

# Approximate High Temperature $\text{Mo}_8\text{O}_{23}$ Structure: A8B23\_mP62\_13\_4g\_a11g-001

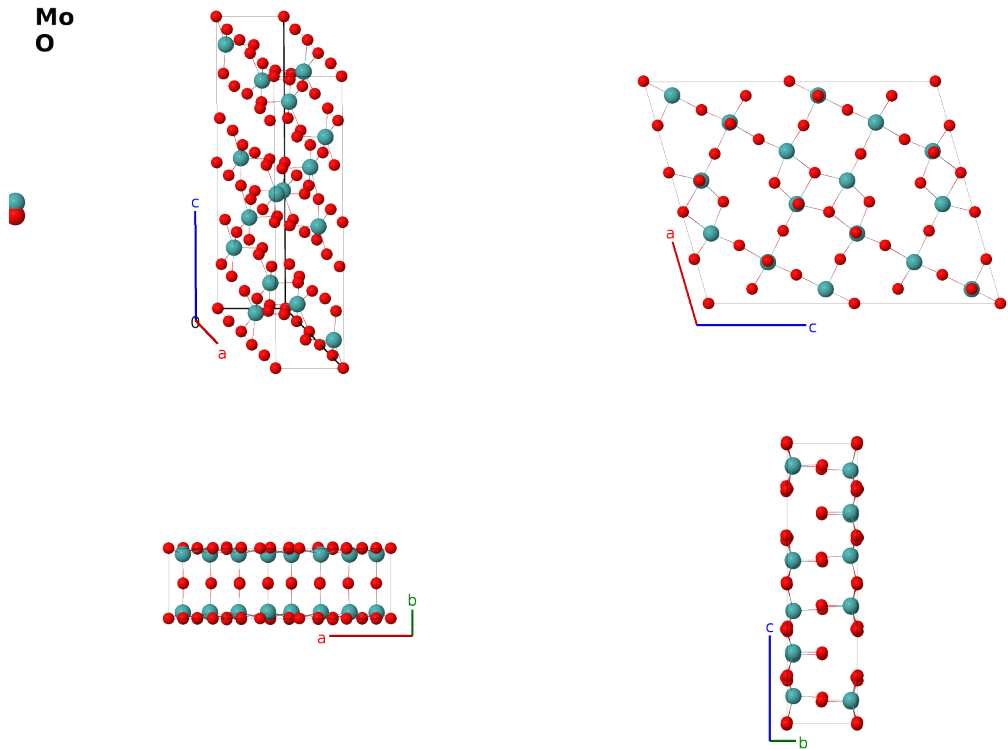
This structure previously used the label(s) **A8B23\_mP62\_13\_4g\_c11g**. Calls to these addresses will be redirected here.

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- D. Hicks, M. J. Mehl, M. Esters, C. Oses, O. Levy, G. L. W. Hart, C. Toher, and S. Curtarolo, *The AFLOW Library of Crystallographic Prototypes: Part 3*, Comput. Mater. Sci. **199**, 110450 (2021), doi: 10.1016/j.commatsci.2021.110450.

<https://aflow.org/prototype-encyclopedia/UWFW>

[https://aflow.org/prototype-encyclopedia/A8B23\\_mP62\\_13\\_4g\\_a11g-001](https://aflow.org/prototype-encyclopedia/A8B23_mP62_13_4g_a11g-001)

