



## CAPILLARY TUBE

---

This case study demonstrates the modeling of a capillary tube. Capillary tubes are used as expansion devices on some vapor-compression refrigeration systems. The refrigerant used in this case study is R22.

## HVAC

### CHALLENGE:

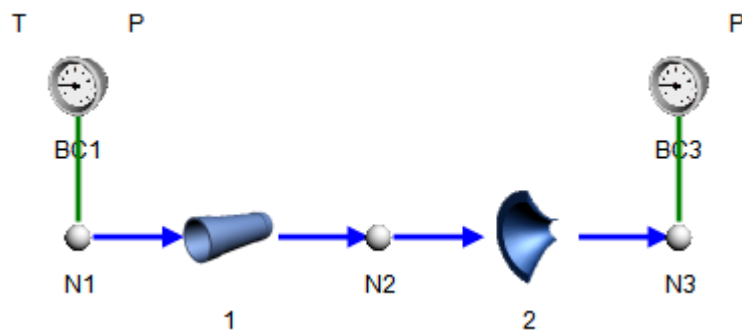
The objective of the simulation is to determine the mass flow through the capillary tube.

### BENEFITS:

This case study demonstrates the modeling of a capillary tube. Capillary tubes are used as expansion devices on some vapor-compression refrigeration systems. The refrigerant used in this case study is R22.

### SOLUTION:

Flownex was used to determine the mass flow of R22 through a capillary tube given the inlet pressure and temperature and the outlet pressure. This case study demonstrated Flownex's ability to calculate two-phase flow in a tube including choking at the exit.



The objective of the simulation is to determine the mass flow through the capillary tube.

Flownex was used to determine the mass flow of R22 through a capillary tube given the inlet pressure and temperature and the outlet pressure. This case study demonstrates Flownex's ability to calculate two-phase flow in a tube including choking at the exit.

## INTRODUCTION

This case study demonstrates the modeling of a capillary tube. Capillary tubes are used as expansion devices on some vapor-compression refrigeration systems. The refrigerant used in this case study is R22.

## SYSTEM DESCRIPTION

A tube with a length of 400 mm and an inside diameter of 2 mm is considered. The fluid is R22 with an inlet pressure of 1990 kPa and an inlet temperature of 43 °C. The outlet pressure is 680 kPa.

## OBJECTIVE OF SIMULATION

The objective of the simulation is to determine the mass flow through the capillary tube.

## FLOWNEX MODEL

The Flownex model of the tube is shown in Figure 1.

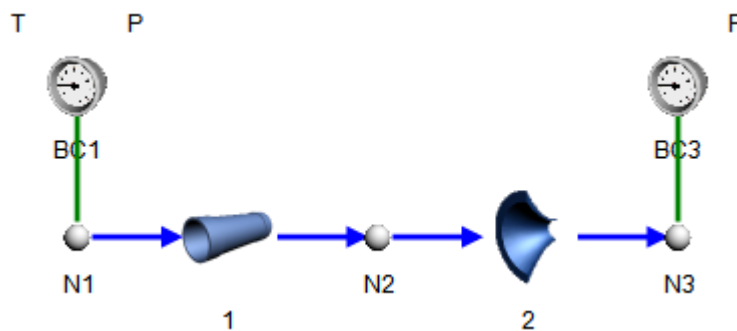


Figure 1: Flownex model of capillary tube.

Element 2 is a Restrictor with Discharge coefficient (Flownex's RD element). This type of element is used to model the exit losses, which can be very large. RD elements can model exit losses accurately, even in the case of choked two-phase flow.

## DESCRIPTION OF SIMULATION

A pressure and temperature boundary condition is specified at node 1 while only a pressure boundary condition is specified at node 2.

Flownex was used to determine the mass flow of R22 through a capillary tube given the inlet pressure and temperature and the outlet pressure. This case study demonstrated Flownex's ability to calculate two-phase flow in a tube including choking at the exit.

This case study demonstrates the modeling of a capillary tube. Capillary tubes are used as expansion devices on some vapor-compression refrigeration systems. The refrigerant used in this case study is R22.

## RESULTS

Flownex calculates the mass flow as 0.0467428 kg/s.

Figure 2 shows the variation of pressure and Figure 3 shows the variation of quality over the length of the tube. The large drop in pressure at the exit indicates that the flow is choked at the exit.

