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ספירים

JOULIES

Two inventors came up with an interesting product that they called "Joulies" (pronounced "Joo-lees"). Each Joulie looks like a 2 inch-long stainless steel coffee bean and is filled with a proprietary material. The material inside the Joulie is designed to absorb heat that is more than 140° F and then release that heat when the surrounding area cools below 140° F. Consumers are supposed to put Joulies into their coffee mugs so that the Joulies will quickly cool the coffee to a drinkable temperature; then as the coffee cools the "magic beans" release their heat and thereby maintain the temperature of the coffee. This article will address a number of questions (*kashrus*, *Shabbos*, and others) that are raised by this product. We will start with a more detailed description of the product.

Joulie – cut open

Joulie – after some PCM melted

PCM

The company is understandably secretive about what the Joulies are filled with, but we were able to come up with an educated guess as to what the material is. We based this on (a) the pieces of information they provided, (b) review of scientific literature on the topic, and (c) physical and chemical analysis of the material, as follows.

The company website and literature note that Joulies are, "filled with a proprietary substance called a 'Phase Change Material' (PCM) that melts at 140°F and is 100% edible food-grade magic." The company also told me (via email) that "the PCM inside is made from plants".

We purchased a set of Joulies and had one cut open revealing

that the PCM is a white, waxy, somewhat-grainy material. When the (open) Joulie was put into boiling hot water, the PCM began to melt and the liquid floated to the top of the water. [After the water cooled, the liquid solidified.]

The following is a helpful definition of the term "Phase Change Material":

> PCM materials have high heats of fusion so they can absorb a lot of energy before melting or solidifying. A PCM temperature remains constant during the phase change, which is useful for keeping the subject at a uniform temperature.[1]

In other words, a PCM is a type of material which requires a relatively large amount of energy to convert it from a solid state/phase to a liquid state/phase (i.e. high heat of fusion) such that the material absorbs heat/energy as it melts (i.e. as it changes "phases"). Thus the material remains at a constant temperature (its melting point) as it changes from a solid into a liquid. When the surrounding material cools below the PCM's melting point, the latent heat in the liquid PCM is released back into the surrounding material as the PCM changes back into a solid.

In recent years, a number of papers have been written in scientific journals[2] detailing the dozens of different PCMs available and describing the properties of each. Armed with the knowledge that the PCM used in Joulies has a melt-point of 140° F, is a food-grade material, is claimed to be made of plant materials, and has a solid waxy consistency at room temperature, we reviewed some of those articles to see if we could pinpoint which PCM is inside a Joulie. This investigation showed that the PCM used in Joulies is most likely

[1] http://www.colorado.edu/engineering/ASEN/asen5519/1999-Files/presentations/ben-mottinger.pdf.

[2] For purposes of this investigation, the most helpful article was, *Review on Thermal Energy Storage with Phase Change: Materials, Heat Transfer Analysis and Applications*, by Belén Zalba, José Marín, Luisa F. Cabeza, and Harald Mehling in *Applied Thermal Engineering* 23 (2003) 251–283 available at http://ecaaser5.ecaa.ntu.edu.tw/weifang/pcm/Review%20of%20PCM.pdf. Other articles can be found at http://resource.tcc.edu.tw/resdata/3703/a%20review%20on%20phase%20change%20energy%20storage--materials%20and%20applications.pdf, http://www.iea-shc.org/publications/downloads/task32-Inventory_of_PCM.pdf, and http://web.mit.edu/3.082/www/team2_s02/phase_change.html.

palmitic acid which has a melting point of 61-64° C (142-147° F) or possibly myristic acid (which has a melting point of 49-58° C / 120-136° F). Both of these fatty acids have a relatively high heat of fusion (185-204 kJ/kg), are waxy solids at room temperature, and can be food-grade materials made of plant products. We then had a cRc certified company run the PCM through a Gas Chromatography (GC) Mass Spectrum which confirmed that it is, in fact, palmitic acid.[3]

Kashrus

Palmitic acid is definitely a kosher-sensitive ingredient, as it is often derived from animal fat,[4] and even when it is derived from plant materials, as the company claims,[5] the palmitic acid is commonly produced at high temperatures on large equipment which is also used for animal fat. Thus, even if the Joulie PCM is, in fact, "made from plants" it might not be kosher.[6]

There are, however, a few reasons why even if the PCM is not kosher, one might still be permitted to use it in hot kosher beverages.

Firstly, a Jew who tasted the PCM said that it was basically tasteless with a waxy consistency. If so, it would seem that we should be able to apply the ruling of *Rema* 103:2 that one does not have to be concerned about *b'lios* from forbidden items which are

[3] The test also showed traces of oleic acid. Oleic acid is not a known PCM and therefore it is most likely that the traces of oleic acid are due to impurities in the palmitic acid rather than an intentional additive.

[4] Palmitic acid (like most fatty acids) is isolated by "splitting" fats or oils at very high temperatures (~700° F) into two parts – glycerin and fatty acids. The mixture of fatty acids derived from the given fat or oil is then further processed at high temperatures (~150-250° F) to separate, purify, and deodorize them for use. The sophisticated equipment used for these processes is (a) at times used for both animal and vegetable products, (b) often not cleaned between products (since the products do not easily spoil, and the distillation and other purifications remove impurities), and (c) relatively large (such that absorbed non-kosher taste may not be *batel b'shishim* into subsequent kosher products).

[5] There may be basis for accepting the company's claim even as relates to a potential *issur d'oraisah* based on the principle of אומן לא מרע אמנתו (see *Shach* 98:2 and *Iggeros Moshe* YD 1:55).

[6] If the PCM is plant-based and is only non-kosher due to absorbed non-kosher taste, should we possibly apply the rule of אין הבלוע יוצא...בלא רוטב (*Shulchan Aruch* 105:7) and say that the absorbed *ta'am* cannot transfer into the stainless steel shell since there is no liquid medium between the PCM and shell? This suggestion is incorrect for two reasons: 1) The absorbed non-kosher animal fat is a *davar shamein* which most hold can transfer from food into a *kli* without a liquid medium (see *Badei HaShulchan* 105:112), and 2) when the Joulie is put into hot water the PCM changes into a liquid!

tasteless.[7] There are a number of concerns with this line of reasoning:

- It would seem that a decision that the PCM is tasteless should be based on the tastings of multiple people.
- Whether other Jews are permitted to taste the *safek issur* and whether the permitted level of tasting is sufficient to determine that the food is tasteless is discussed in *Taz* 98:2, *Pri Megadim* ad loc, and *Yad Yehuda* 98:2. On the other hand, it may be sufficient that the gut reaction of all those who saw and touched the PCM was that it would be tasteless, and this may not be much different than *Rema* ibid. who assumed that bee legs are tasteless even though we can only imagine that he never actually tasted them.
- Scientific reference works[8] indicate that palmitic acid has almost no "taste" but does provide some element of mouthfeel. Seemingly, mouthfeel qualifies as "*ta'am*" even if scientifically it may not be considered "taste", which would imply that these items are not "tasteless". On the other hand, it may well be that the subtleties detected by flavor chemists may be too insignificant to qualify as "*ta'am*" for the average person.
- *Toras Chattas* (*Rema*), *Shach* and others say that nowadays one may not rely on a Jew's tasting of a food to determine that it does not have a taste of meat so as to then *l'chatchilah* mix it with dairy; rather, "tasting" (even by a Jew) is only relied upon for cases of *b'dieved*.[9] The reasons[10] given

[7] This line of reasoning was suggested by R' Elli Leibenstein. See *Aruch HaShulchan* 103:19 and *Pri Megadim* SD 103:2 who explain why the case of tasteless food is different than the case of *Shach* 103:2 of food which is *nosein ta'am* but the *ta'am* does not contribute positive (or negative) taste into the kosher food.

