How to control cement product fineness by control card

Introduction

- Cement performance (strength, workability, water demand, etc.) is impacted by cement fineness. The cement fineness is influenced by the following main factors:
  - Cement grinding material characteristics: grindability, moisture, size, etc.
  - Main equipments performance: roller press reliability, mill internal situation, separator efficiency, etc.
  - Operational settings: mill ventilation, separator ventilation, separator rpm setting, etc.
  - The different request on product.
- Cement quality control is essential to ensure a stable finished product for our customers. Several process parameters (separator speed, Blaine, SO3, etc.) impact the cement fineness. The control card is the procedure to be applied to check if the cement fineness remains within the targeted limits.

Objective

- The aim of this "How To" procedure is to present a basic quality management method of control cement production fineness by control card. Other cement control parameters like SO3 content can use this kind of control card too.

Prerequisites

- A Standard Operating Procedure (SOP) for applying the "rule of decision" has been developed to assist the process operators to take necessary corrective action in any case when there is deviation of the results from the target limits. The operators must follow strictly the SOP requirements in order to implement the control cards for process control efficiently.
- The operating ratio "speed of the cage (rpm) Vs the corresponding fineness of the finish product" must be defined.
- See below a reference on O-sepa rpm Vs product fineness:

  Vr±0.65m/s→ Blaine±10m2/kg

  $Vr=\pi*D*N/60$ Vr: Rotor Linear velocity (m/s)
  D: Rotor diameter (m)
  N: Rotor speed (rpm)

  Note that this ratio is specific for each separator.

  Refer to Cement Blaine control SOP - see appendix 1: ATC example "Finish Mill Fineness Control" document.

- 200 samples need to be collected (details are given in section 1 next page).

In this procedure you may find references to other information (tools, other "How to" procedures, knowledge documents, indicators, etc…). You can access them (unless they are still under development) from their respective domain of the Web Cement Portal (e.g. Grinding, Pyroprocessing..) or from the BRS database (indicators).

Action Steps

1. Set up the production fineness control card according to the Spcl calculation

What is Spcl?

Spcl stands for Statistical Process Control Limits.

Spcl was popular in cement plants for raw mix and cement quality control (like C3S content in raw mix, Blaine and SO3 control in finished mill).

Calculate the specific production Blaine Spcl:

- 1. Collect a series of around 200 normal production data submitted to the normal process control.
- 2. Organize data in time sequence.
- 3. Calculate moving ranges (MR) of the data (absolute values).

  x1 x1 – x2 = MR1

  x2 x2 – x3 = MR2

  x3 x3 – x4 = MR3

  etc.
- 4. Calculate the average of the moving ranges (MRbar).
- 5. Calculate Upper Control Limit (UCL) of MR.

  UCL = 3.27 x MRbar
- 6. Delete all MR values that are greater than UCL defined in step 5.
- 7. If there were deletions in step 6, repeat steps 4, 5 and 6 until no further deletions are necessary.
- 8. Spcl = final MRbar / 1.128.

See the example on Blaine control in Appendix 2.

2. Set the Blaine limitation for the control cards

The target limits in the control are defined into the 4 following zones:

Zone 1 => between Target – 1*Spcl and Target + 1*Spcl

Zone 2 => between Target – 1*Spcl and Target – 2*Spcl or between Target + 1*Spcl and Target + 2*Spcl

Zone 3 => between Target – 2*Spcl and Target – 3*Spcl or between Target + 2*Spcl and Target + 3*Spcl

