Slurry Line Evaluation

Doc. No: ECHO_Slurry_Line_Evaluation_EN

0	16.04.2026	Calculation and Evaluation, first issue	PSÖ	SKN	FJU
Revision	Date	Description	Created	Checked	Approved

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1 Introduction

The purpose of this document is to provide a hydraulic proof of feasibility for the transportation of a petroleum coke–water slurry, within the ECHO plant, through a pipeline system (Slurry Line) with a total length of 4,500 m.

The assessment demonstrates that:

- the required mass and volume flow rates are hydraulically achievable,
- the resulting pressure losses are acceptable,
- the minimum flow velocity required to prevent sedimentation is exceeded,
- and the system can be operated using our existing Slurry Pump technology.

The proof is based on a detailed hydraulic calculation performed with CONVAL® (Version 11.2).

2 General Design Conditions and Input Data

2.1 Transported Medium

Parameter	Value
Medium	Petroleum coke–water slurry
Hydraulic model	Single-phase
State	Liquid
Operating density	1,085 kg/m^3
Dynamic viscosity	3.26 cP
Operating temperature	approx. 70 °C

2.2 Slurry Line Data

Parameter	Value
Nominal diameter	DN 450 (horizontal) DN 400 (vertical)
Absolute roughness	0.08 mm
Total pipeline length	4,500 m
Geodetic elevation difference	30 m

2.3 Fittings and Components

Component	Quantity / Value
90° bends, radius 5D	40 pcs
Gate valves	3 pcs
Flow-optimized branch	1 pc

3 Operating Conditions

Parameter	Value
Mass flow rate	976.5 t/h
Volume flow rate	900 m^3/h
Maximum flow velocity	1.71 m/s (horizontal part) 2.15 m/s (vertical part)

The calculated flow velocity is above the minimum critical velocity required to prevent sedimentation and therefore ensures particle suspension along the entire pipeline length.

4 Hydraulic Calculation Results (CONVAL®)

4.1 Pressure Loss Breakdown

Contribution	Pressure loss
Pipe friction losses	2.72 bar (horizontal part) 0.05 bar (vertical part)
Static head (elevation)	0.00 bar (horizontal part) 3.19 bar (vertical part)
Local losses (fittings)	0.17 bar (horizontal part) 0.13 bar (vertical part)
Total pressure loss	**6.26 bar**

4.2 Power Requirement

Parameter	Value
Hydraulic loss power	72 kW (horizontal part) 84 kW (vertical part)
Mean Darcy friction factor λ	0.0165

The calculated pressure loss and power demand lie well within the typical range for Slurry Line systems of comparable size and throughput.

5 Hydraulic Evaluation

Based on the calculated hydraulic results, the following engineering assessment can be made:

- The pipeline system is hydraulically feasible under the defined operating conditions.
- The selected operating point includes an adequate hydraulic margin to accommodate normal operational fluctuations in flow rate and slurry properties.
- Pressure losses are dominated by pipe friction and static elevation but remain technically moderate.
- The required pumping power can be provided by our proprietary Slurry Pump.
- Stable continuous operation is technically assured.

6 Conclusion - Proof of Feasibility

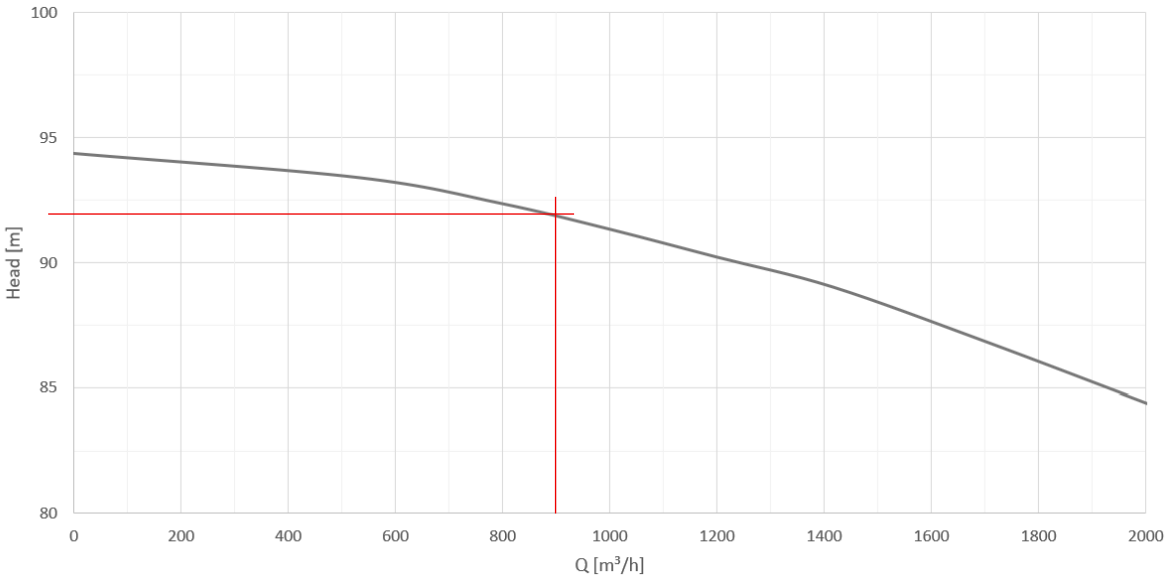
Based on the CONVAL® hydraulic calculation, it is concluded that the planned Slurry Line:

- is hydraulically feasible,
- meets all requirements regarding pressure loss and flow velocity,
- and can be operated safely and reliably under continuous conditions.
- The hydraulic feasibility of the pipeline system is therefore confirmed.

7 Slurry Pump information

The Slurry Pump is designed for the continuous transfer of a mixture of crushed coke and water from the ECHO system to the Dewatering Bin. The pump is internally armored to withstand abrasive service conditions and to ensure reliable long-term operation under the specified process conditions.

The following curve illustrates the pump performance (Q/H curve) at an operating speed of 800 rpm. The curve demonstrates that the Slurry Pump is capable of overcoming the calculated system pressure losses and fully complies with the hydraulic requirements of the ECHO process.



8 Attachments

1. Att1_CONVAL calculation result – upon request (please ask us)