W A T L O W

MI Band Heaters and MI Savings Predictor Program

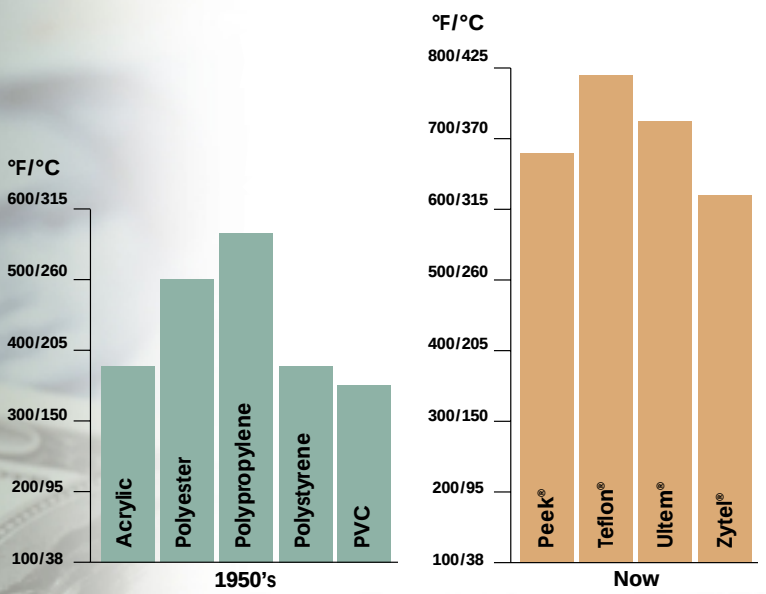
Save Time, Money and Energy

MI Band Heaters: Superior Design and Operating Efficiency for Today's Plastic Processing Machinery

In the 1950's, injection molding machines processed relatively low-melt temperature plastics. Mica band and ceramic knuckle heaters adequately served the plastics industry back then. But today's technology demands higher watt densities, operating temperatures and greater efficiencies to melt resins such as Peek®, Teflon®, Ultem® and Zytel®. Band heaters are now required to maintain temperatures to 800°F (425°C) and still provide efficient, long-lived, reliable service.

To keep up with these ongoing demands, Watlow developed the MI Band heater, a mineral insulated heater that provides the high temperatures and watt densities needed, with the maximum efficiency and life possible. With performance temperatures reaching 1400°F (760°C) and watt densities up to 230 W/in^2, Watlow's MI Band heaters are the ideal choice for plastics processing equipment.

In conjunction with the superior performance of the MI Band heater, Watlow has developed the MI Savings Predictor Program designed to analyze the cost savings users can realize by using MI Band heaters versus ceramic knuckle or mica band heaters. This comprehensive program takes into account not only the energy savings but also the cost of downtime and labor incurred when heaters fail on the production line.



With temperature capabilities up to 1400°F(760°), Watlow's MI Band heater can easily handle the high melt temperatures required today.

Superior Heat Transfer for Efficient, Long-Lived Performance

The key to the MI Band heater is its compacted mineral insulation, specially formulated for its excellent heat transfer and performance capabilities. Watlow's exclusive mineral insulation material has much higher thermal conductivity than the mica and hard ceramics used in conventional heaters.

During construction, a thin layer of higher thermal conductivity MI material separates the element wire from the inside diameter sheath. A thicker, lower thermal conductivity layer backs up the element wire to direct the heat inward towards the barrel. This special construction promotes longer heater life because the sheath can operate at high temperatures with low internal wire temperatures.

The heater is formed before the leads or post terminals are attached so they do not interfere with the curving process. The result is an exceptionally round heater that fits the barrel tightly and conducts its heat uniformly, with no hot spots.

Faster Response to Temperature Control for Higher Productivity

Hardened stainless steel clamping bars contribute to even heat distribution. The bars extend the full width of the heater for clamping uniformity around the barrel.

Due to its low profile and low thermal mass, the MI Band heater is highly responsive to precise heat control. Less thermal lag and minimum temperature overshoot result in faster start-up and reduced cycle time.

