UPSTREAM COMBUSTION TECHNOLOGIES:

Emission Control for the Upstream Oil and Gas Industry

FLARES | COMBUSTORS | SERVICE | RENTALS

ZEECO®

Work with the World Leader.

Zeeco is the global leader in combustion and environmental solutions for the production, gas processing, refining, petrochemical, LNG, power, pharmaceutical, pulp and paper, food processing, marine and offshore, and biogas industries. An ISO 9001:2015 certified company with more than 40 years of industry experience and a worldwide footprint of built-for-purpose manufacturing facilities, Zeeco's reputation for excellence in engineering, reliability, and integrity sets the industry standard.

Zeeco's product lines include ultra-low emission burners, gas and liquid flaring systems, hazardous and non-hazardous waste incinerators; vapor control, vapor recovery, and flare gas recovery units.

Working with the world leader matters because we utilize the entire depth and breadth of our combustion experience to pre-engineer and customize emission control solutions specifically to your application and to meet upstream regulatory requirements today – and into the future.

ZEECO®

CELEBRATING 40 YEARS | EST. 1979

Talented. Experienced. Dedicated.

Headquartered in Broken Arrow, OK, Zeeco is comprised of industry experts who combine decades of combustion experience with cutting edge technology to provide innovative solutions and seamless project execution. With an ever-growing global installation list of thousands of flares, including some of the largest and most complex systems in the world, our 700+ engineers have met every combustion challenge. Zeeco's reputation for doing what we say we'll do, when we say it, is unparalleled in the industry – customers trust us time and time again to deliver on time, on budget, and on spec. If you need a solution right away, depend on our strategically located **sales and service teams positioned in every major North American shale basin** to make it happen.

Located at our global headquarters near Tulsa, Oklahoma, Zeeco's 10-acre Research and Test Facility is the largest in the world and the first of its kind to become ISO 9001 certified.

24/7 Global Support.

Our field service engineers and support specialists are strategically located around the world to ensure you stay up and running – and better than ever. 24/7 support, service technicians staged near every shale basin, a comprehensive spare parts inventory available from regional hubs and local technicians – all backed by Zeeco engineering and expertise. Whether it's our equipment or someone else's equipment, we're ready, willing, and able to help. Retrofits, pilot upgrades, parts and service: we've got you covered.

Call 1-844-GO ZEECO for 24/7 Service

Services Provided.

- Lump sum turnkey installations and unit relocations
- 24/7 aftermarket parts support for all combustion manufacturer's equipment
- Preventative maintenance programs
- Start-up and commissioning
- Installation supervision
- 24/7 trouble shooting
- Emission testing
- Automation/programming
- Drone aerial inspections

Zeeco's Upstream Flares

Best of Both Worlds:

Custom flaring solutions for the price and delivery of a standard product.

We offer a range of pre-engineered designs for a variety of typical upstream applications, and our engineers can customize any of them to specifically fit your design scenario. For customers, that means taking advantage of the affordability and availability of pre-engineered designs without suffering the longer lead times or higher costs sometimes associated with custom solutions. Zeeco's flares, combustors, and ignition systems operate in nearly every major unconventional and conventional gas gathering field today.

From open and enclosed well test flares to portable vapor combustors and trailer-mounted flaring systems, all ZEECO® flare stacks meet or exceed the latest EPA standards. Our enclosed ground flare systems meet the NSPS OOOO (QuadO), OOOOa, and Maximum Achievable Control Technology HH/HHH code of regulations. ZEECO enclosed ground flares have also been proven to meet EPA's standard for the Combustion Control Devices Manufacturer's Performance Test.

Picking the Perfect Flare.

Zeeco's upstream combustion solutions help producers effectively deal with waste gas while staying in compliance with oil and gas gathering field environmental regulations. We have flare and combustor options to meet a variety of operating conditions and applications.

