Scraped-Surface Heat Exchanger Training

February 2017
1. Product and Application Overview
2. SPX Flow Portfolio
3. Product Positioning
4. Medium-Viscosity SSHE
5. Low-Viscosity SSHE
6. Application Case Studies
7. Competition
8. Understanding Customer Needs
9. Wrap-Up
Product and Application Overview

Scraped-Surface Heat Exchangers
What is a scraped-surface heat exchanger?
- Heat exchanger for viscous / high-fouling products (>1000 cps)
- Product flows through inner tube
- Inner shaft with blades rotates to continuously remove product from the tube walls

Typical applications:
- Dressings
- Ketchup / mustard / dips
- Soups
- Mechanically deboned meat
- Cream cheese / sour cream
- Peanut butter

How It Works
Scraped-Surface Heat Exchangers

Targeted Application Space

- High viscosity applications
  - Typically greater than approx. 1,000 cP
- Any particle size
- Sticky or heat-sensitive products where fouling may be a concern

<table>
<thead>
<tr>
<th>Product</th>
<th>Typical Viscosity (cP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortening</td>
<td>1,000,000– 2,000,000</td>
</tr>
<tr>
<td>Peanut Butter</td>
<td>150,000– 250,000</td>
</tr>
<tr>
<td>Chocolate Syrup</td>
<td>10,000– 25,000</td>
</tr>
<tr>
<td>Molasses</td>
<td>5,000– 10,000</td>
</tr>
<tr>
<td>Ketchup</td>
<td>2,000– 7,000</td>
</tr>
<tr>
<td>Honey</td>
<td>2,000– 3,000</td>
</tr>
<tr>
<td>Maple Syrup</td>
<td>150– 200</td>
</tr>
<tr>
<td>Corn Oil</td>
<td>65</td>
</tr>
<tr>
<td>Water @ 70 F (21 °C)</td>
<td>1– 3</td>
</tr>
</tbody>
</table>
Scraped-Surface Heat Exchange Portfolio Breadth

- **High Viscosity** $$$
- **Medium Viscosity** $$
- **Low Viscosity** (no refrigeration) $

Viscosity

- Scрапed surface heat exchanger
- Tubular heat exchanger
- Plate heat exchanger

Viscosity (cP)

Particle size (mm)
### SSHE Application Range

#### Viscosity

<table>
<thead>
<tr>
<th>Viscosity</th>
<th>Examples</th>
</tr>
</thead>
</table>
| **High Viscosity**| • Margarine  
   • Low-fat spreads  
   • Shortening  
   • Ghee  
   • Bakery filling cream  |
| **Medium Viscosity**| • Peanut butter  
   • Gelatin  
   • Marshmallow  
   • Syrups  
   • Frostings & Icings  
   • Mechanically deboned meat  |
| **Low Viscosity**  | • Aseptic puddings / cheese sauces  
   • Cream cheese / sour cream  
   • Aseptic fruit & vegetable purees  |
|                   | • Personal care (i.e. lotions)  
   • Salsa  
   • Dressings  
   • Ketchup / mustard / dips  
   • Soups  
   • Sauces  |
What does a SSHE do?

Address a variety of processes

- Heating
- Cooling
- Crystallization
- Pasteurization
- Sterilization
- Gelatinize
- Freezing
- Evaporation*
Application Examples

Food & Beverage
Application Examples

Industrial / Personal Care
How does a SSHE work?
The basic components

- Tube
- Blade
- Seals
- Shaft / Mutator / Dasher
- Drives
### Blade Types

#### Metals

<table>
<thead>
<tr>
<th>Blade Type</th>
<th>Description</th>
<th>Cost</th>
<th>Application</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>410 Stainless Steel</td>
<td>• Universal pin slots &lt;br&gt; • Application: all processes, high viscosity &lt;br&gt; • Characteristics: corrosion resistance, possible tube wear</td>
<td>$$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-7 Stainless Steel</td>
<td>• Universal pin slots &lt;br&gt; • Application: all processes, high viscosity &lt;br&gt; • Characteristics: corrosion resistance, possible tube wear</td>
<td>$$$$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>410 Stainless Steel</td>
<td>• Cutaway style &lt;br&gt; • Application: all processes, high viscosity &lt;br&gt; • Characteristics: reduced product buildup, reduced power consumption</td>
<td>$$$$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brass</td>
<td>• Cutaway style with dual use pin slots &lt;br&gt; • Application: pet food, inedible products &lt;br&gt; • Characteristics: reduced product buildup, reduced power consumption</td>
<td>$$$$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Plastics

