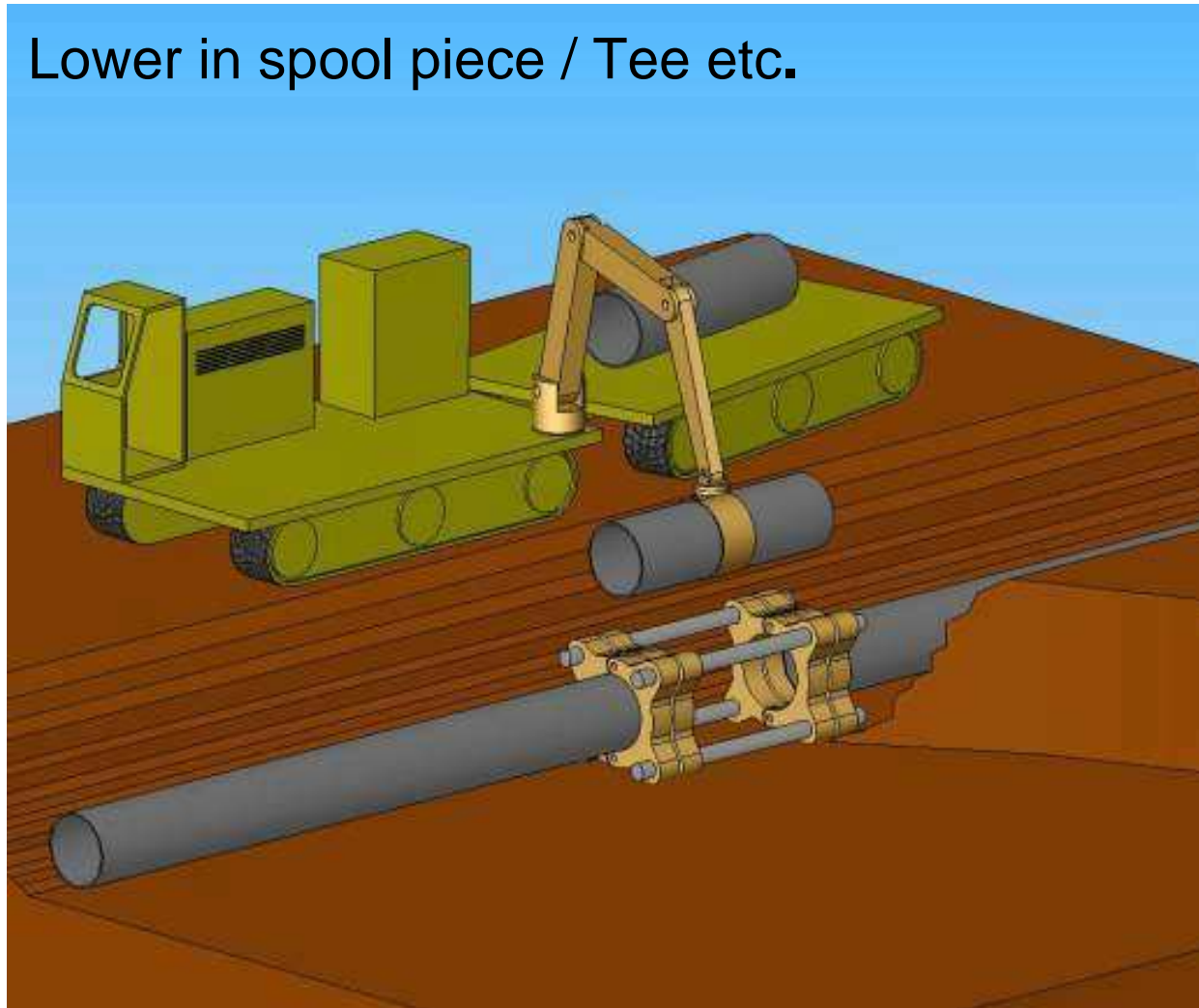




# Project Description & Findings



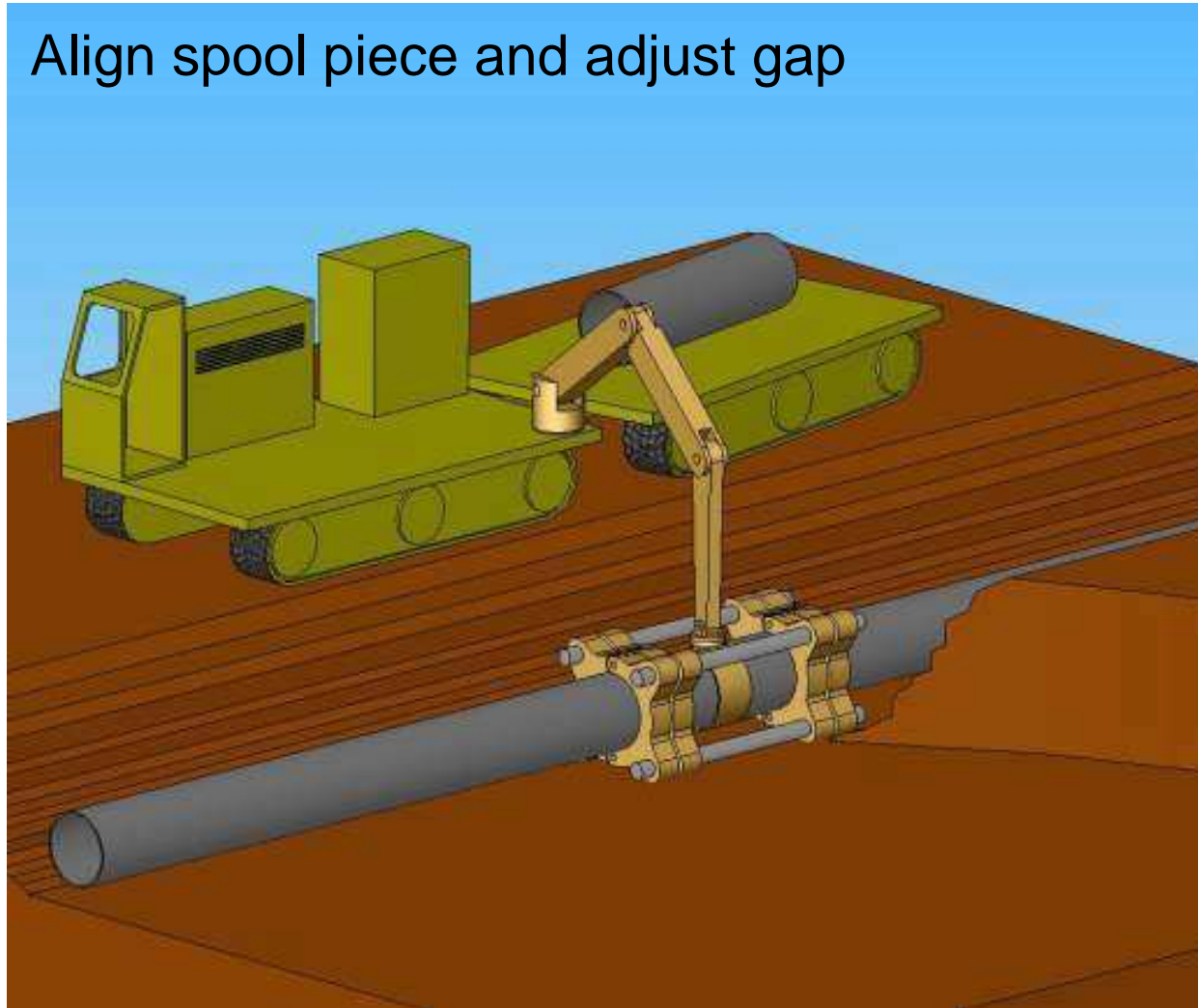
Lower in spool piece / Tee etc.



