A Simplified Way To Predict The Cybenetics Efficiency Ratings

Revision 2.0

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Revision History

Version	Release Date	Notes
1.0	September 2022	First draft
1.1	September 2022	Additions and various grammatical error corrections
1.2	June 2024	Grammatical error corrections
1.3	August 2026	230 V ETA requirements added, together with a note that the prediction offsets in this document were derived at 115 V input and have not been re-derived for 230 V. A cross-reference to the Cybenetics PSU Test Protocol (METHOD 1) Revision 3.9 was added to the test-setup section.
2.0	August 2026	Rebuilt on the full Cybenetics database - 2,011 units at 115 V and 1,628 at 230 V, against the 55 units used in 2024. The 0.5-point margin at 115 V is confirmed as the best available; a separate 0.6-point margin is introduced for 230 V. Adds the margin trade-off table, the per-level test (tried, and rejected as no better than a flat margin), and the accuracy ceiling set by the power-factor, 5VSB and vampire-power downgrade rule. The chapters duplicating METHOD 1 have been removed in favour of a cross-reference.

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Prologue

This article aims to provide an easier way for manufacturers, brands, and other interested parties with the necessary equipment to accurately predict the Cybenetics efficiency ratings.

Typically, Cybenetics applies more than 1450 load combinations, covering the entire load range of a power supply, to calculate the efficiency (ETA) and noise (LAMBDA) ratings, but this is not easy to do for the majority of external labs. Cybenetics uses in-house software to achieve that, making the whole procedure fully automatic and easy to handle. Still, the process takes several hours to finish. In the case of manual measurements, this would take days, so it is imperative to find a way to predict the Cybenetics efficiency rating, for starters, through much fewer measurements.

Before we proceed to the description of the methodology you could follow, we should emphasize that the used equipment should be certified and calibrated, if required, to ensure accurate results. Otherwise, you won't be able to exploit the methodology we describe. We will provide information in the following paragraphs about our equipment to let you know what is required. Generally, every lab following the ISO/IEC 17025 [3] guidelines in the corresponding field can get accurate results following the suggested methodology.

What This Document Assumes

Everything in this document rests on the Cybenetics PSU Test Protocol (METHOD 1), Revision 3.9. That protocol is the controlled method: it defines the equipment, the software, the ambient conditions, the load combinations and the noise procedure, and it governs wherever the two documents could be read differently.

Earlier revisions of this article reproduced those chapters here almost word for word. That was a liability rather than a convenience - a copy of a controlled method goes stale the moment the original is revised, and this one did. They have been removed. What follows is only what is specific to predicting a rating: the requirements, the dataset, and the analysis.

One figure from METHOD 1 is worth restating because every number below depends on it. A Cybenetics efficiency result is the average of more than 1450 different load combinations spread across the whole operating range, measured at 30 to 32 degrees Celsius inside a hot box. It is not three or four load points. That is the quantity this document teaches you to estimate from a much smaller set of measurements.

Cybenetics Efficiency (ETA) Grades & Requirements – 115V

Before diving into the alternative and easier way to predict the ETA ratings, let's first look at the efficiency levels and the corresponding requirements.

EFFICIENCY LEVELS (115V INPUT)	EFFICIENCY (1) (2)	PF (3)	5VSB EFFICIENCY (1) (3) (4)	VAMPIRE POWER (3)
DIAMOND	⩾93% overall efficiency	⩾0.985	>79%	<0.10W
TITANIUM	⩾91% & <93% overall efficiency	⩾0.980	>77%	<0.13W
PLATINUM	⩾89% & <91% overall efficiency	⩾0.975	>76%	<0.16W
GOLD	⩾87% & <89% overall efficiency	⩾0.970	>75%	<0.19W
SILVER	⩾85% & <87% overall efficiency	⩾0.960	>73%	<0.22W
BRONZE	⩾82% & <85% overall efficiency	⩾0.950	>71%	<0.25W

