

217Plus Application Note 2: Working with Multiple Bills of Material (BOMs)

The 217Plus Application Note 1 explained how to “pre-condition” a single Bill of Material for importing into 217Plus. Most designs have several BOMs that will need to go into 217Plus for analysis. Although the user could follow the instructions of Application Note 1 for each BOM, this Application Note provides procedural shortcuts that can reduce the work effort associated with multiple BOMs. The pre-formatted MS Excel® - based workbook **217Plus_BOM_Tool-REV2.xls** developed by the RIAC, can facilitate BOM combination prior to a 217Plus data import.

This Application Note assumes that BOMs are available in Excel-compatible format, and that all of the BOMs are in the same data format. If either of these is not true, the user needs to put the data into the same format, or they can revert to working with one BOM at a time (reference Application Note 1).

Always work with **COPIES** of the original documents. In case an error is made, the original data can be retrieved from the original document.

Saving Time When Working With Multiple BOMs

As explained in 217Plus Application Note 1, pre-conditioning of BOM data is necessary to ensure that Part and Part Type data names can be recognized by 217Plus. When like part types are grouped together, the assignment of such data can be simplified using Excel’s *auto-fill* and/or Cut-and-Paste tools. Oftentimes, multiple BOMs of a system will use many of the same parts. This leads to the realization that if all of the system’s BOMs were combined into one BOM and *sorted* according to similar part types, assignment of 217Plus Part and Part Type data for the system could be simplified.

The **217Plus_BOM_Tool-REV2.xls** workbook is a tool that can assist in BOM combination and data assignment. The workbook contains the following worksheets references in this Application Note:

ALLBOMS – This pre-formatted worksheet is used to combine multiple BOMs into one BOM (see Figure 1). Predefined and reserved columns in the worksheet are:

217Part (Column A) – A pull-down menu in this column is used to enter the 217Plus **Part** data.

217PartType (Column B) – this column is used to enter the 217Plus **Part Type** data for each part via a built in pull down menu that becomes active after the “217Part” has been selected.

ASSY (Column C) – this field is used to enter a unique ID code for each BOM that will be in the final, combined BOM. It will also be used to aid in the sorting and re-sorting of data.

Note: Fields are provided for typical forms of BOM information (Item, Description, Quantity, part Number, etc. The user may rearrange or rename the fields to suit their BOM format, if desired.

	A	B	C
1	217Part	217PartType	ASSY
2			
3			
4			
5			
6			
7			

Navigation: ALLBOMS | 217Data | ALLBOMSTRESS

Figure 1. ALLBOMS Worksheet Predefined Columns

User BOM data types supported by 217Plus include (*required* data shown in BOLD typeface, recommended data shown in *Italics*)

- *Description*
- **Quantity**
- *Reference Designator*
- *OEM Part Number*
- *Manufacturer*
- *Industry Part Number*
- National Stock Number
- Specification Number
- Figure Number
- Page Number

Although not supported by the 217Plus software, a BOM's **Item #** (or “find number”) can be useful on the ALLBOMS sheet to facilitate sorting, and may be retained if available.

The data required for the 217Plus Part Category and 217Plus Part Type are usually not on the BOM in the correct format; the purpose of this Application Note is to show how this data needs to be added ‘normal’ BOM data.

217Data – this worksheet (Figure 2) contains data for all 217Plus Parts and 217Plus Part Types. It is used as a ‘look-up’ table for the pull-down selections for “217Part” and “217Part Type” on the ALLBOMS sheet. Since this data must be in a consistent format, the sheet is protected to prevent editing, moving or deletion of data.

