$Ni(NO_3)(H_2O)_3$ Structure: A12B2CD12_aP54_2_12i_2i_i_12i-001

This structure previously used the label(s) `A12B2CD12_aP54_2_12i_2i_i_12i`. Calls to these addresses will be redirected here.

Cite this page as:

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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.

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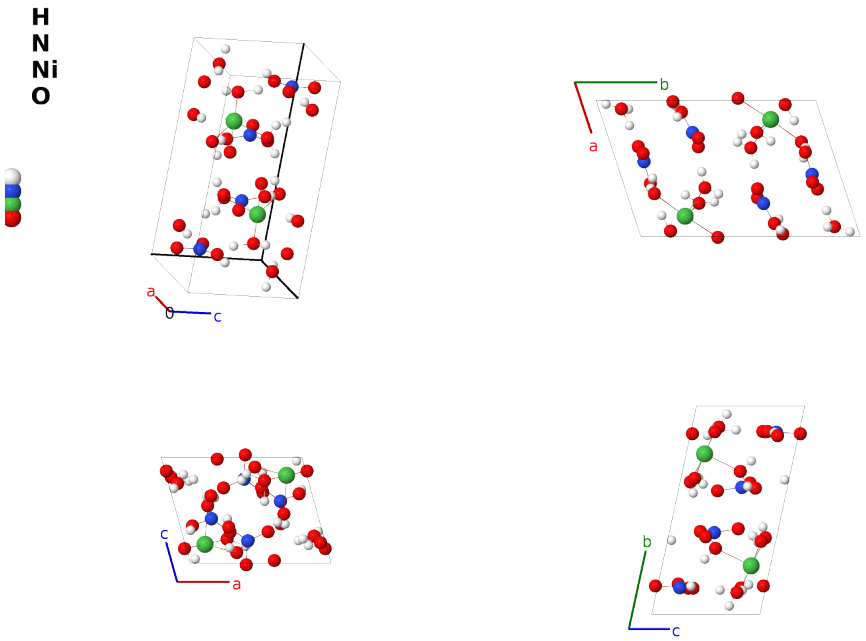
https://aflow.org/prototype-encyclopedia/6GLF

https://aflow.org/prototype-encyclopedia/A12B2CD12_aP54_2_12i_2i_i_12i-001

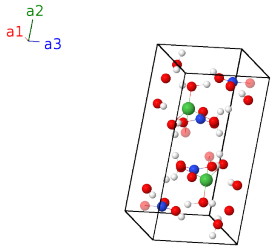


Prototype	$H_{12}N_2NiO_{12}$
AFLOW prototype label	A12B2CD12_aP54_2_12i_2i_i_12i-001
ICSD	9127
CCDC	1594178
Pearson symbol	aP54
Space group number	2
Space group symbol	$P\bar{1}$
AFLOW prototype command	`aflow --proto=A12B2CD12_aP54_2_12i_2i_i_12i-001 --params=`$a, b/a, c/a, \alpha, \beta, \gamma, x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4, x_5, y_5, z_5, x_6, y_6, z_6, x_7, y_7, z_7, x_8, y_8, z_8, x_9, y_9, z_9, x_{10}, y_{10}, z_{10}, x_{11}, y_{11}, z_{11}, x_{12}, y_{12}, z_{12}, x_{13}, y_{13}, z_{13}, x_{14}, y_{14}, z_{14}, x_{15}, y_{15}, z_{15}, x_{16}, y_{16}, z_{16}, x_{17}, y_{17}, z_{17}, x_{18}, y_{18}, z_{18}, x_{19}, y_{19}, z_{19}, x_{20}, y_{20}, z_{20}, x_{21}, y_{21}, z_{21}, x_{22}, y_{22}, z_{22}, x_{23}, y_{23}, z_{23}, x_{24}, y_{24}, z_{24}, x_{25}, y_{25}, z_{25}, x_{26}, y_{26}, z_{26}, x_{27}, y_{27}, z_{27}$

- This is the accepted structure for $Ni(NO_3)(H_2O)_3$, replacing the $H6_4$ structure. The positions of the hydrogen atoms are approximate.

