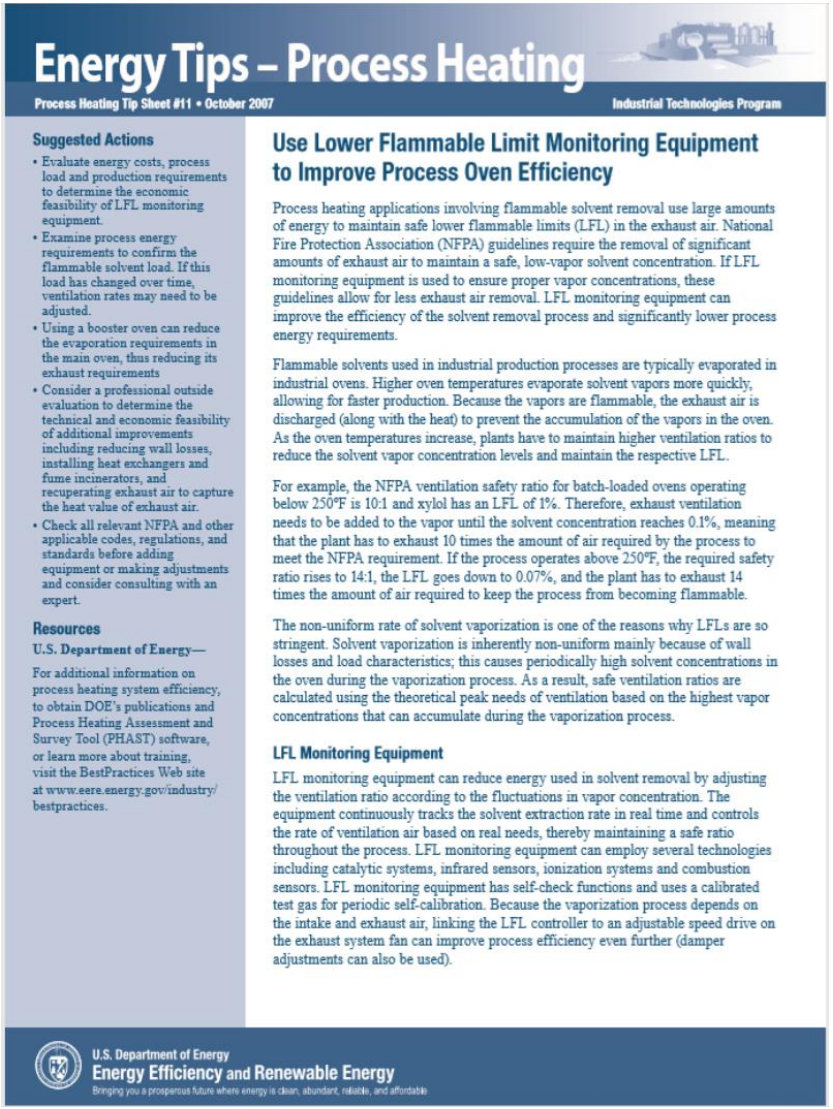
WHY APPLING AUTOMATIC AIR RECIRCULATION?

Through our automatic air recirculation control systems, it is possible to recycle most of the hot air outgoing from the ovens and resend it back as hot fresh air inside the ventilation systems. This drastically reduce the energy consumption on the air heating systems and also the electricity cost associated to the general evacuation air fans. The energy saving through our system can rise from 30 to 40% of your actual yearly thermal energy consumption. This technique is now suggested and applied by many plant builders and state agencies.



Energy Tips – Process Heating

Process Heating Tip Sheet #11 • October 2007 — Industrial Technologies Program

Suggested Actions

- Evaluate energy costs, process load and production requirements to determine the economic feasibility of LFL monitoring equipment.
- Examine process energy requirements to confirm the flammable solvent load. If this load has changed over time, ventilation rates may need to be adjusted.
- Using a booster oven can reduce the evaporation requirements in the main oven, thus reducing its exhaust requirements
- Consider a professional outside evaluation to determine the technical and economic feasibility of additional improvements including reducing wall losses, installing heat exchangers and fume incinerators, and recuperating exhaust air to capture the heat value of exhaust air.
- Check all relevant NFPA and other applicable codes, regulations, and standards before adding equipment or making adjustments and consider consulting with an expert.

