

# Kettles with Inclined Agitation vs. Horizontal Ribbon Blenders

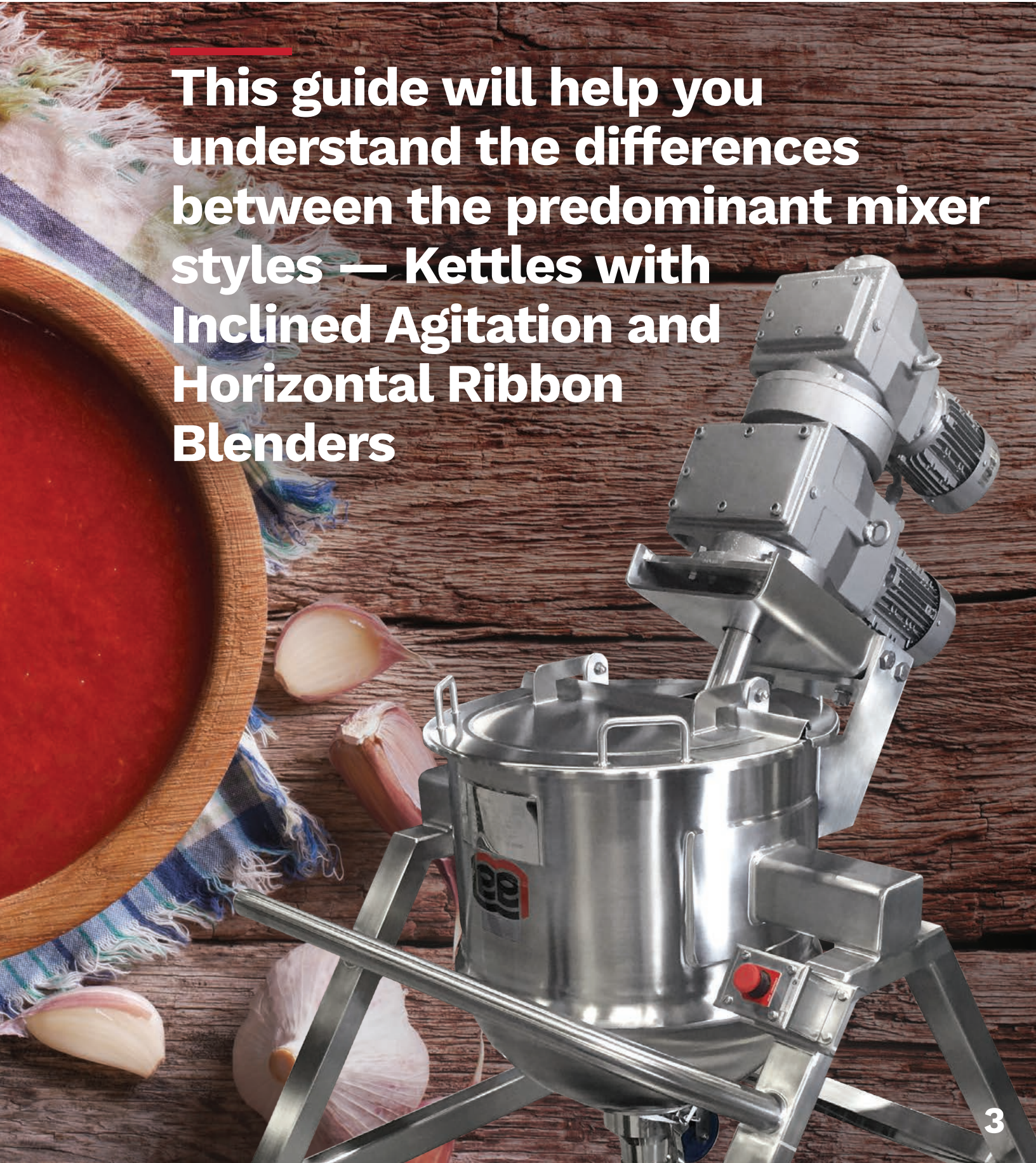
A guide to help food processors optimize production



For food processors, mixing kettles or tanks are critical assets in their operation. Top-performing companies carefully consider many factors – including the ingredients in the products they produce – to determine the type of mixers that will optimize their efficiency and quality.