## CONCLUSION

Flownex was used to determine the mass flow of R22 through a capillary tube given the inlet pressure and temperature and the outlet pressure. This case study demonstrated Flownex's ability to calculate two-phase flow in a tube including choking at the exit.

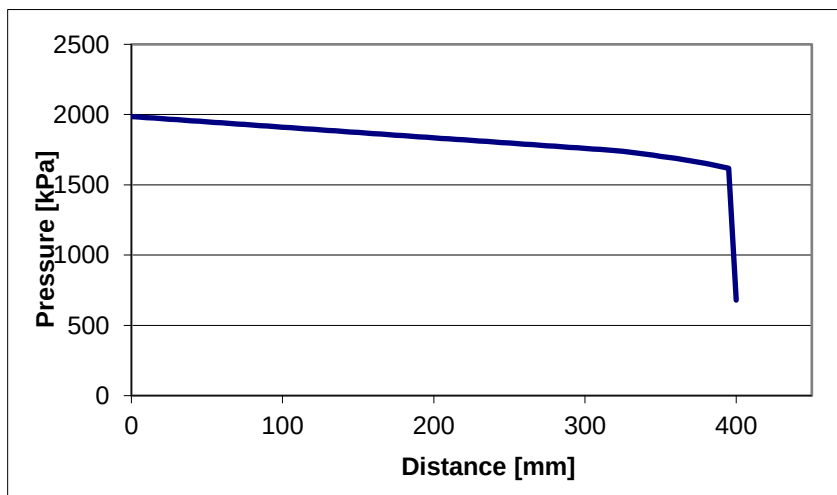


Figure 2: Variation of pressure over the length of the tube.

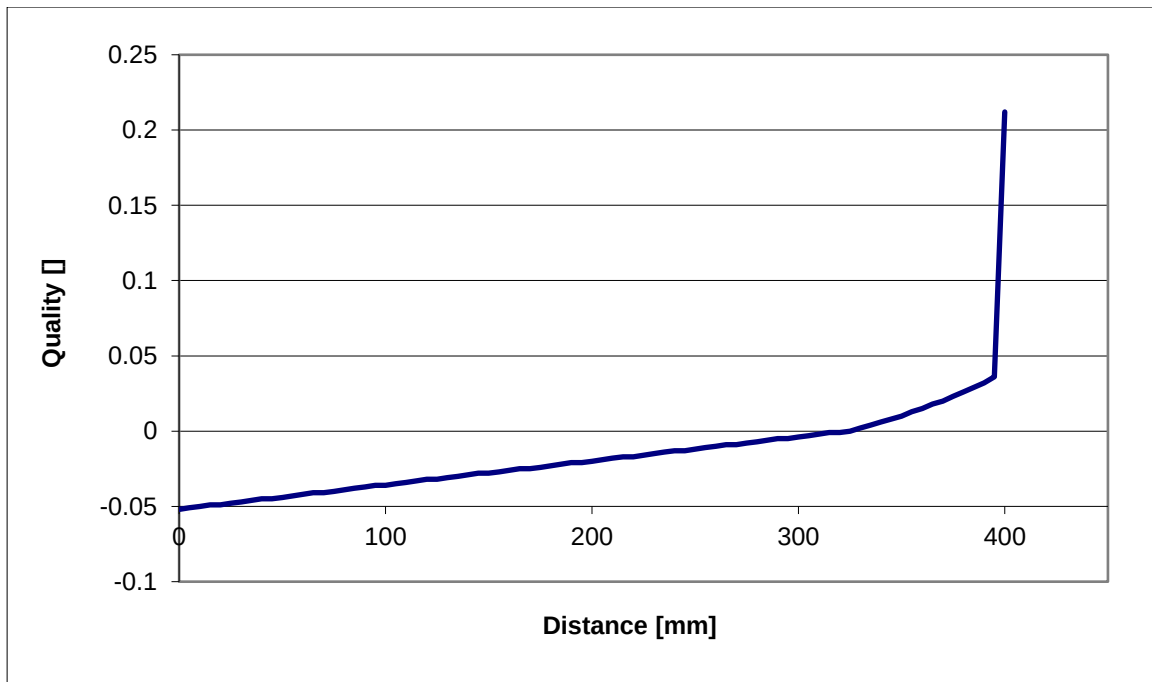


Figure 3: Variation of quality over the length of the tube.