Resources

U.S. Department of Energy—

For additional information on process heating system efficiency, to obtain DOE's publications and Process Heating Assessment and Survey Tool (PHAST) software, or learn more about training, visit the BestPractices Web site at www.eere.energy.gov/industry/bestpractices.

Use Lower Flammable Limit Monitoring Equipment to Improve Process Oven Efficiency

Process heating applications involving flammable solvent removal use large amounts of energy to maintain safe lower flammable limits (LFL) in the exhaust air. National Fire Protection Association (NFPA) guidelines require the removal of significant amounts of exhaust air to maintain a safe, low-vapor solvent concentration. If LFL monitoring equipment is used to ensure proper vapor concentrations, these guidelines allow for less exhaust air removal. LFL monitoring equipment can improve the efficiency of the solvent removal process and significantly lower process energy requirements.

Flammable solvents used in industrial production processes are typically evaporated in industrial ovens. Higher oven temperatures evaporate solvent vapors more quickly, allowing for faster production. Because the vapors are flammable, the exhaust air is discharged (along with the heat) to prevent the accumulation of the vapors in the oven. As the oven temperatures increase, plants have to maintain higher ventilation ratios to reduce the solvent vapor concentration levels and maintain the respective LFL.

For example, the NFPA ventilation safety ratio for batch-loaded ovens operating below 250°F is 10:1 and xylol has an LFL of 1%. Therefore, exhaust ventilation needs to be added to the vapor until the solvent concentration reaches 0.1%, meaning that the plant has to exhaust 10 times the amount of air required by the process to meet the NFPA requirement. If the process operates above 250°F, the required safety ratio rises to 14:1, the LFL goes down to 0.07%, and the plant has to exhaust 14 times the amount of air required to keep the process from becoming flammable.

The non-uniform rate of solvent vaporization is one of the reasons why LFLs are so stringent. Solvent vaporization is inherently non-uniform mainly because of wall losses and load characteristics; this causes periodically high solvent concentrations in the oven during the vaporization process. As a result, safe ventilation ratios are calculated using the theoretical peak needs of ventilation based on the highest vapor concentrations that can accumulate during the vaporization process.

