

# Development of the new beet extraction technology by Fives Cail – the TowerMax and EcoMixer

## Neue Extraktionstechnologie für Zuckerrüben von Fives Cail – TowerMax und EcoMixer

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Fives Cail developed a tower extraction system with own technology. The extraction plant comprises both the TowerMax tower extractor and the EcoMixer countercurrent cossette mixer for the solid/liquid extraction of the sucrose from the cossettes as well as peripheral equipment (heaters, foam separator, pulp strainers and sand removers). The extraction plant is operated and controlled from panels on which all instruments are connected. The extraction equipment has been designed for minimal maintenance. This paper describes the sustainable industrial development of this new technology by adhering to the principles of the Fives Cail Group of reliability, performance, automation, energy savings and client satisfaction.

**Key words:** extraction, countercurrent mixer, tower extractor, Fives Cail

Fives Cail hat eine neue Turm-Extraktionsanlage entwickelt. Diese umfasst den Extraktionsturm TowerMax und die Gegenstromschnitzelmaische EcoMixer zur Fest/Flüssig-Extraktion der Saccharose aus den Rübenschnitzeln sowie periphere Anlagen (Wärmeübertrager, Schaumabscheider, Pülpe- und Sandabscheider). Die Anlage wird bedient und überwacht mittels PLC(programmable logic controller)-Steuerung, mit der alle Apparate verbunden sind. Die Extraktionsanlage wurde für eine minimale Instandhaltung ausgelegt. Der Beitrag beschreibt die nachhaltige Entwicklung der neuen Technologie – entsprechend den Richtlinien der Fives Cail-Group: Sicherheit, Leistungsfähigkeit, Automatisierung, Energieeinsparung und Kundenzufriedenheit.

**Stichwörter:** Extraktion, Gegenstrom-Schnitzelmaische, Extraktionsturm, Fives Cail

### 1 Introduction

Throughout the history of the Fives Cail Group from the conception of the company through to today the company has been involved in the design and supply of equipment for the extraction of sugar from either sugarbeet or sugarcane. At the beginning of the development of continuous extraction of sugar from beet the Fives Cail Group started to build RT type extractors. Rapidly the Fives Cail Group became the world leader in the design and development of this technology with over 240 references worldwide. Later the first tower extractor was developed (*Hempelmann, 1999*) and Fives Cail manufactured and installed several countercurrent cossette mixers and tower extractors in the late 1970's and early 1980's.

Fives Cail continue to support RT extractors and have carried out many projects to maintain and improve the performance of RTs' including increasing their throughput by over 2.0 times their original nominal design capacity.

In 2005 and 2006 the Fives Cail Group along with its partners Maguin S.A.S of France and O.E.P of Turkey built a new 10,000 t beet/d green field sugar factory at Bogazliyan in Turkey. This factory is composed with all the latest equipment, designed to the highest standards in terms of reliability, performance, automation and energy consumption (*Le Maout and Dedole, 2007*).

For that reference, one area of key equipment in the beet sugar process that was missing from the range of equipment which the Fives Cail Group could provide its customers with was the tower extraction system. The Fives Cail Group would like to propose to

its customers a global approach to the design of the beet sugar process and to be able to offer them the full range of equipment which will meet all customers requirements, so the decision was taken to develop the tower extraction system with Group's own technology allowing the Group to offer the full range of equipment. The tower extraction system designed provides this in terms of extraction performance, overall energy consumption, space requirement and capital costs as for all Fives Cail Group equipment.

This paper describes the sustainable industrial development of this new technology by adhering to the principles of the Fives Cail Group of reliability, performance, automation, energy savings and client satisfaction. Fives Cail has used its considerable knowledge in the extraction process, in mechanical design know how, experience in local manufacture and past experience with tower extractors to complete the development of this equipment.