Also contributing to faster heat-up is the MI Band's high watt density capabilities.

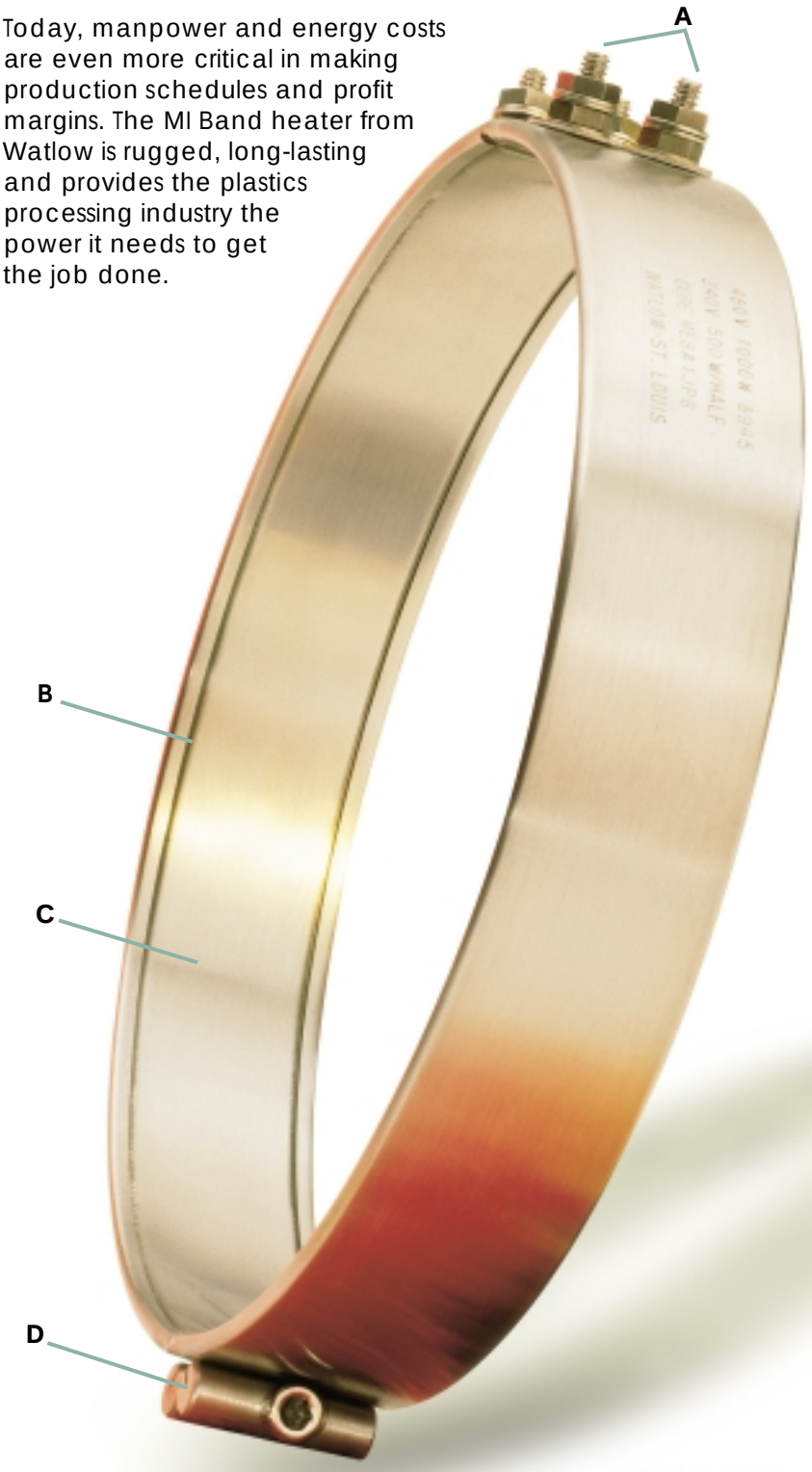
Tough, Contamination Resistant Construction for Long Life

