CHAPTER 1
Definitions and important formulae used in sugar factories

The definitions presented in this section represent the most commonly used terms in the South African sugar manufacturing industry. No attempt has been made to include agricultural terms, as these would be beyond the scope of this document.

A number of important formulae have been included in this section. Where relevant, references to the original author's work have been included to facilitate any further referencing of the calculations/derivations.

AFFINATION

The removal of the layer of molasses from raw sugar crystals through the addition of a syrup and then centrifuging – with or without wash water.

ASH

Carbonated ash: the residue remaining after incineration of a sample at 650°C.
Sulphated ash: the residue remaining after incineration of a sample that was pretreated with sulphuric acid at 650°C.
Conductivity ash: the figure arrived at by correlating the specific conductance of a sample in solution with its *sulphated ash* value.

BAGACILLO

Very small particles of *bagasse* separated either from pre-clarification juices or from final *bagasse*. *Bagacillo* is mainly used as a filter aid with rotary vacuum filters and thus forms part of *filter cake*.

BAGASSE

The fibrous residue obtained after crushing cane in a mill is referred to as *bagasse*. Depending on the number of the mill it is obtained from, the *bagasse* is referred to as first mill *bagasse*, second mill *bagasse*, etc. The residue obtained after a diffuser is called diffuser *bagasse* or *megasse*. The final residue obtained from a milling train or from the dewatering mills of a diffusion plant is called final *bagasse* but is generally referred to simply as *bagasse*.

BAGASSE EXTRACT

For the calculation of *pol* and *Brix* in *bagasse*, a sample of *bagasse* is blended with water in a cold digester, filtered and analysed. The liquid fraction so obtained is referred to as *bagasse extract*.

BOILING HOUSE

The *boiling house* refers to the section of the factory in which mixed juice is converted to raw sugar. It is also referred to as the back-end or *raw house*.

BOILING HOUSE RECOVERY

Boiling house recovery (BHR) is the ratio of *pol* actually recovered in *sugar* to *sucrose* (or *pol*) in *mixed juice* expressed as a percentage. If based on *pol* in *mixed juice* this value is referred to as Boiling House Pol Recovery.

BROWN LIQUOR

A refinery liquor after the primary decolourisation process.

BRIX

Brix is also referred to as soluble solids.

Brix is the percentage by mass of soluble solids in a pure sucrose solution. In all other sugar-containing solutions *Brix* represents the apparent solids according to the *Brix* scale. The term *Brix* is used as if it was a real material and is used in calculations as a measure of substance, *e.g.* tons Brix.

Refractometer Brix is the solids concentration by mass of a sucrose-containing solution obtained using a refractometer. The measurement is based on the relationship between the refractive index and the percentage by mass of total soluble solids of a pure aqueous sucrose solution at 20°C measured in degrees Brix (°Bx) (refer to Table 3 in the Appendix).

Refractometer Brix is also referred to as refractometer solids or refractive dry solids (RDS).

BRIX FACTOR

See *DAC Factors*

BRIX-FREE WATER

Brix-free water is the sorption water associated with the fibre in *cane* and *bagasse*. In some respects this water behaves in a manner similar to water of hydration and is not available for dissolving sucrose. This water can be driven off at elevated temperatures but the fibres will rehydrate when left exposed to atmospheric humidity. In general, the amount of *Brix-free water* is assumed to be 25% on dry *fibre*.

BULK DENSITY

Bulk density is the mass of material per unit of volume occupied. Some useful values are:

Shredded cane on the carrier	280 kg/m^3
Cut whole stick cane loosely piled	200 kg/m^3
Chopped cane from harvesters	350 kg/m^3
Piled bagasse	200 kg/m^3
Piled raw sugar	880 kg/m^3

CANE TO SUGAR RATIO

The *cane to sugar ratio* refers to the tons cane required to produce one ton of *tel quel sugar*.

CARBONATATION/CARBONATION

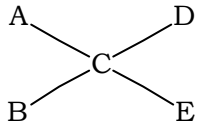
Carbonatation is the process of colour removal through the introduction of CO_2 gas into a juice or syrup. A crystalline calcium carbonate floc is formed which on precipitating removes non-sugar (colour) bodies. The term *carbonation* is sometimes also used.