### 2 General description

The extraction plant comprises the TowerMax tower extractor, the EcoMixer countercurrent cossette mixer and peripheral equipment (heaters, foam separator, pulp strainers and sand removers), see Figure 1. Fives Cail offers a range of plants starting from 4,000 t beet/d to 14,000 t beet/d which cover all market demands (see Table 1). The TowerMax is a countercurrent tower extractor which comprises a base with shaft support and bearings, vertical and horizontal screens, cossettes inlets and juice outlets, an extraction zone

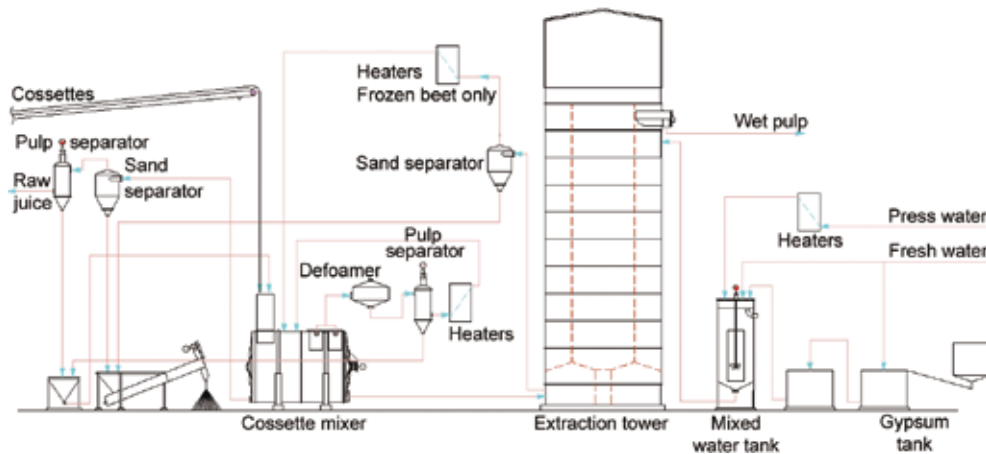


Fig. 1: Extraction plant equipment

Capacity t beet per day	TowerMax® External diameter	EcoMixer® Diameter – in m –	EcoMixer® Length
4,000	6.7	4.3	7
6,000	8.0	5.1	8
8,000	9.3	5.9	8
10,000	10.6	6.7	8.5
12,000	11.9	7.5	9.5
14,000	13.3	8.3	10

with moving and fixed arms to transfer cossettes from the bottom to the top of the tower and an upper part with motorization and 2 pulp extraction screws. Residence time of the cossettes in the extraction zone is between 90 and 120 min. Screens are cleaned permanently by scrapers. An additional cleaning by juice is done when necessary.

TowerMax is designed with proven process rules. Construction rules emphasize robustness associated with cost analysis through local manufacturing possibilities. Reliability and control including safety alarms ensure low maintenance cost and optimized operation of TowerMax. The EcoMixer is a countercurrent cossette mixer which comprises a body with fixed arms, a motorized rotating shaft with moving arms and mixers, screens for juice coming from the foam separator and raw juice. All parts in contact with products are in 3Cr12 or stainless steel.

### 3 Equipment process design requirements

It was decided at the outset of the development of the tower extraction system that the equipment design would not depart significantly from existing proven technology to ensure a robust and safe operation of the equipment and that the operating performance should provide minimum energy consumption, low draft, maximum extraction performance and to produce a wet pulp suitable for pressing. It was decided that the following operational data would be the goals of the equipment design:

- Draft: 95 to 115% on beet
- Steam consumption: 1.3 to 1.9% on beet
- Sugar losses: 0.2 to 0.25% on beet
- $\Delta T$  juice/cossettes: 10 to 15 °C

## 4 Process description

The designed extraction system uses a countercurrent cossette mixer and a tower extractor for the solid/liquid extraction of the sucrose from the beet slices by the process of extraction.

### 4.1 EcoMixer countercurrent cossette mixer

An inclined belt conveyor delivers the cossettes into the feeding chute of the countercurrent cossettes mixer (Fig. 2). An adequate quantity of juice from the extraction tower (flowing by gravity) is added simultaneously to the cossette mixer. The cossette mixer is designed to effectively preheat the incoming cossettes up to the extraction temperature by mixing the cossettes with the juice from the tower and to denature the cossettes to allow for the extraction of sucrose in the tower. Part of this juice goes countercurrent through the cold cossettes leaving the cossette mixer as cold raw juice at approximately 10–15 °C above the cossettes temperature, this cold raw juice can now be reheated using waste energy including process condensate, evaporating crystallizer vapors and low grade evaporator vapor. The remainder of the juice is mixed co-currently with the cossettes into a pumpable mixture and transferred into the bottom of the extraction tower.

