

Mineral Processing Plant Performance Calculation and Acceptance Reference

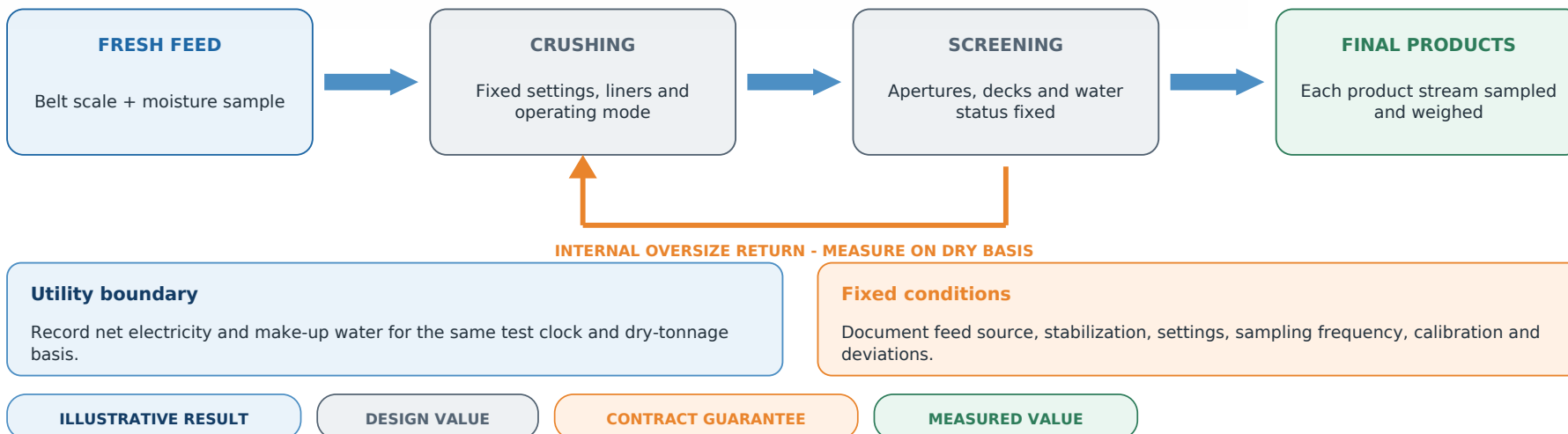
Calculation boundaries, worked balances and test records

PROJECT PERFORMANCE TESTING - ENGINEERING REFERENCE



1. Establish the performance-test boundary before collecting data

A valid test includes every mass and utility stream that crosses the agreed boundary. Internal recycle is measured separately, but it is not counted twice as new feed or final product.



Calculation Formula Reference

Use one defined time window, one dry-mass basis and compatible assay units

Measurement basis

F80 and P80 are the sizes at which 80% of the respective stream passes. M is wet-basis moisture as a decimal. F, C and T are dry masses of feed, concentrate and tailings; f, c and t are their grades. For screening, each recovery is calculated at one stated cut size.



Meter readings require a common test clock, traceable calibration and documented start/end values.

1 Dry throughput

$$Q_d = Q_w \times (1 - M)$$

Q_w = wet throughput; M = moisture fraction on wet basis.

2 Reduction ratio

$$RR = F_{80} / P_{80}$$

Use the same length unit for feed and product sizes.

3 Circulating load

$$CL = R / F \times 100\%$$

R = dry return stream; F = dry fresh feed.

4 Oversize recovery

$$R_o = O(o) / F(o) \times 100\%$$

True feed oversize reporting to the oversize stream.

5 Undersize recovery

$$R_u = U(u) / F(u) \times 100\%$$

True feed undersize reporting to the undersize stream.

6 Screen effectiveness

$$E = (R_o / 100) \times (R_u / 100) \times 100\%$$

Product of the two fractional recoveries at the stated cut.

7 Mass yield

$$Y = C / F \times 100\%$$

Dry concentrate or saleable-product mass divided by dry feed.

8 Metallurgical recovery

$$R_m = C_c / F_f \times 100\%$$

Contained valuable component recovered to concentrate.

9 Specific energy

$$SEC = kWh / dry\ t$$

Net electrical energy inside the boundary per dry tonne.

10 Water intensity

$$WI = \text{make-up } m^3 / dry\ t$$

Use net make-up water, not internal recirculating flow.

11 Plant availability

$$A = \text{operating } h / \text{scheduled } h \times 100\%$$

The contract must define planned stops and excluded delays.

No universal acceptance threshold

Compare each measured result with its approved design basis and contractual guarantee. Do not infer pass/fail from this reference.