**This guide will help you understand the differences between the predominant mixer styles — Kettles with Inclined Agitation and Horizontal Ribbon Blenders**



## LEE INDUSTRIES

**Historically**, horizontal ribbon blenders – which consist of a rectangular or U-shaped trough and an agitator with ribbon blades to mix the product – have been an important contributor to the operations of many food processing facilities. But as food products increasingly featured more challenging ingredients like fresh-cut vegetables, fruit, ground beef or other heavy solids, processors sought mixer designs that were better suited for these types of products.

Inclined mixers are hemispherical kettles specifically engineered to deliver better and more efficient performance, especially when processing food products with delicate, fresh-cut or solid ingredients. First introduced as a replacement for horizontal blenders by Lee Industries over 25 years ago, kettles with inclined agitation have replaced horizontal ribbon blenders in many applications.



*Compared to horizontal blenders (left) kettles with inclined agitation (right) offer major advantages in certain food processing applications.*

## Design Challenges of Horizontal Ribbon Blenders

Although horizontal blenders are commonly used in many food processing applications, drawbacks inherent to their basic design and mechanical features can pose challenges for food processing operations.

### Horizontal Ribbon Blenders: Challenges to Product Quality

#### Mixing gaps:

The physical profile of a horizontal blender – round mixing blades sitting inside of a rectangular or U-shaped tub or trough – create “mixing gaps” where unmixed ingredients outside the reach of the blender’s mixing blades collect along the top side edges and ends of the vessel. In operation, this problem is addressed by either running the blender at a higher speed, which can damage certain ingredients or alter product consistency, or stopping the blender to manually clear these unmixed ingredients, which delays batch production. To improve mixing, food processors can raise one end of the blender to increase product movement from the higher end of the blender to the lower end. However, if the product contains liquid with different solids in suspension, this incline can cause heavier solids to move more quickly to the lower side of the vessel before they can be adequately mixed, creating additional mixing and uneven discharge problems.

#### Difficulty with certain ingredients:

There are additional problems when using a horizontal blender to mix food products containing delicate, chunk-like ingredients, such as sliced vegetables, fruit, or other fresh-cut ingredients. Product quality and consistency can degrade because it is difficult to maintain these materials in suspension in a horizontal blender during mixing and cooking. During mixing, for example, these ingredients will often remain floating on the surface, or sink to the bottom of the vessel. In either case, there is potential for the ingredients to be damaged or undercooked/overcooked. This issue is particularly important for “home style” foods, such as chunky soups, sauces and jams where ingredients must remain intact and consistently cooked during batch processing. Mixing and cooking ground beef can also be a problem in horizontal blenders, where these heavy solids can clump around the blender ribbon, or can leave large chunks of meat with uncooked centers collected on and around the vessel’s mixing shaft.

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Design limitations in horizontal blenders can cause product quality problems for “home style” foods, such as chunky soups, sauces and jams where product ingredients must remain intact and consistently cooked during batch processing.

### **Horizontal Ribbon Blenders: Challenges to Operational Efficiency and Safety**

Beyond quality-related issues, there are challenges to operational efficiency and safety when using horizontal blenders in food processing operations:

#### **Incomplete and uneven product discharge:**

The mixing gaps created in the unswept portions of the horizontal blender's vessel walls can prevent full discharge of finished product, as ingredients stay lodged on the sides and ends of the vessel.