A foam separator is provided to ensure that foam in the cossette mixer is destroyed allowing for adequate packing and heat exchange within the cossette mixer. The juice from the foam separator is circulated through external wide gap juice plate heat exchangers controlling the temperature of the cossette mixer and hence the temperature within the bottom of the tower.



Fig. 2: EcoMixer

### 4.2 TowerMax tower extractor

The tower extractor is a countercurrent device with cossettes entering the bottom of the extractor and being transported upwards by a series of arms which are attached to the rotating central shaft of the tower. A series of fixed arms are attached to the shell of the tower extractor in order to mix the cossettes thoroughly as they are transported upwards and ensuring an even residence time distribution.

The extraction supply water is added near the top of the extractor and runs downwards in a countercurrent flow to the cossettes. The bottom of the tower is designed with bottom and side screens for separation of the juice from the cossettes. Two horizontal screw conveyors at the top of the extraction tower remove the wet pulp from the tower and a screw conveyor transports the cossettes to the pulp press station.

The tower operates with 100% press water recirculation, the press water is de-pulped and heated with evaporator vapor in a plate heat exchanger which is used to control the temperature of the upper tower. As the press water is insufficient in quantity to make up the extractor draft, additional fresh water is added in a mixing tank along with sulfuric acid to control the tower at about pH = 5.5 and gypsum which is used as a pressing aid. The extraction supply water enters the tower below the wet pulp extraction screw conveyors through some specially adapted fixed arms. The level is controlled about 2 m below these screw conveyors to allow for drainage of the wet pulp.

To ensure correct extraction of the sugar from the cossettes it is essential that the packing profile over the tower is correct and stable. The packing density in the inlet section of the tower bottom is maintained loosely to allow good separation of the juice from the cossettes, the main section of the tower has a medium density of packing where the majority of extraction takes place and a dense level of packing is achieved in the top section of the tower above the extraction water addition. The effect of not getting the packing correct results in high extraction losses: if the packing of the tower is too loose then the juice velocities are too high and if too dense then back mixing can occur. Factors affecting the packing include cossette quality, temperature and pH value. Control of packing in the tower can be done by varying the conveying shaft speed and by adjusting the level in the tower. Assessment of the packing is done by torque measurement of the drive unit and pressure measurement above and below the tower screens.

Disinfectants are added to the extraction tower, cossette mixer and several other locations on an ad-hoc basis for keeping microbiological contamination under control. Antifoam oil is added to the extraction tower, foam separator and flume water. The extracted cold raw juice is treated with the following equipment before passing on to the juice purification station:

- Sand separator (cyclone type) with:
  - Overflow going directly to purification station, and
  - Underflow going to a sand separator/classifier;
- Pulp strainer to protect heat exchangers.

#### 4.3 Processing frozen beet

When processing frozen beet some changes to the slicing of the beet may need to be carried out (Nobel, 2007), including increasing the 'Up' setting from 4.5/5.0 mm to 5.0/6.0 mm and reducing the 'Back' setting from 6.0 mm to 5.0 mm. Frozen beet tend to break into small chunks if one tries to produce ordinary standard cossettes, therefore it is better to slab the beet and let the slabs be broken down in the extraction process. The foam separator juice heat exchanger circuit will not have enough capacity and therefore cannot provide all the energy required to keep the lower Tower at the required temperature of 70–72 °C. In this situation additional heat exchangers need to be installed on the circulation juice coming from the tower to the countercurrent cossette mixer to maintain the temperature required

for extraction. Only part of the circulation juice is required for this duty so the circulation juice is divided into two streams after the sand separator, with one flow going through the heat exchangers and the other flow bypassing the heat exchangers and going directly to the cossette mixer. Also the raw juice temperature from the cossette mixer is likely to be fairly low and will require heating up to the temperature for 1<sup>st</sup> carbonatation.

### 5 Mechanical description

The TowerMax and EcoMixer has been designed carefully with cost analysis in mind and the ability to manufacture the main fabricated components locally to the customer, this ensures that the equipment is competitive in the market place. The standard materials of construction set out below take this into consideration. However, the Fives Cail Group has the flexibility to adapt the design and supply of its equipment to any additional requirements of the customer.

