DeltaValve

TechTip #3

Purge Steam Requirements for Unheading Valves

Appropriate usage of purge steam while operating the unheading valves will decrease wear and tear, and maintenance on valve internal components.

Steam Consumption

Steam purge requirements vary from model to model during the stroke. Highest purge steam is with the GV810, designed for on/off service, lower for the GV815, designed for drainable service, and lowest for the GV820, designed for throttling service.

Control System Design

The steam differential control system should be designed to support purge steam pressure in the unheading valve at a constant 20 PSI above drum pressure. Differential pressure is required to keep the process out of the unheading valve. Steam quantity requirements will remain as shown in Table 1, unless an unheading valve has malfunctioned or has been severely damaged.

At the beginning of the warm up cycle, or the point of switch-in, purge steam should be at or near the normal rate. After switch-in the steam flow rate rises to the switch-in rate and then back to the normal rate for the remainder of the coking cycle. This spike typically begins and ends within two hours. As the valve is stroking, an opening is present which allows purge steam to escape unrestricted. The steam system pressure control valve is usually open during this period, and is not expected to maintain pressure.

Unheading Valve	Normal Steam Lb./hr.	Feed Switch-In Steam Lb./hr.
60” Bottom	0 - 800	0 - 6000
36” Top	0 - 200	0 - 720
30” Top	0 - 150	0 - 600

Table 1 – Steam consumption rates for the 20 psi. control range.

Emergency Steam Consumption

Emergency is a term used to describe a worst-case scenario (i.e. severe damage has occurred to the seat assemblies and the seal has been compromised). Emergency steam consumption is a design allowance for rare or extreme events that could occur. When the steam control valve is open, it should be able to supply steam at—or above—the emergency rate shown in Table 2. The control valve does not need to control pressure in an emergency condition.

Unheading Valve	Emergency Steam Lb./hr.
60” Bottom	7500
36” Top	1800
30” Top	1500

Table 2 – Minimum Emergency Steam Consumption.

Steam Consumption

Process steam rates for coking and de-coking operations are listed in Table 3, and provide a base in calculating the total purge steam required. Rates are for a single unheading valve. *Note: The minimum steam rate is the value at the lowest end of the normal steam rate range.*

Operation	Unheading Valve Purge Steam Lb./hr.	36" Top Unheading Valve Purge Steam Lb./hr.	30" Top Unheading Valve Purge Steam Lb./hr.
Close Unheading Valve	Maximum 6000 (2 to 4 minutes)	Control Valve Closed (1 minute - 3 minutes)	Control Valve Closed (1 minute - 3 minutes)
Preheat Coke Drum	0 - 800	0 - 200	0 - 150
Switch-in Feed	0 - 6000 (45 min. to 2 hrs)	0 - 720 (45 min. to 2 hrs)	0 - 600 (45 min. to 2 hrs)
Coking *(from 2 hours after switch-in to end of cycle)*	100-800	0 - 200	0 - 150
Quenching	100-800	0 - 200	0 - 150
Draining	100-800	0 - 200	0 - 150
Open Unheading Valve	Maximum 6000 (2 to 4 minutes)	Control Valve Closed (1 minute - 3 minutes)	Control Valve Closed (1 minute - 3 minutes)
Coke Cutting	0 - 800	None	None

Table 3 – Steam Consumption Ranges For Various Operations.

GV810 Steam Consumption

The GV810 unheading valve is a base model designed for on/off service only. On/off service means that prior to unheading the drum, the quench water is completely drained from the drum. Under such conditions it is anticipated that only small quantities of coke particulate, chunks and/or water will drop from the drum while opening the valve, and is not necessary to use continuous positive pressure. Instead, low pressure high volume steam is used to sweep the internal gate shroud clean and return any deposited solids back through the valve port and into the pit. Upon initial opening, no restriction is placed on the egress of steam from the valve body and bonnets through the valve port since the body and bonnets are resealed and pressurized by the dual metal valve seats at each end of the stroke. The high steam flow will occur only while the gate is stroking.

GV815 Steam Consumption

The GV815 unheading valve is designed for drainable service. This means operators can drain a full or partial drum of quench water and/or coke fines and solids entirely through the valve. The drainable valve is designed to be stroked from the closed position to the fully open position without stopping, or throttling to slow the gate. The GV815 is the same as the GV810 with the addition of a power shroud. The hydraulic actuators move the machined end cap to seal off the end of the power shroud while the shroud is closed and the lower bonnet is pressurized with steam. Solids and water cannot pass from the valve port through the interior of the shroud cavity and into the bonnet of the valve. The machined end cap seals tightly against the end of the power shroud. This seal significantly reduces steam egress from the positively pressurized lower bonnet by the power shroud while it is closed. Steam in a pressurized upper bonnet is able to escape through a passage way at either side of the gate between the body inner diameter and the gate outer diameter. The total steam passage area at the sides of the gate is smaller than the steam purge inlet lines of the bonnet so the upper bonnet purge pressures can be maintained at or above drum pressure if the main purge steam control valve is wide open. This high volume of steam use will only last for the duration of the stroke.

Although the GV815 is designed to maintain a positively pressurized and sealed bonnet cavity while the valve is stroking, steam consumption will remain high during this brief period. This is due to the absence of gate side seals.

GV820 Steam Consumption

The GV820 unheading valve embodies the same power shroud of the GV815 but adds gate side seals. The gate side seals block off steam egress between the body inner diameter and the gate sides while the valve gate is stroking. The effect of this feature is to enable the bonnets of the GV820 to remain positively pressurized for extended periods of time, as may be required while throttling. During this time steam consumption, will be significantly reduced to a volume that is easily sustainable.

Unheading Valve	Steam Purge Lb./hr.	Unheading Valve Condition
Drum 1 – Bottom	7500	Emergency
Drum 1 – 36” Top	200	Normal
Drum 2 – Bottom	6000	Switch-in Feed
Drum 2 – 36” Top	200	Normal
Total Steam	**13900**	**Using 36” Top Unheading Valves**

Unheading Valve	Steam Purge Lb./hr.	Unheading Valve Condition
Drum 1 – Bottom	7500	Emergency
Drum 1 – 30” Top	150	Normal
Drum 2 – Bottom	6000	Switch-in Feed
Drum 2 – 30” Top	150	Normal
Total Steam	**13800**	**Using 30” Top Unheading Valves**

Table 4 – Steam Header Sizing Values.

Steam Trap Specification

To size the steam traps, calculate the amount of condensate by using the “normal condition” steam rates and assume all the steam will return to condensate. Apply the safety factors recommended by the trap’s manufacturer. *Note: The condensate may be contaminated with some solids.*

There will be variances in normal steam consumption from refinery to refinery. To assure steam consumption levels shown in this document are achieved, it may be necessary to set the normal differential pressure between the valve body and the drum to a value other than Δ 20 PSI. Acceptable delta pressures for the normal operating cases are permissible anywhere from Δ 10–Δ20 PSI.

Actual steam values will most likely be the lower values of the ranges shown in this document.