Product discharge can also be complicated if the horizontal blender is set at an incline, as liquids and solids will tend to flow out of the vessel at different rates, creating uneven distribution of ingredients in downstream packaging operations. *See Figures 1-A & 1-B.*

#### **Inconsistent heat transfer:**

Maintaining consistent heating temperatures can be a challenge for horizontal blenders used in cooking processes. Heating jackets are often only placed at the bottom of a horizontal blender vessel, resulting in higher heat transfer on the bottom of the vessel compared to its sidewalls. Because the ribbon mixing blades do not scrape the entire surface of the vessel in a horizontal blender, accumulated pockets of clumped food material at the ends and top sides of the vessel can trap heat, affecting the cooking process for the entire batch. Even when heating jackets are placed on the vessel's sidewall, there is potential for product burn-on since the entire sidewall is not scraped. *See Figures 2-A & 2-B.*

#### **Greater food contamination potential:**

Agitator assemblies in horizontal blenders consist of ribbon blades attached to a single horizontal shaft, which rotates on bearings and seals mounted on both ends of the vessel. Unless product ingredients are always carefully filled to a point well below the edge of these shaft seals, product will accumulate at these seal points, which must then be carefully cleaned on a regular basis to prevent product contamination issues. *See Figures 3-A & 3-B.*

#### **Higher service costs:**

The horizontal blender shaft mounts to both end walls of the vessel, making it difficult to remove, service and repair. This is an especially expensive and time-consuming repair on many horizontal blenders, because there is often no alternative but to cut the vessel's end walls to remove the blender shaft. Although this problem can be eliminated by using a two-piece shaft connected by a mechanical coupling on the blender shaft, this coupling must always be carefully cleaned to avoid product contamination from accumulated food product that can collect in the sleeve, pin or bolt openings.

## Horizontal Blender

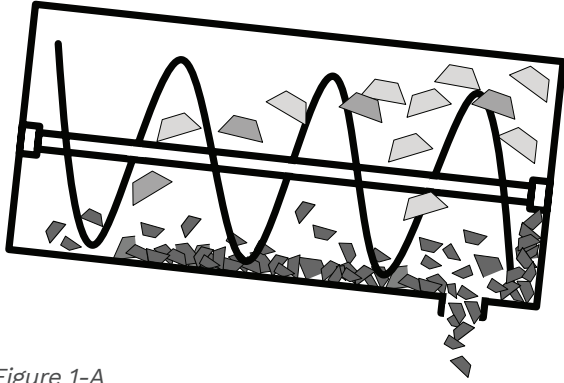


Figure 1-A

**Incomplete and uneven product discharge** when ingredients of different weights are processed in the same vessel.

## Kettles with Inclined Agitation

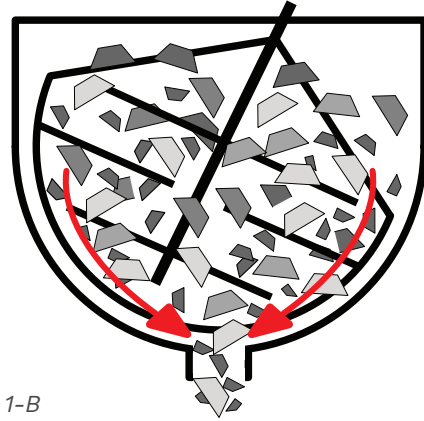


Figure 1-B

**Hemispherical design assures consistent, complete, even discharge** of ingredients regardless of their weight or thickness.