Flare Selection Guide

Item		Tank/Trunk Vents	Vapor Recovery Tower (VRT)	Heater Treater	3-Phase Separator
Available Pressure		<12 oz/in2	3 - 7 psig	30 - 40 psig	>100 psig
Lower Heating Value (Btu/Scf)		2500 - 3000	2000 - 2500	1200 - 1400	1100-1300
Type of Flaring Event (Typically)		Normal Operation	Normal Operation	Emergency/Upset Condition/MSS**	Emergency/Upset Condition/MSS**
Quad O | 40 CFR 60.18 | Smokeless Required		Yes	Yes	Not Required at MMS	Not Required at MMS
Assist Required for Smokeless at Max Rate		Yes	Yes	No	No
Applicable Flare Types	Air-Assisted	✔	✔	✔	✔
	Gas-Assisted	✔	✔	✔	✔
	Pressure-Assisted | HP (Smokeless)	✖	✖	✔	✔
	Unassisted | Utility (Non-smokeless)	✖	✖	✔	✔
	Enclosed	✔	✔	✔	✔

Multiple sources/flare types can be combined into a single flare system.* * Malfunction/Startup/Shutdown*

Smokeless Flaring.

Many of today's applications and regulations require smokeless combustion. Smokeless combustion is obtained by adequate mixing of fuel and oxygen at the time of ignition. For lower heating value streams (<800 Btu/Scf) there is often enough air in the surrounding atmosphere to burn without smoke and therefore no assist is required. For most upstream applications, either pressure, air, or gas-assist (or a combination thereof) are utilized to prevent visible emissions. Pressure-assisted flares use the inherent energy in higher pressure (>15 psig) waste streams and convert it to turbulent flow at the flare tip exit. This entrains needed combustion air from the atmosphere for smokeless operation. Air-assisted flaring often utilizes a blower or fan to create mixing by directing a percentage of the required air into the combustion zone at the exit of the flare tip. Gas-assisted flares will perform the same action by using a small amount of fuel gas to aspirate the exiting waste gas stream with the available air. With all these technologies, tip design and assist media control is needed to ensure that the appropriate amount of fuel and air along with flame stability is maintained. Lack of either can lead to reduced destruction efficiency. You can count on Zeeco's experienced engineering team to incorporate your operating needs and process conditions to design the best flaring solution for smokeless operation. Zeeco offers continuous monitoring devices such as our ZEECO Contour™ to automate and optimize the assist media to ensure smokeless flaring even as process conditions change.

Air-Assisted Flares	
Diameters	3" – 60"+
Heights	10' to over 200'
Typical Flow Range	0 – 200+ MMScfd
Utilities	• Fuel Gas at 15 psig • 3-phase electricity may be required for air blower
Pros	• Utility cost is low for smokeless operation • High smokeless capacities • Fuel gas usage is only required for pilots
Cons	• Can have a higher capital cost • Requires fine-tuned control system to ensure the combustion zone isn't diluted by air • Rotating equipment requires more maintenance • Electricity is required

When smokeless flaring is desired but neither adequate pressure nor assist gas is available, blowers can be used to inject combustion air directly into the waste gas stream as it exits the flare tip. **ZEECO® air-assisted flare tips use a proprietary design** that splits the waste gas stream into several smaller streams at the top of the flare to increase the gas / air contact surface area and promote better mixing. Our air-assisted flare tips produce a superior quality, erect flame that virtually eliminates flame lick on the exterior of the flare and burnback inside the flare tip.

Zeeco's Upstream Flares

Zeeco offers **gas-assisted flares for smokeless burning** of low-pressure, heavy hydrocarbons. Our proprietary designs deliver stable burning, high-destruction efficiency, and low radiation levels when air is not practical. Gas-assisted flares have no moving parts and do not require electricity.