<table>
<thead>
<tr>
<th>Plastic</th>
<th>Description</th>
<th>Cost</th>
<th>Application</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celcon</td>
<td>• Molded locking slots &lt;br&gt; • Application: any viscosity, primarily cooling &lt;br&gt; • Characteristics: molded plastic</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEEK</td>
<td>• Molded locking slots &lt;br&gt; • Application: any viscosity &lt;br&gt; • Characteristics: molded plastic, high strength</td>
<td>$$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MD PEEK</td>
<td>• Metal detectable &lt;br&gt; • Application: any viscosity &lt;br&gt; • Characteristics: metal detectable molded plastic</td>
<td>$$$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Available for medium-viscosity and low-viscosity SSHE**
How does a SSHE work?

Concentric

For most applications

Eccentric

For viscous and sticky products

Oval

For extremely viscous products

<table>
<thead>
<tr>
<th>Shaft Mounting</th>
<th>APV VT+/HT+</th>
<th>WCB Votator II</th>
<th>WCB Votator Extra Heavy Duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentric</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Eccentric</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Oval</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
The SPX Flow Portfolio

Scraped-Surface Heat Exchangers
SSHE Application Range

High Viscosity $$$
- Margarine
- Low-fat spreads
- Shortening
- Ghee
- Bakery filling cream

Medium Viscosity $$
- Peanut butter
- Gelatin
- Marshmallow
- Syrups
- Frostings & Icings
- Mechanically deboned meat

Low Viscosity $
- Personal care (i.e. lotions)
- Salsa
- Dressings
- Ketchup / mustard / dips
- Soups
- Sauces
Product Positioning

Scraped-Surface Heat Exchangers
APV Scraped-Surface Heat Exchangers

Portfolio

- VT+ / HT+ series
  - 520
  - 540
  - 580

Different cylinder sizes for differing heat exchange surface and product volume needs.

Positioning

- High Viscosity
  - $$$

- Medium Viscosity
  - $$

- Low Viscosity
  - $

Low Viscosity portfolio for soups, dressings, sauces, personal care applications, etc.
Waukesha Cherry-Burrell Scraped-Surface Heat Exchangers

Portfolio

- Votator II series
  - Extra Heavy Duty
  - 624
  - 636
  - 648
  - 672
  - 684
- Votator LD series
  - 520
  - 540
  - 580

Positioning

- High Viscosity $$$
- Medium Viscosity $$
- Low Viscosity $

Votator LD is the same product as the APV VT+/HT+. Can be used in the same applications.

For cream cheeses, deboned meats, nut butters, fruit/vegetable purees, etc.
Gerstenberg Schroder Scraped-Surface Heat Exchangers

Portfolio

- Nexus
  - 200C
- Perfector
  - 125
  - 150
  - 180
- Kombinator
  - 250S
  - 250L
  - SCHW
- Consistator
  - MD180
  - MD250

Positioning

- High Viscosity $$$
  - Nexus
  - Perfector
  - Kombinator
- Medium Viscosity $$
  - Consistator MD series
- Low Viscosity $

Consistator MD: Medium to High Viscosity applications, such as ghee, cream fillings, marinades, jams, etc.

Different cylinder sizes for differing heat exchange surface and product volume needs.
SPX Flow Global SSHE Portfolio

High Viscosity $$$
- Margarine
- Low-fat spreads
- Shortening
- Ghee
- Bakery filling cream

Medium Viscosity $$
- Peanut butter
- Gelatin
- Marshmallow
- Syrups
- Frostings & Icings
- Mechanically deboned meat

Low Viscosity $
- Personal care (i.e. lotions)
- Salsa
- Dressings
- Ketchup / mustard / dips
- Soups
- Sauces

The focus of today’s training
Medium-Viscosity SSHE

WCB Votator II
Configurations

Horizontal

Vertical
### Medium-Viscosity SSHE

- **Product max. pressure:**
  - 800 psig (55 bar)