	A	B	I	J
	PART	PART TYPE		PARTS
1				
2	CAPACITOR	FIXED,CERAMIC		CAPACITOR
3	CAPACITOR	FIXED,CERAMIC,DISC		CONNECTOR
4	CAPACITOR	FIXED,CERAMIC,FEED THRU		DIODE
5	CAPACITOR	FIXED,CERAMIC,MULTILAYER CHIP		IC
6	CAPACITOR	FIXED,ELECTROLYTIC		INDUCTOR
7	CAPACITOR	FIXED,ELECTROLYTIC,ALUMINUM		RELAY
8	CAPACITOR	FIXED,ELECTROLYTIC,TANTALUM		RESISTOR
9	CAPACITOR	FIXED,ELECTROLYTIC,TANTALUM,FOIL		SOFTWARE
10	CAPACITOR	FIXED,ELECTROLYTIC,TANTALUM,SOLID		SWITCH
11	CAPACITOR	FIXED,ELECTROLYTIC,TANTALUM,WET SLUG		THYRISTOR
12	CAPACITOR	FIXED,GLASS		TRANSFORMER
13	CAPACITOR	FIXED,MICA		TRANSISTOR
14	CAPACITOR	FIXED,MICA,BUTTON		OTHER
15	CAPACITOR	FIXED,MICA,DIPPED		ASSEMBLY
16	CAPACITOR	FIXED,MICA,FOIL		

Figure 2. 217Data Worksheet - Partial View

ALLBOMSTRESS – this worksheet is reserved to assist users who need to perform 217Plus Stress Analysis Predictions and contains additional data fields related to component parameters and stress conditions. Refer to 217Plus Application Note 3.

BOM Combination

1. Ensure that **ALL BOMs** are of the exact same data format; BOMs cannot be combined if their formats are different. Once the BOMs are in the same format, delete columns of data that are not supported by 217Plus of the 217Plus_BOM-Tool-Rev2.xls (See ALLBOMS in the preceding section for the list of supported data types).
2. **Open** the 217Plus_BOM_Tool-REV2.xls file, and (if necessary) rearrange or rename the 'BOM' columns D through N to match the BOM data format. Any of the Columns D through N that are not used may be deleted.

Use **Save as** to save a copy of the spreadsheet using an appropriate filename (e.g., the project name.)

3. **Open** the first Excel-based BOM to be entered. **Select** the BOM data (excluding the data header row) by selecting the range of cells of the BOM, and then select **Copy**. (DO NOT select the data by selecting the entire "Sheet").
4. **Paste** the BOM data into **ALLBOMS** at **Column D, Row 2** (see Figure 3). The data should match with the column headers that were rearranged or renamed in Step 2.

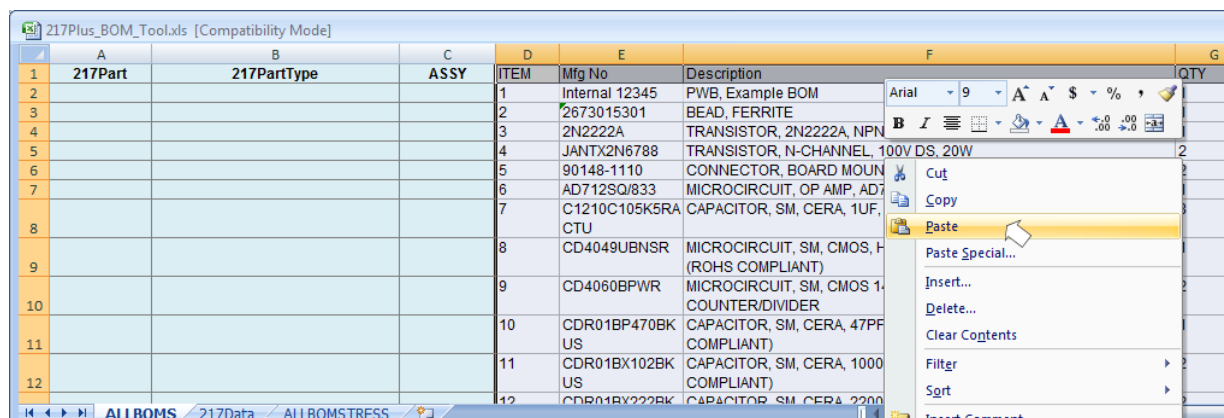


Figure 3. Pasting the First BOM into a User Revised ALLBOMS Worksheet

5. In each of the **ASSY** cells next to that BOM, enter an ID code unique to the BOM, such as the Assembly name or number. This is important, as the data will be used later to re-sort the BOMs. In the example of Figure 4, the name "Power Board" was entered into cell C2, and was then auto-filled into other cells by selecting the lower right corner of the cell and dragging it down into fill the destination cells for all parts in the "Power Board" BOM.

