



Stein JSO Jet Stream® Ovens

JSO-IV TF JSO-III IG JSO-III DG



JSO, the world's most successful linear, high velocity, impingement ovens.

When processors want unsurpassed cooking uniformity, they rely on the Stein family of Jet Stream®(JSO) linear ovens. The JSO oven portfolio includes the JSO IV Thermal Fluid Oven, JSO III Indirect Gas oven and the JSO III Direct Gas Oven. The JSO delivers precisely conditioned high velocity, vertical jets of hot air/vapor mixture which impinge products from the top and bottom. The boundary layer of air is effectively penetrated to achieve the highest heat transfer rates to meet the product/process specific requirements as desired.



Stein JSO IV Thermal Fluid Oven

Offers all the benefits of thermal fluid heating, high velocity impingement and condensational cooking for extremely fast heat transfer rates. The results are excellent color development and the highest possible yields.



Stein JSO III Indirect Gas Oven

Gas provides higher temperature processing while containing the by-products of combustion from the oven cook zone. Higher product yields are achieved with half the cooking time of conventional ovens.

Stein JSO III Direct Gas Oven

Open flame heating is ideal for high temperature processing when products require a flame broiled flavor. This continuous processing, high intensity convection oven is ideal for the browning of red meats.

Cooking with the Very Best

- The JSO series has undergone a continuous evolution of design upgrades that keeps pace with products being processed today and tomorrow
- With three different solutions you have options that empower you to extend your processing capabilities with remarkable simplicity
- JBT FoodTech is always evolving, yet continuing to provide a new industry benchmark for performance, hygiene and overall operating economy
- Our team of application specialists has over 100 years of cumulative cooking experience. They will assist you with the development of new cooking methods

Performance

- High velocity impingement ovens are designed to operate a full range of velocities from forced convection through impingement
- Superior humidity conditions achieved through effective containment that incorporates vertical airflow, strategic fluid dynamics and seals
- Impingement generally controls the heating rate of thinner food products
- Combined benefits of high humidity and impingement are:
 - Reduced cook times
 - Control of heat transfer rates for increased throughput
 - Fine tuned oven conditioning to deliver desired product attributes

Versatility

- Infinite control of product conditioning through change of humidity, temperature, velocity and impingement nozzle height
- Versatility through a choice of ovens with the right heat source for the product mix
- Remove infeed or discharge, add transition and another oven box as your business grows
- Add radiant heat oven, Searing section or Char-Marker to enhance your products or to develop new ones.

Yield

- Superior steam containment of up to 85% moisture by volume at full fan speed allows significant latitude to improve product yields
- The application of the right heat transfer mechanism at just the right time ensures that the shortest cook times and product yields are realized
- Multi-box systems provide ample opportunity to effectively separate the sequence of processing steps to produce the best performance

Reliability

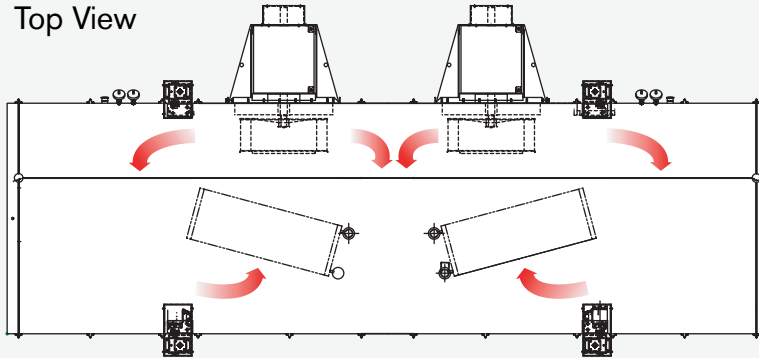
- Accurate steam control and monitoring for improved processing performance
- Robust heat exchanger design with material (AL6XN) to withstand chloride stress corrosion
- Advanced HMI (Allen Bradley) controls to quickly identify problem sources as they occur
- Improved lift system designed to withstand mechanical and thermal loads



