

**EroSolve Flashing**  
for safer, easier, and  
longer operation of  
valves in flashing  
conditions

# Operational challenges

## What is flashing?

Fluid control valves include stems and plugs that are linearly displaced during normal operation of the valve. These linear control valves are often used to control liquids that are at elevated pressures. As the liquid passes through constricted passages of the control valve, the liquid may experience flashing, which refers to the phenomenon where the absolute pressure of the liquid falls below the vapor pressure of that substance, which in turn causes the liquid to boil.

## Flashing is a cause of severe damage

The effect of boiling liquid within the constricted passages of the control valve may result in flow through the valve becoming choked by the rapid expansion of the liquid to vapor as it boils, which reduces the flow capacity of the valve. Furthermore, flashing tends to be destructive to the valve, as the boiling action may propel tiny droplets of liquid at extremely high velocities over the valve structure, which may erode the structure over time. Consequently, there is a need for a control valve specifically configured to mitigate flashing within the valve.

In most cases, flashing is a destructive phenomenon, significantly damaging associated valves and pipes.

## How to identify the problem

The valve's pressure recovery factor can help predict flashing. This is based on a comparison of the valve's total pressure drop from inlet to outlet versus the pressure drop from inlet to the point of minimum pressure within the valve.

Problems may already exist in your plant if you:

- Use steam boilers in your plant
- Use steam processes in your plant
- Frequently replace whole valves or parts
- Observe internal metal parts that look smooth and shiny in appearance
- Observe a pinhole in the valve body or steam leakage out of the valve body
- Have trouble identifying the root cause

## How can you avoid flashing?

Standard control valves are not designed to withstand flashing conditions, which can subsequently lead to significant erosion of the valve and the downstream pipe. If the flashing persists it requires immediate action or the damage can worsen over time.

To eliminate flashing, plants must change the operating conditions and set up, which creates significant costs and operational impact. Alternatively, plants can upgrade their control valves to models that are designed to withstand flashing, to minimize the damage sustained immediately, at much lower costs.