Gas-Assisted Flares	
Diameters	3" – 24"+
Heights	10' to over 200'
Typical Flow Range	0 – 65+ MMScfd
Utilities	• Fuel Gas at 15 psig • Optional solar power
Pros	• No electricity required • No moving parts • Fully smokeless • Low capital costs
Cons	• If gas takeaway is available, the assist-gas becomes an operating cost • Requires fine-tuned control system to ensure the combustion zone isn't diluted by gas

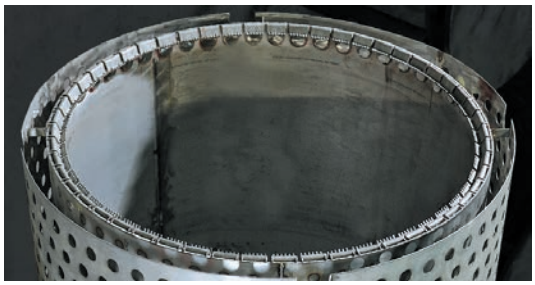
Positive Pressure.

When you need smokeless flaring, but air, steam, or gas assistance isn't an option, our **ZEECO® VariJet (VariableJet) flare tips** may be the answer. VariJet flares are composed of multiple high-pressure tips that use the energy of a high-pressure waste gas stream to achieve smokeless performance. This flare tip design delivers the normal benefits of a high-pressure sonic flare, such as well defined and erect flame patterns and low fractions of heat radiated over a much wider range of flows, which leads to lower radiation levels on platforms and at ground level.

Pressure-Assisted Flares	
Diameters	3" – 24"+
Heights	10' to over 200'
Typical Flow Range	0 – 200+ MMScfd
Utilities	• Fuel Gas at 15 psig • Optional solar power
Pros	• No assist media required for smokeless flaring • Infinite turndown available on some models • Lower radiation than other models • Upright flame shape that is resistant to wind
Cons	• Jet noise in addition to combustion noise • Usually reserved for emergency/ upset conditions only • Minimum flare gas pressure of 15 psig required

Stable. Efficient. Economical.

Zeeco's **UF series utility flare** is ideal for onshore or offshore applications that do not require smokeless performance or where smokeless flaring can be managed without assist media. Our UF flare series is one of the most in-demand flares of its kind for punishing conditions that include extreme temperatures, oxidizing environments, and high winds or heavy rain. Zeeco's UF utility flares are engineered with a unique arrangement of proprietary flame stabilization tabs to ensure stable and high-efficiency flaring through the entire design range of flows – from maximum emergency flaring to purge gas flow rates.



Unassisted Flares	
Diameters	3" – 24"+
Heights	10' to over 200'
Typical Flow Range	0 – 200+ MMScfd
Utilities	• Fuel Gas at 15 psig • Optional solar power
Pros	• No moving parts • High stability flaring • Low capital and operating cost
Cons	• Non-smokeless flaring for most production gases • Smokeless only for low Btu gases • Lack of flame shaping can lead to premature failure of flare tip

Enclosed Flares	
Diameters	2.5' – 13.5'
Heights	15' to over 50'
Typical Flow Range	0 – 5+ MMScfd
Utilities	• Fuel Gas at 15 psig • 3-phase electricity • Optional solar power (for some models)
Pros	• Hidden flame • Lower noise • Combustion zone can be controlled to achieve higher destruction efficiency
Cons	• Large plan layout • Higher capital cost • Limited capacity expansion due to enclosure size

Enclosed Opportunities. Customized Solutions.

When circumstances demand a **fully enclosed flame,** ZEECO® systems offer quiet, smokeless, high-efficiency combustion with no visible flame and easy installation. Zeeco's enclosed flare systems are ideal for use with tank batteries, heater treaters, flow back operations, Vapor Recovery Towers (VRT), separators, and more. Our systems are engineered to **meet the most stringent emissions requirements** while achieving up to 99% or greater destruction removal. Our Enclosed Flare systems meet the NSPS 0000, 0000a, and Maximum Achievable Control Technology HH/HHH code of regulations.

Unique Systems and Options.

Multiple Streams. One Riser.