CLARIFICATION

Clarification is the process in which suspended matter and air are separated from mixed juice, traditionally by *liming,* heating and *flashing*, to produce *clear juice*. The combination of *liming*, heating and *flashing* is called *defecation.*

COBENZE'S DIAGRAM

This diagram is used in boiling schemes for the calculation of the relative quantities of two products to give a mixture of the required purity according to:



where A ≡ purity of product 1
B ≡ purity of product 2
C ≡ purity wanted for the mixture
D ≡ quantity of product 1
E ≡ quantity of product 2

C - B = D
A - C = E

CONSIGNMENT

A *consignment* of *cane* refers to the total batch of similar *cane* delivered by a single grower at any one time. In the cane payment system, a consignment is assigned a single set of analytical results.

CORRECTED REDUCED BOILING HOUSE RECOVERY (CRB)

The *Corrected Reduced Boiling House Recovery* (CRB) formula provides an indication of the *Boiling House Recovery* (BHR) given a constant cane quality. This yields a recovery index independent of cane quality, allowing for inter-factory comparisons. The formula incorporates an *SJM recovery* calculated using a mixed juice purity of 85%, and a molasses purity as per the *TPD* formula.

$$CRB = BHR - 100 \times \frac{S \times (J - M)}{J \times (S - M)} \times \frac{49.8 - TPD}{0.5493 - 0.008543 \times TPD}$$

where BHR ≡ actual sucrose *boiling house recovery* obtained
S ≡ actual *sugar purity*
J ≡ actual mixed juice *purity* (gravity purity)
M ≡ actual final molasses gravity *purity*

TPD ≡ the *target purity difference* given by the difference between the actual molasses purity and a target molasses purity as calculated by the *target purity* formula, but using the mixed juice *reducing sugars to ash ratio*

Lionnet GRE and Koster KC (1986). A boiling house recovery formula independent of juice quality. *Proc S Afr Sug Technol Ass*, 60: 30 - 32.

CORRECTED REDUCED EXTRACTION (CRE)

The *Corrected Reduced Extraction* (CRE) formula provides an indication of the *Extraction* given a constant cane quality (13.0 pol % cane and 15.5 fibre % cane). It attempts to provide an extraction index independent of cane quality, allowing for inter-factory comparisons.

$$CRE = 100 - 0.03936 \times \frac{(100 - E) \times (100 - F)\, P^{0.6}}{F}$$

where E ≡ pol extraction
F ≡ fibre % cane
P ≡ pol % cane

Rein PW (1975). A statistical analysis of the effect of cane quality on extraction performance. *Proc S Afr Sug Technol Ass*, 49: 43 - 48.

CRYSTAL CONTENT

The *crystal content* of a sample is the percentage by mass of crystalline *sugar* present in a *massecuite*, *magma* or similar material.

The formula for the calculation of the *crystal content* of a *massecuite* is as follows:

$$\text{Crystal Content} = \frac{\text{massecuite purity - molasses purity}}{100 - \text{molasses purity}} \times \text{massecuite Brix}$$

Note that the molasses purity used in the formula is the *nutsch purity*, and not the centrifugal molasses purity.

CRYSTAL RECOVERY (XRE)

A measure of the efficiency of a factory (cane to sugar), taking into account cane quality (including the type of non-sucrose in the incoming cane). It is calculated by dividing the actual quantity of crystal produced as sugar, by the theoretical crystal that could have been recovered from the cane.

$$XRE = 100 \times \left[\frac{T_x}{T_c} \times \left(\frac{100}{MERC\ \%\ cane - (1 - a) \times S} \right) \right]$$

and

$$MERC\ \%\ cane = S - b \times N - c \times F$$

where MERC ≡ modified *estimated recoverable crystal (ERC)* formula
T_x ≡ tons crystal actually produced

T_c	≡	tons cane
S	≡	sucrose % cane
N	≡	non-pol % cane
F	≡	Fibre % cane
a	≡	'a' parameter from the *ERC* formula
b	≡	adjusted 'b' parameter from the *ERC* formula; accommodates the reducing sugars to ash ratio in molasses
c	≡	'c' parameter from the *ERC* formula

Peacock SD and Schorn PM (2002). Crystal recovery efficiency as an overall measure of sugar mill performance. *Proc S Afr Sug Technol Ass,* 76: 544 - 560.

