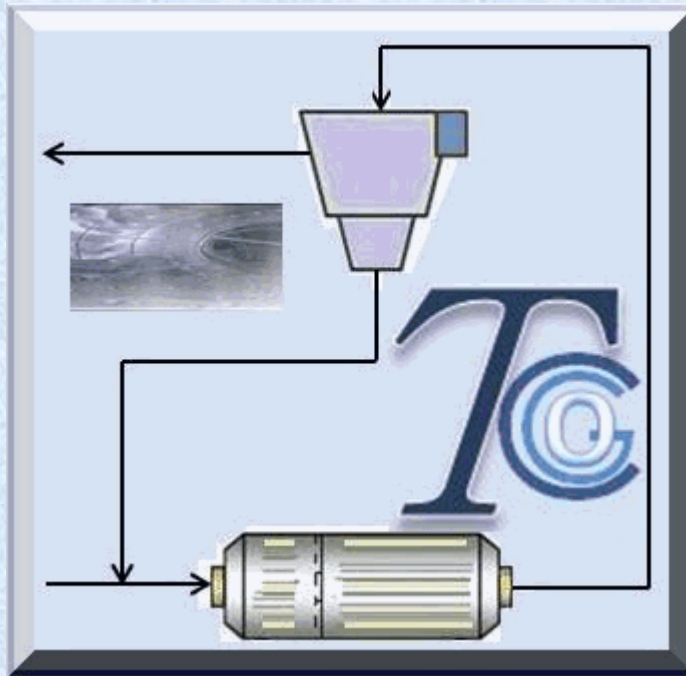


# *The Cement Grinding Office*



Training Courses  
based on the Grinding  
Software

Presentations available

*2015 - Presented by Marc Piccinin*

# **Grinding Software list of calculators**

## Section 1: Ball Charges Kit

1. Ball charges Composition Calculator for Monochamber Mills
2. Ball charges Composition Calculator for 2 Chambers Mills
3. Ball charges Composition Calculator for 3 Chambers Mills
4. Modification of the Ball Charge after Sampling Analysis Calculator
5. Calculation of the Top Size Grinding Media
6. Ball Charges analysis calculator - Weight and Surface of the Grinding Charges
7. Ball Charge Make-up Calculator
8. Ball Mill Simulation
9. Grinding Media Wear Rate Monochamber Mill
10. Grinding Media Wear Rate 2 chambers Mill
11. Marked Ball Test Calculator

## Section 2: Volume Load & Power Kit

12. Volume Load Calculator for 1 chamber mill
13. Volume Load Calculator for 2 chambers mill
14. Volume Load Calculator for 3 chambers mill
15. Bond Power Formula Calculator
16. Hogg and Fuerstenau Power Formula Calculator
17. Monochamber Mill Power Calculator
18. Drying + Grinding Chamber Mill Power Calculator
19. 2 Chambers Mill Power Calculator
20. Central Discharge (Biotator) Mill Power Calculator

## **Grinding Software list of calculators (suite)**

### Section 2: Volume Load & Power Kit (suite)

21. 3 Chambers Mill Power Calculator
22. Mill Power in Wet Process Calculator
23. Material Quantity in Monochamber Mill
24. Material Quantity in 2 chambers Mill

### Section 3: Heat Balance & drying Kit

25. Heat Balance (Find Water) Calculator
26. Heat Balance (Find Temperature) Calculator
27. Drying Capacities with Weber Calculator
28. Drying Capacities with Mill Heat Balance Calculator
29. Cement Cooling in the Separator Calculator
30. Coal Drying Weber
31. Coal Drying Balance
32. Open Circuit Mass Balance Calculator
33. Closed Circuit 1 Mass Balance Calculator
34. Closed Circuit 2 Mass Balance Calculator
35. Closed Circuit 3 Mass Balance Calculator
36. Closed Circuit 4 Mass Balance Calculator
37. Closed Circuit 5 Mass Balance Calculator
38. Closed Circuit 6 Mass Balance Calculator