- **Surface area:**
  - 3, 4.5, 6, 9, 11 ft² (0.28, 0.4, 0.56, 0.84, 1.0 m²)

### Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Heat Transfer Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 x 24</td>
<td>3 ft², 0.28 m²</td>
</tr>
<tr>
<td>6 x 36</td>
<td>4.2 ft², 0.4 m²</td>
</tr>
<tr>
<td>6 x 48</td>
<td>6 ft², 0.56 m²</td>
</tr>
<tr>
<td>6 x 72</td>
<td>9 ft², 0.84 m²</td>
</tr>
<tr>
<td>6 x 84</td>
<td>11 ft², 1.0 m²</td>
</tr>
</tbody>
</table>

Different cylinder sizes for differing heat exchange surface and product volume needs.
<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integral gearmotor</td>
<td>No coupling or alignment issues</td>
</tr>
<tr>
<td>Bayonet locking latch</td>
<td>Less time for serving unit</td>
</tr>
<tr>
<td>3 sanitary connections</td>
<td>Less pressure drop and particle size</td>
</tr>
<tr>
<td>New 2012 seal</td>
<td>More application range and reliability</td>
</tr>
<tr>
<td>High temperature blade material</td>
<td>Broader applications</td>
</tr>
<tr>
<td>Metal-detectable blades</td>
<td>Ensure product quality and safety</td>
</tr>
<tr>
<td>High pressure tube design</td>
<td>Broader applications</td>
</tr>
<tr>
<td>Twin seal— double O-ring product tube</td>
<td>Safety— refrigeration applications</td>
</tr>
<tr>
<td>6x84 model with additional area</td>
<td>Fewer cylinders per application</td>
</tr>
<tr>
<td>Chrome-plated carbon steel product tube</td>
<td>Initial and replacement savings</td>
</tr>
<tr>
<td>Metal-detectable O-rings</td>
<td>Ensure product quality and safety</td>
</tr>
<tr>
<td>Vertical orientation</td>
<td>Minimize floor space</td>
</tr>
</tbody>
</table>
Blade Mounting Configuration

Full blade coverage on tube surface
Votator II

Universal Mutator Shaft

Available Diameters

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 in.</td>
<td>4 in.</td>
</tr>
<tr>
<td>63.5 mm</td>
<td>101.6 mm</td>
</tr>
<tr>
<td>4.5 in.</td>
<td>114.3 mm</td>
</tr>
<tr>
<td>5.25 in.</td>
<td>133.4 mm</td>
</tr>
</tbody>
</table>

- Higher particulate content
- Lower particulate content
- Less heat sensitive products
- More heat sensitive products
Seals

Scraped-Surface Heat Exchangers
# Votator II 2012 Mechanical Seal

## FEATURES:
- Single & Double seal types
- Simple field installation
- Universal VII seal design
- Improved mechanical performance
- Greater range of products
- Expanded applications

## ADVANTAGES:
- Multiple seal configurations
- Sanitary, open design
- VII retrofit capability
- Anti-rotational design
- Multiple seal face types
- Various seal materials

## BENEFITS:
- Expanded process range
- Minimizes maintenance time
- Adaptable to vintage VII designs
- Longer seal life
- Wide thermal range
- Greater flexibility

## MATERIALS & OPTIONS:
- Standard and Knife edge seal faces
- Silicon Carbide, Tungsten Carbide, Ceramic, and Carbon materials
- Elastomer materials – EPDM, FKM, & Buna
- Flushing components – Silicon Carbide/Carbon

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Anti-rotational design that locks the stationary seal into the head housing for optimal mechanical performance.

Multiple rotating and stationary configurations including seal face types and material selections.