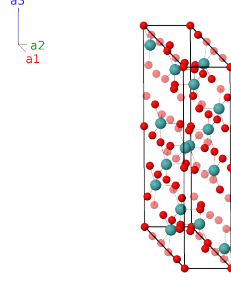


|                         |                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prototype               | $\text{Mo}_8\text{O}_{23}$                                                                                                                                                                                                                                                                                                                               |
| AFLOW prototype label   | A8B23_mP62_13_4g_a11g-001                                                                                                                                                                                                                                                                                                                                |
| ICSD                    | 202202                                                                                                                                                                                                                                                                                                                                                   |
| CCDC                    | 1706789                                                                                                                                                                                                                                                                                                                                                  |
| Pearson symbol          | mP62                                                                                                                                                                                                                                                                                                                                                     |
| Space group number      | 13                                                                                                                                                                                                                                                                                                                                                       |
| Space group symbol      | $P2/c$                                                                                                                                                                                                                                                                                                                                                   |
| AFLOW prototype command | <pre>aflow --proto=A8B23_mP62_13_4g_a11g-001 --params=a,b/a,c/a,<math>\beta</math>,<math>x_2,y_2,z_2,x_3,y_3,z_3,x_4,y_4,z_4,x_5,y_5,z_5,x_6,y_6,z_6,x_7,y_7,z_7,x_8,y_8,z_8,x_9,y_9,z_9,x_{10},y_{10},z_{10},x_{11},y_{11},z_{11},x_{12},y_{12},z_{12},x_{13},y_{13},z_{13},x_{14},y_{14},z_{14},x_{15},y_{15},z_{15},x_{16},y_{16},z_{16}</math></pre> |

- Above 285K the structure exhibits an incommensurate charge density wave. This data was taken at 370K, so the structure given here is only approximate. Below 285K the CDW is locked in, leading to the low temperature  $\text{Mo}_8\text{O}_{23}$  structure.

### Simple Monoclinic primitive vectors

$$\begin{aligned}\mathbf{a}_1 &= a \hat{\mathbf{x}} \\ \mathbf{a}_2 &= b \hat{\mathbf{y}} \\ \mathbf{a}_3 &= c \cos \beta \hat{\mathbf{x}} + c \sin \beta \hat{\mathbf{z}}\end{aligned}$$



