

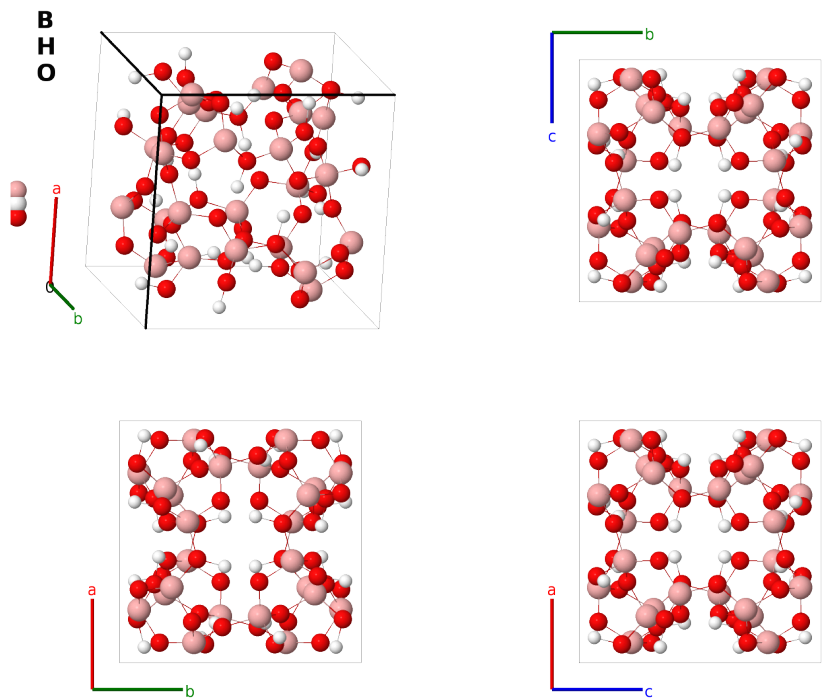
γ -HBO₂ (cubic) Structure: ABC2_cP96_218_i_i_2i-001

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- D. Hicks, M. J. Mehl, M. Esters, C. Osos, 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/W9M1>

https://aflow.org/prototype-encyclopedia/ABC2_cP96_218_i_i_2i-001



Prototype	BHO ₂
AFLOW prototype label	ABC2_cP96_218_i_i_2i-001
ICSD	34639
CCDC	1607014
Pearson symbol	cP96
Space group number	218
Space group symbol	$P\bar{4}3n$
AFLOW prototype command	<code>aflow --proto=ABC2_cP96_218_i_i_2i-001</code> <code>--params=$a, x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4$</code>

- Metaboric acid, HBO₂, is found in three forms (Kracke, 1938):
 - orthorhombic α -HBO₂, also known as HBO₂ I,

- monoclinic β -HBO₂, also known as HBO₂ II, and
- cubic γ -HBO₂, also known as HBO₂ III (this structure).

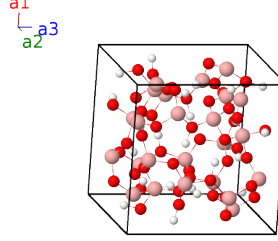
- The structures are named in order of stability, although all can exist at room temperature.