If this line of reasoning is legitimate, it would seem that one could even *l'chatchilah* put the Joulie into hot coffee and it would not be considered *bitul issur l'chatchilah*, because (a) in this case where no one will eat even a drop of the forbidden PCM, and there is no *ta'am* transferring into the coffee, it is not clear that this even qualifies as *bitul issur* at all since the person is not putting *issur* into the *heter*, (b) there are those that hold that the *issur d'rabannan* of *bitul issur l'chatchilah* does not apply to *safek issur* (see *Badei HaShulchan* 99:29), and (c) this case may well qualify as אין כוונתו לבטל where *bitul issur l'chatchilah* does not apply.

[8] Fenaroli page 1478 and Arctander 2447.

[9] *Shulchan Aruch* 98:1 codifies the *Gemara's* halacha that there are situations in which one can rely on a non-Jew's tasting of a food to determine that it does not have an absorbed non-kosher taste. *Rema* records that the *Ashkenazic* custom is to not rely on a non-Jew's tasting under any circumstance. *Shach* 98:5 deduces from *Rema's* wording that this custom is limited to a non-Jew's tasting, but if a Jew tastes a food and says that it does not have the taste of *issur* (e.g. *terumah*, meat), then one

for this *chumrah* would appear to also apply to determining that a food is tasteless. Does this mean that one may not *l'chatchilah* use Joulies in hot beverages even if multiple Jews and scientific publications would inform us that the PCM is tasteless?

– On the other hand, it may be that our case is somewhat more lenient due to the fact that (a) the PCM is only *safek issur*, (b) no one will ever eat the PCM but rather our concern is that it is *nosein ta'am* into the beverage, and (c) the only way it can be *nosein ta'am* is if taste passes through the metal shell, and the ability for *ta'am* to pass through metal is itself a *safek*.[11]

In addition, Joulies are never used in a *kli rishon*, and the PCM only has contact with hot beverages as a *kli sheini*.[12] If so, *ta'am* cannot transfer more than *k'dei klipah*,[13] which means that *ta'am* from the PCM cannot transfer through the *k'dei-klipah*-thick stainless steel shell. Therefore even if the PCM is non-kosher, the status of the hot coffee or other beverage should not be affected by the PCM. [Furthermore, *b'dieved* one does not have to be concerned about the transfer

may rely on that determination and permit the food.

Shulchan Aruch 96:1 continues with this assumption and says that if a radish was cut with a meat knife, one may eat the radish with dairy if a Jew tastes the radish and determines that it does not have a meat-taste. However, *Toras Chattas* (*Rema*) 61:1 and *Shach* 96:5 argue that although we have seen above that a Jew's tasting may be relied upon, that is limited to cases of *b'dieved* where the food was already mixed with *issur* (or the meat suspected of having absorbed a meat taste has already been mixed with dairy), but one may not rely on even a Jew's tasting to make a *l'chatchilah* decision to mix two foods together.

The *l'chatchilah* use of a Joulie in a kosher beverage based on a Jew's tasting of the PCM and determining that it is tasteless, would appear to be an example of the case where *Toras Chattas* and *Shach* say that one may not rely on even a Jew's tasting.

[10] *Pri Megadim* SD 96:5 cites two reasons for this: 1) there may be a *mashehu* of taste, and 2) nowadays, we may not be sufficiently capable of detecting taste.

[11] See *Shulchan Aruch* 92:5 and the *Poskim* ad loc. We calculated that each Joulie holds approximately 0.5 cubic inches of PCM and the company recommends that one Joulie be used for every 4 ounces of beverage. At that ratio, there is approximately 16 times as much beverage as PCM. [4 ounces is approximately 7.2 cubic inches, and the metal in the Joulie is approximately 0.8 cubic inches] That is not enough for *bitul b'shishim* but does somewhat minimize the concern, especially if the PCM is basically flavorless (see *Shach* 103:5).

[12] The company advises that one put the Joulies into the mug before pouring the coffee in such a way that the outer shell's contact with the hot beverage is via *irui kli rishon*. However, as relates to the PCM (which is the potential non-kosher item) the contact is *irui kli rishon* which is נפסק הקילוח, which has the status of a *kli sheini* (*Rema* 68:10). [If, as we suspect, some people put the Joulies into the mug after the coffee is already inside, even the contact with the shell will be as a *kli sheini*.]

[13] See *Rema* YD 92:7 and elsewhere.

of *ta'am* in a *kli sheini*.][14] The concerns with this line of reasoning are:

– If a person would ever put his Joulies into the dishwasher – and if a dishwasher has the status of a *kli rishon*[15] – the (possible) non-kosher taste of the PCM would be fully absorbed into the stainless steel shell such that it could subsequently be released even with an *irui kli rishon*.[16]

– On the other hand, it is generally assumed that any *b'liah* that is extracted via an *irui kli rishon* (i.e. when coffee is poured over the Joulie) is *batel b'shishim* into the hot water.

Summary

Joulies are filled with a material known as PCM that may possibly be non-kosher. The reasons to nonetheless consider permitting the use of Joulies in hot kosher beverages are that:

– The PCM is only safek issur.

– The PCM appears to be tasteless, such that (a) it's b'lios cannot affect other foods, and (b) any minimal taste may possibly be batel b'shishim (see footnote 11).

– The PCM only has indirect contact with the beverage and it is a safek if (and how much) ta'am can pass through metal.

– The Joulies are only used in a kli sheini, such that (a) b'lios cannot pass through the shell, and (b) b'dieved we are not machmir for kli sheini.

Although there are questions on some of these individual reasons and some only apply *b'dieved*, it seems that the combination of all of these factors may be enough to permit the use of Joulies in kosher foods. Others will undoubtedly choose to be *machmir* and not use them due to the *kashrus* concerns.

Under the assumption that the use of Joulies does not pose a general *kashrus* concern, we now turn to some other questions that relate to their use.

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[14] *Rema* 68:11.

[15] For a thorough treatment of the status of dishwashers see the sources and discussion in the article on dishwashers by Rabbi Yisroel Rosen in *Techumin* 11.

[16] In addition, should we be concerned that in the factory the Joulies are likely sealed shut with direct heat (welding), and therefore each was used as a *kli rishon* (albeit not in the presence of a kosher beverage)?

Other Kashrus Issues

Some of the leniencies noted above do not apply on *Pesach*,[17] and it therefore seems prudent to be *machmir* and not use Joulies (even new ones) on *Pesach*.

It is obvious that one may not use the same Joulie for both meat (e.g. soup) and dairy (e.g. coffee with milk). Furthermore, the custom is that if one owns two of the same item and one is designated for dairy use and the other for meat use, the one designated for dairy use should be "marked"[18] so that it will not mistakenly be used for the wrong use.

