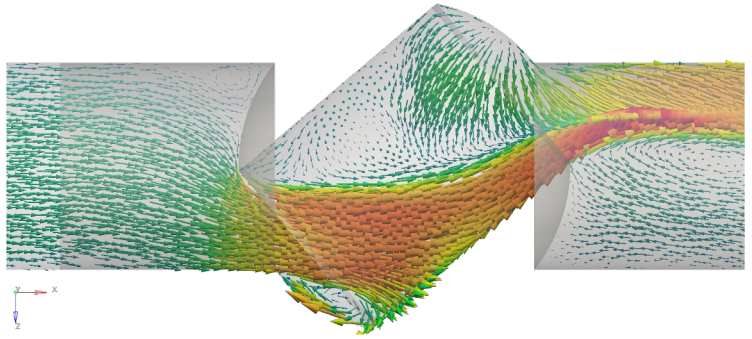
MESSEN

CFD flow simulation of Ball Valve

Messen R&D Team

www.messencontrols.com



-About Messen-

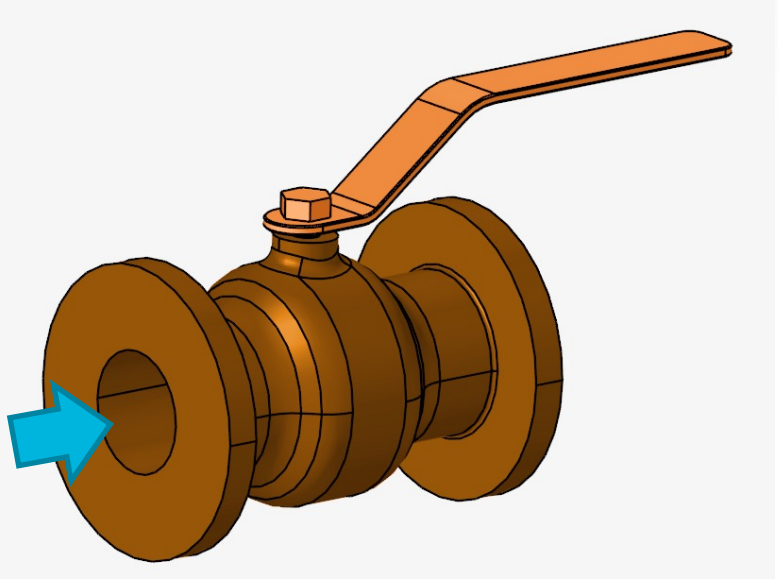
MESSEN in German means *Measure*.
And the name is our commitment to our customers that;

“We are Together in Every Measure”.

Problem Description

- Ball Valve CFD simulation to find out the flow behavior inside the valve.
- Simulated for fully open and 50% open conditions.

Internal dia ~2 inch



Water entering domain at 8 bar pressure

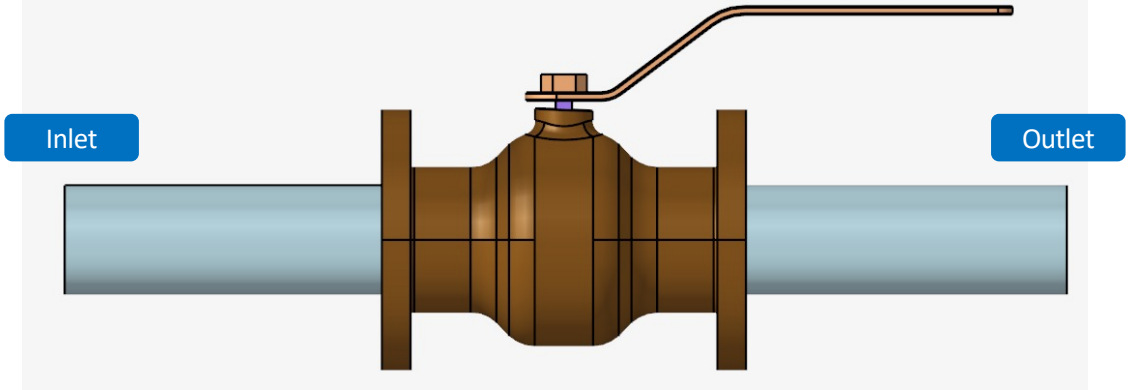
Objective of the activity

Solve for flow coefficient
Flow pattern
Contribution of hydrodynamic forces towards overall torque.