Existing secondary seal flushing components are universal with the 2012 seal design.
Votator II – Seal Configuration

Rotary Seal
- Seal Body (sold as an assembly)
- Seal Face O-Ring
- Seal Face
- Drive Pin (press fit)

Stationary Seal
- Gland-Seal Head Insert
- Seat-Seal Head Insert
- Gland and Seat O-Ring

Designed for easy face installation
Votator II – Mechanical Seal

- Spring out of the product zone
- Convertible to double seal design
- More range of seal face materials
- Longer life/ Reduced cost
- Easier maintenance
Votator II – Primary Seal Removal

Primary Seal Components
Votator II – Secondary Seal Removal

Secondary Seal Components
Tubes

Scraped-Surface Heat Exchangers
Tubes

Types

Spiral w/ SS cover

Stiffening rings
Tubes

Materials

- Chrome-Plated Nickel (VII only)
- 316 Stainless Steel
- Enhanced (Thin-walled) 316 Stainless Steel
- Chrome-Plated Carbon Steel (VII and G/S models only)
Tubes

Removal
Drive System

Scraped-Surface Heat Exchangers
Drive System

- Single-Piece Housing – Machined fit for easy attachment to Votator II pedestal
- Triple Shaft Seal
- Splined Shaft
- 4 Internal Bearings

Power Range: 0.16 HP - 200 HP
Torque Capacity: Up to 765,590 ft-lb
Ratio Range: 4.03:1 - 300,000:1
Output Speed: 0.1 rpm - 450 rpm
Efficiency: Up to 67% Efficient
Drive System

- Hollow shaft to accept splined mutator shaft
- No shaft coupling
Head and Bearing Types

- Standard Bearing
- Heavy Duty Bearing
Product Port Seal

O-ring port seal & bayonet lock

- I-line product connection
- Stationary seal insert
Maintenance

Scraped-Surface Heat Exchangers
Vertical Votator II - Maintenance

- Easy access for inspection and maintenance
- No tools required to remove
- Blades fastened to shaft with universal mounting pins
Vertical Hydraulic Lifting System

- Motor and Pump
- Pressure Control
- Fluid reservoir
- Balance Valve
Seal Maintenance

- Seal components on shaft can be serviced without removing it from hydraulic lift
Vertical Seal Maintenance

Quick connect clamp support holds mutator in Votator cylinder
Mechanical seal on non-driven end can be serviced while shaft is held in cylinder by support clamp.

Shaft lock nut on non-driven end positions mutator in the unit.
Low-Viscosity SSHE

APV VT+/HT+ (WCB Votator LD)
VT+/HT+ Configurations

**Options**

- **Size Range**
  - 5 x 20 (0.2 m² / 2.1 ft²)
  - 5 x 40 (0.4 m² / 4.3 ft²)
  - 5 x 80 (0.80 m² / 8.6 ft²)

- **Same cylinder execution both versions**

- **Cylinders with different heating / cooling media**

- **Horizontal options**
  - Multiple cylinders
  - Cylinders of different size
  - Up to 6 cylinders
  - Cylinders with different heating cooling media
VT+/HT+ - Multiple Tube Configurations

**Horizontal Frame Configuration**

**Vertical Frame Configuration**
Direct Drive

Drive End

- Head and Pedestal (one piece)
- Media Outlet
- Mechanical cartridge sealing
- Cylinder (jacket)
- Gearmotor
Drive End Assembly Cutaway

Product cylinder

Seal ring faces

Casted head / pedestal (one piece!)

Hollow-shaft gearmotor

Rotor shaft fitted directly to the hollow shaft of the gear

Jacket

Tangential product outlet; drains completely

Mechanical cartridge sealing

Single mechanical sealing
Application Case Studies

Scraped-Surface Heat Exchangers
Medium & Low Viscosity Applications

**Purees and Concentrates**
- Apple/Pear/Mango/Papaya
- Pumpkin/Squash
- Tomato & Garlic puree
- Toppings (Ice cream)
- Fruit fillings
- Diced chili peppers

**Condiments**
- Ketchup/Mustard/Salsa/Hummus/Pickle relish
- Dips (Sweet & Sour, Honey Mustard, Ranch)

**Sauces**
- BBQ sauce
- Pizza sauce
- Spaghetti sauce
- Tartar sauce
- Cheese sauce
- Chocolate coatings
- Pudding

**Other Foods**
- Salad dressings
- Mayonnaise
- Soups
- Starch bases
- Honey

**Dairy**
- Sour Cream
- Bakery creams (Bavarian, coconut, custards, etc.)
### Case Study 1

**Application**

- **Cooling soya-cottonseed oil** at 3,000 lbs./hr (1364 kg/hr) from 120°F (48.9 °C) to 65°F (18.3° C) using 0°F (-17.7° C) ammonia

