

Appendix E-M to DE-UZ 219

Energy - measurement requirement, determining recovery times and specifications for the classification of idle modes

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1 Determining the power consumption of the device – General requirements

Sections 4, 5 and 6 of the “*Test Method for Determining Imaging Equipment Energy Use*” in *Energy Star 3.0*¹ must be applied for the test setup and the configuration of the test unit for determining the power consumption. For certification with the Blue Angel, all devices must be measured in accordance with the TEC evaluation method. In the case of devices subject to requirement 3.4.4.2 (Auto-off function), it is important to ensure that this function is disabled for the measurement of the power consumption (see Energy Star 3.0 test method 6.1). The requirements for the test setup for the European market (Switzerland) in Tables 2 and 3 of the test method according to Energy Star 3.0 are valid for all devices. The same is also true for the paper specifications (Table 4 – Switzerland A4).

2 Acronyms used

| | Description |
|--------------|--|
| | <u>General</u> |
| i | Index |
| P | Power consumption |
| t | Time |
| A | - Beginning (of a time period) |
| B | - Point in time at which the recovery time is to be determined in the respective operating mode |
| D | - Duration (of a time period) |
| R | - <u>R</u> ecovery time |
| | <u>The device</u> |
| Z | Operating mode according to the Blue Angel classification |
| a, b, c, ... | Index to denote the idle modes according to the Blue Angel classification (counted from the end of the printing process) |
| — | There are no symbols for the idle modes of the device as classified by the particular manufacturer. Instead, the idle modes are classified as different Z_i modes here (i.e. in this Appendix). |
| | <u>Other</u> |
| 1, 2, 3 | Indexes used a) to indicate the times t_{2B} and t_{3B} which are used to identify those operating modes for which the values for the recovery times are to be determined and b) to indicate the maximum values for the recovery times t_{2R} and t_{3R} . |

¹ <https://www.energystar.gov/sites/de-fault/files/FINAL%20Version%203.0%20ENERGY%20STAR%20Imaging%20Equipment%20Program%20Requirements.pdf>

| | Description |
|----------|---|
| | Examples: |
| t_b | Point in time assigned to the idle mode which is the second idle mode after print mode according to the Blue Angel classification |
| t_{bA} | Delay time of the device for the idle mode Z_b |
| t_{cD} | Duration of the idle mode Z_c |
| t_{dR} | Recovery time of the device in the idle mode Z_d |
| t_{2B} | Time defined in the Basic Award Criteria to identify the operating mode for which the actual value of the recovery time is to be determined |
| t_{2R} | Maximum value as defined in the Basic Award Criteria for the recovery time in the operating mode determined using t_{2B} |

3 Determining the typical energy consumption

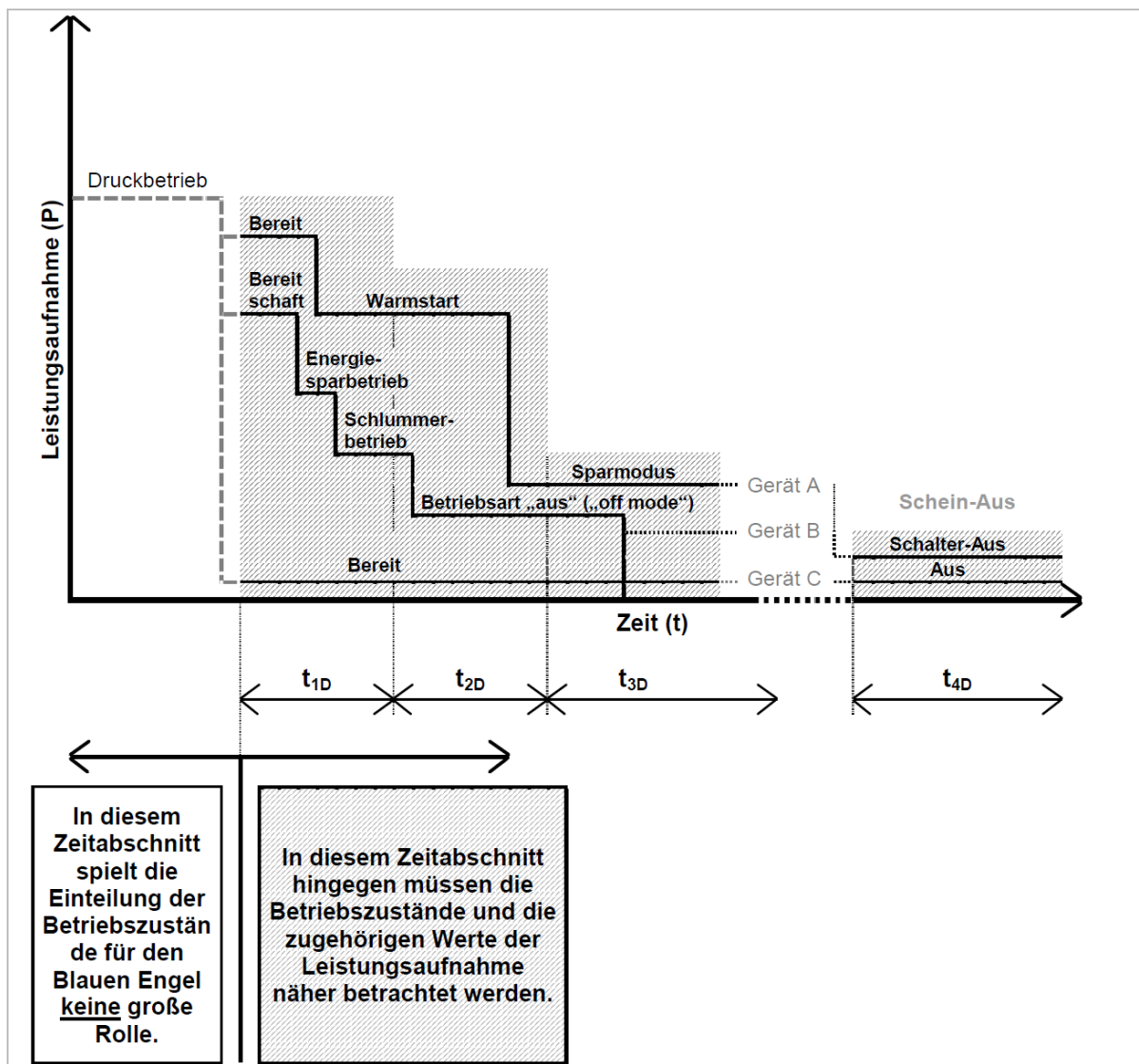
The typical energy consumption (TEC_M) is determined in accordance with Section 7 of the test method for Energy Star 3.0. The page throughput S_M (according to Paragraph 1.5.4 of the Basic Award Criteria) must be used as the product speed for determining the typical energy consumption.

