

In-Line Microwave Processing System for Chemical and Industrial Applications – Tubular Applicator

Many chemical and industrial formulations require the application of heat to initiate a reaction or change in state to achieve the required end product. With its unique application of high-intensity electromagnetic energy to such formulations flowing in cylindrical tubes, pipes, or housings, Industrial Microwave Systems (IMS) can produce results that are difficult and often impossible to achieve with traditional surface heating technologies. The benefits of the unique ultra-rapid in-line microwave heating that IMS provides include:

- Improved product quality resulting from more even heating and reduced residence time.
- Longer production runs due to the reduction of scale or burn-on from hot surface processors.
- Reduced costs of system maintenance and cleaning between production runs.
- Reduction or even elimination of additives or catalysts due to faster reaction kinetics during a chemical heating or curing process.
- When used in combination with ionic fluids, Microwave Assisted Extraction (MAE) greatly improves the speed and yield of a chemical extraction compared to conventional processes.
- Due to the volumetric ionic heating process, the center of any chemical or industrial product stream may reach a higher temperature than the surrounding fluid. This is the exact opposite achieved when using conventional surface heaters and enhances the thermal process.



Applications

IMS in-line microwave heating systems have been successfully applied to a wide range of chemical and industrial process applications on both benchtop and commercial production scales. Although most of these processes are confidential to our end users, many have been proven at our in-house testing facility, and include:

- Biofuels
- Cellulose and Other Casings for Protein Emulsions
- Chemical Formulations
- Chitin Extraction with Ionic Fluid
- Extraction of Oil from Tar Sands using Ionic Fluid
- Nutraceuticals from Plant Extracts
- Petrochemicals with Ionic Fluid
- Pharmaceutical Ampule Heater
- Plastic Recycling using Chemical Solvent
- Polymeric Resin Heating

ABOUT IMS

Industrial Microwave Systems, L.L.C., (IMS) is a wholly owned subsidiary of Laitram, L.L.C., a private company based in Harahan, Louisiana with over 70 years of success in the innovation, design, and construction of food processing equipment. IMS is also partnered with AMTek and SELO to provide additional access to its technology in both the USA and Europe.

IMS PRODUCTS

IMS offers a series of modularized benchtop and commercial in-line heaters, available with 915 or 2,450 MHz microwave generators or transmitters. To maximize efficiency, their patented single-mode applicators insure a uniform energy field is focused and located at the exact position as the product flowing through the heating tube.

Customized designs to meet specific process specifications and production floor footprints are available upon request.

CONTACT

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OPERATING PARAMETERS PER MODULE

| Single Module Process Specification | Benchtop | Commercial |
|-------------------------------------|---------------------|-----------------------|
| Max. Throughput | 1 GPM (250 kg/hour) | 8 GPM (2,000 kg/hour) |
| Max. Temperature | 932°F (500°C) | 932°F (500°C) |
| Max. Pressure | 200 psig (14 Barg) | 200 psig (14 Barg) |

| Design Options | Benchtop | Commercial |
|-----------------------|--|--|
| Generator Frequency | 2,450 MHz | 915 MHz |
| Applicator Material | Aluminum, Stainless Steel (available as an option) | Aluminum, Stainless Steel (available as an option) |
| Product Tube* | 99.8% Alumina Ceramic | 99.8% Alumina Ceramic |
| Tube Size | 3/8" (10mm) to 1" (25mm) | 1.5" (38mm) to 2.5" (63mm) |
| Standard Tube Fitting | Stainless Tri-Clamp Ferrule (Alternatives are available) | Stainless Tri-Clamp Ferrule (Alternatives are available) |

* Other FDA approved materials available.

| Generator, Control Panel & Applicator Dimensions | Benchtop | Commercial |
|--|---|--|
| Length | 1'0" (0.30m), 1'7" (0.48m), 2'8" (0.83m) | 6'0" (1.83m), 2'8" (0.81m), 2'9" (0.84m) |
| Width | 0'8" (0.20m), 0'11" (0.27m), 1'0" (0.30m) | 2'6" (0.76m), 0'9" (0.23m), 2'0" (0.61m) |
| Height | 1'3" (0.37m), 1'7" (0.48m), 3'2" (0.97m) | 9'3" (2.82m), 4'0" (1.22m), 8'2" (2.49m) |

| Utilities | Benchtop | Commercial |
|--------------------------------------|----------------------------|-------------------------------------|
| Power Output | 2 – 15 kW | 75 – 200 kW |
| Electricity | 3-20 kW | 90-240 kW |
| Magnetron Cooling Water ⁺ | 0.9-5.4 GPM (3.5 – 20 LPM) | 27 GPM (100 LPM) / 100 kW Generator |

Actual Process Performance and Specifications will depend on the throughput, properties, and heating range of product.

⁺ To eliminate the need for once through cooling water, IMS strongly recommends the use of a closed circuit chiller package for commercial applications.