

FOR SAFE FIRING
OF BLACK LIQUOR
IN RECOVERY BOILERS

K-PATENTS
PROCESS INSTRUMENTS



K-PATENTS DIGITAL DIVERT CONTROL SYSTEM DD-01

APPLICATION



SAFE OPERATION OF RECOVERY BOILERS REQUIRES K-PATENTS DIGITAL DIVERT SYSTEM

Feeding low concentrations of black liquor solids to a kraft chemical recovery boiler burner can cause a steam explosion. A digital divert control system is required to ensure safe operation.

BLRBAC REGULATIONS

The Black Liquor Recovery Boiler Advisory Committee (BLRBAC) recommends standards for safe firing of black liquor and suggests using an automatic black liquor divert control system to ensure that weak liquor is not fed into the boiler.

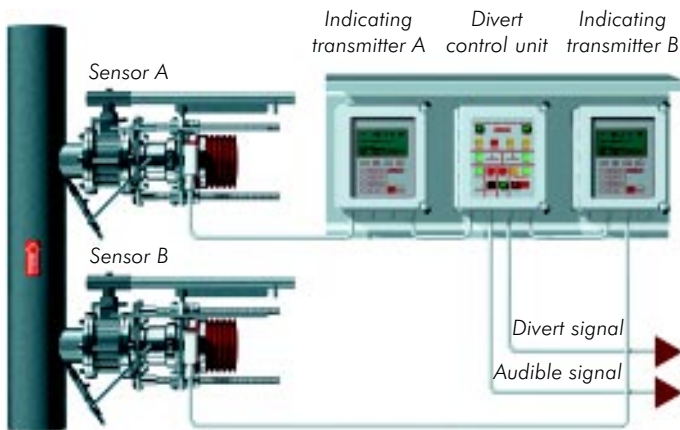
BLRBAC requires that if the black liquor concentration falls below 58%, the system shall give an audible alarm signal, and go to a diversion function to direct the black liquor flow to by-pass the boiler. A concentration value of 60% shall give an audible alarm to notify the users about the low concentration. Furthermore, the control unit shall check that the difference between the two individual refractometer signals does not exceed 2%.

These close tolerances require digital circuitry which eliminates drift.



K-PATENTS DIGITAL DIVERT CONTROL SYSTEM DD-01

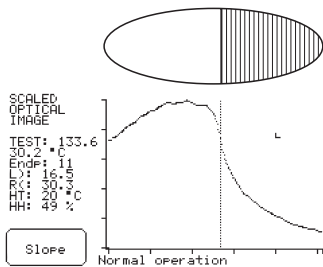
SYSTEM



The K-Patents Digital Divert Control System is built in strict accordance with the recommendations of BLRBAC. The system includes two process refractometers with retraction valves installed in the main black liquor line, two indicating transmitters and a divert control panel.

As an added benefit, each refractometer is a completely independent measurement system. Each system sends a separate output signal, which can be used by the control system or DCS.

OPTICAL IMAGE DETECTION

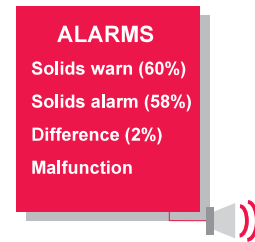


The K-Patents Process Refractometer uses an optical image detection algorithm, which locates the shadow line with higher precision and reliability than the fixed threshold method. The quality of the optical image is mathematically checked and constantly monitored. An incorrect image form gives an alarm.

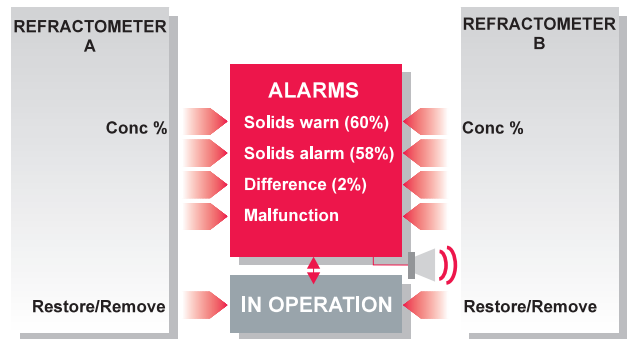
DECISION LOGICS

The divert decision is controlled from the divert control unit. The built-in diagnostics provides three levels of decision logics for a tight control.

