

γ -Fe₂O₃ (*D*5₇) Structure: A2B3_cP60_212_acd_bce-001

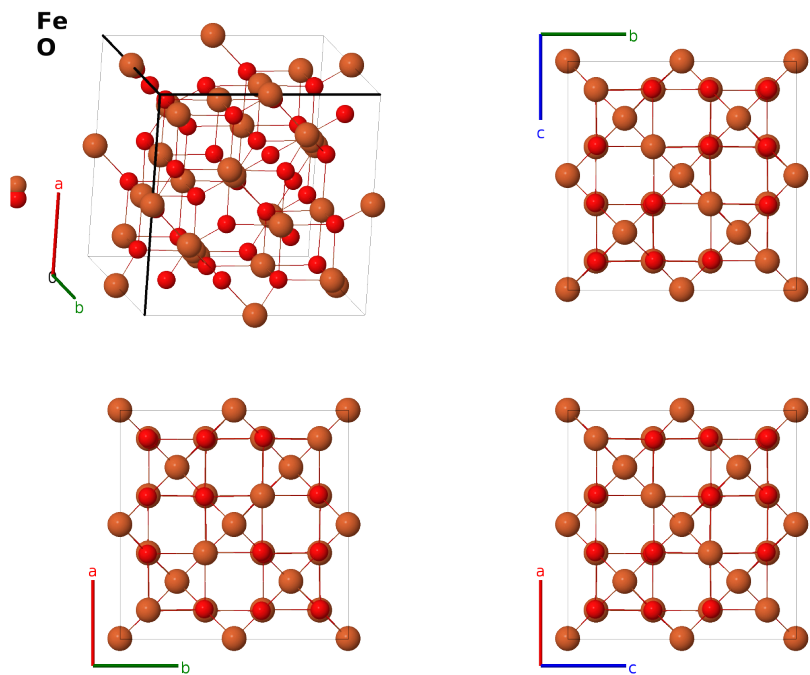
This structure previously used the label(s) **A2B3_cP60_212_bcd_ace**. Calls to these addresses will be redirected here.

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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/J7V3>

https://aflow.org/prototype-encyclopedia/A2B3_cP60_212_acd_bce-001



Prototype	Fe ₂ O ₃
AFLOW prototype label	A2B3_cP60_212_acd_bce-001
<i>Strukturbericht</i> designation	<i>D</i> 5 ₇
Pearson symbol	cP60
Space group number	212
Space group symbol	<i>P</i> 4 ₃ 32
AFLOW prototype command	<code>aflow --proto=A2B3_cP60_212_acd_bce-001</code> <code>--params=<i>a</i>, <i>x</i>₃, <i>x</i>₄, <i>y</i>₅, <i>x</i>₆, <i>y</i>₆, <i>z</i>₆</code>

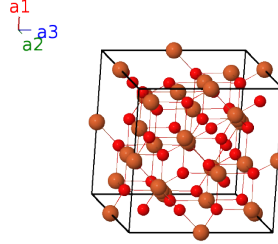
Other compounds with this structure

γ -Al₂O₃ (γ -corundum)

- (Hermann, 1937) gives $\gamma\text{-Al}_2\text{O}_3$ as the prototype for *Strukturbericht D5₇*, but states that the data for $\gamma\text{-Fe}_2\text{O}_3$ is more reliable and presents the data for the later compound, which we use as the prototype.
- More information about the Al_2O_3 compounds can be found on the corundum (*D5₁*) page.
- This is a rock-salt (*B1*) structure with defects.
- This structure can also be expressed in the enantiomorphic space group $P4_132$ #213.