# Project Description & Findings



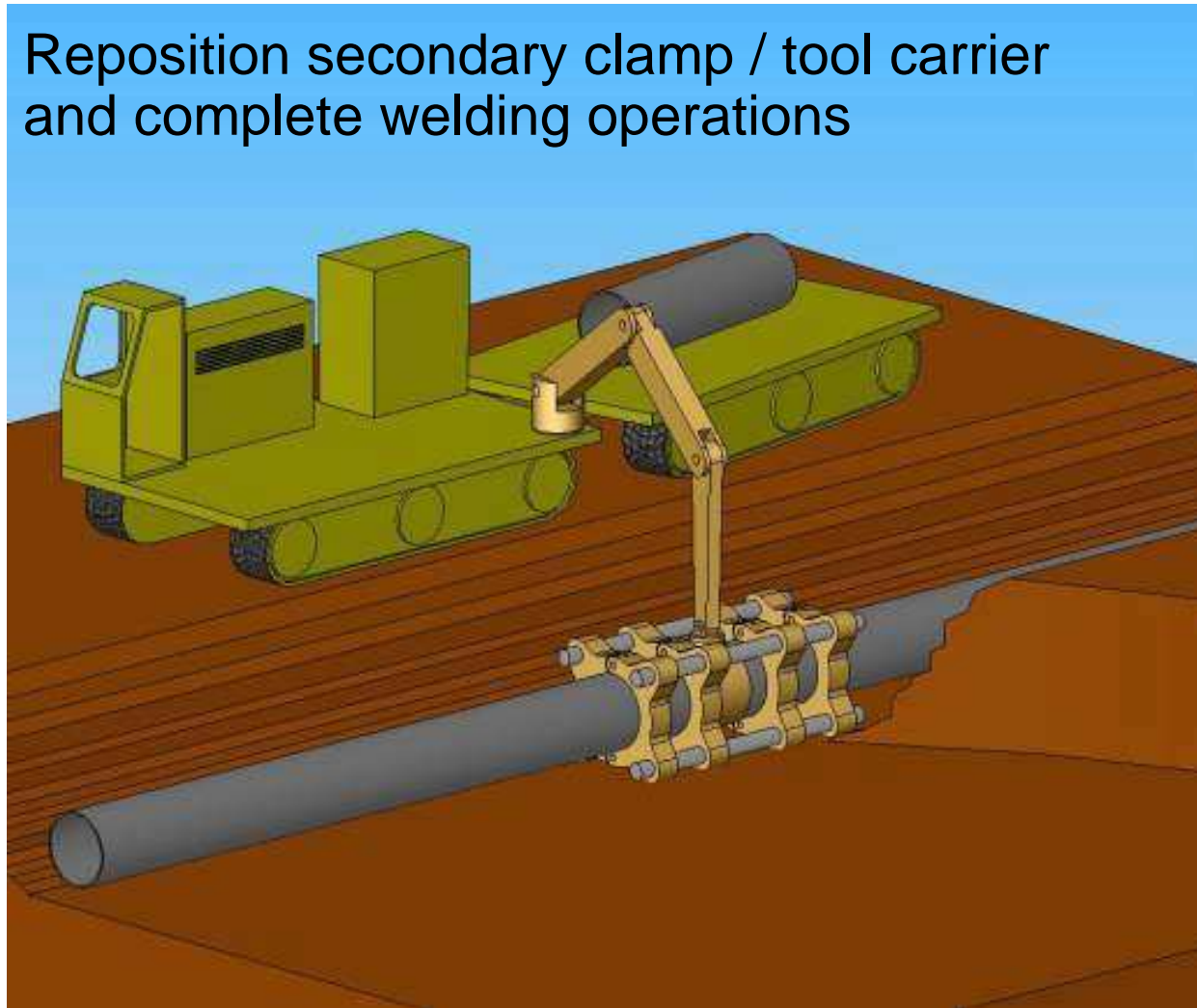
Align spool piece and adjust gap



# Project Description & Findings



Reposition secondary clamp / tool carrier  
and complete welding operations

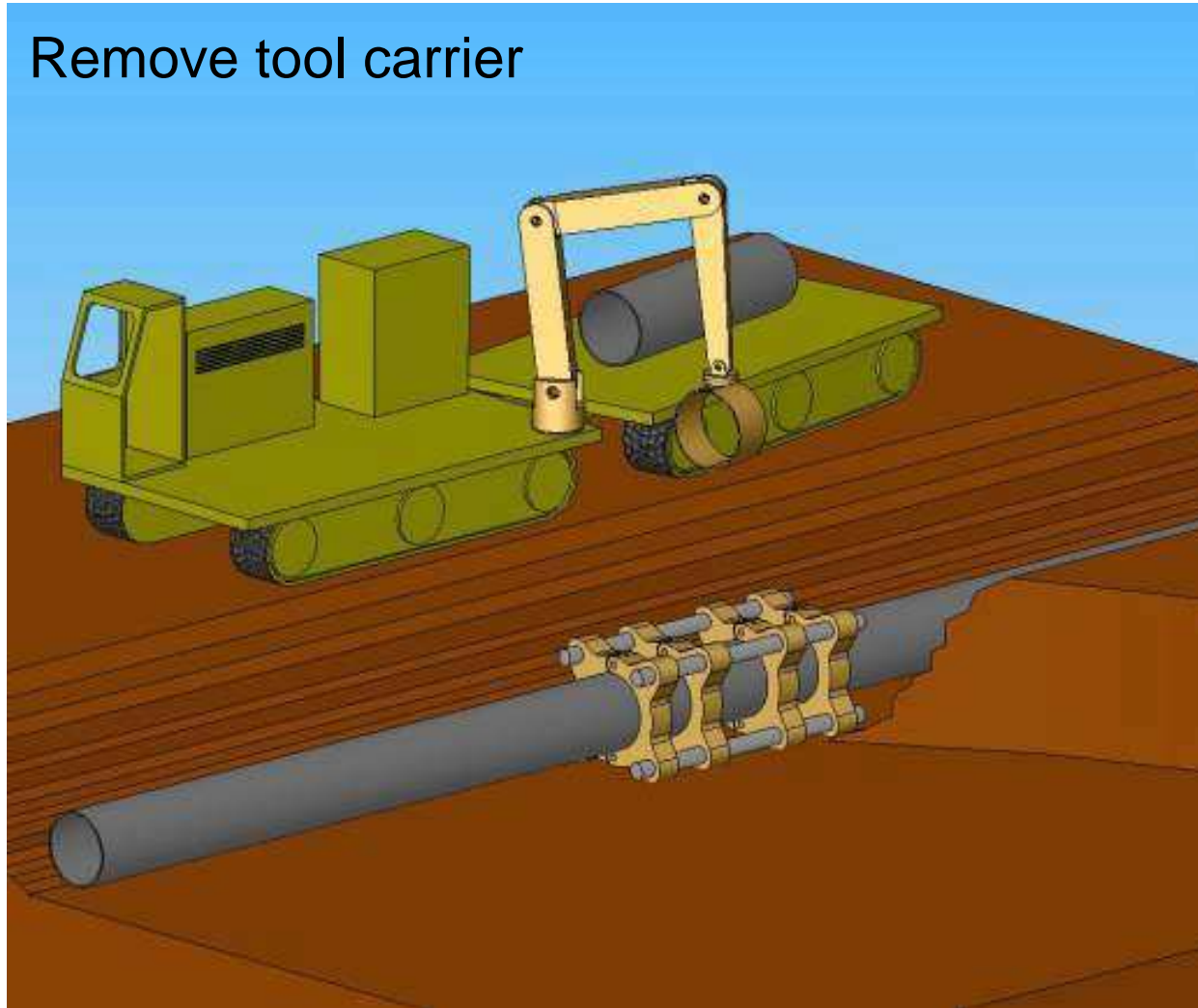




# Project Description & Findings



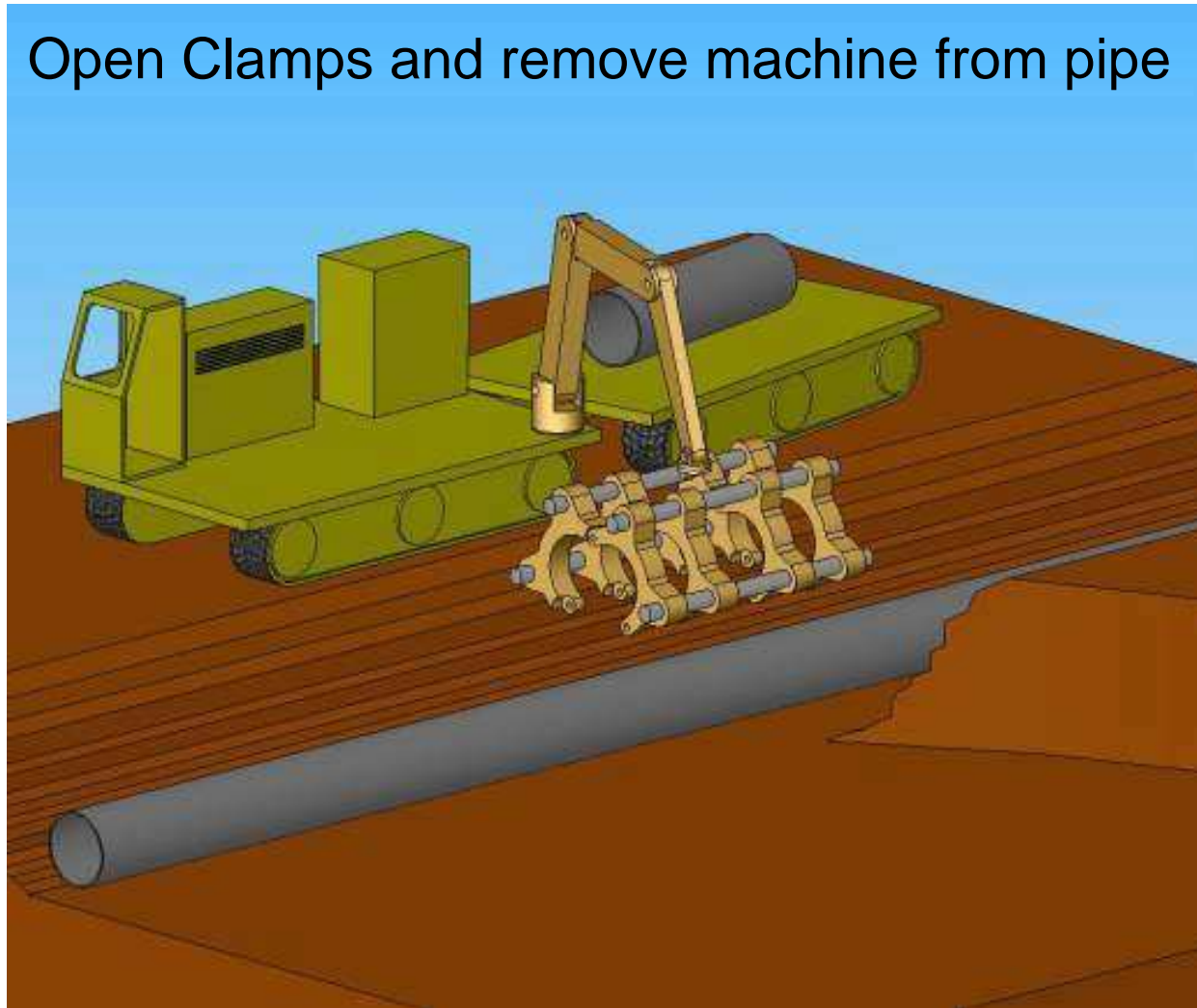
Remove tool carrier



# Project Description & Findings



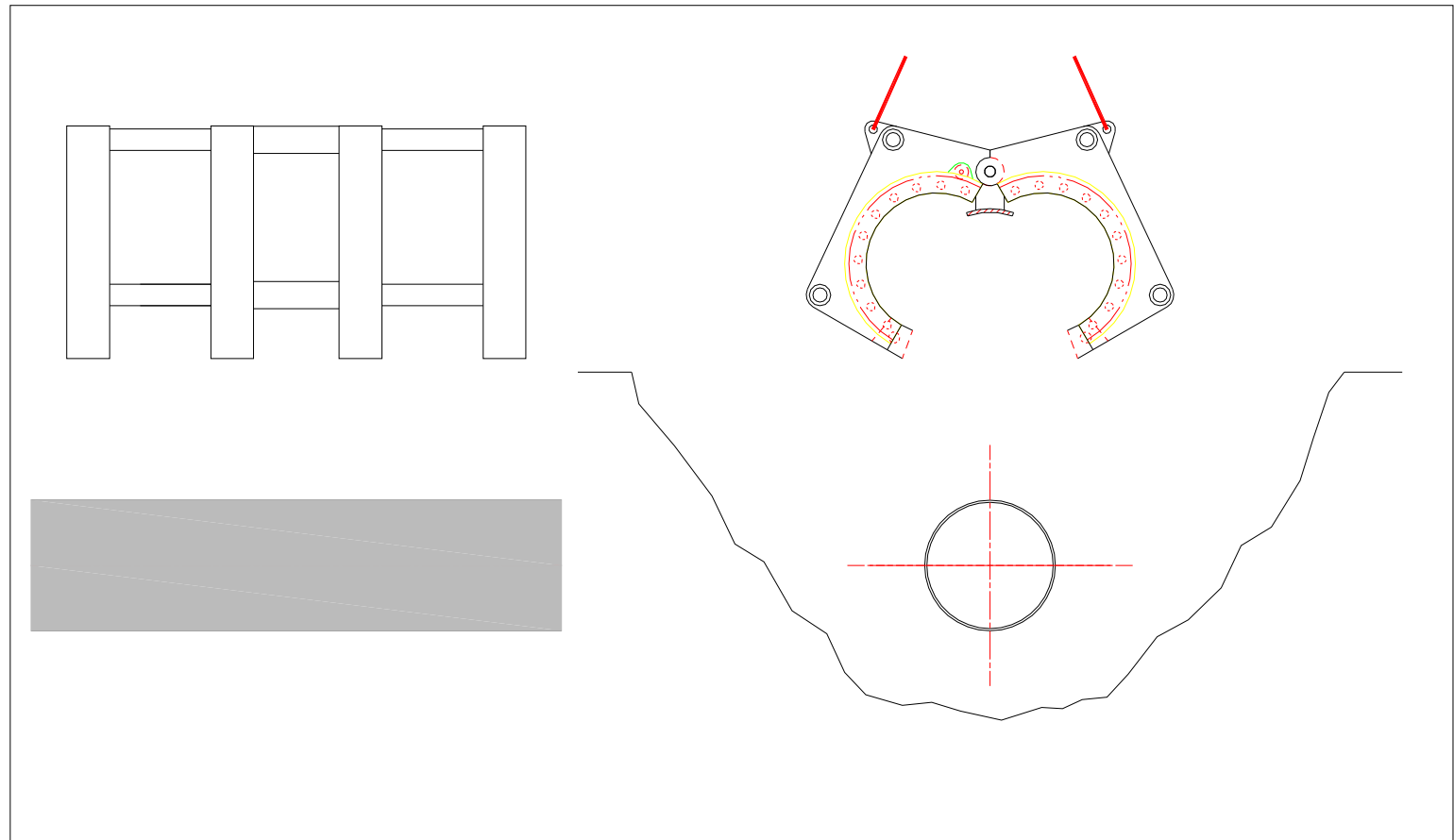
Open Clamps and remove machine from pipe