CUSH-CUSH

The fibrous material removed from mill juice by *screening*.

DAC

DAC stands for the *Direct Analysis of Cane*. The direct analysis of cane comprises the calculation of the percentages of pol, Brix and fibre in cane by direct analyses of the moisture in cane, and the pol and Brix in *DAC extract*.

DAC EXTRACT

DAC extract is obtained by blending a cane sample with water in a 1:2 ratio in a cold digester, digesting for a fixed period, and then decanting, filtering and analysing the resulting mixture.

DAC FACTORS

Brix factor: the percentage ratio of the total Brix in mixed juice corrected for suspended solids - and where applicable corrected for clarifier mud returns - plus the total Brix in final bagasse to the total Brix in cane as determined by the direct analysis of cane (*DAC*).

$$\text{Brix factor} = \frac{\text{tons Brix in mixed juice (corrected)} + \text{tons Brix in bagasse}}{\text{tons Brix in cane by DAC}} \times 100$$

Pol factor: the percentage ratio of the total pol in mixed juice corrected for suspended solids - and where applicable corrected for clarifier mud returns - plus the total pol in final bagasse to the total pol in cane as determined by the direct analysis of cane (*DAC*).

$$\text{Pol factor} = \frac{\text{tons pol in mixed juice (corrected)} + \text{tons pol in bagasse}}{\text{tons pol in cane by DAC}} \times 100$$

DEFECATION

Defecation is the traditional method of using *liming,* heating and *flashing* for the *clarification* of mixed juice.

DEXTRAN

Dextran generally refers to a polysaccharide consisting of glucose units linked predominantly in α-1,6 positions and is mainly produced by microbial activity such as the lactic acid bacteria, *Leuconostoc mesenteroides*. Dextran formation is accompanied by *sucrose* loss.

DEWATERING

The removal of a liquid (generally a low Brix juice) from bagasse. Commonly applied to mill units after a diffuser (dewatering mills).

DISPLACEMENT RATE INDEX (DRI)

A measurement of the preparation of shredded cane. In this technique, a sample of prepared cane is washed, and the amount of Brix extracted is determined by conductivity measurements over a fixed period.

Typical DRI values for variously prepared cane samples are:

DRI Value	*Comments*
5	Very fine preparation
5-7 (6)	Well prepared cane (target value)
12	Coarsely prepared cane

DRY SOLIDS

Also referred to as total solids, dry substance or solids by drying.

Dry solids is the material remaining after drying a product to constant mass, or for a specified period. The mass of dry substance can also be found by deducting from the mass of the product the mass of total moisture, as determined using vacuum oven drying or the Karl Fischer method. This is known respectively as *vacuum oven dry solids* or *Karl Fischer dry solids*.

ESCRIBED VOLUME

The volume escribed by a pair of mill rolls in a given time. It is equal to the roller length (in metres) multiplied by the work opening (in metres) multiplied by the surface speed of the rolls measured at the mean circumference (in metres per second) and is expressed in m^3/sec.

ESTIMATED RECOVERABLE CRYSTAL

Estimated recoverable crystal (ERC) is an index indicating cane quality by calculating the percentage of crystal recovery that is actually possible from the given sample of cane.

$$\text{ERC \% cane} = a \times S - b \times N - c \times F$$

where S ≡ sucrose % cane
N ≡ non-pol % cane
F ≡ fibre % cane
a ≡ constant representing the fraction of sucrose leaving the factory in bagasse, sugar or molasses; it therefore

represents the loss of pol in filter cake and sucrose in undetermined loss

b ≡ constant representing the loss of sucrose in molasses per unit non-sucrose in cane

c ≡ constant representing the loss of pol in bagasse per unit fibre in cane

Factors a, b and c differ slightly from one season to the next, and the values are recalculated at the end of every season using weighted averages and assuming that ERC is equal to the total crystal production of the industry.

van Hengel, A (1974). Proposal for the evaluation of cane and sugar in identical units at standardised efficiency. *Proc Int Soc Sug Cane Technol*, 15: 1446 - 1455.