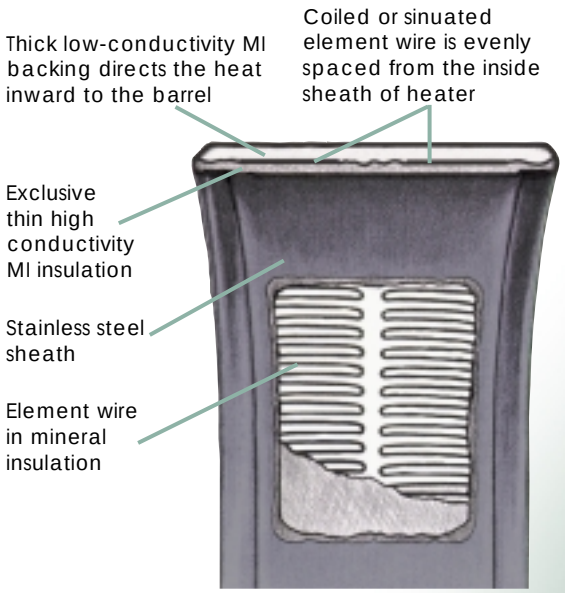
The MI Band heater will withstand extreme levels of shock, vibration and plastic drool. Side folds are positioned on the inside diameter of the band to resist contaminants from entering the heater and causing premature failure.

Hardened stainless steel clamping bars, a stainless steel sheath, mineral insulation and strong, protected leads all make the MI Band a durable heater. A special lead cap is spot-welded to the sheath for added strength.

Excellent Heat Transfer, Durability and Easy Installation...

Today, manpower and energy costs are even more critical in making production schedules and profit margins. The MI Band heater from Watlow is rugged, long-lasting and provides the plastics processing industry the power it needs to get the job done.





A) Post terminals or leads are attached after the curving process for a rounder heater, which improves heat transfer.

B) Side folds turn to the inside diameter to prevent contamination from molten plastics.

C) Rugged stainless steel sheath provides durability and contamination resistance.

D) Hardened stainless steel clamping bars provide uniform clamping and easy installation.

Band Heater Comparison: The Difference is in Green — Energy and Money Savings

Band Heater Comparisons

If You're Using *Ceramic Knuckle* Heaters You Should Be Using Watlow MI Band Heaters to Get These Benefits...

Better Temperature Control And Faster Response With Low Mass Construction
The ceramic knuckle heater has slow heat-up and cool-down rates due to construction. The element wire is located in an open channel surrounded by air, so it must heat up the air and then the ceramic, which is more of an insulator than a a good thermal conductor. Also, the heat has to travel through ½" thick ceramic segments, compared to the thin layer of highly thermal conductive mineral insulation on the MI Band heater. Heat gets to the part faster with the MI Band.

Higher Watt Density Capabilities
The ceramic knuckle heater only operates to 45 W/in^2, while the MI Band heater is capable of watt densities to 230 W/in^2 on small diameter nozzle bands and up to 100 W/in^2 on large diameter barrel bands, resulting in faster, more efficient production.

Watlow's small diameter MI nozzle heaters can operate at five times the watt density of ceramic knuckle heaters while providing the same life. This is due to Watlow's exclusive mineral insulation which permits high watt densities without affecting heater life.

Contamination Resistance Due To The Design
The ceramic knuckle heater is made up of hard ceramic segments, loosely held together by a clamping band. the gaps between the segments and the serrated edges of the housing allow molten plastic to move freely to the element wire, which can cause early heater failure and machine downtime. The fragile ceramic pieces can break easily, another concern for plastics processors.

Watlow specifically designed the MI Band Heater to resist contaminants from entering the heater. The top sheath is wider so it can be folded around the bottom sheath. Therefore, the seams are on the underside of the band, making contamination from plastic drool and other material much less likely.

Better Performance And Efficiency
Ceramic knuckle heaters have poor thermal conductivity due to the use of ceramic materials in their design. Heat transfer from the element wire to the part is slower and less efficient.

The MI Band heater is designed with two layers of mineral insulation to focus heat inward toward the barrel rather then radiating it to the surrounding environment.