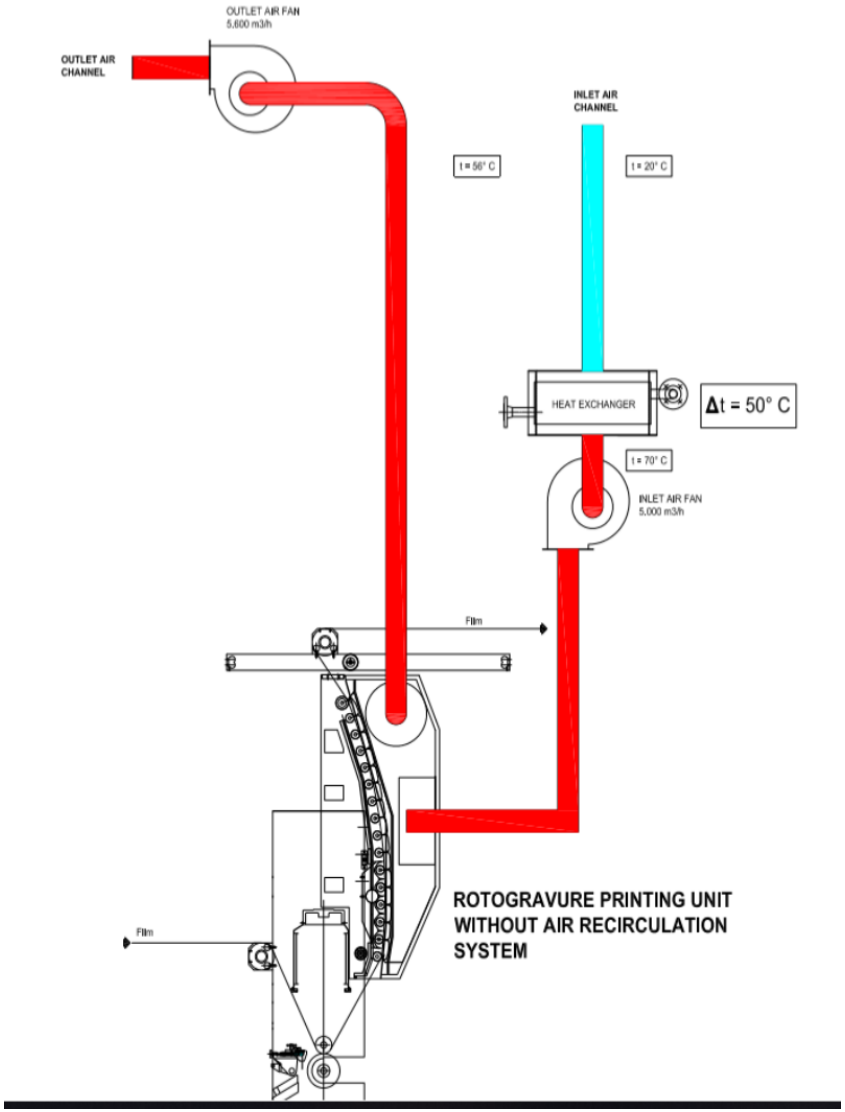
LFL Monitoring Equipment

LFL monitoring equipment can reduce energy used in solvent removal by adjusting the ventilation ratio according to the fluctuations in vapor concentration. The equipment continuously tracks the solvent extraction rate in real time and controls the rate of ventilation air based on real needs, thereby maintaining a safe ratio throughout the process. LFL monitoring equipment can employ several technologies including catalytic systems, infrared sensors, ionization systems and combustion sensors. LFL monitoring equipment has self-check functions and uses a calibrated test gas for periodic self-calibration. Because the vaporization process depends on the intake and exhaust air, linking the LFL controller to an adjustable speed drive on the exhaust system fan can improve process efficiency even further (damper adjustments can also be used).