JSO-IV TF

Thermal Fluid Heating with Impingement Air Flow

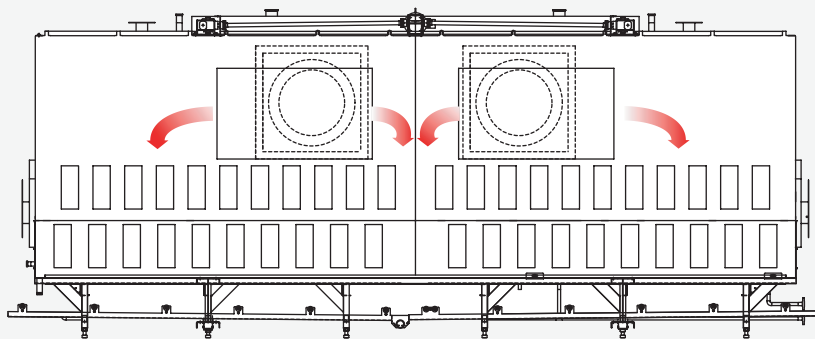
Top View



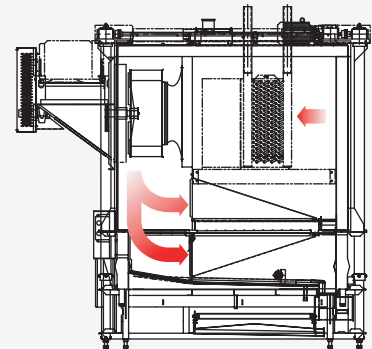
General Selection Criteria

Heating Methods	Products	Operating Cost	Versatility
Direct Fired Gas	Red meat Flavor Extreme Browning Dedicated	High for poultry Low for beef and pork products	Moderate
Indirect Fired Gas	Red meat No Pinking Extreme Browning Dedicated	Highest for poultry Low for beef and pork products	High
Thermal Fluid Heated	All Products	Lowest for all products	Highest

Side View

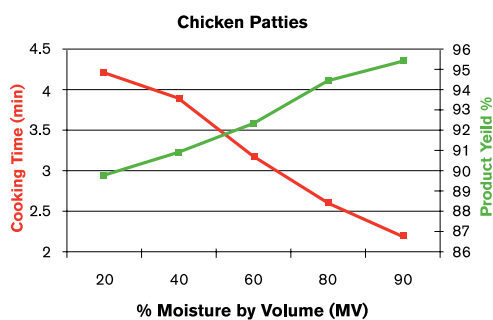


End View



Linear Ovens – Product Effects

Relationship between oven parameters and yield.



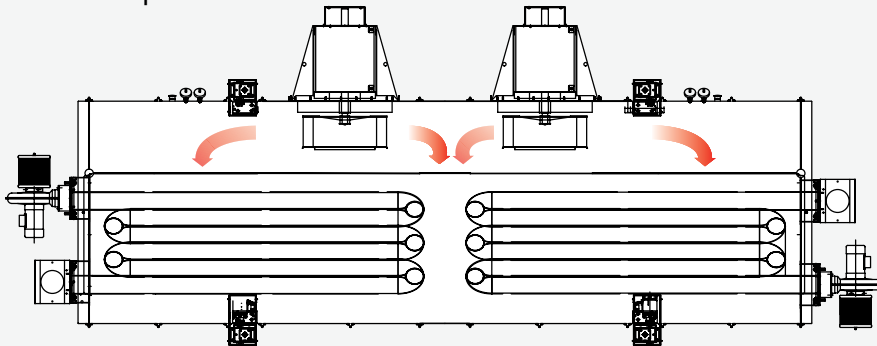
Advantages:

- Better operating efficiency than direct or indirect gas heat
- All circulating air passes through heat exchangers
- High velocity impingement airflow
- High humidity
- Controllable oven atmosphere
- No air migration
- No oven stress
- Cooler cooking room
- Easier to clean
- Shorter cooking time
- Improved yields