4 Determining the idle modes Z_i and determining the power consumption

4.1 1st step: Determining the idle modes Z_i which are to be considered more closely

According to the classification and designations provided by the manufacturer, the considered device will have different idle modes. It is necessary to determine the idle modes within this group that must be listed in Appendix E-I. This includes all idle modes that the device switches to after the end of the printing process (see the shaded area in Figure 1).

Figure 1: Determining the idle modes that are to be tested



Example: This means for device A in Figure 1: The idle modes “ready”, “warm start”, “saving mode” and “switch-off” must be considered.

4.2 2nd step: Checking the classification of the idle modes Z_i

The manufacturer will divide and designate the idle modes based on its own classification system. The classification of the idle modes for the purpose of the Blue Angel – user information in Appendix E-I – may be different. The applicant must not combine any number of time periods into one single operating mode, especially not those time periods that differ considerably in their power consumption.

- In order to clearly designate the modes for the purposes of the Blue Angel, the idle modes must be classified in such a way that only one power consumption level can be assigned to each idle mode.

- If the power consumption in one idle mode (as classified by the applicant) has various different levels, this idle mode must be subdivided accordingly (i.e. into as many subgroups as there are power consumption levels).
- This process must be applied to all idle modes, as set out in Appendix E-I.

In extreme cases, however, subdividing the idle modes according to the power consumption levels can mean that a single idle mode is subdivided into a huge number of subgroups. A confusing number of modes would then have to be listed in the user information (Annex 12). This should be avoided. Therefore, it is possible to combine single power consumption time periods if they are kept within certain limits. This process is described below.

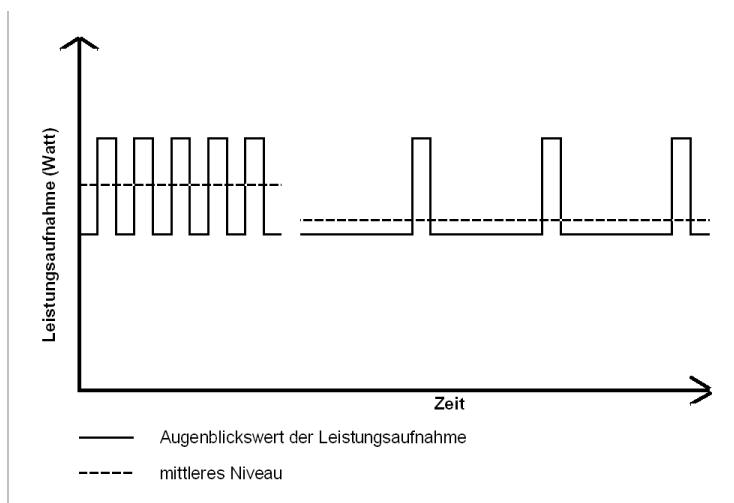
The power consumption levels for many devices fluctuate due to switch on and switch off processes, for example, when switching a fuser unit on and off (e.g. see the curves in Figure 2).

Figure 2



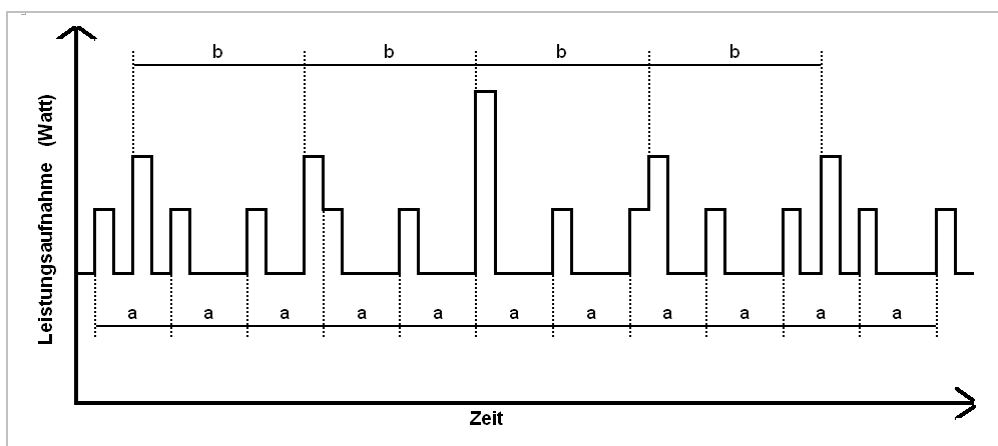
Such fluctuations occur frequently. Provided that the power consumption fluctuates with steady frequency, i.e. periodically, the power consumption at the point in time in which this occurs can be averaged (e.g. see Figure 3). This average value replaces the fluctuating progression of the power consumption in the further consideration of the power consumption. For this approach, it is not relevant whether the power consumption remains at the different levels between which it fluctuates for equally long time periods (e.g. see left curve in Figure 3) or not (e.g. see right curve in Figure 3). The important thing is that the frequency shows steady progression.