#### 5.1 The EcoMixer

The EcoMixer body and stirrer shaft are manufactured from carbon steel with all wetted parts lined with 1.5 mm thick 3Cr12 or stainless steel, the shaft is of tubular construction (Fig. 3). The cossette feed chute, mobile and fixed arms are manufactured from 3Cr12 or stainless steel and the raw juice outlet and foam separator juice outlet screens are manufactured from stainless steel.

The main shaft drive journals are manufactured from forged steel welded to the ends of the tubular shaft. Both ends of the shaft are supported with spherical roller bearings, fixed at the non drive end, floating at the drive end, the shaft is provided with stuffing boxes to prevent leakages. The drive system consists of a frequency converter, an IP55 class F motor, a shaft mounted planetary gearbox and torque arm. The drive system is operated at a constant torque to ensure optimum packing of the cossettes within the mixer helping achieve the best heat exchange between the cossettes and the raw juice and a pumpable mixture to the tower extractor.

The cold raw juice end plate and the foam separator outlet of the EcoMixer are provided with wedge wire screens with twisted double conical stainless steel profile wires (Fig. 4). These screens are

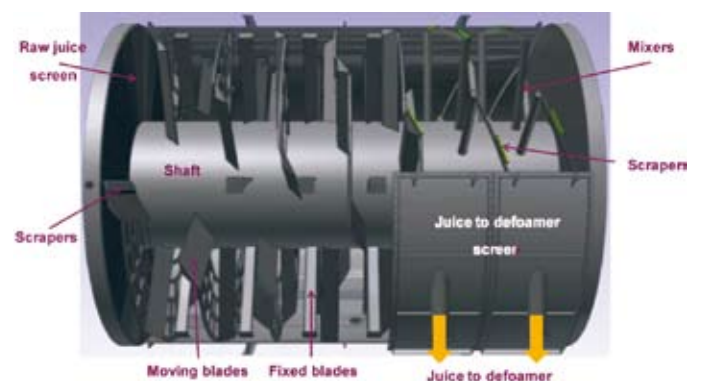


Fig. 3: EcoMixer components



Fig. 4: Self cleaning wedge wire screens

provided with a back flush facility and scrapers are installed on the mobile mixer arms in order to keep the screens free and flowing.

## 5.2 The TowerMax

The tower extractor shell, conveying shaft and pulp discharge scrolls are manufactured from carbon steel with a 1.5 mm 3Cr12 or stainless steel lining. The mobile and fixed arms are manufactured from 3Cr12 or in carbon steel with a 1.5 mm 3Cr12 lining and the tower screens are manufactured from stainless steel.

Both the bottom and side screens in the base of the tower are manufactured from wedge wire screens with twisted double conical stainless steel profile wire these screens are self cleaning see Figure 4, the side screens are fitted in bolted sections and can be replaced from the inside of the extractor, these screens are continuous around the circumference of the extractor shell. The bottom screens cover two thirds of the base, the internal third of the diameter of the base is left plain to allow for the three cossette inlet pipes. Scrapers are fitted to the moving arms, the bottom screens are cleaned with sectional hinged bronze scrapers; the side screens are cleaned with plastic spring loaded scrapers fitted to the end of the distribution arms. The juice from the side screens passes through openings in the shell and directed into collection boxes below the bottom screen at the base of the tower. All the screens are provided with a back flushing facility using a dedicated flushing pump.

The conveying shaft is supported by spherical roller bearing assemblies at the top and bottom of the shaft, the bottom shaft has a stuffing box to prevent leakage from the extractor. The bottom bearing assembly is oil lubricated and has been specifically designed so that the conveying shaft can be lifted off the spherical roller bearings during the maintenance season. The bearing housing is supported by a pedestal and foot plate which can be separated allowing the conveying shaft to be lifted with a hydraulic jack and packed inside the extractor to support its weight. The top bearings are grease lubricated. The conveying shaft is partially filled with either water or concrete as a counter balance to prevent lift in operation. Access to the inside of the conveying shaft is via a manhole in the top of the shaft, an internal ladder and platforms are provided for maintenance inspections.