Shabbos

The general rule is that the prohibition against cooking on *Shabbos* does not apply to foods which have already been cooked once before (אין בישול אחר בישול).[19] Foods which are in liquid form are an exception to that principle, because once the food cools down it loses its "cooked" status.[20]

Magen Avraham[21] clarifies that as relates to this halacha ambient temperature animal fat has the status of a solid food even though it liquefies as it warms up. He therefore rules that the prohibition against cooking on *Shabbos* does not apply to animal fat which was cooked before *Shabbos*. We can apply this same principle to the palmitic acid PCM;[22] it was cooked before *Shabbos*[23] and is now in solid form such that if one would put a Joulie into hot water there would be no violation of the prohibition against cooking on *Shabbos*.[24]

However, it would seem that it is forbidden to put use Joulies with

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[17] For example, *b'lios* in a *kli sheini* are forbidden even *b'dieved* (*Rema* 447:3 as per *Mishnah Berurah* 447:25).

[18] *Rema* 89:4 (end).

[19] *Shulchan Aruch* 318:15 as per *Mishnah Berurah* 318:92-93 & 95.

[20] *Shulchan Aruch*/*Rema* 318:15 as per *Mishnah Berurah* 318:24 & 99.

[21] *Magen Avraham* 318:40 cited in *Mishnah Berurah* 318:100.

[22] *Iggeros Moshe* OC 4:74:f (in the *bishul* section) and *Shemiras Shabbos K'hilchaso* 1:58 (as explained there in footnote 173) disagree as to whether *Magen Avraham's* leniency applies to butter which is cooked in a liquid form (as milk) and cools (i.e. attains an "un-cooked" status) before it solidifies, in the same way that it applies to animal fat which solidifies (i.e. becomes a solid) as it cools. However, the physical properties of palmitic acid are similar to that of animal fat (both solidify as they cool) and therefore all would agree that *Magen Avraham's* ruling applies to PCM.

[23] As noted in an earlier footnote, one step in separating fatty acids such as palmitic acid from oils (or fats) is to cook the oil at very high temperatures (~700° F) which obviously qualifies as a "cooking" for that oil.

[24] In addition to the reason noted in the text there is no prohibition of *bishul* in this case because the Joulie is placed into a *kli sheini*.

hot beverages on *Shabbos* due to the *issur d'rabannan* of *nolad*, intentionally converting an item from solid to liquid form.[25] We have already seen that this change in form is critical to the Joulie performing its "magic", and therefore that change is considered intentional and forbidden.

Tevillas Keilim

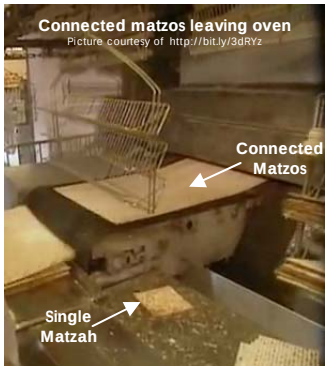
The functional portion of the Joulie is the PCM which is a material that does not require *tevillas keilim*. However, since the stainless steel shell comes in contact with the food, and the Joulie would clearly not function without the shell, the Joulies must undergo *tevillas keilim* before they are used, and one should recite a *bracha* on that *tevillah*.[26]

Summary

Joulies are filled with a material known as PCM that may possibly be non-kosher, but there are nonetheless reasons to permit their use in kosher beverages. Separate Joulies should be used for meat and dairy. One may not use Joulies on *Shabbos*, and it seems appropriate not to use them on *Pesach*. Before Joulies are used, they should undergo *tevillah* with a *bracha*.

MULTIPLE MATZOS BAKED AS A SINGLE SHEET

In some machine *matzah* bakeries, the *matzos* go through the entire oven as one long sheet. As an introduction to the two halachic issues raised by that practice, we will review some details of how these types of machine *matzos* are formed and baked. After the dough is kneaded, it is rolled into a long, flat sheet which passes under two sets of blades that score the sheet lengthwise and widthwise. These blades score the sheet into *matzah*-sized squares but do <u>not</u> cut the dough all the way through; rather, the *matzah* passes through the oven as a scored sheet, and after it leaves



[25] *Rema* 318:16 as per *Mishnah Berurah* 318:105. In our case, it appears that all conditions of *nolad* (a meaningful amount of liquid which does not immediately become mixed into another food) apply.

[26] Based on *Rema* 120:7 (end). *Chochmas Adam* 73:11 says that this type of case requires *tevillah* and the fact that he does not say "*tevillah* without a *bracha*" (as he does for other cases in that same halacha) implies that a *bracha* should be recited in this case.

the oven it is broken into individual *matzos*.

Shalem

The most well known issue that this setup raises is that perhaps the individual *matzos* should not be considered *shalem* in terms of using them for *lechem mishneh*. [This issue is relevant year-round and is not specific to *Pesach*.] How can a single *matzah* be considered "whole" if it was baked as part of a 300-*matzah*-long sheet? Although this question seems compelling, most *Poskim*[27] hold that the individual *matzos* are, in fact, considered *shalem* and they offer three reasons for this position:

1. *Shulchan Aruch*[28] rules that if two pieces of dough were stuck together in the oven and were then separated from one another after baking, the individual גלוסקאות have the status of being *shalem* (and the joined גלוסקאות do not).[29]

2. *Shulchan Aruch*[30] says that if a loaf of bread is broken in half, a person can join the two pieces together with a toothpick and consider the newly-connected loaf to be a *shalem*.[31]

Some question these proofs (and particularly the first one) based on *Machatzis HaShekel*[32] who suggests that these halachos may only apply in cases of *b'dieved*. However, others[33] rejoin that (a) *Minchas Pitim*[34] clearly disagrees with *Machatzis HaShekel's* suggestion, and (b) there is reason to think that in our case it is even more obvious that the individual *matzos* are considered *shalem* because the joined *matzos* were specifically scored to begin the separation

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[27] Many of the sources brought to the author's attention are from the discussion on this topic in *She'arim Metzuyanim B'halacha* 110:23, available at http://hebrewbooks.org/14619.

[28] *Shulchan Aruch* 168:3. A similar proof is brought by *Minchas Pitim* (see below) from the halacha of a double-*esrog* (אתרוג התיום) cited in *Shulchan Aruch* 648:20.

[29] Rav Mordechai Ephraim Fischel Sofer writing in *Yerushas Plaitah* #1. [*Yerushas Plaitah* is a journal printed in Budapest in 1946 which features *divrei Torah* written (primarily) by Hungarian *Rabbonim* before WWII; the journal is available at http://hebrewbooks.org/538, and the first four entries are on the topic of machine *matzos* which are baked in one attached sheet.]

[30] *Shulchan Aruch* 168:2.

[31] *Tzur Yaakov* 151 (Rav Avraham Yaakov Horowitz), available at http://hebrewbooks.org/1116.

[32] *Machatzis HaShekel* 274:1 (end).

[33] *Orchos Chaim* 274:2 (a) and Rav Sofer in *Yerushas Plaitah* #1 (b).

