

UOP Callidus Flares



**FLARES FOR THE PETROCHEMICAL
AND PETROLEUM INDUSTRY**

**A world leader in flare
and flare system applications**

UOP

A Honeywell Company

Advanced flare and flare system designs

UOP Callidus prides itself in providing economical high destruction efficiency, high smokeless, low noise, low radiation flares for a broad range of flare applications. Through our engineering expertise, manufacturing capabilities and worldwide service, UOP Callidus has become a leading provider of flare technology. The UOP Callidus team has hundreds of years of combined flare design experience and has been involved in the fabrication, installation, and startup of thousands of flare systems worldwide.

Quality Manufacturing

Our manufacturing facility complies with the highest quality standards in the industry. Many of our internal quality assurance programs require even higher performance standards than industry certifications. All proprietary items are fabricated at our 82,000 sq. ft. U.S. facility which uses the latest manufacturing techniques and equipment. We can proudly say that our



Flare Testing

U.S. facility has the ASME “U” stamp and NBIC “R” stamp. Our manufacturing techniques use state-of-the-art equipment and our employees are highly trained for their specialized tasks. For example, our welders are all qualified in accordance with ASME Section IX. Ongoing training is regularly scheduled through our research and development group to ensure that the highest level of quality and performance is maintained for each project. UOP Callidus quality assurance personnel thoroughly inspect each flare system prior to shipment reducing installation time. In addition, UOP Callidus project execution and manufacturing is certified ISO 9001:2008.

UOP Callidus has a flare to match your application

UOP Callidus offers a comprehensive array of flares and flare systems.

Our products include:

- Pipe Flares
- Steam Assisted Flares
- Air Assisted Flares
- Gas Assisted Flares
- HemisFlares
- Offshore Flares
- Low BTU Flares
- Portable Flares
- Pit Flares
- Totally Enclosed Ground Flares
- Multipoint Ground Flares

Our elevated flares can be supported by a number of different methods.

Support methods include:

- Tripod Supported
- Self Supported
- Guy Wire Supported
- Derrick Supported
- Demountable Derrick Supported
- Portable Trailer Mounted

UOP Callidus flares are available with a number of accessories.

Available accessories include:

- High Stability Pilots
- Velocity Seal
- Density Seal
- Knock-out Drum
- Liquid Seal Drum
- Aircraft Warning Lights
- Davit
- Flame / Smoke Monitor
- Flame Arrestor
- CCTV

Upper Steam Flares

The UOP Callidus CAL-US flare incorporates a highly stable pilot and flame retention system in conjunction with a high efficiency, low noise steam injection ring to produce stable smokeless combustion. The UOP Callidus upper steam nozzle is a unique investment casting to accomplish the function of inspirating air into the flame bundle with steam. The casting is aerodynamically designed to maximize efficiency as well as multi-ported to minimize noise production. This allows the user to minimize steam consumption while optimizing smokeless capacity.



Upper Steam Flares

Upper Steam Flares:

- Low noise steam ring
- Advanced nozzle casting design
- Superior manifold connection
- Smokeless burning
- Extremely stable pilots

Internal Steam Flares

The UOP Callidus CAL-IS flare is a dramatic improvement over the traditional internal steam design. This flare offers internal steam tubes manufactured with cast 310 SS segments at the top to prevent tube cracking and warping. To prevent vibration failure, UOP Callidus utilizes a proprietary tube support system. This system allows free thermal expansion of the inner tubes and minimal waste gas flow blockage while still constraining flare inner tube vibration. To improve air inspiration, each steam tube inlet is constructed of a true inlet venturi, maximizing air inspiration. CFD modeling was used to optimize tube placement and muffler design, resulting in maximum air flow into the combustion zone with minimum noise.