Table 1: Cybenetics ETA Requirements

5VSB Load	EFFICIENCY TARGET (115V & 230V)
3A or Full Load	75%
1.5A	75%
1.0A	75%
0.55A	75%
90mA	45%
45mA	45%

Table 2: Cybenetics ETA 5VSB Efficiency Requirements

(1) If the PSU is close enough to the limits (0.1%), we will ask its manufacturer if it is willing to send a second sample for re-evaluation. If the second sample registers a significant performance difference compared to the first one (>0.5%), we will ask for a third one to verify the test results. Moreover, if the difference with the upper limit is <= 0.05% (e.g., 91.95%), we will round the number to the second digit, and the PSU will be taxed to the higher category.

(2) We conduct several load tests with 230V input to make sure that the under-evaluation PSUs meet all requirements mentioned in the (EU) No 617/2013 regulation:

- 85% efficiency at 50% of rated output power
- 82% efficiency at 20% and 100% of rated output power
- power factor >= 0.9 at 100% of rated output power

(3) If the PSU fails in any of those requirements, it will lose one class and drop to the lower one (especially for the PF, it will drop to the class that meets the corresponding requirements),

despite its efficiency. In any case, vampire power must be lower than 0.25 W, even with 230 V input.

(4) The 5VSB rail should also achieve the required efficiency levels listed in Table (2) to meet various requirements, including the CEC and ErP Lot 6/3 ones. Those requirements are also listed and recommended by the Power Supply Design Guide for Desktop Platform Form Factors, v3.0 (February 2022) [2]. In the 45mA load test, we allow for a 5% deviation (40-45% range) due to the very low applied load, and the 0.55 A to 1.5 A load tests, where we also allow for the same 5% deviation (70-75% range).

One caution about the rest of this document. The prediction offsets derived in the sections that follow, the +0.5 % on average efficiency and the +0.002 on average power factor, come from an analysis of 55 power supplies measured at 115 V input. They have not been re-derived for 230 V. Until that analysis is carried out, treat the 230 V figures in the table above as the requirement to be met directly, and apply the prediction offsets only to 115 V results.

Cybenetics Efficiency (ETA) Grades & Requirements – 230V

The requirements listed above apply to 115 V input. ETA also certifies at 230 V input, where the thresholds are different, and the table below is the one that applies in Europe and everywhere else the mains supply is 230 V. A power supply is graded against the table that matches the input voltage it was certified at.

EFFICIENCY LEVELS (230V INPUT)	EFFICIENCY (1) (2)	PF (3)	5VSB EFFICIENCY (1) (3) (4)	VAMPIRE POWER (3)
DIAMOND	⩾95% overall efficiency	⩾0.950	>78%	<0.12W
TITANIUM	⩾93% & <95% overall efficiency	⩾0.940	>76%	<0.15W
PLATINUM	⩾91% & <93% overall efficiency	⩾0.935	>75%	<0.18W
GOLD	⩾89% & <91% overall efficiency	⩾0.930	>74%	<0.20W
SILVER	⩾87% & <89% overall efficiency	⩾0.920	>72%	<0.23W
BRONZE	⩾84% & <87% overall efficiency	⩾0.910	>70%	<0.25W

Table 8: Cybenetics ETA Requirements – 230V Input

Our Approach To Simplifying ETA Predictions

Alongside the 1450-plus load combinations that produce a Cybenetics efficiency result, we run a much shorter series: 10 % to 100 % of rated load in 10 % steps, at operating temperatures from 35 °C up to 45-47 °C. Those ten points are the kind of measurement any competent laboratory can take in an afternoon. The question this article answers is how closely they let you predict the full result, and therefore the ETA badge.

