TIP 0404-24

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Recommended operation of dryer section hood air systems

Scope

The purpose of this Technical Information Paper is to provide guidelines for engineers and operators involved in evaluating the effectiveness of paper machine hoods and related air systems. A certain amount of understanding about the form and function of the components within the hood system is critical prior to the application of this TIP.

Safety Precautions

There are no specific safety precautions for the use or application of this TIP.

Definitions

A dryer section hood is defined as the enclosure that surrounds the dryers. Its' function is threefold:

1. To contain the water released in the drying process,
2. To provide a uniform drying environment by controlling airflows, temperature and humidity, and
3. To reduce the energy requirements for evaporation by reduction of airflow and control of air currents.

There are two general forms of dryer section hoods; open and closed.

1. An open hood is characterized by a roof and four walls which extend from the roof down to a point that is generally 8' to 9' above the operating floor. Generally, these hoods are of insulated panel construction to reduce the incidence of condensation and to reduce radiant heat that would otherwise be rejected to the machine room.
2. A closed hood has all the features of an open hood but also has tending and drive side movable doors - and often sheet opening doors, to isolate the dryer section from the machine room. A totally closed hood also has an enclosure at the basement level to create a controlled drying environment.

It should be understood by the reader that the use of terms such as powered, mass ratios and balances refer to flows derived from fan systems, unless otherwise explicitly stated.

piping, ducts, and doors. Front lifting and rear sliding doors are generally provided with flexible seal strips to ensure free movement and a good seal. Hinged access doors are gasketed and designed to be tight closing. These seals should be routinely inspected and maintained, and all doors should be tightly closed. It is important that all openings into the hood be as small as practical. The portion of the hood above the machine frame is, by nature, pressurized as a result of the constantly building vapor pressure and movement of air by the dryer fabrics within it. Openings above this level should be minimized to avoid spillage, which can cause condensation on the outer surface of the hood, cause degradation of the hood, adversely affect machine room working conditions and possibly, production off the machine. Sheet entry and exit openings in the end panels should be as tight as possible. They are often provided with adjustable doors for this purpose.

Observation of water droplets or streaks on the exterior of the hood is an indication that the hood is pressurized, *or panel joints are not sealed and vapor is leaking through*. *Leakage* can be a result of too little exhaust, or too great a supply mass as well. This phenomenon will most likely be observed at the wet end of the hood. The top dryer fabrics move a great deal of air toward the wet end of the machine on their return run. Without fixed baffles to break up this airflow, pressurization is inevitable unless other means, such as cross-machine exhaust headers, are employed. The phenomenon can also be observed in other areas. It is often evident in the constant drying zone where evaporation is maximized. Machines with poorly designed or maintained hood exhaust plenums (or the complete lack thereof) are primarily afflicted.

The hood exhaust plenum is a frequently, and ultimately costly, overlooked critical component of the hood system. The plenum is created by the hood roof and a machine direction false ceiling. Opinions differ on the size and style of the false ceiling but the purpose of the plenum remains constant; to promote uniform MD *and CD* exhaust flow the length of the hood. Effective plenum design requires that it be deep enough to affect a minimum 3:1 velocity reduction from the vapor pick-up point in the ceiling to the largest cross-sectional area of the plenum. Many open hoods are mistakenly designed without a plenum because it is felt that the exhaust volume is sufficiently high to not need one. Unfortunately, the lack of the hood exhaust plenum creates a situation where the majority of the air handled by the exhaust fans comes from the drive aisle behind the dryer section instead of from beneath the hood. Almost all closed hoods are designed with a hood exhaust plenum. Many have only a half-width false ceiling with a single, continuous pick-up slot on the centerline of the machine. While entirely adequate for a number of installations, it has been proven to be short of what is required on newer vintage machines. All too often, users of this approach have resorted to cutting openings in the drive side portion of the ceiling to evacuate vapor accumulating in a particular region. The preferred method is to have a full-width ceiling with adjustable dampers on each side of the paper machine the full length of the hood. The size and location is generally determined by consultation between the user and hood vendor but again their function is constant; to provide a mechanism for uniform MD *and CD* removal of exhaust from the hood.

An over-pressurized (under-exhausted or over-supplied) hood will blow-out, at the hood ends and at the joints between sliding doors and between lifting doors and fixed panels. If the hood is of poor, or old-style construction the fixed panel joints will also leak. The air moving with the dryer fabrics – boundary air – has to release somewhere if it is not captured and mechanically removed. The most prevalent location is at the generally very large sheet opening at the press section to dryer section interface. Sheet instability is usually a secondary indicator of a problem here. Tightly sealing this opening with baffles and/or air curtains, and directly evacuating air from the area will reduce wet end blow-out.

Blow-out can also be the result of a closed hood with a zero balance level that is too low. Zero level is the vertical point above the operating floor inside the hood where the vapor pressure is neutral. Observation of the zero level is not particularly difficult. An influx of air will be noted below the point, while air above this point will tend to leave the hood. This neutral point should be above the top of the higher of the tending side lifting doors and the drive side sliding doors. A zero point below this level will result in vapor release at the joint and fogging of the windows in the hood doors. More humid top tier dryer pockets are also a possibility. It is recommended that the top of the doors on each side be at the same height above the operating floor.

Observation of water droplets on the hood interior is an indication of too high a humidity level within the hood. Two approaches may be taken. Exhaust air mass must be increased if it is found to be insufficient for the amount of water evaporated and the style hood employed. Alternatively, if the exhaust mass is sufficient, the heated supply air mass and/ or temperature must be increased to raise the water carrying capability of the air within the hood.

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