### Basis vectors

|                   | Lattice coordinates                                                         |     | Cartesian coordinates                                                                                                                   | Wyckoff position | Atom type |
|-------------------|-----------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------|
| $\mathbf{B}_1$    | $= 0$                                                                       | $=$ | $0$                                                                                                                                     | (2a)             | O I       |
| $\mathbf{B}_2$    | $= \frac{1}{2} \mathbf{a}_3$                                                | $=$ | $\frac{1}{2} c \cos \beta \hat{\mathbf{x}} + \frac{1}{2} c \sin \beta \hat{\mathbf{z}}$                                                 | (2a)             | O I       |
| $\mathbf{B}_3$    | $= x_2 \mathbf{a}_1 + y_2 \mathbf{a}_2 + z_2 \mathbf{a}_3$                  | $=$ | $(ax_2 + cz_2 \cos \beta) \hat{\mathbf{x}} + by_2 \hat{\mathbf{y}} + cz_2 \sin \beta \hat{\mathbf{z}}$                                  | (4g)             | Mo I      |
| $\mathbf{B}_4$    | $= -x_2 \mathbf{a}_1 + y_2 \mathbf{a}_2 - (z_2 - \frac{1}{2}) \mathbf{a}_3$ | $=$ | $-(ax_2 + c(z_2 - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_2 \hat{\mathbf{y}} - c(z_2 - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$ | (4g)             | Mo I      |
| $\mathbf{B}_5$    | $= -x_2 \mathbf{a}_1 - y_2 \mathbf{a}_2 - z_2 \mathbf{a}_3$                 | $=$ | $-(ax_2 + cz_2 \cos \beta) \hat{\mathbf{x}} - by_2 \hat{\mathbf{y}} - cz_2 \sin \beta \hat{\mathbf{z}}$                                 | (4g)             | Mo I      |
| $\mathbf{B}_6$    | $= x_2 \mathbf{a}_1 - y_2 \mathbf{a}_2 + (z_2 + \frac{1}{2}) \mathbf{a}_3$  | $=$ | $(ax_2 + c(z_2 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_2 \hat{\mathbf{y}} + c(z_2 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$  | (4g)             | Mo I      |
| $\mathbf{B}_7$    | $= x_3 \mathbf{a}_1 + y_3 \mathbf{a}_2 + z_3 \mathbf{a}_3$                  | $=$ | $(ax_3 + cz_3 \cos \beta) \hat{\mathbf{x}} + by_3 \hat{\mathbf{y}} + cz_3 \sin \beta \hat{\mathbf{z}}$                                  | (4g)             | Mo II     |
| $\mathbf{B}_8$    | $= -x_3 \mathbf{a}_1 + y_3 \mathbf{a}_2 - (z_3 - \frac{1}{2}) \mathbf{a}_3$ | $=$ | $-(ax_3 + c(z_3 - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_3 \hat{\mathbf{y}} - c(z_3 - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$ | (4g)             | Mo II     |
| $\mathbf{B}_9$    | $= -x_3 \mathbf{a}_1 - y_3 \mathbf{a}_2 - z_3 \mathbf{a}_3$                 | $=$ | $-(ax_3 + cz_3 \cos \beta) \hat{\mathbf{x}} - by_3 \hat{\mathbf{y}} - cz_3 \sin \beta \hat{\mathbf{z}}$                                 | (4g)             | Mo II     |