Figure 2-A

**Burn-on and inconsistent heating** due to insufficient vessel scrape surface and jacketing limitations.

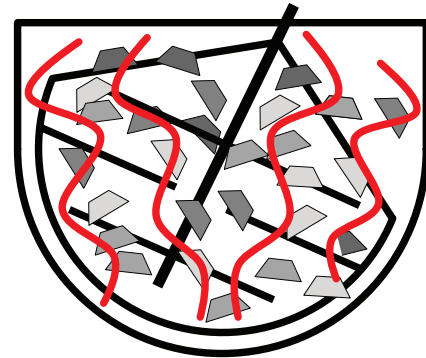


Figure 2-B

**Even heating on bottom and sides of vessel** for uniform cooking results.

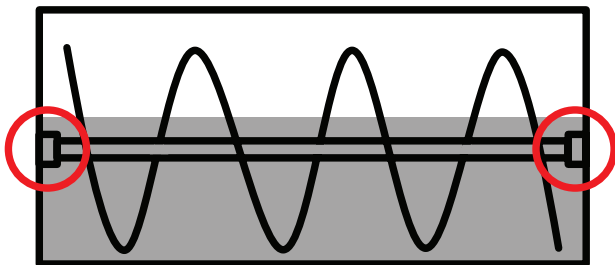


Figure 3-A

**Contamination risk and cleaning issues** due to food accumulation in drive shaft end seals and bearings.

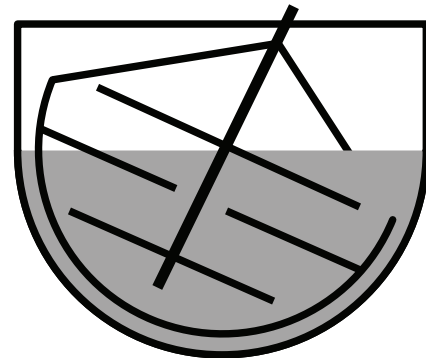


Figure 3-B

**No seals in agitator drive design** for food particles to accumulate; hemispherical design provides easier and more efficient cleaning.

## Horizontal Blender

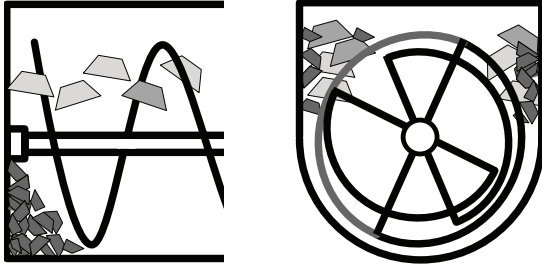


Figure 4-A

**Ingredients clump to ends and top edges** of vessel during mixing.

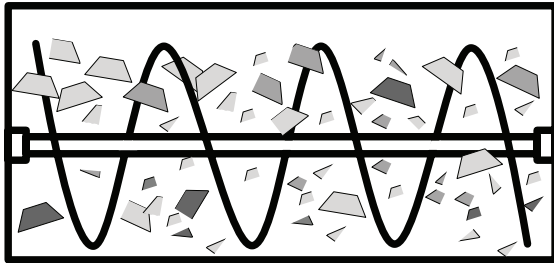


Figure 5-A

**Damage to fresh-cut ingredients** like vegetables and fruit used in “home style” food products.

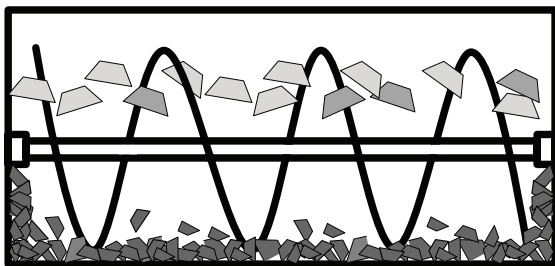


Figure 6-A

**Difficult to maintain even suspension** during batch mixing and cooking.

## Kettles with Inclined Agitation

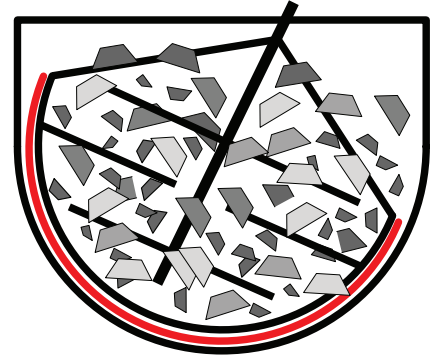


Figure 4-B

**Scraper blades sweep away hemispherical surface of kettle**, leaving no unmixed ingredients and assuring consistent mixing results for every batch.