**Equipment**

- **Votator II 6 x 48** (1 concentric cylinder)

**Specifications**

- Horizontal configuration
- Chromed nickel tube (Carbon steel – low cost option)
- 4.5” (114.3 mm)diameter shaft – (shaft heater often used)
- Celcon blades
- Single mechanical seals Ceramic/Carbon
- 20 Hp (15 KW) motor at 360 rpm
- BUNA elastomers

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Palm oil-based products can also be processed at lower production rates depending on the % of palm oil present in the formula.
Case Study 2

**Cookie Cream (1947)**

**Application**
- Cooling cookie cream at 1500 lbs/hr (682 kg/hr) from 120°F (48.9°C) to 80°F (26.7°C) using 50 gpm (180 lpm) of 28°F (-2.22°C) glycol solution

**Equipment**
- Votator II 6 x 72 (1 eccentric cylinder)

**Specifications**
- Horizontal configuration
- Chromed nickel tube
- 4.0” (101.6 mm) diameter shaft
- 410 stainless steel blades
- Double mechanical seals, SiC/TC narrow
- 20 Hp (15 KW) motor at 116 rpm
- BUNA elastomers

Early designs utilized the EXHD version based on the product viscosity. New formulations have reduced the apparent viscosity resulting in a concentric configuration.
Case Study 3

**Peanut Butter (1958)**

**Application**
- **Cooling standard peanut butter** at 3,500 lbs/hr (1591 kg/hr) from 160°F (71.1°C) to 95°F (35°C) using 25°F (-3.88°C) glycol.

**Equipment**
- **Votator II 6 x 72** (1 eccentric cylinder)

**Specifications**
- Horizontal configuration
- Chromed nickel tube
- 4.0” (101.6 mm) diameter shaft
- 17-7 stainless steel blades
- Single mechanical seals SiC/SiC
- 20 Hp (15 KW) motor at 230 rpm
- Buna elastomers

Low fat formulation must represent 10% or less to total production to utilize above configuration. Otherwise, an extra heavy duty oval configuration is required.
Case Study 4

Marshmallow (1959)

Application

• **Cooling extruded product** at 7,000 lbs/hr (3,182 kg/hr) from 160°F (71.1°C) to 88°F (31.1°C) using 50 gpm of 42°F (5.5°C) chilled water.

Equipment

• **Votator II 6 x 72** (2 extra heavy duty oval cylinders)

Specifications

• Horizontal configuration
• Chromed nickel oval tube
• 4.0” (101.6 mm)diameter shaft
• 410 stainless steel blades
• Double mechanical seals SC/SC
• 30 Hp (22 KW) motor at 114-164 rpm
• EPDM elastomers

Marshmallow creme can also be processed on the configuration above, although not required based on the viscosity.
Case Study 5

Aseptic Fruit (1969)

Application
- Heating yogurt fruit slurry at 2500 pph from 180°F (30.2 °C) to 250°F (121.1 °C) using 300°F (148.9 °C) steam, pre-cooling from 250°F (121.1 °C) to 150°F (65.5 °C) using 85°F (30.2 °C) water, final cooling to 70°F (21.1 °C) using 28°F (-2.22 °C) glycol.

Equipment
- Votator II 6 x 72 (Medium duty, 3 cylinders)

Specifications
- Horizontal configuration
- Enhanced 316SS tubes
- 2.5” (63.5 mm) diameter shafts
- PEEK blades
- Double mechanical seals C/SC
- 10 Hp (7.5 kW) motor at 120 rpm
- FKM elastomers
Case Study 6

Baker’s Fondant (1975)

Application

• Crystallizing 88% table sugar fondant at 6 gpm (21.6 lpm) from 244°F (117.7 °C) to 145°F (62.8°C) using 50 gpm of water at 85°F (29.4°C) Ultra-smooth sugar crystals < 10 microns.

Equipment

• Votator II 6 x 72 (Medium duty, 1 cylinder)

Specifications

• Horizontal configuration
• Chrome-plated nickel tube
• 5.25” (133.3 mm) diameter shaft
• 410 SS blades
• Double mechanical seals SC/SC
• 15 Hp (11.2 KW) motor at 160 rpm
• EPDM elastomers
Case Study 7

**Application**

- Cooling mechanically deboned meat (MDM) at 9,000 lbs/hr (59.4 lpm) from 55°F (12.7 °C) to 35°F (1.67 °C) using 0°F (-17.7 °C) ammonia/Freon.

