ORBITRIM
FLOW TECHNOLOGY

Severe Service Control Valve Trim Solutions.

ORBITRIM designs and manufactures application specific trim solutions for control valves, from simple plug-type trims to multi-stage, multi-path designs for severe-service applications.



RETROFIT & REPLACEMENT | OEM SUPPORT | VALVE PERFORMANCE ASSESMENT

OUR SOLUTIONS

ENGINEERED SOLUTIONS FOR EVERY TRIM CHALLENGE

Retrofit & Replacement

Restore valve performance without replacing the valve body, actuator and accessories. We design drop-in replacement trims engineered to address cavitation, excessive noise, vibration and changing process requirements, minimizing downtime and avoiding costly valve replacement.

OEM & Manufacturer Support

Support your severe-service projects without expanding your in-house engineering team. We develop custom multi-stage trim solutions for demanding applications, allowing you to deliver complete valve packages under your own brand.

Valve Performance Assessment

Experiencing cavitation, excessive noise or vibration? We evaluate your valve and process conditions, identify the root cause, and recommend the most appropriate solution whether that's a trim upgrade, retrofit or other corrective action.

CHALLENGES WE ADDRESS

- CAVITATION
- NOISE
- VIBRATION
- EROSION
- FLASHING
- LIMITED TURNDOWN

TECHNICAL INSIGHT

MANAGE PRESSURE DROP, MANAGE VELOCITY

How engineered flow paths address the criticalities of high-pressure-drop and severe-service applications.

1. Introduction

A control valve regulates flow by creating a controlled pressure drop across the valve. As the fluid passes through the restriction formed by the trim, the available flow area decreases, causing the local flow velocity to increase and the static pressure to decrease.

The pressure and velocity do not remain uniform through the restriction. As the flow accelerates, the lowest local pressure and highest velocity occur around the vena-contracta region. Downstream of this region, the flow expands and the static pressure begins to recover and the velocity decreases.

In liquid service, the local minimum pressure is particularly important. If it falls to or below the fluid vapour pressure, vapour bubbles can form and may subsequently collapse as pressure recovers downstream. Depending on the operating conditions and flow behaviour, these conditions can contribute to cavitation, noise, vibration and erosion. High local velocity can also contribute to these effects.

Figure 1 illustrates the typical relationship between pressure and velocity as fluid passes through a restriction, highlighting the vena-contracta region, minimum pressure, peak velocity and subsequent pressure recovery.