Example: **Figure 3**



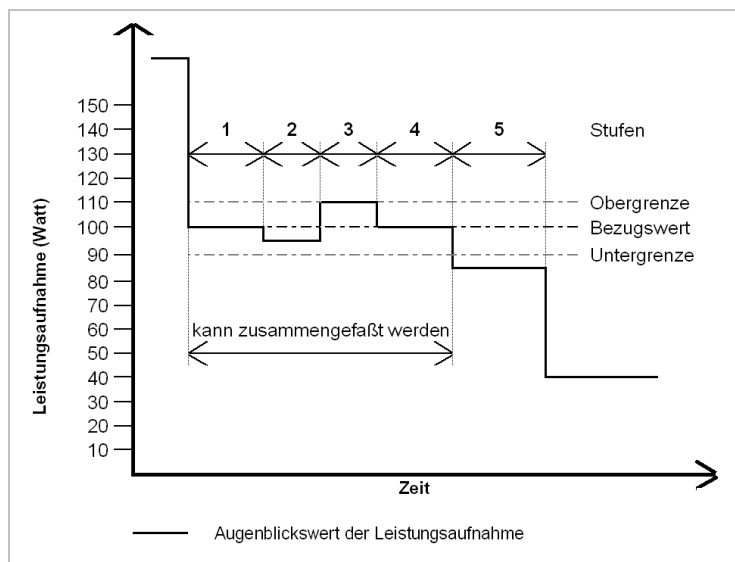
Steady frequency can also result from the overlapping of several, regular fluctuations (e.g. see the fluctuations of the period lengths a and b in Figure 4).

Example: **Figure 4**



Successive power consumption levels can be combined into one time period as follows; level 1 is the reference value in this case (see Figure 5): If level 2 differs by ≤ 10 percent (maximum 10 watts) from level 1, both levels can be combined into one time period. If level 3 also differs by ≤ 10 percent (maximum 10 watts) from level 1, this level 3 can also be added to the time period. This applies to further levels as well. However, if a level exceeds the limit of 10 percent (maximum 10 watts), it is considered to be a new time period. When calculating the average value for the power consumption, the single values must be weighted according to their duration.

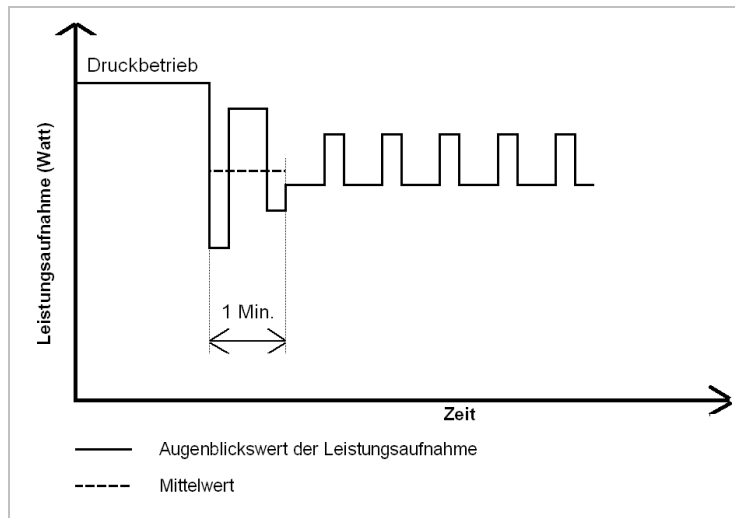
Example: **Figure 5**



If the power consumption fluctuates irregularly, the single levels can also be combined as follows – with the differences in the power consumption levels having no relevance (see Figure 6):

- For the first 5 minutes after the end of the printing job, levels with a total duration of ≤ 1 minute can be combined into one time period and
- in the following time period, levels with a total duration of ≤ 5 minute can be combined into one time period.

Example: **Figure 6**



Example for dealing with regular fluctuations: In *Figure 7*, it is assumed that device A from *Figure 1* displays a power consumption curve in “saving mode” (example term for a state in idle mode) that fluctuates between two values; quickly in the first time period and then slower in the second time period.

According to the procedure described above, the power consumption can be averaged for each of these two time periods (see *Figure 8*).

Assuming an average value for the power consumption of 90 watts in the first time period in *Figure 8* and 75 watts in the second time period, the second value differs from the first value by ~17 percent. This exceeds the limit stated above of 10 percent (*maximum 10 watts*) for combining the levels. As a result, this idle mode must be subdivided further into two subgroups: “saving mode A” and “saving mode B” in this example.