# Project Description & Findings

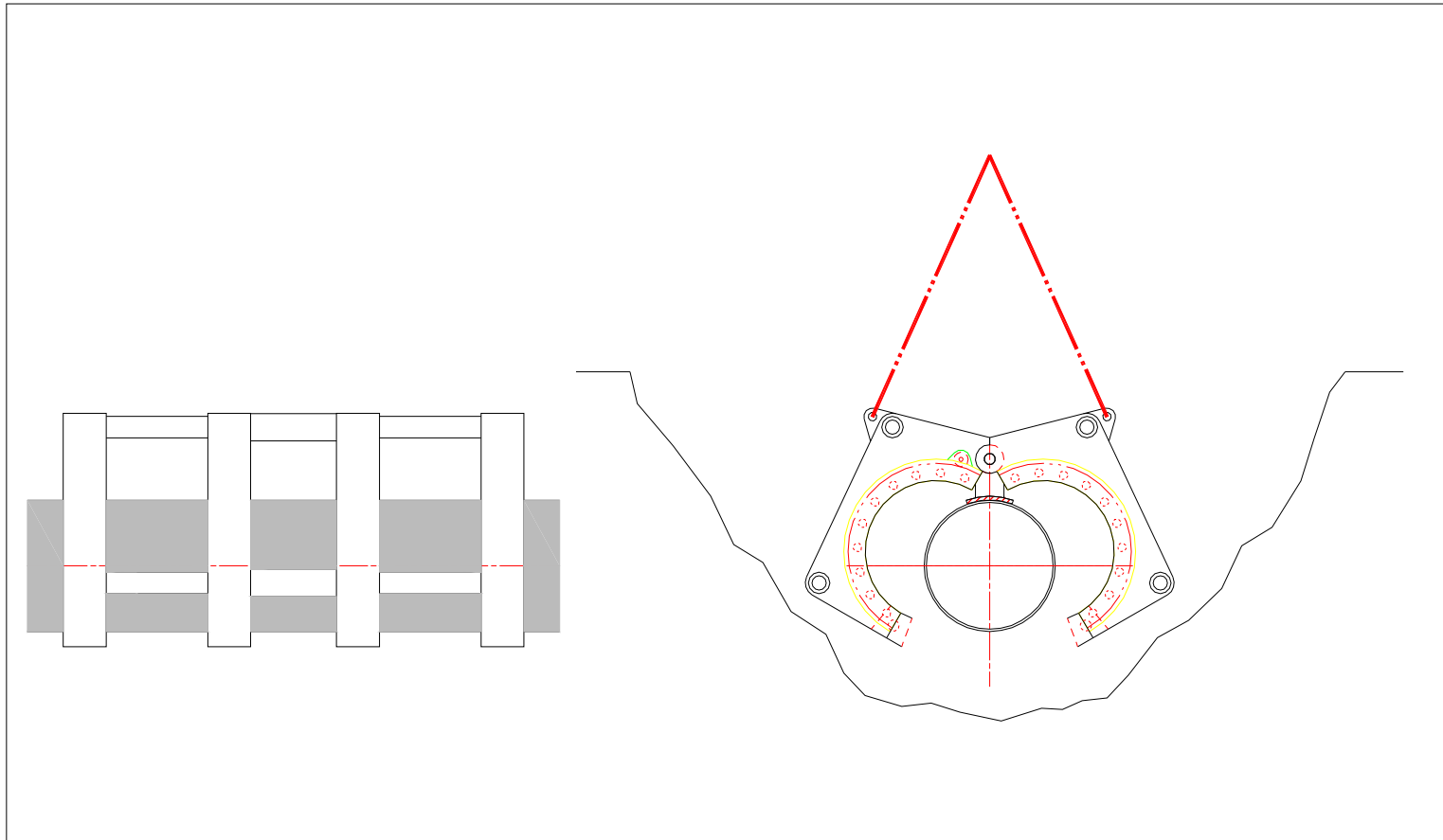


## Lowermaschine





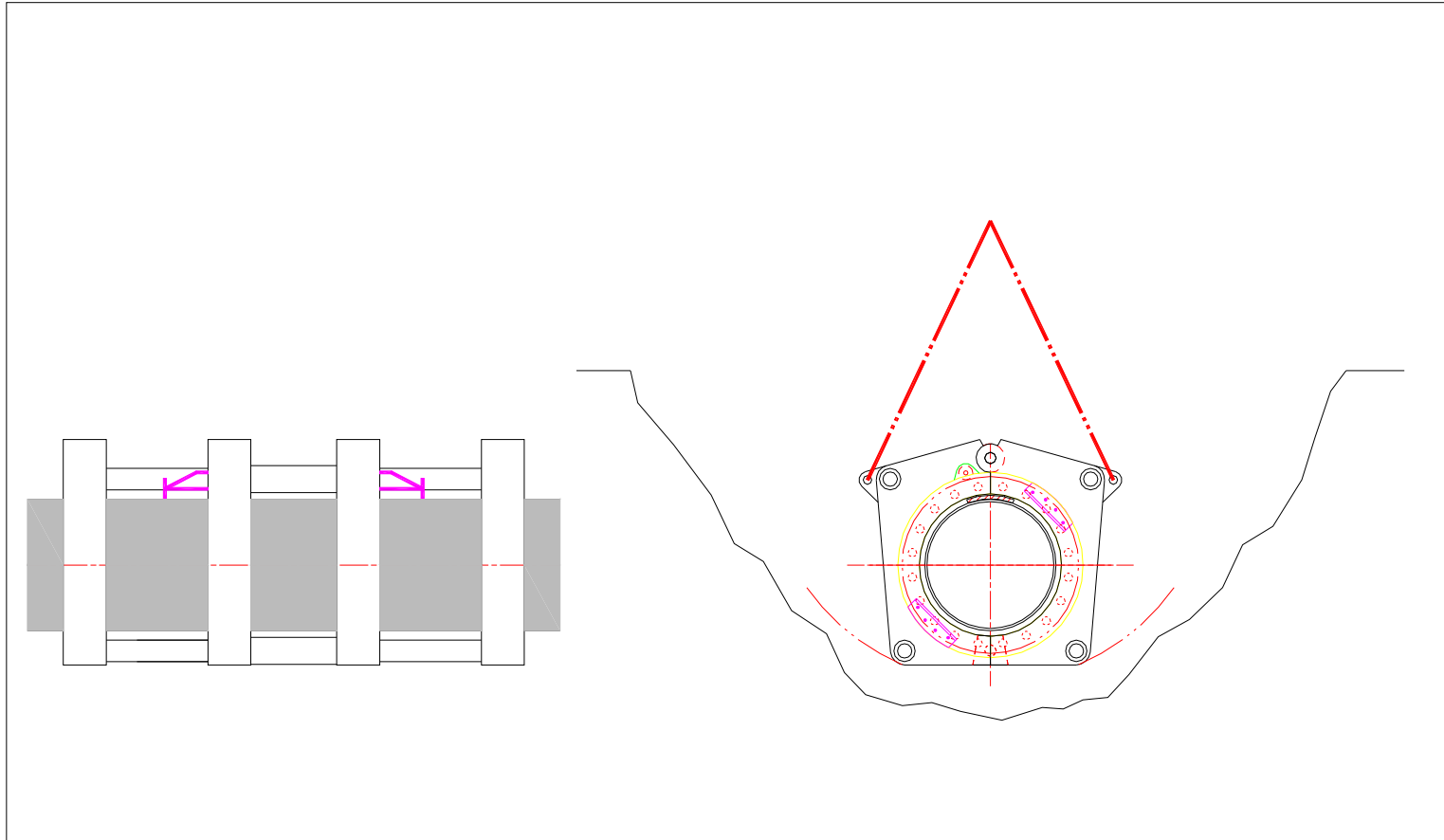
## Fixing





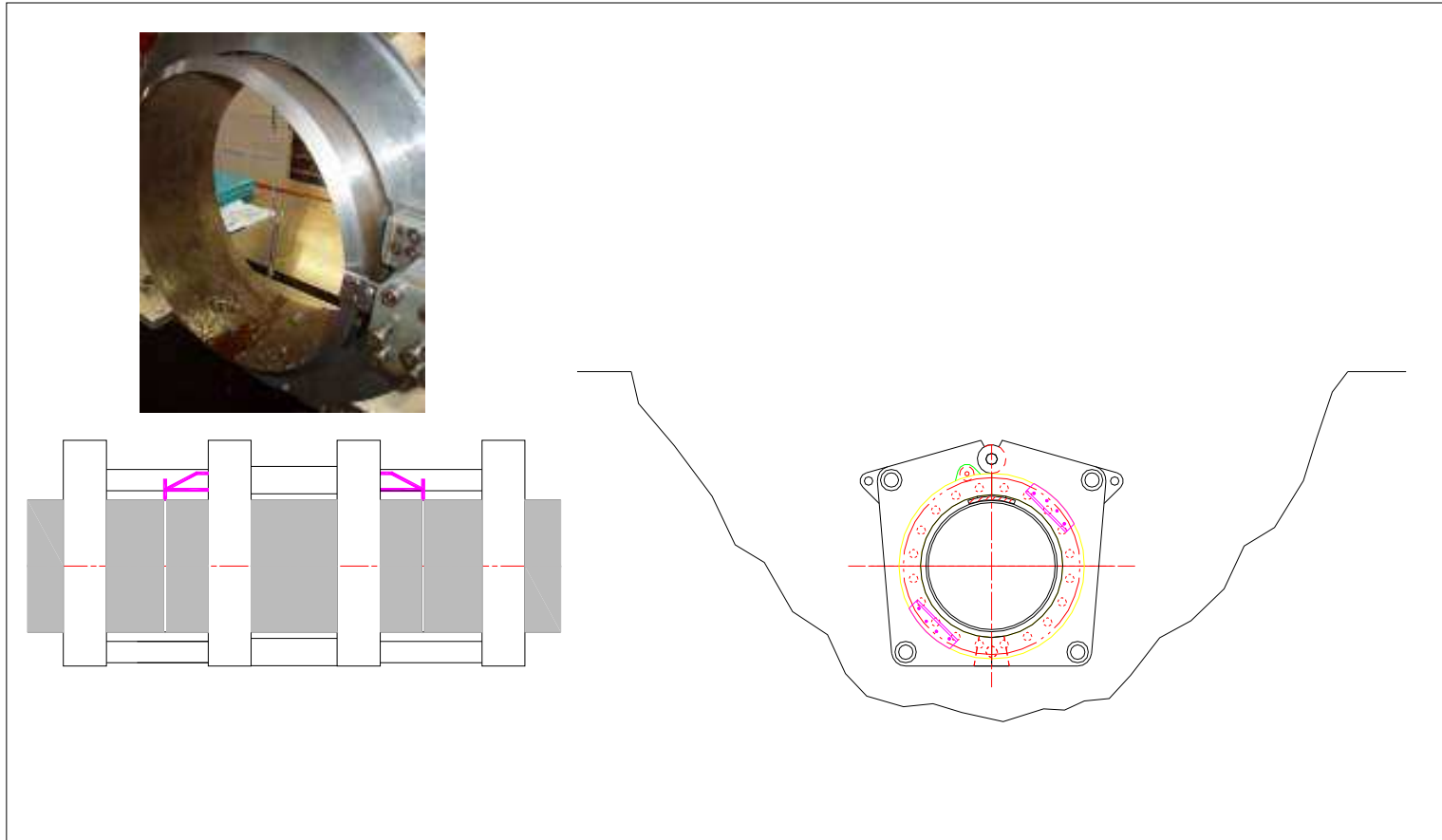


