

**Food Processing - SugarBeet Filtration**

**Automated Durco EP Sidebar Filter Press & Durco QP1200 Overhead Filter Press Units  
Manual Durco Type V Wet Cake Discharge Pressure Leaf Filters**

**Industry:** Sugar Production  
**Locations:** MI, ND, NE, WY, USA  
**Installation Dates:** 1964 Onwards  
**Capacities:** >100 CuFt

**More Information**

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**Engineered For Efficient &  
Reliable Operation**

May 2011 - This **Durco Filters** Pressure Leaf Filter Unit has performed faultlessly in a large Michigan sugar beet processing plant since it was installed in early 1964.

The filter can process up to 250,000 lbs of liquid sugar/day, for 33.6 million individual sugar packets/day, or 1.23<sup>10</sup> sugar packets/year.

*A Sweet Enough Number Of  
Sugar Packets To Circle The  
Earth 1,435 Times 1964-2011!*



*This **Durco Filters Type V Pressure Leaf Filter** was deployed in 1964 at a large Michigan sugar beet processing operation. The filter unit removes extremely fine lime particulates following the Second Carbonation Step, prior to Evaporation for Thick Juice production.*

Standard **Durco Filters Type V Pressure Leaf Filter Unit** design features include; inlet baffle profile to balance slurry distribution for uniform cake build up and prevent washout, oversized drain for fast discharge of sluiced cake, and tank bottom flow pattern to prevent settling. The optional conical bottom profile further facilitates sluice discharge.

## INDUSTRIAL FILTRATION EQUIPMENT FOR SUGARBEET PROCESSING

*Durco Filters specializes in providing Filter Press Units and Pressure Leaf Filters that are specifically engineered for performance & durability. With a pedigree and expertise developed from over 45 years of experience in providing industrial filtration units optimized for sugarbeet processing, we can help You define the optimum filter unit & media for your particular process.*

### **Sugarbeet Processing**

Sugarbeet processing is a widely used industrial process that converts raw harvested sugarbeets into food-grade sugar and byproducts such as fertilizers and quality dried animal feeds. Industrial Filtration Technology is a key component of any sugarbeet processing operation, with Durco Filter Press units and Pressure Leaf Filters both finding applications at appropriate places in a typical sugarbeet process stream (see pages 3 and 4).

Sugarbeet processing involves several steps to produce quality sugar and byproducts from raw harvested sugarbeets. Typical process steps include: cleaning, slicing & cossette mixing, sucrose diffusion, juice purification, evaporation, sugar crystallization, dried-pulp manufacture, and sugar recovery from molasses. These process steps are further described below.

### **Durco Filters Industrial Filtration Equipment For Sugarbeet Processing**

**Durco Filters** offers You a range of heavy-duty industrial filtration equipment specifically designed to bring lasting value to sugarbeet processing operations. **Durco Filters** are also widely used in the desugaring of molasses by both the Steffen Process and by Chromatographic Processes. You can be confident that Your **Durco Sugarbeet Filter** is a well-proven solution, engineered for high performance operation, reliability, and durability in Your particular application.

- Durco Filters Overhead Filter Press Units & Sidebar Filter Press Units
- Durco Filters Wet Cake Discharge Pressure Leaf Filter Units
- Automated & Manual Control Options

### **SugarBeet Processing - Process Overview** *(See The Sugarbeet Pocess Flow Chart On Page 4)*

#### **Production Of Raw Juice And Wet Pulp**

Beets are typically separated from their roots and leaves, then washed to remove soil and surface debris. In order to obtain maximum surface area for extraction of sucrose the cleaned beets are then sliced into long thin strips, known as cossettes, which are mixed and fed into a continuous diffuser. In the diffuser, the cossettes are exposed to dilute disinfectant and hot water (in the range 50-80°C / 122-176°F), which extracts sucrose into solution. The resulting liquid **Raw Juice** contains ~10-15% sucrose and is piped off for *juice purification*. The remaining **Wet Pulp** is conveyed to dried-pulp manufacturing for production of animal feed.