Figure 7

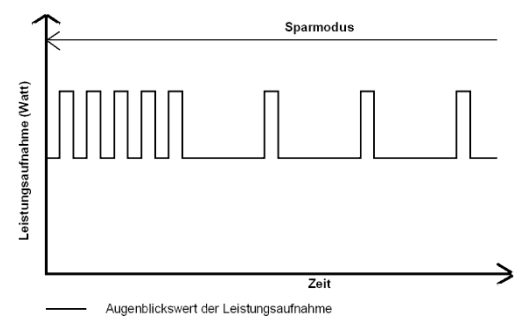


Figure 8

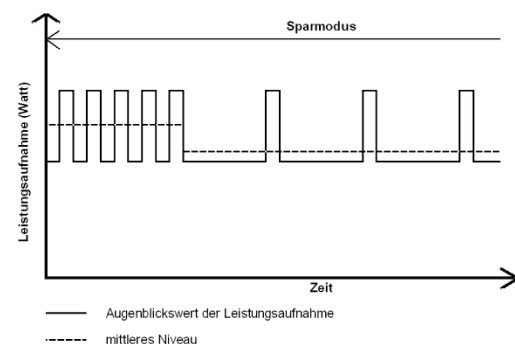
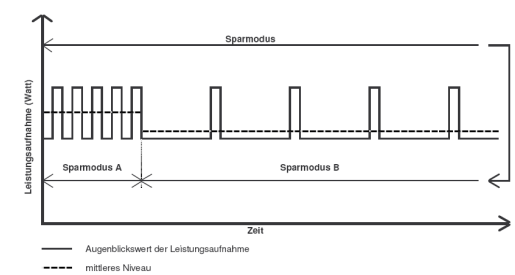
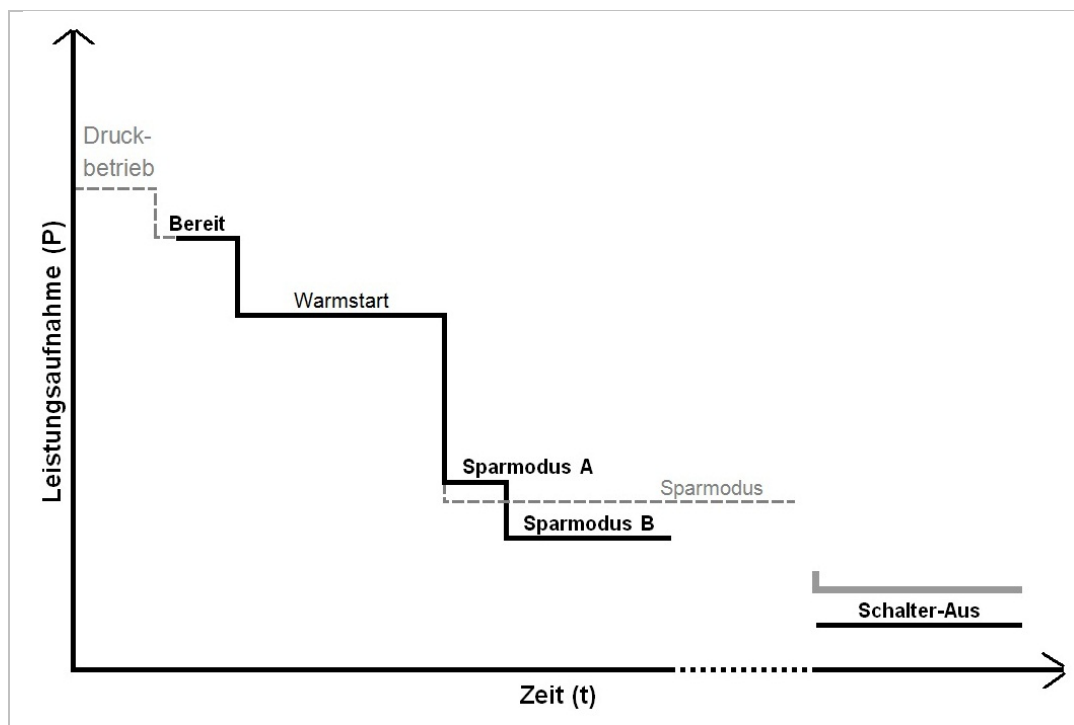


Figure 9



This results in the following classification of these idle modes – at least for the purposes of the Blue Angel:

Figure 10:



4.3 3rd step: Determining the power consumption values and delay times for the idle modes Z_i

The power consumption values and delay times must be determined for the idle modes classified according to Section 4.2. The power consumption values from the test method for determining the TEC can be used here.

The measurement process is based on the test method shown in Table 8 of ENERGY STAR 3.0. As a deviation from the method used in ENERGY STAR 3.0, the power consumption value and delay time must be determined for all relevant idle modes.

The power consumption in ready mode as well as in the electric power saving modes and sleep mode can be measured, by way of derogation from ENERGY STAR 3.0, in the delivery status for up to 15 minutes. This measurement time must be stated in the test report.

5 Determining the recovery times

Paragraph 3.4.4 of the Basic Award Criteria stipulates the idle modes Z_i in which it is necessary to determine the recovery times t_{iR} . As described, the recovery time is defined as the time it takes the device to return to ready mode from an electric power saving mode Z_i (here: Z_b , Z_c , ...). The recovery time is determined as the difference between

- a) the time ($t_{\text{print},a}$) required by the device to complete a specific print job from ready mode Z_a and
- b) the time ($t_{\text{print},i}$) required by the device to complete the same print job from the considered electric power saving mode Z_i (here Z_b , Z_c , ...).