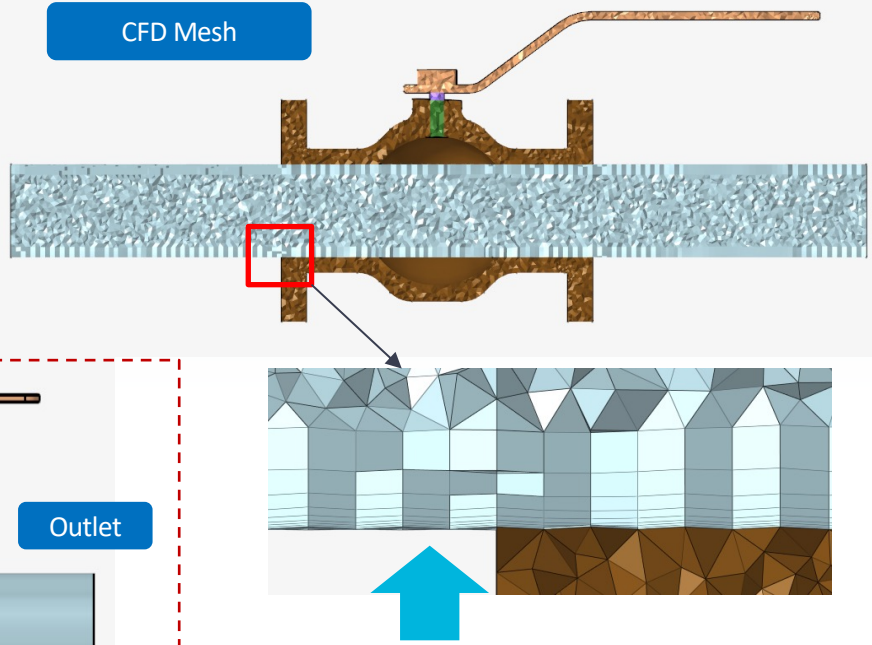
Note: Sample model from grab CAD

CFD Domain and Mesh

Inlet and Outlet extended for flow development and mitigating reverse flow risks respectively.



CFD Mesh

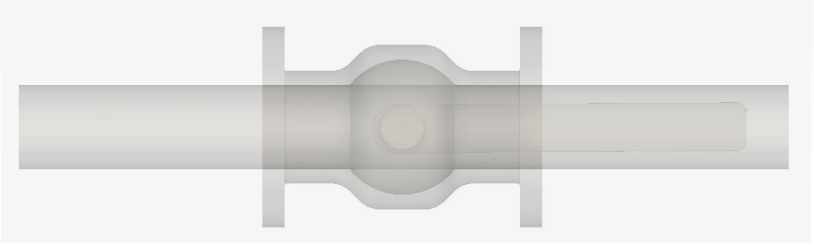


Boundary layers have been generated on the fluid domain walls.