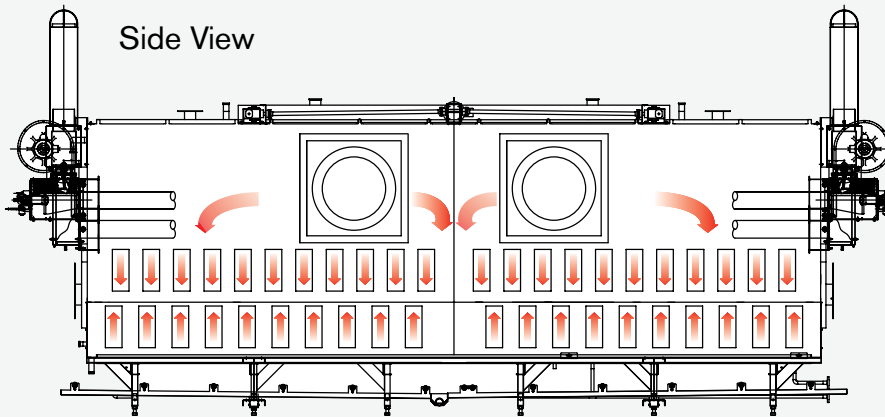
JSO-III IG

Indirect Fired Ovens with Tubes in Oven Box

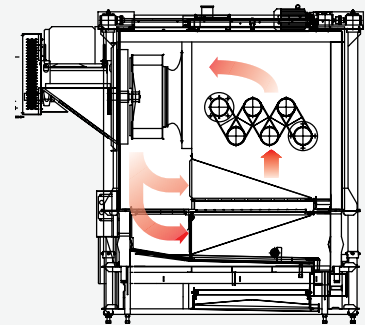
Top View



Side View

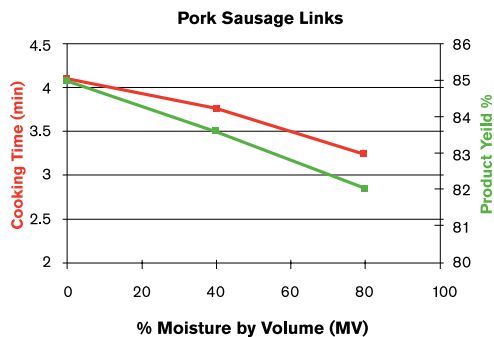


End View



Linear Ovens – Product Effects

Relationship between oven parameters and yield.



Advantages:

- Isolates combustion by-products
- Impingement airflow
- Higher humidity relative to DG

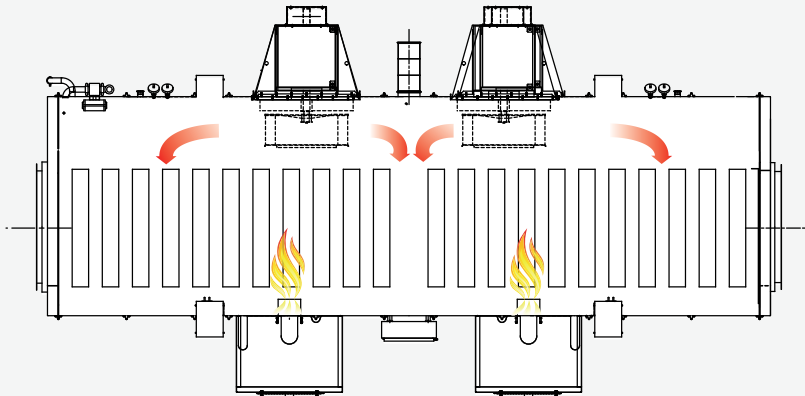
Disadvantages:

- Lower combustion efficiency
- Burner maintenance
- Requires additional roof penetrations
- Higher localized stresses in oven box