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

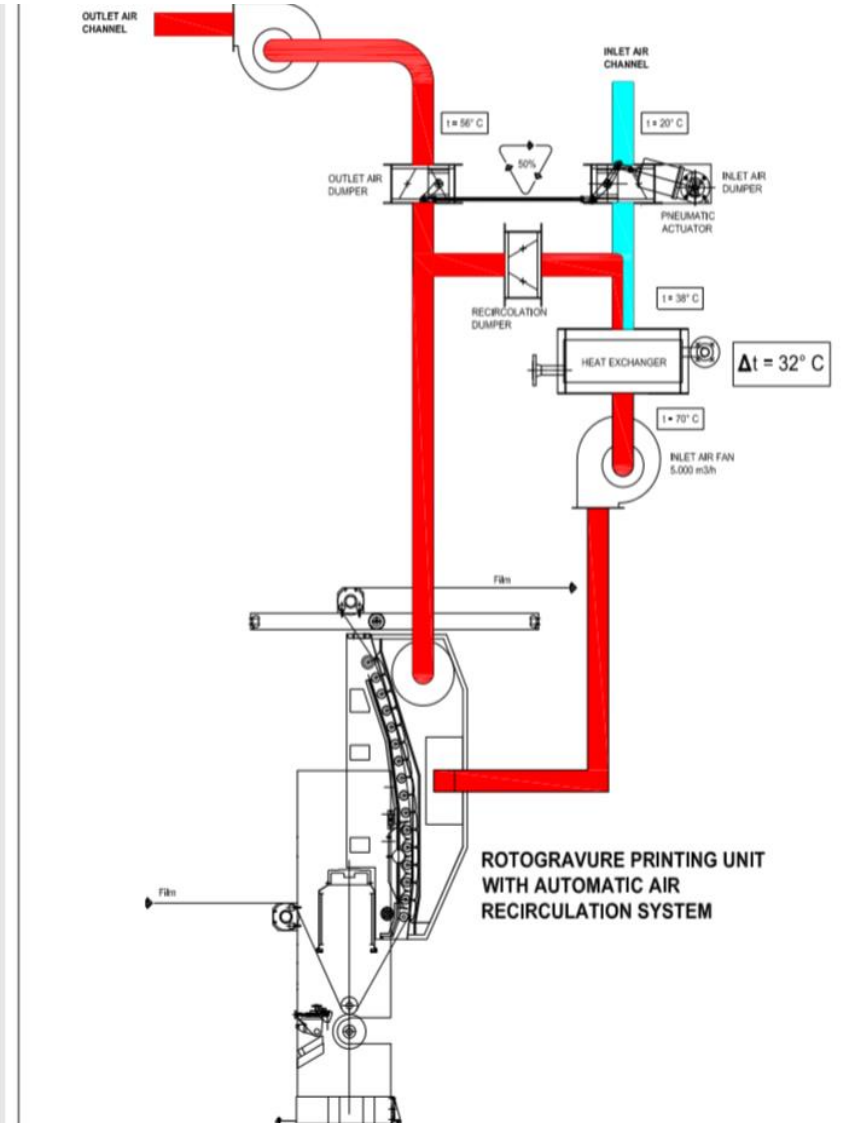
Non recirculated ventilation element

Fresh air is preheated before entering into the drying station, then exhausted without any energy recuperation, all the non used energy for the process is lost into the environment and you money as well as…

