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## CLEARWATER CONSULTING PARTNERS

### PAPER MACHINE STEAM SYSTEM DESIGN

#### BLOW-THROUGH (FLOW) CONTROL FOR PAPER MACHINE STEAM AND CONDENSATE SYSTEMS

Blow-through control is often called flow control. Blow-through control is a better way of controlling steam and condensate than the alternative; simple differential pressure control system. Instead of controlling the flow of blow-through steam to maintain a fixed pressure drop between the supply and condensate headers (i.e. across a group of drying cylinders), the controller maintains a fixed pressure drop across an orifice or restriction in the blow-through (recycled) steam line resulting in **constant flow** of blow-through steam at any given pressure.

This approach causes the differential pressure to adjust to system requirements rather than to a fixed target. It will automatically **maintain the same rate of drainage** regardless of changes in speed, condensing load, and pressure. Simple differential control cannot do this. With blow-through control, for example, when dryer pressure is increased, condensing rate increases, and the quantity of blow-through steam increases proportionally due to the increased density of the blow-through steam.

Blow-through (flow) control is especially advantageous during a sheet break. During a sheet break, the condensing load drops to roughly ten percent of normal running load. With simple differential control, the blow-through rate can increase by more than 200% of the normal running requirement. This is due to a temporary loss of siphon resistance caused by the loss of condensing load at the point of sheet break. The differential valves and/or thermo-compressor then go wide open in an attempt to maintain differential pressure at the set point target. This is usually not enough, and the atmospheric or heat exchanger vent valve(s) also open. However, with blow-through steam control, the blow-through remains constant during a sheet break, and the dryer pressure drop automatically reduces. That allows the thermo-compressor to close due to the lower differential requirements. This reduces the motive steam supply so that, even with lower condensing load demand, the vent valves remain closed.

Hence, blow-through steam control offers the following **advantages** over simple differential control:

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1. Self-adapting to changes in operating conditions
2. Stable dryer performance under upset conditions
3. Greater steam use efficiency
4. Less atmospheric venting under quick upsets (eg. sheet breaks).  
Blow-through control will dump 75-80% less steam than simple differential control during sheet breaks.
5. Reduced erosion of internals such as siphons → hence longer life
6. Better response to breaks and sheet-on conditions.

There are **no known disadvantages** to blow-through steam control.

Since Clearwater believes it to be important to provide operators with a comprehensive picture of the performance of a dryer section, we also provide differential pressure measurement and indication as standard. In doing so, we routinely connect the differential pressure indication into a control loop. With the addition of an operator selectable switch, we thus provide the customer with the choice of using either blow-through steam control, or simple differential control; and whilst we always advocate the use of blow-through control, this facility means that, even if a failure should occur with any of the blow-through control instrumentation, a back-up control is always available (i.e. providing **maximum reliability** for long term operation).