MOUNT ISA MINES

LABORATORY AND TECHNICAL INFORMATION SERVICES

METHODS FOR THE SIZING ANALYSIS

OF

ORES AND METALLURGICAL SAMPLES

Cyclosizer Operation

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METHODS FOR THE SIZING ANALYSIS OF ORES AND METALLURGICAL SAMPLES _ MET02.02 - CYCLOSIZING

1 SCOPE

This method sets out the steps to be followed in order to perform a sizing analysis, using the Cyclosizer, as requested and required by the customers of the Metallurgical Services Laboratory. The method is in two parts as the customer may require a cyclosizing with further sizing by a centrifuge attached to the cyclosizer.

2 APPLICATION

The cyclosizer is capable of treating samples consisting of particles of size –270 #. As such it is suitable for use with samples from both the Copper and Lead/Zinc Concentrator. Other metallurgical samples such as dusts and fumes (from the smelters) may also be suitable for sizing by this method.

3 PRINCIPLE

Sample mixed with water is passed into the cyclosizer and separation into various size classes is accomplished by centrifugal force. A centrifuge coupled to the cyclosizer enables separation of particles as fine as –5 microns.

Cyclosizing is a simple, reliable, mechanical means of sizing the finer particles contained in some sample.

4 REFERENCED DOCUMENTS

The following documents are referenced in this method ---

JSA GEN.008 – Handling Hot Objects from Ovens or Hotplates
JSA GEN.009 – Weighing of Samples
JSA SIZ.002 – Cyclosizing
Met 02.03 Version 2.0 – Sizing a Sample.

5 EQUIPMENT

5.1 Cyclosizer.

5.2 Centrifuge.

5.3 Sample Beakers (plastic 2L and aluminium 1L).

5.4 Clean water supply (deionised water is suitable).

5.5 Plastic vial scoop.

5.6 Plastic sample vials (25-50 mL).

5.7 Pre-Cyclone Rig – bench mounted and consists of - holding tank; high-pressure centrifugal pump (SUNFLO); small cyclone; and cyclone underflow cutter.

5.8 Plastic buckets - 10 L – with handles.

5.9 Gloves – leather, disposable plastic and cotton.

5.10 Detergent.

5.11 Top pan balance, capable of weighing up to 3 kg and accurate to three decimal places.

5.12 Filter papers

5.13 Vacuum Pump

6 Part 1 – Cyclosizing (Without Centrifuge)

Note 1: Sample is always prepared using the Pre-Cyclone first before Cyclosizing. Prior to commencing work ensure that any bench areas and all equipment to be used has been thoroughly cleaned. Also the operator/s should be familiar with the risks associated with the task/s about to be performed.

6.1 Collect the "-400" portion of a sample that has been processed as per steps 6.1 - 6.25 of MET02.03.

6.2 Pour the bucket containing the -400 fines sample into the holding tank of the Pre-Cyclone making sure the bucket is rinsed thoroughly into the tank.

6.3 Position the overflow (C7) hose from the cyclone so that it is directed into the bucket.

6.4 Position the 2 L plastic beaker (C6) on the holding trolley to collect the cyclone underflow and place the overflow hose in the C7 bucket to collect the overflow

6.5 Remove pin from the right hand side of the holding tank, slide the arm across to the left and replace the pin.

6.6 Turn on the water tap, and then press the green start button.

CAUTION: Do not attempt to operate the pump without water flow as this will result in damage to the mechanical seal and pump failure.

6.7 Allow the pre-cyclone to run for a minimum of 30 seconds in order to mix the sample in the holding tank, thoroughly. Check water pressure is at 600 kpa and record it.

6.8 Start cutting sample by shifting the arm back to original position – this causes the sample to be split into the containers previously placed.

6.9 Introduce clean water into the holding tank during cutting in order to ensure that all the sample is flushed out.

Note2: Use as much water as in necessary to remove ALL the sample from the holding tank.

6.10 When the pre-cut is finished, turn off water tap and remove the beaker (C6) and the bucket (C7 containing sample) and label them. Repeat if there are other samples.

6.11 Allow the pre-cyclone underflow (C6) to settle in the beaker.

6.12 Carefully decant most of the clear water, ensuring all settled material is retained. This material is now ready for classification through the cyclosizer.

6.13 Filter the pre-cyclone overflow material (collected in the bucket) to obtain the C7 fraction. Dry, weigh, label and store in appropriate bag for assay if required.