## Clamping



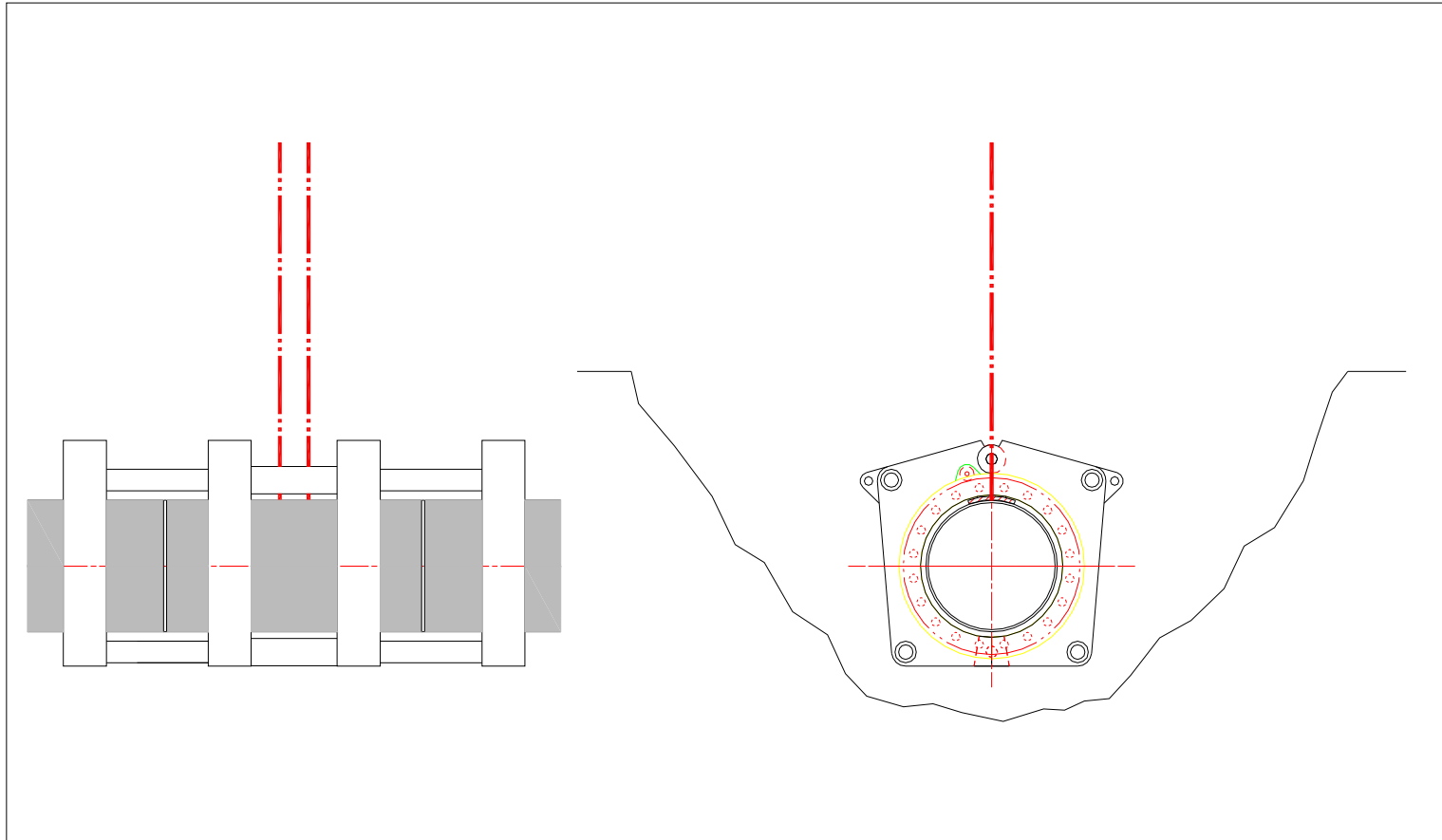


## Cutting and Beveling



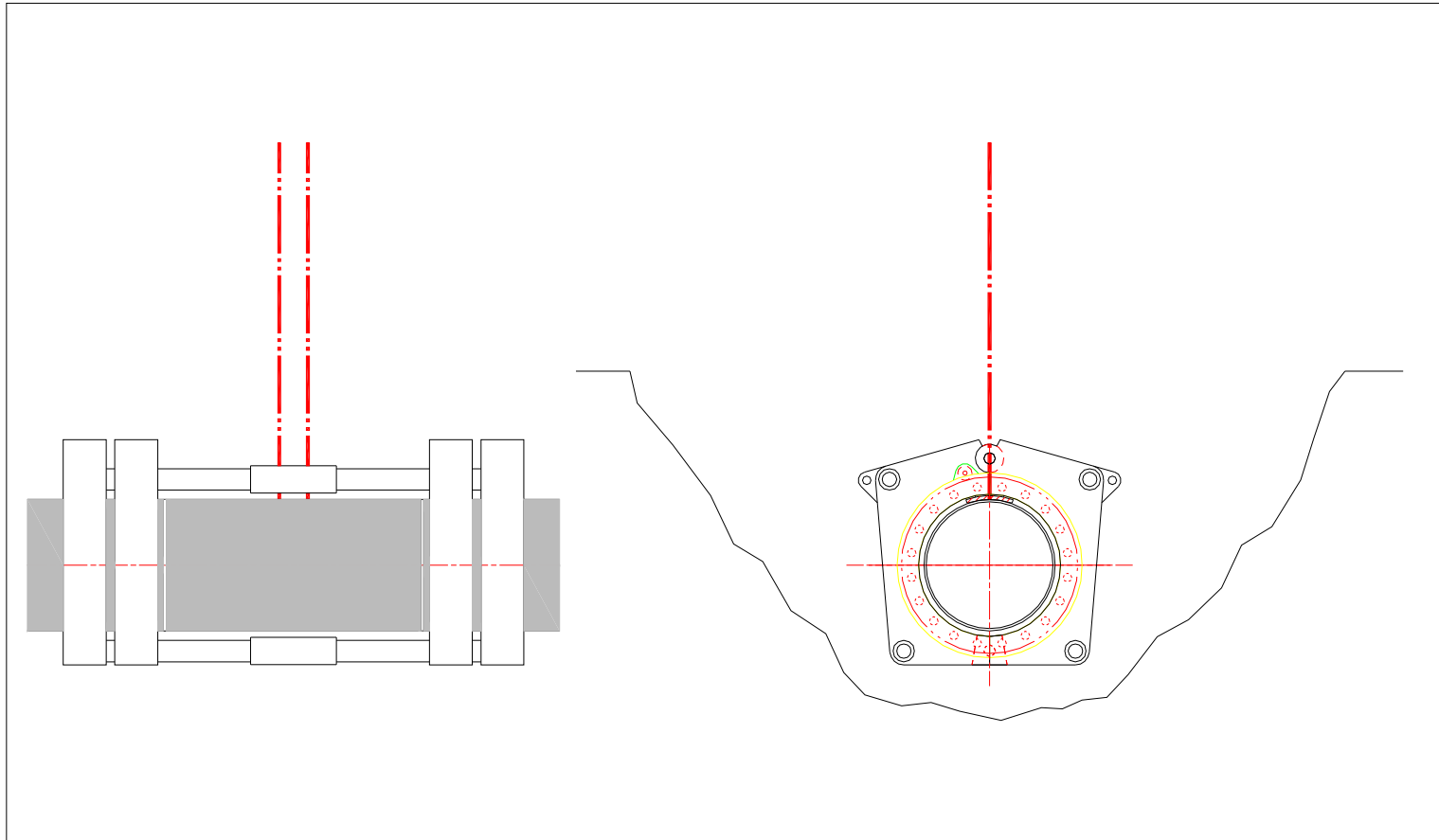


## Remove cutting tools





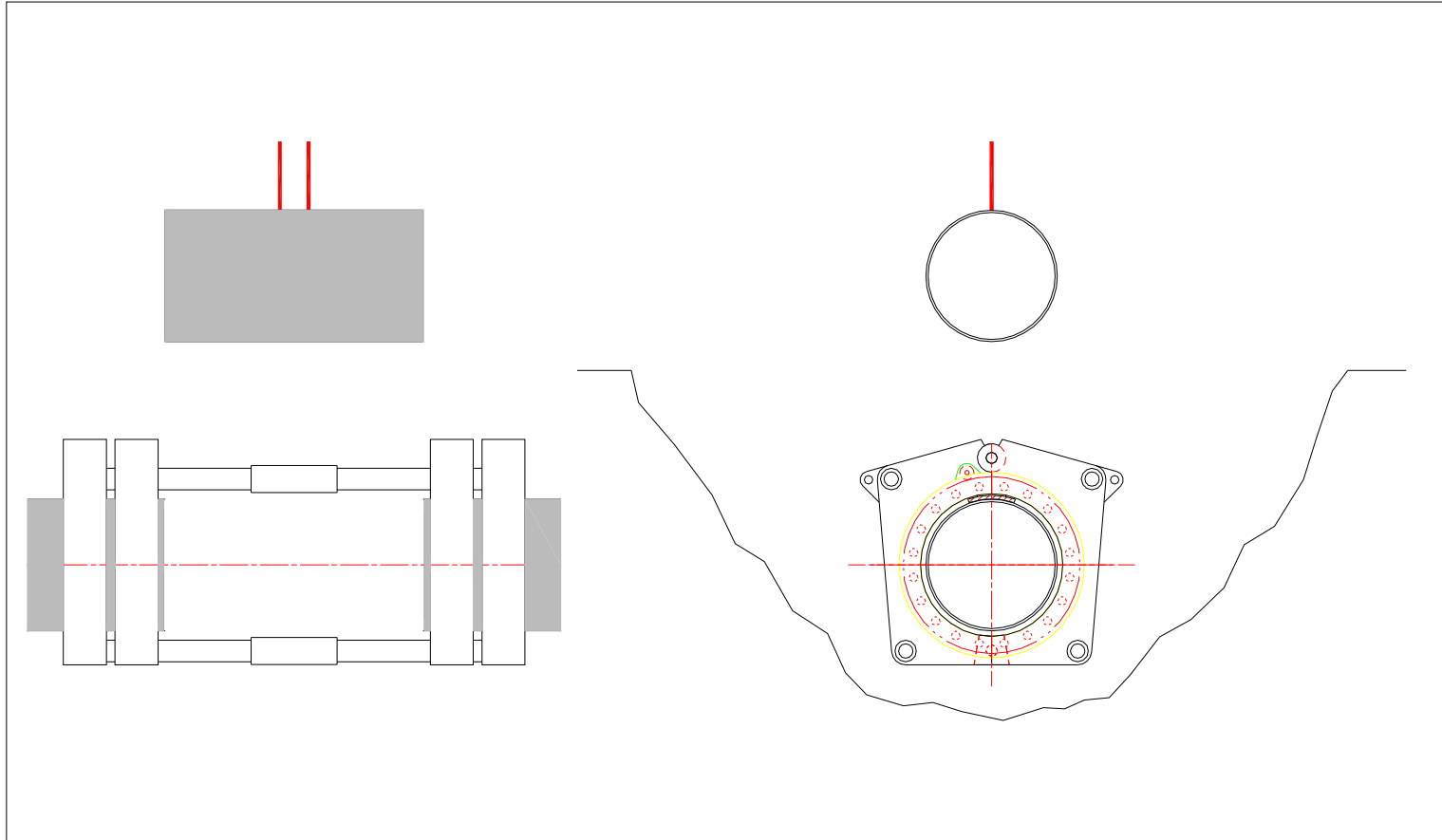
## Withdraw secondary clamps / tool carriers





