Slurry Line Evaluation

焦浆长距离管线输送评估

Doc. No: ECHO_Slurry_Line_Evaluation_EN+CN

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

Table of Contents

目录

1 Introduction 简介

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.

本文旨在提供一个水力学可行性研究，评估 ECHO 装置的石油焦焦浆通过管道系统（焦浆管线）进行距离高达 4500 米的远距离输送的可行性。

The assessment demonstrates that:

本评估的主要结论如下：

- the required mass and volume flow rates are hydraulically achievable,
- 系统所需的质量流量和体积流量在水力学上是可实现的，
- the resulting pressure losses are acceptable,
- 系统产生的压力降损失是可以接受的，
- the minimum flow velocity required to prevent sedimentation is exceeded,
- 系统流速高于为防止焦浆的沉积所需要的最小流速
- and the system can be operated using our existing Slurry Pump technology.
- 最后，现有的焦浆泵技术可以完全满足该系统的运行和操作。

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

本评估使用 CNOVAL（11.2 版本）软件进行了详细的水力学计算和验证。

2 General Design Conditions and Input Data 设计条件和输入数据

2.1 Transported Medium 输送介质

Parameter 参数	Value 指标
Medium 介质	Petroleum coke–water slurry 石油焦焦浆
Hydraulic model 水力学模型	Single-phase 单相流
State 相态	Liquid 液体
Operating density 操作密度	1,085 kg/m^3
Dynamic viscosity 粘度	3.26 cP
Operating temperature 操作温度	approx. 70 °C

2.2 Slurry Line Data 焦浆管线数据

Parameter 参数	Value 指标
Nominal diameter 公称直径	DN 450 (horizontal 水平段) DN 400 (vertical 竖直段)
Absolute roughness 绝对粗糙度	0.08 mm
Total pipeline length 管线总长度	4,500 m
Geodetic elevation difference 总高差	30 m