Simple Cubic primitive vectors

$$\mathbf{a}_1 = a \hat{\mathbf{x}}$$

$$\mathbf{a}_2 = a \hat{\mathbf{y}}$$

$$\mathbf{a}_3 = a \hat{\mathbf{z}}$$



Basis vectors

	Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B}_1$	$= x_1 \mathbf{a}_1 + y_1 \mathbf{a}_2 + z_1 \mathbf{a}_3$	$=$	$ax_1 \hat{\mathbf{x}} + ay_1 \hat{\mathbf{y}} + az_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_2$	$= -x_1 \mathbf{a}_1 - y_1 \mathbf{a}_2 + z_1 \mathbf{a}_3$	$=$	$-ax_1 \hat{\mathbf{x}} - ay_1 \hat{\mathbf{y}} + az_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_3$	$= -x_1 \mathbf{a}_1 + y_1 \mathbf{a}_2 - z_1 \mathbf{a}_3$	$=$	$-ax_1 \hat{\mathbf{x}} + ay_1 \hat{\mathbf{y}} - az_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_4$	$= x_1 \mathbf{a}_1 - y_1 \mathbf{a}_2 - z_1 \mathbf{a}_3$	$=$	$ax_1 \hat{\mathbf{x}} - ay_1 \hat{\mathbf{y}} - az_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_5$	$= z_1 \mathbf{a}_1 + x_1 \mathbf{a}_2 + y_1 \mathbf{a}_3$	$=$	$az_1 \hat{\mathbf{x}} + ax_1 \hat{\mathbf{y}} + ay_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_6$	$= z_1 \mathbf{a}_1 - x_1 \mathbf{a}_2 - y_1 \mathbf{a}_3$	$=$	$az_1 \hat{\mathbf{x}} - ax_1 \hat{\mathbf{y}} - ay_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_7$	$= -z_1 \mathbf{a}_1 - x_1 \mathbf{a}_2 + y_1 \mathbf{a}_3$	$=$	$-az_1 \hat{\mathbf{x}} - ax_1 \hat{\mathbf{y}} + ay_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_8$	$= -z_1 \mathbf{a}_1 + x_1 \mathbf{a}_2 - y_1 \mathbf{a}_3$	$=$	$-az_1 \hat{\mathbf{x}} + ax_1 \hat{\mathbf{y}} - ay_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_9$	$= y_1 \mathbf{a}_1 + z_1 \mathbf{a}_2 + x_1 \mathbf{a}_3$	$=$	$ay_1 \hat{\mathbf{x}} + az_1 \hat{\mathbf{y}} + ax_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{10}$	$= -y_1 \mathbf{a}_1 + z_1 \mathbf{a}_2 - x_1 \mathbf{a}_3$	$=$	$-ay_1 \hat{\mathbf{x}} + az_1 \hat{\mathbf{y}} - ax_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{11}$	$= y_1 \mathbf{a}_1 - z_1 \mathbf{a}_2 - x_1 \mathbf{a}_3$	$=$	$ay_1 \hat{\mathbf{x}} - az_1 \hat{\mathbf{y}} - ax_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{12}$	$= -y_1 \mathbf{a}_1 - z_1 \mathbf{a}_2 + x_1 \mathbf{a}_3$	$=$	$-ay_1 \hat{\mathbf{x}} - az_1 \hat{\mathbf{y}} + ax_1 \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{13}$	$= \left(y_1 + \frac{1}{2}\right) \mathbf{a}_1 + \left(x_1 + \frac{1}{2}\right) \mathbf{a}_2 + \left(z_1 + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$a \left(y_1 + \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(x_1 + \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(z_1 + \frac{1}{2}\right) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{14}$	$= -\left(y_1 - \frac{1}{2}\right) \mathbf{a}_1 - \left(x_1 - \frac{1}{2}\right) \mathbf{a}_2 + \left(z_1 + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-a \left(y_1 - \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(x_1 - \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(z_1 + \frac{1}{2}\right) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{15}$	$= \left(y_1 + \frac{1}{2}\right) \mathbf{a}_1 - \left(x_1 - \frac{1}{2}\right) \mathbf{a}_2 - \left(z_1 - \frac{1}{2}\right) \mathbf{a}_3$	$=$	$a \left(y_1 + \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(x_1 - \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(z_1 - \frac{1}{2}\right) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{16}$	$= -\left(y_1 - \frac{1}{2}\right) \mathbf{a}_1 + \left(x_1 + \frac{1}{2}\right) \mathbf{a}_2 - \left(z_1 - \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-a \left(y_1 - \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(x_1 + \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(z_1 - \frac{1}{2}\right) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{17}$	$= \left(x_1 + \frac{1}{2}\right) \mathbf{a}_1 + \left(z_1 + \frac{1}{2}\right) \mathbf{a}_2 + \left(y_1 + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$a \left(x_1 + \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(z_1 + \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(y_1 + \frac{1}{2}\right) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{18}$	$= -\left(x_1 - \frac{1}{2}\right) \mathbf{a}_1 + \left(z_1 + \frac{1}{2}\right) \mathbf{a}_2 - \left(y_1 - \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-a \left(x_1 - \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(z_1 + \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(y_1 - \frac{1}{2}\right) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{19}$	$= -\left(x_1 - \frac{1}{2}\right) \mathbf{a}_1 - \left(z_1 - \frac{1}{2}\right) \mathbf{a}_2 + \left(y_1 + \frac{1}{2}\right) \mathbf{a}_3$	$=$	$-a \left(x_1 - \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(z_1 - \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(y_1 + \frac{1}{2}\right) \hat{\mathbf{z}}$	(24i)	B I