EXHAUSTION

Exhaustion is a measure of the recovery of sucrose in crystalline sugar form across a particular boiling station (A, B or C).

$$\text{Exhaustion} = \frac{100 \times (\text{massecuite purity - molasses purity})}{\text{massecuite purity} \times (100 - \text{molasses purity})} \times 100$$

Note that the molasses purity referred to here is the molasses obtained from the centrifugals.

Massecuite exhaustion is a measure of the recovery of sucrose in crystalline sugar form from across a massecuite. The molasses purity in this instance would be the massecuite *nutsch purity*.

EXTRACTION

Extraction is the ratio of sucrose (or pol) in mixed juice to sucrose (or pol) in cane expressed as percentage and is an indication of the theoretical efficiency of the extraction process. If based on pol this value is referred to as *pol extraction*.

$$\text{Extraction} = \frac{\text{tons sucrose (pol) in mixed juice}}{\text{tons sucrose (pol) in cane}} \times 100$$

FACTORY PERFORMANCE INDEX

The Factory Performance Index (FPI) is an index used to rate the overall performance of a factory, and is defined as the ratio of tons crystal in sugar produced to tons *estimated recoverable crystal* in (ERC) cane expressed as a percentage.

$$\text{FPI} = \frac{\text{tons crystal in sugar produced}}{\text{tons estimated recoverable crystal in cane}} \times 100$$

and

$$\text{tons crystal in sugar produced} = \frac{\text{tons raw sugar} \times \text{crystal \% raw sugar}}{100}$$

and

$$\text{crystal \% raw sugar} = 1.724\ P + 0.724\ M - 72.4$$

where P ≡ pol % raw sugar
M ≡ moisture % raw sugar

and

$$\text{tons estimated recoverable crystal in cane} = \frac{\text{tons cane} \times \text{ERC}}{100}$$

and

$$\text{ERC \% cane} = a \times S - b \times N - c \times F$$

where ERC ≡ estimated recoverable crystal
S ≡ sucrose % cane
N ≡ non-pol % cane
F ≡ fibre % cane
a ≡ 'a' parameter from the *ERC* formula
b ≡ 'b' parameter from the *ERC* formula
c ≡ 'c' parameter from the *ERC* formula

van Hengel, A (1974). Proposal for the evaluation of cane and sugar in identical units at standardised efficiency. *Proc Int Soc Sug Cane Technol,* 15: 1446 - 1455.

FIBRE

Fibre is the water-insoluble matter of *cane* and *bagasse* from which the *Brix-free water* has been removed by drying.

Where associated with *Brix-free water*, *fibre* is often called natural fibre.

FILTER CAKE

Filter cake is the bulk residue removed by the filter station and includes *mud* and any filter aid such as *bagacillo*.

FINE LIQUOR

A low colour refinery liquor prior to concentration in an evaporator set. This liquor is usually obtained after a secondary decolourisation process in the refinery.

FLASHING

Flashing is the process in which the juice is heated in a closed system to just above its boiling point and flashed by sudden release of the built up pressure in order to remove unwanted dissolved air. *Flashing* forms part of the *clarification* process.

FRUCTOSE

Fructose (also known as fruit sugar) is a monosaccharide and a *reducing sugar*.

GAS CHROMATOGRAPHY

Generally referred to as GC, *gas chromatography* is a widely known technique to very accurately determine the quantity of a specified substance in a sample. GC is routinely used in the Southern African sugar industry to determine the amount of *sucrose*, *fructose* and *glucose* in mixed juice.

GLUCOSE

Glucose (also known as grape sugar) is a monosaccharide and a *reducing sugar*.

GUMS

Gums is a heterogeneous group of compounds that form a precipitate on addition of acidified alcohol and includes natural sugar cane polysaccharides such as starch, deterioration polysaccharides such as dextran, other organic compounds such as waxes, some inorganic compounds (ash) and protein.

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Generally referred to as HPLC this is a widely known technique to very accurately determine the quantity of a specified substance in a sample. HPLC is routinely used in the Southern African sugar industry to determine the amount of *sucrose*, *fructose* and *glucose* in molasses.

IMBIBITION

Imbibition is the process in which water or juice is put on bagasse to mix with and dilute the juice present in the bagasse. The water so used is termed imbibition water. General terms in use are: single imbibition, double imbibition, compound imbibition, depending on the manner in which the water and/or juice is added.