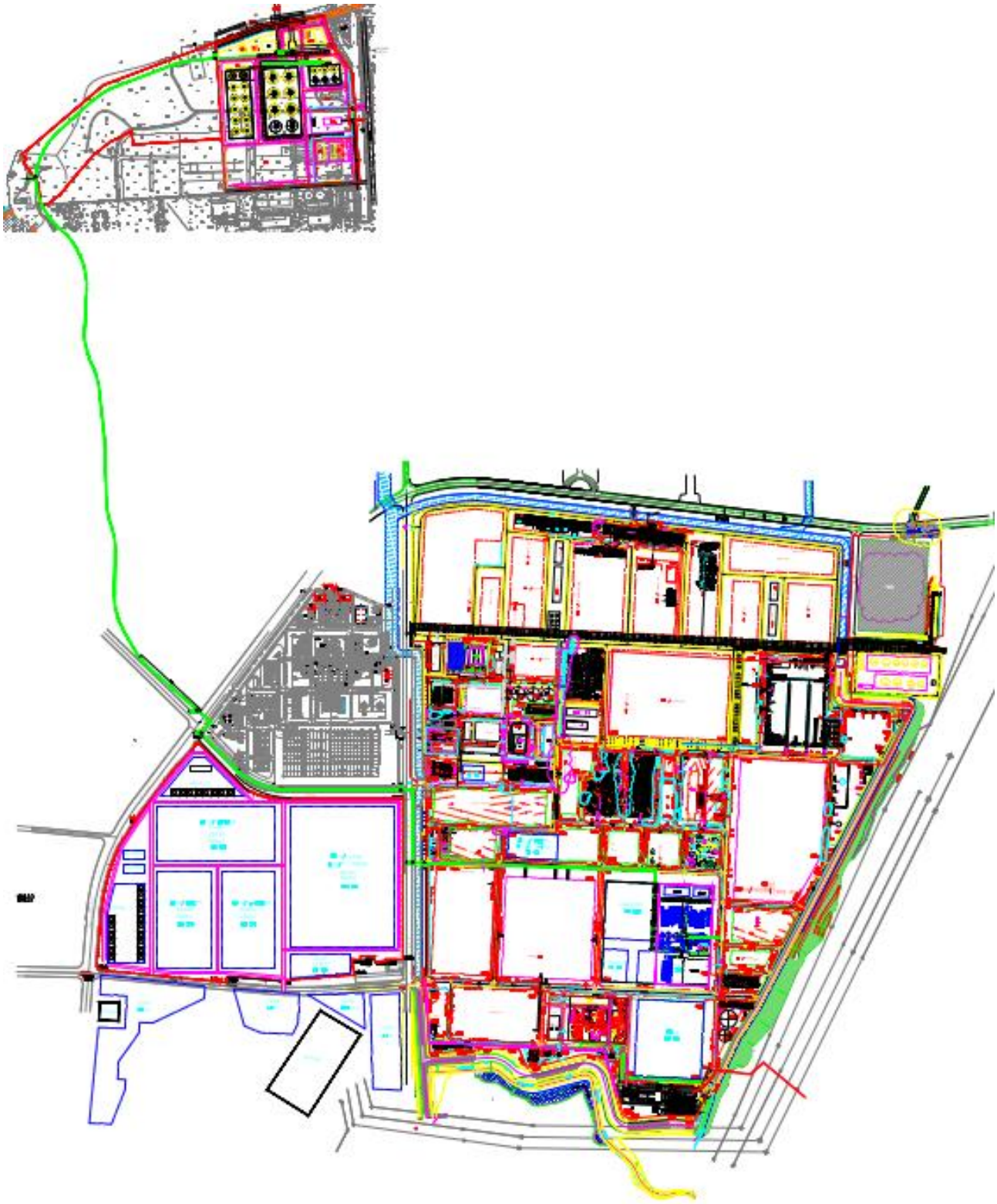


Figure 1 Plotplan of Refinery and Port

图 1：炼厂及码头总平面布置图

2.3 Fittings and Components 管道组件

Component 组件	Quantity / Value 数量/指标
90° bends, radius 5D 90°弯头，5D 半径	40 pcs
Gate valves 闸阀	3 pcs
Flow-optimized branch 流量优化支管	1 pc

3 Operating Conditions 操作条件

Parameter 参数	Value 指标
Mass flow rate 质量流量	976.5 t/h
Volume flow rate 体积流量	900 m^3/h
Maximum flow velocity 最高流速	1.71 m/s (horizontal part 水平段) 2.15 m/s (vertical part 竖直段)

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

计算所得流速高于防止沉积的最小临界速度，因此可以保证焦炭在整个管线输送过程中的保持良好的分散悬浮状态。

4 Hydraulic Calculation Results (CONVAL®) 水力学计算结果 (CONVAL®)

4.1 Pressure Loss Breakdown 压降分布

Contribution 分布	Pressure loss 压降
Pipe friction losses 管道阻力压降	2.72 bar (horizontal part 水平段) 0.05 bar (vertical part 竖直段)
Static head (elevation) 静压头（高度）	0.00 bar (horizontal part 水平段) 3.19 bar (vertical part 竖直段)
Local losses (fittings) 局部压降	0.17 bar (horizontal part 水平段) 0.13 bar (vertical part 竖直段)
Total pressure loss 总压降	**6.26 bar**

4.2 Power Requirement 能耗要求

Parameter 参数	Value 指标
Hydraulic loss power 水力学压降能耗	72 kW (horizontal part) 84 kW (vertical part)
Mean Darcy friction factor λ 平均摩擦因子 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.