$\mathbf{B}_{20}$	$=$	$(x_1 + \frac{1}{2}) \mathbf{a}_1 - (z_1 - \frac{1}{2}) \mathbf{a}_2 -$ $(y_1 - \frac{1}{2}) \mathbf{a}_3$	$=$	$a(x_1 + \frac{1}{2}) \hat{\mathbf{x}} - a(z_1 - \frac{1}{2}) \hat{\mathbf{y}} - a(y_1 - \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{21}$	$=$	$(z_1 + \frac{1}{2}) \mathbf{a}_1 + (y_1 + \frac{1}{2}) \mathbf{a}_2 +$ $(x_1 + \frac{1}{2}) \mathbf{a}_3$	$=$	$a(z_1 + \frac{1}{2}) \hat{\mathbf{x}} + a(y_1 + \frac{1}{2}) \hat{\mathbf{y}} + a(x_1 + \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{22}$	$=$	$(z_1 + \frac{1}{2}) \mathbf{a}_1 - (y_1 - \frac{1}{2}) \mathbf{a}_2 -$ $(x_1 - \frac{1}{2}) \mathbf{a}_3$	$=$	$a(z_1 + \frac{1}{2}) \hat{\mathbf{x}} - a(y_1 - \frac{1}{2}) \hat{\mathbf{y}} - a(x_1 - \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{23}$	$=$	$-(z_1 - \frac{1}{2}) \mathbf{a}_1 + (y_1 + \frac{1}{2}) \mathbf{a}_2 -$ $(x_1 - \frac{1}{2}) \mathbf{a}_3$	$=$	$-a(z_1 - \frac{1}{2}) \hat{\mathbf{x}} + a(y_1 + \frac{1}{2}) \hat{\mathbf{y}} - a(x_1 - \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{24}$	$=$	$-(z_1 - \frac{1}{2}) \mathbf{a}_1 - (y_1 - \frac{1}{2}) \mathbf{a}_2 +$ $(x_1 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-a(z_1 - \frac{1}{2}) \hat{\mathbf{x}} - a(y_1 - \frac{1}{2}) \hat{\mathbf{y}} + a(x_1 + \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	B I
$\mathbf{B}_{25}$	$=$	$x_2 \mathbf{a}_1 + y_2 \mathbf{a}_2 + z_2 \mathbf{a}_3$	$=$	$ax_2 \hat{\mathbf{x}} + ay_2 \hat{\mathbf{y}} + az_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{26}$	$=$	$-x_2 \mathbf{a}_1 - y_2 \mathbf{a}_2 + z_2 \mathbf{a}_3$	$=$	$-ax_2 \hat{\mathbf{x}} - ay_2 \hat{\mathbf{y}} + az_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{27}$	$=$	$-x_2 \mathbf{a}_1 + y_2 \mathbf{a}_2 - z_2 \mathbf{a}_3$	$=$	$-ax_2 \hat{\mathbf{x}} + ay_2 \hat{\mathbf{y}} - az_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{28}$	$=$	$x_2 \mathbf{a}_1 - y_2 \mathbf{a}_2 - z_2 \mathbf{a}_3$	$=$	$ax_2 \hat{\mathbf{x}} - ay_2 \hat{\mathbf{y}} - az_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{29}$	$=$	$z_2 \mathbf{a}_1 + x_2 \mathbf{a}_2 + y_2 \mathbf{a}_3$	$=$	$az_2 \hat{\mathbf{x}} + ax_2 \hat{\mathbf{y}} + ay_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{30}$	$=$	$z_2 \mathbf{a}_1 - x_2 \mathbf{a}_2 - y_2 \mathbf{a}_3$	$=$	$az_2 \hat{\mathbf{x}} - ax_2 \hat{\mathbf{y}} - ay_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{31}$	$=$	$-z_2 \mathbf{a}_1 - x_2 \mathbf{a}_2 + y_2 \mathbf{a}_3$	$=$	$-az_2 \hat{\mathbf{x}} - ax_2 \hat{\mathbf{y}} + ay_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{32}$	$=$	$-z_2 \mathbf{a}_1 + x_2 \mathbf{a}_2 - y_2 \mathbf{a}_3$	$=$	$-az_2 \hat{\mathbf{x}} + ax_2 \hat{\mathbf{y}} - ay_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{33}$	$=$	$y_2 \mathbf{a}_1 + z_2 \mathbf{a}_2 + x_2 \mathbf{a}_3$	$=$	$ay_2 \hat{\mathbf{x}} + az_2 \hat{\mathbf{y}} + ax_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{34}$	$=$	$-y_2 \mathbf{a}_1 + z_2 \mathbf{a}_2 - x_2 \mathbf{a}_3$	$=$	$-ay_2 \hat{\mathbf{x}} + az_2 \hat{\mathbf{y}} - ax_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{35}$	$=$	$y_2 \mathbf{a}_1 - z_2 \mathbf{a}_2 - x_2 \mathbf{a}_3$	$=$	$ay_2 \hat{\mathbf{x}} - az_2 \hat{\mathbf{y}} - ax_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{36}$	$=$	$-y_2 \mathbf{a}_1 - z_2 \mathbf{a}_2 + x_2 \mathbf{a}_3$	$=$	$-ay_2 \hat{\mathbf{x}} - az_2 \hat{\mathbf{y}} + ax_2 \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{37}$	$=$	$(y_2 + \frac{1}{2}) \mathbf{a}_1 + (x_2 + \frac{1}{2}) \mathbf{a}_2 +$ $(z_2 + \frac{1}{2}) \mathbf{a}_3$	$=$	$a(y_2 + \frac{1}{2}) \hat{\mathbf{x}} + a(x_2 + \frac{1}{2}) \hat{\mathbf{y}} + a(z_2 + \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{38}$	$=$	$-(y_2 - \frac{1}{2}) \mathbf{a}_1 - (x_2 - \frac{1}{2}) \mathbf{a}_2 +$ $(z_2 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-a(y_2 - \frac{1}{2}) \hat{\mathbf{x}} - a(x_2 - \frac{1}{2}) \hat{\mathbf{y}} + a(z_2 + \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{39}$	$=$	$(y_2 + \frac{1}{2}) \mathbf{a}_1 - (x_2 - \frac{1}{2}) \mathbf{a}_2 -$ $(z_2 - \frac{1}{2}) \mathbf{a}_3$	$=$	$a(y_2 + \frac{1}{2}) \hat{\mathbf{x}} - a(x_2 - \frac{1}{2}) \hat{\mathbf{y}} - a(z_2 - \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{40}$	$=$	$-(y_2 - \frac{1}{2}) \mathbf{a}_1 + (x_2 + \frac{1}{2}) \mathbf{a}_2 -$ $(z_2 - \frac{1}{2}) \mathbf{a}_3$	$=$	$-a(y_2 - \frac{1}{2}) \hat{\mathbf{x}} + a(x_2 + \frac{1}{2}) \hat{\mathbf{y}} - a(z_2 - \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{41}$	$=$	$(x_2 + \frac{1}{2}) \mathbf{a}_1 + (z_2 + \frac{1}{2}) \mathbf{a}_2 +$ $(y_2 + \frac{1}{2}) \mathbf{a}_3$	$=$	$a(x_2 + \frac{1}{2}) \hat{\mathbf{x}} + a(z_2 + \frac{1}{2}) \hat{\mathbf{y}} + a(y_2 + \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{42}$	$=$	$-(x_2 - \frac{1}{2}) \mathbf{a}_1 + (z_2 + \frac{1}{2}) \mathbf{a}_2 -$ $(y_2 - \frac{1}{2}) \mathbf{a}_3$	$=$	$-a(x_2 - \frac{1}{2}) \hat{\mathbf{x}} + a(z_2 + \frac{1}{2}) \hat{\mathbf{y}} - a(y_2 - \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{43}$	$=$	$-(x_2 - \frac{1}{2}) \mathbf{a}_1 - (z_2 - \frac{1}{2}) \mathbf{a}_2 +$ $(y_2 + \frac{1}{2}) \mathbf{a}_3$	$=$	$-a(x_2 - \frac{1}{2}) \hat{\mathbf{x}} - a(z_2 - \frac{1}{2}) \hat{\mathbf{y}} + a(y_2 + \frac{1}{2}) \hat{\mathbf{z}}$	(24i)	H I
$\mathbf{B}_{44}$	$=$	$(x_2 + \frac{1}{2}) \mathbf{a}_1 - (z_2 - \frac{1}{2}) \mathbf{a}_2 -$ $(y_2 - \frac{1}{2}) \mathbf{a}_3$				

