BEST PRACTICE NO. 23

INVENO ENGINEERING

WHAT IS THE CORRECT QUANTITY OF STEAM VENTING

FROM A DEAERATOR NONCONDENSABLE VENT?

1. WHY DEAERATOR VENTING IS NECESSARY

In a steam deaerator, steam serves as the scrubbing agent to reduce the partial pressures of the gases being removed. Removing noncondensable gases from make-up water and condensate exposed to the atmosphere through the use of steam and some type of scrubbing in a deaerator can be accomplished in several different ways.

With the scrubbing action occurring, the deaerator must vent the noncondensable gases to the atmosphere. Therefore, the only acceptable steam venting from a steam system operation is the deaerator venting noncondensable gases along with a very small percentage of steam.

With the high cost of steam today, the deaerator vent must be investigated to ensure that excessive steam venting does not occur.

Inveno Engineering teams have found that unnecessary steam venting from deaerator noncondensable vents can cause steam losses in excess of $30,000.00 a year.

Figure 1: Deaerator Operation

Figure 2. Proper Steam Venting

2. DEAERATOR DEVICES

Typically, deaerator manufacturers provide a manual vent mechanism, which can be an orifice or manual valve with a small hole in the gate of the valve. The engineering design of the vent opening in the valve or vent orifice provides a means of continuous venting of noncondensable gases with minimal steam loss during operation.

These devices should be located at the highest point of the deaerator to eliminate the possibility that noncondensable gas buildup becomes entrained in the deaerator process.

2.1. Deaerator Startup

A manual valve provides the best means of evacuating large volumes of noncondensable gases present during any cold startup. The operation of the manual valve should be part of the deaerator standard operating procedures (SOPs).

Once a deaerator is in operation, then the proper noncondensable vent should be added to the operation.

3. Excessive Steam Venting

3. WHAT IS THE CORRECT VENTING OF STEAM?

Plants often modify deaerators to increase steam flow rates in the belief that increasing the steam flow volume helps remove noncondensable gases. This theory is incorrect.

The manufacturer's device should be in operation, and no modifications should be made to the device. The proper flow rate is documented in the deaerator engineering design sheet found in the deaerator instruction manual. The true method of checking the performance of the deaerator is a dissolved oxygen test. The dissolved oxygen test needs to be performed on the deaerator at least every three months to ensure that the deaerator is meeting specifications (7 ppb without sulfite being added). Today, the standard is to continuously monitor the dissolved oxygen in the deaerator system.

If the design specifications are not known, the rule of thumb in the industry is that the vent valve must pass, as a maximum, one-tenth of 1% of the deaerator capacity.

The exact vent rate can be calculated as follows:
Vent rate in lbs./hr. = $24.24 \times Pa \times D^2$
Where:

Pa	=	Deaerator operating in PSIA (absolute)
D	=	Diameter (inches) of opening in the manual valve or orifice

All plant operations should set a goal of minimizing steam losses. One key way to prevent unnecessary steam loss is to review the deaerator operation.

4. RECOVERING THE VENTED STEAM

It is a standard procedure to recover the energy from the steam being discharged with a noncondensable vent. The use of a vent condenser specifically designed for the application will have a very attractive payback. Make-up water going to the deaerator is an excellent heat sink for the vent condenser.

A shell-and-tube heat exchanger is the preferred technology for a vent condenser. It is important that the condensate drainage from the vent condenser is discharged to the proper tank system.

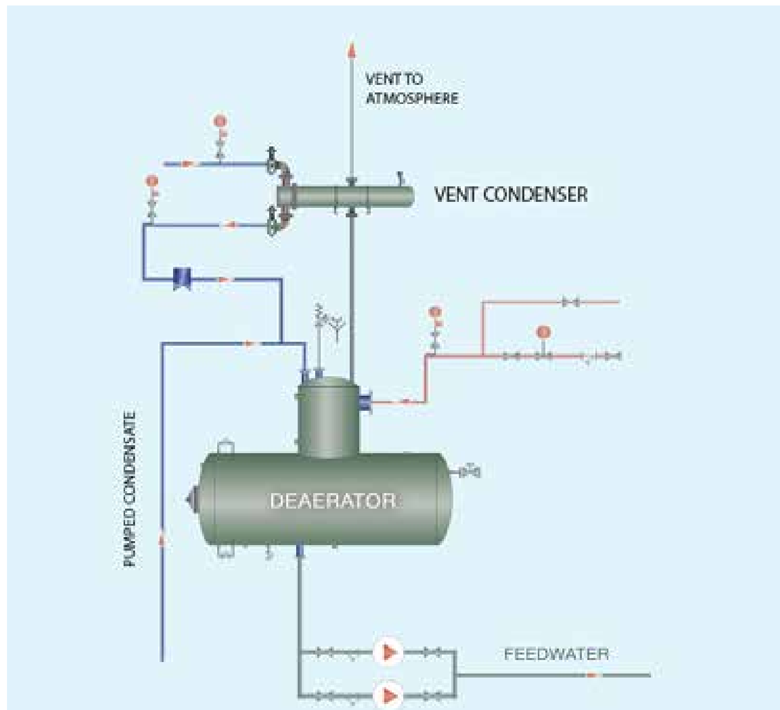

Figure 4. Deaerator Vent Condenser

5. BEST PRACTICES

1. Inspect the vent visually from the deaerator operation.
2. Check the venting mechanism for proper sizing. If the correct size is unknown, consult with the deaerator manufacturer.
3. Use a stainless-steel needle valve instead of a gate valve for better performance.