This means that: $t_{iR} = t_{\text{print},i} - t_{\text{print},a}$

Requirements for determining the recovery time t_{iR} :

1. Beginning and end of the times $t_{\text{print},a}$ and $t_{\text{print},i}$:

These times begin when the print job is initiated – for a printer when the print job is sent from a computer. The manufacturer can define the end of the printing process and, thus, the end of the print times $t_{\text{print},a}$ and $t_{\text{print},i}$. For instance, this could be the point in time when the paper reaches the output tray or when it leaves the device. In contrast to the procedure for determining the delay time, the manufacturer does not have to follow the definitions in the Basic Award Criteria. The manufacturer is also free to choose the number of printouts to be created during the measurement. The important thing is that the same number of printouts, the same settings (resolution, colour and similar) and the same end of printing time are used for both measurements.

2. Measurement of the time $t_{\text{print},a}$ (ready mode Z_a):

The print job must be initiated 2 minutes after the end of the last printing process.

If the device switches from one idle mode to another at precisely this point in time, the print job must be initiated a few seconds before this switching process occurs.

3. Measurement of the time $t_{\text{print},i}$ (electric power saving mode Z_i [here Z_b , Z_c , ...]):

Requirements:

The delay time t_{iA} for an electric power saving mode Z_i (here: Z_b , Z_c , ...) for which the recovery time must be determined should be the same as when the device was delivered (delivery status). The delay time t_{i+1A} for the electric power saving mode Z_{i+1} which follows Z_i must be set to a value ≥ 50 minutes. This means that t_{i+1A} must be changed for the length of the measurement where necessary. For the measurement, the aim is for mode Z_i to be maintained for at least 50 minutes after the end of the last printing process. The time $t_{\text{print},i}$ must be measured from step 5 or 6 – provided that the device is in mode Z_i at that time.

The print job must be initiated 50 minutes after the end of the last printing process.

Exception A: If you are testing a device that

1. operates with ink line printing technology and
2. only passes through states that always last the same period of time when returning to ready mode Z_a from electric power saving mode Z_i (here Z_b, Z_c, \dots) – irrespective of when a print job is initiated –,

the recovery time is not dependent on the time that has elapsed since the end of the last printing process. Therefore, the “delay time” of 50 minutes does not apply in this case. Instead, the print job for the measurement must be initiated 10 minutes after the delay time t_{iA} for the considered electric power saving mode Z_i has expired.

Exception B: If you are testing a device that

1. has a fixed value of ≤ 50 minutes for the delay time t_{i+1A} for electric power saving mode Z_{i+1} that cannot be extended by the user and
2. the user cannot deactivate electric power saving mode Z_{i+1} ²,

the electric power saving mode Z_i cannot last for longer than 50 minutes after the end of the last printing job in practice. Therefore, the “delay time” of 50 minutes does not apply in this case. Instead, the print job for the measurement must be initiated $[t_{i+1A} - 1]$ minutes after the end of the last printing process ³.

4. Further requirements

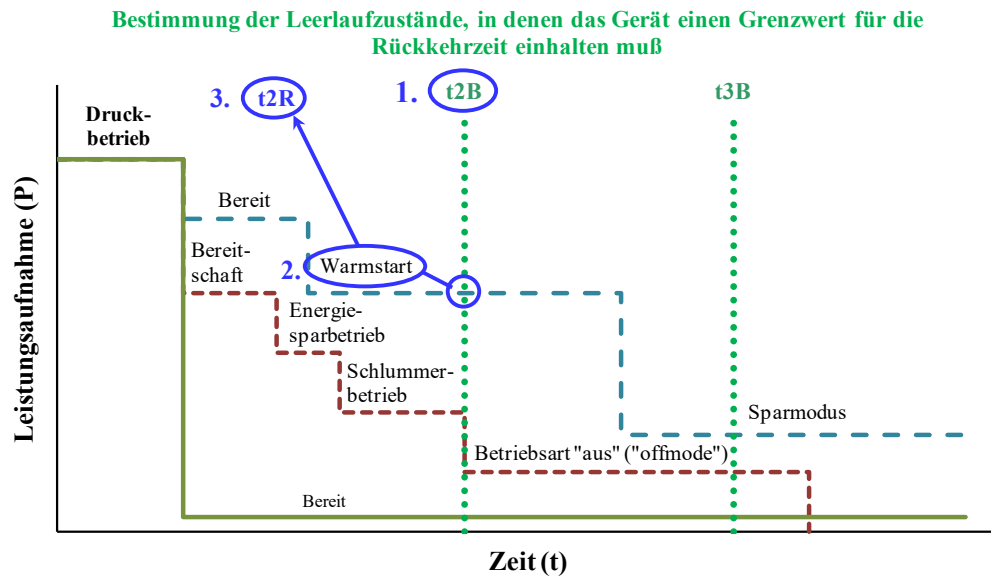
The tests must be conducted using monochrome printing in the primary function printing and in simplex mode.

² Deactivating this mode will result in a “delay time” t_A = unlimited.

³ meaning 1 minute before the delay time t_{i+1A} for electric power saving mode Z_{i+1} .

6 Interpretation aid: Determining the operating modes in which the maximum values for the recovery times must be observed

This section describes how the values for times t_{2B} and t_{3B} are used to determine the operating modes Z_i for which the actual values for the recovery times t_{iR} must be determined, which in turn are not permitted to exceed the maximum values t_{2R} and t_{3R} .



Beispiele für einen möglichen Verlauf der Leistungsaufnahme eines Gerätes im Auslieferungszustand und für die Bezeichnung einzelner Betriebszustände (Beispiele A...C):

— Gerät A - - - Gerät B — Gerät C

- 1st step: Use Table 15 of the Basic Award Criteria to select the appropriate value for t_{iB} (t_{2B} in the diagram).
- 2nd step: Check where t_{2B} meets the curve progression of the device's power consumption to determine the respective operating mode (for device A: warm start).
- 3rd step: Determine the recovery time (here: t_{2R}) for this operating mode.

