3. EQUIPMENT DESCRIPTION

1
ENCLOSED HOOD

1.1
Design

One (1) enclosed hood of "conventional" tongue-and-groove design, suitable for 850 grain operation. Instead of the conventional tongue-and-groove upper front fixed panels, provided are high performance hood panels. These panels come in large sections approximately 10' wide by 11' high.

Also provided is hood ventilation ductwork consisting of two (2) headers running down the inside of the hood just above the front lifting panels and rear sliding panels.

The hood has a half-width false ceiling. Front lifting panels with 2'-1" high thermopanel glass windows will be raised by center guided air cylinder lift mechanisms exclusive to Valmet-Enerdry.

Machine direction monorails provided as a support point for dryer section work.

Rear sliding panels 11'-0" high provided for removal of top return fabric. Rear sliding panels will ride on a floor-mounted track with top guides designed for easy panel removal for maintenance purposes.

1.2
Function

The primary function of the hood is to enclose as completely as possible the environment surrounding the paper machine so that the entire process and general ventilation of the machine room can be separately controlled and regulated suitable for each purpose. This enables the regulation of supply air flows into and exhaust air flows from the enclosure to maximize the drying process while eliminating undesirable drafts and air currents.

1.3 Operating Advantages

The ability to sustain higher humidity operation results in the following advantages:

1. Hood exhaust rate is minimized.

2. The amount of hood supply air which must be heated is reduced resulting in energy savings.

3. The potential of heat recovery is increased reducing the amount of heat recovery equipment (heat recovery an optional feature).

4. Building make-up air requirement is reduced resulting in energy savings.

5. Infiltration into the basement is minimized. This creates a more stable environment minimizing the drying variations and sheet flutter caused by conditions of high-drafts.

1.4 Hood Ventilation Equipment

Hood exhaust air mixed with moisture evaporated from the paper web is drawn through ductwork by the hood exhaust fans and discharged out of the building to the atmosphere.

Supply air (Pocket Ventilation) raised up to operating temperature (180°F) by means of the heat recovery system and steam heating coils is conveyed to the machine to feed seventeen (17) cross machine pocket ventilators.

1.5 Hood Air Balance

Due to the temperature inside the hood being higher than outside, the air tends to flow upwards forming an overpressure in the hood (so called "Chimney Effect"). This natural upward course of air is enhanced with the effects of the hood's exhaust fans and the hot, humid air is lead away form the paper machine.

To counteract this outflow from the hood there is a tendency for room air to infiltrate into the hood through its lower levels and basement enclosure. The temperature of this air in comparison to the hood's operating condition is, however, low and taking such cold air into the dryer section is uneconomical. In addition, as the cold air mixes with hot, humid air flowing from the paper machine pockets, it can lower the temperature of this air below dewpoint resulting in condensate forming inside the hood and on the machine surfaces.

In order to improve the economy of the hood operation, supply air which is sufficiently preheated, is fed into the hood. This means that the air does not need heating by means of the machine's cylinder dryers and in addition, condensate of water in the dryer section is prevented.

What determines quantity of supply and exhaust air?

In general, the quantity of exhaust is a function of the rate of moisture evaporated form the web in relation to the machine's production rate and allowable final moisture content at the reel, and the level of humidity the hood can tolerate in a controlled manner. In other words, the minimum quantity of air which can safely hold and transport out of the hood moisture evaporated from the sheet. As a matter of economics, it is desirable to operate the hood with the least amount of exhaust at the highest practical humidity level which will not result in open condensation formation.

The rate of supply air is a percentage of the exhaust mass flow (generally 60 to 70%) as required to sufficiently offset the rate of exhaust while minimizing uncontrolled infiltration of room air and avoiding undesirable spillage of hood air.

What happens if the proportion of supply to exhaust is inadequate?

Too much supply air in relation to exhaust air quantity causes an unacceptable overpressure in the hood. As a result, humid air spills from the hood into the machine room.

Too little supply air in relation to exhaust air quantity causes an excessive under pressure in the hood. This increases the amount of uncontrolled infiltration into the hood making energy economics worse.

A condition of balance is achieved when the point at which pressure inside and outside of the hood equalizes occurs just above the upper edge of the lift doors. This point of equalization is known as the "zero-point."

2
HOOD EXHAUST

2.1
Design

Two (2) hood exhaust systems consisting of ductwork and fans have been provided for the enclosed hood.

The fans are mounted above the building roof level and discharge the air to atmosphere.

Before the air is discharged to atmosphere one (1) hood exhaust passes through the air-to-air heat recovery system.