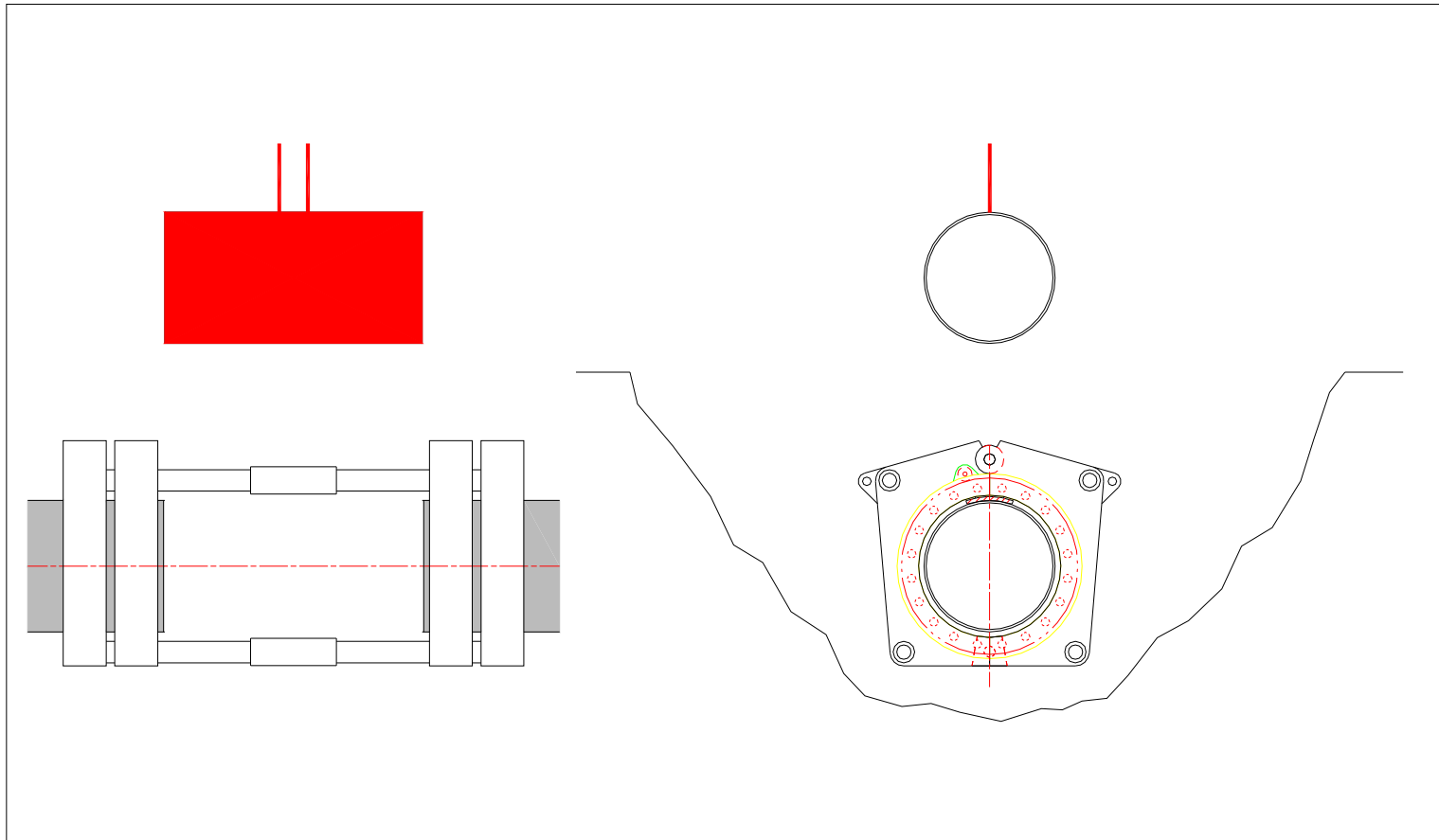


## Removement cut pipe ends



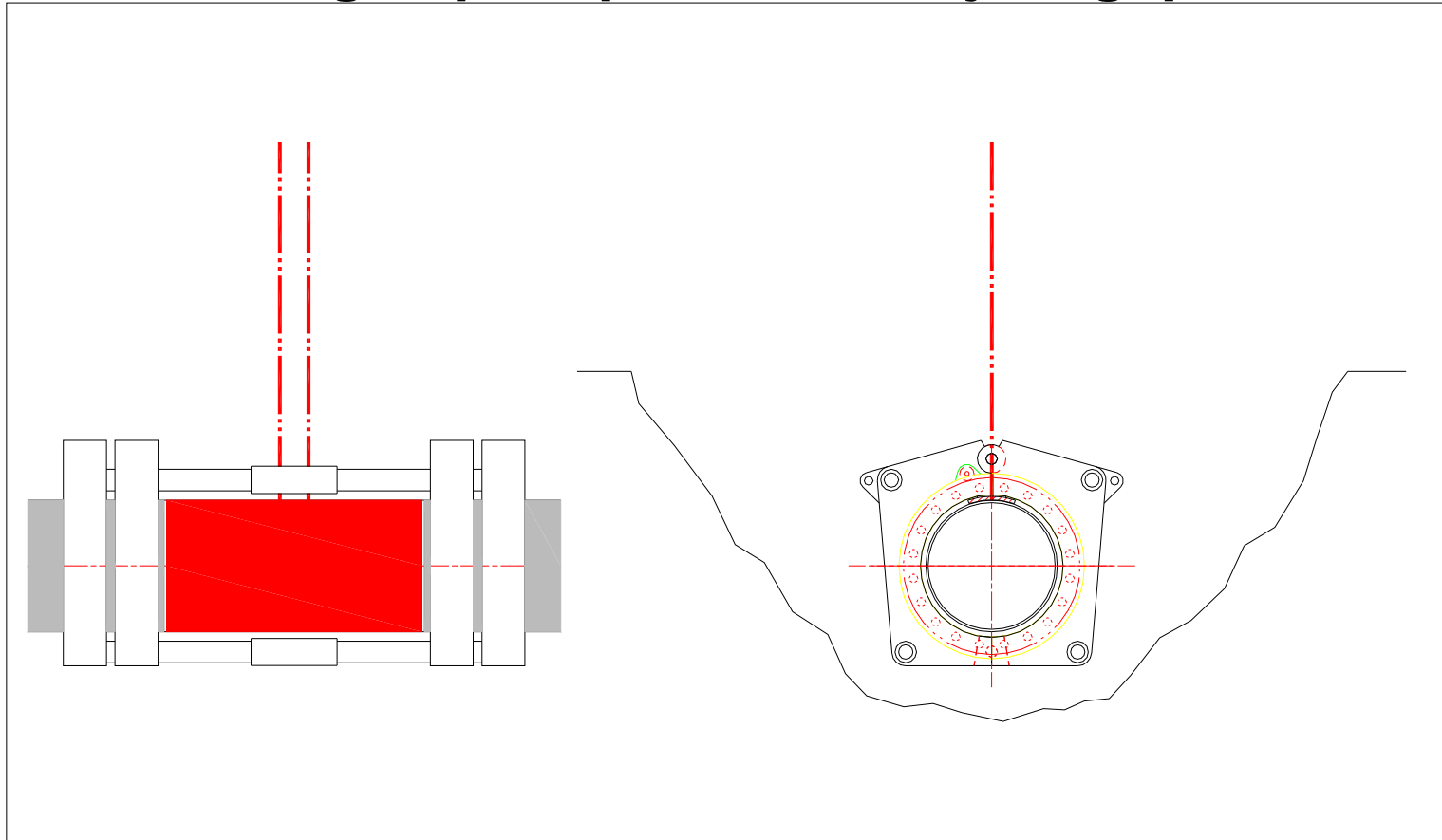


## Lower in spool piece



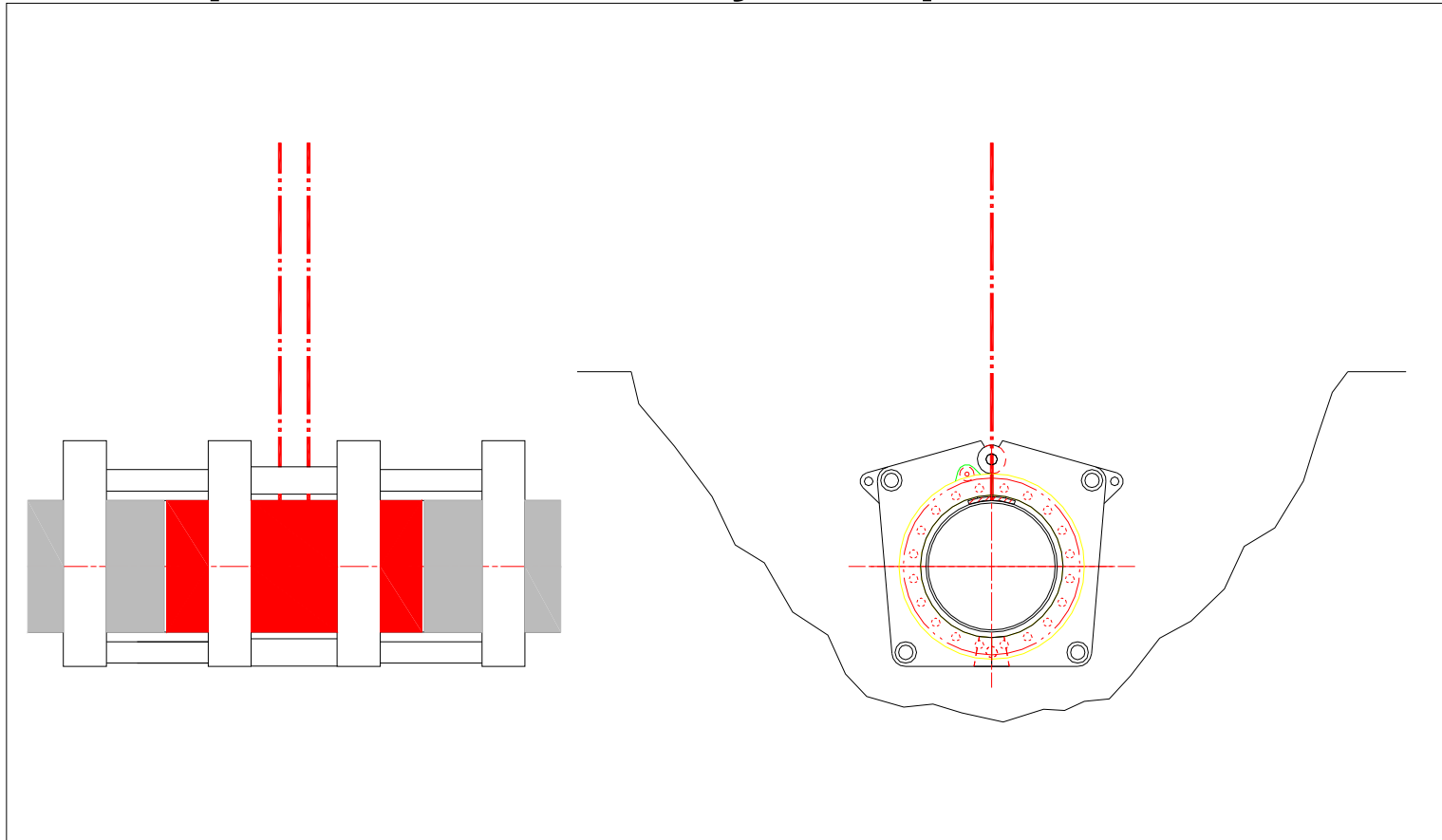


## Align spool piece and adjust gap





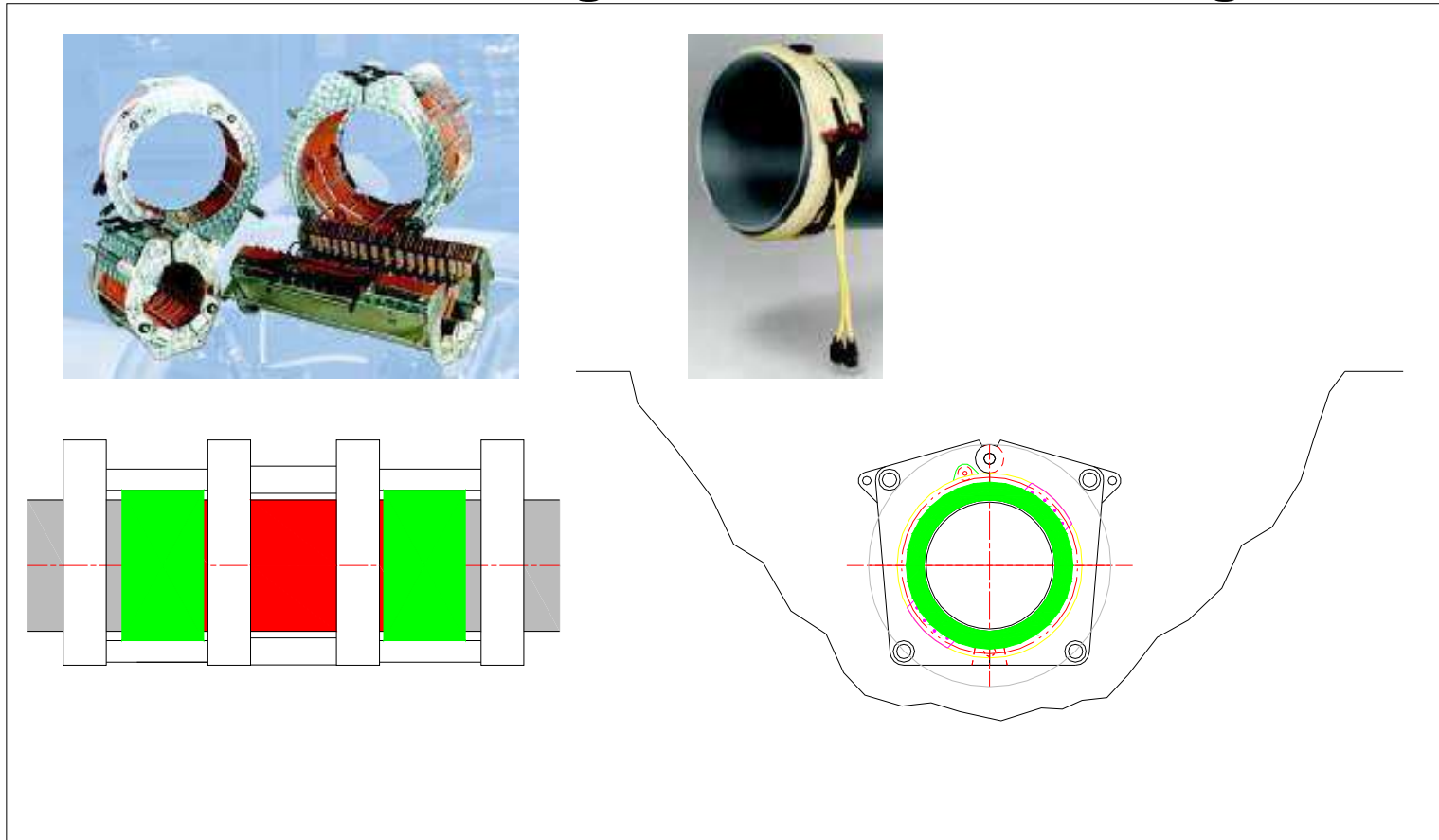
## Reposition secondary clamp / tool carrier