**Equipment**

- Votator II 6 x 72 (2 concentric cylinders)

**Specifications**

- Vertical configuration
- Chromed nickel tube
- 4.0” (101.6 C) diameter lightweight shaft
- 410 stainless steel blades
- Single mechanical seals Cox/Cox
- 20 Hp (15 KW) motor at 190 rpm
- Buna elastomers
- Refrigeration circuit with 16” (228.6 mm) accumulators

Chunky MDM with 2 ½” diameter shaft at reduced RPM's can be produced at lower rates.
### Case Study 8

#### Popcorn oil (2007)

**Application**
- Cool and crystalize 3.9 gpm (14 lpm) of popcorn oil slurry from 140 °F (60 °C) to 75 °F (24 °C) using 58 °F (14.4 °C) propylene glycol

**Equipment**
- Votator II 6 x 72 (1 Concentric cylinder)

**Specifications**
- Horizontal configuration
- Chrome Plated Nickel Tube
- 4.5" (114.3 mm) shaft diameter
- PEEK metal detectable
- Seal TC narrow face
- 10 hp (7.46 KW) at 117 rpm
Competition

Scraped-Surface Heat Exchangers
Competition

Global

APAC

Americas

EMEA
Competitive Profile

- **Background**
  - Offers single and double-walled SSHE
  - Recent history of aggressive pricing
  - Has copied Terlet for Contherm Max (surface area, throughput)
  - 3A certification: Contherm and Contherm Select

- **Strengths**
  - Brand recognition
  - Food development centers and rental equipment available worldwide
  - Customer Testing Centers in U.S. and Europe
  - Components (cylinders, rotors, etc.) available on a rental or exchange basis

- **Weaknesses**
  - Less robust SSHE units vs. SPX
  - Units difficult to service

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**Contherm Core**
- For low-viscosity, low-fouling products
- Economical solution
- Easy to service; automated components removal

**Contherm Max**
- For low to medium viscosity products, where more surface area and throughput are required

**Contherm Select**
- For extremely viscous, fouling, or sticky products

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**Contherm**
- For medium-viscosity, medium-fouling products
How to compete versus Alfa Laval

The APV VT+/HT+ series and WCB Votator LD series...

...feature a manual pivot for horizontal or vertical orientation of the SSHE,
...whereas the Alfa Laval Contherm Core and Contherm require hydraulics for changing the unit’s orientation.

SPX advantage: no additional costs for rotation of the barrels for easier maintenance.

The APV VT+/HT+ series and WCB Votator LD series...

...feature three surface area options, including 0.2, 0.4, and 0.8m²,
...whereas the Alfa Laval Contherm Core is available with only two surface area options (0.84 and 1.0m²).

SPX advantage: greater ability to select a light duty SSHE that fits the application’s needs.

The WCB Votator II series...

...features five surface area options,
...whereas the Alfa Laval Contherm is available with only four surface area options.

SPX advantage: greater ability to select a medium to high duty SSHE that fits the application’s needs.

The WCB Votator II series...

...features high product-side max working pressure (42 bar or 56 bar),
...whereas the Alfa Laval Contherm is capable only to 20 or 27 bar.

SPX advantage: greater ability to perform in more challenging applications.

SPX Flow scraped-surface heat exchangers...

...are well-built units with quality components and design,
...whereas the Alfa Laval SSHEs are generally perceived as having a less robust design.