Revision 1.2 of this article answered that question from a sample of 55 power supplies. This revision answers it from the whole database: 2,011 units at 115 V input and 1,628 units at 230 V input, every one of them a completed Cybenetics evaluation. That is roughly a thirty-fold increase, and it is enough to replace an average with a distribution. Four records carrying physically impossible values were excluded as data-entry errors rather than measurements. The quantities we compare are:

- Average Efficiency - 10-100% Load with a 10% step
- Average PF - 10-100% Load with 10% step
- AVG 5VSB Efficiency
- Vampire Power Consumption

Average Efficiency

Across 2,011 units at 115 V the mean of the 1450-combination result is 88.894 % and the mean of the 10 % to 100 % result is 89.237 %, a difference of 0.343 points. The 55-unit sample gave 0.448, which was published as 0.5. At 230 V, across 1,628 units, the difference is 0.457 points. The two mains voltages are not the same, and the earlier article covered only the first of them.

The difference of two averages, however, is not what a manufacturer needs. What matters is the difference for one power supply - yours. Per unit, the offset at 115 V has a median of 0.377 points and a standard deviation of 0.365, and for 289 of the 2,011 units, one in seven, it is negative: their 10 % to 100 % average came out lower than their full result, so adding a margin moves the estimate the wrong way. At 230 V that happens to 5.9 % of units. No single number can be right for every unit, and this article no longer pretends otherwise.

EFFICIENCY LEVELS (115V INPUT)	Min AVG Efficiency (1450x load combinations)	Min AVG EFFICIENCY (10-100% load combinations with 10% step)
DIAMOND	93%	93.5%
TITANIUM	91%	91.5%
PLATINUM	89%	89.5%
GOLD	87%	87.5%
SILVER	85%	85.5%
BRONZE	82%	82.5%

Table 3: Average Efficiency Requirements

At 230 V input the offset is larger, so the margin is larger. The table below is the 230 V equivalent of the one above, built with a 0.6-point margin for the reason set out in the next section.

EFFICIENCY LEVELS (230V INPUT)	Min AVG Efficiency (1450+ load combinations)	Min AVG EFFICIENCY (10-100 % load, 10 % step)
DIAMOND	95%	95.6%
TITANIUM	93%	93.6%
PLATINUM	91%	91.6%
GOLD	89%	89.6%
SILVER	87%	87.6%
BRONZE	84%	84.6%

Table 9: Average Efficiency Requirements - 230V Input

Choosing Your Margin

A margin is not a fact to be discovered; it is a choice about which mistake you would rather make. Set it too small and you will announce a level the full test does not award - an over-claim, and the expensive kind of error. Set it too large and you will under-sell a power supply that would have earned the higher badge. With 2,011 units we can put numbers on both sides of that trade for the first time.

Each row below applies one margin to every unit in the database, predicts the badge, and compares it with the badge Cybenetics actually awarded.

Margin (points)	115 V: correct / over / under	230 V: correct / over / under
0.0 (no margin)	77.4 % / 21.8 % / 0.8 %	71.5 % / 28.1 % / 0.4 %
0.3	85.2 % / 10.4 % / 4.4 %	82.2 % / 15.7 % / 2.1 %
0.4	85.2 % / 8.3 % / 6.6 %	84.1 % / 12.6 % / 3.3 %
0.5	85.3 % / 5.9 % / 8.8 %	83.1 % / 11.4 % / 5.5 %
0.6	83.7 % / 4.5 % / 11.8 %	81.7 % / 9.5 % / 8.7 %
0.8	78.5 % / 3.3 % / 18.2 %	77.4 % / 7.7 % / 14.9 %
1.0	70.6 % / 2.9 % / 26.6 %	69.0 % / 6.5 % / 24.5 %

Table 10: What each margin costs. 'Over' means the prediction claimed a higher level than was awarded; 'under' means it claimed a lower one.

At 115 V, 0.5 points is simply the best choice available: it predicts more badges correctly than any other margin we tested, and it does so while over-claiming only 5.9 % of the time. The value published in 2024 from 55 units survives a thirty-fold increase in evidence unchanged, which is worth saying plainly.

At 230 V the picture is different. Raw accuracy peaks at 0.4 points, but that margin over-claims for one unit in eight. Because over-claiming is the costlier mistake we recommend 0.6 points, which brings over-claims down to 9.5 % for a little over two points of accuracy. If your priority is a central estimate rather than a safe one, use 0.4 and read the table.