Simple Cubic primitive vectors

$$\begin{aligned}\mathbf{a}_1 &= a \hat{\mathbf{x}} \\ \mathbf{a}_2 &= a \hat{\mathbf{y}} \\ \mathbf{a}_3 &= a \hat{\mathbf{z}}\end{aligned}$$



Basis vectors

	Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B}_1$	$= \frac{1}{8} \mathbf{a}_1 + \frac{1}{8} \mathbf{a}_2 + \frac{1}{8} \mathbf{a}_3$	$=$	$\frac{1}{8} a \hat{\mathbf{x}} + \frac{1}{8} a \hat{\mathbf{y}} + \frac{1}{8} a \hat{\mathbf{z}}$	(4a)	Fe I
$\mathbf{B}_2$	$= \frac{3}{8} \mathbf{a}_1 + \frac{7}{8} \mathbf{a}_2 + \frac{5}{8} \mathbf{a}_3$	$=$	$\frac{3}{8} a \hat{\mathbf{x}} + \frac{7}{8} a \hat{\mathbf{y}} + \frac{5}{8} a \hat{\mathbf{z}}$	(4a)	Fe I
$\mathbf{B}_3$	$= \frac{7}{8} \mathbf{a}_1 + \frac{5}{8} \mathbf{a}_2 + \frac{3}{8} \mathbf{a}_3$	$=$	$\frac{7}{8} a \hat{\mathbf{x}} + \frac{5}{8} a \hat{\mathbf{y}} + \frac{3}{8} a \hat{\mathbf{z}}$	(4a)	Fe I
$\mathbf{B}_4$	$= \frac{5}{8} \mathbf{a}_1 + \frac{3}{8} \mathbf{a}_2 + \frac{7}{8} \mathbf{a}_3$	$=$	$\frac{5}{8} a \hat{\mathbf{x}} + \frac{3}{8} a \hat{\mathbf{y}} + \frac{7}{8} a \hat{\mathbf{z}}$	(4a)	Fe I
$\mathbf{B}_5$	$= \frac{5}{8} \mathbf{a}_1 + \frac{5}{8} \mathbf{a}_2 + \frac{5}{8} \mathbf{a}_3$	$=$	$\frac{5}{8} a \hat{\mathbf{x}} + \frac{5}{8} a \hat{\mathbf{y}} + \frac{5}{8} a \hat{\mathbf{z}}$	(4b)	O I
$\mathbf{B}_6$	$= \frac{7}{8} \mathbf{a}_1 + \frac{3}{8} \mathbf{a}_2 + \frac{1}{8} \mathbf{a}_3$	$=$	$\frac{7}{8} a \hat{\mathbf{x}} + \frac{3}{8} a \hat{\mathbf{y}} + \frac{1}{8} a \hat{\mathbf{z}}$	(4b)	O I
$\mathbf{B}_7$	$= \frac{3}{8} \mathbf{a}_1 + \frac{1}{8} \mathbf{a}_2 + \frac{7}{8} \mathbf{a}_3$	$=$	$\frac{3}{8} a \hat{\mathbf{x}} + \frac{1}{8} a \hat{\mathbf{y}} + \frac{7}{8} a \hat{\mathbf{z}}$	(4b)	O I
$\mathbf{B}_8$	$= \frac{1}{8} \mathbf{a}_1 + \frac{7}{8} \mathbf{a}_2 + \frac{3}{8} \mathbf{a}_3$	$=$	$\frac{1}{8} a \hat{\mathbf{x}} + \frac{7}{8} a \hat{\mathbf{y}} + \frac{3}{8} a \hat{\mathbf{z}}$	(4b)	O I
$\mathbf{B}_9$	$= x_3 \mathbf{a}_1 + x_3 \mathbf{a}_2 + x_3 \mathbf{a}_3$	$=$	$a x_3 \hat{\mathbf{x}} + a x_3 \hat{\mathbf{y}} + a x_3 \hat{\mathbf{z}}$	(8c)	Fe II
$\mathbf{B}_{10}$	$= -\left(x_3 - \frac{1}{2}\right) \mathbf{a}_1 - x_3 \mathbf{a}_2 + \left(x_3 + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-a \left(x_3 - \frac{1}{2}\right) \hat{\mathbf{x}} - a x_3 \hat{\mathbf{y}} + a \left(x_3 + \frac{1}{2}\right) \hat{\mathbf{z}}$	(8c)	Fe II