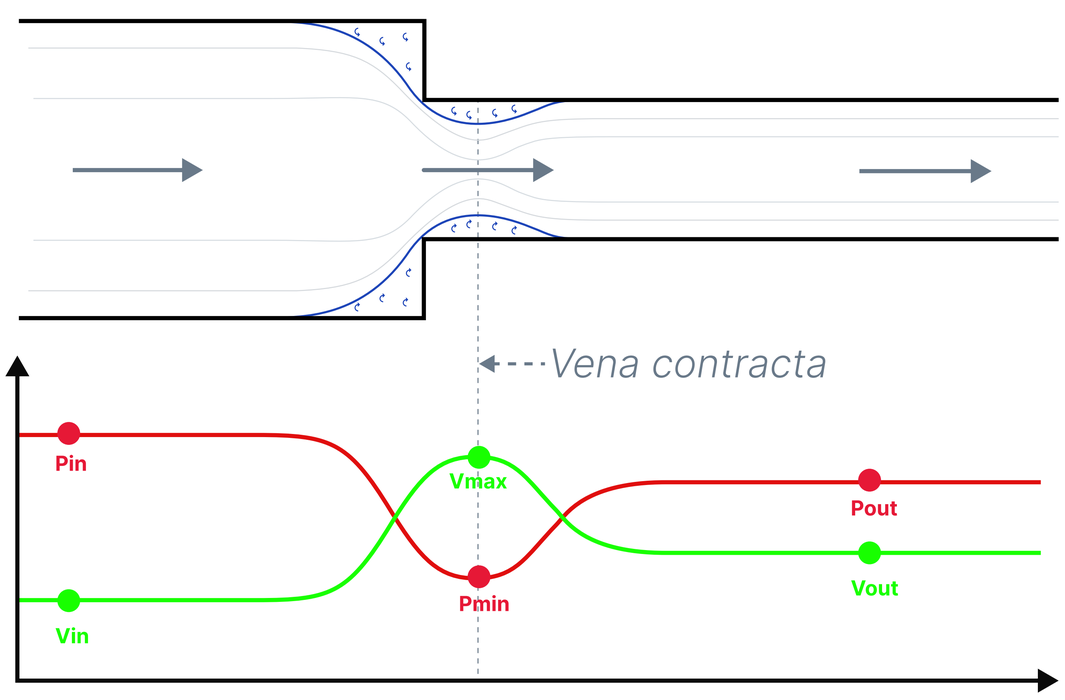


Figure 1 : Indicative Pressure and Velocity Profile Through a Restriction

2. Manage Pressure Drop, Manage Velocity

When a large pressure drop is concentrated across a single restriction, the pressure and velocity changes are concentrated within a relatively short flow path. This can result in a high local velocity and a significant reduction in pressure around the vena-contracta region.

A multi-stage trim distributes the total pressure drop across successive controlled restrictions and flow passages. Each stage handles a portion of the pressure reduction, allowing the pressure and velocity conditions to be managed progressively through the trim. The pressure drop does not necessarily need to be divided equally between stages. Each stage geometry is engineered to achieve the required overall pressure reduction with suitable velocity.

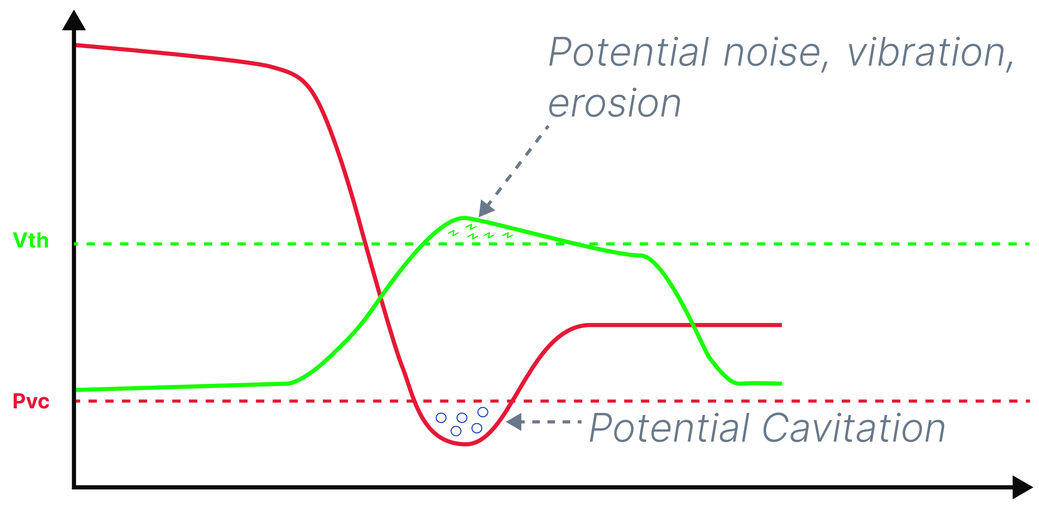


Figure 2 : Indicative comparison of pressure and velocity profiles for single restriction pressure reduction

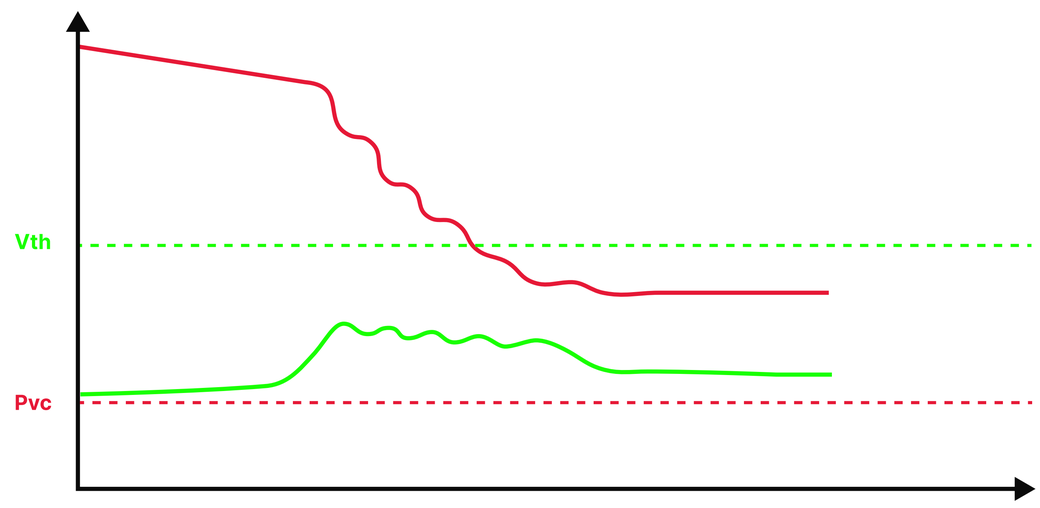


Figure 3 : Indicative comparison of pressure and velocity profiles for multi-stage pressure reduction