### **Sugar Production From Raw Juice**

Sugar is produced in 3 Steps: *Juice Purification*, *Evaporation*, and *Sugar Crystallization*

**Juice Purification** - The raw juice is passed through a screen which removes entrained cossette particulates, and is then heated to ~80°C (176°F) for input to the *Juice Purification* step, involving 2 carbonation and filtration operations:

In the *First Carbonation Step*, milk of lime (MOL = [Ca(OH)<sub>2</sub>]) is added to bind with impurities. Then gaseous CO<sub>2</sub> is bubbled through the mixture to precipitate the lime as solid calcium carbonate [CaCO<sub>3</sub>] crystals, which may be settled out in a clarification tank. The resultant liquid is sent to a second carbonation reactor and the settled mud may be passed through a **Durco Filter Press** to produce a solid cake byproduct that may then be sold as fertilizer.

In the *Second Carbonation Step*, the juice is treated with more CO<sub>2</sub> to precipitate any remaining lime and impurities, and is then filtered through a series of 2 **Durco Pressure Leaf Filter Units** to remove these solids. It may then be treated with SO<sub>2</sub> to prevent darkening.

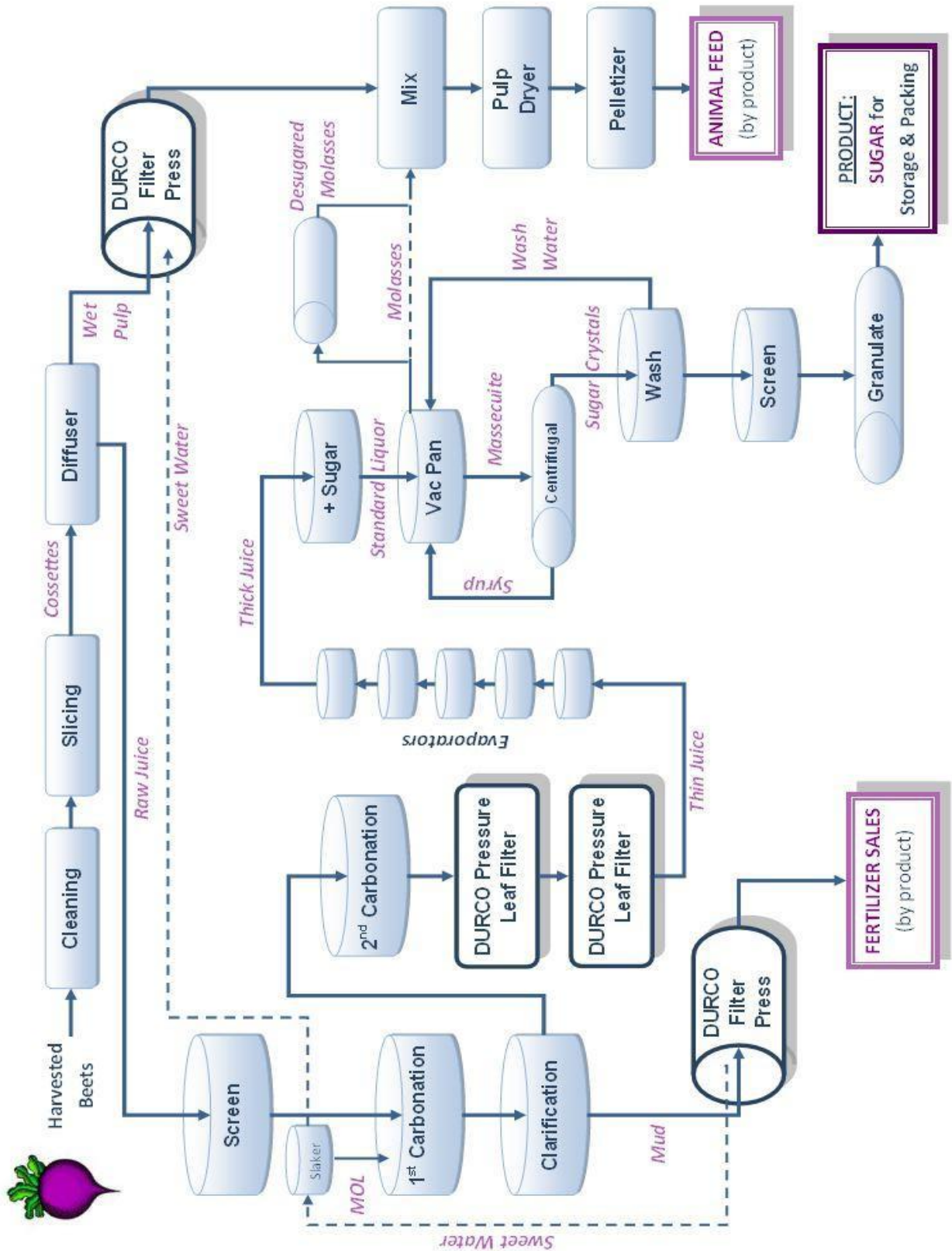
**Evaporation And Crystallization Of Sugar** - The resultant *Thin Juice* is piped to a series of *evaporators* where water is removed producing *Thick Juice* (~50-65% sucrose solution). Following addition and dissolution of crystalline sugar (provided from a later process step) a clear liquid known as *Standard Liquor* is produced. This liquor is then boiled in *vacuum pans* and “shocked” or “seeded” to nucleate and grow sugar crystals.