[34] *Minchas Pitim* (Rav Meir Arik) 274 & 648, available at http://hebrewbooks.org/37527. This also appears to be the opinion of *Shoel U'Maishiv* I:I:167 (towards the end), referenced in *Da'as Torah* 274:1, regarding the use of *challos* (stuck together during baking) for *lechem mishneh*.

process (as opposed to the case of *Shulchan Aruch*/*Machatzis HaShekel* where the separated *matzos* were unintentionally joined).

3. There is a principle that at times a larger item can be considered divided into individual parts if the original intention is to later break it up. Rav Sofer and *Tzur Yaakov*[35] suggest that this principle, known as כל העומד לחתוך כחתוך דמי, can be applied to our case where the *matzah* is only temporarily maintained as a long sheet and the obvious intention is to break it into individual *matzos* after the baking.

Rav Shteif[36] argues that (a) the above principle is the subject of a halachic dispute, and the accepted halacha (at least in this type of case) does <u>not</u> follow this opinion, and (b) although it is clear that the sheet will be broken into individual *matzos* <u>after</u> it leaves the oven, it is equally clear that in order for the oven to function properly the sheet must remain whole until it <u>leaves</u> the oven such that it is not עומד לחתוך until it is already baked.[37] [The discussion regarding point "a" is beyond the scope of this document.] Rav Sofer[38] replies to point "b" that (c) the scoring of the *matzah* before it enters the oven sufficiently indicates the intention to eventually divide the sheet, and (d) the oven can function well if there is even a minimal connection[39] between the portions of the sheet.

Rav Sofer and Rav Mordechai Meir Bennet[40] support their overall lenient positions by citing the "*minhag* in all of Poland" to purposely bake 12 pieces of dough together (for non-*Pesach* use) and then use the individual pieces as whole *challos*/rolls for *lechem mishneh*.

Heating of the dough

The fact that the dough enters the oven and is baked as one long sheet raises another question

[35] Rav Sofer in *Yerushas Plaitah* #1, and *Tzur Yaakov* ibid.

[36] Rav Yonnason Shteif writing in *Yerushas Plaitah* #2.

[37] *Tzur Yaakov* ibid. makes a similar point (regarding to a leniency he suggests based on the experiment noted in *Shulchan Aruch* 167:1) but concludes with a proof that the *matzah* is considered *shalem* for other reasons, as noted earlier in the text.

[38] *Yerushas Plaitah* #3.

[39] In fact, in most ovens the dough must merely be attached when it enters the oven (so that the dough that is not yet in the oven will be pulled onto the oven-belt), but once it is on the oven-belt there is no need for the individual *matzos* to be attached to one another.

[40] *Yerushas Plaitah* #1 & #4.

which is particular to *Pesach*. It is well known that *matzah*-dough cannot be at all warm (before it is baked), because that might cause it to become *chametz* in less than 18 minutes. Accordingly Rav Shteif[41] wonders if the dough which is not yet in the oven might get hot/warm, because it attached to the dough which is already baking in the oven. In response to this, Rav Sofer and Rav Bennet[42] report that their experience showed that the dough shows no sign of heat before it goes into the oven, and they were therefore unconcerned with this issue. Rav Bennet further suggests that even if the dough would be very hot for a few seconds before it gets into the oven that would not be enough time for it to become *chametz*.[43]

The aforementioned *Poskim* specifically note that their discussion presupposed that the principle of חם מקצתו חם כולו does not apply to foods and is limited to heat spreading through metal utensils.[44] *Chazon Nachum*[45] cites others who agree with that position but then argues that חם מקצתו חם כולו does apply to foods. He therefore supports a Rav in Antwerp who forbade the use of *Pesach matzah* baked as one long sheet.[46] Those illustrious Rabbonim who have permitted the use of multiple *matzos* baked as a single sheet have apparently adopted the lenient position on this question.

BUTYL COMPOUNDS

Butyric acid is a carboxylic acid with 4 carbons (and is technically known as butanoic acid), which is most commonly found as a component of (rancid) butter. The following are notes from the June 2008 AKO Ingredient Meeting:

> Rabbi Gornish reported that the OK does not consider butyric acid a Group 1, because of a concern that it is produced from grape-based fusel oil. The committee members agreed

[41] *Yerushas Plaitah* #2.
[42] *Yerushas Plaitah* #3 & #4.
[43] He notes that although *Shulchan Aruch* 459:2 implies that in such circumstances the *chimutz* can happen instantly, those words should not be taken literally; it actually takes some time for the dough to become *chametz*. [See *Mishnah Berurah* 459:18 who makes a similar point.]
[44] In other words, they were focusing on whether the dough outside the oven is perceptibly hot and not whether the halacha dictates that we should consider it hot.
[45] *Chazon Nachum* YD 45, available at http://hebrewbooks.org/819.
[46] This also appears to be the conclusion of *She'arim Metzuyanim B'halacha* 110:23.

that butyric acid can be isolated from fusel oil, but argued that the amount of work required to isolate and purify butyric acid from fusel oil made it not commercially viable to do so. Therefore all butyric acid should be assumed to be from synthetic sources.[47] Thus, the consensus was that although fusel oil and even isoamyl alcohol are not considered Group 1 because they may be derived from grape-based alcohol, butyric acid and butyl compounds should be Group 1.

Rabbi Gornish accepted these arguments, and on the day after the meeting he reported that Rabbi Don Yoel Levy was amenable to the OK changing its policy on this issue; the butyl compounds could therefore be included on the Group 1 list.

Based on the above, butyl (a.k.a. butanoic) compounds are Group 1 as they are assumed to be synthetic, but the "natural" version of butyric acid or butyric compounds are <u>not</u> Group 1 as they may come from butter or fusel oil.[48]

HOT BOX KASHERING

Background

A hot box is an insulated box into which one puts pans or plates of food to either maintain or increase their temperature. Some of them have built-in heating elements, and others are heated by putting "Sternos"[49] onto the floor of the hot box. The boxes range in size from approximately 10,000-90,000 cubic inches[50] and


Hot Box (midsized)

[47] Additionally, it was noted that (a) *Rema* 114:10 (as explained by *Shach* 114:21) holds that in cases such as this, one need not be concerned that the item is produced from *stam yayin* and (b) grape-based fusel oil is often used specifically for natural grape flavors, because that fusel oil is believed to carry trace notes that are appropriate for a grape flavor.

[48] Some literature indicates that it can also be made via fermentation.

[49] Sterno is a brand name for portable, disposable canisters of chafing fuel (a flammable gel or liquid). The Sterno brand is so popular that all varieties of these canisters are colloquially known as "Sternos".

[50] A hot box's cubic inches are calculated by multiplying its (interior) height by its width by its depth. Thus a hot box which has an interior height of 59 inches, width of 60 inches, and depth of 25 inches will have 88,500 cubic inches (59 X 60 X 25 = 88,500) of interior space. Most hot boxes are wider than they are tall, and can be divided into the following four approximate sizes extra large (>80,000 cubic inches), large (70-80,000 cubic inches), medium (60-70,000 cubic inches), and small (<60,000 cubic inches). Upright hot boxes come in "full" (20,000-40,000

are ubiquitous in banquet hall kitchens where a caterer might use many hot boxes for a given event.