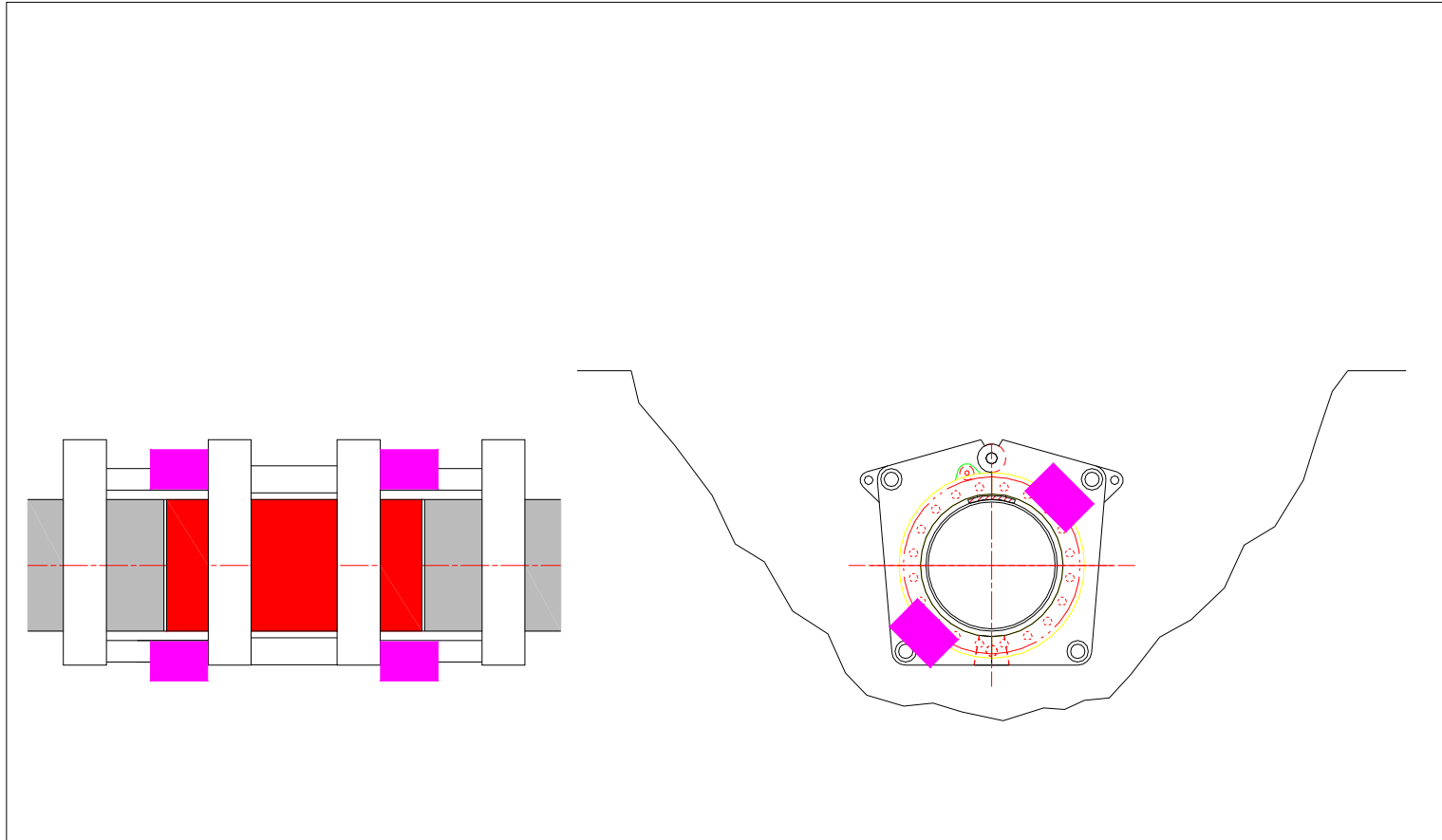


## Backcut Coating and Weld Pre-heating



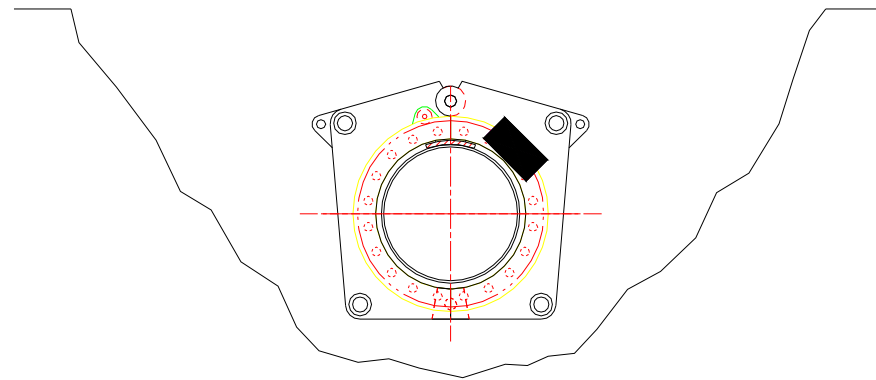
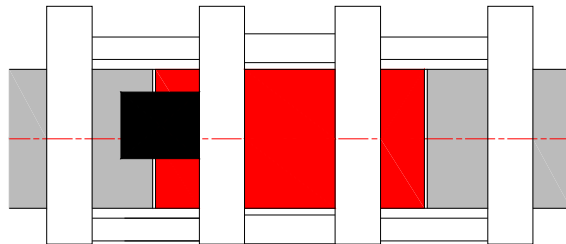


