

Microwave Vessel Heating System with Mixer



Marion Mixers has joined forces with Applied Microwave Technology (AMTek) to design and manufacture microwave vessel heating systems for the processing industries. Our designs include both vertical and horizontal stainless steel tanks with Fristam pumping/mixing systems and Marion's unique, paddle-style agitator for powder applications.

DESIGN FEATURES

The new Marion Mixers/AMTek vertical tank microwave heating/cooking /drying vessels are supplied with generous standard features.

- Fristam Pumping System including skid, piping and valves; optional powder mixer
- AMTek Microwave System including power supply in 75 and 100 kilowatt output levels
- Custom Control Assemblies/Software Packages
- 3A Sanitary-compliant for food safety and hygienic processing applications
- CIP/COP cleaning & sanitation systems
- Paddle-style or propeller-type agitators
- Compact design – smaller footprint
- Exclusive Performance Guarantee
- Test units available
- USA – Made “in the Heartland”

Benefits

- Shorter batch times
- Smaller footprint
- Efficient energy conversion
- Uniform material handling
- Increased process speed
- Easy cleanup & maintenance
- Increased throughput (less handling)
- More sustainable chemical & physical reactions
- Utmost in safety
- 3A Sanitary-Compliant

Our new system is ideal for

• Sauces • Soups • Chili's • Gravies • Syrups • Jams/ Jellies • Salad dressings • Spices • Canned fruits & vegetables • Meat products & more



Powder Mixer

Wet/Dry Mixed into Fluid Stream



Feature	Benefit	Economic Value
Decreased Process Time	Decreased energy usage on basis of btu per cooked batch	Energy savings due to shorter batch times
	Ability to pulse the power for precise control	Reduced production costs
More Compact	Requires a smaller equipment space or footprint	Reduced fixed cost savings
	Can be remotely located in a dry, safe area	More usable plant floor space for increased production
Safety	Chokes, mesh screens, and safety interlocks for complete operator safety	Prevent employee injuries and liability claims
	Safer than steam and hot oil heating	Prevents injury & worker discomfort
Easy Cleanup & Maintenance	CIP and COP capable	Less teardown/better turnaround
	Less chemical and water usage	Higher profit margins
	More production time available	More product/more profit
	Less mess	Improved working conditions
Higher Power Densities	More efficient energy usage	Increased production speeds
	Selective heating - "product not plant"	Decreased production costs
	Heat not expended to heating air, walls of the oven, conveyor and other parts	Since energy source is not hot there is a plant cooling savings
Precision Energy Control	Can be turned on and off instantly	Eliminates the need for warm up and cool down
	Product heating occurs from top down	Reduces product fouling
More Uniform Temperature Profiles	Energy is selectively absorbed by areas of greater moisture	Minimizes overprocessing; no scorching, overheating or case hardening
	Enhanced product performance	Improved yields
No-Contact Drying Technology	Increases production run times	Reduces both cleaning times and chemical costs
	Lack of high temperature heating surfaces	Reduces material finish marring
No Greenhouse Gas Emissions From Heating Source	May Eliminate the need for environmental permits	Cost savings
	Improves working conditions	Employee retention
3A Sanitary Compliant	Product safety	Prevent product recalls and liability expense
	USDA accepted designs International ISO 14159 compliant	Sanitary & hygienic standards compliant
Increased Plant Throughput	Less handling, floor traffic, fork trucks, pallets, transfer points and congestion	Better employee ergonomics, safety and product damage
	Less floor space requirements, contamination, product damage	More productivity



Comparing Microwave to Conventional
Heating and Drying Systems
Industrial Product Processing