IMPURITIES

Impurities generally refer to any substances present other than the main specified substance.

INTERMIXED CANE

Intermixed cane refers to that portion of *cane* on a cane carrier originating from the overlapping of different *consignments*. Its composition is unlikely to be representative of any one *consignment* and it is therefore excluded from consignment sampling.

INSOLUBLE SOLIDS

The mass of solids that does not dissolve in water at elevated temperatures expressed as percentage on sample (in case of sugars) or percentage on Brix (in case of juices/syrups). *Insoluble solids* are also sometimes referred to as suspended solids.

INJECTION WATER

Cooling water used in pan or evaporator condensers.

INVERT SUGAR

A 1:1 mixture of *glucose* and *fructose* obtained by the hydrolysis or inversion of *sucrose*.

JAVA RATIO

The percentage ratio of pol % cane to pol % first expressed juice.

Note: In calculating an average pol % first expressed juice, the weighting given to the individual analyses is on the basis of the tons cane from which the respective first expressed juice samples were taken.

JETS

A *jet* is the mother liquor separated from a refined *massecuite* by mechanical means (centrifugation). It is distinguished by the same prefixes as the *massecuites* from which it is separated (1st, 2nd, 3rd or 4th). The final *jet* returned to the *raw house* in a back-end (annexed) refinery is termed *return syrup.* In some industries, jets are known as *run-offs* (1st run-off, 2nd run-off, etc) or greens. In the South African industry, the term *jet* is preferred.

JUICE

Absolute juice: a hypothetical juice, the mass of which is equal to the mass of cane minus the mass of fibre. It comprises all the dissolved solids in the cane plus the total water in cane.
Clarified juice: the juice obtained as a result of the clarification process.
Diffuser juice, also called draught juice: the juice that is withdrawn from a cane or bagasse diffuser.
First expressed juice: the juice expressed by the first two rollers of a tandem.
First mill juice: the juice expressed by the first mill of a tandem.
Last expressed juice: the juice expressed by the last two rollers of a tandem.
Last mill juice: the juice expressed by the last mill of a tandem.
Primary juice: all the juice expressed before dilution begins.
Residual juice: the juice left in intermediate or final *bagasse*.
Secondary juice: the diluted juice which, together with the primary juice, forms the mixed juice.
Mixed juice: the mixture of primary and secondary juices from the extraction plant delivered into the juice scales.
Press water: the juice expressed in dewatering diffuser *bagasse*.
Undiluted juice: all the *juice* existing as such in the *cane*; its mass is equal to the mass of *cane* minus the combined mass of *fibre* and *Brix-free water*.

LIMING

The addition of lime to *mixed juice* for the purpose of *clarification*.

MACERATION

In the South African sugar industry the term is synonymous with imbibition. *Imbibition* is the preferred terminology.

MAGMA

Magma is a mixture of crystals and sugar liquor produced by mechanical means. Magma is often used as a seed or footing in the vacuum pans.

MASSECUITE

Massecuite is the mixture of crystals and mother liquor discharged from a vacuum pan. *Massecuites* are classified in order of descending purity as A, B, C in raw factories, or first, second, third, fourth in refineries.

MEGASSE

The bagasse obtained from the discharge of a diffuser before it is dewatered in the dewatering mills.

MELT

Melt generally refers to dissolved raw sugar prior to the decolourisation steps in a refinery.

MELTING

The dissolving of sugar crystals – either raw or refined – using hot water (usually condensate). Steam (low grade vapours) is also often added into the vessel – the remelter - where the melting is done. *Melting* is a misnomer, as the intention is to dissolve the sugar, and not melt it in the true sense of the word (*i.e.* convert the crystal to the liquid phase).

MILLING HOUSE

The *milling house* is that portion of the factory where the extraction equipment is situated. In the extraction plant *sugar cane* is separated into *juice* and *bagasse.*

MILL SETTINGS

Mean circumference: mean diameter $\times \pi$.

Mill ratio: the ratio of feed to discharge work openings.

Set opening: the distance between the circumferences escribed by the mean diameters of the top roller and feed or discharge roller with the mill running empty. This definition applies *pari passu* for the openings between underfeed and top roller and between pressure feeder rollers.