The resulting mixture of liquid and sugar crystals (aka *Massecurite* or *Fillmass*) is then separated using *centrifugals* to produce liquid syrup (recycled to the vacuum pans) and solid sugar crystals. The sugar crystals are then washed with pure hot water and granulated, screened, and stored for packaging (wash water, containing some sucrose, is also recycled to the vacuum pans). Liquids recycled to the vacuum pans are mixed with Standard Liquor and this process is repeated to produce *Molasses*. The Molasses are usually further desugared, or may be immediately reclaimed for use as a component of animal feed byproduct.

### **Animal Feed Production From Wet Pulp & Molasses**

**Wet Pulp** from the diffusion process is passed through a **Durco Filter Press Unit** to reduce its' moisture content from ~95% to ~25% percent (the water may be recycled as diffusion water). After pressing, recovered molasses are added to the pressed pulp, which is then dried in a *pulp dryer*. The resulting product may then be cooled, pelletized, and used as quality animal feed.

SugarBeet Process Flow Diagram



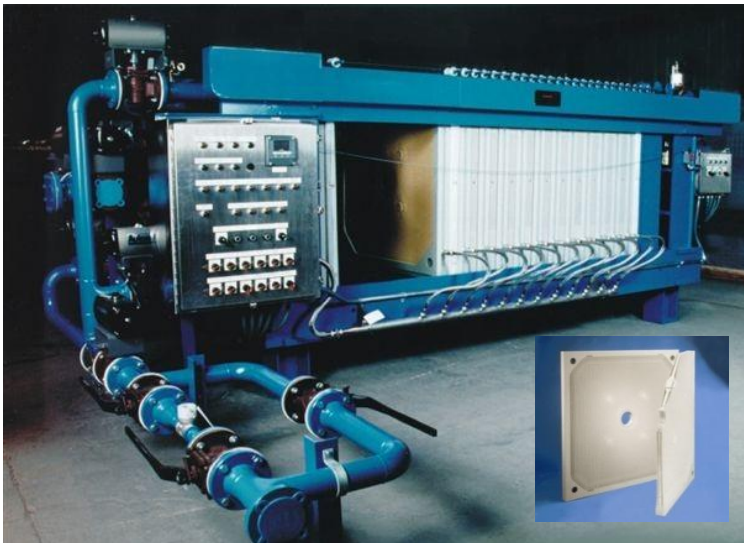
**1. Automated Durco Filters QP Overhead Filter Press For SugarBeet Processing**

**Increase Your Sugar Recovery - The Durco Filters Quadra Press Overhead Filter Press Is Your Ideal Solution For SugarBeet Process Optimization:**



**1.1. Post-First Carbonation & Clarification Filtration:** after First Carbonation, the reacted juice (from the top of the clarifier) is sent on to the *Second Carbonation Step*. The **mud slurry** discharged from the bottom of the clarifier is dewatered using a **Durco Filter Press** which discharges filter cakes (~65% solids) that are saleable as a soil pH enhancer/fertilizer.

*Durco Filters Quadra Press Overhead Filter Press*



**1.2. Cake Washing:** for enhanced mud dewatering & residual sugar recovery. A **Durco Filters Quadra Press w. Membrane Plates** reduces channeling of wash water through the filter cake. and enables both secondary pressing and steaming for increased efficiency.

Additionally, the recovered *Sweet Water* can be recycled to the *slaker* for production of *Milk of Lime* (MoL).