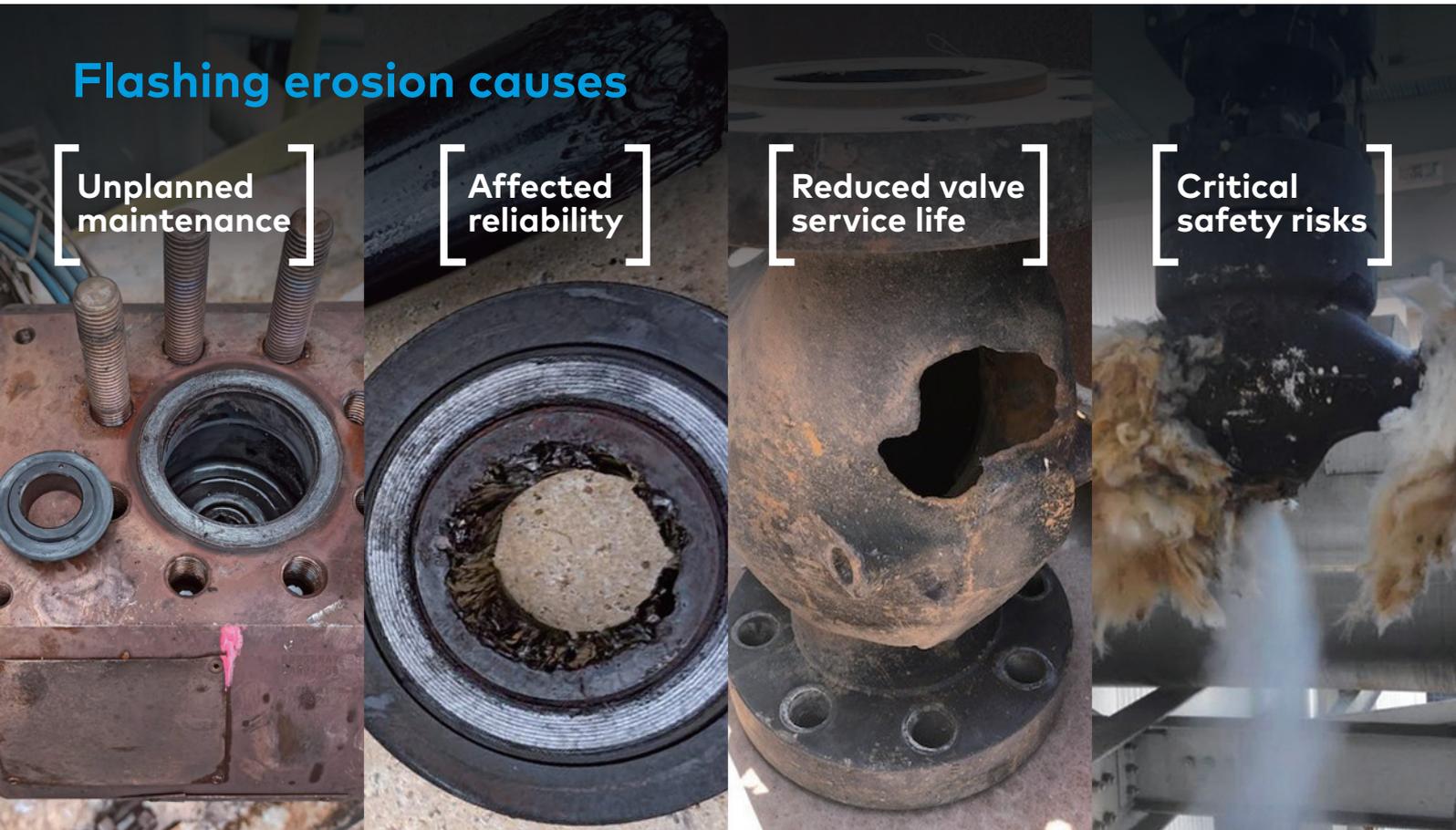
## Flashing erosion causes

[ Unplanned maintenance ]

[ Affected reliability ]

[ Reduced valve service life ]

[ Critical safety risks ]



# EroSolve Flashing solution

EroSolve Flashing provides an ultimate flashing solution configured to reduce valve erosion caused by flashing while maximising the valve performance against the given conditions. Thanks to our Valve Doctors® and experienced engineers, our solution is available for both new and existing installations. Each valve condition is evaluated for flashing conditions that may occur in order to provide the right solution.

If the operation continues without taking measures, over time it can cause costly unplanned maintenance, affecting operational reliability, significantly reducing the valve service life, and posing critical safety risks.

It is important to be aware of the problem, acknowledge it, and to mitigate risks by using the right solution.



## Product specification

The EroSolve Flashing product line is available in both angle and globe configurations. Angle body valves are recommended as they are proven to be the most effective flashing solutions in controlling the flashing fluid. Where the angle control valve installation is not possible, the globe control valve is also available as a solution.

Model name		860G-ESF   860H-ESF	840G-ESF   840H-ESF
<b>Body</b>	Body configuration	Angle	
	Flow direction	Flow to close (OTP)	
	Valve size range	1", 2", 3", 4", 6"	1", 1.5", 2", 3", 4", 6", 8", 10", 12"
	Valve rating	Up to 1500#	Up to 2500#
	End connections	Butt-weld, socket-weld, flanged	
<b>Trim</b>	Trim size range	3/8", 5/8", 1", 1.5", 2", 2.5", 3", 4"	3/4", 5/8", 1", 1.5", 2", 2.5", 3", 4", 5", 6", 8"
	Trim characteristics	Customised EQ%	
	Trim type	Multi-path, multi-turn trim (Pintle)	Window cage, 1-stage drilled hole cage
	Shut-off class	ANSI/FCI 70.1 class IV, class V	
	Stem packing	V-PTFE (25% G.F), Graphite (VOC)	
	Balance seal	316+TFE, Graphite	
<b>Other</b>	Temperature	Maximum 550°C	
	Orientation	Valve stem vertical	