### Section 4: Sizing Kit

39. Monochamber Mill Sizing Calculator
40. 2 Chambers Mill Sizing Calculator
41. Monochamber Mill Sizing for Wet Process Calculator



## **Grinding Software list of calculators (suite)**

### **Section 4: Sizing Kit (suite)**

42. Separator of Third Generation Sizing Calculator
43. Ventilation of the Mill an Fan Sizing calculator
44. Cyclones Sizing Calculator
45. Roller Press
46. Hydrocyclones Sizing Calculator
47. Bag Filter (Reverse) Calculator
48. Bag Filter (Pulse) Calculator
49. ESP Filter Calculator
50. Production vs Blaine and residue Calculator
51. Mill Modification ROI and Payback Calculator
52. Mill Circuit Modification IRR and Payback Calculator
53. Energy Optimization Calculator

### **Section 5: Tromp RRSB Kit**

54. Tromp Curve calculator
55. Lagrange Correction calculator
56. RRSB (0,1 - 1000 microns) calculator
57. RRSB (1 - 10000 microns) calculator
58. RRSB (10 - 100000 microns) calculator
59. Blaine Calculator
60. Tromp simulation

# **List of presentations available**

## **1 Comminution and Laws of Comminution**

*Introduction*

*Definition of the comminution*

*Comminution in the cement industry*

*Forces applied in comminution*

*Classification and designation of the stages of comminution*

*The three laws of comminution*

*Efficiency of the different crushing grinding devices*

## **2 Types of Tube Mills**

*Introduction*

*Rod mills*

*AG and SAG mills*

*Pebbles mills*

*Slurry mills*

*Monochamber mills*

*2 Compartments compound mills*

*3 Compartments compound mills*

*Central discharge double rotator mills*

*Airswept mills*

## **3 Power Formulas**

*Introduction*

*Bond Formula*

*Hogg and Fuerstenau Formula*

*Other power formulas*

*Power Calculators*

*Exercises*



## **4 Volume Load Measurement Explanation**

*Introduction*

*Measurement of H*

*Counting of the number of visible plates*

*Measurement of the central part*

*Volume Load Calculators*

*Exercises*



## **5 Ball Charges Composition**

*Introduction*

*Cement mill with 2 compartments*

*Cement mill with 3 compartments*

*Cement mill with only 1 compartment*

*Raw mills*

*Ball Charges Calculators*

*Exercises*

*Ball Mill Simulation*

## **6 Cement Mill Heat Balance**

*Introduction*

*Principle*

*The three basic parameters*

*Definitions of the parameters*

*Equations of the heat balance*

*Hyphothesis*

*Animated explanation*

*Heat Balance Calculators*

*Exercises*

## **7 Drying capacities calculation**

*Introduction*

*Kinds of drying methods*

*Drying capacities calculation*

*Conclusion*

*Drying capacities Calculators*

*Exercises*



## **8 Mill's Internals**

*Introduction*

*Head Liners*

*Linings*

*Lifting plates for drying chambers*

*Lifting linings for first or grinding (crushing) compartment*

*Linings of semi-finishing and finishing compartments*

*Retaining rings*

*Rubber linings*

*Diaphragms*

*Transfer diaphragms*

*Intermediate diaphragms*

*Single diaphragm*

*Double diaphragm*

*Flow control diaphragm*

*Flow control diaphragm for slurry mills*

*Comments on the slots*

*Central discharge diaphragms*

*Outlet diaphragms*

*Life time of diaphragms*

*Grinding media*

*Introduction*

*Ball charges quality*

*Wear rate*

*Wear rate calculation*

*Cylpebs*

*Wear rate Calculator*

*Exercise*

## **9 Ball Charge Sampling**

*Introduction*

*Method used in the mining industry*

*Method to be used in the cement mill*

*Analysis of the samples*

*Conclusion*

## **10 Marked Ball Test**

*Introduction*

*Goals of the MBT*

*Marked balls*

*Controls procedure*

*Data to take during the test*

*Results of the marked ball test*

*Example*

*MBT calculator*

*Exercise*