The UOP Callidus CAL-IS³ flare is the newest generation of efficient internal steam design. The steam nozzles used in this flare tip utilize a converging/diverging nozzle to maximize steam velocity, and therefore air inspiration. This is a significant improvement in flare technology and increases our



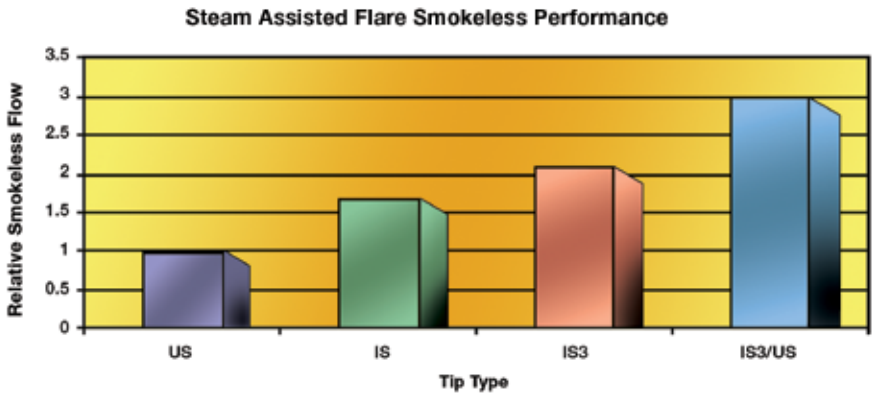
Internal Steam Flares

steam efficiency and thus allows increased smokeless capacity. This flare tip design generates some of the lowest noise levels and highest smokeless capacities of any tip on the market.

The UOP Callidus CAL-IS³/US flare utilizes both the upper steam injection technique and the internal steam tube inspiration methods to produce the most smokeless capacity possible. Injecting steam from two different sources also allows for more control of the steam consumption during intermediate flaring events.

Internal Steam Flares:

- Super sonic steam nozzles
- Muffler to reduce noise
- Cast 310SS internal tube segments
- Improved air inspiration
- Optimum tube density



- Venturi inlet at steam ejectors
- Higher smokeless capacity
- Extremely stable pilots

Air Assisted Flares

The UOP Callidus CAL-AA flare is an effective alternative to steam assisted smokeless flares, especially when steam is not available. The main advantages of our air assisted flare design over steam are:

- Operation in freezing climates
- Lower operating costs in desert areas where steam is expensive
- Smokeless operation where steam is not available

The UOP Callidus design locates the air blower near grade to allow “on-line” maintenance of the smoke suppression system. In addition, the continual flow of forced draft air cools the tip and prevents flame pull down in high wind conditions. This greatly extends the life of the tip.

Air Assisted Flares:

- Low maintenance
- Long service life
- Low operating costs
- No steam lines
- High smokeless capacity
- Low noise design available
- Online maintenance of smoke suppression equipment
- Extremely stable pilots



Air Assisted Flares

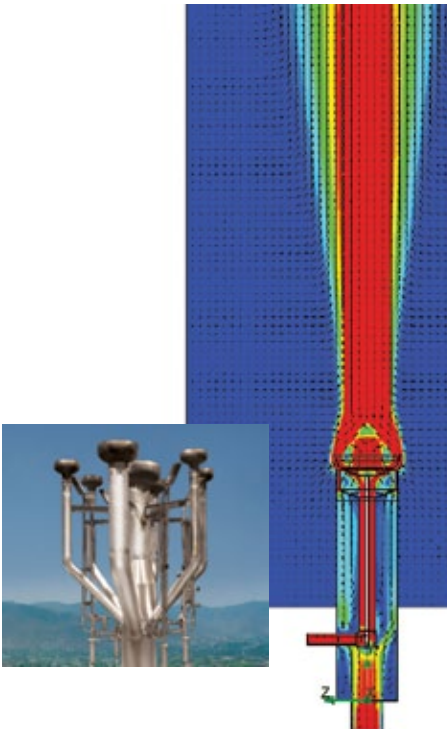
The best in design, quality, performance and delivery.

HemisFlares

The UOP Callidus CAL-HF utilizes the Coanda effect in conjunction with a variable exit area principle to produce better air/fuel mixing, resulting in increased smokeless capacity and lower radiation. These flares have the ability to dispose of high molecular weight gases smokelessly at low pressures without the use of steam or expensive air induction equipment. These flares use stainless construction and CK-20 investment cast nozzles that operate well at low flow and low purge conditions with dramatically extended flare tip life.

HemisFlares:

- Low radiation over wide range
- Light weight
- Short rigid flame
- Long service life
- Smokeless flaring
- High stability pilots



HemisFlare CFD Modeling



Offshore application for production flare

Offshore Flares

The UOP Callidus CAL-EXPERT is the next generation of sonic flare technology. Due to the proximity of flares to equipment and operators on offshore platforms, it is imperative that offshore flare designs maximize reliability and minimize radiation, noise, and smoke. UOP Callidus has met this challenge with a unique casting design. This proprietary tip design is coupled with extended periphery exit nozzles to produce a high flow, low thermal radiation, low noise flame.

