

Comparing characteristic curves with the original data sheet

A RoeTest user contacted me regarding the following issue:

He wants to compare his tube's recorded characteristic curves from the RoeTest with the characteristic curves from the original data sheet. For this purpose he wants to scale the recorded characteristic curves to the same size as in the data sheet. Then he wants to put the two papers on top of each other for comparison.

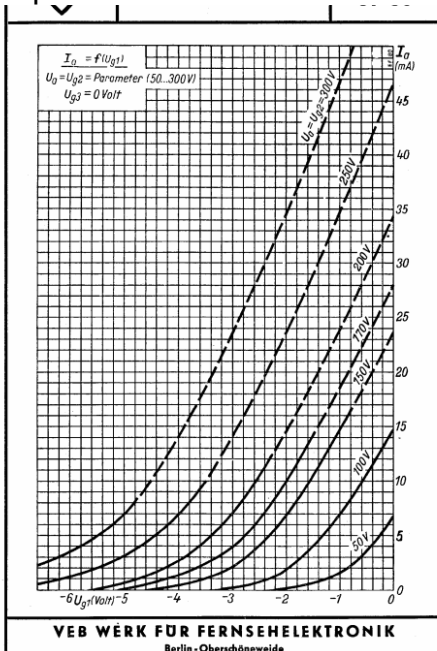
Putting two papers on top of each other for comparison is not an optimal solution. It would be better to digitize the original characteristic curve from the data sheet and then compare the curves on the PC's screen.

1. New Method starting with Software Version 10.2.5.0

With the new software it is possible to load a background picture into the evaluation graphics. This can also be a characteristic curve diagram from an original data sheet.

In the following I show you in an example how easy this can be done.

Excerpt from the data sheet of an EF80 given as a PDF file:



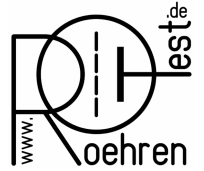
With suitable software (I use "Hardcopy") the picture data from the pdf file can be extracted and stored as bitmap data (.bmp). Then the bitmap picture data must be processed a little further. I will show this using the free of charge software "IrfanView".

The picture must be cut to size:

- at the left side and at the top: adjust to integral axis values (I used 50mA and -6V)
- at the right side and at the bottom: adjust to 0mA and 0V

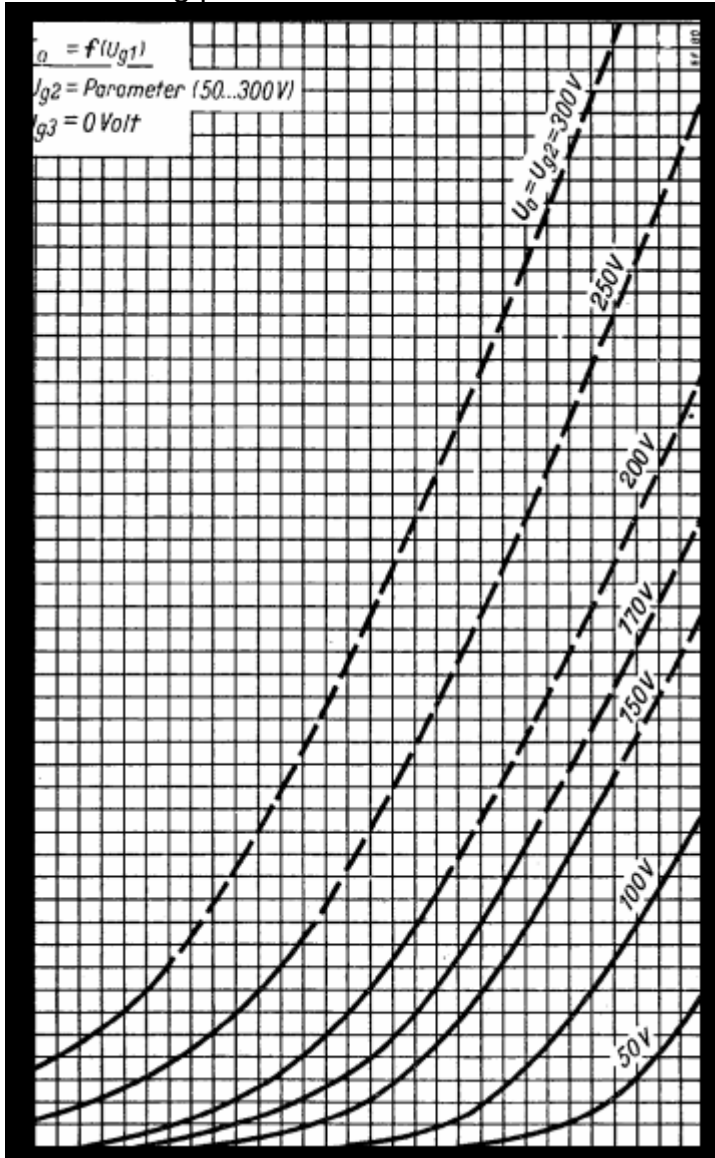
Mark this section in IrfanView with the mouse and extract it with the key combination <Ctrl-Y>.

