**User manual for the Warhammer 40k point efficiency calculator**

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Introduction:

This document is about the Warhammer 40k point efficiency calculator, which is an Excel file where you can supply unit stats as input and you get information about the units’ efficiency. The user manual has two main parts: The first one explains the basic concepts, while the second one tells you how to properly use the sheet.

Each output sheet is colour coded. Green is good, red is bad.

**Basic concepts:**

When playing a game of Warhammer 40k, there are many important factors contributing to your victory or defeat. This article is about only one of them, the mathematics of destroying your opponents units. Naturally, mathematics will not lead to victory alone, but it can be very useful to keep in mind when building your lists or choosing which target to attack.

[Damage] Expected number of wounds:

The most basic piece of mathematics we can apply to a unit is to calculate the expected number of wounds it will cause to a target. Of course, Warhammer is a game of dice, so you can never be certain of the result. This chart only gives the average result that you can expect over time. Nevertheless this is very useful information. For example, if I want to get rid of a Rhino I would like to know whether I can expect my Exocrine to finish the job alone, or whether I should commit other anti-tank weapons to destroy it as well.

[PPW] Points per expected wound caused

Let us go one step further and talk about efficiency. That a Tyrannofex with a Fleshborer Hive can expect to kill about 14 orks is all well and good, but how many points we have to spend on the Tyrannofex to do this is crucial. One measure of point efficiency is to calculate the number of points we have to spend on a Tyrannofex to be able to slay a single ork. If we are looking to slay orks, we want the unit that kills as many orks as possible for the price we pay for it. To arrive at this number, we simply divide the point cost of the unit by the expected number of wounds caused. Doing this, we see that we have to spend about 16 points on Tyrannofexes to be able to kill a single ork in a shooting phase. That’s not too bad! This might seem a bit nonsensical because we can’t buy fractions of a Tyrannofex, but it is still a useful way to tell how much we get for our points.

Where [DMG] was most useful for informing our choices in battle, [PPW] is most useful in list building and planning. If I want to buy a shooting unit to kill orks, I can consult the ‘Ork’ column of the table to look for the units that kill orks most efficiently. I’d certainly like to avoid Hive Guard for this job, since they spend 43 points killing an ork, which is a lot more than 16. On the other hand, we might consider Termagants with Devourers. They can kill orks as cheaply as 11 points a wound! There are, of course, other concerns than this as well. The Hive Guard have longer range than the Tyrannofex, while the Tyrannofex might be tougher. Use the information in the chart as a part of your unit evaluation, not instead of it.

[PPP] Points per point killed

We can take our analysis of point efficiency even further. We noted in [PPW] that we have to spend 43 points on Hive Guard to cause a wound to an ork. The table also shows that we have to spend 72 points on Hive Guard to cause a wound to a Land Raider. Since lower is better, does this mean that Hive Guards are better at killing orks than Land Raiders? This seems strange. Hive Guard is an anti-tank unit, not anti-infantry. And indeed, it is false. This is because a Land Raider wound is more valuable than an ork wound. To get a better measure of point efficiency we have to account for the point cost of the target as well.

To arrive at the [PPP] value, we multiply [PPW] with the targets point value and divide by its wounds. We now have a measure of how many points we have to spend on our unit to kill a single point of a target. Let’s revisit our Hive Guard example. In the table we see that we have to spend 7.2 points on HG to kill 1pt of orks, while we only have to spend 3.2 points on HG to kill 1pt of Land Raiders. Hive Guards are better at killing tanks after all!

An alternative interpretation of the [PPP] value that might be more intuitive is the number of turns required for a unit to kill its own point cost in enemies. Under this interpretation we see that Hive Guard spend about 3 turns killing their own point cost in Land Raiders. This is acceptable as the Land Raider is tough. But spending more than an entire game killing their own cost in orks is not. Some units, such as genestealers, are very efficient, often killing their own point cost in a single turn or less. Doing this should not be required of every worthwhile unit, but offensive units should be able to kill their own point cost of their preferred enemies within 2-3 turns.