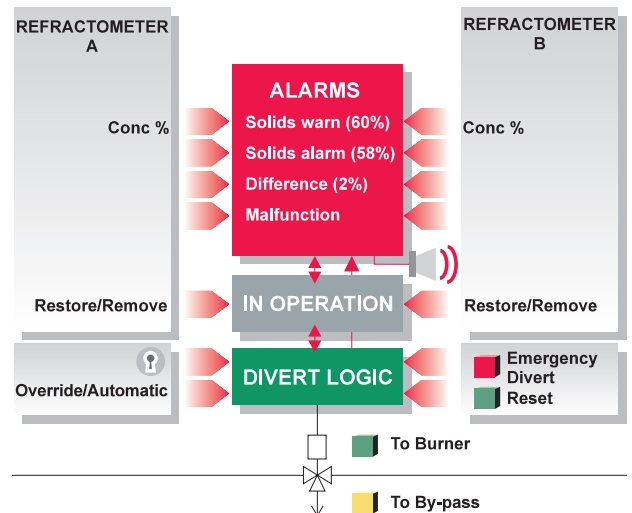
1. ALARMS



2. STATUS OF THE REFRACTOMETERS



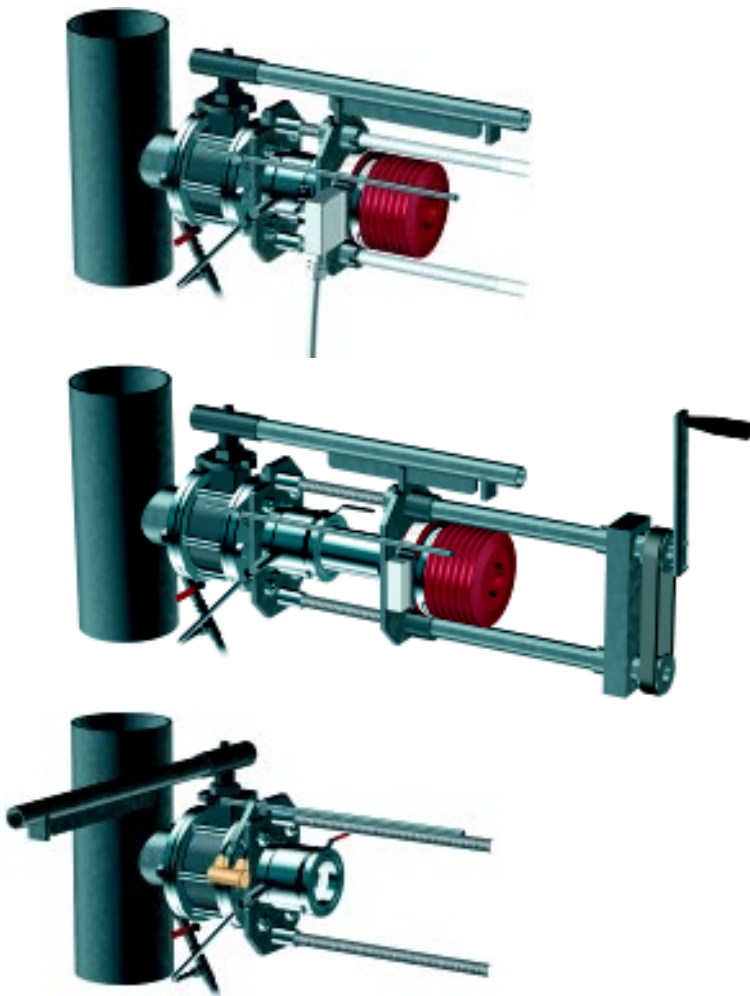
3. DIVERT DECISION



RETRACTION & ISOLATION VALVE

The design of the K-Patents retractor & isolation valve provides maximum safety for the operation. The design eliminates the safety risk resulting from partial closure of the isolation valve and therefore activation of false divert alarms.