## Typical applications

Some water applications are prone to severe flashing erosion:

- Intermittent Blowdown Valve
- Continuous Blowdown Valve
- Superheater Drain Valve
- Steam Line Drain Valve
- Heater Drain Valve

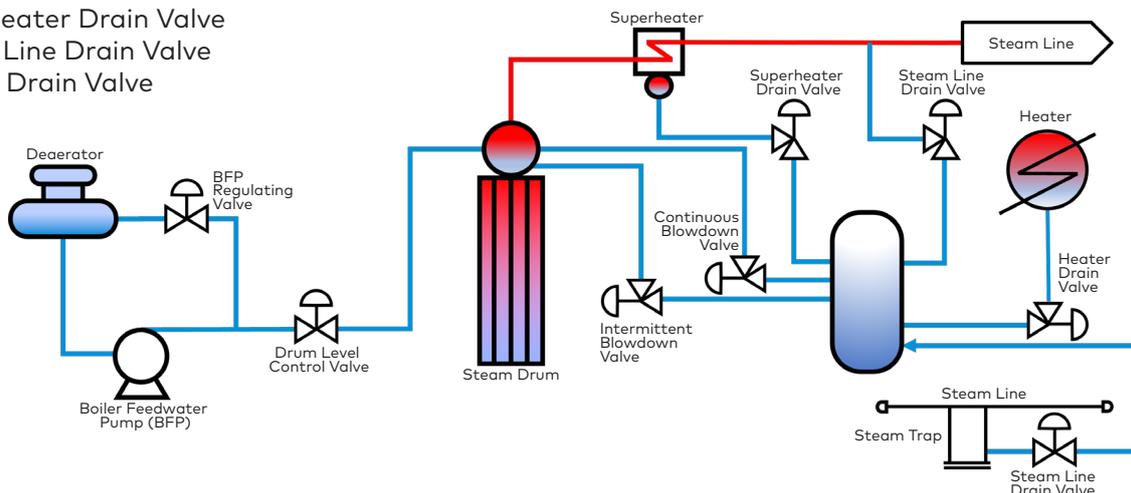


Figure 1: Schematic diagram of flashing applications

## Angle configuration solution

The EroSolve Flashing angle solution is designed to control the most severe flashing conditions of two-phase flow fluids, with high velocity vapor and low velocity liquids. The 860G-ESF and 860H-ESF models are designed to minimise flashing erosion on the internal trim parts, which will also help avoid erosion on the valve body and the downstream pipe, by directing the vapor bubble stream into the centre of valve outlet.

Angle solution is recommended for the most severe flashing conditions.

### Design features:

- Hardened trim material applied to the plug, seat and cage (optional) to increase resistance to erosion
- Special seat design to maintain tightness controlling leakage and performance
- Multi-path, multi-turn plug design to move flashing point away from the seating area between the plug and seat, minimizing damage to important trim parts
- Easy maintenance by replacing the whole valve, or just the valve trim