| $\mathbf{B}_{10}$ | $= x_3 \mathbf{a}_1 - y_3 \mathbf{a}_2 + (z_3 + \frac{1}{2}) \mathbf{a}_3$  | $=$ | $(ax_3 + c(z_3 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_3 \hat{\mathbf{y}} + c(z_3 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$  | (4g)             | Mo II     |
| $\mathbf{B}_{11}$ | $= x_4 \mathbf{a}_1 + y_4 \mathbf{a}_2 + z_4 \mathbf{a}_3$                  | $=$ | $(ax_4 + cz_4 \cos \beta) \hat{\mathbf{x}} + by_4 \hat{\mathbf{y}} + cz_4 \sin \beta \hat{\mathbf{z}}$                                  | (4g)             | Mo III    |
| $\mathbf{B}_{12}$ | $= -x_4 \mathbf{a}_1 + y_4 \mathbf{a}_2 - (z_4 - \frac{1}{2}) \mathbf{a}_3$ | $=$ | $-(ax_4 + c(z_4 - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_4 \hat{\mathbf{y}} - c(z_4 - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$ | (4g)             | Mo III    |
| $\mathbf{B}_{13}$ | $= -x_4 \mathbf{a}_1 - y_4 \mathbf{a}_2 - z_4 \mathbf{a}_3$                 | $=$ | $-(ax_4 + cz_4 \cos \beta) \hat{\mathbf{x}} - by_4 \hat{\mathbf{y}} - cz_4 \sin \beta \hat{\mathbf{z}}$                                 | (4g)             | Mo III    |
| $\mathbf{B}_{14}$ | $= x_4 \mathbf{a}_1 - y_4 \mathbf{a}_2 + (z_4 + \frac{1}{2}) \mathbf{a}_3$  | $=$ | $(ax_4 + c(z_4 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_4 \hat{\mathbf{y}} + c(z_4 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$  | (4g)             | Mo III    |
| $\mathbf{B}_{15}$ | $= x_5 \mathbf{a}_1 + y_5 \mathbf{a}_2 + z_5 \mathbf{a}_3$                  | $=$ | $(ax_5 + cz_5 \cos \beta) \hat{\mathbf{x}} + by_5 \hat{\mathbf{y}} + cz_5 \sin \beta \hat{\mathbf{z}}$                                  | (4g)             | Mo IV     |
| $\mathbf{B}_{16}$ | $= -x_5 \mathbf{a}_1 + y_5 \mathbf{a}_2 - (z_5 - \frac{1}{2}) \mathbf{a}_3$ | $=$ | $-(ax_5 + c(z_5 - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_5 \hat{\mathbf{y}} - c(z_5 - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$ | (4g)             | Mo IV     |
| $\mathbf{B}_{17}$ | $= -x_5 \mathbf{a}_1 - y_5 \mathbf{a}_2 - z_5 \mathbf{a}_3$                 | $=$ | $-(ax_5 + cz_5 \cos \beta) \hat{\mathbf{x}} - by_5 \hat{\mathbf{y}} - cz_5 \sin \beta \hat{\mathbf{z}}$                                 | (4g)             | Mo IV     |
| $\mathbf{B}_{18}$ | $= x_5 \mathbf{a}_1 - y_5 \mathbf{a}_2 + (z_5 + \frac{1}{2}) \mathbf{a}_3$  | $=$ | $(ax_5 + c(z_5 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_5 \hat{\mathbf{y}} + c(z_5 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$  | (4g)             | Mo IV     |
| $\mathbf{B}_{19}$ | $= x_6 \mathbf{a}_1 + y_6 \mathbf{a}_2 + z_6 \mathbf{a}_3$                  | $=$ | $(ax_6 + cz_6 \cos \beta) \hat{\mathbf{x}} + by_6 \hat{\mathbf{y}} + cz_6 \sin \beta \hat{\mathbf{z}}$                                  | (4g)             | O II      |