SENSOR IN OPERATION...



... AND SENSOR SAFELY REMOVED

OTHER APPLICATIONS

K-Patents Process Refractometers are used in various concentration measurements in the pulp and paper processes.

WEAK LIQUOR FROM PULP WASHERS

Black liquor concentration is measured with K-Patents Process Refractometer to optimize the consumption of pulp chemicals and usage of water in the washing. The material balances can be calculated and the efficiency of the washing process can be maximized.

BLACK LIQUOR TO EVAPORATORS

The concentration of feed liquor from washers to evaporation can be kept constant by controlling the mixing liquor with the K-Patents refractometer, thus allowing the capacity of the evaporators to be maximized. Using K-Patents in the intermediate stage the profitability can be increased in the form of minimized steam consumption.

RECOVERY BOILER HEAT ENERGY

K-Patents Process Refractometer can be used as a part of an advanced control system to measure the black liquor refractive index fed to the liquor sprayers. The refractive index is the best measure of the black liquor energy content. This way the heat energy value of the recovery boiler can be determined.

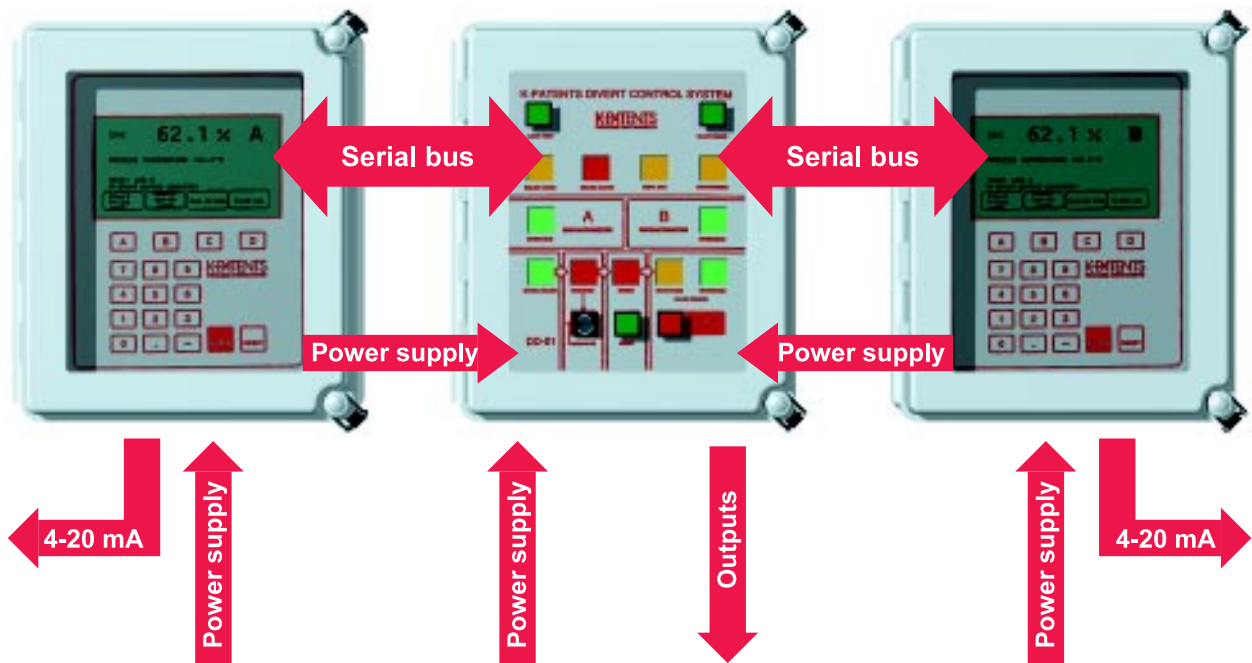
GREEN LIQUOR TTA IN CAUSTICIZING

Better control of the green liquor in the causticizing process leads to increased capacity of the kraft cooking process. Green liquor total titratable alkali (TTA) content can be controlled by addition of weak wash liquor dilution. TTA has a good correlation with Refractive Index, which provides an accurate measurement for the green liquor. The K-Patents refractometer design together with the high pressure prism wash is ideal for the heavy scaling conditions of the green liquor process.

