METHANE FROM FLARING
TOOLKIT

Flare Design: Sonic tips with variable exit area

How is the flare designed to minimise methane? > Flare Design: Sonic tips with variable exit area

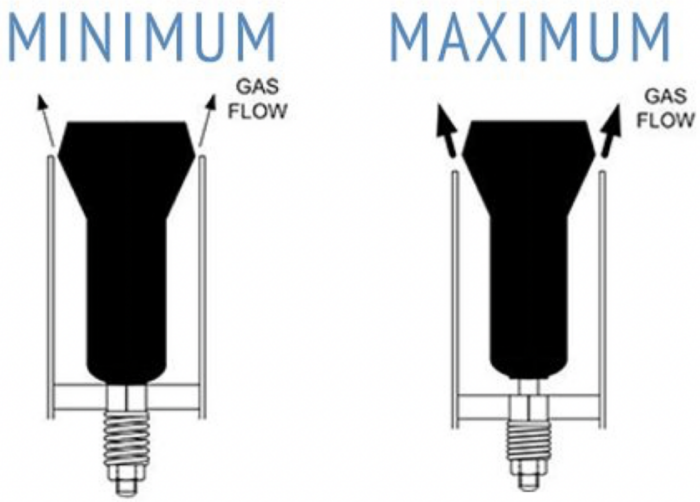
Summary

Sonic tips are designed to discharge the flare gas at sonic velocities. The most conventional technology is the multi-arm design, with fixed or variable exit areas.

Variable exit tips allow greater flexibility in dictating the velocity of gas, and therefore mixing with air for low emission combustion. However, additional moving parts adds complexity to the flare design.

How it Works

- The multi-arm design allows to route the gas to a number of smaller diameter burner nozzles in order to achieve high velocities, increase mixing with combustion air, improve combustion efficiency and reduce soot and smoke formation at high flow rates.
- Multi-arm with variable slot flare tips have been developed to achieve sonic velocities over the entire operating range and maintain a good combustion efficiency at any flow rate thus providing smokeless operation.
- Multi-arm with variable slot flare tips are fitted with a spring mechanism in each arm connected to a moving part that allows the exit area of the flare tip to change depending on the supply pressure and flow rate of the gas.



Advantages

- ☑ High combustion efficiency at high flowrates resulting in reduced smoke formation
- ☑ Sonic discharge over the entire operating range – high turndown capacity
- ☑ Improved performance at low flow rates – better

mixing with combustion air, increased combustion efficiency, smokeless operation

Low – the exit area is almost completely closed at low flow rates; therefore, less purge gas is required to prevent air ingress in the flare tip, lowering emissions from purging

Limitations

Sonic tips with variable slots involve moving parts with an inner spring which can be challenging for inspection.

Go Deeper

- Vendor website: Zeeco
- Vendor website: GBA

Case study

- A high pressure guy-supported flare with a capacity of 120 MMSCFD was installed in a large capacity electric powered compressor station located in the greater Permian Basin area.
- The flare tip consists of high pressure multi-jet tips. Each arm of the tip incorporates a self-actuated variable exit area assembly that opens as necessary relative to internal pressure. This ensures operation at high exit velocities over a wide range of flow rates.
- 80 psig pressure is maintained upstream of the flare tip. Since the flare tip operates at high pressure, it does not require additional assist media (steam or air) even at low flow rates.
- Based on the performance of multi-jet tips in the facility, this type of tip provides smokeless operation with 98% destruction efficiency over a large range of operation.

How is the flare designed to minimise methane?

Flare Design: Pilots

Flare Design: Air-assisted flare

Flare Design: Nitrogen Purge

Flare Design: Sonic tips with fixed exit slot

Flare Design: Flare seals – Molecular (buoyancy) and Velocity Seals