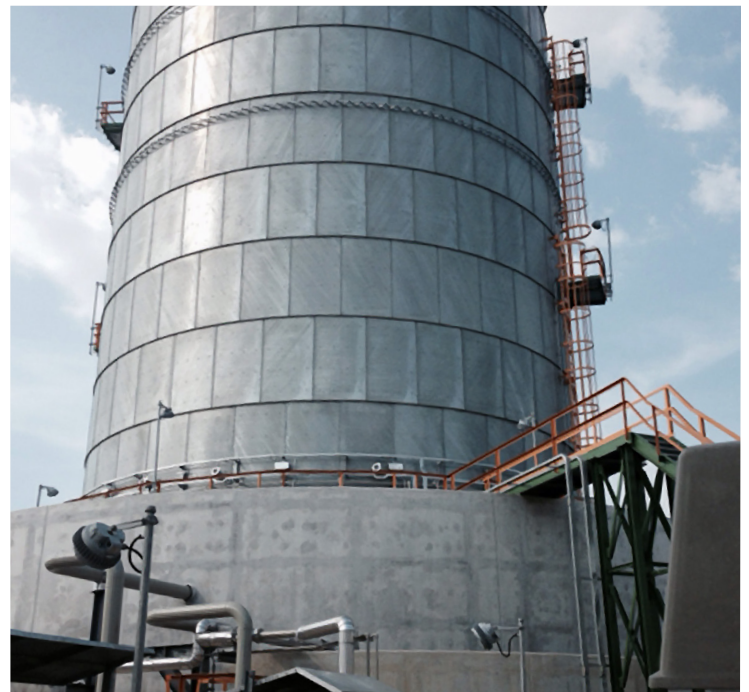
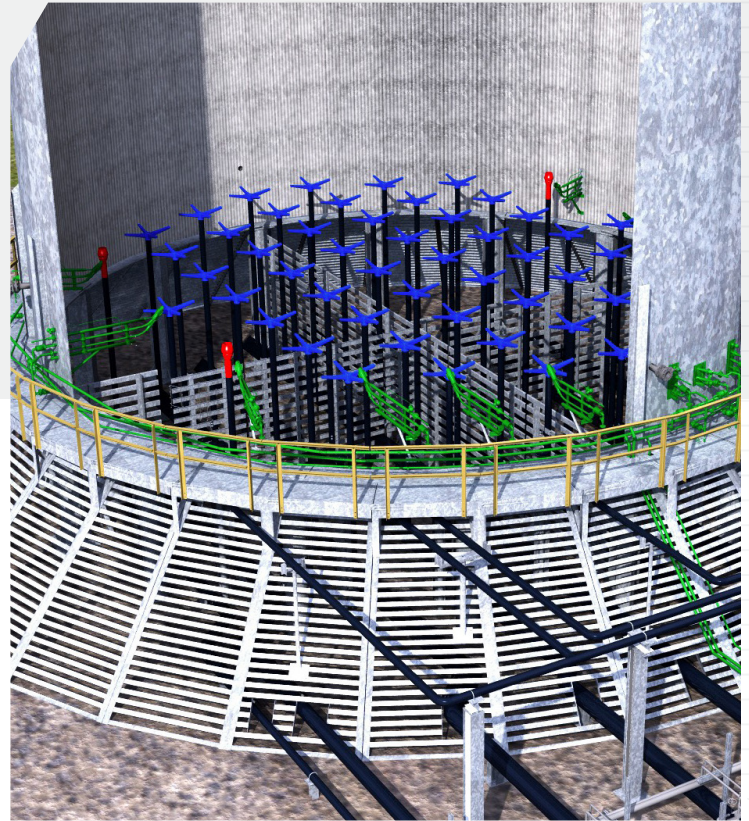


ENCLOSED GROUND FLARES

**ZERO SMOKE, LOW NOISE
AND NO VISIBLE FLAME**

Our enclosed ground flare systems combust waste gases cleanly and efficiently by eliminating smoke and minimizing noise and visible flame from conventional flaring. Enclosed flares are customized to client specifications to achieve excellence in overall system performance.



Decades of research and development are incorporated into every flare design to provide unsurpassed reliability, safety, efficiency and cost effectiveness.

FEATURES AND BENEFITS

John Zink enclosed ground flares incorporate a variety of technological features developed through years of experience in a wide array of applications. Features are customized to provide optimal performance for every application.