$\mathbf{B}_{11}$	$= -x_3 \mathbf{a}_1 + \left(x_3 + \frac{1}{2}\right) \mathbf{a}_2 - \left(x_3 - \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-a x_3 \hat{\mathbf{x}} + a \left(x_3 + \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(x_3 - \frac{1}{2}\right) \hat{\mathbf{z}}$	(8c)	Fe II
$\mathbf{B}_{12}$	$= \left(x_3 + \frac{1}{2}\right) \mathbf{a}_1 - \left(x_3 - \frac{1}{2}\right) \mathbf{a}_2 - x_3 \mathbf{a}_3$	$=$	$a \left(x_3 + \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(x_3 - \frac{1}{2}\right) \hat{\mathbf{y}} - a x_3 \hat{\mathbf{z}}$	(8c)	Fe II
$\mathbf{B}_{13}$	$= \left(x_3 + \frac{1}{4}\right) \mathbf{a}_1 + \left(x_3 + \frac{3}{4}\right) \mathbf{a}_2 - \left(x_3 - \frac{3}{4}\right) \mathbf{a}_3$	$=$	$a \left(x_3 + \frac{1}{4}\right) \hat{\mathbf{x}} + a \left(x_3 + \frac{3}{4}\right) \hat{\mathbf{y}} - a \left(x_3 - \frac{3}{4}\right) \hat{\mathbf{z}}$	(8c)	Fe II
$\mathbf{B}_{14}$	$= -\left(x_3 - \frac{1}{4}\right) \mathbf{a}_1 - \left(x_3 - \frac{1}{4}\right) \mathbf{a}_2 - \left(x_3 - \frac{1}{4}\right) \mathbf{a}_3$	$=$	$-a \left(x_3 - \frac{1}{4}\right) \hat{\mathbf{x}} - a \left(x_3 - \frac{1}{4}\right) \hat{\mathbf{y}} - a \left(x_3 - \frac{1}{4}\right) \hat{\mathbf{z}}$	(8c)	Fe II
$\mathbf{B}_{15}$	$= \left(x_3 + \frac{3}{4}\right) \mathbf{a}_1 - \left(x_3 - \frac{3}{4}\right) \mathbf{a}_2 + \left(x_3 + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$a \left(x_3 + \frac{3}{4}\right) \hat{\mathbf{x}} - a \left(x_3 - \frac{3}{4}\right) \hat{\mathbf{y}} + a \left(x_3 + \frac{1}{4}\right) \hat{\mathbf{z}}$	(8c)	Fe II
$\mathbf{B}_{16}$	$= -\left(x_3 - \frac{3}{4}\right) \mathbf{a}_1 + \left(x_3 + \frac{1}{4}\right) \mathbf{a}_2 + \left(x_3 + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$-a \left(x_3 - \frac{3}{4}\right) \hat{\mathbf{x}} + a \left(x_3 + \frac{1}{4}\right) \hat{\mathbf{y}} + a \left(x_3 + \frac{3}{4}\right) \hat{\mathbf{z}}$	(8c)	Fe II
$\mathbf{B}_{17}$	$= x_4 \mathbf{a}_1 + x_4 \mathbf{a}_2 + x_4 \mathbf{a}_3$	$=$	$a x_4 \hat{\mathbf{x}} + a x_4 \hat{\mathbf{y}} + a x_4 \hat{\mathbf{z}}$	(8c)	O II

