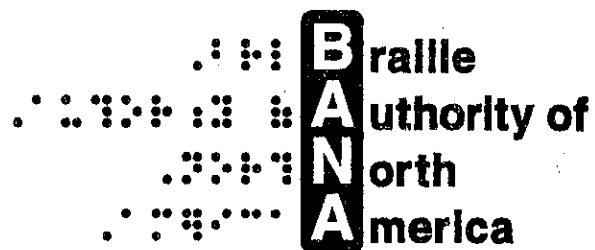


BRAILLE CODE FOR CHEMICAL NOTATION 1997

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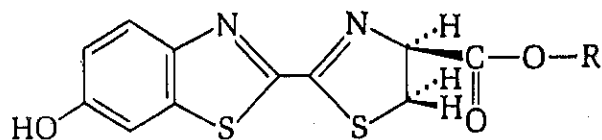
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Example 2.5-4: (spatial structure requiring a runover locator)



1
2
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24

The Braille representation of the chemical structure is a large, complex pattern of dots arranged in a roughly rectangular shape, spanning from line 1 to line 24. The pattern is composed of numerous individual Braille cells, each representing a specific atom or bond in the molecule. The structure is highly detailed, capturing the spatial arrangement of the atoms and the stereochemistry of the carbonyl group.

- 2.6 **Spatial Material.** Structures occupying more than one print line and having a vertical relationship are spatial arrangements. In braille, spatial material must be preceded and followed by a blank line.

Embedded. When spatial expressions are embedded in narrative text, the portions of narrative text which occur on the same braille line as the spatial structure must be aligned with the main line of the structure.

Displayed. In displayed spatial expressions, the leftmost symbol must begin two cells to the right of the current margin. EXCEPTION: It is permissible to start a structure that occupies much space both horizontally and vertically (e.g., a ring structure or a spatial structure of a very large molecule), in cell 1 in order to avoid a runover. (See Example 4.4.3-21.) This exception should be used sparingly.

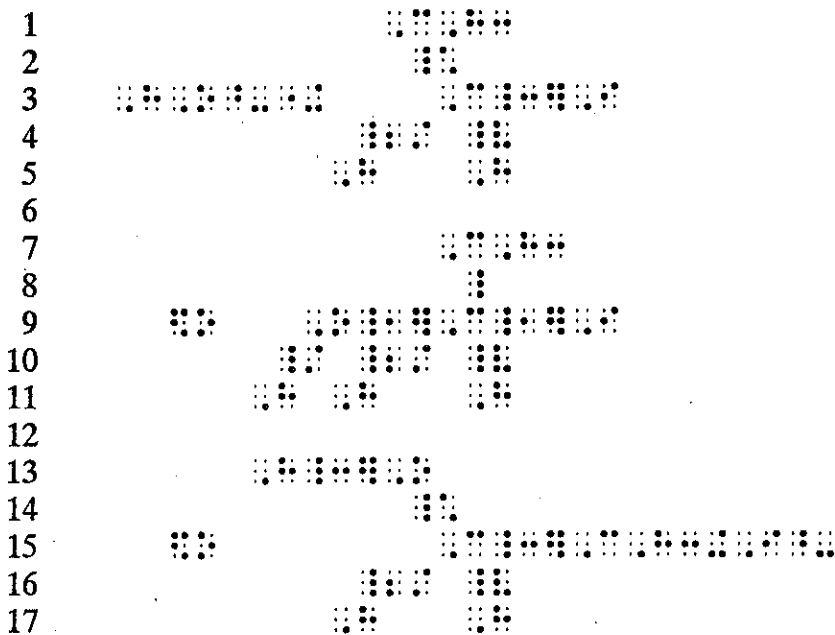
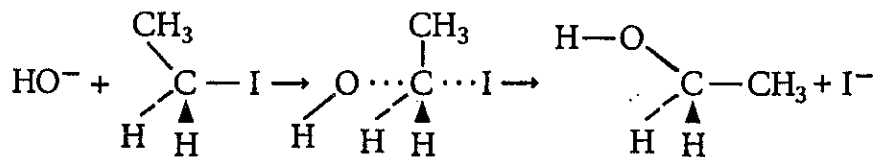
Identified. When a spatial structure or expression is identified by a number or letter (as in an example or set of exercises), the identifier must be placed at the top line of the structure in braille. One column of blank cells must be left between the identifier and the left-most symbol of the structure. If by placing the identifier on a separate line it is possible to get the complete structure across the page, this may be done. In this case, a blank line must be left between the identifier and the spatial structure.