6.14 Remove the cyclosizer sample canister from its housing.

6.15 Open the sample canisters valve fully and allow the water to drain completely.

6.16 Turn the sample canister upside down and transfer the sample from the beaker to the canister – assist the transfer by washing any residue from the beaker into the canister by use of a wash bottle.

Note 3: Avoid the use of excess water in this process as overfilling of the sample canister WILL CAUSE LOSS OF SAMPLE.

6.17 Close the sample canister valve.

6.18 Return the sample canister to its housing and twist or turn it 90 degrees (the glass or perspex side should be now facing the operator). Place the sample identification tag on the unit.

6.19 Make sure the control value (value controlling the water flow to the cyclones is open) then turn on the pump on the control panel.

6.20 Turn water tap on slowly.

6.21 Starting at cyclone No.1 and working to cyclone No.5, bleed off the air from each cyclone by opening the apex valves one at a time.

6.22 Release the sample from the canister slowly over 5-10 minutes.

6.23 Ensure the complete sample has been discharged into the stream and the sample canister valve is opened fully.

6.24 Record the water temperature, check the chart to find the corresponding flow rate – and record. Slowly adjust the control valve to give the correct flow rate.

Note 4: In reading the float valve the correct mark is the upper step on the body of the float.

6.25 Set the timer for 20 minutes and allow the cyclosizer to run for this time.

6.26 After 20 minutes, turn the control valve to the fully open position.

6.27 Close the sample canister valve.

6.28 Starting with cyclone No.5 pull out the plastic tube from the drain manifold. Open the apex valve and discharge the solids into the aluminium beaker marked number 5.

Note 5: There are 4 sets of aluminium beakers (1A-5A, 1B-5B, 1C-5C, 1F-5F) please ensure that the correct beakers series are used.

6.29 Close the discharge valve for cyclone No.5 and then proceed to empty each of the cyclones in turn 4, then 3 and then 2 and 1 into their corresponding beakers.

6.30 Turn off the water tap

6.31 Turn off the pump on the control panel.

6.32 Allow the beakers to stand for 5 minutes and then decant as much excess water as possible (BE CAREFUL not to lose any sample during this step).

6.33 Number, 5 small filter papers 1-5 and using the vacuum pump filter, filter each beaker onto the corresponding numbered filter paper.

6.34 Place filtered samples on to enamel plates and dry on hotplates.

6.35 Once the samples are dry remove from them from the heat and allow them to cool.

6.36 Tare the balance with a small filter paper, then weigh each sample. Record the weights on the appropriate form.

6.37 Place each sample in its appropriately labelled bag.

6.38 Calculate the following:-
The total amount from each cyclone is subtracted from amount of "-"400 sample from your screen sizing, this will give you the calculated C7 sample and shows the difference between the amount fed in and the amount captured. This calculation will also take into account the material discharged to waste.

6.39 Enter results and all information into the computer in appropriate file.

6.40 Forward the results to the Metallurgist.

6.41 Combine the required fractions into the one bag if assay is required.

6.42 Spex mill grind fractions (see MET01.02).

6.43 The orginal sizing sheet is taken to your Supervisor. The samples and a copy of the paperwork are taken to XRF.

7 Part 2 – Cyclosizing with Centrifuge

Note 6: Use of this part of the Cyclosizer Method in conjunction with wire mesh screens and a pre-cyclone allows reproducible sizing down to – 5 microns with recovery of all fractions including the – 5 micron fraction. Centrifugal force in the centrifuge bowl causes certain sample particles to collect on the side of the bowl with clear water overflowing to a drain.

7.1 The pre-cyclone underflow material (from step 6.1 - 6.13) is now going to be passed through the cyclosizer to obtain the C1 to C6 fractions. In order to obtain the C6 fraction (i.e the – 12 + 5 micro material) and the – 5 micron material the cyclosizer discharge is passed into a centrifuge.

Note 7: Check that the centrifuge has been assembled correctly with the rubber bowl in place and the retaining rings tightened properly.

7.2 Connect the cyclosizer discharge hose to the centrifuge inlet.

7.3 Starting at step 6.14, proceed to 6.21.

7.4 Whilst releasing the air from the cyclones you will notice the centrifuge bowl filling with water.

7.5 When the centrifuge bowl is full, Start the centrifuge (allow time for it to come to a constant speed).

7.6 Place one bucket underneath the centrifuge hose (and have 3-4 more buckets ready for use).

Note 8: This is only necessary if we wish to actually measure the total amount of C7 material (otherwise this figure can be calculated as the difference between the total amount of material

fed in and the total amount of material collected). To filter the C7 material collected use Millipore 45 um filter papers (or equivalent)

7.7 Introduce sample to the cyclosizer (after a while material will pass through the cyclosizer discharge hose to the centrifuge) and follow steps 6.22 - 6.31

7.8 Turn off the centrifuge.

7.9 Once centrifuge stops remove cylcosizer discharge hose and disassemble centrifuge to facilitate recovery of sample from rubber insert.