SPX advantage: greater durability, better equipment longevity.
### Competitive Profile

**Background:**
- Focused on batching operations; low-pressure, light-duty
- Only offers vertical units
- Large heat exchange surface area vs. footprint
- Bottom-driven design
- Installed base of ~1500 units worldwide

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
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<tbody>
<tr>
<td>Small footprint</td>
<td>Expensive</td>
</tr>
<tr>
<td>A one-seal design; fast seal</td>
<td>Ease of servicing?</td>
</tr>
<tr>
<td>replacement</td>
<td>Lower thermal efficiencies vs. SPX</td>
</tr>
<tr>
<td></td>
<td>Great hold-up volume as a possible issue</td>
</tr>
<tr>
<td></td>
<td>Max. pressure limited to 100 psi</td>
</tr>
</tbody>
</table>

**Tangential inlet**

**Double heat exchanging walls**
# How to sell against Terlet

## Comparison of product hold-up

<table>
<thead>
<tr>
<th>Ex.</th>
<th>VT+580 (1 cylinder)</th>
<th>Vs.</th>
<th>Terlotherm T1/2 (1 cylinder)</th>
<th>52% more hold-up volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat transfer surface: 0.8 m²</td>
<td></td>
<td>Heat transfer surface: 0.6 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Product hold-up volume: 11.7 L</td>
<td></td>
<td>Product hold-up volume: 20 L</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ex. 2</th>
<th>VT+580 (3 cylinders)</th>
<th>Vs.</th>
<th>Terlotherm T1-4 (1 cylinder)</th>
<th>14 - 64% more hold-up volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat transfer surface: 2.4 m²</td>
<td></td>
<td>Heat transfer surface: 2.4 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Product hold-up volume: 35.2 - 59 L</td>
<td></td>
<td>Product hold-up volume: 68.1 L</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ex. 3</th>
<th>Votator II 672 (3 cylinders)</th>
<th>Vs.</th>
<th>Terlotherm T1-4 (1 cylinder)</th>
<th>30% more hold-up volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat transfer surface: 2.5 m²</td>
<td></td>
<td>Heat transfer surface: 2.4 m²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Product hold-up volume: 47.3 L</td>
<td></td>
<td>Product hold-up volume: 68.1 L</td>
<td></td>
</tr>
</tbody>
</table>

More hold-up volume = More residence time, more exposure to heat, more exposure to shear
Key attack from Terlet

Unnecessary comparison to a medium to high viscosity type of SSHE
- A low-viscosity SSHE aligns better to the target applications
  - Results in Terlet being $75,000 more capital intensive

Seal replacement three times per year is not the average

Analysis has a significant error
- Labor difference is only $5,100
  - Eliminates over $90,000 in costs for the “conventional SSHE”

Reality
- $75,000 more in capital investment
- Only $3,300 in annual labor savings
- $9,000 more expensive in year 1

Seal replacement maintenance cost is not as significant as Terlet claims

<table>
<thead>
<tr>
<th>System</th>
<th>Conventional SSHE</th>
<th>Terlotherm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Units</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Cost Per Unit</td>
<td>$45,000</td>
<td>$115,000</td>
</tr>
<tr>
<td>Total Capital Cost</td>
<td>$405,000</td>
<td>$345,000</td>
</tr>
<tr>
<td>Difference Capital Cost</td>
<td>$60,000</td>
<td></td>
</tr>
<tr>
<td>Seal No.</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>Cost Per Seal</td>
<td>$1,900</td>
<td>$1,900</td>
</tr>
<tr>
<td>No Replacement Per Year</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Total Number Of Seals</td>
<td>54</td>
<td>3</td>
</tr>
<tr>
<td>Spare Part Cost (Seals Only)</td>
<td>$102,600</td>
<td>$5,700</td>
</tr>
<tr>
<td>Difference Spare Part Cost</td>
<td>$96,900</td>
<td></td>
</tr>
<tr>
<td>Time Per Seal Replacement (hr)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total Time (hr)</td>
<td>108</td>
<td>6</td>
</tr>
<tr>
<td>Cost per hour</td>
<td>$50</td>
<td>$50</td>
</tr>
<tr>
<td>Total Yearly Labor Cost</td>
<td>$97,200</td>
<td>$300</td>
</tr>
<tr>
<td>Difference Yearly Labor Cost</td>
<td>$96,900</td>
<td></td>
</tr>
<tr>
<td>Savings Year One</td>
<td>$253,800</td>
<td></td>
</tr>
<tr>
<td>Savings Yearly</td>
<td>$193,800</td>
<td></td>
</tr>
</tbody>
</table>
Understanding Customer Needs