Chemical Equations. When a chemical equation consists of a spatial element and a linear element separated by a sign of operation (usually a plus sign), the linear element, along with the sign of operation, must be placed so that it is not in direct contact with any branch of the spatial structure either vertically or diagonally. A clear blank cell must be left between the beginning (or end) of the linear element and a vertical or diagonal branch of the spatial structure to prevent direct contact. (See Example 4.2.3-4.) Moreover, a diagonal portion of the spatial structure may not "overlap" the linear element either above or below even if this could be done without making direct contact. However, no clear blank cell is necessary if the placement of the linear portion does not make direct vertical or diagonal contact with a branch of the spatial structure. (See Examples 4.2.5-2, 4.8-2.)

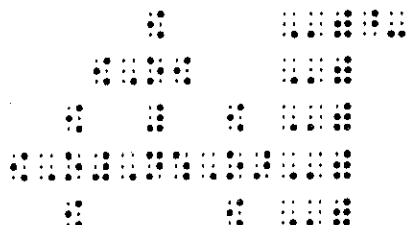
A linear element may be placed adjacent to a ring structure or to a horizontal portion of a spatial structure if that is the print format and if the linear portion can be brailled so that no part of it is in direct contact with a vertical or diagonal branch of the spatial structure. (See Example 4.2.6-3.)

If it is necessary to place a linear portion of an equation so far distant from the main line of a spatial structure that it is difficult to locate, the enlarged transcriber's grouping symbols may be used and the linear material top-adjusted to the grouping symbols. (See Example 2.6-4.)

Example 2.6-3: (linear adjacent to spatial)



Example 2.6-4: (requires transcriber's grouping symbols; what appears as a bold dot is a normal electron dot in this text)



2.7 Cancellation. Material containing cancellation with no replacement symbols may be transcribed linearly. (Nemeth Code Rule XI requiring spatial arrangement does not apply in this situation.) (See Example 9.5-6.)

3 CHEMICAL SIGNS AND SYMBOLS

3.1 **Chemical Arrows.** The braille representation of arrows listed below must be used in place of the ones listed in the Nemeth Code. All other arrows must be transcribed as required by the Nemeth Code.

Up-pointing			
Regular	↑		⠠⠠⠠⠠
Boldface	↑		⠠⠠⠠⠠⠠⠠
Down-pointing			
Regular	↓		⠠⠠⠠⠠
Boldface	↓		⠠⠠⠠⠠⠠⠠
Bold up-pointing followed by regular down-pointing	↑↓		⠠⠠⠠⠠⠠⠠⠠⠠
Regular up-pointing followed by bold down-pointing	↑↓		⠠⠠⠠⠠⠠⠠⠠⠠
Regular up-pointing followed by regular down-pointing	↑↓		⠠⠠⠠⠠⠠⠠
Vertical or oblique dipole			
Up-pointing	↑	or	↑
	⠠⠠⠠⠠		⠠⠠⠠⠠
Down-pointing	↓	or	↓
	⠠⠠⠠⠠		⠠⠠⠠⠠
Half-barb up-pointing followed by half-barb down-pointing	↑↓		⠠⠠⠠⠠⠠⠠⠠⠠

Horizontal

Dipole, right-pointing	\rightarrow	or	\rightarrow	
Dipole, left-pointing	\leftarrow	or	\leftarrow	
Crossed arrow	\leftrightarrow			

3.2 Bonds

3.2.1 Electron Dots

Single regular	.		
Single bold or hollow	•	◦	
Small x	x		
Pair, regular	:	..	
Pair, hollow or bold	••	◦◦	
Pair, x's	xx	x	
Pair, right or upper bold or hollow, left or lower regular	•◦	◦•	
Pair, right or upper x, left or lower regular	•x	x•	
Pair, right or upper regular, left or lower bold or hollow	••	◦◦	

Pair, right or upper regular,
left or lower x

x· ·
 x

⋮

Pair, right or upper bold or
hollow, left or lower x

x• •
x◦ ◦

⋮

Pair, right or upper x, left or
lower bold or hollow

•x x•
◦x x◦

⋮

Triplet (three pairs of regular
electron dots)