The mean diameter of a grooved roller is equal to the diameter of the equivalent (same volume and length) solid roller. In practice the arithmetic mean of the diameters over the

tips of the teeth and at the roots of the grooves (neglecting any Messchaert grooves) affords a sufficiently close approximation.

Work opening: the work opening is equal to the set opening plus the increase in distance between the rollers resulting from the lift during milling operations.

MILLING LOSS

Milling loss is the ratio of pol in bagasse to fibre in bagasse expressed as percentage.

MOLASSES

Molasses is the mother liquor separated from a *massecuite* by mechanical means (centrifugation). It is distinguished by the same prefixes as the *massecuites* from which it is separated (A, B or C).

Final molasses: The mother liquor separated from the final massecuite by mechanical means. *Final Molasses* can be used as a cattle feed supplement or as a feedstock in ethanol plants.

MOTHER LIQUOR

Liquid phase in the massecuite after crystallisation.

MUD

Mud is the material removed from the bottom part of the clarifiers and contains the settled *insoluble solids* that are separated from *mixed juice* during *clarification*.

NON-POL

Non-pol is that part of the *Brix* which is not *pol*. It is often referred to as if it were a real substance.

NON-POL RATIO

The ratio of *non-pol* in *sugar* plus *non-pol* in *final molasses* to *non-pol* in *mixed juice*.

NON-SUCROSE

Non-sucrose is that part of the *dry substance* which is not *sucrose*. It is often referred to as if it were a real substance.

NORMAL MASS

The mass of sample equal to the normal mass of sucrose.

That mass of pure dry sucrose which, when dissolved in water to a total volume of 100.0 cm^3 at 20.0°C and read at the same temperature in a 200 mm tube at 546 nm, gives a reading of 100.00°Z on a saccharimeter scale. According to the International Sugar Scale

the normal mass of sucrose is 26.000 g in air under normal conditions (26.0160 g *in vacuo*).

NUTSCH SAMPLE

A *nutsch sample* is any sample of *molasses* that is separated from a *massecuite* at any time prior to curing of the *massecuite* in the factory centrifugals, and is obtained for the purpose of analysis. In the South African sugar industry, the device used in the separation of the molasses and crystal is termed a nutsch filter.

OLIGOSACCHARIDES

Oligosaccharides are polymers of low molecular mass in which the units are mainly pentoses and/or hexoses.

OVERALL RECOVERY

The *Overall Recovery* is the ratio of pol actually recovered in sugar to sucrose (or pol) in cane expressed as a percentage. If based on pol in cane this value is referred to as Overall Pol Recovery.

$$\text{Overall Recovery} = \frac{\text{tons pol in sugar}}{\text{tons sucrose (pol) in cane}} \times 100$$

PITH

Pith is that portion of *fibre* that consists of the finer particles of *bagasse*, particularly between 120 and 850 microns.

POL

The apparent sucrose content of any substance determined by a polarisation method and expressed as a percentage by mass or in degrees Z (°Z). The term is used as if it were a real substance.

POL FACTOR

See *DAC Factors*

POLYSACCHARIDES

Polysaccharides are polymers of medium to high molecular mass in which the units are mainly pentoses and/or hexoses.

PREPARATION INDEX

The *Preparation Index* (PI) is the ratio of Brix in the ruptured cells to total Brix in cane expressed as a percentage. PI is an empirical method and uses the ratio of the Brixes obtained using two different cane preparation methods.

PURITY

The percentage ratio of sucrose (or pol) to the total soluble solids (or Brix) in a sugar product. The following terms are in general use:

$$\text{Apparent purity} = \frac{\text{Pol}}{\text{Brix}} \times 100$$

$$\text{Gravity purity} = \frac{\text{Sucrose}}{\text{Brix}} \times 100$$

$$\text{True purity} = \frac{\text{Sucrose}}{\text{Total solids}} \times 100$$

In order to specify purity without ambiguity it is necessary to indicate the methods used to determine both the numerator and denominator in obtaining the result.

Refractive apparent purity: the percentage ratio of pol to refractometer Brix.

GC or HPLC sucrose refractometer Brix purity: the percentage ratio of chromatographic (GC or HPLC) sucrose to refractometer Brix.

Target purity (TP) is a reference purity of final molasses which takes the effect of non-sucrose on *exhaustion* into account.