|                     |                                                                                    |     |                                                                                                                                                          |      |        |
|---------------------|------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|
| $\mathbf{B}_{20} =$ | $-x_6 \mathbf{a}_1 + y_6 \mathbf{a}_2 - (z_6 - \frac{1}{2}) \mathbf{a}_3$          | $=$ | $-(ax_6 + c(z_6 - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_6 \hat{\mathbf{y}} -$<br>$c(z_6 - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$             | (4g) | O II   |
| $\mathbf{B}_{21} =$ | $-x_6 \mathbf{a}_1 - y_6 \mathbf{a}_2 - z_6 \mathbf{a}_3$                          | $=$ | $-(ax_6 + cz_6 \cos \beta) \hat{\mathbf{x}} - by_6 \hat{\mathbf{y}} - cz_6 \sin \beta \hat{\mathbf{z}}$                                                  | (4g) | O II   |
| $\mathbf{B}_{22} =$ | $x_6 \mathbf{a}_1 - y_6 \mathbf{a}_2 + (z_6 + \frac{1}{2}) \mathbf{a}_3$           | $=$ | $(ax_6 + c(z_6 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_6 \hat{\mathbf{y}} +$<br>$c(z_6 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$              | (4g) | O II   |
| $\mathbf{B}_{23} =$ | $x_7 \mathbf{a}_1 + y_7 \mathbf{a}_2 + z_7 \mathbf{a}_3$                           | $=$ | $(ax_7 + cz_7 \cos \beta) \hat{\mathbf{x}} + by_7 \hat{\mathbf{y}} + cz_7 \sin \beta \hat{\mathbf{z}}$                                                   | (4g) | O III  |
| $\mathbf{B}_{24} =$ | $-x_7 \mathbf{a}_1 + y_7 \mathbf{a}_2 - (z_7 - \frac{1}{2}) \mathbf{a}_3$          | $=$ | $-(ax_7 + c(z_7 - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_7 \hat{\mathbf{y}} -$<br>$c(z_7 - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$             | (4g) | O III  |
| $\mathbf{B}_{25} =$ | $-x_7 \mathbf{a}_1 - y_7 \mathbf{a}_2 - z_7 \mathbf{a}_3$                          | $=$ | $-(ax_7 + cz_7 \cos \beta) \hat{\mathbf{x}} - by_7 \hat{\mathbf{y}} - cz_7 \sin \beta \hat{\mathbf{z}}$                                                  | (4g) | O III  |
| $\mathbf{B}_{26} =$ | $x_7 \mathbf{a}_1 - y_7 \mathbf{a}_2 + (z_7 + \frac{1}{2}) \mathbf{a}_3$           | $=$ | $(ax_7 + c(z_7 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_7 \hat{\mathbf{y}} +$<br>$c(z_7 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$              | (4g) | O III  |
| $\mathbf{B}_{27} =$ | $x_8 \mathbf{a}_1 + y_8 \mathbf{a}_2 + z_8 \mathbf{a}_3$                           | $=$ | $(ax_8 + cz_8 \cos \beta) \hat{\mathbf{x}} + by_8 \hat{\mathbf{y}} + cz_8 \sin \beta \hat{\mathbf{z}}$                                                   | (4g) | O IV   |