⋮ or ⋮⋮

⋮

Other triplets

Insert dots 46 before a pair shown
horizontally in the list above to
indicate that the arrangement is
a triplet. For example:

•x
•x
•x

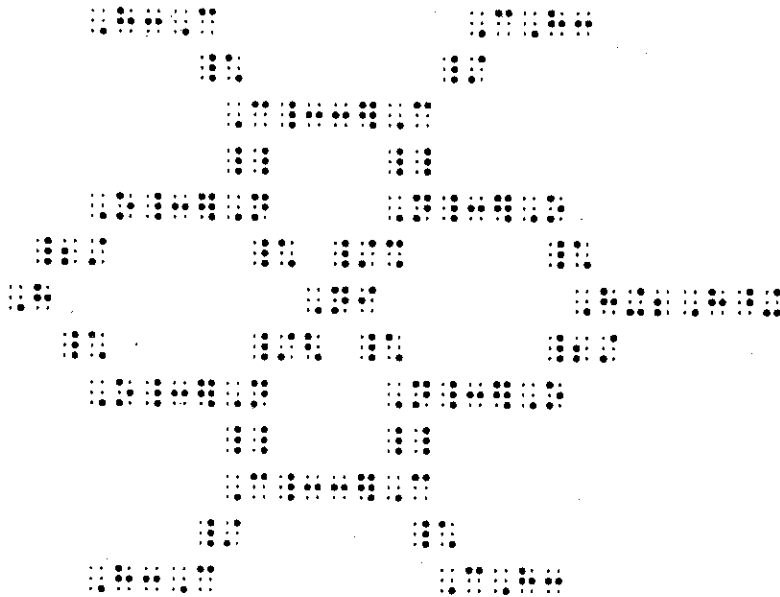
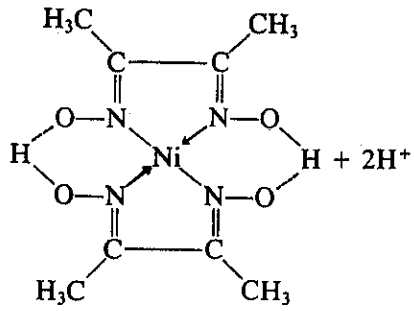
⋮⋮

Bonds, cont.

3.2.2 Horizontal (including indicators)

Single	—	⠠⠠⠠⠠
Double	==	⠠⠠⠠⠠⠠⠠
Triple	≡	⠠⠠⠠⠠⠠⠠⠠⠠
Arrow, right-pointing	→	⠠⠠⠠⠠⠠⠠⠠⠠
Arrow, left-pointing	←	⠠⠠⠠⠠⠠⠠⠠⠠
Barred		⠠⠠⠠⠠⠠⠠
Bold	——	⠠⠠⠠⠠
Broken	---	⠠⠠⠠⠠
Dotted	⠠⠠⠠⠠
Jagged, single	⚡	⠠⠠⠠⠠
Jagged, double	⚡⚡	⠠⠠⠠⠠⠠⠠
Wavy, single	〰	⠠⠠⠠⠠
Wavy, double	〰〰	⠠⠠⠠⠠⠠⠠

Example 4.2.6-4: (oblique arrow bonds within spatial structure)



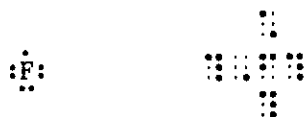
- 4.3 **Electron Dot Bonds.** Although all electron dots have the same chemical meaning, writers of textbooks use different types of dot notation to illustrate a point, trace transferred or shared electrons, denote free electrons, etc. In braille, these differences must be maintained. If what appears to be a bold dot is used and a smaller dot is not used elsewhere in the text, the bold dot must be transcribed as a regular electron dot (dots 16). Other types are transcribed according to the list in Section 3.2 of this Code.

When colored dots are used in print for distinction, choose one of the dot configurations not used elsewhere in the text to represent these colored dots. If this occurs in only one place, a transcriber's note must be used to show the meaning of the configuration chosen. If the technique is used throughout the text, this use, including the color of the print dot, must be noted on the Special Symbols page.