The main shell of the extractor is provided with suitable site glasses, sample points, manholes and instrument connections. The pulp discharge scrolls are welded into the tower discharge section, a roof above the scrolls and vent to above the drive shelter prevents vapor from passing into the drive area.

The main drive system for the conveying shaft uses a bull gear, manufactured in two halves from a treated cast iron, bolted to the top of the conveying shaft, the bull gear is driven using 6–8 Bogiflex type pinions with floating planetary gearbox drives. This type of drive has the advantage that the pinion and bull gear mesh perfectly and is self aligning. An elastic pushing assembly is provided on each drive unit to ensure the correct meshing of the gears, if the gear box becomes miss-aligned a sensor on this unit will either alarm or stop the conveying shaft drive to protect the gears. The drive units are connected to one frequency converter to ensure that they all operate at a constant torque.

An automatic closed oil lubrication system for the main drive unit is provided and housed in a separate building on the ground floor. The system comprises a heated oil reservoir, filter unit with sensor, two pumps, flowmeter, a drip tray and necessary pipes and valves. The oil is fed to every drive unit and directly on to the bull gear between drive units.

An automatic grease lubrication system is also provided to grease the stuffing boxes.

At the top of the tower a drive shelter is provided with lifting beam, electric trolley and hoist assembly. Inside the shelter the lifting beam can be manually positioned through 360° above each drive unit. A door in the shelter wall and second lifting beam outside can be connected to the internal lifting beam to allow for the drive unit to be lowered to the ground floor.

## 6 EcoMixer and TowerMax routine maintenance

The extraction equipment has been designed for minimal maintenance, with the following items regarded as essential:

- Washout all equipment directly after end of campaign.
- Drain oil from gearboxes and replace with new oil or use an approved preserving oil.
- Check bearings and if necessary replace grease.
- Repack stuffing boxes if necessary.
- High pressure clean screens and lightly oil.
- Check internals and repair where necessary, particularly check the weld joints of the fixed and rotating arms.
- Check scrapers and replace worn parts.
- Disconnect the tower bottom bearing pedestal, jack up conveying shaft and shim to relieve stresses on the main bearing or rotate conveying shaft every two weeks.

## 7 Equipment fabrication and on site assembly

Generally the EcoMixer and TowerMax are large items of equipment that cannot be completely manufactured in the workshop and a significant amount of assembly work needs to be carried out at site. The Fives Cail Group policy is to have the majority of the equipment manufactured locally to the customer with only the key critical components being supplied by Fives Cail such as the screens, drive system and bearing assemblies. Local manufacture has the advantage of being cost competitive, ensuring rapid delivery and the customers' expectations in term of quality of manufacture are guaranteed by significant inspection of the manufacture by Fives Cail to ensure it meets our standards.

Significant thought and effort has been put into the method of manufacture and assembly as this plays a major role in the cost of supply. Complete procedures for the assembly of the equipment have been written to ensure that this element of the manufacture is planned correctly and runs smoothly on site. For the smaller throughputs the EcoMixer can be delivered to site in one piece leaving only the cossette feed chute and drive system to be assembled. For the larger sizes of EcoMixer these have to be broken down into several components such as the lower and upper body halves, end plates, the conveying shaft, the fixed and mobile arms, the sets of screens as well as the feed chute and drive system, these components have to be assembled together on site.

For the construction of the TowerMax an on site working surface which is level and plane must be constructed so that the components of the TowerMax can be assembled, this comprises of two work stations, one for the outer shell and one for the central conveying shaft. The work station is provided with a roof on rails so that work can be carried out in all types of weather. Generally the outer shell sections of TowerMax are constructed in two halves and the central conveying shaft sections on one piece.

One critical key area of manufacture is in lining the equipment

shell and conveying shafts with 1.5 mm thick 3Cr12 or stainless steel so as to reduce the cost of manufacture but provide the equipment with a degree of corrosion and erosion resistance. The plates of 3Cr12 or stainless steel are delivered to site to be assembled in situ. The plates are installed offset to cover the longitudinal weld seams between the different parts of the shell. The vertical edges of the plates are prepared with folded S-shaped edges to facilitate sealed welded junctions. The plating is applied on the shell by a series of sealed plug welds.