$$\begin{aligned}
\mathbf{B}_{79} &= -z_4 \mathbf{a}_1 - x_4 \mathbf{a}_2 + y_4 \mathbf{a}_3 &= -az_4 \hat{\mathbf{x}} - ax_4 \hat{\mathbf{y}} + ay_4 \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{80} &= -z_4 \mathbf{a}_1 + x_4 \mathbf{a}_2 - y_4 \mathbf{a}_3 &= -az_4 \hat{\mathbf{x}} + ax_4 \hat{\mathbf{y}} - ay_4 \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{81} &= y_4 \mathbf{a}_1 + z_4 \mathbf{a}_2 + x_4 \mathbf{a}_3 &= ay_4 \hat{\mathbf{x}} + az_4 \hat{\mathbf{y}} + ax_4 \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{82} &= -y_4 \mathbf{a}_1 + z_4 \mathbf{a}_2 - x_4 \mathbf{a}_3 &= -ay_4 \hat{\mathbf{x}} + az_4 \hat{\mathbf{y}} - ax_4 \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{83} &= y_4 \mathbf{a}_1 - z_4 \mathbf{a}_2 - x_4 \mathbf{a}_3 &= ay_4 \hat{\mathbf{x}} - az_4 \hat{\mathbf{y}} - ax_4 \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{84} &= -y_4 \mathbf{a}_1 - z_4 \mathbf{a}_2 + x_4 \mathbf{a}_3 &= -ay_4 \hat{\mathbf{x}} - az_4 \hat{\mathbf{y}} + ax_4 \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{85} &= \left(y_4 + \frac{1}{2}\right) \mathbf{a}_1 + \left(x_4 + \frac{1}{2}\right) \mathbf{a}_2 + \left(z_4 + \frac{1}{2}\right) \mathbf{a}_3 &= a \left(y_4 + \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(x_4 + \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(z_4 + \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{86} &= -\left(y_4 - \frac{1}{2}\right) \mathbf{a}_1 - \left(x_4 - \frac{1}{2}\right) \mathbf{a}_2 + \left(z_4 + \frac{1}{2}\right) \mathbf{a}_3 &= -a \left(y_4 - \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(x_4 - \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(z_4 + \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{87} &= \left(y_4 + \frac{1}{2}\right) \mathbf{a}_1 - \left(x_4 - \frac{1}{2}\right) \mathbf{a}_2 - \left(z_4 - \frac{1}{2}\right) \mathbf{a}_3 &= a \left(y_4 + \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(x_4 - \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(z_4 - \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{88} &= -\left(y_4 - \frac{1}{2}\right) \mathbf{a}_1 + \left(x_4 + \frac{1}{2}\right) \mathbf{a}_2 - \left(z_4 - \frac{1}{2}\right) \mathbf{a}_3 &= -a \left(y_4 - \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(x_4 + \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(z_4 - \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{89} &= \left(x_4 + \frac{1}{2}\right) \mathbf{a}_1 + \left(z_4 + \frac{1}{2}\right) \mathbf{a}_2 + \left(y_4 + \frac{1}{2}\right) \mathbf{a}_3 &= a \left(x_4 + \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(z_4 + \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(y_4 + \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{90} &= -\left(x_4 - \frac{1}{2}\right) \mathbf{a}_1 + \left(z_4 + \frac{1}{2}\right) \mathbf{a}_2 - \left(y_4 - \frac{1}{2}\right) \mathbf{a}_3 &= -a \left(x_4 - \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(z_4 + \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(y_4 - \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{91} &= -\left(x_4 - \frac{1}{2}\right) \mathbf{a}_1 - \left(z_4 - \frac{1}{2}\right) \mathbf{a}_2 + \left(y_4 + \frac{1}{2}\right) \mathbf{a}_3 &= -a \left(x_4 - \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(z_4 - \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(y_4 + \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{92} &= \left(x_4 + \frac{1}{2}\right) \mathbf{a}_1 - \left(z_4 - \frac{1}{2}\right) \mathbf{a}_2 - \left(y_4 - \frac{1}{2}\right) \mathbf{a}_3 &= a \left(x_4 + \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(z_4 - \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(y_4 - \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{93} &= \left(z_4 + \frac{1}{2}\right) \mathbf{a}_1 + \left(y_4 + \frac{1}{2}\right) \mathbf{a}_2 + \left(x_4 + \frac{1}{2}\right) \mathbf{a}_3 &= a \left(z_4 + \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(y_4 + \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(x_4 + \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{94} &= \left(z_4 + \frac{1}{2}\right) \mathbf{a}_1 - \left(y_4 - \frac{1}{2}\right) \mathbf{a}_2 - \left(x_4 - \frac{1}{2}\right) \mathbf{a}_3 &= a \left(z_4 + \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(y_4 - \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(x_4 - \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{95} &= -\left(z_4 - \frac{1}{2}\right) \mathbf{a}_1 + \left(y_4 + \frac{1}{2}\right) \mathbf{a}_2 - \left(x_4 - \frac{1}{2}\right) \mathbf{a}_3 &= -a \left(z_4 - \frac{1}{2}\right) \hat{\mathbf{x}} + a \left(y_4 + \frac{1}{2}\right) \hat{\mathbf{y}} - a \left(x_4 - \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II} \\
\mathbf{B}_{96} &= -\left(z_4 - \frac{1}{2}\right) \mathbf{a}_1 - \left(y_4 - \frac{1}{2}\right) \mathbf{a}_2 + \left(x_4 + \frac{1}{2}\right) \mathbf{a}_3 &= -a \left(z_4 - \frac{1}{2}\right) \hat{\mathbf{x}} - a \left(y_4 - \frac{1}{2}\right) \hat{\mathbf{y}} + a \left(x_4 + \frac{1}{2}\right) \hat{\mathbf{z}} &(24i) &\text{O II}
\end{aligned}$$

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