Triclinic primitive vectors

$$
\begin{aligned}
\mathbf{a_1} &= a\,\hat{\mathbf{x}} \\
\mathbf{a_2} &= b\cos\gamma\,\hat{\mathbf{x}} + b\sin\gamma\,\hat{\mathbf{y}} \\
\mathbf{a_3} &= c_x\,\hat{\mathbf{x}} + c_y\,\hat{\mathbf{y}} + c_z\,\hat{\mathbf{z}} \\
c_x &= c\cos\beta \\
c_y &= c(\cos\alpha - \cos\beta\cos\gamma)/\sin\gamma \\
c_z &= \sqrt{c^2 - c_x^2 - c_y^2}
\end{aligned}
$$



Basis vectors

		Lattice coordinates		Cartesian coordinates	Wyckoff position	Atom type
$\mathbf{B_1}$	=	$x_1\,\mathbf{a}_1 + y_1\,\mathbf{a}_2 + z_1\,\mathbf{a}_3$	=	$(ax_1 + by_1\cos\gamma + c_x z_1)\,\hat{\mathbf{x}} + (by_1\sin\gamma + c_y z_1)\,\hat{\mathbf{y}} + c_z z_1\,\hat{\mathbf{z}}$	(2i)	H I
$\mathbf{B_2}$	=	$-x_1\,\mathbf{a}_1 - y_1\,\mathbf{a}_2 - z_1\,\mathbf{a}_3$	=	$-(ax_1 + by_1\cos\gamma + c_x z_1)\,\hat{\mathbf{x}} - (by_1\sin\gamma + c_y z_1)\,\hat{\mathbf{y}} - c_z z_1\,\hat{\mathbf{z}}$	(2i)	H I
$\mathbf{B_3}$	=	$x_2\,\mathbf{a}_1 + y_2\,\mathbf{a}_2 + z_2\,\mathbf{a}_3$	=	$(ax_2 + by_2\cos\gamma + c_x z_2)\,\hat{\mathbf{x}} + (by_2\sin\gamma + c_y z_2)\,\hat{\mathbf{y}} + c_z z_2\,\hat{\mathbf{z}}$	(2i)	H II
$\mathbf{B_4}$	=	$-x_2\,\mathbf{a}_1 - y_2\,\mathbf{a}_2 - z_2\,\mathbf{a}_3$	=	$-(ax_2 + by_2\cos\gamma + c_x z_2)\,\hat{\mathbf{x}} - (by_2\sin\gamma + c_y z_2)\,\hat{\mathbf{y}} - c_z z_2\,\hat{\mathbf{z}}$	(2i)	H II
$\mathbf{B_5}$	=	$x_3\,\mathbf{a}_1 + y_3\,\mathbf{a}_2 + z_3\,\mathbf{a}_3$	=	$(ax_3 + by_3\cos\gamma + c_x z_3)\,\hat{\mathbf{x}} + (by_3\sin\gamma + c_y z_3)\,\hat{\mathbf{y}} + c_z z_3\,\hat{\mathbf{z}}$	(2i)	H III
$\mathbf{B_6}$	=	$-x_3\,\mathbf{a}_1 - y_3\,\mathbf{a}_2 - z_3\,\mathbf{a}_3$	=	$-(ax_3 + by_3\cos\gamma + c_x z_3)\,\hat{\mathbf{x}} - (by_3\sin\gamma + c_y z_3)\,\hat{\mathbf{y}} - c_z z_3\,\hat{\mathbf{z}}$	(2i)	H III
$\mathbf{B_7}$	=	$x_4\,\mathbf{a}_1 + y_4\,\mathbf{a}_2 + z_4\,\mathbf{a}_3$	=	$(ax_4 + by_4\cos\gamma + c_x z_4)\,\hat{\mathbf{x}} + (by_4\sin\gamma + c_y z_4)\,\hat{\mathbf{y}} + c_z z_4\,\hat{\mathbf{z}}$	(2i)	H IV
$\mathbf{B_8}$	=	$-x_4\,\mathbf{a}_1 - y_4\,\mathbf{a}_2 - z_4\,\mathbf{a}_3$	=	$-(ax_4 + by_4\cos\gamma + c_x z_4)\,\hat{\mathbf{x}} - (by_4\sin\gamma + c_y z_4)\,\hat{\mathbf{y}} - c_z z_4\,\hat{\mathbf{z}}$	(2i)	H IV