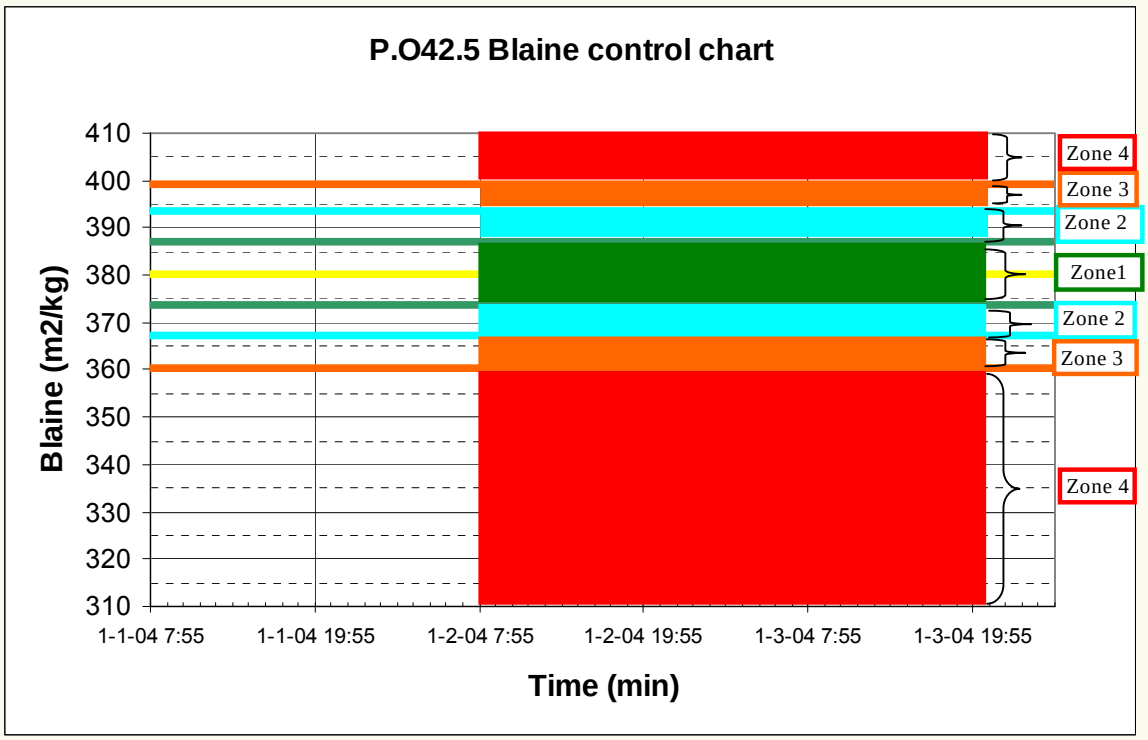
Zone 4 => Lower than Target – 3*Spcl or upper than Target + 3*Spcl

For example, the Blaine target is 380m2/kg and Spcl is 6.7, then:

	<T-3*Spcl	T-3*Spcl	T-2*Spcl	T-1*Spcl	Target	T+1*Spcl	T+2*Spcl	T+3*Spcl	>T+3*Spcl
Blaine (m2/kg)	< 360	360	367	373	380	387	393	400	>400
Spcl					6.7				

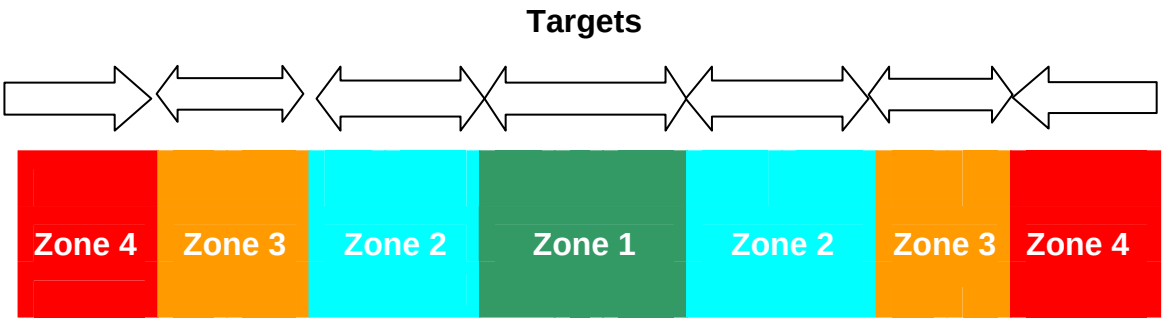
Action Steps

And the zone chart like below:

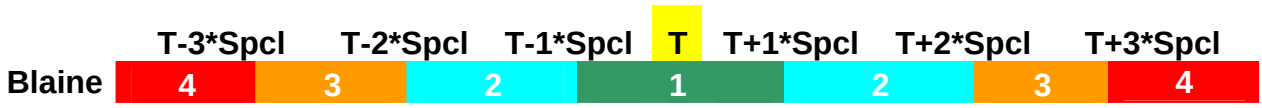


3. Control cement production fineness by control card

- The process operator shall input each of the test results for example Blaine into the working sheet [Excel program] immediately once received the results from the laboratory.
- The result will be updated automatically in the graph (control card).
- The operator has to analyze the result depending on the position in the zone. He applies the specific rules defined below:



Action Steps



Zone 1	No actions except there are eight out of the last nine samples are on the same side of the target.
Zone 2	No actions except there are four out the last five samples are charted in band of T+1*Spcl and T+2*Spcl or T-1*Spcl and T-2*Spcl.
Zone 3	No actions except there are two out of the last three samples are charted in band of T+2*Spcl and T+3*Spcl or T-2*Spcl and T-3*Spcl.
Zone 4	Immediate take correct actions when one sample is charted in band of lower than T-3*Spcl or higher than T+3*Spcl.

See detailed Blaine Control procedure in appendix 4

Appendix

1. ATC example "Finish Mill Fineness Control"

App1_Finish mill finenessATC

2. ATC example of Blaine control

App2_BlaineControl_ ATC

3. ATC guideline

App3_GuidelineATC

4. Cement production fineness control procedure

Source : ATC