Scraped-Surface Heat Exchangers
### SCRAPED SURFACE HEAT EXCHANGER DATA SHEET

SEND INQUIRES TO DeDe Nelson – APPLICATION ENGINEERING MANAGER

<table>
<thead>
<tr>
<th>Date:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributor / End User:</td>
<td></td>
</tr>
<tr>
<td>Technical Contact / Phone:</td>
<td></td>
</tr>
<tr>
<td>Email:</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td></td>
</tr>
</tbody>
</table>

**Type Quote:**
- [ ] Budget
- [ ] Firm

**Due Date:**
- [ ]
- [ ]

**Product Description:**
- [ ]
- [ ]

**Current Processing Method:**
- [ ]
- [ ]

**Any Problems:**
- [ ]
- [ ]

**Product Flow Rate & Temperatures:**
- [ ] lbs/hr or kg/hr
- [ ] °F or °C

<table>
<thead>
<tr>
<th>Sales temp.</th>
<th>°F or °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet temp.</td>
<td>°F or °C</td>
</tr>
</tbody>
</table>

**Product:**
- [ ]
- [ ]

<table>
<thead>
<tr>
<th>Specific Heat</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td></td>
</tr>
<tr>
<td>% Solids</td>
<td></td>
</tr>
<tr>
<td>% Crystallization</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>cps</th>
<th>°F or °C</th>
</tr>
</thead>
</table>

**Utilities:**
- [ ] Steam @ psig or barg
- [ ] Water @ °F or °C
- [ ] Refrigerant @ °F or °C

**Auxiliary Equipment Required:**
- [ ] Product Pump
- [ ] Other

**Equipment Design:**
- [ ] Horizontal
- [ ] Vertical

**Competition:**
- [ ]

---

**Waukesha Cherry-Burrell**

611 Signi Creek Road
Delavan, WI 53115 USA
Phone: 1-800-252-5050 or 262-729-1600
Fax: 1-800-252-5050 or 262-729-6566
E-mail: cidee.callison@spx.com

---

Critical data for proper application specification and sizing
The importance of understanding the application

Cheese sauce example

Viscosity at no shear and room temperature

Lower viscosity at no shear and elevated temperature

Even lower viscosity under shear

Avoid over-specifying and therefore pricing ourselves out of competition

Key takeaways

- Shear rate and temperature can affect viscosity
- Not considering this can result in specifying a more expensive solution than is needed
- Always gather complete application details
Gathering key customer input

### Voice of the customer

<table>
<thead>
<tr>
<th>Details of the application</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is creating the need for the SSHE for the end user?</td>
</tr>
<tr>
<td>Are there any particular issues the customer/end user is trying to address?</td>
</tr>
<tr>
<td>What environment will the unit be going into?</td>
</tr>
<tr>
<td>What has been the customer’s/end user’s experience with SSHEs in the past?</td>
</tr>
</tbody>
</table>
Wrap-Up

Scraped-Surface Heat Exchangers
SPX Flow Scraped-Surface Heat Exchangers

**Low Viscosity**

- VT+ / HT+ series
  - 520
  - 540
  - 580

**Medium Viscosity**

- Votator II series
  - Extra Heavy Duty
    - 624
    - 636
    - 648
    - 672
    - 684
- Votator LD series
  - 520
  - 540
  - 580
The focus of today’s training
## Value Proposition and Key Selling Points

<table>
<thead>
<tr>
<th>Low-Viscosity – APV VT+/HT+</th>
<th>Medium-Viscosity – WCB Votator II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broad range of configurations</td>
<td>Broad range of applications</td>
</tr>
<tr>
<td>Easy to service and maintain</td>
<td>High pressure (800 psig/55 bar)</td>
</tr>
<tr>
<td>Attractive price per cylinder</td>
<td>Multiple orientations</td>
</tr>
<tr>
<td>Vertical without hydraulics</td>
<td>Rugged ASME/PED design</td>
</tr>
<tr>
<td></td>
<td>Simple maintenance</td>
</tr>
</tbody>
</table>

**Low-Viscosity – APV VT+/HT+**
- Broad range of configurations
- Easy to service and maintain
- Attractive price per cylinder
- Vertical without hydraulics

**Medium-Viscosity – WCB Votator II**
- Broad range of applications
- High pressure (800 psig/55 bar)
- Multiple orientations
- Rugged ASME/PED design
- Simple maintenance