$\mathbf{B_9}$	=	$x_5\,\mathbf{a}_1 + y_5\,\mathbf{a}_2 + z_5\,\mathbf{a}_3$	=	$(ax_5 + by_5\cos\gamma + c_x z_5)\,\hat{\mathbf{x}} + (by_5\sin\gamma + c_y z_5)\,\hat{\mathbf{y}} + c_z z_5\,\hat{\mathbf{z}}$	(2i)	H V
$\mathbf{B_{10}}$	=	$-x_5\,\mathbf{a}_1 - y_5\,\mathbf{a}_2 - z_5\,\mathbf{a}_3$	=	$-(ax_5 + by_5\cos\gamma + c_x z_5)\,\hat{\mathbf{x}} - (by_5\sin\gamma + c_y z_5)\,\hat{\mathbf{y}} - c_z z_5\,\hat{\mathbf{z}}$	(2i)	H V
$\mathbf{B_{11}}$	=	$x_6\,\mathbf{a}_1 + y_6\,\mathbf{a}_2 + z_6\,\mathbf{a}_3$	=	$(ax_6 + by_6\cos\gamma + c_x z_6)\,\hat{\mathbf{x}} + (by_6\sin\gamma + c_y z_6)\,\hat{\mathbf{y}} + c_z z_6\,\hat{\mathbf{z}}$	(2i)	H VI
$\mathbf{B_{12}}$	=	$-x_6\,\mathbf{a}_1 - y_6\,\mathbf{a}_2 - z_6\,\mathbf{a}_3$	=	$-(ax_6 + by_6\cos\gamma + c_x z_6)\,\hat{\mathbf{x}} - (by_6\sin\gamma + c_y z_6)\,\hat{\mathbf{y}} - c_z z_6\,\hat{\mathbf{z}}$	(2i)	H VI
$\mathbf{B_{13}}$	=	$x_7\,\mathbf{a}_1 + y_7\,\mathbf{a}_2 + z_7\,\mathbf{a}_3$	=	$(ax_7 + by_7\cos\gamma + c_x z_7)\,\hat{\mathbf{x}} + (by_7\sin\gamma + c_y z_7)\,\hat{\mathbf{y}} + c_z z_7\,\hat{\mathbf{z}}$	(2i)	H VII
$\mathbf{B_{14}}$	=	$-x_7\,\mathbf{a}_1 - y_7\,\mathbf{a}_2 - z_7\,\mathbf{a}_3$	=	$-(ax_7 + by_7\cos\gamma + c_x z_7)\,\hat{\mathbf{x}} - (by_7\sin\gamma + c_y z_7)\,\hat{\mathbf{y}} - c_z z_7\,\hat{\mathbf{z}}$	(2i)	H VII
$\mathbf{B_{15}}$	=	$x_8\,\mathbf{a}_1 + y_8\,\mathbf{a}_2 + z_8\,\mathbf{a}_3$	=	$(ax_8 + by_8\cos\gamma + c_x z_8)\,\hat{\mathbf{x}} + (by_8\sin\gamma + c_y z_8)\,\hat{\mathbf{y}} + c_z z_8\,\hat{\mathbf{z}}$	(2i)	H VIII
$\mathbf{B_{16}}$	=	$-x_8\,\mathbf{a}_1 - y_8\,\mathbf{a}_2 - z_8\,\mathbf{a}_3$	=	$-(ax_8 + by_8\cos\gamma + c_x z_8)\,\hat{\mathbf{x}} - (by_8\sin\gamma + c_y z_8)\,\hat{\mathbf{y}} - c_z z_8\,\hat{\mathbf{z}}$	(2i)	H VIII

$$\mathbf{B_{17}} = x_9\,\mathbf{a}_1 + y_9\,\mathbf{a}_2 + z_9\,\mathbf{a}_3 = (ax_9 + by_9\cos\gamma + c_x z_9)\,\hat{\mathbf{x}} + (by_9\sin\gamma + c_y z_9)\,\hat{\mathbf{y}} + c_z z_9\,\hat{\mathbf{z}} \quad (2i) \quad \text{H IX}$$