## **11 Cement Ball Mill Sizing Explanation**

*Introduction*

*Bond equation and correction factors*

*Define fresh feed characteristics*

*Define target fineness*

*Define production target*

*Define efficiency factors*

*Define the estimated mill specific energy*

*Define the absorbed power required*

*Sizing of the ball mill*

*Other power correction factors*

*Ball mill final dimensions*

*Drying chamber (for raw mill)*

*Required installed power*

*Cement Ball Mill Sizing Calculators*

*Exercises*

## **12 Mill Ventilation Measurement**

*Location of the measurement point(s)*

*Pitot Tube*

*Method of measurement*

*Mill Ventilation Calculator*

*Exercise*

## **13 Material inside the mill and retention time**

*Introduction*

*Quantity of material inside the ball mill*

*Calculation with example*

*Residence time inside the mill*

*Material and retention time Calculator*

*Exercise*



# **14 Ball Mill Inspection Procedure**

*Introduction*

*First chamber*

*Second chamber*

## **15 Granulometry along the ball mill**

*Introduction*

*The Sampling Campaign*

*The Sieving in the laboratory*

*The results analysis with the curve and its interpretation*

# **16 Mill Circuit Sampling Points and Procedure**

*Introduction*

*Example*

*Summary sheet of the work to do*



## **17 Grindability and Hardness Tests**

*Introduction*

*Grindability definition*

*Hardness definition*

*Grindability tests*

*Hardness tests*

## **18 Blaine Specific Surface Area**

*Introduction*

*Cement densities*

*Blaine and Air Permeability Method*

*Principle of the Blaine method*

*Determination of the amount of the cement sample*

*Calibration of the Blaine apparatus*

*Result*

*Example*

*Online Blaine Analyser*

*Blaine Calculator*

*Exercise*

## **19 Production vs Blaine or Residue**

*Introduction*

*First Formula*

*Second formula*

*Third formula*

*Bond Formula*

*Production vs Blaine or Residue Calculator*

*Exercise*

## **20 Cyclones**

*Introduction*

*Advantages*

*Disadvantages*

*Principle of operation*

*Forces affecting the particles*

*Flow Characteristics*

*Mechanical parts*

*Cyclones families*

*Design of the cyclones*

*Cyclones scale-up*

*Cyclone's efficiency*

*Cyclone's pressure drop*

*Design modifications and consequences*

*Methodology for sizing cyclones*

*Example of calculation*

*Cyclones sizing Calculator*

*Exercise*



## **21 Static Separators**

*Introduction*

*Advantages*

*Disadvantages*

*Principle of operation*

*Mechanical parts*

*Operating characteristics*

*Diameter calculation*

*V-Separators*

*Introduction*

*Principle of operation*

*Mechanical parts*

*Operating characteristics*

*Dimensioning parameters*

## **22 Dynamic Separators (Part 1)**

*Introduction*

*Dynamic Separators*

*Dynamic Separators: 1° generation*

*Introduction*

*Advantages*

*Disadvantages*

*Principle of operation*

*Possibilities of adjustments*

*Parameter of dimensioning*

*Suppliers*

*First generation separators data sheet*

*Dynamic Separators: 2° generation*

*Types of circuits*

*Advantages*

*Disadvantages*

*Principle of operation*

*Possibilities of adjustments*

*Parameter of dimensioning*

*Suppliers*

*Second generation separators data sheet*

## **22 Dynamic Separators (Part 2)**

*Dynamic Separators: 3° generation*

*Introduction*

*Advantages*

*Disadvantages*

*General principle of operation*

*Suppliers principles of operation*

*Possibilities of adjustments*

*Possible causes of malfunction*

*Parameter of dimensioning*

*Suppliers*

*Types of circuits*

*Special designs for raw mill circuits*

*Example of dimensioning*

*Third generation separators data sheet*

*Separator Sizing calculator*