## Complete welding operations



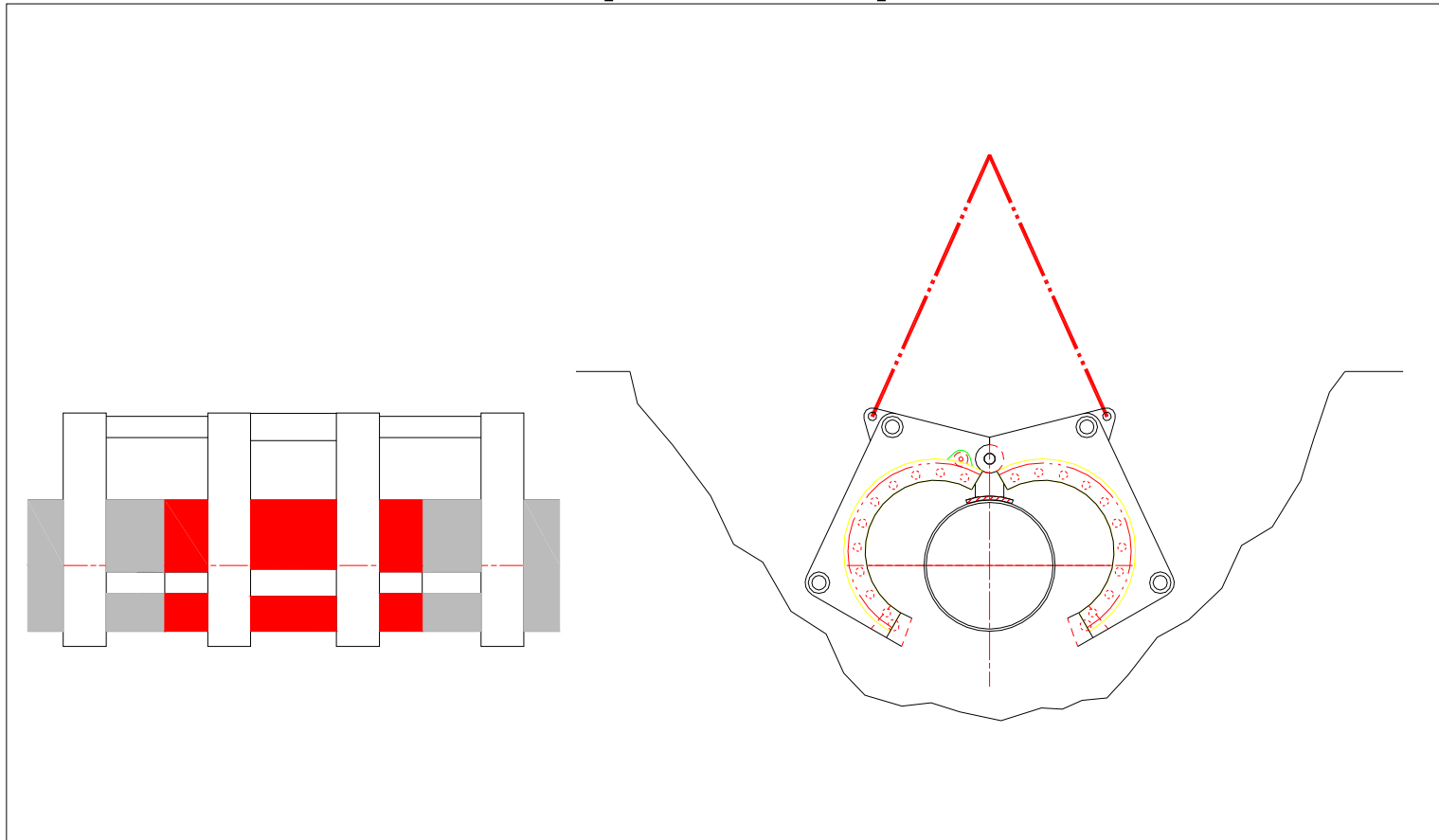


## Welding inspection



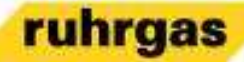


## Open Clamp

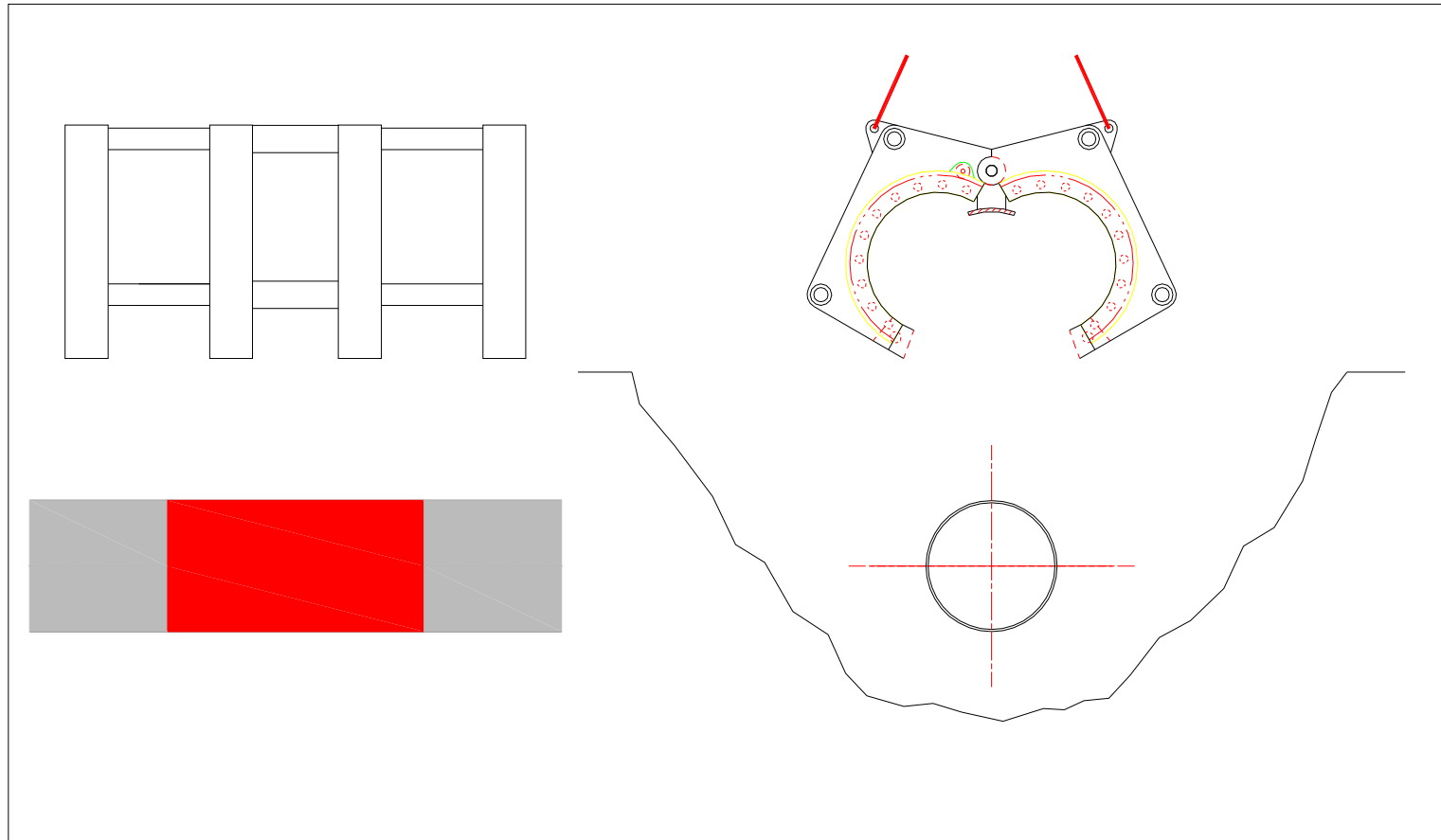




# Project Description & Findings



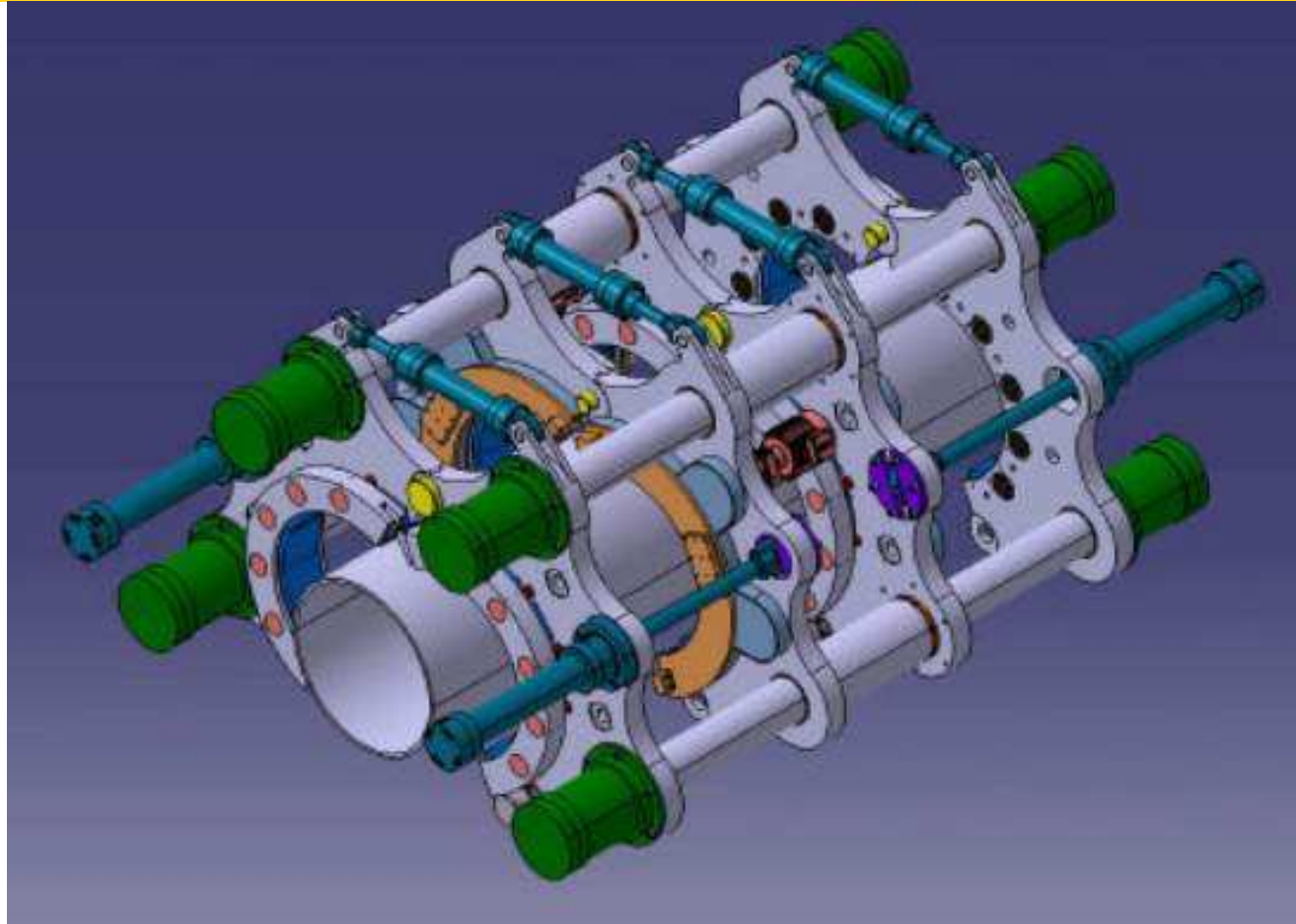
## Remove machine from pipe



# Current Status



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1. Feasibility study is finished with positive results
2. Basic design is finished