If you need to safely and effectively handle different types of waste streams, including the high pressure well head separator / heater treater flows, as well as low pressure tank battery vent gases common to most well pad locations, Zeeco's multi-stream capabilities are the answer. Our production flare tip and stack systems can be engineered to perform independently or combined to form a multi-stream flare, saving space and reducing costs. Our systems can combine air-assist, gas-assist, and non-assist flare systems on a single riser and can be converted from single stream to dual stream or multi-stream and back as conditions demand. Zeeco offers a wide range of pre-engineered models handling LP flowrates up to 2 MMScfd and HP flowrates ***up to 60 MMScfd, with self-supported designs up to 40' tall, and guy-wire supported designs for taller flares.***

Combustion Equipment Options.

- Detonation and deflagration arrestors
- Knockout drum (integral and standalone)
- Waste block valves
- Process control system (minimal outside control interface required)
- ZEECO Wireless Remote Monitoring System (cellular accessibility)
- Solar energy-powered control systems available for remote locations
- Fuel gas scrubbers
- Retractable pilot components
- Skid mounting to eliminate concrete foundation requirements
- Automated temperature control options on enclosed flares

ZEECO® Contour™

The ZEECO Contour delivers automated, real-time, direct monitoring, and flare control at a fraction of the cost of indirect measurement systems. Unlike other systems that require direct contact with the flare header, ZEECO Contour uses infrared (IR) technology to assess the flare combustion zone and control the optimal volume of air assist to ensure proper combustion with high destruction efficiency (DE) – independent of the waste gas composition and flow. Operators around the world utilize this system at grade to optimize flare control, prevent non-compliance with environmental regulations, reduce utility consumption, prolong equipment life, and enhance destruction efficiency.

Zeeco's Contour system delivers reliable, automated real-time direct monitoring and flare control.

ProFlame™ and ProFlame+™

Zeeco offers a line of proprietary ProFlame and ProFlame+ scanners to meet a variety of flame detection requirements in the oil and gas industry. Our scanners are approved by various bodies, including UL and CSA, and meet different hazardous environment classifications, such as Zone I, II, and III. Common upstream applications of this technology include flame verification in enclosed flares, vapor combustors, heater treaters, and more. ProFlame scanners offer greater reliability and flexibility over other flame detection technologies, such as ionization rods and thermal couples.

Zeeco's ProFlame integrated flame scanners provide reliable flame detection and superior background flame signal suppression.

Rental and Aftermarket Solutions.

Right Equipment. Right Now. Wherever You Are.

With the largest fleet of rental equipment in the world and personnel staged across every major U.S. shale basin, Zeeco is ready to respond whenever and wherever you need us. From rental flares, vapor combustors, and thermal oxidizers to parts and service on demand – for our equipment or other manufacturers' equipment – customers trust Zeeco. ZEECO® temporary/rental systems can be portable (trailer mounted), or skid mounted for easy movement by truck for onsite assembly. Our temporary flare systems range from 300 foot tall guy wire supported units with all associated controls, to two inch flare tip assemblies for well testing or well site use.

Beyond flare systems, Zeeco maintains a rental fleet of skid and trailer-mounted vapor combustor units (VCUs) staged around the world and available on demand. Our rental vapor combustors offer easy operation and installation within a matter of hours. From simple skid

mounted designs to fully automated, trailer mounted enclosed combustors, we can help. Whether you have high flow, high pressure hydrocarbon-rich streams, lean low pressure contaminated air streams – or anything in between – our rental systems make automatic adjustments to provide consistently smokeless operation with high destruction efficiencies. And if the composition of your waste stream varies, we have rental systems designed to take operational variances in stride.