All of the critical welding such as the plating joints are fully inspected, 100% of the welds by 100% dye penetration both of the exposed root weld before back welding and of the finished weld.

Once the components have been constructed on site then they can be assembled on to the foundations with the aid of a crane. Of critical importance is the installation of the bottom bearing assembly as this must be thoroughly checked to ensure perpendicularity, centering and height position as this will be the reference for the rest of the installation. The construction of each section of the tower must be checked for its perpendicularity with a plumb line or plumb laser and all welds are to be inspected thoroughly with dye penetration.

## 8 Extraction plant control system

The extraction plant is operated and controlled from panels on which all instruments are connected (Fig. 5). One or several operator stations display a general flow diagram mimic with complete process information, trending and alarms. All control loops and sequence are generated by the control system and can be customized according to the client requirements.

One panel is allocated to the control of the tower itself, including the variable frequency converter and the motors to drive the conveying shaft. A small human interface machine allows the operator to monitor locally the many switches which interlock the tower. An automatic washing sequence is generated regularly or activated by 2 pressure transmitters which allow the cleaning of the bottom screens. The complete lubrication system is also monitored by this panel.

The process panel is dedicated to the extraction plant and communicates through a network to the tower panel. This panel manages all sub-systems such as the cossette mixer, the foam separator and circulation juice circuits and also the extraction water preparation systems, press water, gypsum preparation etc. The operator is able to start and stop all equipment and set the global flow of the plant from the control room. In case of any deviation, an alarm is automatically generated and a horn is activated in order to alert as soon as possible the operator of a problem. Trend reports are automatically generated.

The control system can be interfaced with any existing factory PLC or DCS and a remote connection allow eventual external assistance through a safe Ethernet connection.

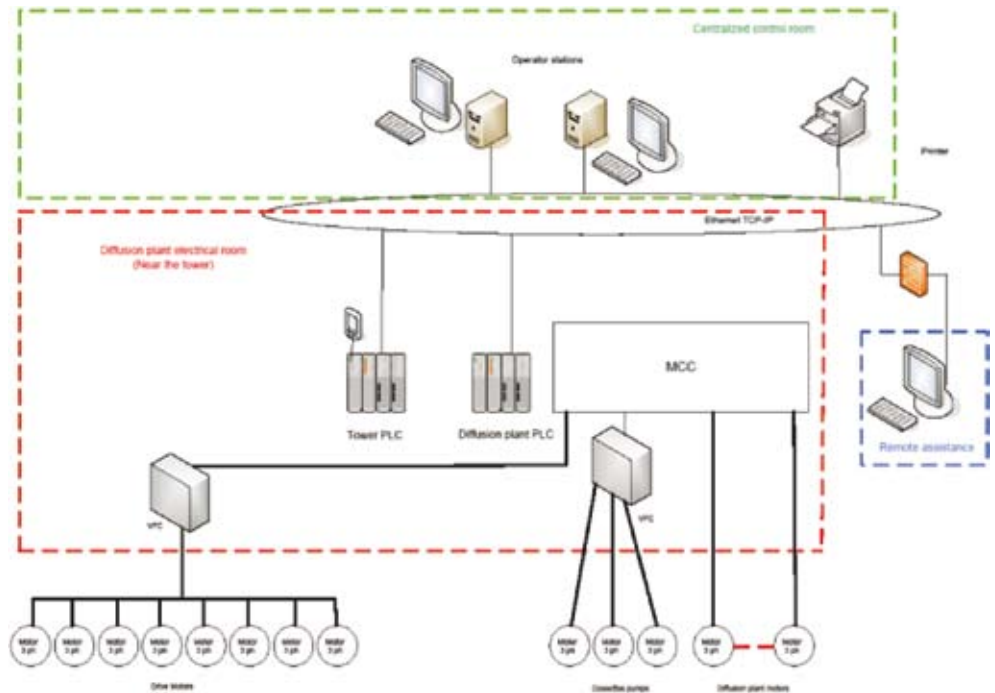


Fig. 5: Visio-Architecture TowerMax

## 9 Mass and energy balance

Figure 6 shows a typical mass balances for a 10,000 t beet/d factory. To produce this balance some assumptions have been made as follows:

– Sugar content of cossettes	17%
– Marc content of cossettes	4.5%
– Draft	110%
– Extraction loss	0.25%
– Raw juice purity	90%
– Pulp press water purity	80%
– Juice to foam separator flow rate	80% on beet
– Circulation juice flow rate	350% on beet
– Dry substance of wet pulp	10%
– Dry substance of pressed pulp	26%

Figure 7 shows a typical energy balance for a 10,000 t beet/d factory. To produce this balance some assumptions have been made as follows:

– Cossette temperature	13 °C
– Vapor temperature	91 °C
– Wet pulp temperature	69 °C
– Pressed pulp temperature	62 °C
– Cossette specific heat capacity (Bubnik et al., 1995)	3640 J/(kg · K)
– Wet pulp specific heat capacity (Bubnik et al., 1995)	3830 J/(kg · K)
– Pressed pulp specific heat capacity (Bubnik et al., 1995)	3800 J/(kg · K)

The energy balance has been based on processing beet of normal condition, and that only vapor is used to heat the pulp press water and the juice to foam separator circuit. In this case the energy required for heating the tower extraction system is very low at 1.07% vapor on beet for the juice to foam separator circuit and 0.85% vapor on beet for the pulp press water circuit. The amount of heat depends significantly on the temperature of the incoming cossettes and if frozen beet are processed additional heating surface area on the circulation juice and raw juice is required resulting in addi-

## Inputs/Outputs

Cossettes		%	Tonnes/hr
Sugar Content	17.0		70.8
Soluble Non Sugar Content	2.0		8.3
Marc	4.5		18.8
Total Dry Substance	23.5		318.8
Water Content	76.5		97.9
Total	100.0		416.7

Raw Juice		%	Tonnes/hr
Sugar Content	15.2		69.8
Soluble Non Sugar Content	1.7		7.8
Total Dry Substance	16.9		77.6
Water Content	83.1		380.8
Total	100		458.4

Pressed Pulp		%	Tonnes/hr
Sugar Content	1.3		1.0
Soluble Non Sugar Content	0.7		0.6
Marc	23.9		18.8
Total Dry Substance	26.0		20.4
Water Content	74.0		58.0
Total	100		78.4

Fresh Water		%	Tonnes/hr
Water Content	100.0		120.0
Total	100		120

## Internal Circulation

Defoamed Juice		%	Tonnes/hr
Sugar Content	15.0		56.1
Soluble Non Sugar Content	1.6		5.3
Total Dry Substance	16.6		55.4
Water Content	83.4		277.9
Total	100		333.3

Circulation Juice		%	Tonnes/hr
Sugar Content	15.6		234.5
Soluble Non Sugar Content	1.7		25.6
Total Dry Substance	17.3		260.1
Water Content	82.7		1240.0
Total	100		1500.1

Juice - Cossettes		%	Tonnes/hr
Sugar Content	16.1		235.5
Soluble Non Sugar Content	1.8		26.1
Marc	1.3		18.8
Total Dry Substance	19.2		280.4
Water Content	80.8		1178.1
Total	100		1458.5

Wet Pulp		%	Tonnes/hr
Sugar Content	1.7		4.2
Soluble Non Sugar Content	0.7		1.6
Marc	7.6		18.8
Total Dry Substance	10.0		20.4
Water Content	90.0		221.3
Total	100		245.9

Pressed Pulp Water		%	Tonnes/hr
Sugar Content	1.9		3.2
Soluble Non Sugar Content	0.6		1.1
Total Dry Substance	2.5		4.3
Water Content	97.5		163.4
Total	100		167.6

Diffusion Supply Water		%	Tonnes/hr
Sugar Content	1.1		3.2
Soluble Non Sugar Content	0.4		1.1
Total Dry Substance	1.5		3.3
Water Content	98.5		283.4
Total	100		287.6

Fig. 6: Typical mass balance for a 10,000 t beet/d factory

tional energy consumption of 3.7–7.5% steam on beet depending on the appropriate heating medium used (Thompson, 1999).