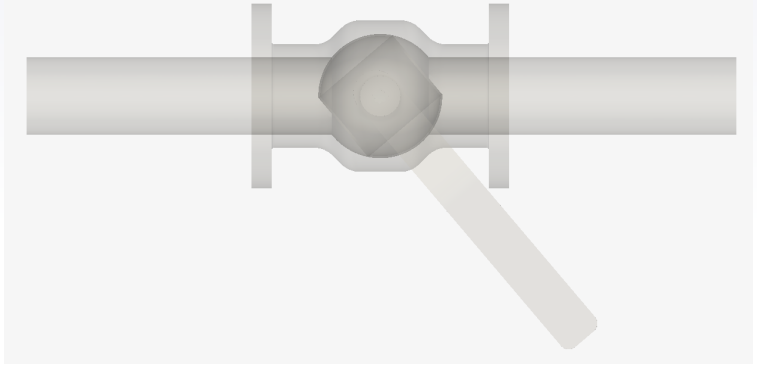
Case Description

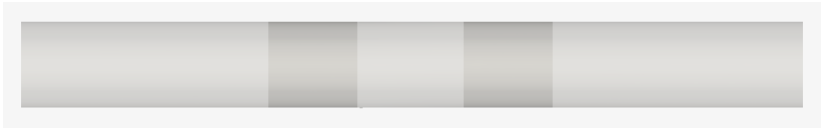
Valve Fully Open

Valve 50% Open

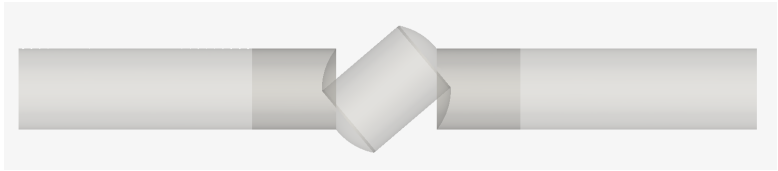


Overall Domain



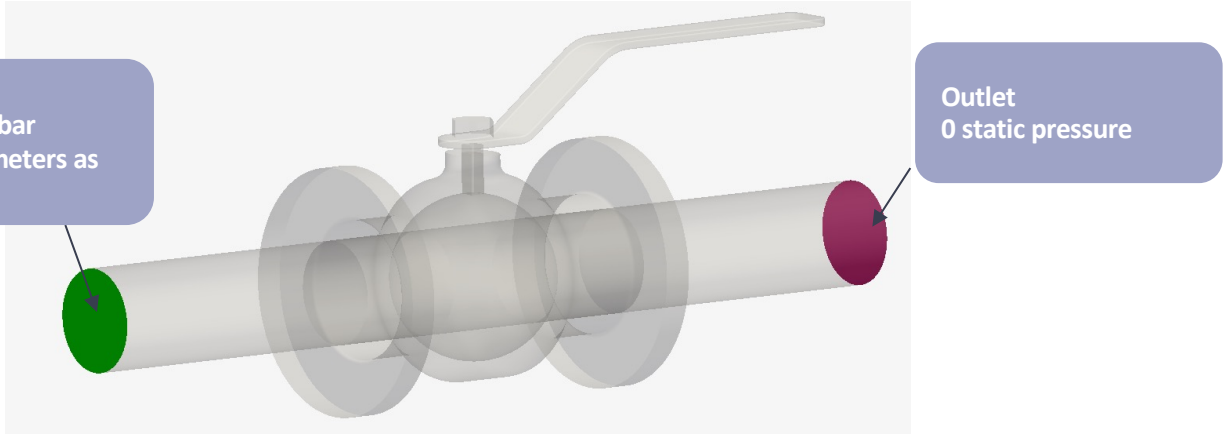


Flow Domain



Assumptions, Boundary Conditions and Material

- 3D, steady state, flow analysis
- Inlet at 8 bar static pressure
- Outlet at 0 static pressure
- Material : Water, Density 998 Kg/m^3, Viscosity 0.001 Pa.s
- Turbulence model : SST k-ω

