Paper 2 – Wastewater discharge

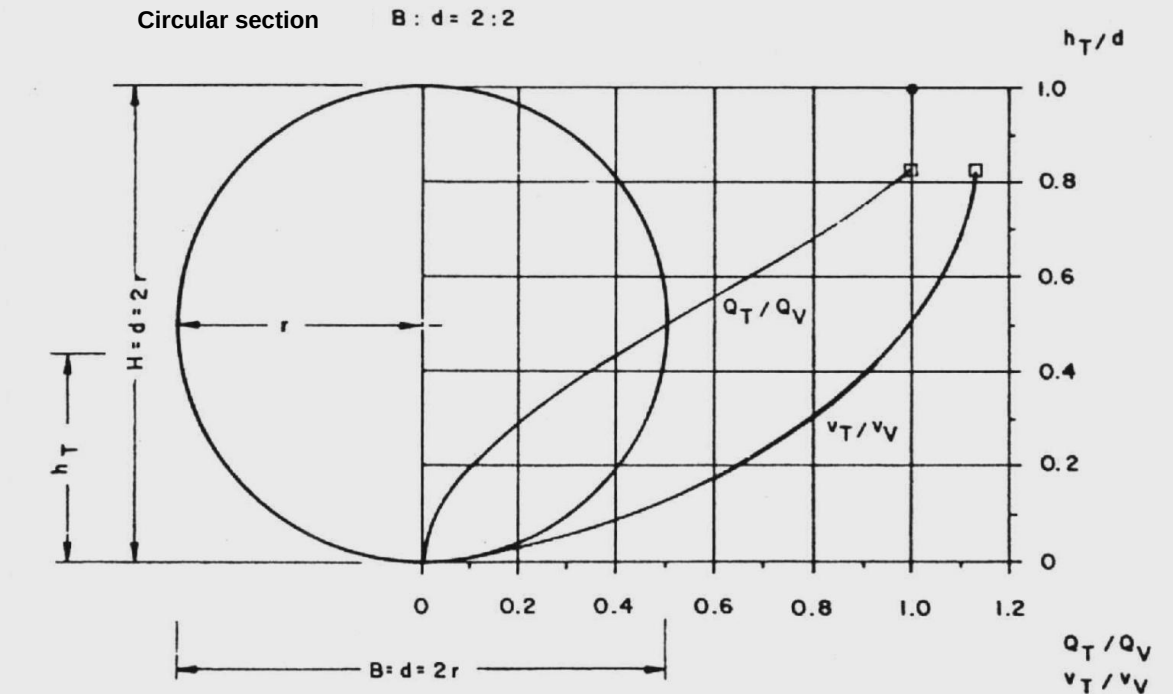
Sanitary Engineering

SS 12

1 Sewage system

Determine for a partially filled pipeline the partial filling height and velocity.

- Diameter of the pipe = 150 mm
- Discharge in the filled pipe = 0.25 m³/s
- $\frac{Q_T}{Q_V} = 0.7$



2 Pumps

A pumping station is to be designed for two different scenarios, as shown in Fig. 1 and 2. The storage tanks are connected in both cases through a 3 km long pipeline with a diameter of DN 300 and a roughness of k_i = 0.4 mm. The pump curve for the centrifugal pump used in both scenarios is illustrated in Fig. 5.

1. Determine the pressure head h depending on the discharge.
2. What is the operation point if only one centrifugal pump is operated in the pumping station?
3. The operation point can be adjusted in favour of the delivery head or the flow rate by installing two pumps parallel or in series. Choose the most convenient pump installation for scenario A and B and name the resulting operation point, if
   - the delivery rate for system A should be about 90 l/s,
   - the delivery rate for system B should be about 45 l/s.

Note: This task is to be solved graphically. Use the attached pump curve and the diagrams.