## 10 Summary – advantage of Fives Cail’s new extraction technology

The Fives Cail Group has developed the EcoMixer and TowerMax to similar principles as existing equipment supplied by the group, i.e. with the best process, energy and mechanical design standards, using experience gained in over 60 years of design and supply of continuous extraction equipment to the beet sugar industry. To summarize the advantages of the equipment developed by the Fives Cail Group, these include:

- Robust design, respecting construction rules and mechanically strong
- Proven process
- Standard range of equipment covering all market demands
- Designed and built to the Fives Cail quality control and international standards
- Majority of the equipment manufactured locally to the customer, providing rapid delivery and competitive costing.
- Outstanding performance designed for the following:

- A draft between 95–115% on beet
- Sugar losses of between 0.20–0.25% on beet
- A cossette to raw juice  $\Delta T$  of 10–15 K
- Low energy consumption of 1.3–1.9% on beet (non frozen condition)
- Production of a quality wet pulp suitable for pressing
- Low raw juice temperature allowing the recovery of waste energy
- Outside installation with small footprint
- Minimal maintenance requirements
- Equipment fully automated.
- Flexibility of design and supply to meet all of the customers’ requirements.

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Inputs/Outputs

Cossettes	
Temp °C	10
Throughput T/hr	417
Energy In	15168

Defoamed Juice Heater	
Energy Required KJ	10165
Vapour Temp °C	91
Quantity of Vapour T/hr	4.46
Vapour % Beet Sliced	1.07

Raw Juice	
Temp °C	23
Throughput T/hr	458
Energy Out	40058

Energy Losses	
Energy In KJ	8312
Energy Lost	

Pressed Pulp	
Temp °C	62
Throughput T/hr	78
Energy Out	17683

Pressed Pulp Water Heater	
Energy Required KJ	8111
Vapour Temp °C	91
Quantity of Vapour T/hr	3.56
Vapour % Beet Sliced	0.85

Fresh Water	
Temp °C	65
Throughput T/hr	126
Energy In	32609

Internal Circulation

Circulation Juice	
Temp °C	70
Throughput T/hr	1500
Energy In/Out	399000

Cossette - Juice Mixture	
Temp °C	70
Throughput T/hr	1458
Energy In/Out	383250

Wet Pulp	
Temp °C	69
Throughput T/hr	246
Energy In/Out	64897

Pressed Pulp Water	
Temp °C	62
Throughput T/hr	168
Energy In/Out	43430

Diff Supply Water	
Temp °C	70
Throughput T/hr	268
Energy In/Out	84150

Fig. 7: Typical energy balance for a 10,000 t beet/d factory

La nouvelle technologie d'extraction de betteraves par Fives Cail: La TowerMax et l'EcoMixer (Résumé)

Fives Cail a développé sa propre technologie d'extraction pour sucreries de betteraves. Le système d'extraction est composé d'une tour d'extraction à contre-courant, la TowerMax, et d'un malaxeur de cossètes, l'EcoMixer. Cette technologie comprend aussi des équipements périphériques (réchauffeurs, démousseur, épulseurs, désableurs, préparation des eaux mélangées). Les équipements ont été conçus de manière à ce qu'il y ait le moins de maintenance possible. Cet article décrit cette nouvelle technologie qui s'inscrit parfaitement dans le cadre du développement durable avec le respect des règles Fives Cail tant dans le domaine de la robustesse, de la fiabilité, des performances, de l'automatisation, des économies d'énergie que dans celui de la satisfaction client.

Nueva tecnología de extracción de Fives Cail para remolachas azucareras: TowerMax y EcoMixer (Resumen)

Fives Cail desarrolló una nueva planta de extracción de torre. La planta consta (a) de la torre de extracción TowerMax, (b) del macerador de cossetas EcoMixer de contracorriente para la extracción sólido-líquida de sacarosa de las cossetas y (c) de instalaciones periféricas como transmisores caloríferos, separadores de espuma y separadores de pulpa y arena. Se manda y controla la planta y todos los aparatos por medio de PLC (programmable logic controller). Se diseñó esta planta para un mínimo de mantenimiento. Este artículo describe el desarrollo de esta tecnología persistente según las normas del Fives Cail Group: seguridad, eficacia, automatización, ahorro de energía y satisfacción del cliente.

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