Does The Margin Depend On The Level?

It looked as though it should. Sorted by the level actually awarded, the mean offset climbs steadily from Bronze to Titanium, and a rule that used a different margin for each level seemed the obvious improvement.

EFFICIENCY LEVEL	Mean offset, 115 V	Mean offset, 230 V
TITANIUM	0.433	0.514
PLATINUM	0.382	0.492
GOLD	0.350	0.473
SILVER	0.281	0.327

BRONZE	0.167	0.356

Table 11: Mean offset by awarded level, in efficiency points.

We tested it and it does not work. Fitting a separate margin for each level on a random half of the database and testing it on the other half, repeated two hundred times, a per-level rule scored 85.3 % against 85.3 % for a single flat margin at 115 V, and 83.7 % against 83.6 % at 230 V. The differences are 0.06 and 0.10 percentage points: noise.

The reason is visible in the numbers above. The spread of the offset within any one level is far larger than the difference between levels - a standard deviation of about 0.37 points against a Bronze-to-Titanium range of about 0.27. A more complicated rule that does not predict better is not an improvement, so we have not adopted one. We report the test because a reader deserves to know which refinements were tried and rejected.

Besides the efficiency levels described in the table above, every power supply has to meet the following requirements, with 230V input, to receive a Cybenetics efficiency badge.

- 85% efficiency at 50% of rated output power
- 82% efficiency at 20% and 100% of rated output power
- Power factor >= 0.9 at 100% of rated output power

These requirements are not tough for most modern platforms. Still, we include them because they are mentioned in the (EU) No 617/2013 regulation.

Average PF

The power-factor guidance has not been re-derived. The database stores one average power factor per unit per voltage, not the pair of figures - the 1450-combination mean and the 10 % to 100 % mean - that the comparison needs. The 2024 finding therefore stands unchanged and unconfirmed: from 55 units, mean PF 0.9871 across the load combinations against 0.9886 across the 10 % to 100 % tests, a difference of 0.0015, for which a 0.002 margin was recommended. Treat it as the weakest number in this document. For context, the mean of the stored average power factor is 0.9849 at 115 V (n = 1,947) and 0.9506 at 230 V (n = 1,628).

EFFICIENCY LEVELS (115V INPUT)	Min AVG PF (1450x load combinations)	Min AVG PF (10-100% load combinations with 10% step)
DIAMOND	0.985	0.987
TITANIUM	0.980	0.982
PLATINUM	0.975	0.977
GOLD	0.970	0.972
SILVER	0.960	0.962
BRONZE	0.950	0.952

Table 4: Average PF Requirements

5VSB Efficiency

The following table shows the load levels that you need to check at 5VSB.

Test #	5VSB Load (Amperes)
1	0.1
2	0.25
3	0.55
4	1.0
5	1.5
6	Full Load

Table 5: 5VSB Test Loads

Across 1,946 units at 115 V the average 5VSB efficiency is 79.98 %, with a median of 79.82 % and a 10th-to-90th percentile span of 77.30 % to 83.35 %. At 230 V, across 1,625 units, the mean is 79.14 %. The load points below remain the ones to check, and the targets in Table 6 are unchanged; what has changed is that you can now see where a typical unit actually sits.

EFFICIENCY LEVELS (115V INPUT)	Min AVG Efficiency (1450x load combinations)	Min AVG Efficiency (6x load combinations)
DIAMOND	78%	78%
TITANIUM	76%	76%
PLATINUM	75%	75%
GOLD	74%	74%
SILVER	72%	72%
BRONZE	70%	70%

Table 6: Average 5VSB Efficiency Requirements

Besides the efficiency levels described above, a PSU should meet the efficiency thresholds shown in table (7). If it doesn't, it cannot meet the requirements of any Cybenetics ETA level.