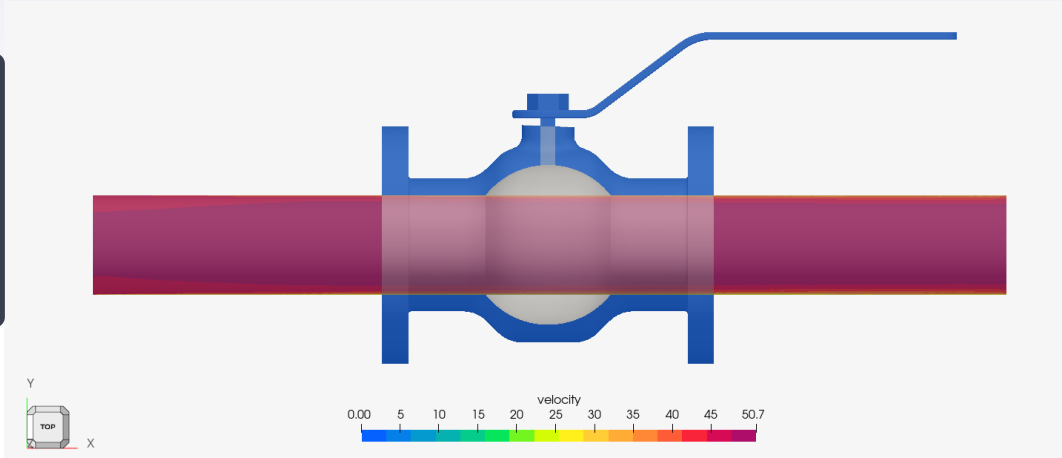


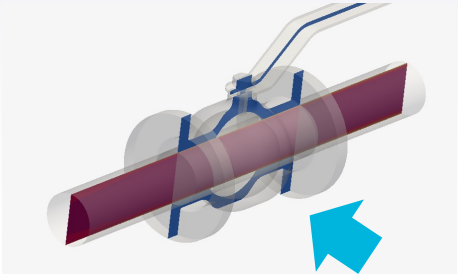
CFD FLOW SIMULATION OF BALL VALVE

RESULTS

Velocity Contours – Vertical Plane

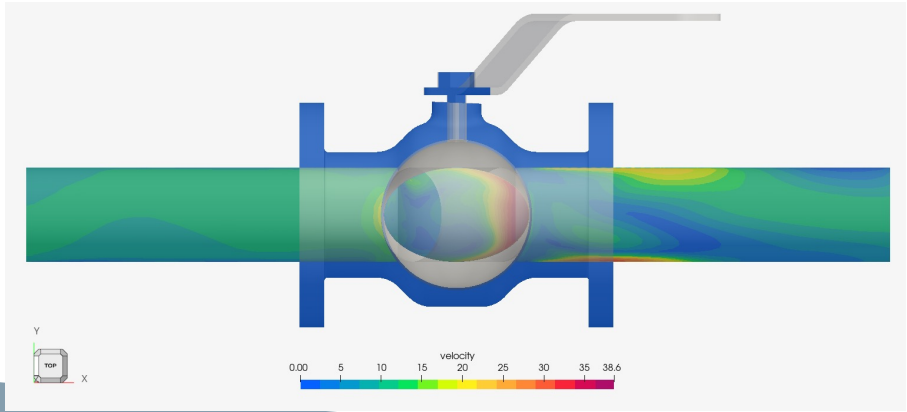
Fully Open





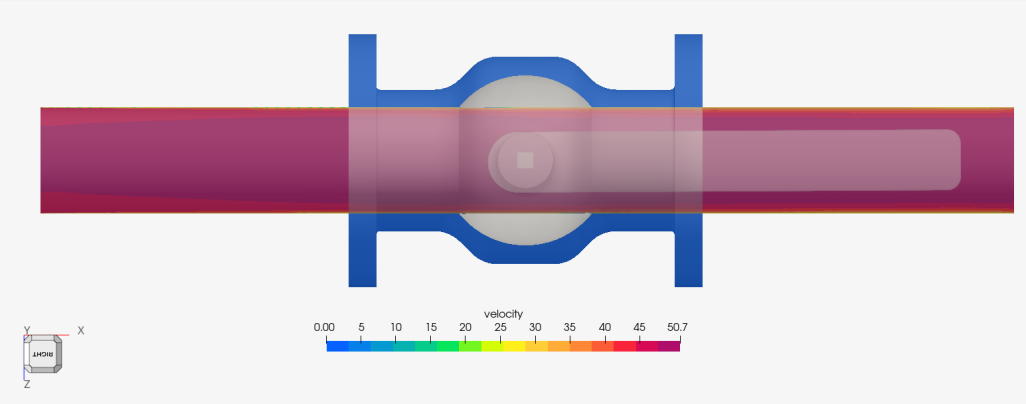
View direction

50% Open

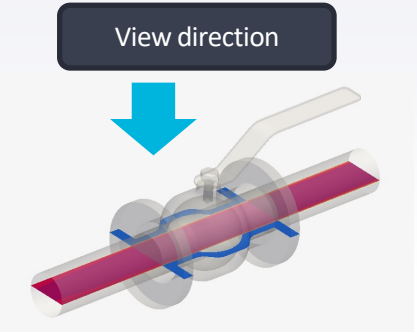