In addition to the traditional uses for a hot box, kosher caterers will sometimes use them as "portable ovens" when they are catering an event at a non-kosher venue. The caterer will cook all food in his kosher commissary, and instead of cleaning and *kashering* the hotel's ovens he will use hot boxes to heat up the food at the event.

Since hot boxes are regularly used for the storage of hot food, there is no question that a non-kosher hot box cannot be used unless it is *kashered* beforehand. The *zei'ah* (and spillage) escaping from pans of non-kosher food renders the racks, ceiling, and even walls[51] non-kosher. The fact that a heating element or Sterno is often heating the chamber (in addition to the hot food) means that the hot box is absorbing *ta'am* as a *kli rishon* rather than via *irui kli rishon*, and the level of *kashering* must be commensurate with that status.

Of course, it is not possible to perform a traditional *hag'alah* to a hot box, and therefore the standard method of *kashering* hot boxes has been with *libun kal*[52]

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cubic inches) and "half" sizes (<20,000 cubic inches). Some actual dimensions of hot boxes in these categories are [dimensions are in inches]:

Size	Height	Width	Depth	Cubic inches
Extra large	59	60	25	88,500
Large	63	54	23	78,246
Medium	57	48	23	62,928
Small	56	43	23	55,384
Full upright	64	19	28	34,048
Half upright	28	19	26	13,832

[51] The *b'liah* into the hot box is primarily via *zei'ah* which, of course, rises to render the ceiling, racks, and upper walls as non-kosher (see *Shulchan Aruch* 92:8). If/when steam from kosher food condenses on the ceiling of the hot box and drips into the food, the non-kosher *b'liah* will transfer into the (previously) kosher food (see *Rema* 108:1 and the limitation noted in *Iggeros Moshe* YD 1:40). The floor of the hot box could possibly absorb non-kosher taste through dripping of food (which is not very common due to the way hot boxes are used and the fact that there are usually many layers of trays stacked upon each other), but it is almost impossible for that non-kosher *b'liah* to get into the kosher food subsequently warmed in the hot box. The significance of this point will be noted below in footnote 84.

[52] There is a common misconception that the *kashering* is accomplished via *k'bol'oh kach polto*, which is to say that if the hot box is only heated via Sternos then it can also be *kashered* with a similar number of Sternos. The fallacy with this is that it is widely accepted that the concept of *k'bol'oh kach polto* applies to (a) choosing whether *libun* or *hag'alah* is required (*Shulchan Aruch* 451:4-5), and (b) the level of *hag'alah* which is required (*kli rishon*, *kli sheini*, exact temperature) (ibid. 451:5), but does not apply to the temperature of *libun*. In other words, *libun* can only be accomplished when the item reaches a specific objective temperature (regardless of how hot the food and utensil were when they were used for non-

which was accomplished by putting lit Sternos into the box. [Details on how many and which type of Sternos should be used will be noted below in this article.] This article will discuss (a) the OU's recent decision to no longer allow this type of *kashering*, (b) reasons why others might suggest a different standard as a justification of the original method, and (c) details of how to *kasher* as per either standard.

OU Ruling

As noted, the aforementioned method of *kashering* hot boxes is an attempt to create *libun kal* in place of *hag'alah*. What temperature is required for *libun kal*? It is well documented in earlier *Poskim*[53] that *libun kal* is accomplished when heat is applied to a surface until the backside side of that surface reaches *yad soledes bo* (~160-175° F).

However, Rav Belsky said that those *Poskim* were only discussing a case where the person put fire or coals directly onto the non-kosher surface. If one merely heats up a chamber then the metal must reach a considerably hotter temperature before *libun kal* is accomplished. In order to accomplish *libun kal* in that scenario the chamber must maintain a temperature of 550° F for one hour, 450° F for 1.5 hours, or 375° F for two hours. This is by no means a "new" position of Rav Belsky's and was included in what is likely the very first record of rulings which he gave to the OU more than two decades ago.[54]

Until now, the OU[55] and others assumed that the *kashering* method outlined above met this standard. However, in recent weeks the OU conducted tests which showed that when people performed the "*kashering* procedure" the hot boxes did not necessarily reach and maintain

kosher), and the utensil is not considered "kosher" just because it was heated to a temperature which is hotter than the one used during cooking of non-kosher food.

[53] *Taz* 451:8, *Magen Avraham* 451:27, *Gra"z* 451:10, and *Aruch HaShulchan* 451:5. Earlier sources for this issue (and others who appear to require a higher temperature) will be noted below towards the end of the article.

[54] See questions 25-27 in OU Document X-1 which was written circa 1990.

[55] See, for example, Section X of the OU's *Commercial and Retail Kashering*, authored by Rabbi Yosef Eisen which was printed in 1993 and (essentially) recommended this method of *kashering* for hot boxes (warming cabinets). One reason why people have thought that the hot boxes met the standard for *libun kal* is that many *Mashgichim* report that during *kashering* even the outside of the hot box is exceedingly hot in spite of the fact that the walls are insulated.

the desired temperature. [Our own tests confirmed this.]

Accordingly, the OU announced a change of policy and will henceforth not allow the *kashering* of hot boxes.[56] Thus, the OU's standard has not changed, but rather they have become aware that the common method of *kashering* does not meet that standard.

Justification of the Original Method

Libun kal

We have seen that Rav Belsky's standard for *libun kal* is based on a distinction between whether *libun kal* is performed by placing a flame directly onto the surface or by warming a chamber without a flame touching each surface. He based this on the assumption that the former case is the "standard" one discussed in the *Poskim*, in which they rule that it is sufficient to heat the utensil until it is *yad soledes bo*, because that shows that the fire's heat has penetrated the entire thickness of the utensil. However, he reasoned that the latter case is one in which those *Poskim* would have demanded a different standard.

The reason to disagree with this is that the following early sources for the use of *libun kal* in place of *hag'alah* are, in fact, discussing cases that seem quite similar to the latter case:

– *Gemara*, *Avodah Zara* 33b cites a *machlokes* as to whether a non-kosher wine barrel can be *kashered* by placing burning slivers of wood (קינסא) into the barrel until the tar melts on the inside. The *Gemara's* conclusion is that this is not sufficient for *kashering* because it does not indicate that the heat penetrated the full thickness of the barrel. However, *Tosfos*[57] infers from this that if enough heat would be placed into the barrel so as to render the outer surface of the barrel *yad soledes bo*, that would be sufficient to *kasher* the barrel.

[56] In the words of Rabbi E. Gersten, writing for the OU *Poskim*:

> There is a grave concern that when kashering hotel warming boxes this minimum libun temperature is not being achieved. Additionally, it has been reported that those who have strived to reach these libun temperatures have found that they have caused damage to the warmers by melting the rubber gaskets. Therefore, the OU is instituting that one should not attempt to kasher hotel warming boxes, but rather caterers must bring their own warmers with them to hotels.

[57] *Tosfos* s.v. *kinsah*.

The implication is that as long as there is enough heat inside the barrel to penetrate the full thickness of the barrel-walls, the barrel has been *kashered* regardless of whether the flames touch all or any surfaces of the barrel.

