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Measurement of dryer condensing rates (continuous method)

Scope

This technical information paper outlines a method for measuring the rate of steam condensation and blow-through flow rate from a single dryer cylinder. The method requires that the discharge from the dryer be temporarily diverted, to pass through a water-cooled heat exchanger.

Safety precautions

This method for measuring the rate of steam condensation places the technician near steam (hot water vapor) and condensate (hot liquid water) under pressure. Care must be taken to insure that all equipment is properly and securely connected. Extreme care should be taken to avoid direct contact with hot pipes, valves, and other equipment. Use hand and eye protection when setting up and operating the equipment.

Content

Test instructions

1. Dryers must be operating under pressure and not under vacuum conditions.
2. Connect dryer condensate line and cooling water line to heat exchanger according to schematic arrangement shown in Figure 1. CAUTION: These lines may be hot and under pressure. Avoid direct contact with hot pipes and valves. Be sure the connections are properly secured before opening valves. Vent lines before disconnecting them.

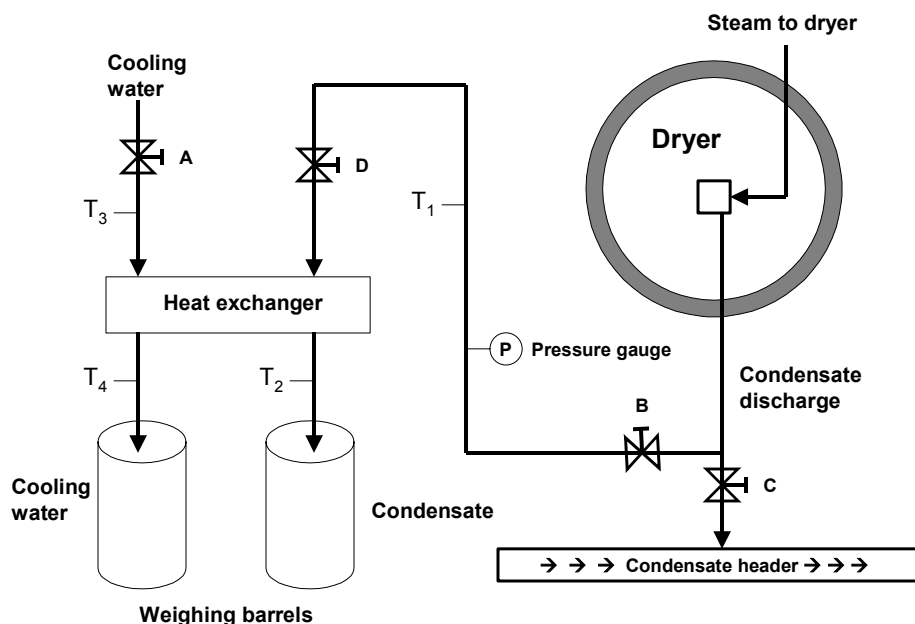


Fig. 1. Dryer condensate measuring system.

3. Open cooling water supply valve A to produce a flow rate of approximately 40-80 l/min (10 to 20 gal/min). This flow rate can be measured with a water meter in the supply line or by timing the rise of the cooling water discharging into the weighing barrel (200-liter or 55-gallon drum).
4. Measure the static pressure in the condensate discharge line by closing valve D and opening valves B and C. Valve C would be fully open during normal operation.
5. Direct condensate to heat exchanger by opening valves B and D, and closing valve C. Modulate valve D to produce the same static pressure measured in Step 4, which will result in the same differential across dryer.
6. Adjust cooling water flow rate by modulating valve A to produce a temperature of 65 to 95°C (150° to 200°F) for the cooling water and condensate. The temperatures T_2 and T_4 should not be allowed to exceed 95°C (200°F).
7. After an equilibrium condition is established, measure and record static pressure in the line between the condensate line and heat exchanger (this should be the same as measured in Step 4), temperature of condensate and cooling water entering and leaving the heat exchanger (T_1 , T_2 , T_3 , and T_4), and flow rates of the cooling water and condensate leaving the heat exchanger.
8. The flow rate of cooling water and condensate can be measured directly by measuring the change in weight of the collection barrels over a specific amount of time or the time required to raise the water level in the barrels a measured amount.
9. Calculate condensing rate and blow-through steam rate using equations shown subsequently.

Flexible hoses 3-4 m (10-12 ft) long are convenient means to handle cooling water and condensate discharge from heat exchanger. These hoses can lie on the floor and discharge to sewer when flow is not being measured.

It is important to calibrate pressure and temperature gauges prior to the start of tests and to recheck calibration after tests have been completed to assure reliable data.

Globe valves are recommended for control valves A and D. Fast-acting, full-port, ball valves are recommended for valves B and C.