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The resulting picture will look then as follows:

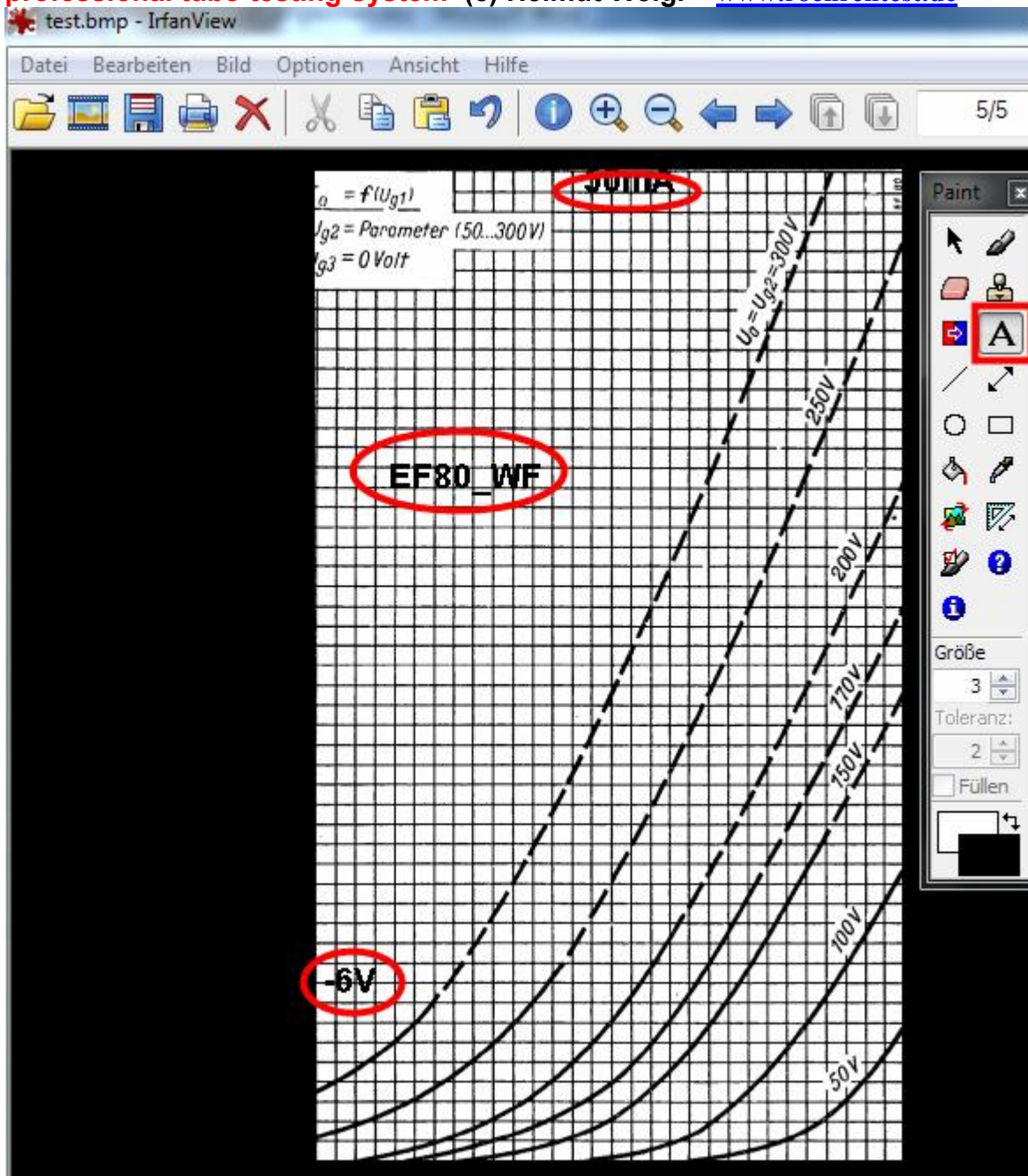


As the marking of the axes has been cut out I suggest to insert the values of the axes manually into the graphics (here: -6V and 50mA). I also put the tube's name to the graphics.