2.2
Function

The function of the hood exhaust is to remove the evaporated sheet moisture from the enclosed hood and discharge it outside the building.

3
AIR-TO-AIR HEAT RECOVERY

3.1
Design

One (1) air-to-air heat recovery system has been provided to pre-heat the hood supply air.

The air-to-air economizer consists of a series of 22 gauge type 316 stainless steel corrugated metal plates about 8' high and 6' wide; the corrugations being vertical so that the passages for the exhaust vapor is vertical and straight, and the passage for the fresh air is horizontal and curved, or sinuous.

The economizer is mounted on a sump with drain and access door and have a top plenum complete with washdown sprays.

3.2
Function

The function of the Heat Recovery System is to recover heat that would be wasted from the hood exhaust and transfer it to the hood supply air there-by saving steam and reducing energy cost.

4
POCKET VENTILATION SYSTEM

4.1
Design

One (1) pocket ventilation system consisting of fan, steam heating coils, filters, insulated casing and a total of seventeen (17) Hi-Flow Pocket Ventilators have been provided for the paper machine dryer section.

Air is drawn from the machine room, pre-heated in the air-to-air heat recovery, passed through steam coil to reach the designed final temperature and then blown through ducts to the Hi-Flow Pocket Ventilators.

The supply unit will handle 32,000 cfm, providing supply air to seventeen (17) pocket ventilators and hood ventilation system in the Main Dryer section and, in the future, to seven (7) pocket ventilators in the After Dryer section. For the present time, the supply air to the After Dryer Section will be distributed in the basement enclosure of the After Dryer Section.

Of the seventeen (17) pocket ventilators to be supplied, eight (8) are provided with front and rear edge control. These pocket ventilators are located in the prime drying zone of the main dryer section.

The Valmet-Enerdry Hi-Flow Ventilator is supported from each end with steel brackets attached to the dryer frame work. Dry, warm air is fed into one end of the ventilator through supply ductwork from an external air supply fan.

4.2
Benefits

Some of the benefits that are realized as a result of our system design are:

1. Increased drying capacity. By virtue of its patented ventilator design, which uses a pressurization technique for introducing air through the dryer fabric, the Valmet-Enerdry P.V. system sustains low pocket humidities for maximum drying.

2. Improved moisture profile. The Valmet-Enerdry PV system provides uniform cross-machine pocket humidities. This is an essential component for uniform reel moisture profile.

3. Large ventilator clearances. The Valmet-Enerdry pressurization concept allows the ventilator to be placed high above the felt roll. This allows roll wraps and wads to pass without damage to dryer fabrics or the ventilators.

4. Heavy aluminum construction. The ventilators are constructed with heavy extruded aluminum extrusion and 1/8" thick aluminum plate. This construction will withstand the abuse associated with paper mill operation.

5. Maintenance free ventilators. The ventilator nozzles are virtually maintenance free.

6. Fabric conditioning. Hot dry air is continually blown through the full width of the fabric, providing conditioning and increased fabric life.

4.3 How the Hi-Flow Pocket Ventilator Works

The Valmet-Enerdry Hi-flow Pocket Ventilator is a stationary dryer ventilation apparatus, substantially equal in length to the width of the web to be dried. It distributes tempered air into a dryer "pocket".

The following points explain how the Pocket Ventilator works:

1. Air at 2" to 3" w.g. pressure and 170°F to 190°F temperature enters the P.V. at one end.

2. The air passes through an internal baffle where the flow is carefully distributed within the ventilator across the full width of the machine and where all cross machine velocity vectors are eliminated.

3. Air leaving the distributor enters a pressure plenum where any remaining non-uniformity is eliminated. Pressure taps in the pressure plenum provide an accurate measure of jet velocity and flow and permit accurate setting of the damper on the inlet duct. The damper setting is semi-permanent.

4. Air leaves the pressure plenum through two (2) nozzles extending across the machine. These machine width jets impinge off the felt obliquely at velocities of 6,000 to 8.000 fpm at the points at which the felt run is tangent to adjacent dryers.

5. A pressure 0.1" to 0.3" w.g. is built up in the pressure space by the reaction of the jets. A minor portion of the jet flow reverses direction, flowing in a continuous sheet around the back of the dryers. This aerodynamic seal is very stable and does not rely on perfect alignment of the pocket ventilator or perfect slot tolerance.

6. The small pressure in the pressure space produces a percolation flow through the fabric and because of the large area of fabric exposed, a very large volume of air is inserted into the pocket.

7. The air enters the pocket uniformly in large volumes and moves out the ends of the pocket at mean velocities between 100 and 300 fpm. This method produces uniform low humidity across the pocket without distributing the web.