STARCH, SIZING CHEMICALS AND ADDITIVES

The final concentration and the quality of the cooked starch can be verified by using the K-Patents in the cooking control. In the size press the concentration of the sizing chemicals or starch added to the paper can be optimized for different paper grades and this way the best quality for each grade can be achieved.

ALL-DIGITAL DESIGN

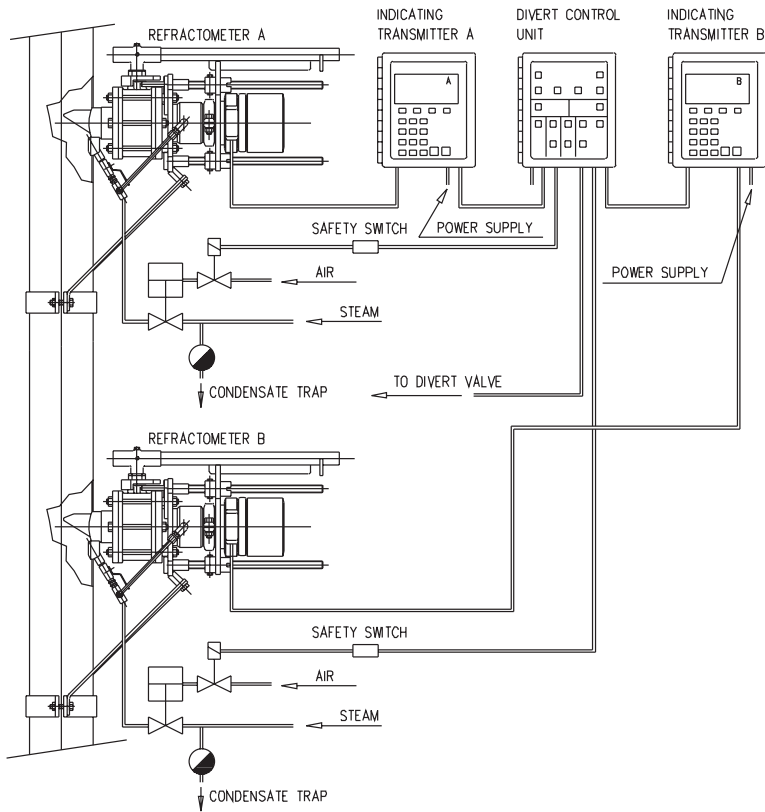


K-Patents DD-01 eliminates false divert alarms

The K-Patents Digital Divert Control System is completely microprocessor controlled. All analog circuitry has been eliminated. The digital signal transmission and microprocessor implemented diagnostics ensure error free operation.

The system eliminates false alarms, because it reacts only when the level of solids truly falls below the safe limit.

K-PATENTS DIGITAL DIVERT CONTROL SYSTEM DD-01 SPECIFICATIONS



The K-Patents DD-01 Digital Divert Control System is built strictly according to the principles of Recommended Good Practice for Safe Firing of Black Liquor in Black Liquor Recovery Boilers (BLRBAC, August 1982, revised March 2001).

THE DD-01 SYSTEM CONSISTS OF:

- Two K-Patents Process Refractometers PR-01-S (A and B) are installed in series in the main black liquor line. Each refractometer is complete with a sensor, an indicating transmitter and interconnecting cables. Each refractometer provides also a measurement signal not used by the divert control system.
- The Divert Control Unit is contained in one enclosure. The unit includes an operator panel and control logics. The unit provides contact outputs for prism wash and black liquor diversion.
- Two Retraction & Isolation Valves HIMP-2-CR to allow safe removal of the refractometers from a pipe with full flow and pressure. The isolation valve includes a prism wash nozzle and two check valves; one for prism wash, one for stuffing box flush.
- A roofed mounting plate for mounting the two indicating transmitters and the divert control unit together.

ORDERING INFORMATION:

Desired scale, properties of process solution

Process temperature and pressure range

Process flow range and pipe diameter

Desired process connection

Length of interconnecting cables

Supply voltage and frequency

Options and accessories

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