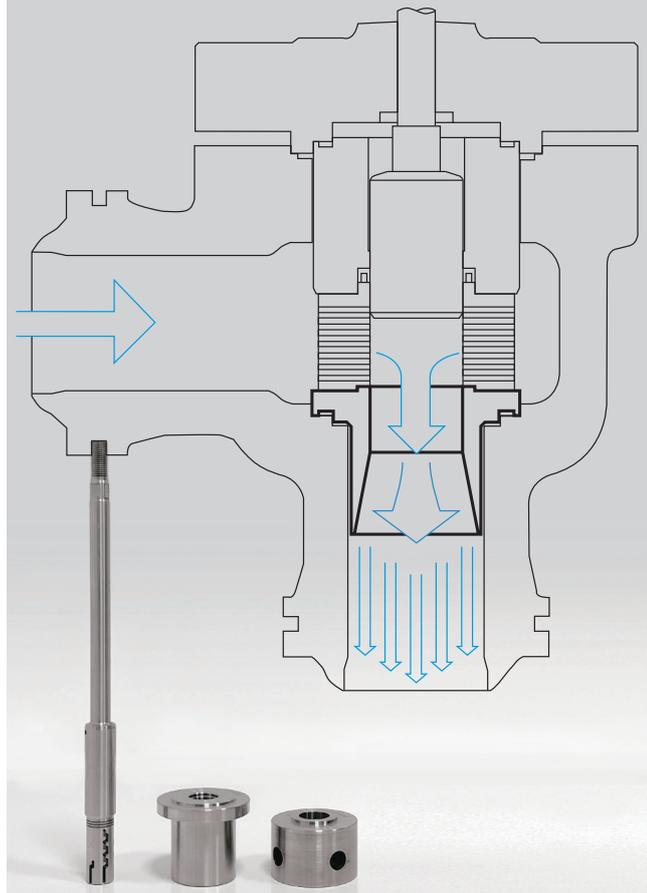


Figure 2: Angle valve parts (plug, seat, cage)

## Case study in a combined cycle power plant

A combined cycle power plant (2x900MW) found a severe erosion issue in the Heat Recovery Steam Generators (HRSG). As this private power plant was highly driven by safety across the plant operations, an immediate solution proposal was requested.

### Challenges

Four angle valves (3", 1500#) in the HP intermittent blowdown applications were experiencing the same severe internal parts erosion after two years of operation, and this had started damaging the downstream piping wall.

### EroSolve Flashing angle solution

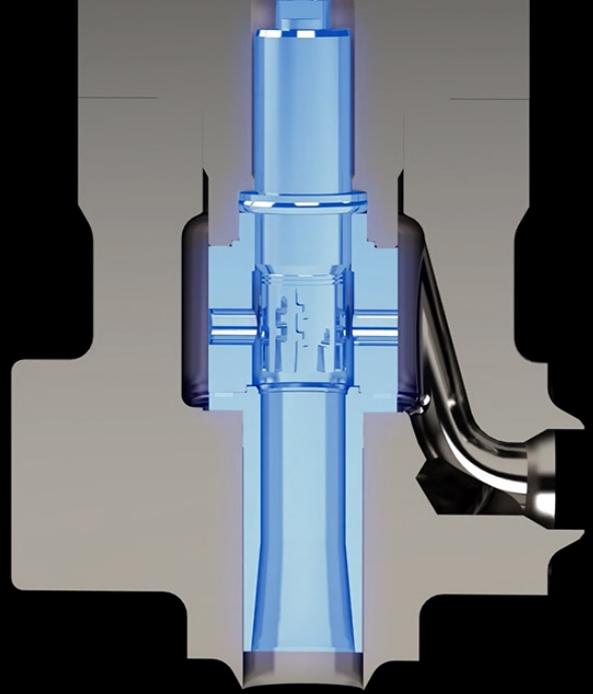
Engineering analysis defined the root cause to be the two-phase flow fluids of high velocity vapor and low velocity liquids at >45% steam quality, indicating the highest degree of flashing condition.

A 860G-ESF model was proposed to the customer to upgrade the valve seat and plug design and material. The valve replaced one of the old valves in May 2021 and no damage was found on the plug and seat liner when inspected after a year of operation. This customer now plans to upgrade the remaining three valves to the EroSolve Flashing solution.