FEATURES	BENEFITS
Refractory-lined combustion chamber	<ul style="list-style-type: none"> Minimizes environmental impact Safe flaring in tight locations
Proprietary burner designs	<ul style="list-style-type: none"> Minimizes or eliminates the need for assist air or steam High-destruction efficiencies
Staged flare gas controls	<ul style="list-style-type: none"> 100% smokeless performance Minimizes utility consumption
Proprietary wind fence designs	<ul style="list-style-type: none"> Maximizes system performance

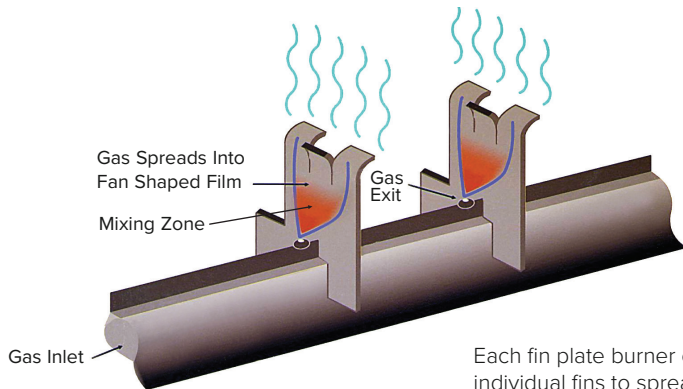
BURNER TECHNOLOGIES

John Zink burner technologies utilize proven methods to deliver:

- Short flame lengths
- Simple operation
- Reduced maintenance costs
- Reliable cross-lighting
- Long operating life
- 99.5% + DRE
- Efficient air entrainment
- Smokeless operation

Unassisted Fin Plate Burners

Our fin plate burner provides smokeless flaring without steam or air assist. The proprietary design offers superior mixing performance over a wide range of operating conditions. The burner design utilizes proprietary fin technology to provide highly effective air/gas mixing zones that optimize combustion performance.



Each fin plate burner contains many individual fins to spread the flare gas into a thin film and optimize the gas/air mixing area.



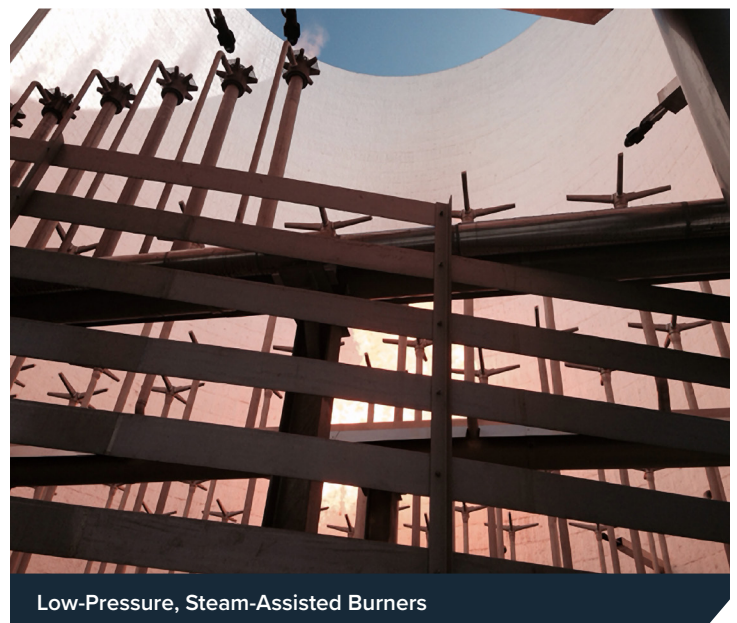
The fin plate burner provides unassisted, highly efficient, smokeless flaring of highly unsaturated hydrocarbons such as ethylene and propylene.

Pressure-Assisted Burners

For high-pressure applications, up-fired, pressure assisted burners provide optimum flame stability, high hydrocarbon destruction efficiency, and many additional benefits. The pressure-assisted burner designs utilize proprietary methods to promote high efficiency mixing.

Low-Pressure Assisted Burners

For low-pressure applications that require assistance to control smoke or flame stability, John Zink offers a variety of steam-assisted, air-assisted, and gas-assisted burners that are used in enclosed ground flares. These assisted burners are commonly used as first-stage burners in applications that need smoke control at turndown.



Low-Pressure, Steam-Assisted Burners

Low-pressure, steam-assisted burners staged with pressure-assisted burners.

Combustion Air Dynamics

A wind fence is a proprietary aerodynamic structure at grade used to modify the effect of crosswinds on the combustion process and hide the visible radiation. These fences are also used as an important safety control, preventing unauthorized access into the combustion zone. Locked access ways are provided for maintenance operations. John Zink provides two types of wind fences:

Solid-wall fences consist of one or two walls typically made of concrete that surrounds the enclosure at grade. This wall provides a blockage from the crosswinds and allows air to flow over the wall and into the combustion zone aerodynamically.



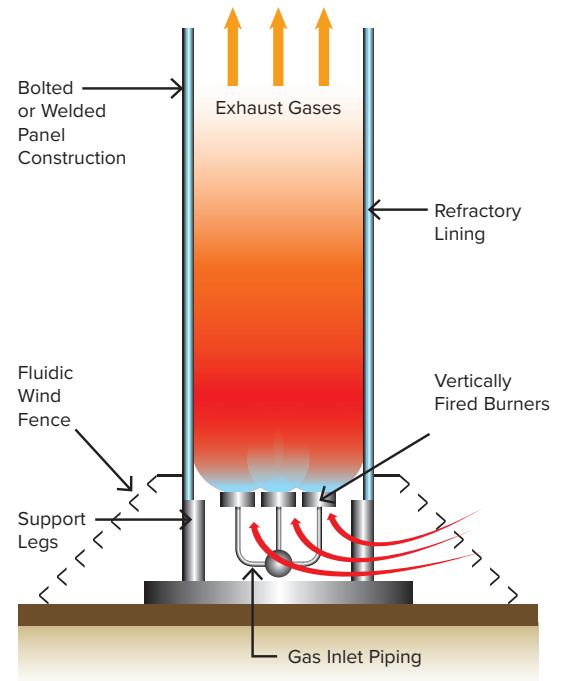
A **fluidic wind fence** consists of a structure at the base of the flare enclosure with angled slats. These slats are designed to modify the effect of crosswinds on the combustion process and evenly distribute drafted air toward the burners.



