

# **INSTRUMENTATION AND CONTROL**

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# 1. Why Instrumentation and Control?

- There are many reasons for instrumentation and control in a seed processing plant.
- These include:-

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- To ensure safety of workers, visitors neighbours and passers-by
- Safety of equipment, machines, buildings and other structures
- Efficient use of utilities such as steam, water and electricity
- Increase productivity of machines
- Increase product quality regularity
- Increase flexibility of machines and processes
- Meet regulatory requirements such as consistent package weights within specifications

## 2. Boiler instrumentation and Control

- The use of boiler is preferable to direct mixing of maize cob combustion products with air

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## (i) Steam pressure

- The steam pressure must meet the processing requirement,
- i.e. the drying air must be heated to the desired temperature and other steam using operations such as cleaning and disinfection must be effective.
- This means that there is a minimum pressure.

- Boilers always have a maximum allowable steam pressure beyond which material failure leads to boiler explosion with dire consequences.
- In an oil-fired boiler, an automatic control system that measures the steam pressure and turns the fuel flow on when it is at the minimum and off when it is at the maximum level.

- In seed processing plants, the boiler is often fired by maize cobs.
- The on-off control described above is therefore not easy to implement.
- The minimum steam pressure is assured by maintaining adequate fire.
- A safety valve that releases steam to the atmosphere ensures that the maximum allowable pressure is not exceeded.
- In all cases a steam pressure gauge is installed.

## **(ii) Boiler water level**

- The boiler tubes must always be covered with water to avoid overheating that leads to material failure and release of steam in the working environment. Two measures are taken:
  1. An automatic control system measures the water level and switches the water feed pump on when it is at the specified minimum value.
  2. A sight glass gauge is installed to enable the boiler operator to monitor the water level and to intervene when necessary.



# 3. Control of in-bin aeration

- The main objective of aeration is to maintain seed grain stored at 12-15% moisture content to within 3-6°C of ambient temperature.
- An aeration controller decides if, when, and for how long air blowing is needed.
- Sophisticated aeration controllers measure the temperature and relative humidity of the ambient air and the temperature and equilibrium relative humidity of the grain.
- Less sophisticated aeration controllers base their decisions solely on the air and grain temperature.

# 4. Control of in-bin supplemental heat drying

- The objective of in-bin supplemental heat drier controllers is to dry seed grain at minimum energy use without significantly affecting the storability and quality.
- Control of drying air temperature is important to ensure that the drying is effective and seed quality is maintained.
- An automatic control system measures the drying air temperature and adjusts the steam flowrate to maintain it at the desired value.

- Fan control is also important to ensure that it stops operating when the seed moisture content reaches a specified minimum value and starts operating when it reaches a specified maximum value.
- Indirect heating systems, a mixing valve connects the hot and cold channels and controls the drying air temperature.
- The required drying conditions (T and RH) can be programmed based on the desired equilibrium moisture of the seed.
- The air flow is dynamic: higher at the beginning of the process and lower at the end of the process as the seed gets drier.
- Relative humidity of the incoming air is compared with that of the exhaust air. The drying process stops when the former is higher than the latter.
- Measuring and parameter settings are read out on a control screen and PC.
- Graphics are used to visualize the drying process.

## 5. Control of Seed cleaning and treatment

- The seed feed rate is determined by the speed of the bucket elevators which can be controlled if variable speed drives are used.
- Control of air flow rate in the aspiration cleaner is important to ensure that the impurities are adequately removed without blowing away the good seed grains.
- Control of dosing of the treatment chemicals is important to ensure that good seed quality is achieved without excessive use of chemicals.

# 6. Control of seed packaging

- Instrumentation and control enables the selection of throughput and packaging size and maintenance of package weights consistently within specifications.

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**THANK YOU**

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