3. Patent application for new Tie-In technology is finished

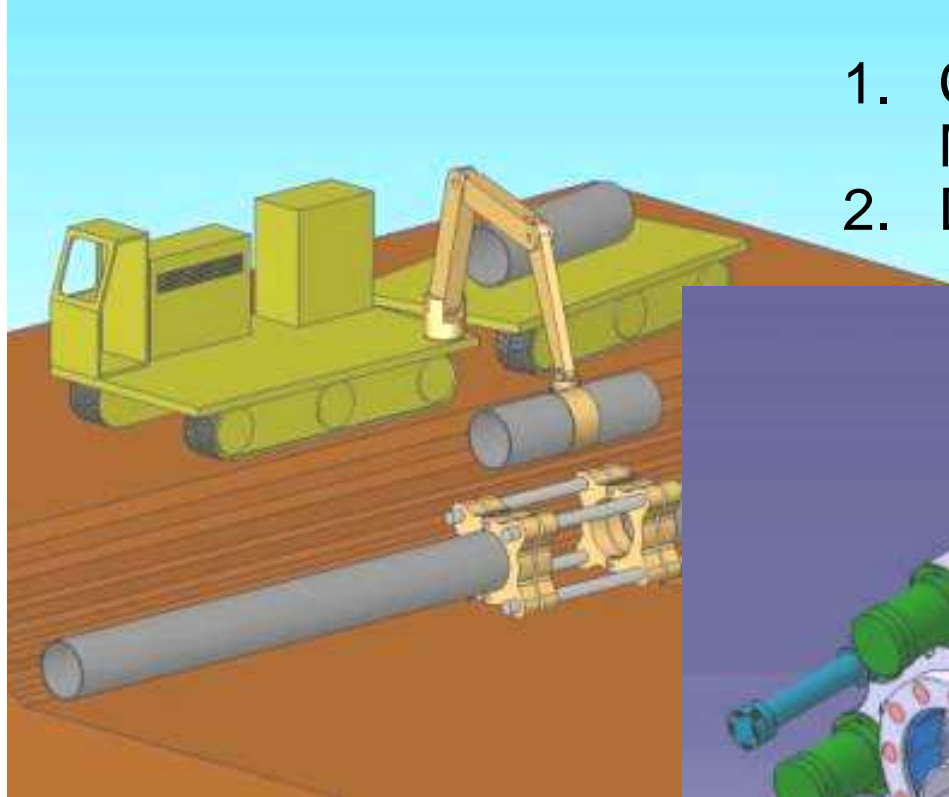
## Further Actions



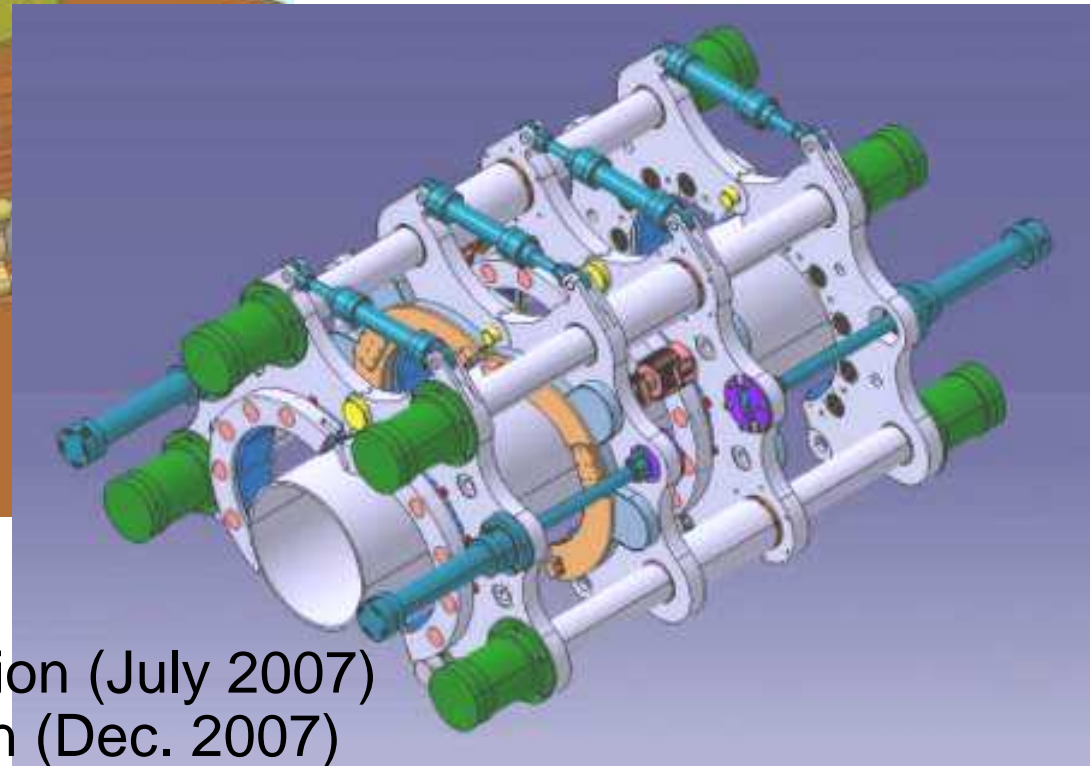
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56



1. Co-operation with manufacturer Max Streicher
2. Detail design (Sept./Oct. 2006)



3. Component construction (July 2007)
4. Prototype construction (Dec. 2007)
5. Tests under real condition (2008)

# Automated Tie-In



Thank you