If You're Using *Mica Band* Heaters You Should Be Using Watlow MI Band Heaters to Get These Benefits...

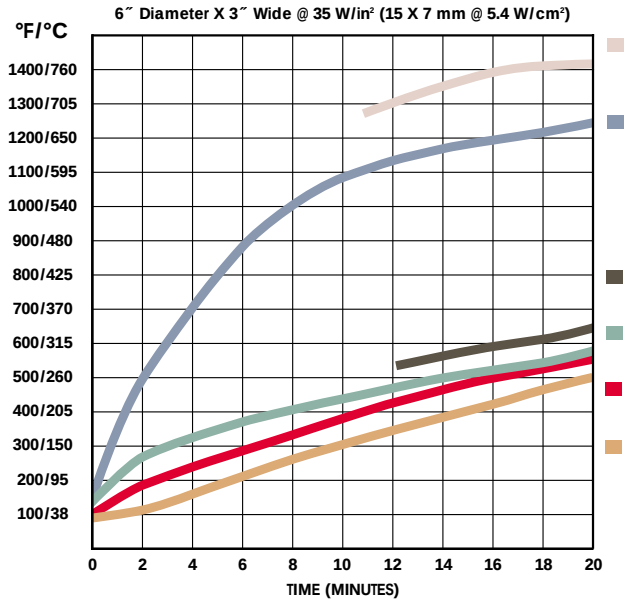
Higher Temperature Capabilities
Mica band heaters cannot operate safely beyond 900°F (480°C). Watlow's MI Band heaters will perform to 1400°F (760°C). This means more versatility in heating applications without jeopardizing heater life.

Higher Watt Density Capabilities
The mica heater's maximum watt density is 60 W/in^2, versus 230 W/in^2 on the MI Band. Higher watt densities can permit substantially greater production rates from machinery.

Longer Heater Life
On most mica band heaters, a winder is used to support the element wire, and the wire on top must push its heat through two layers of mica insulation. The wire on top operates at higher temperatures, shortening the life of the heater. However, the MI Band heater's high thermal conductivity mineral insulation and uniform distance of the element wire from the sheath mean low wire temperatures and extended life.

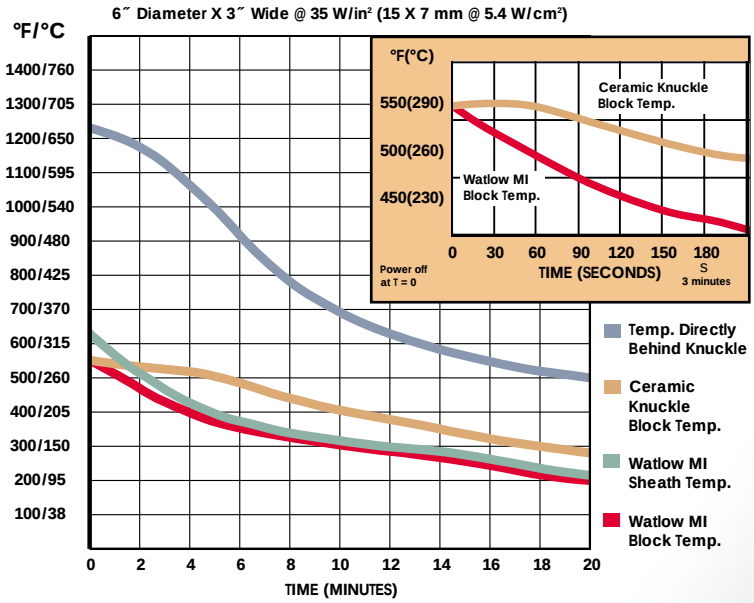
Easier Installation
Installation is faster and easier using the MI Band heater's full-width permanently attached clamping bars, rather than the separate clamping strap found on most mica band heaters.