$$\mathbf{B_{18}} = -x_9\,\mathbf{a}_1 - y_9\,\mathbf{a}_2 - z_9\,\mathbf{a}_3 = -(ax_9 + by_9\cos\gamma + c_x z_9)\,\hat{\mathbf{x}} - (by_9\sin\gamma + c_y z_9)\,\hat{\mathbf{y}} - c_z z_9\,\hat{\mathbf{z}} \quad (2i) \quad \text{H IX}$$

$$\mathbf{B_{19}} = x_{10}\,\mathbf{a}_1 + y_{10}\,\mathbf{a}_2 + z_{10}\,\mathbf{a}_3 = (ax_{10} + by_{10}\cos\gamma + c_x z_{10})\,\hat{\mathbf{x}} + (by_{10}\sin\gamma + c_y z_{10})\,\hat{\mathbf{y}} + c_z z_{10}\,\hat{\mathbf{z}} \quad (2i) \quad \text{H X}$$

$$\mathbf{B_{20}} = -x_{10}\,\mathbf{a}_1 - y_{10}\,\mathbf{a}_2 - z_{10}\,\mathbf{a}_3 = -(ax_{10} + by_{10}\cos\gamma + c_x z_{10})\,\hat{\mathbf{x}} - (by_{10}\sin\gamma + c_y z_{10})\,\hat{\mathbf{y}} - c_z z_{10}\,\hat{\mathbf{z}} \quad (2i) \quad \text{H X}$$

$$\mathbf{B_{21}} = x_{11}\,\mathbf{a}_1 + y_{11}\,\mathbf{a}_2 + z_{11}\,\mathbf{a}_3 = (ax_{11} + by_{11}\cos\gamma + c_x z_{11})\,\hat{\mathbf{x}} + (by_{11}\sin\gamma + c_y z_{11})\,\hat{\mathbf{y}} + c_z z_{11}\,\hat{\mathbf{z}} \quad (2i) \quad \text{H XI}$$

$$\mathbf{B_{22}} = -x_{11}\,\mathbf{a}_1 - y_{11}\,\mathbf{a}_2 - z_{11}\,\mathbf{a}_3 = -(ax_{11} + by_{11}\cos\gamma + c_x z_{11})\,\hat{\mathbf{x}} - (by_{11}\sin\gamma + c_y z_{11})\,\hat{\mathbf{y}} - c_z z_{11}\,\hat{\mathbf{z}} \quad (2i) \quad \text{H XI}$$

$$\mathbf{B_{23}} = x_{12}\,\mathbf{a}_1 + y_{12}\,\mathbf{a}_2 + z_{12}\,\mathbf{a}_3 = (ax_{12} + by_{12}\cos\gamma + c_x z_{12})\,\hat{\mathbf{x}} + (by_{12}\sin\gamma + c_y z_{12})\,\hat{\mathbf{y}} + c_z z_{12}\,\hat{\mathbf{z}} \quad (2i) \quad \text{H XII}$$

$$\mathbf{B_{24}} = -x_{12}\,\mathbf{a}_1 - y_{12}\,\mathbf{a}_2 - z_{12}\,\mathbf{a}_3 = -(ax_{12} + by_{12}\cos\gamma + c_x z_{12})\,\hat{\mathbf{x}} - (by_{12}\sin\gamma + c_y z_{12})\,\hat{\mathbf{y}} - c_z z_{12}\,\hat{\mathbf{z}} \quad (2i) \quad \text{H XII}$$

$$\mathbf{B_{25}} = x_{13}\,\mathbf{a}_1 + y_{13}\,\mathbf{a}_2 + z_{13}\,\mathbf{a}_3 = (ax_{13} + by_{13}\cos\gamma + c_x z_{13})\,\hat{\mathbf{x}} + (by_{13}\sin\gamma + c_y z_{13})\,\hat{\mathbf{y}} + c_z z_{13}\,\hat{\mathbf{z}} \quad (2i) \quad \text{N I}$$

$$\mathbf{B_{26}} = -x_{13}\,\mathbf{a}_1 - y_{13}\,\mathbf{a}_2 - z_{13}\,\mathbf{a}_3 = -(ax_{13} + by_{13}\cos\gamma + c_x z_{13})\,\hat{\mathbf{x}} - (by_{13}\sin\gamma + c_y z_{13})\,\hat{\mathbf{y}} - c_z z_{13}\,\hat{\mathbf{z}} \quad (2i) \quad \text{N I}$$