Offshore Flares:

- Low radiation
- Long service life
- Low weight
- Investment cast burners and components
- High smokeless capacity
- Shorter boom length/less boom weight
- Extremely stable pilot

Totally Enclosed Ground Flares

The UOP Callidus CAL-TEGF was developed by UOP Callidus to burn flare gases with minimal environmental impact. The flame burns completely concealed from view with no smoke, low noise, reduced emissions, and no radiation at grade outside the combustor. This design is ideal for FPSO/FSO applications where constant flaring can occur. The CAL-TEGF flare utilizes a refractory lined combustor with highly efficient burners. Most equipment is located near grade for easy and online maintenance. Both forced draft and natural-draft systems are available. Our experience provides a one stop source for enclosed flares from vapor inlet to combustor stack. UOP Callidus enclosed flares are available completely skid mounted, pre-wired, pre-piped, and tested. Applications include truck, marine and rail car terminals, production onshore and offshore (FPSO), refining, and petrochemical plants.



Totally Enclosed Ground Flare

Totally Enclosed Ground Flares:

- Easy, on-line maintenance
- Turnkey systems including installation
- Skids 100% pre-wired, pre-piped, assembled and tested
- Flame finder technology
- Smokeless combustion
- Very low noise levels
- No radiation outside the combustor
- Reduced emissions

Multipoint Ground Flares

The UOP Callidus CAL-MP flare system is the result of over 20 years of work in the development of multipoint flare designs. UOP Callidus' superior burner system develops significantly higher surface to area relationships for the waste gas exit. This feature provides more air inspiration and greater turndown capability. Multipoint flares offer unlimited smokeless capacity and the lowest possible radiation. UOP Callidus MP burners are high quality stainless steel castings with thicker metal cross sections, longer life, better waste gas flow patterns, and lower internal pressure drops. These high quality castings also dramatically reduce the potential of cracking.



Multipoint

Multipoint Flares:

- Unique burner design provides high surface to area relationship
- Unlimited smokeless capacity
- Extremely stable pilots
- Easy maintenance-all equipment at grade
- Low radiation and no radiation designs available
- High quality investment cast stainless steel burner
- Infinite turndown staging system
- Extremely long life burners

Demountable Flare Systems

The CAL-DFS (Demountable Flare System) features a derrick with the risers mounted in such a way as to permit the lowering of the flare burner to grade for service without the use of a crane. Since the stack is lowered to grade, no personnel are required to climb the stack beyond the first riser length to perform needed maintenance. Flare systems with multiple risers allow service to be performed on all risers and flare burners except the one flare in service. This means flare maintenance can be performed safer without a plant wide shutdown saving time and money.



Demountable Flare System

Demountable Flare Systems:

- Pivoting working platforms are designed for 360° access to the flare stack.
- Multiple risers allow flare tip to be maintained at grade while the flare system and plant remain in operation.
- Multiple risers allow for smaller plot space.
- Extra space on derrick may allow for the addition of risers for future expansion.

Flares designed to meet the application

Pipe Flares

The UOP Callidus CAL-PF incorporates several key design features which ensure a stable burning flare designed for long life and dependable service. The flare comes with a high stability flame retention system to ensure stable burning during all types of weather conditions. This feature also allows the use of smaller flares, greatly increasing flare life while also decreasing operating costs.

Pipe Flares:

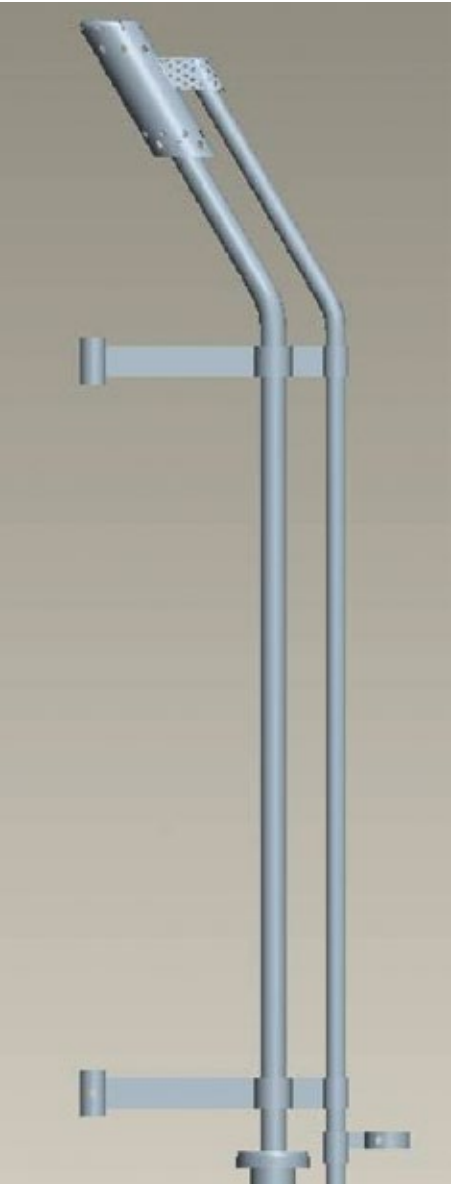
- High stability flame retention system
- Extremely stable pilots
- Long service life
- Reliable pilot ignition systems
- Plug welded brackets



Pipe Flare

High Stability Pilots

UOP Callidus has developed an extremely stable pilot system that can survive hurricane wind conditions of over 125 mph with rainfalls over 12 inches per hour. The pilot system incorporates a windshield, strainer, and a true premix burner capable of firing in 0% oxygen environments at the pilot tip ensuring stable operation. The pilot gas tip, flame shield and thermocouple mounting well are all investment castings of CK-20 material, which is a casting version



High Stability Pilots

of 310SS. The castings metallurgy, the lack of forming stresses, and the metal thickness combine to make a long-lived pilot. In addition, UOP Callidus designers have selected a thermocouple placement to maximize response in all weather conditions, as well as minimize the exposure to direct flame. The stability, metallurgy, and thermocouple placement make the UOP Callidus pilot one the most reliable pilots on the market.

Density Seal

UOP Callidus offers an advanced CAL-DS purge reduction labyrinth-type density seal. The UOP Callidus density seal design uses two 180° bends in the waste gas flow stream. Because the purge gas has a different density than air, lighter purge gas tends to collect in the upper end of the seal while heavier purge gas tends to collect at the bottom of the seal. The accumulated purge gas forms an effective barrier to air infiltration. At proper purge rates, oxygen levels below the density seal will be less than 0.1%.

The UOP Callidus density seal has several improved features not found in the industry standard labyrinth seal:

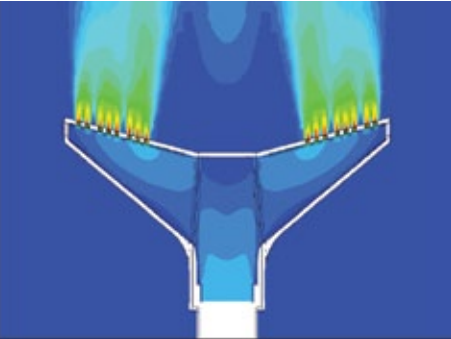
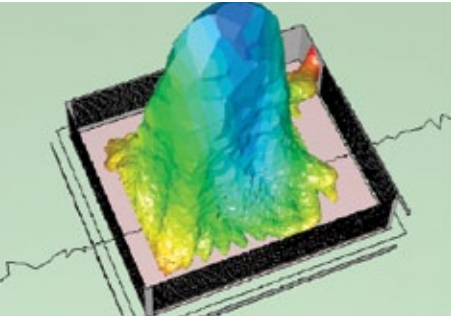
- 1) The unique internals of the UOP Callidus density seal are designed to support maximum flow with minimum pressure drop while still maintaining an adequate purge gas accumulation.
- 2) The UOP Callidus density seal is available with an industry-exclusive lower head rather than the standard flat plate or rolled cone. This results in a stronger, better draining density seal chamber.

Velocity Seal

UOP Callidus also offers a CAL-VS purge reduction velocity seal which is a less expensive option to the density seal design that uses more purge gas. At low gas flow rates, air will enter the flare tip through the top and tends to travel down the inside wall of the tip. The cone-shaped design of the velocity seal breaks the flow of air into the system by disrupting the flow attachment of air to the wall of the flare tip and creating a velocity differential barrier in the purge gas. Proper purge rates will ensure 6 to 8% oxygen below the seal.