$\mathbf{B}_{18} =$	$-\left(x_4 - \frac{1}{2}\right) \mathbf{a}_1 - x_4 \mathbf{a}_2 +$	$=$	$-a\left(x_4 - \frac{1}{2}\right) \hat{\mathbf{x}} - ax_4 \hat{\mathbf{y}} + a\left(x_4 + \frac{1}{2}\right) \hat{\mathbf{z}}$	(8c)	O II
	$\left(x_4 + \frac{1}{2}\right) \mathbf{a}_3$				
$\mathbf{B}_{19} =$	$-x_4 \mathbf{a}_1 + \left(x_4 + \frac{1}{2}\right) \mathbf{a}_2 -$	$=$	$-ax_4 \hat{\mathbf{x}} + a\left(x_4 + \frac{1}{2}\right) \hat{\mathbf{y}} - a\left(x_4 - \frac{1}{2}\right) \hat{\mathbf{z}}$	(8c)	O II
	$\left(x_4 - \frac{1}{2}\right) \mathbf{a}_3$				
$\mathbf{B}_{20} =$	$\left(x_4 + \frac{1}{2}\right) \mathbf{a}_1 - \left(x_4 - \frac{1}{2}\right) \mathbf{a}_2 - x_4 \mathbf{a}_3$	$=$	$a\left(x_4 + \frac{1}{2}\right) \hat{\mathbf{x}} - a\left(x_4 - \frac{1}{2}\right) \hat{\mathbf{y}} - ax_4 \hat{\mathbf{z}}$	(8c)	O II
$\mathbf{B}_{21} =$	$\left(x_4 + \frac{1}{4}\right) \mathbf{a}_1 + \left(x_4 + \frac{3}{4}\right) \mathbf{a}_2 -$	$=$	$a\left(x_4 + \frac{1}{4}\right) \hat{\mathbf{x}} + a\left(x_4 + \frac{3}{4}\right) \hat{\mathbf{y}} - a\left(x_4 - \frac{3}{4}\right) \hat{\mathbf{z}}$	(8c)	O II
	$\left(x_4 - \frac{3}{4}\right) \mathbf{a}_3$				
$\mathbf{B}_{22} =$	$-\left(x_4 - \frac{1}{4}\right) \mathbf{a}_1 - \left(x_4 - \frac{1}{4}\right) \mathbf{a}_2 -$	$=$	$-a\left(x_4 - \frac{1}{4}\right) \hat{\mathbf{x}} - a\left(x_4 - \frac{1}{4}\right) \hat{\mathbf{y}} -$	(8c)	O II
	$\left(x_4 - \frac{1}{4}\right) \mathbf{a}_3$		$a\left(x_4 - \frac{1}{4}\right) \hat{\mathbf{z}}$		
$\mathbf{B}_{23} =$	$\left(x_4 + \frac{3}{4}\right) \mathbf{a}_1 - \left(x_4 - \frac{3}{4}\right) \mathbf{a}_2 +$	$=$	$a\left(x_4 + \frac{3}{4}\right) \hat{\mathbf{x}} - a\left(x_4 - \frac{3}{4}\right) \hat{\mathbf{y}} + a\left(x_4 + \frac{1}{4}\right) \hat{\mathbf{z}}$	(8c)	O II
	$\left(x_4 + \frac{1}{4}\right) \mathbf{a}_3$				
$\mathbf{B}_{24} =$	$-\left(x_4 - \frac{3}{4}\right) \mathbf{a}_1 + \left(x_4 + \frac{1}{4}\right) \mathbf{a}_2 +$	$=$	$-a\left(x_4 - \frac{3}{4}\right) \hat{\mathbf{x}} + a\left(x_4 + \frac{1}{4}\right) \hat{\mathbf{y}} +$	(8c)	O II
	$\left(x_4 + \frac{3}{4}\right) \mathbf{a}_3$		$a\left(x_4 + \frac{3}{4}\right) \hat{\mathbf{z}}$		
$\mathbf{B}_{25} =$	$\frac{1}{8} \mathbf{a}_1 + y_5 \mathbf{a}_2 - \left(y_5 - \frac{1}{4}\right) \mathbf{a}_3$	$=$	$\frac{1}{8} a \hat{\mathbf{x}} + ay_5 \hat{\mathbf{y}} - a\left(y_5 - \frac{1}{4}\right) \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{26} =$	$\frac{3}{8} \mathbf{a}_1 - y_5 \mathbf{a}_2 - \left(y_5 - \frac{3}{4}\right) \mathbf{a}_3$	$=$	$\frac{3}{8} a \hat{\mathbf{x}} - ay_5 \hat{\mathbf{y}} - a\left(y_5 - \frac{3}{4}\right) \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{27} =$	$\frac{7}{8} \mathbf{a}_1 + \left(y_5 + \frac{1}{2}\right) \mathbf{a}_2 + \left(y_5 + \frac{1}{4}\right) \mathbf{a}_3$	$=$	$\frac{7}{8} a \hat{\mathbf{x}} + a\left(y_5 + \frac{1}{2}\right) \hat{\mathbf{y}} + a\left(y_5 + \frac{1}{4}\right) \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{28} =$	