计算所得压降和功率需求完全位于类似尺寸和处理量的焦浆系统的典型操作范围。

5 Hydraulic Evaluation 水力学评估结论

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

基于计算所得水力学结果:

- The pipeline system is hydraulically feasible under the defined operating conditions.
- 基于定义的操作条件，该管道输送系统在水力学上是可行的。
- The selected operating point includes an adequate hydraulic margin to accommodate normal operational fluctuations in flow rate and slurry properties.
- 系统所选择的操作点包含了充分的水力学余量以满足系统正常运行过程中的流量波动和焦浆性质变化。
- Pressure losses are dominated by pipe friction and static elevation but remain technically moderate.
- 系统的压降主要来源于管道摩擦和静态高差，技术挑战仍然属于中等。
- The required pumping power can be provided by our proprietary Slurry Pump.
- 系统所需的泵送功率，我方专有的焦浆泵完全可以提供和满足。
- Stable continuous operation is technically assured.
- 系统稳定连续运行从技术角度上是完全保证的。

6 Conclusion - Proof of Feasibility 结论- 可行性验证

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

基于 CONVAL®的水力学结算结果，有关该规划的焦浆管线的结论如下:

- is hydraulically feasible,
- 水力学上可行,
- meets all requirements regarding pressure loss and flow velocity,
- 满足所有压力降和流速的相关要求,
- and can be operated safely and reliably under continuous conditions.
- 可以安全、可靠和连续的运行
- The hydraulic feasibility of the pipeline system is therefore confirmed.
- 综上，该焦浆管线的水力学可行性得到验证。

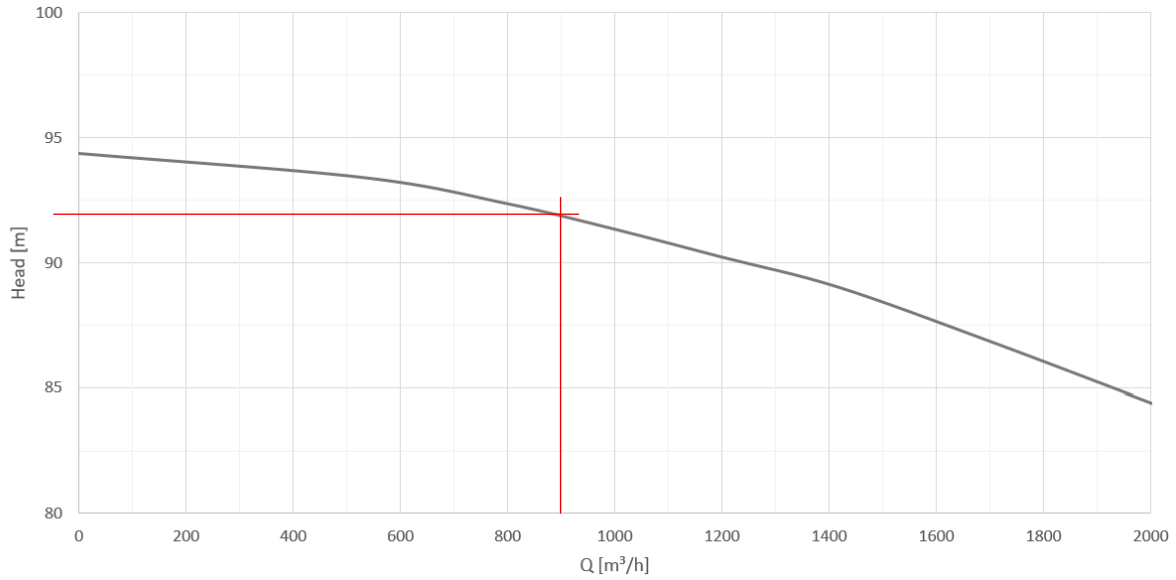
7 Slurry Pump information 焦浆泵相关信息

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.

焦浆泵设计用于连续的将破碎后的石油焦和水的混合物从 ECHO 系统输送到脱水仓。该焦浆泵内部采用防磨层可以满足磨蚀工况条件，并保证在设计的工艺条件下可以稳定、长期的运行。

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.

下图曲线为泵在 800rpm 操作转速下的性能曲线（Q/H 曲线）。该曲线表明焦浆泵能够提供和满足系统计算所需的压力降，完全满足 ECHO 工艺的水力学要求。



8 Attachments 附件

1. Att1_CONVAL calculation result (translated to English) 附件 1- CONVAL 软件计算结果。