The following steps use t_{2B} and t_{2R} as an example.

Proceed in the same way for t_{3B} and t_{3R} .

The first step is to select t_{2B} .

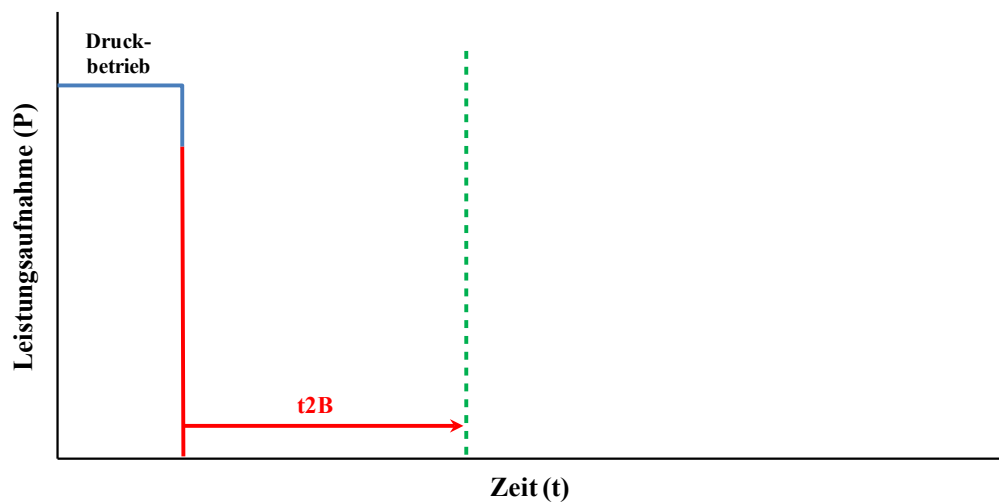
1st step

Use Table 15 of the Basic Award Criteria to select the appropriate value for t_{2B} for the device being tested.

Tafel 3-3 Zeiten zur Bestimmung der Betriebszustände in Minuten, in denen die Rückkehrzeiten t_{2R} und t_{3R} einzuhalten sind

| alle Geräte mit einem Seitendurchsatz S_M von | t_{2B} | t_{3B} |
|---|----------|----------|
| > 0 ... 5 Seiten/Minute | 5 | 10 |
| > 5 ... 10 Seiten/Minute | 10 | 15 |
| > 10 ... 20 Seiten/Minute | 10 | 20 |
| > 20 ... 30 Seiten/Minute | 10 | 30 |
| > 30 ... 40 Seiten/Minute | 10 | 45 |
| > 40 Seiten/Minute | 15 | 60 |

Bestimmung der Leerlaufzustände, in denen das Gerät einen Grenzwert für die Rückkehrzeit einhalten muß

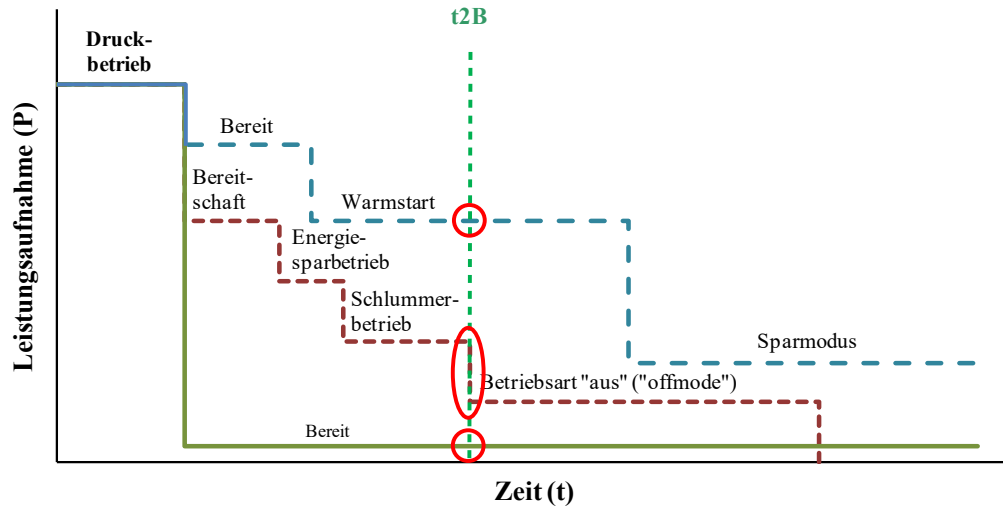


Beispiele für einen möglichen Verlauf der Leistungsaufnahme eines Gerätes im Auslieferungszustand und für die Bezeichnung einzelner Betriebszustände (Beispiele A...C):

2nd step

Check where t_{2B} meets the curve progression of the device's power consumption to determine the respective operating mode. In this case, the device must meet the maximum value for the recovery time (t_{2R}).

Bestimmung der Leerlaufzustände, in denen das Gerät einen Grenzwert für die Rückkehrzeit einhalten muß



Beispiele für einen möglichen Verlauf der Leistungsaufnahme eines Gerätes im Auslieferungszustand und für die Bezeichnung einzelner Betriebszustände (Beispiele A...C):

— Gerat A - - - Gerat B — Gerat C

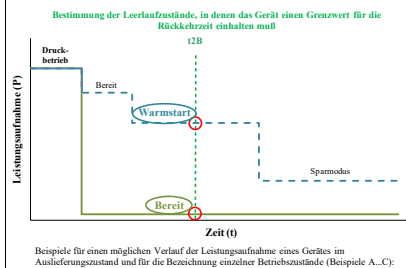
Is the device in (only) one operating mode at the point in time t_{2B} ?