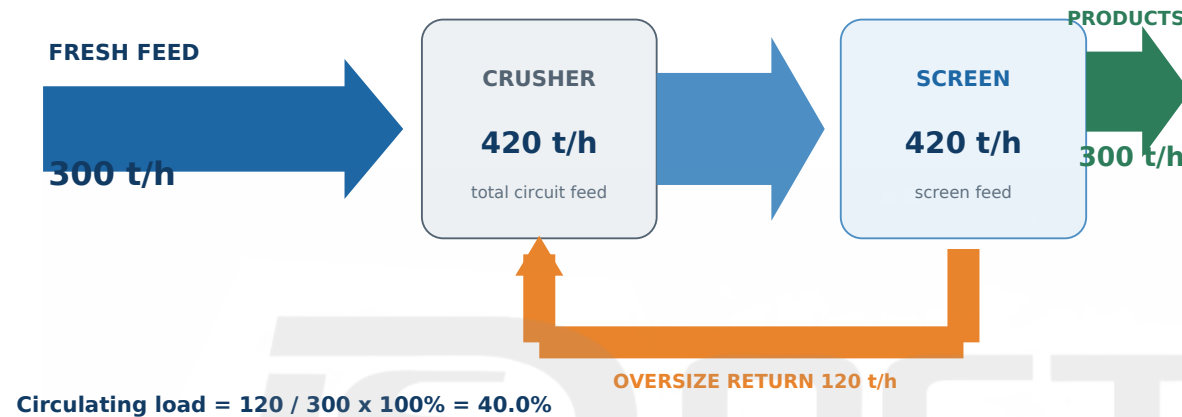
Crushing and Screening Mass Balance

Illustrative dry-basis example - every stream closes before performance is interpreted

ILLUSTRATIVE RESULT

Wet fresh feed = 318 t/h at 5.66% moisture; dry fresh feed = $318 \times (1 - 0.0566) = 300.0$ t/h.

Closed-circuit dry mass flow



Product split and closure

Final product	Dry flow	Fresh-feed share
0-5 mm	78 t/h	26.0%
5-10 mm	66 t/h	22.0%
10-20 mm	96 t/h	32.0%
20-31.5 mm	60 t/h	20.0%
Total final product	300 t/h	100.0%

Mass-balance check

Internal: $420 = 120 + 300$ t/h. External: 300 t/h fresh feed = 300 t/h final products.

Screen classification at one selected cut size

Stream	True oversize	True undersize	Stream total	Calculation
Screen feed	140 t/h	280 t/h	420 t/h	Measured size distribution
Overflow / return	112 t/h	8 t/h	120 t/h	$R_o = 112 / 140 = 80.0\%$
Undersize / product	28 t/h	272 t/h	300 t/h	$R_u = 272 / 280 = 97.1\%$
Overall effectiveness				$E = 0.800 \times 0.971 = 77.7\%$

Classification recovery must state the cut size, sampling basis and test uncertainty. A multi-deck plant requires a separate partition assessment for each relevant cut.

Grade and Recovery Calculation

Illustrative two-product metal balance - dry mass and compatible assays



Representative feed, concentrate and tailings samples support the metal balance; appearance alone does not establish grade.

Worked inputs - illustrative result

Dry feed $F = 1,000$ t at $f = 1.20\%$; dry concentrate $C = 100$ t at $c = 9.60\%$; dry tailings $T = 900$ t. Feed metal = 12.0 t and concentrate metal = 9.6 t.

Mass yield

$$Y = C / F \times 100\%$$

$$Y = 100 / 1,000 = 10.0\%$$

Metallurgical recovery

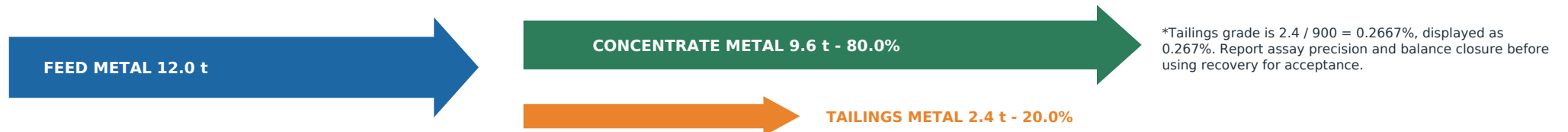
$$R_m = C_c / F_f \times 100\%$$

$$R_m = 9.6 / 12.0 = 80.0\%$$

Contained-metal balance

Stream	Dry mass	Assay grade	Contained metal	Mass share	Interpretation
Feed	1,000 t	1.20%	12.0 t	100.0%	Reference input
Concentrate	100 t	9.60%	9.6 t	10.0%	80.0% of feed metal recovered
Tailings	900 t	0.267%*	2.4 t	90.0%	20.0% of feed metal remains
Balance closure	1,000 t	-	12.0 t	100.0%	Feed = concentrate + tailings

Contained metal split



Energy, Water and Wear Accounting

Normalize resource and wear data to the same verified dry-tonnage basis

SPECIFIC ENERGY

1.90 kWh/t

4,560 kWh / 2,400 dry t during an 8.0 h illustrative test.