Velocity Contours – Horizontal Plane

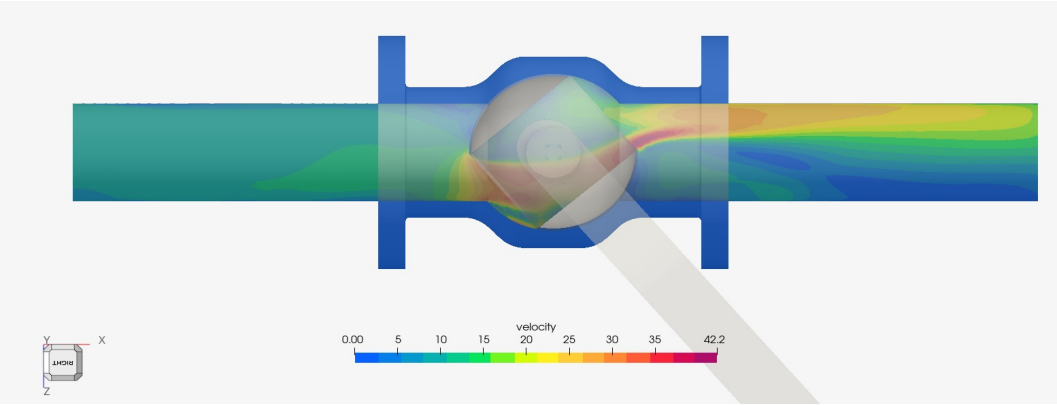
Fully Open



View direction



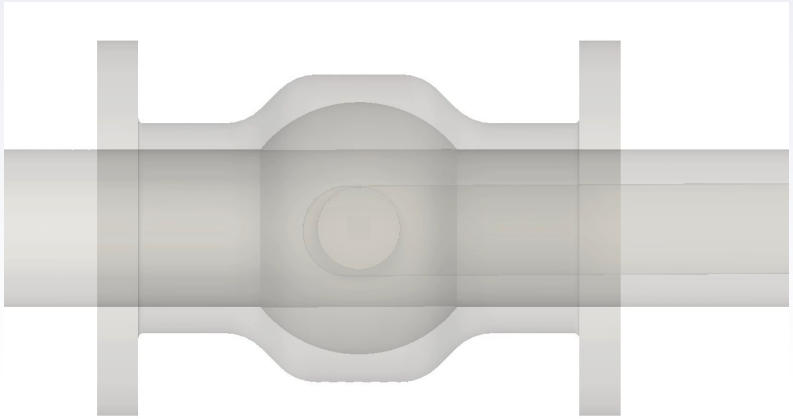
50% Open



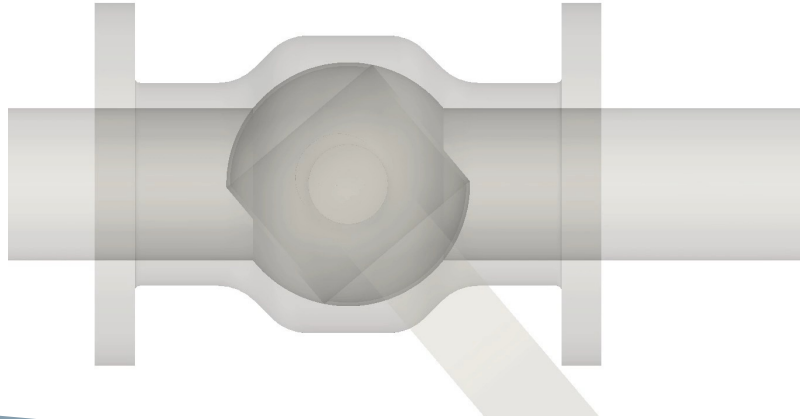
Pressure inlet conditions are causing the velocity to drop in the lower opening case.