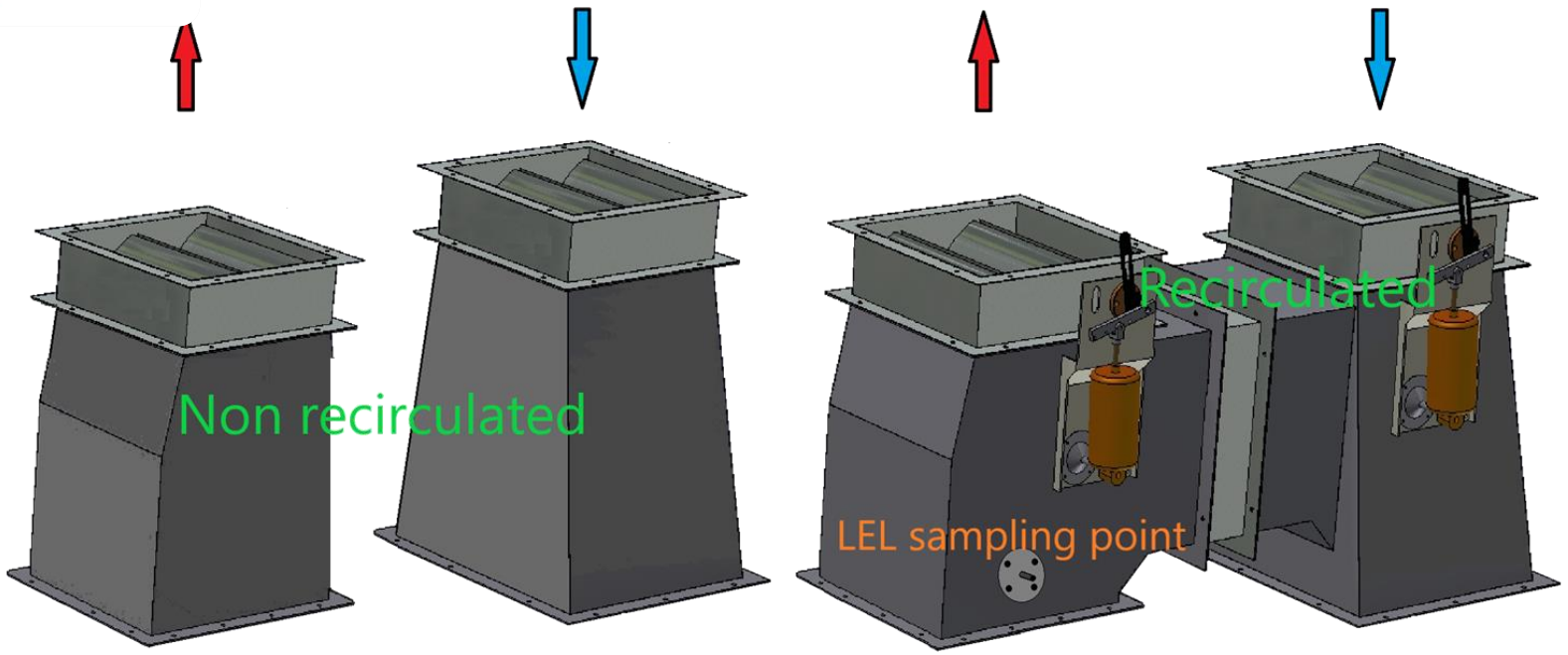


Auto recirculated ventilation element

Fresh air is preheated before entering into the drying station, then partially reinserted into the process reducing the thermal energy consumption of the heating system. The flows regulations are driven considering the LEL concentration. A green way to save money…



New ventilation system drawing



The fresh air is sucked in by an inlet fan, heated to the desirable temperature and sent inside the drying station. The hot air vaporizes the solvent on the flexible coated, laminated or printed materials and after the vaporization process, the exhausted air is sent out in discharge. If the solvent concentration is lower than its admissible Lower Explosion Limit (EN 1539:2015), most of the exhausted air can be recycled and reused as inlet fresh air.

HOW TO DO THAT?

The customer has to collect and send all the relevant data of the press/converting machine, using our specific format.

Nira will study, develop and propose a custom solution to upgrade the ventilation system and the LEL analyzers.

OUR AUTOMATIC AIR RECIRCULATION CONTROLLER

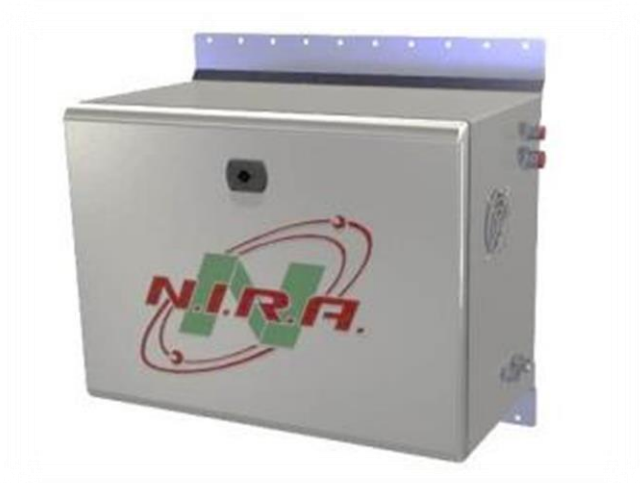
Integrated PLC controller

Receives solvent concentrations from NIRA LEL monitoring systems and automatically regulate electric or pneumatic modulating dumpers, in order to create the automatic air recirculation systems, by keeping higher solvent concentration inside the drying stations safely. This system reduces the exhaust hot air in discharge.

Stand-alone pulpit assembly

OUR LEL SYSTEM

- Fast response time (T_{90} in 1,6)
- High reliability
- EN 1539:2015 certified
- Low management costs
- Single or multipoint monitoring



Sagittarius 5000 (IR)

COMPETENCE

Our technical staff work worldwide every day.

- Internal aeraulic engineer available for a complete ventilation system revision.
- Specialized technicians for FID and IR LEL analyzers support.
- Developing, supply and startup of all the whole system from one single supplier (N.I.R.A.).