| $\mathbf{B}_{28} =$ | $-x_8 \mathbf{a}_1 + y_8 \mathbf{a}_2 - (z_8 - \frac{1}{2}) \mathbf{a}_3$          | $=$ | $-(ax_8 + c(z_8 - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_8 \hat{\mathbf{y}} -$<br>$c(z_8 - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$             | (4g) | O IV   |
| $\mathbf{B}_{29} =$ | $-x_8 \mathbf{a}_1 - y_8 \mathbf{a}_2 - z_8 \mathbf{a}_3$                          | $=$ | $-(ax_8 + cz_8 \cos \beta) \hat{\mathbf{x}} - by_8 \hat{\mathbf{y}} - cz_8 \sin \beta \hat{\mathbf{z}}$                                                  | (4g) | O IV   |
| $\mathbf{B}_{30} =$ | $x_8 \mathbf{a}_1 - y_8 \mathbf{a}_2 + (z_8 + \frac{1}{2}) \mathbf{a}_3$           | $=$ | $(ax_8 + c(z_8 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_8 \hat{\mathbf{y}} +$<br>$c(z_8 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$              | (4g) | O IV   |
| $\mathbf{B}_{31} =$ | $x_9 \mathbf{a}_1 + y_9 \mathbf{a}_2 + z_9 \mathbf{a}_3$                           | $=$ | $(ax_9 + cz_9 \cos \beta) \hat{\mathbf{x}} + by_9 \hat{\mathbf{y}} + cz_9 \sin \beta \hat{\mathbf{z}}$                                                   | (4g) | O V    |
| $\mathbf{B}_{32} =$ | $-x_9 \mathbf{a}_1 + y_9 \mathbf{a}_2 - (z_9 - \frac{1}{2}) \mathbf{a}_3$          | $=$ | $-(ax_9 + c(z_9 - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_9 \hat{\mathbf{y}} -$<br>$c(z_9 - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$             | (4g) | O V    |
| $\mathbf{B}_{33} =$ | $-x_9 \mathbf{a}_1 - y_9 \mathbf{a}_2 - z_9 \mathbf{a}_3$                          | $=$ | $-(ax_9 + cz_9 \cos \beta) \hat{\mathbf{x}} - by_9 \hat{\mathbf{y}} - cz_9 \sin \beta \hat{\mathbf{z}}$                                                  | (4g) | O V    |
| $\mathbf{B}_{34} =$ | $x_9 \mathbf{a}_1 - y_9 \mathbf{a}_2 + (z_9 + \frac{1}{2}) \mathbf{a}_3$           | $=$ | $(ax_9 + c(z_9 + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_9 \hat{\mathbf{y}} +$<br>$c(z_9 + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$              | (4g) | O V    |
| $\mathbf{B}_{35} =$ | $x_{10} \mathbf{a}_1 + y_{10} \mathbf{a}_2 + z_{10} \mathbf{a}_3$                  | $=$ | $(ax_{10} + cz_{10} \cos \beta) \hat{\mathbf{x}} + by_{10} \hat{\mathbf{y}} + cz_{10} \sin \beta \hat{\mathbf{z}}$                                       | (4g) | O VI   |
| $\mathbf{B}_{36} =$ | $-x_{10} \mathbf{a}_1 + y_{10} \mathbf{a}_2 - (z_{10} - \frac{1}{2}) \mathbf{a}_3$ | $=$ | $-(ax_{10} + c(z_{10} - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_{10} \hat{\mathbf{y}} -$<br>$c(z_{10} - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$ | (4g) | O VI   |
| $\mathbf{B}_{37} =$ | $-x_{10} \mathbf{a}_1 - y_{10} \mathbf{a}_2 - z_{10} \mathbf{a}_3$                 | $=$ | $-(ax_{10} + cz_{10} \cos \beta) \hat{\mathbf{x}} - by_{10} \hat{\mathbf{y}} -$<br>$cz_{10} \sin \beta \hat{\mathbf{z}}$                                 | (4g) | O VI   |