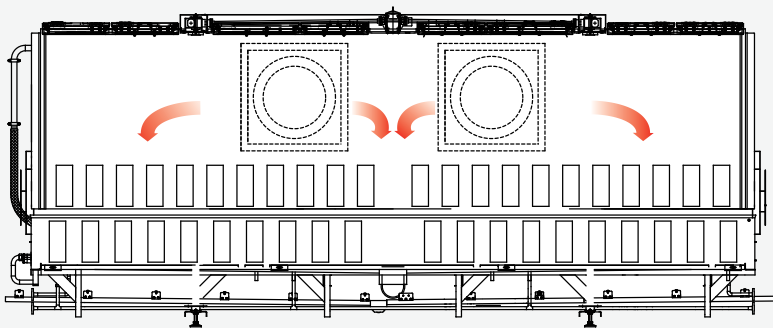
JSO-III DG

Direct Fired Ovens with Burner in Oven Box

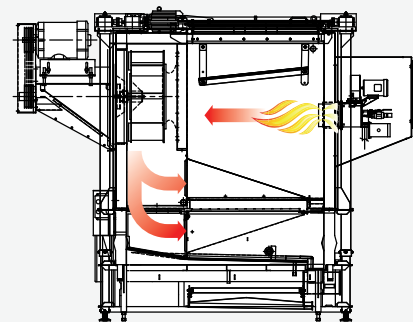
Top View



Side View

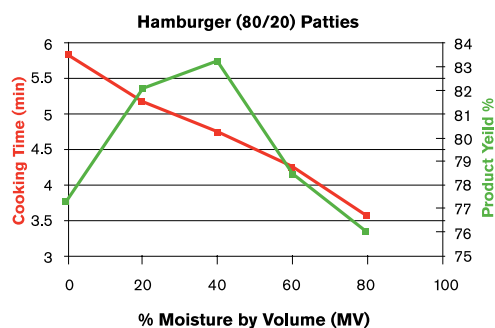


End View



Linear Ovens – Product Effects

Relationship between oven parameters and yield.



Advantages:

- Lower initial cost
- Simple design
- Impingement airflow

Disadvantages:

- Combustion by-products in oven box
- Requires volume of air for combustion
- Poor containment / Reduced humidity
- Localized stresses in oven box



Humidity in Oven Systems

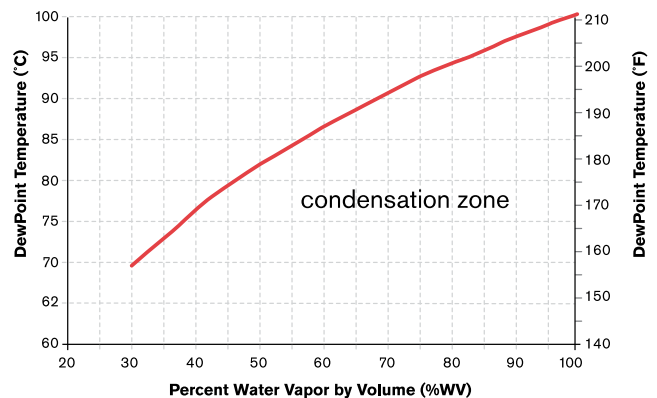
- Can significantly enhance heat transfer
 - Powerful condensation heat transfer when surface is below the dew point (moderate fan speed and lower temperatures).
 - Impingement with higher temperatures when surface is above the dew point.
 - Controlling humidity and impingement variables down a continuous process can deliver desired product attributes.
- Lower temperature processing
 - Reduce operating costs through optimized processing.
 - Lower sanitation costs.
- Line configuration, end point temperature, substrate composition, and product thickness will influence the selection of operating parameters.
- Appropriate humidity measurement units
 - % Relative Humidity relevant only below 212°F dry bulb (e.g., at 300°F, the maximum relative humidity is 20%)
 - % Moisture by Volume (0-100% MV) for air above 212°F dry bulb

Moisture Monitoring and Control

- Humitrol-II measures moisture by volume (%MV) in the oven environment
- Sensor signal provides feedback to the steam control system for enabling to meter the right amount steam
- Maintaining control of oven humidity is critical to controlling the process of condensation on the product
- Accurate measurement, monitoring and control provides the basis for process optimization

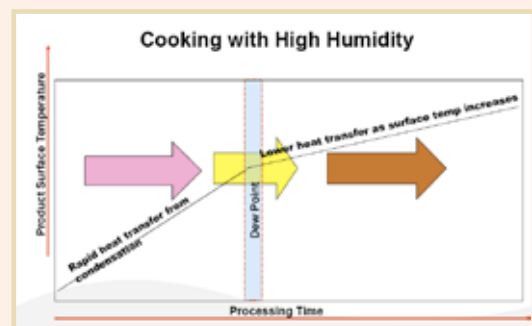
Condensation Curve

Defines the conditions wherein water vapor will condense on a surface.