IrfanView: You open the tools using the F12 key. Text can be inserted into the graphics with 'A':

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The graphics will be used as background picture, so the colors should be somewhat transparent. You can change the colors using <shift-G> and change the dark black color to a light gray. Then store the edited picture as bitmap file (.bmp).

RoeTest:

With the button <Grafik laden> (load graphics) the background picture is imported. A window will open where you can select the area of the axes manually ("Bereichsenden der Grafik manuell wählen"). In this window set the axes' values, maximum 50mA for the y-axis, minimum value of -6V for the x-axis and maximum value of 0V for the x-axis:

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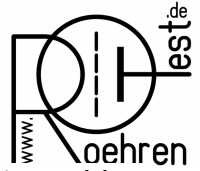
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The screenshot displays the RoeTest software interface for evaluating tube characteristics. The main window shows a graph for an **EF80_WF** tube. The y-axis is labeled I (mA) and the x-axis is labeled U_g1 (V). The graph shows several curves, with one curve highlighted in red. A dialog box titled "Bereichsenden der Grafik manuell wählen" (Manually select graph range) is open, showing a small version of the graph with a red box around the value 50 on the x-axis and another red box around the value -6 on the y-axis. The dialog has "abbrechen" (cancel) and "o.k." buttons.

The right-hand control panel includes the following sections:

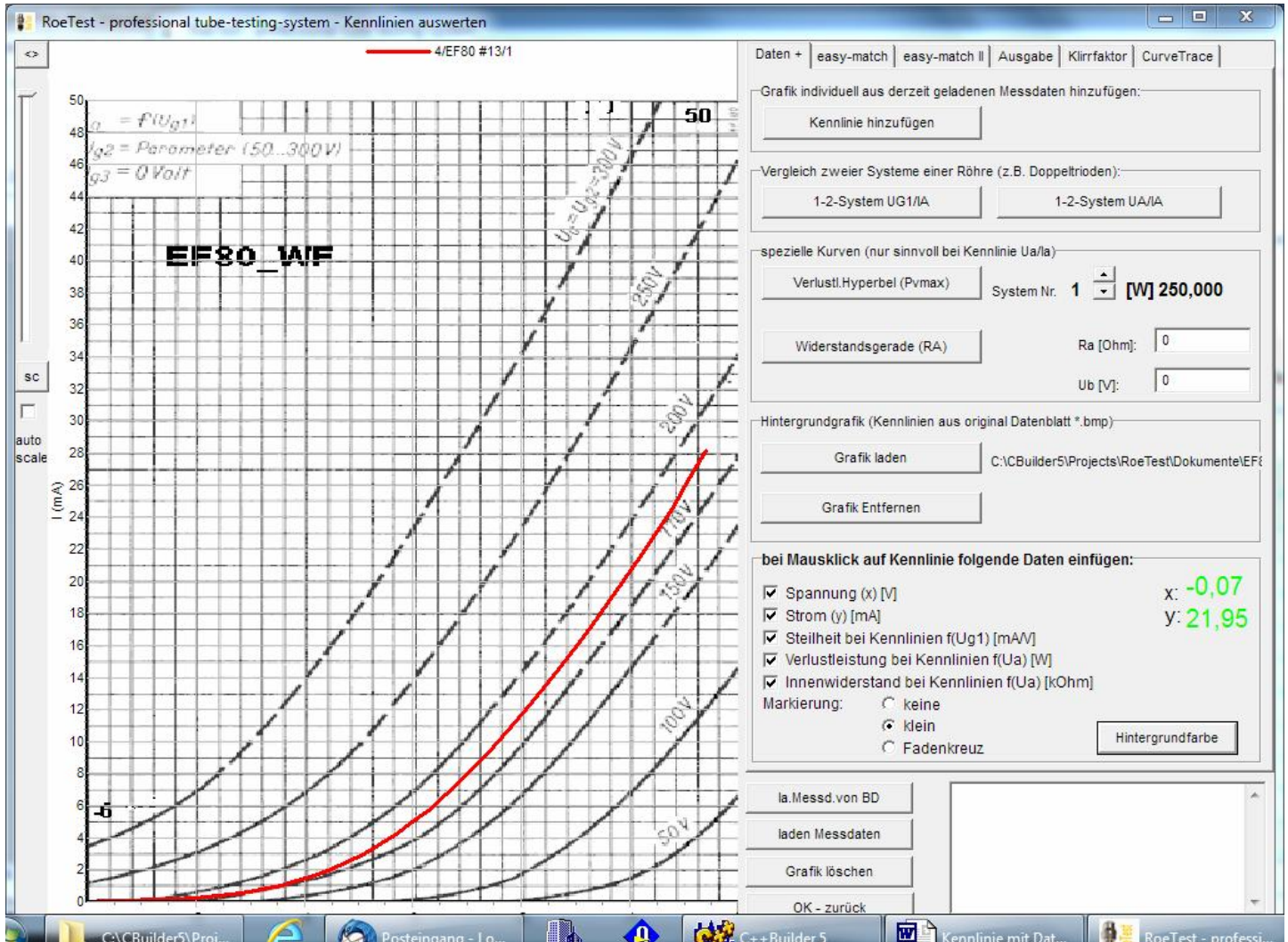
- Daten +**: easy-match, easy-match II, Ausgabe, Klirrfaktor, CurveTrace
- Grafik individuell aus derzeit geladenen Messdaten hinzufügen:** Kennlinie hinzufügen
- Vergleich zweier Systeme einer Röhre (z.B. Doppeltrioden):** 1-2-System UG1/IA, 1-2-System UA/IA
- spezielle Kurven (nur sinnvoll bei Kennlinie U_a/I_a):**
 - Verlust.Hyperbel (Pvmax) System Nr. 1 [W] 250,000
 - Widerstandsgerade (RA) Ra [Ohm]: 0, Ub [V]: 0
- Hintergrundgrafik (Kennlinien aus original Datenblatt *.bmp):** Grafik laden, Grafik Entfernen
- bei Mausclick auf Kennlinie folgende Daten einfügen:**
 - Spannung (x) [V] X: 0
 - Strom (y) [mA] Y: 0
 - Steilheit bei Kennlinien $f(U_{g1})$ [mAV]
 - Verlustleistung bei Kennlinien $f(U_a)$ [W]
 - Innenwiderstand bei Kennlinien $f(U_a)$ [kOhm]
- Markierung:** keine, klein, Fadenkreuz
- Hintergrundfarbe**
- la. Messd. von BD**
- laden Messdaten**
- Grafik löschen**
- OK - zurück**