| $\mathbf{B}_{38} =$ | $x_{10} \mathbf{a}_1 - y_{10} \mathbf{a}_2 + (z_{10} + \frac{1}{2}) \mathbf{a}_3$  | $=$ | $(ax_{10} + c(z_{10} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{10} \hat{\mathbf{y}} +$<br>$c(z_{10} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$  | (4g) | O VI   |
| $\mathbf{B}_{39} =$ | $x_{11} \mathbf{a}_1 + y_{11} \mathbf{a}_2 + z_{11} \mathbf{a}_3$                  | $=$ | $(ax_{11} + cz_{11} \cos \beta) \hat{\mathbf{x}} + by_{11} \hat{\mathbf{y}} + cz_{11} \sin \beta \hat{\mathbf{z}}$                                       | (4g) | O VII  |
| $\mathbf{B}_{40} =$ | $-x_{11} \mathbf{a}_1 + y_{11} \mathbf{a}_2 - (z_{11} - \frac{1}{2}) \mathbf{a}_3$ | $=$ | $-(ax_{11} + c(z_{11} - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_{11} \hat{\mathbf{y}} -$<br>$c(z_{11} - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$ | (4g) | O VII  |
| $\mathbf{B}_{41} =$ | $-x_{11} \mathbf{a}_1 - y_{11} \mathbf{a}_2 - z_{11} \mathbf{a}_3$                 | $=$ | $-(ax_{11} + cz_{11} \cos \beta) \hat{\mathbf{x}} - by_{11} \hat{\mathbf{y}} -$<br>$cz_{11} \sin \beta \hat{\mathbf{z}}$                                 | (4g) | O VII  |
| $\mathbf{B}_{42} =$ | $x_{11} \mathbf{a}_1 - y_{11} \mathbf{a}_2 + (z_{11} + \frac{1}{2}) \mathbf{a}_3$  | $=$ | $(ax_{11} + c(z_{11} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{11} \hat{\mathbf{y}} +$<br>$c(z_{11} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$  | (4g) | O VII  |
| $\mathbf{B}_{43} =$ | $x_{12} \mathbf{a}_1 + y_{12} \mathbf{a}_2 + z_{12} \mathbf{a}_3$                  | $=$ | $(ax_{12} + cz_{12} \cos \beta) \hat{\mathbf{x}} + by_{12} \hat{\mathbf{y}} + cz_{12} \sin \beta \hat{\mathbf{z}}$                                       | (4g) | O VIII |
| $\mathbf{B}_{44} =$ | $-x_{12} \mathbf{a}_1 + y_{12} \mathbf{a}_2 - (z_{12} - \frac{1}{2}) \mathbf{a}_3$ | $=$ | $-(ax_{12} + c(z_{12} - \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} + by_{12} \hat{\mathbf{y}} -$<br>$c(z_{12} - \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$ | (4g) | O VIII |
| $\mathbf{B}_{45} =$ | $-x_{12} \mathbf{a}_1 - y_{12} \mathbf{a}_2 - z_{12} \mathbf{a}_3$                 | $=$ | $-(ax_{12} + cz_{12} \cos \beta) \hat{\mathbf{x}} - by_{12} \hat{\mathbf{y}} -$<br>$cz_{12} \sin \beta \hat{\mathbf{z}}$                                 | (4g) | O VIII |
| $\mathbf{B}_{46} =$ | $x_{12} \mathbf{a}_1 - y_{12} \mathbf{a}_2 + (z_{12} + \frac{1}{2}) \mathbf{a}_3$  | $=$ | $(ax_{12} + c(z_{12} + \frac{1}{2}) \cos \beta) \hat{\mathbf{x}} - by_{12} \hat{\mathbf{y}} +$<br>$c(z_{12} + \frac{1}{2}) \sin \beta \hat{\mathbf{z}}$  | (4g) | O VIII |
| $\mathbf{B}_{47} =$ | $x_{13} \mathbf{a}_1 + y_{13} \mathbf{a}_2 + z_{13} \mathbf{a}_3$                  | $=$ | $(ax_{13} + cz_{13} \cos \beta) \hat{\mathbf{x}} + by_{13} \hat{\mathbf{y}} + cz_{13} \sin \beta \hat{\mathbf{z}}$                                       | (4g) | O IX   |