# Design benefits of EroSolve Flashing

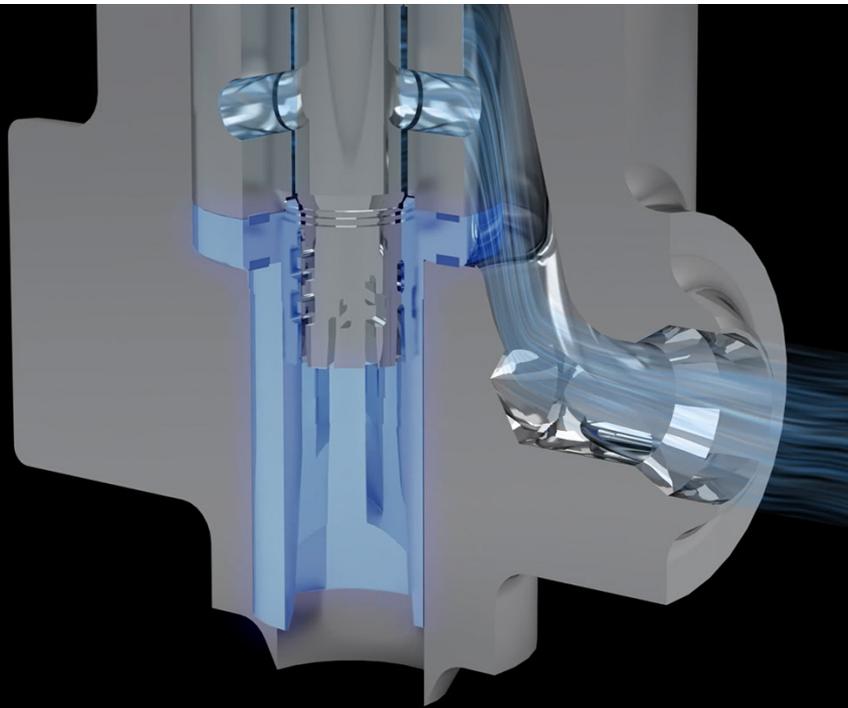
## Hardened trim materials

The critical trim parts are protected by hardened material to minimize erosion. A special assembly feature associated with the hardened material enables the parts to withstand internal erosion.



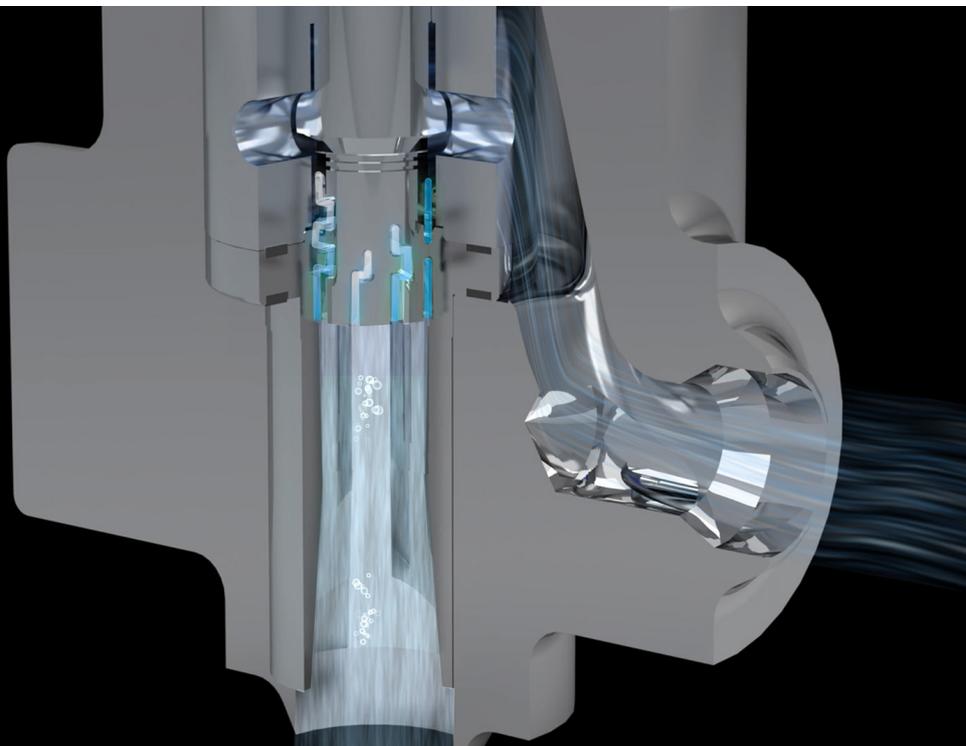
## Enhanced seat design

Our special seat and plug design helps to minimize the pressure drop inside, between the seat ring and plug at initial valve open conditions, as well as to maintain the seat tightness.