C	D	
ASSY	ITEM	Mfg No
Power Board	1	Internal 12345
Power Board	2	2673015301
Power Board	3	2N2222A
Power Board	4	JANTX2N6788
Power Board	5	90148-1110
Power Board	6	AD712SQ/833
Power Board	7	C1210C105K5RA
Power Board	8	CD4049UBNSR
Power Board	9	CD4060BPWR
Power Board	10	CDR01BP470BK
Power Board	11	CDR01BX102BK
Power Board	12	CDR01BX222BK

Figure 4. Multi-Cell Entry of an ASSY Name Using Excel's Auto-Fill

NOTE: If the assigned ASSY designator ends in a numeric character, DO NOT use the auto-fill function, as this will increment the number with each row, causing each row to have a different ASSY name. Instead, **Copy** the cell, which has the desired assembly name/number, and **Paste** it into all of the ASSY cells associated with the BOM.

6. **Close** the original BOM, and **Open** the next BOM
 7. **Select** the BOM data (excluding the header data) by highlighting the desired range of cells within the BOM, and then select **COPY**
 8. **Paste** the BOM data into the **ALLBOMS** worksheet in **Column D**, at the first blank row/cell following the preceding BOM data row/cell
 9. In each of the **ASSY** cells (Column C) next to that BOM, enter an ID code that will be unique that BOM
 10. **Repeat steps 7 through 10** until all of the desired BOMs for the system are pasted into the **ALLBOMS** worksheet.
 11. Next, go through the combined BOM on the ALLBOMS worksheet and **DELETE** any rows that may contain blank lines or data separation characters. Only **Row 1** should contain BOM header information. If the header information of BOMs was copied and pasted into the **ALLBOMS** worksheet, *these rows must be deleted*.
- Comment: As an experiment, Steps 1-12 above were performed for a project with 11 BOMs, and the process took less than 5 minutes to complete.
12. **Select** the preformatted cells A2 and B2, select **COPY**, and then **PASTE** into all blank column A and B cells that are associated with rows of BOM data. These cells will now have the 'formulas' necessary to aid in the selection of valid **217Part** and "**217PartType**" data.
 13. **SORT** the BOM. Begin by highlighting (selecting) all columns and rows that are used by the combined BOMs, including the header row of Row 1. Then, select using the "**Data**", "**Sort**", "**Expand the selection**", "**Sort...**", check "**My data has headers**", then select the desired column in the **Sort by** pull-down. Select the column that could best group the BOM data so that 'like' parts will be in adjacent rows (reference Figure 5). Usually, the part description is the best field for this purpose, although the BOM's part number field may also be effective if the user's organization has implemented a semi- intelligent part numbering system. Finally, click on **OK**.