$$\begin{aligned}
\mathbf{B}_{48} &= -x_{13} \mathbf{a}_1 + y_{13} \mathbf{a}_2 - \left(z_{13} - \frac{1}{2}\right) \mathbf{a}_3 = -\left(ax_{13} + c\left(z_{13} - \frac{1}{2}\right) \cos \beta\right) \hat{\mathbf{x}} + by_{13} \hat{\mathbf{y}} - c\left(z_{13} - \frac{1}{2}\right) \sin \beta \hat{\mathbf{z}} & (4g) & \text{O IX} \\
\mathbf{B}_{49} &= -x_{13} \mathbf{a}_1 - y_{13} \mathbf{a}_2 - z_{13} \mathbf{a}_3 = -\left(ax_{13} + cz_{13} \cos \beta\right) \hat{\mathbf{x}} - by_{13} \hat{\mathbf{y}} - cz_{13} \sin \beta \hat{\mathbf{z}} & (4g) & \text{O IX} \\
\mathbf{B}_{50} &= x_{13} \mathbf{a}_1 - y_{13} \mathbf{a}_2 + \left(z_{13} + \frac{1}{2}\right) \mathbf{a}_3 = \left(ax_{13} + c\left(z_{13} + \frac{1}{2}\right) \cos \beta\right) \hat{\mathbf{x}} - by_{13} \hat{\mathbf{y}} + c\left(z_{13} + \frac{1}{2}\right) \sin \beta \hat{\mathbf{z}} & (4g) & \text{O IX} \\
\mathbf{B}_{51} &= x_{14} \mathbf{a}_1 + y_{14} \mathbf{a}_2 + z_{14} \mathbf{a}_3 = \left(ax_{14} + cz_{14} \cos \beta\right) \hat{\mathbf{x}} + by_{14} \hat{\mathbf{y}} + cz_{14} \sin \beta \hat{\mathbf{z}} & (4g) & \text{O X} \\
\mathbf{B}_{52} &= -x_{14} \mathbf{a}_1 + y_{14} \mathbf{a}_2 - \left(z_{14} - \frac{1}{2}\right) \mathbf{a}_3 = -\left(ax_{14} + c\left(z_{14} - \frac{1}{2}\right) \cos \beta\right) \hat{\mathbf{x}} + by_{14} \hat{\mathbf{y}} - c\left(z_{14} - \frac{1}{2}\right) \sin \beta \hat{\mathbf{z}} & (4g) & \text{O X} \\
\mathbf{B}_{53} &= -x_{14} \mathbf{a}_1 - y_{14} \mathbf{a}_2 - z_{14} \mathbf{a}_3 = -\left(ax_{14} + cz_{14} \cos \beta\right) \hat{\mathbf{x}} - by_{14} \hat{\mathbf{y}} - cz_{14} \sin \beta \hat{\mathbf{z}} & (4g) & \text{O X} \\
\mathbf{B}_{54} &= x_{14} \mathbf{a}_1 - y_{14} \mathbf{a}_2 + \left(z_{14} + \frac{1}{2}\right) \mathbf{a}_3 = \left(ax_{14} + c\left(z_{14} + \frac{1}{2}\right) \cos \beta\right) \hat{\mathbf{x}} - by_{14} \hat{\mathbf{y}} + c\left(z_{14} + \frac{1}{2}\right) \sin \beta \hat{\mathbf{z}} & (4g) & \text{O X} \\
\mathbf{B}_{55} &= x_{15} \mathbf{a}_1 + y_{15} \mathbf{a}_2 + z_{15} \mathbf{a}_3 = \left(ax_{15} + cz_{15} \cos \beta\right) \hat{\mathbf{x}} + by_{15} \hat{\mathbf{y}} + cz_{15} \sin \beta \hat{\mathbf{z}} & (4g) & \text{O XI} \\
\mathbf{B}_{56} &= -x_{15} \mathbf{a}_1 + y_{15} \mathbf{a}_2 - \left(z_{15} - \frac{1}{2}\right) \mathbf{a}_3 = -\left(ax_{15} + c\left(z_{15} - \frac{1}{2}\right) \cos \beta\right) \hat{\mathbf{x}} + by_{15} \hat{\mathbf{y}} - c\left(z_{15} - \frac{1}{2}\right) \sin \beta \hat{\mathbf{z}} & (4g) & \text{O XI} \\
\mathbf{B}_{57} &= -x_{15} \mathbf{a}_1 - y_{15} \mathbf{a}_2 - z_{15} \mathbf{a}_3 = -\left(ax_{15} + cz_{15} \cos \beta\right) \hat{\mathbf{x}} - by_{15} \hat{\mathbf{y}} - cz_{15} \sin \beta \hat{\mathbf{z}} & (4g) & \text{O XI} \\
\mathbf{B}_{58} &= x_{15} \mathbf{a}_1 - y_{15} \mathbf{a}_2 + \left(z_{15} + \frac{1}{2}\right) \mathbf{a}_3 = \left(ax_{15} + c\left(z_{15} + \frac{1}{2}\right) \cos \beta\right) \hat{\mathbf{x}} - by_{15} \hat{\mathbf{y}} + c\left(z_{15} + \frac{1}{2}\right) \sin \beta \hat{\mathbf{z}} & (4g) & \text{O XI} \\
\mathbf{B}_{59} &= x_{16} \mathbf{a}_1 + y_{16} \mathbf{a}_2 + z_{16} \mathbf{a}_3 = \left(ax_{16} + cz_{16} \cos \beta\right) \hat{\mathbf{x}} + by_{16} \hat{\mathbf{y}} + cz_{16} \sin \beta \hat{\mathbf{z}} & (4g) & \text{O XII} \\
\mathbf{B}_{60} &= -x_{16} \mathbf{a}_1 + y_{16} \mathbf{a}_2 - \left(z_{16} - \frac{1}{2}\right) \mathbf{a}_3 = -\left(ax_{16} + c\left(z_{16} - \frac{1}{2}\right) \cos \beta\right) \hat{\mathbf{x}} + by_{16} \hat{\mathbf{y}} - c\left(z_{16} - \frac{1}{2}\right) \sin \beta \hat{\mathbf{z}} & (4g) & \text{O XII} \\
\mathbf{B}_{61} &= -x_{16} \mathbf{a}_1 - y_{16} \mathbf{a}_2 - z_{16} \mathbf{a}_3 = -\left(ax_{16} + cz_{16} \cos \beta\right) \hat{\mathbf{x}} - by_{16} \hat{\mathbf{y}} - cz_{16} \sin \beta \hat{\mathbf{z}} & (4g) & \text{O XII} \\
\mathbf{B}_{62} &= x_{16} \mathbf{a}_1 - y_{16} \mathbf{a}_2 + \left(z_{16} + \frac{1}{2}\right) \mathbf{a}_3 = \left(ax_{16} + c\left(z_{16} + \frac{1}{2}\right) \cos \beta\right) \hat{\mathbf{x}} - by_{16} \hat{\mathbf{y}} + c\left(z_{16} + \frac{1}{2}\right) \sin \beta \hat{\mathbf{z}} & (4g) & \text{O XII}
\end{aligned}$$

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