5VSB Load	Min Efficiency Target (115V & 230V)
3A or Full Load	75%
1.5A	70%
1A	70%
0.55A	70%
90mA	45%
45mA	40%

Table 7: 5VSB Minimum Efficiency Requirements

Vampire Power

For the standby power measurements, we strictly follow the internationally recognized IEC 62301 standard [3]. For measurements with a current as low as 1mA, external current shunts can be helpful, but their use isn't necessary for IEC 62301 testing. External shunts make the measurement procedure more complex and lead to measurement errors. Advanced power analyzers can test IEC 62301 by relying only on their internal current shunts. Generally, lab-grade power analyzers with a large enough dynamic range don't need external current shunts to measure standby (or vampire) power.

According to the IEC 62301 standard, the standby power measurements should be made with the Total Harmonic Content of the AC source (up to and including the 13th harmonic) must be less than 2%. In addition, the Voltage Crest Factor should be between 1.34 and 1.49. You can find more info about the standby power measurement procedure according to the IEC 62301 standard by reading this application note, which Newtons4th provides.

Vampire-power limits by level are given in Table 1 and Table 8. A power supply drawing 0.25 W or more with either 115 V or 230 V input does not receive a Cybenetics ETA badge. In practice this is rarely the binding constraint: across 2,011 units at 115 V the median is 0.052 W and only 11 units (0.5 %) reach 0.25 W. At 230 V the median is 0.113 W and 48 units (2.9 %) reach the limit, so the 230 V case deserves more attention than the 115 V one.

Why This Can Never Be Exact

Even a perfect estimate of average efficiency would not predict every badge, because efficiency is not the only requirement. A power supply that misses the power-factor, 5VSB or vampire-power threshold for its level drops to the level below, however efficient it is.

The database shows how often that happens. Of 1,887 rated units at 115 V, 87 - some 4.6 % - carry a different badge from the one their average efficiency alone would give. At 230 V it is 141 of 1,498, or 9.4 %. The commonest cases are a Platinum-level efficiency awarded Gold, and a Gold-level efficiency awarded Silver.

That sets a ceiling. No rule based on efficiency alone can be right much more than 95 % of the time at 115 V, or 91 % at 230 V, and the 85.3 % this article achieves should be read against that ceiling rather than against 100 %. If your estimate says Gold and the report says Silver, check the power factor and the standby rail before you question the efficiency.

Epilogue

The purpose of this article is to let a manufacturer estimate a Cybenetics ETA rating from ten load points instead of fifteen hundred. Revision 2.0 rebuilds that estimate on the full database rather than a 55-unit sample, and the headline is a pleasant one: the margin published in 2024 was right. At 115 V, adding 0.5 points still predicts more badges correctly than any other value we tested. What the larger sample adds is honesty about the spread, a separate figure for 230 V, and a clear statement of how often this can be expected to be wrong.

- At 115 V input, aim for 0.5 points higher average efficiency in the 10 % to 100 % load tests, at 35 °C to 47 °C, than the level you are targeting. At 230 V input, aim for 0.6 points.
- Aim for 0.002 higher average PF in the 10 % to 100 % load tests at 35 °C to 47 °C. This figure still rests on the 55-unit sample and has not been re-derived.
- Aim for at least the same 5VSB average efficiency with 0.1A, 0.25A, 0.55A, 1A, 1.5A, and full load at 28-32°C operating temperatures.
- Meet the standby power consumption (vampire power) of each level at 28-32°C operating temperatures. In any case, vampire power should be below 0.25W with either 115V or 230V input.

References

[1] IEC 62301 International Standard: https://webstore.iec.ch/preview/info_iec62301%7Bed2.0%7Db.pdf. Accessed on 22 September 2022.

[2] Intel Introduces New ATX PSU Specifications: https://www.intel.com/content/www/us/en/newsroom/news/intel-introduces-new-atx-psu-specifications.html#gs.d5qj04. Accessed on 22 September 2022.

[3] ISO/IEC 17025:2017, General requirements for the competence of testing and calibration laboratories, November 2017.