Target purity difference (TPD) is the difference between the *true purity* as determined by chromatographic (GC or HPLC) sucrose and Karl Fischer *dry solids,* and the *target purity.*

RAW HOUSE

The *raw house* refers to the section of the factory in which mixed juice is converted to raw sugar. It is also referred to as the back-end or *boiling house*

RECOVERABLE VALUE (RV)

RV forms the basis of the cane payment system in South Africa. It represents the total value of the cane that may be recovered in the factory. The value of the molasses produced, as well as the sugar, is incorporated into the formula.

$$\text{RV \% cane} = S - d \times N - c \times F$$

where	S	≡	sucrose % cane
	N	≡	non-sucrose % cane
	F	≡	fibre % cane
	d	≡	relative value of sucrose which each unit of non-sucrose diverts from sugar production to molasses
	c	≡	loss of sucrose per unit of fibre (same as the *ERC* 'c' factor)

The formula is similar to the *ERC* format; note that the 'a' factor has been dropped on the principle that the grower does not have control over filter cake and undetermined losses.

The 'd' factor is recalculated monthly, as the values (prices) of sugar and molasses are not constant. The 'c' factor is recalculated at the start of each season. The mass of recoverable value is calculated in terms of the procedures contained in the Official Methods (Chapter 6, Section 1).

REDUCING SUGARS

Reducing sugars (RS) refer to saccharides that reduce Tollens' or Fehlings' reagents. While all monosaccharides and most disaccharides are *reducing sugars,* the term as it is used in sugar milling mainly refer to *glucose* and *fructose,* as apposed to *sucrose* which is a non-reducing sugar.

REDUCING SUGAR TO ASH RATIO

The *reducing sugar to ash ratio* refers to the ratio of *reducing sugars* to *conductivity ash* in a sample.

REDUCING SUGAR TO POL RATIO

The *reducing sugar to pol ratio* refers to the ratio of *reducing sugars* to *pol* expressed as percentage and is often referred to as the reducing sugar ratio.

REFINERY

The *refinery* is where *raw sugar* is converted into *refined sugar*. If a refinery is attached to a cane sugar mill, it is referred to as a *back-end (or annexed) refinery*.

REMELT

Remelt consists of a solution of dissolved sugars. This term is generally applied to B- and C-sugars returned to syrup for further processing.

RETURN SYRUP

The final *jet* in a back-end (annexed) refinery that is returned to the *raw house*.

RUN OFF

The mother liquor separated from a refined *massecuite* by mechanical means. An alternative name for *jets*.

SAFETY FACTOR

The safety factor is a number designed to indicate the probable keeping quality of a fresh raw sugar that has a pol of less than 99.0°Z. It is calculated using the formula below.

$$\text{Safety factor} = \frac{\text{moisture \% sugar}}{(100 - \text{pol \% sugar})}$$

For satisfactory keeping quality the safety factor should have a value less than 0.23.

SATURATED SOLUTION

A *saturated solution* is a solution which would not visibly dissolve or crystallise solute in the presence of undissolved solute.

SCREENING

Juice collected from the mills contains particles of *bagasse/bagacillo* that require removal prior to juice *clarification*. Removal of these particles to be collected as *cush-cush* by means of a screen is referred to as *screening*.

SJM RECOVERY

The theoretical recovery of sucrose from a given juice or syrup. Note that undetermined loss is not accommodated in the calculation.

$$\text{SJM Recovery} = \frac{S \times (J - M)}{J \times (S - M)} \times 100$$

where S ≡ expected purity of the sugar
J ≡ purity of the juice/syrup in question
M ≡ expected molasses purity

SOIL IN CANE OR BAGASSE

Soil refers to the sand that enters a factory together with the cane. While there is no method to determine the amount of *soil*, an indirect method is use to estimate the *soil* in *cane* or *bagasse* by comparing the *ash* content of a sample to the *ash* content of a 'clean' sample. If the ash content of a clean sample is not available, then a value of 0,5% is assumed.

SOLUBILITY

Solubility refers to the concentration of a solute in a solvent in a *saturated solution*. The *solubility* is dependent on the temperature of the solution and the nature and concentration of impurities. The *solubility* of pure *sucrose* in pure water at 20°C is 66.61 g per 100 g water (refer to Table 2 in the Appendix).