The comparison illustrates how concentrating the pressure drop in a single restriction can produce a high local pressure reduction and velocity peak. Distributing the pressure drop across multiple stages spreads these changes through the flow path, allowing the local pressure and velocity conditions to be managed more progressively.

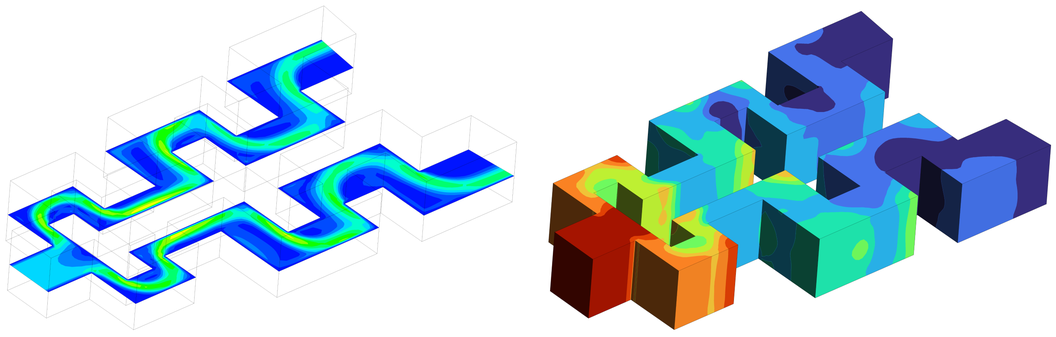


Figure 4 : Indicative velocity and pressure distributions through an ORBITRIM-engineered multi-stage flow path.

The pressure and velocity contours provide a closer look at how the fluid behaves within the engineered flow path. They show how the pressure and velocity change as the flow passes through each successive restriction and passage.

3. Multi-Path, Multi-Stage, Multi-Axis Flow Distribution and Velocity Control

Multi-stage pressure reduction can be further enhanced by distributing the flow through multiple engineered passages within the trim. By introducing a combination of restrictions, turns and expansion regions, the flow can be guided through a longer and more controlled path rather than being concentrated through a single restriction. This provides greater flexibility to manage local velocity, pressure distribution and pressure recovery within the available trim envelope.

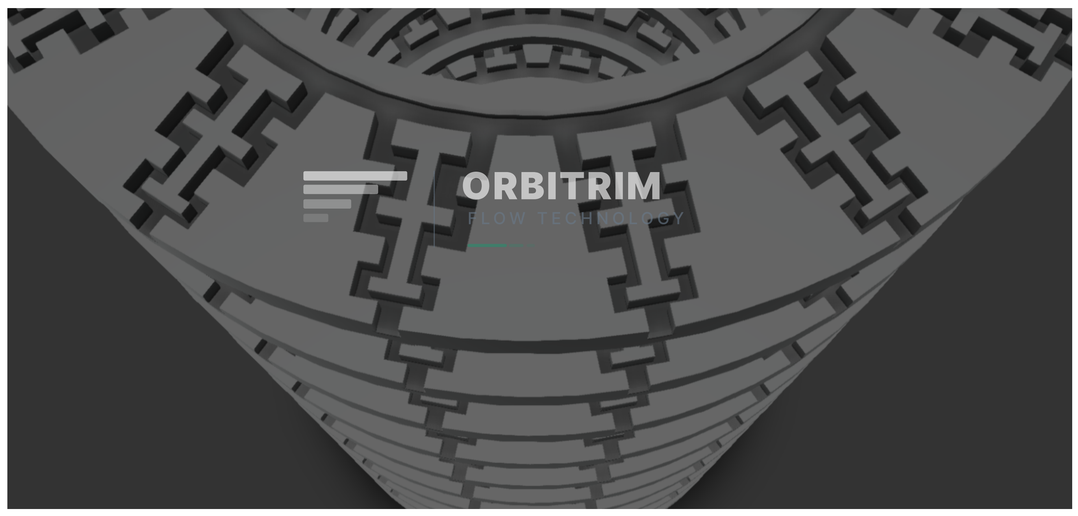


Figure 5 : Example of an ORBITRIM multi-stage flow-path design.