*Durco Filters Quadra Press with Membrane Plates*

**Durco Filters offers You a range of Test Filters, Laboratory Analysis of your Process Fluids, and on-site Pilot Testing to optimize Your specific filtration process. To Find Out More Call Durco Filters At **716-693-9381 ext.217** or e-mail [filterengineering@asmfab.com](mailto:filterengineering@asmfab.com)**

## 2. Durco Filters Type V Wet Cake Discharge Pressure Leaf Filter For SugarBeet Process

*The [Durco Filters Type V Wet Cake Pressure Leaf Filter](#) Is Ideal For Thin Juice Clarification Following The Second Carbonation Step In SugarBeet Processing:*



**Durco Filters Type V Pressure Leaf Filter Units** offer minimal footprint area, and are designed to ASME Code. Available in steel, stainless steel, monel, nickel, or non-metallic linings. Each filter features a rugged cover closure and oversized drain for fast discharge of sluiced cake. There are no piping connections to break.

The inlet baffle balances slurry distribution for uniform cake build up, to prevent cake washout. The flow pattern across the bottom of the tank prevents settling. Other features include a manual or hydraulic cover lift, leaf spacers to prevent rising out of the manifold, thermonized or jacketed tanks and an optional conical bottom to facilitate sluice discharge.

**The Problem** – After passing through the *Second Carbonation Step*, the Thin Juice still contains extremely fine lime particulates that must be removed prior to *Evaporation* to make *Thick Juice*.

**Durco Filters Solution** - A **Durco Filters Type V Pressure Leaf Filter Polishing System** comprised of a primary filter unit and a secondary 'safety' filter unit reliably removes fine particulates from the thin juice stream. For larger operations a **Durco Filters HC Horizontal Pressure Leaf Filter** is recommended to provide higher filter surface area and therefore higher throughput.

**Durco Filters Experience** - Many years of empirical testing have proven that precoating the filter leaves (0.1-0.2 lbs/ft<sup>2</sup>) with a slurry of *Filter Aid* in clarified thin juice and provides optimum filtration. Diatomaceous Earth, Pearlite, and Cellulose materials can all serve as effective Filter Aids. For juice feeds that are heavy in organic debris, a body feed of 1:1 ratio of filter aid : debris will generate a porous cake structure and extend filtration cycle times. The filters are typically sluiced clean with hot wash water or thin juice in order to avoid dilution.

**More Benefits** – *Durco Filters Pressure Leaf Filters* offer *Dura-Sluice* technology to minimize the amount of fluid required to clean Your screens. *Durco Filters* also has extensive experience *automating* the operation of Pressure Leaf Filter units. Complete packaged Pressure Leaf Systems consisting of precoat, body feed and sluice cleaning systems can be designed and fabricated to fit Your requirements.

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### 3. Durco Filters Filter Presses For Desugaring Molasses In SugarBeet Processing

**Desugaring of molasses** can be accomplished by either the *Steffen Process* or by *Chromatographic Separation*.



#### **The Steffen Process**

Molasses is diluted down with wash water to ~10% dissolved solids content, and mixed with quick lime (CaO). This mixture is cooled to around 50°F, and the resulting *saccharate precipitation* is removed using a **Durco Filter Press**.

The filtrate from this process is heated to ~200°F, to precipitate more saccharate, and then filtered a second time to capture more sucrose.

*Durco Filters EP Sidebar Filter Press*

#### **Chromatographic Desugaring**

Molasses is diluted to 60-70% concentration with soft water, heated, and filtered using a **Durco Filters HC Pressure Leaf Filter**. Filtration is critical to this operation in order to avoid fouling the surfaces of the resin beads in the chromatographic units.

**Durco Filters Pressure Leaf Filters** can separate colloidal debris from the process stream which would otherwise block the effective adsorption of sucrose by the resin beads. Best-in-class flux rates and extended run times make Durco Pressure Leaf Filters the ultimate technology for this application.



*Durco Filters HC Horizontal Pressure Leaf Filter*

**To Find Out More About Durco Filters For Sugar Beet Processing Operations**

**Call 716-693-9381 ext.217 or e-mail [filtersales@asmfab.com](mailto:filtersales@asmfab.com)**

**Durco Filters Information Online: [www.durcofilters.com](http://www.durcofilters.com) and [www.durco-filters.com](http://www.durco-filters.com)**