– *Shulchan Aruch*[58] rules that if one places a new (layer onto the) "floor" in an oven, that oven can be used for baking *matzos* for *Pesach*. We understand that placing a new floor prevents *chametz b'lios* absorbed into the original floor from being absorbed into the *Pesach matzah*, but what about the *b'lios* in the walls and ceiling of the oven? *Magen Avraham*[59] answers that when the oven is preheated for the baking of *Pesach matzos*, that heat will constitute a *libun* (*kal*) on the oven's walls and ceiling.

Clearly, the oven's flames will not touch every surface,[60] yet the oven has been *kashered*. Thus, this is an example of a chamber being heated by a flame without direct contact, and *Magen Avraham* assumes that in the preheating of the oven the walls will surely become hot enough to have undergone *libun kal*. If *libun kal* in such situations requires that the walls merely reach *yad soledes* (on the outer side) we can understand why it is "automatic" that the walls are *kashered* during every startup. If, however, *libun kal* in that case requires a high heat which is maintained for an extended time, it would seem that *Shulchan Aruch* and *Magen Avraham* should have provided directions for this procedure.

These sources – coupled with the fact that no other *Poskim* give any indication that there is an alternate *shiur* for chambers than for cases where the flame is put directly onto the surface – indicate that in all cases *libun kal* is accomplished when the full thickness of the metal is heated to *yad soledes bo*. Rav Schwartz agreed with this line of reasoning. **If this is the standard which is required for all *libun kal*, then it is most definitely possible to *kasher***

[58] *Shulchan Aruch* 461:1.
[59] *Magen Avraham* 461:2.
[60] Not only is this statement logical, but in fact the beginning of that halacha (*Shulchan Aruch* 461:1) notes that if one *kashers* an oven floor with coals (instead of putting down a new oven floor), he must make a special effort to put coals on every surface because we assume that otherwise there will not be coals everywhere.

a hot box with Sternos, as will be described in more detail below.

> *It was the author's intention to present the above proofs to Rav Belsky for review so that he could clarify if and why he disagrees. We continue to be mispallel that Hashem should send Rav Belsky a refuah sheleimah so that he will have the strength to respond to the above points and continue in his other* עבודת הקודש.

Before concluding this section we must address two further questions – one on the lenient standard suggested above, and one on Rav Belsky's standard.

Home Oven

If the above analysis is correct, we might wonder why it is commonly accepted that the method of *kashering* a home oven is to turn the oven on to 550° F and leave it at that temperature for an hour. [This method is attributed to Rav Aharon Kotler.] Why must the oven be so hot and be on for so long? Does that not indicate that *libun kal* for an oven chamber requires more than merely heating the metal to *yad soledes bo*?

In order to answer this question we must first review the little known fact that there are actually two method of *kashering* known as "*libun kal*":[61]

– Libun kal in place of hag'alah

The source that allows *libun kal* to be used instead of *hag'alah* is the *Gemara* cited above, and we have seen that *Tosfos* indicates that the required temperature is *yad soledes bo* (on the backside of the utensil).

In this context, it is noteworthy that after *Mordechai*[62] records this requirement he then notes that it is common for people to test this temperature by placing a piece of straw on the utensil to see if it burns (*kash nisraf*). The auto-ignition temperature of straw is considerably higher than *yad soledes bo*,[63] and thus the test was clearly a *chumrah* over the technical requirement of the halacha.

- Libun kal in place of libun gamur

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[61] In addition to the details provided in the text that follows, see *Pri Megadim* MZ end of 452 (דיני וסדר ההגעלה בקצרה in the *libun* section) who differentiates between the different types of *libun kal* (although we do not follow all details of the positions presented there). The difference between the types of *libun kal* will also explain why *Gra"z* provides different *shiurim* for *libun kal* in 451:10, 451:16, 451:38 & 451:70.

[62] *Mordechai*, *Avodah Zara* 860. His words are עד שתהא יד סולדת בו משני עבריה והם רגילים לבדוק על ידי נתינת קש עליה מבחוץ לראות אם הקש נשרף. [Possibly the reason they tested with straw instead of their hands (for יד סולדת) was just to avoid burning themselves.]

[63] *Yad soledes bo* for these purposes is assumed to be approximately 160-175° F, while the auto-ignition temperature of straw is approximately 300-400° F (http://bit.ly/yGWQmG) (although others claim it is 500-600° F – see http://bit.ly/Az7m1E).

The *Gemara*[64] says that *libun* is accomplished when the utensil's surface begins to peel or when sparks begin to fly from it, but *Hago'os Maimonios*[65] suggests that this is somewhat of an exaggeration and the true requirement is that the utensil reaches the temperature where straw would burn on it. Although the *halacha* does not accept this latter opinion, *Rema*[66] rules that in situations where the requirement to perform *libun* is a mere *chumrah* we may be satisfied with this lower level of *libun*.

In this case, *kash nisraf* is not the test for *libun kal* but is rather the actual required temperature level. This is in contrast to the first case where *libun kal* merely replaces *hag'alah*.

A home oven is an example of an item which requires *libun* as a *chumrah*, as follows: The walls and ceiling of a home oven are made of a material called "porcelain enamel", which is glass fused onto metal. [In addition the window in the oven's door is made of glass.] Since the *Ashkenazic* custom is to be *machmir* and treat glass like *cheress*,[67] the oven walls and door must be *kashered* with *libun*. However, since it is only a *chumrah* to consider glass as *cheress*, one may satisfy themselves by *kashering* those surfaces with *libun kal* which takes the place of *libun gamur* (as per *Hago'os Maimonios*).

[Another case where the higher level of *libun kal* (i.e. *kash nisraf* rather than *yad soledes bo*) is required is where one is using *libun kal* to incinerate small amounts of residue found on a utensil (*Rema* 451:4). Whether this occurs by heating a chamber to *kash nisraf* temperatures or whether self-cleaning temperatures of 800-1000° F are necessary, requires further study.]

Therefore, a home oven must be *kashered* with a much higher temperature than a hot box as it is made of different materials. The

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[64] *Gemara*, *Avodah Zara* 76a (תשיר קליפתו) cited in *Mishnah Berurah* 451:29, and *Yerushalmi*, *Avodah Zara* 5:15 (ניצוצות ניתזין) cited in *Shulchan Aruch* 451:4. Nowadays, when metals do not exhibit these signs (possibly because they are refined more thoroughly than in earlier centuries), it is common to judge that metal has undergone *libun gamur* when it glows red hot, as noted in *Teshuvos Maimonios*, *Hil. Ma'acholos Asuros* #5 (R' Chaim Chernoff).

[65] *Hago'os Maimonios* to *Rambam*, *Hil. Ma'acholos Asuros* 17:3 note 5, cited in *Beis Yosef* 451 page 194a.

[66] *Rema* 451:4 as per *Pri Megadim* AA 451:22.

[67] *Rema* 451:26.

home oven requires *kash nisraf*, since it is made of glass, a material that requires *libun kal* as *libun*, and the hot box can be *kashered* with *yad soledes bo* since all it requires is (*libun kal* as) *hag'alah*.

Kash nisraf temperature

The discussion of home ovens and the temperature required to *kasher* them raises another question on Rav Belsky's approach. Rav Belsky essentially holds that in order to *kasher* a chamber heated without a direct flame on the surface, the utensil must reach a temperature of *kash nisraf*, and that this can/should be measured with paper.[68] [69]

In tests that we conducted we found that if paper was placed into an oven which was preheated to 550° F the paper was blackened and burnt within 10 minutes. Thus, it seems that the common practice to *kasher* a home oven by putting it at 550° F for an hour is a way of assuring that the entire thickness of all parts of the oven walls are truly heated to that temperature.