Heat Up Test: Watlow MI vs. Ceramic Knuckle Heater



In this test, MI Band and a ceramic knuckle heater of the same size and watt density were placed on identical water cooled blocks. After 20 minutes, the MI Band block reached 550°F (285°C), and the ceramic knuckle reached 500°F (260°). But the critical measurement — element wire temperature — showed a drastic difference. The temperature directly behind the ceramic knuckle was measured at 1250°F (675°C), with an estimated wire temperature of 1450°F (785°C). The sheath temperature of the MI Band heater, however, reached 575°F (300°C) and the element wire was estimated at 650°F (340°C). ***This lower wire temperature means substantial longer life for the MI Band.***

Cool Down Test: Watlow MI vs. Ceramic Knuckle Heater

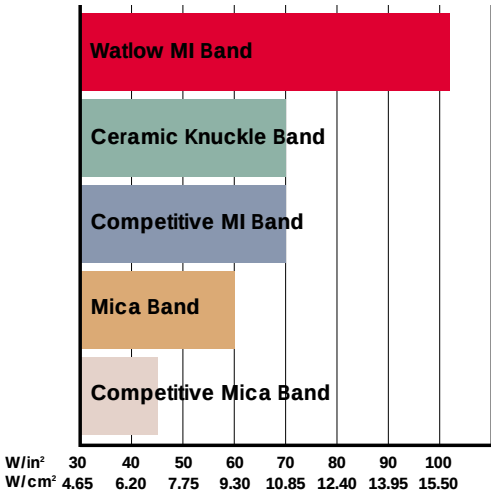


After maintaining both heated blocks at 560°F (290°C), the power was turned off and the block temperatures and heater temperatures were monitored for 20 minutes. The MI Band began cooling immediately, but the ceramic knuckle block continued to heat up for almost one minute, then the temperature began to drop gradually. Even though the power was turned off, the ceramic segments were storing a substantial amount of heat; they measured about 1200°F (645°C), much hotter than the 560°F (290°C) part temperature. Because the segments are insulated, the heat has nowhere to go except into the part being heated. The poor thermal response illustrated in this test means reduced productivity, and possible temperature overshoot, for the ceramic knuckle heater. ***The MI Band's lower sheath temperature together with its excellent heat transfer capabilities results in faster response to temperature control for higher productivity.***

Accelerated Life Test Results: *Each heater was cycled two minutes on, 15 seconds off, and watt density was increased 10 W/in² every 55 hours until failure.*

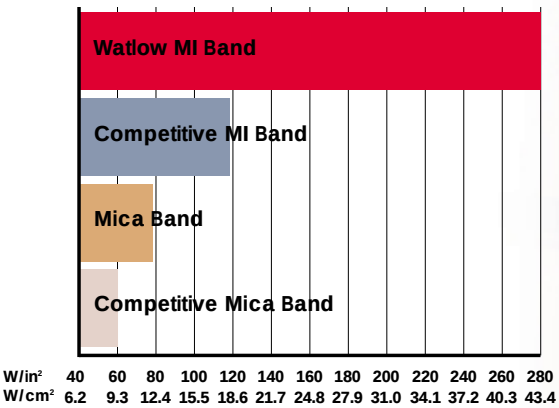
Barrel Bands

(6˝ ID X 3˝ Wide — 152 mm ID X 76 mm Wide)

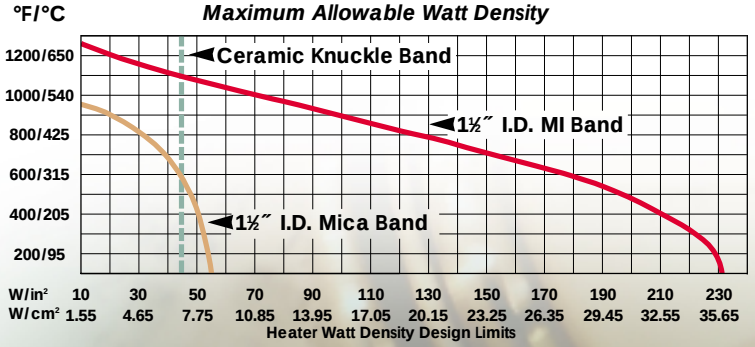


Nozzle Bands

(1½˝ ID X 1½˝ Wide — 38 mm ID X 38 mm Wide)



