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**Application Bulletin**
**TDS02S**

# Heat-On™

## Replace messy oil baths, heating mantles, avoid spills and make your chemistry safer, cleaner and faster.

It is accepted that oil baths and heating mantles are no longer the preferred choice of chemists to heat round bottom flasks.

The risk of oil fires and injury from hot oil spills, plus the mess associated with the use of oil means that using oil baths no longer represents a safe working practice in labs. Heating mantles are expensive, difficult to clean, do not respond well to spills and often create hot spots when heating.

Therefore scientists are increasingly turning to specially designed aluminium blocks located on stirring hotplates to heat standard round bottom flasks.

## Not all block designs are the same

Heat-On is simple to use and it incorporates many subtle design features that combine to make it head-and-shoulders above the rest. Here are some of those features:

1. Heat-On is available with a fluoropolymer coating for increased chemical-resistance compared with anodised blocks.
2. Heat-On is lighter, with a lower thermal mass which produces significantly faster heat up times (see report overleaf)
3. Heat-On is lighter and offers faster post synthesis cool down times.
4. Heat-On blocks feature a proprietary well design that eliminates the sticking and cracking of flasks that is associated with other inferior blocks.
5. Yet, that same proprietary well design allows Heat-On blocks to have deeper wells that maximise the heated surface area to improve heat up times and minimise the differential between the block and solution temperature.
6. Because of these thermal features Heat-On is more efficient, using less energy to achieve the same results, saving money and reducing the environmental impact.
7. Heat-On features optional, detachable safety lifting handles rather than compromising the overall design by having them permanently attached.

## Heat-On uses up to 30% less energy to heat

A series of controlled heating tests were undertaken to establish the energy consumption of Heat-On and another leading brand, Brand A.

### The Test

Heat-On and Brand A blocks of equivalent size were placed directly onto a Radleys Carousel stirring hotplate. To simulate laboratory working conditions, each flask was filled with water to half its nominal volume. Using a digital temperature controller plugged into the stirring hotplate with its sensor placed into the water, the solution temperature was set to 100˚C. Identical stirrer bars were used and the solution stirred continuously at 500 rpm. A meter was used to record and log the energy consumption of the stirring hotplate over a period of 7 hours. The experiment was undertaken with a 500ml and 2000ml block.

### Heat-On vs Brand A, 500ml block
500ml flask, 200ml water

Result: 7 hours at 100˚C for Heat-On = 0.87KWh
7 hours at 100˚C for Brand A = 1.24KWh
Conclusion: Heat-On used 30% less energy

### Heat-On vs Brand A, 2000ml block
2000ml flask, 1000ml water

Result: 7 hours at 100˚C for Heat-On = 1.64KWh
7 hours at 100˚C for Brand A = 1.84KWh
Conclusion: Heat-On used 11% less energy

## Heat-On heat-up summary

The following data is a summary of time taken for Heat-On to boil various volumes of water. The data was compiled using a Carousel Stirring Hotplate set at its maximum operating temperature.

| Flask Volume | Volume of Water | Hotplate Temperature | Time for contents to reach boiling |
|---|---|---|---|
| 10 ml | 6 ml | 310˚C | 4 min 48 sec |
| 25 ml | 15 ml | 310˚C | 5 min 54 sec |
| 50 ml | 30 ml | 310˚C | 7 min 12 sec |
| 100 ml | 60 ml | 310˚C | 7 min 54 sec |
| 150 ml | 100 ml | 310˚C | 10 min 36 sec |
| 250 ml | 150 ml | 310˚C | 9 min 48 sec |
| 500 ml | 300 ml | 310˚C | 13 min 30 sec |
| 1000 ml | 600 ml | 310˚C | 17 min 06 sec |
| 2000 ml | 1200 ml | 310˚C | 26 min 18 sec |
| 3000 ml | 2000 ml | 310˚C | 39 min 36 sec |
| 5000 ml | 3000 ml | 310˚C | 51 min 00 sec |

Heat-On uses 30% less energy than Brand A

sales@radleys.co.uk
Tel +44 1799 513320
www.radleys.com

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Heat-On heats 66% faster than Brand A

# Heat-On heats hotter, faster

A series of controlled heating tests were undertaken to establish the heat-up times of Heat-On and another leading brand, Brand A.