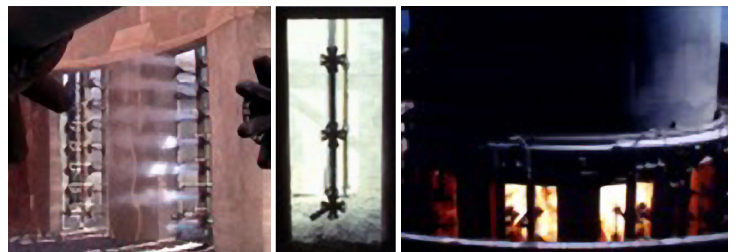
Burner Orientation

John Zink provides two burner configurations for enclosed ground flares. Both configurations can be high-pressure or low-pressure designs.

- Vertically fired burners are located at an elevation above the wind fence at the base of the flare enclosure. These systems utilize an array of multiple burners for smokeless combustion spread out like a floor, creating even access to the drafted air.
- Horizontally fired burners are located near grade of the flare enclosure and fire through windows that control the amount of air that passes through the burners. These systems are typically steam-assisted or air-assisted.



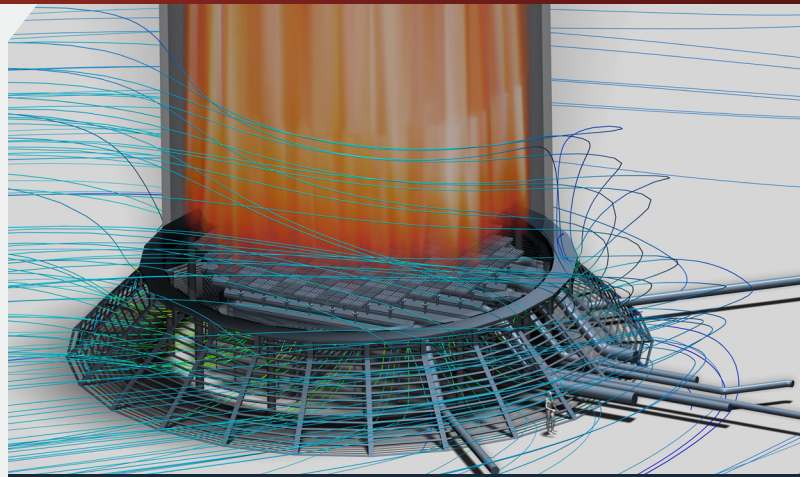
Vertical Orientation



Horizontal Orientation

Computational Fluid Dynamics (CFD)

At John Zink, CFD simulation is an integral part of the research and development of industry-leading flare technologies. CFD modeling is a simulation methodology that can provide a prediction of flow, mixing, and combustion in flare flames. Our engineers routinely perform CFD analysis on our enclosed ground flare technologies to optimize flare performance. CFD is also used extensively to assess exhaust gas dispersion and environmental impact at customer sites.



Computational Fluid Dynamics (CFD)

CFD is used by John Zink to simulate the air flow characteristic into and hot plume flow out of ground flares.

Ease of Installation and Modularization

We offer enclosed ground flares in a variety of configurations designed for ease of installation. The modular ground flare combustion chamber is designed with all bolted panels for simple site erection. The sections can be designed to allow multiple levels to be pre-assembled at grade to minimize lifting requirements and save installation time. We utilize ceramic fiber refractory modules for the combustion chamber walls, which allow simple bolt-on assembly. The burners and staging valves can be provided as pre-assembled skidded modules to minimize field work.



Flare Installation

Modular design simplifies the installation of our ground flares.

Experience/Range of Applications

We've provided enclosed ground flare systems for decades in a wide range of industries including refining, petrochemical, LNG production, and oil and gas production and distribution. Applications include cryogenic LNG gas, paraffins, olefins and polyolefins, low BTU gases, and many other challenging applications. Our proprietary Fin Plate designs provide unassisted, highturndown smokeless flaring below 1 psig (70 mbarg), even with difficult compounds such as ethylene/propylene. Our range of pressure-assisted burners can provide optimum operation at higher operating pressures.

GLOBAL REACH

John Zink has locations all over the map, with thousands of employees worldwide.



Global Headquarters // Tulsa, OK, USA // +1-918-234-1800 // To locate an office in your region, visit johnzink.com/contact.