SOLUBILITY COEFFICIENT OF SUCROSE

The *solubility coefficient of sucrose* is the ratio of the *solubility* of *sucrose* in a sample to the *solubility* of *sucrose* in pure water at the same temperature (both expressed as gram sucrose per gram water).

SUCROSE

Sucrose is the pure disaccharide α-D-glucopyranosyl-β-D-fructofuranoside, commonly referred to as *sugar*. Sucrose is the only non-reducing disaccharide, which may account for its unique properties and applications. A sucrose molecule comprises one fructose and one glucose monosaccharide.

In the South African Sugar Industry sucrose is determined by gas chromatography (GC) and high performance liquid chromatography (HPLC).

SUGAR

Sugar is the main product of a sugar factory consisting of crystals of *sucrose* as removed from a massecuite and containing a number of *impurities*, depending on the type of sugar.

Refined sugar:	The final product of a sugar refinery
Raw sugar:	The final product of a sugar mill
Very high pol sugar (VHP):	Raw sugar with a pol of not less than 99.3°Z
High pol sugar (HP):	Raw sugar with a pol between 98.0 and 99.3°Z
Low pol sugar (LP):	Raw sugar with a pol below 98.0°Z
Low colour sugar (LC):	Raw sugar with a colour below 900 IU
Brown sugar:	Raw sugar for direct consumer use
Tel quel sugar.	Bulk raw sugar without reference to its quality

SUGAR CANE

Sugar cane is botanically a tall grass of the type *Saccharum* and agriculturally the crop produced from hybrids that are the descendants of a number of Saccharum species commonly referred to as sugar cane and is the raw material accepted at the cane sugar mill for processing.

Clean cane stalk: cane which has been cut above the highest subterranean roots, has been topped below the level of the growing point, has no leaves or adhering foreign matter and has not died or dried out.

Cane tops: the portion of the stalk above the natural breaking point, plus all green leaves and sheaths attached to that part of the stalk.

Extraneous matter: any solid material delivered with clean cane stalk, including dead and dried out stalks.

Trash: leaves and sheaths delivered with the clean cane stalk.

SUPERSATURATION COEFFICIENT OF SUCROSE

The ratio of the concentration of sucrose in the sample to the solubility of sucrose in the sample at the same temperature (both expressed as gram sucrose per gram water).

SYRUP

Concentrated clear juice leaving the evaporator station and generally having a Brix of between 60° and 70°Bx is referred to as *syrup*.

TARGET PURITY

The theoretical *true purity* of *final molasses* that can be obtained, taking into account the reducing sugar and ash content of the molasses.

$$\text{TargetPurity} = 43.1 - 17.5 \times (1 - e^{-0.74 \times (F+G/ash)})$$

where F ≡ fructose % final molasses
G ≡ glucose % final molasses
ash ≡ ash % final molasses (conductivity ash)

Smith, IA (1995). Exhaustibility of molasses with very low reducing sugar levels. *Proc S Afr Sug Technol Ass,* 69: 163 - 165.

TARGET PURITY DIFFERENCE (TPD)

The difference between the actual true purity of *final molasses* obtained in the factory and the theoretical *target purity*.

TEL QUEL SUGAR

Bulk raw sugar without reference to its quality

THICK LIQUOR

A refinery liquor concentrated up in an evaporator set, prior to being boiled in a pan.

VALUE RECOVERY (VR)

An overall factory performance indicator, compensating for cane quality, and using *Recoverable Value* (*RV)* as a base.

A Derived Value (DV) is calculated which represents the recovered value of both the sugar and molasses produced. The Derived Value divided of Recoverable Value produces the Value Recovery (VR)

$$VR = \frac{DV}{RV} \times 100$$

and

$$DV = X + (P_m / P_{c)}) \times M + (1 - a) \times S$$

where $X \equiv$ crystal in sugar produced % cane
$S \equiv$ sucrose % cane
$M \equiv$ molasses % cane
$a \equiv$ 'a' parameter in the *ERC* formula
$P_m \equiv$ average price of molasses for the period
$P_s \equiv$ average price of sugar for the period

WASH

Wash is the diluted liquor thrown off by the centrifugals during washing and/or steaming of *massecuites,* or the total liquor separated from a *magma*.