7.10 Rinse off the lid of the centrifuge into a clean bucket and up end the rubber insert so the contained slurry pours into a bucket and then rinse remaining contents of the insert so it is also collected in the bucket. This is your C6 sample.

7.11 Rinse/wash the retaining rings and the insert bowl retaining plate into the same bucket (keep your lablel for the bucket with it at all times).

Note 9: Ensure that all components are <u>thoroughly</u> rinsed so as NOT to contaminate the next sample.

7.12 Filter, dry and weigh the sample obtained from the centrifuge rubber insert bowl (the C6 fraction).

7.13 Place the sample in a bag, label the bag and record all necessary information on the appropriate form. Keep for assay.

7.14 Re-assemble centrifuge – put the rubber insert bowl in place with retaining plate and attach the retaining rings (DO NOT OVER TIGHTEN the nuts on the centrifuge as this will strip the threads).

8 Quality Control

8.1 The main quality control is regular cleaning and regular calibration of the unit.

8.2 Calibration is carried out using Standard Silica.

8.3 A standard sample is run, in duplicate, at 15, 30 and 45 minutes at a standard flow rate of 11.6 litres/minute and the results recorded.

8.4 These results are plotted and compared to the ideal calibration curve (supplied with the standards). This information is filed for future reference (and NATA requirements).

9 Maintenance & Monitoring

9.1 During the standard operation of the cyclosizer temperature and flowrate measurements are taken every 10 minutes. These details are recorded on the results sheet (Form MET02.02FA - see Appendix 1)

9.2 Cleaning is important and is carried out as directed throughout this method. No records are kept of the frequency and duration of the cleaning (or even what is cleaned).

10 Forms

MET02.02FA Results/Recording Sheet

Appendix 1 - Form MET02.02FA

WARMAN CYCLOSIZER RESULTS SHEET						
SAMPLE NO.						
SAMPLE wt Gross						
Tare						
Nett						
TEMPERATURE						
PARTICLE SP.GR						
FLOWRATE						
ELUTRIATION TIME	15	15	30	30	45	45
Correction Factor (temp)						
" (sp.gr.)						
" (flow)						
" (time)						
No.1 Sample wt gross						
Tare						
Nett						
No.2 Sample wt gross						
Tare						
Nett						
No.3 Sample wt gross						
Tare						
Nett						
No.4 Sample wt gross						
Tare						
Nett						
No.5 Sample wt gross						
Tare						
Nett						
% RETAINED No.1 Cycl.						
" " No.2 "						
" " No.3 "						
" " No.4 "						
" " No.5 "						
% PASSING No.1 Cycl.						
" " No.2 "						
" " No.3 "						
" " No.4 "						
" " No.5 "						
OVERALL CORRECTION. FACT						
De No. 1 Cyclone						
De No. 2 "						
De No. 3 "						
De No. 4 "						
De No. 5 "						
CALIBRATION DATA	Remarks:					
D1 No. 1 Cyclone						
D1 No. 2 "						
D1 No. 3 "						
D1 No. 4 "						
D1 No. 5 "						

Appendix 2 - BREAK DOWN OF CYCLOSIZING WITH CENTRIFUGE

1. Fill sample canister with sample
2. Place canister into lock position on cyclosizer
3. Turn pump on
4. Turn water tap on slowly
5. Check valve is open so water is able to enter cyclones and centrifuge
6. Release air bubbles from cyclones (start at No. 1 - 5)
7. Turn on Centrifuge at switch box when water overflows the bowl
8. Release sample slowly over 5-10 minutes
9. Ensure all sample has gone from canister and open valve fully
10. Check water temperature
11. Adjust flow rate to water temperature as per chart by closing valve
12. Set timer to 20 minutes
13. Run machine for at least 20 minutes
14. Turn valve to full flow rate
15. Close canister
16. Empty cyclones start at No. 5 - 1
17. Turn water tap off
18. Turn pump off
19. Turn off Centrifuge (c6) at Switch Box
20. Turn off Centrifuge at Power Outlet