The flow-path geometry is not limited to a single planar arrangement. Depending on the application, passages can be developed in two-dimensional (planar) or three-dimensional geometries, with changes in direction across multiple axes. This design freedom allows restrictions and flow passages to be positioned according to the required pressure reduction and velocity control, while making effective use of the available valve envelope.

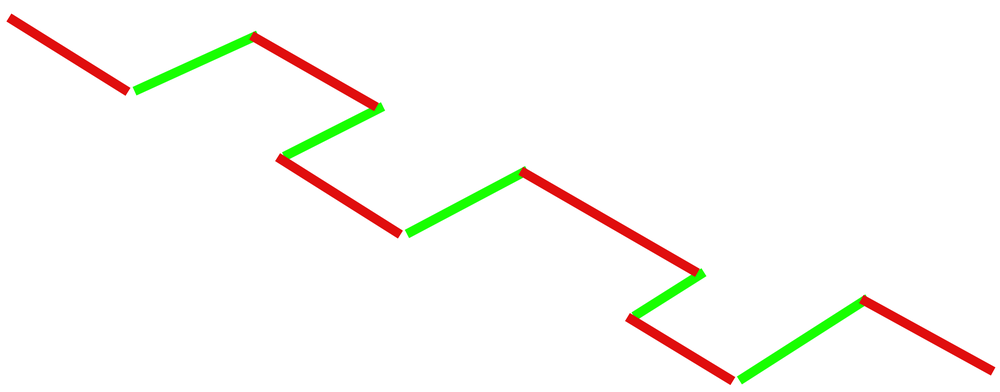


Figure 6 : Indicative schematic of planar flow-path geometry.

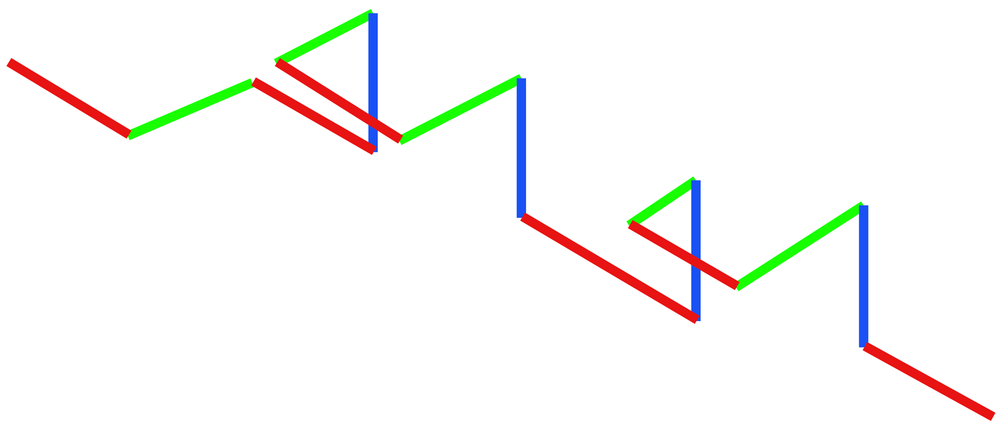


Figure 7 : Indicative schematic of multi-axis flow-path geometry.

4. From Engineered Design to Actual Trim

The performance of a severe-service trim depends on how the complete flow path is engineered. Staged pressure drops, flow areas, passage geometry, flow direction and pressure recovery are considered together with the fluid properties and operating conditions.

The engineered flow path is then translated into a detailed three-dimensional design, considering the available valve envelope, interfaces and manufacturing requirements. Complex multi-stage, multi-path and multi-axis geometries can be developed to achieve the required flow behaviour within these constraints. Once design is finalized computational analysis will be used to validate the design before manufacture.

ORBITRIM can manufacture the engineered trim using conventional precision machining methods, advanced additive manufacturing methods and specialized bonding technologies. The manufacturing method shall be selected based on the geometry, material and application.