$\frac{5}{8} \mathbf{a}_1 - \left(y_5 - \frac{1}{2}\right) \mathbf{a}_2 + \left(y_5 + \frac{3}{4}\right) \mathbf{a}_3$	$=$	$\frac{5}{8} a \hat{\mathbf{x}} - a\left(y_5 - \frac{1}{2}\right) \hat{\mathbf{y}} + a\left(y_5 + \frac{3}{4}\right) \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{29} =$	$-\left(y_5 - \frac{1}{4}\right) \mathbf{a}_1 + \frac{1}{8} \mathbf{a}_2 + y_5 \mathbf{a}_3$	$=$	$-a\left(y_5 - \frac{1}{4}\right) \hat{\mathbf{x}} + \frac{1}{8} a \hat{\mathbf{y}} + ay_5 \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{30} =$	$-\left(y_5 - \frac{3}{4}\right) \mathbf{a}_1 + \frac{3}{8} \mathbf{a}_2 - y_5 \mathbf{a}_3$	$=$	$-a\left(y_5 - \frac{3}{4}\right) \hat{\mathbf{x}} + \frac{3}{8} a \hat{\mathbf{y}} - ay_5 \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{31} =$	$\left(y_5 + \frac{1}{4}\right) \mathbf{a}_1 + \frac{7}{8} \mathbf{a}_2 + \left(y_5 + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$a\left(y_5 + \frac{1}{4}\right) \hat{\mathbf{x}} + \frac{7}{8} a \hat{\mathbf{y}} + a\left(y_5 + \frac{1}{2}\right) \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{32} =$	$\left(y_5 + \frac{3}{4}\right) \mathbf{a}_1 + \frac{5}{8} \mathbf{a}_2 - \left(y_5 - \frac{1}{2}\right) \mathbf{a}_3$	$=$	$a\left(y_5 + \frac{3}{4}\right) \hat{\mathbf{x}} + \frac{5}{8} a \hat{\mathbf{y}} - a\left(y_5 - \frac{1}{2}\right) \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{33} =$	$y_5 \mathbf{a}_1 - \left(y_5 - \frac{1}{4}\right) \mathbf{a}_2 + \frac{1}{8} \mathbf{a}_3$	$=$	$ay_5 \hat{\mathbf{x}} - a\left(y_5 - \frac{1}{4}\right) \hat{\mathbf{y}} + \frac{1}{8} a \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{34} =$	$-y_5 \mathbf{a}_1 - \left(y_5 - \frac{3}{4}\right) \mathbf{a}_2 + \frac{3}{8} \mathbf{a}_3$	$=$	$-ay_5 \hat{\mathbf{x}} - a\left(y_5 - \frac{3}{4}\right) \hat{\mathbf{y}} + \frac{3}{8} a \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{35} =$	$\left(y_5 + \frac{1}{2}\right) \mathbf{a}_1 + \left(y_5 + \frac{1}{4}\right) \mathbf{a}_2 + \frac{7}{8} \mathbf{a}_3$	$=$	$a\left(y_5 + \frac{1}{2}\right) \hat{\mathbf{x}} + a\left(y_5 + \frac{1}{4}\right) \hat{\mathbf{y}} + \frac{7}{8} a \hat{\mathbf{z}}$	(12d)	Fe III
$\mathbf{B}_{36} =$	$-\left(y_5 - \frac{1}{2}\right) \mathbf{a}_1 + \left(y_5 + \frac{3}{4}\right) \mathbf{a}_2 +$	$=$	$-a\left(y_5 - \frac{1}{2}\right) \hat{\mathbf{x}} + a\left(y_5 + \frac{3}{4}\right) \hat{\mathbf{y}} + \frac{5}{8} a \hat{\mathbf{z}}$	(12d)	Fe III
	$\frac{5}{8} \mathbf{a}_3$				
$\mathbf{B}_{37} =$	$x_6 \mathbf{a}_1 + y_6 \mathbf{a}_2 + z_6 \mathbf{a}_3$	$=$	$ax_6 \hat{\mathbf{x}} + ay_6 \hat{\mathbf{y}} + az_6 \hat{\mathbf{z}}$	(24e)	O III
$\mathbf{B}_{38} =$	$-\left(x_6 - \frac{1}{2}\right) \mathbf{a}_1 - y_6 \mathbf{a}_2 +$	$=$	$-a\left(x_6 - \frac{1}{2}\right) \hat{\mathbf{x}} - ay_6 \hat{\mathbf{y}} + a\left(z_6 + \frac{1}{2}\right) \hat{\mathbf{z}}$	(24e)	O III
	$\left(z_6 + \frac{1}{2}\right) \mathbf{a}_3$				
$\mathbf{B}_{39} =$	$-x_6 \mathbf{a}_1 + \left(y$				