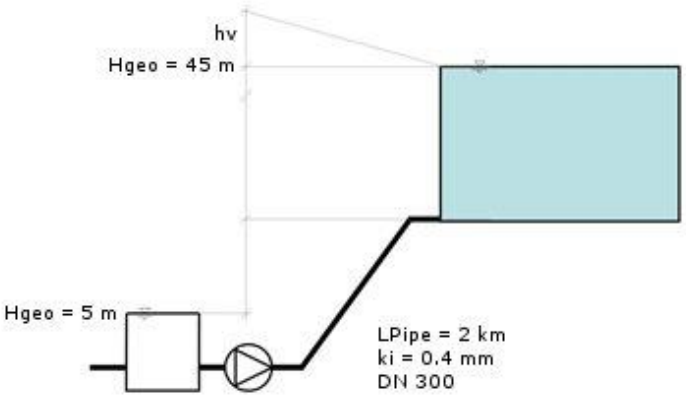


Fig. 1: System A

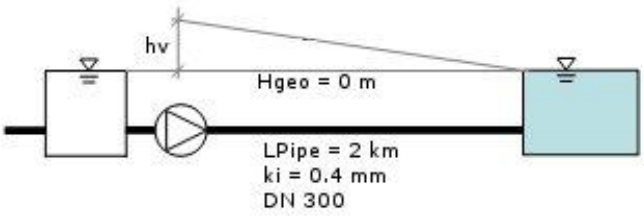


Fig. 2: System B