WATER INTENSITY

0.45 m3/t

1,080 m3 net make-up water / 2,400 dry t.

WEAR CONSUMPTION

0.020 kg/t

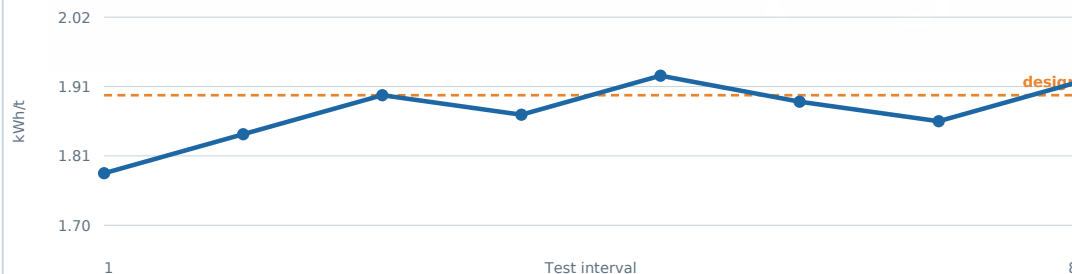
3,600 kg metal loss / 180,000 dry t over a liner campaign.



Accounting basis and worked results

Indicator	Recorded inputs	Illustrative calculation	Required boundary statement
Specific energy	Meter start/end; 4,560 kWh; 2,400 dry t	$4,560 / 2,400 = 1.90 \text{ kWh/t}$	List all included drives and auxiliaries
Water intensity	Net make-up flow total; 1,080 m3	$1,080 / 2,400 = 0.45 \text{ m3/t}$	Exclude internal recirculation; state rainfall and inventory change
Wear consumption	New 12,000 kg; discarded 8,400 kg; 180,000 dry t	$3,600 / 180,000 = 0.020 \text{ kg/t}$	Campaign basis; include hardfacing or replacement convention
Availability	666 operating h; 720 scheduled h	$666 / 720 = 92.5\%$	Define planned stops, external delays and standby
Utilization	666 operating h; 744 calendar h	$666 / 744 = 89.5\%$	Do not substitute utilization for contractual availability

Specific-energy stability during the illustrative test



Interpret the trend with throughput

A low kWh/t value is not automatically good if throughput, product size or recovery changed. Compare intervals only after feed conditions and operating settings are confirmed stable.

Acceptance rule

Design and guarantee values must come from the approved project documents; this page supplies calculation structure only.

Acceptance Test Record

Record conditions, traceability and approved comparison logic before assigning pass, review or fail

Test control record

Control item	Required record	Example status
Test window	Start/end time, stabilization period and excluded interruptions	Verified
Feed condition	Source, F80/F100, moisture, grade and observed variability	Verified
Operating condition	Crusher settings, screen apertures, liners, water and control mode	Fixed / logged
Sampling	Locations, increments, frequency, sample mass and preparation chain	Traceable
Instrumentation	Scale zero/span, power and flow meters, calibration date and uncertainty	In date



Timed sampling, weighing and sieve verification must share a traceable sample ID.

Result comparison - illustrative record structure

ILLUSTRATIVE RESULT

DESIGN VALUE

CONTRACT GUARANTEE

MEASURED VALUE

Metric	Design value	Contract guarantee	Measured value	Illustrative result	Basis / decision note
Dry throughput	300 t/h	≥ 285 t/h	296 t/h	PASS	Dry basis; defined feed and test window
Product passing 31.5 mm	95.0%	$\geq 90.0\%$	93.2%	PASS	Composite product sample; stated sieve method
Specific energy	1.90 kWh/t	≤ 2.10 kWh/t	1.94 kWh/t	PASS	Approved electrical boundary; dry tonnes
Metallurgical recovery	80.0%	Project-defined	79.4%	REVIEW	No pass/fail until guarantee and assay uncertainty are confirmed
Plant availability	92.0%	$\geq 90.0\%$	91.6%	PASS	Scheduled-time definition per illustrative contract

Decision authority

Only the signed test procedure and contract define guarantees, tolerances, retest rules and exclusions. An illustrative PASS above is not a universal criterion.

Record package

Attach raw meter files, sample register, laboratory reports, moisture corrections, calibration evidence, deviations and the approved mass balance.