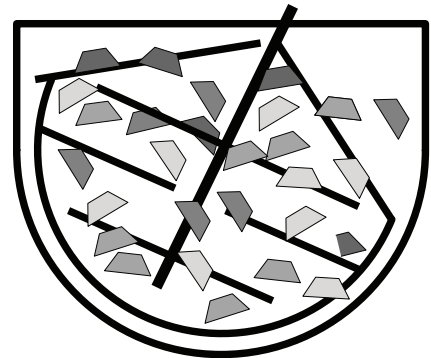


Figure 5-B

**Gentle lifting and folding** action prevents damage to freshcut ingredients, preserving flavor and appearance.

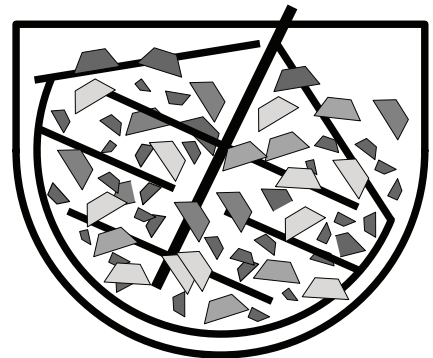


Figure 6-B

**Ingredients evenly suspended** during mixing and cooling for more consistent results.

## Advantages of Kettles with Inclined Agitation

Hemispherical kettles with inclined agitation, introduced by Lee Industries in the late 1980's, offer key advancements for many food processing applications, especially those involving delicate, fresh-cut or solid ingredients.

### How Kettles with Inclined Agitation Improve Product Quality

#### Effective mixing:

The scraper blades of a kettle with inclined agitation sweep the inside hemispherical surface of the kettle, leaving no unmixed product in the vessel and minimizing the potential for product to accumulate during mixing – a common problem in horizontal blenders. This is especially important when mixing ingredients like ground beef, baking mixes, peanut butter and other heavy solids. *See Figures 4-A & 4-B.*

#### Lower risk of ingredient damage:

Kettles with inclined agitation produce a gentle lifting and folding action that not only keeps all the ingredients evenly suspended in the batch for more consistent cooking results, but eliminates the potential for damage to fresh-cut ingredients, such as potatoes, tomatoes, cut vegetables and fruit, which are important in many of today's "home style" and organic food products. *See Figures 5-A & 5-B.*

#### Consistent heating:

The mixing action of kettles with inclined agitation puts more product in contact with the heating jacket along the vessel's inside surface. This eliminates uncooked material in the batch and yields better and more consistent heating and cooking results. *See Figures 6-A & 6-B.*



## **How Kettles with Inclined Agitation Improve Operational Efficiency and Safety**

### **Faster product discharge with no waste:**

The vessel's hemispherical shape and bottom discharge port provide a fast and efficient pathway for complete discharge of the product after each batch. Moreover, for ingredients that tend to either float to the surface or sink to the bottom of the vessel if not adequately mixed, the inclined agitator's mixing action is designed to keep all ingredients evenly blended during discharge.

### **Wider agitator options:**

Kettles are available in a wide variety of both single and double-motion agitator drive options, varying degrees of incline, and can be designed in many blade and scraper configurations to meet any mixing requirement. This versatility makes it possible to use a kettle with inclined agitation to mix, cook and process a wider variety of food products and many different ingredients.

### **Easier service access:**

The inclined agitation's assembly can be readily removed from the kettle for service at any time, which makes it far easier and less costly to maintain, service and repair.

### **Smaller footprint:**

The compact design of a kettle with inclined agitation is smaller than a horizontal blender of similar capacity, which facilitates a more space-efficient design for plant processes.

## **Kettles with Inclined Agitation or Horizontal Ribbon Blender... Which is the Right Choice for Your Operation?**

High quality mixing tanks or kettles are the engine that drives the successful food processing operation. The best choice for your operation is dependent on such factors as the ingredients you use, the variety of products you produce, the configuration of your process and your emphasis on efficiency and safety. Understanding how each of these factors is affected by the type of mixer will help you determine your most productive and cost-efficient solution.





## About Lee Industries

The mission of Lee Industries is to assure our customers are successful by focusing on their custom processing needs and providing them with the highest quality, most durable products and services available.

Lee Industries is committed to the success of your company by providing you with world-class, high-quality stainless alloy process equipment and service. We design and manufacture the most technologically advanced equipment in the industry. Our customer service team, backed by over 90 years of innovation and experience, provides Lee clients with a single source for all their processing system needs.





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