The above graph shows how the condensation zone can be extended by adding humidity

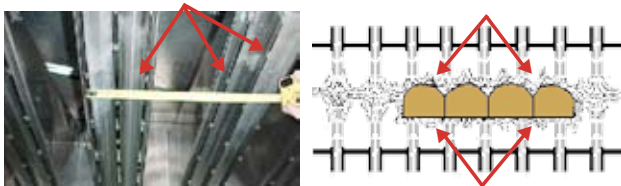
- Condensation cooking provides extremely rapid heat transfer that allows greater retention of moisture within food items
- Browning takes place during the convection-dominant phase of cooking.
- The ratio of condensation cooking versus convection cooking in an oven is almost never 1:1. Therefore, it is impossible to optimize cooking in two equal length zones.



% moisture by volume (MV)	absolute humidity (lb/lb)	dewpoint (°F)
0	0	-460
10	0.0691	115
20	0.155	141
40	0.415	169
80	2.49	201
100 (pure steam)	infinity	212

General Construction Details that Incorporate Hygiene and Food Safety

- Fully welded stainless steel enclosure
- Modular design to accommodate throughput expansion
- Floor cooling, to prevent rendering from sticking to floor
- Split design with hood and tank section
- Lift system to open hood for cleaning and inspection
- Removable impingement nozzle plates
- Automated clean in place system (CIP)
- Continuous hot water, single pass belt washer

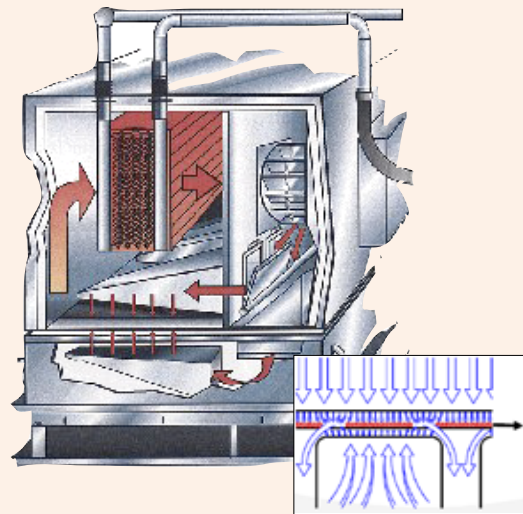


Impingement System

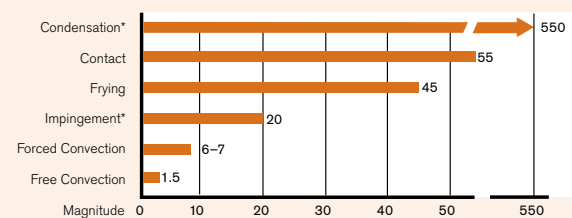
Impingement slots direct high velocity jets of air (~ 4,300 fpm, 22 m/s, 49 mph) onto the top and bottom of the product.

Impingement

- High velocity air/vapor impinges perpendicular to the product surface, creating high and low pressure areas because of the arrangement of the jets (slots, holes, tubes).
- As the columns of air impinge upon the product surface, they effectively reduce the boundary layer across the product surface.
- At sufficiently high temperatures and velocities, the high surface impingement can remove surface moisture faster than moisture diffuses to the surface from the center. This helps to produce product crispness and browning.