*Exercise*

## **23 Cement cooling in the separator**

*Introduction*

*Separator as cooler*

*Heat balance of the separator*

*Cement cooling Calculator*

*Exercise*



## **24 Particle Size Distribution**

*Introduction*

*Linear distribution*

*Linear distribution with x-log scale axis*

*Log - Normal distribution*

*Gaudin - Schuhmann distribution*

*Rosin-Rammler-Bennett distribution*

*Linear regression and correlation*

*Particle Size Distribution Calculator*

*Exercise*

## **25 Tromp Curve Explanation**

*Introduction*

*Background of the theory*

*Circulation factor calculation*

*Separator's efficiency*

*Tromp curve*

*Tromp curve parameters*

*Practicle Example*

*Tromp Curve animated*

*Tromp Curve Calculator*

*Exercise*

*Lagrange calculator*

*Tromp Curve Simulation*

## **26 Limestone Technology with Ball Mills**

*The limestone*

*Different applications of the limestone powder*

*Different types of grinding*

*Different types of mills and circuits*

*Mill's internals*

*Ball charge of the raw mills*

*Problems of drying*

## **27 Coal Grinding Technology**

*Introduction*

*Types of coals*

*Coal properties*

*Petcoke*

*Reasons for grinding coal*

*Ball mills*

*Vertical Roller mills (VRM)*

*Comparison Ball mills vs Vertical mills*

*Drying problems*

*Fineness of the dust coal*

*Safety considerations*

*Dust collectors*

*Calculators*

*Exercises*



# **28 Mill Circuit Modification ROI, IRR and Payback**

*Introduction*

*Definition*

*Payback Period*

*Discounted Payback Period*

*ROI (Return on Investment)*

*IRR (Internal rate of return)*

*Depreciation*

*Straight-Line Depreciation Example*

*Declining-Balance Depreciation Example*

*Calculators*

*Exercises*

## **29 Mass Balance of grinding circuits**

*Introduction*

*Necessary data*

*Equations used*

*Sieves used in the calculation*

*Calculators*

*Exercises*

## **30 Filters**

*Introduction*

*Electrofilters*

*Bag filters*

*Comparison between electrostatic precipitators  
and bag filters*

*Calculators*

*Exercises*

## **31 Vertical shaft impactor**

*Introduction*

*Operating principle*

*Conventional circuit*

*Advantages of the VSI*

*Disadvantages of the VSI*

*Conclusion*



## **32 Roller Press**

*Introduction*

*Operating principle*

*Explanation of the grinding action*

*General representation*

*Methods of use and types of circuits*

*Problem of the feed*

*Problem of the roller pressure*

*Operating parameters*

*Wear problems of the rollers*

*Particle size results of the press*

*Elements of sizing considerations*

*Main dimensions of the roller press*

*Determine the increase of production*

*Comparison of the situations before / after  
modification*

*Modification of the ball mill*

*Advantages of the roller press*

*Disadvantages of the roller press*

*Conclusion*

## **33 Mills controls systems**

*Introduction*

*Concept of open loop (OL) and closed loop (CL)*

*Notions of transfer functions - Laplace Transform*

*Types of control systems*

*ON-OFF controllers*

*PID controllers (P, PI, PD and PID)*

*Fuzzy logic*

*Expert systems*

*Control possibilities of the grinding plants*

*Conclusion*

## **34 Different ways to get an efficient grinding plant**

*Introduction*

*Increase the filling degree*

*Right lifting lining in chamber 1*

*Flow control intermediate diaphragm*

*Classifying lining in second chamber*

*Right ball charge gradation*

*From open to closed circuit*

*High Efficiency separator*

*Pre-crushing system*

*Pre-grinding system*

*Automated control*

*Predictive maintenance*

*Grinding aids*

# **35 Grinding Software presentation**



# ***The Cement Grinding Office***

**END**