Yes

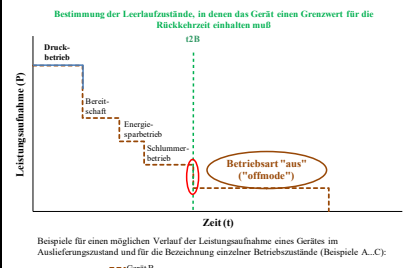
No, it is switching between modes at that point in time

→ Select the operating mode into which the device is switching.

Examples:

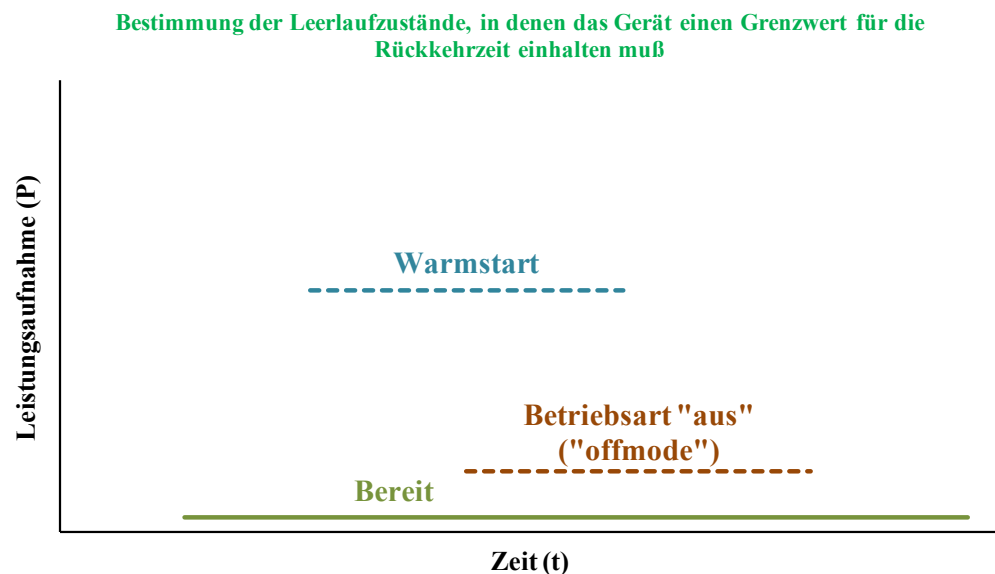


Example:



→ This is the operating mode Z_i in which the device must meet the maximum recovery time t_{2R} .

t_{2B} still played a role when determining the operating mode Z_i . However, the time t_{2B} is no longer relevant for the subsequent steps – especially when determining the point in time at which the measurement starts (i.e. the point in time at which a certain print job is initiated for the measurement).



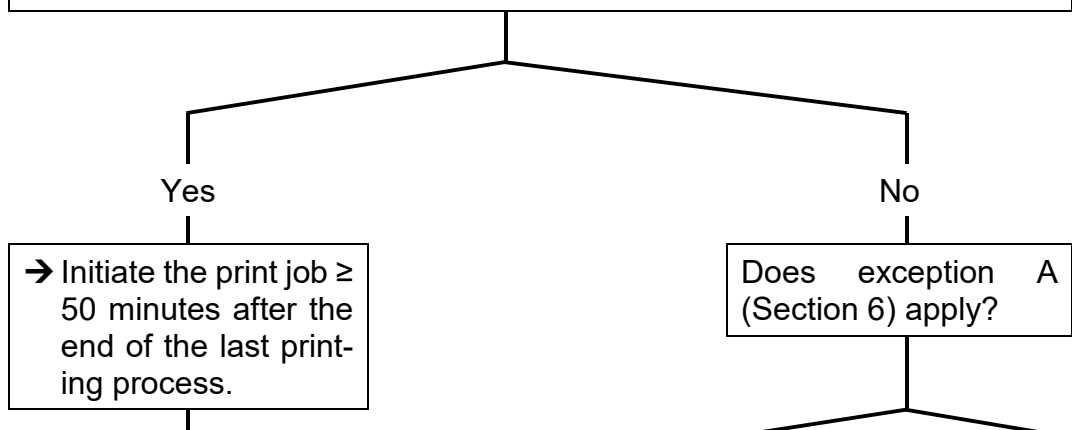
Beispiele für einen möglichen Verlauf der Leistungsaufnahme eines Gerätes im Auslieferungszustand und für die Bezeichnung einzelner Betriebszustände (Beispiele A...C):