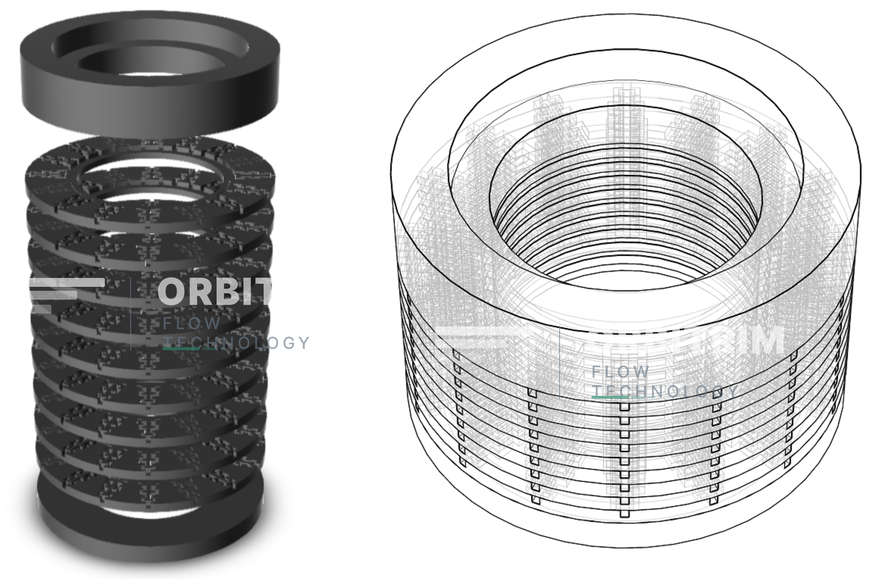


Figure 8 : Example of an ORBITRIM multi-stage flow-path design.

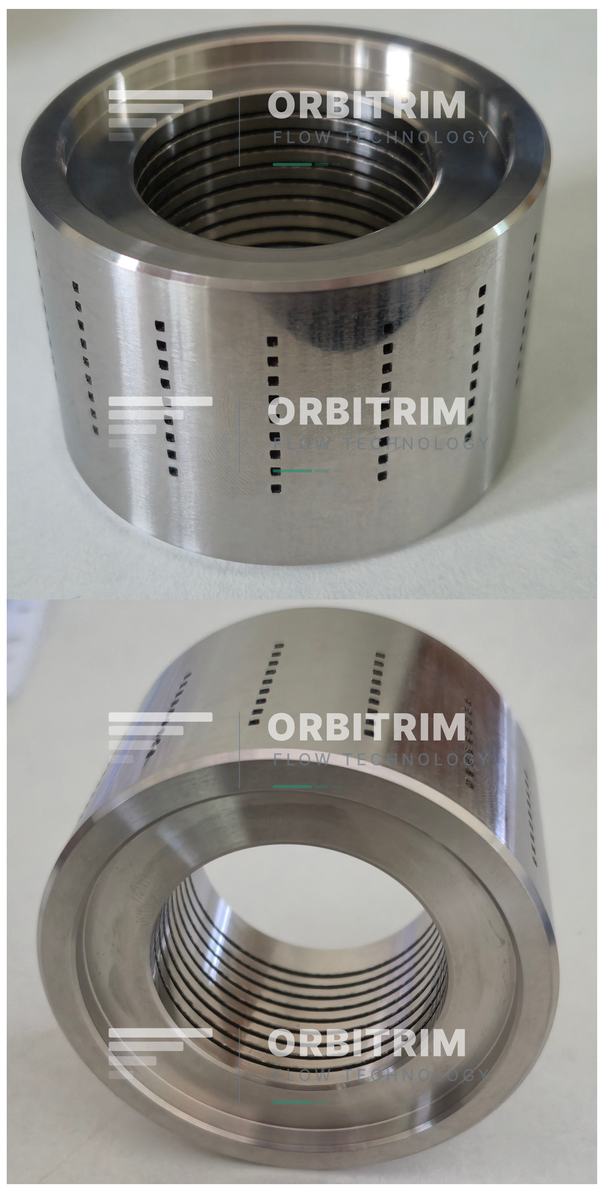


Figure 9 : Example of an actual multi-stage trim manufactured by ORBITRIM.

ORBITRIM

FLOW TECHNOLOGY

E sales@orbitrim.com | **W** www.orbitrim.com

ORBITRIM LLP
Kerala, India
LLPIN : ACZ-7076
GSTIN : 32AAKFO3378F1Z8