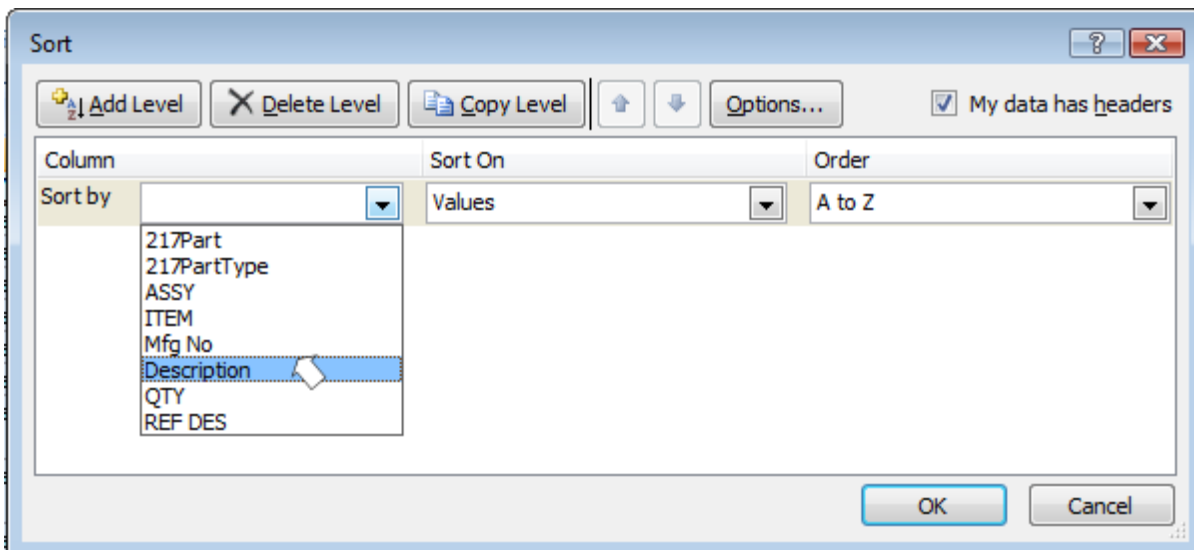


Figure 5. Sort Criteria Selection by "Description"

14. **Select (or enter)** the 217Part and 217PartType data that corresponds to the component (refer to Table 1 of 217Plus Application Note 1 for additional guidance).

	A	B	C	D	E	
	217Part	217PartType	ASSY	ITEM	Mfg No	Description
1			Power Board	2	2673015301	BEAD, FERRITE
2			Power Board	13	CDR02BX103BK US	CAPACITOR, SM, CERA, .01UF
3			Power Board	14	CDR04BX104AK US	CAPACITOR, SM, CERA, .1UF, US
4			Power Board	11	CDR01BX102BK US	CAPACITOR, SM, CERA, 1000F COMPLIANT)
5			Power Board	7	C1210C105K5RA	CAPACITOR, SM, CERA, 1UF, 5

Figure 6. Selecting the 217Part Name

	A	B	C	D	E	
	217Part	217PartType	ASSY	ITEM	Mfg No	Description
1			Power Board	2	2673015301	BEAD, FERRITE
2	INDUCTOR		Power Board	13	CDR02BX103BK US	CAPACITOR, SM, CERA, .01UF
3			Power Board	14	CDR04BX104AK US	CAPACITOR, SM, CERA, .1UF, US
4			Power Board	11	CDR01BX102BK US	CAPACITOR, SM, CERA, 1000F COMPLIANT)
5			Power Board	7	C1210C105K5RA	CAPACITOR, SM, CERA, 1UF, 5

Figure 7. Selecting the 217PartType Name

15. **COPY** the 217Part and 217PartType selections just made, and **PASTE** them into the 217Part and 217PartType cells for all other parts that **have the identical description**.
16. Continue with the Part and Part Type assignment in steps 15 and 16 until all items on the BOM have data in their **217Part** and **217PartType** cells
17. **Re-Sorting BOMs** - Once again highlight (select) all of the columns and rows associated with the combined BOMs including the header, then select the **Data, Sort, Expand on Selection, Sort... Sort by** and select “**ASSY**” as the main column for re-sorting (see Figure 8). If the BOM has an “Item” column, use it as a secondary sort criterion. Click on OK. The BOM will now be re-arranged such that all parts are again grouped according to their respective assembly.

