

# Silo Technology 15<sup>th</sup> + 16<sup>th</sup> of September 2025

A practice-orientated overview of the basics of silo technology with practical examples.

## Date / Location

15<sup>th</sup> of September 2025, 11:30 a.m. – 5:00 p.m. and 16<sup>th</sup> of September 2025, 9:00 a.m. – 5:00 p.m.  
MADISON HOTEL, Schaarsteinweg 4, 20459 Hamburg

## Speakers

Mario Dikty, Dipl.-Ing., Schwedes + Schulze Schüttguttechnik GmbH, Apensen  
Martin Kaldenhoff, Dr.-Ing., HHW Gesellschaft Beratender Ingenieure mbH, Braunschweig  
Dietmar Schulze, Prof. Dr.-Ing., Dr. Dietmar Schulze GmbH, Wolfenbüttel

## Participants

The seminar is aimed at anyone involved in the planning, construction or operation of silos.

## Content

The extensive field of silo technology is primarily concerned with the storage and flow of bulk solids (powders, granulates, etc.) in containers. The field of application ranges from small dosing bins to storage silos with several ten thousand of cubic metres. Silos, feed hoppers and other bulk solids containers are often not the main focus when planning a system, as they generally contribute little to value creation by refining or producing a product. On the other hand, they can have a negative impact on plant throughput or product quality if they are not designed properly. Nevertheless, many silos are built without considering the behaviour of the bulk solid to be stored. This leads to the well-known effects, e.g. flow problems, which can often be recognised by the traces of hammers on the hopper wall.

The seminar deals with the flow properties of bulk solids and the behaviour of bulk solids in silos. In addition, the application of the Jenike method for determining the hopper inclination to achieve mass flow and the outlet size to avoid arching or ratholing will be explained, in each case based on the measured flow properties (yield loci, time yield loci, wall yield loci). Practical examples will be shown. Together we will measure and analyse flow properties using shear testers.

You will also gain an insight into the stresses (pressures) in silos that occur after filling or during discharge. We look at typical problems in silo operation, e.g. funnel flow with stagnant zones, flow obstructions due to arching, segregation, flooding, or buckling of the silo wall, and present measures to avoid these problems. The design of discharge units such as belt conveyors, rotary valves, orbiting screw conveyors, vibrating hoppers, screw feeders or oscillation bar dischargers will be presented regarding the optimum silo design for avoiding funnel flow and flow obstructions. Finally, we will look at EN 1991-4. This standard is used to calculate the strength of the silo body. We will work out which pitfalls the plant planner can/should avoid achieving an economical silo concept.

## Day 1 – Monday, 15<sup>th</sup> of September 2025

**11:30 a.m. Registration**

**12:00 p.m. Lunch**

**1:00 p.m. Welcome**

**1:05 p.m. Flow properties of bulk solids**

- ③ Stresses in bulk solids, Mohr's stress circle, stress ratio
- ③ Yield locus, flow function, bulk solids strength, uniaxial compression test
- ③ Time consolidation
- ③ Definition of flowability

**2:00 p.m. Stresses in silos**

- ③ Active and passive stress state, Janssen equation, stress curves
- ③ Stresses in the hopper and at the silo outlet opening
- ③ Stress peak in mass flow and funnel flow situations, eccentric flow

**2:45 p.m. Coffee break**

**3:15 p.m. Silo problems**

- ③ Why do silo problems arise: funnel flow, segregation, arching, flooding, ratholing, eccentric flow?
- ③ How can they be avoided?

**3:45 p.m. Silo design acc. to Jenike's approach**

- ③ Mass flow
- ③ Arching
- ③ Ratholing

**5:00 p.m. End Day 1**

**6:00 p.m. City tour**

## Day 2 - Tuesday, 16<sup>th</sup> of September 2025

**9:00 a.m. Measurement of flow properties**

- ③ Live measurement of flow properties with the Schulze ring shear tester
- ③ Performance of a uniaxial compression test to explain time consolidation

**9:45 a.m. Silo design based on measured flow properties**

- ③ Dimensioning of a silo for mass flow based on shear analyses.
- ③ Determination of the minimum silo outlet size to avoid arching.
- ③ Influence of the storage time on the silo outlet size.

**10:15 a.m. Coffee break**

**10:45 a.m. Silo hopper geometries and wall linings**

- ③ Which silo hopper geometries are common and how do they influence the flow profile?
- ③ Which hopper wall linings can improve the flow behaviour?

**11:00 a.m. Designing silo discharge correctly**

- ③ Discharge capacities
- ③ Silo discharge devices and their limits of use (rotary valve, screw conveyor, belt conveyor, trough chain conveyor, vibrating hopper, rotary plough, multiple screw feeder, fluidising elements, compressed air cannons, knockers, vibrators)

**1:00 p.m. Lunch**

**1:45 p.m. EN 1991-4 Part 1**

**3:15 p.m. Coffee break**

**3:45 p.m. EN 1991-4 Part 2**

**4:30 p.m. Questions**

**5:00 p.m. End of Seminar**