The [PPP] charts are useful both in list building and in actual games. For list building, it lets us see whether a model will be able to do its job well enough. For instance, we see that the Haruspex is not particularly efficient at any job. In an actual game the table can be useful for directing your troops to do the job that they are best at. For instance, you would get better results sending your Termagants at ork boyz and your Hive Tyrant at bikes than the other way around. This is from a point efficient killing point of view; keep other elements of the game in mind also.

**Sheet overview:**

The Excel file contains a lot of sheets. Luckily, only a few are relevant to a user; the rest are just computational machinery. The interesting sheets are the following: There is a single input sheet, named ‘Input’. When you are using the Excel file, this is the only sheet where you need to write anything at all. The three others are the output sheets. They are named ‘PPP’, ‘PPW’ and ‘Damage’. The meaning of their contents is detailed in the ‘Basic concepts’ part of this document.

**Input guide:**

This section talks about the Input sheet. It explains what to write to tell the program the stats of your units. For each row in the sheet, you can add an attack profile which efficiency you are wondering about. Each column in the sheet asks about a particular quality of all weapon profiles. It is not strictly necessary to read all of this, you could also look at the already filled out example sheets to guide you.

As a general note, the formulas in each sheet extend to line number 300. This means that if you want to use more than that many attack profiles, I recommend that you open an additional copy of the Excel file. Another warning: The Input sheet is very particular about how it is used. Moving input from one place to another in the input sheet might not work. More importantly, do not insert any new lines into the input sheet. These things can be made to work, but I have found that the easiest thing to do with input that is in the wrong place is to delete it and start over.

Finally, I believe that the Excel file works for Google Sheets, but I recommend that you download it to your computer and use Excel. The reason for this is that I have found the sheet to function slowly in Google Sheets, due to the sheer number of sheets and calculations.

The input sheet has five main types of input:

* Headline information
* Point costs
* Basic Attack profile
* Special rules
* Attack profile combinations

For each column or type of information, I will either denote it *[optional]* or *[mandatory]*. If you wish, or if they are not applicable, you can leave optional columns blank. Mandatory columns, on the other hand, will have to be filled with input, or the profile might not work properly.

Headline information:

This group of input contains three columns. The main purpose of these columns is to make the output sheet more readable; any information written here is copied to them.

* **Unit** *[optional]*  
  This column contains that name of the unit.
* **Weapons** *[mandatory]*This column contains the name of the weapon that your unit is using.
* **Other (note)** *[optional]*This column lets you write notes about the attack profile.

Point costs:

This category only consists of a single column: **points**. Write the total point cost of the unit configuration you are considering for the attack profile. It is not strictly necessary to provide this information. The ‘Damage’ chart will function without it, but the ‘PPP’ and ‘PPW’ charts will not.

Basic attack profile: *[mandatory]*

You will need to supply the basic characteristics of your attack for the calculations to work. This consists of the following information:

* **BS / WS**Ballistic skill or weapon skill, whichever is relevant. Either way, enter the lowest die roll needed to hit. For instance, if your space marine with a bolter hits on 3+, enter ‘3’ (without the ‘’).
* **Attacks**The number of attacks your attack has. For instance, if your weapon is Assault 3, write ‘3’. The marine with a Rapid Fire 1 Bolter should have either ‘1’ or ‘2’, depending on the range. Some weapons have a random number of shots. For them, you could enter the average number of attacks, for instance ‘3.5’ for a weapon with d6 shots. You can also simply write the random number of attacks that your weapon has. For instance, ‘d6’ instead of ‘3.5’.  
  Note: The program translates most random number of attacks to numbers, but not all. Only the following strings are accepted instead of numbers:  
  d3, 1d3, 2d3, d6, 1d6, 2d6, 3d6, 4d6, 5d6
* **Strength**  
  Enter the strength characteristic of your weapon (e.g. ‘4’ for a Bolter).
* **AP**Enter the Armour Piercing value of your weapon as a positive integer. (‘3’ for a Lascannon)
* **Damage**The damage characteristic of the weapon used. For random damage weapons enter the dice used.   
  Note: Only the following input is accepted:  
  1, 2, 3, 4, 5, 6, 7, 8, 9, 10,  
  d3, d3+1, d3+2, d3+3, 2d3,  
  d6, d6+1, d6+2, d6+3, d6 min 3, melta.