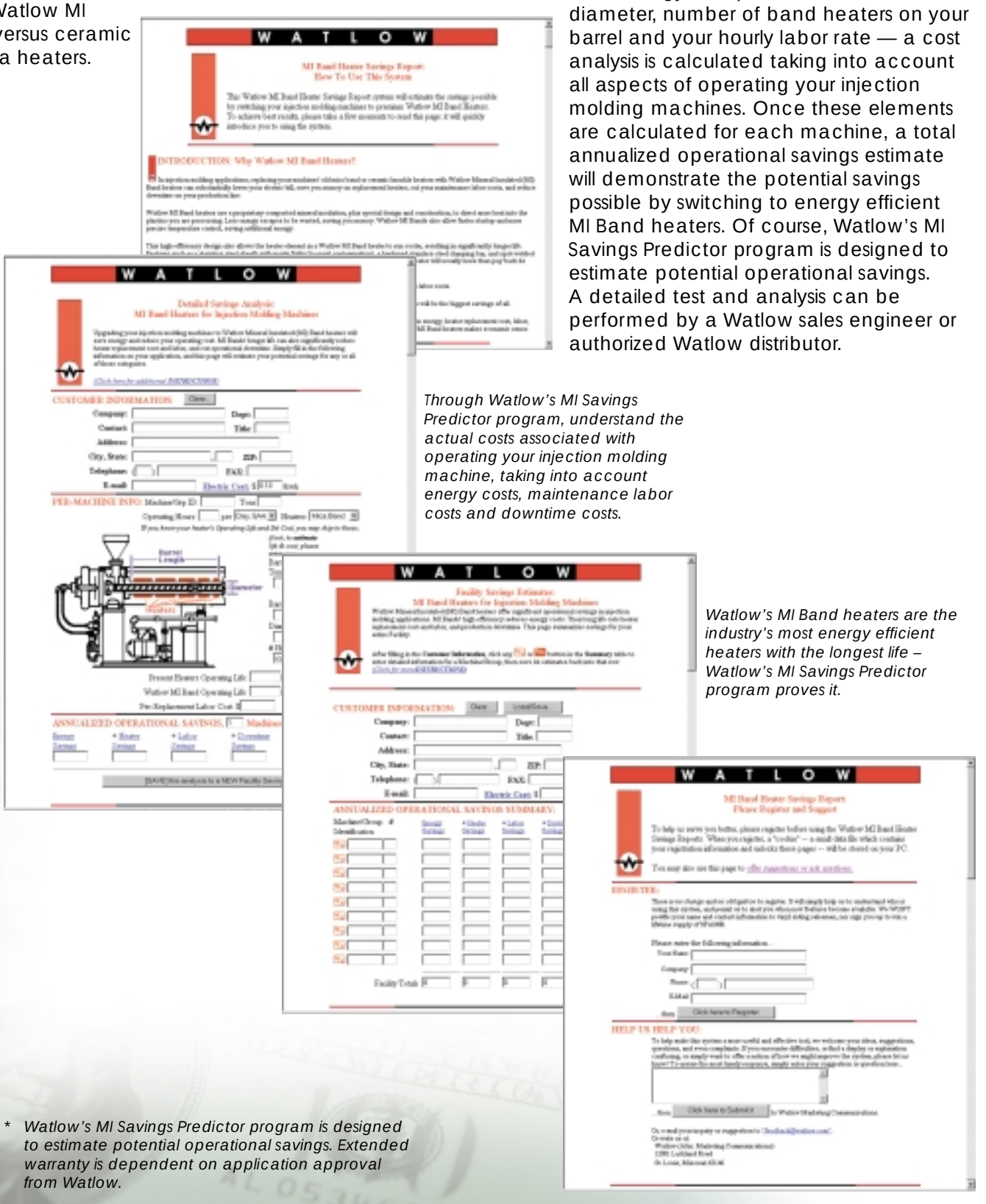
Maximum Allowable Watt Density



Calculate Energy & Cost Savings In Seconds With Watlow's MI Savings Predictor Program

Concerned about rising utility costs? Looking for ways to decrease overhead? Want to make your manufacturing facility as energy efficient as possible? Watlow's MI Savings Predictor program is designed to analyze energy, maintenance labor and production line downtime cost savings using Watlow MI Band heaters versus ceramic knuckle or mica heaters.