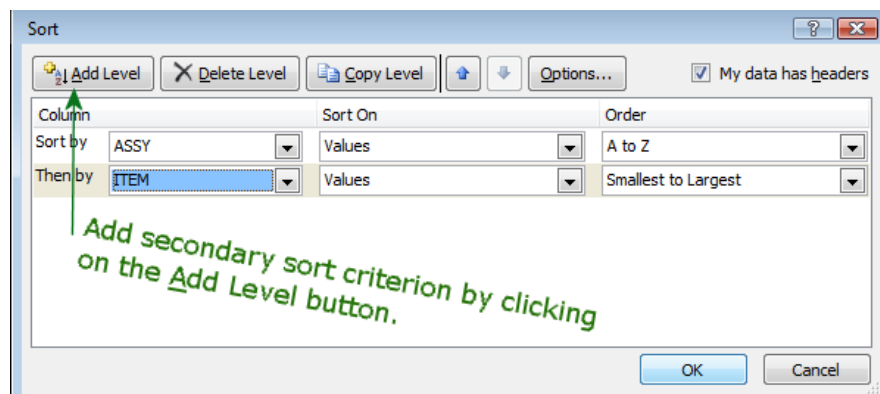


Figure 8. Re-Sorting by ASSY (Primary) and Item (Secondary)

Comment: For the project with 11 BOMs previously mentioned, steps 13-18 took about 10 minutes to complete for the entire combined BOM. Obviously, the work time can vary from project to project.

18. Steps 19 through 23 add information that will allow 217Plus to identify the assemblies in the combined BOM.

In the first row of the first BOM (after the Header row, it should be Row 2 of the spreadsheet), select the row by right-clicking on the row number, then select and click on **Insert**. A new row will be inserted into the worksheet.

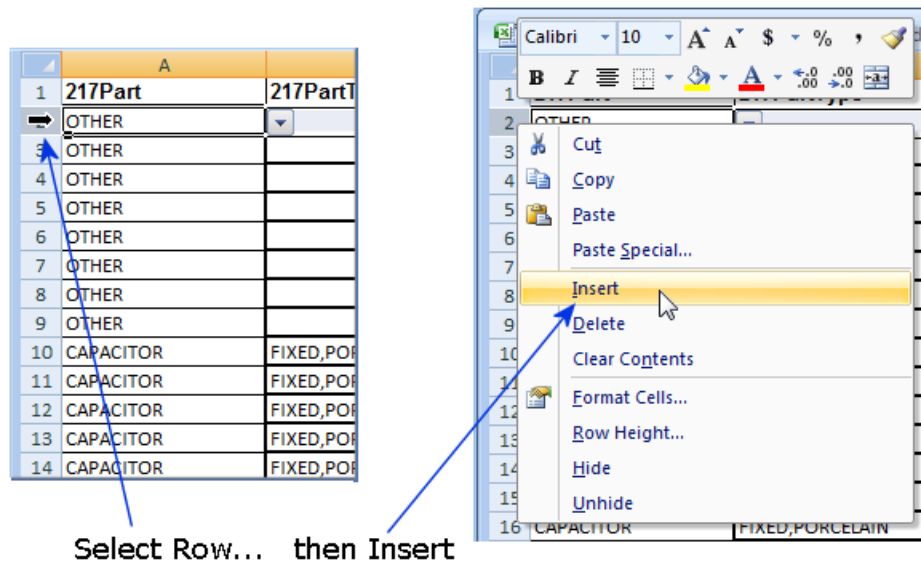


Figure 9. Inserting a Row at the Beginning of a BOM

19. For that new row, enter the data **ONLY** into the designated columns, as specified below:

- For Column labeled “**217Part**”, Select “**ASSEMBLY**”; (a 217PartType is NOT required for assemblies)
- For the Column containing BOM quantity data, enter the number **1**
- For the Column ‘Description’, enter a unique name or number for the assembly (e.g., **Power Board**)
- If desired, for Reference Designator, enter a *unique* reference such as **A1** or **ASSY1**

20. Find the first row of data for the next BOM. At that row, right-click and select **Insert**. A row will be inserted.

21. For that new row enter data into the columns as follows:

- For Column labeled “**217Part**”, select “**ASSEMBLY**”
- For the Column containing BOM quantity data, enter the number **1**
- For the Column ‘Description’, enter a unique name or number for the assembly (e.g., **Filter Board**)
- If desired, for Reference Designator, enter a unique reference such as **A2** or **ASSY2** (the name must contain only alphanumeric characters – commas and spaces are not permitted)

22. Repeat Steps 21-22 for all BOMs

23. **Save** the workbook before proceeding.