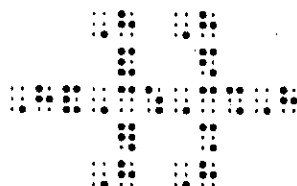
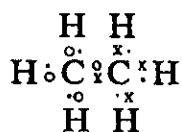
- 4.3.1 **Placement of Electron Dots.** Electron dots must be placed above, below, to the right, to the left or on the diagonal as they appear in print. At times a single dot which appears above, below, to the right or left of the element may not be centered in print, but in braille this displacement is to be ignored unless it is on the diagonal. (See Examples 4.3.1-3, 4.3.1-4, and 4.3.1-5.)

When dots appear on the diagonal to the element in print, the symbol must be located to the right or left of the SYMBOL in braille on the line immediately above/below in the first cell preceding or following the SYMBOL to which it applies. When a pair of electron dots appears on the diagonal to the element, the left-most dot of the pair is considered the "left" dot in selecting the correct symbol to use (from the list in Section 3.2.1). If there are two sets of dots on the diagonal in print, they should be placed one directly under the other, on the diagonal to the SYMBOL. However, they may be placed diagonally to each other when it is necessary to avoid confusion with other notation in the structure. (See Example 4.3.1-11.)

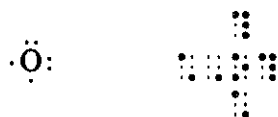
Example 4.3.1-1: (all dots, single or double, identical in size and shape)



Example 4.3.1-2: (different types of dots)



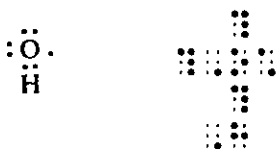
Example 4.3.1-3: (single dots, centered in print)



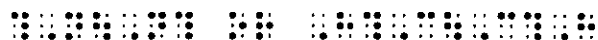
Example 4.3.1-4: (single dots not centered on the SYMBOL in print)



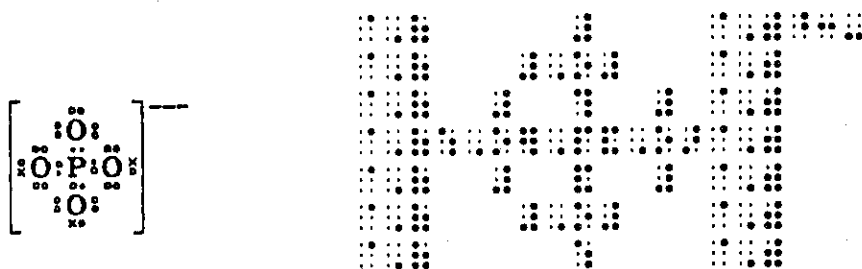
Example 4.3.1-5: (single dot appears to be in subscript position in print)



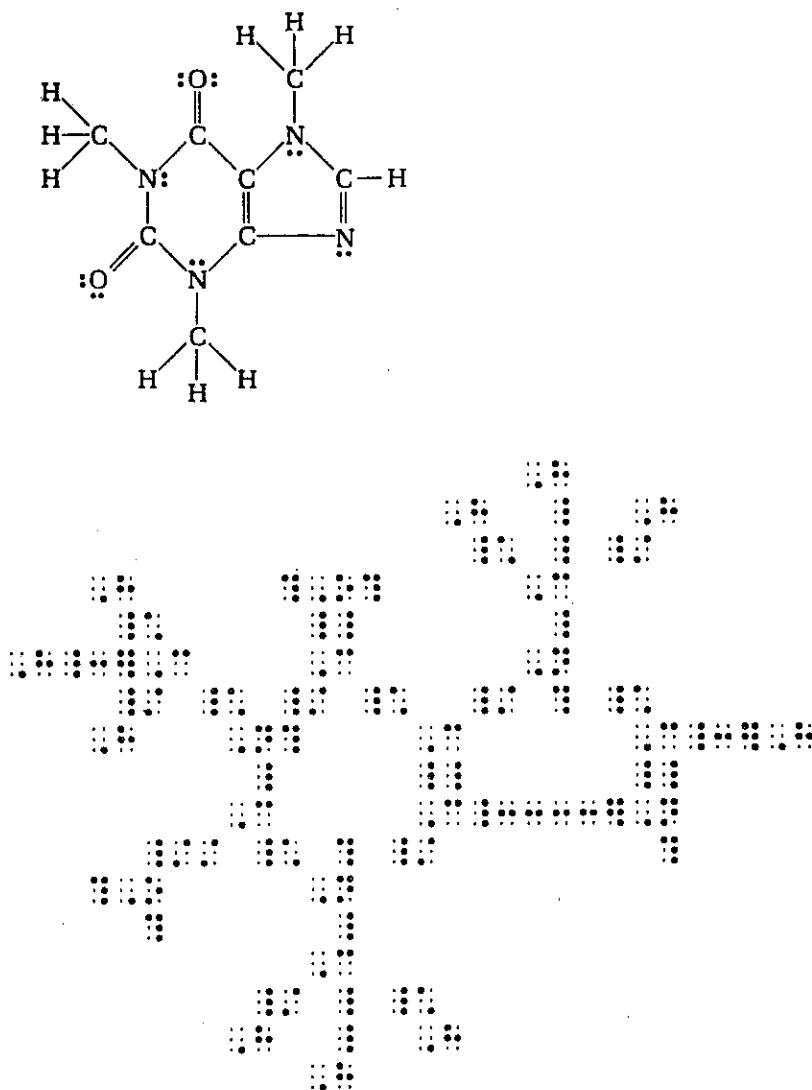
Example 4.3.1-6: (triplets)