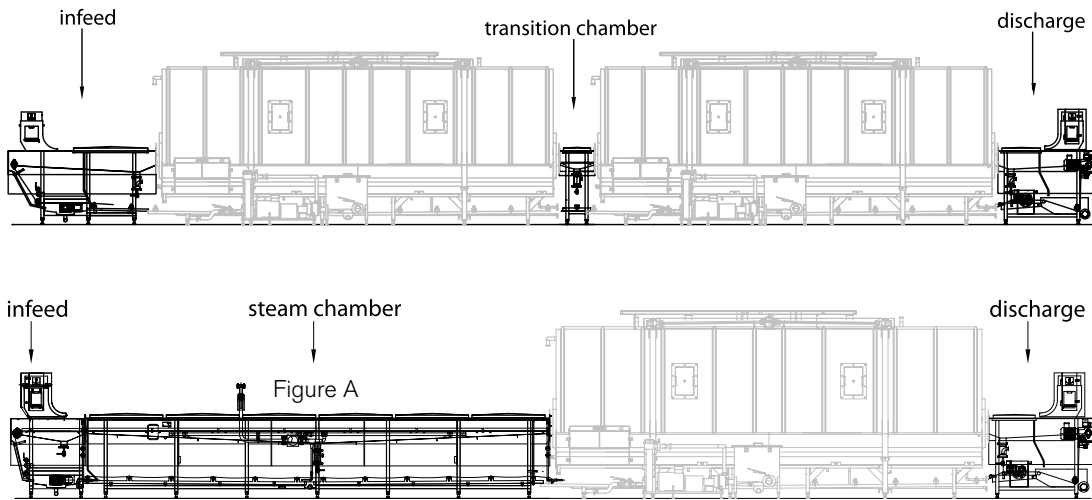
Heat Transfer Coefficients



General Airflow Configuration of JSO Ovens

Vertical

- Flows perpendicular to the direction of product flow.
- Allows for more effective containment at higher velocities.
- Better control of temperatures across the belt width for elevated temperature cooking.
- Complements conductive heat transfer [$Q = K \cdot A \cdot (dt/dx)$]



Chambers

- Consists of the following basic types: Infeed chamber, discharge chamber, transition chamber, steam chamber
- The infeed chambers are available in 3.5', 8.5', 12.5', 16.5' and 20.5' lengths. All of these include a return roller for the conveyor belt, a coanda exhaust with 1890 ft³/min. exhaust fan and a containment steam knife
- For customers with special situations a 24' steam chamber is also available with short or standard infeed for feeding an oven as illustrated in figure (A).
- All lids on chambers are insulated and equipped with a water seal for steam containment
- The 8.5' through 20.5' chambers are equipped with a manual steam valve, internal steam header and a steam flow meter; flow capability 1200 lbs./hr.
- All infeed steam chambers are equipped with a Lecithin application system; a brush applicator is standard
- The discharge chamber is designed in 5.5' standard length and is equipped with the drive system for the conveyor

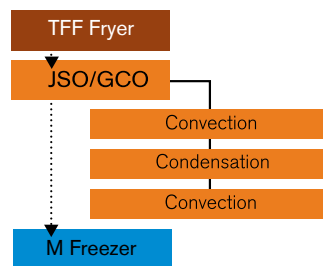
MultiPhase™ Cooking

Your food item is unique, so it requires a specific sequence of processing steps to deliver the desired attributes along with process economics.

Therefore, no one cooking process can be said to be the best until the desired quality criteria are met. Shown here are just some of many MultiPhase Cooking options available:

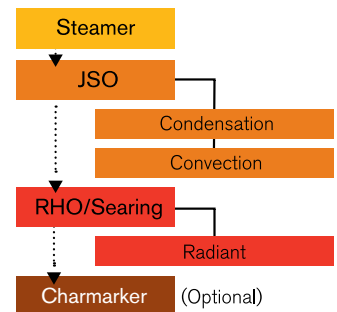
Typical Applications:

- All coated products such as Nuggets and Patties



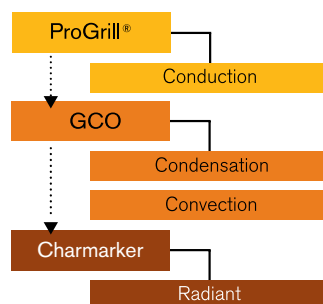
Typical Applications:

- Beef and Pork Products
- Specialty Poultry Products



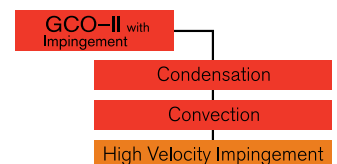
Typical Applications:

- Skinless Boneless Chicken Breast Sheet Meat



Typical Applications:

- (a) Provides the versatility to produce the broadest range of products
- (b) Flexibility to add capacity to accommodate future expansion within the same foot print
- All products; (a) Coated products will require a fryer upstream (b) Sheet meat will require a ProGrill upstream





We are your single source for profitable processing solutions

JBT can provide you with portioners, freezers, and everything in between – including process control, food product development assistance, operator training and a full range of customer support alternatives.

Our Food Technology Centers have served leading processors in the development of many of the world's most popular food brands. Learn how to increase your processing potential by contacting your JBT Representative or by visiting our website.

We're with you right down the line.™

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