## Multi-path, multi-turn plug design

Thanks to the original DRAG® technology, the spindle is designed and machined with a series of the multi-path, multi-turn features. This design reduces velocity of the fluid and thus the erosion, by moving the severe flashing point away from the critical trim parts.



## Globe configuration solution

EroSolve Flashing globe valves provide an excellent solution by utilising a seat basket. The seat basket improves performance and safety without having to modify the current pipe configuration.

Our globe valves provide the best possible solution for your existing plant set up.

### Design features

- Seat basket applied and placed inside of the valve to avoid damage to the valve body
- Customised seat basket to create back pressure to reduce downstream velocity as well as the pressure drop
- Easier and cheaper maintenance by replacing parts without removing the whole valve from the piping whilst using the current pipe configuration
- Machined (standard) or additive manufactured seat baskets are available to find the best fit for each service and operation:
  - Standard seat basket as a target plate
  - Seat basket with diffuser as a back-pressure device

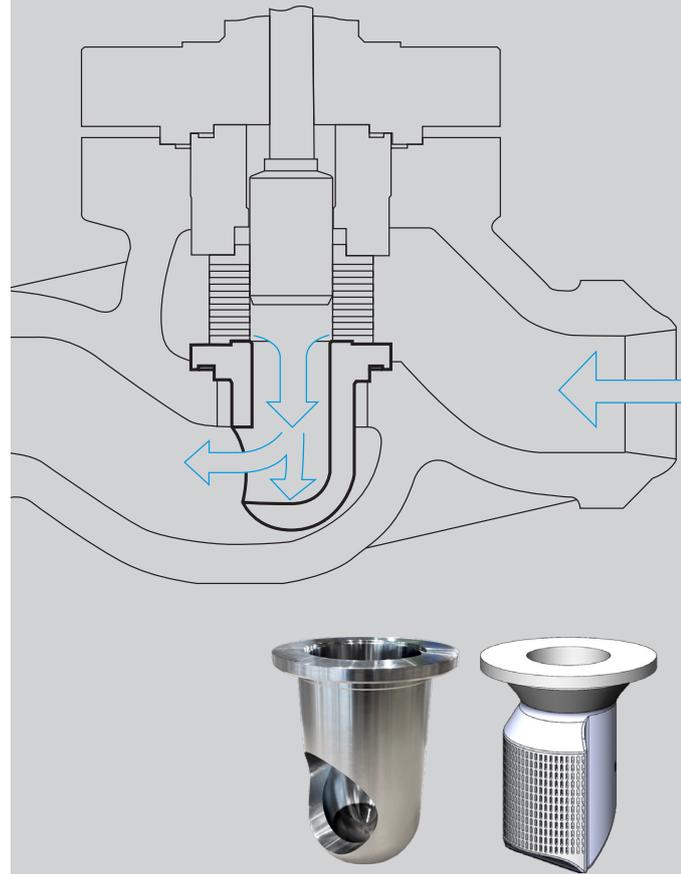


Figure 3: Globe valve parts (seat baskets)

## Case study in a petrochemical plant

A Naphtha Cracking Center (NCC) facility was experiencing a chronic control valve problem that repeatedly occurred for over a decade in Steam Drum Blowdown applications.

### Challenges

Internal parts were damaged and a body pinhole on the globe valve had caused frequent on-site maintenance every 7 to 10 months of operation. The problem was persistent with unidentified causes despite changing vendor three times in 15 years.

### EroSolve Flashing globe solution

Our engineering analysis indicated that the previous competitor valves were not designed to withstand flashing conditions. A 840G-ESF valve was installed in May 2021 and an on-site inspection in December 2021 confirmed that there was no damage in the internal parts. In comparison, the competitor valve had developed a pinhole within its first 6 months of service.