Typical Rental Applications

- Facility turnarounds
- Well testing and drilling
- Flow back operations
- Emergency flare replacement
- High pressure blowdowns (pipeline and product storage)
- Low pressure tank degassing
- Loading operations (gasoline and others)
- Flares for day-to-day equipment maintenance
- RTO/Incineration and Thermal Oxidation System Backup and Replacement
- Vapor control
- Vapor combustor backup
- Combustion equipment to meet new stream regulations
- Capacity upgrades for existing systems
- Performance enhancement for existing systems
- Soil and groundwater remediation

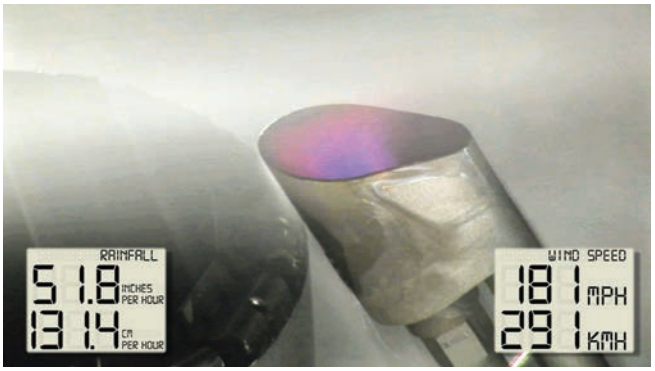
Available Rental Equipment

- Large elevated flares up to 300ft
- Trailer-mounted flares
- Skid-mounted flares
- Air-assisted flares
- Thermal oxidizers
- RTO backup systems
- Enclosed flares
- Vapor combustors
- Knockout drums, liquid seals and detonation arresters
- Other equipment available

The Zeeco Advantage.

- Zeeco's superior pilots are hurricane tested to API 537 specifications.
- High Energy Ignition (HEI) and thermocouple (TC) are retractable to grade which leaves no electrical control components in the heat affected zone. No winch, cables, or other moving parts, which reduces failures and ensures perfect alignment of pilot head to flare tip at all times.
- Extensive use of castings in the Heat-Affected Zone (HAZ) – including pilot heads – to eliminate stress concentrations and increase tip life.
- Superior Materials: 310 Stainless is the Zeeco standard for all materials in the HAZ, including flare tips and pilots. 310 SS offers the highest heat tolerance of all the grades of stainless and provides the longest life for your flare.
- More self-supported designs with easy installation and smaller footprints.
- Advanced testing and engineering modeling to ensure your system is **proven technology** before it is installed in the field.
- More than 40 years of combustion experience with the industry's most challenging regulatory requirements and environmental conditions, supported by the world's largest combustion research and testing facility.
- Custom solutions for the price and delivery of standard products.

For 24/7 service call 1-844-GO ZEECO



ZEECO® pilot hurricane tested to API 537 specifications

Internal view of a ZEECO enclosed combustor

Close up of a gas-assisted flare tip

The Zeeco Difference

By concentrating on what we do best, Zeeco has grown into a worldwide leader in combustion and environmental solutions. We are a privately held company whose ownership stays highly involved in daily operations, with upper management comprised of the world's leading combustion experts.

When you call Zeeco, we answer. When you make a request, you get a quick, efficient response. We are lean and efficient, able to make decisions quickly, without bureaucracy and red tape. Our sales, engineering, and purchasing groups work hand-in-hand to deliver highly competitive quotes and heroic turnaround times. We stand ready and willing to travel anywhere in the world to discuss upcoming projects firsthand, and to ensure that every existing project runs seamlessly.

*Visit **zeeco.com/contact** for additional Global Location contact information*

GO ZEECO®

Choose to work with our dedicated, flexible, and innovative team, and you won't be disappointed. Call or email us today to request a quote or to learn more about our proprietary combustion systems.

Zeeco Headquarters
22151 East 91st Street
Broken Arrow, OK 74014

Learn more at zeeco.com

sales@zeeco.com
+1 (918) 258 8551

For 24/7 Service:
1-844-GO ZEECO

REGISTERED
ISO 9001: 2015

Certification applies to Zeeco Headquarters.