In contrast, most paper placed into an oven at 375° F or 450° F did not show any signs of being burnt even after being in the oven for the designated 1.5-2 hours or longer. The paper did show signs of browning the longer it stayed in the oven, but (a) there was no clear difference between paper that was in the oven for the specified amount of time as opposed to paper that was in for longer or shorter,[70] and (b) some paper that was in the oven for the specified amount of time


550° F – 10 minutes

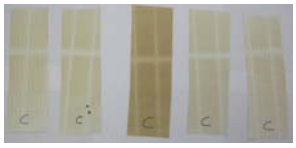
[68] In explaining how the temperatures for *kashering* an oven were determined, Rav Belsky told this author (OU Document K-203) that:

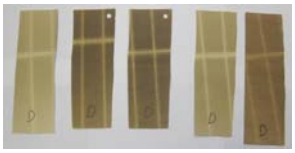
> ...one can perform "*libun kal*" even without a direct flame by heating the utensil/oven until *kash* is *nisraf* on it because that also shows that the fire has penetrated the thickness of the utensil. *Kash nisraf* is the proper barometer for this because just like paper burns up immediately when fire is place on it, we can reason that once paper/*kash* burns on a utensil the fire is having the same effect as a flame. The Poskim tested this and noticed that if paper is placed in an oven then at 550 degrees it takes only an hour for t
> at lower temperatures
> 375° for 2 hours) it is a
> takes much longer.

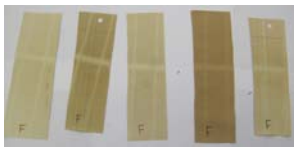
[69] It is well known that paper au 451° F which is somewhat higher than the auto-ignition temperature of straw (see footnote 73), but presumably the use of paper for this test is an example of לחומרא לא דק.

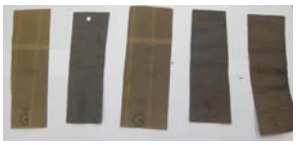
[70] See the pinwheel-shaped picture of papers shown in graduated color. The actual order of papers in this pinwheel – from lightest to darkest – are as follows: [Letters represent the different time and temperature (see the pictures) and those marked with a star (*) were in the oven for long enough to meet Rav Belsky's *libun kal* requirements.] C, C, C, C, F*, F*, F*, C, A*, D, D, A*, F*, A*, A*, F*, D, A*, D, D, B*, G*, G*, B*, B*, B*, G*, B*, G*, E, G*, E, E, G*, G*.

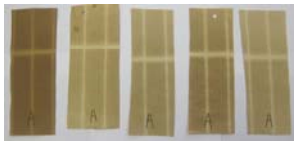
appeared to undergo very little change at all.

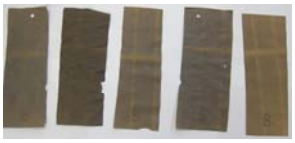

375° F – 10 minutes


450° F – 10 minutes


375° F – 1.5 hours


450° F – 2 hours


375° F – 2.5 hours


450° F – 2.5 hours

Thus, the widely accepted practice of considering 550° F (for an hour) to be considered *kash nisraf* seems to be firmly based on a meaningful occurrence, but it is not clear what the basis is for suggesting that *kash nisraf* occurs at 375° F or 450 ° F, even if the chamber is "held" at that temperature for an extended time.

Kashering a Hot Box

We have seen that there are two possible standards for *kashering* a hot box; Rav Belsky says that the hot box must be 550° F for an hour, 450° F for 1.5 hours, or 375° F for 2 hours, and the lower standard would only require that the hot box's interior surfaces be heated until (the back side of) those surfaces are *yad soledes bo*. Let us now consider methods of *kashering* (or using) hot boxes which would satisfy these standards.

Alternatives

As noted, the OU suggested that people should not *kasher* hot boxes but rather each caterer should bring his own dedicated kosher hot boxes to each event. This will work for many situations but will make things quite difficult for (a) certain groups, such as NCSY, who "self-cater" events in remote locations far away from kosher caterers, and (b) hotels which want to be kosher for *Pesach*. In each of these cases, the requirement to own, store, and bring kosher hot boxes to the event will be a particular hardship.

Others have suggested that alternate methods of *kashering* be used:

- Some propose using a blow torch on all surfaces, but this is only reasonable for (a) *Mashgichim* and facilities which are comfortable using a torch on equipment, and (b) hot boxes that have no gaskets (because gaskets will melt if touched by the torch's flame).
- Others might use a steam jenny or put pans of hot water into the

hot box (with Sternos) so as to accomplish a *hag'alah*. For this to qualify as *hag'alah*, the steam would have to condense on the ceiling and walls of the hot box;[71] if this was done correctly it would be a suitable *kashering*.

– Lastly, a suggestion was made that food be covered when put into the hot box. This would entail putting a layer or two of foil on the shelves/racks and some cover over the top layer of pans or plates in the hot box. This would prevent *b'lios* absorbed in the hot box from entering the kosher food.

Sternos

It would seem that the simplest suggestion would be to merely modify the original method of *kashering* in a manner that accomplishes the requirements of either standard above. In our testing using Sternos for *kashering*, different hot boxes reached 400-450° F and maintained that temperature for 30 minutes, and **it seems that if we were more particular about the number and type of Sternos used we could easily reach 450° F and maintain that temperature for 1.5 hours** (and possibly even reach 550° F), as discussed below.

Hot box at 450° F during *kashering*

Fuels

A study of more than 20 types of Sterno-like chafing dish warmers manufactured by a half dozen manufacturers showed that they all[72] use one of three fuels: ethanol, methanol, or diethylene glycol (DEG). [Some use ethanol with a bit of methanol mixed in.] Of those fuels:

– The first two are gels, while DEG is used as a liquid with the flame on a wick.

– Ethanol consistently provides the most BTU[73] per hour (i.e. the most heat), closely followed by methanol.[74] In almost every

[71] If non-kosher flavor is absorbed purely via steam, then the hot box could be *kashered* with steam based on the principle of כבולעו כך פולטו (*Maharsham* 1:92). However, if the non-kosher steam had condensed into liquid those areas would have to be *kashered* with water (i.e. condensed steam) that is at a *hag'alah* temperature (based on *Iggeros Moshe* YD 1:60).

[72] One exception that was found was that the liquid CandleLamp is made of a "proprietary blend of glycols" which contains 0% DEG.

[73] BTU = British Thermal Units, a standard method of measuring energy by the amount of water it can heat.

[74] Based on information provided by four manufacturers, the average BTU per hour in Sterno-like canisters was 1,767 for ethanol, 1,463 for methanol, and only 866 for DEG (or 1,021 if one includes the double-wicked DEG canisters).

case,[75] the liquid DEG provides considerably less BTU than the others.

– The canisters made by different manufacturers provide different amounts of BTU per hour and total BTU.[76] These differences depend on the amount and percentage of fuel in each canister,[77] the size of the canister's opening,[78] and (likely) other factors.