Through simple information gathering, a detailed analysis of each injection molding machine in your facility can be calculated by a Watlow distributor or sales engineer. Upon gathering the necessary information – energy cost per kilowatt hour, barrel diameter, number of band heaters on your barrel and your hourly labor rate — a cost analysis is calculated taking into account all aspects of operating your injection molding machines. Once these elements are calculated for each machine, a total annualized operational savings estimate will demonstrate the potential savings possible by switching to energy efficient MI Band heaters. Of course, Watlow's MI Savings Predictor program is designed to estimate potential operational savings. A detailed test and analysis can be performed by a Watlow sales engineer or authorized Watlow distributor.



Through Watlow's MI Savings Predictor program, understand the actual costs associated with operating your injection molding machine, taking into account energy costs, maintenance labor costs and downtime costs.

Watlow's MI Band heaters are the industry's most energy efficient heaters with the longest life – Watlow's MI Savings Predictor program proves it.

* *Watlow's MI Savings Predictor program is designed to estimate potential operational savings. Extended warranty is dependent on application approval from Watlow.*

Look inside pocket for test analyses and case studies.

MI Bands: Saving Energy and Production Downtime Costs

What's In It For You

Potentially thousands of dollars in saved energy costs each year and a longer warranty on Watlow's MI Band heaters. When all of the barrel heaters are replaced with MI Band heaters, there is a large initial investment; however in most cases, the cost of the heater retrofit is recapped in 6 to 12 months while you continue to see a cost savings on your electric bill. And, you're buying the best heaters in the industry for long life, trouble-free operation and of course, high energy efficiency.

How Do You Get An Energy Cost Savings Estimate for Your Facility?

Contact your Authorized Watlow Distributor or Watlow sales engineer to schedule a brief meeting at your facility. At that meeting, the distributor or sales engineer will demonstrate the capabilities of the program, discuss your energy rate, consumption use and gather other relevant information to calculate the most accurate estimate of how much you could save by switching your injection molding machine heaters to Watlow's MI Band heaters.

Call 1-800-4WATLOW to find distributor or sales engineer in your area.

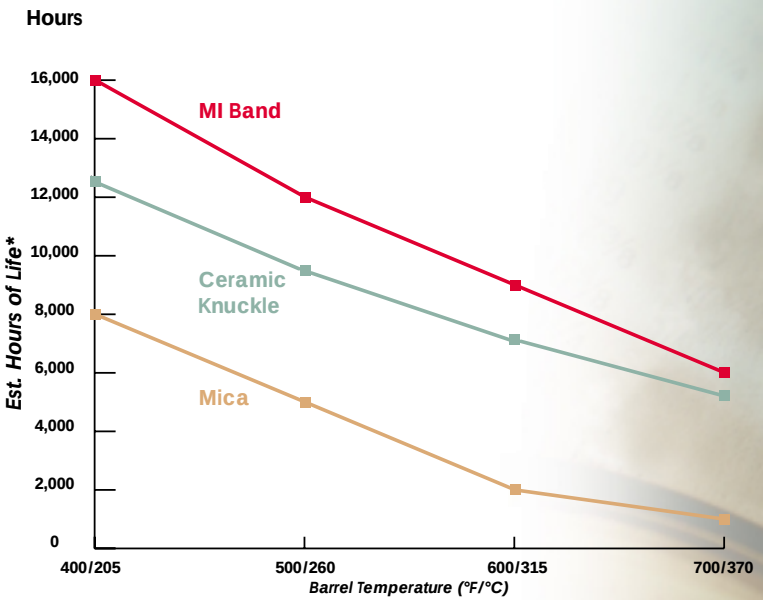
How Should You Use This Information?

Since the MI Savings Predictor program is only an estimation of what your savings could be, ask a Watlow distributor or sales agent for a more detailed energy assessment of your facility and application.