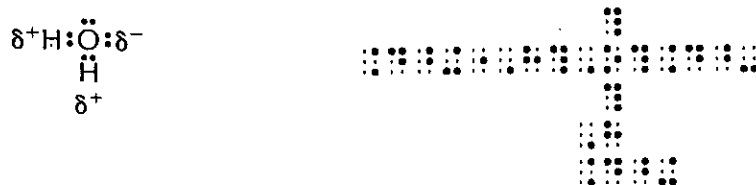
Example 4.3.1-7: (structure enclosed in grouping signs with superscript)



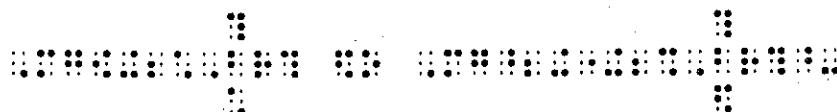
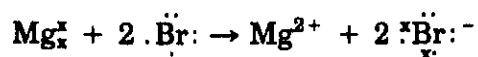
Example 4.3.1-8: (dots in ring structure)



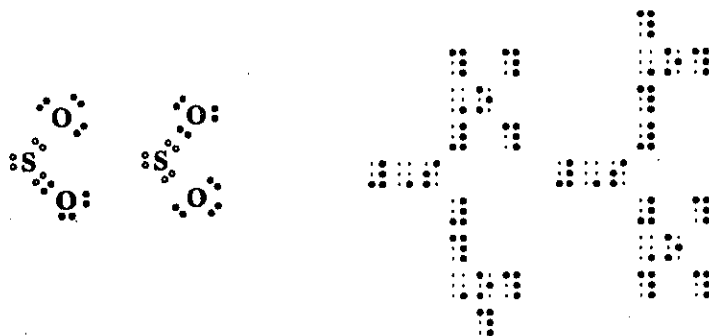
Example 4.3.1-9: (dots combined with other notation [delta - partial charge])



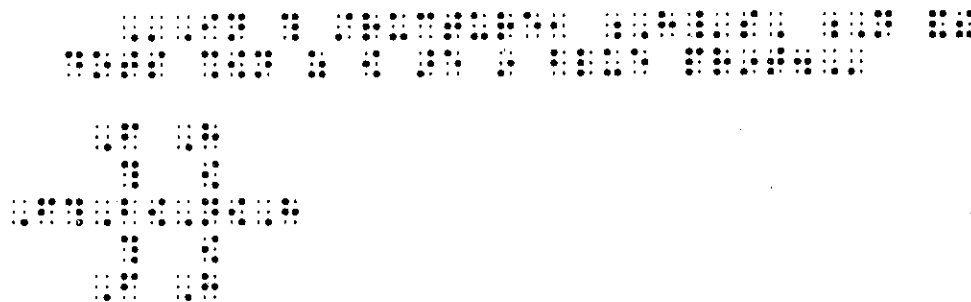
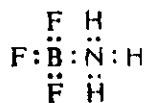
Example 4.3.1-10: (dots combined with superscript)