Streamlines Animations

Fully Open



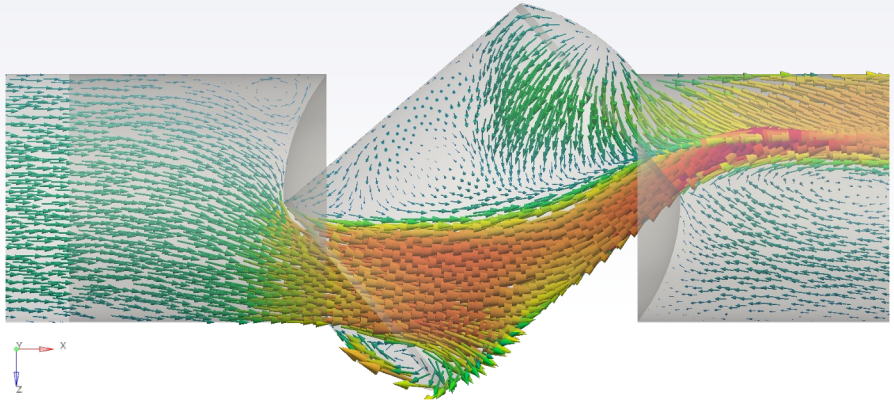
50% Open

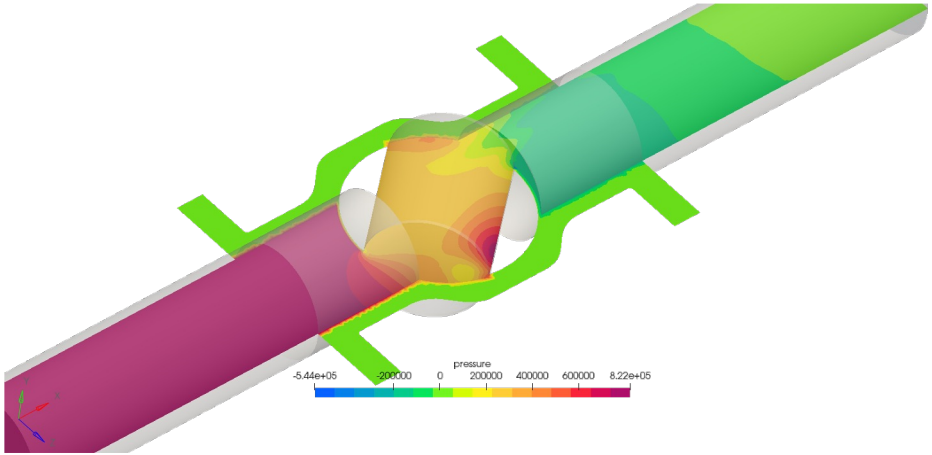


Note : Go full screen mode to play

Velocity vectors and Pressure – Horizontal plane

50% Open





Flow Coefficients

Valve open condition	Pressure Drop (bar)	Flow rate Q (m^3/h)	Pipe Factor* (Fp)	Sp. Gravity (SG)	Flow Coefficient (Cv) - Calculated
100%	0.512	335.2	0.998	0.998	542.1
50%	8.17	90.04	0.998	0.998	36.5

$$Flow\ Coefficient\ (Cv): \frac{Q}{0.865 * Fp} * \sqrt{\frac{SG}{\Delta P}}$$

Note : The calculation shown above is only for demonstration purpose. Validation might require all conditions including the test bench to be replicated properly.

Thank You!

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