



VELOCITY PURGE REDUCER Notes and Purge Rates

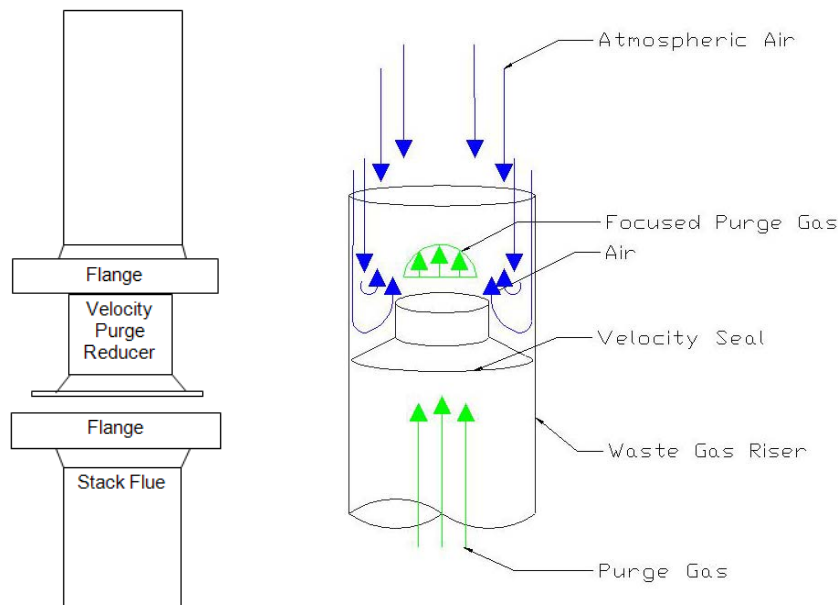
What is Purge Gas?

Purge gas (or "purge flow") is required to prevent air impingement in the process header when there is little or no process flow going to the flare (as in the case of a dedicated intermittent or ESD flare). Should air enter the flare stack, a release of process gas could result in a combustible mixture present within the flare in a restricted zone. The ignition of this air/gas mixture can result in an explosion and cause severe equipment damage.

What is a Velocity Purge Reducer?

Velocity or fluidic seals (Purge Reducers) are used to limit the required fuel gas, "sweep flow" or "purge flow" rate. The Velocity Seal is intended to manipulate the flow path at the top of the flare so as to inhibit air infiltration by buoyant decanting and thus, reduce the amount of continuous purge gas needed to protect the stack against atmospheric air infiltration. Velocity seals have **no factor of safety** for cases of loss of purge and the correct rate of purge must be maintained at all times.

The velocity seal is much lower in cost than other seal methods (molecular or liquid) and is located in the base of the flare tip, it reduces the purge or sweep rate by 92%. Because seal remains out of the flame zone it can be constructed of either carbon steel or stainless steel. The seal can also be equipped with drain holes to prevent rain or condensation from collecting, and damaging the flare tip wall. Integral velocity seals are known by numerous other vendor specific names, such as Airrestor, Reactive, Orifice, Integral or Baffle Type seals.





VELOCITY PURGE REDUCER: Notes – Continued

How does a Velocity Purge Reducer work?

The action of such a seal is three-fold:

- 1) It presents a smaller cross section area to the upward moving gases thereby reducing the volume of gas needed in order to maintain a fixed purge velocity or momentum;
- 2) It allows flows in the correct (up-flow) direction to suffer lesser flowing friction losses than incoming (downward) air flows;
- 3) It acts to reduce the amount of purge because it simulates a length of stack somewhat greater than its true length by presenting an impedance to air flows down into the stack. Typically, a seal of this type may simulate 2 to 20 stack diameters, depending on its design configuration and minimum diameter

As per API 521, "This seal works under the premise that infiltrating air enters through the flare tip and hugs the inner wall of the flare tip. The velocity is a cone shaped obstruction with single or multiple baffles, which forces the air away from the wall where it encounters the focused purge gas flow and is swept out of the tip. This seal normally reduces the purge gas velocity through the tip to between 0.02 feet per second and 0.04 feet per second, which keeps the oxygen concentrations below the seal to 4 percent to 8 percent (approximately 50 percent of the limiting oxygen concentration required to create a flammable mixture)."

Application Notes

- Purge Reducers are not effective in preventing oxygen entry into the flare under conditions of internal suction (negative pressure) caused by thermal contractions of the process gases. Such matters must be considered separately.
- Purge Reducers do add pressure drop to the overall system and the sizing and selection of the equipment becomes an integral part of system sizing as well as a purge consideration.
- Purge Reducers are not flame arrestors and should not be thought of as equivalents, even though the underlying issue in the use of a gas seal is the prevention of flash-back. A flame arrestor works passively whereas a "seal" must be properly purged to have any effect. Additionally, a true flame arrestor or detonation arrestor must be employed in situations where oxygen rich gas mixtures originate within the plant, whereas Purge Reducers have no beneficial effect on this condition.
- In the undesirable event of an actual flash back, and a subsequent explosion or detonation because of the pressure piling effect in the pipe, the use of a gas seal may not be beneficial and some seals can be detrimental at arresting the detonation. As Purge Reducers incur a significant flowing pressure loss when compared with the length of plain pipe they replace, any flame passing (backward) through the seal can experience a dramatic change of pressure condition and turbulence. In many cases the total equivalent distance traveled by the flame passing (backward) through the seal can approach or exceed the run-up distance limit to an explosive condition. The basis for selection, location and sizing of the Purge Reducers and its associated purge conditions must be such that the oxygen concentration on the input side is maintained to be less than the Upper Explosive Limit (UEL) and will not support further passage of a flame.



VELOCITY PURGE REDUCER: Notes – Continued

TORNADO Velocity Purge Reducer – PURGE RATES

Model	Min. Purge c/w Purge Reducer [SCFH]	Min. Purge w/o Purge Reducer [SCFH]
2-inch Velocity Purge Reducer	3	40
3-inch Velocity Purge Reducer	7	90
4-inch Velocity Purge Reducer	13	157
6-inch Velocity Purge Reducer	30	353
8-inch Velocity Purge Reducer	50	628
10-inch Velocity Purge Reducer	80	982
12-inch Velocity Purge Reducer	118	1414
14-inch Velocity Purge Reducer	143	1724
16-inch Velocity Purge Reducer	190	2283
18-inch Velocity Purge Reducer	241	2921
20-inch Velocity Purge Reducer	298	3638
22-inch Velocity Purge Reducer	380	5307
24-inch Velocity Purge Reducer	435	8400
30-inch Velocity Purge Reducer	685	12200
36-inch Velocity Purge Reducer	990	15125
42-inch Velocity Purge Reducer	1353	16705
48-inch Velocity Purge Reducer	1772	21920
54-inch Velocity Purge Reducer	2247	27746
60-inch Velocity Purge Reducer	2760	34255

See Note (1)

See Note (2)

Note (1): Tornado Velocity Purge Reducer uses a 0.04 ft/s Purge Velocity (Reference API RP521 4.4.3.4.2 b) Velocity Seal... pp.48

Note (2): Purge Velocity when No Purge Reducer is supplied is based on 0.5 ft/s velocity, as per Imperial and Home Oil Studies