For Cooking, Heating & Drying Applications

Mechanics

Advantages

Economics

Microwave Drying

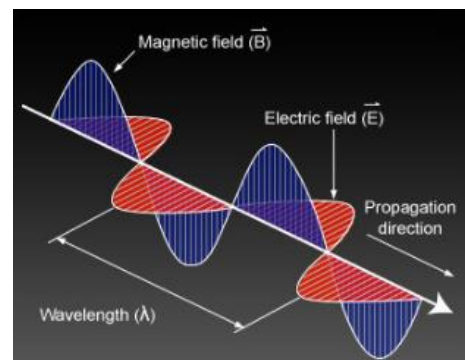
The mechanism for drying with microwave energy is quite different from that of conventional drying. In conventional drying heat is transferred to the surface of the material by conduction, convection or radiation and into the interior of the material by thermal conduction. Moisture is initially flashed off from the surface and the remaining water diffuses to the surface. This is often a *slow process* in conventional drying and the diffusion rate is limited, requiring high external temperatures to generate the temperature differences required.

In conventional or surface heating, the process time is limited by the rate of the heat flow into the body of the material from the surface as determined by its specific heat, thermal conductivity, density and viscosity. Surface heat is not only slow, but also non-uniform with the surfaces, edges and corners being much hotter than the inside of the material. Consequently, the quality of conventionally heated materials is variable and frequently inferior to the desired result.

Microwaves are not forms of heat but rather forms of energy that are manifested as heat through their interaction with materials. Microwaves initially excite the outer layers of molecules. The inner part of the material is warmed as heat travels from the outer layers inward. Most of the moisture is vaporized before leaving the material. If the material is very wet and the pressure inside rises rapidly the liquid will be removed from the material due to the difference in pressure. This creates a sort of pumping action forcing liquid to the surface, often as vapor. The result is *very rapid drying* without the need to overheat the atmosphere and perhaps cause case hardening or other surface overheating phenomena.

Mechanism of Heating

Microwave energy does not heat the room; only the desired material with no harmful greenhouse gas emissions from the heat source. The energy is mainly absorbed by a wet material placed in the cavity. Water, fat and sugar molecules in food materials absorb energy from the microwave in a process called electromagnetism; a phenomena associated with electric and magnetic fields and their interactions with each other and with electric charges and currents.



Microwaves are electromagnetic waves having a wavelength (peak to peak distance) varying from 1 millimeter to 1 meter. 1GHz = 1,000 MHz. Frequency of microwaves lies between 0.3 GHz and 3 GHz. A domestic microwave operates at 2450 MHz (a wavelength of 12.24 cm). 90% of American homes have microwave ovens. Industrial/commercial microwave systems typically operate at 900 MHz (a wavelength of 32.68 cm). This range allows more efficient penetration of the microwave through the material.

Microwave heating is most efficient on liquid water and much less on fats and sugars and frozen water where the molecules are not free to rotate. Depending on water content the depth of initial heat deposition may be several centimeters or more with microwave ovens, in contrast to grilling, which relies on infrared radiation, or the thermal convection of a convection oven, which deposit heat shallowly at the food surface.

Historically the biggest constraint to using microwave energy for industrial processing has been the inability to heat the material with uniform energy distribution. If you have non-uniform heat distribution the result is underexposed and overexposed material in the same batch or continuous process. Our innovative solution provides agitation that stirs the material exposing the mass to uniform heat distribution.

Marion Mixers has joined forces with Applied Microwave Technology (AMTek) to design and manufacture mixer vessel heating systems with microwave technology for the processing industries.

Marion Mixers has over 70 years of experience in custom design manufacturing of horizontal and vertical mixing equipment in numerous industries. AMTek specializes in microwave systems, primarily for the food industry. Our unique combination of a microwave and a mixer in one piece of equipment has solved one of the biggest challenges of the microwave industry; the ability to achieve uniform heat distribution. This is accomplished with the unique paddle-style agitation within the mixer vessel and AMTek's patented microwave systems,

Energy Savings

There was a time when electrically powered systems were considered too costly to operate for high-power applications. Today, with the rising costs of oil and gas, this is no longer necessarily true. There is significant interest today in the potential energy saving from a microwave heating system. The offsets to the current cost of electricity include the increased speed of drying, the direct coupling of energy into the material and possible lower drying temperatures. Processors that use steam, gas or electric heating systems are aware of the high costs of running these systems. Consider the energy-saving benefits of microwave heating verses conventional heating.