$$\mathbf{B_{27}} = x_{14}\,\mathbf{a}_1 + y_{14}\,\mathbf{a}_2 + z_{14}\,\mathbf{a}_3 = (ax_{14} + by_{14}\cos\gamma + c_x z_{14})\,\hat{\mathbf{x}} + (by_{14}\sin\gamma + c_y z_{14})\,\hat{\mathbf{y}} + c_z z_{14}\,\hat{\mathbf{z}} \quad (2i) \quad \text{N II}$$

$$\mathbf{B_{28}} = -x_{14}\,\mathbf{a}_1 - y_{14}\,\mathbf{a}_2 - z_{14}\,\mathbf{a}_3 = -(ax_{14} + by_{14}\cos\gamma + c_x z_{14})\,\hat{\mathbf{x}} - (by_{14}\sin\gamma + c_y z_{14})\,\hat{\mathbf{y}} - c_z z_{14}\,\hat{\mathbf{z}} \quad (2i) \quad \text{N II}$$

$$\mathbf{B_{29}} = x_{15}\,\mathbf{a}_1 + y_{15}\,\mathbf{a}_2 + z_{15}\,\mathbf{a}_3 = (ax_{15} + by_{15}\cos\gamma + c_x z_{15})\,\hat{\mathbf{x}} + (by_{15}\sin\gamma + c_y z_{15})\,\hat{\mathbf{y}} + c_z z_{15}\,\hat{\mathbf{z}} \quad (2i) \quad \text{Ni I}$$

$$\mathbf{B_{30}} = -x_{15}\,\mathbf{a}_1 - y_{15}\,\mathbf{a}_2 - z_{15}\,\mathbf{a}_3 = -(ax_{15} + by_{15}\cos\gamma + c_x z_{15})\,\hat{\mathbf{x}} - (by_{15}\sin\gamma + c_y z_{15})\,\hat{\mathbf{y}} - c_z z_{15}\,\hat{\mathbf{z}} \quad (2i) \quad \text{Ni I}$$

$$\mathbf{B_{31}} = x_{16}\,\mathbf{a}_1 + y_{16}\,\mathbf{a}_2 + z_{16}\,\mathbf{a}_3 = (ax_{16} + by_{16}\cos\gamma + c_x z_{16})\,\hat{\mathbf{x}} + (by_{16}\sin\gamma + c_y z_{16})\,\hat{\mathbf{y}} + c_z z_{16}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O I}$$

$$\mathbf{B_{32}} = -x_{16}\,\mathbf{a}_1 - y_{16}\,\mathbf{a}_2 - z_{16}\,\mathbf{a}_3 = -(ax_{16} + by_{16}\cos\gamma + c_x z_{16})\,\hat{\mathbf{x}} - (by_{16}\sin\gamma + c_y z_{16})\,\hat{\mathbf{y}} - c_z z_{16}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O I}$$

$$\mathbf{B_{33}} = x_{17}\,\mathbf{a}_1 + y_{17}\,\mathbf{a}_2 + z_{17}\,\mathbf{a}_3 = (ax_{17} + by_{17}\cos\gamma + c_x z_{17})\,\hat{\mathbf{x}} + (by_{17}\sin\gamma + c_y z_{17})\,\hat{\mathbf{y}} + c_z z_{17}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O II}$$

$$\mathbf{B_{34}} = -x_{17}\,\mathbf{a}_1 - y_{17}\,\mathbf{a}_2 - z_{17}\,\mathbf{a}_3 = -(ax_{17} + by_{17}\cos\gamma + c_x z_{17})\,\hat{\mathbf{x}} - (by_{17}\sin\gamma + c_y z_{17})\,\hat{\mathbf{y}} - c_z z_{17}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O II}$$

$$\mathbf{B_{35}} = x_{18}\,\mathbf{a}_1 + y_{18}\,\mathbf{a}_2 + z_{18}\,\mathbf{a}_3 = (ax_{18} + by_{18}\cos\gamma + c_x z_{18})\,\hat{\mathbf{x}} + (by_{18}\sin\gamma + c_y z_{18})\,\hat{\mathbf{y}} + c_z z_{18}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O III}$$