– Since the ethanol and methanol burn without a wick, the canister that holds them becomes hot, and that heat spreads to the floor upon which they rest. In contrast, DEG burns on a wick that is suspended above the canister, such that the floor underneath the canister will not get hot/*kashered*.

One should definitely not *kasher* with a canister fueled by diethylene glycol (i.e. liquid, wicked)

Thus in choosing a Sterno for use in *kashering*, one should definitely not use a DEG/liquid/wicked canister.[79] It would be best to use an ethanol-based gel, and a second choice would be to use one that is methanol-based.[80] Of the ethanol-based gels, the ones we are familiar with that provide the highest amount of BTU per hour are the Sterno brand, and the FancyHeat brand (red or green).[81]

Number of Sternos

Many seasoned *Mashgichim* feel comfortable judging how many Sternos to use when *kashering* a hot box, but for the purposes of this article – and in particular, for those who want to satisfy Rav Belsky's higher standard of *libun kal* – we made a more formal

[75] The exception was that in some DEG canisters that come with two wicks the fuel burnt so quickly as to provide more (or equal) BTU per hour than the gels. It is also worth noting that a particular popular DEG canister which is billed as being particularly "hot", does in fact burn considerably more BTU per hour than other DEG canisters (~1,300 vs. ~800-900 for most others) but is still only about 2/3 the strength of the best ethanol canisters.

[76] There was a surprisingly wide range of BTU per canister. In approximately 20 varieties the BTU per hour ranged from 778-1,966 and the total BTU in the canister was 1,430-5,460.

[77] The liquid/wicked products were (basically) all 100% DEG, and the range of percentages of the primary ingredients in different canisters was ethanol – 65-78%, and methanol – 70-75%.

[78] The standard opening size (for gels) is 2 inches. An opening of a different size would allow for fuel to burn at a different rate.

[79] The two reasons for this are, as noted, that (a) DEG generally provides fewer BTU per hour, and (b) the can (and area below it) do not get hot.

[80] The range of BTU per hour for methanol-based gels (for those that shared information with us) was 1,430-1,530.

[81] The Sterno brand ethanol canisters claim to provide 1,966 BTU per hour, and the FancyHeat (red and green) canisters claim to provide 1,840 BTU per hour.

calculation of how many Sternos are required.[82] Based on the goal of heating the chamber to 450° F in approximately 40 minutes,[83] and under the assumption that a person is using one of the Sternos recommended in the previous section, we advise the following:

Hot Box Size	Cubic Inches	Ethanol Sternos	Methanol Sternos
Extra large	>80,000	10	12
Large	70-80,000	9	10-11
Medium	60-70,000	8	9
Small	<60,000	7	8
Full upright	20-40,000	6	7
Half upright	<20,000	3	3-4

For more details on the sizes of hot boxes used in the above chart, see footnote 50.

The recommended Sternos each burn for approximately 2 hours, and for those who want to satisfy the OU's requirements of having a temperature of 450° F for 1.5 hours, the aforementioned recommendations would fall just short of that amount of time. [In addition, in our testing we noticed that the temperature of the hot box tended to drop towards the end of cycle, such that there would likely be only about an hour at 450° F]. Accordingly, we recommend that those who would like to fulfill the OU requirements should insert a second set of lit Sternos into the hot box towards the end of the 2 hours and **wait until this second set burns out before declaring the hot box to be *kashered***.

Position of Sternos

Many *Mashgichim* randomly scatter the Sternos around the hot box during *kashering*. In our testing of this procedure we noticed that when this was done there were two areas that did not get as hot as the others. Those areas were the bottom part of the hot box and the floor space near the door. The reasons for this and the proposed solutions to these concerns are presented in the chart below:

Area	Reason	Solution
Bottom 1/4 of the hot box walls	Heat rises	Place all Sternos on the floor of the hot box
Floor space between the Sternos and the door[84]	Ambient temperature air leaking in from the door	Place 2-3 of the Sternos near the door[85]

[82] A good portion of the calculations were based on formulas and charts presented on pages 141-151 of the HotWatt 2010 Catalogue which can be found at http://bit.ly/wz7owi. The calculations considered the energy required to heat the chamber and the heat lost through the insulation and from the door.

[83] The time and temperature were chosen because they were not only reasonable choices that could be accomplished without apparent fear of ruining the gaskets, but were also simultaneously in the range of Rav Belsky's *libun kal* requirements.

[84] It was noted in footnote 51 that it is not clear that there is truly a need to *kasher* the floor of the hot box. The procedures in the text are

A related complication of *kashering* a hot box is that if the door is open at all, hot air will be allowed to escape, but if the door is sealed shut then no oxygen will enter the box, and the flames will be extinguished. The proper compromise for this conundrum appears to be that if the hot box has gaskets around the door (which would seal it well) then the door should be left open slightly during *kashering*, and if the door does not have gaskets then it can/should be tightly closed (and enough oxygen will leak through the door to maintain combustion).

Kashering Procedure (Summary)

Based on the information presented above, the following is the recommended procedure for *kashering* a hot box:

1. Clean the hot both thoroughly, and do not use it for 24 hours.[86]
2. Calculate the correct number of 2-hour ethanol or methanol Sternos (preferably ethanol-based canisters of the Sterno or FancyHeat brands) based on the size of the hot box. [Liquid diethylene glycol canisters should not be used.]

Hot Box Size	Cubic Inches	Sternos Needed	Methanol Sternos
Extra large	>80,000	10	12
Large	70-80,000	9	10-11
Medium	60-70,000	8	9
Small	<60,000	7	8
Full upright	20-40,000	6	7
Half upright	<20,000	3	3-4

3. Put Sternos into the hot box, placing 2-3 near the door.
4. Light the Sternos, and close the hot box's door.
   - If there is no gasket around the door, close the door tightly.
   - If there is a gasket around the door, leave the door open very slightly.

written under the assumption that the entire floor does require *kashering*.

[85] Some *Mashgichim* attempt to solve this concern by emptying gel from a Sterno and placing the gel directly onto the floor of the hot box. This procedure raises serious safety concerns (in addition to the inability to properly judge the correct amount of gel to use, and the fact that "loose" gel will burn considerably faster than gel in a can) and we therefore do not recommend this practice.

[86] Although it is generally accepted that the letter of the law is that one may perform *libun kal* even if the item is *ben yomo* (implicitly rejecting the idea considered by *Pri Megadim* MZ 452:4), it is also prudent for all *kashering* to be performed when equipment is *aino ben yomo* (along the lines of *Rema* 452:2).

5. Keep the door closed until all Sternos have burnt out (and have had a chance to cool off).

6. Those wishing to *kasher* hot boxes according to the OU standard should do as follows, approximately 1.5 – 2 hours after Step 4 is performed:

   - Extinguish approximately half of the original Sternos
   - Add a second set of Sternos to the hot box as per the following chart:

Hot Box Size	Ethanol Sternos	Methanol Sternos
Extra large	8	10
Large	7	8
Medium	6	7
Small	5	6
Full upright	4	5
Half upright	2-3	3

   - Place 2-3 of the new Sternos near the door, light the Sternos and close the hot box's door (as above).
   - Light the Sternos and close the hot box's door.
   - Keep the door closed until all Sternos have burnt out (and have had a chance to cool off).