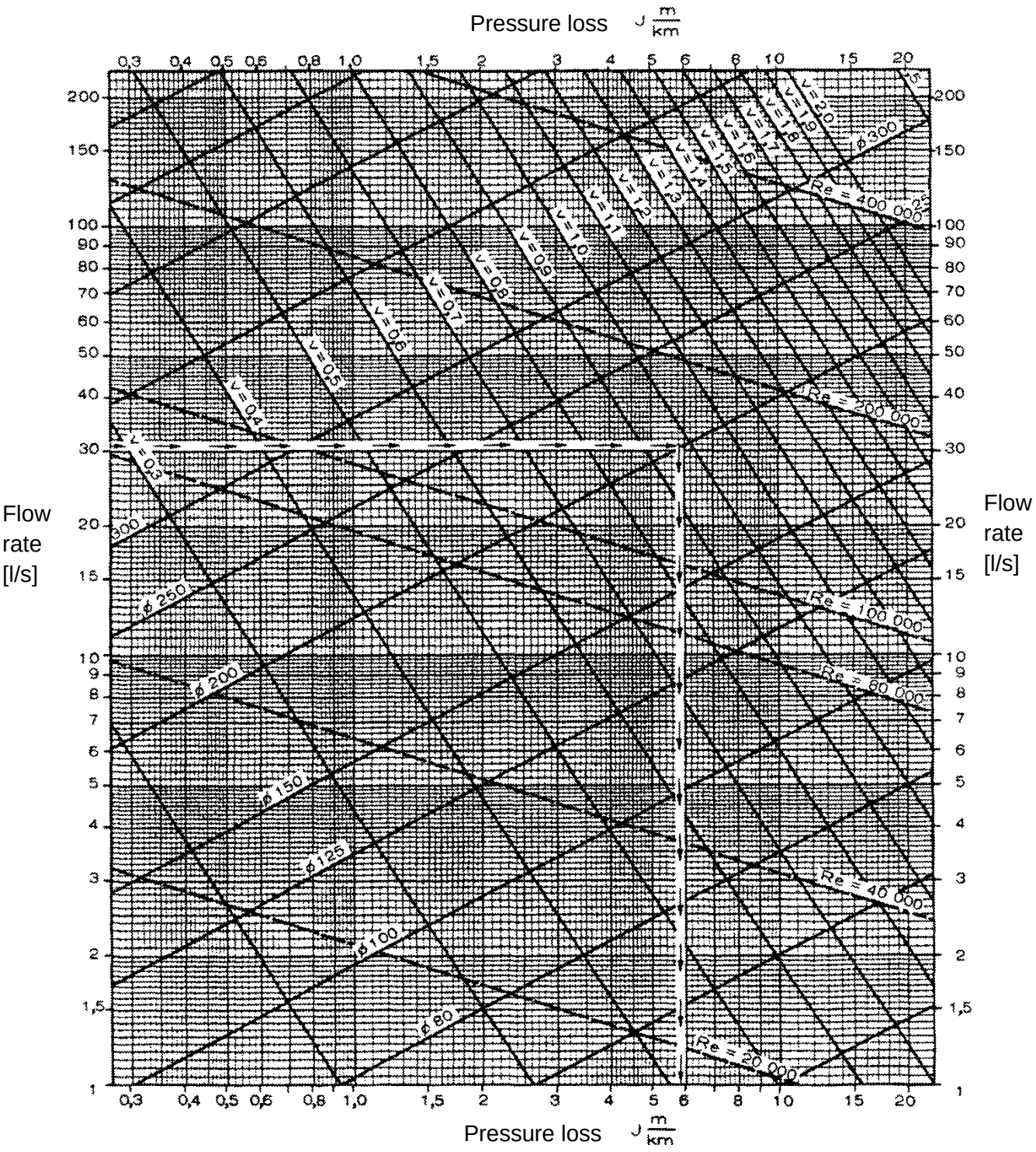


Fig. 3: Nomogram for k_i=0.4 mm

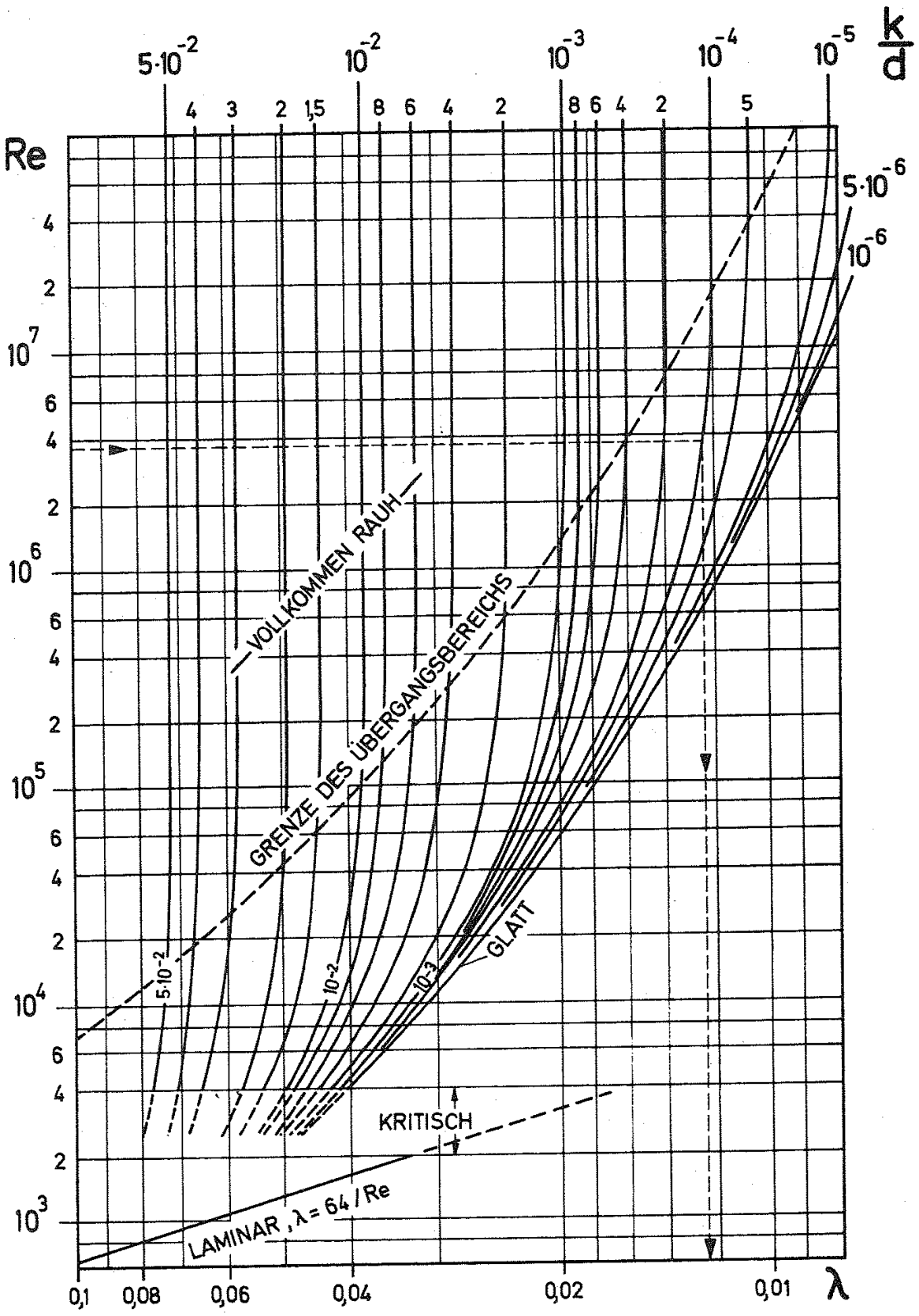