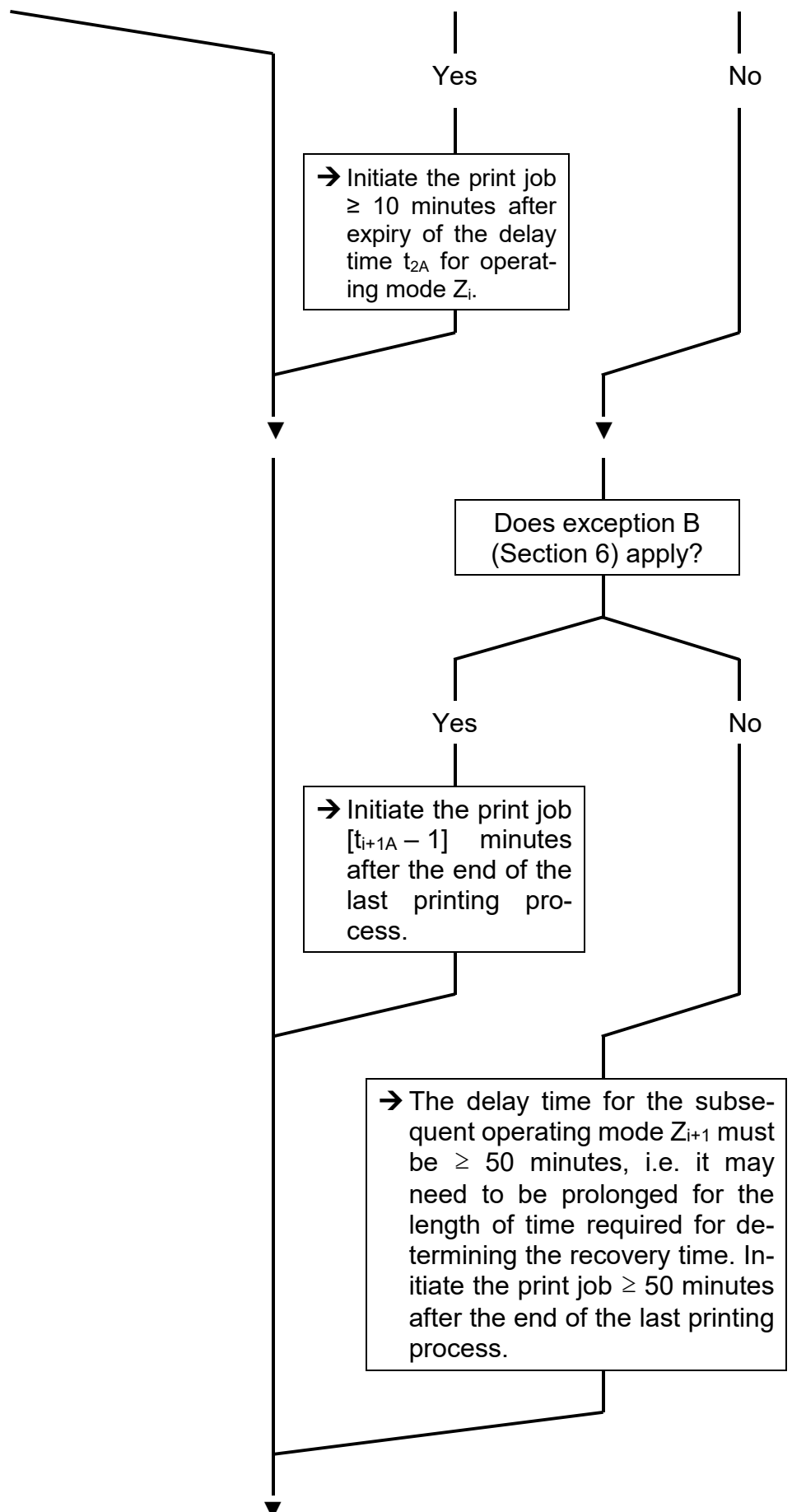
--- Gerät A --- Gerät B ——— Gerät C

3rd step

The print job for determining the recovery time t_{2R} must be initiated 50 minutes after the end of the last printing job at the earliest.

Is the device in the previously determined operating mode Z_i at a point in time ≥ 50 minutes after the end of the last printing process? Meaning: Is the subsequent operating mode Z_{i+1} activated at the earliest ~ 52 minutes after the end of the last printing process?





Next

Carry out the same steps for t_{3B} and t_{3R} .

7 Minimum requirements for the test reports

Alongside the information in the requirements described in Sections 1 to 6, the test report must contain at least the following information:

- A declaration by the laboratory confirming that the measurements were conducted in accordance with this Appendix E-M. A separate confirmation that the measurement was conducted at 230 volt, 50 hertz.
- Supply voltage of the tested device during the measurements.
- Indication of the types of measurement devices used and their measurement inaccuracies.
- Confirmation that the device was delivered to the laboratory by the manufacturer in a status corresponding to the normal delivery status – especially with regards to the delay times and other factors influencing power consumption/electric power consumption – and that the device was measured in the laboratory in the state it was delivered to the laboratory (delivery status). Any deviating requirements in this Appendix E-M are exempted.
- For each value stated in the report that can be interpreted as a measured value, it must be indicated whether it was measured in accordance with the Blue Angel requirements or determined differently, e.g. by estimation.
- For measured values for the power consumption during continuous operation, the chosen primary function must be indicated, as well as whether continuous operation was performed using monochrome or colour printing.
- Regarding the measurements for determining the recovery times: For the idle modes a) ready mode Z_a as a reference and b) the considered electric power saving mode Z_i (here Z_b , Z_c , ...) from which the device must meet a maximum value for the recovery time, the following information must be indicated:
 - The time that elapsed from the end of the printing process until the print job for the measurement was initiated.
 - Confirmation that the settings (primary function, number of test pattern and printed pages, resolution, printing colour, etc.) decisive for the printing process were the same for both idle modes (Z_a and Z_i [here Z_b , Z_c , ...]).
 - The time that elapsed from initiating this print job until the end of the corresponding printing process.

- Each page of the measurement report must state the name of the manufacturer, the type designation of the device and the date of the measurement.
- When stating the names of the idle modes in the report, the designations Z_i (with $i=2, 3, 4, \dots$) must be used in addition to the designations selected by the manufacturer.
- The measurement report must be signed by an authorized employee of the measurement laboratory.