Special rules: *[optional]*

This category contains columns for many special rules, such as rending or sniper. Listed below is how you should format your input for each special rule.

* **Reroll to hit**  
  Enter the highest dice result for which your special rule allows you to reroll, divided by six. For instance, if the rule allows you to reroll ones, write ‘1/6’. If it allows you to reroll all to hit rolls, write ‘6/6’ or just ‘1’.
* **Plus to hit**Enter total to hit bonus. Effective bonus is capped at +/-1.
* **Exploding 6s**Write the number of additional hits on a 6 to hit.
* **Reroll to wnd**  
  This column tracks reroll to wound abilities. It functions the same as reroll to hit above.
* **Plus to wnd**Enter total to wound bonus. Effective bonus is capped at +/-1.
* **Rend AP**  
  If your unit has a different AP value on a roll of natural 6 to wound then write this AP value here.
* **Rend dmg**

If your unit has a different damage value on a roll of natural 6 to wound then write this damage value here.

* **Mortal wounds**  
  Write ‘sniper’, ‘haywire’ or ‘biovore’ to use the corresponding rule.
* **Poison**Write the lowest number that the poison attack wounds on. E.g., write ‘4’ for posion 4+ and ‘2’ for poison 2+.

Attack profile combinations *[optional / special]*

This group contains the least used input columns, which are also the easiest to get wrong. Some models have multiple weapons. If these weapons are all the same, there is no problem. Simply multiply the number of attacks for each weapon with the number of weapons. On the other hand, if they are not, then we have a problem. We can make a profile for each weapon and get the expected number of wounds separately, but what is the point efficiency of the model? An example of this problem is the Leman Russ tank with a Battle Cannon and Heavy Bolter sponsons. The regular sheet is not able to handle this problem, which is the reason for this category.

This category contains three columns: **weapon 1**, **weapon 2** and **weapon 3**. In each column, write a reference to the row belonging to each attack profile that you want to combine. Format these references in the following way: Let’s say that you are making an attack profile in some row (for instance in row 14). You want to combine the weapon profiles found in row 11, 12 and 13. You then write ‘R11C’ in the **weapon 1** column in row 14, ‘R12C’ in the **weapon 2** column and ‘R13C’ in the **weapon 3** column.

That there are only three such columns means that the sheet only supports combining three different weapons simultaneously. Sadly, some models have more than three different weapons. Luckily, it is still possible to combine four or more different weapons, but you have to do it iteratively. For a model with 4 weapons, you could combine two of them in row 21, then two more in row 22 and then finally combine row 21 and row 22 in row 23.

This category is special instead of simply optional since it should not be combined with neither Basic attack profile or Special rules information. If you write anything in this category, leave both of those other two blank.

Enemies sheet: *[optional]*

This sheet contains information on the defensive profiles on enemies that are the targets of attacks. Here are descriptions of how to input some of their stats:

* **Dmg. Red.**

Enter the amount of reduced damage this unit takes from attacks.

* **Ignore AP**Enter the highest AP value that this unit ignores on its save. The sheet assumes that the model also ignores all lower AP values.
* **Transhuman**Enter the highest to wound roll that can’t wound this unit if it has an ability that resembles Transhuman Physiology.
* **All is dust**Enter ‘1’ if the unit gains a +1 bonus to armour saves vs damage 1 attacks.
* **Vehicle**Enter ‘1’ if the unit is a vehicle and ‘0’ otherwise.

**Known errors:**

* Overkill resulting from the interaction between multi wound models and multi damage attacks is only approximately correct.
* Overkill on multi wound models with FNP from multi damage weapons is only approximately correct.