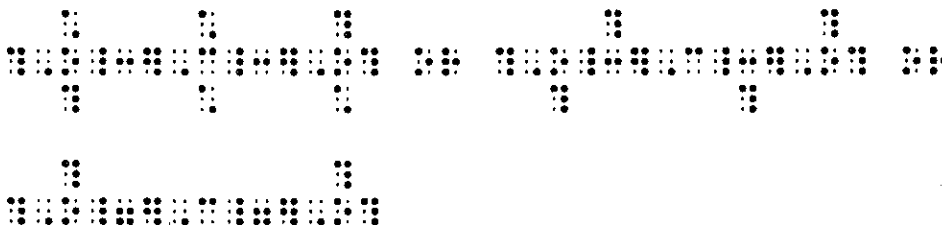
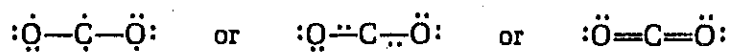
Example 4.3.1-11: (diagonal dots)



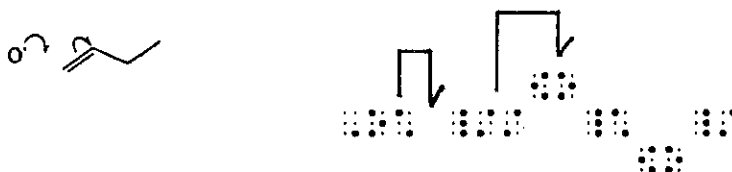
Example 4.3.1-12: (dots and letters in colored print)



Example 4.3.1-13: (dots combined with bonds)



Example 4.3.1-14: (ion transfer)



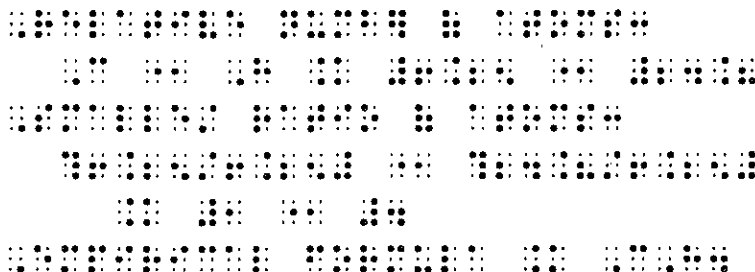
4.3.2 Proportion. Sometimes print dots appear to be pairs of electron dots but are denoting proportion. Context will determine the meaning of these dots.

Example 4.3.2-1: (dots mean ratio, not electron dots)

Relative number of atoms: $\text{C}:\text{H} = 6.25:24.8$

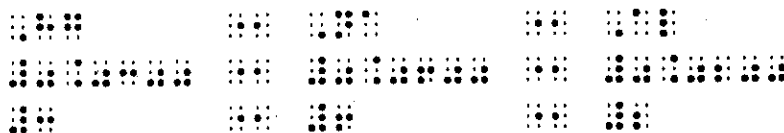
Smallest ratio of atoms: $\frac{6.25}{6.25} : \frac{24.8}{6.25} = 1:4$

Empirical formula = CH_4



Example 4.3.2-2: (dots mean ratio, not electron dots)

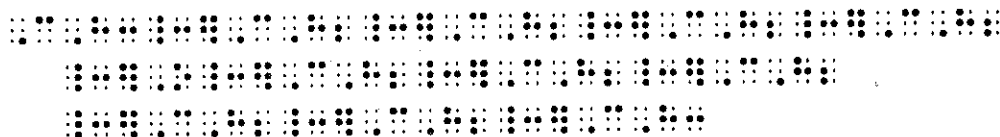
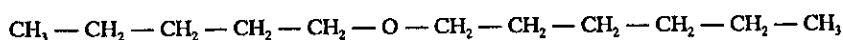
Hg : Na : Al
 0.0300:0.0600:0.0200
 3 : 6 : 2



4.4 Other Bonds. All of the following bonds may be extended to accommodate surrounding material. (See Examples 4.4.3-1, 4.4.3-6, and 4.4.3-19.)

4.4.1 Horizontal Bonds. Horizontal bonds are employed in both spatial and non-spatial structures and they are subject to Nemeth Code Rule XIX (Operation Signs). See Section 1.1 of this Code for construction of horizontal bonds. If numbers or other notation appear above and/or below some of the SYMBOLS or symbols, the arrangement is spatial. See Section 5.3 for placement of numbers and other notation.

Example 4.4.1-1: (horizontal bonds; no comparison sign; runovers required; displayed but not spatial)



Example 4.4.1-2: (horizontal bond; displayed; spatial because of electron dots over/under SYMBOL)