- Slash energy consumption by up to 50%.
- Reduce man-hours and downtime involved in cleaning.
- Minimize ancillary equipment such as heated jackets, boiling pans and heating vessels.
- Shrink your heating and/or cooking footprint.
- Eliminate warm up and cool down time.
- Microwave energy does not heat the room only the material.

Economics of Microwave Systems

Several criteria for successful microwave drying systems are related to reduced cost. Cost saving may be realized through:

1. Energy savings
2. Faster batch processing
3. Operational efficiencies
4. Increased throughput
5. Labor reduction
6. Reduction in heat load in the plant
7. Reduced maintenance costs
8. Reduction in product fouling
9. Less floor space needed

The bottom line is economics. If a process does not produce a sufficient return on investment, it will not meet with success. You should only consider equipment manufacturers that provide a performance guarantee. We offer a performance guarantee on our equipment.

In addition, with the challenges of the current economic climate as well as growing concerns about carbon footprints, many manufacturers are looking for ways to reduce operating costs and cut down on energy consumption.

Conversely, with microwaves, heating the volume of a material at substantially the same rate is possible. This is known as **volumetric heating**. Energy is transferred through the material electro-magnetically, not as a thermal heat flux. Therefore, the rate of heating is not limited and the uniformity of heat distribution is greatly improved. The microwaves heat the product at the surface and deep into the product until the microwave energy is absorbed.

A common misconception is that microwave heating is always more expensive than heating by conventional techniques. Of course the actual answer depends on the application. In some cases, microwaves can be used 50% more efficiently than conventional systems, resulting in major savings in energy consumption and cost.

Imperfect heating causes product rejections, wasted energy and extended process times that require large production areas devoted to ovens. Large ovens are slow to respond to needed temperature changes, take a long time to warm up and have high heat capacities and radiant losses. Their sluggish performance makes them slow to respond to changes in production requirements making their control difficult, subjective and expensive.

Applications/Functions/Industries

Our equipment is capable of performing multiple applications including heating, drying, tempering, cooking on multiple stage recipes that thaw, cook and simmer in the same vessel aided by programmable process control. Possibly eliminate some permits and do away with your troublesome boilers with costly insurance.

Microwave technology is a viable commercial alternative to traditional cooking and heating methods and is now being seriously considered by many food, drink and pharmaceutical producers. Our equipment is ideal for cooking foodstuffs such as gravies, sauces, chilies, soups, syrups, eggs, puddings, fruit juice, salad dressings, canned and packaged fruits and vegetables and many, many more.

Uniformity of heating with precise temperature control is also important to many other industries including chemicals, plastics, minerals, textiles, in a variety of industrial processes.

Microwave Safety and Myths

Safety

Using patented applicator design geometries and devices such as chokes or attenuating tunnels, AMTek Microwaves reduces microwave leakage from system entry and exit points to virtually non-detectable levels in our microwave mixer heating vessels. Chokes are used around doors, windows and seams to prevent electromagnetic radiation leakage. This poses no threat of electromagnetic radiation to the health and safety of equipment operators. As a further precaution, all AMTek control systems are supplied with safety interlocks and leakage detectors that shut down power instantaneously in the event of equipment malfunction or misuse.

In addition microwave exposure limits are promulgated by the Federal Communication Commission (FCC) and the Occupational Health and Safety Administration (OSHA). Mesh screening is used to shield windows and view ports to prevent eye injury. All equipment enclosures, access panel doors and inlets are typically sealed with metal braid or other conductive gaskets. Thermal switches that sense overheating will shut off the power.