24. Select **Save As, Other Formats**. In the **Save as type** box, select “**Text (Tab delimited).txt**” from the list, enter the desired file name, and save the file. This is illustrated in Figure 10.

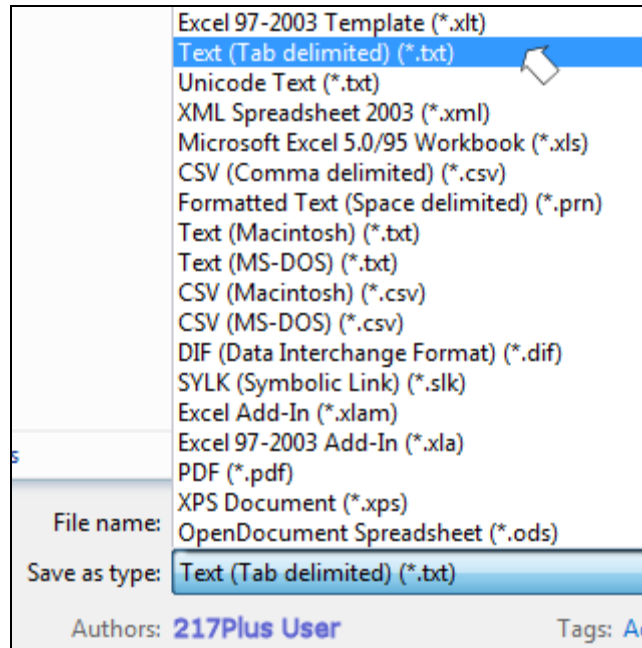


Figure 10. Save the Workbook as a Tab-Delimited Text File

25. **Close** the workbook.
26. **Save** the file and **Close**.
27. The “**.txt**” file version of the combined BOM can now be imported into 217Plus for Parts Count Analysis, as per the normal 217Plus Import procedure, or as per the “Importing to 217Plus Procedure” portion of the 217Plus Application Note 1

Important: At the **File Delineation** screen during the **Import** process, be sure to set the **Text Qualifier** as “ (quotation mark), since the Excel application will have placed quotation marks on text fields. (See Figure 11)

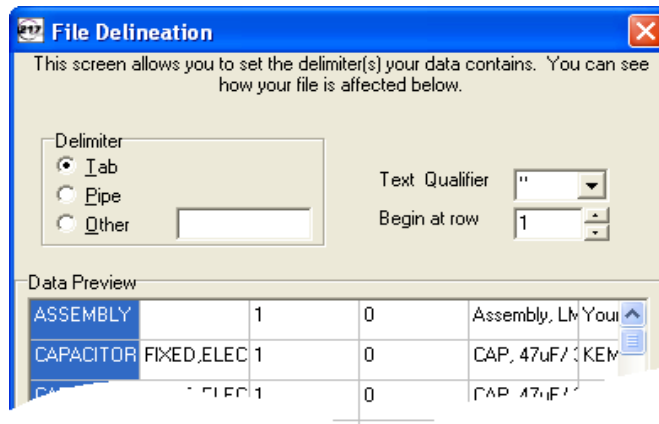


Figure 11. File Delineation Settings



The user will notice that once the Import process begins, the **217Plus** application will provide a prompt each time it sees an **ASSEMBLY**. This allows the user to decide whether they want to assign the assembly as being a direct sub-assembly to the system level, or as sub-assembly of another assembly. However, since the **Import** function processes the file's data in sequence starting with Row 1, it only 'knows' of assemblies it has already encountered. As a result, if an assembly BOM is encountered before its parent assembly BOM has been processed, the user will not be able to select the true parent assembly. In such an instance, the user should simply assign the assembly to the system. Once the import is completed, one can easily move assemblies as desired using the **Cut** and **Paste** features within 217Plus.

Performing the above steps facilitates a 217Plus Parts Count reliability analysis for a multi-BOM system.

For information on how to break down and import BOM data for a 217Plus Stress Analysis, see the 217Plus Application Note 3.