$$\mathbf{B_{36}} = -x_{18}\,\mathbf{a}_1 - y_{18}\,\mathbf{a}_2 - z_{18}\,\mathbf{a}_3 = -(ax_{18} + by_{18}\cos\gamma + c_x z_{18})\,\hat{\mathbf{x}} - (by_{18}\sin\gamma + c_y z_{18})\,\hat{\mathbf{y}} - c_z z_{18}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O III}$$

$$\mathbf{B_{37}} = x_{19}\,\mathbf{a}_1 + y_{19}\,\mathbf{a}_2 + z_{19}\,\mathbf{a}_3 = (ax_{19} + by_{19}\cos\gamma + c_x z_{19})\,\hat{\mathbf{x}} + (by_{19}\sin\gamma + c_y z_{19})\,\hat{\mathbf{y}} + c_z z_{19}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O IV}$$

$$\mathbf{B_{38}} = -x_{19}\,\mathbf{a}_1 - y_{19}\,\mathbf{a}_2 - z_{19}\,\mathbf{a}_3 = -(ax_{19} + by_{19}\cos\gamma + c_x z_{19})\,\hat{\mathbf{x}} - (by_{19}\sin\gamma + c_y z_{19})\,\hat{\mathbf{y}} - c_z z_{19}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O IV}$$

$$\mathbf{B_{39}} = x_{20}\,\mathbf{a}_1 + y_{20}\,\mathbf{a}_2 + z_{20}\,\mathbf{a}_3 = (ax_{20} + by_{20}\cos\gamma + c_x z_{20})\,\hat{\mathbf{x}} + (by_{20}\sin\gamma + c_y z_{20})\,\hat{\mathbf{y}} + c_z z_{20}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O V}$$

$$\mathbf{B_{40}} = -x_{20}\,\mathbf{a}_1 - y_{20}\,\mathbf{a}_2 - z_{20}\,\mathbf{a}_3 = -(ax_{20} + by_{20}\cos\gamma + c_x z_{20})\,\hat{\mathbf{x}} - (by_{20}\sin\gamma + c_y z_{20})\,\hat{\mathbf{y}} - c_z z_{20}\,\hat{\mathbf{z}} \quad (2i) \quad \text{O V}$$

$$\mathbf{B_{41}} = x_{21}\,\mathbf{a}_1 + y_{21}\,\mathbf{a}_2 + z_{21}\,\mathbf{a}_3 = (ax_{21} + by_{21}\cos\gamma + c_x z_{21})\,\hat{\mathbf{x}} + (by_{21}\sin\gamma + c_y z_{21})\,\hat{\mathbf{y}} + c_z z_{21}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O VI}$$

$$\mathbf{B_{42}} = -x_{21}\,\mathbf{a}_1 - y_{21}\,\mathbf{a}_2 - z_{21}\,\mathbf{a}_3 = -(ax_{21} + by_{21}\cos\gamma + c_x z_{21})\,\hat{\mathbf{x}} - (by_{21}\sin\gamma + c_y z_{21})\,\hat{\mathbf{y}} - c_z z_{21}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O VI}$$

$$\mathbf{B_{43}} = x_{22}\,\mathbf{a}_1 + y_{22}\,\mathbf{a}_2 + z_{22}\,\mathbf{a}_3 = (ax_{22} + by_{22}\cos\gamma + c_x z_{22})\,\hat{\mathbf{x}} + (by_{22}\sin\gamma + c_y z_{22})\,\hat{\mathbf{y}} + c_z z_{22}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O VII}$$

$$\mathbf{B_{44}} = -x_{22}\,\mathbf{a}_1 - y_{22}\,\mathbf{a}_2 - z_{22}\,\mathbf{a}_3 = -(ax_{22} + by_{22}\cos\gamma + c_x z_{22})\,\hat{\mathbf{x}} - (by_{22}\sin\gamma + c_y z_{22})\,\hat{\mathbf{y}} - c_z z_{22}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O VII}$$

