STEAM ASSISTED FLARE

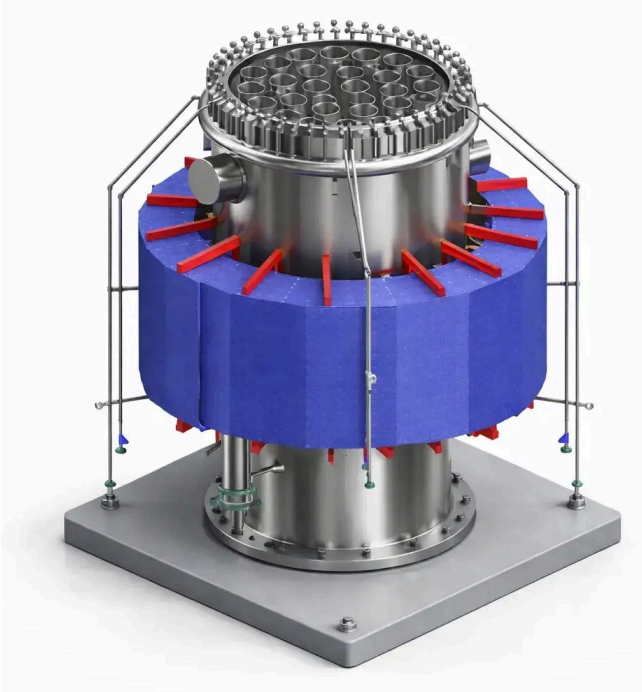
CRA
Engineering a Safer World

HIGH-CAPACITY SMOKELESS COMBUSTION FOR REFINERY-SCALE RELIEF LOADS

Heavy hydrocarbon relief loads crack into soot when burned in an open flame. Refinery and petrochemical relief systems have to stay smokeless across a flow range that runs from routine purge up to a single contingency event that can be a thousand times larger.

CRA's Steam Assisted Flares inject high-velocity steam at the flare tip through proprietary nozzles, creating the turbulence needed to entrain combustion air into the gas stream and break up heavy hydrocarbon molecules before they can crack into soot. Steam injection stages to match the steam-to-gas ratio to actual load, reducing consumption during low-flow periods while holding smokeless performance during peak relief events. Steam also lowers combustion temperature, reducing thermal cracking and protecting flame stability in high-wind conditions.

Steam-assisted flares are the industry standard for large refinery main flares, engineered by CRA to API 537 and API 521, with emissions performance per EPA 40 CFR 60.18, and built under the ISO 9001 quality system that governs every CRA skid.



CRA ADVANTAGE

+ Smokeless High-Volume Operation (clean combustion even at high flow rates)	+ Optimal Design & Performance + Accomodate Special Requirements
+ Enhanced Mixing Efficiency (stable flames across varying load conditions)	+ On-Time Delivery + Responsive & Organized Team
+ Smokeless At Peak Relief (steam ratio staged against actual gas composition)	+ Stringent Quality Management + Fast Turnaround
+ Flexible Performance Range (staged steam reduces consumption at part load)	+ Cost Effective Maintenance Packages + Long-Term CRA Support

APPLICATIONS

Supplied for high-volume smokeless combustion of heavy hydrocarbons across refinery, petrochemical, and biogas duty

+ Low-BTU Gas Disposal
+ Heavy Hydrocarbon Vent Gas
+ High-Volume Relief And Emergency Flaring
+ Odorous And Smoky Gas Streams
+ Off-Spec And Variable Waste Gas Streams
+ Low-Pressure Or Variable Biogas Flows

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ISO 9001 QUALITY ASSURANCE MANAGEMENT

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WORKING & PERFORMANCE

Engineering a Safer World

STEAM INJECTION STAGES TO GAS LOAD, HOLDING SMOKELESS PERFORMANCE AT SCALE

WORKING

+ Steam is injected at controlled pressure through proprietary tip nozzles, creating turbulence that entrains combustion air into the gas stream

+ The turbulence breaks up large hydrocarbon molecules before they crack into soot, preventing the visible black smoke an unassisted flame would produce

+ Steam injection stages to match the steam-to-gas ratio to actual load, cutting consumption 40-60% versus single-stage operation across typical duty cycles

+ Tip geometry maintains stable flame attachment in high-wind conditions, protecting the combustion zone from blow-off

+ Modern controls modulate steam flow continuously based on gas flow and composition, holding smokeless performance across normal, turndown, and peak relief

SIZING REFERENCE

+ Peak Flow Range: 10,000 To 300,000+ Nm3/hr

+ Tip Diameter: Can Exceed 1.5 M

+ Turndown Ratio: Up To 50:1

+ Steam-To-Gas Ratio: 0.2-0.5 Kg Steam Per Kg Waste Gas

+ Standards: API 537, API 521, API 560 (Shared Utilities)

Heavy aromatics need more steam than light olefins to stay smokeless at the same flow, so steam ratio is set against actual gas composition rather than a single default figure.

TYPICAL DESIGN & PERFORMANCE PARAMETERS

Turndown ratio	Up to 50:1
Peak flow range	10,000 to 100,000+ Nm3/hr for refinery and petrochemical service
Tip diameter	Can exceed 1.5 m at the largest sizes
Steam-to-hydrocarbon ratio	0.2-0.5 kg steam per kg waste gas, composition-dependent
Staged steam savings	40-60% reduction in steam consumption versus single-stage injection
Applicable standards	API 537 (flare design), API 521 (pressure relief systems), API 560 (heaters, shared utilities), EPA 40 CFR 60.18 (emissions)

Figures per CRA published product data.

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