## The test

Both blocks are designed to be located onto leading brands of stirring hotplate. Both blocks are designed to heat single round bottom flasks.

Heat-On (fluoropolymer coated option) and Brand A (anodised) of equivalent sizes were placed directly onto a Radleys Carousel stirring hotplate. To simulate laboratory working conditions, each flask was charged with half its nominal volume. Temperature probes were placed directly in the solution via the neck port and into the block and the temperature automatically recorded every 5 seconds. Identical stirrer bars were used and the solution stirred continuously at 500rpm.

Hotplates were set between 20˚C and 30°C above the desired solution temperature and the hotplates activated at the same time for a direct comparison. Data logging was stopped when the required solution temperature was met or a stable maximum had been reached.

100ml, 500ml and 2000ml blocks were tested. See graphs to the right.

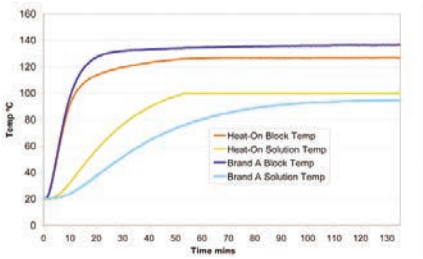
## Why does Heat-On heat so much better?

A combination of faster heat up times and increased thermal contact area means that in all tests, the water in Heat-On reached temperature faster and in one case reached a higher maximum temperature.

- The lower thermal mass of Heat-On blocks provides faster heat up times because there is less metal to heat up.
- The higher metal to glass surface contact area of Heat-On provides for more efficient heat transfer than Brand A.
- The greater thermal mass of Brand A can result in a higher final block temperature, but this does not reduce heat up times or result in a higher solution temperature. This is probably due to excessive heat loss from the external surface of the block. This also undoubtedly means Brand A is less efficient and expels more heat into your lab.
- The two piece design of Brand A leads to additional heat loss within the block assembly.
- Additionally, cool down times of Heat-On blocks are also significantly shorter than Brand A for similar reasons. This means Heat-On blocks can be safely removed from the hotplate much sooner.

## Heat-On vs Brand A, 2000ml block

2000ml flask, 1000ml water - hotplate at 140°C

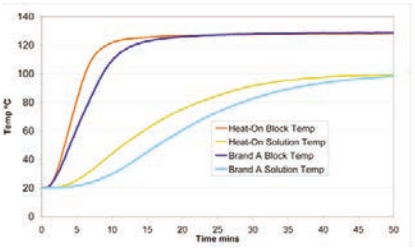



Result: Heat-On 'time to boil' = 53 mins
Brand A 'time to boil' = Not achieved after 120 mins

Conclusion: Heat-On heats 66% faster (time to 95˚C)

## Heat-On vs Brand A, 500ml block

500ml flask, 200ml water - hotplate at 130°C

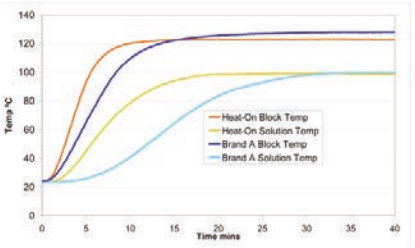



Result: Heat-On 'time to boil' = 45 mins
Brand A 'time to boil' = 55 mins

Conclusion: Heat-On heats 18% faster

## Heat-On vs Brand A, 100ml block

100ml flask, 50ml water - hotplate at 130°C




Result: Heat-On 'time to boil' = 23 mins
Brand A 'time to boil' = 35 mins

Conclusion: Heat-On heats 34% faster

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