$$\mathbf{B_{45}} = x_{23}\,\mathbf{a}_1 + y_{23}\,\mathbf{a}_2 + z_{23}\,\mathbf{a}_3 = (ax_{23} + by_{23}\cos\gamma + c_x z_{23})\,\hat{\mathbf{x}} + (by_{23}\sin\gamma + c_y z_{23})\,\hat{\mathbf{y}} + c_z z_{23}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O VIII}$$

$$\mathbf{B_{46}} = -x_{23}\,\mathbf{a}_1 - y_{23}\,\mathbf{a}_2 - z_{23}\,\mathbf{a}_3 = -(ax_{23} + by_{23}\cos\gamma + c_x z_{23})\,\hat{\mathbf{x}} - (by_{23}\sin\gamma + c_y z_{23})\,\hat{\mathbf{y}} - c_z z_{23}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O VIII}$$

$$\mathbf{B_{47}} = x_{24}\,\mathbf{a}_1 + y_{24}\,\mathbf{a}_2 + z_{24}\,\mathbf{a}_3 = (ax_{24} + by_{24}\cos\gamma + c_x z_{24})\,\hat{\mathbf{x}} + (by_{24}\sin\gamma + c_y z_{24})\,\hat{\mathbf{y}} + c_z z_{24}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O IX}$$

$$\mathbf{B_{48}} = -x_{24}\,\mathbf{a}_1 - y_{24}\,\mathbf{a}_2 - z_{24}\,\mathbf{a}_3 = -(ax_{24} + by_{24}\cos\gamma + c_x z_{24})\,\hat{\mathbf{x}} - (by_{24}\sin\gamma + c_y z_{24})\,\hat{\mathbf{y}} - c_z z_{24}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O IX}$$

$$\mathbf{B_{49}} = x_{25}\,\mathbf{a}_1 + y_{25}\,\mathbf{a}_2 + z_{25}\,\mathbf{a}_3 = (ax_{25} + by_{25}\cos\gamma + c_x z_{25})\,\hat{\mathbf{x}} + (by_{25}\sin\gamma + c_y z_{25})\,\hat{\mathbf{y}} + c_z z_{25}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O X}$$

$$\mathbf{B_{50}} = -x_{25}\,\mathbf{a}_1 - y_{25}\,\mathbf{a}_2 - z_{25}\,\mathbf{a}_3 = -(ax_{25} + by_{25}\cos\gamma + c_x z_{25})\,\hat{\mathbf{x}} - (by_{25}\sin\gamma + c_y z_{25})\,\hat{\mathbf{y}} - c_z z_{25}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O X}$$

$$\mathbf{B_{51}} = x_{26}\,\mathbf{a}_1 + y_{26}\,\mathbf{a}_2 + z_{26}\,\mathbf{a}_3 = (ax_{26} + by_{26}\cos\gamma + c_x z_{26})\,\hat{\mathbf{x}} + (by_{26}\sin\gamma + c_y z_{26})\,\hat{\mathbf{y}} + c_z z_{26}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O XI}$$

$$\mathbf{B_{52}} = -x_{26}\,\mathbf{a}_1 - y_{26}\,\mathbf{a}_2 - z_{26}\,\mathbf{a}_3 = -(ax_{26} + by_{26}\cos\gamma + c_x z_{26})\,\hat{\mathbf{x}} - (by_{26}\sin\gamma + c_y z_{26})\,\hat{\mathbf{y}} - c_z z_{26}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O XI}$$

$$\mathbf{B_{53}} = x_{27}\,\mathbf{a}_1 + y_{27}\,\mathbf{a}_2 + z_{27}\,\mathbf{a}_3 = (ax_{27} + by_{27}\cos\gamma + c_x z_{27})\,\hat{\mathbf{x}} + (by_{27}\sin\gamma + c_y z_{27})\,\hat{\mathbf{y}} + c_z z_{27}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O XII}$$

$$\mathbf{B_{54}} = -x_{27}\,\mathbf{a}_1 - y_{27}\,\mathbf{a}_2 - z_{27}\,\mathbf{a}_3 = -(ax_{27} + by_{27}\cos\gamma + c_x z_{27})\,\hat{\mathbf{x}} - (by_{27}\sin\gamma + c_y z_{27})\,\hat{\mathbf{y}} - c_z z_{27}\,\hat{\mathbf{z}} \quad \text{(2i)} \quad \text{O XII}$$

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