# Benefits of EroSolve Flashing

## The best choice

Our Valve Doctors® and experienced engineers help customers choose the right solution by using data evaluation and root cause analysis.

## Optimised solution

EroSolve Flashing helps you find the best possible solution for a given problem under defined set of customer conditions.

## Easy maintenance

Replacing either the valve or only the trim parts is available to provide an immediate improvement.

## Improved flow control

Our design features ensure improved flow control without vibration, noise or leakage.

## Longer valve lifecycle

Controlling erosion and performance extends valve lifecycle by up to 4 times compared to similar products.

## Safer operations

Effective flashing control means enhancing operational safety by stopping an aggravating problem.

**Save up to 40% on  
the cost of ownership  
by choosing the right  
EroSolve Flashing solution**

**IMI** Critical  
Engineering

IMI Critical Engineering are global critical flow control specialists with decades of experience in research, development and manufacturing of valves and other flow control solutions.

This expertise has been channelled into our new EroSolve solution, providing a suite of services designed to resolve many of our customers most common erosion issues.

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## Americas

[imiccsales.americas@imi-critical.com](mailto:imiccsales.americas@imi-critical.com)

### IMI CCI Brazil

Sorocaba  
Brasil

Tel: +55 11 2645 6503

### IMI CCI Houston

Texas  
USA

Tel: +1 281 670-5357

### IMI CCI RSM

California  
USA

Tel: +1 949 858 1877

---

## Asia-Pacific

[imiccsales.apac@imi-critical.com](mailto:imiccsales.apac@imi-critical.com)

### IMI Critical Australia

Melbourne  
Australia

Tel: +61 3 9213 0800

### IMI Critical Japan

Kobe  
Japan

Tel: +81 78 277 1880

### IMI Critical Korea

Paju-si  
Korea

Tel: +82 31 980 9800

### IMI Critical Malaysia

Kuala Lumpur  
Malaysia

Tel: +60 3 6412 3500

### IMI Critical Singapore

Singapore

Tel: +65 6653 7000

### IMI Critical Engineering

Lakeside, Solihull Parkway  
Birmingham Business Park  
Birmingham B37 7XZ  
United Kingdom

Tel: +44 (0)121 717 3700  
Fax: +44 (0)121 717 3701

[www.imi-critical.com](http://www.imi-critical.com)

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## China

[imiccsales.china@imi-critical.com](mailto:imiccsales.china@imi-critical.com)

### IMI Critical China

Shanghai  
PR China

Tel: +86 21 3973 8008

---

## Europe

[imiccsales.europe@imi-critical.com](mailto:imiccsales.europe@imi-critical.com)

### IMI CCI Austria

Wien  
Austria

Tel: +43 1 869 27 40

### IMI CCI Brno

Brno  
Czech Republic

Tel: +420 511 188 111

### IMI CCI Sweden

Säffle  
Sweden

Tel: +46 533 689 600

### IMI CCI Switzerland

Balterswil  
Switzerland

Tel: +41 52 264 9500

### IMI CCI United Kingdom

Manchester  
UK

Tel: +44 (0)161 655 1680

---

## India

[imiccsales.india@imi-critical.com](mailto:imiccsales.india@imi-critical.com)

### IMI CCI Bangalore

Bangalore  
India

Tel: +91 80 4030 3500

### IMI CCI SriCity

Andhra Pradesh  
India

Tel: +91 86 2371 8000

---

## Middle East and Africa

[imiccsales.mea@imi-critical.com](mailto:imiccsales.mea@imi-critical.com)

### IMI CCI Dubai

Dubai  
United Arab Emirates

Tel: +971 4 807 3111

### IMI Saudi Industry LLC

Dammam  
Saudi Arabia

Tel: +966 13 868 8119

**EROSOLVE**  
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→ [imi-critical.com/erosolve.flashing](http://imi-critical.com/erosolve.flashing)

→ [erosolve.flashing@imi-critical.com](mailto:erosolve.flashing@imi-critical.com)

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