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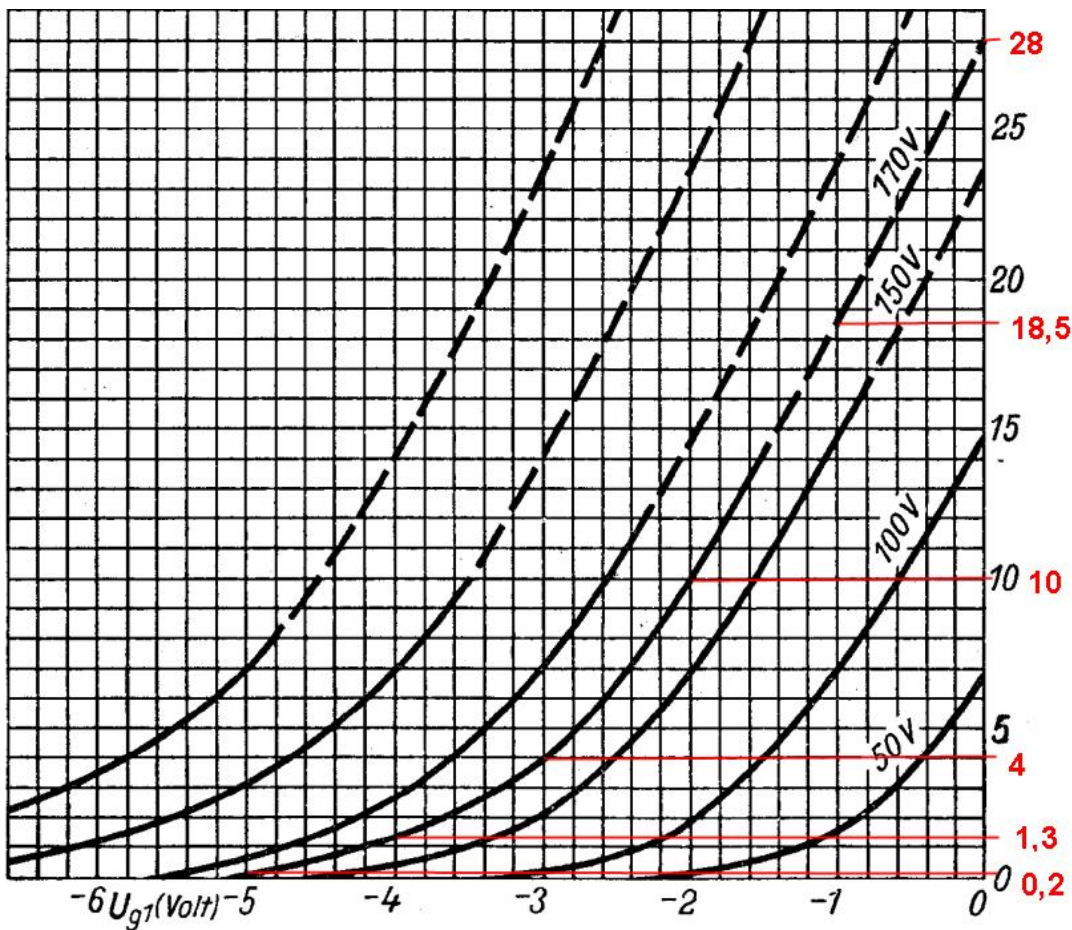
Thus the background graphics from the data sheet gets the same scaling as the RoeTest graphics. So it is very easy to compare measured characteristic curves with the data sheet. In the following picture a characteristic curve measured at U_a and $U_{g2} = 170V$:



2. Alte Methode (auch weiterhin möglich)

Direct scanning of the data sheets is not feasible as the characteristic curves in the data sheets have different scaling. So the characteristic curves have to be transferred manually. For this purpose already a few pairs of values will suffice and this can be done very quickly.

Example EF80, U_a and $U_{g2} = 170V$, original data sheet:



The characteristic curve's pairs of values are entered in the evaluation window at the item "add curve" (red marked fields), with increasing x-values ("gesendete Spannung [sent voltage]") from the left to the right. Empty fields will represent the value pair 0/-99. There is one specific peculiarity to observe: It is not possible to represent an anode current of 0mA. You have to enter a very small value (e.g. 0,01mA) instead of 0mA.

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The screenshot shows the 'analyse curve' window with a graph of current (mA) on the y-axis (0 to 28) and voltage (V) on the x-axis (-4 to -1). A blue curve is plotted. A red box highlights the 'add curve' button. A secondary window, 'select curve', shows a table of measured values:

Meßwert Nr.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
gesendet:	-5	-4,5	-4	-3,5	-3	-2,5	-2	-1,5	-1	-0,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
gemessen:	0,2	0,6	1,3	2,3	4	6,5	10	14,2	18,5	23,1	28	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	

Buttons for 'save table to file' and 'load table from file' are highlighted in green.

The original characteristic curve's data can be stored to file using the button **<save table to file>** and are then available for later comparisons. You should use meaningful file names that correspond to the underlying characteristic curve data. The file extension for the characteristic curve data file is ".rkl".

The screenshot shows a 'Speichern unter' (Save As) dialog box. The file name is 'Röhrenkennlinie - tube curve.rkl'. The file type is 'Röhrenkennlinie - tube curve'. The file is being saved in the 'Messdaten' folder. Below the dialog, a list of files is shown:

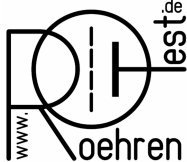
Name	Änderungsdatum	Typ	Größe
Rene	02.09.2012 09:34	Dateiordner	
EF80 datasheet WF, f(Ug1), Ua=Ug2=170V.rkl	24.09.2017 18:34	RKL-Datei	1 KB
EL84 datasheet Philips, f(Ug1), Ua=Ug2=250V.rkl	09.10.2017 13:49	RKL-Datei	1 KB
RV12P4000 datasheet Tlf f(Ug1), Ua=200,Ug2=100V, rkl.rkl	09.10.2017 13:48	RKL-Datei	1 KB

With the button **<add curve>** the characteristic curve is shown in the graphics. As you can see from the characteristic curve above already a few pairs of values suffice for a suitable representation. If you want a more accurate representation you can enter additional pairs of values. This can also be done later using the "Insert" key at the table's current cursor position to add a pair of values or with the "Delete" key to erase a pair of values at the cursor position.

The stored characteristic curve's data can later be reloaded with the button **<load table from file>**. With the button **<add curve>** the characteristic curve is then displayed in the graphics.

The following shows the comparison of a characteristic curve from the data sheet (blue) with the tube's measured characteristic curve (red). For my tube (used, 100%) the measured curve nearly matches that of the data sheet.

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