Microwave Myths

Microwaves leak unsafe levels of electromagnetic energy. This is a myth. The FDA limits the amount of microwaves that can leak from an oven. The limit is far below the level known to harm people. Our microwave equipment is inspected and tested on a regular basis. Microwave energy decreases dramatically as you move away from the source of electro-magnetic radiation. In industrial settings the transmitter device is typically located away from the processing equipment.

Microwaves can cause damage to pacemakers. Modern pacemakers are shielded from stray electro-magnetic forces and have a backup mode that takes over if a really strong electro-magnetic field disrupts the main circuit's programming.

Microwave heating can be an issue because of uneven heating. Its true that microwaves will have slight issues with temperature uniformity. However, with our new microwave mixer vessel, gentle agitation stirs the material. Heat is applied volumetrically. Therefore heating the volume of a material at substantially the same rate is possible. Since the rate of heating is not limited, the uniformity of heat distribution is greatly improved.

Many people believe microwaves cook from the inside out. This is also untrue. Microwaves actually work on the outer layers of food, heating it by exciting the water molecules there. The inner parts of food are warmed as heat transfers from the outer layers inward. It is important that the energy penetrates as deeply as possible. Electromagnetic heating allows this.



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For Immediate Release

Collaborative Joint Venture Develops First Microwave Vessel Heating System for the Processing Industries

Marion, Iowa, July 20th, 2011 – Marion Mixers has joined forces with Applied Microwave Technology

(AMTek) to design and manufacture microwave vessel heating systems for the processing industries.

“This is a great example of collaboration where two companies are able to build a culture of trust and innovation,” said Scott Jones Marketing Manager of Marion Mixers. “In a few applications we compete.

However, in our mutual new product development strategies we are able to reduce cost, leverage strength, accelerate scale and amplify influence in order to generate results.

Marion Mixers has over 70 years of experience in the custom design and manufacture of horizontal mixing equipment. Because of this narrow focus, we have experience with 1,000’s of different applications in numerous industries. AMTek specializes in microwave systems, primarily for the food industry. The unique combination of a microwave and a mixer in one piece of equipment has solved one of the biggest challenges of the microwave industry; the ability to achieve uniform heat distribution. This is accomplished with the unique paddle-style agitation within the mixer vessel and AMTek’s patented microwave systems.

Both of our companies are located in or near Cedar Rapids, Iowa; home to many of the world’s largest food processors. For the remainder of the year we will be testing selected product recipes we’ll process at the AMTek facility to further develop the horizontal unit. We currently have a vertical tank design ready

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for manufacturing and available for sale. This unit features a pumping system on a skid and suitable with many liquid and dry mix applications. Other benefits of the microwave mixer vessel include:

- Efficient Energy Conversion
- Uniform Material Heating
- Increased Process Speed
- Easy Cleanup & Maintenance
- Increased Throughput (less handling)
- More sustainable chemical & physical reactions
- Utmost Safety
- Shorter Batch Times
- Smaller Footprint
- 3A Sanitary-Compliant

About Marion Mixers

Since 1938 Marion Mixers has been the “brand of choice” for horizontal mixing and blending, batch and continuous process equipment. Recognized globally as the innovation leader in custom designed mixing equipment, Marion Mixers is the only mixer manufacturer that offers a unique Performance Guarantee. In process industries such as of food, chemical, plastic, mineral, energy, recycling, waste management and more Marion Mixers is unsurpassed in quality, customer-support and machine durability.

About AMTek

Since 2003 AMTek has achieved worldwide recognition for microwave equipment solutions. AMTek provides all of the resources needed to support industrial microwave processing equipment and systems. Products include drying ovens, cooking and tempering systems, standalone transmitters as well as controls and cable systems. Industries served include food, chemical, mineral, energy, and waste management. AMTek holds various patents in microwave pulsing software and transmitter equipment. AMTek leads the industry in innovation, technical knowledge and service.

For additional information visit www.marionmixers.com and www.4amtek.com.

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