Watlow MI Band Heater Features & Benefits

- **Improved responsiveness to control** results in more parts per hour.
- **Superior heat transfer** generates energy at a lower cost per piece.
- **Longest basic warranty in the industry** provides reliable and trouble-free operation.
- **Lower element wire temperature** ensures longer heater life.

Comparative Life Tests MI vs. Mica vs. Ceramic Knuckle Heaters



* *Estimated life hours based on internal and field testing.*

WATLOW

Designer and Manufacturer of
Industrial Heaters, Sensors and Controls

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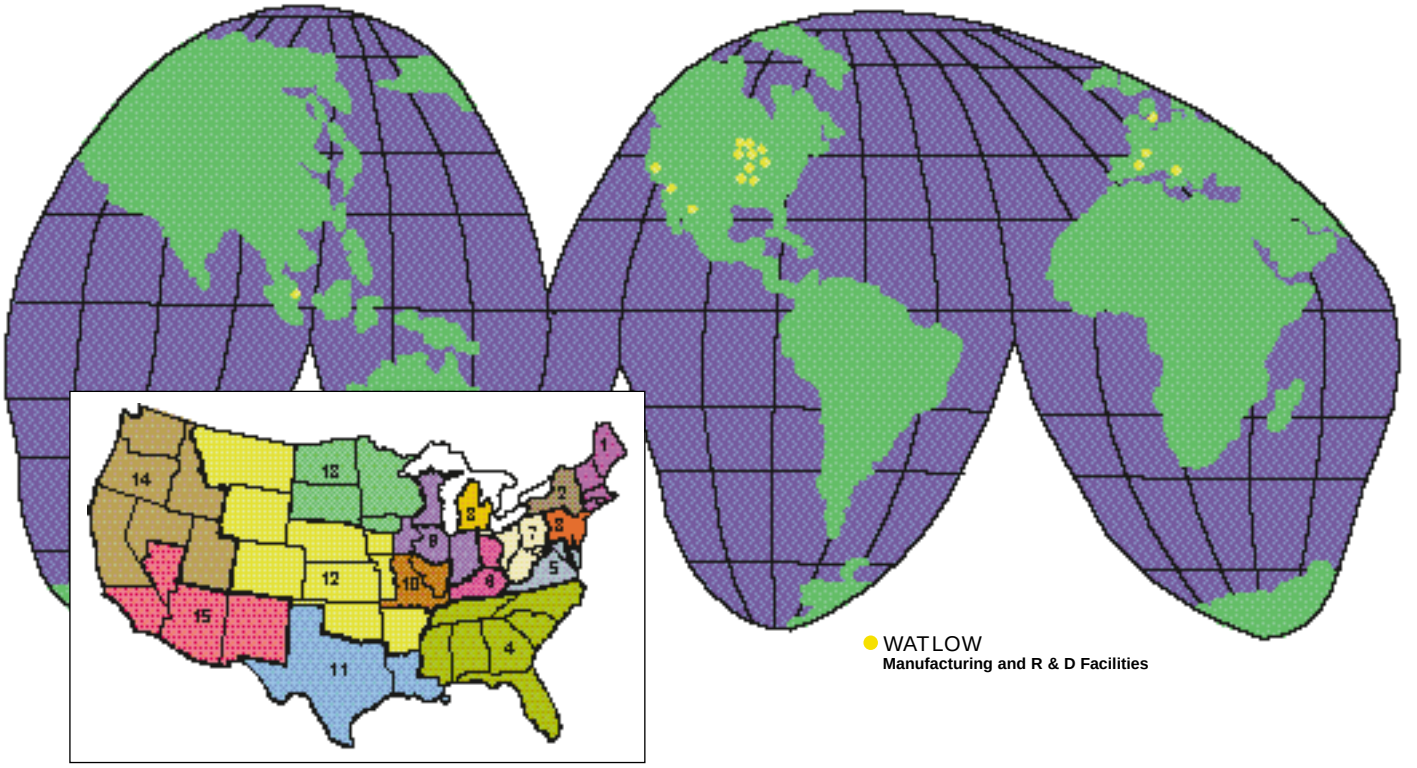

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