$$\begin{aligned}
\mathbf{B}_{49} &= \begin{pmatrix} y_6 + \frac{1}{4} \\ z_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_1 + \begin{pmatrix} x_6 + \frac{3}{4} \\ z_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_2 - \begin{pmatrix} y_6 + \frac{1}{4} \\ z_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_3 &= a \begin{pmatrix} y_6 + \frac{1}{4} \\ z_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{x}} + a \begin{pmatrix} x_6 + \frac{3}{4} \\ z_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{y}} - a \begin{pmatrix} y_6 + \frac{1}{4} \\ z_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{50} &= -\begin{pmatrix} y_6 - \frac{1}{4} \\ z_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_1 - \begin{pmatrix} x_6 - \frac{1}{4} \\ z_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_2 - \begin{pmatrix} y_6 - \frac{1}{4} \\ z_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_3 &= -a \begin{pmatrix} y_6 - \frac{1}{4} \\ z_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{x}} - a \begin{pmatrix} x_6 - \frac{1}{4} \\ z_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{y}} - a \begin{pmatrix} y_6 - \frac{1}{4} \\ z_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{51} &= \begin{pmatrix} y_6 + \frac{3}{4} \\ z_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_1 - \begin{pmatrix} x_6 - \frac{3}{4} \\ z_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_2 + \begin{pmatrix} y_6 + \frac{3}{4} \\ z_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_3 &= a \begin{pmatrix} y_6 + \frac{3}{4} \\ z_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{x}} - a \begin{pmatrix} x_6 - \frac{3}{4} \\ z_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{y}} + a \begin{pmatrix} y_6 + \frac{3}{4} \\ z_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{52} &= -\begin{pmatrix} y_6 - \frac{3}{4} \\ z_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_1 + \begin{pmatrix} x_6 + \frac{1}{4} \\ z_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_2 + \begin{pmatrix} y_6 - \frac{3}{4} \\ z_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_3 &= -a \begin{pmatrix} y_6 - \frac{3}{4} \\ z_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{x}} + a \begin{pmatrix} x_6 + \frac{1}{4} \\ z_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{y}} + a \begin{pmatrix} y_6 - \frac{3}{4} \\ z_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{53} &= \begin{pmatrix} x_6 + \frac{1}{4} \\ y_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_1 + \begin{pmatrix} z_6 + \frac{3}{4} \\ y_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_2 - \begin{pmatrix} x_6 + \frac{1}{4} \\ y_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_3 &= a \begin{pmatrix} x_6 + \frac{1}{4} \\ y_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{x}} + a \begin{pmatrix} z_6 + \frac{3}{4} \\ y_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{y}} - a \begin{pmatrix} x_6 + \frac{1}{4} \\ y_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{54} &= -\begin{pmatrix} x_6 - \frac{3}{4} \\ y_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_1 + \begin{pmatrix} z_6 + \frac{1}{4} \\ y_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_2 + \begin{pmatrix} x_6 - \frac{3}{4} \\ y_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_3 &= -a \begin{pmatrix} x_6 - \frac{3}{4} \\ y_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{x}} + a \begin{pmatrix} z_6 + \frac{1}{4} \\ y_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{y}} + a \begin{pmatrix} x_6 - \frac{3}{4} \\ y_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{55} &= -\begin{pmatrix} x_6 - \frac{1}{4} \\ y_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_1 - \begin{pmatrix} z_6 - \frac{1}{4} \\ y_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_2 - \begin{pmatrix} x_6 - \frac{1}{4} \\ y_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_3 &= -a \begin{pmatrix} x_6 - \frac{1}{4} \\ y_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{x}} - a \begin{pmatrix} z_6 - \frac{1}{4} \\ y_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{y}} - a \begin{pmatrix} x_6 - \frac{1}{4} \\ y_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{56} &= \begin{pmatrix} x_6 + \frac{3}{4} \\ y_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_1 - \begin{pmatrix} z_6 - \frac{3}{4} \\ y_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_2 + \begin{pmatrix} x_6 + \frac{3}{4} \\ y_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_3 &= a \begin{pmatrix} x_6 + \frac{3}{4} \\ y_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{x}} - a \begin{pmatrix} z_6 - \frac{3}{4} \\ y_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{y}} + a \begin{pmatrix} x_6 + \frac{3}{4} \\ y_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{57} &= \begin{pmatrix} z_6 + \frac{1}{4} \\ x_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_1 + \begin{pmatrix} y_6 + \frac{3}{4} \\ x_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_2 - \begin{pmatrix} z_6 + \frac{1}{4} \\ x_6 - \frac{3}{4} \end{pmatrix} \mathbf{a}_3 &= a \begin{pmatrix} z_6 + \frac{1}{4} \\ x_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{x}} + a \begin{pmatrix} y_6 + \frac{3}{4} \\ x_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{y}} - a \begin{pmatrix} z_6 + \frac{1}{4} \\ x_6 - \frac{3}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{58} &= \begin{pmatrix} z_6 + \frac{3}{4} \\ x_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_1 - \begin{pmatrix} y_6 - \frac{3}{4} \\ x_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_2 + \begin{pmatrix} z_6 + \frac{3}{4} \\ x_6 + \frac{1}{4} \end{pmatrix} \mathbf{a}_3 &= a \begin{pmatrix} z_6 + \frac{3}{4} \\ x_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{x}} - a \begin{pmatrix} y_6 - \frac{3}{4} \\ x_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{y}} + a \begin{pmatrix} z_6 + \frac{3}{4} \\ x_6 + \frac{1}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{59} &= -\begin{pmatrix} z_6 - \frac{3}{4} \\ x_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_1 + \begin{pmatrix} y_6 + \frac{1}{4} \\ x_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_2 + \begin{pmatrix} z_6 - \frac{3}{4} \\ x_6 + \frac{3}{4} \end{pmatrix} \mathbf{a}_3 &= -a \begin{pmatrix} z_6 - \frac{3}{4} \\ x_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{x}} + a \begin{pmatrix} y_6 + \frac{1}{4} \\ x_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{y}} + a \begin{pmatrix} z_6 - \frac{3}{4} \\ x_6 + \frac{3}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III} \\
\mathbf{B}_{60} &= -\begin{pmatrix} z_6 - \frac{1}{4} \\ x_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_1 - \begin{pmatrix} y_6 - \frac{1}{4} \\ x_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_2 - \begin{pmatrix} z_6 - \frac{1}{4} \\ x_6 - \frac{1}{4} \end{pmatrix} \mathbf{a}_3 &= -a \begin{pmatrix} z_6 - \frac{1}{4} \\ x_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{x}} - a \begin{pmatrix} y_6 - \frac{1}{4} \\ x_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{y}} - a \begin{pmatrix} z_6 - \frac{1}{4} \\ x_6 - \frac{1}{4} \end{pmatrix} \hat{\mathbf{z}} &(24e) & \text{O III}
\end{aligned}$$

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