Purge Reduction Devices

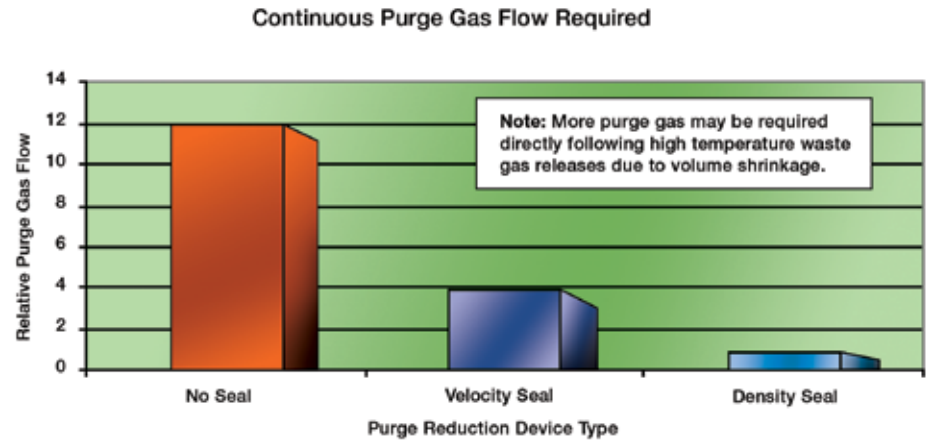
During normal operation, a flare stack is open to atmosphere in an unpurged flare system. It is possible for air to infiltrate the flare stack and mix with the hydrocarbons in the stack, resulting in a combustible mixture. In order to prevent this from happening, flare stacks are operated with continuous purge gas flow. The flow of the purge gas will sweep the oxygen from the stack, preventing combustion inside the flare stack. The purge gas can be any non-condensable oxygen free gas. Nitrogen and natural gas are the two most common purge gasses.



CFD Modeling

Rental Flares

UOP Callidus understands that taking a flare out of service may require a plant shutdown, resulting in lost revenue. Additionally it can be very costly to expedite flare delivery for emergency flare replacement. To minimize these costs, UOP Callidus has a fleet of rental flares that are ready to ship. If a suitable flare is not in our inventory, our rental group can fast-track a custom unit for short or long-term rental usage. As with all UOP Callidus equipment, our rental units are rigorously inspected by our quality assurance personnel before leaving



our facility. Each rental unit includes a full warranty and comprehensive customer support.

UOP Callidus also offers complete installation, start up and other after-market services to fit all your combustion needs.

CFD Modeling

Requirements for ever-increasing efficiency and reduced emissions require innovative design. UOP Callidus has used CFD modeling for more than 20 years to provide products that better meet our client's needs. UOP Callidus design engineers utilize the latest CFD software in conjunction with Honeywell's HPC (high performance cluster) to produce CFD simulations to answer difficult questions with precision and speed, reducing the amount of physical testing required. Used alone or in conjunction with physical testing at our industrial scale test facility, simulation results allow for the evaluation of virtually all combustion questions, including: efficiency, temperature profiles, flame shape, dispersion, and pollutant formation.

Flare Installation

UOP Callidus offers turnkey installation and aftermarket support for all our flares and flare systems around the world. Because we are the manufacturer we know the product better than any contractor. Our goal is to provide first class service from professionals who have years of experience with our equipment and understand how it should be installed and operated to obtain the highest quality and efficiency.

Our services include:

- Installation
- Guy wire tensioning
- Supervision and inspections
- Commissioning and start-up
- Servicing tuning and training
- Rental fleet
- Spare parts



UOP Callidus 82,000 sq. ft. manufacturing and fabrication facility in USA



UOP Callidus headquarters - Tulsa, Oklahoma. USA

ISO 9001:2008 Certification



USA Certification



China Certification

Test Facility

The UOP Callidus test facility is in continual use for combustion technology research and development as well as customer witnessed demonstrations. Our array of test systems allows us to closely match actual field operating conditions, providing results which will more accurately predict actual measured performance.

Global Coverage

UOP Callidus reaches the global market through our headquarters located in Tulsa, Oklahoma, USA with regional direct sales offices and independent sales representation around the world. Meeting our customers' expectations and setting the standards for the combustion industry have always been our company goals. Each burner, flare, thermal oxidizer and catalyst system we design and manufacture is built with those goals in mind.

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