Fig. 4: Diagram for calculating λ

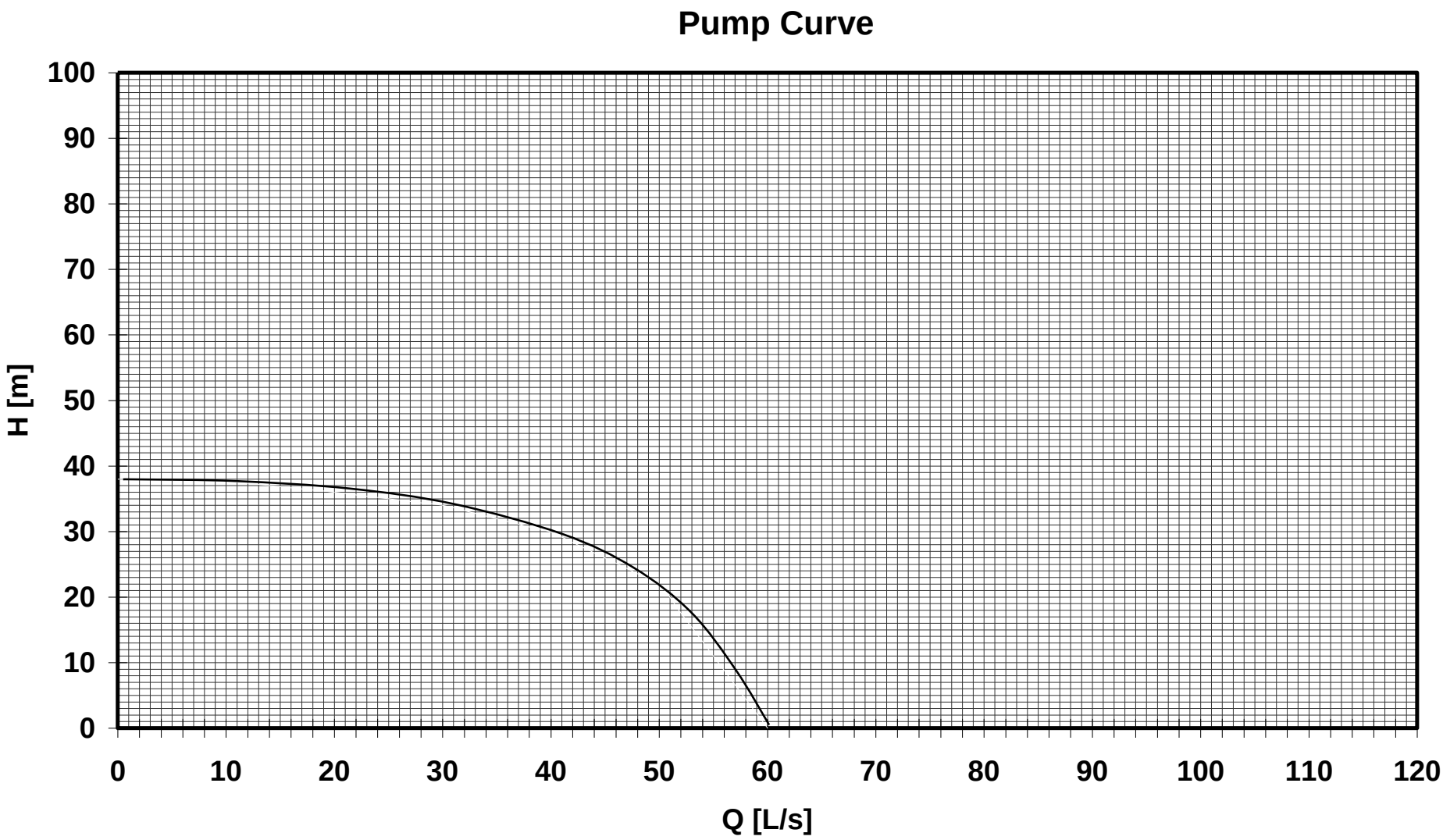


Fig. 5: Pump curve of a centrifugal pump